



MELSOFT

Data Science Tool

MELSOFT MaiLab User's Manual

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-SW1DND-MAILABPR-M
-SW1DNN-MAILABAN-M
-SW1DNN-MAILAB-M
-SW1DNN-MAILABPR-M



SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the MELSEC iQ-R Module Configuration Manual.

In this manual, the safety precautions are classified into two levels: "⚠ WARNING" and "⚠ CAUTION".

 WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
 CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠ CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

WARNING

- To perform an operation, such as data change or operating status change, to running devices, such as a programmable controller, servo, robot, or server, from a personal computer equipped with this product, configure an interlock circuit outside of the devices so that the entire system always operates to the safety side. Additionally, read this manual carefully and ensure the safety before operations. Especially, in the above mentioned operations that are performed from external devices through network, any problems on devices may not be dealt with promptly due to an abnormal data communication.
 - Configure a safety circuit outside of a personal computer equipped with this product so that the entire system operates to the safely side even when a fault occurs in the personal computer. Failure to do so may result in an accident due to an incorrect output or malfunction.
-

[Design Precautions]

CAUTION

- During application of each setting, do not perform the operation that forcibly turns a personal computer equipped with this product OFF. Otherwise, the data will be undefined and resetting and re-registering data will be required. Additionally, doing so may cause the malfunction of this product.
-

[Security Precautions]

WARNING

- To maintain the security (confidentiality, integrity, and availability) of access target devices and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.
-

[Learning Precautions]

CAUTION

- When performing supervised learning, assign an accurate value to an objective variable. Otherwise, the accuracy for a diagnosis may be lowered.
 - Machine learning algorithm uses random numbers. Therefore, learning results and diagnosis results may not match even under the same conditions.
 - The accuracy calculated in learning is an index obtained by using learning data. The diagnosis performance may be lowered when the characteristics differ between data for learning and that for a diagnosis.
-

CONDITIONS OF USE FOR THE PRODUCT

- (1) This software shall be used under the following conditions;
 - i) that any failure occurred in this software, if any, shall not lead to any serious accident.
 - ii) that the backup and/or fail-safe functions are systematically performed outside the devices in the cases of any failure occurred in this software.
- (2) Mitsubishi Electric assumes no responsibility and liability (including but not limited to, default liability, defect liability, quality assurance responsibility, tort liability, product liability) for the quality, performance, and safety of both this software and products using this software.
- (3) Mitsubishi Electric shall have no responsibility or liability for any problems involving this software and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

INTRODUCTION

Thank you for purchasing MELSOFT MaiLab.

This manual describes the procedures before operation, operation methods, and troubleshooting of MELSOFT MaiLab.

Before using MELSOFT MaiLab, please read this manual and the relevant manuals carefully, and develop familiarity with the functions and performance of this product to handle correctly.

Note that the menu names and operating procedures may differ depending on an operating system in use and its version.

When reading this manual, replace the names and procedures with the applicable ones as necessary.

Please make sure that the end users read this manual.

Model names of supported products

The product model names described in this manual are omitted.

A symbol or number indicating a license form may be in the omitted part.

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RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSOFT MaiLab User's Manual [SH-082446ENG] (this manual)	System configuration, procedure before operation, operation methods, and troubleshooting of MELSOFT MaiLab	PDF

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Analysis	An approach to acquire new information from data. It refers to the whole approach including learning, diagnosis, etc.
Deep learning	A method of machine learning. It constructs a deep layer model on a neural network, which imitates human neural circuits, and makes a highly accurate inference.
Diagnosis	Processing to judge the pass or fail of a target by using a learning model. It means the same as "prediction" or "inference."
Edge computing	An information processing method and area, for not only collecting and analyzing data in production sites in real-time, and feed backing the data, but summarizing the production site data and sharing information with IT systems efficiently with the hardware and software in production sites
Edgecross	An open software platform that coordinates FA and IT in the edge computing area
Edgecross Basic Software	The name of the software product that implements the Edgecross function
Feedback	Processing to return an inference result to FA devices and IT systems by writing data or executing a program
Learning	Processing to create a model to judge the pass or fail by entering data in the statistical method and machine learning method.
Learning model	Output of a data analysis result. The pass or fail of a device can be judged based on this output.
Machine learning	A field of AI. It is technology and methods that enable things that humans naturally do with computers, or a research field to enable them. In addition, it also refers to processing to learn repeatedly from data and find a pattern hidden in the data.
Offline analysis	Processing to perform an analysis by using data of IT systems that are not connected to production sites

Terms for machine learning

■ Basic terms

Term	Synonym	Description
Classification model	—	A learning model that predicts which class (category) a target record will be classified to. It is used in supervised learning.
Explanatory variable	<ul style="list-style-type: none"> • x • Variable • Independent variable • Feature 	A variable required for predicting an objective variable
Learning data	<ul style="list-style-type: none"> • Training data 	Data used for a model to learn. When learning with a data set, it is divided into learning data, validation data, and test data to prepare unknown data for simulation.
Objective variable	<ul style="list-style-type: none"> • y • Dependent variable • Explained variable • External criterion 	A variable to be predicted
Regression model	—	A learning model that predicts what value a target record will be. It is used in supervised learning.
Test data	<ul style="list-style-type: none"> • Evaluation data 	Data used for calculating the model performance after learning. When learning with a data set, it is divided into learning data, validation data, and test data to prepare unknown data for simulation.
Validation data	—	Data used for calculating the model performance while learning. When learning with a data set, it is divided into learning data, validation data, and test data to prepare unknown data for simulation.

■ Evaluation indexes

Term	Synonym	Description
Accuracy	—	An index used for evaluating a classification model. It indicates the rate at which classes are predicted correctly. The range is from zero to one; the closer a value is to one, the higher the accuracy is.
AUC	• Area Under Curve	An index used for evaluating a classification model. It is calculated from the area under an ROC curve (Receiver Operating Characteristic Curve). The range is from zero to one; the closer a value is to one, the higher the accuracy is.
F1 score	• F-value • F-measure	An index used for evaluating a classification model. It is calculated by the harmonic mean of precision and recall. The range is from zero to one; the closer a value is to one, the higher the accuracy is.
LogLoss	• Cross Entropy	An index used for evaluating a classification model. It is calculated based on information theory (entropy). The range is from zero to positive infinity; the smaller a value is, the higher the accuracy is.
MAE	• Mean Absolute Error	An index used for evaluating a regression model. It is calculated by the mean of the absolute values of residuals between measured values and predicted values. The range is from zero to positive infinity; the smaller a value is, the higher the accuracy is.
MAPE	• Mean Absolute Percentage Error	An index used for evaluating a regression model. It is calculated to express MAE as a percentage. The range is from zero to positive infinity; the smaller a value is, the higher the accuracy is.
R2	• Adjusted coefficient of determination	An index used for evaluating a regression model. It indicates the goodness of fit in regression analysis. Maximizing this index is the same as minimizing the RMSE. The range is from negative infinity to one; the closer a value is to one, the higher the accuracy is.
RMSE	• Root Mean Squared Error	An index used for evaluating a regression model. It is calculated by squaring residuals between measured values and predicted values, then taking the square root of their mean. The range is from zero to positive infinity; the smaller a value is, the higher the accuracy is.

PART 1

MELSOFT MaiLab

This part explains MELSOFT MaiLab.

1 MELSOFT MaiLab

2 SYSTEM CONFIGURATION

3 PROCEDURE BEFORE OPERATION

1 MELSOFT MaiLab

MELSOFT MaiLab is an application that analyzes and diagnoses data in production sites by using AI and machine learning. This product supports AIs of not only the statistical methods and similar waveform recognition that are supported by the existing product (Real-time Data Analyzer) but also deep learning, etc.

In addition, compared with the existing product, this product is different in the following points:

- The UI design and operability are renewed to improve usability.
- Learning and diagnosis can be performed on different personal computers.
- This product is a web application; therefore, operations can be performed on a web browser from another environment via a network.

1.1 Data Set, AI, and Task

This section explains the flow to create a data set, AI, and task, then analyze and diagnose data in this product.

1. Let's add a data set!



First, prepare a data set used for creating AI.

1. Creating a data set

Import data to be analyzed into this product to analyze the data and create a diagnosis model.

A group of this imported data is called a data set.

For details on the data set, refer to the following:

☞ Page 78 Data Set

2. Let's create AI!



Next, create AI from the added data set. Creating AI is very easy.

2. Creating an AI

Create a model that derives data patterns and rules automatically and can diagnose unknown data by performing learning with a data set.

This model is called an AI by this product.

For details on the AI, refer to the following:

☞ Page 135 AI

3. Let's create a task!



When creating AI is completed, create a "task", which defines the execution method of AI, and send it to the predictor terminal.

3. Creating a task

Create a group of processing to diagnose unknown data with the created AI.

This group of processing is called a task.

Set an input/output method for data, and a threshold to judge the pass or fail of a diagnosis result.

For details on the task, refer to the following:

☞ Page 203 Task

4. Let's execute!



Finally, activate the task to execute AI.

4. Executing a task

Execute a task, and monitor the diagnosis status for unknown data.

A data flow (whether data flows as intended) and the pass/fail judgment status can be checked by using the monitoring function.

2 SYSTEM CONFIGURATION

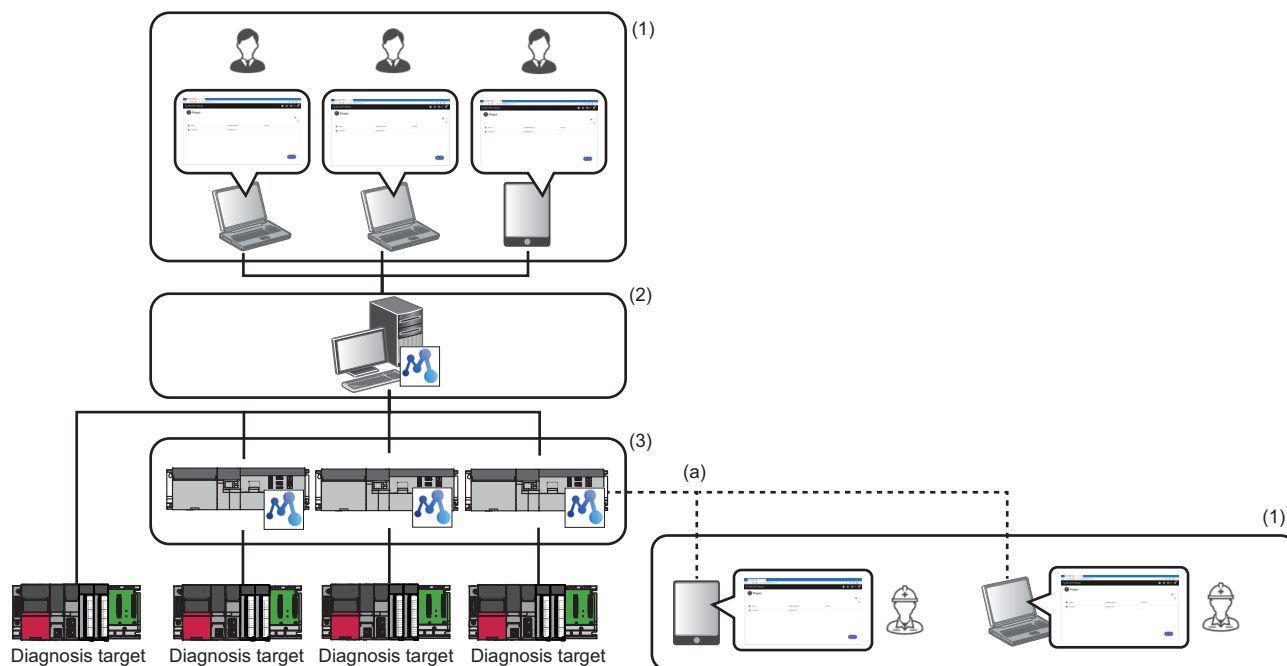
This chapter shows the system configuration and licenses of MELSOFT MaiLab.

2.1 System Configuration

This section shows the system configuration of this product.

Components

This product requires an operation terminal, learning station, and diagnosis terminal.



Device	Description
(1) Operation terminal (personal computer or tablet)	An environment to operate this product or monitor a diagnosis by opening the operation screen of this product in a web browser. Multiple users can operate this product or monitor a diagnosis by preparing multiple environments.*1 In addition, a diagnosis terminal can be accessed directly from an operation terminal, and a task that was sent from the learning station to a diagnosis terminal can be started, stopped, or monitored as (a) shows. Therefore, each operator can perform required operation or monitoring of the status in production sites.
(2) Learning station (personal computer, industrial PC, or server)	An environment to generate a learning model by offline analysis, then send the created model to a diagnosis terminal. Use an installer of this product (for the learning station) to build this environment. The learning station also has the function of a diagnosis terminal shown below.*2
(3) Diagnosis terminal (personal computer, industrial PC, or server)	An environment to diagnose data and feed back the diagnosis result by using a learning model. Use an installer of this product (for a diagnosis terminal) to build this environment. In addition, a diagnosis can be performed and its result can be fed back on multiple diagnosis terminals by preparing multiple environments.*3

*1 To add a user, an additional user license needs to be registered.

☞ Page 21 Licenses

*2 For details, refer to the following:

☞ Page 60 Local host diagnosis terminal

*3 To add a diagnosis terminal, an additional diagnosis license needs to be registered.

☞ Page 21 Licenses

Point

The environment of an operation terminal and learning station/diagnosis terminal can be built on the same personal computer.

Operating environment


The following shows the operating environment required for each device.

Operation terminal

The following table shows the operating environment of an operation terminal.


Item		Description
Personal computer	—	Personal computer or tablet
	CPU	Equivalent to Intel® Core™ i3 or higher
	Required memory	4 GB or more
Web browser		■Personal computer Microsoft Edge® (version: 86 or later) Google Chrome® (version: 87 or later) ■Tablet <ul style="list-style-type: none">• For Windows® Microsoft Edge (version: 86 or later) Google Chrome (version: 87 or later)• For Android™ Mobile Google Chrome (version: 87 or later)• For iOS® Mobile Safari (version: 13 or later)

Precautions

- When the following functions are used, this product may not run properly.
 - Application start-up in Windows compatibility mode
 - Fast user switching
 - Touch function
 - Client Hyper-V
 - Virtual Desktops
 - Tablet mode
 - Multiboot
- In the following cases, the screen of this product may not work properly.
 - A value other than 100% is set for "Change the size of text, apps, and other items" in Windows.
For details, refer to the following:
 Page 548 Display in a web browser
 - The resolution of the screen is changed in operation.
 - The multi-display is set.
- When remote desktop is used, the following cases may occur.
 - Screen update is slow during monitoring or operation due to the network environment (such as speed or load).
 - Some texts or a part of a window get cut due to the screen settings of remote desktop.

Learning station and diagnosis terminal

For the operating environment of the learning station and diagnosis terminal, refer to the following:

 MELSOFT Mailab Installation Instructions

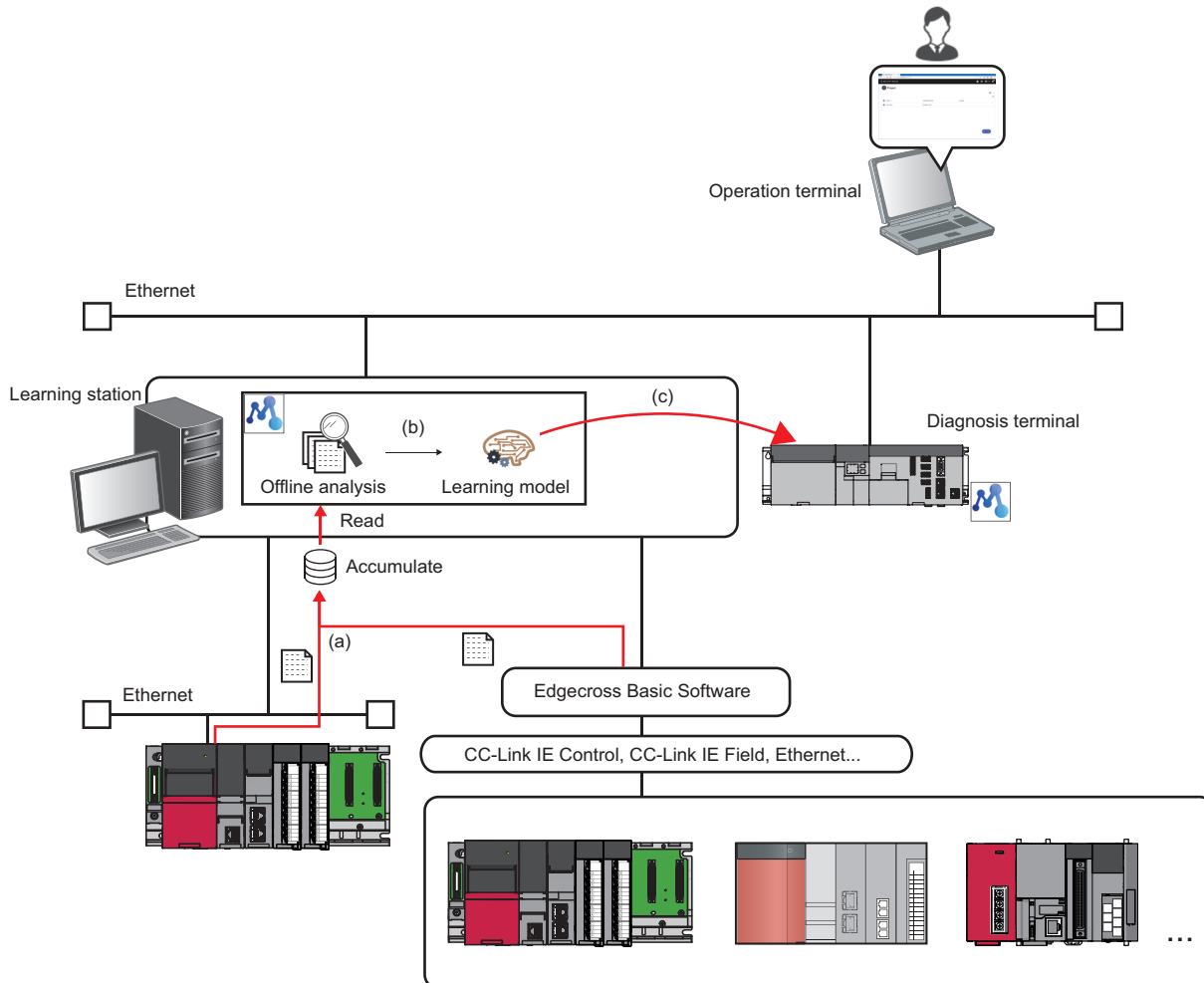
Overall system configuration

The following shows the overall system configuration.

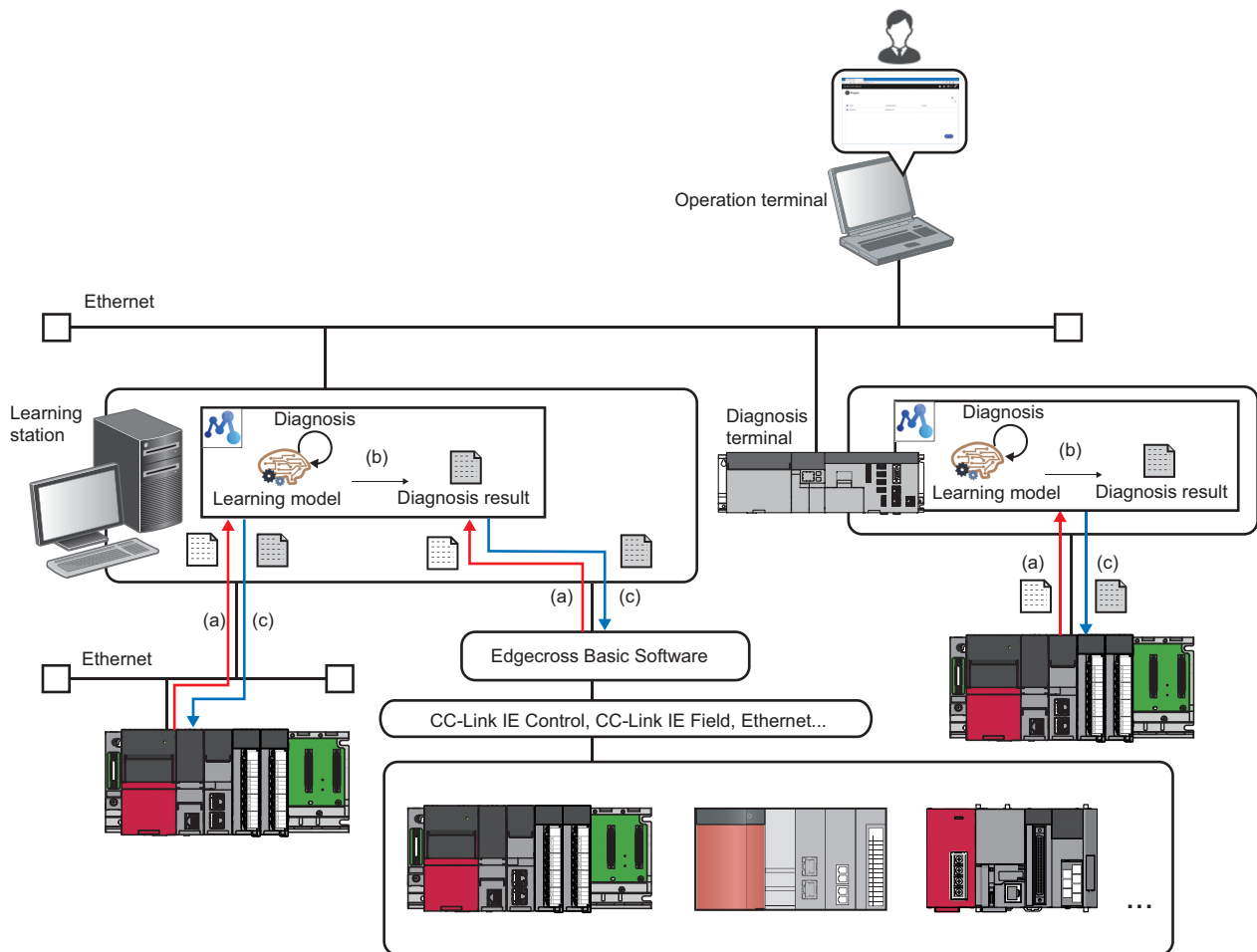
There are the following phases when using this product:

- Learning phase: A phase to perform offline analysis and create a learning model
- Diagnosis phase: A phase to diagnose data with the created learning model

Learning phase



- (a) Data is collected from a programmable controller and Edgecross Basic Software.
- (b) Offline analysis is performed for the data, and a learning model is created.
- (c) The created learning model is sent to a diagnosis terminal.



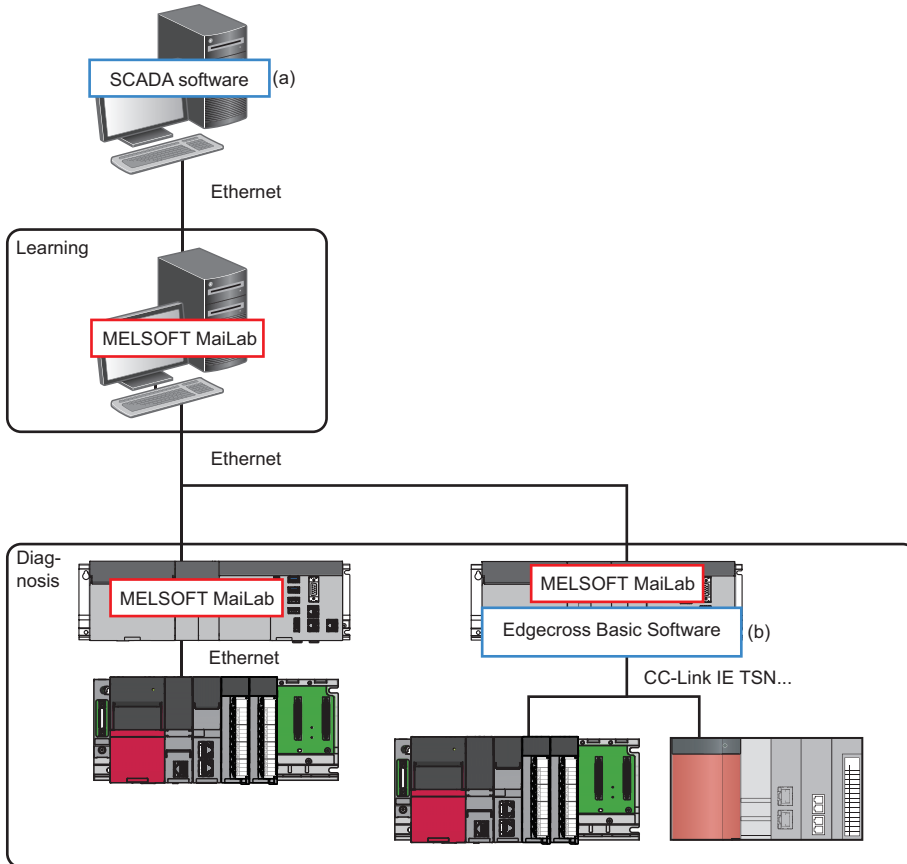
- (a) Data is collected from a programmable controller and Edgecross Basic Software.
- (b) Data is diagnosed by using a created learning model, and the diagnosis result is output.
- (c) The diagnosis result is fed back.

System configuration example for including other software

The following shows the system configuration example considering cooperation with other software.

The CPU and memory usage rates increase while learning; therefore, it is recommended not to use this product with other software for visualizing data, etc. in the same environment.

If it needs to be used in the same environment, prepare a high-performance hardware environment. In addition, when the usage rate of this product increases, stop other products or lower their usage rate.



(a) Data is linked with SCADA software and visualized.

(b) Data is collected in Edgecross Basic Software and diagnosed.

2.2 Licenses

This section shows the licenses of this product.

There are the following types of licenses. Register an additional license as necessary.


License	Description	Maximum number of registrations
Standard license	A license to be registered to use this product. Licenses for one user and one diagnosis terminal (local host only) are included.	1 ^{*1}
Additional user license	A license to be registered to add a user	15
Additional diagnosis license	A license to be registered to add a diagnosis terminal	63
Temporary license	A license provided when installing this product to allow using this product for 30 days. This license can be used temporarily instead of the standard license; however, additional user licenses and additional diagnosis licenses cannot be used with this license.	1 ^{*1}

*1 Only one of either the standard license or temporary license can be registered.

Registration and management method

License Manager is used to register and manage licenses.

For details on License Manager, refer to the following:

 Page 26 License Manager

3 PROCEDURE BEFORE OPERATION

This chapter shows the procedure from start-up to operation of MELSOFT MailLab.

Exclusion setting with antivirus software

Antivirus software may affect the operation of this product. Therefore, exclude the following folders from the monitoring targets in the antivirus software setting:

For the setting method, refer to the manual for each antivirus software.

- Installation folder of this product
- C:\ProgramData\MELSOFT\MaiLab

3.1 Starting Using this Product with the Standard License

This section shows the procedure for starting using this product by registering the standard license.

When a temporary license (one valid for 30 days from the first registration) included in the installer is registered, steps 4 and later can be performed even before obtaining or registering the standard license.

Point

To add a user or diagnosis terminal, refer to the following:

☞ Page 23 Adding a User with an Additional User License

☞ Page 24 Adding a Diagnosis Terminal with an Additional Diagnosis License

—: No operation required

Step	Learning station	Operation terminal
1	Install this product with an installer for the learning station. ☞ MELSOFT MailLab Installation Instructions	—
2	Fill in the required information in the license application form to apply for the standard license. ☞ MELSOFT MailLab License Application Instructions	—
3	Register the standard license in License Manager. ☞ Page 26 License Manager	—
4	—	Open the operation screen of this product. ☞ Page 31 Opening the Operation Screen (Learning Station)
5	—	Register (sign up) the administrative user who uses this product. ☞ Page 51 Signing up
6	—	Create a project. ☞ Page 67 PROJECT CREATION AND MANAGEMENT
7	—	Create a data set. ☞ Page 78 DATA SET CREATION AND MANAGEMENT
8	—	Create an AI. ☞ Page 135 AI CREATION AND MANAGEMENT
9	—	Create a task, and send it to a diagnosis terminal. ☞ Page 203 TASK CREATION AND MANAGEMENT
10	—	Start a task. ☞ Page 228 Starting and Stopping a Task
11	—	Start monitoring. If an error occurs, check the details and take corrective action. ☞ Page 467 MONITOR

Precautions


This product does not support the sleep state of Windows.

If other software is installed in a personal computer, Windows may switch to the sleep state. In this case, review the settings of other software and set the settings to prevent Windows from switching to the sleep state.






3.2 Adding a User with an Additional User License

This section shows the procedure for adding a user by registering an additional user license.

To add a user, perform steps 1 to 5 shown in the following section in advance to be able to sign in as the administrative user.

 Page 22 Starting Using this Product with the Standard License

—: No operation required

Step	Learning station	Operation terminal
1	Fill in the required information in the license application form to apply for the additional user license.  MELSOFT MailLab License Application Instructions	
2	Register an additional user license in License Manager.  Page 26 License Manager	—
3	—	Open the operation screen of this product.  Page 31 Opening the Operation Screen (Learning Station)
4	—	Sign in to this product as the administrative user.  Page 52 Signing in
5	—	Create a user.  Page 53 Creating and Managing Users

After this procedure, the added user can sign in and operate this product by opening the operation screen of this product.

For the operating procedure after sign-in, refer to steps 6 and later shown in the following:

 Page 22 Starting Using this Product with the Standard License

3.3 Adding a Diagnosis Terminal with an Additional Diagnosis License

This section shows the procedure for adding a diagnosis terminal by registering an additional diagnosis license.

To add a diagnosis terminal, perform steps 1 to 5 shown in the following section in advance to be able to sign in as the administrative user.

☞ Page 22 Starting Using this Product with the Standard License

—: No operation required

Step	Diagnosis terminal	Operation terminal
1	Install this product with an installer for a diagnosis terminal. ☞ MELSOFT MailLab Installation Instructions	—
2	Fill in the required information in the license application form to apply for the additional diagnosis license. ☞ MELSOFT MailLab License Application Instructions	
3	Register an additional diagnosis license in License Manager. ☞ Page 26 License Manager	—
4	Switch the operating status of this product to "Running" in the setting management tool. ☞ Page 41 Setting Management Tool (Diagnosis Terminal)	
5	—	Open the operation screen of this product on the learning station. ☞ Page 31 Opening the Operation Screen (Learning Station)
6		Sign in to this product as the administrative user. ☞ Page 52 Signing in
7		Register a diagnosis terminal. ☞ Page 60 Registering and Managing Diagnosis Terminals

After this procedure, a diagnosed can be performed by creating a task on the added diagnosis terminal.

For details on the task and its creation procedure, refer to the following:

☞ Page 203 TASK CREATION AND MANAGEMENT

For other operating procedures, refer to steps 5 and later in the following:

☞ Page 22 Starting Using this Product with the Standard License

For the procedure for accessing a diagnosis terminal directly and monitoring a task created on the diagnosis terminal by starting it, refer to the following:

☞ Page 25 Accessing diagnosis terminal directly

Point

Use the setting management tool to change the operating status and configure the connection settings for this product installed on a diagnosis terminal.

☞ Page 41 Setting Management Tool (Diagnosis Terminal)

Accessing diagnosis terminal directly

The following shows the procedure to access a diagnosis terminal directly and monitor a task created on the diagnosis terminal by starting it.

Operating procedure

- 1.** Open the operation screen of this product on a diagnosis terminal.
☞ Page 34 Opening the Operation Screen (Diagnosis Terminal)
- 2.** Sign in to this product with the user name and password to access the diagnosis terminal.
☞ Page 522 Signing in
- 3.** Start a task.
☞ Page 528 Starting and Stopping a Task
- 4.** Start monitoring.
☞ Page 529 MONITOR

3.4 License Manager

License Manager is used to register and delete licenses of this product or check their status.

For the procedure for registering a license, refer to the following:

☞ Page 30 Procedure for registering a license

To use this product immediately before obtaining the standard license, register a temporary license. This product is available for 30 days from when registering the temporary license. However, the temporary license is available only once per personal computer.

To keep using this product after 30 days, obtain and register the standard license.

For the license types, refer to the following:

☞ Page 21 Licenses

Precautions

- Make sure that the clock setting on Windows is correct before registering a license file for the first time. If the time on Windows is shifted forward or backward for 24 hours or more after a license file is registered, the license authentication will fail.
- The license expires at 0:00:00 on the next day of its expiration date. The license expiration is checked by using UTC time as a standard. Therefore, it is not affected by daylight saving time. (For a temporary license, it will expire on the next day of the date when the license expiration date becomes less than one day (at 0:00:00 in local time).)

License types that can be registered

A license type that can be registered differs depending on the environment of a registration destination. Registering a license that cannot be registered may cause an error.

■For the learning station

The standard license, an additional license, or a temporary license can be registered in License Manager of the learning station.

■For a diagnosis terminal

An additional diagnosis license can be registered in License Manager of a diagnosis terminal.

Startup method

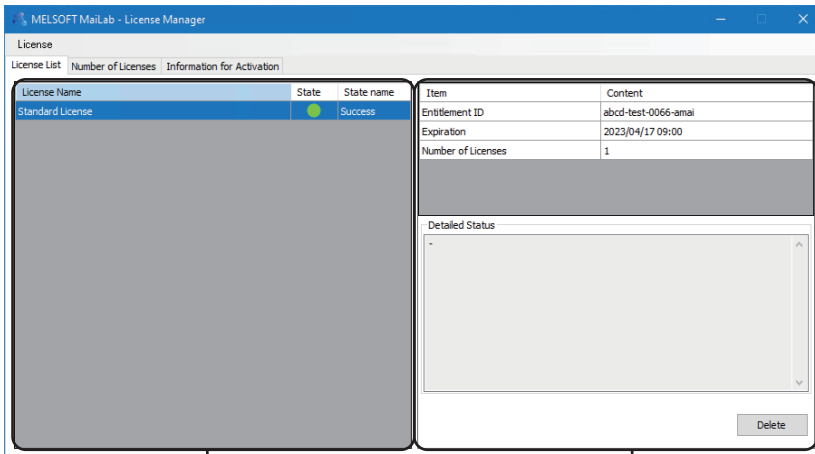
MELSOFT MailLab License Manager can be started from "MELSOFT" in Windows Start.



The display language of License Manager is the same as the language set for the operating system.

Screen configuration

Window



(1)


(2)

(1) License list


(2) Detailed information

Displayed items

■ Menu configuration

Menu item		Description
License	Registration	To register a license file or renew a registered license file. For the procedure for obtaining and registering a license, refer to the following:  Page 30 Procedure for registering a license
	Update	To update the screen.


■ Screen configuration

Item	Description	
[License List] tab	<p>(1) License list</p> <p>Registered licenses are listed with their statuses. *1</p> <p>■ License Name The name of a license is displayed.</p> <p>■ State/State name The status of a license is displayed.</p> <ul style="list-style-type: none"> • "Success": Authentication for a license other than a temporary license succeeded. • "Failure": Authentication failed. • "Temporary": Authentication for a temporary license succeeded. <p>(2) Detailed information</p> <p>The detailed information of a selected license is displayed.</p> <p>■ Entitlement ID The entitlement ID of a license is displayed. "." is displayed in either of the following cases:</p> <ul style="list-style-type: none"> • A temporary license is used. • The entitlement ID cannot be read from a license file. <p>■ Expiration The expiration date of a license is displayed. "." is displayed when the expiration date cannot be read from a license file.</p> <ul style="list-style-type: none"> • Temporary license When more than one day remains, "Days Remaining: XX" (XX: Remaining days - 1) is displayed. When less than one day remains, "Less than 1day" is displayed. Otherwise, "-" is displayed. • Standard license or additional user license The expiration date (local time) is displayed in the format 'YYYY/MM/DD hh:mm.' • Additional diagnosis license "None" is displayed. <p>■ Number of Licenses The number of licenses is displayed. "." is displayed when the number of licenses cannot be read from a license file.</p> <p>■ Detailed Status Error description is displayed when "State name" is "Failure." ( Page 29 Error description) "." is displayed when "State name" is "Success" or "Temporary."</p>	
	[Delete] button	Click this to delete a selected license.*2
[Number of Licenses] tab	<p>The number of licenses is displayed for each license type.</p> <p>■ License Name The name of a license is displayed.</p> <p>■ Authentication Successful The number of authenticated licenses is displayed.</p> <p>■ Total The total number of licenses is displayed.</p>	
[Information for Activation] tab	<p>Hardware code</p> <p>The code created based on the hardware-specific information necessary for application of a license file is displayed.*3</p>	

*1 Multiple selections are not allowed.

*2 A license needs to be deleted when moving its registered license file to another personal computer.

*3 For considerations on the hardware code, refer to the following:

 Page 30 Procedure for registering a license

Error description

The following table shows the error descriptions displayed in "Detailed Status" and the corrective actions when "State name" is "Failure."

Error code	Error description	Cause	Corrective action
210018	There are problems with the license file that is registered.	A license file issued for another personal computer is specified.	Register the correct license file issued for the personal computer in use.
		After registering a license file for the first time to the personal computer in use, the date and time was changed and the time on Windows was shifted before the license issue date and time.	Change the time on Windows to the time after the license issue date and time.
		<ul style="list-style-type: none"> • An Ethernet port or wireless LAN of the personal computer is disabled. • An external Ethernet adapter in use is removed. 	<ul style="list-style-type: none"> • Enable the Ethernet port or wireless LAN of the personal computer. • Connect the external Ethernet adapter.
210026	The Windows time has changed.	<ul style="list-style-type: none"> • After registering a license file for the first time to the personal computer in use, the date and time was changed and the time on Windows was shifted forward or backward for 24 hours or more. • Antivirus software locks a license file temporarily. 	Exclude the following folder from monitoring targets in the antivirus software setting. For the setting method, refer to the manual for each antivirus software. <ul style="list-style-type: none"> • Installation folder of this product If the symptom cannot be solved by the above corrective action, contact your local Mitsubishi Electric sales office or representative.
210037	The license has expired.	The temporary license expired.	Contact your local Mitsubishi Electric sales office or representative to acquire a new license, and register the license.
214109		The standard license or additional user license expired.	
Other error codes	A system error has occurred.	Errors that seems not to occur in actual operation occurred due to an internal operation of the software.	Contact your local Mitsubishi Electric sales office or representative to acquire a new license, and register the license.

Procedure for registering a license

The following shows the procedure for registering a license.

Procedure for registering a temporary license

The following shows the procedure for registering a temporary license.

Operating procedure

1. Select [License] ⇒ [Registration] in the "MELSOFT MaiLab - License Manager" screen.
2. Select 'mailabbasic_temp.elic' stored in the 'TempLicense' folder in the installation folder of this product, and click the [Open] button.

Procedure for registering a license other than a temporary license

The following shows the procedure for registering a license other than a temporary license.

Operating procedure

1. Check the entitlement ID shown in the Entitlement ID Notification.

When renewing the standard license or additional user license, check also the entitlement IDs in use which are displayed in "Entitlement ID" in the [License list] tab in the "MELSOFT MaiLab - License Manager" screen.

2. Check the hardware code displayed in "Hardware code" in the [Information for Activation] tab of the "MELSOFT MaiLab - License Manager" screen of a registration destination.

 Page 26 License types that can be registered

3. Access to the web form for issuing licenses, then enter the following information and apply for the license.

- Entitlement ID
- Entitlement ID in use (only when renewing the standard license and additional user license)
- Hardware code
- User information (company name, customer name, phone number, address, e-mail address, and others)

For the web form for issuing licenses, refer to MELSOFT MaiLab License Application Instructions.

4. Save the license file delivered to the entered e-mail address into a folder of a registration destination.

 Page 26 License types that can be registered

5. Select [License] ⇒ [Registration] in the "MELSOFT MaiLab - License Manager" screen.

Point

When a temporary license is in use, delete the license before registering the standard license.

6. Select the license file saved in step 4, and click the [Open] button.

Precautions

- License authentication may fail if the Ethernet port, which was enabled when checking the hardware code, is disabled after obtaining and registering a license file^{*1}. When checking the hardware code, enable only the Ethernet port which is used all the time while this product is running.

^{*1} It is the same as when removing an external Ethernet adapter or disabling the wireless LAN.

- Be sure to enter the correct e-mail address carefully to receive a license file without fail.
- Do not change the license file extension (.elic).
- Use this product with a temporary license while waiting for a license issuance after the application. If a temporary license expires before obtaining a license, contact your local Mitsubishi Electric sales office or representative to reissue a temporary license.

3.5 Opening the Operation Screen (Learning Station)

This section shows the methods for opening the operation screen of this product on the learning station. (☞ Page 46 OPERATION SCREEN)

When building an operation terminal and the learning station in the same environment

The following shows the procedure to open the operation screen when building an operation terminal and the learning station in the same environment.

The operation screen can be opened by either of the methods shown below:

- From the task tray (☞ Page 31 From the task tray)
- From the setting management tool (☞ Page 31 From the setting management tool)

For the considerations for opening the screen, refer to the following:

☞ Page 33 Considerations

Point


The operation screen opens in a default web browser that is set on Windows.

From the task tray

Right-click the icon of this product from the task tray, and select [Open].

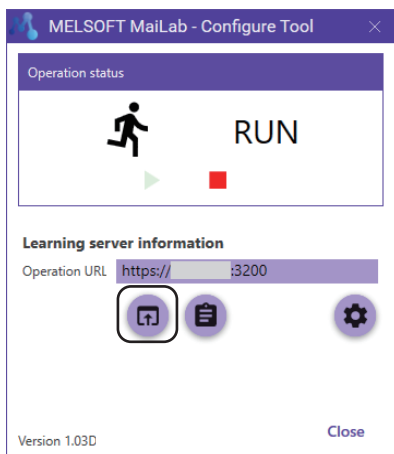
From the setting management tool

Operating procedure

1. Right-click the icon of this product from the task tray, and select [Setting].
2. Click  (Open in browser) in the setting management tool.

For details on the setting management tool, refer to the following:


☞ Page 37 Setting Management Tool (Learning Station)



When building an operation terminal and the learning station in different environments


The following shows the procedure to open the operation screen when building an operation terminal and the learning station in different environments.

For the considerations for opening the screen, refer to the following:

 Page 33 Considerations

Operating procedure

1. Install the server certificate of the learning station on an operation terminal.

 Page 32 Installing a server certificate

Point

- The server certificate must be installed on an operation terminal to connect it to the learning station in secured communication.
Even without the server certificate, operations can be performed in unsecured communication; however, the communication may be disturbed or information may be stolen by a malicious user.
To install the server certificate on an operation terminal with Android or iOS, contact its sales agency for the installation method.
- When the server certificate is already installed, this step is not required.
- The server certificate must be created again after changing the IP address of the learning station. Then, install the server certificate on an operation terminal again.

2. Right-click the icon of this product from the task tray of the learning station, and select [Setting].

3. Enter an operation URL, which is shown in the setting management tool, in the address bar of a web browser on the operation terminal.

For details on the setting management tool, refer to the following:

 Page 37 Setting Management Tool (Learning Station)

Point

An operation URL can be copied to the clipboard by clicking  (Copy to clipboard).

Installing a server certificate

The following shows the procedure for installing the server certificate of the learning station on an operation terminal.

Operating procedure

1. Copy the server certificate folder of the learning station to the operation terminal.

- Server certificate folder: (Installation destination of this product)\MaiLabCert

2. Execute 'install_cert.bat' in the MaiLabCert folder on the operation terminal with an administrator authority.

Closing the operation screen

The operation screen can be closed by closing the browser or tab where the operation screen is opened.

However, if learning is being performed or any tasks (including the scheduled ones) is running, the processing continues in the background even after the operation screen is closed.

To prevent processing from continuing in the background, stop learning or the task before closing the operation screen.

Considerations

The following shows the considerations for opening the operation screen.

- If the operating status of this product is "Stop," the operation screen cannot be opened. In this case, switch the status to "Running" in the setting management tool, then open the operation screen.
- If the port number for this product is used by another application, the operating status of this product is switched to "Stop" and the operation screen cannot be opened. In this case, change the port number and switch the operating status to "Running" in the setting management tool, then open the operation screen. (Another application may be using the port number that is set by default for this product after installation.)

☞ Page 37 Setting Management Tool (Learning Station)

- Depending on a web browser, its translation function may be displayed when the operation screen is opened. To switch the display language, do not use the translation function but use the personal setting screen.

☞ Page 515 PERSONAL SETTINGS

3.6 Opening the Operation Screen (Diagnosis Terminal)

This section shows the methods for opening the operation screen of this product on a diagnosis terminal. (☞ Page 518 OPERATION SCREEN)

When building an operation terminal and a diagnosis terminal in the same environment

The following shows the procedure to open the operation screen when building an operation terminal and a diagnosis terminal in the same environment.

The operation screen can be opened by either of the methods shown below:

- From the task tray (☞ Page 34 From the task tray)
- From the setting management tool (☞ Page 34 From the setting management tool)

For the considerations for opening the screen, refer to the following:

☞ Page 36 Considerations




The operation screen opens in a default web browser that is set on Windows.

From the task tray

Right-click the icon of this product from the task tray, and select [Open].

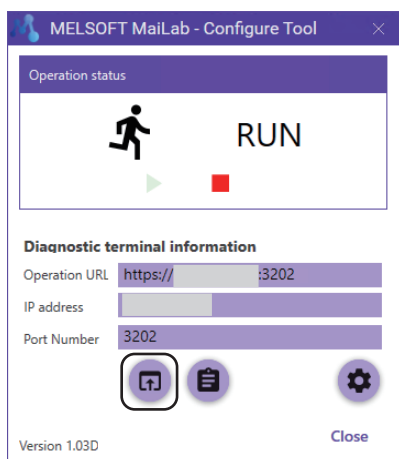
From the setting management tool

Operating procedure

1. Right-click the icon of this product from the task tray, and select [Setting].
2. Click  (Open in browser) in the setting management tool.

For details on the setting management tool, refer to the following:

☞ Page 41 Setting Management Tool (Diagnosis Terminal)



When building an operation terminal and a diagnosis terminal in different environments


The following shows the procedure to open the operation screen when building an operation terminal and a diagnosis terminal in different environments.

For the considerations for opening the screen, refer to the following:

 Page 36 Considerations

Operating procedure

1. Install the server certificate of a diagnosis terminal on an operation terminal.

 Page 35 Installing a server certificate


Point

- The server certificate must be installed on an operation terminal to connect it to a diagnosis terminal in secured communication.
Even without the server certificate, operations can be performed in unsecured communication; however, the communication may be disturbed or information may be stolen by a malicious user.
To install the server certificate on an operation terminal with Android or iOS, contact its sales agency for the installation method.
- When the server certificate is already installed, this step is not required.
- The server certificate must be created again after changing the IP address of a diagnosis terminal. Then, install the server certificate on an operation terminal again.

2. Right-click the icon of this product from the task tray of the diagnosis terminal, and select [Setting].

3. Enter an operation URL, which is shown in the setting management tool, in the address bar of a web browser on the operation terminal.

For details on the setting management tool, refer to the following:

 Page 41 Setting Management Tool (Diagnosis Terminal)

Point

An operation URL can be copied to the clipboard by clicking  (Copy to clipboard).

Installing a server certificate

The following shows the procedure for installing the server certificate of a diagnosis terminal on an operation terminal.

Operating procedure

1. Copy the server certificate folder of a diagnosis terminal to the operation terminal.

- Server certificate folder: (Installation destination of this product)\MaiLabCert

2. Execute 'install_cert.bat' in the MaiLabCert folder on the operation terminal with an administrator authority.

Closing the operation screen

The operation screen can be closed by closing the browser or tab where the operation screen is opened.

However, if any tasks (including the scheduled ones) are running, the processing continues in the background even after the operation screen is closed.

To prevent processing from continuing in the background, stop the task before closing the operation screen.

Considerations

The following shows the considerations for opening the operation screen.

- If the operating status of this product is "Stop," the operation screen cannot be opened. In this case, switch the status to "Running" in the setting management tool, then open the operation screen.
- If the port number for this product is used by another application, the operating status of this product is switched to "Stop" and the operation screen cannot be opened. In this case, change the port number and switch the operating status to "Running" in the setting management tool, then open the operation screen. (Another application may be using the port number that is set by default for this product after installation.)

☞ Page 41 Setting Management Tool (Diagnosis Terminal)

- Depending on a web browser, its translation function may be displayed when the operation screen is opened. To switch the display language, do not use the translation function but use the personal setting screen.

☞ Page 542 PERSONAL SETTINGS



3.7 Setting Management Tool (Learning Station)

This section explains the setting management tool that manages the settings for this product on the learning station. The operating status can be changed and connection settings can be configured.


Startup method

Right-click the icon of this product from the task tray of the learning station, and select [Setting].

Point

- The display language of the setting management tool follows the language setting of the operating system.
- The operating status of this product can be checked with icons.
 - : Operating
 - : Stopped

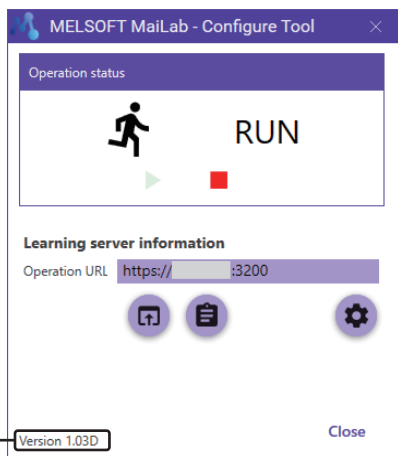
Precautions

The operation screen of this product opens by right-clicking the icon of this product then selecting [Open]. ( Page 46 OPERATION SCREEN)

However, [Open] cannot be selected when the operating status of this product is 'Stopped.'

Screen configuration

Window



(1)

Displayed items

Item	Description	
Operation status	The operating status of this product is displayed. (☞ Page 40 Changing operation status) <ul style="list-style-type: none"> • RUN: This product is running. • STOP: This product is stopped. 	
Learning station information	Operation URL	A URL to open the operation screen of this product is displayed. <ul style="list-style-type: none"> • https://(IP address set in the connection setting screen):(port number set in the connection setting screen)
	(Open in browser)*1	Click this to open the operation screen of this product in a default browser of Windows.
	(Copy to clipboard)	Click this to copy the operation URL to the clipboard.*2
	(Connection Setting)	Click this to configure connection settings. (☞ Page 39 Connection settings) <ul style="list-style-type: none"> ! is displayed if a set value is not available.
(1) Product version	The version of this product is displayed.	

*1 Can be clicked when the operating status is "Running."

*2 After copying the URL, the operation screen can be opened by the following methods:

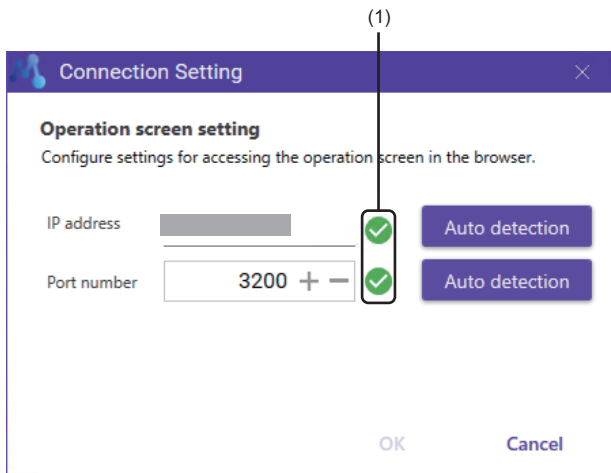
- Pasting the copied URL to the address bar in a web browser, then opening it
- Registering the copied URL as a favorite in a web browser, then opening it from the favorites menu
- Notifying the copied URL from an administrative user to a user, pasting the URL to the address bar in a web browser by a user who receives the notification, then opening it

Connection settings

The following shows the screen for configuring connection settings.

The settings can be configured only when the operating status of this product is "Stop."

Window



3

Displayed items

Item	Description
Operation screen setting	—
IP address	To configure the setting for accessing the operation screen from a web browser.
Port number	Set an IP address (0.0.0.0 to 255.255.255.255). To access from another operation terminal, an IP address accessible from the operation terminal must be set.
(1) Availability	Set a port number (0 to 65535).
[Auto detection] button	Whether the set IP address or port number is available is displayed. <ul style="list-style-type: none"> • : Usable • : Unusable
	<p>■ IP address Click this to set the IP address linked to a computer name as the default. If multiple network adapters are enabled in the operating environment, set the IP address of a network adapter with the highest priority (metric). When the default IP address cannot be acquired, '127.0.0.1' is set.</p> <p>■ Port number Click this to detect unused port numbers in the range of 1024 to 65535 and set the minimum port number among the detected ones.</p>

Changing operation status

The operation status of this product can be switched with ► (Start operation) or ■ (Stop operation).

If a server certificate does not exist when changing the status to "Running," the certificate will be generated.

After the certificate is generated, the following message appears. Click the [Yes] button to install it.



When clicking the [No] button, the processing to start the operation of this product is stopped.

Note that the server certificate must be generated again when the IP address of the learning station is changed. In this case, perform the following procedure:

☞ Page 32 Installing a server certificate



If a server certificate is expired (365 days after it is generated), the certificate is generated again even when it already exists.



3.8 Setting Management Tool (Diagnosis Terminal)

This section explains the setting management tool that manages the settings for this product on a diagnosis terminal. The operating status can be changed and connection settings can be configured.


Startup method

Right-click the icon of this product from the task tray of a diagnosis terminal, and select [Setting].

Point

- The display language of the setting management tool follows the language setting of the operating system.
- The operating status of this product can be checked with icons.
 - : Operating
 - : Stopped

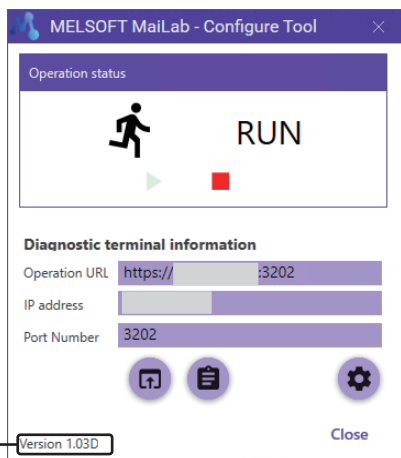
Precautions

The operation screen of this product opens by right-clicking the icon of this product then selecting [Open]. ( Page 518 OPERATION SCREEN)

However, [Open] cannot be selected when the operating status of this product is 'Stopped.'

Screen configuration

Window



Displayed items

Item	Description	
Operation status	The operating status of this product is displayed. (Page 44 Changing operation status) <ul style="list-style-type: none"> • RUN: This product is running. • STOP: This product is stopped. 	
Diagnosis terminal information	Operation URL	A URL to open the operation screen of this product is displayed. <ul style="list-style-type: none"> • https://(IP address set in the connection setting screen):(port number set in the connection setting screen)
	IP address	An IP address set in the connection setting screen is displayed.
	Port Number	A port number set in the connection setting screen is displayed.
	(Open in browser)*1	Click this to open the operation screen of this product in a default browser of Windows.
	(Copy to clipboard)	Click this to copy the operation URL to the clipboard.*2
(Connection Setting)	Click this to configure connection settings. (Page 43 Connection settings) <ul style="list-style-type: none"> ! is displayed if a set value is not available. 	
(1) Product version	The version of this product is displayed.	

*1 Can be clicked when the operating status is "Running."

*2 After copying the URL, the operation screen can be opened by the following methods:

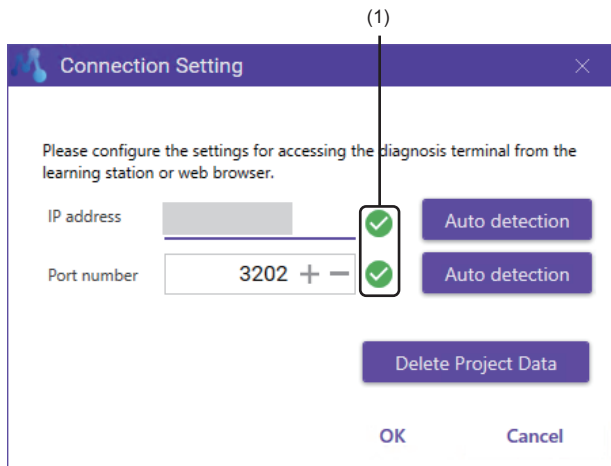
- Pasting the copied URL to the address bar in a web browser, then opening it
- Registering the copied URL as a favorite in a web browser, then opening it from the favorites menu
- Notifying the copied URL from an administrative user to a user, pasting the URL to the address bar in a web browser by a user who receives the notification, then opening it

Connection settings

The following shows the screen for configuring connection settings.

The settings can be configured only when the operating status of this product is "Stop."

Window



3

Displayed items

Item	Description
IP address	Set an IP address (0.0.0.0 to 255.255.255.255).
Port number	Set a port number (0 to 65535).
(1) Availability	Whether the set IP address or port number is available is displayed. <ul style="list-style-type: none"> • : Usable • : Unusable
[Auto detection] button	<p>■ IP address Click this to set the IP address linked to a computer name as the default. If multiple network adapters are enabled in the operating environment, set the IP address of a network adapter with the highest priority (metric). When the default IP address cannot be acquired, '127.0.0.1' is set.</p> <p>■ Port number Click this to detect unused port numbers in the range of 1024 to 65535 and set the minimum port number among the detected ones.</p>
[Delete Project Data] button	Click this to delete project data.

Changing operation status

The operation status of this product can be switched with ► (Start operation) or ■ (Stop operation).
If a server certificate does not exist when changing the status to "Running," the certificate will be generated.
After the certificate is generated, the following message appears. Click the [Yes] button to install it.



When clicking the [No] button, the processing to start the operation of this product is stopped.
Note that the server certificate must be generated again when the IP address of the learning station is changed. In this case, perform the following procedure:

☞ Page 32 Installing a server certificate



If a server certificate is expired (365 days after it is generated), the certificate is generated again even when it already exists.

PART 2

OPERATION METHOD (LEARNING STATION)

This part explains the operation methods of MELSOFT MaiLab on the learning station.

4 OPERATION SCREEN

5 USER AND DIAGNOSIS TERMINAL MANAGEMENT

6 PROJECT CREATION AND MANAGEMENT

7 DATA SET CREATION AND MANAGEMENT

8 AI CREATION AND MANAGEMENT

9 TASK CREATION AND MANAGEMENT

10 EXTENSION BLOCK SETTINGS

11 MONITOR

12 EVENT LOG CHECK

13 PERSONAL SETTINGS

4 OPERATION SCREEN

This chapter shows the operation screen of MELSOFT MaiLab.

For the procedure for opening the operation screen, refer to the following:

☞ Page 31 Opening the Operation Screen (Learning Station)

Window

■ Before signing up/signing in

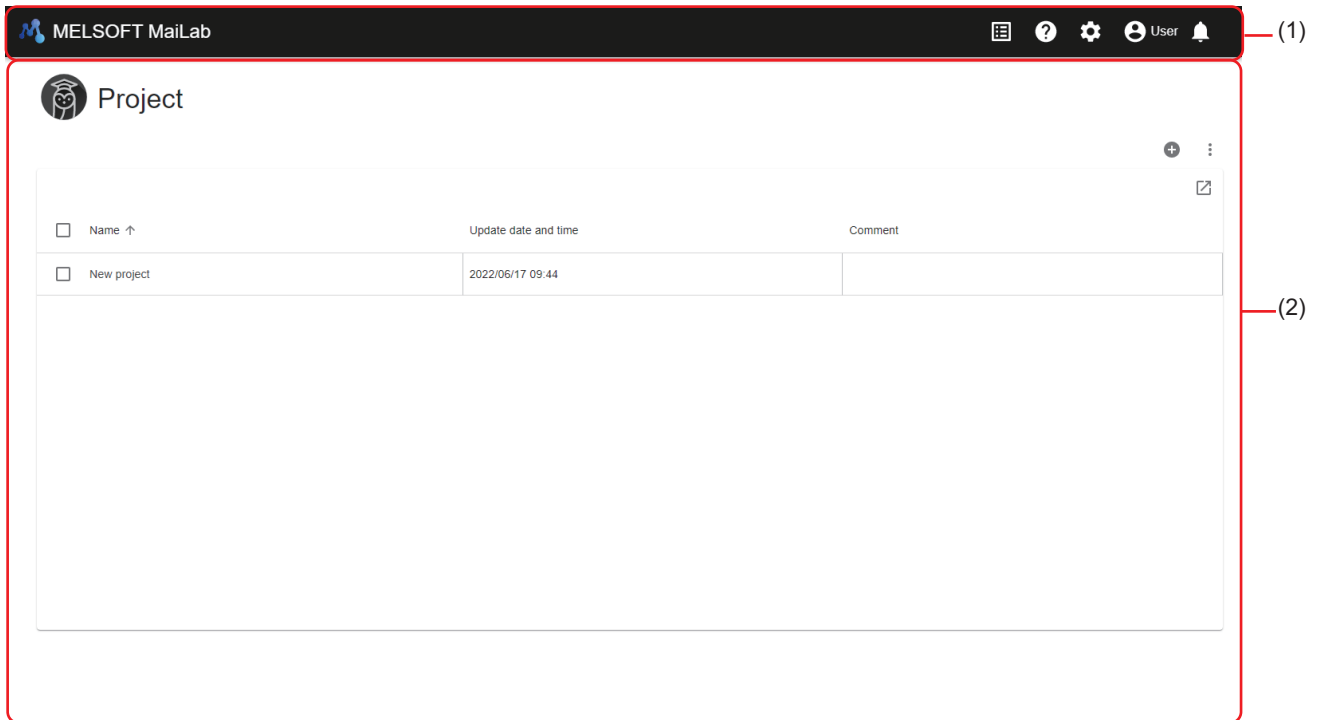
☞ Page 51 Signing up

☞ Page 52 Signing in

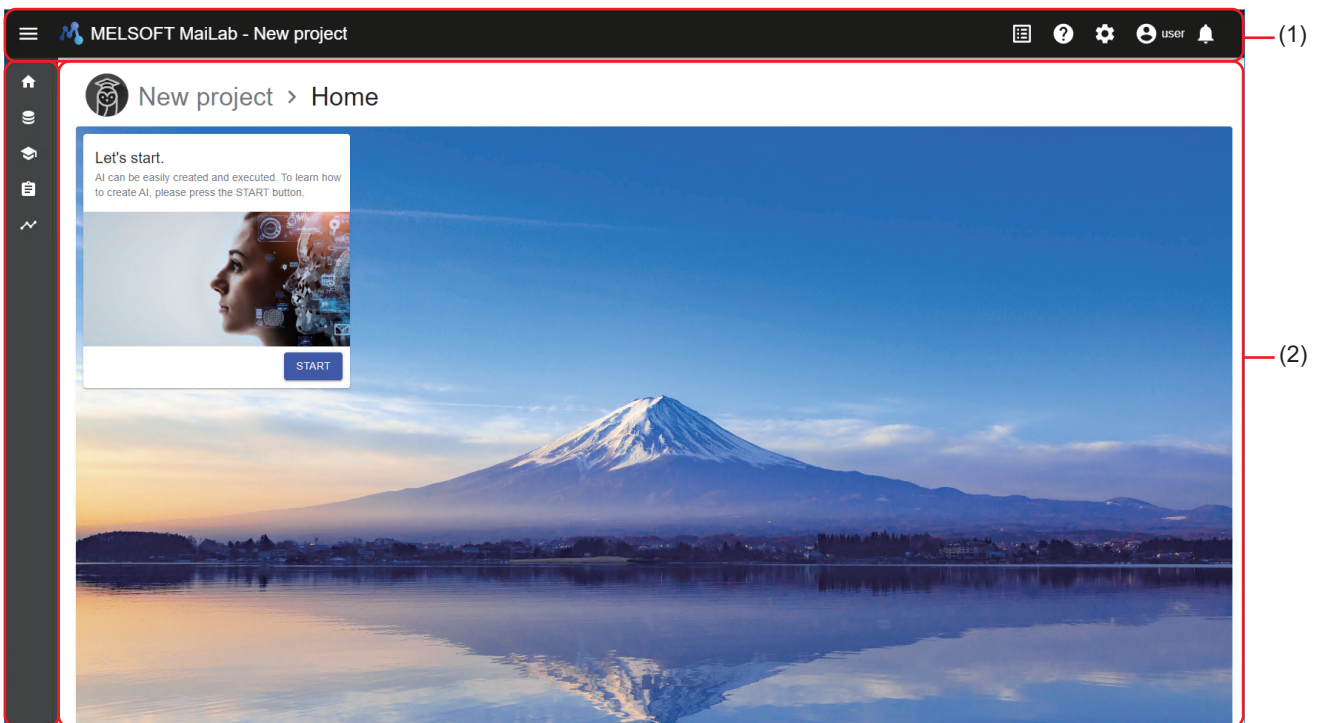


■After signing up/signing in

- When a project is closed



- When a project is opened

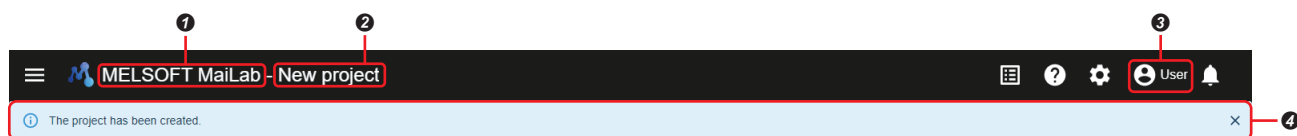


(3)

- (1) Main bar (☞ Page 48 Main bar)
- (2) Setting screen (☞ Page 48 Setting screen)
- (3) Side bar (☞ Page 49 Side bar)

Displayed items

■ Main bar



Item	Description
(Expand/Collapse)	Click this to expand or collapse the side bar when a project is opened. ☞ Page 49 Side bar
① Product name	"MELSOFT MailLab" is displayed. The project management screen is displayed by clicking the name.*1 ☞ Page 69 Project Management Screen
② Project name	A project name is displayed when a project is opened The project is closed and the project management screen is displayed by clicking the name. ☞ Page 69 Project Management Screen
(Project management)	Click this to display the project management screen.*1 ☞ Page 69 Project Management Screen
(Help)	Click this to display the help menu. <ul style="list-style-type: none"> • Open manual: To display the manual for this product in another tab • Connect to MITSUBISHI ELECTRIC FA Global Website: To display the MITSUBISHI ELECTRIC FA Global website in another tab*2
(Setting)	Click this to display the setting menu. <ul style="list-style-type: none"> • Manage users: To display the user management screen*1 (☞ Page 54 User management screen) • Manage diagnosis terminal: To display the diagnosis terminal management screen*1 (☞ Page 61 Diagnosis terminal management screen)
③ User name	The name of a signed-in user is displayed. The user menu is displayed by clicking the name. <ul style="list-style-type: none"> • User setting: To display the personal setting screen*1 (☞ Page 515 PERSONAL SETTINGS) • Sign out: To sign out and display the sign-in screen (☞ Page 52 Signing in)
(Notify)	Notifications for events that occur in data sets, AIs, and tasks are displayed. (Up to 100 notifications) ☞ Page 49 Notification list The number of notifications is displayed on the upper right of this button. (If there are 100 or more notifications, "+99" is displayed.)
④ Overall notification	Notifications for events on the system that affect the entire product, such as license information, are displayed. (Up to 10 notifications) Only the ones that occur in projects that a signed-in user can access are displayed. If the number of notifications exceeds 10, they are deleted in chronological order. <ul style="list-style-type: none"> • : Information • : Warning • : Error The event log screen is displayed in another tab by clicking a notification.*3*4 ☞ Page 511 EVENT LOG CHECK A notification is deleted by clicking .

*1 A project will be closed if it is opened.

*2 When setting Simplified Chinese for a display language, the MITSUBISHI ELECTRIC FA Global website is displayed in English.

*3 A clicked notification will be deleted.

*4 When the corresponding event exists, the event log screen is displayed with the event selected and also the details on the event displayed.

■ Setting screen

Various setting screens are displayed.

■ Side bar

The side bar is displayed when a project is opened.

Item	Description
(Home)	Click this to display the home screen. Page 76 Home screen
(Data set)	Click this to display the data set management screen. Page 86 Data Set Management Screen
(AI)	Click this to display the AI management screen. Page 137 AI Management Screen
(Task)	Click this to display the task management screen. Page 207 Task Management Screen is displayed when an unassigned task (Page 204 Tasks added by importing a project) exists. In this case, assign the task to a diagnosis terminal in the task management screen.
(Monitor)	Click this to display the diagnosis terminal list screen. Page 471 Diagnosis Terminal List Screen

Notification list

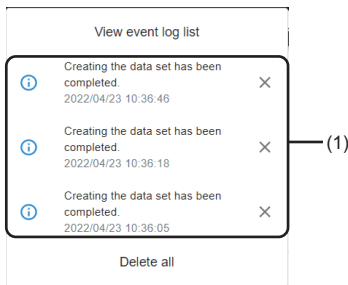
Notifications for events that occur in data sets, AIs, and tasks are displayed. (Up to 100 notifications)

Only the ones that occur in projects that a signed-in user can access are displayed.

When the number of notifications exceeds 100, up to 100 notifications are displayed from the newest one.

Window

Click (Notify) on the main bar. (Page 48 Main bar)



Displayed items

Item	Description
[View event log list] button	Click this to display the event log screen in another tab. Page 511 EVENT LOG CHECK
(1) Notification list	Notifications are listed. <ul style="list-style-type: none"> : Information : Warning : Error The event log screen is displayed in another tab by clicking a notification.*1*2 Page 511 EVENT LOG CHECK A notification is deleted by clicking (Delete).
[Delete all] button	Click this to delete all notifications.

*1 A clicked notification will be deleted.

*2 When the corresponding event exists, the event log screen is displayed with the event selected and also the details on the event displayed.

Precautions

- For a standard user, the following events are displayed in the notification list if the user is signed in when the event occurs or if the user performs the corresponding operation. However, these events will not be displayed after refreshing the web browser or when signing in the next time because the user no longer has the right.
 - Event for the deletion of a project
 - Event for a change in the access right to the operation target project (loss of the access right)
- Even if the connection status of a diagnosis terminal is changed from "Disconnect" to "Connect" while the main bar is

displayed, events that occur while the status is "Disconnect" are not displayed in the notification list. To acquire the notification list of all the diagnosis terminals being connected, refresh the web browser.

- When the connection status of a diagnosis terminal is "Disconnect," a notification can be deleted only on the screen. However, the notification itself is not deleted and displayed when connected in the next time.
- When all notifications are deleted, notifications exceeding the maximum number to be displayed are also deleted.
- When notifications are deleted one by one, notifications exceeding the maximum number to be displayed are not displayed on the screen. To display these notifications, refresh the web browser.

4.1 Signing up

This section shows the screen for registering (signing up) the administrative user*¹ who uses this product by entering a user name and password.

*¹ For details on the administrative user, refer to the following:

☞ Page 53 User types

After sign-up, the project management screen is displayed with the create new project screen displayed.

☞ Page 69 Project Management Screen

☞ Page 72 Creating a New Project

Window



Displayed items

Item	Description
User name	Enter a user name (up to 128 characters). ^{*1}
Password	Enter a password (8 to 64 characters).
Check password	Enter the password again for verification.
[Sign up] button	Click this to sign up for this product as the administrative user who uses this product with the entered user name and password.

*¹ Alphabetical characters are case-sensitive.

Point

- This screen is displayed when starting this product for the first time (when the administrative user is not registered). From the next time (after the administrative user is registered), the sign-in screen is displayed.

☞ Page 52 Signing in


- When user information is signed up, a user is signed in to this product. A user remains signed in for 24 hours from the last operation.

- To add more users, create users in the user management screen after sign-in.

☞ Page 54 User management screen

4.2 Signing in

This section shows the screen for signing in to this product by entering a user name and password. After sign-in, the project management screen is displayed.

 Page 69 Project Management Screen

Window



Displayed items

Item	Description
User name	Enter a user name (up to 128 characters). ^{*1}
Password	Enter a password (8 to 64 characters).
[Sign in] button	Click this to sign in to this product with the entered user name and password.

*1 Alphabetical characters are case-sensitive.

Point

- A user remains signed in for 24 hours from the last operation.
- When a signed-in user is already signed in in another environment (another personal computer or another web browser), sign-in in a new environment is enabled and the user is signed out in another environment.
- If the function to save passwords is enabled in a browser, a password entered in another setting screen of this product may be displayed.

5 USER AND DIAGNOSIS TERMINAL MANAGEMENT


This chapter shows the methods for managing users who use this product and diagnosis terminals that perform a diagnosis.

5.1 Creating and Managing Users

This section shows the method for creating and managing users who use this product.


Sign in to this product as the administrative user to create or delete a user, or to change properties.

For the procedure for creating a user, refer to the following:

 Page 58 Creating a new user

User types

There are two types of users: administrative user and standard user.

Type	Description	License to be assigned	Creation and deletion
Administrative user	A user who can access all projects and has administrative rights. Operations such as creation/registration/deletion can be performed in the user management screen and diagnosis terminal management screen.*1	Standard license (One license and one user only)	<p>■Creation Register the administrative user in the sign-up screen displayed when starting this product for the first time.  Page 51 Signing up</p> <p>■Deletion Once the administrative user is registered, the user cannot be deleted. By deleting data as well when uninstalling this product, all data including the information of the administrative user can be deleted.</p>
Standard user	A user who can access specific projects. Only browsing is allowed in the user management screen and diagnosis terminal management screen.*2	Additional user license (Users can be created for the number of licenses)	<p>■Creation and deletion Sign in to this product as the administrative user, and create or delete a user in the user management screen.</p>

*1 The license assigned to the administrative user cannot be changed.

*2 The password of a signed-in user can be changed in the personal settings.

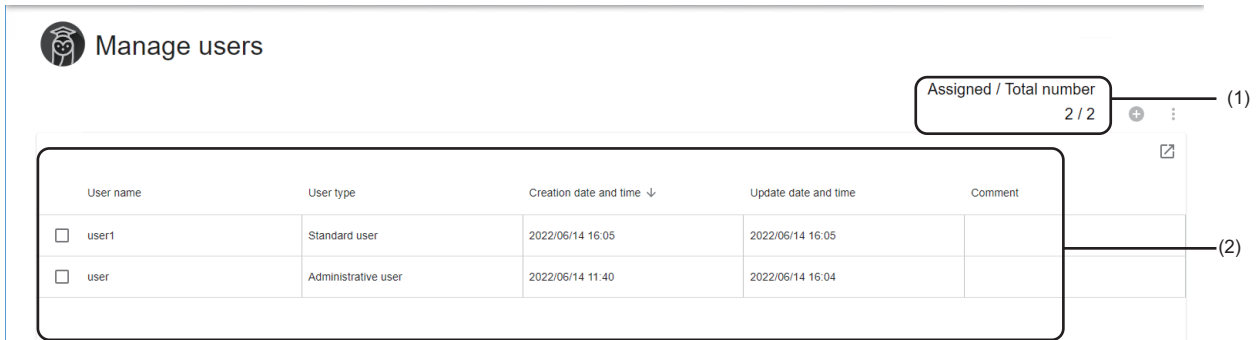
 Page 515 PERSONAL SETTINGS

User management screen
















The following shows the user management screen for creating and managing users.

Window

Click  (Setting) on the main bar, and select [Manage users]. ( Page 48 Main bar)



Displayed items



Item	Description																		
(1) Number of licenses	The total number of registered licenses and the number of those assigned to users are displayed. (The standard license is also included.)																		
 (Create new) ^{*1*2}	Click this to create a new user.  Page 58 Creating a new user																		
 (Menu) ^{*1*3*4}	<table border="1"> <tr> <td>Delete</td> <td>To delete a selected user.</td> </tr> <tr> <td>Property</td> <td>To change the following properties of a selected user. ( Page 55 Changing properties) - Name - Entitlement ID - Password - Comment</td> </tr> </table>	Delete	To delete a selected user.	Property	To change the following properties of a selected user. ( Page 55 Changing properties) - Name - Entitlement ID - Password - Comment														
Delete	To delete a selected user.																		
Property	To change the following properties of a selected user. ( Page 55 Changing properties) - Name - Entitlement ID - Password - Comment																		
(2) User list	<table border="1"> <tr> <td>—</td> <td>Users are listed. Multiple users cannot be selected. In addition, the line for a user with no valid license is grayed out.</td> </tr> <tr> <td> (Expand)/ — (Collapse)</td> <td>Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header</td> </tr> <tr> <td>User name</td> <td>A user name is displayed.</td> </tr> <tr> <td>User type</td> <td>A user type is displayed.  Page 53 User types</td> </tr> <tr> <td>Creation date and time</td> <td>The date and time when a user was created is displayed.</td> </tr> <tr> <td>Update date and time</td> <td>The date and time when user information was updated is displayed.</td> </tr> <tr> <td>Entitlement ID^{*5}</td> <td>The entitlement ID of an assigned license is displayed.^{*6}</td> </tr> <tr> <td>Expiration date^{*5}</td> <td>The expiration date of an assigned license is displayed.</td> </tr> <tr> <td>Comment</td> <td>A set comment is displayed.</td> </tr> </table>	—	Users are listed. Multiple users cannot be selected. In addition, the line for a user with no valid license is grayed out.	 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header	User name	A user name is displayed.	User type	A user type is displayed.  Page 53 User types	Creation date and time	The date and time when a user was created is displayed.	Update date and time	The date and time when user information was updated is displayed.	Entitlement ID ^{*5}	The entitlement ID of an assigned license is displayed. ^{*6}	Expiration date ^{*5}	The expiration date of an assigned license is displayed.	Comment	A set comment is displayed.
—	Users are listed. Multiple users cannot be selected. In addition, the line for a user with no valid license is grayed out.																		
 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header																		
User name	A user name is displayed.																		
User type	A user type is displayed.  Page 53 User types																		
Creation date and time	The date and time when a user was created is displayed.																		
Update date and time	The date and time when user information was updated is displayed.																		
Entitlement ID ^{*5}	The entitlement ID of an assigned license is displayed. ^{*6}																		
Expiration date ^{*5}	The expiration date of an assigned license is displayed.																		
Comment	A set comment is displayed.																		

*1 Displayed only when signing in as the administrative user.

*2 Can be clicked when both of the following conditions are satisfied:
- There is an additional user license that a user is not assigned to yet.
- A temporary license is not used.

*3 Can be clicked when selecting a user.

*4 The context menu can be displayed also by right-clicking on the user list when signing in as the administrative user.

*5 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.
 Page 56 Switching to show or hide

*6 "-" is displayed for a temporary license.

Changing properties

The following properties of a user can be changed:

- Name
- Entitlement ID
- Password
- Comment

Operating procedure

1. Select a user in the user management screen. (☞ Page 54 User management screen)
2. Click ☰ (Menu), and select [Property].

User name	User type	Creation date and time ↓	Update date and time	Comment
<input checked="" type="checkbox"/> New user	Standard user	2022/04/23 10:46	2022/04/23 10:46	
<input type="checkbox"/> user	Administrative user	2022/04/23 09:44	2022/04/23 10:42	

3. Configure various settings.

Item	Description
Name	Set a new user name (up to 128 characters). ^{*1}
Entitlement ID	The entitlement ID of a license assigned to a user is displayed. The entitlement ID selection screen appears by clicking the [Select] button, and the entitlement ID of a license to be assigned to a user can be selected. ^{*2} (☞ Page 59 Selecting an entitlement ID)
Change password	Select the checkbox to change a password.
Password	Set a new password (8 to 64 characters).
Check password	Enter the password again for verification.
Comment	Set a new comment (up to 1024 characters).

*1 Alphabetical characters are case-sensitive.

*2 A license assigned to the administrative user cannot be changed. Only a license (additional user license) assigned to a standard user can be changed. (☞ Page 53 User types)

4. Click the [OK] button.

Point

- When a user name is changed, it is updated when a target user reloads the screen or re-signs in if the user is signed in.
- When a password is changed, a target user is signed out if the user is signed in.

Expanding the header

The following operations can be performed by expanding the header.

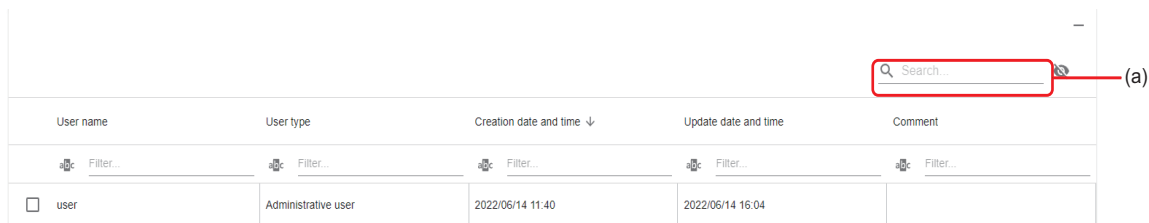
- Searching (🔍 Page 56 Searching)
- Switching to show or hide (🔍 Page 56 Switching to show or hide)
- Filtering (🔍 Page 57 Filtering)

■ Searching

Lines including an entered character string can be searched for. (Characters are not case-sensitive.)

Data in all columns is searched including hidden columns.

Ex.



User name	User type	Creation date and time ↓	Update date and time	Comment
<input type="checkbox"/> user	Administrative user	2022/06/14 11:40	2022/06/14 16:04	

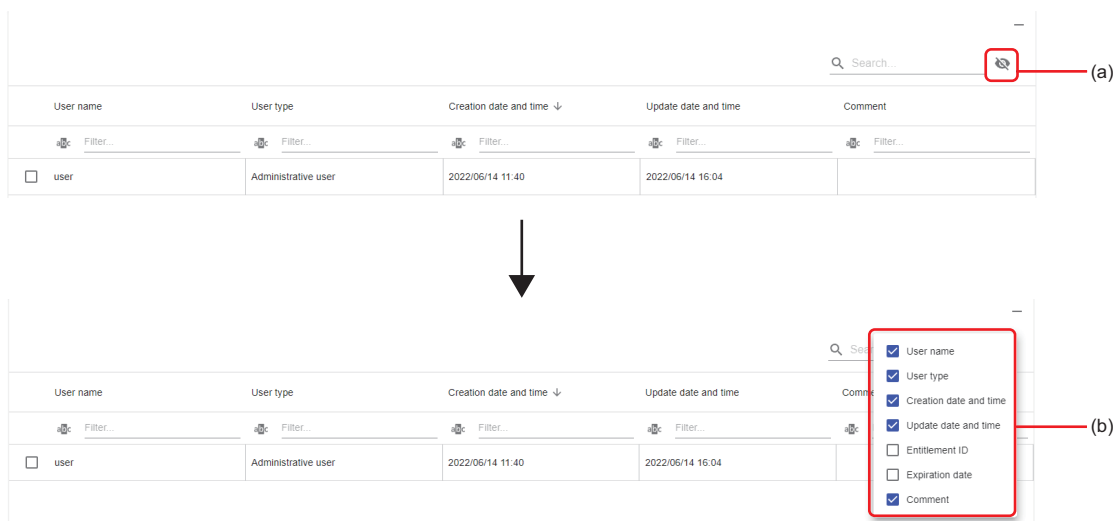
(a) Enter a character string.

■ Switching to show or hide

A column can be shown or hidden.

Select the checkboxes of columns to be shown, and unselect the ones to be hidden.

Ex.



User name	User type	Creation date and time ↓	Update date and time	Comment
<input type="checkbox"/> user	Administrative user	2022/06/14 11:40	2022/06/14 16:04	

(a) Click .

(b) Select the checkbox of a column to be shown, and unselect the one to be hidden.

■Filtering

Lines can be filtered by setting a condition and character string. (Characters are not case-sensitive.)

Ex.

(a) Click .

(b) Specify a condition.

(c) Enter a character string.

User name	User type	Creation date and time ↓	Update date and time	Comment
Filter...	Filter...	Filter...	Filter...	Filter...
<input type="checkbox"/> user	Administrative user	2022/06/14 11:40	2022/06/14 16:04	

User name	User type	Creation date and time ↓	Update date and time	Comment
Contains the specified value Does not contain the specified value Starts with the specified value Ends with the specified value Equals the specified value Does not equal the specified value	Filter...	Filter...	Filter...	Filter...
<input type="checkbox"/>	Administrative user	2022/06/14 11:40	2022/06/14 16:04	

User name	User type	Creation date and time ↓	Update date and time	Comment
user	Filter...	Filter...	Filter...	Filter...
<input type="checkbox"/> user	Administrative user	2022/06/14 11:40	2022/06/14 16:04	

Creating a new user

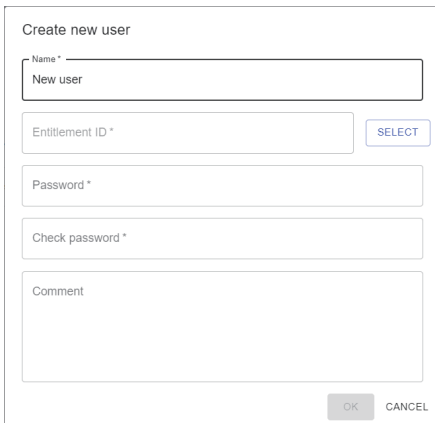
The following shows the procedure for creating a new user.

Registering an additional user license is required to create a new user. If an additional user license is not registered, a new user cannot be created. (☞ Page 26 License Manager)

Up to 16 users can be created including the administrative user. (☞ Page 53 User types)

Operating procedure

1. Click **+** (Create new) in the user management screen. (☞ Page 54 User management screen)
2. Configure various settings.



Item	Description
Name	Set a user name (up to 128 characters). ^{*1}
Entitlement ID	The entitlement ID of an additional user license assigned is displayed. The entitlement ID selection screen appears by clicking the [Select] button, and the entitlement ID of a license to be assigned to a user can be selected. (☞ Page 59 Selecting an entitlement ID)
Password	Set a password (8 to 64 characters).
Check password	Enter the password again for verification.
Comment	Set a comment (up to 1024 characters).

*1 Alphabetical characters are case-sensitive.

3. Click the [OK] button.

Point

Contents set in this screen can be changed in the user property screen.

☞ Page 55 Changing properties

Selecting an entitlement ID

The following shows the screen for selecting the entitlement ID of a license to be assigned.

Valid registered licenses are displayed.

Window

Entitlement ID ↑	Expiration date
<input type="checkbox"/> abcd-test-0123-bmai	2023/04/17 18:00

5

Displayed items

Item	Description
(Expand) / – (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
Entitlement ID	The entitlement ID of a license is displayed.
Expiration date	The expiration date of a license is displayed.

5.2 Registering and Managing Diagnosis Terminals

This section shows the method for registering and managing diagnosis terminals that perform a diagnosis.

Sign in to this product as the administrative user^{*1} to register or unregister a diagnosis terminal, or to change properties.

*1 For details on the administrative user, refer to the following:

☞ Page 53 User types

For the procedure for registering a diagnosis terminal, refer to the following:

☞ Page 65 Registering a new diagnosis terminal

Local host diagnosis terminal

The learning station also has the function of a diagnosis terminal, which is to perform a diagnosis and feed back its result.

This function embedded on the learning station is called the local host diagnosis terminal, and it is registered as one of diagnosis terminals as shown in the following table:



Item	Description
Diagnosis terminal name	Localhost diagnosis terminal
Address	IP address of the learning station:3201 ^{*1}
Comment	Blank

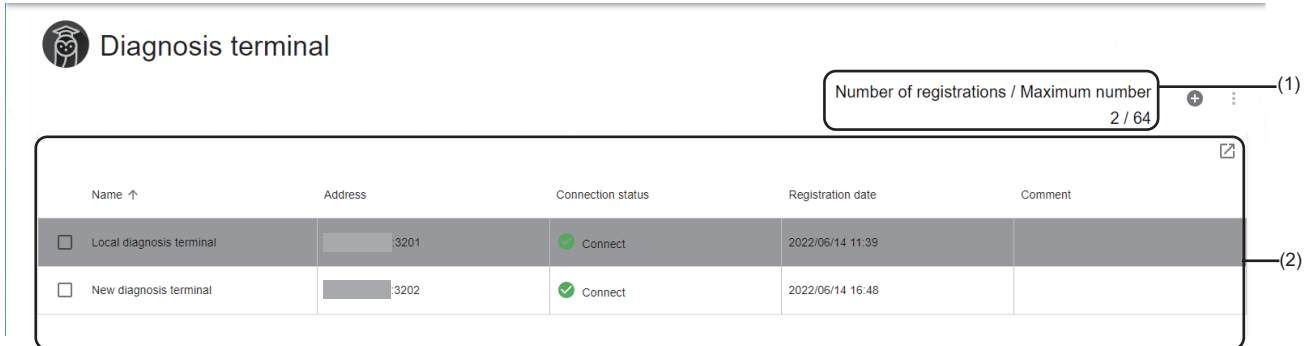
*1 The port number of the local host diagnosis terminal is fixed to 3201.

Diagnosis terminal management screen









The following shows the diagnosis terminal management screen for registering and managing diagnosis terminals.


Window

Click  (Setting) on the main bar, and select [Manage diagnosis terminal]. ( Page 48 Main bar)




Displayed items


Item	Description	
(1) Number of diagnosis terminals	The number of registered diagnosis terminals and the maximum number of diagnosis terminals that can be registered are displayed.	
 (Register) ^{*1*2}	Click this to register a new diagnosis terminal.  Page 65 Registering a new diagnosis terminal	
 (Menu) ^{*1*3*4}	Unregister ^{*5}	To unregister a selected diagnosis terminal.
	Property ^{*6}	To change the following properties of a selected diagnosis terminal. ( Page 63 Changing properties) - Name - User name to access a diagnosis terminal - Password to access a diagnosis terminal - Comment
(2) Diagnosis terminal list	—	Diagnosis terminals are listed. Multiple diagnosis terminals cannot be selected. In addition, the lines for the following diagnosis terminals are grayed out: • Local host diagnosis terminal ( Page 60 Local host diagnosis terminal) • Diagnosis terminal with no valid license
	 (Expand)/  (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
	Name	A diagnosis terminal name is displayed.
	Address	The address of a diagnosis terminal is displayed in either of the following formats: • IP address:port number • Host name:port number
	Connection status	The connection status of a diagnosis terminal is displayed. • Connect: The diagnosis terminal is connected. • Disconnect: The diagnosis terminal is not connected.
	Registration date and time	The date and time when a diagnosis terminal was registered is displayed.
	Comment	A set comment is displayed.

*1 Displayed only when signing in as the administrative user. ( Page 53 User types)


*2 Can be clicked when not using a temporary license.

*3 Can be clicked when selecting a diagnosis terminal.

*4 The context menu can be displayed also by right-clicking on the diagnosis terminal list when signing in as the administrative user. ( Page 53 User types)

*5 Can be selected when a selected diagnosis terminal is not the local host diagnosis terminal. ( Page 60 Local host diagnosis terminal)

*6 Can be selected when both of the following conditions are satisfied:

- A selected diagnosis terminal is not the local host diagnosis terminal. ( Page 60 Local host diagnosis terminal)
- A selected diagnosis terminal is connected.

Precautions

If a diagnosis terminal is unregistered while its task is running, the task will not run properly after the diagnosis terminal is registered again.


Stop a task before unregistering a diagnosis terminal.

Changing properties

The following properties of a selected diagnosis terminal can be changed.

- Name
- User name to access a diagnosis terminal
- Password to access a diagnosis terminal
- Comment

Operating procedure

1. Select a diagnosis terminal in the diagnosis terminal management screen. (☞ Page 61 Diagnosis terminal management screen)
2. Click  (Menu), and select [Property].

Name ↑	Address	Connection status	Registration date	Comment
<input type="checkbox"/> Local diagnosis terminal	:3201	Connect	2022/06/14 11:39	
<input checked="" type="checkbox"/> New diagnosis terminal	:3202	Connect	2022/06/14 16:48	


Number of registrations / Maximum number 2

Unregister
Property

3. Configure various settings.

Diagnosis terminal property

Name *

Sign-in information 

User name *

Change password

Item	Description
Name	Set a new diagnosis terminal name (up to 128 characters).
User name	Set a new user name to access a diagnosis terminal (up to 128 characters). ^{*1}
Change password	Select the checkbox to change a password. ^{*1}
New password	Set a new password to access a diagnosis terminal (8 to 64 characters).
Check new password	Enter the password again for verification.
Comment	Set a new comment (up to 1024 characters).

*1 Can be set or selected when the version of this product on a diagnosis terminal is 1.03D or later.

4. Click the [OK] button.

Point 

When a user name or a password is changed, a target user is signed out if the user is accessing the diagnosis terminal.

Registering a new diagnosis terminal

The following shows the procedure for registering a new diagnosis terminal.

Registering an additional diagnosis license is required to register a new diagnosis terminal. If an additional diagnosis license is not registered, a new diagnosis terminal cannot be registered. (📖 Page 26 License Manager)

Up to 64 diagnosis terminals can be registered including the local host diagnosis terminal. (📖 Page 60 Local host diagnosis terminal)

Operating procedure

1. Click **+** (Register) in the diagnosis terminal management screen. (📖 Page 61 Diagnosis terminal management screen)
2. Configure various settings.

Item	Description
Name	Set a diagnosis terminal name (up to 128 characters).
Destination address	Set an address of a diagnosis terminal (up to 253 characters).
Port number	Set a port number of a diagnosis terminal (0 to 65535).
[Check] button	Click this to check whether a diagnosis terminal with the set address and port number can be registered. The button name will be "Checking" while checking.
User name	Set a user name to access a diagnosis terminal (up to 128 characters).
Password	Set a password to access a diagnosis terminal (8 to 64 characters).
Check password	Enter the password again for verification.
Comment	Set a comment (up to 1024 characters).

3. Click the [OK] button.

Point

- A diagnosis terminal name, user name, password, and comment can be changed in the diagnosis terminal property screen.
📖 Page 63 Changing properties
- When a user name or a password is changed to register a diagnosis terminal again, a user accessing the diagnosis terminal is signed out.

Precautions

- To register a diagnosis terminal that was unregistered again, delete project data in the setting management tool on the diagnosis terminal in advance.
- ☞ Page 41 Setting Management Tool (Diagnosis Terminal)
- When directly accessing a diagnosis terminal that satisfies either of the following conditions, perform either of the operations shown below in ❶ or ❷:
 - A diagnosis terminal registered on the learning station where this product with version 1.02C or earlier is installed
 - A diagnosis terminal where this product with version 1.02C or earlier was installed when registered on the learning station
- Operation required when accessing a diagnosis terminal directly
- ❶ Sign in to this product as follows: User name: guest; Password: password.
 - ❷ On the learning station, change properties of the target diagnosis terminal to change a user name and password in the diagnosis terminal management screen of this product with version 1.03D or later.

6 PROJECT CREATION AND MANAGEMENT

This chapter shows the methods for creating and managing projects.

A series of data (data set and AI) required for analysis can be created and managed for each project.

For details on a data set and AI, refer to the following:

☞ Page 78 Data Set, Page 135 AI

For the procedure for creating a project, refer to the following:

☞ Page 72 Creating a New Project

Precautions

- Only one user can edit a project. Multiple users cannot edit the same project at the same time.
- When another user is accessing a project*¹, the following operations cannot be performed for the project: copying, deleting, changing properties, changing a user authority, and exporting.

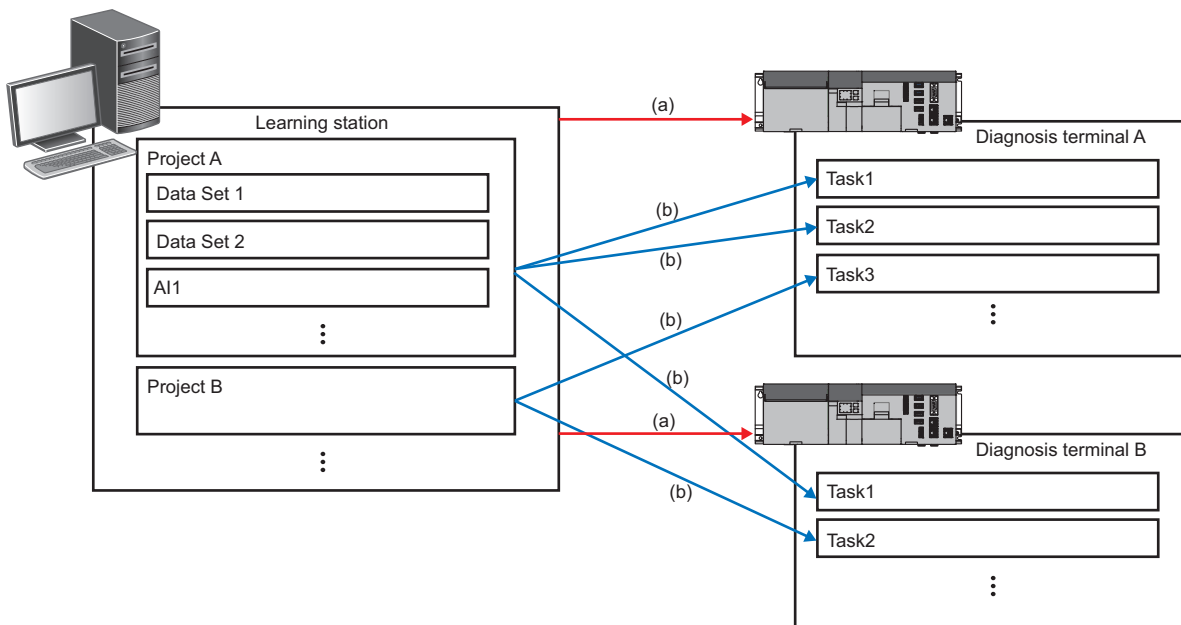
*¹ A case where all the following conditions are satisfied:

- It has been within 15 minutes since the user performed the last operation such as screen transition.
- The user has not signed out.
- The user has not accessed a screen other than one for the project (such as the screen for another project, diagnosis terminal management screen, or user management screen)
- A project is being exported.

Save location for project data

A project is saved on the learning station.

A task is created by opening a project; however, the task is saved on a diagnosis terminal. Therefore, the task on the diagnosis terminal is not deleted even if the project is deleted on the learning station. In addition, a task that does not belong to any projects can be deleted in the task management screen for any projects by signing in as the administrative user.



(a) A diagnosis terminal is registered.

(b) A task is created.

Project data migration

A data set and AI can be backed up or migrated by exporting or importing a project.

☞ Page 74 Exporting and Importing a Project

Tasks that belong to a project can be exported and imported; however they are saved on the learning station as unassigned tasks when imported. The unassigned tasks can be used by assigning them to a diagnosis terminal.

☞ Page 204 Tasks added by importing a project

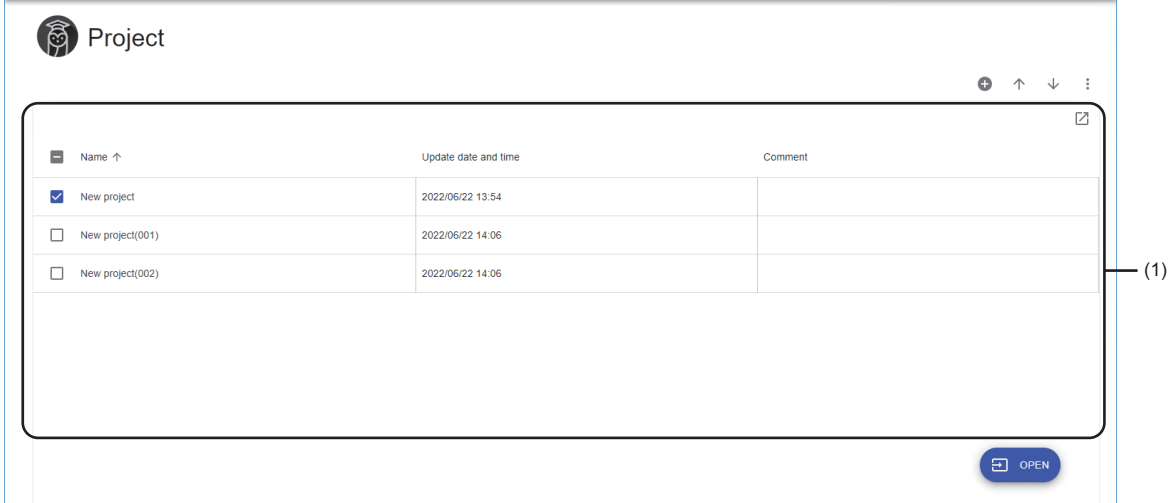
The monitoring settings are associated with tasks; therefore, when the tasks are exported and imported, the monitoring settings are also exported and imported.

6.1 Project Management Screen

This section shows the project management screen for creating and managing projects.






Window

Click a product name or project name on the main bar. (📖 Page 48 Main bar)




Displayed items

Item	Description	
+ (Create new)	Click this to create a new project. 📖 Page 72 Creating a New Project	
↑ (Import) ^{*1*2}	Click this to import an exported project as a new project. 📖 Page 74 Exporting and Importing a Project	
↓ (Export) ^{*3*4}	Click this to export a selected project. 📖 Page 74 Exporting and Importing a Project	
⋮ (Menu) ^{*5}	Copy ^{*6*7}	To create a copy of a selected project. ^{*8*9}
	Delete ^{*6*7}	To delete a selected project.
	Import ^{*10}	To import an exported project as a new project. 📖 Page 74 Exporting and Importing a Project
	Export ^{*11*12}	To export a selected project. 📖 Page 74 Exporting and Importing a Project
	Member ^{*7*11}	To set users who can access a selected project. 📖 Page 73 Setting Members
	Property ^{*7*11}	To change properties (name and comment) of a selected project. 📖 Page 71 Changing properties


Item	Description
(1) Project list	— Projects are listed. The lines for projects that a signed-in user cannot access are grayed out.
 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
Name	A project name is displayed.  (Exporting) is displayed while exporting a project. A project can be opened by clicking its name when export is not in progress and a signed-in user can access the project. ( Page 76 Opening a Project)
Update date and time	The date and time when a data set or AI in a project was updated is displayed. This item is not updated by the following operations: <ul style="list-style-type: none"> • Editing the name or comment for a project • Editing the name or comment for a data set or AI in a project
Creation date and time ^{*13}	The date and time when a project was created is displayed. For a project created as a copy, the date and time when the copy was created is displayed. (This applies to the date and time for data sets and AIs in the project.) For a project created by importing an exported project, the date and time when the project was imported is displayed.
Comment	A set comment is displayed.
Size [MB] ^{*13}	The file size of a project is displayed.
[Open] button ^{*14}	Click this to open a selected project. ( Page 76 Opening a Project)

*1 Can be clicked when import of a project is not in progress.

*2  (Importing) is displayed while importing a project.

*3 Can be clicked when all the following conditions are satisfied:

- Only one project is selected.
- A project that a sign-in user can access is selected.

*4  (Cancel export) is displayed while exporting a project. The export is canceled by clicking the icon.

*5 The context menu can be displayed also by right-clicking on the project list.

*6 Displayed when selecting a project.

*7 Can be clicked when both of the following conditions are satisfied:

- A project not being exported is selected.
- A project that a sign-in user can access is selected.

*8 A copy project name will be "copy source project name (001)."

If the name is duplicate, a value in the parentheses '()' will be incremented.

If the copy source project name has 251 or more characters, the number of characters in "copy source project name (001)" will exceed its maximum number (255 characters). In this case, the 251st and later characters will be deleted when a copy is created.


*9 When an AI in the "Learning," "Learned," or "Error" state exists in a project, the status of the AI will be changed to "Editing" when a copy is created.


*10 Can be clicked when import of a project is not in progress.

*11 Displayed when selecting only one project.

*12 Can be clicked when both of the following conditions are satisfied:

- Export of a project is not in progress.
- A project that a sign-in user can access is selected.

*13 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

 Page 56 Switching to show or hide

*14 Displayed when all the following conditions are satisfied:

- Only one project is selected.
- A project not being exported is selected.
- A project that a sign-in user can access is selected.


Point

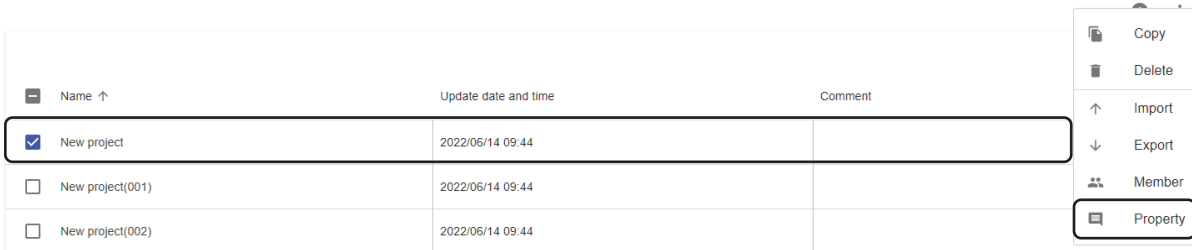
Copying a project enables a data set and AI to be utilized and applied to another CPU in a short-term. For example, it can be used when applying a project for devices, where a data set and AI are created, to another CPU.

Changing properties

The following shows the procedure for changing properties (name and comment) of a project.

Operating procedure

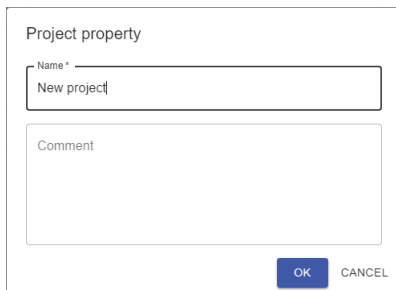
1. Select a project in the project management screen. (☞ Page 69 Project Management Screen)
2. Click  (Menu), and select [Property].



<input type="checkbox"/> Name ↑	Update date and time	Comment
<input checked="" type="checkbox"/> New project	2022/06/14 09:44	
<input type="checkbox"/> New project(001)	2022/06/14 09:44	
<input type="checkbox"/> New project(002)	2022/06/14 09:44	

- Copy
- Delete
- Import
- Export
- Member
- Property

3. Set a new project name (up to 255 characters) or comment (up to 1024 characters).



Project property

Name *
New project

Comment

OK CANCEL

4. Click the [OK] button.

6.2 Creating a New Project

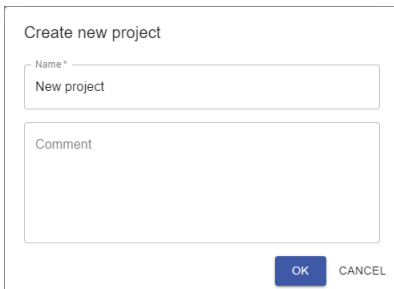
This section shows the procedure for creating a new project.

Up to 16 projects can be created.

A created project can be accessed only by the administrative user and a user who created the project. (☞ Page 53 User types)

Operating procedure

1. Click **+** (Create new) in the project management screen. (☞ Page 69 Project Management Screen)
2. Set a project name (up to 255 characters) or comment (up to 1024 characters).



The screenshot shows a dialog box titled "Create new project". It contains two text input fields: "Name*" with the text "New project" and "Comment". At the bottom right, there are two buttons: "OK" and "CANCEL".

3. Click the [OK] button.

Point

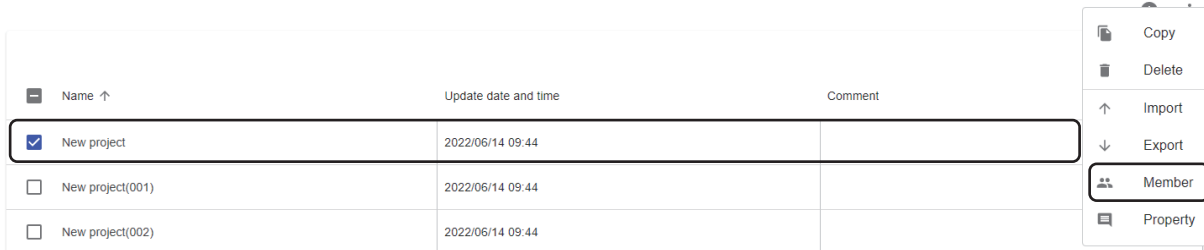
- Another user can access a project by adding the user as a member of the project.
☞ Page 73 Setting Members
 - Contents set in this screen can be changed in the project property screen.
☞ Page 71 Changing properties
-

6.3 Setting Members

This section shows the procedure for setting users who can access a project.

Operating procedure

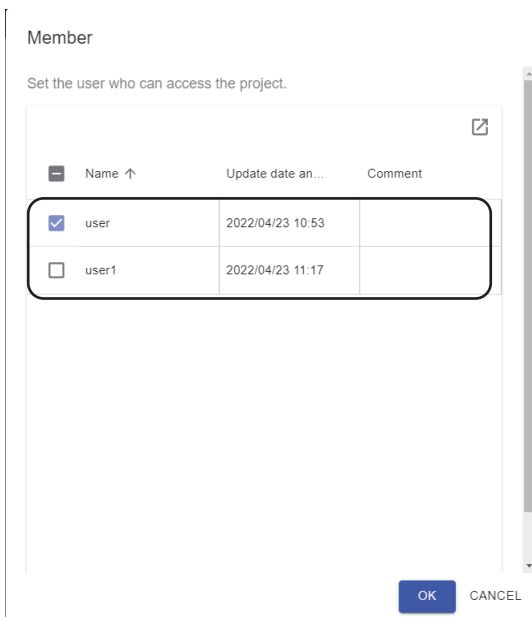
1. Select a project in the project management screen. (☞ Page 69 Project Management Screen)
2. Click ☰ (Menu), and select [Member].



3. Select the checkbox of a user to allow access.

Only users with valid licenses are displayed.

However, the selection status of the administrative user and a user who configures this setting cannot be changed. (☞ Page 53 User types)



Item	Description
<input checked="" type="checkbox"/> (Expand)/ – (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. (☞ Page 56 Expanding the header)
Name	A user name is displayed.
Update date and time	The date and time when user information was changed is displayed. (☞ Page 54 User management screen)
Comment	A set comment is displayed.

4. Click the [OK] button.

6.4 Exporting and Importing a Project

This section shows the procedure for exporting a project and importing it as a new project in another environment. Data sets, AIs, or tasks that satisfy the following conditions can be included in an exported project.

- Data set: The status is "Completed."
- AI: The status is "Complete."
- Task: It belongs to a project, and the status is not "EDIT."

Precautions

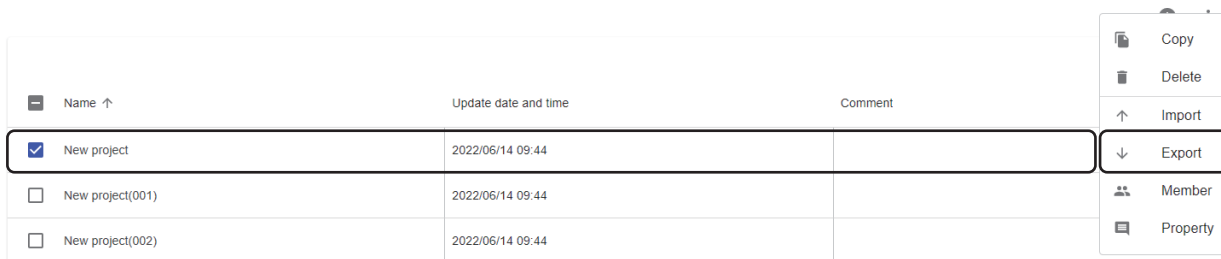
For tasks, only tasks on the connected diagnosis terminal can be exported.

Point

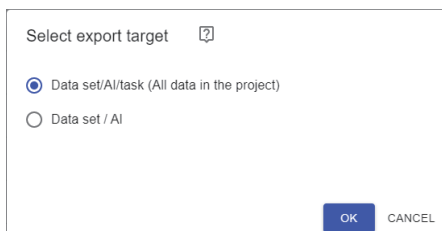
Exporting a project enables data sets, AIs, or tasks (including the monitoring settings) to be utilized to the learning station and diagnosis terminal built in another environment. For example, it is useful when applying a project created in the factory A to the factory B where the same product as the factory A is manufactured.

Operating procedure

1. Select a project in the project management screen. (☞ Page 69 Project Management Screen)
2. Click ☰ (Menu), and select [Export].



3. Select data to be exported.



4. Click the [OK] button.

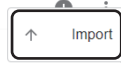
A project file (file name: (project name).mailab) is exported.

Point

- A project can also be exported by clicking ↓ (Export).
- A project file is output by the download function of a web browser.
- Windows has a limit of the path length; therefore, a file name is shortened by a web browser. In addition, when a shortened file name is duplicate, the name is also changed according to the specifications of the web browser function.
- A project file can also be used as a backup of the project.
- ↓ (Export) changes to ↵ (Cancel export) while exporting a project. The export is canceled by clicking the icon.

5. Move the exported project file to an import destination environment.
6. Display the project management screen in the import destination environment. (📖 Page 69 Project Management Screen)
7. Click ☰ (Menu), and select [Import].

<input type="checkbox"/> Name ↑	Update date and time	Comment
<input type="checkbox"/> New project	2022/06/14 10:30	
<input type="checkbox"/> New project(001)	2022/06/14 10:30	
<input type="checkbox"/> New project(002)	2022/06/14 10:30	



Point

- A project can also be imported by clicking ↑ (Import).
- ↑ (Import) changes to ↻ (Importing) while importing a project.
- When importing a project, the project name is suffixed with (XXX) if the name is duplicate with the import destination project. ('XXX' is a three-digit number. The number will be incremented from '001' until it is not duplicate.)
If the project name has 251 or more characters, the number of characters in "project name (001)" will exceed its maximum number (255 characters). In this case, the 251st and later characters will be deleted, then (XXX) is added.
- Tasks will be unassigned when imported.
For details, refer to the following:
📖 Page 204 Tasks added by importing a project
- 📄 (Task) on the side bar changes to 📄 when an unassigned task exists.
📖 Page 49 Side bar

Precautions

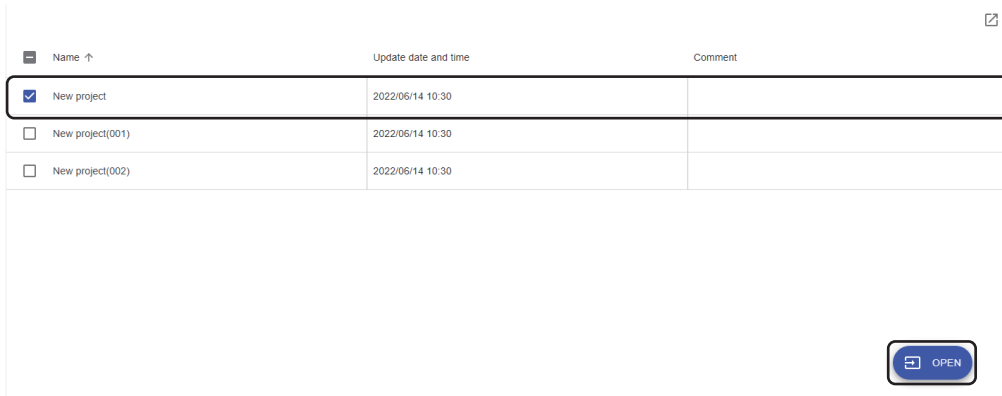
- For a project file exported by using this product with version 1.02C, tasks are not included when importing the project file in a version earlier than 1.01B. In addition, an error occurs when editing an imported AI if a variable deletion block is included in the AI.
- A client certificate created when connecting to an OPC UA server is not exported. Create it again in the import destination for a task. (📖 Page 399 OPC UA server authentication settings)

6.5 Opening a Project

This section shows the procedure for opening a project.

Operating procedure

1. Select a project in the project management screen. (☞ Page 69 Project Management Screen)
2. Click the [Open] button.

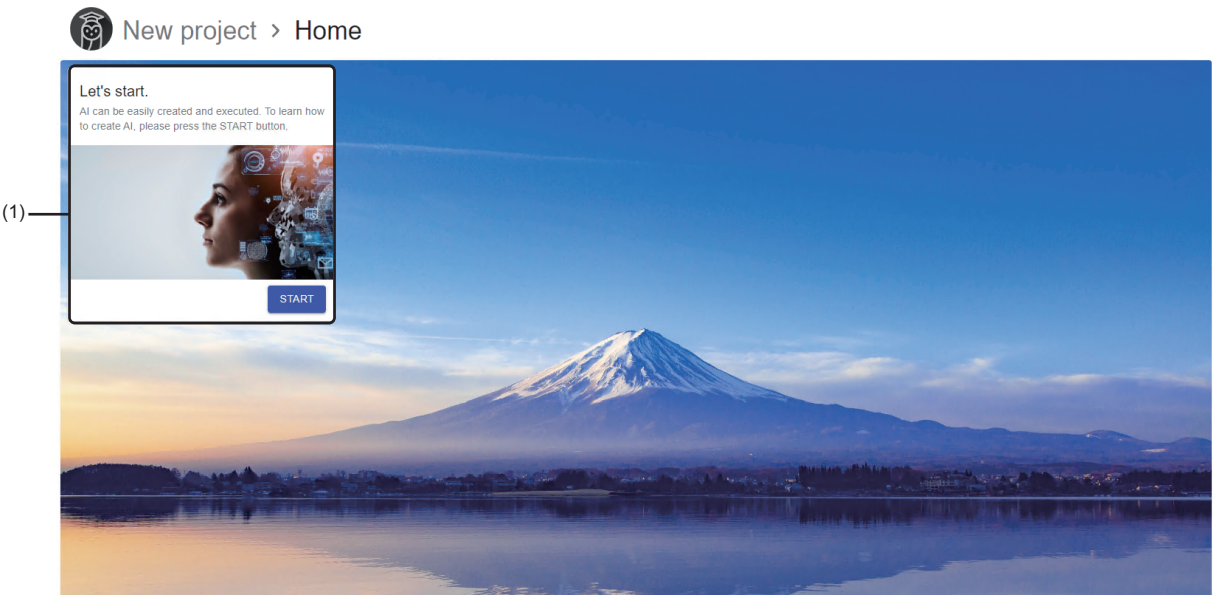


The home screen is displayed when a project is opened.

Home screen

Window

Click (Home) on the side bar. (☞ Page 49 Side bar)



Displayed items

Item	Description
(1) Start AI Experience widget	The Start AI Experience screen appears by clicking the [START] button. (☞ Page 77 Start AI Experience screen)

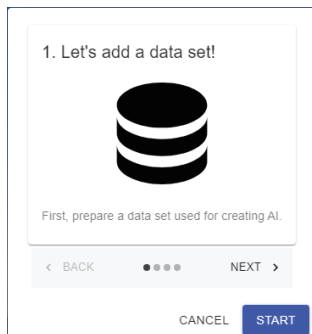
Start AI Experience screen

The flow from preparing to create an AI until executing the AI can be checked.

The data set management screen is displayed by clicking the [START] button, and creating a data set can be started.

☞ Page 86 Data Set Management Screen

Window



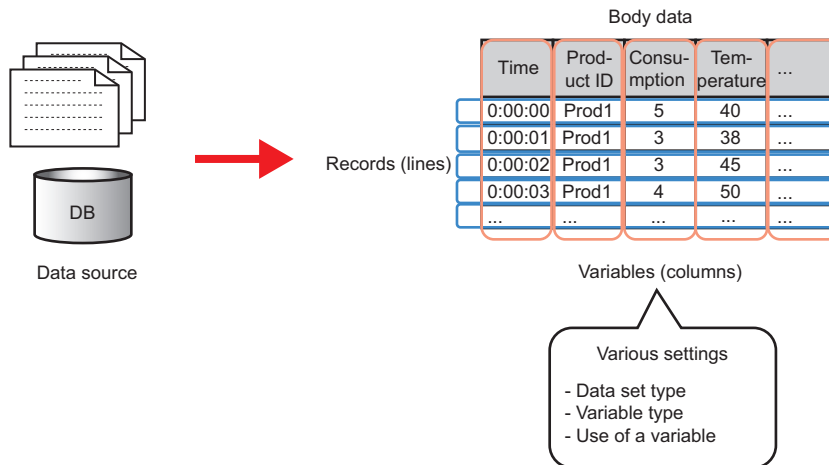
7 DATA SET CREATION AND MANAGEMENT

This chapter shows the methods for creating and managing data sets.

7.1 Data Set

This section explains a data set. A data set is a group of data required for learning.

It is created by generating body data from data sources and configuring various settings (data set type, variable type, and use of a variable).



Once a data set is created, an AI can be created by performing learning with the data set.

For the procedure for creating a data set, refer to the following:

- ☞ Page 90 Creating a New Data Set (Text File)
- ☞ Page 103 Creating a New Data Set (Database)

For a data source, body data, and various settings, refer to the following:

- ☞ Page 79 Data source
- ☞ Page 80 Body data (text file)
- ☞ Page 83 Body data (database)
- ☞ Page 84 Various settings

Point

- Data in a created data set can be visualized by using each type of preview, such as a chart or graph.
 - ☞ Page 111 Visualizing Data
- A data set can be edited after creation.
 - ☞ Page 134 Editing a Data Set

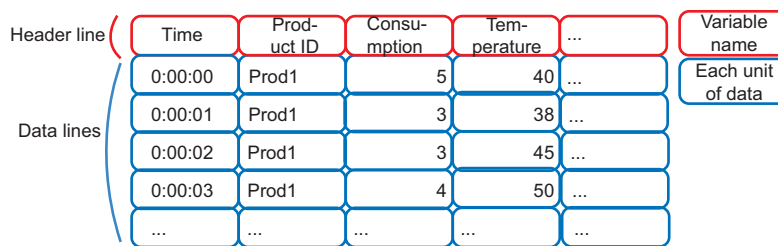
Data source

The following explains a data source. A data source is a text file or database that becomes a base of a data set.

Text file

A file in the following format is available:

Item	Description	Remarks
Extension	<ul style="list-style-type: none"> .csv .tsv 	Characters are not case-sensitive.
Delimiter	<ul style="list-style-type: none"> For CSV: Comma For TSV: Tab 	—
Number of characters in a variable name	Up to 255 characters	Characters after the 255th will be deleted when reading a file.
Number of characters in each unit of data	Up to 255 characters	
Size per file	Up to 1 GB	—
Readable character code	<ul style="list-style-type: none"> UTF-8 (with/without BOM) SJIS 	Unsupported character codes may be garbled and not displayed properly.
Readable character	Characters other than the following: ☞ Page 570 Unusable Characters for this Product	—
Minimum number of lines	3	One header line and two or more data lines are required.



Precautions

- A value is treated as missing in the following cases:
 - There is a blank between delimiters.
 - A value is NaN, nan, N/A, n/a, or NA.
- A character that cannot be read is replaced with a period (.).
- A character enclosed with double quotes (") is read as a value even if it is a delimiter.
- If a variable name is duplicate, it is suffixed with '1.' If it is still duplicate, the number will be incremented until it is not duplicate.

Point

One data set can be made of multiple data sources joined vertically or horizontally.

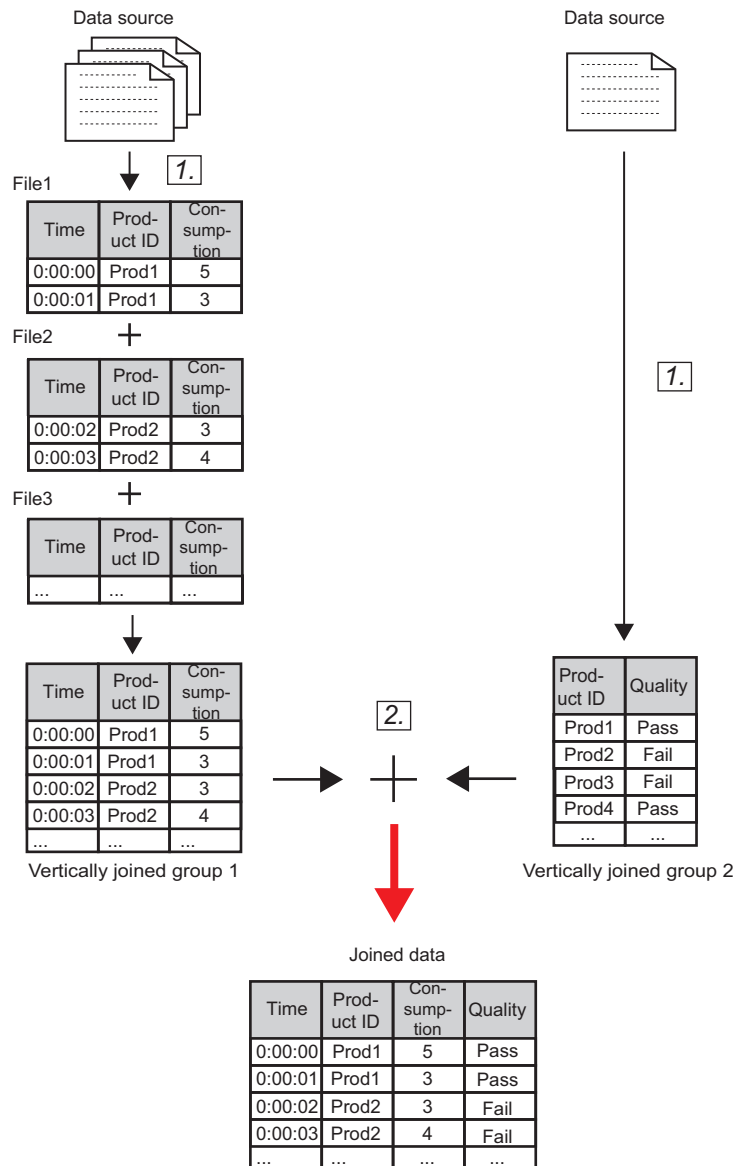
Database

A database of the following types is available:

Item	Description	Remarks
Supported databases	MySQL® 8.0	Versions with the operations confirmed
	SQL Server 2022	
	PostgreSQL 15	
Number of characters in a variable name	Up to 255 characters	Characters after the 255th will be deleted when acquiring data.
Number of characters in each unit of data	Up to 255 characters	
Range of the number of records	2 to 864000	—
Range of the number of variables	1 to 256	—

Body data (text file)

The following explains joined data that is generated as body data when using a text file as a data source. Joined data is generated by the following procedure:



1. Generating the vertically joined groups 1 and 2 from data sources

When there are multiple files of data sources, data sources with matching header line are joined vertically in ascending order of their file names and a vertically joined group is generated.

When there is only one file of a data source, a vertically joined group is generated with the file only.

A vertically joined group can be generated in the data source setting screen.

☞ Page 93 Data source setting

2. Generating joined data by joining the vertically joined groups 1 and 2 horizontally

A horizontal join is performed according to the join rules (join key and method) shown in the following:

☞ Page 81 Join rules

When the vertically joined group 2 is not generated in step 1, a horizontal join is not performed. The vertically joined group 1 becomes joined data as it is.

Point

A horizontal join is optional.

For example, when 'data at manufacture' and 'inspection result data after manufacture' are logged to different files, these two units of data can be converted into a unit of data appropriate for learning by joining them horizontally with the following settings:

- Vertically joined group 1: Data at manufacture
- Vertically joined group 2: Inspection result data after manufacture
- Join key: Variable that can be linked (manufacturing number, lot number, product ID, etc.)

Restriction

- The maximum number of data sources that can be joined at a time is 10000 files.
- The maximum number of records (excluding the header line) is 864000 lines and that of variables is 256 columns in total in the vertically joined groups 1 and 2.
- The maximum number of records is 864000 lines and that of variables is 256 columns in joined data.

Join rules

The following shows the join rules to be set for a horizontal join.

Join rules can be set in the horizontal data join screen.

☞ Page 101 Horizontal data join

Join key

A join key is a variable used to join the vertically joined groups 1 and 2. Select one variable common to both groups.

Point

If a common variable exists besides the variable set as a join key, the variable name will be changed to '(variable name)_left' and '(variable name)_right' when joining the groups.

However, if '(variable name)_left' and '(variable name)_right' are duplicate with other existing variables, the names will be suffixed with '_001' and '_left' or '_right.' (If the names suffixed with '_001' are still duplicate, the number will be incremented.)

If a suffixed name has more than 255 characters, characters in the variable name will be deleted in order from the end to fit within 255 characters.

Join method

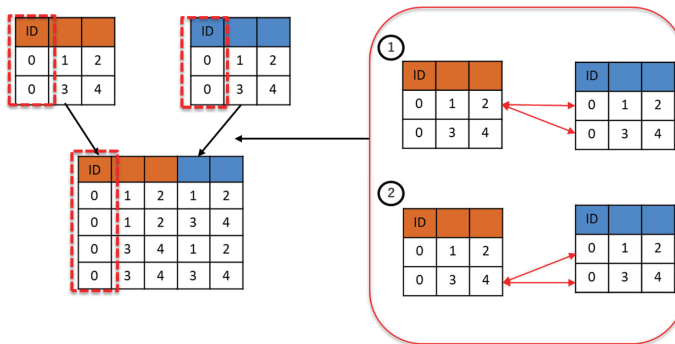
The following table shows the types of methods for joining the vertically joined groups 1 and 2.

Type	Description	Image
Left outer join	A join method that leaves data matching with that on the left side based on a join key. If there is no matching data on the right side, missing values are generated.	
Right outer join	A join method that leaves data matching with that on the right side based on a join key. If there is no matching data on the left side, missing values are generated.	

Type	Description	Image
Inner join	A join method that leaves data matching between both the left and right sides based on a join key. Missing values are not generated with this method; however, data may not be left after the join if no values match between both sides.	
Full outer join	A join method that leaves all data based on a join key. If there is no matching data on the other side, missing values are generated.	

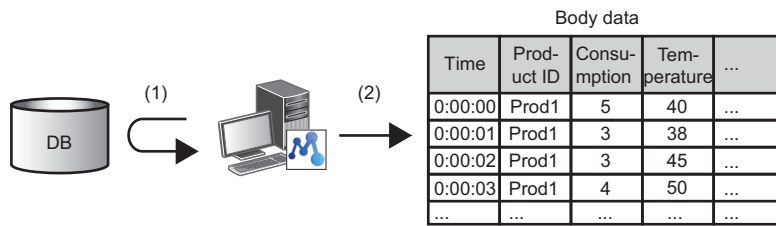
Point

When all data of a join key is matched between both the left and right sides, all matched data is joined.



Body data (database)

The following explains body data that is generated as follows when using a database as a data source.



(1) Data is acquired from a database.




(2) Body data is generated.

Restriction



The maximum number of records is 864000 and that of variables is 256 columns in data.

Various settings

The following shows various settings to be configured for generated body data.

- Data set type ( Page 84 Data set types)
- Variable type ( Page 85 Variable types)
- Use of a variable ( Page 85 Use of a variable)

Settings can be configured in the data check screen.

- When using a text file as a data source ( Page 102 Data check)
- When using a database as a data source ( Page 109 Data check)

Data set types

There are the following types of data sets.

■Table data set

A table data set has no meaning in its data order.

This type applies to data such as production data for each factory or each product.

Factory	Product name	Production volume	...	Profit
Factory A	Servo	1000	...	5
Factory A	PLC	2000	...	18
Factory B	Servo	500	...	2
Factory B	PLC	1200	...	20
...

■Waveform data set

A waveform data set has continuous data that changes over time.

This type applies to data such as sensor data that can be acquired from a device during a manufacturing process.



Variable types

There are the following types of variables.

The variable types are for specifying how to handle variables in this product.

A variable type can be set for each variable. Depending on the set type, the methods for visualizing data and for handling data when learning differ.

Type	Description	Example
Numerical value	<p>A type for a variable with continuous values that can be calculated.</p> <p>When using this type of an objective variable for learning, an AI will predict a numerical value; therefore, learning is performed with a regression model.</p> <p>Values in the range of double precision floating point numbers (15 significant digits) can be handled. When a value is out of this range, it may not be processed properly.</p> <p>In addition, when handling a value close to the boundary value, variables may not be processed properly or drawing may not be performed correctly if it exceeds the range while being processed.</p>	<ul style="list-style-type: none">• 0• -12345• 1.1• 0.123
Category	<p>A type for a variable with discrete values that cannot be calculated.</p> <p>This type applies to a string value; however, set this type also for a numeric value when it is not continuous or has no meaning in its magnitude (it represents an ID or type).</p> <p>Maximum 1000 items can be set for the number of levels of categories (the number of value types). When it is out of the range, variables may not be processed properly or drawing may not be performed correctly.</p>	<ul style="list-style-type: none">• A• Product001• '100'• True
Timestamp	<p>A type for a variable that indicates a date and time.</p> <p>This type cannot be an objective variable; however, it can be used as information to simply visualize the data order or to modify data.</p> <p>It is recommended to include the year, month, and day although this product can handle a time stamp only with the hour, minutes, and seconds. When the year, month, and day are not included, they are automatically interpolated; therefore, the order may not be maintained in some setting screens and unintended operation may occur.</p> <p>An error of one microsecond or less may occur in processing of a timestamp type variable.</p> <p>This product supports the following range: 1900-01-01 00:00:00 to 2100-01-01 00:00:00</p>	<p>■ Available formats</p> <ul style="list-style-type: none">• YYYY/MM/DD• YYYY-MM-DD• MM/DD/YYYY• hh:mm:ss.fff• hh:mm:ss• YYYY/MM/DD hh:mm:ss.fff• hh:mm:ss.fff YYYY/MM/DD <p>■ Unavailable formats</p> <ul style="list-style-type: none">• MM/DD

Use of a variable

Whether to use a variable can be set.

It can be set for each variable. Set "Not use" for a variable that is not used for data visualization and learning.



7.2 Data Set Management Screen

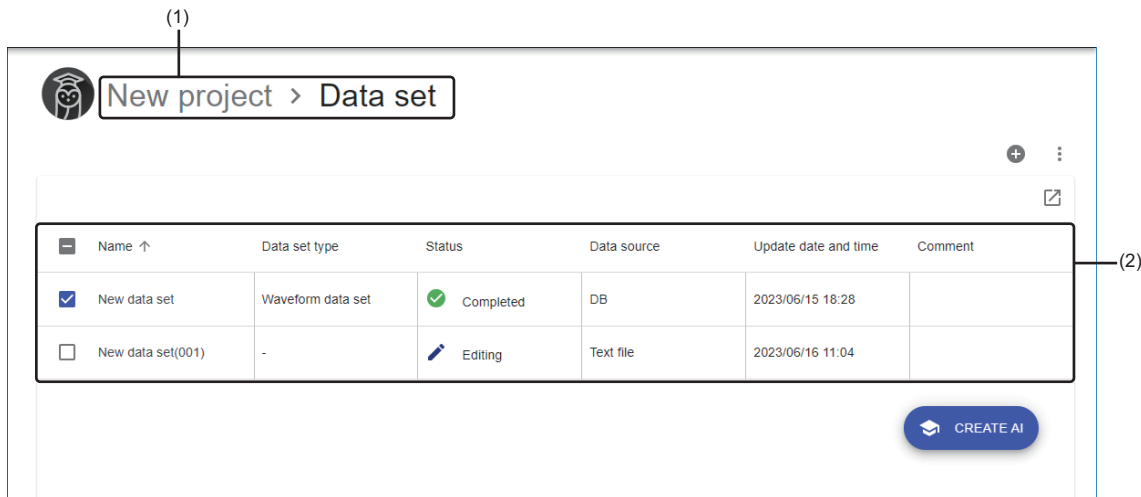
This section shows the data set management screen for creating and managing data sets.

Up to 128 data sets can be created in each project.





















However, the total size of data sets that can be created is up to 2 GB.

Window

Click  (Data set) on the side bar. ( Page 49 Side bar)



Displayed items

Item	Description												
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> Current project name > Data set By clicking a project name, the screen returns to the home screen.  Page 76 Home screen												
 (Create new)	Click this to create a new data set.  Page 90 Creating a New Data Set (Text File)  Page 103 Creating a New Data Set (Database)												
 (Menu) ^{*1*2}	<table border="1"> <tbody> <tr> <td>Open^{*3}</td> <td>To open a selected data set. For a text file  Page 91 Data set creation screen For a database  Page 104 Data set creation screen</td> </tr> <tr> <td>Copy</td> <td>To create a copy of a selected data set.^{*4}</td> </tr> <tr> <td>Delete</td> <td>To delete a selected data set.</td> </tr> <tr> <td>Download^{*3*5}</td> <td>To download a selected data set as a text file.  Page 132 Downloading a Data Set</td> </tr> <tr> <td>Property^{*3}</td> <td>To change properties (name and comment) of a selected data set.  Page 89 Changing properties</td> </tr> <tr> <td>Preview^{*3*5}</td> <td>To visualize data in a selected data set by using each type of preview, such as a chart or graph, to check the content.  Page 111 Visualizing Data</td> </tr> </tbody> </table>	Open ^{*3}	To open a selected data set. For a text file  Page 91 Data set creation screen For a database  Page 104 Data set creation screen	Copy	To create a copy of a selected data set. ^{*4}	Delete	To delete a selected data set.	Download ^{*3*5}	To download a selected data set as a text file.  Page 132 Downloading a Data Set	Property ^{*3}	To change properties (name and comment) of a selected data set.  Page 89 Changing properties	Preview ^{*3*5}	To visualize data in a selected data set by using each type of preview, such as a chart or graph, to check the content.  Page 111 Visualizing Data
Open ^{*3}	To open a selected data set. For a text file  Page 91 Data set creation screen For a database  Page 104 Data set creation screen												
Copy	To create a copy of a selected data set. ^{*4}												
Delete	To delete a selected data set.												
Download ^{*3*5}	To download a selected data set as a text file.  Page 132 Downloading a Data Set												
Property ^{*3}	To change properties (name and comment) of a selected data set.  Page 89 Changing properties												
Preview ^{*3*5}	To visualize data in a selected data set by using each type of preview, such as a chart or graph, to check the content.  Page 111 Visualizing Data												

Item	Description
(2) Data set list	—
	<p>☑ (Expand)/ — (Collapse)</p> <p>Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. ☞ Page 56 Expanding the header</p>
Name	<p>A data set name is displayed.</p> <p>A data set can be opened by clicking the name.</p> <p>For a text file ☞ Page 91 Data set creation screen For a database ☞ Page 104 Data set creation screen</p>
Data set type	<p>A data set type is displayed.*6 ☞ Page 84 Data set types</p>
Status	<p>The status of a data set is displayed.*7</p> <ul style="list-style-type: none"> • Completed: Creating a data set is completed. • Editing: A data set is being edited and its creation is not completed. • Error: An error has occurred because editing a data set failed. • Uploading: A data source is being uploaded. • Acquiring: Data acquisition processing is being performed. • Acquired: Data acquisition processing is completed.
Data source	"Text file" or "DB" is displayed.
Number of records*8	<p>The number of records in a data set is displayed.*9</p> <p>The number does not always match with the total number of records in data sources because the specified header line and data lines are extracted when reading the data sources (text files) or because headers are deleted when joining the data sources vertically. ☞ Page 94 Uploading a data source</p>
Number of variables*8	<p>The number of variables in a data set is displayed.*9</p> <p>The number does not always match with the total number of variables in a vertically joined group of data sources because the variable of a join key is deleted due to duplication when joining data sources (text files) horizontally or because a variable not to be used can be set. ☞ Page 101 Horizontal data join ☞ Page 102 Data check</p>
Update date and time	<p>The date and time when a data set was updated is displayed.</p> <p>This item is not updated by editing a data set name or comment.</p>
Creation date and time*8	<p>The date and time when a data set was created is displayed.</p> <p>For a data set created as a copy, the date and time when the copy was created is displayed.</p>
Comment	A set comment is displayed.
Size [MB]*8	<p>The file size of a data set is displayed.*9</p> <p>The displayed size is different from the size of the downloaded text file since it is the size handled in this product.</p>
[Create AI] button*10	<p>Click this to display the AI management screen. The create new AI screen also appears with a selected data set selected.</p> <p>For the procedure for creating an AI, refer to the following. (The procedure differs depending on the AI creation method.) ☞ Page 140 Creating a New AI (Automatically) ☞ Page 172 Creating a New AI (Manually)</p> <p>For the creation method, refer to the following: ☞ Page 135 Creation method</p> <p>For details on the AI management screen, refer to the following: ☞ Page 137 AI Management Screen</p>

*1 Can be clicked when selecting a data set.

*2 The context menu can be displayed also by right-clicking on the data set list.

*3 Displayed when selecting only one data set.

*4 A copy data set name will be "copy source data set name (001)."

If the name is duplicate, a value in the parentheses '(')' will be incremented.

If a copy source data set name has 251 or more characters, the number of characters in "copy source data set name (001)" will exceed its maximum number (255 characters). In this case, the 251st and later characters will be deleted to fit within 255 characters when a copy is created.

*5 Can be selected when selecting a data set of which "Status" is "Completed."

*6 "-" is displayed when "Status" is not "Completed."

*7 When editing a data set of which "Status" is "Completed," the status becomes "Editing" at the time when either of the following operations are performed. (Until then, the status remains "Completed.")

- Adding or deleting a data source

- Changing settings for join rules

*8 Hidden by default. Click ☑ (Expand) to expand the header, and switch the item to be shown as necessary.

 Page 56 Switching to show or hide


*9 "-" is displayed when "Status" is not "Completed" or "Acquired."

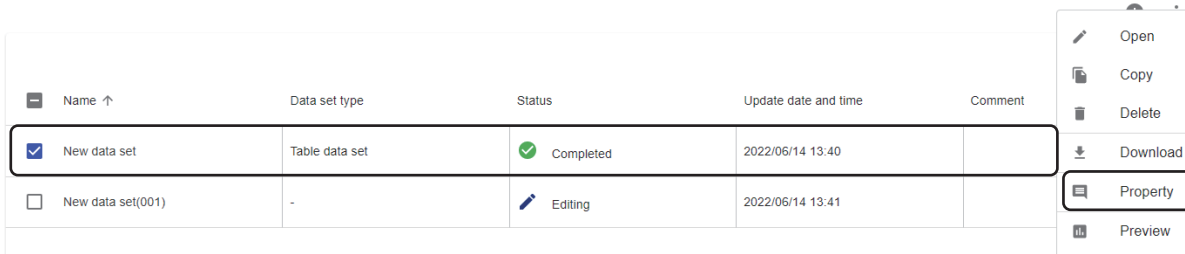
*10 Displayed when selecting only one data set of which "Status" is "Completed."

Changing properties

The following shows the procedure for changing properties (name and comment) of a data set.

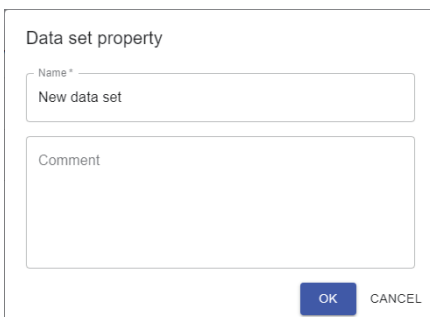
Operating procedure

1. Select a data set in the data set management screen. (☞ Page 86 Data Set Management Screen)
2. Click  (Menu), and select [Property].



<input type="checkbox"/>	Name ↑	Data set type	Status	Update date and time	Comment
<input checked="" type="checkbox"/>	New data set	Table data set	Completed	2022/06/14 13:40	
<input type="checkbox"/>	New data set(001)	-	Editing	2022/06/14 13:41	

3. Set a new data set name (up to 255 characters) or comment (up to 1024 characters).



Data set property

Name*
New data set

Comment


OK CANCEL

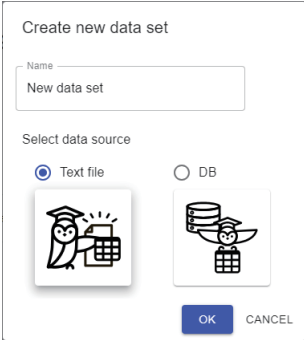
4. Click the [OK] button.

7.3 Creating a New Data Set (Text File)

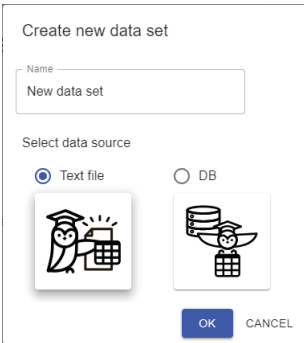
This section shows the procedure for creating a new data set from a text file.

Operating procedure

1. Click **+** (Create new) in the data set management screen. ( Page 86 Data Set Management Screen)
2. Set a data set name (up to 255 characters) in the create new data set screen.




3. Select [Text file] in "Select data source."




4. Click the [OK] button.

Point

A data set name can be changed in the data set property screen.

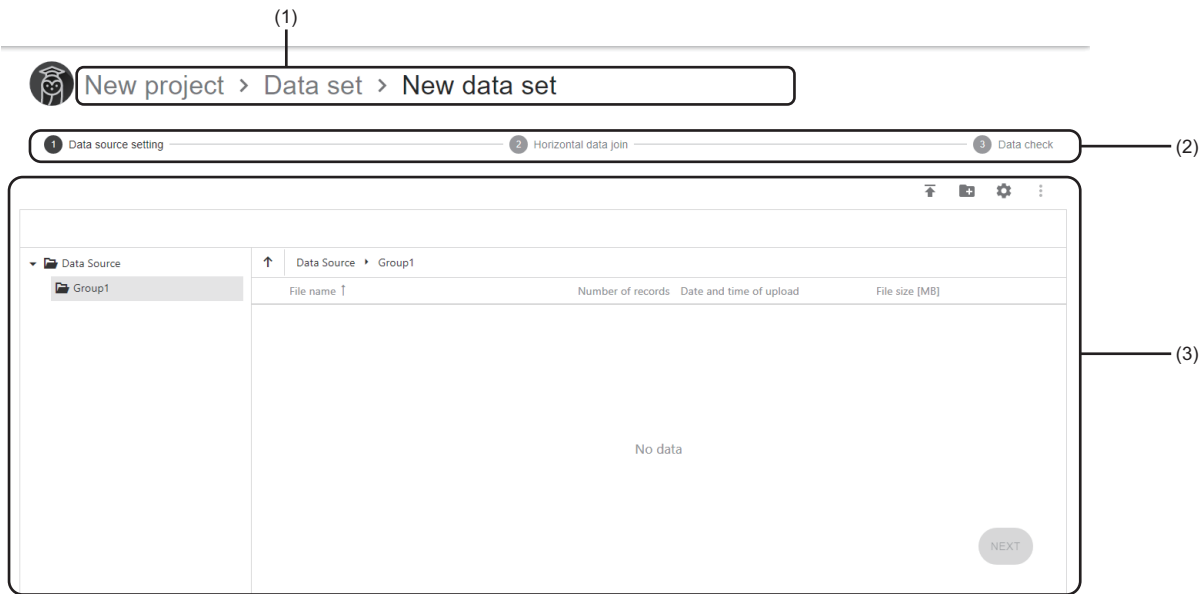
 Page 89 Changing properties

5. Create a data set in the data set creation screen.
 Page 91 Data set creation screen

Data set creation screen

The following shows the screen for creating a data set.

Window



7

Displayed items

Item	Description
(1) Breadcrumb bar	<p>A breadcrumb bar is displayed.</p> <ul style="list-style-type: none"> • Current project name > Data set > current data set name <p>By clicking a project name, the screen returns to the home screen. (☞ Page 76 Home screen)</p> <p>By clicking "Data set," the screen returns to the data set management screen. (☞ Page 86 Data Set Management Screen)</p>
(2) Stepper	<p>The progress of settings is displayed.</p> <p>A check mark (✔) is put for a completed setting.</p> <p>Each setting screen can be displayed by clicking ✔.</p>
(3) Setting screen	<p>Configure various settings to create a data set. (☞ Page 92 Creation procedures)</p>

Creation procedures

The following shows the procedures for creating a data set.

The procedure depends on whether to join data horizontally when generating joined data.

For the process to generate joined data, refer to the following:

☞ Page 80 Body data (text file)

Operating procedure

■When not performing a horizontal join

1. Upload data sources to a folder in the data source setting screen.

☞ Page 93 Data source setting

2. Check joined data and configure various settings (data set type, variable type, and use of a variable) in the data check screen.

☞ Page 102 Data check

■When performing a horizontal join

1. Upload data sources to a folder in the data source setting screen.

To perform a horizontal join, create a folder and upload data sources in the folder as well.

☞ Page 93 Data source setting

2. Set rules for a horizontal join in the horizontal data join screen.

☞ Page 101 Horizontal data join

3. Check joined data and configure various settings (data set type, variable type, and use of a variable) in the data check screen.

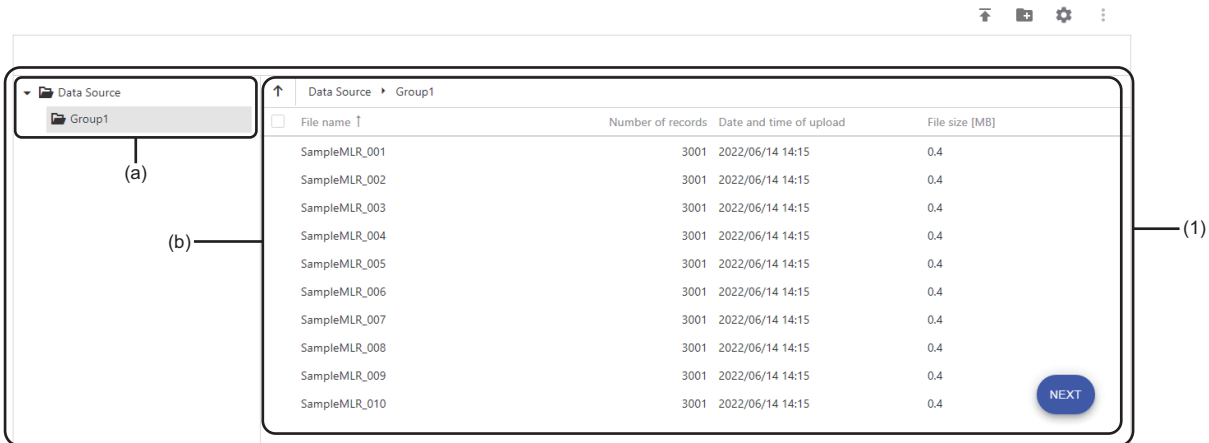
☞ Page 102 Data check

Data source setting

The following shows the screen for uploading a data source.
 A vertically joined group is generated from uploaded data sources.
 For the upload procedure, refer to the following:

Page 94 Uploading a data source

Window



Displayed items


Item	Description	
(Upload) ^{*1}	Click this to upload a data source. (Page 94 Uploading a data source)	
(Create new folder) ^{*1}	Click this to create a folder when a folder for the vertically joined group 2 is not created yet.	
(Display file reading setting) ^{*1}	Click this to configure settings for reading a data source. (Page 98 File reading setting)	
(Menu) ^{*2*3}	Download	To download a selected data source as a text file. (Page 99 Downloading a data source)
	Delete	To delete a selected data source.
	Preview ^{*4}	To display the preview screen for a selected data source in another tab. ^{*5} (Page 112 Preview screen)
(1) File manager explorer	—	Check information on uploaded data sources. A data source can be uploaded to a folder selected in the folder tree by dragging and dropping the data source. (Page 94 Uploading a data source)
	(a) Folder tree	Folders are listed. <ul style="list-style-type: none"> • Group1: A folder for the vertically joined group 1 • Group2: A folder for the vertically joined group 2. This folder can be created by clicking (Create new folder).
	(b) Explorer	Data sources uploaded in a folder selected in the folder tree are listed. <ul style="list-style-type: none"> • File name: A data source name is displayed.^{*6} • Number of records: The number of lines in a data source is displayed.^{*7} • Date and time of upload: The date and time when a data source was uploaded is displayed. • File size [MB]: The file size of a data source is displayed.^{*8}
[Next] button ^{*9}	<ul style="list-style-type: none"> ■When not performing a horizontal join Click this to display the data check screen. (Page 102 Data check) ■When performing a horizontal join Click this to display the horizontal data join screen. (Page 101 Horizontal data join) 	

*1 Can be clicked when upload is not in progress.
 *2 Can be clicked when selecting a data source.
 *3 The context menu can be displayed also by right-clicking on the explorer.
 *4 Can be clicked when selecting only one data source.
 *5 The types of variables displayed in the preview screen are automatically determined based on the first 100 lines of data.
 Page 85 Variable types
 *6 When a file path to a data source is long, the file name may be displayed with the Windows short file name. In this case, the name may differ from the one in Windows Explorer.
 *7 The number does not always match with the actual number of lines in an uploaded data source because the header line and data lines are extracted when reading the data source.
 Page 94 Uploading a data source

- *8 The displayed size is different from the size of the downloaded text file since it is the size handled in this product.
- *9 Can be clicked when both of the following conditions are satisfied:
 - A data source is uploaded in a folder for the vertically joined group 1.
 - Upload is not in progress. (The button name will be "Uploading" while in progress.)

Uploading a data source


The following shows the procedure for uploading a data source.
 For data sources that can be uploaded, refer to the following:

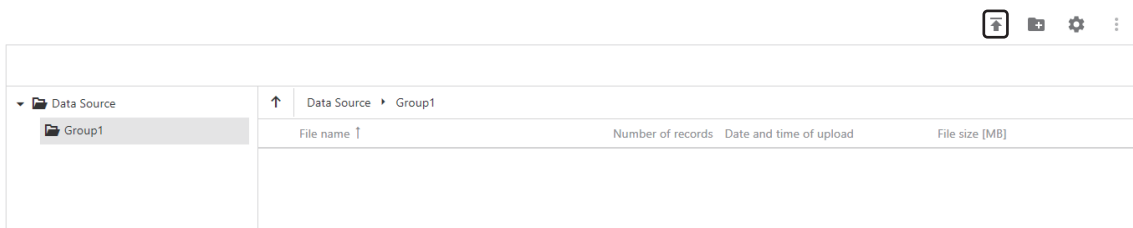
 Page 79 Data source

Restriction

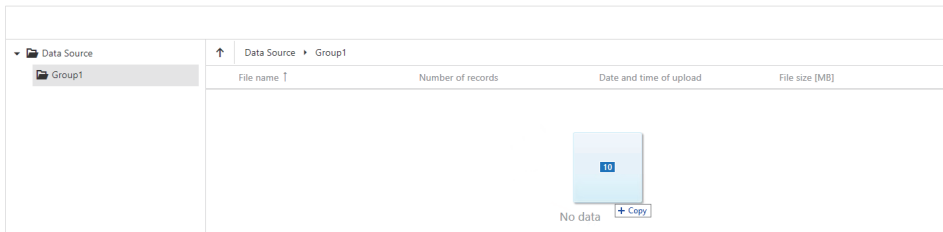
Uploading a data source can be performed for only one data set on the learning station.

Operating procedure

1. Select Group1 (a folder for the vertically joined group 1) and perform either of the following operations:
 - Click  (Upload) and select a data source to be uploaded.



- Drag and drop a data source to be uploaded.



Point

- Multiple data sources can be uploaded if the contents in their header lines match. In this case, data sources are joined vertically in ascending order of their file names.
- Up to 1000 files of data sources can be uploaded at once.
- Data sources can be uploaded also by dragging and dropping a folder where the data sources are stored.

2. Set the header line number (1 to 19)^{*1} and the data start line number (2 to 20)^{*2} to read data sources.

*1 The maximum value that can be set is 'number of lines - 1' when the number of lines in the read data source is less than 20.

*2 The maximum value that can be set is 'number of lines' when the number of lines in the read data source is less than 20.

Group1 file reading setting

Please specify the header line number and data start line number of the text file to be uploaded. The reading setting will be applied to all the files in Group1.

Header line number

Data start line number

Line nu...	col1	col2	col3	col4	col5	col6
1	Cement (com...	Blast Furnace...	Fly Ash (com...	Water (compo...	Superplasticiz...	Coarse Aggr...
2	332.5	142.5	0	228	0	932
3	332.5	142.5	0	228	0	932
4	266	114	0	228	0	932
5	380	95	0	228	0	932
6	380	95	0	228	0	932
7	266	114	0	228	0	932
8	475	0	0	228	0	932
9	190	190	0	228	0	932

(1)

(1) The first 20 lines of the data source are displayed.

For data with a BOOL value (True/False), the value is displayed as True/False regardless of the upper/lower case.

For data with a value close to the maximum value of double precision floating point numbers, the value is displayed as 'Infinity,' and for data with a value close to the minimum value, the value is displayed as '-Infinity.'

(Example) When a value is 1.7976931348623157e+308: Infinity

Data is extracted according to the set header line number and data start line number. For details, refer to the following:

📖 Page 98 Extracting the header line and data lines

Point

This screen is not displayed when a data source is uploaded in Group1 (a folder for the vertically joined group 1). The vertically joined group 1 is generated with data sources that are read according to the file reading setting.

📖 Page 98 File reading setting

3. Click the [OK] button.

The vertically joined group 1 is generated.

To perform a horizontal join, the vertically joined group 2 needs to be created.


Create a folder for the vertically joined group 2 and upload data sources.

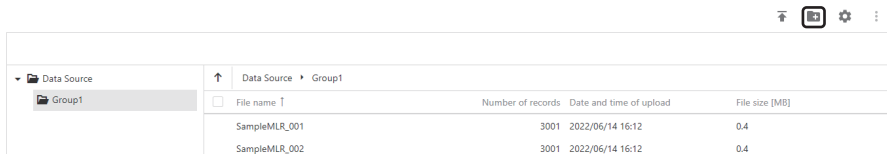
📖 Page 96 When performing a horizontal join

■ When performing a horizontal join

To perform a horizontal join, create a folder for the vertically joined group 2 and upload data sources.


Operating procedure

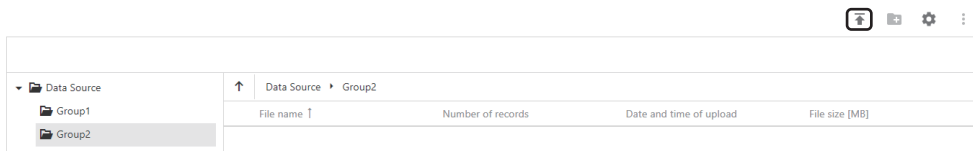
1. Click  (Create new folder) and create a folder for the vertically joined group 2.



File name	Number of records	Date and time of upload	File size [MB]
SampleMLR_001	3001	2022/06/14 16:12	0.4
SampleMLR_002	3001	2022/06/14 16:12	0.4

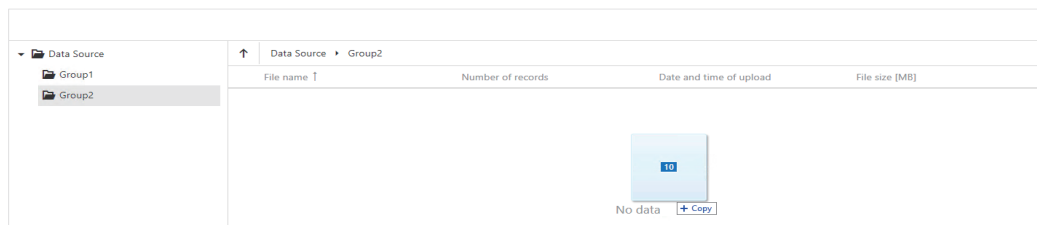
2. Select Group2 (a folder for the vertically joined group 2) and perform either of the following operations:

- Click  (Upload) and select a data source to be uploaded.



File name	Number of records	Date and time of upload	File size [MB]
-----------	-------------------	-------------------------	----------------

- Drag and drop a data source to be uploaded.



No data [+ Copy](#)

A common variable must be included in the data source to join horizontally to the vertically joined group 1.

Point

- When a data set is created without data sources being uploaded in a folder for the vertically joined group 2, the folder will be deleted when creating a data set is completed.
- Multiple data sources can be uploaded if the contents in their header lines match. In this case, data sources are joined vertically in ascending order of their file names.
- Up to 1000 files of data sources can be uploaded at once.
- Data sources can be uploaded also by dragging and dropping a folder where the data sources are stored.

3. Set the header line number (1 to 19)^{*1} and the data start line number (2 to 20)^{*2} to read data sources.

*1 The maximum value that can be set is 'number of lines - 1' when the number of lines in the read data source is less than 20.

*2 The maximum value that can be set is 'number of lines' when the number of lines in the read data source is less than 20.

Group2 file reading setting

Please specify the header line number and data start line number of the text file to be uploaded. The reading setting will be applied to all the files in Group2.

Header line number

Data start line number

Line nu...	col1	col2	col3	col4	col5	col6
1	Cement (com...	Blast Furnace...	Fly Ash (com...	Water (compo...	Superplasticiz...	Coarse Agg...
2	332.5	142.5	0	228	0	932
3	332.5	142.5	0	228	0	932
4	266	114	0	228	0	932
5	380	95	0	228	0	932
6	380	95	0	228	0	932
7	266	114	0	228	0	932
8	475	0	0	228	0	932
9	190	190	0	228	0	932

(1)

(1) The first 20 lines of the data source are displayed.

For data with a BOOL value (True/False), the value is displayed as True/False regardless of the upper/lower case.

For data with a value close to the maximum value of double precision floating point numbers, the value is displayed as 'Infinity,' and for data with a value close to the minimum value, the value is displayed as '-Infinity.'

(Example) When a value is 1.7976931348623157e+308: Infinity

Data is extracted according to the set header line number and data start line number. For details, refer to the following:

Page 98 Extracting the header line and data lines

Point

This screen is not displayed when a data source is uploaded in Group2 (a folder for the vertically joined group 2). The vertically joined group 2 is generated with data sources that are read according to the file reading setting.

Page 98 File reading setting


4. Click the [OK] button.

The vertically joined group 2 is generated.

File reading setting

The following shows the screen for configuring settings to read data sources.

Window

Click  (Display file reading setting). ([Page 93 Data source setting](#))

File reading setting

Set the reading method of text files.
When the setting is changed, all the files uploaded to the changed group are deleted.

Group1 setting

Header line number

Data start line number

Group2 setting

Header line number

Data start line number

Displayed items

Item		Description
Group1 setting	—	Configure settings for uploading data sources to Group1 (a folder for the vertically joined group 1).
	Header line number	Set the header line number (1 to 19). Data is extracted according to the set header line number. Page 98 Extracting the header line and data lines
	Data start line number	Set the data start line number (2 to 20). Data is extracted according to the set data start line number. Page 98 Extracting the header line and data lines
Group2 setting	—	Configure settings for uploading data sources to Group2 (a folder for the vertically joined group 2).
	Header line number	Same as the Group1 setting.
	Data start line number	

■Extracting the header line and data lines

Data is extracted as shown below according to the set header line number and data start line number:

If a data line has more columns than the header line, the columns that the header line has no data are deleted when a data source is read.

Ex.

Header line number: 2, data start line number: 5

A	B	C	
TIME	INDEX	Data1	
DATETIME...	INDEX	LONG[DEC.0]	
09:18.6	1	26	4
09:18.6	2	13	8
09:18.6	3	-81	12



TIME	INDEX	Data1
09:18.6	1	26
09:18.6	2	13
09:18.6	3	-81

Downloading a data source

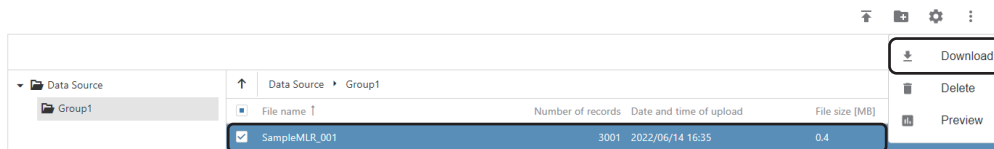
The following shows the procedure for downloading an uploaded data source as a text file.

Point

A text file is downloaded by the download function of a web browser.

Operating procedure

1. Select a data source in the data source setting screen. (☞ Page 93 Data source setting)
2. Click ☰ (Menu), and select [Download].



3. Set an output format and division format.

Download

Output format
CSV format

Division format
 Output all records to one file without dividing
 Output with dividing one file into 65535 lines

OK CANCEL

Item	Description
Output format	Select an output format for a file. <ul style="list-style-type: none">• CSV format: A comma is used as a delimiter.• TSV format: A tab is used as a delimiter.
Division format	Select a division format. <ul style="list-style-type: none">• Output all records to one file without dividing: The contents of a data source are output to one file.• Output with dividing one file into 65535 lines: The contents of a data source are divided by every 65535 lines and output to multiple files. If the whole contents fit in one file, they are downloaded as one file.

4. Click the [OK] button.

Point

When downloading a data source, an event at the download does not occur. (An event occurs when downloading a data set.)

☞ Page 132 Downloading a Data Set

■File name

A file name differs depending on the division format.

- Output all records to one file without dividing: (Data source name) + (extension (.csv or .tsv))^{*1}
- Output with dividing one file into 65535 lines: (Data source name) + (division number^{*2}) + (extension (.csv or .tsv))^{*1}

*1 Windows has a limit of the path length; therefore, a file name is shortened by a web browser. In addition, when a shortened file name is duplicate, the name is also changed according to the specifications of the web browser function.

*2 Starts from '_001' and is incremented for the number of division files.

■Character code

The character code for a text file to be output is UTF-8 (with BOM).

■ Output contents

Records of each variable are output in order.

Ex.

```
Day,TimeCode,A_Area_Price,B_Area_Price,C_Area_Price,D_Area_Price,DayType
1,1,5.143,5.143,6.773,10.173,2.Day-off
1,2,5.034,5.034,6.764,9.844,2.Day-off
1,3,5.054,5.054,6.574,10.284,2.Day-off
```

Point 

For a numerical value type variable, if the value has more than 18 digits, it is rounded to 17 digits and output in exponent notation.

Horizontal data join

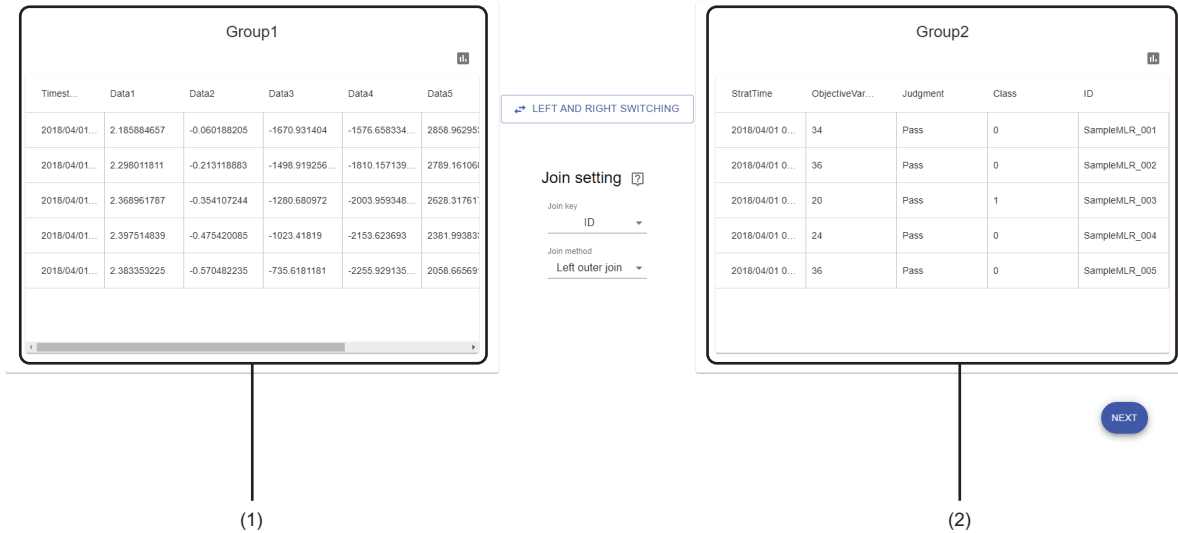
The following shows the screen for setting join rules for a horizontal join.

The vertically joined groups 1 and 2 are joined horizontally with the set join rules to generate joined data.

For details on join rules, refer to the following:

Page 81 Join rules

Window



Displayed items

Item	Description
(1) Left joined group	<p>— Data that comes on the left side when joined horizontally. The first five lines in data are displayed.</p> <p> (Preview) Click this to display the preview screen for the left joined group in another tab.*1 (Page 112 Preview screen)</p>
[Left and right switching] button	Click this to switch the position of data.
Join setting	<p>Join key Select a variable to be used to join data.</p> <p>Join method Select a join method.</p>
(2) Right joined group	<p>— Data that comes on the right side when joined horizontally. The first five lines in data are displayed.</p> <p> (Preview) Click this to display the preview screen for the right joined group in another tab.*1 (Page 112 Preview screen)</p>
[Next] button	Click this to display the data check screen. (Page 102 Data check)

*1 The types of variables displayed in the preview screen are automatically determined based on the first 100 lines of data.

Page 85 Variable types

Data check

The following shows the screen for checking joined data and configuring various settings (data set type, variable type, and use of a variable).

Window

The screenshot shows a window titled 'Waveform data set' with a table of data. The table has columns: Line ID, Timestamp, Data1, Data2, Data3, Data4, Data5, Data6, ID, StratTime, ObjectiveVa, Judgment, and Class. The data rows show various numerical values and timestamps. A 'COMPLETE' button is located at the bottom right of the window.

Displayed items

Item	Description
Data set type	Select a data set type. (📖 Page 84 Data set types)
(Preview)	Click this to display the preview screen for joined data in another tab.*1 (📖 Page 112 Preview screen)
(1) Data set view	Contents of joined data are displayed.*2 The line ID is a number assigned from '1' in the record order. Use this ID to restore the default order after sorting.
(a) Use of a variable	Set whether to use a variable. (📖 Page 85 Use of a variable)
(b) Variable type	Set a variable type. (📖 Page 85 Variable types) The type of each variable is automatically determined and set by default based on the first 100 lines of data. Variable types that can be set differ depending on the automatically determined type. <ul style="list-style-type: none"> Numerical value type variable: Numerical value or category Timestamp type variable: Timestamp or category Category type variable: Category only
[Complete] button*3	Click this to complete creating a data set. Once creation is completed, the data set management screen is displayed. (📖 Page 86 Data Set Management Screen)

*1 Even when settings such as the variable type are changed in this screen, the preview screen shows the settings before change.

*2 is displayed for a variable that cannot be used for learning.

*3 Displayed when 'Use of a variable' is set to "Use" for at least one variable.

Point


If a folder for the vertically joined group 2 exists with no data sources uploaded, the folder will be deleted when creating a data set is completed.

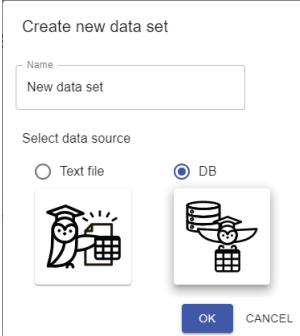
Page 93 Data source setting

7.4 Creating a New Data Set (Database)

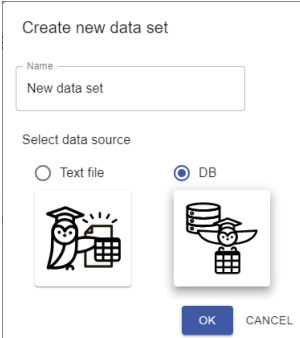
This section shows the procedure for creating a new data set from a database (DB).

Operating procedure

1. Click **+** (Create new) in the data set management screen. ( Page 86 Data Set Management Screen)
2. Set a data set name (up to 255 characters) in the create new data set screen.




3. Select [DB] in "Select data source."




4. Click the [OK] button.

Point

A data set name can be changed in the data set property screen.

 Page 89 Changing properties

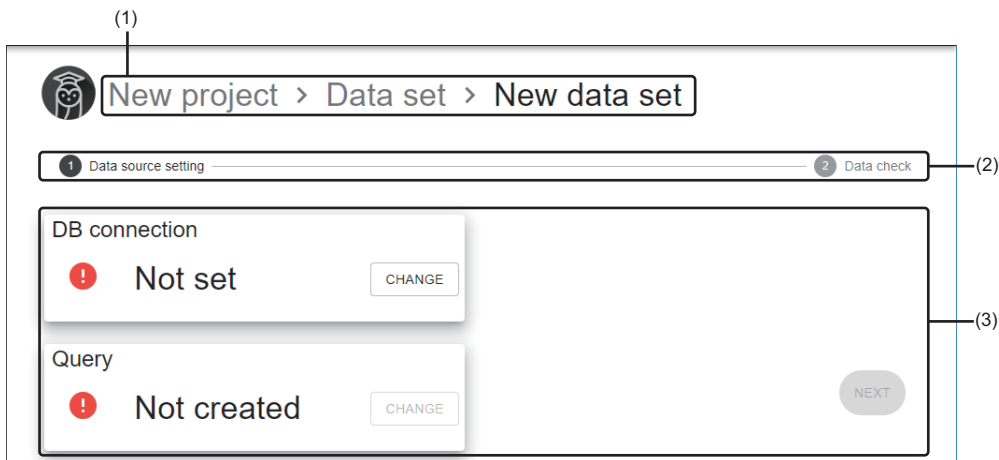
5. Create a data set in the data set creation screen.

 Page 104 Data set creation screen

Data set creation screen

The following shows the screen for creating a data set.

Window



Displayed items

Item	Description
(1) Breadcrumb bar	<p>A breadcrumb bar is displayed.</p> <ul style="list-style-type: none"> • Current project name > Data set > current data set name <p>By clicking a project name, the screen returns to the home screen. (☞ Page 76 Home screen)</p> <p>By clicking "Data set," the screen returns to the data set management screen. (☞ Page 86 Data Set Management Screen)</p>
(2) Stepper	<p>The progress of settings is displayed.</p> <p>A check mark (✔) is put for a completed setting.</p> <p>Each setting screen can be displayed by clicking ✔.</p>
(3) Setting screen	<p>Configure various settings to create a data set. (☞ Page 105 Creation procedure)</p>

Creation procedure

The following shows the procedure for creating a data set.

- 1.** Set connection information to connect to a database.

☞ Page 106 Database connection setting

- 2.** Create a query to acquire data from the database.

☞ Page 107 Creating a query

- 3.** Check data and configure various settings (data set type, variable type, and use of a variable) in the data check screen.

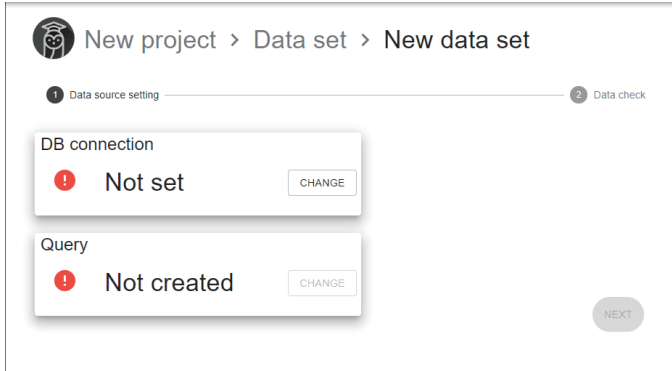
☞ Page 109 Data check

Database connection setting

The following shows the procedure for setting connection information to connect to a database.

Operating procedure

1. Click the [Change] button in "DB connection" in the data set creation screen.



2. Set the following items:

A screenshot of a 'DB connection setting' dialog box. It has a title bar 'DB connection setting'. Below the title, there is a 'DB type' dropdown menu currently set to 'MySQL'. Below the dropdown are five text input fields: 'Destination address *', 'Port number *', 'DB name', 'User name *', and 'Password *'. At the bottom of the dialog, there are three buttons: 'CONNECTION CHECK', 'OK', and 'CANCEL'.

Item	Description
DB type	Select the type of a database to connect to. <ul style="list-style-type: none">• MySQL• PostgreSQL• SQL Server
Destination address	Set the IP address or computer name of a database to connect to.
Port number	Set the port number of a database to connect to.
DB name	Set the name of a database to connect to.
User name	Set the user name used for authentication when connecting to a database.
Password	Set the password used for authentication when connecting to a database.

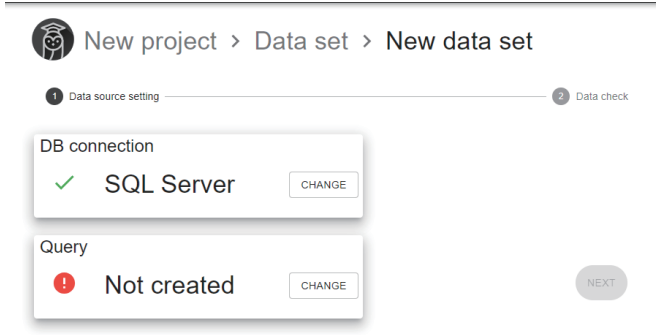
3. Click the [Connection check] button to check whether the database can be connected.
4. Click the [OK] button.

Creating a query

The following shows the procedure for creating a query to acquire data from a database.

Operating procedure

1. Click the [Change] button in "Query" in the data set creation screen.



2. Create a query.



Item	Description	
(Template insertion)	Click this to insert a template. SELECT * FROM "__sample_table__"	
	"__sample_table__"	Replace '__sample_table__' with the table name of a data acquisition target.
▶ (Test execution)	Click this to test if a query works. Up to 100 records are acquired. (Even if a query is created to acquire 101 or more records, only a maximum of 100 records are acquired.)	
(1) Query editor	An area for creating a query. (Number of characters: up to 600000, number of lines: up to 3000) Enter only one query.	
(2) Execution result	[Console] tab	An error occurred in test execution is displayed.
	[Acquired data] tab	A record acquired in test execution is displayed. No values are displayed for missing values (NaN).

3. Click ▶ (Test execution).

Point

For errors returned by a database, refer to the manual for each database to take corrective action.

4. Click the [OK] button.

Precautions

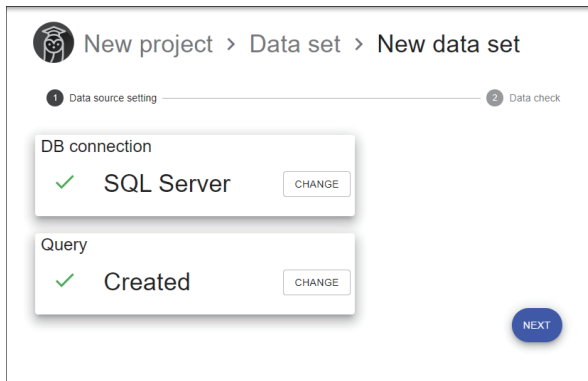
Data in a database may be rewritten depending on the content of a query. Check the content, then click the [OK] button.

Data check

The following shows the procedure for checking acquired data and configuring various settings (data set type, variable type, and use of a variable).

Operating procedure

1. Click the [Next] button in the data set creation screen to acquire data.



For errors returned by a database, refer to the manual for each database to take corrective action.

2. Check the acquired data.

Data set type
Waveform data set


Line ID	id	datetime_value	string_value	float_value
	(a) Use ▾	Use ▾	Use ▾	Use ▾
	(b) Number ▾	Timestamp ▾	Category ▾	Number ▾
1	1	2023-05-19 19:12:26.400	b	0.6280867123461137
2	2	2023-05-19 19:12:27.400	b	0.5093681115392255
3	3	2023-05-19 19:12:28.400	a	0.8514498003628781
4	4	2023-05-19 19:12:29.400	c	0.680377427147575
5	5	2023-05-19 19:12:30.400	b	0.8141621061558292
6	6	2023-05-19 19:12:31.400	b	0.32038041337411494
7	7	2023-05-19 19:12:32.400	b	0.08972378269199854
8	8	2023-05-19 19:12:33.400	c	0.6059088380061773

(1)

COMPLETE

Item	Description
Data set type	Select a data set type. (☞ Page 84 Data set types)
🔄 (Reacquire data) ^{*1}	Click this to reacquire data from a database.
📄 (Preview)	Click this to display the preview screen for data in another tab. ^{*1} (☞ Page 112 Preview screen)
(1) Data set view	Contents of data are displayed. ^{*2} The line ID is a number assigned from '1' in the record order. Use this ID to restore the default order after sorting.
(a) Use of a variable	Set whether to use a variable. (☞ Page 85 Use of a variable)
(b) Variable type	Set a variable type. (☞ Page 85 Variable types) The type of each variable is automatically determined and set by default based on the first 100 lines of data. Variable types that can be set differ depending on the automatically determined type. <ul style="list-style-type: none"> Numerical value type variable: Numerical value or category Timestamp type variable: Timestamp or category Category type variable: Category only
[Cancel]/[Complete] button ^{*3}	[Cancel] button: Click this to cancel data acquisition. [Complete] button: Click this to complete creating a data set. Once creation is completed, the data set management screen is displayed. (☞ Page 86 Data Set Management Screen)

*1 Even when settings such as the variable type are changed in this screen, the preview screen shows the settings before change.

*2  is displayed for a variable that cannot be used for learning.

*3 Not displayed when all variables are set to "Not use" or the status of a data set is "Editing."

3. Click the [Complete] button.

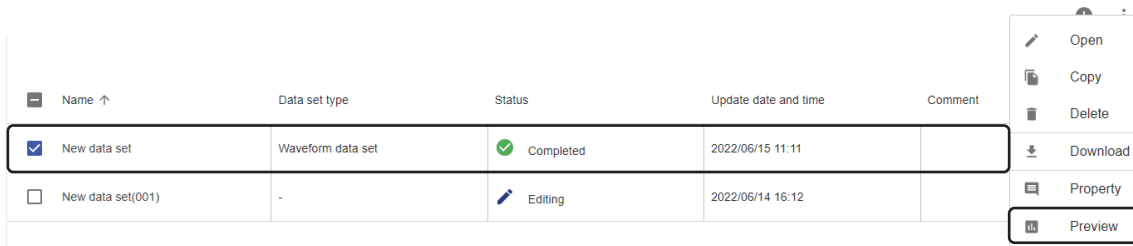
7.5 Visualizing Data

This section shows the procedure for visualizing data by using each type of preview, such as a chart or graph, to check the content.

Visualize data to get insight from the data or to check an objective variable and explanatory variables for learning.

Operating procedure

1. Select a created data set in the data set management screen. (☞ Page 86 Data Set Management Screen)
2. Click ☰ (Menu), and select [Preview].



The screenshot shows a table with the following columns: Name (with an upward arrow), Data set type, Status, Update date and time, and Comment. The first row is selected, and a context menu is open over it, showing options: Open, Copy, Delete, Download, Property, and Preview. The 'Preview' option is highlighted with a red box.

<input type="checkbox"/>	Name ↑	Data set type	Status	Update date and time	Comment
<input checked="" type="checkbox"/>	New data set	Waveform data set	Completed	2022/06/15 11:11	
<input type="checkbox"/>	New data set(001)	-	Editing	2022/06/14 16:12	

3. Visualize data by using each type of preview, such as a chart or graph, in the preview screen.

☞ Page 112 Preview screen

Preview screen

The following shows the screen for visualizing data by using each type of preview, such as a chart or graph. The preview screen is displayed in another tab.



- The variable list in the preview screen shows data of when the screen is displayed.
- In addition, the same data can be displayed in multiple preview screens.

Window


(a)

Variable ...	Variable type	Number of e...	Number of ...	Average value	Standard de...	Minimum va...	Median	Maximum v...	Number of u...	Mode
Timestamp	Timestamp	30010	0	-	-	2018-04-01 00:0...	-	2018-04-01 09:5...	30010	2018-04-01 00:0...
Data1	Number	30010	0	0.00164569129...	1.19333402234...	-2.404112156	-0.0023659905	2.398088502	-	-
Data2	Number	30010	0	-0.00136991965...	0.33612510187...	-0.68113501599...	-0.00076832399...	0.679362053	-	-
Data3	Number	30010	0	4.11422661453...	931.823616494...	-1866.230203	79.94244548	1717.82876499...	-	-
Data4	Number	30010	0	-0.44675612627...	1206.97552271...	-2376.18399999...	5.2049588885	2376.183518	-	-
Data5	Number	30010	0	1.56319290656...	1433.97852463...	-2706.137413	94.960574565	2861.82836999...	-	-
Data6	Number	30010	0	-11963.1660316...	2660497.22198...	-5304914.919	42296.55866	5172893.213	-	-
ID	Category	30010	0	-	-	-	-	-	10	SampleMLR_001
StratTime	Timestamp	30010	0	-	-	2018-04-01 00:0...	-	2018-04-01 09:0...	10	2018-04-01 00:0...

(1) (2)

Displayed items

Item	Description
(Close menu/Open menu)	Click this to open or close the preview menu.
(Reload data)	Click this to read target data again. After data is read, the data overview (Page 114 Data overview) is displayed in the preview display. The selection status of variables is all cleared.

Item			Description
(1) Preview menu	Select preview		Select a preview. <ul style="list-style-type: none"> ■ Table <ul style="list-style-type: none"> • Data overview (Page 114 Data overview) • Raw data (Page 117 Raw data) ■ Single preview <ul style="list-style-type: none"> • Line chart & histogram (Page 118 Line chart and histogram) • Box plot (Page 120 Box plot) • Pie chart & histogram (Page 123 Pie chart and histogram) ■ Correlation preview <ul style="list-style-type: none"> • Scatter plot matrix (Page 125 Scatter plot matrix) • Correlation matrix heat map (Page 127 Correlation matrix heat map) ■ Multiple waveform preview <ul style="list-style-type: none"> • Multiple waveform preview (Page 129 Multiple waveform preview)
	(a) Select variable	—	Variables in target data are listed. Select the checkbox of a variable to be previewed. (Up to 10 variables can be selected.)
		 (Expand) / — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
		Variable name	A variable name is displayed. For a variable to be diagnosed, "(Diagnosis target)" is displayed at the end of the name.
		Variable type	A variable type is displayed. (Page 85 Variable types)
(2) Preview display			The selected preview is displayed.

Data overview

Summarized information (information that shows the overview of data with commonly used statistics) on variables is displayed.

Regardless of the selection status of variables in the preview menu, summarized information on all variables is displayed in the data overview.



The list of variables in data and their overview can be checked, which helps to select a preview and variables to be displayed.

Window

(1) Data1 Data3 Data2


Data overview

Variable...	Variable t...	Number o...	Number o...	Average ...	Standard ...	Minimum ...	Median	Maximum...
Timestamp	Timestamp	30010	0	-	-	2018-04-01 0...	-	2018-04-01 0...
Data1	Number	30010	0	0.001645691...	1.193334022...	-2.404112156	-0.0023659905	2.398088502
Data2	Number	30010	0	-0.001369919...	0.336125101...	-0.681135015...	-0.000768323...	0.679362053
Data3	Number	30010	0	4.1114226614...	931.8236164...	-1866.230203	79.94244548	1717.828764...
Data4	Number	30010	0	-0.446756126...	1206.975522...	-2376.183999...	5.2049588885	2376.183518
Data5	Number	30010	0	1.563192906...	1433.978624...	-2706.137413	94.960574565	2861.828369...
Data6	Number	30010	0	-11963.16603...	2660497.221...	-5304914.919	42296.55866	5172893.213
ID	Category	30010	0	-	-	-	-	-
StratTime	Timestamp	30010	0	-	-	2018-04-01 0	-	2018-04-01 0


(2)


Displayed items

Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. By unselecting a variable, its checkbox in the preview menu is also unselected.

Item	Description
(2) Summarized information ^{*1}	—
 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
Variable name	A variable name is displayed.
Variable type	A variable type is displayed. ( Page 85 Variable types)
Number of elements	The number of elements is displayed. It indicates the number excluding the missing values (NaN) from all records.
Number of missing elements	The number of missing elements is displayed. It indicates the number of missing values (NaN) of all records.
Missing rate ^{*2}	The rate of the number of missing elements is displayed (up to four decimal places). It is calculated by the following formula: • Number of missing elements of the variable / number of all records of the variable × 100
0 number ^{*2}	The number of records where the value is '0' is displayed. ^{*3*4}
0 rate ^{*2}	The rate of the number of records with the value '0' is displayed (up to four decimal places). ^{*5} It is calculated by the following formula: • Number of records with the value '0' of the variable / number of all records of the variable × 100
Average value	The average value is displayed. ^{*3*4} It indicates the arithmetic mean value of all elements excluding the missing values from all records.
Standard deviation	The standard deviation is displayed. ^{*3*4} It indicates the standard deviation value of all elements excluding the missing values from all records.
Minimum value	The minimum value is displayed. ^{*3} It indicates the minimum value of all elements excluding the missing values from all records. For a timestamp type variable, it indicates the oldest date and time.
First quartile ^{*2}	The first quartile is displayed. ^{*3*4} It indicates the value of an element that is at 25% (25th percentile) when sorting the elements excluding the missing values from all records in ascending order.
Median	The median is displayed. ^{*3*4} It indicates the value of an element that is at 50% (50th percentile) when sorting the elements excluding the missing values from all records in ascending order.
Third quartile ^{*2}	The third quartile is displayed. ^{*3*4} It indicates the value of an element that is at 75% (75th percentile) when sorting the elements excluding the missing values from all records in ascending order.
Maximum value	The maximum value is displayed. ^{*3} It indicates the maximum value of all elements excluding the missing values from all records. For a timestamp type variable, it indicates the latest date and time.
Kurtosis ^{*2}	The kurtosis ^{*6} is displayed. ^{*3*4} It indicates the kurtosis value of all elements excluding the missing values from all records.
Skewness ^{*2}	The skewness ^{*7} is displayed. ^{*3*4} It indicates the skewness value of all elements excluding the missing values from all records.
Number of unique elements	The number of unique element types is displayed. ^{*8} It indicates the number of types excluding the missing values from all records.
Mode	The mode is displayed. ^{*8} It indicates the value that appears the most of all elements excluding the missing values from all records. When multiple values appear the same number of times, only one of them is displayed.
Number of mode occurrences ^{*2}	The number of times that the mode appears is displayed. ^{*8}

*1 The state of filtering, sorting, etc. will return to the default when summarized information is hidden by operations such as switching to another preview display.

*2 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

 Page 56 Switching to show or hide

*3 "-" is displayed for a category type variable.

*4 "-" is displayed for a timestamp type variable.

*5 '0' is displayed for a category or timestamp type variable.

*6 An index that shows the sharpness of the probability density function or frequency distribution of a random variable.

*7 An index that shows the asymmetry of a distribution

*8 "-" is displayed for a numerical value type variable.

Precautions

Regardless of the variable type, "-" is displayed when calculation is not possible for the item due to a value of 'inf' or '-inf.'

Raw data

Raw data (unprocessed values in target data) of a selected variable is displayed.

Point Concrete values of data that cannot be checked in the summary information or graphs can be checked.

Window



Displayed items

Item	Description	
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)	
(2) Raw data ^{*1}	—	
	(Expand) / (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
	(a) Variable name	A variable name is displayed.
	(b) Variable type	A variable type is displayed. (Page 85 Variable types)

*1 The state of filtering, searching, etc. will return to the default when raw data is hidden by operations such as unselecting all variables or switching to another preview display.

Point A missing value (NaN) or infinity value (Inf) is displayed as a blank.

Line chart and histogram

A line chart and histogram are displayed for each selected variable.

To overlay line charts of multiple variables, refer to the following:

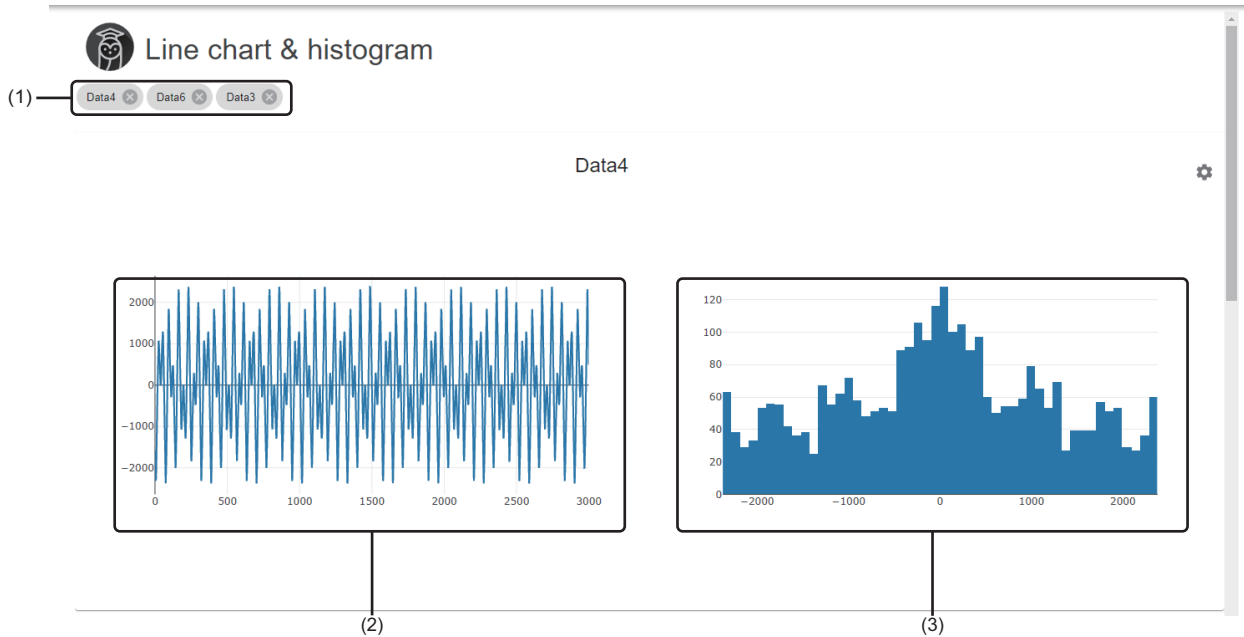
Page 129 Multiple waveform preview

Point

The transition of each variable can be checked in chronological order by using a line chart.

In addition, the entire distribution can be checked by using a histogram.

Window

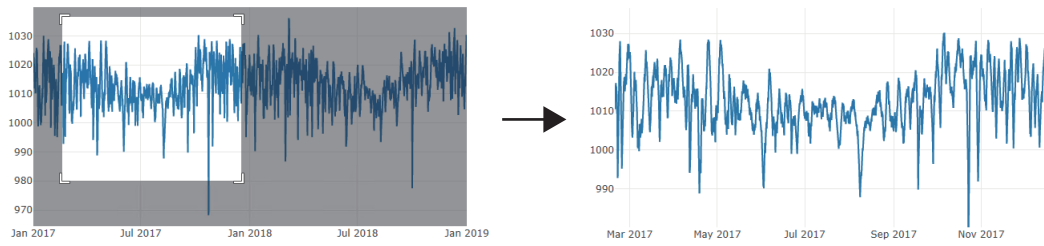


Displayed items

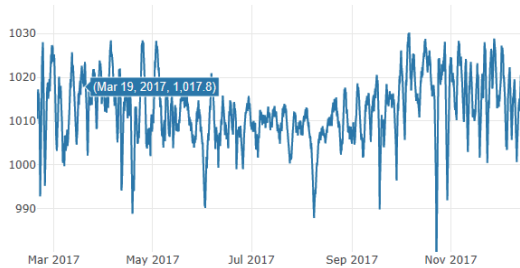
Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)
(Drawing setting)	Click this to display the drawing setting screen for the preview.*1 (Page 119 Drawing setting screen) The screen is closed by clicking this icon again.
(2) Line chart	A line chart is displayed. Whole data is displayed by default. The detailed transition of values can be checked by zooming in the chart. The display is changed according to the setting of "Line chart x-axis label selection" in the drawing setting screen. However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.
(3) Histogram	A histogram (x axis: bin, y axis: frequency for the x axis) is displayed. Whole data is displayed by default. The detailed distribution of values can be checked by zooming in the histogram or changing the number of bins. For a numerical value type variable, the display is changed according to the setting of "Number of histogram bins setting" in the drawing setting screen.

*1 When the drawing setting screen for another variable is displayed, the screen is hidden by clicking this icon. Click this icon again to display the drawing setting screen for a target variable.

A line chart and histogram can be zoomed in as follows by dragging the cursor on them.



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



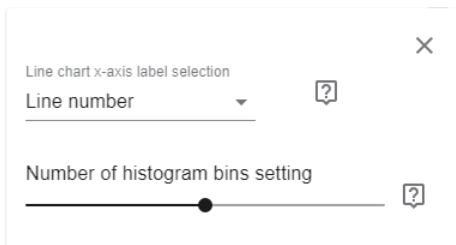
The display will return to the default when performing either of the following operations:

- Selecting a new variable or unselecting any selected variables
- Clicking ⚙️ (Drawing setting)

Drawing setting screen

The following shows the screen for configuring drawing settings for a preview.

Window



Displayed items

Item	Description
Line chart x-axis label selection	Set the x axis of a line chart from the following: <ul style="list-style-type: none"> • "Line number" • Timestamp type variable in target data For time-series data, chronological changes in values can be checked by setting a timestamp type variable.
Number of histogram bins setting ^{*1}	Set the number of bins of a histogram (1 to 100) with a slider. The broad distribution can be checked by reducing the number of bins, and the detailed distribution can be checked by increasing the number of bins.

*1 Displayed for a numerical value type variable.

Precautions

The settings will return to the default when the preview is hidden by operations such as switching to another preview display.

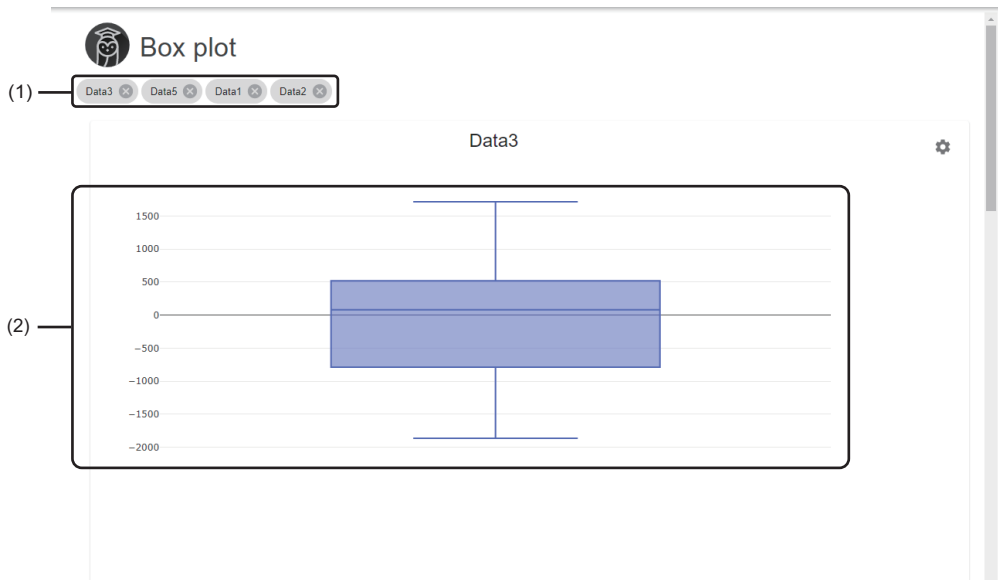
Box plot

A box plot is displayed for each selected variable.


Point 

A whole distribution of each variable and whether there is an outlier can be checked by using a box plot. In addition, differences between categories can be checked by plotting a box plot by category.

Window

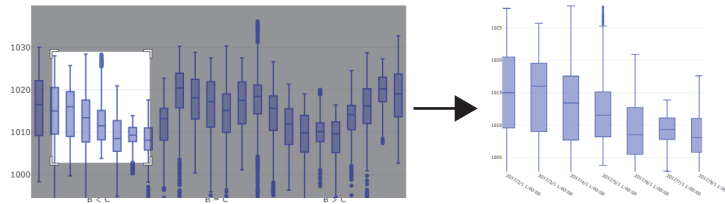


Displayed items

Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)
 (Drawing setting)	Click this to display the drawing setting screen for the preview. ^{*1} (Page 122 Drawing setting screen) The screen is closed by clicking this icon again.
(2) Box plot	A box plot is displayed. (Up to 100 box plots) Whole data is displayed by default. The detailed distribution and differences between categories can be checked by zooming in the box plot or dividing it by category. The display is changed according to the settings in the drawing setting screen. (When settings are not configured, all points are displayed as one box plot.)

*1 When the drawing setting screen for another variable is displayed, the screen is hidden by clicking this icon. Click this icon again to display the drawing setting screen for a target variable.

A box plot can be zoomed in as follows by dragging the cursor on it.



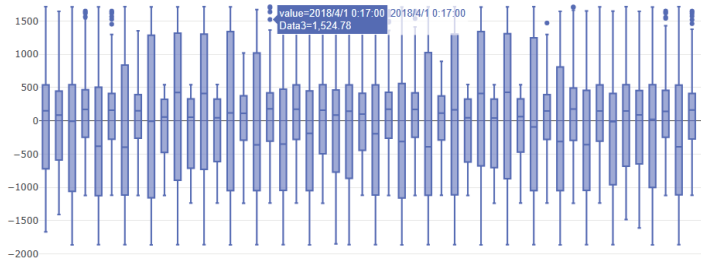
In addition, the following value(s) can be displayed by placing the cursor:

❶ Box plot: The following values can be displayed at once:


- Maximum value (max)
- Third quartile (q3)
- Second quartile (median)
- First quartile (q1)
- Minimum value (min)

The upper side boundary (upper fence) is displayed when an outlier exists on the upper side, and the lower side boundary (lower fence) is displayed when an outlier exists on the lower side.

❷ Outlier: The value of a point closest to the cursor is displayed.



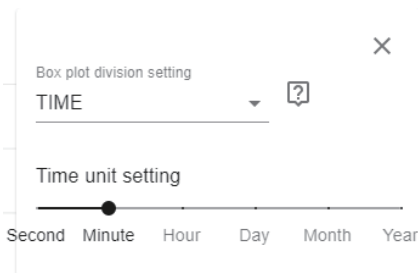
The display will return to the default when performing either of the following operations:

- Selecting a new variable or unselecting any selected variables
- Clicking  (Drawing setting)

Drawing setting screen

The following shows the screen for configuring drawing settings for a preview.

Window



Displayed items

Item	Description
Box plot division setting	Set the x axis of a box plot from category type variables or timestamp type variables in target data. Differences in the distribution between categories or the chronological transition of the distribution can be checked. For a category type variable, when the number of unique elements exceeds 100, 99 elements are displayed in descending order according to the data quantity, and other elements are displayed together as "Others."
Time unit setting ^{*1}	<p>Select a time unit to display a box plot with a slider.</p> <p>When the difference between the upper and lower limit values of a selected timestamp type variable exceeds 100 in a time unit, the smallest unit in which the difference does not exceed 100 is selected. (The time unit exceeding 100 cannot be selected.)</p> <p>The following shows the example when the difference between the upper and lower limits exceeds 100 minutes: (Example) Changing time units of a box plot from minutes to hours</p>

*1 Displayed when setting a timestamp type variable in "Box plot division setting."

Precautions

The settings will return to the default when the preview is hidden by operations such as switching to another preview display.

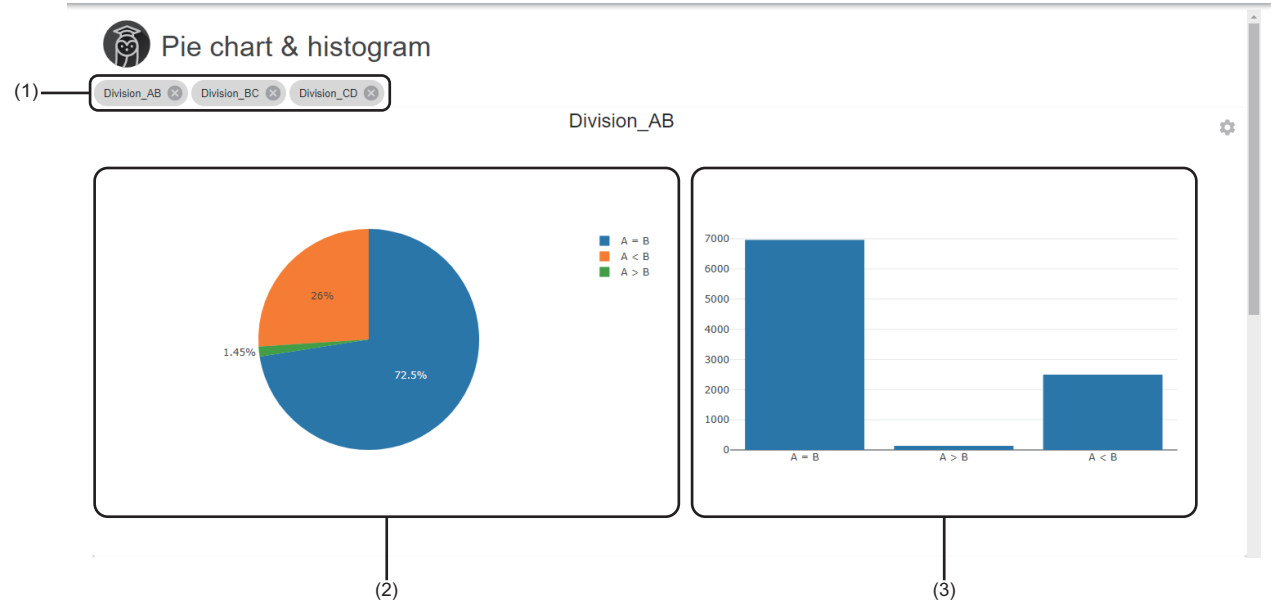
Pie chart and histogram

A pie chart and histogram are displayed for each selected variable.
 However, a pie chart cannot be displayed for a timestamp type variable.

Point

The proportion of components can be checked for each variable by using a pie chart.
 In addition, the entire distribution can be checked by using a histogram.

Window



Displayed items

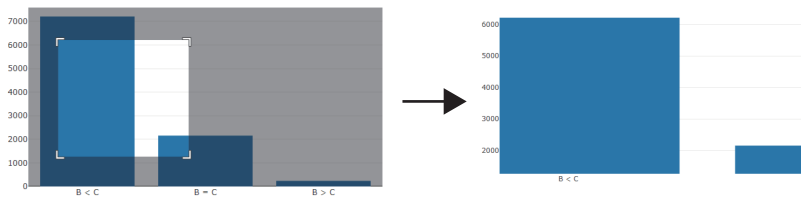
Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)
⚙️ (Drawing setting) ^{*1}	Click this to display the drawing setting screen for the preview. ^{*2} (Page 124 Drawing setting screen) The screen is closed by clicking this icon again.
(2) Pie chart	A pie chart is displayed. ^{*3} A missing value is also displayed as one of the components. An infinity value is treated as a missing value.
(3) Histogram	A histogram (x axis: bin, y axis: frequency for the x axis) is displayed. Whole data is displayed by default. The detailed distribution of values can be checked by zooming in the histogram or changing the number of bins. The display is changed according to the settings in the drawing setting screen.

*1 Can be clicked only for a numerical value type variable.

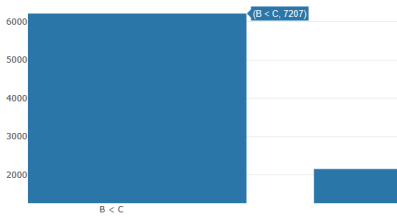
*2 When the drawing setting screen for another variable is displayed, the screen is hidden by clicking this icon. Click this icon again to display the drawing setting screen for a target variable.

*3 For a numerical type variable, when the number of unique elements is 100 or more, the whole numerical range is binned into 100 sections and displayed as 100 components.


A histogram can be zoomed in as follows by dragging the cursor on it. (A pie chart cannot be zoomed in.)



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



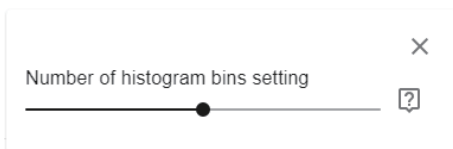
The display will return to the default when performing either of the following operations:

- Selecting a new variable or unselecting any selected variables
- Clicking  (Drawing setting)

Drawing setting screen

The following shows the screen for configuring drawing settings for a preview.

Window



Displayed items

Item	Description
Number of histogram bins setting	Set the number of bins of a histogram (1 to 100) with a slider. The broad distribution can be checked by reducing the number of bins, and the detailed distribution can be checked by increasing the number of bins.

Precautions

The settings will return to the default when the preview is hidden by operations such as switching to another preview display.

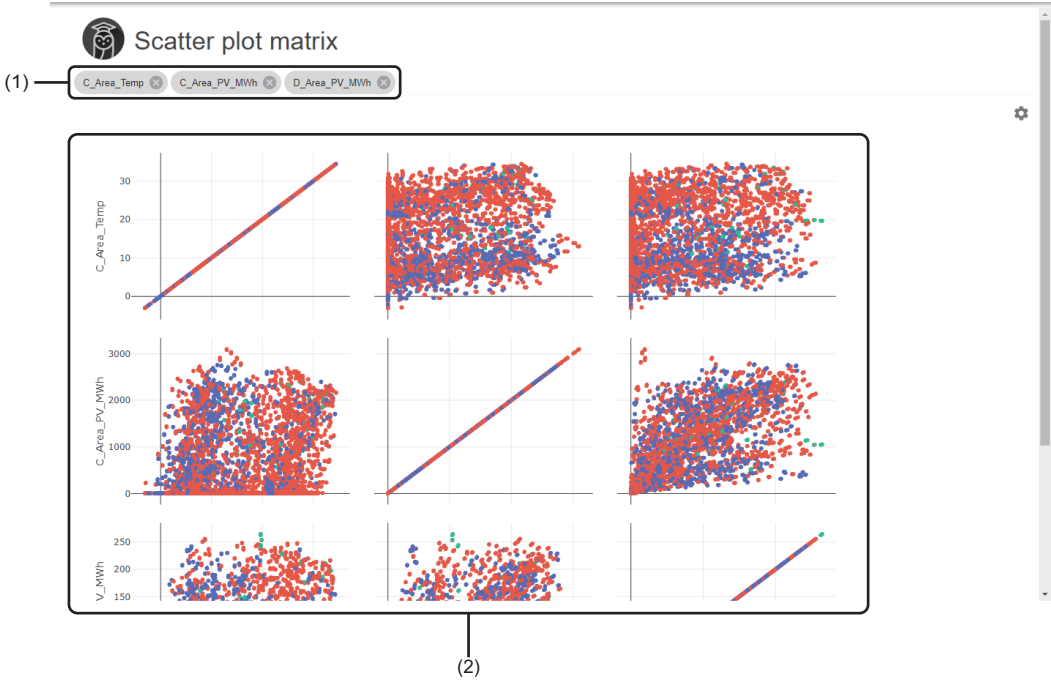
Scatter plot matrix

A scatter plot matrix for selected variables is displayed.

Point

Scatter plots for all the combinations of selected variables are displayed; therefore, the relation between the variables can be checked.

Window



Displayed items

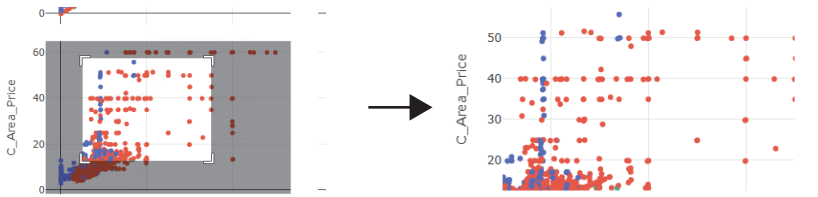
Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)
⚙️ (Drawing setting)	Click this to display the drawing setting screen for the preview. (Page 126 Drawing setting screen) The screen is closed by clicking this icon again.
(2) Scatter plot matrix	A scatter plot matrix is displayed.*1 On the diagonal line of a matrix, scatter plots for the same variables (scatter plots distributed on $y=x$) are displayed. Whole data is displayed by default. The detailed distribution of values can be checked by zooming in a scatter plot. The display is changed according to the settings in the drawing setting screen. (When settings are not configured, the scatter plot matrix is not color-coded.)

*1 When the character length of each y axis value displayed on scatter plots in the leftmost column is long, the axis value may appear to overlap with the variable name displayed on the left side of the value.
When the character length of each x axis value displayed on scatter plots in the bottom row is long, the axis value may appear to overlap with the variable name displayed under the value.

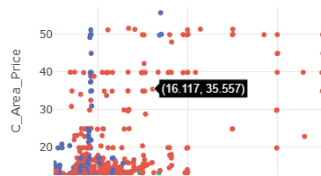
Precautions

A scatter plot matrix may not be displayed properly when selecting a timestamp type variable.


A scatter plot matrix can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



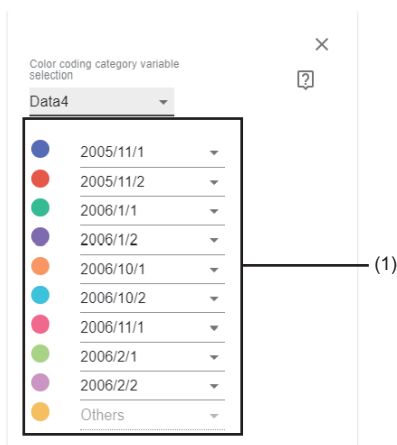
The display will return to the default when performing either of the following operations:

- Selecting a new variable or unselecting any selected variables
- Clicking  (Drawing setting)

Drawing setting screen

The following shows the screen for configuring drawing settings for a preview.

Window



Displayed items

Item	Description
Color coding category variable selection	A scatter plot is color-coded by category in a selected variable. A variable can be selected from the category type variable in target data. Differences in the distribution between categories can be checked.
(1) Color group	Map colors in a scatter plot to categories. A scatter plot is color-coded based on this setting. When there are 11 or more types of categories, colors can be set for up to 9 types of categories. The rest is all color-coded with a color of the last line ("Others").

Precautions

The settings will return to the default when the preview is hidden by operations such as switching to another preview display.

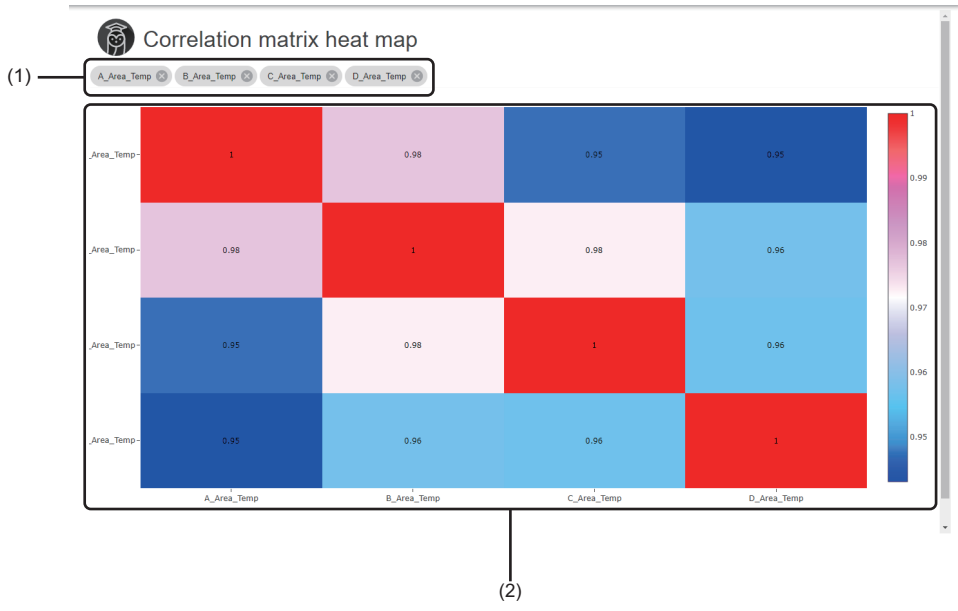
Correlation matrix heat map

A correlation matrix for selected variables is displayed with a heat map. However, this is not available for a category or timestamp type variable.

Point 

The correlation coefficients are calculated for all the combinations of selected variables, and the magnitude of the coefficients is displayed intuitively with the color density. The relation between variables can be checked.

Window



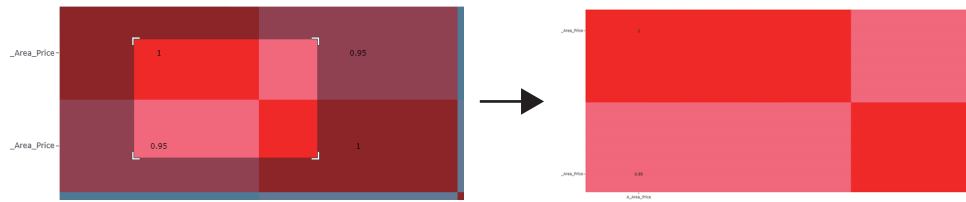
Displayed items

Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)
(2) Correlation matrix heat map	A correlation matrix heat map is displayed. The correlation coefficients*1 for all the combinations of variables and the correlation degrees are displayed with a color scale.*2 The x and y axes have the same variable on the diagonal line of a matrix; therefore, the correlation coefficient becomes '1.' A whole correlation matrix is displayed by default, and it can be zoomed in to check details. If all values are infinite (Inf), the values become missing values (NaN) because their correlation coefficients cannot be calculated.

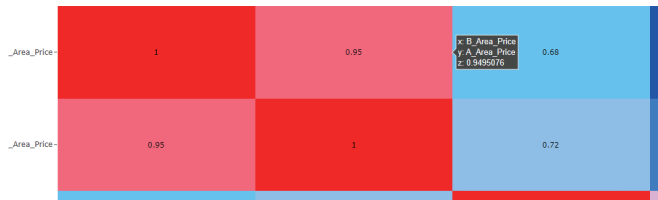
*1 Rounded up to two decimal places.

*2 If the correlation coefficients are all missing values (NaN), the variable names displayed on the leftmost or bottom of the heat map are hidden.

A correlation matrix heat map can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



When selecting a new variable or unselecting any selected variables, the display will return to the default.

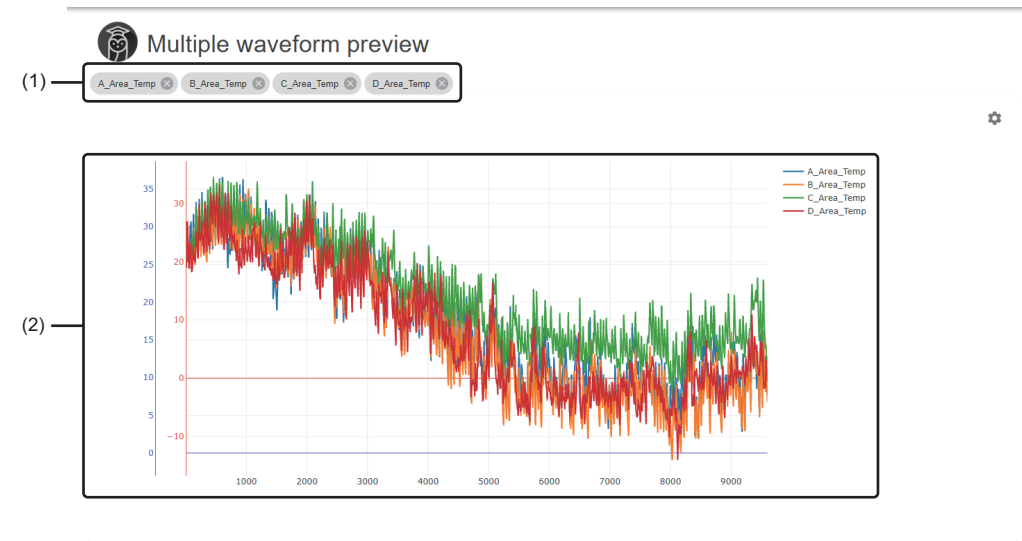
Multiple waveform preview

Multiple selected variables are displayed as line charts.
 However, this preview cannot be displayed for timestamp type variables.



Point 

Not only the chronological transition but also the relation between variables can be checked by displaying line charts for multiple variables on the same graph.
 In addition, variables in different value ranges can be overlaid by dividing them into groups and displaying each group on the y axis with a different scale.

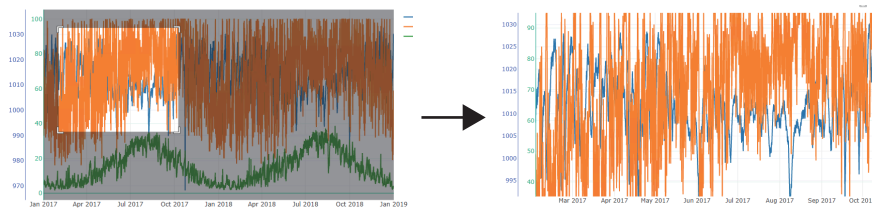
Window



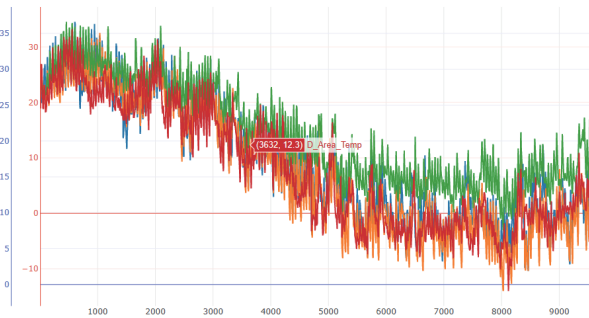
Displayed items

Item	Description
(1) Variable list	Variables selected in the preview menu are displayed. A variable is not previewed by unselecting the variable. (Its checkbox in the preview menu is also unselected.)
 (Drawing setting)	Click this to display the drawing setting screen for the preview. ( Page 130 Drawing setting screen) The screen is closed by clicking this icon again.
(2) Line chart	Line charts for multiple selected variables are displayed. Whole data is displayed by default. The detailed transition of values can be checked by zooming in the graph. The display is changed according to the settings in the drawing setting screen. However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.

A line chart can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



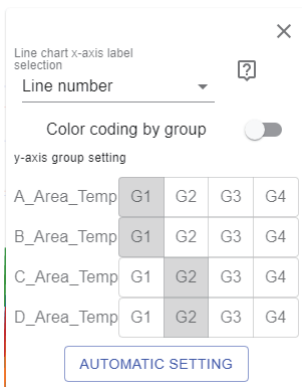
The display will return to the default when performing either of the following operations:

- Selecting a new variable or unselecting any selected variables
- Clicking ⚙️ (Drawing setting)

Drawing setting screen

The following shows the screen for configuring drawing settings for a preview.

Window



Displayed items

Item	Description
Line chart x-axis label selection	Set the x axis of a line chart from the following: <ul style="list-style-type: none"> • "Line number" • Timestamp type variable in target data For time-series data, chronological changes in values can be checked by setting a timestamp type variable.
Color coding by group	Turn this ON to color-code charts by group.
y-axis group setting	Set groups of variables (G1 to G4) to share the y axis.*1 Variables on different scales can be overlaid by displaying variables with a close value range on the same y axis scale; therefore, the correlation relations can be checked. Variables are automatically divided into groups by default. To restore the default settings after setting groups manually, click the [Automatic setting] button.*2 In addition, G1 is set for a newly selected variable.

*1 The number of groups that can be set is as follows:
 - When setting manually: 4

- When setting automatically: 2 each for numerical value type variables and category type variables
- *2 Automatic grouping is performed according to the following:
 - Numerical value type variables: When two or more variables are selected, they are divided into two groups based on the average value calculated from the maximum value of each variable.
 - ❶ The maximum value of each variable is acquired.
 - ❷ The average value is calculated for the maximum values of all variables acquired in step ❶.
 - ❸ Variables are divided by 'maximum value of each variable > average value' and 'maximum value of each variable \leq average value.'
 - Category type variables: Selected variables are divided into two groups, one with only the variable on the top in the displayed order, and one with the rest of the variables. Groups later than the ones used by numerical value type variables will be used. For example, if G1 and G2 are used by numerical value type variables, category type variables are divided into G3 and G4.

Precautions

The settings will return to the default when the preview is hidden by operations such as switching to another preview display.

7.6 Downloading a Data Set

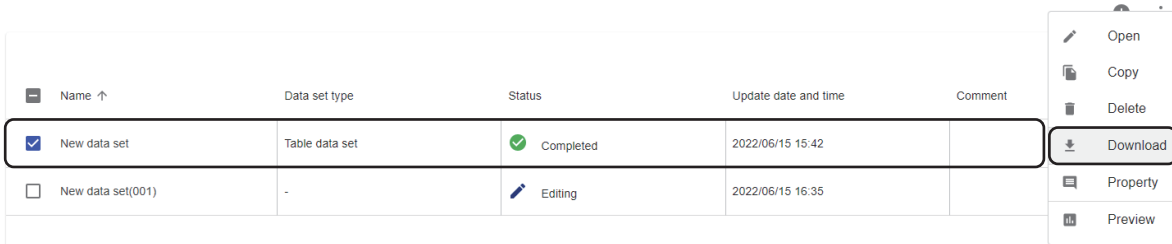
This section shows the procedure for downloading a created data set as a text file. A downloaded text file can be used in Excel or other software.

Point

- However, variables for which 'Use of a variable' is set to "Not use" are not output.
- A text file is downloaded by the download function of a web browser.

Operating procedure

1. Select a created data set in the data set management screen. (☞ Page 86 Data Set Management Screen)
2. Click ☰ (Menu), and select [Download].



3. Set an output format and division format.

Download

Output format

Division format

Output all records to one file without dividing

Output with dividing one file into 65535 lines

Item	Description
Output format	Select an output format for a file. <ul style="list-style-type: none"> • CSV format: A comma is used as a delimiter. • TSV format: A tab is used as a delimiter.
Division format	Select a division format. <ul style="list-style-type: none"> • Output all records to one file without dividing: The contents of a data set are output to one file. • Output with dividing one file into 65535 lines: The contents of a data set are divided by every 65535 lines and output to multiple files. If the whole contents fit in one file, they are downloaded as one file.

4. Click the [OK] button.

■File name

A file name differs depending on the division format.

- Output all records to one file without dividing: (Data set name) + (extension (.csv or .tsv))*¹
- Output with dividing one file into 65535 lines: (Data set name) + (division number*²) + (extension (.csv or .tsv))*¹

*1 Windows has a limit of the path length; therefore, a file name is shortened by a web browser. In addition, when a shortened file name is duplicate, the name is also changed according to the specifications of the web browser function.
 *2 Starts from '_001' and is incremented for the number of division files.

■Character code

The character code for a text file to be output is UTF-8 (with BOM).

■Output contents

Records of each variable are output in order.

Ex.

```
Day,TimeCode,A_Area_Price,B_Area_Price,C_Area_Price,D_Area_Price,DayType
1,1,5.143,5.143,6.773,10.173,2.Day-off
1,2,5.034,5.034,6.764,9.844,2.Day-off
1,3,5.054,5.054,6.574,10.284,2.Day-off
```

Point

For a numerical value type variable, if the value has more than 18 digits, it is rounded to 17 digits and output in exponent notation.

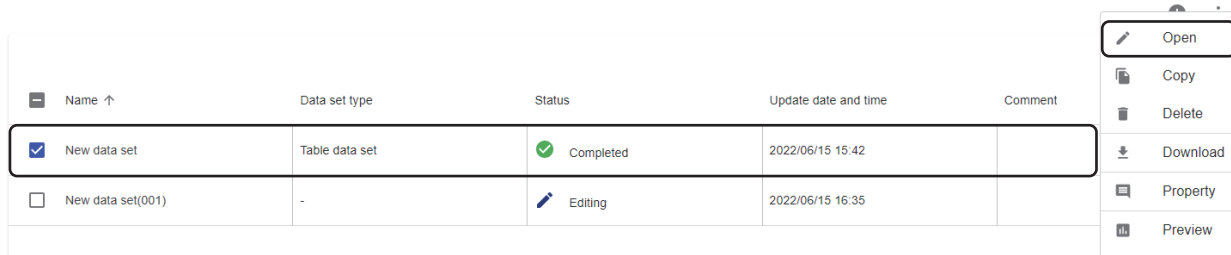
7.7 Editing a Data Set

This section shows the procedure for editing a created data set.

Edit a data set to visualize data or create an AI again by applying newly collected data or newly accumulated data in a database to the data set after visualizing data or creating an AI with the data set.

Operating procedure

1. Select a created data set in the data set management screen. (☞ Page 86 Data Set Management Screen)
2. Click ☰ (Menu), and select [Open].



The screenshot shows a table with the following columns: Name, Data set type, Status, Update date and time, and Comment. The first row, 'New data set', is selected and has a context menu open over it. The context menu options are: Open, Copy, Delete, Download, Property, and Preview. The second row, 'New data set(001)', is not selected and has a status of 'Editing'.

Name	Data set type	Status	Update date and time	Comment
<input checked="" type="checkbox"/> New data set	Table data set	Completed	2022/06/15 15:42	
<input type="checkbox"/> New data set(001)	-	Editing	2022/06/15 16:35	

3. Edit the data set in the data set creation screen.
 - When using a text file as a data source (☞ Page 91 Data set creation screen)
 - When using a database as a data source (☞ Page 104 Data set creation screen)

8 AI CREATION AND MANAGEMENT

This chapter shows the methods for creating and managing AIs.

8.1 AI

This section explains an AI. An AI is a model that derives data patterns and rules automatically and can diagnose unknown data by performing learning with a data set (or data that a data set is converted into).

Once an AI is created, a task can be created by using the AI.



Precautions

Learning or diagnosis may not be performed as intended depending on the data used for learning and the method to create an AI (analysis method).

Creation method

There are the following two types of methods to create an AI.


As long as a purpose is determined, an AI can be created even when a user is not familiar with analysis methods or is not sure which method to select among a number of methods.

Creation method	Description	Application	Creation procedure
Automatic creation	A method to create an AI automatically. By selecting the purpose to use an AI in a conversational format, the optimal analysis method is selected automatically according to the selected purpose. All that is left is to set simple parameters; the appropriate learning method is determined automatically according to the set parameters.	When a purpose to use an AI is determined though a user is not familiar with analysis methods or not sure which analysis method to select	 Page 140 Creating a New AI (Automatically)
Manual creation	A method to create an AI manually. A learning method is determined by selecting a concrete analysis method and customizing each unit of processing for learning and its parameters one by one.	When an analysis method to be used is determined	 Page 172 Creating a New AI (Manually)

Point

An AI can be edited after creation.

For an AI that is created automatically, its accuracy can be improved by customizing the AI manually after creation.

 Page 192 Editing an AI

Learning flow

The following shows the process flow for learning.

Each unit of processing and its parameters can be customized one by one.

1. Preprocessing

Data is formed and features are added to improve the accuracy of a model.

2. Optimizing and learning an analysis method

Hyperparameters of an analysis method are optimized, and learning is performed.

3. Selecting an analysis method

Results predicted by multiple analysis methods are gathered.

Restriction

The number of units of learning that can be performed at the same time is limited as follows:

- Per project: 1
 - In the entire learning station: 3
-


Precautions

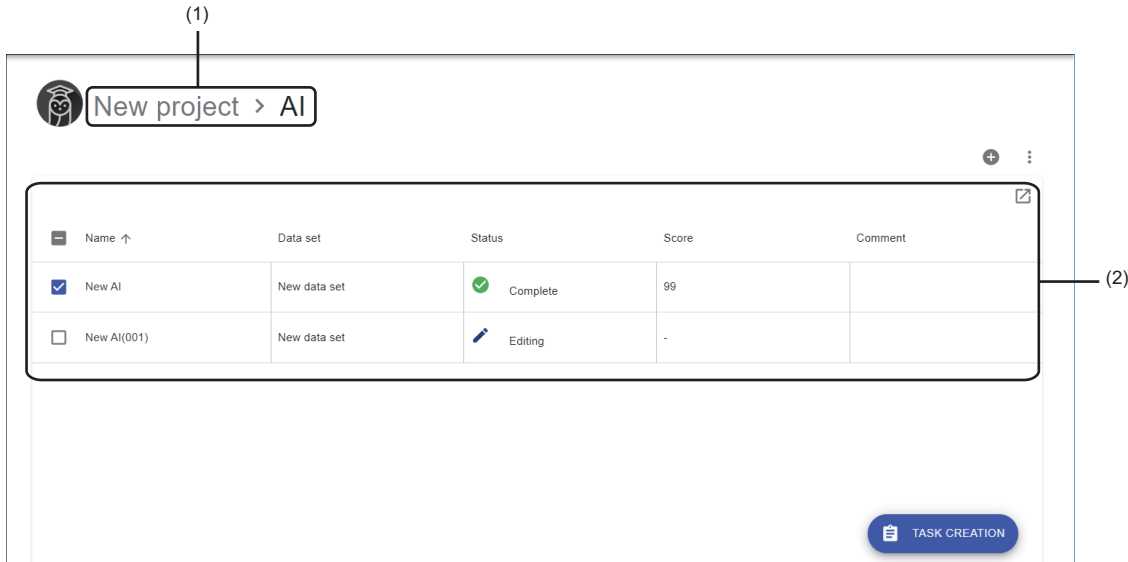
Processing of step 2 is proceeded randomly; therefore, even when learning is performed for the same data with the same settings, the models of evaluation results or diagnosis results are not necessarily the same.

8.2 AI Management Screen



This section shows the AI management screen for creating and managing AIs.
Up to 128 AIs can be created in each project.

Window

Click  (AI) on the side bar. ([Page 49 Side bar](#))



Displayed items

Item	Description												
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> Current project name > AI By clicking a project name, the screen returns to the home screen. <ul style="list-style-type: none"> Page 76 Home screen 												
 (Create new)	Click this to create a new AI. The procedure differs depending on the AI creation method. <ul style="list-style-type: none"> Page 140 Creating a New AI (Automatically) Page 172 Creating a New AI (Manually) For the creation method, refer to the following: <ul style="list-style-type: none"> Page 135 Creation method 												
 (Menu) ^{*1*2}	<table border="1"> <tbody> <tr> <td>Open^{*3}</td> <td>To open a selected AI.^{*4}</td> </tr> <tr> <td>Copy</td> <td>To create a copy of a selected AI.^{*5*6}</td> </tr> <tr> <td>Delete</td> <td>To delete a selected AI.</td> </tr> <tr> <td>Property^{*3}</td> <td>To change properties (name and comment) of a selected AI. <ul style="list-style-type: none"> Page 139 Changing properties </td> </tr> <tr> <td>Preview^{*3*7}</td> <td>To check the learning result of a selected AI. <ul style="list-style-type: none"> Page 190 Displaying a Learning Result </td> </tr> <tr> <td>Test^{*3*8}</td> <td>To test a selected AI. <ul style="list-style-type: none"> Page 193 Testing an AI </td> </tr> </tbody> </table>	Open ^{*3}	To open a selected AI. ^{*4}	Copy	To create a copy of a selected AI. ^{*5*6}	Delete	To delete a selected AI.	Property ^{*3}	To change properties (name and comment) of a selected AI. <ul style="list-style-type: none"> Page 139 Changing properties 	Preview ^{*3*7}	To check the learning result of a selected AI. <ul style="list-style-type: none"> Page 190 Displaying a Learning Result 	Test ^{*3*8}	To test a selected AI. <ul style="list-style-type: none"> Page 193 Testing an AI
Open ^{*3}	To open a selected AI. ^{*4}												
Copy	To create a copy of a selected AI. ^{*5*6}												
Delete	To delete a selected AI.												
Property ^{*3}	To change properties (name and comment) of a selected AI. <ul style="list-style-type: none"> Page 139 Changing properties 												
Preview ^{*3*7}	To check the learning result of a selected AI. <ul style="list-style-type: none"> Page 190 Displaying a Learning Result 												
Test ^{*3*8}	To test a selected AI. <ul style="list-style-type: none"> Page 193 Testing an AI 												

Item	Description											
(2) AI list	—	Als are listed.										
	(Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header										
	Name	An AI name is displayed. An AI can be opened by clicking the name.*4										
	Data set	The name of a data set selected to create an AI is displayed. is displayed when the data set is being edited or deleted. is displayed when an AI is in the "Complete," "Learned," or "Learning" state and also the data set is changed after starting learning.										
	Diagnosis target*9	The name of an objective variable specified for learning is displayed.*10										
	Status	The status of an AI is displayed. The progress is also displayed while learning.										
		<table border="1"> <tr> <td>Complete</td> <td>Creating an AI is completed.</td> </tr> <tr> <td>Learned</td> <td>Learning is completed but creation is not completed.</td> </tr> <tr> <td>Learning</td> <td>Learning started and still is in progress.</td> </tr> <tr> <td>Editing</td> <td>An AI is being edited and does not start learning.</td> </tr> <tr> <td>Error</td> <td>Learning failed.</td> </tr> </table>	Complete	Creating an AI is completed.	Learned	Learning is completed but creation is not completed.	Learning	Learning started and still is in progress.	Editing	An AI is being edited and does not start learning.	Error	Learning failed.
Complete	Creating an AI is completed.											
Learned	Learning is completed but creation is not completed.											
Learning	Learning started and still is in progress.											
Editing	An AI is being edited and does not start learning.											
Error	Learning failed.											
	Model type*9	The model type of an AI that completes learning is displayed.*11 "Others" is displayed for a model type other than a classification or regression model.										
	Score	The learning performance (overview score) is displayed.*12 An overview score is an evaluation index that shows the accuracy of an AI which completes learning with a value between 0 and 100. This score indicates the prediction accuracy of an AI. When the score is 80, the AI can predict a result for input data correctly at approximately 80%. The score is calculated as follows:										
		<table border="1"> <tr> <td>For a classification model</td> <td>An integer value obtained by multiplying the F1 score by 100</td> </tr> <tr> <td>For a regression model</td> <td>An integer value obtained by multiplying R2 by 100 (When R2 has a negative value, the score will be '0' regardless of the value. If R2 cannot be calculated, the overview score cannot be calculated either.)</td> </tr> </table>	For a classification model	An integer value obtained by multiplying the F1 score by 100	For a regression model	An integer value obtained by multiplying R2 by 100 (When R2 has a negative value, the score will be '0' regardless of the value. If R2 cannot be calculated, the overview score cannot be calculated either.)						
For a classification model	An integer value obtained by multiplying the F1 score by 100											
For a regression model	An integer value obtained by multiplying R2 by 100 (When R2 has a negative value, the score will be '0' regardless of the value. If R2 cannot be calculated, the overview score cannot be calculated either.)											
	Learning time*9	Time required for entire learning processing is displayed.*13										
	Diagnosis time (reference) [ms]*9	Time taken to diagnose one record on the learning station is displayed.*14										
	Update date and time*9	The date and time when an AI was updated is displayed. This item is not updated by editing an AI name or comment.										
	Creation date and time*9	The date and time when an AI was created is displayed. For an AI created as a copy, the date and time when the copy was created is displayed.										
	Comment	A set comment is displayed.										
	Size [MB]*9	The file size of an AI is displayed.*13										
[Create task] button*15	Click this to display the task management screen. The create a new task screen also appears with a selected AI set. For the procedure for creating a task, refer to the following. (The procedure differs depending on the task type.) Page 215 Creating a Task (Simple Task) Page 219 Creating a Task (Advanced Task) For task types, refer to the following: Page 205 Task types For details on the task management screen, refer to the following: Page 207 Task Management Screen											

*1 Can be clicked when selecting an AI.

*2 The context menu can be displayed also by right-clicking on the AI list.

*3 Displayed when selecting only one AI.

*4 The screen to be displayed differs depending on the status of an AI and its creation status.

When "Status" is "Editing" or "Error"

- When a selected AI is being created automatically, the AI automatic learning screen for the selected AI is displayed.

For an autoencoder model: Page 154 AI automatic learning screen for an autoencoder model

For a classification or regression model: Page 156 AI automatic learning screen for classification and regression models

For a similar waveform recognition model: Page 158 AI automatic learning screen for a similar waveform recognition model

- In other cases, the AI editor screen for a selected AI is displayed. (Page 175 AI editor screen)

When "Status" is "Learning" or "Learned"

- When a selected AI is being created automatically, the AI automatic learning monitoring screen for the selected AI is displayed.

(☞ Page 160 AI automatic learning monitoring screen)

- In other cases, the AI customization learning monitoring screen for a selected AI is displayed. (☞ Page 186 AI customization learning monitoring screen)

③ When "Status" is "Complete"

- The AI editor screen for a selected AI is displayed. (☞ Page 175 AI editor screen)

*5 The name of an AI created as a copy will be "copy source AI name (001)."

If the name is duplicate, a value in the parentheses '(')' will be incremented.

If a copy source AI name has 251 or more characters, the number of characters in "copy source AI name (001)" will exceed its maximum number (255 characters). In this case, the 251st and later characters will be deleted to fit within 255 characters when a copy is created.

*6 A copy is created with the "Editing" state when "Status" of the copy source AI is "Learning," "Learned," or "Error."

*7 Can be selected when selecting an AI of which "Status" is "Complete."

*8 Can be selected when selecting an AI of which "Status" is "Learned" or "Complete."

*9 Hidden by default. Click ☑ (Expand) to expand the header, and switch the item to be shown as necessary.

☞ Page 56 Switching to show or hide

*10 "-" is displayed when "Status" is "Editing" or unsupervised learning is used.

*11 "-" is displayed when "Status" is not "Complete," "Learned," or "Learning."

*12 "-" is displayed when "Status" is not "Complete" or "Learned" or when learning is performed with an analysis method of unsupervised learning.

*13 "-" is displayed when "Status" is not "Complete" or "Learned."

*14 "-" is displayed when "Status" is not "Complete" or "Learned" or when the model type of the AI is a similar waveform recognition model.

*15 Displayed when selecting only one AI of which "Status" is "Complete."

Changing properties

The following shows the procedure for changing properties (name and comment) of an AI.

Operating procedure

1. Select an AI in the AI management screen. (☞ Page 137 AI Management Screen)
2. Click ☰ (Menu), and select [Property].

<input type="checkbox"/>	Name ↑	Data set	Status	Score	Comment
<input checked="" type="checkbox"/>	New AI	New data set	Complete	84	
<input type="checkbox"/>	New AI(001)	New data set(001)	Editing	-	

- Open
- Copy
- Delete
- Property
- Preview
- Test

3. Set a new AI name (up to 255 characters) or comment (up to 1024 characters).

AI property

Name *

New AI

Comment

OK CANCEL

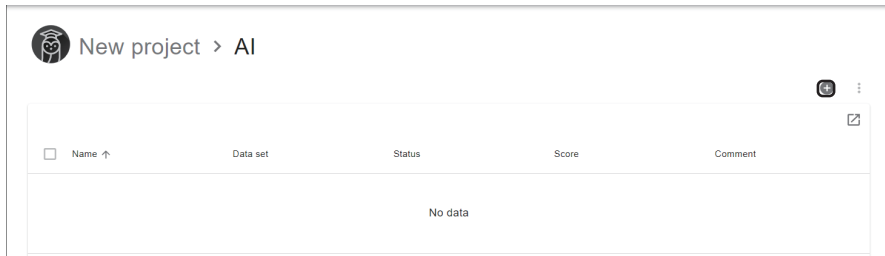
4. Click the [OK] button.

8.3 Creating a New AI (Automatically)

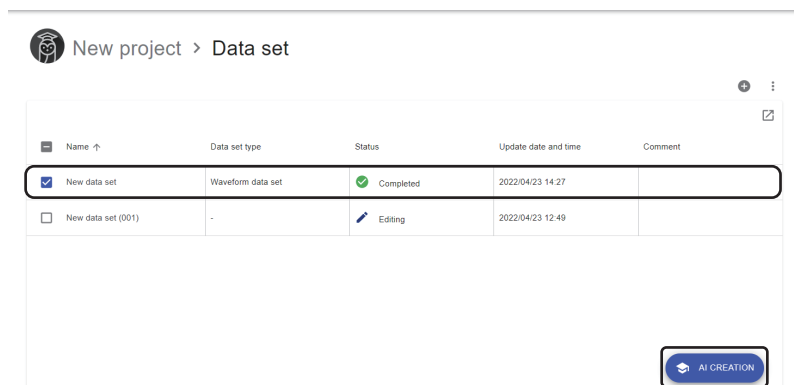
This section shows the procedure for creating a new AI automatically.

1. Perform either of the following operations:

- Click **+** (Create new) in the AI management screen. (👉 Page 137 AI Management Screen)

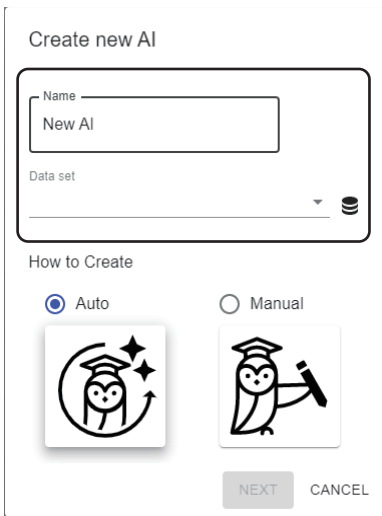


- Select a data set in the data set management screen, and click the [Create AI] button. (👉 Page 86 Data Set Management Screen)



2. Set an AI name (up to 255 characters) and a data set*¹ to be used for learning in the create new AI screen.

*1 When the screen is opened from the data set management screen, the data set selected in the screen is set by default. (📄 Page 86 Data Set Management Screen)

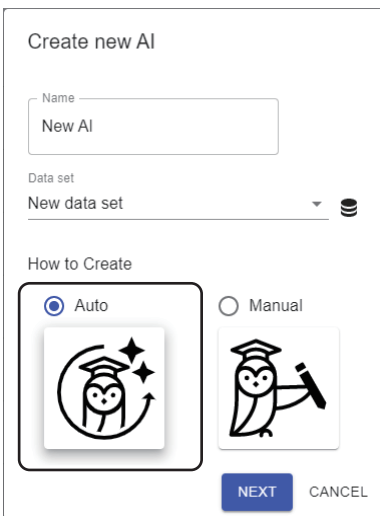


Point

An AI name can be changed in the AI property screen.

📄 Page 139 Changing properties

3. Select [Auto] in "How to Create."



4. Click the [Next] button.

5. Select a purpose.

What is the purpose?

To detect errors ^
 To detect a sign of device failure due to wear of parts

To predict the quality index value v

To automate the cause estimation v

To adjust device parameters v

BACK NEXT CANCEL

6. Click the [Next] button.



7. Follow the procedure shown in the referenced section according to the selected purpose and data set type.

Purpose	Data set type	Reference
To detect errors	Table data set	Page 143 Purpose 'to detect errors' and a data set of the table data set type
	Waveform data set	Page 145 Purpose 'to detect errors' and a data set of the waveform data set type
Others	Table data set	Page 151 Purpose other than 'to detect errors' and a data set of the table data set type
	Waveform data set	Page 152 Purpose other than 'to detect errors' and a data set of the waveform data set type

Purpose 'to detect errors' and a data set of the table data set type

The following shows the setting procedure to follow when a purpose is 'to detect errors' and a data set is of the table data set type.

The procedure differs depending on whether an error value is in a selected data set.

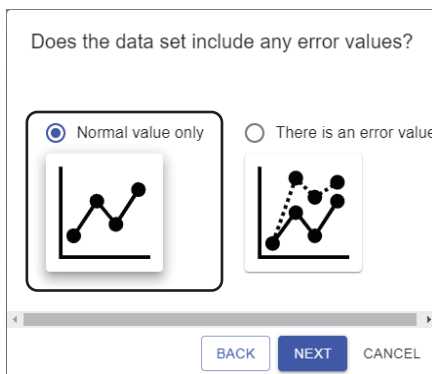
- When no error values are in a data set ( Page 143 When no error values are in a data set)
- When an error value is in a data set ( Page 144 When an error value is in a data set)

When no error values are in a data set

The following shows the procedure to follow when no error values are in a data set.

The model type of an AI to be created is an autoencoder model (unsupervised learning).



1. Select [Normal value only].



Does the data set include any error values?

Normal value only There is an error value

BACK NEXT CANCEL

2. Click the [Next] button.
3. Set parameters in the AI automatic learning screen for an autoencoder model, and start learning.
 Page 154 AI automatic learning screen for an autoencoder model
4. Monitor the learning status in the AI automatic learning monitoring screen.
 Page 160 AI automatic learning monitoring screen

When an error value is in a data set

The following shows the procedure to follow when an error value is in a data set.

The model type of an AI to be created is a classification or regression model (supervised learning).

1. Select [There is an error value].

Does the data set include any error values?

Normal value only

There is an error value

BACK NEXT CANCEL

2. Click the [Next] button.

3. Select a variable with an error value.

Numerical value or category type variables in a data set are listed.

Which variable includes the error value?

Cement (component 1)(kg in a m³mixture)

Blast Furnace Slag (component 2)(kg in a m³mixture)

Fly Ash (component 3)(kg in a m³mixture)

Water (component 4)(kg in a m³mixture)

Superplasticizer (component 5)(kg in a m³mixture)

Coarse Aggregate (component 6)(kg in a m³mixture)



Fine Aggregate (component 7)(kg in a m³mixture)

Age (day)

Concrete compressive strength(MPa,megapascals)


BACK NEXT CANCEL

Point


When clicking  (Preview), the preview screen for the selected data set is displayed in another tab.
( Page 112 Preview screen)

4. Click the [Next] button.

5. Set parameters in the AI automatic learning screen for classification and regression models, and start learning.

 Page 156 AI automatic learning screen for classification and regression models

6. Monitor the learning status in the AI automatic learning monitoring screen.

 Page 160 AI automatic learning monitoring screen

Purpose 'to detect errors' and a data set of the waveform data set type

The following shows the setting procedure to follow when a purpose is 'to detect errors' and a data set is of the waveform data set type.

The procedure differs depending on whether an error value is in a selected data set.

- When no error values are in a data set ([Page 145](#) When no error values are in a data set)
- When an error value is in a data set ([Page 149](#) When an error value is in a data set)

When no error values are in a data set

The following shows the procedure to follow when no error values are in a data set.

The procedure differs depending on whether to judge an error from the shape of a waveform.

- Judging an error from the shape of a waveform ([Page 145](#) To judge an error from the shape of a waveform)
- Not judging an error from the shape of a waveform ([Page 147](#) Not to judge an error from the shape of a waveform)

■To judge an error from the shape of a waveform

Follow the procedure below.

The model type of an AI to be created is a similar waveform recognition model (unsupervised learning).

1. Select [Normal value only].

Does the data set include any error values?

Normal value only There is an error value

BACK NEXT CANCEL

2. Click the [Next] button.

3. Select [Yes].

Do you want to determine abnormalities based on the shape of periodic waveforms?

Yes No

BACK NEXT CANCEL

4. Click the [Next] button.

5. Select a variable to detect an error.

Numerical value or category type variables in a data set are listed.

Which is the variable whose error will be judged?

No

pm2.5

DEWP

TEMP

PRES

cbwd

lws



ls

lr

ws


BACK NEXT CANCEL

Point


When clicking  (Preview), the preview screen for the selected data set is displayed in another tab.
( Page 112 Preview screen)

6. Click the [Next] button.

7. Set parameters in the AI automatic learning screen for a similar waveform recognition model, and start learning.

( Page 158 AI automatic learning screen for a similar waveform recognition model)

8. Monitor the learning status in the AI automatic learning monitoring screen.

( Page 160 AI automatic learning monitoring screen)

■ Not to judge an error from the shape of a waveform

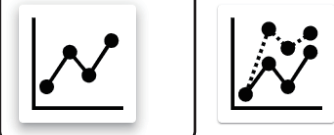
Follow the procedure below.

The model type of an AI to be created is an autoencoder model (unsupervised learning).

1. Select [Normal value only].

Does the data set include any error values?

Normal value only There is an error value




BACK **NEXT** CANCEL

2. Click the [Next] button.

3. Select [No].

Do you want to determine abnormalities based on the shape of periodic waveforms?

Yes No



BACK **NEXT** CANCEL

4. Click the [Next] button.

5. Configure simple settings for section generation.

- Select [Yes] when there is a variable of which the beginning of a section is clear.

Select "Use the change of the variable as the start / end condition of the section" or "Set file switching as the start / end condition of the section."



When selecting "Use the change of the variable as the start / end condition of the section," category type variables except for objective variables are listed. Therefore, select a variable that includes a value (flag) indicating the beginning of a section from the list.

When there are no such variables, "There is no variable that can be selected." is displayed.

- When selecting [No], set a section manually.


The screenshot shows a dialog box with the title "Are there any variables that tell the beginning of the section?". It has two radio buttons: "Yes" (selected) and "No". Below the radio buttons is a "Settings" section with three options: "Use the change of the variable as the start / end condition of the section" (selected), "cbwd", and "Set file switching as the start / end condition of the section". At the bottom right, there are three buttons: "BACK", "NEXT", and "CANCEL". A small icon with the letters "ii" is visible in the bottom right corner of the dialog box.

Point


When selecting [Yes],  (Preview) is displayed. By clicking the icon, the preview screen for target data is displayed in another tab. ( Page 112 Preview screen)

6. Click the [Next] button.

7. Set parameters in the AI automatic learning screen for an autoencoder model, and start learning.

 Page 154 AI automatic learning screen for an autoencoder model

8. Monitor the learning status in the AI automatic learning monitoring screen.

 Page 160 AI automatic learning monitoring screen

When an error value is in a data set

The following shows the procedure to follow when an error value is in a data set.

The model type of an AI to be created is a classification or regression model (supervised learning).

1. Select [There is an error value].

Does the data set include any error values?

Normal value only

There is an error value

BACK NEXT CANCEL

2. Click the [Next] button.

3. Select a variable with an error value.

Numerical value or category type variables in a data set are listed.

Which variable includes the error value?

Cement (component 1)(kg in a m³mixture)

Blast Furnace Slag (component 2)(kg in a m³mixture)

Fly Ash (component 3)(kg in a m³mixture)

Water (component 4)(kg in a m³mixture)

Superplasticizer (component 5)(kg in a m³mixture)

Coarse Aggregate (component 6)(kg in a m³mixture)


Fine Aggregate (component 7)(kg in a m³mixture)


Age (day)

Concrete compressive strength(MPa,megapascals)

BACK NEXT CANCEL

Point

When clicking  (Preview), the preview screen for the selected data set is displayed in another tab.

( Page 112 Preview screen)

4. Click the [Next] button.

5. Configure simple settings for section generation.

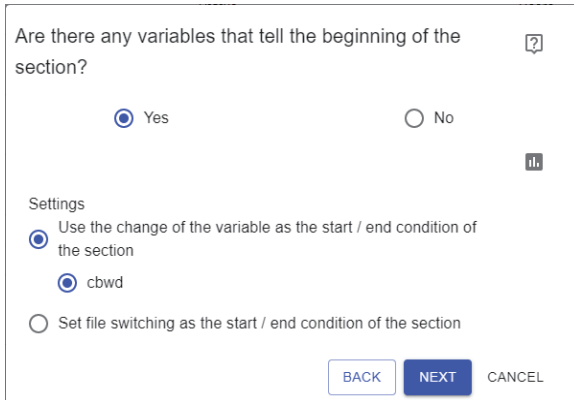
- Select [Yes] when there is a variable of which the beginning of a section is clear.

Select "Use the change of the variable as the start / end condition of the section" or "Set file switching as the start / end condition of the section."

When selecting "Use the change of the variable as the start / end condition of the section," category type variables except for objective variables are listed. Therefore, select a variable that includes a value (flag) indicating the beginning of a section from the list.

When there are no such variables, "There is no variable that can be selected." is displayed.



- When selecting [No], set a section manually.



The screenshot shows a dialog box with the following content:


- Question: "Are there any variables that tell the beginning of the section?" with a help icon (?) on the right.
- Radio buttons: "Yes" (selected) and "No".
- Settings section:
 - Radio button: "Use the change of the variable as the start / end condition of the section" (selected).
 - Radio button: "cbwd" (selected).
 - Radio button: "Set file switching as the start / end condition of the section".
- Buttons: "BACK", "NEXT" (highlighted in blue), and "CANCEL".
- A small icon with three vertical bars is visible on the right side of the dialog.

Point


When selecting [Yes],  (Preview) is displayed. By clicking the icon, the preview screen for target data is displayed in another tab. ( Page 112 Preview screen)

6. Click the [Next] button.

7. Set parameters in the AI automatic learning screen for classification and regression models, and start learning.

 Page 156 AI automatic learning screen for classification and regression models

8. Monitor the learning status in the AI automatic learning monitoring screen.

 Page 160 AI automatic learning monitoring screen

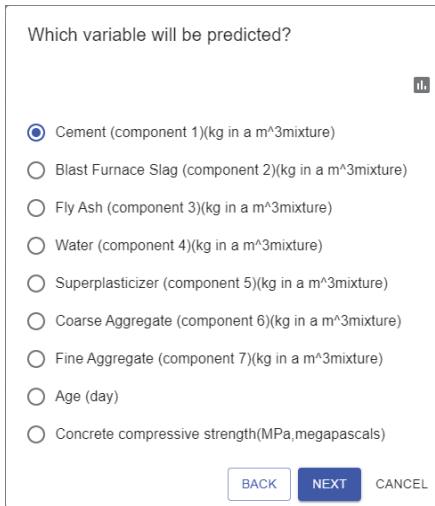
Purpose other than 'to detect errors' and a data set of the table data set type

The following shows the procedure to follow when a purpose is not 'to detect errors' and a data set is of the table data set type.

The model type of an AI to be created is a classification or regression model (supervised learning).

1. Select a target variable.

Numerical value or category type variables in a data set are listed.



Which variable will be predicted?

Cement (component 1)(kg in a m³mixture)

Blast Furnace Slag (component 2)(kg in a m³mixture)

Fly Ash (component 3)(kg in a m³mixture)

Water (component 4)(kg in a m³mixture)

Superplasticizer (component 5)(kg in a m³mixture)

Coarse Aggregate (component 6)(kg in a m³mixture)



Fine Aggregate (component 7)(kg in a m³mixture)

Age (day)

Concrete compressive strength(MPa,megapascals)

BACK NEXT CANCEL

Point


When clicking  (Preview), the preview screen for the selected data set is displayed in another tab. ( Page 112 Preview screen)

2. Click the [Next] button.

3. Set parameters in the AI automatic learning screen for classification and regression models, and start learning.

 Page 156 AI automatic learning screen for classification and regression models

4. Monitor the learning status in the AI automatic learning monitoring screen.

 Page 160 AI automatic learning monitoring screen

Purpose other than 'to detect errors' and a data set of the waveform data set type


The following shows the procedure to follow when a purpose is not 'to detect errors' and a data set is of the waveform data set type.

The model type of an AI to be created is a classification or regression model (supervised learning).

1. Select a target variable.

Numerical value or category type variables in a data set are listed.

Which variable will be predicted?



Cement (component 1)(kg in a m³mixture)

Blast Furnace Slag (component 2)(kg in a m³mixture)

Fly Ash (component 3)(kg in a m³mixture)

Water (component 4)(kg in a m³mixture)

Superplasticizer (component 5)(kg in a m³mixture)


Coarse Aggregate (component 6)(kg in a m³mixture)

Fine Aggregate (component 7)(kg in a m³mixture)

Age (day)

Concrete compressive strength(MPa,megapascals)

Point

When clicking  (Preview), the preview screen for the selected data set is displayed in another tab.

( Page 112 Preview screen)

2. Click the [Next] button.

3. Configure simple settings for section generation.

- Select [Yes] when there is a variable of which the beginning of a section is clear.

Select "Use the change of the variable as the start / end condition of the section" or "Set file switching as the start / end condition of the section."

When selecting "Use the change of the variable as the start / end condition of the section," category type variables except for objective variables are listed. Therefore, select a variable that includes a value (flag) indicating the beginning of a section from the list.

When there are no such variables, "There is no variable that can be selected." is displayed.

- When selecting [No], set a section manually.

The screenshot shows a dialog box with the following content:

- Question: "Are there any variables that tell the beginning of the section?" with a help icon (?) on the right.
- Radio buttons: "Yes" (selected) and "No".
- Settings section:
 - Radio button "Use the change of the variable as the start / end condition of the section" (selected), with a preview icon (ii) to its right.
 - Radio button "cbwd" (selected).
 - Radio button "Set file switching as the start / end condition of the section".
- Buttons: "BACK", "NEXT" (highlighted in blue), and "CANCEL".

Point

When selecting [Yes], (Preview) is displayed. By clicking the icon, the preview screen for target data is displayed in another tab. (Page 112 Preview screen)

4. Click the [Next] button.

5. Set parameters in the AI automatic learning screen for classification and regression models, and start learning.

Page 156 AI automatic learning screen for classification and regression models

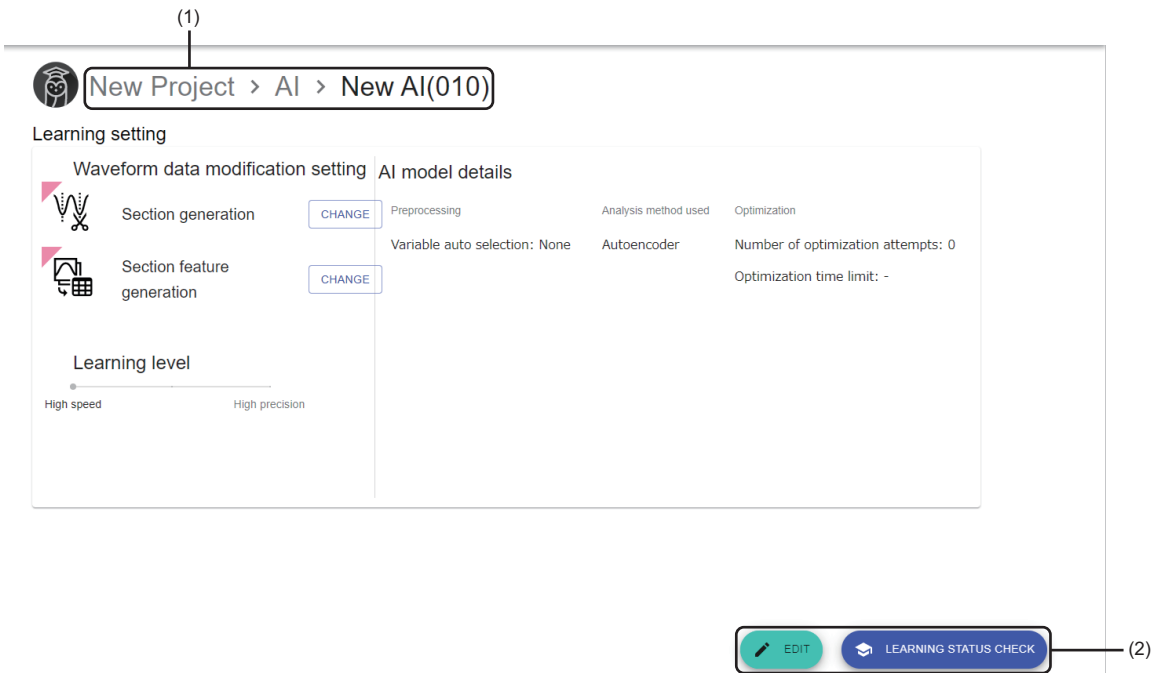
6. Monitor the learning status in the AI automatic learning monitoring screen.

Page 160 AI automatic learning monitoring screen

AI automatic learning screen for an autoencoder model

The following shows the screen for setting parameters to start learning.

Window



Displayed items

Item		Description	
(1) Breadcrumb bar		<p>A breadcrumb bar is displayed.</p> <ul style="list-style-type: none"> Current project name > AI > current AI name <p>By clicking a project name, the screen returns to the home screen. (Page 76 Home screen)</p> <p>By clicking "AI," the screen returns to the AI management screen. (Page 137 AI Management Screen)</p>	
Learning setting	Waveform data modification setting ^{*1}	Section generation	<p>Click the [Change] button to change settings for section generation.^{*2}</p> <p>Section generation is a type of preprocessing to convert a waveform data set into a format where the data set can be learned.</p> <p>Records in a data set are divided into some sections.</p> <p>Page 267 Section generation screen</p>
		Section feature generation	<p>Click the [Change] button to change settings for section feature generation.^{*2}</p> <p>Section feature generation is a type of preprocessing to convert a waveform data set into a format where the data set can be learned.</p> <p>Features in divided sections are extracted.</p> <p>Page 281 Section feature generation screen</p>
	Learning level		<p>Set the level (1 to 3) to adjust the speed and accuracy of learning.</p> <ul style="list-style-type: none"> Level 1: The learning speed is prioritized. Level 2: The learning speed and accuracy are well balanced. Level 3: The learning accuracy is prioritized.
	AI model details	Preprocessing	Units of preprocessing to be used are listed. ^{*3}
		Analysis method used	"Autoencoder" is displayed.
Optimization		Properties to optimize analysis methods are displayed. ^{*3}	


Item	Description
(2) [Edit]/[Learning status check]/[Start learning] button	<p>■When an AI is in the "Learning" state</p> <p>[Learning status check] button: Click this to check the learning status. (Page 160 AI automatic learning monitoring screen)</p> <p>■When an AI is in the "Learned" state, and "Read-only" is selected when displaying this screen</p> <p>[Edit] button: Click this to release read-only and edit parameters.</p> <p>[Learning status check] button: Click this to check the learning status. (Page 160 AI automatic learning monitoring screen)</p> <p>■Other cases</p> <p>[Start learning] button: Click this to start learning.</p> <p>Once learning is started, the AI automatic learning monitoring screen is displayed. (Page 160 AI automatic learning monitoring screen)</p>


- *1 Displayed only when a selected data set is of the waveform data set type. However, this setting refers to the data set type set when an AI was created; therefore, the displayed contents do not change even if the data set type is changed after the creation.
- *2 Settings cannot be edited when an AI is read-only. (The setting screen is displayed with the [OK] button disabled.)
- *3 Displayed contents differ depending on the set learning level.

Precautions

An AI becomes read-only and cannot be edited in the following cases:


- The AI is in the "Learning" state.
- The AI is in the "Learned" state, and "Read-only" is selected when displaying this screen.


If an error occurs while setting or learning,  is displayed for a relevant item.

Click  to check details.

Learning setting

Waveform data modification setting


 Section generation CHANGE

 Section feature generation CHANGE

Learning level

High speed
●
 High precision

AI model details

Preprocessing Analysis method used  Optimization

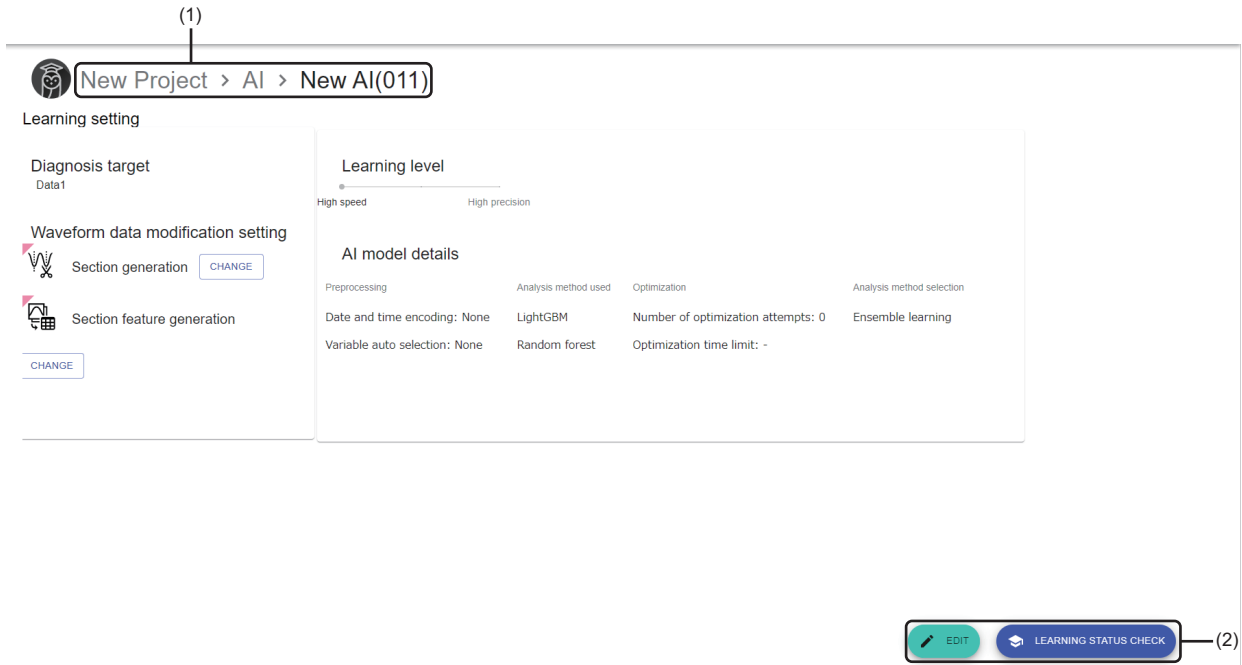
Variable auto selection: None Autoencoder Number of optimization attempts: 0

Optimization time limit: -

AI automatic learning screen for classification and regression models

The following shows the screen for setting parameters to start learning.

Window



Displayed items

Item	Description		
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> • Current project name > AI > current AI name By clicking a project name, the screen returns to the home screen. (Page 76 Home screen) By clicking "AI," the screen returns to the AI management screen. (Page 137 AI Management Screen)		
Learning setting	Diagnosis target	The objective variable selected as a diagnosis target is displayed.	
	Waveform data modification setting* ¹	Section generation	Click the [Change] button to change settings for section generation.* ² Section generation is a type of preprocessing to convert a waveform data set into a format where the data set can be learned. Records in a data set are divided into some sections. (Page 267 Section generation screen)
		Section feature generation	Click the [Change] button to change settings for section feature generation.* ² Section feature generation is a type of preprocessing to convert a waveform data set into a format where the data set can be learned. Features in divided sections are extracted. (Page 281 Section feature generation screen)
	Learning level	Set the level (1 to 3) to adjust the speed and accuracy of learning. <ul style="list-style-type: none"> • Level 1: The learning speed is prioritized. • Level 2: The learning speed and accuracy are well balanced. • Level 3: The learning accuracy is prioritized. 	
	AI model details	Preprocessing	Units of preprocessing to be used are listed.* ³
		Analysis method used	Analysis methods to be used for learning are listed.* ³
		Optimization	Properties to optimize analysis methods are displayed.* ³
Analysis method selection		"Ensemble learning" is displayed.	


Item	Description
(2) [Edit]/[Learning status check]/[Start learning] button	<p>■When an AI is in the "Learning" state [Learning status check] button: Click this to check the learning status. (☞ Page 160 AI automatic learning monitoring screen)</p> <p>■When an AI is in the "Learned" state, and "Read-only" is selected when displaying this screen [Edit] button: Click this to release read-only and edit parameters. [Learning status check] button: Click this to check the learning status. (☞ Page 160 AI automatic learning monitoring screen)</p> <p>■Other cases [Start learning] button: Click this to start learning. Once learning is started, the AI automatic learning monitoring screen is displayed. (☞ Page 160 AI automatic learning monitoring screen)</p>


- *1 Displayed only when a selected data set is of the waveform data set type. However, this setting refers to the data set type set when an AI was created; therefore, the displayed contents do not change even if the data set type is changed after the creation.
- *2 Settings cannot be edited when an AI is read-only. (The setting screen is displayed with the [OK] button disabled.)
- *3 Displayed contents differ depending on the set learning level.

Precautions

An AI becomes read-only and cannot be edited in the following cases:

- The AI is in the "Learning" state.
- The AI is in the "Learned" state, and "Read-only" is selected when displaying this screen.

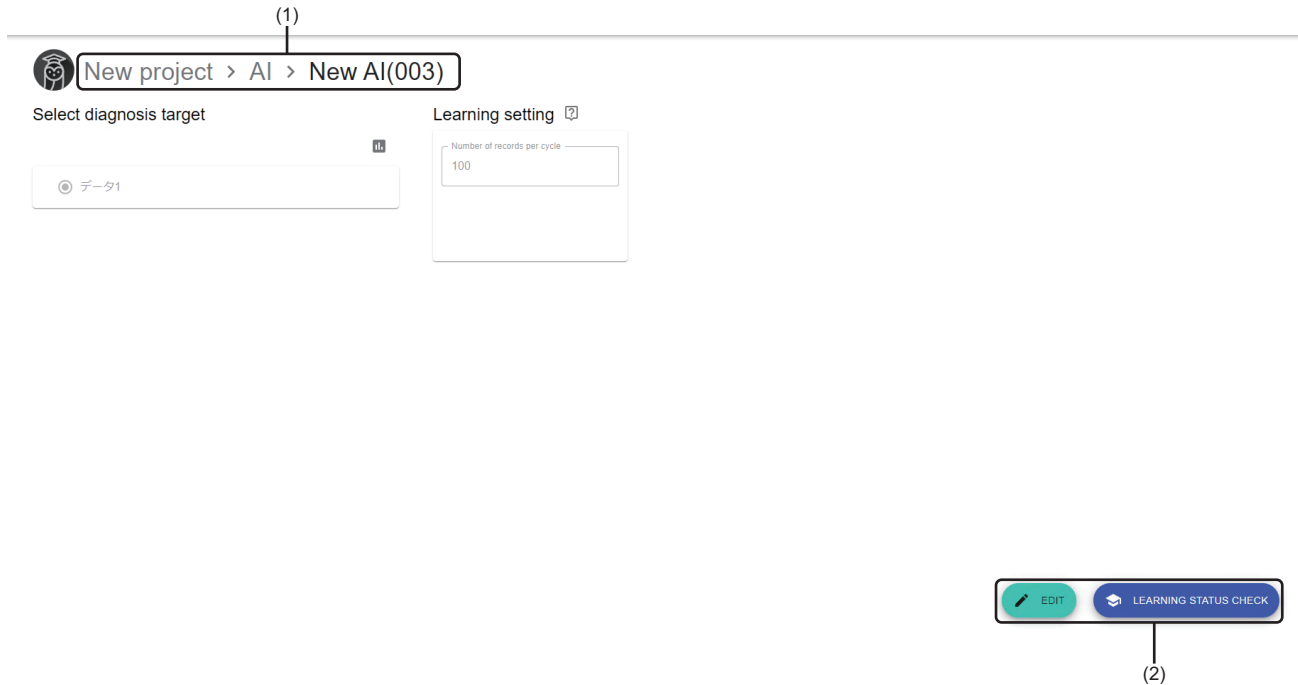
If an error occurs while setting or learning,  is displayed for a relevant item.

Click  to check details.

AI automatic learning screen for a similar waveform recognition model

The following shows the screen for setting parameters to start learning.

Window



Displayed items


Item	Description
(1) Breadcrumb bar	<p>A breadcrumb bar is displayed.</p> <ul style="list-style-type: none"> Current project name > AI > current AI name <p>By clicking a project name, the screen returns to the home screen. (Page 76 Home screen)</p> <p>By clicking "AI," the screen returns to the AI management screen. (Page 137 AI Management Screen)</p>
Select diagnosis target	<p>Select a variable to be diagnosed.</p> <p>Numerical value type variables in a selected data set are listed.</p> <p>When selecting (Preview), the preview screen for the selected variable is displayed in another tab. (Page 112 Preview screen)</p>
Learning setting	<p>Number of records per cycle</p> <p>Set the number of records for one cycle (8 to 1000). Processing differs depending on the set number of records. For details on the processing, refer to the following: Page 356 Operational specifications</p>
(2) [Edit]/[Learning status check]/[Start learning] button	<ul style="list-style-type: none"> When an AI is in the "Learning" state [Learning status check] button: Click this to check the learning status. (Page 160 AI automatic learning monitoring screen) When an AI is in the "Learned" state, and "Read-only" is selected when displaying this screen [Edit] button: Click this to release read-only and edit parameters. [Learning status check] button: Click this to check the learning status. (Page 160 AI automatic learning monitoring screen) Other cases [Start learning] button: Click this to start learning. Once learning is started, the AI automatic learning monitoring screen is displayed. (Page 160 AI automatic learning monitoring screen)

Precautions

An AI becomes read-only and cannot be edited in the following cases:


- The AI is in the "Learning" state.
- The AI is in the "Learned" state, and "Read-only" is selected when displaying this screen.

If an error occurs while learning,  is displayed on the following part.

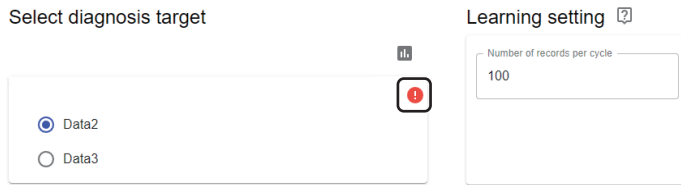
Click  to check details.

Select diagnosis target

Data2
 Data3

Learning setting 

Number of records per cycle
100



AI automatic learning monitoring screen

The following shows the screen for monitoring the learning status.

Window

(1) New project > AI > New AI > Learning status

Progress

- Learning status ✓
- Preprocessing
 - Missing value processing ✓
 - Date and time encoding ✓
 - Category encoding ✓
 - Outlier processing1 ✓
 - Outlier processing2 ✓
 - Scaling ✓
 - Variable deletion ✓
- Optimization ✓
 - Deep learning ✓
 - LightGBM ✓
 - Random forest ✓
- Analysis method selection ✓
 - Ensemble learning ✓

Elapsed: 0.01:24
Remaining: 0.00:00

Learning result

(2) Display Target: Ensemble learning

Ensemble learning

RMSE	
Learning score	0.4758314810189493
Evaluation score	0.6244386778609816

Learning time: 9 [s]
Diagnosis time: 0.11 [ms]

Evaluation value graph (3)

Analysis method: Random forest

RMSE vs Count graph showing train (blue) and test (red) values. A sad face icon is above the test line at count 20, and a happy face icon is below the train line at count 20.

Residual plot and Line chart (5)










Residual plot: Residual vs Predict Value. Legend: train (blue), test (red).

Line chart: Value vs Index. Legend: true (blue), prediction (red).

(4) TEST button
(5) COMPLETE button

Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. Current project name > AI > name of an AI in the "Learning" state > Learning status By clicking a project name, the screen returns to the home screen. (Page 76 Home screen) By clicking "AI," the screen returns to the AI management screen. (Page 137 AI Management Screen) By clicking the name of an AI in the "Learning" state, the screen returns to the AI automatic learning screen. <ul style="list-style-type: none"> For an autoencoder model: Page 154 AI automatic learning screen for an autoencoder model For a classification or regression model: Page 156 AI automatic learning screen for classification and regression models For a similar waveform recognition model: Page 158 AI automatic learning screen for a similar waveform recognition model
Progress	The learning progress is displayed. Page 162 Progress
Evaluation value graph ^{*1}	The transition of evaluation index scores while learning is displayed as a graph. Page 163 Evaluation value graph

Item	Description
Learning result* ²	<p>A learning result is displayed.</p> <p>Displayed contents differ depending on the model type of an AI to be created.</p> <p>Only for a classification or regression model, displayed contents (overview or details) can be switched in (2) "Display switching."</p> <p>In addition, for ensemble learning, (3) "Display target" is displayed by selecting "Details" for (2) "Display switching." The learning result of each analysis method used for ensemble learning can be displayed by selecting "Analysis method."</p> <p>■For an autoencoder model  Page 165 Learning result (MT method or autoencoder model)</p> <p>■For a classification or regression model  Page 167 Learning result (classification or regression model (overview))  Page 169 Learning result (classification or regression model (details))</p> <p>■For a similar waveform recognition model  Page 171 Learning result (similar waveform recognition model)</p>
(4) [Test] button* ²	Click this to test if a learned AI functions properly and display the test result. ( Page 197 AI test screen)
(5) [Cancel]/[Complete] button	<p>■While learning</p> <p>[Cancel] button: Click this to cancel learning.</p> <p>Once learning is canceled, the AI automatic learning screen is displayed.</p> <ul style="list-style-type: none"> • For an autoencoder model:  Page 154 AI automatic learning screen for an autoencoder model • For a classification or regression model:  Page 156 AI automatic learning screen for classification and regression models • For a similar waveform recognition model:  Page 158 AI automatic learning screen for a similar waveform recognition model <p>■When learning is completed</p> <p>[Complete] button: Click this to complete creating an AI.</p> <p>Once creation is completed, the AI management screen is displayed. ( Page 137 AI Management Screen)</p>

*1 Displayed when both of the following conditions are satisfied:

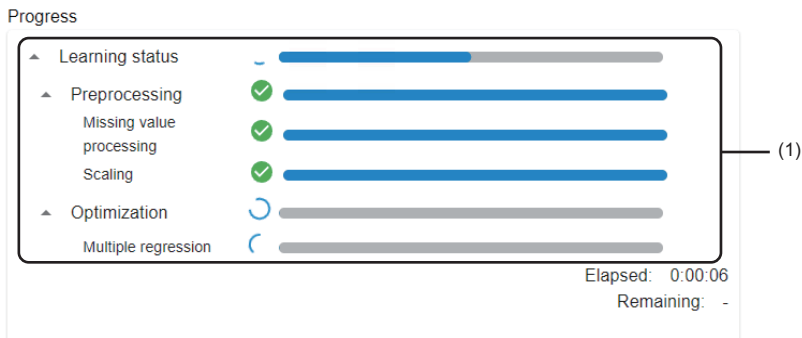
- Learning proceeds to optimization processing.
- For supervised learning, optimization is attempted at least once. For ensemble learning, optimization is attempted at least once in all the analysis methods.

*2 Displayed when learning is completed.

Progress

The learning progress is displayed.

Window



Displayed items

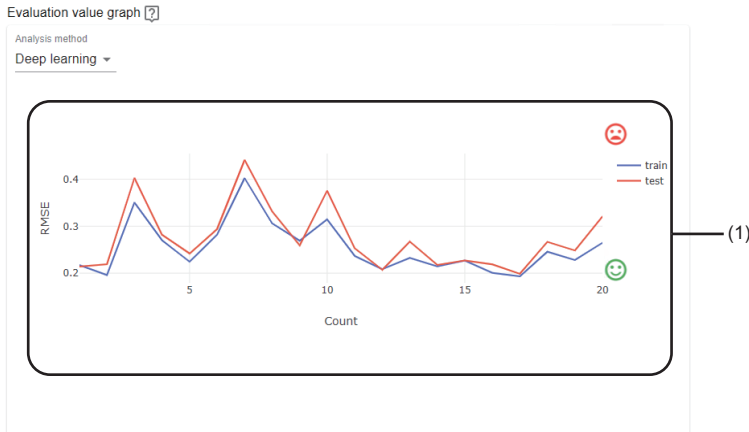
Item	Description
(1) Learning status	The learning progress is displayed. The detailed progress for each processing block can be checked by clicking ▼ (Open).
Elapsed	Time elapsed since learning is started is displayed.
Remaining	Time estimated for the remaining processing to be completed is displayed. "-" is displayed when the time cannot be estimated. "Generating the learning result" is displayed while creating the learning result after learning is completed.

Evaluation value graph

The transition of evaluation index scores while learning is displayed as a graph.

However, a graph is not displayed when the number of optimization attempts for a target analysis method is zero.

Window



Displayed items

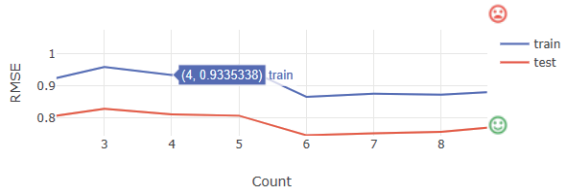
Item	Description
Analysis method	Select the block name of an analysis method to be displayed in a graph. "No analysis method" is displayed when not using an analysis method. When optimization processing for the current analysis method is completed and that for the next analysis method is started, the selection in this item automatically changes to the analysis method for which optimization processing is started.
(1) Graph	The transition of evaluation index scores while learning with a selected analysis method is displayed. (x axis: number of optimization attempts, y axis: value of an evaluation index ^{*1}) <ul style="list-style-type: none"> • Blue: train (data used for learning) • Red: test (data not used for learning) 😊 and 😞 are displayed on the right side of a graph. When a larger value indicates higher accuracy, 😊 is displayed at the top and 😞 at the bottom. When a smaller value indicates higher accuracy, 😊 is displayed at the bottom and 😞 at the top.

- *1 Differs depending on the model type.
- For a classification model: F1 Score
 - For a regression model: RMSE

A graph can be zoomed in as follows by dragging the cursor on it.



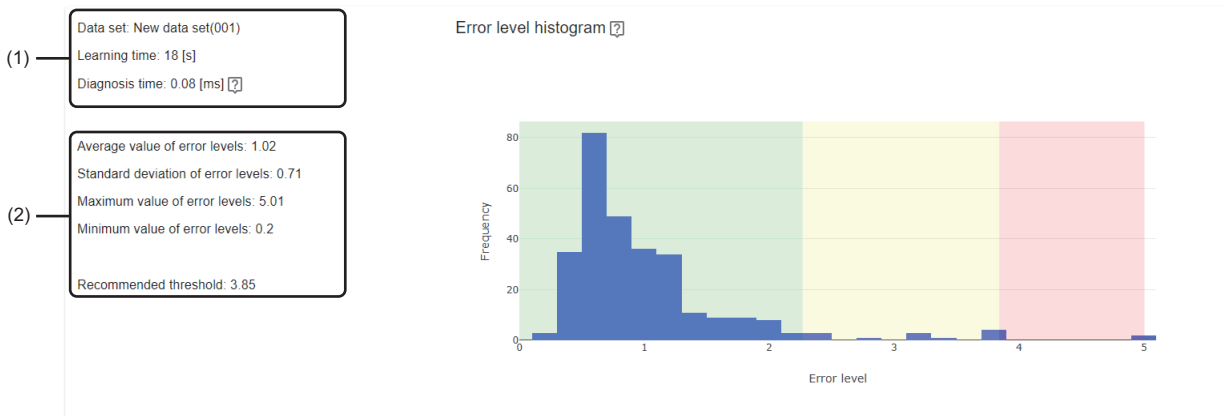
In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



Learning result (MT method or autoencoder model)

The following shows the learning result of an MT method or autoencoder model.

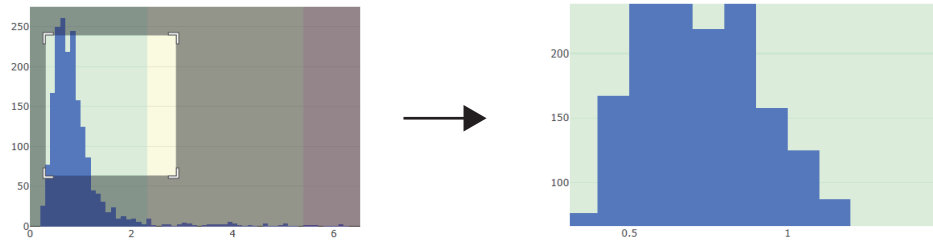
Window



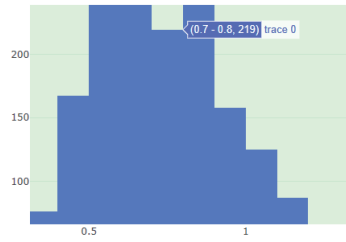
Displayed items

Item	Description	
(1) Learning information	Data set	The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.
	Learning time	Time required for entire learning processing is displayed.
	Diagnosis time	Time required for diagnosing an analysis method on the learning station is displayed.
(2) Error level statistics	Statistics of an error level is displayed. Rounded up to two decimal places. <ul style="list-style-type: none"> • Average value • Standard deviation • Maximum value • Minimum value • Recommended threshold (value of the error level where the cumulative distribution function takes 0.99) 	
Error level histogram	A histogram for the error level is displayed. <ul style="list-style-type: none"> • Green: 0 to 95% area (where the cumulative distribution function of a histogram takes a value between 0 and 0.95) • Yellow: 95 to 99% area (where the cumulative distribution function of a histogram takes a value between 0.95 and 0.99) • Red: 99 to 100% area (where the cumulative distribution function of a histogram takes a value between 0.99 and 1.0) <p>The upper limit value in the red area is equal to the one in a histogram. Check this histogram to determine a threshold to judge an error. For example, to judge 95% as normal, regard a value on the border of green and yellow areas as a threshold; to judge 99% as normal, regard a value on the border of yellow and red areas as a threshold.</p>	

A histogram can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.

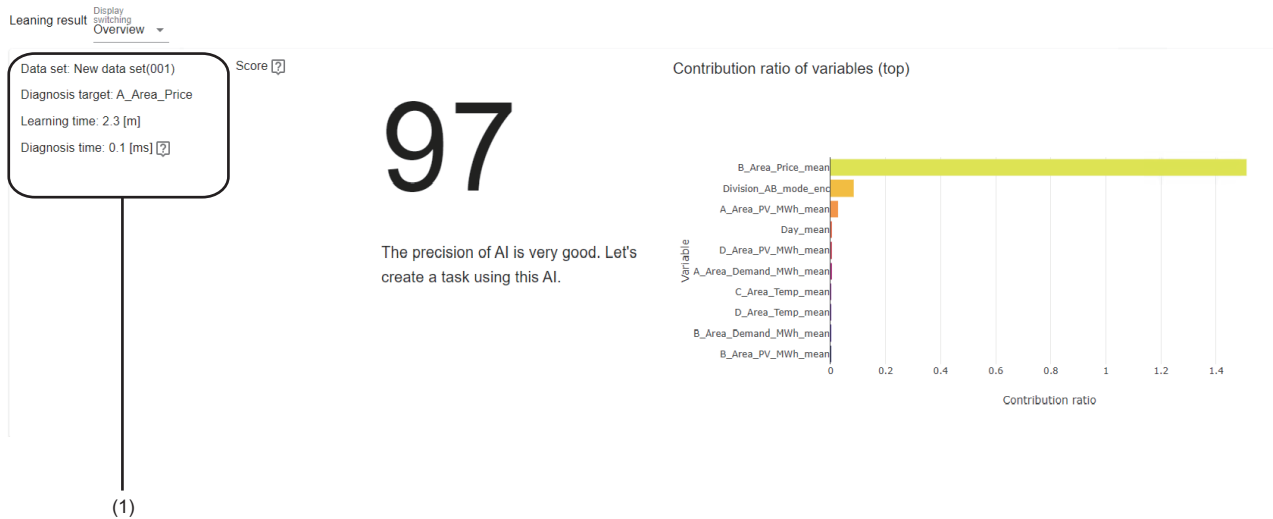


Learning result (classification or regression model (overview))

The following shows the learning result of a classification or regression model when selecting "Overview" for "Display switching."

- ☞ Page 160 AI automatic learning monitoring screen
- ☞ Page 186 AI customization learning monitoring screen
- ☞ Page 191 AI preview screen

Window



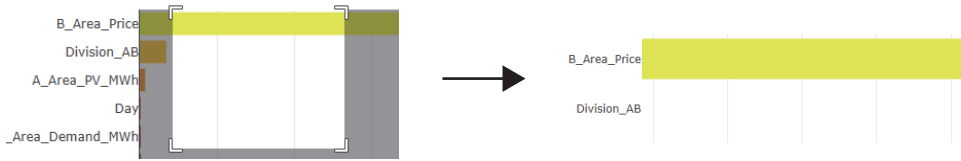
Displayed items

Item	Description								
(1) Learning information	<table border="1"> <tr> <td>Data set</td> <td>The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.</td> </tr> <tr> <td>Diagnosis target</td> <td>The name of a variable set as a diagnosis target is displayed.</td> </tr> <tr> <td>Learning time</td> <td>Time required for entire learning processing is displayed.</td> </tr> <tr> <td>Diagnosis time</td> <td>Time required for diagnosing an analysis method on the learning station is displayed.</td> </tr> </table>	Data set	The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.	Diagnosis target	The name of a variable set as a diagnosis target is displayed.	Learning time	Time required for entire learning processing is displayed.	Diagnosis time	Time required for diagnosing an analysis method on the learning station is displayed.
Data set	The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.								
Diagnosis target	The name of a variable set as a diagnosis target is displayed.								
Learning time	Time required for entire learning processing is displayed.								
Diagnosis time	Time required for diagnosing an analysis method on the learning station is displayed.								
Score	The score of AI test data and a general comment for the score are displayed.*1 However, "-" is displayed when the number of records used for learning*2 meets the following condition:*3 <ul style="list-style-type: none"> (Number of records used for learning - 1) < (number of explanatory variables) In addition, for a regression model, "-" is displayed also when only one record is used for evaluation.								
Contribution ratio of variables (top)	The contribution ratios of up to top 10 explanatory variables of which contribution ratio is '0' or more are displayed as a horizontal bar chart graph.*4*5 Whole data is displayed by default. The detailed distribution of values can be checked by zooming in the histogram.								

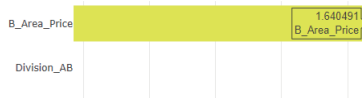
- *1 An evaluation index that shows the accuracy of an AI which completes learning with a value between 0 and 100. This score indicates the prediction accuracy of an AI. When the score is 80, the AI can predict a result for input data correctly at approximately 80%.
The score is calculated as follows:
 - For a classification model: An integer value obtained by multiplying the F1 score by 100
 - For a regression model: An integer value obtained by multiplying R2 by 100 (When R2 has a negative value, the score will be '0' regardless of the value. If R2 cannot be calculated, the score cannot be calculated either.)
- *2 Number of records for 'learning' after dividing the number of all records into the ratio of 'learning:validation:evaluation = 8:1:1'
- *3 When starting learning with a process flow set in the AI editor screen, the number of explanatory variables may vary if "Automatic feature selection" is ON in the setting screen for an extension block of supervised learning in the analysis method category. This is because some variables are not used for learning.
- *4 When starting learning with a process flow set in the AI editor screen, the number of explanatory variables in the data set may not match with the number of displayed variables if "Automatic feature selection" is ON in the setting screen for an extension block of supervised learning in the analysis method category. This is because some variables are not used for learning.
- *5 When the variables judged as unnecessary for learning are automatically deleted by a variable deletion block, the number of explanatory variables in a data set may not match with the number of displayed variables.



A graph can be zoomed in as follows by dragging the cursor on it.



In addition, the value on a bar can be displayed as follows by placing the cursor.

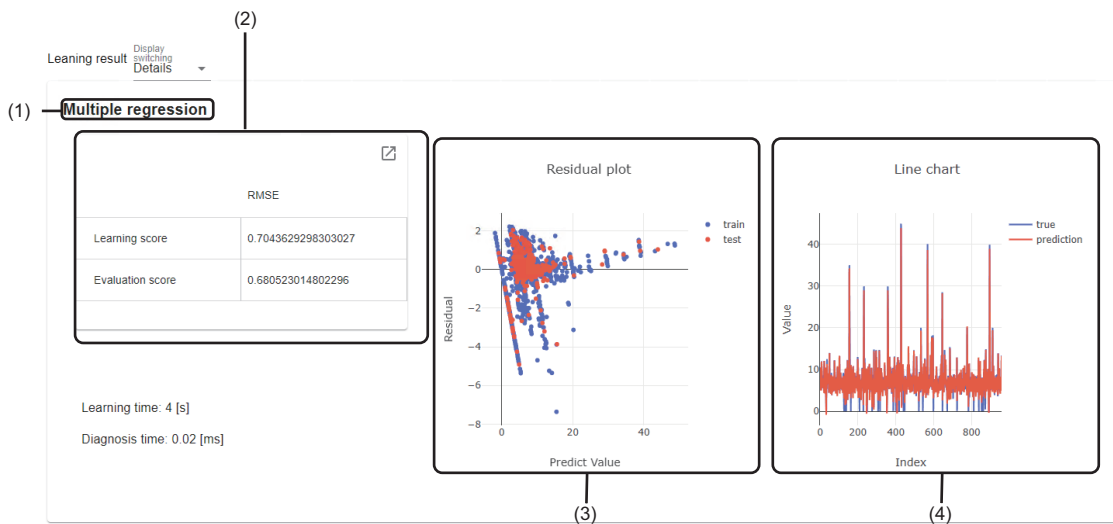


Learning result (classification or regression model (details))

The following shows the learning result of a classification or regression model when selecting "Details" for "Display switching." For ensemble learning, the learning result of each analysis method used for ensemble learning is displayed by selecting "Analysis method" for "Display Target."

- ☞ Page 160 AI automatic learning monitoring screen
- ☞ Page 186 AI customization learning monitoring screen
- ☞ Page 191 AI preview screen

Window



Displayed items

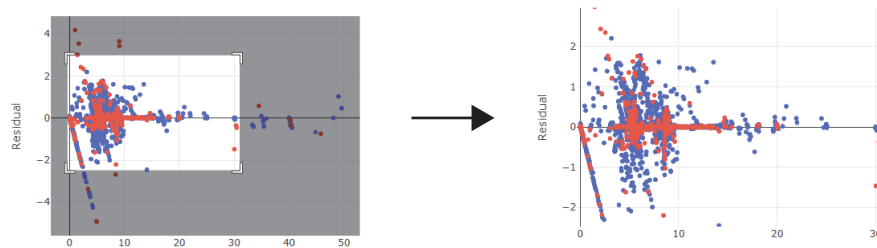
Item	Description
(1) Analysis method	The block name of an analysis method used for learning is displayed.
(2) Score list	<p>Scores of a learned AI are listed.^{*1*2} A displayed evaluation index differs depending on the model type of an AI.</p> <ul style="list-style-type: none"> ■Classification model <ul style="list-style-type: none"> • F1 Score • Accuracy^{*3} • LogLoss^{*3} • AUC^{*3} ■Regression model <ul style="list-style-type: none"> • RMSE • R2^{*3} • MAE^{*3} • MAPE^{*3}
	<p>🔍 (Expand) / — (Collapse)</p> <p>Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. ☞ Page 56 Expanding the header</p>
Learning score	A learning score is displayed.
Evaluation score	An evaluation score is displayed.
Learning time	Time required for learning an analysis method is displayed.
Diagnosis time	Time required for diagnosing an analysis method on the learning station is displayed.
(3) Learning result 1	<p>Displayed contents differ depending on the AI model type.</p> <ul style="list-style-type: none"> ■Classification model <p>A confusion matrix in learning data, normalized by the actual number of categories, is displayed.^{*4}</p> ■Regression model <p>Residual plots are displayed. (x axis: predicted value, y axis: difference between a measured value and predicated value)</p> <ul style="list-style-type: none"> • Blue: train (data used for learning) • Red: test (data not used for learning)

Item	Description
(4) Learning result 2	<p>Displayed contents differ depending on the AI model type.</p> <ul style="list-style-type: none"> ■ Classification model A confusion matrix in evaluation data, normalized by the actual number of categories, is displayed.*4 ■ Regression model Line charts are displayed. (x axis: index value of each unit of data, y axis: measured value or predicted value) <ul style="list-style-type: none"> • Blue: true (measured value) • Red: prediction (predicted value)

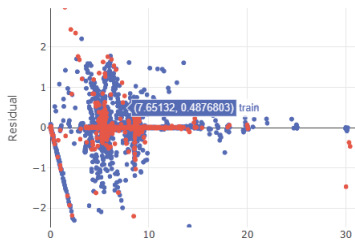
- *1 "-" is displayed when a value cannot be calculated.
- *2 For an evaluation score, different data is used for calculation and some analysis methods have randomness. Therefore, its value may differ from the one in the evaluation value graph.
 - ☞ Page 163 Evaluation value graph
- *3 Hidden by default. Click (Expand) to expand the header, and switch the item to be shown as necessary.
 - ☞ Page 56 Switching to show or hide
- *4 Calculated values are rounded up to two decimal places.

Point 

Graphs of learning result 1 and 2 can be zoomed in as follows by dragging the cursor on them.



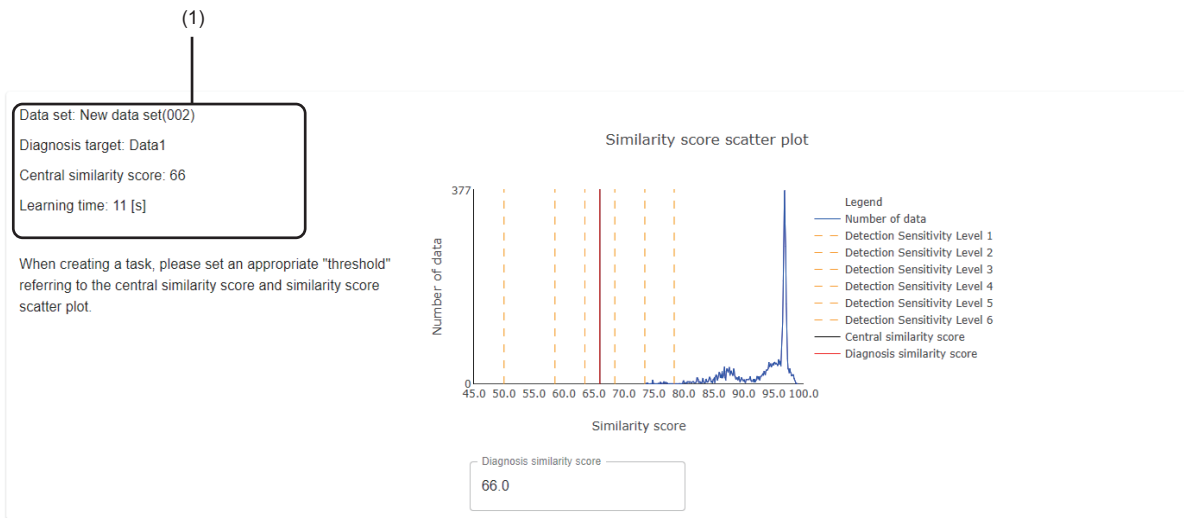
In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



Learning result (similar waveform recognition model)

The following shows the learning result of a similar waveform recognition model.

Window



Displayed items

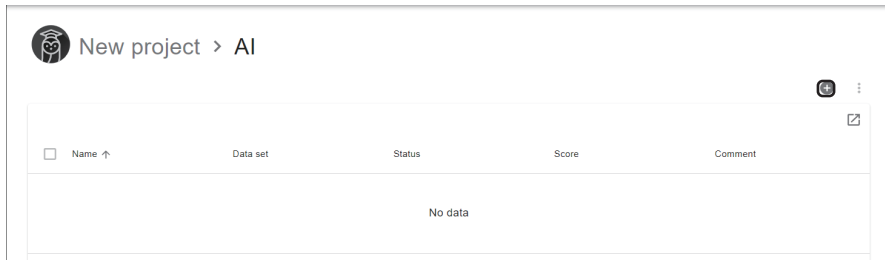
Item	Description	
(1) Learning information	Data set	The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.
	Diagnosis target	The name of a variable set as a diagnosis target is displayed.
	Central similarity score	The central similarity score is displayed (up to one decimal place.)
	Learning time	Time required for entire learning processing is displayed.
Similarity score scatter plot	The similarity score scatter plot for a data set selected as a learning target is displayed as a line chart. When the cursor position of the central similarity score and that of similarity score scatter plot are different, only the cursor of the similarity score scatter plot is displayed. When the cursor position of the detection sensitivity level 1 to 6 and that of the central similarity score or similarity score scatter plot are different, only the cursor of the central similarity score or similarity score scatter plot is displayed.	
Diagnosis similarity score	Set a diagnosis similarity score. The available value range is as follows: <ul style="list-style-type: none"> • Minimum value: A smaller value between the lowest similarity score and the value of detection sensitivity level 1 • Maximum value: A larger value between the highest similarity score and the value of detection sensitivity level 6 The cursor position of the diagnosis similarity score in the scatter plot moves according to the set value.	

8.4 Creating a New AI (Manually)

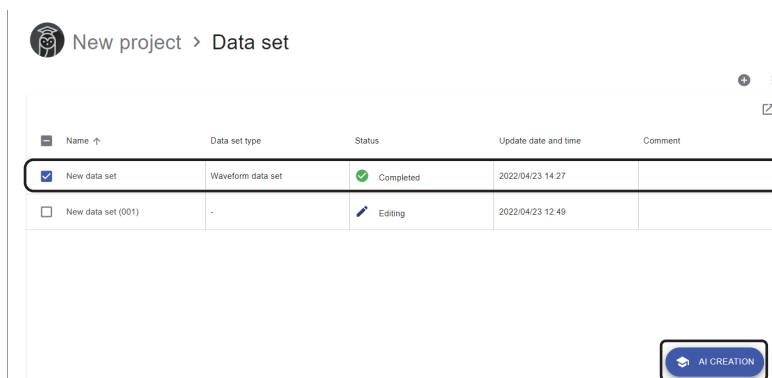
This section shows the procedure for creating a new AI manually.

1. Perform either of the following operations:

- Click **+** (Create new) in the AI management screen. (👉 Page 137 AI Management Screen)

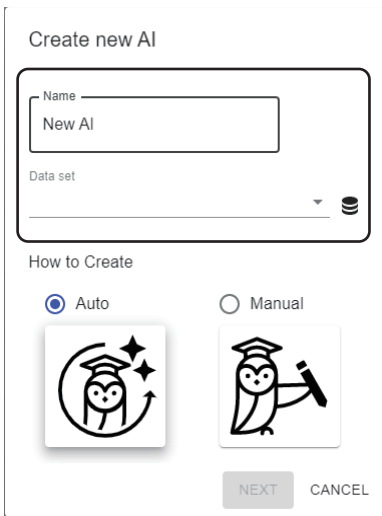


- Select a data set in the data set management screen, and click the [Create AI] button. (👉 Page 86 Data Set Management Screen)



2. Set an AI name (up to 255 characters) and a data set*¹ to be used for learning in the create new AI screen.

*1 When the screen is opened from the data set management screen, the data set selected in the screen is set by default. (🔗 Page 86 Data Set Management Screen)

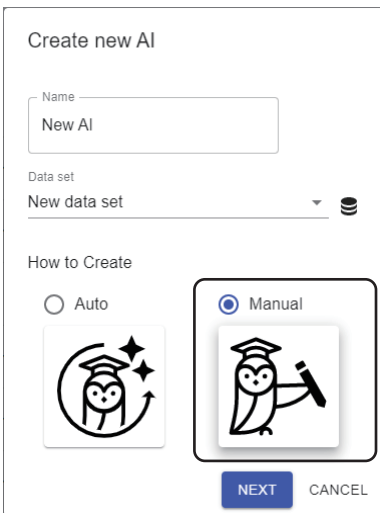


Point 🔍

An AI name can be changed in the AI property screen.

🔗 Page 139 Changing properties

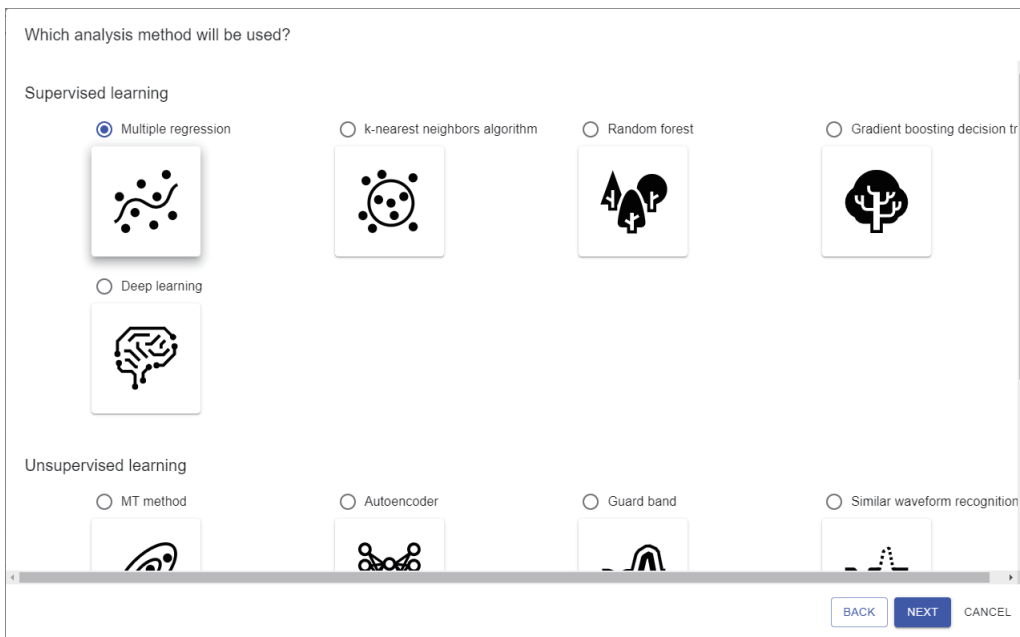
3. Select [Manual] in "How to Create."



4. Click the [Next] button.

5. Select an analysis method to be used.

Select "No analysis method" to log data or to judge input data without using an analysis method.



Point

For available analysis methods, refer to extension blocks of the analysis method category shown in the following:

Page 335 Analysis Method Category

6. Click the [Next] button.

7. Set processing for learning and its parameters in the AI editor screen, and start learning.

Page 175 AI editor screen

8. Monitor the learning status in the AI customization learning monitoring screen.

Page 186 AI customization learning monitoring screen

AI editor screen

The following shows the screen for setting processing for learning and its parameters to start learning.

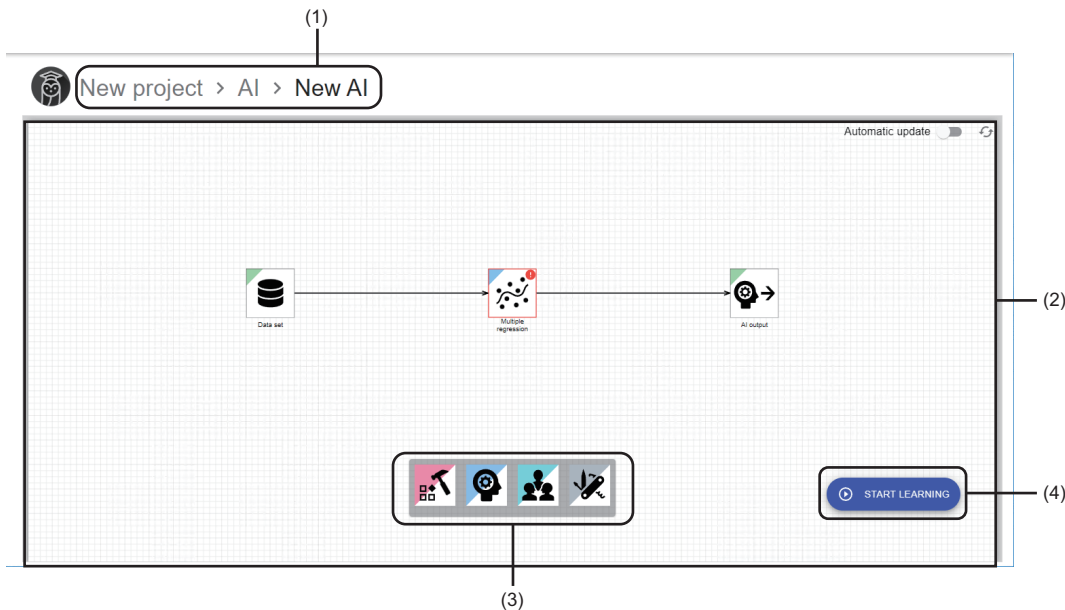
A process flow of learning can be created by placing blocks representing processing (extension blocks) and connectors representing data flow between blocks on the canvas.

For details on extension blocks, refer to the following:

☞ Page 178 Extension blocks

Up to 128 extension blocks and connectors can be placed. However, for extension blocks of the analysis method category, up to 8 blocks can be placed.

Window




Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> Current project name > AI > current AI name By clicking a project name, the screen returns to the home screen. (☞ Page 76 Home screen) By clicking "AI," the screen returns to the AI management screen. (☞ Page 137 AI Management Screen)
Automatic update* ¹	Turn this ON to automatically update the status of a process flow.* ²
↻ (Update)* ¹	Click this to update the status of a process flow.* ² ✓ is displayed when the status is already updated.
(2) Canvas	Place extension blocks and connectors to create a process flow. For the creation method, refer to the following: ☞ Page 182 Creation method
(3) Dock* ¹	An area to select an extension block to be placed
(4) [Edit]/[Learning status]/[Start learning] button	<ul style="list-style-type: none"> When an AI is in the "Learning" state [Learning status] button: Click this to check the learning status. (☞ Page 186 AI customization learning monitoring screen) When an AI is in the "Complete" state, and "Read-only" is selected when displaying this screen [Edit] button: Click this to release read-only and edit a process flow. When an AI is in the "Learned" state, and "Read-only" is selected when displaying this screen [Edit] button: Click this to release read-only and edit a process flow. [Learning status] button: Click this to check the learning status. (☞ Page 186 AI customization learning monitoring screen) Other cases [Start learning] button: Click this to start learning. Once learning is started, the AI customization learning monitoring screen is displayed. (☞ Page 186 AI customization learning monitoring screen)

*1 Displayed when an AI is not read-only.

*2 The status of a process flow is updated at the timings listed below.

If "Automatic update" is ON, the status is updated also when changing a connector.

- When clicking  (Update)

- When displaying the setting screen for an extension block while the update of a process flow is not completed

- When clicking the [OK] button in the setting screen for an extension block

- When starting learning while the update of a process flow is not completed

- When right-clicking an extension block then selecting [Display preview] or [Display AI preview] while the update of a process flow is not completed

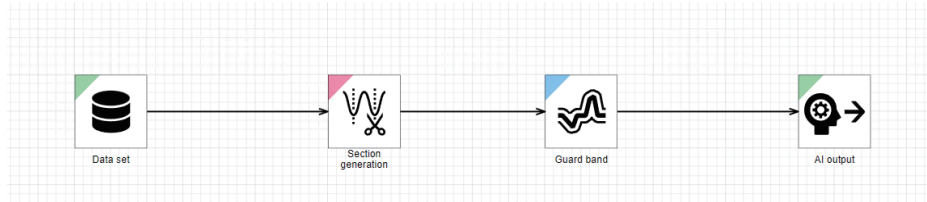
Precautions

An AI becomes read-only and cannot be edited in the following cases:

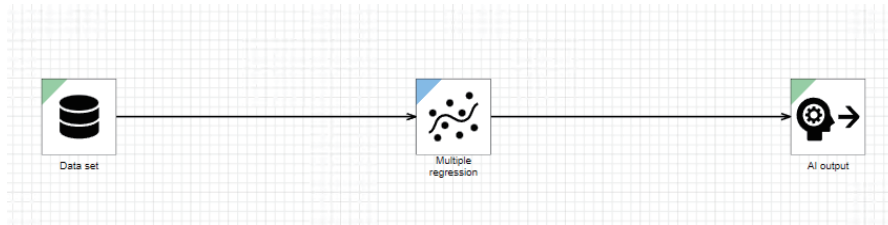
- The AI is in the "Learning" state.
- The AI is in the "Complete" or "Learned" state, and "Read-only" is selected when displaying this screen

When creating a new AI, the following extension blocks are displayed by default with connectors connected:

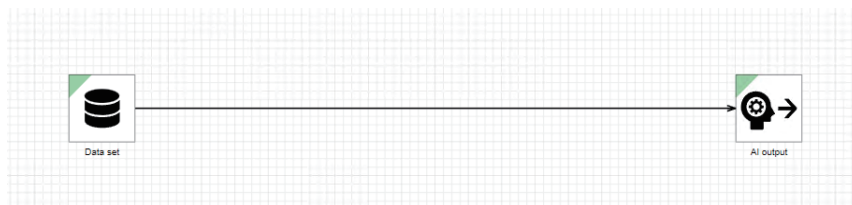
- When selecting a guard band for an analysis method
 - Data set block (A data set selected when creating a new AI is set.)
 - Section generation block
 - Guard band block
 - AI output block



- When selecting a method other than a guard band for an analysis method
 - Data set block (A data set selected when creating a new AI is set.)
 - Extension block of the selected analysis method category
 - AI output block



- When selecting "No analysis method"
 - Data set block (A data set selected when creating a new AI is set.)
 - AI output block



Extension blocks

Extension blocks represent processing.

There are types of extension blocks. Each of the blocks has a specific data processing method defined, such as data reading, preprocessing, and analysis method.

Various data processing can be performed by combining multiple extension blocks.

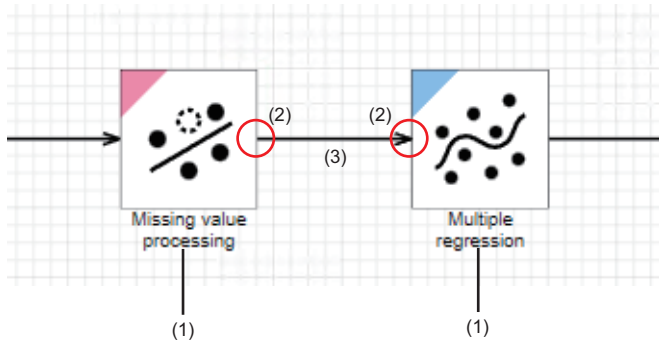
For the types of extension blocks and setting example, refer to the following:

☞ Page 230 EXTENSION BLOCK SETTINGS

An extension block has an input and an output. Processing can be performed by setting data output by an extension block as input data of another extension block.

An input and output of extension blocks can be connected by placing a connector.

By connecting blocks, the connection target block can refer to data output by its source block.



- (1) Extension block
- (2) Connection point
- (3) Connector

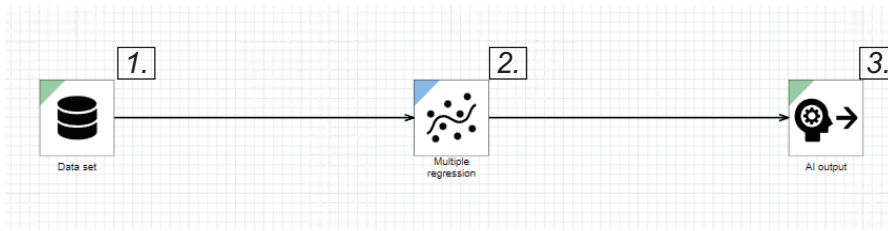
When no errors have occurred in any of the extension blocks on the canvas, each extension block in a set process flow can be executed by performing the process flow.

Whether an error has occurred can be checked with an icon displayed on an extension block.

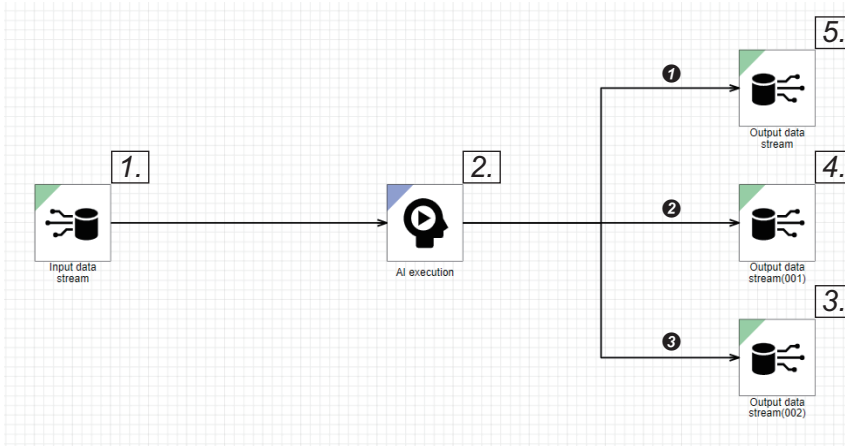
☞ Page 182 Placing an extension block

■ Execution order

Placed extension blocks are executed according to the order of the connections of connectors.



When connected in parallel, extension blocks are executed from the one of the connection destination of the connector the most recently placed.



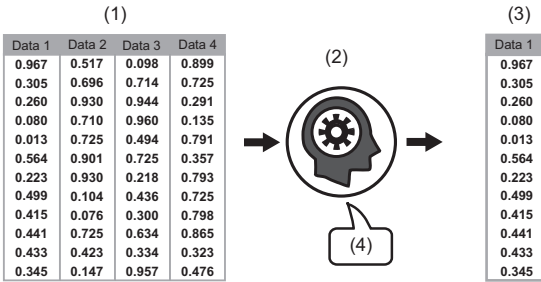
① to ③: Placement order of connectors

Input/output types

In data that is output from/input to an extension block, a data type (input/output type) and its detailed information are defined. To execute an extension block, the input/output types and detailed information must match. Otherwise, an error occurs. For details on data to be input and output, refer to the description of each extension block in the following:

Page 230 EXTENSION BLOCK SETTINGS

Input/output type	Description	Image
Data frame type	<p>The type of table format data</p> <p>■Detailed information</p> <ul style="list-style-type: none"> Number of records (integer between 1 and 864000) Number of variables (integer between 1 and 1024) Type of each variable (numerical value, category, or timestamp) 	<p>(1) Number of records (2) Variable (3) Variable name (4) Number of variables</p>
Multi-data frame type	<p>The type of data that contains multiple units of data frame type data. Variable names and the number of records differ per data frame.</p> <p>■Detailed information</p> <p>Entire multi-data frame</p> <ul style="list-style-type: none"> Number of data frames (integer between 1 and 432000) <p>Each contained data frame</p> <ul style="list-style-type: none"> Number of records (integer between 1 and 864000) (different per data frame) Number of variables (integer between 1 and 1024) (different per data frame) Type of each variable (numerical value, category, or timestamp) (different per data frame) 	<p>(1) Multi-data frame (2) Number of records in each data frame (3) Number of variables in each data frame</p>

Input/output type	Description	Image
Diagnosis rule type	<p>The input/output type that sets data frame type data to be diagnosed as input, and outputs data frame type data of the diagnosis result. Diagnosis rule type data is mainly output from an extension block of the analysis method category.</p> <p>■Detailed information</p> <ul style="list-style-type: none"> • Diagnosis rule type (classification or regression) 	 <p>(1) Diagnosis target</p> <p>(2) Diagnosis rule</p> <p>(3) Diagnosis result</p> <p>(4) Performing a diagnosis</p>

Creation method

The following shows the method for creating a process flow.

■Placing an extension block

Place an extension block.

Operating procedure

1. Select the category of an extension block to be placed from the dock.

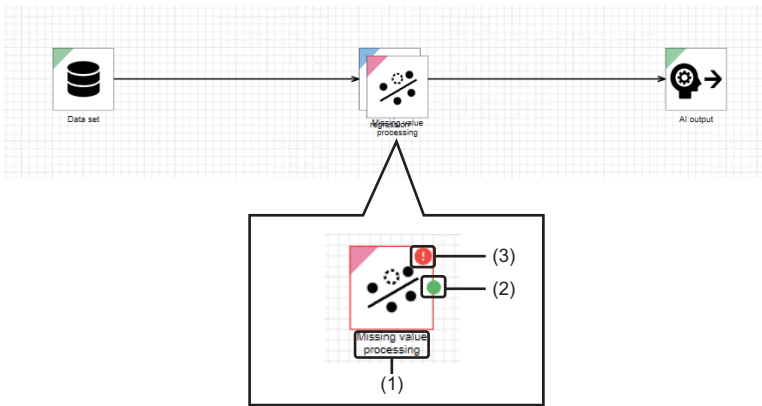
For the category of each extension block, refer to the following:

☞ Page 234 Extension Block List

2. Select an extension block to be placed from the block list for the selected category.



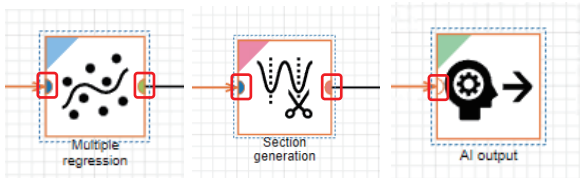
The extension block is placed on the canvas.



Item	Description
(1) Extension block name	The name of an extension block. An extension block name can be changed in the block name change screen. (Up to 32 characters) • Right-click an extension block, and select [Name change].
(2) Connection point	A contact between a connector and an extension block. The left side of the block is an input connection point, and the right side of the block is an output connection point.
(3) Error icon (❗)	An icon displayed when an error occurs in an extension block. Details can be checked by clicking the icon.

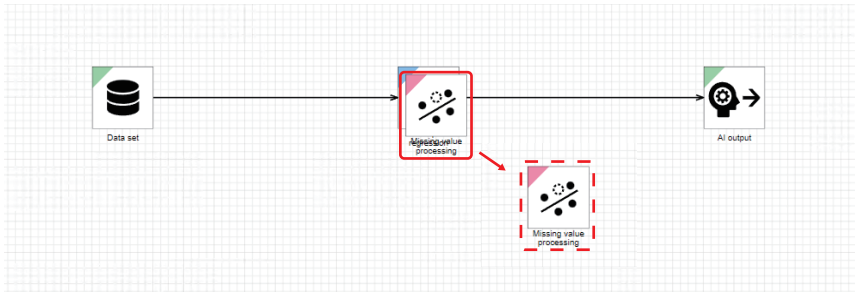
When clicking a placed block, its connection points are displayed in colors as shown below depending on the input/output type. (☞ Page 180 Input/output types)

Check the colors, and connect blocks with the same input/output type.



- Data frame type: ▢
- Multi-data frame type: ▢
- Diagnosis rule type: ▢
- Diagnosis rule or data frame type: ▢

3. Move the extension block by dragging.



Operations such as copy can be performed for an extension block from the right-click menu.

For the right-click menu, refer to the following:

☞ Page 231 Right-click menus

Point

When adding an extension block, the block name is suffixed with (XXX) if the name is duplicate with an exiting one. ('XXX' is a three-digit number. The number will be incremented from '001' until it is not duplicate.)

If the block name with (XXX) has more than 32 characters, characters in the block name are deleted from the end to fit within 32 characters even after (XXX) is added.

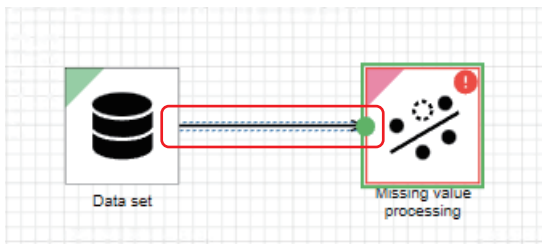
■Placing a connector

Place a connector to connect extension blocks.

Operating procedure

Drag the cursor from the output connection point of an extension block to the connection point of a connection target block.

A connector is placed on the canvas.

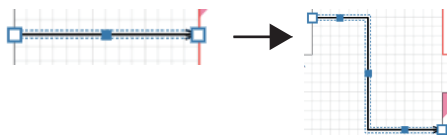


The connector is displayed as follows while selected.

The shape of the connector can be changed by dragging a blue square.



The connection target of the connector can be changed by dragging a white square.



Operations such as copy can be performed for a connector from the right-click menu:

- [Copy]^{*1}: To copy a selected connector
- [Paste]^{*1}: To paste a copied connector; however, it cannot be pasted when an AI is read-only.
- [Delete]^{*1}: To delete a selected connector; however, it cannot be deleted when an AI is read-only.

*1 Only an icon is displayed for a touch screen personal computer.

Precautions

Multiple connectors can be connected to the output connection point, but not to the input connection point. An error occurs if connected.

In addition, a connector is not connected to an extension block in the following cases:

- The arrow head of a connector is attempted to be connected to the output connection point of an extension block.
- The arrow tail of a connector is attempted to be connected to the input connection point of an extension block.

Point

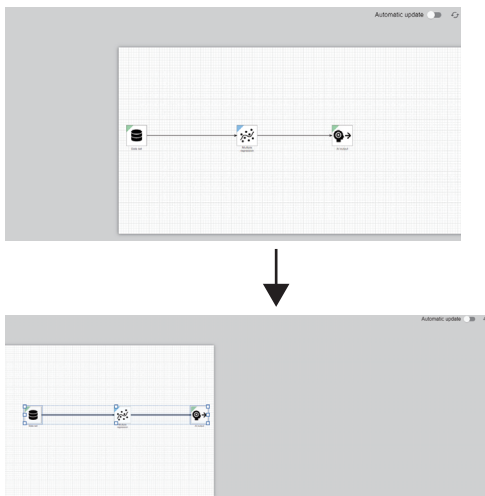
- The shape of a connector changes as a connection target extension block is moved.
- A connector is displayed as follows when neither or either of the connector ends is connected to an extension block.



- A connector alone can be moved by dragging only when neither of the connector ends is connected to extension blocks.
- When an extension block or connector is placed outside of the canvas for the up/down/left/right direction, the canvas is expanded to the direction where the block or connector is placed.
For a diagonal direction, the canvas is expanded to the direction where the block or connector is placed and also to the adjacent position.



- When all extension blocks and connectors are placed outside of the canvas, the canvas is expanded to the direction where the blocks and connectors are placed, and the canvas is no longer in the original position.



■ Setting properties

Display the setting screen and set properties for an extension block.

The setting screen appears by double-clicking an extension block.

For details on the setting screen, refer to the description of each extension block in the following:

☞ Page 230 EXTENSION BLOCK SETTINGS

Precautions

- Settings cannot be edited when an AI is read-only. (The setting screen for each extension block is displayed with the [OK] button disabled.)
- Properties set with integers or floating point numbers are handled as double precision floating point numbers. Therefore, a value cannot be processed properly if it exceeds the range of double precision floating point numbers or it is close to the boundary value of a upper or lower limit.
(Example) When setting a value smaller than '4.9406564584124654E-324,' it is recognized as '0'; therefore, an error cannot be detected properly.
(Example) A graph is not drawn properly.

AI customization learning monitoring screen

The following shows the screen for monitoring the learning status.

Window

(1) New project > AI > New AI > Learning status

Progress

- Learning status ✓
- Preprocessing
 - Missing value processing ✓
 - Date and time encoding ✓
 - Category encoding ✓
 - Outlier processing ✓
 - Outlier processing(001) ✓
 - Scaling ✓
 - Variable deletion ✓
- Optimization
 - Deep learning ✓
 - Gradient boosting decision tree ✓
 - Random forest ✓
- Analysis method selection
 - Ensemble learning ✓

Elapsed: 0:02:31
Remaining: 0:00:00

Learning result: Display switching Details (2) | Display Target Ensemble learning (3)

Ensemble learning

RMSE	
Learning score	0.23873829297273
Evaluation score	0.5866934309462623

Learning time: 17 [s]
Diagnosis time: 0.12 [ms]










Residual plot

Line chart

(4) TEST (5) COMPLETE

Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. Current project name > AI > name of an AI in the "Learning" state > Learning status By clicking a project name, the screen returns to the home screen. (Page 76 Home screen) By clicking "AI," the screen returns to the AI management screen. (Page 137 AI Management Screen) By clicking the name of an AI in the "Learning" state, the screen returns to the AI editor screen. (Page 175 AI editor screen)
Progress	The learning progress is displayed. (Page 162 Progress)
Evaluation value graph ^{*1}	The transition of evaluation index scores while learning is displayed as a graph. (Page 163 Evaluation value graph)

Item	Description
Learning result* ²	<p>A learning result is displayed.</p> <p>Displayed contents differ depending on the model type of an AI to be created.</p> <p>Only for a classification or regression model, displayed contents (overview or details) can be switched in (2) "Display switching."</p> <p>In addition, for ensemble learning, (3) "Display target" is displayed by selecting "Details" for (2) "Display switching." The learning result of each analysis method used for ensemble learning can be displayed by selecting "Analysis method."</p> <p>■ For an MT method or autoencoder model  Page 165 Learning result (MT method or autoencoder model)</p> <p>■ For a classification or regression model  Page 167 Learning result (classification or regression model (overview))  Page 169 Learning result (classification or regression model (details))</p> <p>■ For a similar waveform recognition model  Page 171 Learning result (similar waveform recognition model)</p> <p>■ For a guard band model  Page 188 Learning result (guard band model)</p> <p>■ For a model without an analysis method  Page 189 Learning result (model without an analysis method)</p>
(4) [Test] button* ²	Click this to test if a learned AI functions properly and display the AI test screen. ( Page 197 AI test screen)
(5) [Cancel]/[Complete] button	<p>■ While learning [Cancel] button: Click this to cancel learning. Once learning is canceled, the AI editor screen is displayed. ( Page 175 AI editor screen)</p> <p>■ When learning is completed [Complete] button: Click this to complete creating an AI. Once creation is completed, the AI management screen is displayed. ( Page 137 AI Management Screen)</p>

*1 Displayed when both of the following conditions are satisfied:

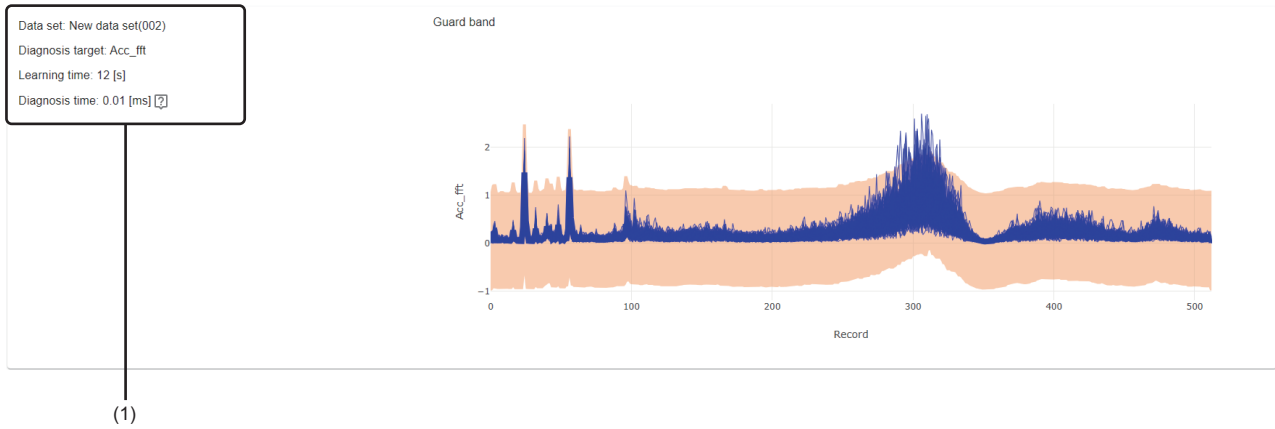
- Learning proceeds to optimization processing.
- For supervised learning, optimization is attempted at least once. For ensemble learning, optimization is attempted at least once in all the analysis methods.

*2 Displayed when learning is completed.

Learning result (guard band model)

The following shows the learning result of a guard band model.

Window



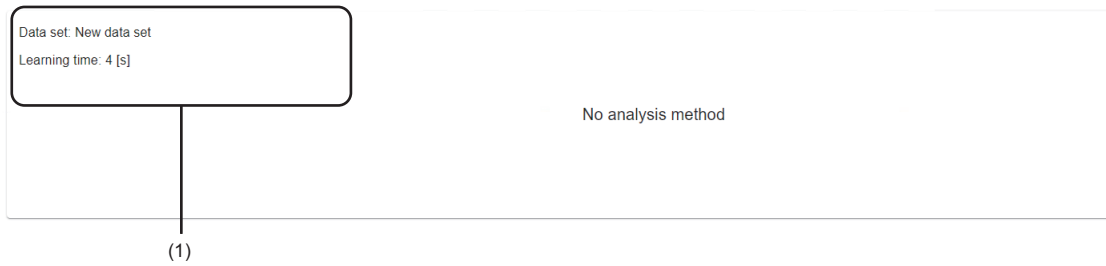
Displayed items

Item	Description	
(1) Learning information	Data set	The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.
	Diagnosis target	The name of a variable set as a diagnosis target is displayed.
	Learning time	Time required for entire learning processing is displayed.
	Diagnosis time	Time required for diagnosing an analysis method on the learning station is displayed.
Guard band	A guard band is displayed. (x axis: number of records, y axis: diagnosis target)	

Learning result (model without an analysis method)

The following shows the learning result of a model without an analysis method.

Window



Displayed items

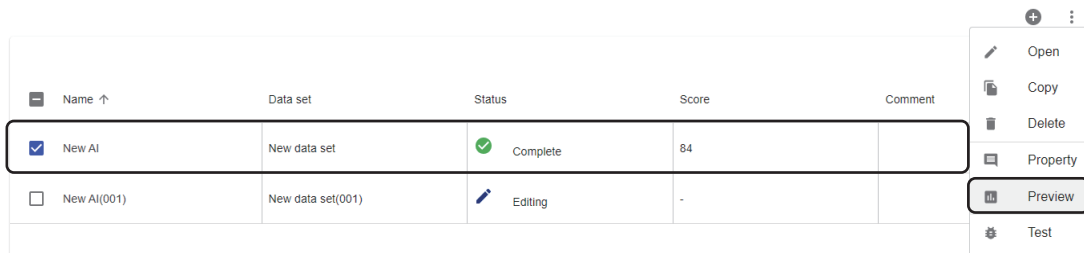
Item		Description
(1) Learning information	Data set	The name of a data set used for learning is displayed. "Deleted data set" is displayed when the data set is deleted.
	Learning time	Time required for entire learning processing is displayed.

8.5 Displaying a Learning Result

This section shows the procedure for checking the learning result of a created AI.

Operating procedure

1. Select a created AI in the AI management screen. (☞ Page 137 AI Management Screen)
2. Click ⋮ (Menu), and select [Preview].



The screenshot shows a table with the following columns: Name, Data set, Status, Score, and Comment. The first row is selected, and a context menu is open over it, with the 'Preview' option highlighted.

Name	Data set	Status	Score	Comment
<input checked="" type="checkbox"/> New AI	New data set	Complete	84	
<input type="checkbox"/> New AI(001)	New data set(001)	Editing	-	

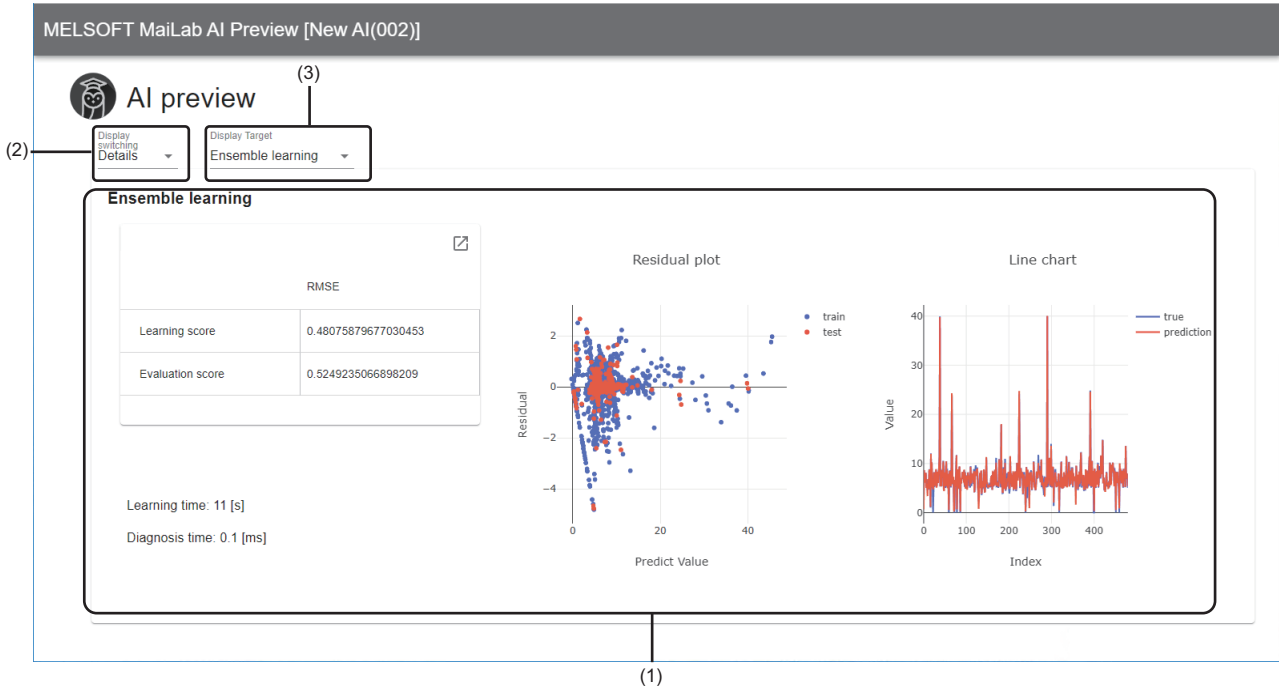
- Open
- Copy
- Delete
- Property
- Preview**
- Test

3. Check the learning result in the AI preview screen.
☞ Page 191 AI preview screen

AI preview screen

The following shows the screen for checking a learning result.
The AI preview screen is displayed in another tab.

Window



Displayed items

Item	Description
(1) Learning result	<p>A learning result is displayed. Displayed contents differ depending on the AI model type. Only for a classification or regression model, displayed contents (overview or details) can be switched in (2) "Display switching." In addition, for ensemble learning, (3) "Display target" is displayed by selecting "Details" for (2) "Display switching." The learning result of each analysis method used for ensemble learning can be displayed by selecting "Analysis method." <ul style="list-style-type: none"> ■ For an MT method or autoencoder model <ul style="list-style-type: none"> ☞ Page 165 Learning result (MT method or autoencoder model) ■ For a classification or regression model <ul style="list-style-type: none"> ☞ Page 167 Learning result (classification or regression model (overview)) ☞ Page 169 Learning result (classification or regression model (details)) ■ For a similar waveform recognition model <ul style="list-style-type: none"> ☞ Page 171 Learning result (similar waveform recognition model) ■ For a guard band model <ul style="list-style-type: none"> ☞ Page 188 Learning result (guard band model) ■ For a model without an analysis method <ul style="list-style-type: none"> ☞ Page 189 Learning result (model without an analysis method) </p>

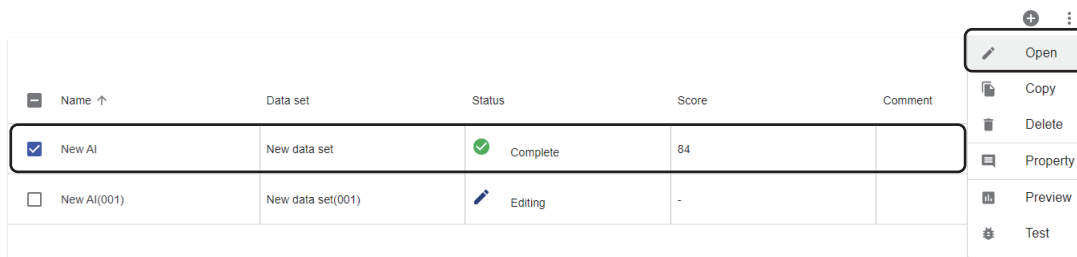
8.6 Editing an AI

This section shows the procedure for editing a created AI.

Edit an AI to improve the accuracy when it is low.

Operating procedure

1. Select a created AI in the AI management screen. (☞ Page 137 AI Management Screen)
2. Click ⋮ (Menu), and select [Open].



The screenshot shows a table with the following columns: Name, Data set, Status, Score, and Comment. The first row, 'New AI', is selected and has a score of 84. The second row, 'New AI(001)', is in an 'Editing' state. A context menu is open over the first row, showing options: Open, Copy, Delete, Property, Preview, and Test.

Name	Data set	Status	Score	Comment
<input checked="" type="checkbox"/> New AI	New data set	Complete	84	
<input type="checkbox"/> New AI(001)	New data set(001)	Editing	-	

3. Edit processing for learning and its parameters in the AI editor screen, and start learning.
☞ Page 175 AI editor screen
4. Monitor the learning status in the AI customization learning monitoring screen.
☞ Page 186 AI customization learning monitoring screen

8.7 Testing an AI

This section shows the procedure for performing a diagnosis with a learned AI and testing if the AI functions properly.

By performing a diagnosis with an AI for data different from the one at learning on the assumption of a real diagnosis, whether a diagnosis can be performed as expected also when executing a task can be verified in advance.

A data set that satisfies both of the following conditions can be selected as data to be used for a test (test data):

- The status is "Completed."
- Information on variables in a data set used for learning is included.*1

However, the diagnosis target variable is excluded when the analysis method used by an AI is unsupervised learning.

*1 Refers to a case where names and types of some variables in the data set completely match with the ones in the data set used for learning.


Point

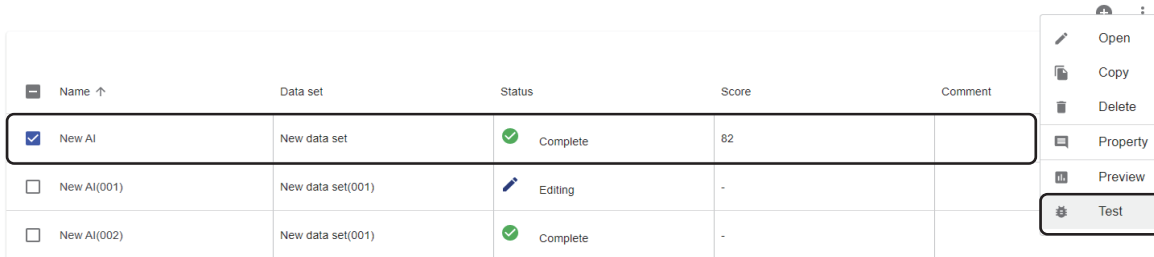
- Depending on the test result, it can be determined as follows:
 - When the result of the test with the data assuming diagnosis is same as the one at learning, diagnosis likely can be performed as expected also when executing an actual task.
 - When the result of the test with the data assuming diagnosis is different from the one at learning, diagnosis may cannot be performed as expected also when executing an actual task.Therefore, an AI should be created again by preparing more data for other patterns, and should be verified. (Example) When creating an AI with data from January to June, it was a good result. A test is performed with data from July to August before starting a diagnosis.
 - The result is same as the one at learning, therefore it is determined that diagnosis can be performed, and a diagnosis should be started.
 - The result is different from the one at learning, therefore, it is determined that a learning should be performed again including data for the summer season, and an AI should be created again after accumulating data.
- When the analysis method used by an AI is supervised learning, a diagnosis target variable is not required in a data set to be selected. However, if a diagnosis target variable is included, not only the values of a diagnosis result (predicted values) but also the values of the diagnosis target variable (measured values) are displayed; therefore, their values can be compared.

Precautions

Even when the test result is good, the result may not be the same as the one at the test due to the deviation from the data used in the test, such as changes of trends during actual diagnosis. Therefore, it is recommended to perform a test with some data and operate a task experimentally, then judge whether start a diagnosis.

Operating procedure

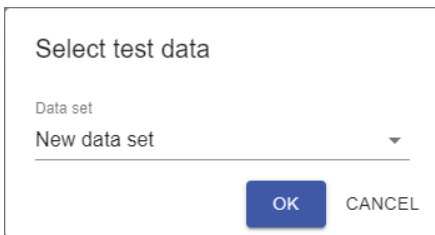
1. Select an AI in the AI management screen. (☞ Page 137 AI Management Screen)
2. Click  (Menu), and select [Test].



<input type="checkbox"/>	Name ↑	Data set	Status	Score	Comment
<input checked="" type="checkbox"/>	New AI	New data set	Complete	82	
<input type="checkbox"/>	New AI(001)	New data set(001)	Editing	-	
<input type="checkbox"/>	New AI(002)	New data set(001)	Complete	-	

- Open
- Copy
- Delete
- Property
- Preview
- Test**

3. Select a data set to be used as test data.



Select test data

Data set

New data set

4. Click the [OK] button.
5. Check the test result in the AI test screen.
☞ Page 197 AI test screen

Precautions

The maximum number of records that an AI can diagnose at once (hereinafter, this number is referred to as 'maximum number of diagnosable records') is 86400.

If the number of records in test data exceeds the maximum number of diagnosable records, test data is divided and a diagnosis is performed multiple times.

When dividing test data, each data source of test data is read as one text file so that the operation becomes almost the same as the one for when the connection method of an input data stream is "Text file." (☞ Page 370 Connection method (text file)) However, specific operation is performed as an exception when any of the data sources has records that exceed the maximum number of diagnosable records.

■When the number of records in each data source is less than the maximum number of diagnosable records

Within a range that does not exceed the maximum number of diagnosable records, data is divided into groups to have records closest to the maximum number of diagnosable records.

Ex.

When the number of data sources is 13 (1.csv to 13.csv) and the total number of records is 106000

	file	index	x1	x2	x3
(a)	1.csv	1	0.1	1	5
	1.csv	2	0.5	2	5

	8.csv	86397	0.2	1	5
(b)	8.csv	86398	0.2	1	5
	9.csv	86399	0.0	0	5
	9.csv	86400	1.0	3	5
	9.csv	86401	1.2	1	5
	9.csv	86402	0.5	2	5

	13.csv	106000	0.2	2	5

(a) Group used in the first diagnosis

(b) Group used in the second diagnosis

■When a data source with records that exceed the maximum number of diagnosable records is included

For a data source with records that exceed the maximum number of diagnosable records, the records are divided so that the maximum number of diagnosable records is used in the first diagnosis. The remaining records are regarded as one data source, and the same processing is repeated as necessary.

For data sources with records that does not exceed the maximum number of diagnosable records, data is divided in the same manner as shown in the following:

☞ Page 195 When the number of records in each data source is less than the maximum number of diagnosable records

Ex.

When the number of data sources is three (1.csv to 3.csv, 1.csv exceeds the maximum number of diagnosable records) and the total number of records is 106000

file	index	x1	x2	x3
1.csv	1	0.1	1	5
1.csv	2	0.5	2	5
...
1.csv	86400	0.2	1	5
1.csv	86401	0.4	1	5
...
1.csv	96400	1.0	3	5
2.csv	96401	1.2	1	5
2.csv	96402	1.3	5	5
...
3.csv	106000	0.2	2	5

(a) Group used in the first diagnosis

(b) Group used in the second diagnosis

AI test screen

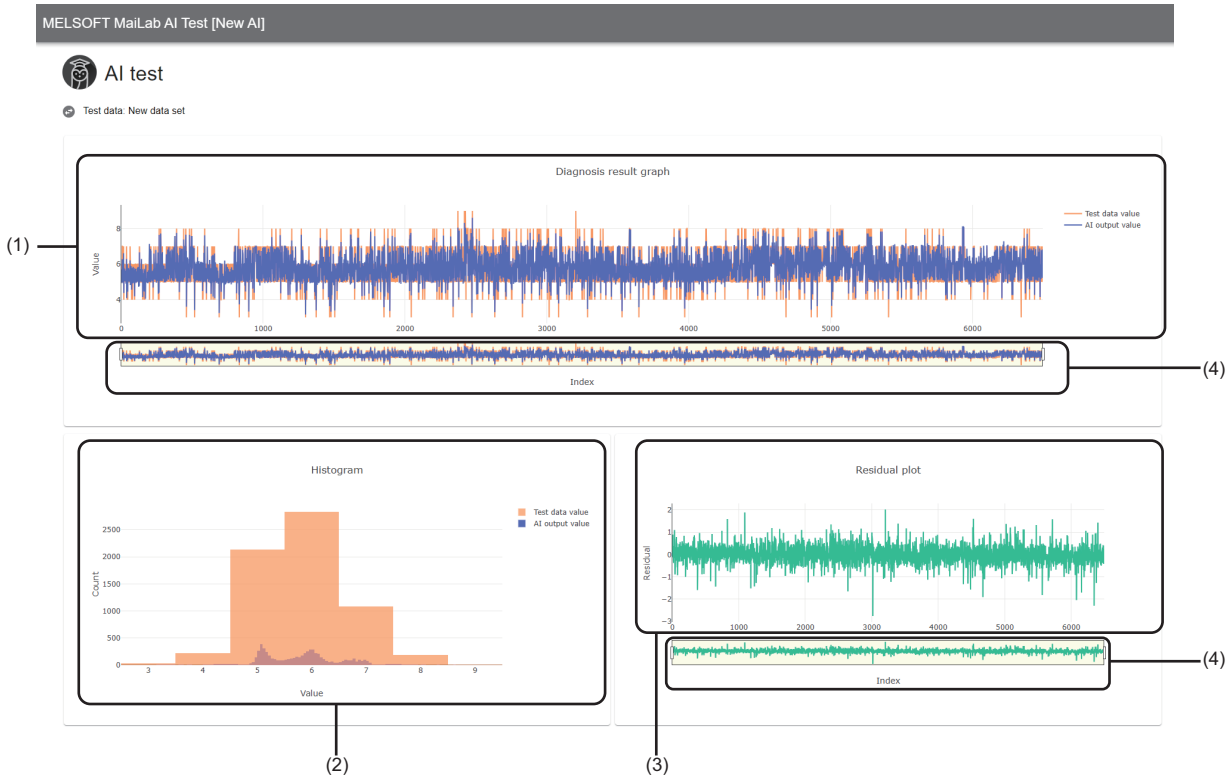
The following shows the screen for checking a test result.

The AI test screen is displayed in another tab.

By clicking a part to check the details, how much each variable value affects the diagnosis result can be displayed.

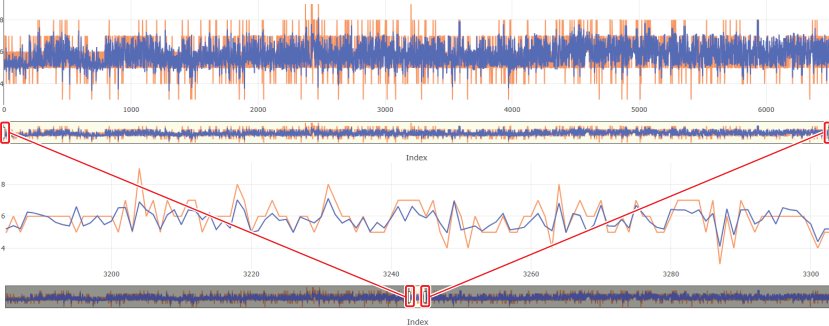
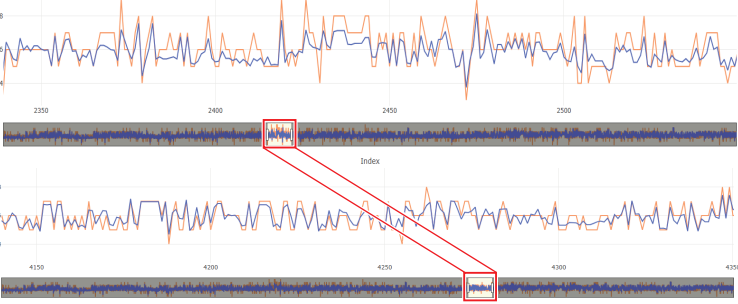
☞ Page 201 AI test details check screen

Window

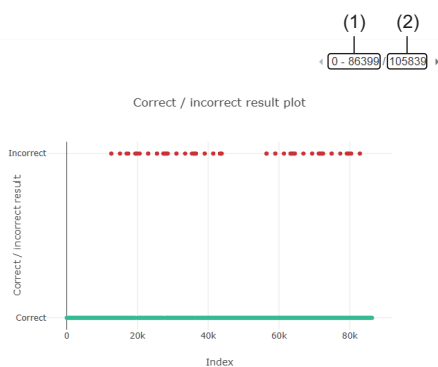


Displayed items

Item	Description
⊕ (Change test data)	Click this to display the "Select test data" screen and change a data set to be used as test data.
Test data	The name of a data set used as test data is displayed.*1
(1) Diagnosis result graph	<p>The values of a diagnosis result and test data are displayed as line charts. A whole diagnosis result is displayed by default. The detailed transition of values can be checked by zooming in the graph.</p> <p>Displayed contents differ depending on the analysis method used by an AI.</p> <p>However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.</p> <p>■For similar waveform recognition The values of the inspection waveform, reference waveform, and similarity score of similar waveform recognition are displayed as line charts. A similarity score is displayed in a range of 0 to 100 regardless of the output value.</p> <p>■For other analysis methods The values of a diagnosis result are displayed as a line chart. When the analysis method used by an AI is supervised learning and the diagnosis target variable is included in test data, not only the predicted values (values of a diagnosis result) but also the measured values (values of the diagnosis target variable) are displayed; therefore, their values can be compared.</p>
(2) Diagnosis result histogram	<p>The values of a diagnosis result and test data are displayed as histograms. Displayed contents differ depending on the analysis method used by an AI.</p> <p>Note that a missing value (NaN) is not counted.</p> <p>■For similar waveform recognition Nothing is displayed.</p> <p>■For an autoencoder or MT method ☞ Page 199 Error level histogram</p> <p>■For other analysis methods ☞ Page 200 Diagnosis result histogram</p>

Item	Description
(3) Residual plot or Correct / incorrect result plot	<p>Differences of values between a diagnosis result and test data are displayed.</p> <p>These plots are displayed only when the analysis method used by an AI is supervised learning and the diagnosis target variable is included in test data.</p> <p>Displayed contents differ depending on the type of a variable in a diagnosis result.</p> <p>However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.</p> <ul style="list-style-type: none"> • Numerical value: Residual between a measured value (value of a diagnosis result) and a predicted value (value of the diagnosis target variable) • Category: Correct/incorrect result (result of whether a prediction is correct by comparing a measured value and predicted value)*2
(4) Display range slider	<p>This is displayed in (1) diagnosis result graph and (3) residual plot.</p> <p>By dragging the slider, the display range of a graph changes.</p>  <p>By dragging the range in the slider, the display area of a graph moves while the width is maintained.</p> 

- *1 A data set name that was set when the data set was selected in the "Select test data" screen is displayed. Even if a data set name is changed in another tab, the name is not updated until the data set is selected in the "Select test data" screen.
- *2 Up to 86400 records can be displayed. If the number of records in the test result exceeds 86400, switch the range of records to be displayed with ◀▶.

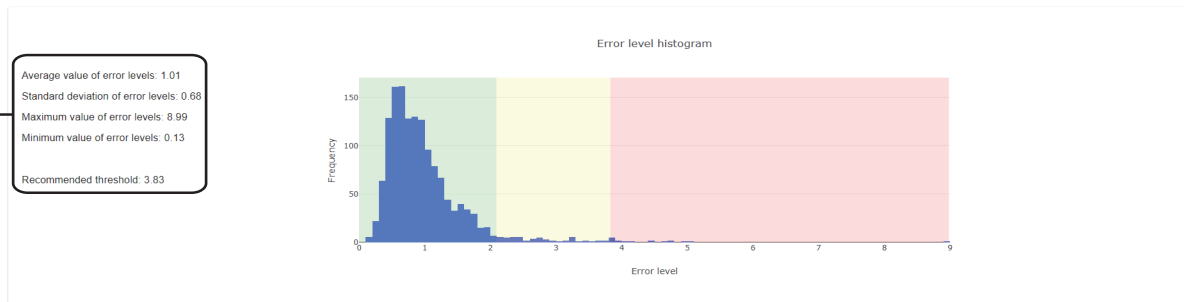


- (1) Record range being displayed (start index value - end index value of the x axis)
- (2) Maximum value of records (maximum index value of the x axis)

Error level histogram

The following shows the screen for displaying the values of error level as a histogram.

Window



Displayed items

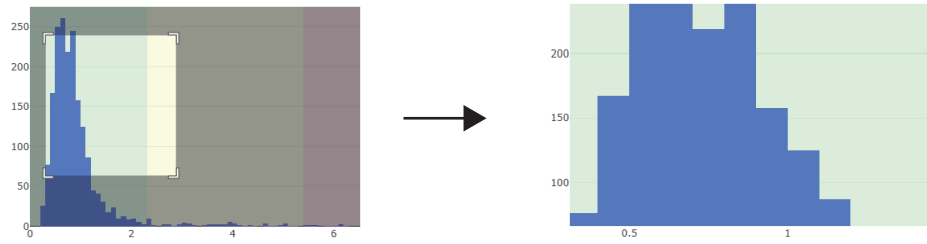
Item	Description
(1) Error level statistics	<p>Statistics of an error level is displayed. Rounded up to two decimal places.</p> <ul style="list-style-type: none"> • Average value • Standard deviation • Maximum value • Minimum value • Recommended threshold (value of the error level where the cumulative distribution function takes 0.99)
Error level histogram	<p>A histogram for the error level is displayed.</p> <ul style="list-style-type: none"> • Green: 0 to 95% area (where the cumulative distribution function of a histogram takes a value between 0 and 0.95) • Yellow: 95 to 99% area (where the cumulative distribution function of a histogram takes a value between 0.95 and 0.99) • Red: 99 to 100% area (where the cumulative distribution function of a histogram takes a value between 0.99 and 1.0) <p>The upper limit value in the red area is equal to the one in a histogram. Check this histogram to determine a threshold to judge an error. For example, to judge 95% as normal, regard a value on the border of green and yellow areas as a threshold; to judge 99% as normal, regard a value on the border of yellow and red areas as a threshold.</p>

Precautions

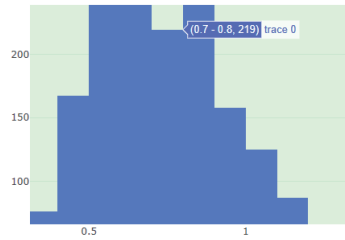
Data to be displayed is selected according to the processing for learning in an analysis method used; therefore, even if the same data set as the one used for learning is used, the result displayed in this screen do not always match the one displayed in the screen for learning.

📖 Page 165 Learning result (MT method or autoencoder model)

A histogram can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor can be displayed as follows by placing the cursor.



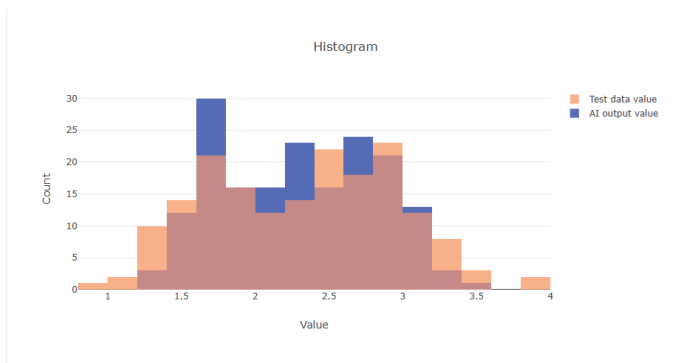
Diagnosis result histogram

The following shows the screen for displaying the distribution as a histogram.

A whole histogram is displayed by default. The detailed transition of values can be checked by zooming in the histogram.

In addition, when the analysis method used by an AI is supervised learning and the diagnosis target variable is included in test data, not only the values of a diagnosis result (predicted values) but also the values of the diagnosis target variable (measured values) are displayed; therefore, their values can be compared.

Window



AI test details check screen

The diagnosis contribution ratio, which indicates how much each variable affects the test result is displayed.

By analyzing the diagnosis contribution ratio and changing the preprocessing, the accuracy of an AI can be improved.

(Example)

- Add a feature that uses a variable with high diagnosis contribution ratio then perform learning again.
- Delete a variable with low diagnosis contribution ratio, then perform learning again.

Precautions

● The following are not supported:

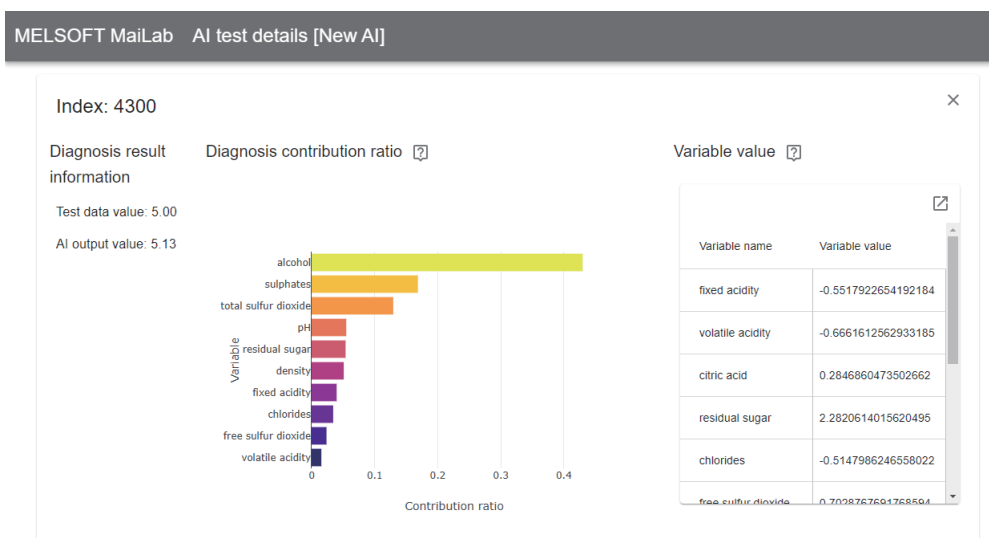
- An AI that uses similar waveform recognition
- An AI without an analysis method

● When displaying the AI test details check screen, diagnosis processing of the target AI is executed for calculating the diagnosis contribution ratio.

For an AI that uses a Python block (including the processing to access or change an external file), an external file may be accessed or changed at the timing when the diagnosis contribution ratio is displayed.

Window

Click a part to check the details in a diagnosis result graph or residual plot or correct/incorrect result plot. (Page 197 AI test screen)



Displayed items

Item	Description	
Index	An index value of the displayed data is displayed.	
Diagnosis result information	Test data value	A measured value is displayed. When a measured value does not exist, no value is displayed.
	AI output value	A predicted value output by an AI is displayed.
Diagnosis contribution ratio ^{*1*2*3}	The contribution ratios of up to top 10 explanatory variables of which contribution ratio is '0' or more are displayed as a horizontal bar chart graph. ^{*4} Whole data is displayed by default. The detailed distribution of values can be checked by zooming in a scatter plot.	
Variable value ^{*1}	Variable name	A variable name is displayed.
	Variable value	A variable value is displayed.

- *1 Not displayed for the following AIs:
 - AI that completes learning in this product with version 1.05F or earlier
 - AI uses a section generation block
 - AI uses a guard band block
- *2 In the following cases, the calculation result of a contribution ratio may not be correct:
 - A missing value processing block is used in an AI and a missing value processing methods is "Interpolate by median of previous and next values (Linear interpolation)," and a record of a missing value is selected.
 - An outlier processing block is used in an AI and an outlier processing method is "Replace by median of previous and next values," and a record of an outlier is selected.
 - A digital filter block is used in an AI
- *3 This may not match with the value displayed in the AI preview screen. (Page 167 Learning result (classification or regression model (overview)))
- *4 When an MT method block or autoencoder block is used in an AI, for a category type variable, the number of explanatory variables in a data set may not match with the displayed one.

9 TASK CREATION AND MANAGEMENT

This chapter shows the methods for creating and managing tasks.

Tasks are created and managed not for each project but for each diagnosis terminal. However, a task is created by using an AI in a project; therefore, a project needs to be opened to create and manage tasks.

9.1 Task


This section explains a task. A task is a group of processing from diagnosing collected data with an AI until outputting the diagnosis result.

The following table shows the types of processing to be combined to create a group of processing (process flow).

Processing	Description	Setting
Input data stream	Processing to collect data to be diagnosed with an AI. There are various collection methods, and setting contents differ for each method. The following records (number of lines) and variables (number of columns) can be collected: <ul style="list-style-type: none">• Records (number of lines): Up to 86400• Variables (number of columns): Up to 256	Required
Diagnosis AI	Processing to diagnose data with an AI the creation of which is completed. In addition, conditions to judge whether data is to be diagnosed (diagnosis execution conditions) can be set. (Up to eight conditions)	Required
Threshold processing	Processing to judge whether a value output during a diagnosis exceeds the set threshold	Optional
Optional processing	Optional processing that can be performed after a diagnosis with an AI. Set optional processing in the following cases: <ul style="list-style-type: none">• When dividing or postprocessing data to process a diagnosis result in other software or tool.	Optional
Output data stream	Processing to output a diagnosis result from an AI. There are various collection methods, and setting contents differ for each method. The following records (number of lines) and variables (number of columns) can be output: <ul style="list-style-type: none">• Records (number of lines): Up to 86400• Variables (number of columns): Up to 1024	Required

A diagnosis can be performed by executing a created task.

Each task has a type (task type). Processing that can be set differs depending on the selected task type.

 Page 205 Task types

A task can be executed on any schedule.


 Page 224 Execution setting screen

Precautions

- An AI may not be able to perform a diagnosis data as intended if the collected data has a tendency different from the one observed when learning. Fully verify a created task before starting an operation.
- Variables to be input to a task are fixed when creating the task; therefore, the task needs to be created again to change variables. (Variables are fixed to the ones used by an AI selected when creating a new task.)

Point


- When creating a new task, the task (including an AI to be used) is sent to a diagnosis terminal.
By this processing, the task is created not on the learning station but on the diagnosis terminal, and a diagnosis can be performed by executing the task on the diagnosis terminal.
- A task can be edited after creation.

 Page 229 Editing a Task

Restriction

Up to 64 AIs can be executed on a diagnosis terminal at the same time.

Tasks added by importing a project

Tasks added by importing a project are saved on the learning station as unassigned tasks. ( Page 74 Exporting and Importing a Project)

Unassigned tasks are not managed by any diagnosis terminals and managed for each unassigned task group on the learning station.


An unassigned task group is created for each diagnosis terminal managing tasks when they were exported. The group name is the same as the name of each diagnosis terminal.

For unassigned tasks, operations other than assignment and deletion are not available until they are assigned to a new diagnosis terminal.

For task assignment, refer to the following:

 Page 213 Task assignment

Point

Unassigned tasks are listed for each unassigned task group in the task management screen. ( Page 207 Task Management Screen)

Task types

The following explains task types.

Processing that can be set for a task differs depending on the selected task type.

Simple task


Select this type to create a task easily.

Only parameters for each unit of processing can be set, and a process flow is automatically created according to the settings.

For a simple task, only the following number of units of processing can be set.

- Input data stream: 1
- Diagnosis AI: 1 (Only one AI can be used.)
- Threshold processing: 0 to 1
- Output data stream: 1

For the procedure for creating a task of the simple task type, refer to the following:

 Page 215 Creating a Task (Simple Task)

Advanced task


Select this type to create a task in detail.

Parameters can be set for each unit of processing, and a process flow can be created by combining any units of processing.

For an advanced task, the following number of units of processing can be set.

- Input data stream: 1
- Optional processing: 0 or more (optional)
- Diagnosis AI: 1 (Up to 64 AIs can be used.)
- Threshold processing: 0 or more (optional)
- Output data stream: 1 to number of output method types (Only one output data stream can be created for each output method type.)

For the procedure for creating a task of the advanced task type task, refer to the following:

 Page 219 Creating a Task (Advanced Task)

Process flow of a task


The following shows a process flow when executing a task.

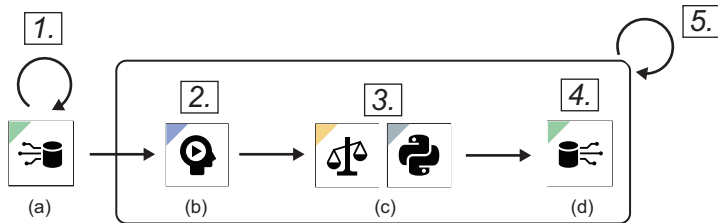
A task starts running by performing the start operation for the task.

A task that starts running repeats processing at the timing when the set execution period^{*1} starts.

When performing the stop operation for the task, it stops after the running processing is completed.

For the procedure for starting and stopping a task, refer to the following:

 Page 228 Starting and Stopping a Task



- (a) Input data stream
- (b) Diagnosis AI
- (c) Threshold processing/optional processing
- (d) Output data stream

1. An input data stream collects data in the set collection cycle^{*1} and saves the data.


2. Accumulated data is diagnosed for each diagnosis AI.

Only data that satisfies the set diagnosis execution conditions are used.

3. Optional processing is performed.

4. An output data stream outputs a diagnosis result.

5. Steps 2 to 5 are repeated in every set diagnosis cycle^{*1}.

^{*1} An execution period, collection cycle, and diagnosis cycle can be set in the execution setting. ( Page 224 Execution setting screen)

Point

A task is stopped automatically when the set execution period ends and the next execution period does not exist.



Precautions

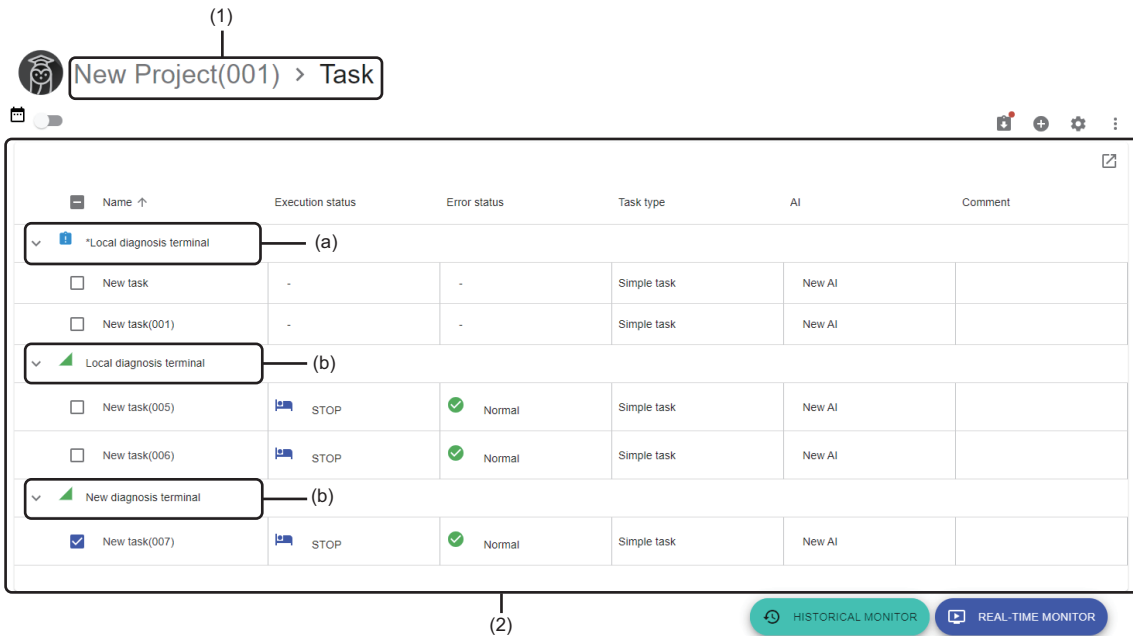
Immediately after starting a task, processing may not be performed in the set collection cycle and diagnosis cycle due to the effect of start processing.

9.2 Task Management Screen




















This section shows the task management screen for creating and managing tasks. Up to 16 tasks can be created on each diagnosis terminal.








Window

Click  (Task) on the side bar. ( Page 49 Side bar)








Displayed items

Item	Description	
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> • Current project name > Task By clicking a project name, the screen returns to the home screen. ( Page 76 Home screen)	
 (Calendar view)	Turn this ON to switch the task list to the calendar view. The execution schedule of tasks can be checked by switching to the calendar view. ( Page 212 Calendar view)	
 (Assign)	Displayed when an unassigned task exits in the task list. ( Page 204 Tasks added by importing a project) Click this to assign unassigned tasks to a diagnosis terminal. ( Page 213 Task assignment)  (Cancel assignment) is displayed while assigning tasks. The assignment is canceled by clicking the icon.	
 (Create new)	Click this to create a new task. The procedure differs depending on the task type to be selected. <ul style="list-style-type: none">  Page 215 Creating a Task (Simple Task)  Page 219 Creating a Task (Advanced Task) For task types, refer to the following: <ul style="list-style-type: none">  Page 205 Task types 	
 (Display setting)	Click this to set tasks to be displayed in the task management screen. ( Page 214 Display setting)	
 (Menu) ^{*1*2}	Start ^{*3}	To start a selected task. ( Page 228 Starting and Stopping a Task)
	Stop ^{*4}	To stop a selected task. ( Page 228 Starting and Stopping a Task)
	Open ^{*5*6}	To open a selected task. ^{*7*8}
	Copy ^{*9}	To create a copy of a selected task on the same diagnosis terminal. ^{*10*11}
	Delete ^{*12}	To delete a selected task.
	Execution setting ^{*5*6}	To set a schedule to execute a selected task. ( Page 223 Execution Setting)
	Property ^{*5*6}	To change properties (name and comment) of a selected task. ( Page 211 Changing properties)
	Convert to an advanced task ^{*5*13}	To convert the type of a selected task from the simple task to the advanced task. The task editor screen is displayed after conversion. ( Page 221 Task editor screen)

Item	Description
(2) Task list	<p>Tasks are listed for each diagnosis terminal.</p> <p>When unassigned tasks are in an open project, these tasks are displayed for each unassigned task group. (☞ Page 204 Tasks added by importing a project)</p> <p>For a standard user, the lines for other than the following tasks are grayed out. (☞ Page 53 User types)</p> <ul style="list-style-type: none"> • Tasks that belong to the open project • Unassigned tasks <p>When sorting the list, tasks are sorted for each diagnosis terminal.</p> <p>In addition, this list is switched to a calendar by turning ON  (Calendar view). (☞ Page 212 Calendar view)</p>
 (Expand)/ – (Collapse)	<p>Click either of these to expand or collapse the header.</p> <p>Operations such as search can be performed by expanding the header.</p> <p>☞ Page 56 Expanding the header</p> <p>When no tasks include a character string entered for the search or filter, the (a) unassigned task group or (b) diagnosis terminal is also hidden.</p> <p>When a character string entered for search is included in the name of (a) unassigned task group or (b) diagnosis terminal, the list of tasks in the group or diagnosis terminal is also displayed.</p>
(a) Unassigned task group	<p>An unassigned task group name^{*14} is displayed when an unassigned task exists in the task list. This item is displayed above (b) diagnosis terminal.^{*15}</p> <p>By clicking an unassigned task group name, unassigned tasks in the group are displayed as a list.</p> <p>In addition, by right-clicking an unassigned task group, the following context menu items are displayed:</p> <ul style="list-style-type: none"> • Assign^{*16}: To assign unassigned tasks to a diagnosis terminal (☞ Page 213 Task assignment) • Delete^{*16}: To delete all unassigned tasks in an unassigned task group
(b) Diagnosis terminal	<p>The name of a registered diagnosis terminal and its connection status (: Connect, : Disconnect) are displayed.^{*17}</p> <p>By clicking a connected diagnosis terminal name, tasks in the diagnosis terminal are displayed as a listed.</p> <p>In addition, by right-clicking a connected diagnosis terminal and selecting [Create a new task], the create a new task screen appears with the right-clicked diagnosis terminal selected.</p> <p>For the procedure for creating a task, refer to the following. (The procedure differs depending on the task type.)</p> <p>☞ Page 215 Creating a Task (Simple Task)</p> <p>☞ Page 219 Creating a Task (Advanced Task)</p> <p>For task types, refer to the following:</p> <p>☞ Page 205 Task types</p>
Name	<p>A task name is displayed.</p> <p>A task that belongs to the open project can be opened by clicking the name.^{*7*18}</p>
Execution status	<p>The execution status of a task is displayed.^{*19}</p> <ul style="list-style-type: none"> • EDIT: Setting a task is not completed. • RUN: Processing of a task is running. • BOOT: Processing to change from "READY" to "RUN" is in progress.^{*20} • READY: A task is started but the execution period has not started yet. • SHUTDOWN: Processing to change from "RUN" to "STOP" or "READY" is in progress.^{*21*22} • STOP: A task is not started or it is stopped.^{*23} <p>The execution status restarts from "READY" in the following cases. (If the operations described below is performed during the execution period, the status changes from "READY" to "RUN.")</p> <ul style="list-style-type: none"> • When "Execution status" is "READY," "BOOT," or "RUN," the operating status of this product on a diagnosis terminal is changed to "Stop" then to "Run" again.
Error status	<p>The current error status is displayed.^{*19}</p> <ul style="list-style-type: none"> • Normal: No warnings or errors have occurred. • Warning: A warning has occurred.^{*24*25} • Error: A task is stopped due to an error.^{*26}
Task type	A task type is displayed. (☞ Page 205 Task types)
AI	<p>The name of an AI used in a task is displayed.</p> <p>"Multiple AI" is displayed when using multiple AIs. By clicking  (Details), the AIs used are displayed as a list.</p> <p> is displayed when an AI used is changed.^{*27}</p> <p> is displayed when an AI used is not in the "Complete" state or is deleted.^{*27}</p>
Number of AI used ^{*28}	The number of AIs used in a task is displayed.
Diagnosis cycle [ms] ^{*28}	A set diagnosis cycle is displayed in milliseconds. (☞ Page 224 Execution setting screen)
Task execution period ^{*28}	A set execution period ("Always," "Date and time specification," or "Periodic") is displayed. (☞ Page 224 Execution setting screen)
Update date and time ^{*28}	<p>The date and time when a task was updated is displayed.</p> <p>This item is not updated by editing a task name or comment.</p>
Creation date and time ^{*28}	<p>The date and time when a task was created is displayed.</p> <p>For a task created as a copy, the date and time when the copy was created is displayed.</p>
Comment	A set comment is displayed.
Project name ^{*28}	The name of a project that a task belongs to is displayed. ^{*29}
Size [MB] ^{*28}	The file size of a task is displayed.

Item	Description
[Historical monitor] button ^{*30}	Click this to display the past diagnosis result of a selected task in another tab. (☞ Page 506 Historical monitor Screen)
[Real-time monitor] button ^{*31}	<p>Click this to display the task monitoring screen for a selected task in another tab. Displayed contents differ depending on the version of this product on a diagnosis terminal of the connection destination.</p> <ul style="list-style-type: none"> • The version is 1.02C or earlier: ☞ Page 478 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.02C or Earlier) • The version is 1.03D or later: ☞ Page 493 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later)

- *1 Can be clicked when selecting a task with the calendar view turned OFF.
- *2 The context menu can be displayed also by right-clicking on the task list.
- *3 For the administrative user, this menu can be selected when "Execution status" of a selected task is "STOP."
For a standard user, this menu can be selected when "Execution status" of a selected task is "STOP" and also the task belongs to the open project.
☞ Page 53 User types
However, this menu item cannot be selected when selecting an unassigned task.
- *4 For the administrative user, this menu can be selected when "Execution status" of a selected task is "READY," "BOOT," or "RUN."
For a standard user, this menu can be selected when "Execution status" of a selected task is "READY," "BOOT," or "RUN" and also the task belongs to the open project.
☞ Page 53 User types
However, this menu item cannot be selected when selecting an unassigned task.
- *5 Displayed when selecting only one task.
- *6 Can be selected when all the following conditions are satisfied:
 - The project that a selected task belongs to is not deleted.
 - A selected task belongs to the open project.
 - A selected task is assigned.
- *7 The screen to be displayed differs depending on the task type.
 - For a simple task: The simple task creation screen for a selected task is displayed. (☞ Page 217 Simple task creation screen)
 - For an advanced task: The task editor screen for a selected task is displayed. (☞ Page 221 Task editor screen)
- *8 When editing a task, refer to the precautions described in the following:
☞ Page 229 Editing a Task
- *9 Can be selected when both of the following conditions are satisfied:
 - A selected task belongs to the open project.
 - A selected task is assigned.
- *10 A copy task name will be "copy source task name (001)."
If the name is duplicate with a task in the same diagnosis terminal, a value in the parentheses '(') will be incremented.
If a copy source task name has 251 or more characters, the number of characters in "copy source task name (001)" will exceed its maximum number (255 characters). In this case, the 251st and later characters will be deleted when a copy is created.
- *11 A copy is created with the "STOP" state when "Execution status" of the copy source task is "RUN," "BOOT," "READY," or "SHUTDOWN."
"Error status" becomes "Normal" regardless of "Error status" of the copy source task.
- *12 For the administrative user, this menu can be selected when selecting a task whose project it belongs to has not been deleted.
For a standard user, this menu can be selected when selecting a task that belongs to the open project.
☞ Page 53 User types
However, this menu cannot be selected in either of the following cases:
 - Assigned and unassigned tasks are selected at the same time.
 - An unassigned task is selected while assigning tasks.
- *13 Can be selected when all the following conditions are satisfied:
 - "Execution status" of a selected task is "STOP" or "EDIT."
 - "Task type" of a selected task is "Simple task."
 - The project that a selected task belongs to is not deleted.
 - A selected task belongs to the open project.
 - A selected task is assigned.
- *14 Displayed with "*" prefixed.
- *15 Unassigned tasks are displayed in registration order of diagnosis terminals that group unassigned tasks.
- *16 Can be selected when assignment is not in progress.
- *17 Diagnosis terminals are displayed in the following order:
 - Diagnosis terminal where tasks exist (in order of registration)
 - Diagnosis terminal where no tasks exist (in order of registration)
- *18 Excluding unassigned tasks
- *19 "." is displayed for an unassigned task.
- *20 Once the processing is completed, the status changes to "RUN."
- *21 Once the processing is completed, the status changes to "STOP" or "READY."
- *22 If an error occurs while the status is "RUN" or "BOOT" and then the status changes to "SHUTDOWN," only errors that occur while the status is "RUN" or "BOOT" are notified. Warnings and errors that occur while the status is "SHUTDOWN" are not notified.

- *23 Includes the case when a task is started but the next execution period does not exist.
- *24 Once a warning occurs, this "Warning" state remains as long as "Execution status" of a task is "RUN."
- *25 This state is cleared when "Execution status" of a task changes from "RUN."
- *26 This state is cleared by performing the start operation for a task again.
- *27 When two or more warnings or errors occur while using multiple AIs, only one of them is displayed in the following priority order:
 -  ("AI has been deleted.")
 -  ("AI is not in the completed state.")
 -  ("AI has been changed.")
- *28 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.
 -  Page 56 Switching to show or hide
- *29 "-" is displayed when the project is deleted.
- *30 Displayed when selecting only one task with the calendar view turned OFF.
- *31 Displayed when selecting only one task of which "Execution status" is not "EDIT" with the calendar view turned OFF.

Point 

If an unassigned task exists and also the assignment is not in progress, the screen for assigning the task is displayed when displaying the task management screen.

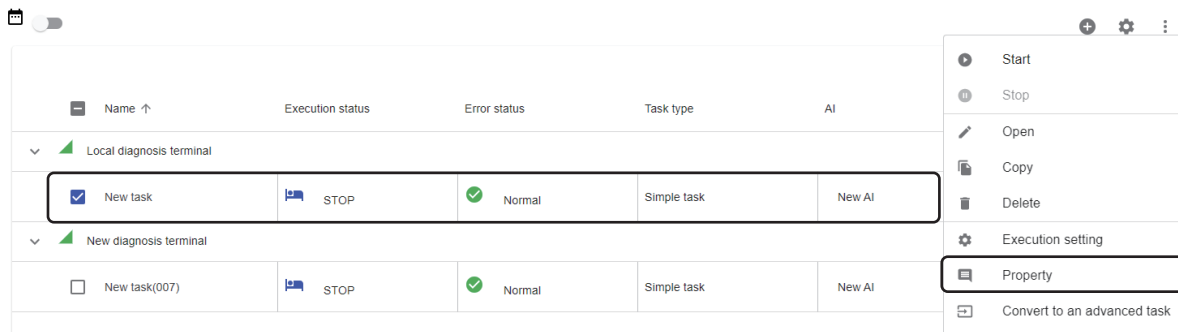
 Page 213 Task assignment

Changing properties

The following shows the procedure for changing properties (name and comment) of a task.

Operating procedure

1. Select a task in the task management screen. (☞ Page 207 Task Management Screen)
2. Click ⋮ (Menu), and select [Property].



3. Set a new task name (up to 255 characters) or comment (up to 1024 characters).

The 'Task property' dialog box contains two input fields: 'Name*' with the text 'New task' and 'Comment'. At the bottom, there are 'OK' and 'CANCEL' buttons.

4. Click the [OK] button.

Calendar view

The execution schedule of tasks are displayed on a calendar.

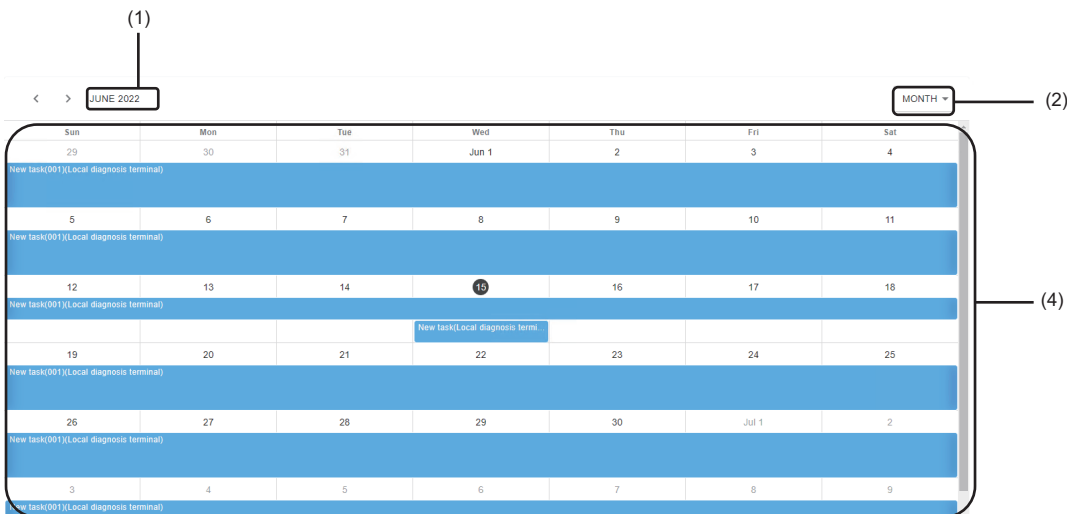
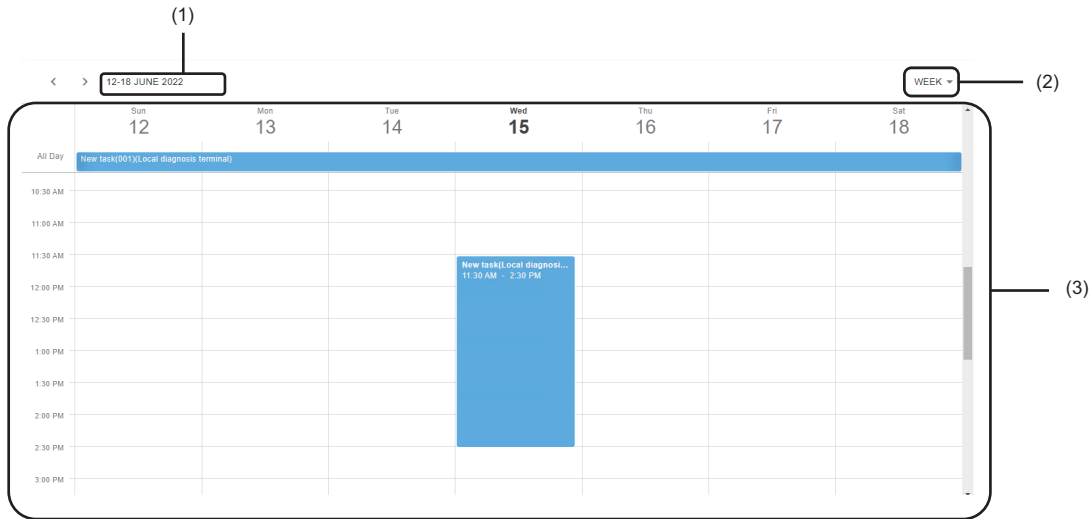
Tasks to be displayed on a calendar can be set in the screen shown in the following.

Note that up to five tasks can be displayed at the same time.

Page 214 Display setting

Window


Turn ON (Calendar view) in the task management screen. (Page 207 Task Management Screen)



Displayed items


Item	Description
(1) Year and date	The year and date being displayed on a calendar is displayed. A small calendar is displayed by clicking the string. The year and date on a calendar can be changed by selecting a year and date on the small calendar.
(2) Display switching	The display format of a calendar can be switched between the week view (WEEK) or month view (MONTH).
(3) Week view	A calendar is displayed per week. By clicking a schedule, its detailed information can be checked on the tooltip.
(4) Month view	A calendar is displayed per month. By clicking a schedule, its detailed information can be checked on the tooltip.

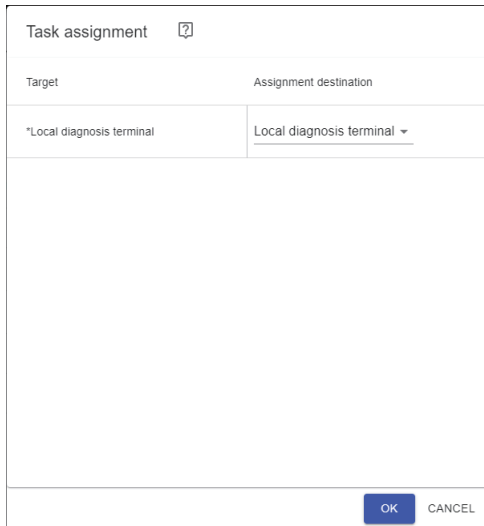
Task assignment

The following shows the screen for assigning unassigned tasks to a diagnosis terminal. ( Page 204 Tasks added by importing a project)

Tasks can be assigned to a diagnosis terminal in the "Connect" state for each unassigned task group. After assigning tasks, their execution status will be "STOP" and their error status will be "Normal."

Window


Click  (Assign) in the task management screen. ( Page 207 Task Management Screen)






Displayed items

Item	Description
Target	An unassigned task group name is displayed.
Assignment destination	Select a diagnosis terminal to be assigned the tasks to.*1*2 Select "Not assigned" when not assigning the tasks to any diagnosis terminals.

*1 A diagnosis terminal of which the connection status is "Connect" can be selected.

*2 Only a local host diagnosis terminal can be set when using a temporary license. ( Page 60 Local host diagnosis terminal)



Point

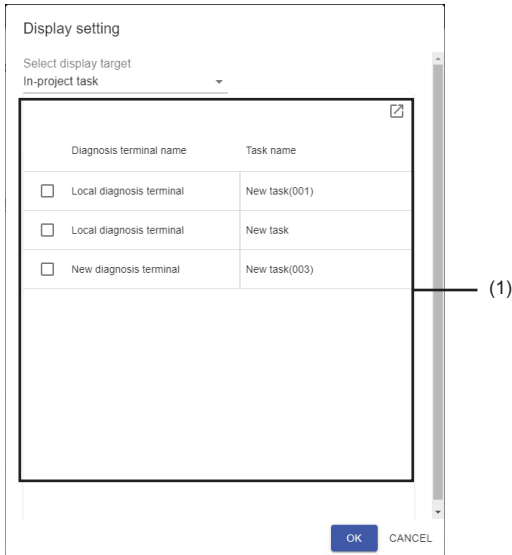
-  (Assign) in the task management screen changes to  (Cancel assignment) while assigning tasks. The assignment is canceled by clicking the icon. ( Page 207 Task Management Screen)
- Tasks that are successfully assigned are moved to under their assignment destination diagnosis terminal. In addition, the line for the unassigned task group is deleted from the task management screen and this screen.
- When assigning a task, the task name is suffixed with (XXX) if the name is duplicate with the one in the assignment destination diagnosis terminal. ('XXX' is a three-digit number. The number will be incremented from '001' until it is not duplicate.)

Display setting




The following shows the screen for setting tasks to be displayed in the task management screen.

Window

Click  (Display setting) in the task management screen. ( Page 207 Task Management Screen)



Displayed items

Item	Description
Select display target	Select tasks to be displayed in the task management screen. <ul style="list-style-type: none"> • In-project task: Tasks that belong to the open project and unassigned tasks are displayed. • All tasks: All tasks created on registered diagnosis terminals and unassigned tasks that belong to the open project are displayed, regardless of a project.
(1) Select display target (calendar view) ^{*1}	Select the checkbox of a task to display its execution schedule on a calendar. (Up to five tasks) Only tasks that belong to the open project are displayed when selecting "In-project task" for "Select display target."
 (Expand)/  (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
Diagnosis terminal name	The name of a diagnosis terminal where a task is created is displayed.
Task name	A task name is displayed.

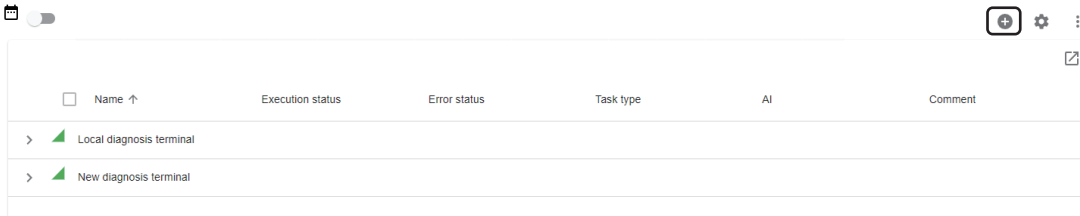
*1 Displayed when the calendar view is ON.

9.3 Creating a Task (Simple Task)

This section shows the procedure to create a new task of the simple task type.

1. Perform any of the following operations:

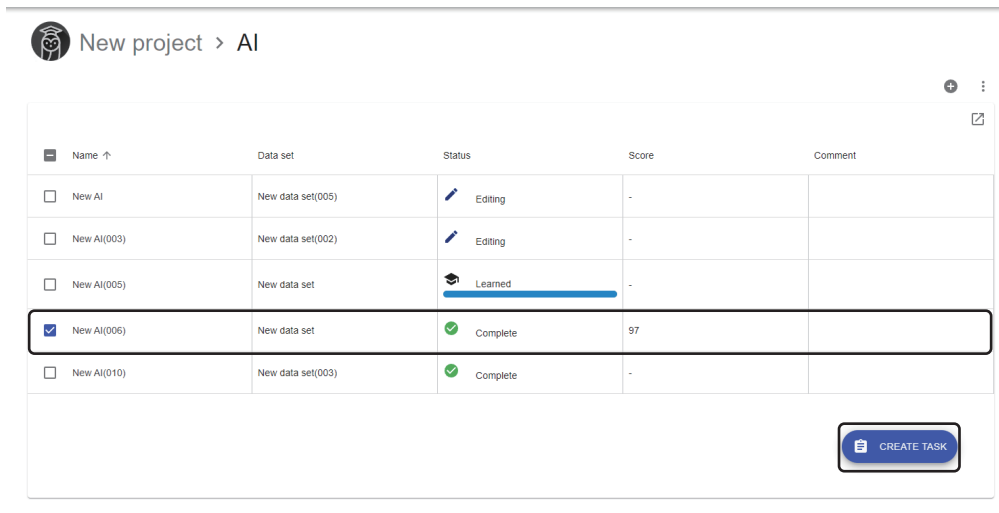
- Click + (Create new) in the task management screen. (Page 207 Task Management Screen)



- Select and right-click a diagnosis terminal in the task list of the task management screen, then select [Create a new task]. (Page 207 Task Management Screen)



- Select an AI in the AI management screen, and click the [Create task] button. (Page 137 AI Management Screen)



2. Set a task name (up to 255 characters), AI to be used^{*1*2}, and diagnosis terminal to create the task on^{*3*4*5} in the create a new task screen.

*1 An AI of which the status is "Complete" in the open project can be selected.

*2 When the screen is opened from the AI management screen, the AI selected in the screen is set by default. (☞ Page 137 AI Management Screen)

*3 A diagnosis terminal of which the connection status is "Connect" can be selected.

*4 When the screen is opened by selecting and right-clicking a diagnosis terminal, then selecting [Create a new task], the selected diagnosis terminal is set by default. (☞ Page 207 Task Management Screen)

*5 Only a local host diagnosis terminal can be set when using a temporary license. (☞ Page 60 Local host diagnosis terminal)

Create a new task

Name
New task(002)

Select AI

Select diagnosis terminal
Local diagnosis terminal

Select task type

Simple task Advanced task

OK CANCEL

Point

A task name can be changed in the task property screen.

☞ Page 211 Changing properties

3. Select [Simple task] in "Select task type."

Create a new task

Name
New task(002)

Select AI
New AI(006)

Select diagnosis terminal
Local diagnosis terminal

Select task type

Simple task Advanced task

OK CANCEL

4. Click the [OK] button.

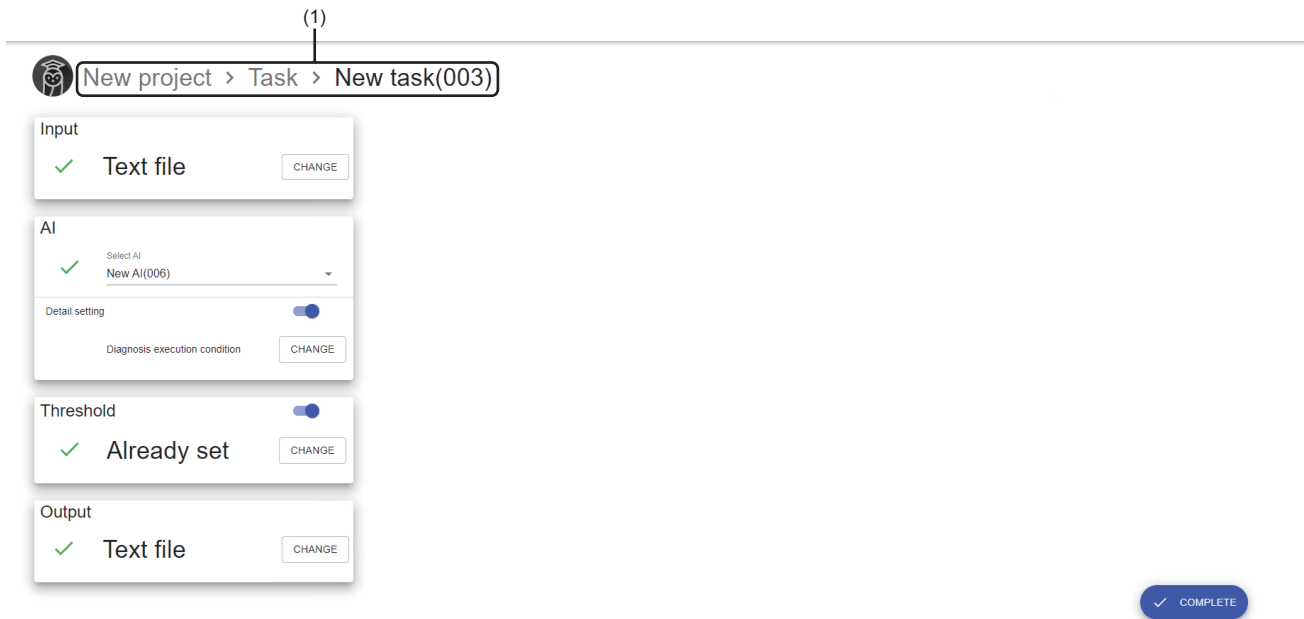
5. Configure various settings for the task in the simple task creation screen.

☞ Page 217 Simple task creation screen

Simple task creation screen

The following shows the screen for configuring various settings for a task.

Window



Displayed items

Item	Description				
(1) Breadcrumb bar	<p>A breadcrumb bar is displayed.</p> <ul style="list-style-type: none"> • Current project name > Task > current task name <p>By clicking a project name, the screen returns to the home screen. (☞ Page 76 Home screen)</p> <p>By clicking "Task," the screen returns to the task management screen. (☞ Page 207 Task Management Screen)</p>				
Input	<p>Set an input data stream.</p> <p>The setting screen appears by clicking the [Change] button.*¹</p> <p>☞ Page 388 Input data stream screen</p> <p>When setting is completed, ✓ and the set collection method are displayed.</p> <p>Otherwise, ! is displayed.</p>				
AI	<table border="1"> <tr> <td>Select AI</td> <td> <p>Select an AI to be used.*²</p> <p>When a selected AI is deleted, ! is displayed.</p> <p>When any changes are made in a selected AI, ⚠ is displayed.</p> <p>Otherwise, ✓ is displayed.</p> </td> </tr> <tr> <td>Detail setting</td> <td> <p>Turn this ON to set a diagnosis execution condition.*³</p> <p>The setting screen appears by clicking the [Change] button.*^{1,4}</p> <p>☞ Page 447 Diagnosis execution condition</p> </td> </tr> </table>	Select AI	<p>Select an AI to be used.*²</p> <p>When a selected AI is deleted, ! is displayed.</p> <p>When any changes are made in a selected AI, ⚠ is displayed.</p> <p>Otherwise, ✓ is displayed.</p>	Detail setting	<p>Turn this ON to set a diagnosis execution condition.*³</p> <p>The setting screen appears by clicking the [Change] button.*^{1,4}</p> <p>☞ Page 447 Diagnosis execution condition</p>
Select AI	<p>Select an AI to be used.*²</p> <p>When a selected AI is deleted, ! is displayed.</p> <p>When any changes are made in a selected AI, ⚠ is displayed.</p> <p>Otherwise, ✓ is displayed.</p>				
Detail setting	<p>Turn this ON to set a diagnosis execution condition.*³</p> <p>The setting screen appears by clicking the [Change] button.*^{1,4}</p> <p>☞ Page 447 Diagnosis execution condition</p>				
Threshold	<p>Turn this ON to set a threshold.</p> <p>The setting screen appears by clicking the [Change] button.*¹</p> <p>☞ Page 452 Comparison judgment screen</p> <p>When setting is completed and there are no errors in the setting, ✓ is displayed.</p> <p>Otherwise, ! is displayed.</p>				
Output	<p>Set an output data stream.</p> <p>The setting screen appears by clicking the [Change] button.*¹</p> <p>☞ Page 423 Output data stream screen</p> <p>When setting is completed, ✓ and the set output method are displayed.</p> <p>Otherwise, ! is displayed.</p>				
[Complete] button* ⁵	<p>Click this to complete creating a task.*⁶</p> <p>Once creation is completed, the task management screen is displayed. (☞ Page 207 Task Management Screen)</p>				

*¹ When a task is read-only, only browsing is available. (The button name will be "Details.")

*² An AI that satisfies both of the following conditions can be selected:

- The status is "Complete."
 - The names and types of variables (explanatory and objective variables) match with the ones for an AI selected when creating a new task.
- *3 The ON/OFF status can be switched when both of the following conditions are satisfied:
- A task is not read-only.
 - An AI is selected for "Select AI."
- *4 Can be clicked only when an AI is selected for "Select AI."
- *5 Displayed when all the following conditions are satisfied:
- A task is not read-only.
 - "Input" is set.
 - "Threshold" is set (only when it is ON).
 - "Output" is set.
- *6 The execution status of the task changes from "EDIT" to "STOP."

Precautions

A task becomes read-only and cannot be edited in the following cases:

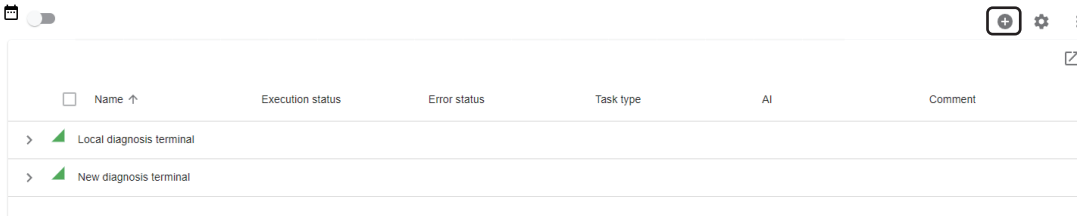
- The execution status of the task is "RUN," "BOOT," "READY," or "SHUTDOWN."
- The execution status of the task is "STOP," and "Read-only" is selected when displaying this screen.

9.4 Creating a Task (Advanced Task)

This section shows the procedure to create a new task of the advanced task type.

1. Perform any of the following operations:

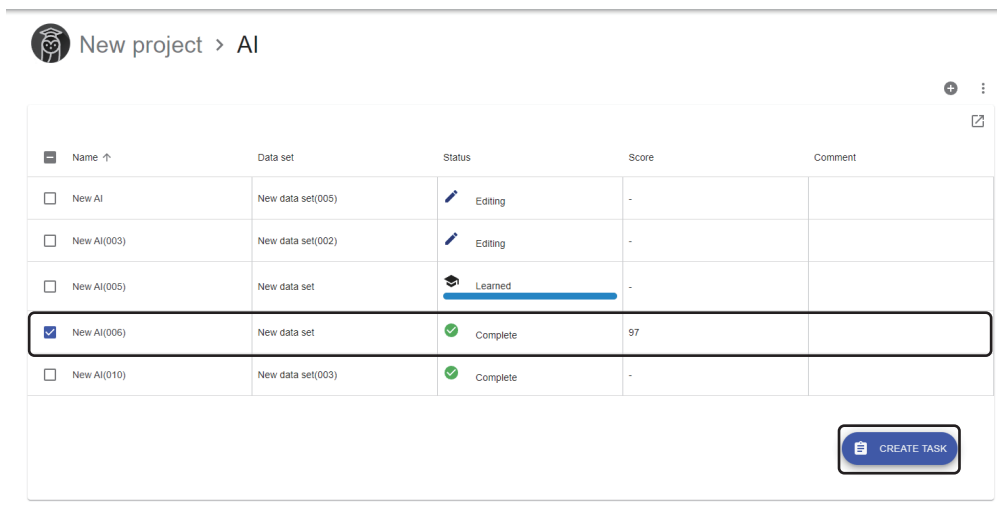
- Click + (Create new) in the task management screen. (Page 207 Task Management Screen)



- Select and right-click a diagnosis terminal in the task list of the task management screen, then select [Create a new task]. (Page 207 Task Management Screen)



- Select an AI in the AI management screen, and click the [Create task] button. (Page 137 AI Management Screen)



2. Set a task name (up to 255 characters), AI to be used^{*1*2}, and diagnosis terminal to create the task on^{*3*4*5} in the create a new task screen.

*1 An AI of which the status is "Complete" in the open project can be selected.

*2 When the screen is opened from the AI management screen, the AI selected in the screen is set by default. (☞ Page 137 AI Management Screen)

*3 A diagnosis terminal of which the connection status is "Connect" can be selected.

*4 When the screen is opened by selecting and right-clicking a diagnosis terminal, then selecting [Create a new task], the selected diagnosis terminal is set by default. (☞ Page 207 Task Management Screen)

*5 Only a local host diagnosis terminal can be set when using a temporary license. (☞ Page 60 Local host diagnosis terminal)

Create a new task

Name
New task(002)

Select AI

Select diagnosis terminal
Local diagnosis terminal

Select task type

Simple task Advanced task

OK CANCEL

Point

A task name can be changed in the task property screen.

☞ Page 211 Changing properties

3. Select [Advanced task] in "Select task type."

Create a new task

Name
New task(002)

Select AI
New AI(006)

Select diagnosis terminal
Local diagnosis terminal

Select task type

Simple task Advanced task

OK CANCEL

4. Click the [OK] button.

5. Create a process flow for the task in the task editor screen.


☞ Page 221 Task editor screen

Task editor screen

The following shows the screen for creating a process flow for a task.

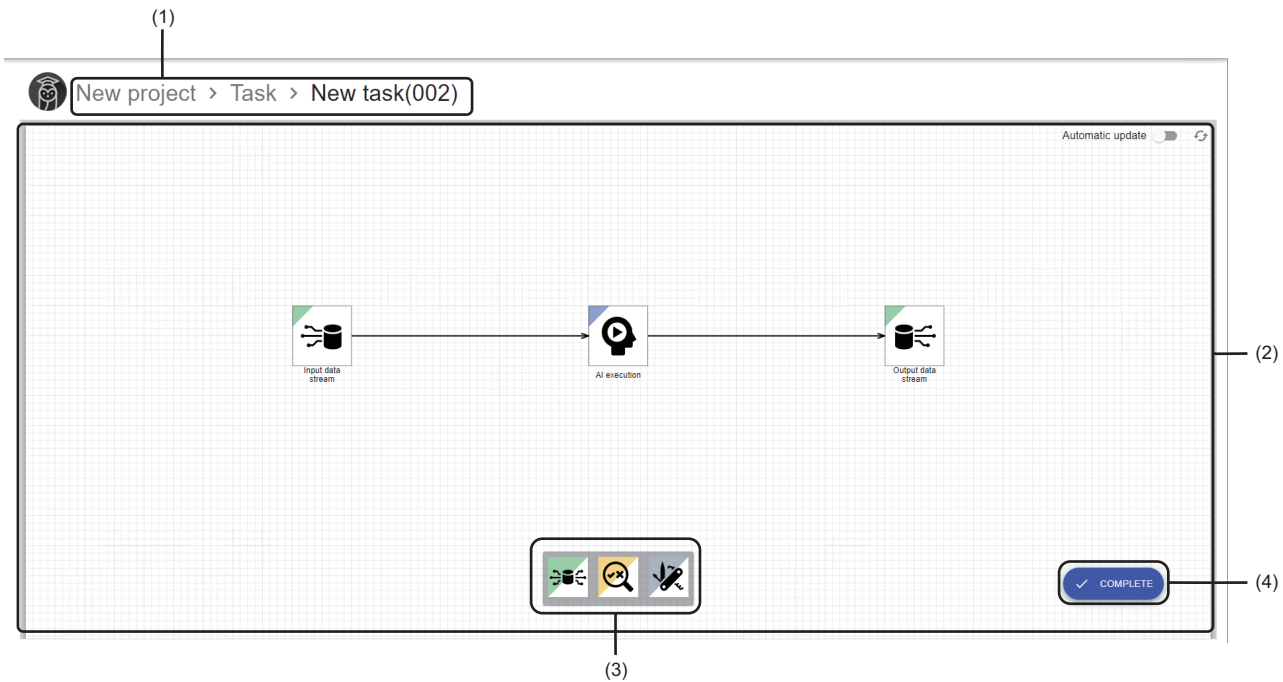
A process flow for a task can be created by placing blocks representing processing (extension blocks) and connectors representing data flow between blocks on the canvas.

For details on extension blocks, refer to the following:







 Page 178 Extension blocks

Up to 64 extension blocks and connectors can be placed each.

Window




Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> Current project name > Task > current task name By clicking a project name, the screen returns to the home screen. ( Page 76 Home screen) By clicking "Task," the screen returns to the task management screen. ( Page 207 Task Management Screen)
Automatic update ^{*1}	Turn this ON to automatically update the status of a process flow. ^{*2}
 (Update) ^{*1}	Click this to update the status of a process flow. ^{*2}  is displayed when the status is already updated.
(2) Canvas	Place extension blocks and connectors to create a process flow. For the creation method, refer to the following:  Page 182 Creation method
(3) Dock ^{*1}	An area to select an extension block to be placed
(4) [Edit]/[Complete] button	<ul style="list-style-type: none"> When the execution status of a task is "STOP," and "Read-only" is selected when displaying this screen [Edit] button: Click this to release read-only and edit a process flow. When the execution status of a task is "EDIT" [Complete] button: Click this to complete creating a task with the set process flow.^{*3} Once creation is completed, the task management screen is displayed. ( Page 207 Task Management Screen) <ul style="list-style-type: none"> Other cases Nothing is displayed.

*1 Displayed when a task is not read-only.

*2 The status of a process flow is updated at the timings listed below.

If "Automatic update" is ON, the status is updated also when changing a connector.

- When clicking  (Update)

- When displaying the setting screen for an extension block while the update of a process flow is not completed

- When clicking the [OK] button in the setting screen for an extension block while the update of a process flow is not completed

- When clicking the [Complete] button

*3 The execution status of the task changes from "EDIT" to "STOP."

Precautions

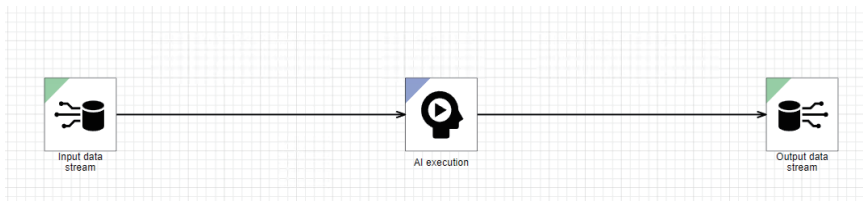
A task becomes read-only and cannot be edited in the following cases:

- The execution status of the task is "RUN," "BOOT," "READY," or "SHUTDOWN."
- The execution status of the task is "STOP," and "Read-only" is selected when displaying this screen.

Point

When creating a new task, the following extension blocks are displayed by default with connectors connected:

- Input data stream block
- AI execution block (An AI selected when creating a new task is set.)
- Output data stream block

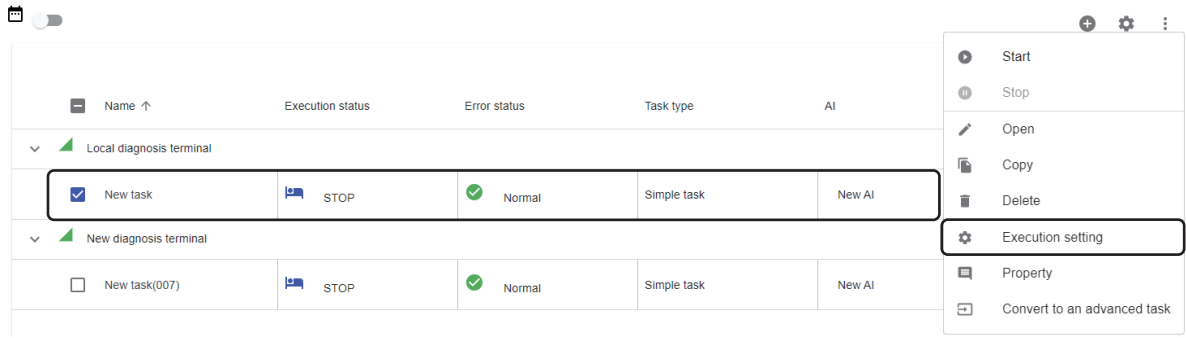


9.5 Execution Setting

This section shows the procedure to set a schedule of a task.

Operating procedure

1. Select a task in the task management screen. (☞ Page 207 Task Management Screen)
2. Click ⋮ (Menu), and select [Execution setting].



3. Set a schedule of a task in the execution setting screen.
☞ Page 224 Execution setting screen
4. Switching the display in the task management screen to a calendar and check the set schedule.
☞ Page 212 Calendar view

Execution setting screen

The following shows the screen for setting a schedule of a task.

In addition, whether to enable or disable a historical monitor*¹ can be set in the execution setting screen.

A task is executed based on the settings.

*¹ By enabling a historical monitor, a diagnosis result is saved, and it can be checked later. (Page 467 MONITOR)

Point

Adjust the diagnosis cycle according to the data collection speed of the production line, the performance of a diagnosis terminal, or the restrictions by another environment.

By setting the execution period, a diagnosis can be started or stopped automatically according to days of the week or time zone where a production line operates.

The available execution period is from 1900/1/1 00:00 to 2100/1/1 23:59.

Window

(1)

New Project > Task > New task > Execution setting

Historical monitor setting

Enable historical monitor ?

Saving folder path ?

Monitor data name prefix

Example of monitor data path

Cycle setting

Collection cycle
1000 ms

Diagnosis cycle
Synchronize with the collection cycle
1000 ms

Execution period setting

(2)

Execution period specification method
Date and time s...
Start date and time 2023/08/31 11:24 End date and time

(3)

Execution period specification method
Periodic
Start time 09:00 End time 17:00
Execution time 8 hour(s) 0 minute(s)
Pattern setting
Start date 2023/08/31 End date
Sun. Mon. Tue. Wed. Thu. Fri. Sat.



(4)

COMPLETE



Displayed items

Item		Description	
(1) Breadcrumb bar		<p>A breadcrumb bar is displayed.</p> <ul style="list-style-type: none"> • Current project name > Task > current task name > execution setting <p>By clicking a project name, the screen returns to the home screen. (☰ Page 76 Home screen)</p> <p>By clicking "Task," the screen returns to the task management screen. (☰ Page 207 Task Management Screen)</p>	
Historical monitor setting	Enable historical monitor	Turn this ON to enable a historical monitor.	
	Saving folder path ^{*1}	Set the absolute path (1 to 178 characters) of a folder to store a diagnosis result of a task (monitor data). ^{*2}	
	Monitor data name prefix	Set a prefix (1 to 32 characters) to specify monitor data. A file name is '(prefix of a monitor data name)_YYYYMMDDhhmmss.' YYYYMMDDhhmmss is the date and time information at the time of creating the monitor data.	
	Example of monitor data path	A path based on the setting for "Saving folder path" and "Monitor data name prefix" is displayed.	
Cycle setting	Collection cycle	Set a time interval (10 to 60000 milliseconds) to collect data with an input data stream.	
	Diagnosis cycle	<p>Set a time interval (10 to 60000 milliseconds) to repeat processing of a task from the diagnosis AI to the output data stream.</p> <p>To synchronize the diagnosis cycle with a collection cycle, turn ON "Synchronize with the collection cycle."</p> <p>■When synchronizing the diagnosis cycle with the collection cycle A diagnosis is performed after collection is completed. Therefore, data collected within a cycle is always diagnosed within the cycle. However, since collection and diagnosis are synchronized, processing may not be completed within a cycle when either takes time. In this case, collection and diagnosis take longer than their specified cycles.</p> <p>■When not synchronizing the diagnosis cycle with the collection cycle A diagnosis is performed without waiting for the collection to be completed. Therefore, collected data is not always diagnosed within the cycle and the number of units of output data varies. Undiagnosed data will be diagnosed in the next cycle. Diagnosing multiple units of data improves the processing performance for each unit of data. Therefore, more data can be diagnosed by setting the diagnosis cycle longer than the collection cycle and diagnosing data collected over multiple times together. (Throughput increases to process a lot of data.) However, sufficient buffer size is required because undiagnosed data is accumulated in the buffer.</p>	
Execution period setting	Execution period specification method		
	Set a period to repeat processing of a task. ^{*3}		
	<ul style="list-style-type: none"> • Always: Processing runs as soon as a task is started. • Date and time specification: Specify the date and time to start or end a task. Processing runs in the specified period. • Periodic: Specify the date and time to start or end the processing of a task as well as the pattern (start time, end time, and day of the week) to execute a task from the start date and time to the end date and time. Processing runs with the specified pattern.^{*4} 		
	(2) Date and time specification	Start date and time	Set a start date and time.
		End date and time	Turn this ON to set an end date and time.
	(3) Periodic	Start time	Set a start time.
		End time	Set an end time.
		Execution time	Set an execution time.
Pattern setting		Start date	Set a start date.
		End date	Turn this ON to set an end date.
(4) Day of the week	Turn ON a day of the week to execute a task.		
[Complete] button ^{*5}		<p>Click this to complete the setting.</p> <p>Once setting is completed, the task management screen is displayed. (☰ Page 207 Task Management Screen)</p>	

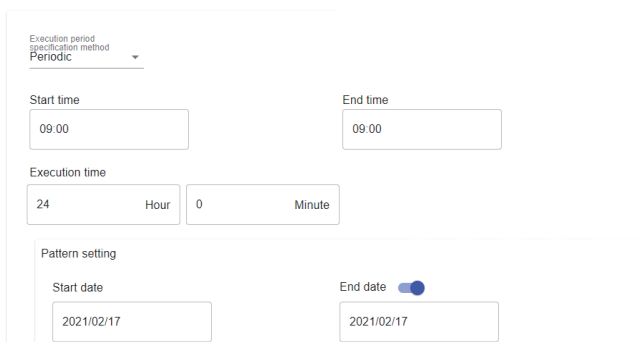
- *1 The file system supports NTFS only.
- *2 Specify a folder without data sources that is not specified in other tasks.
- *3 For the difference of the execution period among options, refer to the following:
 Page 226 Difference of the execution period
- *4 For details on the execution start and end conditions, refer to the following:
 Page 227 Execution start and end conditions
- *5 Displayed when a task is not read-only.

Precautions

A task becomes read-only and cannot be edited when its execution status is "RUN," "BOOT," "READY," or "SHUTDOWN."

Point

- A set schedule works based on the time setting on the operating system of a diagnosis terminal. (This also applies to the summer time.)
- To control the execution and stop of a task in detail, such as to stop a task when a factory line stops, input execution control data and diagnosis data together, then set the execution control data for a diagnosis execution condition to ensure that a diagnosis is not performed by the execution control data.
- For the execution period of "Periodic," when setting the start and end dates to the same date and the execution time to 24 hours, the processing of a task is started at the set time but ended 24 hours later (on the next day of the set date).
 (Example) In the following case, the actual execution period will be from 2021/2/17 09:00 to 2021/2/18 09:00.



Difference of the execution period

The execution period differs as follows depending on the specification method:

Specification method	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
Always	→						
Date and time specification	Start date and time		→			End date and time	
Periodic	→		→		→		
	Start time	End time					

Execution start and end conditions

The following table shows the execution start and end conditions for the execution period of "Periodic."

Item	Description	Remarks
Execution start condition	Execution is started when all the following conditions are satisfied: <ul style="list-style-type: none"> • It is between "Start date" and "End date." • It is on an execution day of the week. • It is "Start time." 	When the execution start condition is satisfied while a diagnosis terminal is stopped and the diagnosis terminal starts before the execution end condition is satisfied, execution is started from that point.
Execution end condition	Execution is ended when "Execution time" passes after the execution start.	The timing that "Execution time" passes after the execution start may be on the next day of "End date" or not be on an execution day of the week. In this case, the task execution continues until "Execution time" passes.

Ex.

"Start date": 2022/06/16 (Thu.), "End date": 2022/06/17 (Fri.)

Execution day of the week: Thu., Fri.

"Start time": 9:00, "End time": 8:59

"Execution time": 23 hours and 59 minutes

Execution period specification method: Periodic

Start time: 09:00 End time: 08:59

Execution time: 23 Hour 59 Minute

Pattern setting

Start date: 2022/06/16 End date: 2022/06/17

Day: Mon: Tue: Wed: Thu: Fri: Sat:

In the example above, the actual date and time that execution is started and ended is as follows:

Start date and time: 2022/06/16 (Thu.) 9:00

End date and time: 2022/06/18 (Sat.) 8:59 (23 hours and 59 minutes after 06/17 (Fri.) 9:00)

9.6 Starting and Stopping a Task

This section shows the procedures for starting and stopping a task.

Starting a task

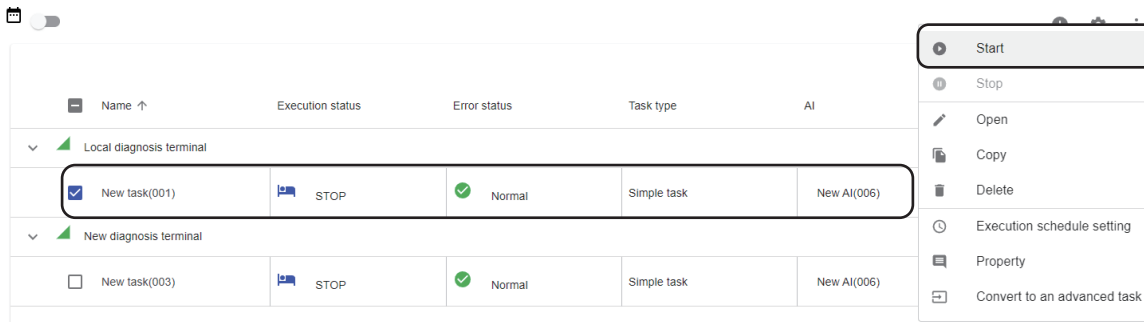
The following shows the procedure for starting a task.

Operating procedure

1. Select a task to be started in the task management screen. (☞ Page 207 Task Management Screen)
2. Click ⋮ (Menu), and select [Start].

The execution status of the task becomes "READY."

It will be "RUN" when the set execution period starts. (☞ Page 224 Execution setting screen)



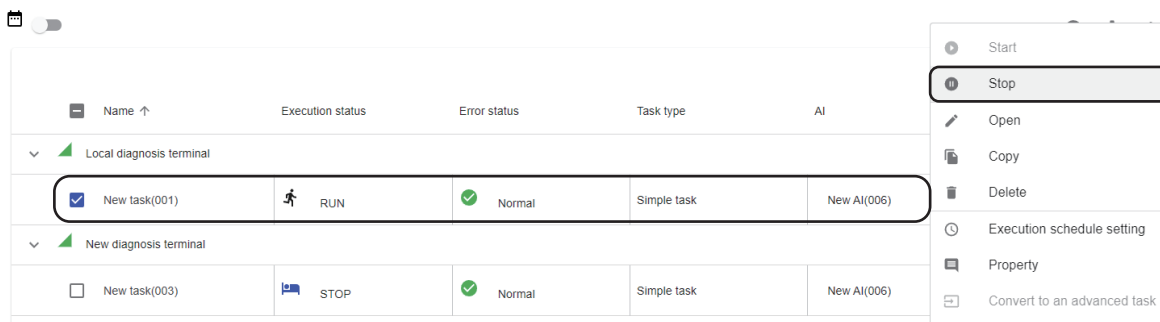
Stopping a task

The following shows the procedure for stopping a task.

Operating procedure

1. Select a task to be stopped in the task management screen. (☞ Page 207 Task Management Screen)
2. Click ⋮ (Menu), and select [Stop].

The execution status of the task becomes "STOP."



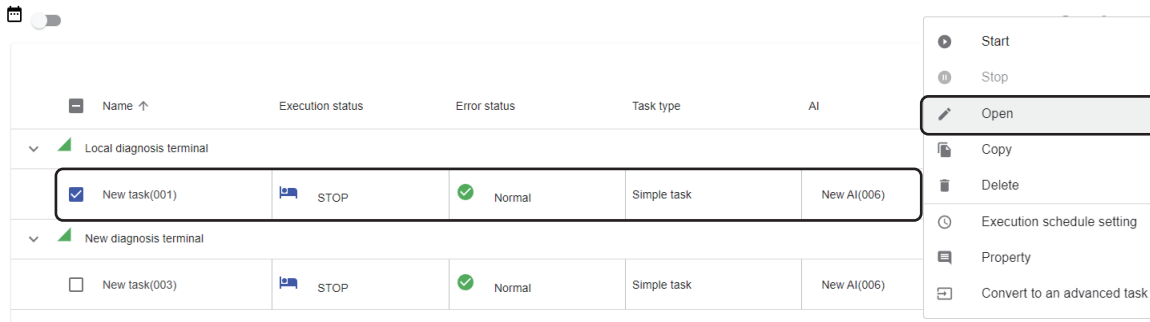
9.7 Editing a Task

This section shows the procedure for editing a created task.

Edit a task to change settings such as the input and output destinations of data or the AI to be used for a diagnosis.

Operating procedure

1. Select a created task in the task management screen. (☞ Page 207 Task Management Screen)
2. Click ☰ (Menu), and select [Open].



3. Perform either of the following operations depending on the task type:
 - For a simple task: Edit various settings in the simple task creation screen. (☞ Page 217 Simple task creation screen)
 - For an advanced task: Edit the process flow in the task editor screen. (☞ Page 221 Task editor screen)

Precautions

- A task on a diagnosis terminal is updated when editing is completed. Therefore, even if an AI set in the task is edited or deleted on the learning station, information on the AI set in the task on the diagnosis terminal is not updated until the task is edited.
- When the execution status of a task is "RUN," "BOOT," "READY," or "SHUTDOWN," the simple task creation screen or task editor screen is read-only and cannot be edited.

Therefore, it is not possible to edit a task in any of these state and apply new settings immediately.

In such case, perform the following procedure:

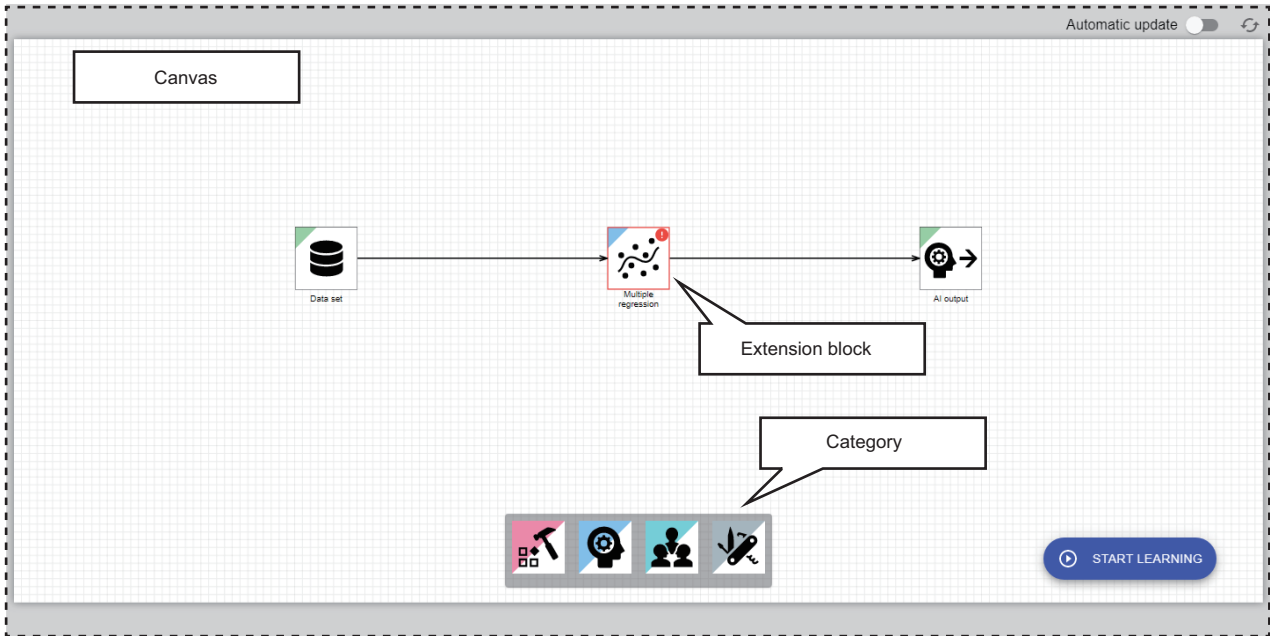
- ① Select a task to be edited and create a copy.
- ② Edit the copy task.
- ③ Stop the copy source task.
- ④ Start the copy task.

10 EXTENSION BLOCK SETTINGS

This chapter shows the types and setting examples of extension blocks.

Extension blocks are used to define the data processing method on the canvas in the AI editor screen and task editor screen.

New project > AI > New AI



Property settings

Properties for an extension block can be set in the setting screen.

The setting screen appears by double-clicking an extension block or selecting [Open] from the right-click menu.

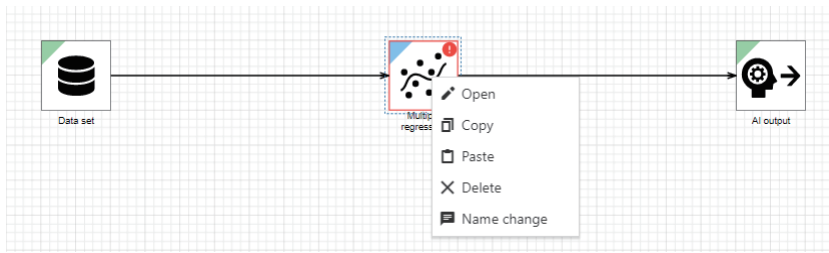
For details on the setting screen, refer to the description for each extension block.

Precautions

- Settings cannot be edited when an AI or task is read-only. (The setting screen for each extension block is displayed with the [OK] button disabled.)
- Properties set with integers or floating point numbers are handled as double precision floating point numbers. Therefore, a value cannot be processed properly if it exceeds the range of double precision floating point numbers or it is close to the boundary value of a upper or lower limit.
(Example) When setting a value smaller than '4.9406564584124654E-324,' it is recognized as '0'; therefore, an error cannot be detected properly.
(Example) A graph is not drawn properly.

Right-click menus

Operations such as copy can be performed for an extension block from the right-click menu.



Item	Description
[🔧 Open] ^{*1}	To open properties for an extension block.
[📄 Copy] ^{*1}	To copy a selected extension block.
[📄 Paste] ^{*1}	To paste a copied extension block.
[✕ Delete] ^{*1}	To delete a selected extension block.
[🗨 Name change] ^{*1}	To change the name of a selected extension block (up to 32 characters).
[📊 Display preview] ^{*1}	To display the preview screen for a selected extension block in another tab. (📄 Page 112 Preview screen)
[📊 Display AI preview] ^{*1}	To display the AI preview screen for a selected extension block in another tab. (📄 Page 191 AI preview screen)

*1 Only an icon is displayed for a touch screen personal computer.

Right-click menu display list

Menus displayed in the right-click menu differ depending on the category.

○: Displayed, ×: Not displayed

Category		Right-click menu						
		🔧 Open	📄 Copy	📄 Paste	✕ Delete	🗨 Name change	📊 Display preview	📊 Display AI preview
Data set		○ ^{*1}	×	○ ^{*3}	×	○ ^{*5}	○ ^{*6}	×
Preprocessing	Blocks that output a multi-data frame (section generation block and sub-section forming block)	○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	×	×
	Others	○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	○ ^{*6}	×
Analysis method	MT method block	×	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	×	○ ^{*7}
	Others	○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	×	○ ^{*7}
Ensemble learning		○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	×	○ ^{*7}
AI output		×	×	○ ^{*3}	×	○ ^{*5}	×	×
Data stream	Input data stream block	○ ^{*1}	×	○ ^{*3}	×	○ ^{*5}	×	×
	Output data stream block	○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	×	×
Diagnosis execution		○ ^{*1}	×	○ ^{*3}	×	○ ^{*5}	×	×
Diagnosis		○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	×	×
Utility		○ ^{*1}	○ ^{*2}	○ ^{*3}	○ ^{*4}	○ ^{*5}	○ ^{*6}	×

- *1 Displayed when selecting only one extension block.
- *2 Displayed when selecting only extension blocks that can be added.
Extension blocks that cannot be added are as follows:
 - Data set block
 - AI output block
 - Input data stream block
 - AI execution block
- *3 Displayed when an AI or task is not read-only.
- *4 Displayed when both of the following conditions are satisfied:
 - An AI or task is not read-only.
 - Only extension block that can be deleted are selected.Extension blocks that cannot be deleted are as follows:
 - Data set block
 - AI output block
 - Input data stream block
 - AI execution block
- *5 Displayed when both of the following conditions are satisfied:
 - An AI or task is not read-only.
 - Only one extension block is selected.
- *6 Displayed only when all the following conditions are satisfied:
 - The AI editor screen is opened.
 - Only one extension block is selected.
 - No errors have occurred in a selected extension block.
- *7 Displayed when both of the following conditions are satisfied:
 - An AI is in the "Learned" or "Complete" state.
 - Only one extension block is selected.

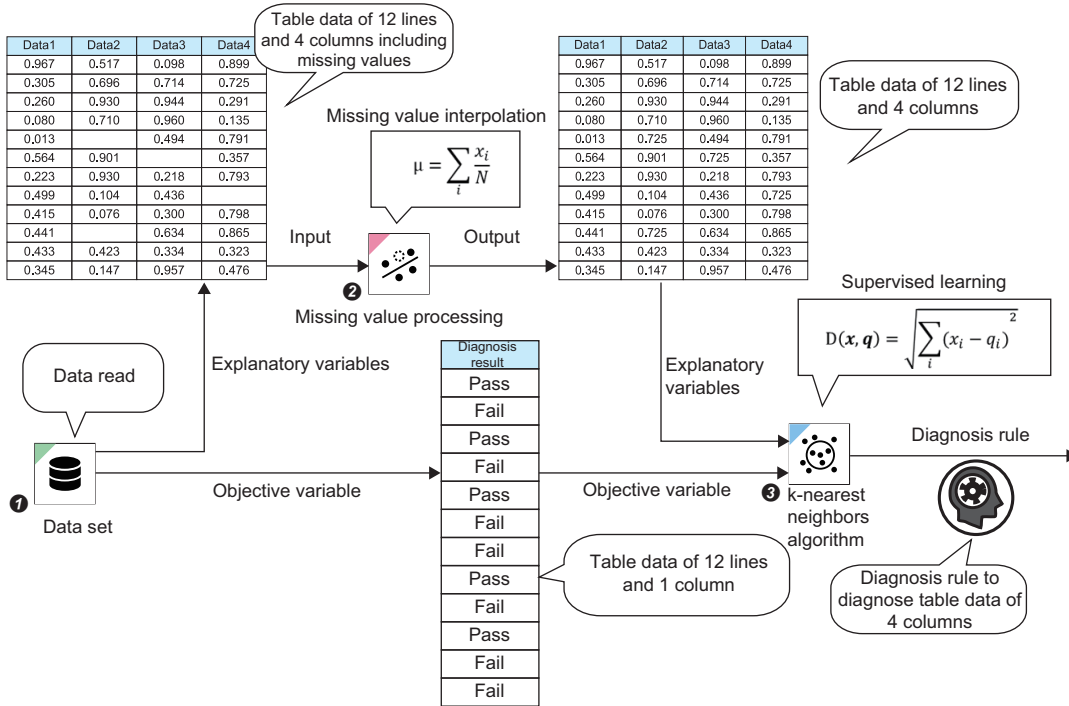
Setting example




Each extension block has a specific data processing method defined, such as data reading, preprocessing, and analysis method.

Various data processing can be performed by combining multiple extension blocks.

Ex.

Process flow for supervised learning


















Extension block	Description
1 Data set 	Data is read from a data set, then explanatory variables and objective variable are output. The explanatory variables and objective variable are in the table format.
2 Missing value processing 	Missing value processing is performed for the table format data that is input from a data set, then a processing result is output. Output data is in the table format.
3 k-nearest neighbors algorithm 	Supervised learning is performed with the analysis method of k-nearest neighbors algorithm by using table format data, explanatory variables, and objective variable, then a diagnosis rule is output.





















10.1 Extension Block List






The following table lists the extension blocks.

○: Available, ×: Not available

Category	Extension block	Editor screen		Feature and purpose	Reference
		AI	Task		
Data set	Data set 	○*1	×	This block outputs data of a created data set. An AI can be created by using the output data with blocks of the preprocessing category and analysis method category.	Page 238 Data set block

Category	Extension block	Editor screen		Feature and purpose	Reference
		AI	Task		
Preprocessing 	Missing value processing 	<input type="radio"/>	×	This block interpolates a missing value in data frame type data. Interpolating a missing value of each variable by an appropriate method can reduce the gap with data that has no missing values.	Page 242 Missing value processing block
	Outlier processing 	<input type="radio"/>	×	This block replaces an outlier in a data frame. Replacing an outlier of each variable by an appropriate method can prevent the outlier from reducing the accuracy of a diagnosis rule.	Page 247 Outlier processing block
	Scaling 	<input type="radio"/>	×	This block converts the value range for numerical value type variables into the format in which the values can be handled easily in a diagnosis. A value range is aligned by processing such as standardization, normalization, and logarithmic transformation.	Page 253 Scaling block
	Numerical value operation 	<input type="radio"/>	×	This block calculates the sum, difference, product, and quotient of two numerical value type variables, and adds the results as new variables. Variables that contribute to the improvement of accuracy can be created and added.	Page 257 Numerical value operation block
	Dimensionality compression 	<input type="radio"/>	×	This block converts variables in a data frame into fewer new variables without damaging their information as much as possible. Redundant information can be reduced.	Page 261 Dimensionality compression block
	Section generation 	<input type="radio"/>	×	This block cuts out waveform data into multiple sections by setting conditions. Note that high accuracy cannot be acquired when handling waveform data in analysis methods other than ones dedicated to waveforms; however, by dividing waveform data into sections such as in periodic units and calculating a feature for each section, the waveform data can be converted into a format where it can be handled in those methods.	Page 264 Section generation block
	Section feature generation 	<input type="radio"/>	×	This block generates a feature from multiple units of extracted waveform data.	Page 279 Section feature generation block
	Sub-section forming 	<input type="radio"/>	×	This block divides each section of waveform data divided by the section generation under further conditions.	Page 286 Sub-section forming block
	Date and time encoding 	<input type="radio"/>	×	This block extracts information such as date and time from a time stamp, and adds the information as new features. Information can be added according to time conditions.	Page 299 Date and time encoding block
	Category encoding 	<input type="radio"/>	×	This block converts a category type variable into a numerical value type variable.	Page 304 Category encoding block
	Add category statistic 	<input type="radio"/>	×	This block combines a category type variable and numerical value type variable, and creates a new feature. A feature of each category can be added as new information.	Page 311 Add category statistic block
	Variable deletion 	<input type="radio"/>	×	This block deletes unnecessary variables. Variables unnecessary for learning or ones with negative effects can be deleted.	Page 316 Variable deletion block
	Digital filter 	<input type="radio"/>	×	This block extracts or removes the frequency components other than the data to be focused on, and creates highly accurate data.	Page 320 Digital filter block
FFT 	<input type="radio"/>	×	This block calculates a spectrum (magnitude of frequency components).	Page 327 FFT block	

Category	Extension block	Editor screen		Feature and purpose	Reference
		AI	Task		
Analysis method (Supervised learning) 	Multiple regression 	○	×	This block assumes linearity between an explanatory variable and objective variable. It is suitable for when calculation resources in a diagnosis environment are limited.	Page 339 Multiple regression block
	k-nearest neighbors algorithm 	○	×	This block makes an inference from a neighbor point. It is suitable for when learning data is small.	Page 341 k-nearest neighbors algorithm block
	Random forest 	○	×	This block executes a lot of decision trees in parallel and makes an inference by integrating the execution results. It is suitable for fast learning because parallelization is easy and the number of hyperparameters is small.	Page 343 Random forest block
	Gradient boosting decision tree 	○	×	This block uses the gradient boosting decision tree. It is suitable for when a user does not have domain knowledge.	Page 344 Gradient boosting decision tree block
	Deep learning 	○	×	This block automatically designs and learns a light neural network. It is suitable for operation in the edge computing area.	Page 345 Deep learning block
Analysis method (Unsupervised learning) 	MT method 	○	×	This block calculates an error level by using the Mahalanobis-Taguchi method. An error can be detected at high speed and with high accuracy when data is normally distributed.	Page 346 MT method block
	Autoencoder 	○	×	This block calculates an error level by using the reconstruction error of an autoencoder. An error can be detected with high accuracy for data of various distribution types.	Page 347 Autoencoder block
	Guard band 	○	×	This block judges an error by using a guard band. It is suitable for periodic time-series data.	Page 349 Guard band block
	Similar waveform recognition 	○	×	This block judges a failure based on the similarity to normal pattern waveform data. Characteristics of a waveform of which the cycle is not constant or a waveform in which multiple patterns are switched can be learned. In addition, the normality of a diagnosis target waveform can be judged by calculating the similarity between the target waveform and learned waveform.	Page 354 Similar waveform recognition block
Ensemble learning 	Ensemble learning 	○	×	This block performs ensemble learning by combining multiple analysis methods. High inference accuracy may be acquired even when accuracy is low in each learning method. The learning and inference speed is low because all the target learning methods are performed.	Page 363 Ensemble learning block
AI output 	AI output 	○ ^{*1}	×	This block determines the output of the process flow of an AI. This block itself has no functions; by connecting this block, a flow from a data set block to this block is output as an AI when this block is executed.	Page 367 AI output block
Data stream 	Input data stream 	×	○ ^{*1}	This block can collect data to be used for a diagnosis by various methods. One collection method can be set with one block.	Page 368 Input data stream block
	Output data stream 	×	○	This block can output data externally by various methods. A block can be placed for each output method. One output method can be set with one block.	Page 410 Output data stream block
Diagnosis execution 	AI execution 	×	○ ^{*1}	This block can perform a diagnosis by using an AI in the "Complete" state. Up to 64 AIs can be used. Execution conditions can be set for each AI. Use this block to operate an AI that completes learning.	Page 442 AI execution block

Category	Extension block	Editor screen		Feature and purpose	Reference
		AI	Task		
Diagnosis 	Comparison judgment 	×	○	This block sets a variable to be judged and a comparison condition, and outputs a comparison judgment result. Multiple conditions can be set. The judgment results for all settings are integrated into input data, then output. A condition can be set not only for the numerical value type but also for the category type. Use this block to detect an error value by monitoring a variable and outputting its judgment result.	Page 450 Comparison judgment block
	SPC judgment 	×	○	This block sets a variable to be judged and an SPC rule, and outputs a judgment result. Multiple SPC rules can be set. The output of this block outputs the judgment results integrated into input data. Use this block to detect an error value by monitoring a variable and outputting its judgment result.	Page 455 SPC judgment block
Utility 	Python 	○	○	This block performs processing described in Python. Various usage is available by changing the input/output or description in Python. Use this block to perform processing that cannot be implemented by other blocks.	Page 463 Python block

*1 Placed on the canvas by default and not displayed in the dock.
 This block cannot be added or deleted.

10.2 Data Set Category

An extension block of the data set category outputs data of a created data set.

This block is available in the AI editor screen.

For operations that can be performed by right-clicking a block, refer to the following:

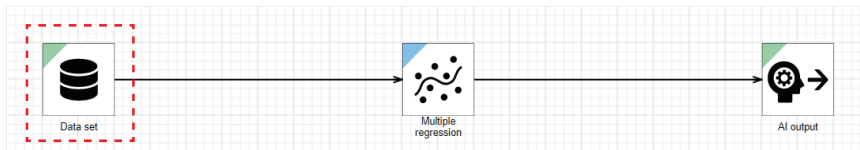
 Page 231 Right-click menus

Data set block

A data set block outputs data of a created data set in the data frame format.

Among output data, a diagnosis target variable for supervised learning can be set.

A variable set as a diagnosis target is referred to as an objective variable, the other variables are referred to as explanatory variables.



Input/output specifications

■Output

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none">• Number of records: Number of records in a data set• Number of variables: Number of variables in a data set• Type of each variable: Any types

Data set screen

The following shows the screen for selecting a data set to be used for learning or a variable to be output as a diagnosis target.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

The screenshot shows the 'Data set' dialog box. At the top, there is a 'Data set name' dropdown menu set to 'New data set' with a preview icon. Below this is the 'Learning type' section with two radio buttons: 'Supervised learning' (which is selected) and 'Unsupervised learning'. Underneath is the 'Diagnosis target' section, which contains a table with two columns: 'Variable name' and 'Variable type'. The table lists three variables: 'TIME' (Timestamp), 'INDEX' (Number), and 'DO' (Number). Each variable has a checkbox to its left. At the bottom right of the dialog are 'OK' and 'CANCEL' buttons.

This screenshot is identical to the previous one, but the 'Unsupervised learning' radio button is selected instead of 'Supervised learning'. The 'OK' button is now highlighted in blue.

Displayed items

Item	Description
Data set name	Select a data set. A data set in the "Completed" state can be selected.
(Preview)	Click this to display the preview screen for a selected data set in another tab. (Page 112 Preview screen)
Learning type	Supervised learning Unsupervised learning
Diagnosis target*1	Variables in a selected data set are listed. Select the checkbox of a variable to be output as a diagnosis target. (Only one selection is available among numerical value and category type variables.)
	(Expand)/ – (Collapse)
	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
	Variable name
	Variable type
	A variable name is displayed.
	A variable type is displayed. (Page 85 Variable types)

*1 Displayed only when selecting "Supervised learning" for "Learning type."

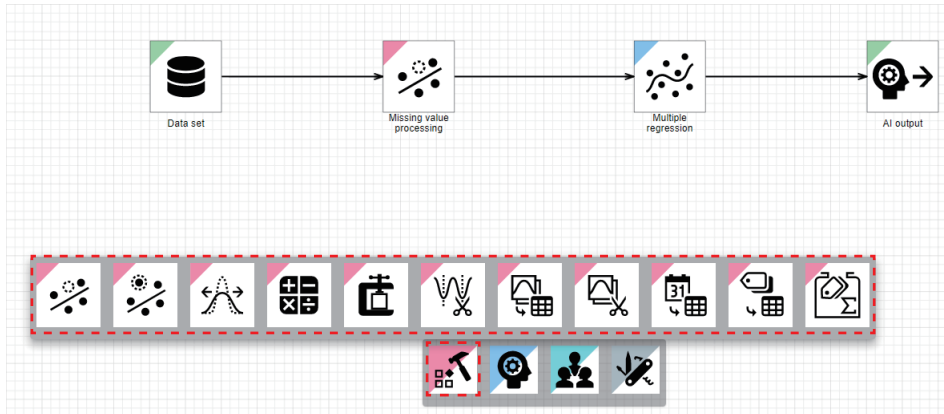
10.3 Preprocessing Category

Extension blocks of the preprocessing category perform preprocessing, such as missing value processing or outlier value processing, for data frame type data.

These blocks are available in the AI editor screen.

For operations that can be performed by right-clicking a block, refer to the following:




☞ Page 231 Right-click menus



Handling methods for waveform data

The following shows two methods for handling waveform data in this product.

To handle waveform data by converting it into the table data format, use the following blocks:

-  Page 264 Section generation block
-  Page 279 Section feature generation block
-  Page 286 Sub-section forming block

■Method for learning or diagnosing the shape of continuous waveform data as it is

A block that analyzes the shape of a waveform learns the shape from continuous waveform data, and judges data based on the similarity to the learned shape.

Input waveform data can be input and handled as it is as follows:

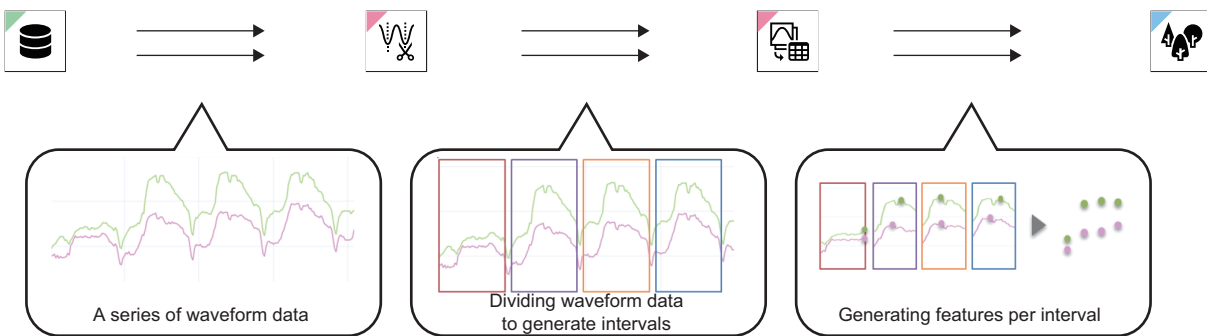
Inputting waveform data as it is



■Method for learning or diagnosing data after converting waveform data into table data

A block that processes table data cannot handle waveform data as it is.

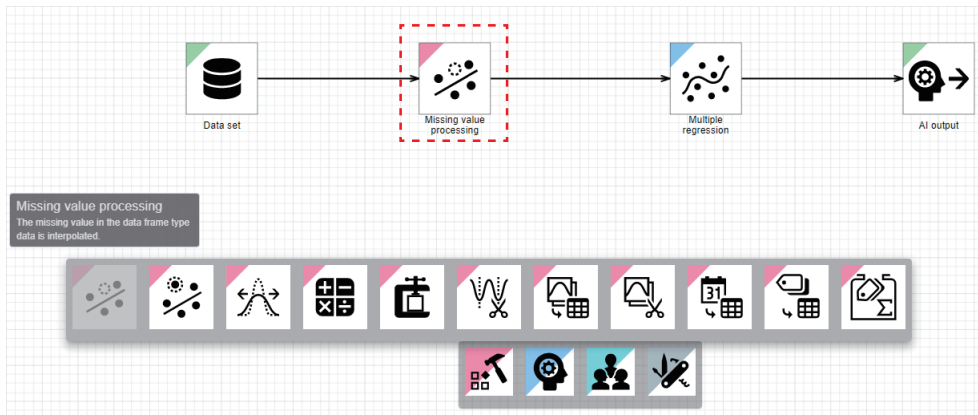
Therefore, learning or diagnosis is performed by dividing waveform data into sections, converting each section of waveform data into features, then into the table data format.



Missing value processing block

A missing value processing block interpolates a missing value in data frame type data.

Use this block to make a more accurate model by processing a missing value in an appropriate method mainly by using the output of a data set block as the input of this block.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output


Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of input variables Type of each variable: Same as the input variable type 	

Operational specifications

Missing value processing is performed for each variable according to a selected processing method.

Ex.

Missing value processing (interpolating a missing value by an average value)

Input		Output
Variable		Variable
10	 Interpolating a missing value by the average value	10
11		11
9		9
8		8
Missing value		10
12		12

A missing value may not be processed depending on the processing method.

For example, when "Interpolate by previous value" is selected but the first record was missing, the first record cannot be interpolated since its previous value does not exist. In such case, a missing value that cannot be processed remains as it is, or an error occurs.

■ Missing value processing methods

The following table shows the processing of each method.

Missing value processing method	Processing		Condition and operation when a missing value cannot be processed
	When learning	When diagnosing	
Interpolate by average value ^{*1}	The average value of a variable is calculated, and a missing value is interpolated by the average value. A missing value is not included when calculating an average value.	Same as when learning	An error occurs if a variable has only missing values learning.
Interpolate by median ^{*1}	The median of a variable is calculated, and a missing value is interpolated by the median. A missing value is not included when calculating a median.	A missing value is interpolated by the median obtained when learning.	An error occurs if a variable has only missing values learning.
Interpolate by mode ^{*2}	The mode of a variable is calculated, and a missing value is interpolated by the mode. A missing value is not included when calculating a mode. If multiple modes exist, the one that has the smallest value when comparing the Unicode code points one by one from the first character is used to interpolate a missing value.	A missing value is interpolated by the mode obtained when learning.	An error occurs if a variable has only missing values learning.
Interpolate by previous value	A missing value is interpolated by the same value as the previous value of the same variable. If the previous value is also missing, a value that is not missing is searched for in the further previous values, and the one that is found the first is used to interpolate a missing value. If the first value of a variable is missing, it remains even after the processing.	A missing value is interpolated by the same value as the previous value of the same variable. When a diagnosis is already performed at least once, one of the records output in the previous diagnosis is recorded, and interpolation is performed with the last value added at the top.	A missing value remains if all the values before the missing value are also missing.

Missing value processing method	Processing		Condition and operation when a missing value cannot be processed
	When learning	When diagnosing	
Interpolate by median of previous and next values (Linear interpolation) ^{*1}	<p>A missing value is interpolated by the median of the previous and next values of the same variable.</p> <p>When missing values continue, they are interpolated so that their value intervals become equal. (Example: For the values '1.0, missing value, missing value, missing value, 5.0,' they are interpolated to '1.0, 2.0, 3.0, 4.0, 5.0.')</p> <p>If the first or last value of a variable is missing, it remains.</p> <p>If only two or less records are input, a missing value is not interpolated.</p>	<p>A missing value is interpolated by the median of the previous and next values of the same variable.</p> <p>When missing values continue, they are interpolated so that their value intervals become equal.</p> <p>When a diagnosis is already performed, the newest record among the ones output in the previous diagnosis is recorded, and interpolation is performed with the last value added at the top.</p>	<ul style="list-style-type: none"> A missing value remains if all the values before or after the missing value are also missing.
Interpolate by specified value ^{*2}	A missing value is interpolated by a value specified by a user.	Same as when learning	None

*1 Can be set only for a numerical value type variable.

*2 Can be set only for a numerical value or category type variable.

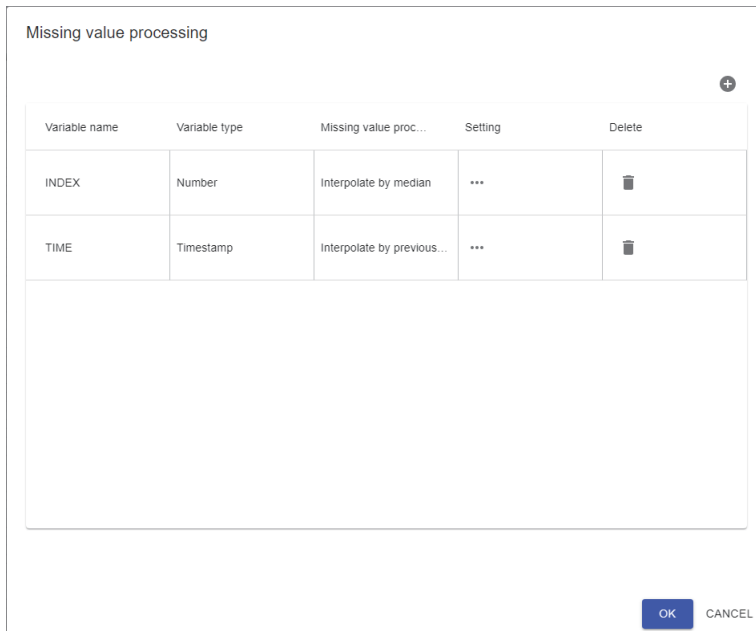
Missing value processing screen

The following shows the screen for displaying the list of added methods for processing a missing value.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



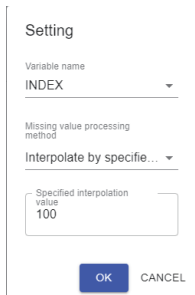
Displayed items

Item	Description
(Add)	Click this to add a missing value processing method. (Page 246 Settings)
Variable name	The name of a variable is displayed.
Variable type	The type of a variable is displayed. (Page 85 Variable types)
Missing value processing method	A missing value processing method is displayed. (Page 243 Missing value processing methods)
Setting	Click the icon displayed in this column to change settings for missing value processing. (Page 246 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for adding a missing value processing method.

Window



Displayed items

Item	Description
Variable name	Select a target variable of missing value processing. A variable can be selected from all the variables in the input data frame except for objective variables.*1
Missing value processing method	Select a missing value processing method. (📖 Page 243 Missing value processing methods)
Specified interpolation value*2	Specify a value to interpolate. The available value range and number of characters are as follows: <ul style="list-style-type: none">• Numerical value type variable: -1.79769313486231e+308 to 1.79769313486231e+308• Category type variable: up to 255 characters

*1 Variables that do not include a missing value are also displayed.

*2 Displayed when selecting "Interpolate by specified value" for "Missing value processing method."

Point

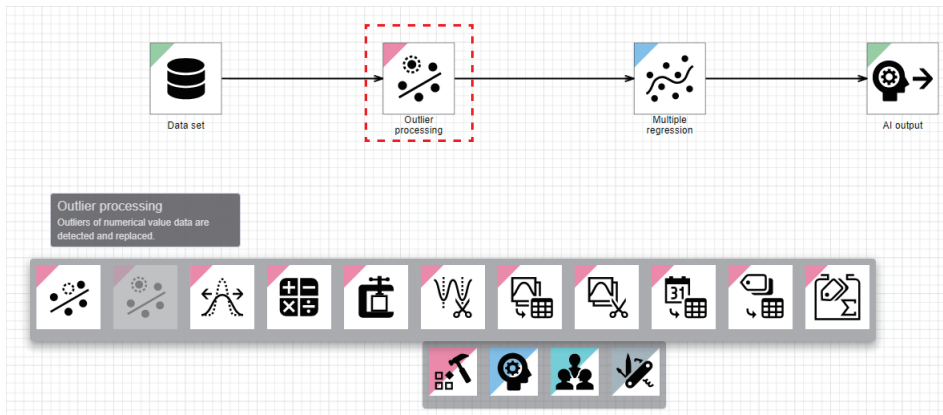
When selecting and setting a variable in which a missing value processing method has already been set, the old setting will be deleted when adding a new setting.

📖 Page 245 Missing value processing screen

Outlier processing block

An outlier processing block detects an outlier of numerical value data, and replaces the outlier.

Use this block to make a more accurate diagnosis rule by processing an outlier mainly by using the output of a data set block as the input of this block.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of input variables Type of each variable: Same as the input variable type 	

Operational specifications

An outlier is detected for each numerical value type variable, and processing is performed for the detected outlier.

Ex.

Outlier processing (when replacing an outlier by a median)

Input		Output
Variable		Variable
10		10
11		11
9		9
8		8
1000	→ Replacing the record of an outlier by the median	9
12		12
7		7
6		6
5		5

The following shows the flow:

1. Calculating boundary values

Based on the set outlier detection method, multiplying factor, and boundary values, boundary values are calculated by using variable values obtained when learning.

When boundary values cannot be calculated, an outlier is not detected or processed.

☞ Page 249 Calculation methods for boundary values

2. Detecting an outlier

An outlier of the variable is detected based on the boundary values calculated in step 1 and the set outlier detection target.

☞ Page 249 Outlier detection targets

3. Processing the outlier

Processing is performed based on the set outlier processing method.

The outlier may not be processed depending on the processing method.

For example, when "Replace by previous value" is selected but the first record has an outlier or missing value, the first record cannot be replaced since its previous value does not exist. In such case, an outlier that cannot be processed remains as it is.

However, an error occurs if a variable has missing values only.

☞ Page 249 Outlier processing method

■ Calculation methods for boundary values

Detection method for an outlier	Calculation method for boundary values	Case where boundary values cannot be calculated
Values that are away from the average value by more than the value obtained by multiplying the standard deviation by the specified number	<ul style="list-style-type: none"> Upper side boundary value = average value of a variable + standard deviation of the variable × multiplying factor Lower side boundary value = average value of a variable - standard deviation of the variable × multiplying factor 	A variable has missing values only.
Values that are away from the median by more than the value obtained by multiplying the quartile range by the specified number	<ul style="list-style-type: none"> Upper side boundary value = median of a variable + quartile range × multiplying factor Lower side boundary value = median of a variable - quartile range × multiplying factor 	A variable has missing values only.
Values outside the specified range	<ul style="list-style-type: none"> Upper side boundary value = value that is input as the upper side boundary value by a user Lower side boundary value = value that is input as the lower side boundary value by a user 	None

■ Outlier detection targets

Outlier detection target	Target outlier
Both sides	Value larger than an upper boundary value or smaller than a lower side boundary value
Upper side	Value larger than an upper side boundary value
Lower side	Value smaller than a lower side boundary value

■ Outlier processing method

Outlier processing method	Processing		Case where an outlier cannot be processed
	When learning	When diagnosing	
Replace by average value	The average value of a variable is calculated, and an outlier is replaced by the average value. A missing value and outlier are not included when calculating an average value.	An outlier is replaced by the average value obtained when learning.	A variable has only missing values or outliers when learning.
Replace by mode	The mode of a variable is calculated, and an outlier is replaced by the mode. A missing value and outlier are not included when calculating a mode. If multiple modes exist, the one that has the smallest value when comparing the Unicode code points one by one from the first character is used to replace an outlier.	An outlier is replaced by the mode obtained when learning.	A variable has only missing values or outliers when learning.
Replace by median	The median of a variable is calculated, and a missing value is replaced by the median. A missing value and outlier are not included when calculating a median.	A missing value is replaced by the median obtained when learning.	A variable only has missing values when learning.
Replace by previous value	An outlier is replaced by the same value as the previous value of the same variable. When the previous value is also a missing value or outlier, a value that is not a missing value or outlier is searched for in the further previous values, and the one that is found the first is used to replace an outlier. If the first value of a variable is an outlier, it is not processed. When there is a missing value, it is included when calculating a specified replacement value. However, the missing value is not interpolated. For example, when replacing a variable by the values '1, missing value, outlier, outlier, 5,' the values will be '1, missing value, 1, 1, 5.'	An outlier is replaced by the same value as the previous value of the same variable. When a diagnosis is already performed at least once, one of the records output in the previous diagnosis is recorded, and replacement is performed with the last value added at the top.	All values before an outlier are outliers or missing values.

Outlier processing method	Processing		Case where an outlier cannot be processed
	When learning	When diagnosing	
Replace by median of previous and next values	<p>An outlier is replaced by the median of the previous and next values of the same variable.</p> <p>When the previous and next values are a missing value or outlier, missing values are ignored and outliers are interpolated so that their value intervals become equal. (Example: For the values '1.0, missing value, outlier, outlier, 4.0,' they are interpolated to '1.0, missing value, 2.0, 3.0, 4.0'.)</p> <p>If the first or last value of a variable is an outlier or missing value, an outlier remains.</p> <p>When there is a missing value, it is included when calculating a specified replacement value. However, the missing value is not interpolated.</p> <p>For example, when replacing a variable by the values '1, missing value, outlier, outlier, 5,' the values will be '1, missing value, 1, 1, 5.'</p>	<p>Same as when learning</p> <p>When a diagnosis is already performed at least once, one of the records output in the previous diagnosis is recorded, and replacement is performed with the last value added at the top.</p>	All values before or after an outlier are outliers or missing values.
Replace by specified value	A missing value is replaced by a value specified by a user.	Same as when learning	None

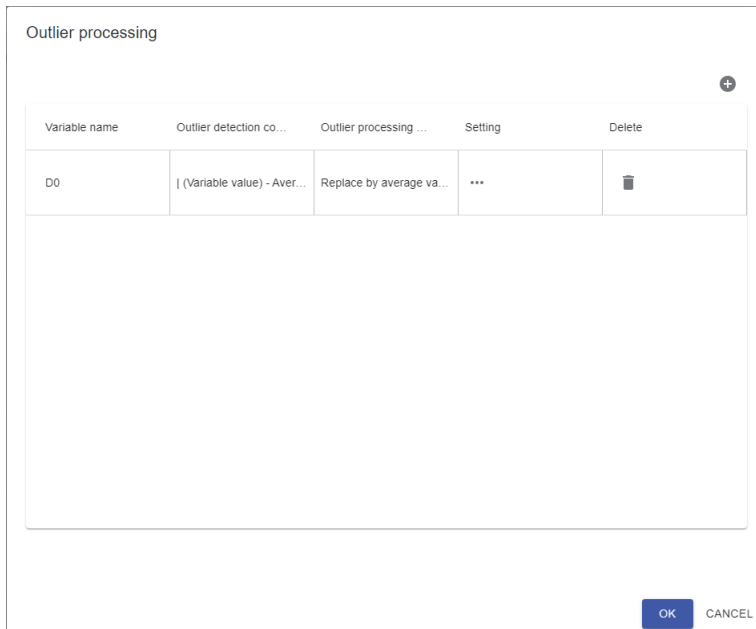
Outlier processing screen

The following shows the screen for displaying the list of added methods for processing an outlier.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
+ (Add)	Click this to add an outlier processing method. (Page 252 Settings)
Variable name	The name of a variable is displayed.
Outlier detection condition	An outlier detection condition is displayed. (Page 251 Outlier detection conditions)
Outlier processing method	An outlier processing method is displayed. (Page 249 Outlier processing method)
Setting	Click the icon displayed in this column to change settings for outlier processing. (Page 252 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Outlier detection conditions

Conditions to detect an outlier differ depending on the set outlier detection method and target.

Outlier detection method	Outlier detection target	Outlier detection condition
Values that are away from the average value by more than the value obtained by multiplying the standard deviation by the specified number	Both sides	$ (Value\ of\ a\ variable) - average\ value > standard\ deviation \times multiplying\ factor$
	Upper side	$(Value\ of\ a\ variable) - average\ value > standard\ deviation \times multiplying\ factor$
	Lower side	$(Value\ of\ a\ variable) - average\ value < standard\ deviation \times multiplying\ factor$
Values that are away from the median by more than the value obtained by multiplying the quartile range by the specified number	Both sides	$ (Value\ of\ a\ variable) - average\ value > quartile\ range \times multiplying\ factor$
	Upper side	$(Value\ of\ a\ variable) - average\ value > quartile\ range \times multiplying\ factor$
	Lower side	$(Value\ of\ a\ variable) - average\ value < quartile\ range \times multiplying\ factor$
Values outside the specified range	Both sides	$(Value\ of\ a\ variable) > upper\ side\ boundary\ value, or (value\ of\ a\ variable) < lower\ side\ boundary\ value$
	Upper side	$(Value\ of\ a\ variable) > upper\ side\ boundary\ value$
	Lower side	$(Value\ of\ a\ variable) < lower\ side\ boundary\ value$

■ Settings

The following shows the screen for adding an outlier processing method.

Window

Displayed items

Item	Description
Variable name	Select a target variable of outlier processing. A variable can be selected from the numerical value type variables in the input data frame except for objective variables.
Outlier processing target	Select an outlier detection target. (Page 249 Outlier detection targets)
Outlier detection method	Select an outlier detection method. (Page 249 Calculation methods for boundary values)
Multiplying factor ^{*1}	Set a multiplying factor used for the outlier detection method (0 to 1.79769313486231e+308). (Page 249 Calculation methods for boundary values)
Upper side boundary value ^{*2}	Set an upper side boundary value (-1.79769313486231e+308 to 1.79769313486231e+308). (Page 249 Calculation methods for boundary values)
Lower side boundary value ^{*3}	Set a lower side boundary value (-1.79769313486231e+308 to 1.79769313486231e+308). (Page 249 Calculation methods for boundary values)
Outlier processing method	Select a processing method for an outlier. (Page 249 Outlier processing method)
Specified replacement value ^{*4}	Specify a value to be replaced (-1.79769313486231e+308 to 1.79769313486231e+308).

*1 Displayed when selecting "Values that are away from the average value by more than the value obtained by multiplying the standard deviation by the specified number" or "Values that are away from the median by more than the value obtained by multiplying the quartile range by the specified number" for "Outlier detection method."

*2 Displayed when selecting "Values outside the specified range" for "Outlier detection method" and also "Both sides" or "Upper side" for "Outlier processing target."

*3 Displayed when selecting "Values outside the specified range" for "Outlier detection method" and also "Both sides" or "Lower side" for "Outlier processing target."

*4 Displayed when selecting "Replace by specified value" for "Outlier processing method."

Point

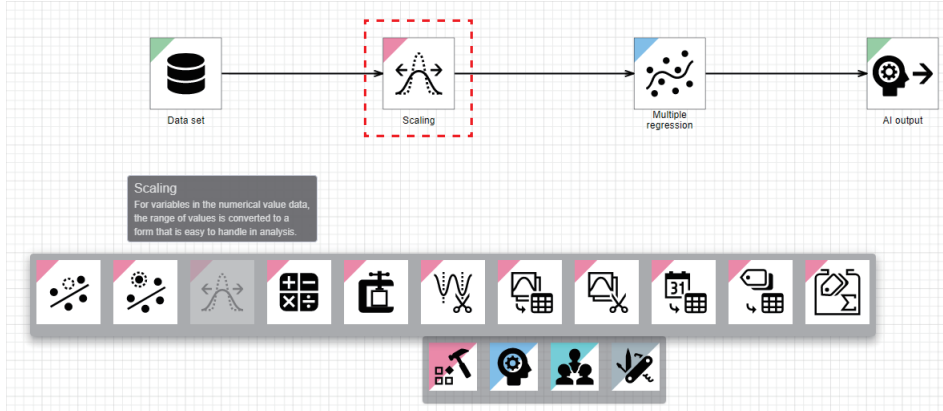
When selecting and setting a variable in which an outlier processing method has already been set, the old setting will be deleted when adding a new setting.

[Page 251 Outlier processing screen](#)

Scaling block

A scaling block converts values of a numerical value type variable.

This block converts a numerical value type variable into a format where the values can be handled easily in an analysis (for example, aligning a value range). Use this block to make a more accurate diagnosis rule with a block of the analysis method category.



Scaling
For variables in the numerical value data, the range of values is converted to a form that is easy to handle in analysis.

Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

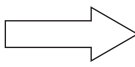
Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of input variables Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of input variables Type of each variable: Same as the input variable type

Operational specifications

A numerical value type variable is converted by a specified processing method, and values of the variable are changed to the ones after conversion.

Ex.

Scaling (for standardization)

Input		Output
Variable		Variable
1	 Standardizing values	-1.460593
2		-1.095445
3		-0.7302967
4		-0.3651484
5		0
6		0.3651484
7		0.7302967
8		1.095445
9		1.460593

■ Processing methods

A missing value is not converted in all the processing methods. (A missing value is not included in calculation.)

Processing method	Processing	
	When learning	When diagnosing
Standardization	A variable is standardized; it is converted so that the average of all elements becomes '0,' and the standard deviation becomes '1.' When the standard deviation of a variable becomes '0' (all values in the variable are the same), the values are all converted into '0.'	Values are standardized by using the average value and standard deviation obtained when learning. When the standard deviation obtained when learning is '0,' the values become '0.'
Normalizing	A variable is normalized; it is converted so that the minimum value becomes '0,' and the maximum value becomes '1.' When the maximum and minimum values of a variable are the same (all values in the variable are the same), the values are all converted into '0.'	Values are normalized by using the minimum and maximum values obtained when learning. When the maximum and minimum values obtained when learning is the same, the values become '0.'
Exponential transformation	All elements in a variable are converted into exponents by using a specified base. When 'a' represents a value before conversion and 'b' a base, the value after conversion will be 'b ^a .'	Same as when learning
Logarithmic transformation	All elements in a variable are converted into logarithms by using a specified base. When 'a' represents a value before conversion and 'b' a base, the value after conversion will be 'log _b a.' A missing value is returned for a value equal to or smaller than '0.'	Same as when learning
Square root	The square roots of all elements in a variable are taken. A missing value is returned for a negative value.	Same as when learning
Exponentiation	All elements in a variable are raised to the power of a specified value.	Same as when learning

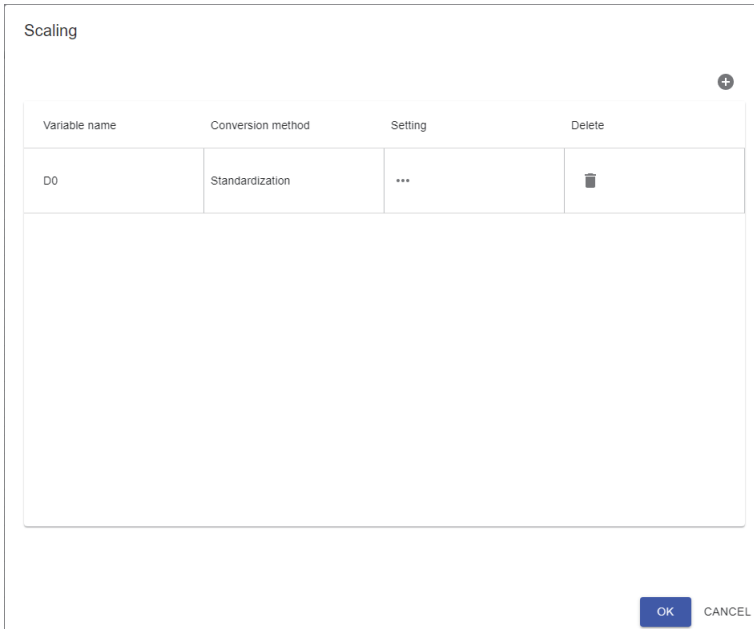
Scaling screen

The following shows the screen for displaying the list of added scaling methods.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
(Add)	Click this to add a scaling method. (Page 256 Settings)
Variable name	The name of a variable is displayed.
Conversion method	A conversion method is displayed. (Page 254 Processing methods)
Setting	Click the icon displayed in this column to change settings for scaling. (Page 256 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for adding a scaling method.

Window

The image shows two side-by-side 'Setting' dialog boxes. The left dialog has 'Variable name' set to 'D0', 'Conversion method' set to 'Logarithmic transform...', and 'Base' set to '2'. The right dialog has 'Variable name' set to 'D0', 'Conversion method' set to 'Exponentiation', and 'Exponent' set to '2'. Both dialogs have 'OK' and 'CANCEL' buttons at the bottom.

Displayed items

Item	Description
Variable name	Set a target variable of scaling processing. A variable can be selected from the numerical value type variables in the input data frame except for objective variables.
Conversion method	Select a conversion method. (👉 Page 254 Processing methods)
Base ^{*1}	Set a base (2.22507385850721e-308 to 1.79769313486231e+308).
Exponent ^{*2}	Set an exponent (-1.79769313486231e+308 to 1.79769313486231e+308).

*1 Displayed when selecting "Logarithmic transformation" or "Exponential transformation" for "Conversion method."

*2 Displayed when selecting "Exponentiation" for "Conversion method."

Point

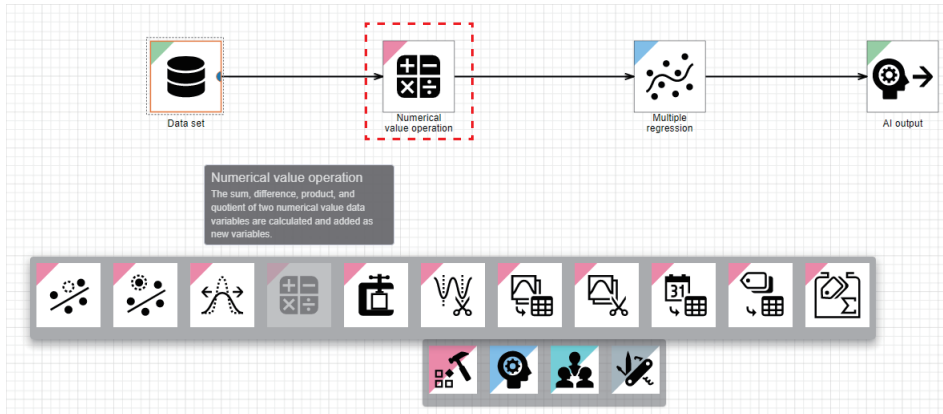
When selecting and setting a variable in which a scaling method has already been set, the old setting will be deleted when adding a new setting.

👉 Page 255 Scaling screen

Numerical value operation block

A numerical value operation block selects two variables in a data frame, performs a numerical value operation, then adds the result as a new variable.

Use this block to make a more accurate diagnosis rule by creating and adding a variable that contributes to the improvement of accuracy.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

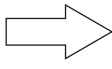
Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of input variables + number of added expressions Type of each variable: Numerical value for an added variable, same as the type of an input variable for others 	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of variables for learning Type of each variable: Same as the variable type for learning

Operational specifications

Two variables or specified values are calculated with an operator, and the result is output as a new variable.

Ex.

Numerical value operation (when calculating a difference between two variables)

Input			Output		
Variable 1	Variable 2		Variable 1	Variable 2	(Variable 1) - (Variable 2)
500	490	 (Variable 1) - (Variable 2)	500	490	10
510	500		510	500	10
505	510		505	510	-5
502	490		502	490	12
495	505		495	505	-10
480	499		480	499	-19

■ Calculation methods

When variable 1 or 2 has a missing value, the result will also be a missing value.

Calculation method	Processing
+	'Value of variable 1' + 'value of variable 2' is calculated, and the result will be a new variable
-	'Value of variable 1' - 'value of variable 2' is calculated, and the result will be a new variable.
×	'Value of variable 1' × 'value of variable 2' is calculated, and the result will be a new variable.
÷	'Value of variable 1' ÷ 'value of variable 2' is calculated, and the result will be a new variable.

Value to be output by numerical value operation processing

'inf,' '-inf,' or 'NaN' is output in the following cases:

- When a value is larger than '1.7976931348623157e+308' or when a positive value is divided by '0': inf
- When a value is smaller than '-1.7976931348623157e+308' or when a negative value is divided by '0': -inf
- When '0' is divided by '0': NaN

■ Naming rule for a new variable

A newly added variable is named as follows:

(Name of variable 1) operator (name or variable 2)

Ex.

In the following case, a variable name will be '(aaa)+(bbb).'

- Name of variable 1: aaa
- Name of variable 2: bbb
- Operator: +

Point

If a variable name has more than 255 characters, characters in the names of variable 1 and 2 will be deleted in order from the end.

When deleting characters, ones in the variable name that has more characters than the other are deleted first.

If two variable names have the same number of characters, which exceeds 250 characters in total, characters in the name of each variable are deleted so that each name will be 125 characters long.

If a variable name is duplicate with an existing variable, the name is suffixed with '_001.' If the name is still duplicate, the number will be incremented. If a suffixed name has more than 255 characters, characters in the variable name will be deleted until 246 characters long by the method described above to fit within 255 characters in total including the suffix.

Numerical value operation screen

The following shows the screen for displaying the list of added numerical value operations.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Variable name	Calculation formula	Setting	Delete
(D0)+(10)	(D0) + (10)	...	

Displayed items

Item	Description
(Add)	Click this to add a numerical value operation. (Page 260 Settings)
Variable name	The name of a variable is displayed. (Page 258 Naming rule for a new variable)
Calculation formula	A calculation formula is displayed.
Setting	Click the icon displayed in this column to change settings for a numerical value operation. (Page 260 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for adding a numerical value operation.

Window

Displayed items

Item	Description
Variable 1/Variable 2	Select a variable to be used in calculation. A variable can be selected from the numerical value type variables in the input data frame except for objective variables. To use a constant value, select "Constant value."
Constant value* ¹	Set a constant value (-1.79769313486231e+308 to 1.79769313486231e+308).
Operator	Select an operator to be used in calculation. (☞ Page 258 Calculation methods)

*¹ Displayed when selecting "Constant value" for "Variable 1" or "Variable 2."

Point

When the same calculation formula has already been in the list, the old setting will be deleted when adding a new setting.

☞ Page 259 Numerical value operation screen

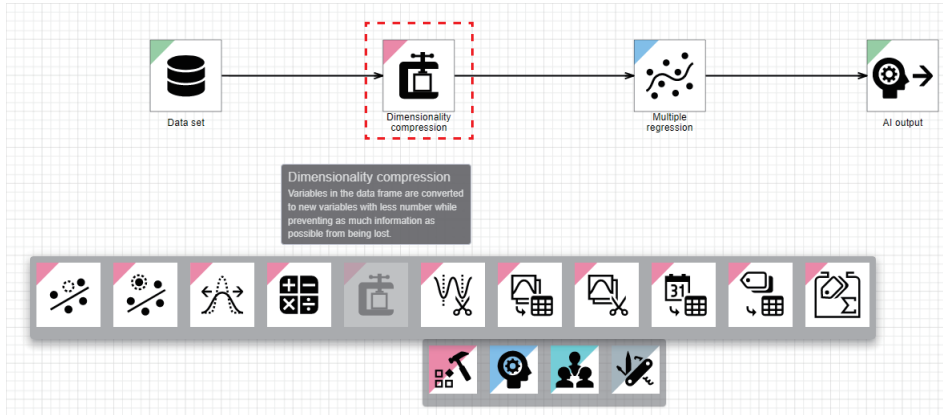
Dimensionality compression block

A dimensionality compression block compresses data of a numerical value type variable without damaging its important information.

Dimensionality compression can be performed for numerical value type variables excluding objective variables.

Variables in a data frame are converted into fewer new variables without damaging their information as much as possible.

A highly accurate diagnosis rule can be created by reducing redundant information.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Number of dimensionality compression target variables to 864000 Number of variables: Integer between 2 and 512 Type of each variable: two or more numerical value type variables besides objective variables 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of variables other than input dimensionality compression target variables + number of dimensions after compression Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Same as the number of records for learning Number of variables: Same as the number of variables for learning Type of each variable: Same as the variable type for learning

Operational specifications

Dimensionality of target variables is compressed by using PCA, and the number of variables is reduced to the number specified for the number of dimensions after compression.

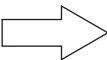
Ex.

PCA (compressing four variables to two)

Input: Data with four numerical value type variables (excluding an objective variable)

Output: Data with dimensionality of numerical value type variables compressed

Input						Output			
Numerical value 1	Numerical value 2	Numerical value 3	Numerical value 4	Category	Numerical value 5*1	Category	Numerical value 5*1	PCA_001	PCA_002
14.23	1.71	2.43	15.6	A	5.64	A	5.64	0.769	-0.394
13.2	1.78	2.14	11.2	B	4.38	B	4.38	5.110	0.884
13.16	2.36	2.67	18.6	C	5.68	C	5.68	-2.327	0.620
14.37	1.95	2.5	16.8	A	7.8	A	7.8	-0.444	-0.543
13.24	2.59	2.87	21	B	4.32	B	4.32	-4.741	0.454
14.2	1.76	2.45	15.2	C	6.75	C	6.75	1.158	-0.329
14.39	1.87	2.45	14.6	A	5.25	A	5.25	1.751	-0.450
14.06	2.15	2.61	17.6	B	5.05	B	5.05	-1.276	-0.242



 Converting values by setting the number of dimensions after compression to 2

*1 Objective variable

■ Naming rule for a variable after dimensionality compression

A variable after dimensionality compression is named as follows:

PCA_(three-digit sequential number)

A three-digit sequential number is incremented and used in order from '001.'

However, when the same name is used for a variable other than the dimensionality compression targets, the variable name is not used and a sequential number is further incremented.

Ex.

When the number of dimensions after conversion is '3,' variables name will be as follows:

- Variable name: PCA_001
- Variable name: PCA_002
- Variable name: PCA_003

Dimensionality compression screen

The following shows the screen for displaying the list of variable names and contribute ratios after compression.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Dimensionality compression

Variable name	Contribution ratio ↓	Cumulative contributio...
PCA_001	0.999999380080815	0.999999380080815
PCA_002	3.26099254722279e-7	0.9999997061800697
PCA_003	2.0588397587058404e-7	0.9999999120640456
PCA_004	8.793594125327873e-8	0.9999999999999869

Number of dimensions after compression

EXECUTE CALCULATION

Displayed items

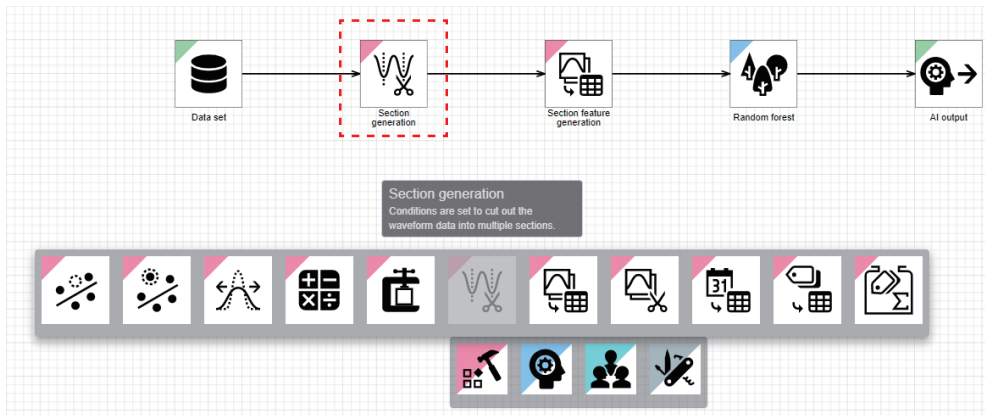
Item	Description
Variable name	The name of a variable after dimensionality compression is displayed.*1
Contribution ratio	A contribution ratio after dimensionality compression is displayed.*1
Cumulative contribution ratio	A cumulative contribution ratio after dimensionality compression is displayed.*1
Number of dimensions after compression	Set the number of dimensions (1 to 'number of dimensionality compression target variables - 1') after compressing dimensionality of numerical value data.
[Execute calculation] button	Click this to compress data to the set number of dimensions and display the result in the list. The button name will be "Executing calculation" while calculating.

*1 Displayed in the following cases:

- An AI is in the "Learned" or "Complete" state.
- Dimensionality compression is already performed by clicking the [Execute calculation] button.

Section generation block

A section generation block sets conditions to generate sections, and extracts multiple sections from waveform data. By dividing waveform data into multiple sections, a feature can be calculated from each section and the sections can be overlaid to set a reference waveform.



Restriction

Only one section generation block can be placed.

Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 2 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of explanatory variables used for learning Type of each variable: Same as the type of an explanatory variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> ■Entire multi-data frame (number of sections) <ul style="list-style-type: none"> Number of units of data frame type data: Integer between 1 and 432000 ■Each contained data frame (data per section) <ul style="list-style-type: none"> Number of records: Integer between 2 and 864000 (different per data frame) Number of variables: Integer between 1 and 512 (same in all data frames) Type of each variable: Any types (same in all data frames) 	<ul style="list-style-type: none"> ■Entire multi-data frame (number of sections) <ul style="list-style-type: none"> Number of units of data frame type data: Integer between 1 and 43200 ■Each contained data frame (data per section) <ul style="list-style-type: none"> Number of records: Integer between 2 and 86400 (different per data frame) Number of variables: Same as the number of explanatory variables used for learning (same in all data frames) Type of each variable: Same as the type of an explanatory variable used for learning (same in all data frames)

Operational specifications

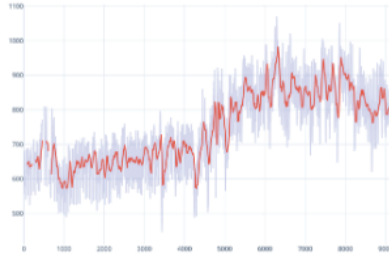
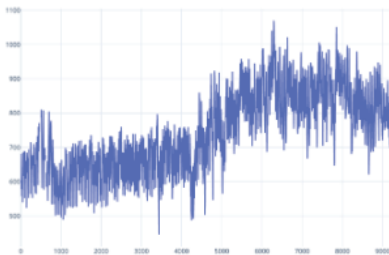
■ Addition of a converted waveform

A target variable is converted by a set conversion method, and a converted waveform is added as a new variable.

- Conversion method: Moving average

The moving average is calculated by dividing the sum of the values of a target variable for the set number of records by the number of records.

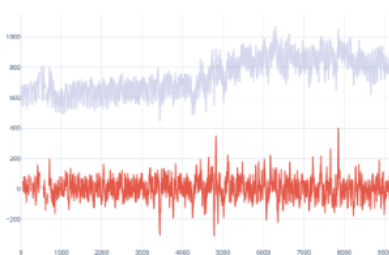
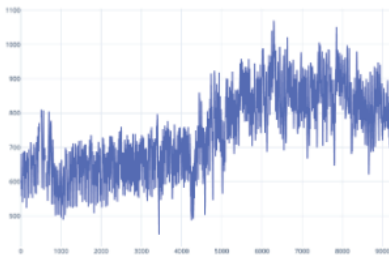
A missing value is returned within a range smaller than the set number of records because the moving average cannot be calculated.



- Conversion method: Derivation

The derivation is calculated by dividing the variation of the values of a target variable for the set number of records by the number of records.

A missing value is returned within a range smaller than the set number of records because the derivation cannot be calculated.



■ Section generation condition

Sections are generated from waveform data by setting conditions.

1. Judging a start condition (up to four conditions)

Whether a start condition is satisfied is judged for each record. When the condition is satisfied, the record is set as the start point of a section.

- When the position adjustment is set, the start record position is adjusted.
- When a position before the first record is set as the start position, the first record is set as the start point.
- When a position after the last record is set as the start position, the last record is set as the start point.
- When file switching is set as a condition, it is judged as follows:

Judgment of file switching

Item	Description
When learning	File switching is judged based on one data source file that was uploaded to group 1 when a data set was created.
When executing a task	File switching is judged based on one file read by an input data stream block.

2. Judging an end condition (up to four conditions)

Whether an end condition is satisfied is judged for each record from the next of the start record. When the condition is satisfied, the record is set as the end point of a section.

- When the position adjustment is set, the end record position is adjusted.
- When a position after the last record is set as the end position, the last record is set as the end point.
- When a position before the first record is set as the end position, the first record is set as the end point.

3. Extracting a section from the start to end points

The range from the start to end points is extracted as a section based on the judgment.

4. Excluding invalid data

When an invalid section is set, a section shorter than the shortest section length and one longer than the longest section length are excluded from the sections to be generated.

5. Numbering sections

The remaining sections are numbered in order from '1.'

■Output section selection

Sections to be output are selected after section generation.

- When learning, only sections set as section targets are output among generated ones. The sections are renumbered when output.
- When executing a task, all the generated sections are output.

■Buffer processing (only when performing a diagnosis)

When the previous diagnosis reached the last input record without end conditions satisfied after start conditions were satisfied, the part is retained as a buffer. In the next diagnosis, section generation is performed by joining the buffer part to the top part of input records.

Up to 8640 records can be retained as a buffer. An error occurs if the number of records that can be retained is exceeded.

Section generation screen

The following shows the screen for generating sections by setting section generation conditions to extract waveform data. Input waveform data can be checked with extracted sections overlaid; therefore, appropriate generation conditions and sections to be output when learning can be selected.

In addition, a drawn graph can be customized by changing the y axis scale.

When setting a section generation block for the first time, the initial setting screen shown in the following section appears after this screen is displayed:

☞ Page 270 Section generation (initial settings)

10

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

The screenshot displays the 'Section generation' window with the following components:





- (1) Variable list:** A table listing variables for selection.

Variable n...	Variable t...	Conversl...	Number o...	Dele
<input type="checkbox"/>	TIME	Timestamp	-	-
<input checked="" type="checkbox"/>	Data1	Number	-	-
<input type="checkbox"/>	Data2	Number	-	-
<input type="checkbox"/>	Data3	Number	-	-
<input checked="" type="checkbox"/>	Data4	Number	-	-
<input type="checkbox"/>	Data5	Number	-	-
<input type="checkbox"/>	Data6	Number	-	-
<input type="checkbox"/>	Data7	Number	-	-
<input type="checkbox"/>	Data8	Number	-	-
- (2) Input waveform graph:** A plot showing two overlapping waveforms, Data1 (blue) and Data4 (red), over a time range from 0 to 1800. The y-axis ranges from -1 to 80.
- (3) Section generation settings:**
 - Time-series standard:** Record number
 - Start condition:** Condition convergence method: AND. Includes a table for conditions:

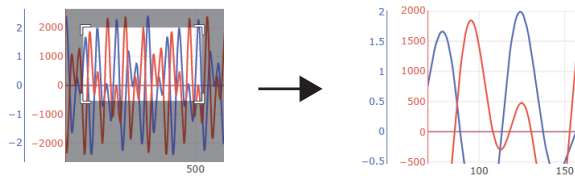
Condition	Setting	Delete
Immediately after end c...	...	🗑️
 - End condition:** Condition convergence method: AND. Includes a table for conditions:

Condition	Setting	Delete
After the start condition...	...	🗑️
 - Position adjustment:**
 - Change generation start position:
 - Change generation end position:
 - Generation condition:**
 - Set invalid section:
 - Minimum section length:
 - Maximum section length:
- (4) Graph after section generation:** A plot showing the original waveforms (Data1 and Data4) overlaid with generated sections (blue and red lines) over a time range from 0 to 200. The y-axis ranges from -1 to 80.

Displayed items

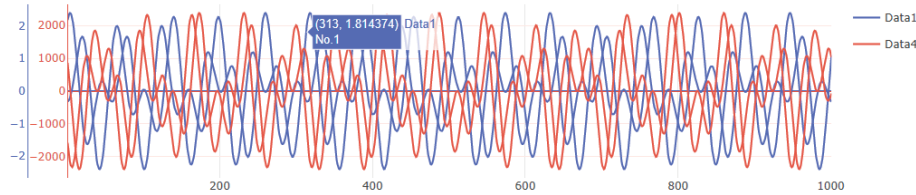
Item	Description
(1) Variable list/Section list	The variable list and/or section list is/are displayed. ( Page 271 Variable list/section list)
 (Drawing setting)	Click this to display the drawing setting screen. ( Page 273 Drawing settings) The screen is closed by clicking this icon again.
(2) Input waveform graph	Line charts for waveform data before section generation are displayed. Select a variable to be displayed from the variable list. Whole data is displayed by default. The detailed transition of values can be checked by zooming in the graph. The display is changed according to the settings of "y-axis group setting" in the drawing setting screen or "Time-series standard" in "Section generation." However, when a missing value (NaN) exists, the missing part is not drawn.
(3) Section generation	Set conditions to generate sections from waveform data. ( Page 274 Section generation (start condition/end condition/generation condition))
(4) Graph after section generation	Line charts for waveform data after section generation are displayed. Select a variable and section to be displayed from the variable list/section list. The display format can be switched by "Graph selection." Whole data is displayed by default. The detailed transition of values can be checked by zooming in the graph. However, when a missing value (NaN) exists, the missing part is not drawn. <ul style="list-style-type: none"> ■ Superimposed graph Line charts are displayed with waveform data of multiple sections overlaid. The display is changed according to the setting of "y-axis group setting" in the drawing setting screen. ■ Time-series graph Line charts for waveform data of multiple sections are displayed in chronological order. A record is excluded if it does not satisfy conditions when generating sections. In this case, it is displayed with a space. The display is changed according to the settings of "y-axis group setting" in the drawing setting screen or "Time-series standard" in "Section generation."

A graph can be zoomed in as follows by dragging the cursor on it.

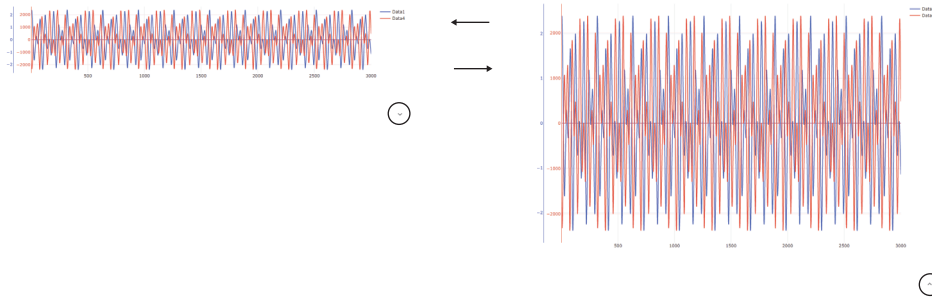


In addition, the following values can be displayed by placing the cursor. (The values can remain displayed by clicking.)

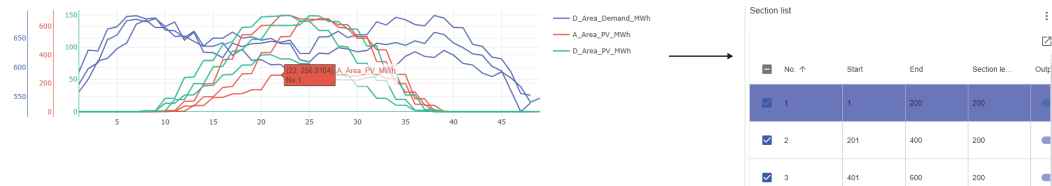
- Input waveform graph: Value of the point closest to the cursor
- Graph after section generation: Value of the point closest to the cursor and section number



A graph can be enlarged or reduced with the button on the right bottom.



The section that includes a point clicked on the graph after section generation is highlighted on the section list. For example, to check information on the section which has a tendency different from other sections, click the section. The corresponding section can be found in the section list; therefore, hiding the section or disabling the output can be performed efficiently in the list.



■Section generation (initial settings)

This screen appears after the section generation screen is displayed only when setting a section generation block for the first time.

When it is set, this screen does not appear.

Window

Section generation ?

Please select the initial setting method.
If there is a flag that indicates repetition of waveform data, please select a variable to be a flag. If there is no appropriate variable, please select the manual setting.

Generation condition

Automatic setting Manual setting

Settings

Use the change of the variable as the start / end condition of the section

Division_AB

Division_BC

Division_CD

DayType

Set file switching as the start / end condition of the section

Section generation ?

Please select the initial setting method.
If there is a flag that indicates repetition of waveform data, please select a variable to be a flag. If there is no appropriate variable, please select the manual setting.

Generation condition

Automatic setting Manual setting

The section is manually set.

Displayed items

Item	Description
Generation condition	Select a generation condition. <ul style="list-style-type: none"> • Automatic setting • Manual setting
Settings* ¹	Select a start/end condition for "Automatic setting." <ul style="list-style-type: none"> • Use the change of the variable as the start / end condition of the section • Set file switching as the start / end condition of the section <p>When selecting "Use the change of the variable as the start / end condition of the section," category type variables except for objective variables are listed. Therefore, select a variable that includes a value (flag) indicating the beginning of a section from the list.</p> <p>When there are no such variables, "There is no variable that can be selected." is displayed.</p>

*1 Displayed when selecting "Automatic setting" for "Generation condition."

■Start/end condition

When selecting "Automatic setting," start and end conditions are set in the generation screen by default.

Item	Description
Start condition	<ul style="list-style-type: none"> • "Judge with the variable value used as a condition" is set when selecting "Use the change of the variable as the start / end condition of the section." • "Judgment based on file switching" is set when selecting "Set file switching as the start / end condition of the section."
End condition	"Judge immediately before the next start condition establishment" is set.

■ Variable list/section list

The lists of variables and sections are displayed.

Select a variable and section to be displayed on a graph.

A new variable can be added by converting input waveform data. In addition, a section to be output for learning can be selected.

Window














Variable list

Variable n...	Variable L...	Conversi...	Number o...	Dele
<input type="checkbox"/> TIME	Timestamp	-	-	
<input type="checkbox"/> Data1	Number	-	-	
<input type="checkbox"/> Data2	Number	-	-	
<input type="checkbox"/> Data3	Number	-	-	
<input type="checkbox"/> Data4	Number	-	-	
<input type="checkbox"/> Data5	Number	-	-	
<input type="checkbox"/> Data6	Number	-	-	
<input type="checkbox"/> Data7	Number	-	-	
<input type="checkbox"/> Data8	Number	-	-	

Section list

<input checked="" type="checkbox"/>	No. ↑	Start	End	Section le...	Outp
<input checked="" type="checkbox"/>	1	1	200	200	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	2	201	400	200	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	3	401	600	200	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	4	601	800	200	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	5	801	1000	200	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	6	1001	1200	200	<input checked="" type="checkbox"/>

Displayed items

Item	Description
 (Add converted waveform)	Click this to convert and add a waveform as a new variable.  Page 273 Converting and adding a waveform
Variable list	Explanatory variables in target data and variables added by converting waveforms are listed. Select the checkbox of a variable to be displayed on a graph. (Up to 10 variables)
 (Expand)/  (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
Variable name	A variable name is displayed. For a variable added by converting a waveform, the name is suffixed with the conversion type to distinguish it from the variable before conversion. <ul style="list-style-type: none"> • Moving average: (Variable name)_MA • Derivation: (Variable name)_DC If '(variable name)_MA' or '(variable name)_DC' exceeds 255 characters, characters in the variable name, which is before '_MA'/'_DC,' will be deleted in order from the end to fit within 255 characters. In addition, if '(variable name)_MA' or '(variable name)_DC' already exists, the name will be suffixed with '_0001.' The number will be incremented if the name is still duplicate. If the suffixed name has more than 255 characters, characters in the variable name, which is before '_MA'/'_DC,' will be deleted in order from the end to fit within 255 characters.
Variable type	A variable type is displayed. ( Page 85 Variable types)
Conversion type	For a variable added by converting a waveform, the conversion type is displayed. For other variables, "-" is displayed.
Number of records	For a variable added by converting a waveform, the number of converted records is displayed. For other variables, "-" is displayed.
Delete	A line is deleted by clicking  (Delete). The icon is displayed only for a variable added by converting a waveform.
Section list	Sections generated according to section generation conditions are listed. Select the checkbox of a section to be displayed on a graph.
 (Menu)	Output all sections
 (Expand)/  (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
No.	A section number (number appended to extracted sections in order from '1') is displayed.
Start	Information on the start of a section is displayed. <ul style="list-style-type: none"> • When the section is extracted by selecting "Record number" for "Time-series standard" in "Section generation": Start record number • When the section is extracted by selecting a timestamp type variable for "Time-series standard" in "Section generation": Value of the variable in the start record  Page 274 Section generation (start condition/end condition/generation condition)
End	Information on the end of a section is displayed. <ul style="list-style-type: none"> • When the section is extracted by selecting "Record number" for "Time-series standard" in "Section generation": End record number • When the section is extracted by selecting a timestamp type variable for "Time-series standard" in "Section generation": Value of the variable in the end record  Page 274 Section generation (start condition/end condition/generation condition)
Section length	The number of records in a section is displayed.
Output	Turn the switch OFF to disable the output of a section. The checkbox is also unselected when turning this OFF. Disabling the output of all sections is not possible.

■Converting and adding a waveform

The following shows the screen for performing various conversion processing for a numerical value type variable and adding it as a new variable.

Window

Displayed items

Item	Description
Variable name	Select a variable to be newly added by converting a waveform. A variable can be selected from the numerical value type variables except for objective variables.
Conversion method	Select a conversion method. (☞ Page 265 Addition of a converted waveform) <ul style="list-style-type: none"> • Moving average • Derivation
Number of records to be converted	Set the number of records to be converted (2 to 86400).

■Drawing settings

The following shows the screen for changing the y axis scale of a graph.

When different variables are on multiple scales, dividing variables into groups enables to compare their transitions on the same graph and to find their relations.

Window

Displayed items

Item	Description
Target	Turn this ON for a graph to set the y-axis groups.
y-axis group setting	Set groups of variables to share the y axis (G1 to G4). Variables on different scales can be overlaid by displaying variables with a close value range on the same y axis scale; therefore, the correlation relations can be checked. Variables are automatically divided into groups by default. To restore the default settings after setting groups manually, click the [Automatic setting] button.*1 In addition, G1 is set for a newly selected variable.

*1 Automatic grouping is performed according to the following:

- Numerical value type variables: Selected numerical value type variables are divided into two groups evenly from the top. Therefore, variables with odd numbers are in G1, and ones with even numbers are in G2.
- Category type variables: Selected category type variables are divided into two groups, one with only the variable on the top in the displayed order, and one with the rest of the variables. Groups later than the ones used by numerical value type variables will be used. For example, if G1 and G2 are used by numerical value type variables, category type variables are divided into G3 and G4.

■Section generation (start condition/end condition/generation condition)

Conditions to generate sections from waveform data can be set.

Sections are extracted by setting start and end conditions.

Up to four conditions can be set each for the start and end conditions.

Save the conditions as settings of this block after checking that sections are generated as intended in a graph.

Window

Section generation [?](#) Time-series standard
Record number

Start condition

Condition convergence method
AND

+

Condition	Setting	Delete
Variable value: Changi...	...	

Position adjustment

Change generation start position

10 Record

Bef... ▾

Generation condition

Set invalid section

Minimum section length 10 Record

Maximum section length 100 Record

End condition

Condition convergence method
AND

+

Condition	Setting	Delete
Variable value: TimeCo...	...	

Position adjustment

Change generation end position

10 Record

Bef... ▾

↓ SECTION GENERATION

Displayed items

Item	Description
Time-series standard	Select information that becomes the time-series standard for data to generate sections from the options shown below. The x axis of the input waveform graph and the graph after section generation (time-series graph) is changed according to the selected option. <ul style="list-style-type: none"> • "Record number" • Timestamp type variable in target data
^ v (Enlarged display/Reduced display)	Click either of these to enlarge or reduce the display area of this setting.
Start condition End condition	Condition convergence method Select a method for combining conditions. <ul style="list-style-type: none"> • AND • OR
	+ (Add condition) ^{*1} Click this to add a condition to generate sections. (Page 276 Start condition, Page 277 End condition)
	Condition A condition set in the condition settings is displayed.
	Setting Click the icon displayed in this column to set a condition. (Page 276 Start condition, Page 277 End condition)
	Delete Click the icon displayed in this column to delete a line.
	Position adjustment Turn this ON to enable to adjust the position of the start/end record after conditions are met. <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400, then select "Before" or "After." ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit, then select "Before" or "After." The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24
Generation condition	Set invalid section Turn this ON to enable to set a section not to be used ("Minimum section length" or "Maximum section length") among sections that meet conditions. <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400. ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24
[Section generation] button	Click this to generate sections based on the set conditions.

*1 Can be clicked when the number of conditions is less than its maximum number.

Point

When "Judgment based on file switching" is set for the start condition, set "Judge immediately before the next start condition establishment" for the end condition, and do not set other start and end conditions.
When generating sections under other conditions, place a sub-section forming block the next of the block, and form sections.

Precautions

■When changing an option for "Time-series standard"

The following settings return to the default:

- "Position adjustment" of "Start condition"/"End condition"
- "Generation condition"

In addition, all the set start and end conditions are deleted.

■When generating sections

When the number of generated sections exceeds 1024, data of 1024 sections is displayed in the graph after section generation and the section list.

The output of sections that are not displayed is enabled; therefore, they are output when learning.

■ Start condition

The following shows the screen for setting a start condition to generate sections.

Window

Displayed items

Item	Description
Judgment type	Select the type of a judgment condition. <ul style="list-style-type: none"> • Judge with the variable value used as a condition^{*1} • Judgment based on file switching • Judge immediately after the end condition establishment
Judgment target variable ^{*2}	Select a variable to be judged. A variable can be selected from the variables other than timestamp type variables except for objective variables.
Operator/feature point ^{*2}	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> • Numerical value type variable: <, ≤, >, ≥, =, ≠ • Category type variable: =, ≠, Changing point
Comparison target ^{*3}	Select a comparison target from the following options: <ul style="list-style-type: none"> • "Constant" • Variable with the same type as a variable selected for "Judgment target variable" except for objective variables^{*4}
Setting value ^{*5}	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> • Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) • Category type variable: All categories in the variable
Continuation condition ^{*5}	Turn the switch ON to specify a continuation condition. When a condition is specified, section generation starts at the timing when a variable value satisfies the condition continuously for the set period. ^{*6} <ul style="list-style-type: none"> ■ When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400. ■ When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24

*1 Cannot be selected when all the variables are of the timestamp type.

*2 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type."

*3 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type" and also selecting an option other than "Changing point" for "Operator/feature point."

*4 Excluding a variable selected for "Judgment target variable"

*5 Displayed when selecting "Constant" for "Comparison target."

*6 For example, if the condition is 'a≥1' and also the period set as a continuation condition is set to 30 records, the start condition is satisfied when the value of 'a' is larger than '1' for 30 records continuously.

■ End condition

The following shows the screen for setting an end condition to generate sections.

Window

Displayed items

Item	Description
Judgment type	Select the type of a judgment condition. <ul style="list-style-type: none"> • Judge with the variable value used as a condition^{*1} • Judge immediately before the next start condition establishment • Judge in period after the start condition establishment
Judgment target variable ^{*2}	Select a variable to be judged. A variable can be selected from the variables other than timestamp type variables except for objective variables.
Operator/feature point ^{*2}	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> • Numerical value type variable: <, ≤, >, ≥, =, ≠ • Category type variable: =, ≠, Changing point
Comparison target ^{*3}	Select a comparison target from the following options: <ul style="list-style-type: none"> • "Constant" • Variable with the same type as a variable selected for "Judgment target variable" except for objective variables^{*4}
Setting value ^{*5}	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> • Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) • Category type variable: All categories in the variable
Continuation condition ^{*5}	Turn the switch ON to specify a continuation condition. When a condition is specified, section generation ends at the timing when a variable value satisfies the condition continuously for the set period. ^{*6} <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400. ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24
Period after start ^{*7}	Set a period after start. <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 2 to 86400. ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 2 to 86400 • Minute: 2 to 60 • Hour: 2 to 24

*1 Cannot be selected when all the variables are of the timestamp type.

*2 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type."

*3 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type" and also selecting an option other than "Changing point" for "Operator/feature point."

*4 Excluding a variable selected for "Judgment target variable"

*5 Displayed when selecting "Constant" for "Comparison target."

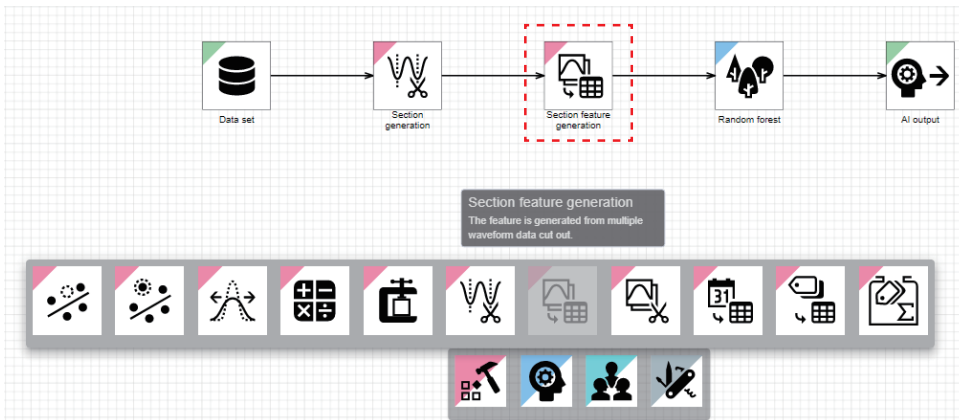
*6 For example, if the condition is 'a≥1' and also the period set as a continuation condition is set to 30 records, the end condition is satisfied

when the value of 'a' is larger than '1' for 30 records continuously.

*7 Displayed when selecting "Judge in period after the start condition establishment" for "Judgment type."

Section feature generation block

A section feature generation block generates a feature from waveform data of each generated section. Waveform data of each section is replaced with a line of feature data; therefore, it can be used as table data by connecting feature data of all sections.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Entire multi-data frame (number of sections) <ul style="list-style-type: none"> Number of units of data frame type data: Integer between 1 and 432000 Each contained data frame (data per section) <ul style="list-style-type: none"> Number of records: Integer between 2 and 864000 (different per data frame) Number of variables: Integer between 1 and 512 (same in all data frames) Type of each variable: Any types (same in all data frames) 	<ul style="list-style-type: none"> Entire multi-data frame (number of sections) <ul style="list-style-type: none"> Number of units of data frame type data: Integer between 1 and 43200 Each contained data frame (data per section) <ul style="list-style-type: none"> Number of records: Integer between 2 and 86400 (different per data frame) Number of variables: Same as the number of explanatory variables used for learning (same in all data frames) Type of each variable: Same as the type of an explanatory variable used for learning (same in all data frames)

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 432000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 43200 Number of variables: Same as the number of explanatory variables used for learning Type of each variable: Same as the type of an explanatory variable used for learning

Operational specifications

■Waveform feature addition

Calculation targets and types of features are set, and section lengths and waveform features are added as new variables. Except for the section length, types that can be set differ depending on the variable type. (📖 Page 85 Variable types)

Type	Description	Remarks
Average value	The arithmetic mean value of all elements excluding the missing values from records in each section	These types can be set only for numerical value type variables.
Standard deviation	The standard deviation value of all elements excluding the missing values from records in each section	
Minimum value	The minimum value of all elements excluding the missing values from records in each section	
Median	The value of an element that is at 50% (50th percentile) when sorting the elements excluding the missing values from records in each section in ascending order	
Maximum value	The maximum value of all elements excluding the missing values from records in each section	
Range	The value obtained by subtracting the minimum value from the maximum value of each section	
Kurtosis ^{*1}	The kurtosis value of all elements excluding the missing values from records in each section	
Skewness ^{*2}	The skewness value of all elements excluding the missing values from records in each section	
Integral value	The value obtained by integrating all elements excluding the missing values from records in each section	
Mode	The value that appears the most of all elements excluding the missing values from records in each section	
Starting point	The value of the first record in each section	This type can be set only for timestamp type variables.
Section length	The value of the number of records in each section	—

*1 An index that shows the sharpness of the probability density function or frequency distribution of a random variable

*2 An index that shows the asymmetry of a distribution

■Output section selection

Features are calculated and sections to be output are selected.

- When learning, features are output for selected sections.
- When executing a task, features of all the input sections are output.

Section feature generation screen

The following shows the screen for calculating a feature of each input section and converting waveform data into table data. A feature to be generated from a section can be set in "Waveform feature generation."

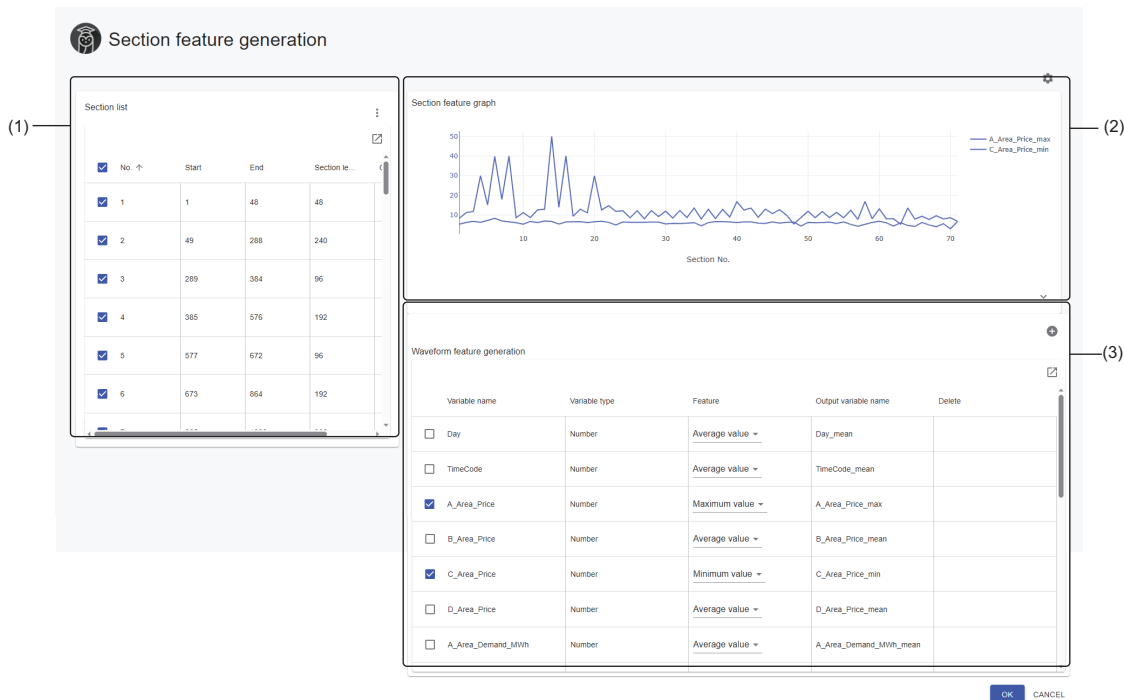
Graphs are displayed according to the sections selected in the section list. Configure settings to generate a feature to be used for learning and visualization while selecting a variable and feature in "Waveform feature generation."

In addition, a drawn graph can be customized by changing the y axis scale.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

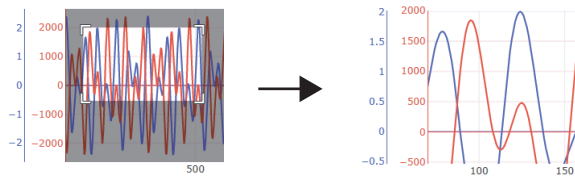
Item	Description
(1) Section list	Sections are listed. (Page 283 Section list)
⚙️ (Drawing setting)	Click this to display the drawing setting screen. (Page 273 Drawing settings) The screen is closed by clicking this icon again.
(2) Section feature graph	Line charts that show the transition per section of each feature are displayed. Select a section to be displayed in "Section list." Select a variable to be displayed in "Waveform feature generation." Whole data is displayed by default. The detailed transition of values can be checked by zooming in the graph. The display is changed according to the setting of "y-axis group setting" in the drawing setting screen. However, when a missing value (NaN) exists, the part is not drawn.
(3) Waveform feature generation	Set a combination of a variable to be generated and a feature. (Page 284 Waveform feature generation)

Precautions

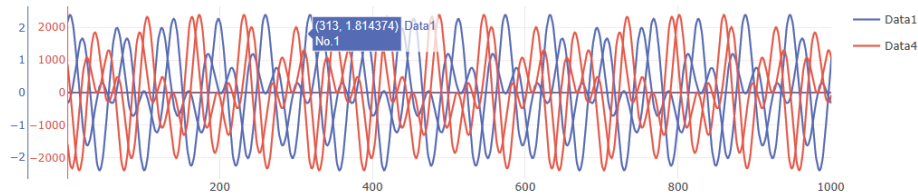
When the number of sections to be displayed exceeds 1024, data of 1024 sections is displayed in the section feature graph and the section list.

The output of sections that are not displayed is enabled; therefore, they are output when learning.

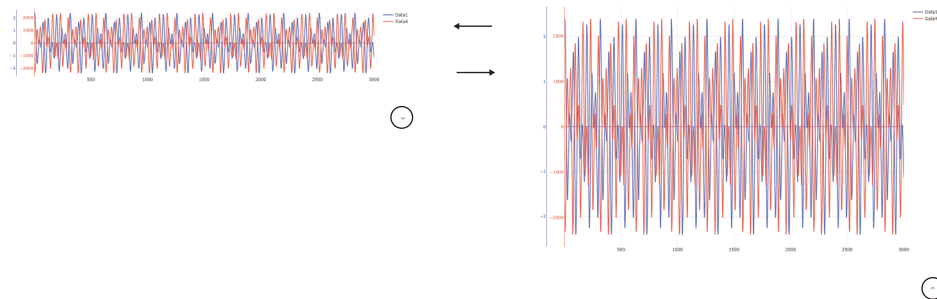
A graph can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor and the section number can be displayed as follows by placing the cursor. (They can remain displayed by clicking.)

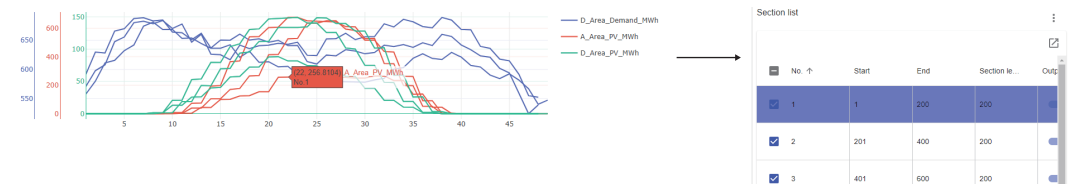


A graph can be enlarged or reduced with the button on the right bottom.



The section that includes a point clicked on the graph is highlighted on the section list.

For example, to check information on the section which has a tendency different from other sections, click the section. The corresponding section can be found in the section list; therefore, hiding the section or disabling the output can be performed efficiently in the list.



■Section list

The list of sections is displayed.

Select a section to be displayed on a graph.

In addition, a section to be output when learning can be selected.

Window

<input checked="" type="checkbox"/>	No. ↑	Start	End	Section le...
<input checked="" type="checkbox"/>	1	1	200	200
<input checked="" type="checkbox"/>	2	201	400	200
<input checked="" type="checkbox"/>	3	401	600	200
<input checked="" type="checkbox"/>	4	601	800	200
<input checked="" type="checkbox"/>	5	801	1000	200
<input checked="" type="checkbox"/>	6	1001	1200	200

Displayed items

Item	Description
Section list	—
☰ (Menu)	Output all sections
🔍 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. 📖 Page 56 Expanding the header
No.	A section number (number appended to sections in target data in order from '1') is displayed.
Start	Information on the start of a section is displayed. <ul style="list-style-type: none"> When the section is extracted by selecting "Record number" for "Time-series standard" in "Section generation": Start record number When the section is extracted by selecting a timestamp type variable for "Time-series standard" in "Section generation": Value of the variable in the start record 📖 Page 274 Section generation (start condition/end condition/generation condition)
End	Information on the end of a section is displayed. <ul style="list-style-type: none"> When the section is extracted by selecting "Record number" for "Time-series standard" in "Section generation": End record number When the section is extracted by selecting a timestamp type variable for "Time-series standard" in "Section generation": Value of the variable in the end record 📖 Page 274 Section generation (start condition/end condition/generation condition)
Section length	The number of records in a section is displayed.
Output	Turn the switch OFF to disable the output of a section. The checkbox is also unselected when turning this OFF. Disabling the output of all sections is not possible.

■ Waveform feature generation

A feature is generated from waveform data of each section.

Any features can be generated for a section by selecting the feature for an input variable.

In addition, multiple features can be generated for one variable by adding a combination of the variable and another feature.

The eventual list is saved as the setting of this block.

Window

Variable name	Variable type	Feature	Output variable name	Delete
<input type="checkbox"/> Day	Number	Average value ▾	Day_mean	
<input type="checkbox"/> TimeCode	Number	Average value ▾	TimeCode_mean	
<input checked="" type="checkbox"/> A_Area_Price	Number	Maximum value ▾	A_Area_Price_max	
<input type="checkbox"/> B_Area_Price	Number	Average value ▾	B_Area_Price_mean	
<input type="checkbox"/> C_Area_Price	Number	Average value ▾	C_Area_Price_mean	
<input checked="" type="checkbox"/> D_Area_Price	Number	Minimum value ▾	D_Area_Price_min	
<input type="checkbox"/> A_Area_Demand_MWh	Number	Average value ▾	A_Area_Demand_MWh_mean	

Displayed items

Item	Description
(Add waveform feature)	Click this to add a waveform feature as a new variable. (Page 285 Adding a waveform feature)
Waveform feature generation	Variables in target data and added variables are listed. Select the checkbox of a variable to be displayed on a graph. (Up to 10 types)
(Expand)/ (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
Variable name	A variable name is displayed.* ¹
Variable type	A variable type is displayed. (Page 85 Variable types)
Feature	Select the type of a feature. (Page 280 Waveform feature addition)
Output variable name	A variable name to be set when outputting the variable is displayed. Multiple features may be used by the same variable; therefore, a variable name is suffixed with a character string depending on the type when the variable is output. Page 285 Character string to be suffixed for each type
Delete	A line is deleted by clicking (Delete). The icon is displayed only for an added variable.

*1 "—" is displayed when selecting "Section length" for "Feature."

Point

One feature is generated for each section; therefore, records are output for the number of sections in the section list.

■ Character string to be suffixed for each type

A variable name is suffixed with the following character string depending on the type of a feature.

However, the source variable name does not exist for "Section length"; therefore, its output variable name will be "section_length."

Type	Character string to be suffixed
Average value	_mean
Standard deviation	_std
Minimum value	_min
Median	_med
Maximum value	_max
Range	_range
Kurtosis	_kurt
Skewness	_skew
Integral value	_integ
Mode	_mode
Starting point	_start

If '(variable name)(character string)' exceeds 255 characters, characters in the variable name, which is before '(character string),' will be deleted in order from the end to fit within 255 characters.

If a variable name is duplicate with an existing variable, the name is suffixed with '_0001.' If the name is still duplicate, the number will be incremented. If the suffixed name has more than 255 characters, characters in the variable name, which is before '(character string),' will be deleted in order from the end to fit within 255 characters.

Point

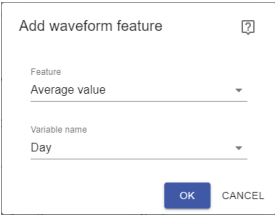
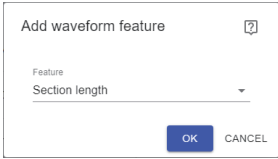
When calculation takes time, a name which only the above suffix is added to a variable name is displayed temporarily. Therefore, the temporary name may be duplicate with another output variable name during the calculation.

In addition, an output variable name is always updated to the new name according to the addition or change of other features.


■ Adding a waveform feature

The following shows the screen for adding a section length or a waveform feature for a numerical value type variable as a new variable.

Window

Displayed items

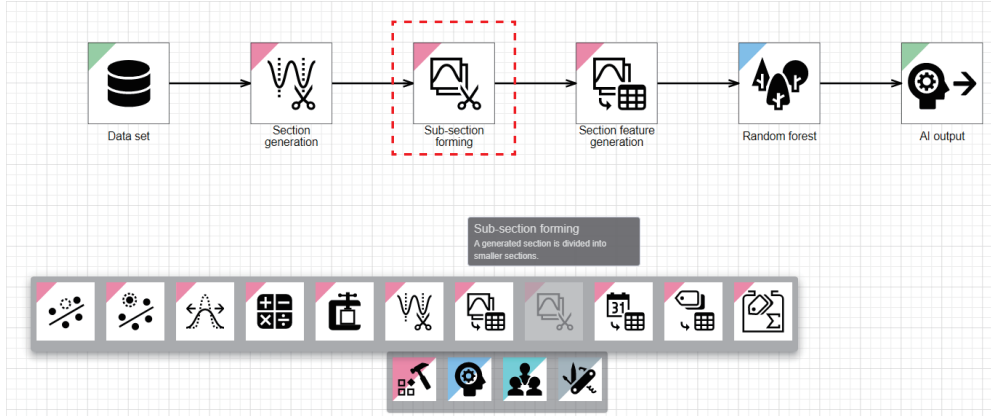
Item	Description
Feature	Select a waveform feature. ( Page 280 Waveform feature addition)
Variable name*1	Select a variable to be combined with a waveform feature and added as a new variable. A variable can be selected from the numerical value type variables except for objective variables.

*1 Displayed when selecting an option other than "Section length" for "Feature."

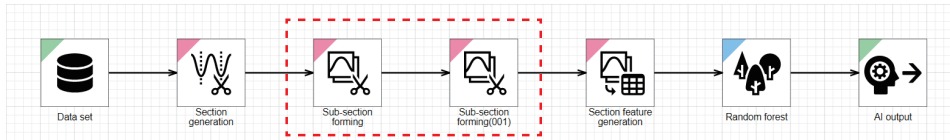
Sub-section forming block

A sub-section forming block divides each section of waveform data divided by a section generation block under further conditions.

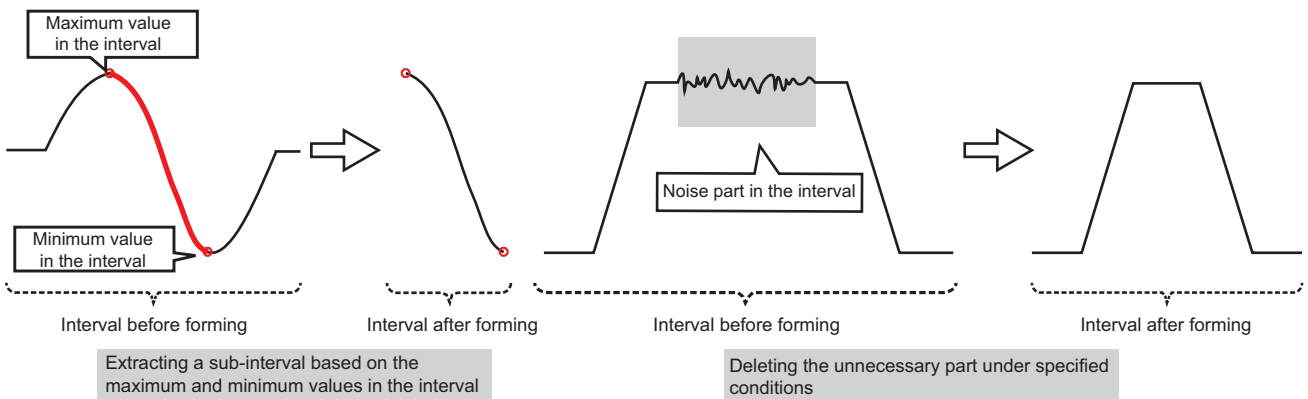
Even when a generation condition is set by a section generation condition block, sections may not be generated as intended. Therefore, by setting further conditions and forming sub-sections, a more accurate analysis can be performed.



By connecting multiple sub-section forming blocks, forming can be performed multiple times.



Example when sub-sections forming is required



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> ■ Entire multi-data frame (number of sections) <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 432000 ■ Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 2 and 864000 (different per data frame) • Number of variables: Integer between 1 and 512 (same in all data frames) • Type of each variable: Any types (same in all data frames) 	<ul style="list-style-type: none"> ■ Entire multi-data frame (number of sections) <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 43200 ■ Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 2 and 86400 (different per data frame) • Number of variables: Same as the number of explanatory variables used for learning (same in all data frames) • Type of each variable: Same as the type of an explanatory variable used for learning (same in all data frames)

10

Output

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> ■ Entire multi-data frame <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 432000 ■ Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 2 and 864000 (different per data frame) • Number of variables: Same as the number of input explanatory variables (same in all data frames) • Type of each variable: Same as the type of an input explanatory variable (same in all data frames) 	<ul style="list-style-type: none"> ■ Entire multi-data frame <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 43200 ■ Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 2 and 86400 (different per data frame) • Number of variables: Same as the number of explanatory variables used for learning (same in all data frames) • Type of each variable: Same as the type of an explanatory variable used for learning (same in all data frames)

Operational specifications

■Sub-section generation condition

Conditions are set, and input sections are divided.

1. Judging a start condition (up to four conditions)

Whether a start condition is satisfied is judged for each record from the start point of each section. When the condition is satisfied, the record is set as the start point of forming.

- When the position adjustment is set, the forming start record position is adjusted.
- When a position before the first record is set as the start position, the first record is set as the forming start point.

2. Judging an end condition (up to four conditions)

Whether an end condition is satisfied is judged for each record from the next of the start record. When the condition is satisfied, the record is set as the end point of forming.

- When the position adjustment is set, the forming end record position is adjusted.
- When a position after the last record is set as the end position, the last record is set as the forming end point.

3. Forming a new section based on the start and end points

A new section is formed by either of the following methods based on the forming specification:

- Forming a range from the forming start to end points as a new section
- Excluding a range from the forming start to end points and forming a remaining range (range from the start point of a section to that of forming + range from the end point of forming to that of a record) as a new section

4. Excluding invalid data

When an invalid section is set, a section shorter than the shortest section length and one longer than the longest section length are excluded from the sections to be generated.

5. Updating the section list

The section list is updated with the sections after forming. Some sections may have zero length after forming.

■Output section selection

Sections to be output are selected after section forming.

- When learning, sections selected among formed ones are output. The sections are renumbered when output.
- When executing a task, all the formed sections are output.

Sub-section forming screen

The following shows the screen for forming sections by setting sub-section forming conditions and setting sections to be output.

Appropriate sections to be output when learning can be selected by checking waveform data with formed sections overlaid in the graph after sub-section forming while checking waveform data in the input sections in the input section graph. In addition, a drawn graph can be customized by changing the y axis scale.

10

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

(1)

(2)

(3)

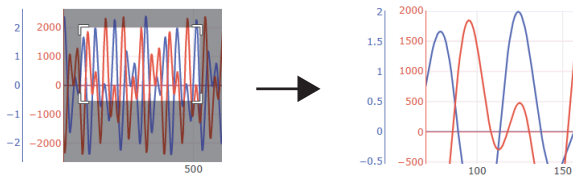
(4)

OK CANCEL

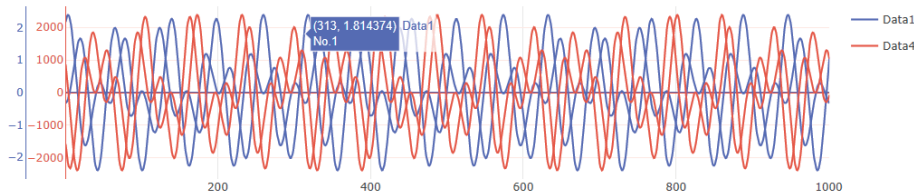
Displayed items

Item	Description
(1) Variable list/Section list	The variable list and/or section list is/are displayed. (☞ Page 292 Variable list/section list)
⚙ (Drawing setting)	Click this to display the drawing setting screen. (☞ Page 273 Drawing settings) The screen is closed by clicking this icon again.
(2) Input section graph	Line charts for waveform data before sub-section forming are displayed. Select a variable to be displayed from the variable list. The display format can be switched by "Graph selection." Whole data is displayed by default. The detailed transition of values can be checked by zooming in the graph. However, when a missing value (NaN) exists, the missing part is not drawn. ■Superimposed graph Line charts are displayed with waveform data of multiple sections overlaid. The display is changed according to the setting of "y-axis group setting" in the drawing setting screen. ■Time-series graph Line charts for waveform data of multiple sections are displayed in chronological order. A record is excluded if it does not satisfy conditions when generating sections. In this case, it is displayed with a space. The display is changed according to the settings of "y-axis group setting" in the drawing setting screen or "Time-series standard" in "Sub-section forming."
(3) Sub-section forming	Set conditions to form each section. (☞ Page 294 Sub-section forming (start condition/end condition/forming condition))
(4) Graph after sub-section forming	Line charts for waveform data after sub-section forming are displayed. Select a variable and section to be displayed from the variable list/section list. The display format can be switched by "Graph selection." Whole data is displayed by default. The detailed transition of values can be checked by zooming in the graph. However, when a missing value (NaN) exists, the missing part is not drawn. ■Superimposed graph Line charts are displayed with waveform data of multiple sections overlaid. The display is changed according to the setting of "y-axis group setting" in the drawing setting screen. ■Time-series graph Line charts for waveform data of multiple sections are displayed in chronological order. A record is excluded if it does not satisfy conditions when generating sections or forming sub-sections. In this case, it is displayed with a space. The display is changed according to the settings of "y-axis group setting" in the drawing setting screen or "Time-series standard" in "Sub-section forming."

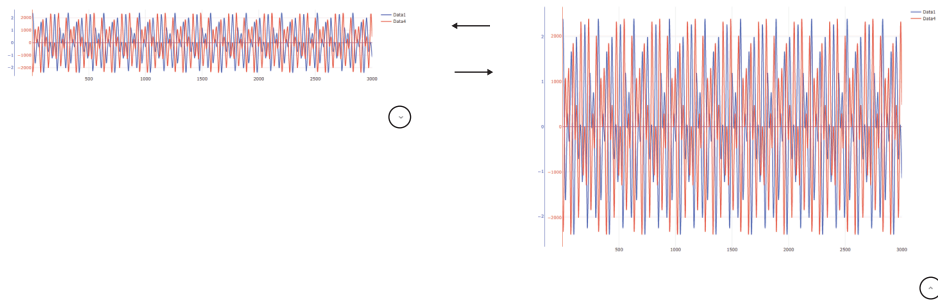
A graph can be zoomed in as follows by dragging the cursor on it.



In addition, the value of a point closest to the cursor and the section number can be displayed as follows by placing the cursor. (They can remain displayed by clicking.)

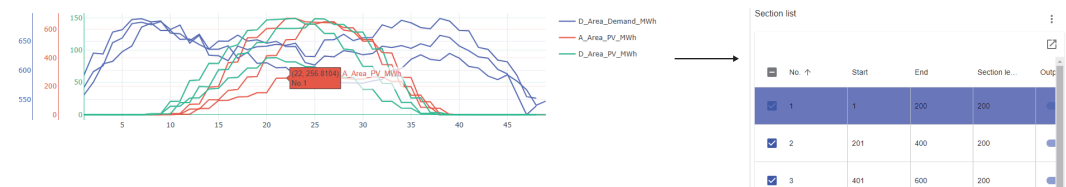


A graph can be enlarged or reduced with the button on the right bottom.



The section that includes a point clicked on the graph after sub-section forming is highlighted on the section list.

For example, to check information on the section which has a tendency different from other sections, click the section. The corresponding section can be found in the section list; therefore, hiding the section or disabling the output can be performed efficiently in the list.



■ Variable list/section list

The lists of variables and sections are displayed.

Select a variable and section to be displayed on a graph.




In addition, a section to be output when learning can be selected.

Window

Variable list	
Variable name	Variable type
<input type="checkbox"/> TIME	Timestamp
<input checked="" type="checkbox"/> Data1	Number
<input type="checkbox"/> Data2	Number
<input type="checkbox"/> Data3	Number
<input checked="" type="checkbox"/> Data4	Number
<input type="checkbox"/> Data5	Number
<input type="checkbox"/> Data6	Number
<input type="checkbox"/> Data7	Number
<input type="checkbox"/> Data8	Number

Section list					
No. ↑	Start	End	Section le...	Out	
<input checked="" type="checkbox"/> 1	1	100	100	<input type="checkbox"/>	
<input type="checkbox"/> 2	101	200	100	<input type="checkbox"/>	
<input checked="" type="checkbox"/> 3	201	300	100	<input type="checkbox"/>	
<input type="checkbox"/> 4	301	400	100	<input type="checkbox"/>	
<input checked="" type="checkbox"/> 5	401	500	100	<input type="checkbox"/>	
<input type="checkbox"/> 6	501	600	100	<input type="checkbox"/>	

Displayed items

Item	Description
Variable list	—
	Explanatory variables in target data are listed. Select the checkbox of a variable to be displayed on a graph. (Up to 10 types)
	 (Expand)/ — (Collapse)
	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
	Variable name
	A variable name is displayed.
	Variable type
	A variable type is displayed.  Page 85 Variable types

Item	Description
Section list	<p>—</p> <p>Input sections are listed by default. After sub-section forming, sections formed according to conditions are listed. Select the checkbox of a section to be displayed on a graph.</p>
☰ (Menu)	<p>Output all sections</p> <p>To turn ON the switches in "Output" for all sections.</p>
🔍 (Expand) / — (Collapse)	<p>Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. 📖 Page 56 Expanding the header</p>
No.	<p>An input section number is displayed. Even when a section no longer exists after forming, the section is displayed as it is with zero length.</p>
Start	<p>Information on the start of a section is displayed.</p> <ul style="list-style-type: none"> • When the section is extracted by selecting "Record number" for "Time-series standard" in "Sub-section forming": Start record number • When the section is extracted by selecting a timestamp type variable for "Time-series standard" in "Sub-section forming": Value of the variable in the start record <p>📖 Page 294 Sub-section forming (start condition/end condition/forming condition) "-" is displayed for a section that no longer exists after forming.</p>
End	<p>Information on the end of a section is displayed.</p> <ul style="list-style-type: none"> • When the section is extracted by selecting "Record number" for "Time-series standard" in "Sub-section forming": End record number • When the section is extracted by selecting a timestamp type variable for "Time-series standard" in "Sub-section forming": Value of the variable in the end record <p>📖 Page 294 Sub-section forming (start condition/end condition/forming condition) "-" is displayed for a section that no longer exists after forming.</p>
Section length	<p>The number of records in a section is displayed.</p>
Output	<p>Turn the switch OFF to disable the output of a section. The checkbox is also unselected when turning this OFF. Disabling the output of all sections is not possible.</p>

■ Sub-section forming (start condition/end condition/forming condition)

Conditions to form each section can be set.

Sections are formed by setting start and end conditions.

Up to four conditions can be set each for the start and end conditions.

Save the conditions as settings of this block after checking that sections are formed as intended in a graph.

Window

Sub-section forming [?](#) Time-series standard
Record number ▼

Start condition

Condition convergence method
AND ▼ +

Condition	Setting	Delete
First record of section	...	

Position adjustment
 Change forming start position

Record

Bef... ▼

End condition

Condition convergence method
AND ▼ +

Condition	Setting	Delete
Last record of section	...	

Position adjustment
 Change forming end position

Record

Bef... ▼

Forming condition

Specify forming details
 Exclude the range that matches conditions and use the range that does not match conditions





Set invalid section

Minimum section length Record

Maximum section length Record

↓ SUB-SECTION FORMING

Displayed items

Item	Description
Time-series standard	Select information that becomes the time-series standard for data to form sub-sections from the options shown below. The x axis of the input waveform graph (time-series graph) and the graph after sub-section forming (time-series graph) is changed according to the selected option. <ul style="list-style-type: none"> • "Record number" • Timestamp type variable in target data
^ v (Enlarged display/Reduced display)	Click either of these to enlarge or reduce the display area of this setting.
Start condition End condition	Condition convergence method Select a method for combining conditions. <ul style="list-style-type: none"> • AND • OR
	+ (Add condition)*1 Click this to add a condition to form sub-sections. ( Page 296 Start condition,  Page 297 End condition)
	Condition A condition set in the condition settings is displayed.
	Setting Click the icon displayed in this column to set a condition. ( Page 296 Start condition,  Page 297 End condition)
	Delete Click the icon displayed in this column to delete a line.
	Position adjustment Turn this ON to enable to adjust the position of the start/end record after conditions are met. <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400, then select "Before" or "After." ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit, then select "Before" or "After." The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24
Forming condition	Specify forming details Turn this ON to exclude the range that meet conditions and use the range that does not meet the conditions.
	Set invalid section Turn this ON to enable to set a section not to be used ("Minimum section length" or "Maximum section length") among sections that meet conditions. <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400. ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24
[Sub-section forming] button	Click this to form sections based on the set conditions.

*1 Can be clicked when the number of conditions is less than its maximum number.

Precautions

■When changing an option for "Time-series standard"

The following settings return to the default:

- "Position adjustment" of "Start condition"/"End condition"
- "Forming condition"

In addition, all the set start and end conditions are deleted.

■When forming sub-sections

When the number of formed sections exceeds 1024, data of 1024 sections is displayed in the graph after sub-section forming and the section list.

The output of sections that are not displayed is enabled; therefore, they are output when learning.

■ Start condition

The following shows the screen for setting a start condition to form sub-sections.

Window

Displayed items

Item	Description
Judgment type	Select the type of a judgment condition. <ul style="list-style-type: none"> • Judge with the variable value used as a condition^{*1} • Judge at the first record of section
Judgment target variable ^{*2}	Select a variable to be judged. A variable can be selected from the variables other than timestamp type variables except for objective variables.
Operator/feature point ^{*2}	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> • Numerical value type variable: <, ≤, >, ≥, =, ≠, Maximum number, Minimum number • Category type variable: =, ≠, Changing point
Comparison target ^{*3}	Select a comparison target from the following options: <ul style="list-style-type: none"> • "Constant" • Variable with the same type as a variable selected for "Judgment target variable" except for objective variables^{*4}
Setting value ^{*5}	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> • Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) • Category type variable: All categories in the variable
Continuation condition ^{*5}	Turn the switch ON to specify a continuation condition. When a condition is specified, sub-section forming starts at the timing when a variable value satisfies the condition continuously for the set period. ^{*6} <ul style="list-style-type: none"> ■ When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400. ■ When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> • Second: 1 to 86400 • Minute: 1 to 60 • Hour: 1 to 24

*1 Cannot be selected when all the variables are of the timestamp type.

*2 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type."

*3 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type" and also selecting an option other than "Maximum value," "Minimum value," and "Changing point" for "Operator/feature point."

*4 Excluding a variable selected for "Judgment target variable"

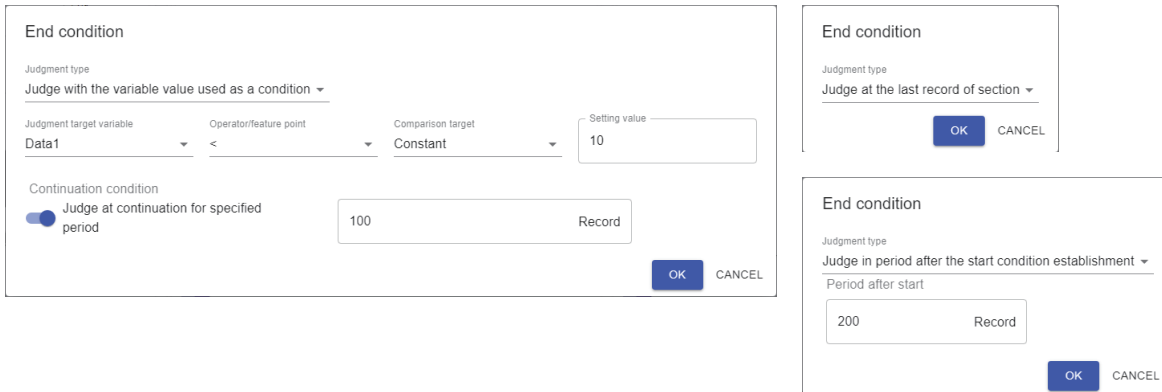
*5 Displayed when selecting "Constant" for "Comparison target."

*6 For example, if the condition is 'a≥1' and also the period set as a continuation condition is set to 30 records, the start condition is satisfied when the value of 'a' is larger than '1' for 30 records continuously.

■ End condition

The following shows the screen for setting an end condition to form sub-sections.

Window



Displayed items

Item	Description
Judgment type	Select the type of a judgment condition. <ul style="list-style-type: none"> Judge with the variable value used as a condition^{*1} Judge at the last record of section Judge in period after the start condition establishment
Judgment target variable ^{*2}	Select a variable to be judged. A variable can be selected from the variables other than timestamp type variables except for objective variables.
Operator/feature point ^{*2}	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> Numerical value type variable: <, ≤, >, ≥, ≠, Maximum number, Minimum number Category type variable: =, ≠, Changing point
Comparison target ^{*3}	Select a comparison target from the following options: <ul style="list-style-type: none"> "Constant" Variable with the same type as a variable selected for "Judgment target variable" except for objective variables^{*4}
Setting value ^{*5}	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." <ul style="list-style-type: none"> Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) Category type variable: All categories in the variable
Continuation condition ^{*5}	Turn the switch ON to specify a continuation condition. When a condition is specified, sub-section forming ends at the timing when a variable value satisfies the condition continuously for the set period. ^{*6} <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 1 to 86400. ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> Second: 1 to 86400 Minute: 1 to 60 Hour: 1 to 24
Period after start ^{*7}	Set a period after start. <ul style="list-style-type: none"> ■When selecting "Record number" for "Time-series standard" Set a record in a range of 2 to 86400. ■When selecting a timestamp type variable for "Time-series standard" Set a numerical value and a unit. The available numerical value range differs depending on the unit as follows: <ul style="list-style-type: none"> Second: 2 to 86400 Minute: 2 to 60 Hour: 2 to 24

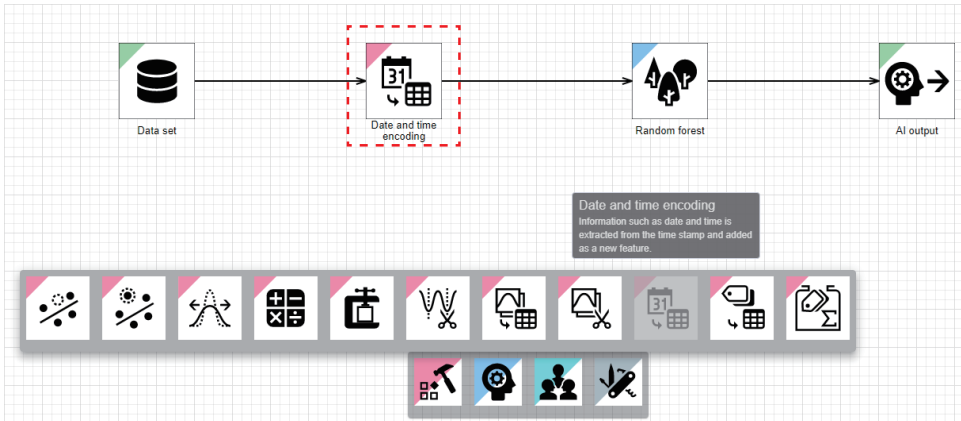
- *1 Cannot be selected when all the variables are of the timestamp type.
- *2 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type."
- *3 Displayed when selecting "Judge with the variable value used as a condition" for "Judgment type" and also selecting an option other than "Maximum value," "Minimum value," and "Changing point" for "Operator/feature point."
- *4 Excluding a variable selected for "Judgment target variable"
- *5 Displayed when selecting "Constant" for "Comparison target."
- *6 For example, if the condition is ' $a \geq 1$ ' and also the period set as a continuation condition is set to 30 records, the end condition is satisfied when the value of 'a' is larger than '1' for 30 records continuously.
- *7 Displayed when selecting "Judge in period after the start condition establishment" for "Judgment type."

Date and time encoding block

A date and time encoding block preprocesses a timestamp type variable by being placed between a data set block and a block of the analysis method category.

Information such as year and date is extracted from a variable of date and time information included in data, and added as new features.

For example, accuracy may be improved by adding the following information as features: time information in the case where the operating status of devices is different in the morning and at night, day-of-the-week information in the case where it is better to distinguish weekends from weekdays, etc.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of input variables + number of added variables Type of each variable: Numerical value for an added variable, same as the type of an input variable for others 	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of variables for learning Type of each variable: Same as the variable type for learning

Operational specifications

Date and time information of a selected timestamp type variable is extracted by a specified conversion method.

Ex.

When selecting "Year," "Day," and "Day of week" in value conversion

Date and time	DT_year	DT_day	DT_dow
2022/1/24 12:34:56	2022	24	0
2022/1/24 14:34:56	2022	24	0
2022/1/24 16:34:56	2022	24	0
2022/1/24 18:34:56	2022	24	0
2022/1/24 20:34:56	2022	24	0
2022/1/24 22:34:56	2022	24	0
2022/1/25 00:34:56	2022	25	1
2022/1/25 02:34:56	2022	25	1
2022/1/25 04:34:56	2022	25	1

Date and time encoding

When selecting "Day" and "Hour" in sin/cos conversion

Date and time	DT_day_sin	DT_day_cos	DT_hour_sin	DT_hour_cos
2022/1/24 12:34:56	-0.9884938868	0.1512608202	0	-1
2022/1/24 14:34:56	-0.9884938868	0.1512608202	-0.5	-0.8660254038
2022/1/24 16:34:56	-0.9884938868	0.1512608202	-0.8660254038	-0.5
2022/1/24 18:34:56	-0.9884938868	0.1512608202	-1	0
2022/1/24 20:34:56	-0.9884938868	0.1512608202	-0.8660254038	-0.5
2022/1/24 22:34:56	-0.9884938868	0.1512608202	-0.5	0.8660254038
2022/1/25 00:34:56	-0.9377556517	0.3472957495	0	1
2022/1/25 02:34:56	-0.9377556517	0.3472957495	0.5	0.8660254038
2022/1/25 04:34:56	-0.9377556517	0.3472957495	0.8660254038	0.5

Date and time encoding

■ Feature of each conversion method

Conversion method	Feature
Value conversion	Time information is handled as it is as a value; therefore the values can be intuitive to use. However, they are converted as the numbers furthest apart. For example, December and January which are close in time are converted into '12' and '1.' In addition, for days of the week, Monday to Sunday are converted into numerical values of '0' to '6.'
sin/cos conversion	Time information can be converted into values showing that December and January are close by considering the periodicity. However, two variables are required for converting each variable. In addition, sin/cos conversion is not performed for days of the week because they have a periodicity but each of them shows a different tendency.

■ Processing of each conversion method

Conversion method	Processing	Processing (When a variable to be converted is a missing value)
Value conversion	Date and time information is extracted directly as the numerical value type, and it is added as a new feature.	A missing value remains after conversion.
sin/cos conversion	sin/cos conversion is performed with the following expressions, where 'x _t ' represents a value for the data number 't' and 'T' represents a cycle, then new features are added. $x_t^{sin} = \sin(2\pi x_t/T)$ $x_t^{cos} = \cos(2\pi x_t/T)$ This is to add features that consider a periodicity of data and time information. For a cycle 'T,' the following values are set for each unit of date and time information: Month: T = 12, day: T = 31, hour: T = 24, minute/second: T = 60	A missing value remains after conversion.

■Date and time types to be extracted and naming rule of each conversion method

Conversion method	Date and time type to be extracted	Naming rule
Value conversion	Year	(Target variable name)_year
	Month	(Target variable name)_month
	Day	(Target variable name)_day
	Hour	(Target variable name)_hour
	Minute	(Target variable name)_minute
	Second	(Target variable name)_second
	Day of week	(Target variable name)_dow ^{*1}
sin/cos conversion	Month	<ul style="list-style-type: none"> • (Target variable name)_month_sin • (Target variable name)_month_cos
	Day	<ul style="list-style-type: none"> • (Target variable name)_day_sin • (Target variable name)_day_cos
	Hour	<ul style="list-style-type: none"> • (Target variable name)_hour_sin • (Target variable name)_hour_cos
	Minute	<ul style="list-style-type: none"> • (Target variable name)_minute_sin • (Target variable name)_minute_cos
	Second	<ul style="list-style-type: none"> • (Target variable name)_second_sin • (Target variable name)_second_cos

*1 dow: day of week

If a suffixed variable name is duplicate with an existing variable, the name will be suffixed with '_001.' (The number will be incremented if the name is still duplicate.)

If a suffixed variable name has more than 255 characters, characters in the variable name, which is before '_001,' will be deleted in order from the end to fit within 255 characters in total.

Date and time encoding screen

The following shows the screen for displaying the list of added date and time encoding settings.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Variable name	Conversion target	Setting	Delete
Timestamp	Year, Month, Day, Hour, Minut...	...	

Displayed items

Item	Description
(Add)	Click this to add a date and time encoding setting. (Page 303 Settings)
Variable name	The name of a variable is displayed.
Conversion target	A date and time type to be extracted is displayed. (Page 301 Date and time types to be extracted and naming rule of each conversion method)
Setting	Click the icon displayed in this column to change settings for date and time encoding. (Page 303 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for setting a target variable of date and time encoding, a date and time type to be extracted, and a conversion method.

Window

Type	Conversion method
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion
<input checked="" type="checkbox"/>	Value conversion

Displayed items

Item	Description
Variable name	Select a variable to be processed. A timestamp type variable can be selected among the variables in an input data frame.
Type	Set the type of date and time to be extracted. For available types, refer to the following: ☞ Page 301 Date and time types to be extracted and naming rule of each conversion method
Conversion method	Select a conversion method. (☞ Page 300 Feature of each conversion method) Available methods differ depending on the date and time type. ☞ Page 301 Date and time types to be extracted and naming rule of each conversion method

Point

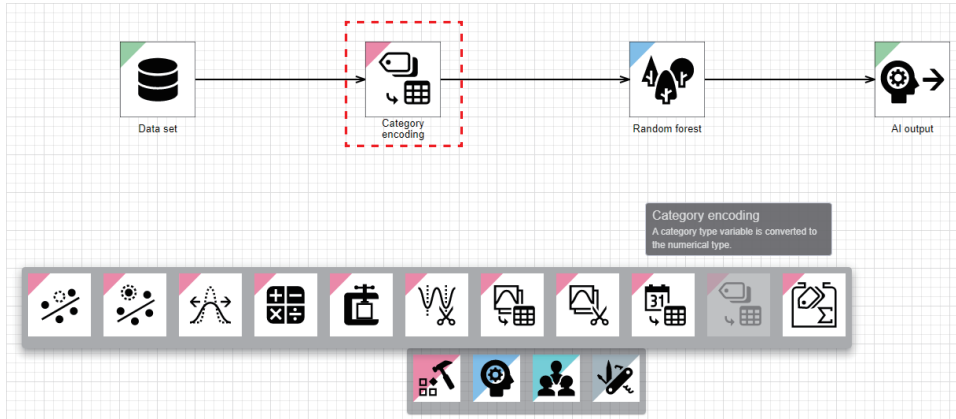
When selecting and setting a variable in which a date and time encoding has already been set, the old setting will be deleted when adding a new setting.

☞ Page 302 Date and time encoding screen

Category encoding block

A category encoding block preprocesses a category type variable by being placed between a data set block and a block of the analysis method category.

A category type variable in data is converted into a numerical value type variable that can be used by an analysis method. For example, information such as on a manufacturing material can be used to learn an analysis method by converting the information from character strings to numerical values.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of input variables + number of added variables^{*1} Type of each variable: Numerical value for an added variable, same as the type of an input variable for others 	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of variables for learning Type of each variable: Same as the variable type for learning

*1 Differs depending on the conversion method.

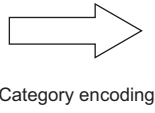
Page 305 Operational specifications

Operational specifications

A selected category type variable is converted into a numerical value type variable by a specified conversion method. However, the converted category type variable will be deleted and not output.

Ex.

Product	Product_enc
Arm	0
Body	1
Door	3
Arm	0
Arm	0
Cube	2
Body	1
Cube	2
Arm	0



Feature of each conversion method

Conversion method	Feature
One-hot encoding	The most common conversion method that creates a binary variable (dummy variable), which takes '0' or '1,' to indicate whether a certain level is present for each level. A binary variable can represent not the magnitude of a value but the absence/presence with 0 or 1. However, the number of variables with little information becomes large as the number of levels becomes large. In this case, negative effects such as increases in calculation time and required memory appear.
Target encoding	A method that converts a category type variable by using information of an objective variable. Information of the objective variable on each level can be included; therefore, an effective feature may be acquired. However, note that learning data may be over-learned when the number of levels is large or when data amount is small.
Label encoding	A simple conversion method that assigns a numerical value to each level. The number of variables does not change after conversion; therefore, this is the most standard method when using a decision tree analysis method. However, a numerical value has no meaning in its magnitude because it is simply assigned in order. In methods other than decision tree analysis methods, an incorrect learning result may be acquired. For example, 'category B ('1' is assigned after conversion) is larger than category A ('0' is assigned after conversion).'
Count encoding	A conversion method that counts the number of appearances of each level and converts the number into an appearance frequency by dividing the number by the number of appearances of all levels. As in label encoding, the number of variables does not change after conversion. This method can give a converted numerical value itself the meaning of 'appearance frequency.'

Processing of each conversion method

- One-hot encoding

When learning	When executing a task																																																		
<p>A dummy variable indicating each level is added, and it is converted into the following numerical values:</p> <ul style="list-style-type: none"> • Absence: 0 • Presence: 1 <p>When the number of levels is less than the specified number of variables after conversion, '0' is set for the remaining dummy variables.</p> <p>When the number of levels is more than the specified number of variables after conversion, dummy variables for levels are converted for 'number of variables after conversion - 1' in descending order of the number of records, then all the remaining levels are aggregated into one dummy variable.</p>	<p>Same as when learning</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Product_1</th> <th>Product_2</th> <th>Product_3</th> <th>Product_4</th> </tr> </thead> <tbody> <tr><td>Door</td><td>0</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>Cube</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>Body</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>Arm</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Edge</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </tbody> </table>	Product	Product_1	Product_2	Product_3	Product_4	Door	0	0	1	0	Cube	0	0	0	1	Body	0	1	0	0	Arm	1	0	0	0	Edge	0	0	0	0																				
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Product	Product_1	Product_2	Product_3	Product_4																																															
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Cube	0	0	0	1																																															
Body	0	1	0	0																																															
Cube	0	0	0	1																																															
Arm	1	0	0	0																																															

- Target encoding (regression) (when an objective variable is of the numerical value type)

When learning				When executing a task																																																				
An average value is calculated for the objective variable of a record including each level, and the variable is converted into the average value.				An objective variable of each level is converted into its average value calculated when learning.																																																				
<table border="1"> <thead> <tr><th>Product</th><th>Target</th></tr> </thead> <tbody> <tr><td>Arm</td><td>100</td></tr> <tr><td>Body</td><td>50</td></tr> <tr><td>Door</td><td>70</td></tr> <tr><td>Arm</td><td>110</td></tr> <tr><td>Arm</td><td>80</td></tr> <tr><td>Cube</td><td>150</td></tr> <tr><td>Body</td><td>60</td></tr> <tr><td>Cube</td><td>120</td></tr> <tr><td>Arm</td><td>50</td></tr> </tbody> </table>	Product	Target	Arm	100	Body	50	Door	70	Arm	110	Arm	80	Cube	150	Body	60	Cube	120	Arm	50	→	<table border="1"> <thead> <tr><th>Product_enc</th><th>Target</th></tr> </thead> <tbody> <tr><td>85</td><td>100</td></tr> <tr><td>55</td><td>50</td></tr> <tr><td>70</td><td>70</td></tr> <tr><td>85</td><td>110</td></tr> <tr><td>85</td><td>80</td></tr> <tr><td>135</td><td>150</td></tr> <tr><td>55</td><td>60</td></tr> <tr><td>135</td><td>120</td></tr> <tr><td>85</td><td>50</td></tr> </tbody> </table>	Product_enc	Target	85	100	55	50	70	70	85	110	85	80	135	150	55	60	135	120	85	50	→	<table border="1"> <thead> <tr><th>Product</th><th>Product_enc</th></tr> </thead> <tbody> <tr><td>Door</td><td>70</td></tr> <tr><td>Cube</td><td>135</td></tr> <tr><td>Body</td><td>55</td></tr> <tr><td>Arm</td><td>85</td></tr> <tr><td>Edge</td><td>87.78</td></tr> </tbody> </table>	Product	Product_enc	Door	70	Cube	135	Body	55	Arm	85	Edge	87.78
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- Target encoding (classification) (when an objective variable is of the category type)

When learning					When executing a task																																																																																					
A variable is added for each level of an objective variable, and it is converted into a value indicating the rate occupied by each target level (appearance frequency).					Same as when learning																																																																																					
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0.50	0.50	0	Factor 2																																																																																							
0.25	0.50	0.25	Factor 1																																																																																							
Product	Product_1	Product_2	Product_3																																																																																							
Door	0	0	1.00																																																																																							
Cube	0.50	0.50	0																																																																																							
Body	0.50	0	0.50																																																																																							
Arm	0.25	0.50	0.25																																																																																							
Edge	0.33	0.33	0.33																																																																																							
<p>(1) Rate occupied by each level of 'Product' in factor 1.</p> <ul style="list-style-type: none"> • Arm: 1 record/4 records (25%) • Body: 1 record/2 records (50%) • Cube: 1 record/2 records (50%) • Door: 0 records/1 record (0%) <p>(2) Rate occupied by each level of 'Product' in factor 2.</p> <ul style="list-style-type: none"> • Arm: 2 records/4 records (50%) • Body: 0 records/2 records (0%) • Cube: 1 record/2 records (50%) • Door: 0 records/1 record (0%) <p>(3) Rate occupied by each level of 'Product' in factor 3.</p> <ul style="list-style-type: none"> • Arm: 1 record/4 records (25%) • Body: 1 record/2 records (50%) • Cube: 0 records/2 records (0%) • Door: 1 record/1 record (100%) 																																																																																										

• Label encoding

When learning	When executing a task																																
<p>Each level is converted by assigning an integer value in order from '1.'</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Product_enc</th> </tr> </thead> <tbody> <tr><td>Arm</td><td>1</td></tr> <tr><td>Body</td><td>2</td></tr> <tr><td>Door</td><td>3</td></tr> <tr><td>Arm</td><td>1</td></tr> <tr><td>Arm</td><td>1</td></tr> <tr><td>Cube</td><td>4</td></tr> <tr><td>Body</td><td>2</td></tr> <tr><td>Cube</td><td>4</td></tr> <tr><td>Arm</td><td>1</td></tr> </tbody> </table>	Product	Product_enc	Arm	1	Body	2	Door	3	Arm	1	Arm	1	Cube	4	Body	2	Cube	4	Arm	1	<p>Each level is converted into an integer value assigned when learning.</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Product_enc</th> </tr> </thead> <tbody> <tr><td>Door</td><td>3</td></tr> <tr><td>Cube</td><td>4</td></tr> <tr><td>Body</td><td>2</td></tr> <tr><td>Arm</td><td>1</td></tr> <tr><td>Edge</td><td>-1</td></tr> </tbody> </table>	Product	Product_enc	Door	3	Cube	4	Body	2	Arm	1	Edge	-1
Product	Product_enc																																
Arm	1																																
Body	2																																
Door	3																																
Arm	1																																
Arm	1																																
Cube	4																																
Body	2																																
Cube	4																																
Arm	1																																
Product	Product_enc																																
Door	3																																
Cube	4																																
Body	2																																
Arm	1																																
Edge	-1																																

• Count encoding

When learning	When executing a task																																
<p>The number of records including each level is counted, and it is converted into the occupation rate (appearance frequency) by dividing the number by the number of appearances of all levels.</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Product_enc</th> </tr> </thead> <tbody> <tr><td>Arm</td><td>0.44</td></tr> <tr><td>Body</td><td>0.22</td></tr> <tr><td>Door</td><td>0.12</td></tr> <tr><td>Arm</td><td>0.44</td></tr> <tr><td>Arm</td><td>0.44</td></tr> <tr><td>Cube</td><td>0.22</td></tr> <tr><td>Body</td><td>0.22</td></tr> <tr><td>Cube</td><td>0.22</td></tr> <tr><td>Arm</td><td>0.44</td></tr> </tbody> </table>	Product	Product_enc	Arm	0.44	Body	0.22	Door	0.12	Arm	0.44	Arm	0.44	Cube	0.22	Body	0.22	Cube	0.22	Arm	0.44	<p>Each level is converted into a value indicating its rate calculated when learning.</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Product_enc</th> </tr> </thead> <tbody> <tr><td>Door</td><td>0.12</td></tr> <tr><td>Cube</td><td>0.22</td></tr> <tr><td>Body</td><td>0.22</td></tr> <tr><td>Arm</td><td>0.44</td></tr> <tr><td>Edge</td><td>0</td></tr> </tbody> </table>	Product	Product_enc	Door	0.12	Cube	0.22	Body	0.22	Arm	0.44	Edge	0
Product	Product_enc																																
Arm	0.44																																
Body	0.22																																
Door	0.12																																
Arm	0.44																																
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Door	0.12																																
Cube	0.22																																
Body	0.22																																
Arm	0.44																																
Edge	0																																

■ Processing of each conversion method (under specific conditions)

Conversion method	Processing			
	When a variable to be converted is a missing value	When learning (When an objective variable includes a missing value, 'inf,' or '-inf')	When learning (When a level of a variable to be converted has only one record)	When executing a task (When a level that did not exist when learning exists)
One-hot encoding	All dummy variables are converted into 'absence: 0.'	—	—	All dummy variables are converted into 'absence: 0.'
Target encoding (regression)	The missing value is converted into the average value of all objective variables.	The missing value, 'inf,' and '-inf' are not included when calculating an average value. If only these values exist, they are converted into missing values.	The level is converted into the average value of all objective variables.	The level is converted into the average value of all objective variables.
Target encoding (classification)	The missing value is treated as one of the levels.	—	Each level of an objective variable is converted into the average value of all.	Each level of an objective variable is converted into the average value of all.
Label encoding		—	—	<ul style="list-style-type: none"> • When the level that did not exist when learning is not a missing value: It is converted into '-1.' • When the level that did not exist when learning is a missing value: It is converted into '-2.'
Count encoding		—	—	The level is converted into '0.'

■ Naming rule after conversion

Conversion method	Naming rule
One-hot encoding	(Target variable name)_1, (target variable name)_2, (target variable name)_3, ... Variables are created for the specified number of variables after conversion.
Target encoding (regression)	(Target variable name)_enc
Target encoding (classification)	(Target variable name)_1, (target variable name)_2, (target variable name)_3, ... Variables are created for the specified number of variables after conversion.
Label encoding	(Target variable name)_enc
Count encoding	(Target variable name)_enc

If a suffixed variable name is duplicate with an existing variable, the name will be suffixed with '_001.' (The number will be incremented if the name is still duplicate.)

If a suffixed variable name has more than 255 characters, characters in the variable name, which is before '_001,' will be deleted in order from the end to fit within 255 characters in total.

Category encoding screen

The following shows the screen for displaying the list of added category encoding settings.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Variable name	Conversion method	Setting	Delete
ID	One-hot encoding	...	

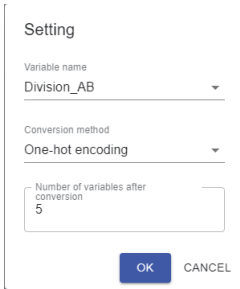
Displayed items

Item	Description
(Add)	Click this to add a category encoding setting. (Page 310 Settings)
Variable name	The name of a variable is displayed.
Conversion method	A conversion method of category encoding is displayed. (Page 305 Feature of each conversion method)
Setting	Click the icon displayed in this column to change settings for category encoding. (Page 310 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for setting a target variable for category encoding and a conversion method.

Window



Setting

Variable name
Division_AB

Conversion method
One-hot encoding

Number of variables after conversion
5

OK CANCEL

Displayed items

Item	Description
Variable name	Select a variable to be processed. A variable can be selected from the category type variables in the input data frame except for objective variables.
Conversion method	Select a conversion method. (📖 Page 305 Feature of each conversion method)
Number of variables after conversion	Set the number of variables after conversion (2 to 100) in the following cases: <ul style="list-style-type: none">• When "One-hot encoding" is selected for "Conversion method"• When "Target encoding" is selected for "Conversion method" and an objective variable is of the category type.

Point

When selecting and setting a variable in which a category encoding has already been set, a old setting will be deleted when adding a new setting.

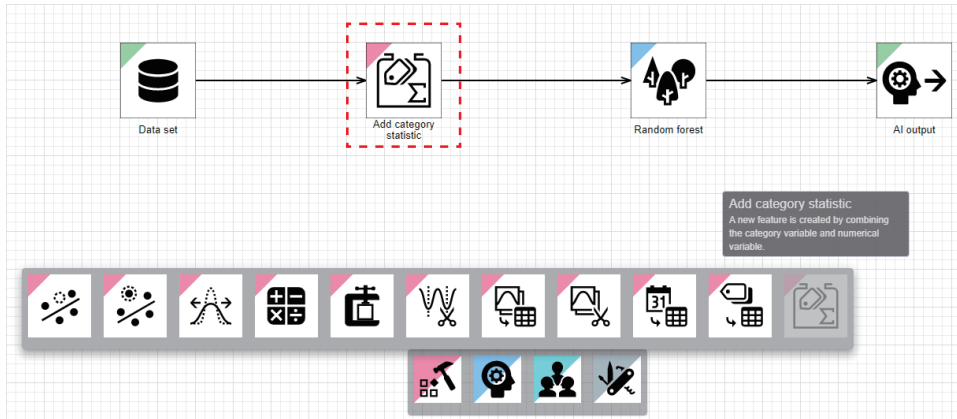
📖 Page 309 Category encoding screen

Add category statistic block

An add category statistic block adds a new variable by being placed between a data set block and a block of the analysis method category.

A statistic of a numerical value type variable is calculated for each level of a category type variable and added as a new variable.

Improvement in accuracy can be expected by adding data with different tendencies as features for each category level.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of input variables + number of added variables Type of each variable: Numerical value for an added variable, same as the type of an input variable for others 	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of variables for learning Type of each variable: Same as the variable type for learning

Operational specifications

Specified statistics of selected category and numerical value type variables are calculated and added as new variables.

Ex.

When selecting "Maximum value" and "Standard deviation"

Area	Amount		
Aichi	100		
Brazil	1100		
Dominica	23		
Aichi	90		
Aichi	130		
Cuba	400		
Brazil	1200		
Cuba	350		
Aichi	110		

➔ Adding category features

Area	Amount	Area_Amount_max	Area_Amount_std
Aichi	100	130	16.99
Brazil	1100	1200	50
Dominica	23	23	0
Aichi	90	130	16.99
Aichi	130	130	16.99
Cuba	400	400	25
Brazil	1200	1200	50
Cuba	350	400	25
Aichi	110	130	16.99

■ Processing of each statistic

Statistic	Processing	
	When learning	When executing a task
Average value	The average value of each level is calculated and added as a new variable.	The average value of target numerical value variables of each level calculated when learning is added.
Standard deviation	The standard deviation of each level is calculated and added as a new variable.	The standard deviation of target numerical value variables of each level calculated when learning is added.
Minimum value	The minimum value of each level is added as a new variable.	The minimum value of target numerical value variables of each level calculated when learning is added.
Median	The median of each level is calculated and added as a new variable.	The median of target numerical value variables of each level calculated when learning is added.
Maximum value	The maximum value of each variable is added as a new variable.	The maximum value of target numerical value variables of each level calculated when learning is added.

■ Processing of each statistic (under specific conditions)

Statistic	Processing		
	When a category variable to be converted includes a missing value	When learning (When a numerical value variable to calculate a statistic includes a missing value, 'inf,' or '-inf')	When executing a task (When a level that did not exist when learning exists)
Average value	The missing value is treated as one of the levels.	The missing value, 'inf,' and '-inf' are not included in calculation. If only these values exist, they are converted into missing values.	The level is converted into the average value of all the target numerical value variables.
Standard deviation			The level is converted into the standard deviation of all the target numerical value variables.
Minimum value			The level is converted into the minimum value of all the target numerical value variables.
Median			The level is converted into the median of all the target numerical value variables.
Maximum value			The level is converted into the maximum value of all the target numerical value variables.

■ Naming rule after conversion

Statistic	Naming rule
Average value	(Target category variable name)_(target numerical value variable name)_mean
Standard deviation	(Target category variable name)_(target numerical value variable name)_std
Minimum value	(Target category variable name)_(target numerical value variable name)_min
Median	(Target category variable name)_(target numerical value variable name)_med
Maximum value	(Target category variable name)_(target numerical value variable name)_max

If a suffixed variable name is duplicate with an existing variable, the name will be suffixed with '_001.' (The number will be incremented if the name is still duplicate.)

If a suffixed variable name has more than 255 characters, characters in the variable name, which is before '_001,' will be deleted in order from the end to fit within 255 characters in total.

Add category statistic screen

The following shows the screen for displaying the list of added category statistic addition settings.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Category variabl...	Numerical variable ...	Statistic	Setting	Delete
ID	Data2	Average value, Standa...	...	

Displayed items

Item	Description
(Add)	Click this to add a category statistic. (Page 315 Settings)
Category variable name	The name of a category variable is displayed.
Numerical variable name	The name of a numerical value variable is displayed.
Statistic	A statistic type is displayed. (Page 312 Processing of each statistic)
Setting	Click the icon displayed in this column to change settings for adding a category statistic. (Page 315 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for combining a category type variable and numerical value type variable and setting the type of a statistic to be calculated by using the combination.

Window

Setting

Category variable name
Division_AB

Numerical variable name
Day

Type

Average value

Standard deviation

Maximum value

Median

Minimum value

Displayed items

Item	Description
Category variable name	Select a category type variable to be processed. A variable can be selected from the category type variables in the input data frame except for objective variables.
Numerical variable name	Select a numerical value type variable to be processed. A numerical value type variable can be selected among the variables in an input data frame.
Type	Select the checkbox of a statistic type to be used. (☞ Page 312 Processing of each statistic)

Point

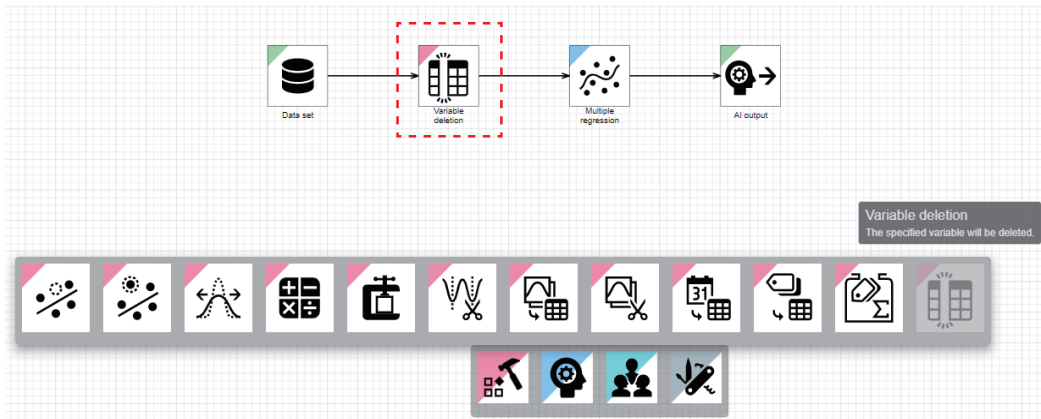
If a setting for the combination of selected category and numerical value type variables is already in the list, the old setting will be deleted when adding a new setting for the combination.

☞ Page 314 Add category statistic screen

Variable deletion block

A variable deletion block deletes specified explanatory variables from a data frame. An AI can analyze data and unnecessary variables can be specified automatically. In particular, use this block to delete the following variables:

- Variables that are used for processing a data set but not for learning
- Variables that are not useful for learning such as IDs assigned to records in order
- Either variable from the combination of variables with correlation coefficient '1' or '-1'



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> • Number of records: Integer between 1 and 864000 • Number of variables: Integer between 1 and 512 • Type of each variable: Any types 	<ul style="list-style-type: none"> • Number of records: Integer between 1 and 86400 • Number of variables: Same as the number of input variables used for learning • Type of each variable: Same as the type of an input variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> • Number of records: Same as the number of input records • Number of variables: Number of input variables - number of deleted variables • Type of each variable: Same as the input variable type 	<ul style="list-style-type: none"> • Number of records: Same as the number of input records • Number of variables: Same as the number of variables for learning • Type of each variable: Same as the variable type for learning

Operational specifications

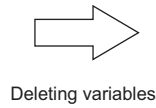
Explanatory variables for which the "Delete / hold" switch is turned OFF in the variable deletion screen are deleted, and a data frame is output. (☞ Page 318 Variable deletion screen)

Explanatory variables of all types can be processed.

Ex.

When not outputting 'Equipment No.,' 'Inspected part,' and 'Measurement date and time'

Equipment No.	Inspected part	Measurement date and time	Measured value	Temperature
4	Resin disk	2021-06-01T01:47:00	1.17	22
4	Resin disk	2021-06-01T01:48:00	1.24	22
1	Resin disk	2021-06-01T01:50:00	1.67	22
1	Resin disk	2021-06-01T01:53:00	1.6	22
3	Resin disk	2021-06-01T13:11:00	1.24	22
3	Resin disk	2021-06-01T13:12:00	1.11	22
3	Resin disk	2021-06-01T13:12:00	1.3	22



Measured value	Temperature
1.17	22
1.24	22
1.67	22
1.6	22
1.24	22
1.11	22
1.3	22

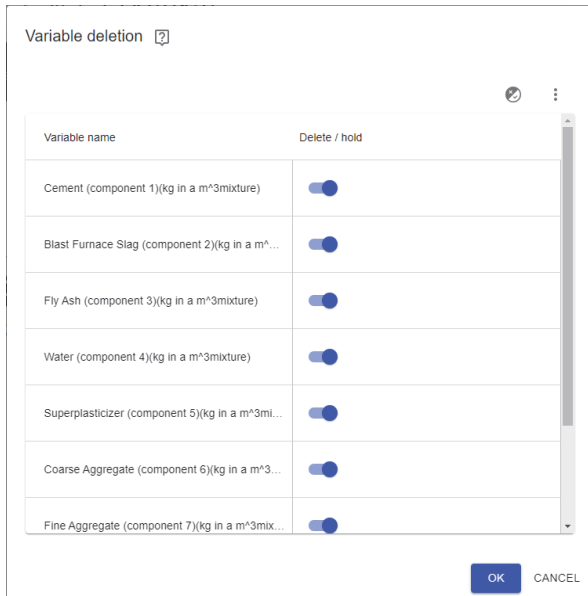
Variable deletion screen

The following shows the screen for selecting whether to hold or delete each explanatory variable included in the input.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description	
(Variable auto selection)	<p>Click this to automatically set the ON/OFF status in the "Delete / hold" column. When a variable does not satisfy the deletion conditions shown below, the switch in the "Delete / hold" column is turned ON. Depending on the value of each variable, all the switches in the "Delete / hold" column may be turned ON or OFF. Page 318 Deletion conditions (Cancel variable auto selection) is displayed while processing. By clicking this icon, automatic selection can be canceled. After the processing, the "Variable auto selection result" screen is displayed. Page 319 Variable auto selection result</p>	
(Menu)	Hold all	To turn ON the switches in the "Delete / hold" column for all variables.
	Delete all	To turn OFF the switches in the "Delete / hold" column for all variables.
Variable name	The name of a variable output from the previous block is displayed. However, the variable selected as the objective variable in a data set block is not displayed.	
Delete / hold	Turn this ON to hold a target variable.	

Precautions

- During variable auto selection, the settings cannot be changed.
- When the absolute value of the target record is large (the number of digits is large) while performing variable auto selection for a numerical value type variable, the selection may not be performed according to the deletion conditions shown below due to a cause such as rounding values in each record.

■ Deletion conditions

The following shows the deletion conditions and variable types to be deleted according to each condition.

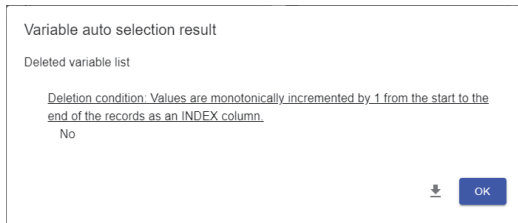
Condition	Variable type
Variables that have the same value	Numerical value Category
Variables that indicate 'INDEX' of data	Numerical value

Condition	Variable type
Variables that can be substituted by another variable	Numerical value
Category variables that have various kinds of values	Category
Variables that are not related to the objective variables statistically	Numerical value

Variable auto selection result

The result of variable auto selection is displayed.

Window



Displayed items

Item	Description
Deleted variable list	The deletion conditions and the variables to be deleted according to each condition are listed.
(Download variable auto selection result)	Click this to output the results of variable auto selection as a CSV file (delimiter: comma). The CSV file is output by the download function of a web browser.

CSV file to be output

Item	Description	Remarks
File name	(AI name)_variable_auto_selection_result.csv	Windows has a limit of the path length; therefore, a file name is shortened by a web browser. In addition, when a shortened file name is duplicate, the name is also changed according to the specifications of the web browser function.
Character code	UTF-8 (with BOM).	—
Output contents	The result of variable auto selection is output for each variable.	All the variables except for the objective variables included in the input of the variable deletion block are output. (The variables are output in the order displayed when right-clicking the previous block to this block then selecting [Display preview].)

The following shows the description of each column.

Column	Header name	Description
First column	Variable name	The name of the variable
Second column	Deletion target	<ul style="list-style-type: none"> Deletion target: 1 Not deletion target: 0
Third column	p-value	<p>A p-value is output only for a numerical value type.</p> <p>"-" is output in any of the following cases because the Kruskal-Wallis test cannot be performed:</p> <ul style="list-style-type: none"> All the records have the same value. Records cannot be divided into four groups. A variable is of the category type.
Fourth column	Deletion condition	<ul style="list-style-type: none"> Deletion target: Deletion condition Not deletion target: "-"

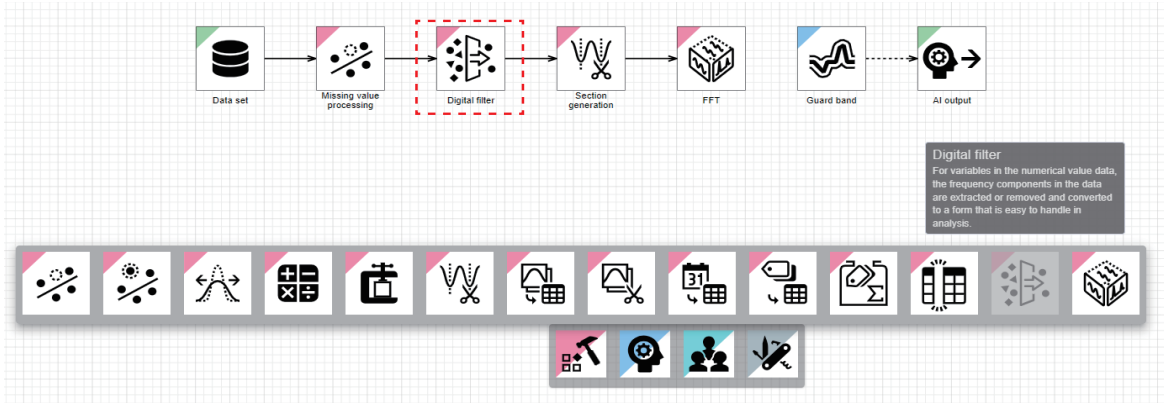
Ex.

```
Variable name,Deletion target,p-value,Deletion condition
No,1,-,Deletion condition: Values are monotonically incremented by 1 from the start to the end of the records as an INDEX column.
date-time,0,-,-
pm2.5,0,-,-
DEWP,0,-,-
TEMP,0,-,-
PRES,0,-,-
cbwd,0,-,-
lws,0,-,-
ls,0,-,-
lr,0,-,-
ws,0,-,-
```

Digital filter block

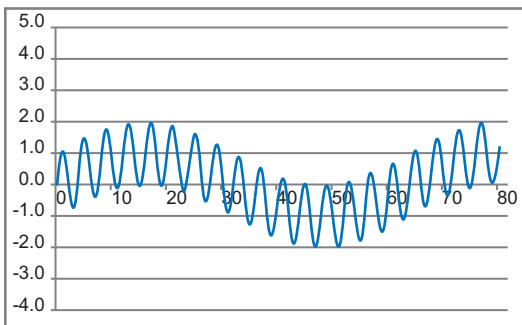
A digital filter block extracts or removes the specified frequency components from the waveform data including the data other than the frequency to be focused on. Data can be created with reduced noise effect.

This block preprocesses a numerical value type variable by being placed between a data set block and a block of the analysis method category.

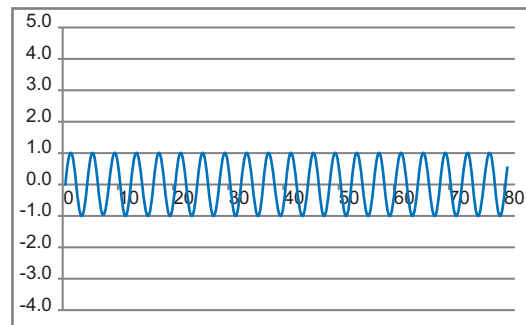


The following shows the operating procedure.

- ❶ Specify the frequency components to be focused on from a catalog of a sensor and others.
- ❷ Determine how to handle the frequency components not to be focused on. (In the following diagrams, low frequency components are attenuated.)



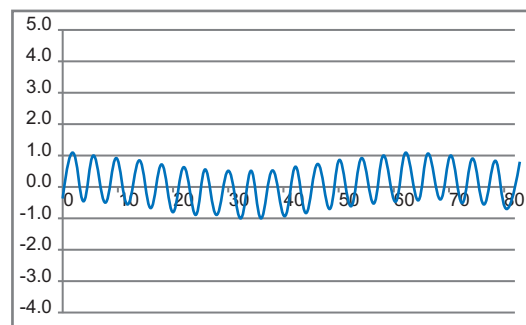
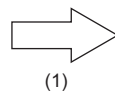
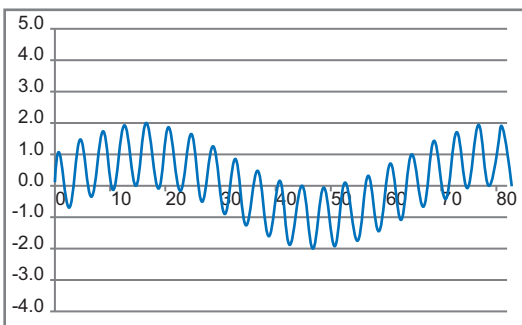
(1)



(2)

- (1) Waveform data in which multiple frequencies exist
 (2) Waveform data of the frequency to be focused on

- ❸ Filter input waveform according to how to handle the frequency components. (In the following diagrams, the frequency components are filtered with high-pass for attenuating the low frequency components.)



- (1) Eliminating the low frequency components with high-pass

- ❹ Use filtered data for analysis.

Input/output specifications

Input

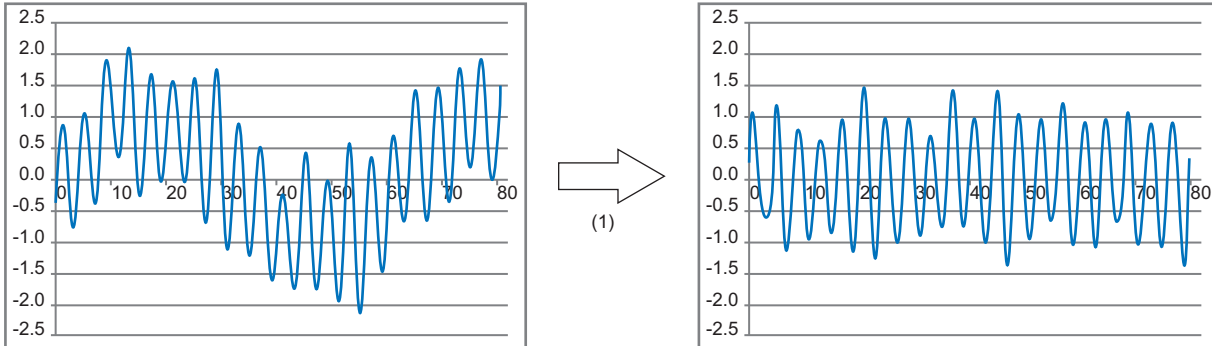
Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 2 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 512 Type of each variable: Any types

Output

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of input variables Type of each variable: Same as the input variable type 	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Same as the number of input variables used for learning Type of each variable: Same as the type of an input variable used for learning

Operational specifications

Specified digital filter processing is performed for the input waveform, and waveform data to be focused on is extracted. When a missing value exists in the input data, the processing cannot be performed. (When a missing value is included in the input data, a waveform cannot be recognized properly; therefore, if there is a possibility that a missing value is included in the input data, interpolate the missing value by using a missing value processing block in advance.)



(1) Elimination of a specific frequency

■ Digital filter processing method

The following table shows the processing of when filtering input waveform by each digital filter processing method.

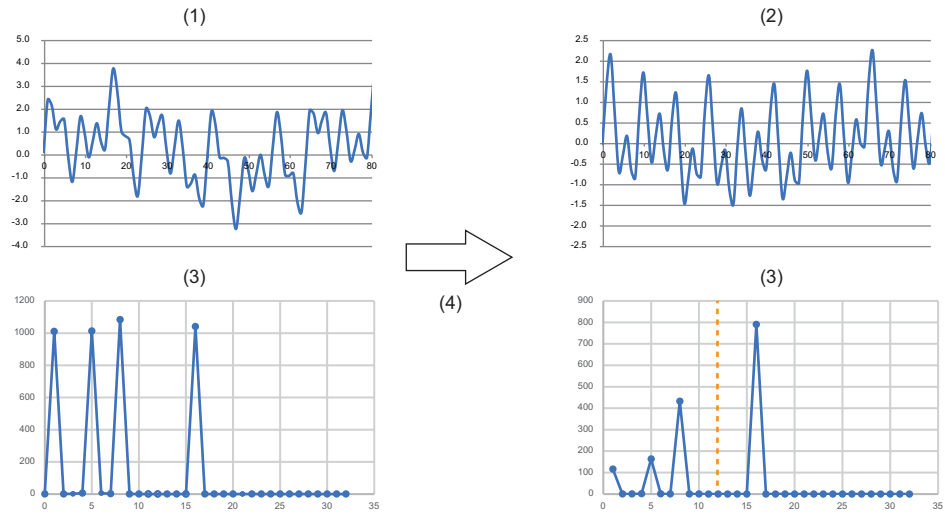
Digital filter processing method	Processing
Low-pass	<p>Data of frequency that is higher than a cutoff frequency is attenuated for the filter target variable.</p> <p>(1) Input waveform (2) Filtered input waveform (3) Frequency (4) Filtering a high frequency Dashed line: Cutoff frequency</p>

Digital filter processing method

Processing

High-pass

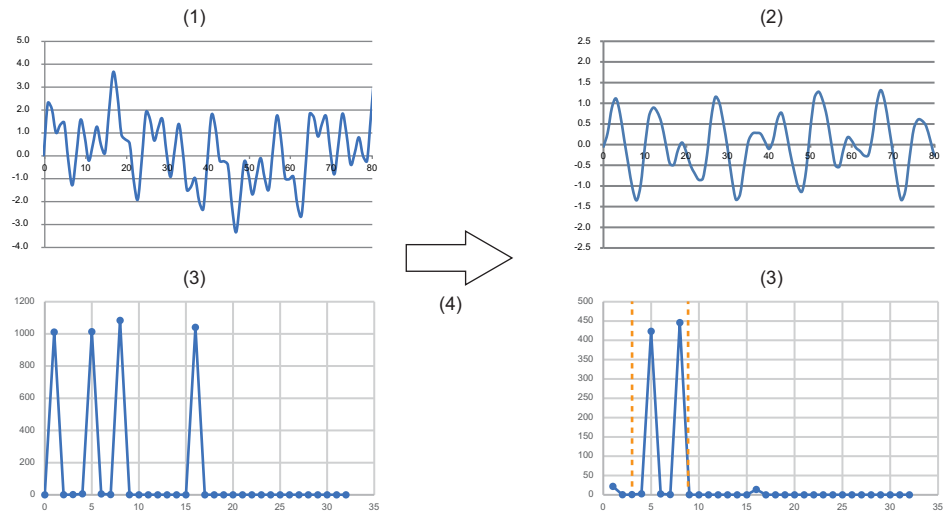
Data of a frequency that is lower than a cutoff frequency is attenuated for the filter target variable.



- (1) Input waveform
 - (2) Filtered input waveform
 - (3) Frequency
 - (4) Filtering the low frequency
- Dashed line: Cutoff frequency

Band-pass

Data of a frequency that is out of the range from a cutoff frequency (low frequency) to a cutoff frequency (high frequency) is attenuated for the filter target variable.



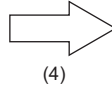
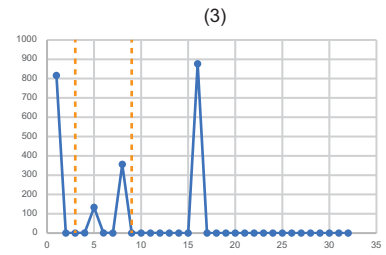
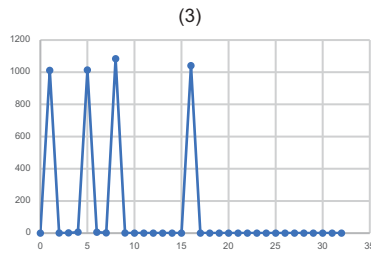
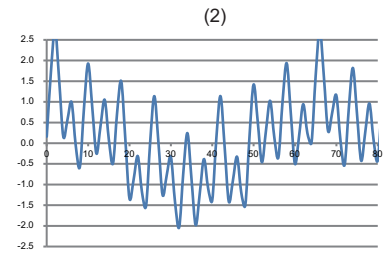
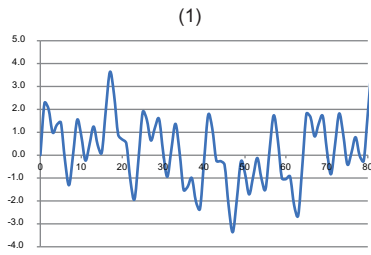
- (1) Input waveform
 - (2) Filtered input waveform
 - (3) Frequency
 - (4) Extracting waveform data only in the range of the specific frequency
- Dashed line: Cutoff frequency

Digital filter processing method

Processing

Band-stop

Data of a frequency that is within the range from a cutoff frequency (low frequency) to a cutoff frequency (high frequency) is attenuated for the filter target variable.



- (1) Input waveform
 - (2) Filtered input waveform
 - (3) Frequency
 - (4) Extracting waveform data out of the range of the specific frequency
- Dashed line: Cutoff frequency

Digital filter screen

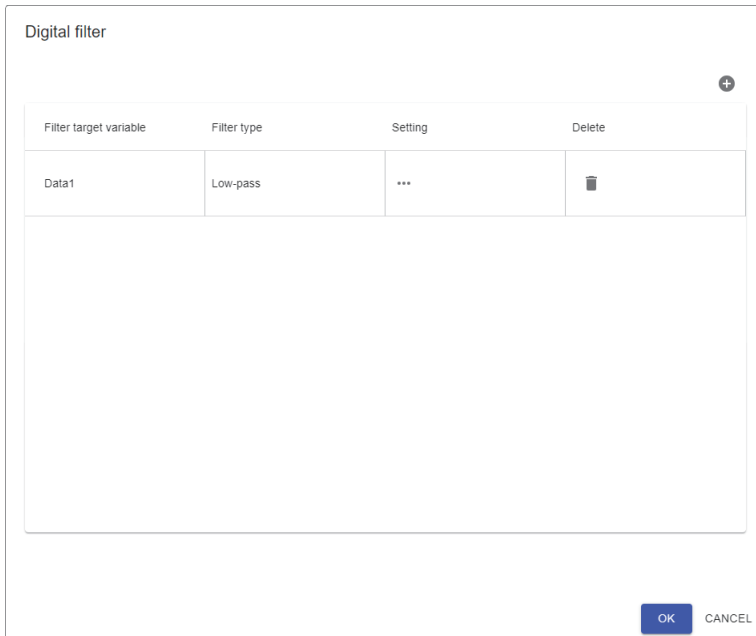
The following shows the screen for displaying the list of added digital filter settings.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

10



Displayed items

Item	Description
(Add)	Click this to add a digital filter setting. (Page 326 Settings)
Filter target variable	The name of a variable that is set as a filter target is displayed.
Filter type	A digital filter type is displayed. (Page 322 Digital filter processing method)
Setting	Click the icon displayed in this column to change the digital filter setting. (Page 326 Settings)
Delete	Click the icon displayed in this column to delete a line.

■ Settings

The following shows the screen for adding a digital filter setting.

Window

The screenshot shows a 'Setting' dialog box with the following fields and values:

- Input setting:**
 - Filter target variable: Data1
 - Sampling cycle: ms
- Filter setting:**
 - Filter type: Low-pass
 - Degree: 2
 - Cutoff frequency: Hz

Buttons: OK, CANCEL

Displayed items

Item		Description
Input setting	Filter target variable	Select a variable to be filtered. A variable can be selected from the numerical value type variables in the input data frame except for objective variables.
	Sampling cycle	Specify a sampling cycle (0.001ms to 1000ms) for sampling data.
Filter setting	Filter type	Select a type of a digital filter. (Page 322 Digital filter processing method)
	Degree	Specify a degree of a digital filter operation (2 to 200) in even number.
	Cutoff frequency ^{*1}	Specify a cutoff frequency (0.0001Hz to 390625Hz).
	Cutoff frequency (Low) ^{*2}	Specify the lower value of a cutoff frequency (0.0001Hz to 390625Hz).
	Cutoff frequency (High) ^{*2}	Specify the higher value of a cutoff frequency (0.0001Hz to 390625Hz).

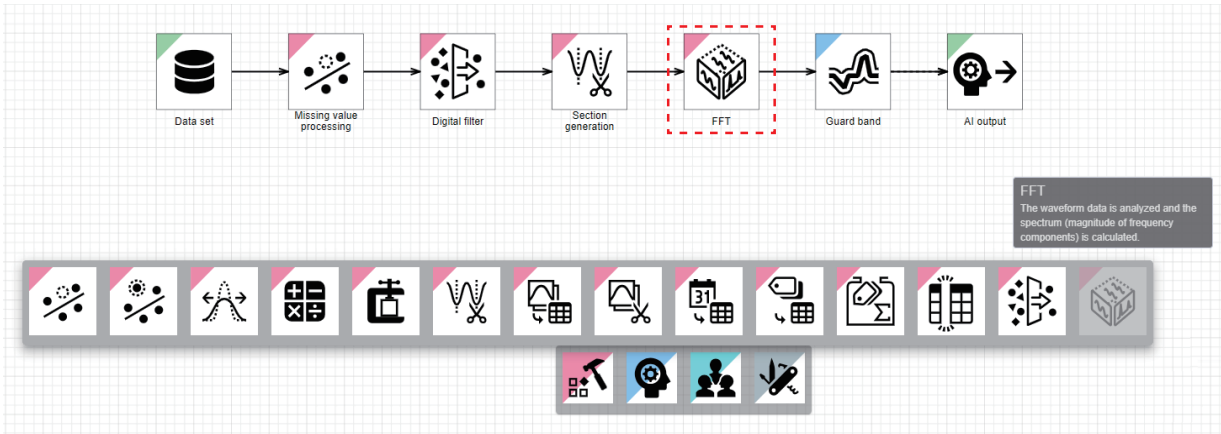
*1 Displayed when selecting "Low-pass" or "High-pass" for "Filter type."

*2 Displayed when selecting "Band-pass" or "Band-stop" for "Filter type."

FFT block

FFT (fast fourier transform) block calculates a spectrum (magnitude of frequency components) that can be used for the malfunction detection.

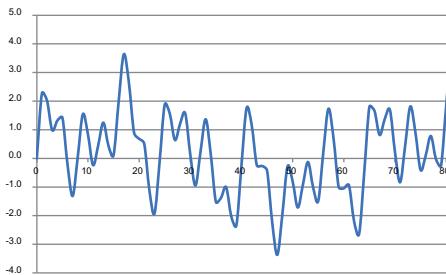
This block preprocesses a numerical value type variable by being placed between a data set block and a block of the analysis method category.



The following shows the flow of usage:

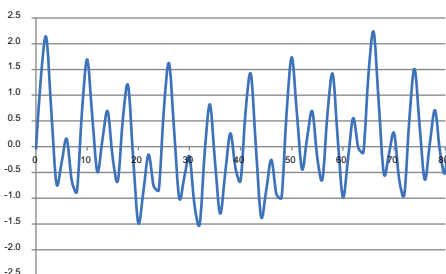
- 1 Interpolate a missing value with a missing value processing block.

When a missing value is included in the input data, a waveform cannot be recognized properly; therefore, if there is a possibility that a missing value is included in the input data, interpolate the missing value by using a missing value processing block in advance.

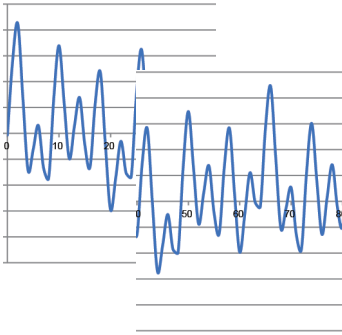


- 2 Use a digital filter block in the following cases:

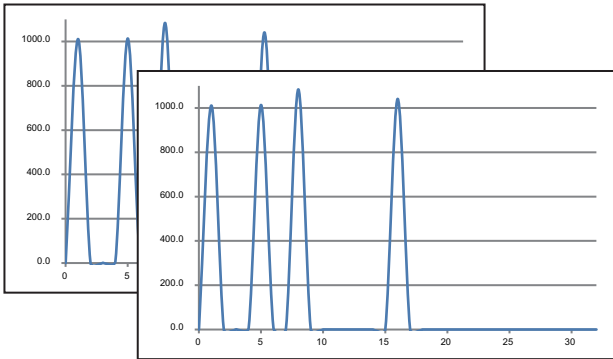
- When eliminating noise included in the input data
- When performing a diagnosis excluding the frequency data during the steady operation



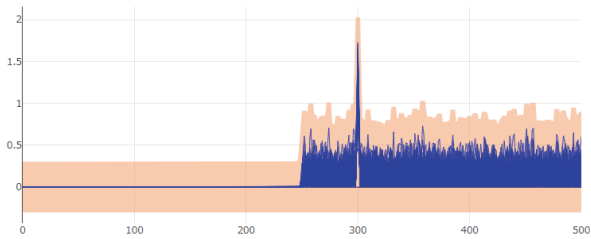
3 Divide the waveform data into any sections with a section generation block.



4 Convert each waveform data into a spectrum with an FFT block.



5 Perform a learning or diagnosis a spectrum which is in the normal state with a guard band block.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> ■Entire multi-data frame (number of sections) <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 432000 ■Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 2 and 864000 (different per data frame) • Number of variables: Integer between 1 and 512 (same in all data frames) • Type of each variable: Any types (same in all data frames) 	<ul style="list-style-type: none"> ■Entire multi-data frame (number of sections) <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 43200 ■Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 2 and 86400 (different per data frame) • Number of variables: Integer between 1 and 512 (same in all data frames) • Type of each variable: Any types (same in all data frames)

Output

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> ■Entire multi-data frame (number of sections) <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 13500 ■Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 33 and 4097 (different per data frame) • Number of variables: 1 (same in all data frames) • Type of each variable: Numerical value (same in all data frames) 	<ul style="list-style-type: none"> ■Entire multi-data frame (number of sections) <ul style="list-style-type: none"> • Number of units of data frame type data: Integer between 1 and 1350 ■Each contained data frame (data per section) <ul style="list-style-type: none"> • Number of records: Integer between 33 and 4097 (different per data frame) • Number of variables: 1 (same in all data frames) • Type of each variable: Numerical value (same in all data frames)

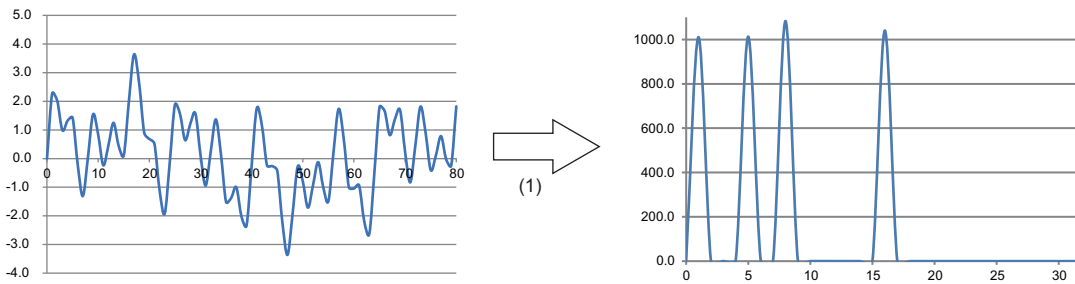
Point

After an FFT processing, a variable name is changed to '(Variable name)_fft.'

If the variable name has more than 255 characters after adding '_fft,' characters in the variable name will be deleted in order from the end to fit within 255 characters.

Operational specifications

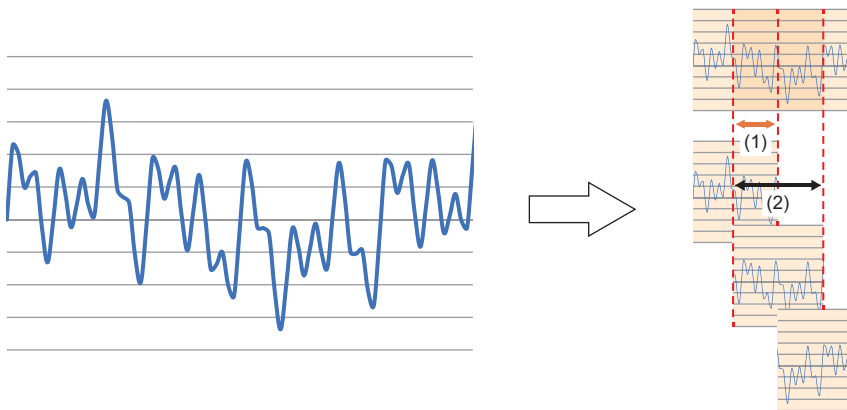
An FFT block analysis the input each section, and calculates a spectrum (magnitude of frequency components). The length of a section (number of records) is same as the one of the output when a spectrum is calculated. However, if a missing value or infinity value exists in the input data, a spectrum is not calculated.



(1) Converting waveform data into a spectrum

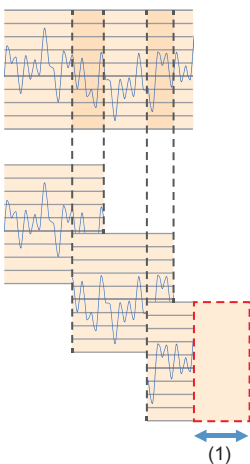
The processing is executed in the following order for calculating a spectrum.

1. An overlap processing is performed for the input waveform data, and the waveform data is extracted for each window length.



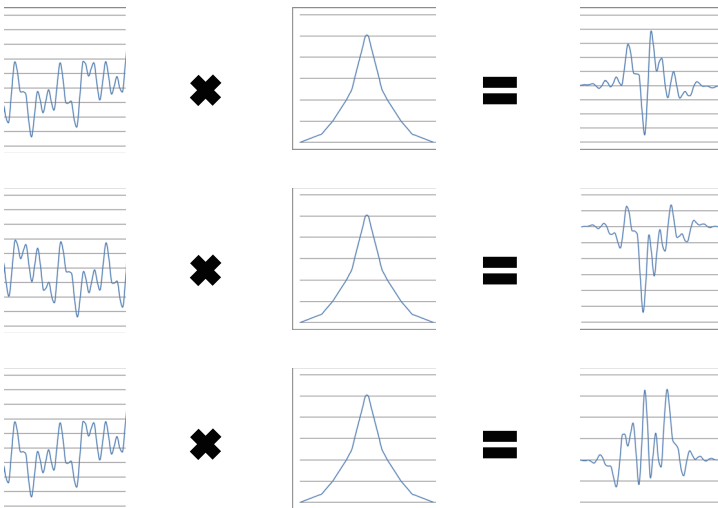
- (1) Overlap rate
- (2) Window length

If the number of the extracted result records is smaller than the window length, '0' is set for the shortage records.

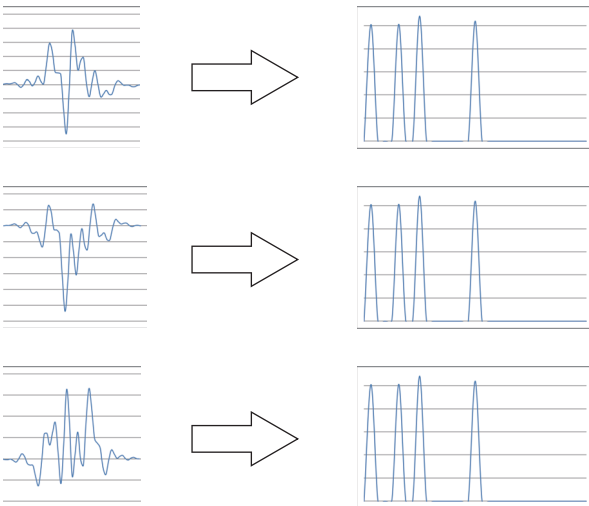


(1) '0' is set for the shortage.

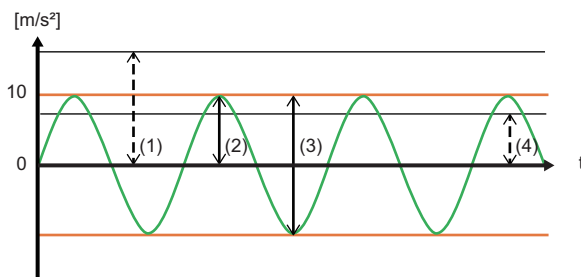
2. A window function is multiplied by the extracted each waveform data, and discontinuity of each waveform data can be reduced.



3. An FFT processing is performed for each waveform data by which a window is multiplied, and spectrum data^{*1} is created.

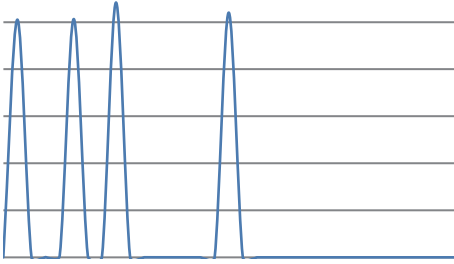


- *1 The output waveform data differs depending on the spectrum format. The following shows the difference between each spectrum format.



- (1) Power = half amplitude²
 (2) Half amplitude
 (3) Total amplitude
 (4) Effective value = half amplitude $\times 1/\sqrt{2}$ (about 71%)

4. The created spectrum data is averaged.



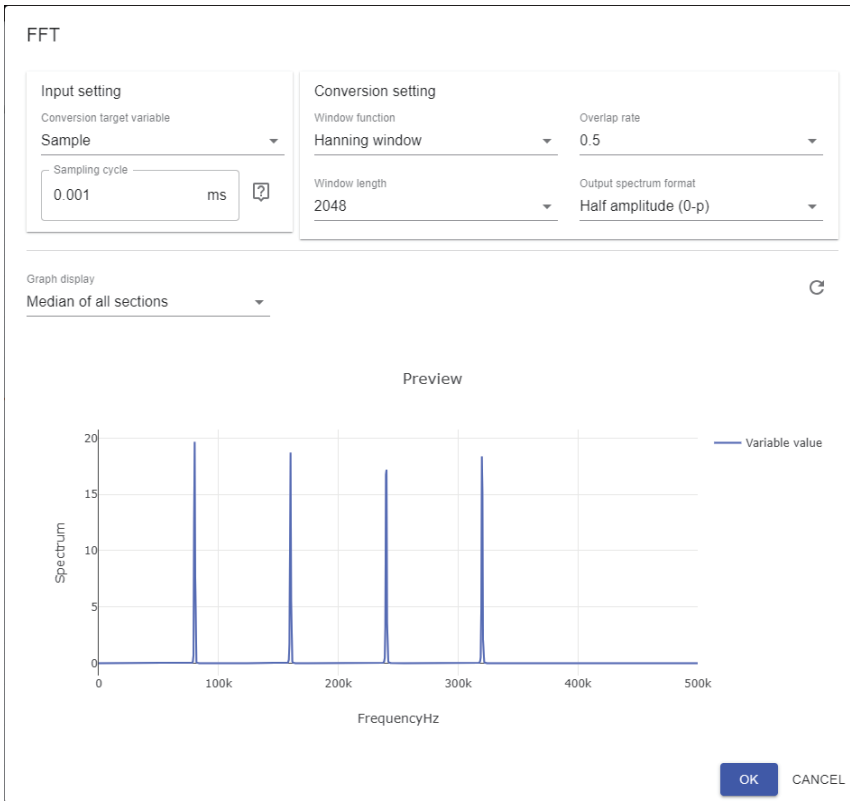
FFT block setting screen

The following shows the screen for setting an FFT block.

Window


Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description	
Input setting	Conversion target variable	Select a variable name that is a target for an FFT. Among the variables in an input data frame, a numerical value type variable can be selected.
	Sampling cycle	Specify a sampling cycle to sample data (0.001ms to 1000ms).

Item	Description	
Conversion setting	Window function	Select a window function to be used for an FFT. <ul style="list-style-type: none"> • Hanning window • Hamming window • Flat top window • Rectangular window
	Window length	Select the length per processing of a window function.*1 <ul style="list-style-type: none"> • 64 • 128 • 256 • 512 • 1024 • 2048 • 4096 • 8192
	Overlap rate	Select the overlap rate of the data when executing a window function processing. <ul style="list-style-type: none"> ■ Flat top window <ul style="list-style-type: none"> • 0% • 50% • 75% ■ Hanning window, hamming window <ul style="list-style-type: none"> • 50% • 75% ■ Flat top window <ul style="list-style-type: none"> • 87.5% • 90%
	Output spectrum format	Select a format of the data output as an FFT result. <ul style="list-style-type: none"> • Half amplitude (0-p) • Total amplitude (p-p) • Power • Effective value (RMS)
Graph display	Select a format of the preview display of an FFT result. <ul style="list-style-type: none"> • Median of all sections • Overlap of all sections 	
 (Display/Update)	Click this to display or update the preview display when setting or changing "Input setting," "Conversion setting," and "Graph display." Up to 1024 sections can be displayed in the preview.	

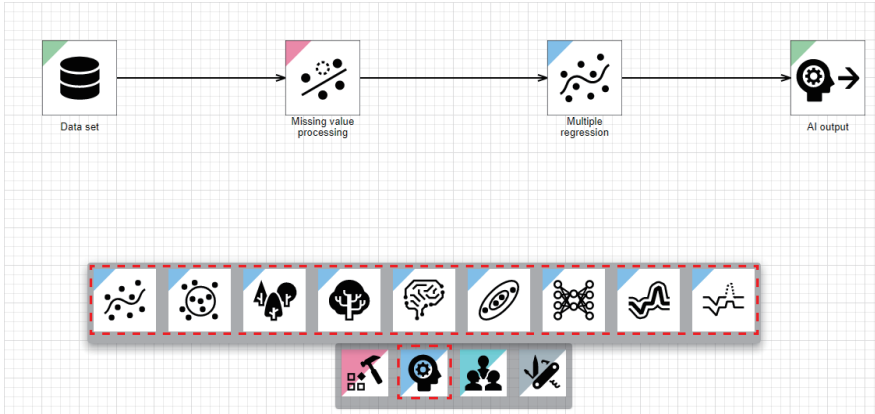
*1 When the length of a section (number of records) is less than the length of a window for an FFT processing, the length is not output. Change the window length to a smaller value or change the section length to a larger value in a section generation block.

10.4 Analysis Method Category

Extension blocks of the analysis method category perform various analysis method algorithm and output a diagnosis rule. These blocks are available in the AI editor screen.



For operations that can be performed by right-clicking a block, refer to the following:

 Page 231 Right-click menus



The analysis method category has the following two types of learning methods:

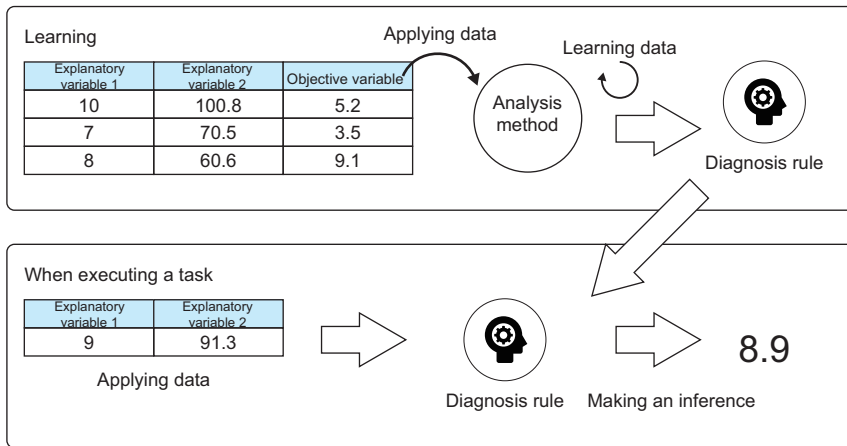
Use supervised learning to perform classification or regression, and use unsupervised learning to detect an error.

- Supervised learning ( Page 336 Supervised learning)
- Unsupervised learning ( Page 338 Unsupervised learning)

Supervised learning

An extension block of the analysis method category that performs supervised learning performs learning with an explanatory variable and objective variables, and outputs a diagnosis rule.

When executing a task, an inference result is output for an unknown explanatory variable by using the diagnosis result.



■ Comparison of learning methods

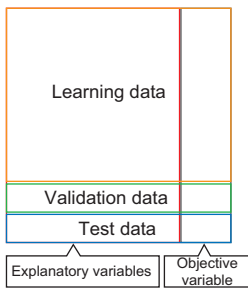
In supervised learning, inference speed and characteristics of suitable data differ depending on the learning algorithm.

Point of view	Method (supervised learning)				
	Multiple regression	Deep learning	Gradient boosting decision tree	Random forest	k-nearest neighbors algorithm
Regression	Available	Available	Available	Available	Available
Classification	Not available	Available	Available	Available	Available
Learning speed	Fast	Slow	Medium	Medium (Parallelization is available.)	Fast
Inference speed	Fast	Medium	Fast	Fast	Slow
Inference accuracy	Low	High	High	Medium	Medium
Memory occupancy for learning	Small	Large	Medium	Medium	Medium
Memory occupancy for inference	Small	Medium	Medium	Medium	Medium
Characteristics of suitable data	When an explanatory variable and objective variable have the linearity	When an explanatory variable and objective variable have a complicated relation (For example, the value of the objective variable is defined by an interaction of values obtained by non-linearly converting multiple variables)	When the value of an objective variable can be calculated by the if-then rule of an explanatory variable	When the value of an objective variable can be calculated by the if-then rule of an explanatory variable	When the number of variables and that of records in learning data are small
Influence by increase in the number of variables	Accuracy is lowered.	Speed is lowered.	Insusceptible	Insusceptible	Learning speed, inference speed, accuracy, and memory occupancy are lowered.
Immunity to redundant dimensions	Low	Medium	High	High	Low
Immunity to noise	Low	Medium	High	High	Medium

Note that different tendencies may be obtained depending on the data characteristics and task contents.

■Data division

For supervised learning, the data for learning is divided into learning data, validation data, and test data, then each processing is performed.



■Learning time

Learning is ended when optimization is attempted for the set number of times or when the optimization time limit is exceeded.

■Feature automatic selection

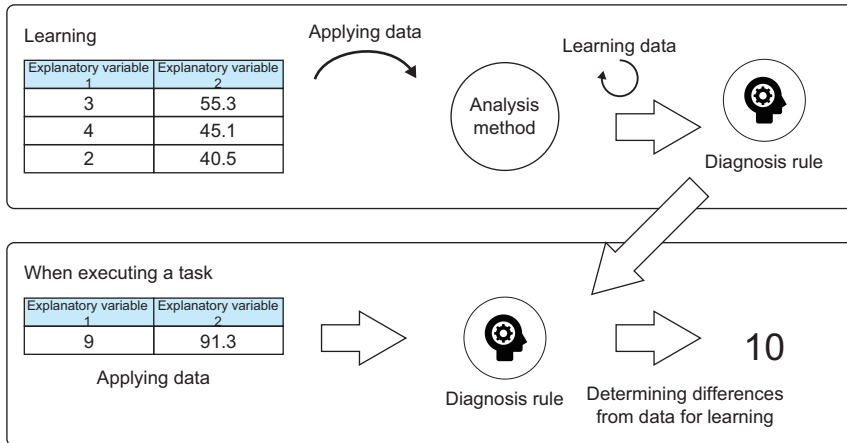
When the automatic feature selection is enabled, less important variables are automatically selected and excluded from the targets of learning and inference.

When it is disabled, all variables are used.

Unsupervised learning

An extension block of the analysis method category that performs unsupervised learning performs learning only with explanatory variables, and outputs a diagnosis rule.

When executing a task, dissimilarity with data used for learning is output by inputting an explanatory variable to a diagnosis rule.



■ Comparison of learning methods

In unsupervised learning, characteristics differ depending on the algorithm, as in supervised learning.

Point of view	Method (unsupervised learning)			
	MT method	Autoencoder	Guard band	Similar waveform recognition
Learning and diagnosis of table data	Yes	Yes	No	No
Learning and diagnosis of time-series data	No	No	Yes	Yes
Learning speed	Fast	Slow	Fast	Fast
Inference speed	Fast	Slow	Fast	Fast
Memory occupancy for learning	Small	Large	Small	Small
Memory occupancy for inference	Small	Large	Small	Small
Characteristics of suitable data	When data is normally distributed	Applicable also to non-normally distributed data	High error detection performance is provided when a noise or amplitude changes.	Good at learning and diagnosing waveform data in which the same pattern of waveforms are repeated
Influence by increase in the number of variables	Accuracy is lowered.	Learning speed and inference accuracy are lowered.	— (Because a target variable is one-dimensional)	— (Because a target variable is one-dimensional)
Immunity to redundant dimensions	Low	High	— (Because a target variable is one-dimensional)	— (Because a target variable is one-dimensional)
Immunity to noise	Low	High	Low	High

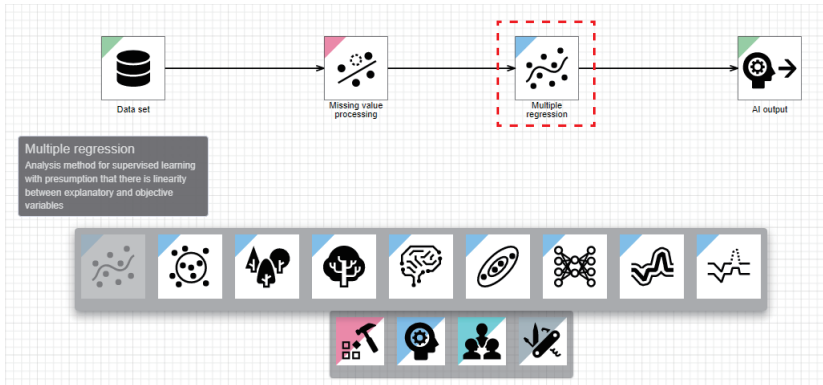
Note that different tendencies may be obtained depending on the data characteristics and task contents.

Multiple regression block

A multiple regression block is an analysis method that assumes the linearity between an explanatory variable and objective variable.

The number of parameters is small; therefore, the learning and inference speed is high.

It is suitable for simple data that has a linear relation between input and output.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 4 and 864000 Number of variables: Integer between 2 and 512 Type of each variable: Numerical value for a diagnosis target column, any types for others 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 512 Type of each variable: Same as the type of each explanatory variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	Diagnosis rule type: Regression	<ul style="list-style-type: none"> Number of records: Same as the number of records of explanatory variables Number of variables: 1 to '1 + number of explanatory variables' Type of each variable: Refer to the table below.

Variable to be output when executing a task				
No. *1	Variable name *2	Variable type	Description	Value
1	(AI name)_DIAG	Same as the type of an objective variable	Inference result	When an objective variable is of the category type: Any of the values of the objective variable used for learning When an objective variable is of the numerical value type: Range of floating point numbers
2 to number of additional features	(AI name)_(variable name)	Same as the type of each additional feature input to a block of the analysis method category	Each additional feature input to a block of the analysis method category after it is processed in the AI editor	Value of each additional feature input to a block of the analysis method category

*1 Variables are sorted in order from No.2 to 'number of additional features,' then No.1.

*2 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

Multiple regression screen

The following shows the screen for setting a condition to end learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Multiple regression

Learning end condition ⓘ

Number of optimization attempts
20

Optimization time limit (minute)
60

Automatic feature selection

OK CANCEL

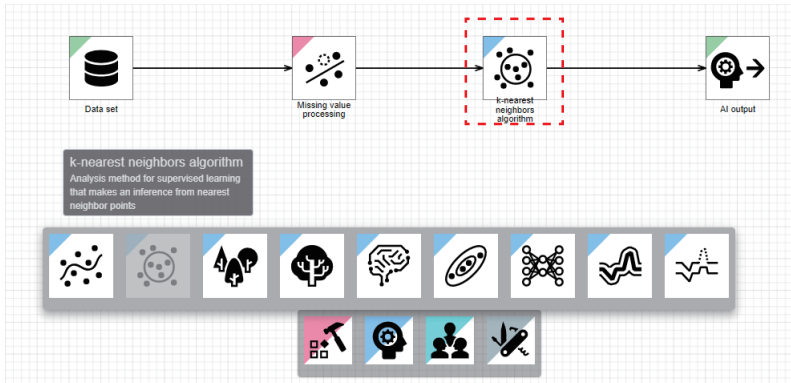
Displayed items

Item		Description
Learning end condition	Number of optimization attempts	Set the number of search iterations (0 to 1000) for hyperparameters.
	Optimization time limit (minute)	Set the limit time (0 to 2880) for optimization.
Automatic feature selection		Turn this ON to automatically select a feature and perform learning. To use all features for learning, turn this OFF.

k-nearest neighbors algorithm block

A k-nearest neighbors algorithm block is an analysis method that calculates an inference value from a neighbor point of learning data.

A highly accurate inference can be made when the number of variables is small. However, the accuracy is lowered as the number of variables increases. In addition, inference time increases as the number of units of learning data increases. Therefore, it is suitable for when both the number of units of learning data and that of variables are small.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 4 and 864000 Number of variables: Integer between 2 and 512 Type of each variable: For explanatory variables: At least one numerical value type or category type variable must be included. For objective variables: Numerical value or category 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 512 Type of each variable: Same as the type of each explanatory variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Diagnosis rule type: When an objective variable is of the category type: Classification When an objective variable is of the numerical value type: Regression 	<ul style="list-style-type: none"> Number of records: Same as the number of records of explanatory variables Number of variables: 1 to '1 + number of explanatory variables' Type of each variable: Refer to the table below.

Variable to be output when executing a task				
No.*1	Variable name*2	Variable type	Description	Value
1	(AI name)_DIAG	Same as the type of an objective variable	Inference result	When an objective variable is of the category type: Any of the values of the objective variable used for learning When an objective variable is of the numerical value type: Range of floating point numbers
2 to number of additional features	(AI name)_(variable name)	Same as the type of each additional feature input to a block of the analysis method category	Each additional feature input to a block of the analysis method category after it is processed in the AI editor	Value of each additional feature input to a block of the analysis method category

*1 Variables are sorted in order from No.2 to 'number of additional features,' then No.1.

*2 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

k-nearest neighbors algorithm screen

The following shows the screen for setting a condition to end learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

The screenshot shows a dialog box titled "k-nearest neighbors algorithm". It contains the following elements:

- A "Learning end condition" label with a help icon.
- A text input field for "Number of optimization attempts" with the value "20".
- A text input field for "Optimization time limit (minute)" with the value "60".
- A toggle switch for "Automatic feature selection" which is currently turned ON.
- "OK" and "CANCEL" buttons at the bottom right.

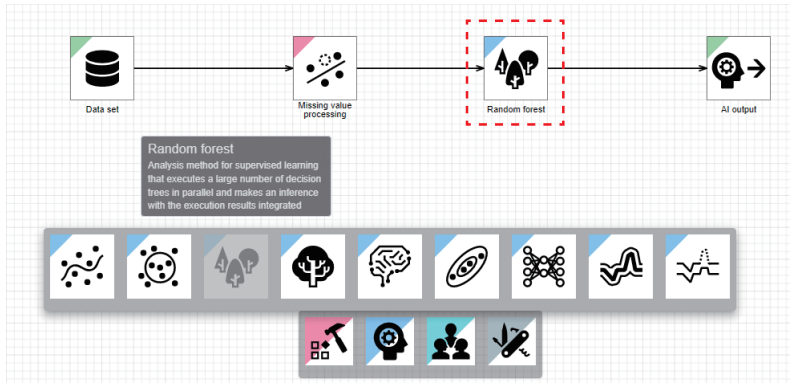
Displayed items

Item		Description
Learning end condition	Number of optimization attempts	Set the number of search iterations (0 to 1000) for hyperparameters.
	Optimization time limit (minute)	Set the limit time (0 to 2880) for optimization.
Automatic feature selection		Turn this ON to automatically select a feature and perform learning. To use all features for learning, turn this OFF.

Random forest block

A random forest block is a machine learning algorithm that learns a lot of decision trees by using a generated data set and makes an inference by integrating the inference results of decision trees.

The learning accuracy may be lower than the one acquired by using the gradient boosting decision tree method; however, this block can perform learning at high speed because parallelization is easy and the number of hyperparameters is small.



Input/output specifications

Page 341 Input/output specifications

Random forest screen

The following shows the screen for setting a condition to end learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Random forest

Learning end condition ?

Number of optimization attempts

Optimization time limit (minute)

Automatic feature selection

Displayed items

Item		Description
Learning end condition	Number of optimization attempts	Set the number of search iterations (0 to 1000) for hyperparameters.
	Optimization time limit (minute)	Set the limit time (0 to 2880) for optimization.
Automatic feature selection		Turn this ON to automatically select a feature and perform learning. To use all features for learning, turn this OFF.

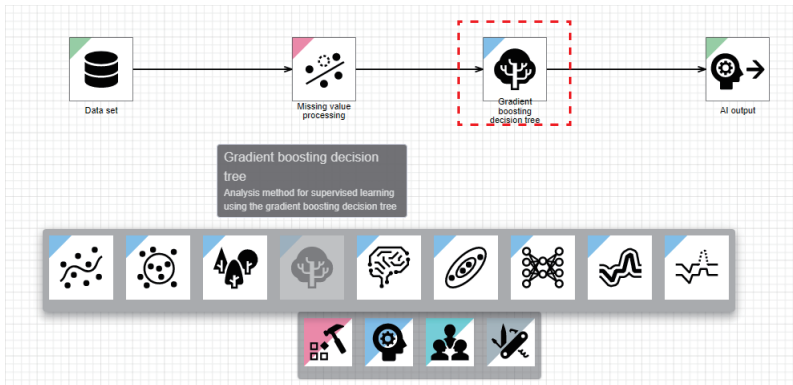
Gradient boosting decision tree block

A gradient boosting decision tree block is an analysis method that takes a value acquired by combining inference results of multiple decision trees as a inference result.

Combining multiple inference results reduces overfitting and improves learning accuracy.

This block is well balanced among accuracy, stability of learning accuracy, and calculation speed; therefore, its learning performance is stable for any data.

In addition, XGBoost or LightGBM can be selected as a learning algorithm.



Input/output specifications

Page 341 Input/output specifications

Gradient boosting decision tree screen

The following shows the screen for setting a learning algorithm and conditions to end learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Gradient boosting decision tree

Learning algorithm
XGBoost

Learning end condition ?

Number of optimization attempts
20

Optimization time limit (minute)
60

Automatic feature selection

OK CANCEL

Displayed items

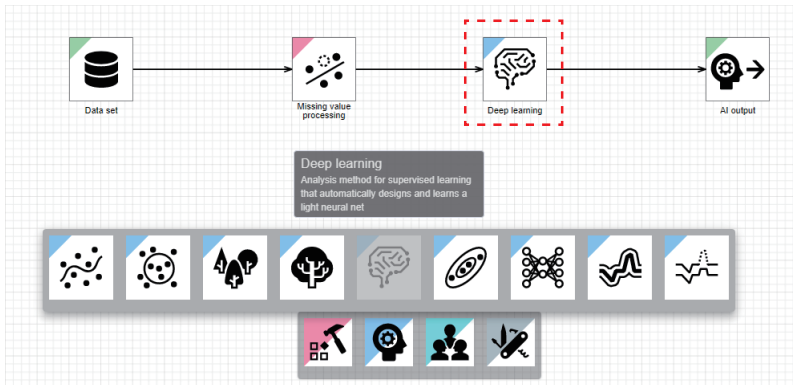
Item	Description	
Learning algorithm	Select a learning algorithm. • XGBoost • LightGBM	
Learning end condition	Number of optimization attempts	Set the number of search iterations (0 to 1000) for hyperparameters.
	Optimization time limit (minute)	Set the limit time (0 to 2880) for optimization.
Automatic feature selection	Turn this ON to automatically select a feature and perform learning. To use all features for learning, turn this OFF.	

Deep learning block

A deep learning block is an analysis method that Mitsubishi Electric Corporation developed with a concept of 'AI that anyone can use easily' in the edge computing area.

This block has the following features:

- A deep neural network can be automatically designed.
- Learning parameters are automatically tuned.
- A diagnosis rule applicable in an environment with small computational resources can be generated.



Input/output specifications

Page 341 Input/output specifications

Deep learning screen

The following shows the screen for setting a condition to end learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Deep learning

Learning end condition ?

Number of optimization attempts

Optimization time limit (minute)

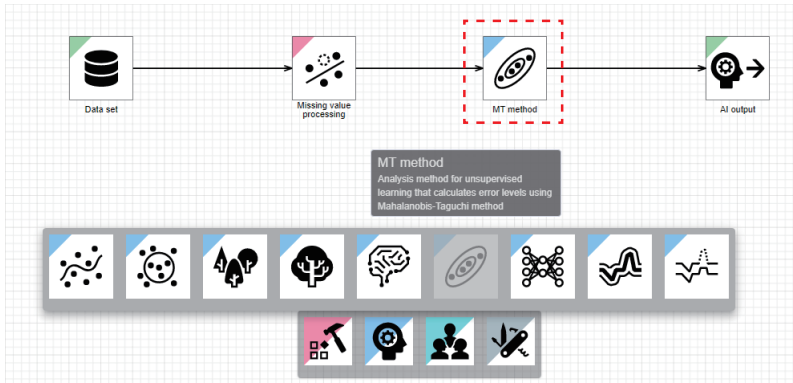
Automatic feature selection

Displayed items

Item		Description
Learning end condition	Number of optimization attempts	Set the number of search iterations (0 to 1000) for hyperparameters.
	Optimization time limit (minute)	Set the limit time (0 to 2880) for optimization.
Automatic feature selection		Turn this ON to automatically select a feature and perform learning. To use all features for learning, turn this OFF.

MT method block

An MT method block is an analysis method of unsupervised learning that calculates an error level with likelihood of a probability density function by inferring statistics of multivariate normal distribution from learning data. This method is used mainly when data to be used for learning is normally distributed.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 3 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: At least one numerical value type or category type variable must be included. 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 512 Type of each variable: Same as the type of each variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	Diagnosis rule type: Regression	<ul style="list-style-type: none"> Number of records: Same as the number of records of explanatory variables Number of variables: 1 to '1 + number of explanatory variables' Type of each variable: Refer to the table below.

Variable to be output when executing a task				
No.*1	Variable name*2	Variable type	Description	Value
1	(AI name)_DIAG	Numerical value	MT distance	Range of floating point numbers
2 to number of additional features	(AI name)_(variable name)	Same as the type of each additional feature input to a block of the analysis method category	Each additional feature input to a block of the analysis method category after it is processed in the AI editor	Value of each additional feature input to a block of the analysis method category

*1 Variables are sorted in order from No.2 to 'number of additional features,' then No.1.

*2 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

Autoencoder block

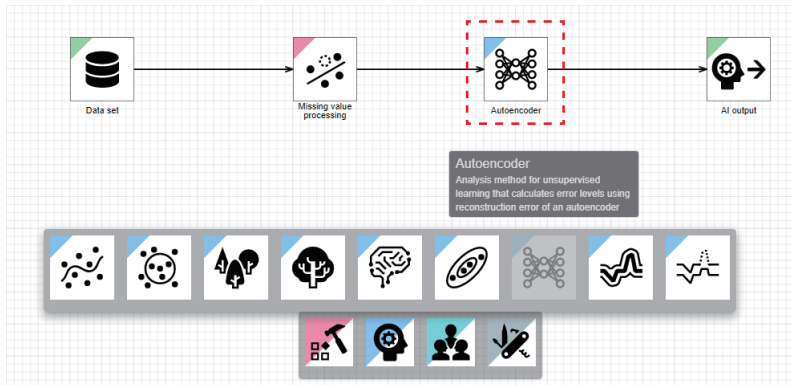
An autoencoder block is an analysis method that performs learning to restore input values.

When inputting data that is similar to the data used for learning, restoration succeeds.

When inputting data that has characteristics greatly different from the data used for learning, restoration fails.

An autoencoder block learns only normal data by using these characteristics, and can detect error data that has characteristics different from normal data when a task is executed.

Autoencoder can be applied to various data.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 3 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: At least one numerical value type or category type variable must be included. 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 512 Type of each variable: Same as the type of each variable used for learning

Output

Item	Description	
	When learning	When executing a task
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	Diagnosis rule type: Regression	<ul style="list-style-type: none"> Number of records: Same as the number of records of explanatory variables Number of variables: 1 to '1 + number of explanatory variables' Type of each variable: Refer to the table below.

Variable to be output when executing a task				
No.*1	Variable name*2	Variable type	Description	Value
1	(AI name)_DIAG	Numerical value	Reconstruction error (mean squared error between an explanatory variable and inference result)	Range of floating point numbers
2 to number of additional features	(AI name)_(variable name)	Same as the type of each additional feature input to a block of the analysis method category	Each additional feature input to a block of the analysis method category after it is processed in the AI editor	Value of each additional feature input to a block of the analysis method category

*1 Variables are sorted in order from No.2 to 'number of additional features,' then No.1.

*2 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

Autoencoder screen

The following shows the screen for setting a condition to end learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Autoencoder

Learning end condition ?

Number of optimization attempts

Optimization time limit (minute)

OK CANCEL

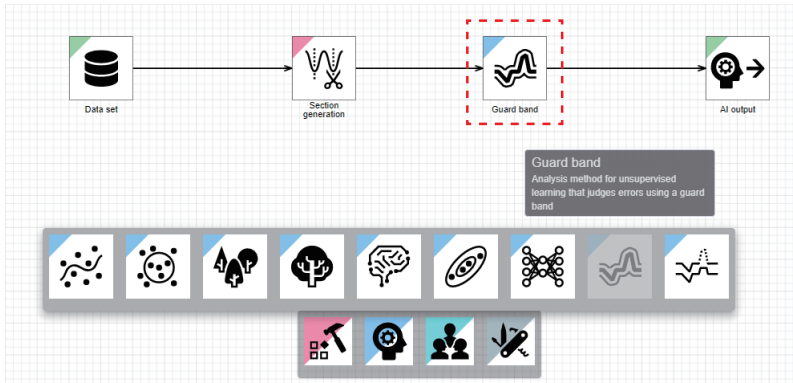
Displayed items

Item		Description
Learning end condition	Number of optimization attempts	Set the number of search iterations (0 to 1000) for hyperparameters.
	Optimization time limit (minute)	Set the limit time (0 to 2880) for optimization.

Guard band block

A guard band block is an analysis method of unsupervised learning that defines a normal range (guard band) for waveform data based on a reference waveform or the upper and lower limits, then judges diagnosis target data as an error when its value is out of the normal range.

It is suitable for judging an error of periodic time-series data at high speed.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Multi-data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Entire multi-data frame <ul style="list-style-type: none"> Number of data frames: Integer between 1 and 432000 Each data frame <ul style="list-style-type: none"> Number of records: Integer between 2 and 864000 (different per data frame) Number of variables: Integer between 1 and 512 (same in all data frames) Type of each variable: Numerical value, category, or timestamp (same in all data frames) 	<ul style="list-style-type: none"> Entire multi-data frame <ul style="list-style-type: none"> Number of data frames: Integer between 1 and 43200 Each data frame <ul style="list-style-type: none"> Number of records: Integer between 2 and 86400 (different per data frame) Number of variables: Integer between 1 and 512 (same in all data frames) Type of each variable: Numerical value, category, or timestamp (same in all data frames)

Output

Item	Description	
	When learning	When executing a task
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	Diagnosis rule type: Classification	<ul style="list-style-type: none"> Number of records: Same as the number of data frames in a multi-data frame^{*1} Number of variables: 1 Type of each variable: Refer to the table below.

*1 Nothing may be output even when a data frame exists. (Page 350 When executing a task)

Variable to be output when executing a task

No.	Variable name ^{*1}	Variable type	Description	Value
1	(AI name)_DIAG	Category	Diagnosis result	<ul style="list-style-type: none"> 0: Normal 1: Error

*1 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

Operational specifications

■When learning

From the input data frame list, the values of a variable selected for "Variable selection" are plotted as sections to calculate a reference waveform. Then, a guard band is calculated from the reference waveform.

- Calculation method for a reference waveform

Item	Description
"Use the median as the reference waveform" is ON.	A waveform taking the maximum and minimum values of all sections becomes a reference waveform.
"Use the median as the reference waveform" is OFF.	A waveform taking the median of all sections becomes a reference waveform.

- Calculation method for a guard band

Item	Description
"Guard band" is selected for "Type."	A range sliding from a reference waveform for the values set in "Upper/lower guard band width" and "Front/back guard band width" becomes a guard band.
"Guard band (rate)" is selected for "Type."	A range sliding from a reference waveform for the rates set in "Upper/lower guard band width (rate)" and "Front/back guard band width (rate)" becomes a guard band. The rate for "Upper/lower guard band width (rate)" is calculated from the maximum amplitude, and the one for "Front/back guard band width (rate)" is calculated from the maximum number of records.
"Upper/lower limit" is selected for "Type."	A reference waveform is not used, and a range between the values set in "Upper limit value" and "Lower limit value" becomes a guard band.

■When executing a task




A guard band is applied to the variable applied when learning. If records exceeding the range continues for "Number of consecutive exceeded records" or more, the variable is judged as it deviates from the guard band of a target section.

A variable is judged as an error and "1" is output when sections deviating from a guard band reaches "Number of error judgment sections" among the latest sections set in "Range of error judgment sections" that are diagnosed after the execution status of a task becomes "RUN." In other cases, the variable is judged as normal and "0" is output. If the number of latest diagnosed sections is less than "Number of error judgment sections," judgment cannot be performed and nothing is output.

Guard band screen

The following shows the screen for selecting a variable to be used creating a guard band and configuring settings for the guard band.

Settings differ depending on the selected type.

- Type: Guard band ( Page 351 Type: Guard band)
- Type: Guard band (rate) ( Page 352 Type: Guard band (rate))
- Type: Upper/lower limit ( Page 353 Type: Upper/lower limit)

■Type: Guard band

Settings when selecting "Guard band" for the type are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
Variable selection	Select a variable to create a guard band. Only a numerical value type variable can be selected.
Type	Select "Guard band."
Use the median as the reference waveform	Turn this ON to create a guard band by using the median of a displayed waveform as a reference waveform.
Upper/lower guard band width	Set a value to specify how much to shift a guard band to up and down along the y axis from a reference waveform. A value can be set in a range of 0 to 2147483647.
Front/back guard band width	Set a value to specify how much to shift a guard band to forward and backward along the x axis from a reference waveform. A value can be set in a range of 0 to 86400.
Start offset	Set the start to end of a guard band in a range of 0 to 86400.
End offset	
Number of error judgment sections	Set whether to judge a diagnosis result as an error when "Number of error judgment sections" (0 to 1000) among "Range of error judgment sections" (0 to 1000) deviates from a guard band.
Range of error judgment sections	
Number of consecutive exceeded records	Set the number of records (1 to 86400) to be judged that they deviate from a guard band. When a value is on the boundary of the guard band, it is also judged as excess.
(1) Graph display area	A selected variable, reference waveform, and guard band are displayed. (x axis: number of records, y axis: value of a selected variable)

■Type: Guard band (rate)

Settings when selecting "Guard band (rate)" for the type are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Displayed items

Item	Description
Variable selection	Select a variable to create a guard band. Only a numerical value type variable can be selected.
Type	Select "Guard band (rate)."
Use the median as the reference waveform	Turn this ON to create a guard band by using the median of a displayed waveform as a reference waveform.
Upper/lower guard band width (rate)	Set a rate (0 to 100) to specify how much to shift a guard band to up and down along the y axis from a reference waveform.
Front/back guard band width (rate)	Set a rate (0 to 100) to specify how much to shift a guard band to forward and backward along the x axis from a reference waveform.
Start offset	Set the start to end of a guard band in a range of 0 to 86400.
End offset	
Number of error judgment sections	Set whether to judge a diagnosis result as an error when "Number of error judgment sections" (0 to 1000) among "Range of error judgment sections" (0 to 1000) deviates from a guard band.
Range of error judgment sections	
Number of consecutive exceeded records	Set the number of records (1 to 86400) to be judged that they deviate from a guard band. When a value is on the boundary of the guard band, it is also judged as excess.
(1) Graph display area	A selected variable, reference waveform, and guard band are displayed. (x axis: number of records, y axis: value of a selected variable)

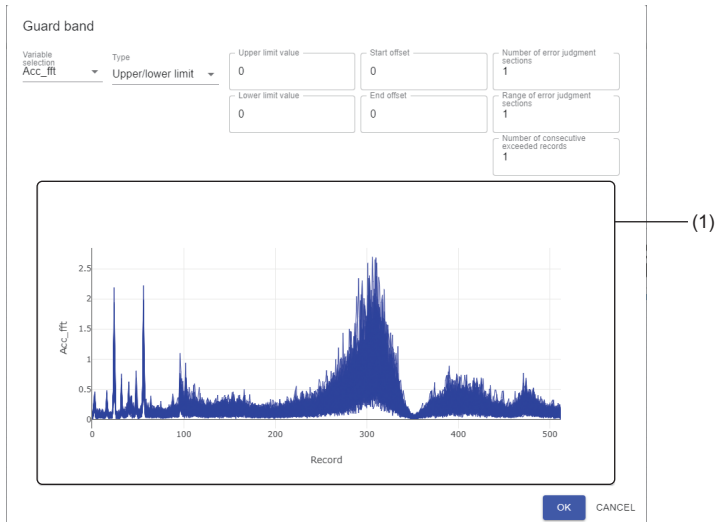
■Type: Upper/lower limit

Settings when selecting "Upper/lower limit" for the type are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



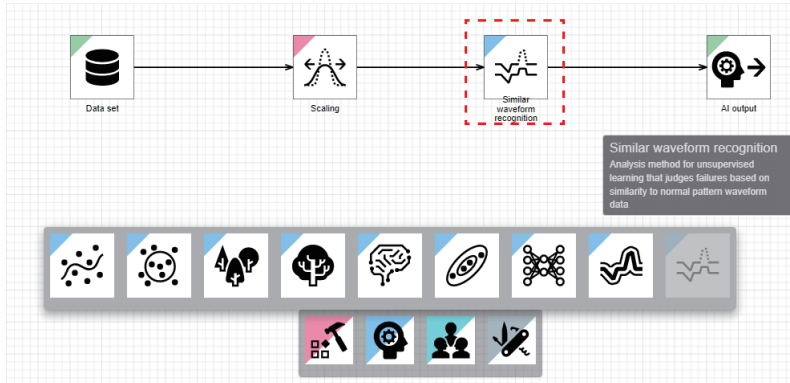
Displayed items

Item	Description
Variable selection	Select a variable to create a guard band. Only a numerical value type variable can be selected.
Type	Select "Upper/lower limit."
Upper limit value	Set the upper and lower limit values of a guard band in a range of '-1.79769313486231e+308' to '1.79769313486231e+308.'
Lower limit value	
Start offset	Set the start to end of a guard band in a range of 0 to 86400.
End offset	
Number of error judgment sections	Set whether to judge a diagnosis result as an error when "Number of error judgment sections" (0 to 1000) among "Range of error judgment sections" (0 to 1000) deviates from a guard band.
Range of error judgment sections	
Number of consecutive exceeded records	Set the number of records (1 to 86400) to be judged that they deviate from a guard band. When a value is on the boundary of the guard band, it is also judged as excess.
(1) Graph display area	A selected variable and guard band are displayed. (x axis: number of records, y axis: value of a selected variable)

Similar waveform recognition block

A similar waveform recognition block is an analysis method that learns cyclic waveform to be a reference, then learns a waveform of which the cycle is not constant or a waveform in which multiple patterns are switched as characteristics of a normal cyclic waveform.

Similar waveform recognition judges the normality of a waveform input as a diagnosis target by calculating an index indicating the similarity between the waveform and learned waveforms.



Input/output specifications

Input

Item	Description	
	When learning	When executing a task
Input/output type	Data frame type	
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 3 and 864000 Number of variables: Integer between 1 and 512 Type of each variable: Any types 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 512 Type of each variable: Numerical value

Output

Item	Description	
	When learning	When executing a task
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	Diagnosis rule type: Similar waveform recognition	<ul style="list-style-type: none"> Number of records: Same as the number of records of an objective variable Number of variables: 8 to '8 + number of explanatory variables' Type of each variable: Refer to the table below.

Variable to be output when executing a task ^{*1}				
No. ^{*2}	Variable name ^{*3}	Variable type	Description	Value
1	(AI name)_FLG	Category	Diagnosis target flag	<ul style="list-style-type: none"> 0: Not diagnosed 1: Diagnosed
2	(AI name)_SEPN		Diagnosis division flag	<ul style="list-style-type: none"> 1: Not divided 0: Divided
3	(AI name)_SELSIMWV	Numerical value	Value of a reference waveform	Range of floating point numbers
4	(AI name)_DIAG		Value of an inspection waveform	
5	(AI name)_SIMSCORE		Similarity score	0.0 to 100.0
6 to number of additional features	(AI name)_(variable name)	Same as the type of each additional feature input to a block of the analysis method category	Each additional feature input to a block of the analysis method category after it is processed in the AI editor	Value of each additional feature input to a block of the analysis method category

*1 The following values are output to the variables of No.1 to No.5 from when a diagnosis starts to when the quarter of the number of records per cycle is reached.

No.1 to 3: 0

No.4: Value of input data

No.5: 100.0

*2 Variables are sorted in order from No.6 to 'number of additional features' then No.1 to No.5.

*3 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

Operational specifications

■ When learning

A similar waveform recognition model is created by using the set parameters and learning data.

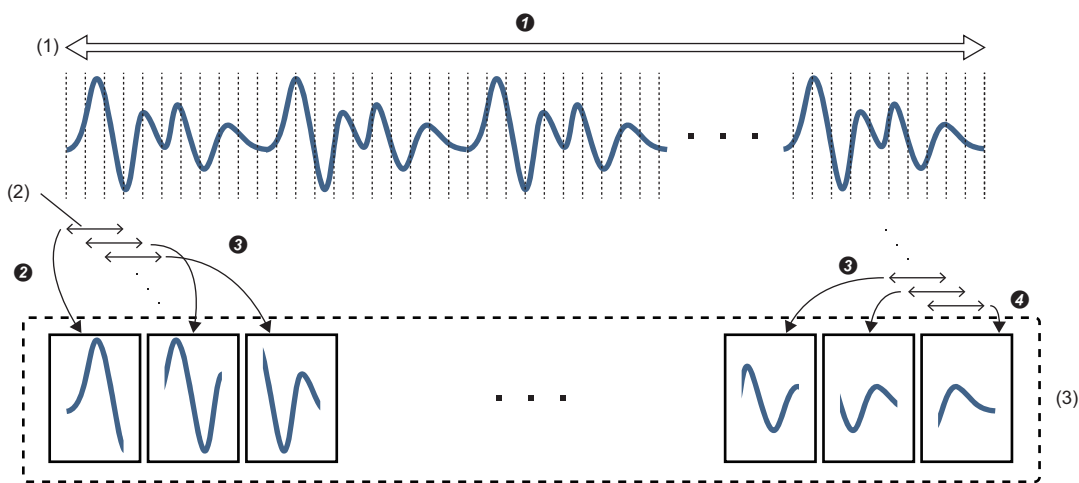
- Operation overview

The partial waveform group is created by extracting waveforms for the number of records of the unit waveform width from a reference waveform group in a learning period while shifting the waveform by one record.

The partial waveform group is used as an index to see how similar a waveform is to the inspection waveform (waveform to be diagnosed when executing a task) when executing the task.

Detailed operations in waveform learning are as follows:

- ❶ Importing all waveforms of a selected variable
- ❷ Analyzing and learning the shape of waveforms (partial waveforms) for the number of records that quarters the specified number of records per cycle
- ❸ Repeating ❷ for each record
- ❹ Completing both learning all partial waveforms in a selected variable and creating a similar waveform recognition model, and ending the analysis



(1) All waveforms of a selected variable

(2) For automatic learning: quarter of the number of records per cycle, for customized learning: unit waveform width (number of records)

(3) Partial waveform group

Precautions

- When a missing value is included in a reference waveform, process data with a preprocessing block.
- A reference waveform requires data including at least four cycles^{*1} of waveforms as cyclic waveforms to be input. However, expected diagnosis accuracy can hardly be acquired when using only four cycles of waveforms for waveform learning. Therefore, it is recommended to prepare a lot of data.

*1 When the learning target waveform consists of multiple and different cycles of waveforms and they are overlapping, prepare learning data including at least four cycles of the waveforms from the longest one.

■When executing a task

A variable selected for learning is diagnosed for each diagnosis cycle.

When the number of records collected for each diagnosis cycle reaches the quarter of the number of records per cycle, a diagnosis is performed to calculate a similarity score, and a reference waveform is determined.

The following explains the operation overview in similarity score calculation and the similarity score.

- Operation overview of similarity score calculation

When executing a task, the partial waveform group created in waveform learning and a waveform acquired by extracting an inspection waveform into a unit waveform width are compared and the similarity score of each is calculated.

Among the multiple similarity scores, the highest one will be the similarity score as the diagnosis result.

Detailed operations in similarity score calculation are as follows:

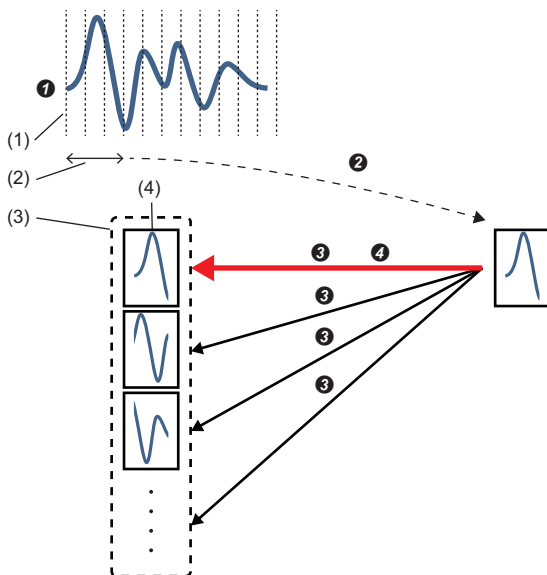
- ① Data is collected.
- ② In the first diagnosis, data is extracted for the quarter width of the number of records per cycle from the beginning of the data to calculate a similarity score by the steps shown in the following table. Then, a reference waveform for each of the extracted records is determined.

No	Description
1	The partial waveform group saved in waveform learning is compared with the extracted waveform, and the similarity score of each partial waveform is calculated.
2	The partial waveform with the highest similarity score calculated in step No.1 is determined as the most similar partial waveform. Its similarity score becomes the calculation result.

- ③ In the second and later diagnoses, the second to the last records among the ones used in the previous diagnosis and the first record collected this time are extracted to calculate the similarity score in the same manner as ②. Among the extracted records, only the reference waveform for the last record (newly added one) is determined.

- ④ ③ is repeated for the records collected this time by shifting one by one from the first record until the reference waveform for the last record is determined.

These operations are repeated for each diagnosis cycle.



(1) Waveform collected for each diagnosis cycle

(2) For automatic learning: quarter of the number of records per cycle, for customized learning: unit waveform width (number of records)

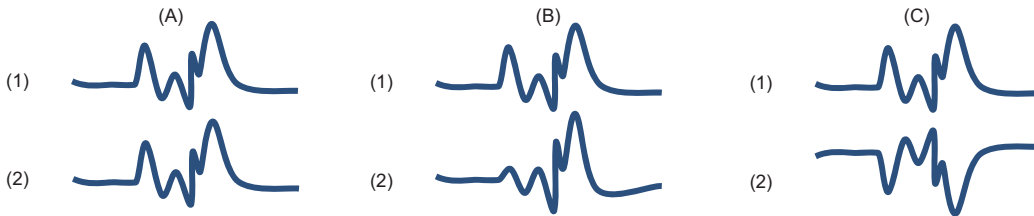
(3) Partial waveform group

(4) Most similar partial waveform

- Similarity score

The similarity score is an index value that indicates how similar an inspection waveform and a reference waveform are. The value of the similarity score is in the range from 0 to 100. When a reference waveform and an inspection waveform is completely matched, the similarity score will be '100.' When an inspection waveform is surely diagnosed as error comparing to a reference waveform, the similarity score will be '0.'

However, due to the effects of the optimization processing for high-speed calculation or slight fluctuation on the time axis of collection data, the similarity score may not be 100 even if an inspection waveform and a reference waveform are completely matched. (In this case, the similarity score marks a high score such as '99' or '98'.)



- (A) Comparison of waveforms to be completely matched (Similarity score = 100)
- (B) Comparison of waveforms to be possibly judged as error (Similarity score = 50)
- (C) Comparison of waveforms to be surely judged as error (Similarity score = 0)
- (1) Reference waveform
- (2) Inspection waveform

Precautions

- Even if a reference waveform and an inspection waveform are smooth (fluctuation is small), the similarity score fluctuation may increase because of the effects of the optimization processing for high-speed calculation or the jitter of collection data.
- Even if the shapes of a reference waveform and an inspection waveform are completely matched, the similarity score may be extremely low because of the slight fluctuation of the data collection timing.

Similar waveform recognition screen

The following shows the screen for setting a learning target variable and unit waveform width (number of records).

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Similar waveform recognition

Select learning target

Learning setting ?

Unit waveform width (number of records)

100

OK CANCEL

Displayed items

Item	Description
Select learning target	Select a learning target variable. Only numerical value type variables are listed.
Learning setting	Set a unit waveform width (number of records) (2 to 1000).

Considerations for similar waveform recognition

The following shows the considerations for similar waveform recognition.

Waveforms used for similar waveform recognition

For similarity waveform recognition, there are some properties of waveforms suitable for a diagnosis; therefore, it is recommended to check the waveform to be a reference waveform in advance. If fluctuation or deviation is large in a waveform which is in the normal state, more accurate reference waveform learning data can be created by increasing the number of records to be acquired.

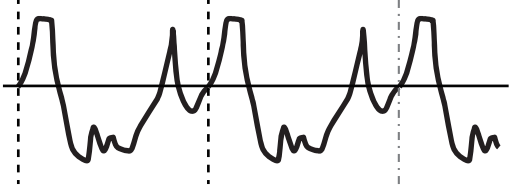

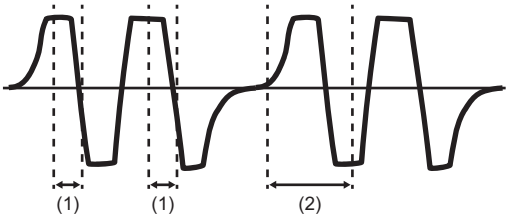
Take the following actions to acquire more accurate diagnosis results in similar waveform recognition:

- Specify an appropriate unit waveform width to include a specific waveform.
- The unit waveform width has the upper limit, so make the collection cycle longer or modify data so that all records in a specific waveform is included in the unit waveform width.
- Use data with resolution which allows for detecting a difference in a specific waveform. (It is recommended data with 500 steps or more of resolution from minimum value to maximum value.)




If the resolution is too low, an expected diagnosis result may not be acquired.

(Example) To detect the level difference '0.5' of a waveform of which the minimum value is '0.0' and the maximum value is '1000.0', resolution '0.5' or higher is necessary.

Properties of a waveform suitable for similar waveform recognition

Waveform property	Example	Remarks
Cyclic and amplitude is not too small.		—
Multiple patterns of correct phenomena are recorded.		The interval is not required to be even. While two or more phenomena can be diagnosed, too many phenomena increases the possibility of incorrect judgment.
The unit waveform width is not too short for one phenomenon.	 (1) Too short and may be confused with other portions. (2) Suitable because it includes a feature for distinction from other portions.	If a single phenomenon is too long to be included in the unit waveform width, shorten the collection cycle.

Properties of a waveform not suitable for similar waveform recognition

Waveform property	Example	Remarks
Not cyclic		—
Waveforms with different cycles are overlapped (noise or others).		While this example shows a case where a short-cycle waveform is overlapped, a long-cycle waveform also decreases the judgment accuracy.
Amplitude is too small for resolution.		It is recommended data with 500 steps or more of resolution from minimum value to maximum value.

Input waveform (reference waveform) and setting items in waveform learning

- For accurate learning and waveform monitoring, set the number of records for the unit waveform width so that a characteristic waveform such as an impulse waveform which appears cyclically can be included.
- Create a data set with only waveforms in the similar state for learning. Judgment accuracy may be lowered if a waveform in the error state is included or noise is generated on a waveform.
- If fluctuation or deviation is large in a waveform which is in the similar state, more accurate learning can be performed by increasing data amount.

Relation between fluctuation of a waveform and a diagnosis result

If an inspection waveform fluctuates, it is judged to be different even when its similarity is high or to be similar even when its similarity is lowered.

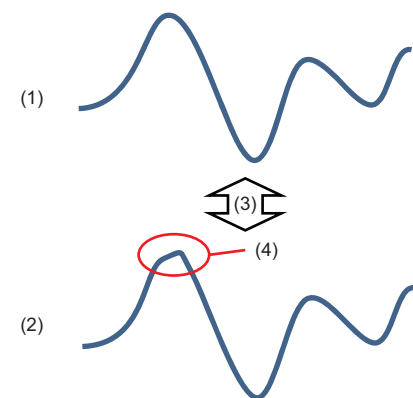
The relation between the similarity score and the fluctuation of a waveform included in a reference waveform is as follows:

Reference waveform group status	Similarity score status
Little fluctuation	<ul style="list-style-type: none"> • Similarity score tends to be high. • Slight misalignment of waveform greatly affects the similarity score.
Lot of fluctuation	<ul style="list-style-type: none"> • Similarity score tends to be low. • Slight misalignment of waveform does not greatly affect the similarity score.

Ex.

Example of a diagnosis in which a similarity score becomes lower than expected

A reference waveform similar to an inspection waveform after fluctuation is not found, so it is judged to be different.

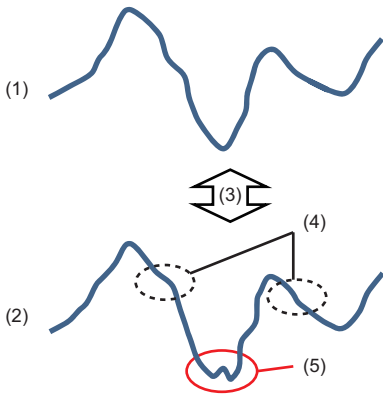


- (1) Reference waveform
- (2) Inspection waveform
- (3) Waveforms are compared.
- (4) Fluctuation is generated.

Ex.

Example of a diagnosis in which a similarity score becomes higher than expected

The similarity is increased with the learning of the reference waveform similar to an inspection waveform after fluctuation, so it is judged to be similar.



- (1) Reference waveform
- (2) Inspection waveform
- (3) Waveforms are compared.
- (4) Fluctuation is generated.
- (5) Abnormal waveform to detect

10.5 Ensemble Learning Category

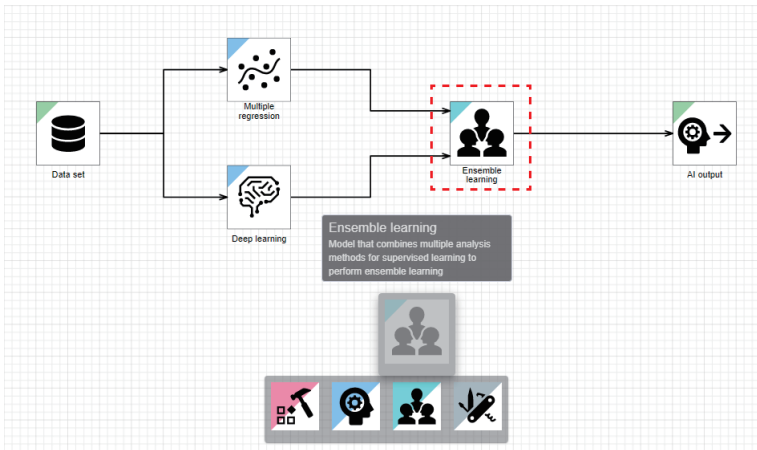
An extension block of the ensemble learning category outputs one diagnosis rule by combining multiple analysis methods. This block is available in the AI editor screen.

For operations that can be performed by right-clicking a block, refer to the following:

☞ Page 231 Right-click menus

Ensemble learning block

An ensemble learning block outputs one diagnosis rule by combining multiple analysis methods. Even when inference accuracy is low in each of the analysis methods, acquiring high inference accuracy can be expected by combining inference results output by multiple analysis methods.

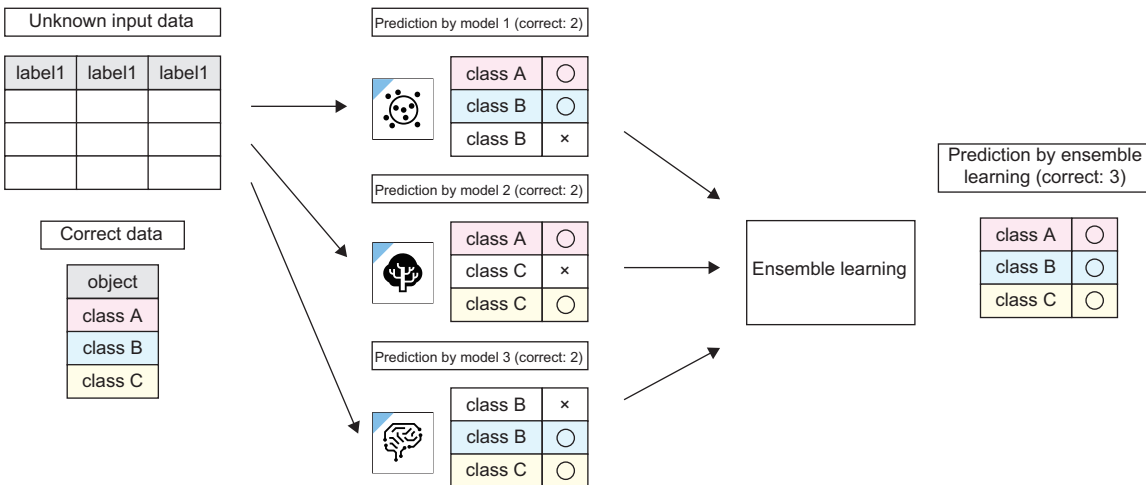


Ensemble learning has multiple methods. For example, an average value is taken for numerical value prediction, and a majority vote is taken for classification.

- Processing image

Ex.

When taking a majority vote for each model



Restriction

Only one ensemble learning block can be placed.

Input/output specifications

Detailed information on the input/output type differs depending on the diagnosis rule type to be input.

Note that the blocks previous to blocks of the analysis method category connected to the input must be all the same.

Input

Up to eight blocks can be input.

Diagnosis rule type to be input	Item	Description	
		When learning	When executing a task
Classification	Input/output type	Diagnosis rule type	Same as when learning
	Detailed information on the type	Diagnosis rule type: Classification	
Regression	Input/output type	Diagnosis rule type	
	Detailed information on the type	Diagnosis rule type: Regression	

Output

Diagnosis rule type to be input	Item	Description	
		When learning	When executing a task
Classification	Input/output type	Diagnosis rule type	Data frame type
	Detailed information on the type	Diagnosis rule type: Classification	<ul style="list-style-type: none"> Number of records: Same as the number of records of explanatory variables input to blocks of the analysis method category Number of variables: 1 to '1 + number of explanatory variables input to blocks of the analysis method category' Type of each variable: Refer to the table below.
Regression	Input/output type	Diagnosis rule type	Data frame type
	Detailed information on the type	Diagnosis rule type: Regression	<ul style="list-style-type: none"> Number of records: Same as the number of records of explanatory variables input to blocks of the analysis method category Number of variables: 1 to '1 + number of explanatory variables input to blocks of the analysis method category' Type of each variable: Refer to the table below.

Variable to be output when executing a task				
No.	Variable name ^{*1}	Variable type	Description	Value
1	(AI name)_DIAG	<ul style="list-style-type: none"> When the diagnosis rule type is 'classification': Category When the diagnosis rule type is 'regression': Numerical value 	Diagnosis result	<ul style="list-style-type: none"> When an objective variable is of the category type: Any of the values of the objective variable used for learning When an objective variable is of the numerical value type: Range of floating point numbers
2 to number of additional features	(AI name)_(variable name)	Same as the type of each additional feature input to a block of the analysis method category	Each additional feature input to a block of the analysis method category after it is processed in the AI editor	Value of each additional feature input to a block of the analysis method category

*1 If a variable name has more than 255 characters, characters in an AI name will be deleted in order from the end.

Detailed processing of an ensemble method

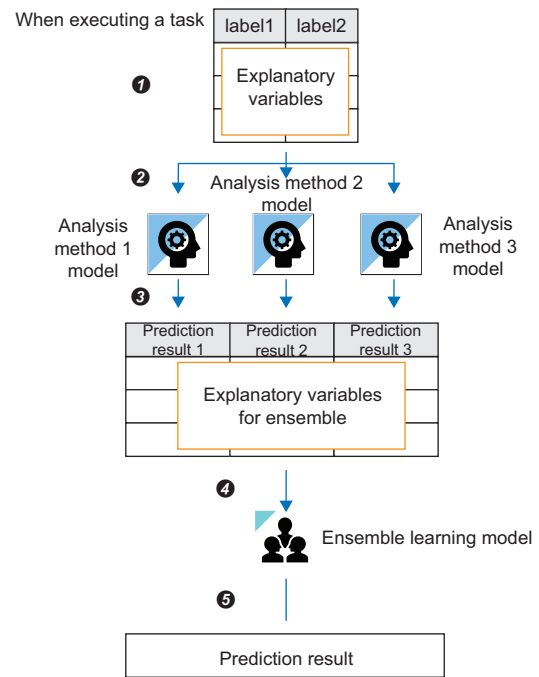
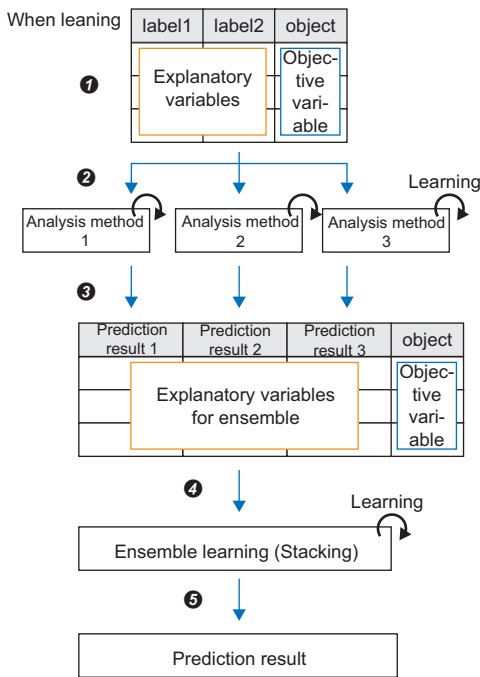
Processing differs depending on the selected ensemble learning method.

■ Stacking

Learning of new classification or regression is performed by using results output by multiple analysis methods as the input.

- For classification, results output by multiple analysis methods are used as the input and classified with logistic regression.
- For regression, results output by multiple analysis methods are used as the input, and values are inferred with linear regression.

The learning and inference speed is lower than other ensemble methods because learning and inference are performed in two steps.

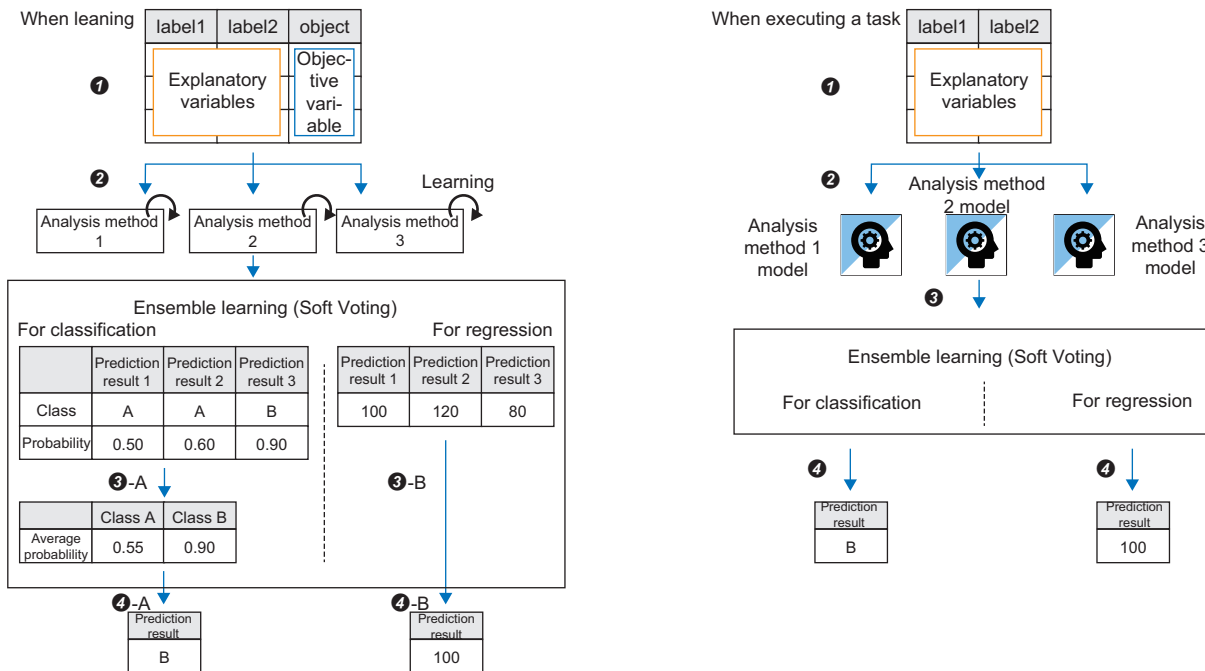


When learning	When executing a task
❶ Input data	❶ Input data
❷ Learning is performed by each analysis method.	❷ An inference is made by each model.
❸ Results output by multiple analysis methods become input data for ensemble learning.	❸ Results output by models become input data for ensemble learning.
❹ Learning is performed again.	❹ An inference is made by an ensemble learning model.
❺ The final result is output. (A model evaluation value is calculated.)	❺ The final result is output.

■ Soft Voting

Results are output by using the average probability or average value of inference results output by analysis methods.

- For classification, the class with the highest average probability is output among inference results output by analysis methods.
- For regression, the average value of results output by analysis methods is output.



When learning	When executing a task
1 Input data	1 Input data
2 Learning is performed by each analysis method.	2 An inference is made by each model.
3-A The average value of the inference probability is calculated for each class. 3-B The average value is output.	3 Same as when learning
4-A The class with the highest average probability is output. 4-B The final result is output. (A model evaluation value is calculated.)	4 The final result is output.

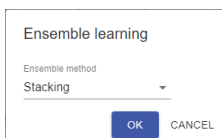
Ensemble learning screen

The following shows the screen for selecting a method of ensemble learning.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
Ensemble method	Select an ensemble method. <ul style="list-style-type: none"> • Stacking • Soft Voting

10.6 AI Output Category

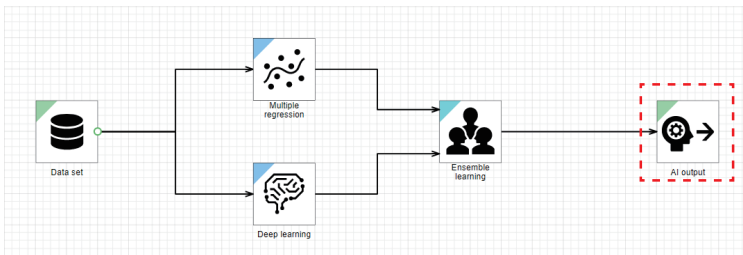
An extension block of the AI output category fixes and outputs the process flow in the AI editor screen. This block is available in the AI editor screen.

For operations that can be performed by right-clicking a block, refer to the following:

☞ Page 231 Right-click menus

AI output block

An AI output block outputs a flow from a data set block to this block as an AI by connecting blocks.



Input/output specifications

■ Input

Item	Description	
Input/output type	Diagnosis rule type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Diagnosis rule type: Classification/regression 	<ul style="list-style-type: none"> Number of records: Integer between 1 and 864000 Number of variables: Integer between 1 and 1024 Type of each variable: Any types

10.7 Data Stream Category

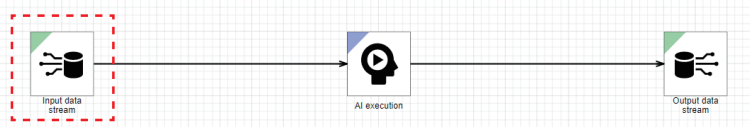
Extension blocks of the data stream category input or output data of when a task is executed. These blocks are available in the task editor screen.

For operations that can be performed by right-clicking a block, refer to the following:

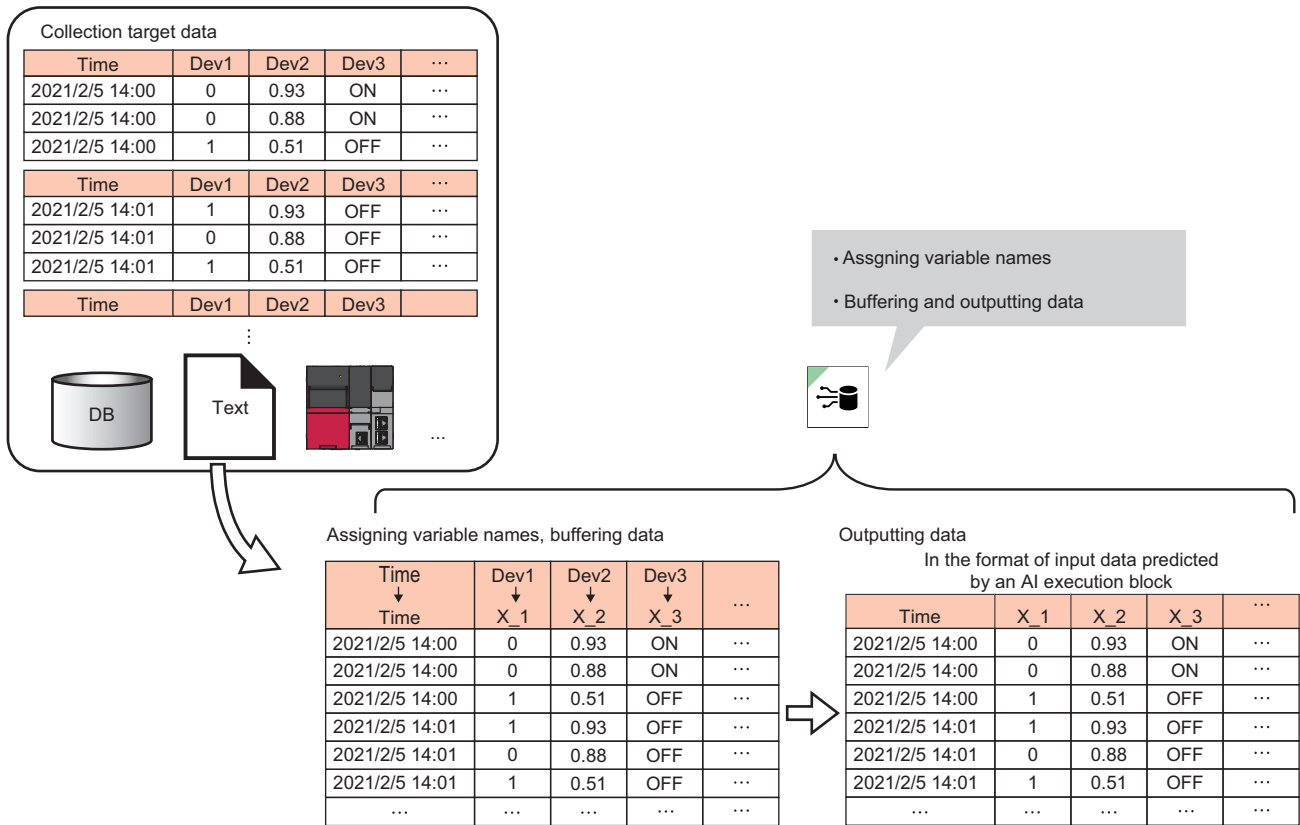
☞ Page 231 Right-click menus

Input data stream block

An input data stream block collects data when a task is executed, and outputs the data to the next block. Only one type of data collection method (connection method) can be set.



- Processing image



Input/output specifications

■Output

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> • Number of records: Integer between 1 and 86400 • Number of variables: Integer between 1 and 256 • Type of each variable: Any types

Variable to be output				
No.	Variable name	Variable type	Description	Range
1 to 256	(Variable name set in the data assignment settings)	Any types	Collection data set in the data assignment settings among collected data	Any ranges

Operational specifications

The following processing is performed when executing a task.

1. Collecting data

Data is collected for each collection cycle.

Detailed specifications follow the ones for each connection method.

☞ Page 370 Connection method (text file)

☞ Page 373 Connection method (Mitsubishi Electric FA connector)

☞ Page 384 Connection method (OPC UA server connection)

☞ Page 386 Connection method (DB connection)

2. Buffering the collected data

The collected data is retained in the buffer until it is output to a block connected to this block.

When retaining the collected data in the buffer, the data acquired in each collection cycle is retained or deleted together.

3. Outputting the collected data

The collected data in the buffer is joined and output to a block connected to this block for each diagnosis cycle.

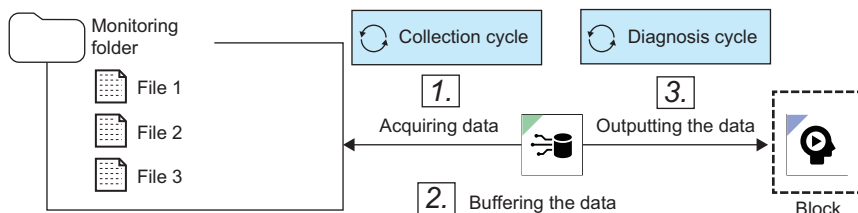
When zero records are output in a diagnosis cycle, the task execution of the next block is skipped in the diagnosis cycle.

Connection method (text file)

A CSV file or TSV file stored in the monitoring folder is read in a specified collection cycle, and data is output to the next block. The format of a readable text file is the same as the one shown in the following. However, the minimum number of lines is excluded.

📖 Page 79 Data source

Operational specifications



1. Collecting data from a monitoring folder

Among files stored in a monitoring folder, files that have a specified prefix (all files if a prefix is not specified) and the extension CSV or TSV are collected in order of when data is updated.

Point

Data is collected within a range that does not exceed the buffer capacity or the number of buffer records in total.

2. Buffering the data

The collected data is accumulated in the buffer.

3. Outputting the data

All the data accumulated in the buffer is output to a connected block for each diagnosis cycle.

■When the collected file saving setting is OFF

The collected files are deleted.

■When the collected file saving setting is ON

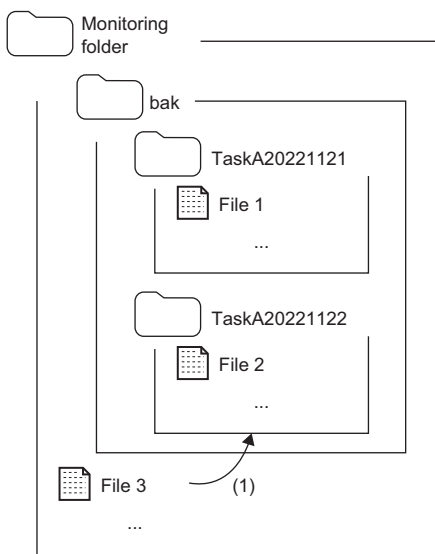
Collected files are moved to the bak folder in the monitoring folder. The files are stored in a folder named with the date when they are collected, and held for the number of days to hold files.

If there is no bak folder or date folders when files are moved, these folders are created as necessary.

The date folder name is 'prefix of a collected file name + yyyyymmdd.'

When the number of files in a folder exceeds 100000, a new folder with the name suffixed with (XXX) is created. After that, files are stored in the new folder. ('XXX' is a three-digit number. The number will be incremented from '001' until it is not duplicate.)

In addition, when a file name is duplicate in the save destination folder, the file name is suffixed with (X). ('X' is a one-digit number. The number will be incremented from '1' until it is not duplicate.)

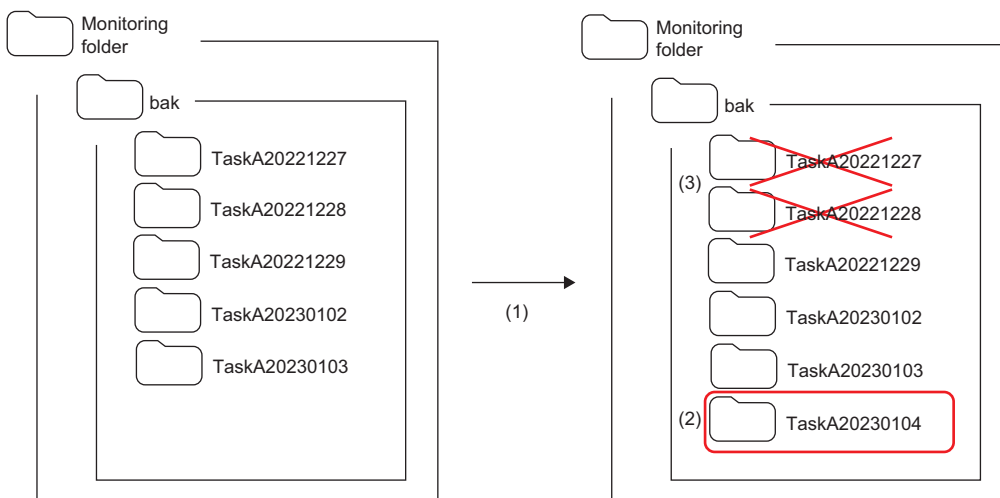


(1) Moved after collection

Deleting a file that exceeds the number of days to hold files

- Data is held according to the number of days to hold files except for the date folder being collected.

(Example) In the case where a bak folder has a structure of folders shown below and the number of days to hold files is three days, if files are collected on 2023/01/04, a folder named with '20230104' is created and three date folders before the folder being collected are held. The data out of the days is deleted.



(1) Files are collected on 2023/01/04.

(2) A new folder named with '20230104' is created.

(3) Folders named with '20221227' and '20221228' are deleted.

- A list of deletion target files are updated in the following timings:
 - When a task is started
 - When a file is collected for the first time after the next day of the previous file collection comes while a task is executed
- If a list of deletion target files exists, deletion target files are deleted as shown in below.

① When files are collected:

The files in the date folder to be deleted are deleted by a few files, and the folder is deleted when it becomes empty. However, if file deletion fails, the deletion of this file is skipped, and the date folder is not deleted.

② When tasks are started or stopped:

The date folders to be deleted are deleted. If the deletion is skipped, it is notified as an event.

■When settings for the same files in the same folder are configured in multiple tasks

- Do not set multiple tasks to read the same file. Set another folder path or specify a prefix that is not duplicate for a file name.
- To perform different diagnoses by using the same data, set multiple AIs in an AI execution block.

■Operation in a bak folder when the collected file saving setting is ON

Do not perform any of the following operations in a bak folder.

Saving collected files or deleting files that exceeds the number of days to hold files may not run properly.

- To change a folder name of a date folder
- To create a folder
- To copy a folder into a bak folder

■Exclusion setting with antivirus software

Antivirus software may affect the operation of this product. Therefore, exclude the following folder from the monitoring targets in the antivirus software setting:

For the setting method, refer to the manual for each antivirus software.

- The path of a folder set as an input data stream

Connection method (Mitsubishi Electric FA connector)

Data sent from a Mitsubishi Electric programmable controller in a collection cycle is read and output to the next block. Only devices in a single network can be accessed. (Stations in co-existence network cannot be accessed.)

For accessible devices (products) and routes, refer to the following:

☞ Page 375 Accessible devices (products)

☞ Page 377 Accessible routes

For accessible devices, refer to the following:

☞ Page 379 Accessible devices

Precautions

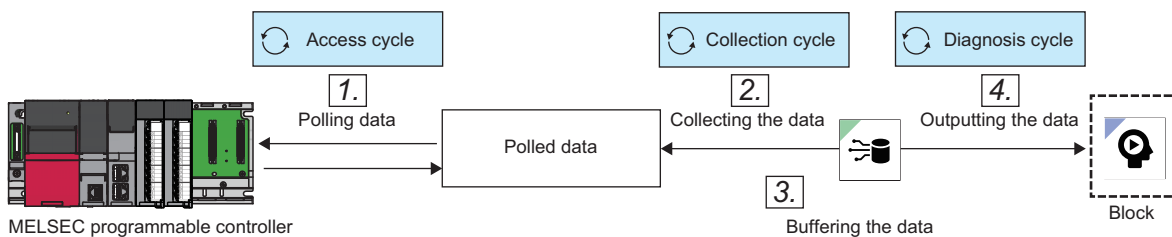
- If a remote password is set for an access target device, it cannot be accessed.
- Some devices may be accessible besides the ones listed in the following section. However, their operation is not guaranteed.

☞ Page 375 Accessible devices (products)

- When the same access target device is connected from multiple diagnosis terminals via TCP, set MELSOFT connection modules for the number of diagnosis terminals to be connected in the parameters for a access target device. (To connect MELSOFT other than this product, it also needs to be set as a MELSOFT connection module.)

For details, refer to the manual for a target Mitsubishi Electric product.

Operational specifications



1. Polling data

Data reading is requested for a MELSEC device in the set access cycle.

Data is collected according to the response from the MELSEC device.

2. Collecting the data

Polled data is collected in the set collection cycle.

Only data collected in the collection cycle is buffered. Therefore, when a high-speed access cycle is set in step 1, polled data is overwritten, and all polled data may not be used in a diagnosis.

(Example) Data with the same value may be collected when the access cycle is 200 ms and the task collection interval is less than 200 ms.

3. Buffering the data

The collected data is accumulated in the buffer.

4. Outputting the data

All the data accumulated in the buffer is output to a connected block for each diagnosis cycle.

When an explanatory variable of an AI set in an AI execution block is of the timestamp type, 'collection date and time' is always output because no timestamp data is collected from a Mitsubishi Electric programmable controller.

In addition, when data is acquired for a category type variable using "Mitsubishi Electric FA Connector" for the connection method, this block outputs a value in the following range:

Data type in MELSEC device	Value to be output as category type variable
BOOL	The following character: • True: "1" • False: "0"
STRING, WSTRING	Character string that has zero to the number of characters defined in data type

Data type in MELSEC device	Value to be output as category type variable
Others	<ul style="list-style-type: none">• NaN: NaN• Other cases: Numerical value that is converted to character string Example: 1: "1," -0.5: "-0.5," inf: "inf"

■ Accessible devices (products)

The following table shows the list of accessible devices (products).

Series	Type	Model name	Remarks	
RCPU	RnCPU	R00	—	
		R01		
		R02		
		R04		
		R08		
		R16		
		R32		
		R120		
	RnPCPU	R08P	The redundant mode is not available.	
		R16P		
		R32P		
	RnENCPU	R04EN	—	
		R08EN		
		R16EN		
		R32EN		
		R120EN		
	Rsafety	RnSFCPU	R08SF	
			R16SF	
			R32SF	
			R120SF	
	FX5CPU	FX5CPU	FX5U	Select "FX5U/FX5UC" to use these modules.
FX5UC				

Series	Type	Model name	Remarks
QCPU	QnU(J)CPU QnUD(E)HCPU	Q00U	—
		Q00UJ	
		Q01U	
		Q02U	
		Q03UD	
		Q04UDH	
		Q06UDH	
		Q10UDH	
		Q13UDH	
		Q20UDH	
		Q26UDH	
		Q03UDE	
		Q04UDEH	
		Q06UDEH	
		Q10UDEH	
		Q13UDEH	
		Q20UDEH	
		Q26UDEH	
		Q50UDEH	
		Q100UDEH	
	QnUDPVCPU	Q04UDPV	
		Q06UDPV	
		Q13UDPV	
		Q26UDPV	
	QnUDVCPU	Q03UDV	
		Q04UDV	
		Q06UDV	
Q13UDV			
Q26UDV			
LCPU	LnCPU	L02S	Select "L02S/L02S-P" to use this module.
		L02	Select "L02/L02-P" to use this module.
		L02-P	
		L06	Select "L06/L06-P" to use this module.
		L26	Select "L26/L26-P" to use this module.
		L26-BT	Select "L26-BT/L26-PBT" to use this module.

■ Accessible routes

The following shows the accessible routes.

Accessible routes differ depending on the series of an access target device.

- When the series of an access target device is RCPUR or RSafety

○: Accessible, △: Partially accessible, ×: Not accessible

PC I/F	Device I/F ^{*1}						Simulator connection
	USB	RJ71EN71 (Direct)	RJ71EN71 (Specify IP Address)	Ethernet Port (Direct)	Ethernet Port (Specify IP Address)	RJ71GN11-T2 (Specify IP Address)	
USB	○	×	×	×	×	×	×
Ethernet Board	×	○	○	○	○	△ ^{*2}	×
GX Simulator3	×	×	×	×	×	×	○
GX Simulator2	×	×	×	×	×	×	×

*1 The meaning of 'Direct' and 'Specify IP Address' is as follows:

- Direct: When connecting a device directly
- Specify IP Address: When connecting a device by specifying the IP address

*2 Not accessible for the following models:

- R08P
- R16P
- R32P

- When the series of an access target device is FX5CPU

○: Accessible, ×: Not accessible

PC I/F	Device I/F ^{*1}						Simulator connection
	USB	FX5-ENET (Direct)	FX5-ENET (Specify IP Address)	Ethernet Port (Direct)	Ethernet Port (Specify IP Address)	FX5-CCLGN-MS (Specify IP Address)	
USB	×	×	×	×	×	×	×
Ethernet Board	×	×	×	○	○	×	×
GX Simulator3	×	×	×	×	×	×	○
GX Simulator2	×	×	×	×	×	×	×

*1 The meaning of 'Direct' and 'Specify IP Address' is as follows:

- Direct: When connecting a device directly
- Specify IP Address: When connecting a device by specifying the IP address

- When the series of an access target device is QCPU

○: Accessible, △: Partially accessible, ×: Not accessible

PC I/F	Device I/F ^{*1}				Simulator connection
	USB	QJ71E71 (Specify IP Address)	Ethernet Port (Direct)	Ethernet Port (Specify IP Address)	
USB	○	×	×	×	×
Ethernet Board	×	○	△ ^{*2}	△ ^{*2}	×
GX Simulator3	×	×	×	×	×
GX Simulator2	×	×	×	×	○

*1 The meaning of 'Direct' and 'Specify IP Address' is as follows:

- Direct: When connecting a device directly
- Specify IP Address: When connecting a device by specifying the IP address

*2 Not accessible for the following models:

- Q01U
- Q02U
- Q03UD
- Q04UDH
- Q06UDH
- Q10UDH
- Q13UDH
- Q20UDH
- Q26UDH

• When the series of an access target device is LCPU

○: Accessible, △: Partially accessible, ×: Not accessible

PC I/F	Device I/F ^{*1}				Simulator connection
	USB	LJ71E71 (Specify IP Address)	Ethernet Port (Direct)	Ethernet Port (Specify IP Address)	
USB	○	×	×	×	×
Ethernet Board	×	○	△ ^{*2}	△ ^{*2}	×
GX Simulator3	×	×	×	×	×
GX Simulator2	×	×	×	×	○

*1 The meaning of 'Direct' and 'Specify IP Address' is as follows:

- Direct: When connecting a device directly
- Specify IP Address: When connecting a device by specifying the IP address

*2 Not accessible for L02S.

■ Accessible devices

The following shows the list of accessible devices.

Accessible devices differ depending on the type of an access target device (product).

- RnCPU/RnENCPU/RnPCPU

Device name	Device type	Data type	Start address	End address	Address representation
X	Bit	BOOL	0	2FFF	Hexadecimal
Y	Bit	BOOL	0	2FFF	Hexadecimal
B	Bit	BOOL	0	9A61FFF	Hexadecimal
CC	Bit	BOOL	0	8993439	Decimal
CN	Word	WORD	0	8993439	Decimal
CS	Bit	BOOL	0	8993439	Decimal
D	Word	WORD	0	10117631	Decimal
F	Bit	BOOL	0	32767	Decimal
GV:	Word	WORD	0	9A5FFF	Hexadecimal
Jn\B ^{*1}	Bit	BOOL	0	9FFFF	Hexadecimal
Jn\SB ^{*1}	Bit	BOOL	0	13FF	Hexadecimal
Jn\SW ^{*1}	Word	WORD	0	13FF	Hexadecimal
Jn\W ^{*1}	Word	WORD	0	27FFFF	Hexadecimal
Jn\X ^{*1}	Bit	BOOL	0	27FFF	Hexadecimal
Jn\Y ^{*1}	Bit	BOOL	0	27FFF	Hexadecimal
L	Bit	BOOL	0	32767	Decimal
LCC	Bit	BOOL	0	4761215	Decimal
LCN	Word	DWORD	0	4761215	Decimal
LCS	Bit	BOOL	0	4761215	Decimal
LSTC	Bit	BOOL	0	2529407	Decimal
LSTN	Word	DWORD	0	2529407	Decimal
LSTS	Bit	BOOL	0	2529407	Decimal
LTC	Bit	BOOL	0	2529407	Decimal
LTN	Word	DWORD	0	2529407	Decimal
LTS	Bit	BOOL	0	2529407	Decimal
M	Bit	BOOL	0	161882111	Decimal
R	Word	WORD	0	32767	Decimal
SB	Bit	BOOL	0	9A61FFF	Hexadecimal
SD	Word	WORD	0	4095	Decimal
SM	Bit	BOOL	0	4095	Decimal
STC	Bit	BOOL	0	8993439	Decimal
STN	Word	WORD	0	8993439	Decimal
STS	Bit	BOOL	0	8993439	Decimal
SW	Word	WORD	0	9A61FF	Hexadecimal
TC	Bit	BOOL	0	8993439	Decimal
TN	Word	WORD	0	8993439	Decimal
TS	Bit	BOOL	0	8993439	Decimal
Un\G ^{*2}	Word	WORD	0	268435455	Decimal
U3En\G ^{*3}	Word	WORD	0	268435455	Decimal
U3En\HG ^{*3}	Word	WORD	0	268435455	Decimal
W	Word	WORD	0	9A61FF	Hexadecimal
ZR	Word	WORD	0	10027007	Decimal

*1 For a link direct device (Jn\), specify a network number (1 to 239) for 'n.'

*2 For a module access device (Un\G), specify the first two digits (0 to FF) of the start input/output number in three-digits representation for 'n.'

*3 For a CPU buffer memory access device (U3En\G/U3En\HG), specify the input/output number of the CPU module (0 to 3) for 'n.'

• RnPSFCPU/RnSFCPU

Device name	Device type	Data type	Start address	End address	Address representation
X	Bit	BOOL	0	2FFF	Hexadecimal
Y	Bit	BOOL	0	2FFF	Hexadecimal
B	Bit	BOOL	0	5A49FFF	Hexadecimal
CC	Bit	BOOL	0	5259711	Decimal
CN	Word	WORD	0	5259711	Decimal
CS	Bit	BOOL	0	5259711	Decimal
D	Word	WORD	0	5917183	Decimal
F	Bit	BOOL	0	32767	Decimal
GV:	Word	WORD	0	5A47FF	Hexadecimal
Jn\B ¹	Bit	BOOL	0	9FFFF	Hexadecimal
Jn\SB ¹	Bit	BOOL	0	13FF	Hexadecimal
Jn\SW ¹	Word	WORD	0	13FF	Hexadecimal
Jn\W ¹	Word	WORD	0	27FFFF	Hexadecimal
Jn\X ¹	Bit	BOOL	0	27FFF	Hexadecimal
Jn\Y ¹	Bit	BOOL	0	27FFF	Hexadecimal
L	Bit	BOOL	0	32767	Decimal
LCC	Bit	BOOL	0	2784543	Decimal
LCN	Word	DWORD	0	2784543	Decimal
LCS	Bit	BOOL	0	2784543	Decimal
LSTC	Bit	BOOL	0	1479295	Decimal
LSTN	Word	DWORD	0	1479295	Decimal
LSTS	Bit	BOOL	0	1479295	Decimal
LTC	Bit	BOOL	0	1479295	Decimal
LTN	Word	DWORD	0	1479295	Decimal
LTS	Bit	BOOL	0	1479295	Decimal
M	Bit	BOOL	0	94674943	Decimal
R	Word	WORD	0	32767	Decimal
SA\B ²	Bit	BOOL	0	9BFFF	Hexadecimal
SA\CC	Bit	BOOL	0	35487	Decimal
SA\CN	Word	WORD	0	35487	Decimal
SA\CS	Bit	BOOL	0	35487	Decimal
SA\D ²	Word	WORD	0	39935	Decimal
SA\M ²	Bit	BOOL	0	638975	Decimal
SA\SD ²	Word	WORD	0	4095	Decimal
SA\SM ²	Bit	BOOL	0	4095	Decimal
SA\STC	Bit	BOOL	0	35487	Decimal
SA\STN	Word	WORD	0	35487	Decimal
SA\STS	Bit	BOOL	0	35487	Decimal
SA\TC	Bit	BOOL	0	35487	Decimal
SA\TN	Word	WORD	0	35487	Decimal
SA\TS	Bit	BOOL	0	35487	Decimal
SA\W ²	Word	WORD	0	9BFF	Hexadecimal
SA\X ²	Bit	BOOL	0	2FFF	Hexadecimal
SA\Y ²	Bit	BOOL	0	2FFF	Hexadecimal
SB	Bit	BOOL	0	5A49FFF	Hexadecimal
SD	Word	WORD	0	4095	Decimal
SM	Bit	BOOL	0	4095	Decimal
STC	Bit	BOOL	0	5259711	Decimal
STN	Word	WORD	0	5259711	Decimal
STS	Bit	BOOL	0	5259711	Decimal
SW	Word	WORD	0	5A49FF	Hexadecimal

Device name	Device type	Data type	Start address	End address	Address representation
TC	Bit	BOOL	0	5259711	Decimal
TN	Word	WORD	0	5259711	Decimal
TS	Bit	BOOL	0	5259711	Decimal
Un\G ^{*3}	Word	WORD	0	268435455	Decimal
U3En\G ^{*4}	Word	WORD	0	268435455	Decimal
U3En\HG ^{*4}	Word	WORD	0	268435455	Decimal
W	Word	WORD	0	5A49FF	Hexadecimal
ZR	Word	WORD	0	5832703	Decimal

*1 For a link direct device (Jn\), specify a network number (1 to 239) for 'n.'

*2 For a safety device, its value is read-only.

*3 For a module access device (Un\G), specify the first two digits (0 to FF) of the start input/output number in three-digits representation for 'n.'

*4 For a CPU buffer memory access device (U3En\G/U3En\HG), specify the input/output number of the CPU module (0 to 3) for 'n.'

• FX5CPU

Device name	Device type	Data type	Start address	End address	Address representation
X	Bit	BOOL	0	1777	Octal
Y	Bit	BOOL	0	1777	Octal
B	Bit	BOOL	0	7FFF	Hexadecimal
CC	Bit	BOOL	0	1023	Decimal
CN	Word	WORD	0	1023	Decimal
CS	Bit	BOOL	0	1023	Decimal
D	Word	WORD	0	7999	Decimal
F	Bit	BOOL	0	32767	Decimal
GV:	Word	WORD	0	FBFF	Hexadecimal
L	Bit	BOOL	0	32767	Decimal
LCC	Bit	BOOL	0	1023	Decimal
LCN	Word	DWORD	0	1023	Decimal
LCS	Bit	BOOL	0	1023	Decimal
M	Bit	BOOL	0	32767	Decimal
R	Word	WORD	0	32767	Decimal
SB	Bit	BOOL	0	7FFF	Hexadecimal
SD	Word	WORD	0	11999	Decimal
SM	Bit	BOOL	0	9999	Decimal
STC	Bit	BOOL	0	1023	Decimal
STN	Word	WORD	0	1023	Decimal
STS	Bit	BOOL	0	1023	Decimal
SW	Word	WORD	0	7FFF	Hexadecimal
TC	Bit	BOOL	0	1023	Decimal
TN	Word	WORD	0	1023	Decimal
TS	Bit	BOOL	0	1023	Decimal
Un\G ^{*1}	Word	WORD	0	262143	Decimal
W	Word	WORD	0	7FFF	Hexadecimal

*1 For a module access device (Un\G), specify the first two digits (0 to FF) of the start input/output number in three-digits representation for 'n.'

• QCPU

Device name	Device type	Data type	Start address	End address	Address representation
X	Bit	BOOL	0	1FFF	Hexadecimal
Y	Bit	BOOL	0	1FFF	Hexadecimal
B	Bit	BOOL	0	FFFF	Hexadecimal
CC	Bit	BOOL	0	32767	Decimal
CN	Bit	WORD	0	32767	Decimal
CS	Bit	BOOL	0	32767	Decimal
D	Word	WORD	0	4849663	Decimal
F	Bit	BOOL	0	2047	Decimal
Jn\B	Bit	BOOL	0	7FFF	Hexadecimal
Jn\SB	Bit	BOOL	0	1FF	Hexadecimal
Jn\SW	Word	WORD	0	1FF	Hexadecimal
Jn\W	Word	WORD	0	1FFFF	Hexadecimal
Jn\X	Bit	BOOL	0	3FFF	Hexadecimal
Jn\Y	Bit	BOOL	0	3FFF	Hexadecimal
L	Bit	BOOL	0	32767	Decimal
M	Bit	BOOL	0	61439	Decimal
R	Word	WORD	0	4849663	Decimal
SB	Bit	BOOL	0	7FFF	Hexadecimal
SD	Word	WORD	0	2047	Decimal
SM	Bit	BOOL	0	2047	Decimal
STC	Bit	BOOL	0	32767	Decimal
STN	Word	WORD	0	32767	Decimal
STS	Bit	BOOL	0	32767	Decimal
SW	Word	WORD	0	7FFF	Hexadecimal
TC	Bit	BOOL	0	32767	Decimal
TN	Word	WORD	0	32767	Decimal
TS	Bit	BOOL	0	32767	Decimal
Un\G	Word	WORD	0	65535	Decimal
U3En\G	Word	WORD	0	24335	Decimal
W	Word	WORD	0	4AEBFF	Hexadecimal
ZR	Word	WORD	0	4849663	Decimal

• LCPU

Device name	Device type	Data type	Start address	End address	Address representation
X	Bit	BOOL	0	1FFF	Hexadecimal
Y	Bit	BOOL	0	1FFF	Hexadecimal
B	Bit	BOOL	0	FFFF	Hexadecimal
CC	Bit	BOOL	0	32767	Decimal
CN	Word	WORD	0	32767	Decimal
CS	Bit	BOOL	0	32767	Decimal
D	Word	WORD	0	421887	Decimal
F	Bit	BOOL	0	32767	Decimal
Jn\SB	Bit	BOOL	0	1FF	Hexadecimal
Jn\SW	Word	WORD	0	1FF	Hexadecimal
Jn\SW	Bit	BOOL	0.0	1FF.F	Hexadecimal
Jn\W	Word	WORD	0	3FFF	Hexadecimal
Jn\W	Bit	BOOL	0.0	3FFF.F	Hexadecimal
Jn\X	Bit	BOOL	0	3FFF	Hexadecimal
Jn\Y	Bit	BOOL	0	3FFF	Hexadecimal
L	Bit	BOOL	0	32767	Decimal
M	Bit	BOOL	0	61439	Decimal
SB	Bit	BOOL	0	7FFF	Hexadecimal
SD	Word	WORD	0	2047	Decimal
SM	Bit	BOOL	0	2047	Decimal
STC	Bit	BOOL	0	32767	Decimal
STN	Word	WORD	0	32767	Decimal
STS	Bit	BOOL	0	32767	Decimal
SW	Word	WORD	0	6FFFF	Hexadecimal
TC	Bit	BOOL	0	32767	Decimal
TN	Word	WORD	0	32767	Decimal
TS	Bit	BOOL	0	32767	Decimal
Un\G	Word	WORD	0	65535	Decimal
W	Word	WORD	0	66FFF	Hexadecimal
ZR	Word	WORD	0	393215	Decimal

■Collection cycle of an OPC UA server

- An OPC UA server periodically collects data; therefore, when the collection cycle of this product is longer than that of the OPC UA server, data may not be collected.

It is recommended to set the collection cycle of this product equal to or shorter than that of the OPC UA server.

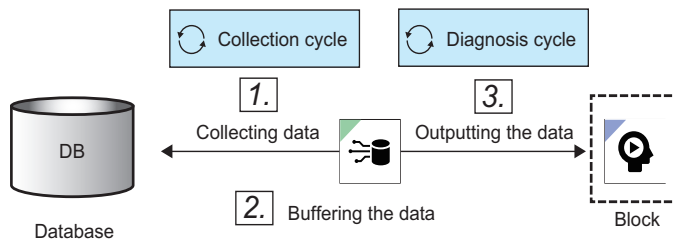
In addition, the collection cycle of the OPC UA server depends on the performance of the OPC UA server. For details, refer to the manual of the OPC UA server to be used.

- When the data update of the OPC UA server and data collection of this product are not performed at the same time, the data to be used for a diagnosis may not be collected as expected. Before the official operation, check whether the data is collected as expected.

Connection method (DB connection)

Data is acquired from a database and output to the next block.

Operational specifications



1. Collecting data

Data is collected from a database.

For the correspondence between the data types for this product and those for a database, refer to the following:

☞ Page 387 Correspondence between the data types for this product and those for a database

2. Buffering the data

The collected data is accumulated in the buffer.

3. Outputting the data

All the data accumulated in the buffer is output to a connected block for each diagnosis cycle.

■Correspondence between the data types for this product and those for a database

Operations are guaranteed with the combinations in the following table.

- MySQL

○: Supported, —: Unsupported

Input data stream/data set	tinyint smallint mediumint int bigint	float double decimal numeric	char varchar text	datetime timestamp
Numerical value type	○	○	○*1	—
Category type	○	○	○*2	○
Timestamp type	—	—	○*1	○

*1 Character strings that can be recognized or parsed as characters for each data type are imported.

*2 According to the specifications of the category type, characters exceeding the maximum number are deleted and unusable ones are replaced to import.

- PostgreSQL

○: Supported, —: Unsupported

Input data stream/data set	smallint integer bigint	real double precision	decimal numeric	character varying varchar character char text	timestamp timestamp with time zone
Numerical value type	○	○	○	○*1	—
Category type	○	○	○	○*2	○
Timestamp type	—	—	—	○*1	○

*1 Character strings that can be recognized or parsed as characters for each data type are imported.

*2 According to the specifications of the category type, characters exceeding the maximum number are deleted and unusable ones are replaced to import.

- SQL Server

○: Supported, —: Unsupported

Input data stream/data set	tinyint smallint int bigint	float real numeric decimal	char varchar text nchar nvarchar ntext	datetime datetime2 smalldatetime
Numerical value type	○	○	○*1	—
Category type	○	○	○*2	○
Timestamp type	—	—	○*1	○





*1 Character strings that can be recognized or parsed as characters for each data type are imported.

*2 According to the specifications of the category type, characters exceeding the maximum number are deleted and unusable ones are replaced to import.

Input data stream screen

The following shows the screen for setting a data collection method (connection method).

Settings differ depending on the connection method.

- When the connection method is "Text file": ( Page 388 When the connection method is "Text file")
- When the connection method is "Mitsubishi Electric FA Connector": ( Page 392 When the connection method is "Mitsubishi Electric FA Connector")
- When the connection method is "OPC UA server connection": ( Page 396 When the connection method is "OPC UA server connection")
- When the connection method is "DB connection": ( Page 406 When the connection method is "DB connection")

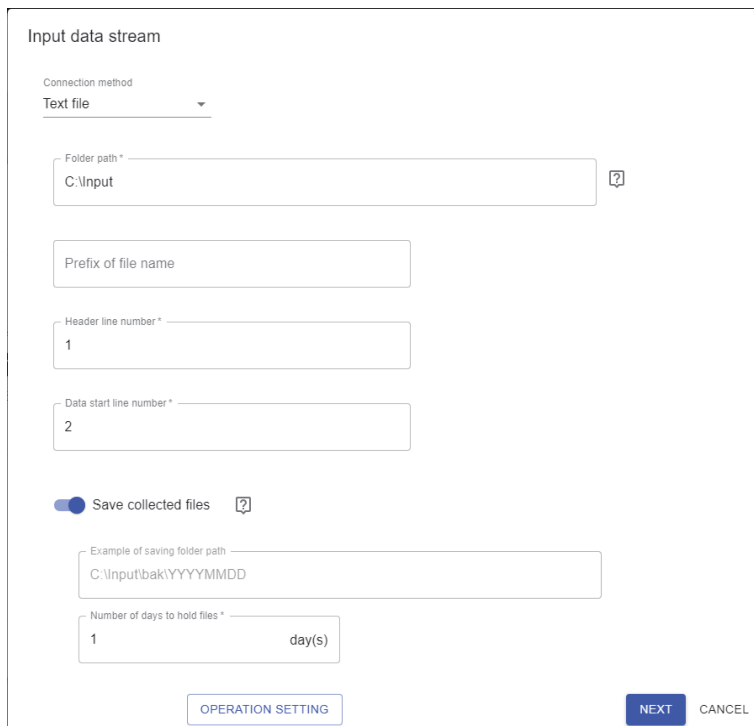
■When the connection method is "Text file"

The contents to be set when the connection method is "Text file" are as follows.



Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items


Item	Description
Connection method	Select "Text file."
Folder path	Set the absolute path (1 to 197 characters) ^{*1} of a folder to store a file. A relative path cannot be set.
Prefix of file name	Set a prefix (1 to 32 characters) to specify a file.
Header line number	Set the header line number (0 to 19) of a file.
Data start line number	Set the data start line number (1 to 20) of a file.
Save collected files ^{*2}	Turn this ON to save collected files.
Example of saving folder path ^{*3}	An example of the path to a save destination folder for collected files is displayed.
Number of days to hold files ^{*3}	Set the number of days to hold collected files (1 to 365 days).
[Operation setting] button	Click this to display the operation setting screen. ( Page 390 Operation setting)
[Next] button	Click this to display the data assignment setting screen (for "Text file"). ( Page 391 Data assignment setting (for "Text file"))

- *1 When "Save collected files" is ON, the setting range is from 1 to 146 characters.
- *2 Can be turned ON when the version of this product on a diagnosis terminal is 1.03D or later.
- *3 Displayed when "Save collected files" is ON.

■ Operation setting

The following shows the screen for setting the operation when the buffer is exceeded.

Window

Operation setting 

When the buffer is exceeded

Diagnosis continuation

The new data waits for the next diagnosis

Delete from the last data

Delete from the oldest data

Displayed items

Item		Description
Diagnosis continuation	—	Turn this ON to continue a diagnosis when the buffer is exceeded. If this is OFF, a task stops when the buffer is exceeded.
	The new data waits for the next diagnosis	Buffered data is not deleted and collection is skipped until the next diagnosis. New data is collected after the buffer storage becomes empty due to a diagnosis.
	Delete from the last data	The task execution continues by deleting the newest data to free up space in the buffer storage.
	Delete from the oldest data	The task execution continues by deleting the oldest data to free up space in the buffer storage.

■Data assignment setting (for "Text file")

The following shows the screen that appears when selecting "Text file" for the connection method.

Set a variable to be assigned to an input data stream.

Window

Data assignment setting

Please assign the input data to the explanatory variable.

Data	Variable name
Day	Day
TimeCode	TimeCode
B_Area_Price	B_Area_Price
C_Area_Price	C_Area_Price
D_Area_Price	D_Area_Price
A_Area_Demand_MWh	A_Area_Demand_MWh
B_Area_Demand_MWh	B_Area_Demand_MWh

Displayed items

Item	Description
Data	Set the name for data to be collected (up to 255 characters). When '0' is set for "Header line number" in the input data stream screen, specify a line number (1 to 256) to set data to be collected. (🔗 Page 388 When the connection method is "Text file")
Variable name	The name of an explanatory variable of an AI set in an AI execution block is displayed. (🔗 Page 445 AI execution screen)

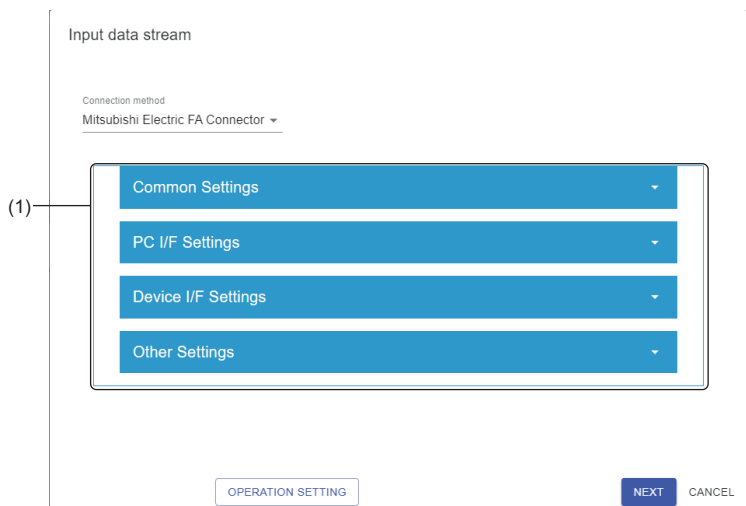
■When the connection method is "Mitsubishi Electric FA Connector"

The contents to be set when the connection method is "Mitsubishi Electric FA Connector" are as follows.

Window






Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
Connection method	Select "Mitsubishi Electric FA Connector."

Item		Description		
(1) Target device setting	Common Settings ^{*1}	Description	Set description (up to 1024 characters). ^{*2}	
		CPU Series	Select a CPU series. <ul style="list-style-type: none"> • RCPU • Rsafety • FX5CPU • QCPU • LCPU 	
		CPU Type	Select a CPU type. For the list of accessible devices, refer to the following:  Page 375 Accessible devices (products)	
	PC I/F Settings ^{*1}	PC I/F	PC I/F	Select the I/F on the personal computer side. <ul style="list-style-type: none"> • USB • Ethernet Board Accessible routes differ depending on the series of an access target device.  Page 377 Accessible routes In addition, when connecting to the simulator function of GX Works2 or GX Works3 to verify a task without the actual system, select the following options: <ul style="list-style-type: none"> • When "CPU Series" is "RCPU," "Rsafety," or "FX5CPU": GX Simulator3 • When "CPU Series" is "QCPU" or "LCPU": GX Simulator2 For the procedure for cooperating with GX Simulator2 or GX Simulator3, refer to the following:  Page 577 Cooperation with GX Simulator2 or GX Simulator3
			IP Address ^{*3}	Enter the IP address (0.0.0.0 to 255.255.255.255) on the personal computer side.
			Source Network Number ^{*4}	Set a network number (1 to 239).
			Source Station Number ^{*4}	Set a station number (1 to 120).
			System Number ^{*5}	Set a system number (1 to 4) when using GX Simulator3.
			CPU Number ^{*5}	Set a CPU number (1 to 4) when using GX Simulator3. ^{*6}
			Target Simulator ^{*7}	Select a target simulator when using GX Simulator2. <ul style="list-style-type: none"> • Simulator A • Simulator B • Simulator C • Simulator D
			Device I/F Settings ^{*1*8}	Device I/F
	Protocol Type ^{*10}	Set a protocol type (TCP or UDP). ^{*11}		
	Network Number ^{*12}	The network number set in the PC I/F settings is displayed.		
	Station Number ^{*12}	Set a station number (0 to 120).		
	IP Address ^{*13}	Enter the IP address (0.0.0.0 to 255.255.255.255) on the device side.		
	Other Settings ^{*1*3}		Timeout	Set the timeout time (1 to 90 seconds).
			Retry	Set the number of retries (0 to 9).
	[Operation setting] button		Click this to display the operation setting screen. ( Page 390 Operation setting)	
	[Next] button		Click this to display the data collection setting screen (for "Mitsubishi Electric FA Connector"). ( Page 395 Data collection setting screen (for "Mitsubishi Electric FA Connector"))	

*1 Setting items can be shown or hidden by clicking it.

*2 An error occurs if a surrogate pair character is used.

*3 Displayed when selecting "Ethernet Board" for "PC I/F."

*4 Displayed when selecting any of the following options for "Device I/F":

- "RJ71EN71 (Direct)"
- "RJ71EN71 (Specify IP Address)"
- "QJ71E71 (Specify IP Address)"

- "LJ71E71 (Specify IP Address)"
- "RJ71GN11-T2 (Specify IP Address)"
- *5 Displayed when selecting "GX Simulator3" for "PC I/F."
- *6 Not displayed when selecting "FX5CPU" for "CPU Series."
- *7 Displaying when selecting "GX Simulator2" for "PC I/F."
- *8 Displayed when selecting "USB" or "Ethernet Board" for "PC I/F."
- *9 The meaning of 'Direct' and 'Specify IP Address' is as follows:
 - Direct: When connecting a device directly
 - Specify IP Address: When connecting a device by specifying the IP address
- *10 Displayed when selecting "Ethernet Board" for "PC I/F" and any of the following options for "Device I/F":
 - "RJ71EN71 (Specify IP Address)"
 - "QJ71E71 (Specify IP Address)"
 - "LJ71E71 (Specify IP Address)"
 - "Ethernet Port (Specify IP Address)" (It is not displayed when selecting "FX5CPU" for "CPU Series.")
 - "RJ71GN11-T2 (Specify IP Address)"
- *11 Some packets may be lost when selecting UDP.
- *12 Displayed when selecting "Ethernet Board" for "PC I/F" and any of the following options for "Device I/F":
 - "RJ71EN71 (Direct)"
 - "RJ71EN71 (Specify IP Address)"
 - "QJ71E71 (Specify IP Address)"
 - "LJ71E71 (Specify IP Address)"
 - "RJ71GN11-T2 (Specify IP Address)"
- *13 Displayed when selecting "Ethernet Board" for "PC I/F" and any of the following options for "Device I/F":
 - "RJ71EN71 (Specify IP Address)"
 - "QJ71E71 (Specify IP Address)"
 - "LJ71E71 (Specify IP Address)"
 - "Ethernet Port (Specify IP Address)"
 - "RJ71GN11-T2 (Specify IP Address)"

■Data collection setting screen (for "Mitsubishi Electric FA Connector")

The following shows the screen that appears when selecting "Mitsubishi Electric FA Connector" for the connection method. Set a variable to be assigned to an input data stream.

Window

Data collection setting

Access Cycle [ms]
1000

Assignment Setting [?](#)

Input data	Data type	Number of chara...	Variable name	Variable type
Data collection tin			Timestamp	Timestamp
X0	BOOL		Data2	Number
Y1	BOOL		Data3	Number
R10	WORD		Data4	Number
W10	WORD		Data5	Number
B100	BOOL		Data6	Number
D10	WSTRING	16	ID	Category

BACK OK CANCEL

Displayed items

Item	Description
Access Cycle [ms]	Select a cycle to request a MELSEC device to read data and poll the data. • 50 ms/200 ms/500 ms/1000 ms/2000 ms/5000 ms
Input data	Set a device to be collected. For the collectable devices, refer to the following: Page 379 Accessible devices However, "Data collection time" is always displayed when the data type of the explanatory variable in a target line is timestamp.
Data type	Set the data type of a device to be collected. However, this item cannot be set when the data type of the explanatory variable in a target line is timestamp. The data types that can be set differ depending on the data type of the explanatory variable in a target line. • When the data type of an explanatory variable is 'numerical value' BOOL, WORD, INT, UINT, DWORD, DINT, UDINT, LINT, ULINT, REAL, LREAL • When the data type of an explanatory variable is 'category' BOOL, WORD, INT, UINT, DWORD, DINT, UDINT, LINT, ULINT, REAL, LREAL, STRING, WSTRING
Number of characters	Set the number of characters in the following range when selecting "STRING" or "WSTRING" for "Data type." • "STRING": 1 to 32 • "WSTRING": 1 to 16
Variable name	The name of a variable of an AI set in an AI execution block is displayed. (Page 445 AI execution screen)
Variable type	The type of a variable is displayed.

Precautions

For a timestamp type variable, the setting cannot be changed.

The time buffered by this product in the collection cycle is set automatically. ([Page 373 Connection method \(Mitsubishi Electric FA connector\)](#))

■When the connection method is "OPC UA server connection"

The contents to be set when the connection method is "OPC UA server connection" are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Displayed items

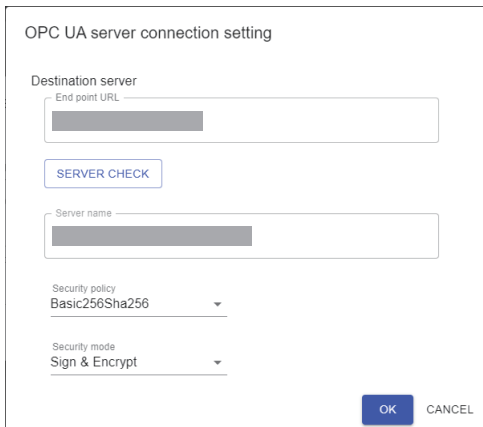
Item	Description	
Connection method	Select "OPC UA server connection."	
(1) OPC UA server setting	Server connection	The status of the OPC UA server connection setting is displayed. Click the [Change] button to configure the connection settings. (☞ Page 397 OPC UA server connection settings)
	Server authentication	The status of the OPC UA server authentication setting is displayed. Click the [Change] button to configure the authentication settings.*1 (☞ Page 399 OPC UA server authentication settings)
[Operation setting] button	Click this to display the operation setting screen. (☞ Page 390 Operation setting)	
[Next] button	Click this to display the data assignment setting screen (for "OPC UA server connection"). (☞ Page 403 Data assignment setting (for "OPC UA server connection"))	

*1 Can be clicked only when "Server connection" is "Already set."

■ OPC UA server connection settings

The following shows the screen for configuring the OPC UA server connection settings.

Window



Displayed items

Item	Description
End point URL	Set the end point URL of the connection destination server (up to 1024 characters). ^{*1}
[Server check] button	Click this to connect to the OPC UA server, and acquire the following information: <ul style="list-style-type: none"> • Server name • Available combinations of a security policy and security mode From the acquired combinations of the security policy and security mode, the setting of the security policy and security mode will be changed according to the priority order shown in the following: <ul style="list-style-type: none"> ☞ Priority order of combinations of a security policy and security mode
Server name	The server name acquired by the server check is displayed.
Security policy	Select a security policy. ^{*2*3} Select a policy according to the settings of the OPC UA server of the connection destination. <ul style="list-style-type: none"> • None: No security • Basic128Rsa15 (Not recommended): 128-bit encryption • Basic256 (Not recommended): 256-bit encryption • Basic256Sha256: 256-bit encryption (using Sha256 algorithm) When changed, if the combination of the "Security policy" and "Security mode" after changing does not exist in the combinations acquired from the OPC UA server, the setting of "Security mode" is also changed according to the priority order shown in the following: <ul style="list-style-type: none"> ☞ Priority order of combinations of a security policy and security mode
Security mode	Select a security mode. ^{*2*3} Select a policy according to the settings of the OPC UA server of the connection destination. <ul style="list-style-type: none"> • None: No security • Sign: Adding a signature to data • Sign & Encrypt: Adding a signature and encrypting the data

*1 When edited after the server check succeeded, "Server name" becomes blank and the status becomes unchecked.

*2 Can be selected after the server check succeeded.

*3 When a security policy and security mode acquired from an OPC UA server does not exist in the options, blank is displayed and this item cannot be changed.

- Priority order of combinations of a security policy and security mode

The following shows the priority order of combinations of a security policy and security mode.

Priority order	Security policy	Security mode
1	Basic256Sha256	Sign & Encrypt
2	Basic256Sha256	Sign
3	Basic256 (Not recommended)	Sign & Encrypt
4	Basic256 (Not recommended)	Sign
5	Basic128Rsa15 (Not recommended)	Sign & Encrypt
6	Basic128Rsa15 (Not recommended)	Sign
7	None	None

Precautions

- The settings cannot be changed during the server check.
- Basic128Rsa15 and Basic256 are not recommended in the OPC UA specifications, because they are considered as less secure. Select a security policy that is highly secured according to the settings of the OPC UA server of the connection destination.

■ OPC UA server authentication settings

The following shows the screen for configuring the OPC UA server authentication setting.

Window

OPC UA server authentication setting

User token type

User name/password

User certificate

Anonymous user

Server certificate

Make server certificate trusted

Client certificate (Local diagnosis terminal)

Creation status:

Authentication status:

Displayed items

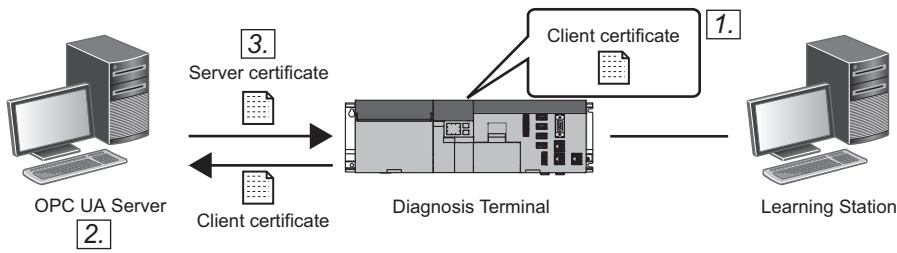
Item	Description		
User token type*1	User name/password	—	Select this to perform user authentication with a user name/password.
		User name	Set a user name to be used for user authentication (up to 1024 characters).*1
		Password	Set a password to be used for user authentication (up to 1024 characters).*1
	User certificate	—	Select this to perform user authentication with a user certificate.
		Certificate file path	Specify the path to the certificate file (up to 255 characters).*1
		Key file path	Specify the path to the private key file (up to 255 characters).*1
Anonymous user	Select this to perform user authentication with an anonymous user.		
Server certificate	Make server certificate trusted	Turn this ON to trust the server certificate.	
Client certificate (diagnosis terminal name)	Creation status	The creation status of a client certificate is displayed. Click the [Create] button to create a client certificate.*1 (Page 402 Client certificate creation) Click the [Download] button to download the client certificate (file name: MaiLabOpcUaClient.der).*2*3*4	
	Authentication status	The server authentication status is displayed. Click the [Server authentication] button after trusting the client certificate on the OPC UA server to perform authentication.*2 After authentication, a server certificate is stored in the following:*5 <ul style="list-style-type: none"> Trusted server certificate: C:\ProgramData\MELSOFT\MaiLab\PKI\opcua\predictor\trusted\server name\thumbprint of the server certificate).der Not trusted server certificate*6: C:\ProgramData\MELSOFT\MaiLab\PKI\opcua\predictor\rejected\server name\thumbprint of the server certificate).der 	

*1 "Authentication status" becomes "Not authenticated" when changed, edited, or created after the server authentication.
*2 Can be clicked when "Creation status" is "Created."
*3 Output by the download function of a web browser.
*4 A warning message may appear depending on security settings of a web browser in use when downloading the certificate.
*5 When the combination of a security policy and security mode is "None" and "None," a server certificate is not stored, because it is not used.
*6 To trust it manually, move the server certificate in 'rejected' folder to 'trusted' folder.

After that, click the [Server authentication] button again to complete the server authentication.

• To perform server authentication by enabling the function to trust a client certificate automatically on an OPC UA server

Follow the procedure shown below to perform server authentication by enabling the function to trust a client certificate automatically on an OPC UA server being used.

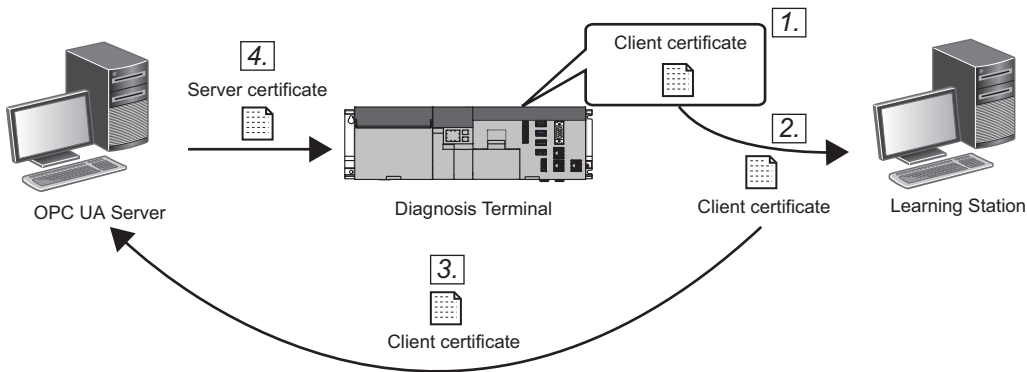


1. Create a client certificate on a diagnosis terminal.
2. Enable automatic exchange of a client certificate on an OPC UA server.
In this case, enable it before server authentication.
3. Perform server authentication.

The server certificate of the OPC UA server is stored on the diagnosis terminal. At this time, the client certificate is automatically trusted on the OPC UA server.

• To perform server authentication by disabling the function to trust a client certificate automatically on an OPC UA server

Follow the procedure shown below to perform server authentication by disabling the function to trust a client certificate automatically on an OPC UA server being used.

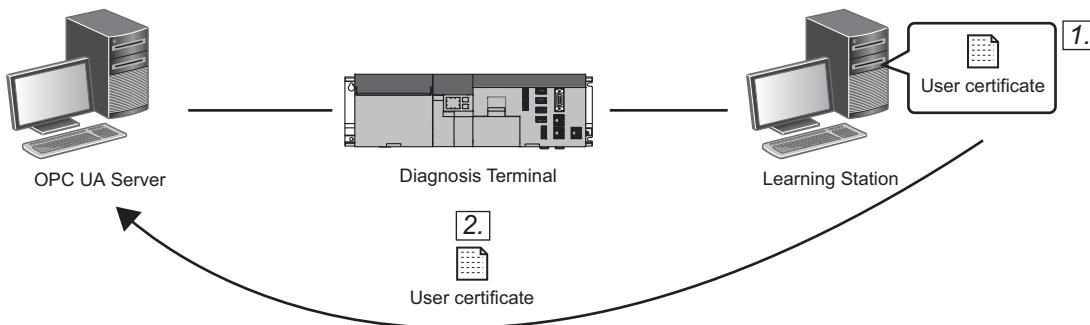


1. Create a client certificate on a diagnosis terminal.
2. Download the client certificate.
3. Trust the client certificate manually on the OPC UA server.
In this case, trust it before server authentication.
4. Perform server authentication.

The server certificate of the OPC UA server is stored on the diagnosis terminal. At this time, the client certificate is trusted on the OPC UA server; therefore, authentication succeeds.

- When "User token type" is "User certificate"

When "User token type" is "User certificate," before the server authentication, it is required to trust the specified client certificate manually on the OPC UA server of the connection destination. (If it is not trusted, the server authentication fails.)



1. Store a user certificate in the place where the certificate can be accessed from a diagnosis terminal.
2. Trust the user certificate manually on the OPC UA server.

Precautions

- While the server authentication is being performed or a client certificate is being created, the settings cannot be changed.
- Set the same user name and password as an OPC UA server of the connection destination. When the user name or password of the OPC UA server has more than 1024 characters, change it to fit within 1024 characters.
- To connect an OPC UA server by specifying a user certificate, options other than "None" are required to be set for a security policy and security mode.
- A client certificate is required to be created again in the following cases:
 - The client certificate has expired.
 - The host name of the diagnosis terminal that executes the task has been changed.
 - A task with the OPC UA server connection set has been imported in a diagnosis terminal with no client certificate created.
- A client certificate created on a diagnosis terminal is used by all the OPC UA servers that are connected from the diagnosis terminal. When different tasks are executed on the same diagnosis terminal, the same client certificate is used; therefore, it is not required to create a new client certificate for each task.

■ Client certificate creation

The following shows the screen for creating a client certificate to perform application authentication with an OPC UA server.

Window

Client certificate creation

Application name
MELSOFT MaiLab

Organization name *
Organization

Organization unit
Unit

Region name
Location

Prefecture/state name
State

Country
JP

Domain *
[Greyed out]

Application URI
urn: [Greyed out] MitsubishiElectric: MaiLab

Expiration date
5 years

RSA key strength
4096bits

Signature algorithm
Sha256

OK CANCEL

Displayed items

Item	Description
Application name	The application name (MELSOFT MaiLab) is displayed.
Organization name	Set an organization name (up to 255 characters).
Organization unit	Set an organization unit (up to 255 characters).
Region name	Set a region name (up to 128 characters).
Prefecture/state name	Set a prefecture/state name (up to 128 characters).
Country	Enter an abbreviation for a country name (up to 2 characters).
Domain	Set a domain (up to 16 characters). Default: The machine name of a diagnosis terminal is displayed.
Application URI	An application URI is displayed in the following format: • urn:Host name of a diagnosis terminal:MitsubishiElectric: MaiLab
Expiration date	Select the expiration date for a client certificate.
RSA key strength	Select an RSA key strength.
Signature algorithm	Select a signature algorithm.
[OK] button	Click this to create a client certificate according to the setting contents. The created client certificate and private key file are stored in the following: • Client certificate: C:\ProgramData\MELSOFT\MaiLab\PKI\opcua\predictor\certs\MaiLabOpcUaClient.der • Private key file: C:\ProgramData\MELSOFT\MaiLab\PKI\opcua\predictor\private\MaiLabOpcUaClient.pem

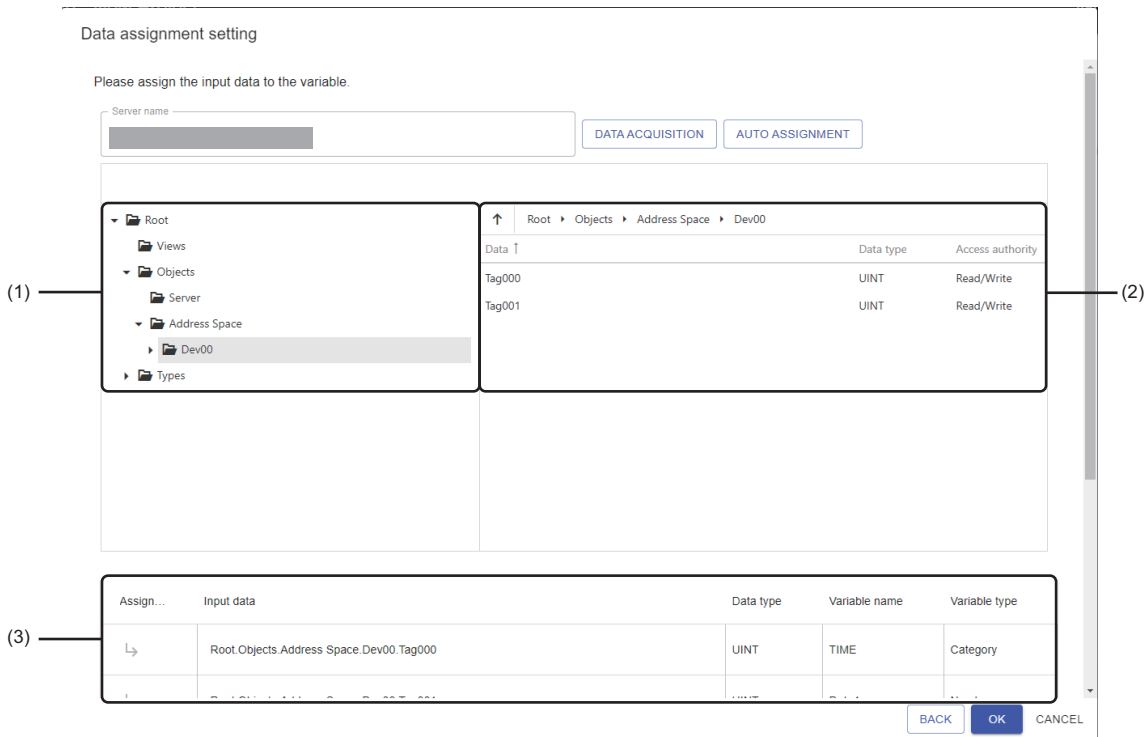
Precautions

Make sure that the time in the environment where the OPC UA server is running matches the one on a diagnosis terminal, and then create a client certificate.

■Data assignment setting (for "OPC UA server connection")



The following shows the screen that appears when selecting "OPC UA server connection" for the connection method. Set a variable to be assigned to an input data stream.

Window



Displayed items

Item	Description	
Server name	A server name acquired from the server authentication is displayed.	
[Data acquisition] button	Click this to acquire data from the OPC UA server and display it in a tree view and data list.	
[Auto assignment] button ^{*1}	Click this to assign data automatically to a target variable, when the variable that has the same name (characters are case-sensitive) as the one displayed in the data list exists in the data assignment setting. However, when "Variable type" of a variable in a target line is "Timestamp," data is not assigned. In addition, when data is already assigned to the target variable of auto assignment, the data is overwritten.	
(1) Tree view	The acquired data hierarchy of an OPC UA server is displayed in a tree format.	
(2) Data list	—	
	Data	A data name is displayed.
	Data type	A data type is displayed. "---" is displayed for unavailable data type in this function.
	Access authority	The data access authority type is displayed.

Item		Description
(3) Data assignment setting	—	Configure the data assignment settings. However, when "Variable type" of a variable in a target line is "Timestamp," these settings cannot be configured.
	Assignment	Click this to assign data selected in the data list to the "Input data" column.
	Input data	Data of an OPC UA server to be set as a variable is displayed. Data names are connected from the start to the end of the item names, and displayed in a layer structure accordingly. (Example) Root.Objects.Dev000.Node01 However, when "Variable type" of a variable in a target line is "Timestamp," "Data collection time" is always displayed. If an error occurs,  is displayed.
	Data type	The type of data set in "Input data" is displayed. "---" is displayed for unavailable data type in this function.
	Variable name	The name of a variable of an AI set in an AI execution block is displayed. ( Page 445 AI execution screen)
	Variable type	The type of a variable is displayed.

*1 Can be clicked when at least one unit of data is displayed in the data list.

The following shows the available data types for this function and the corresponding data types of the OPC UA server.

Data type	Data type of OPC UA server	Description
BOOL	UA_BOOLEAN	Binary (0 or 1)
SINT	UA_SBYTE	Signed 8-bit integer
USINT	UA_BYTE	Unsigned 8-bit integer
INT	UA_INT16	Signed 16-bit integer
UINT	UA_UINT16	Unsigned 16-bit integer
DINT	UA_INT32	Signed 32-bit integer
UDINT	UA_UINT32	Unsigned 32-bit integer
LINT	UA_INT64	Signed 64-bit integer
ULINT	UA_UINT64	Unsigned 64-bit integer
REAL	UA_FLOAT	32-bit real number
LREAL	UA_DOUBLE	64-bit real number
WSTRING ^{*1}	UA_String	Character string (Unicode)

*1 Can be set only when "Variable type" is "Category."


Point

When the screen is displayed, data is acquired from an OPC UA server and displayed in a tree view and data list.

Precautions

- The settings cannot be changed during the acquisition of the data.
In this case, the following is displayed:



- For a timestamp type variable, the setting cannot be changed.
The time buffered by this product in the collection cycle is set automatically. ( Page 384 Connection method (OPC UA server connection))
- When the data settings of an OPC UA server are changed after configuring the data assignment settings, click the [Data acquisition] button to check that there are no errors in the settings.
- The same data of an OPC UA server can be configured for the following settings. However, when the same data is configured, the output value of this product is applied to the collected data of this product.
 - Input data of the input data stream
 - Output data of the output data stream

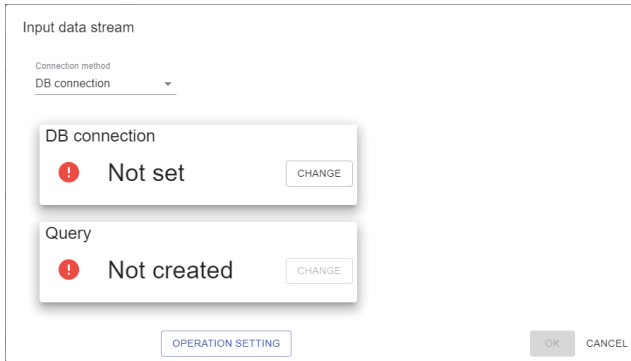
■When the connection method is "DB connection"

The contents to be set when the connection method is "DB connection" are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Input data stream

Connection method
DB connection

DB connection
! Not set CHANGE

Query
! Not created CHANGE

OPERATION SETTING OK CANCEL

Displayed items

Item	Description
Connection method	Select "DB connection."
DB connection	The status of the database connection setting is displayed. Click the [Change] button to set this item. (Page 407 DB connection setting)
Query	The creation status of a query is displayed. Click the [Change] button to create a query. (Page 408 Query)
[Operation setting] button	Click this to display the operation setting screen. (Page 390 Operation setting)

■DB connection setting

The following shows the screen for setting connection information to connect to a database.

Window

DB connection setting

DB type
MySQL

Destination address *

Port number *

DB name

User name *

Password *

CONNECTION CHECK OK CANCEL

(1)

Displayed items

Item		Description
(1) Connection information	DB type	Select the type of a database to connect to. • MySQL • PostgreSQL • SQL Server
	Destination address	Set the IP address or computer name of a database to connect to.
	Port number	Set the port number of a database to connect to.
	DB name	Set the name of a database to connect to.
	User name	Set the user name used for authentication when connecting to a database.
	Password	Set the password used for authentication when connecting to a database.
[Connection check] button		Click this to check whether a database can be connected.


■ Query

The following shows the screen for creating a query to acquire data from a database.

Window



Displayed items

Item	Description	
 (Template insertion)	Click this to insert a template.	
	■MySQL, PostgreSQL SELECT "Database column name" AS "MaiLab variable name" FROM "__sample_table__" LIMIT 100	Replace '__sample_table__' with the table name of a data acquisition target.
	"Database column name" AS "MaiLab variable name"	It is inserted with delimited by commas and line feeds for the number of input variables. Replace '__sample_table__' with the table name of a data acquisition target.
	100	Replace it with the number of records to be acquired. Acquire as many records as necessary for one diagnosis. Records exceeding 86400 are not acquired in one collection.
	■SQL Server SELECT TOP 100 "Database column name" AS "MaiLab variable name" FROM "__sample_table__"	Replace it with the number of records to be acquired. Acquire as many records as necessary for one diagnosis. Records exceeding 86400 are not acquired in one collection.
	"Database column name" AS "MaiLab variable name"	It is inserted with delimited by commas and line feeds for the number of input variables. If the column name in 'database column name' differs from that of a database, replace it with a target one.
	"__sample_table__"	Replace '__sample_table__' with the table name of a data acquisition target.
► (Test execution)	Click this to test if a query works. Up to 100 records are acquired. (Even if a query is created to acquire 101 or more records, only a maximum of 100 records are acquired.)	
(1) Query editor	An area for creating a query. (Number of characters: up to 600000, number of lines: up to 3000) Enter only one query.	
(2) Execution result	[Console] tab	An error occurred in test execution is displayed.
	[Acquired data] tab	A record acquired in test execution is displayed. No values are displayed for missing values (NaN). If data type conversion fails, it is displayed in red.

Precautions

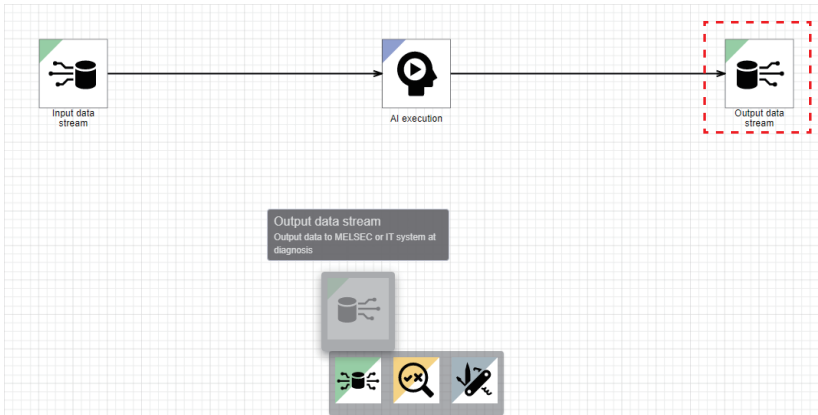
Data in a database may be rewritten depending on the content of a query. Check the content, then click the [OK] button.

Point

- When specifying a variable for a command parameter, enter it in the following format:
%(MaiLab variable name)s
- When acquiring the data on a task execution date, create a query by referring to the following:
(Example) For MySQL
SELECT * FROM xxx_table WHERE DATE(xxx_column) = CURDATE();
(Example) For PostgreSQL
SELECT * FROM xxx_table WHERE xxx_column::date = CURRENT_DATE;
(Example) For SQL server
SELECT * FROM xxx_table WHERE CAST(xxx_column AS DATE) = CAST(GETDATE() AS DATE);
- For errors returned by a database, refer to the manual for each database to take corrective action.

Output data stream block

An output data stream block outputs data externally when a task is executed. One data output method (connection method) can be set for each placed block.



Point

Multiple output destinations can be set by placing multiple pieces of this block.

• Processing image

Input data

Time	X_1	...	Diagnosis result 1	...	Judgment 1	...
2021/2/5 14:00	0	...	96	...	OK	...
2021/2/5 14:00	0	...	100	...	OK	...
2021/2/5 14:00	1	...	53	...	NG	...
2021/2/5 14:01	1	...	47	...	NG	...
2021/2/5 14:01	0	...	88	...	NG	...
2021/2/5 14:01	1	...	45	...	OK	...

Assigning variable names, selecting output targets

Time	X_1 ↓ Dev1	...	Diagnosis result 1 ↓ Dig_rst1	...	Judgment 1 ↓ Alert_1	...
2021/2/5 14:00	0	...	96	...	OK	...
2021/2/5 14:00	0	...	100	...	OK	...
2021/2/5 14:00	1	...	53	...	NG	...
2021/2/5 14:01	1	...	47	...	NG	...
2021/2/5 14:01	0	...	88	...	NG	...
2021/2/5 14:01	1	...	45	...	OK	...

- Whether to output each input variable such as an explanatory variable of an AI, diagnosis result, and judgment result

- Output variable name for data to be output

Output target data

Dev1	Dig_rst1	Alert_1	...
0	96	OK	...
0	100	OK	...
1	53	NG	...
1	47	NG	...
0	88	NG	...
1	45	OK	...

Input/output specifications

Input

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none">• Number of records: Integer between 1 and 86400• Number of variables: Integer between 1 and 1024• Type of each variable: Any types

10

Operational specifications

The following processing is performed when executing a task.

1. Acquiring data

Data is acquired from the previous block to this block.

2. Refining records

Records are refined according to the output condition setting.

☞ Page 426 Output condition

3. Refining variables

Variables are refined according to the output variable setting.

☞ Page 430 Output variable setting (for "Text file")

☞ Page 432 Output variable setting (for "Mitsubishi Electric FA Connector")

☞ Page 434 Output variable setting (for "OPC UA server connection")

☞ Page 437 Output variable setting (for "DB connection")

4. Processing missing values

Missing values are processed according to the missing value processing setting.

☞ Page 428 Missing value processing setting

5. Outputting the data

The data is output by the set connection method.

Detailed specifications follow the ones for each connection method.

☞ Page 412 Connection method (text file)

☞ Page 415 Connection method (Mitsubishi Electric FA connector)

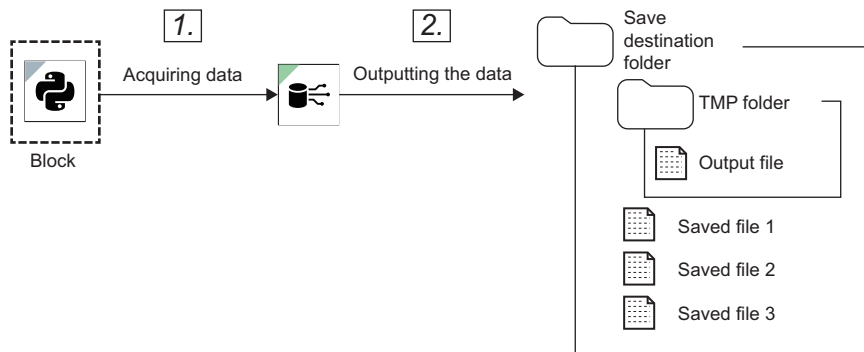
☞ Page 418 Connection method (OPC UA server connection)

☞ Page 421 Connection method (DB connection)

Connection method (text file)

Data is output to a specified save destination folder in the CSV or TSV format.

Operational specifications

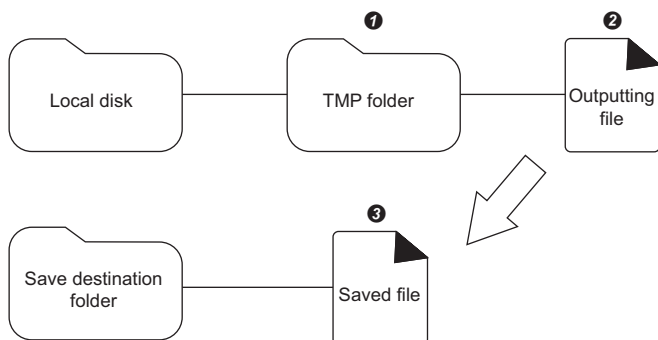


1. Acquiring data

Data is acquired from a block connected to the input of an output data stream block.

2. Outputting the data

The data is output as follows:



① A TMP folder is created in the local disk of a diagnosis terminal.

② A specified text file (tmp.extension) is created in the TMP folder, and data is output until the maximum number of records for one file or the number of diagnosis executions is reached.

③ When the maximum number of records for one file or the number of diagnosis executions is reached, the name of an 'outputting file' is changed to the one with a set prefix, then the file is moved to a 'save destination folder.'

When the file cannot be moved to the 'save destination folder,' it is saved locally. It will be moved when the next 'outputting file' becomes a 'saved file.'

Point

- When the execution status of a task is switched from 'RUN' to 'READY,' 'STOP,' or 'Error,' an 'outputting file' becomes a 'saved file' even if the number of records in the 'outputting file' does not reach the maximum number yet. A new 'outputting file' is not created at this point. The TMP folder will be deleted entirely when the task stops.
- When the maximum number of records is reached while outputting data, an 'outputting file' is changed to a 'saved file' or moved. Then, the remaining data, which is not output yet, is output to a new 'outputting file'.
- For a numerical value type variable, if the value has more than 18 digits, it is rounded to 17 digits and output in exponent notation.

■Output format of a file

- File name

(Set prefix of file name)_YYYYMMDDhhmmSSsss_000001.csv

A file name is suffixed with a six-digit sequential decimal number (000000 to 999998).

- Extension

A file is output with the extension of CSV (delimiter: comma) or TSV (delimiter: tab) according to the setting.


- Format

A file is output in the format of Shift_JIS or UTF-8 (with BOM) according to the setting.

- Output contents

- When cooperating with Edgecross Basic Software

A file is output according to the format of a response data file that is required for cooperation with Edgecross Basic Software.

Column	Data name	Data type	Data content
First column	TIME	DATE[YYYY-MM-DD hh:mm:ss.ms]	File output time For details, refer to the following:  Page 413 Addition of the output time column
Second column and later	Any names (name set in the output variable settings) ^{*1}	The data type follows the type of a variable set in the output variable settings. <ul style="list-style-type: none"> • Numerical value type variable: LREAL[DEC.14] • Category type variable: WSTRING[16] • Timestamp type variable: STRING[32] 	Any contents However, content is output within the number of characters specified by a data type. Characters exceeding the number will be deleted. For a numerical value type variable, an error may occur in an output numerical value because the value is output with the number of digits according to the specifications of Edgecross Basic Software.

*1 Up to 256 columns can be output.

- Other cases

The variable name of acquired data is output in the first line, and data in the second line and later.

■Addition of the output time column

The following item is added in the first column of an output file when addition of the output time column is enabled.

Item	Description
Data name	TIME
Data content	The date and time when the file is output (YYYY-MM-DD hh:mm:ss.ms) is output. Files that are output at the same time have the same date and time in all records.

■Output of a response data definition file

A response data definition file is output with the contents shown in the table below.

The data type is fixed according to the variable type. To handle it with another data type in Edgecross Basic Software, rewrite a response data definition file manually after the file is output.

For available data types and value range, refer to Edgecross Basic Software for Windows User's Manual.

Item		Description
File name		(Prefix of a saved file name)_DATATYPE.csv
File format		<ul style="list-style-type: none">• Delimiter: , (comma)• Line feed code: CRLF (0x0D, 0x0A)• Character code: UTF-8 (with BOM)• Number of lines: 3
Output contents	First line	File information line The following contents are output: (File type),(file version) <ul style="list-style-type: none">• File type: [ECRDD_EC] (fixed character string)• File version: [Major].[minor] (Example) 1.0
	Second line	Data type information line The data type of a column to be output to a response data file is output. <ul style="list-style-type: none">• Numerical value type variable: LREAL[DEC.16]• Category type variable: WSTRING[16]• Timestamp type variable: STRING[32] (Example) DATETIME[YYYY-MM-DD hh:mm:ss.ms], STRING[32], WSTRING[16], LREAL[DEC.16],...
	Third line	Data name line The column name to be output to a response data file is output. (Example) TIME, timestamp, product ID, multiple regression predicted value, ...

■Exclusion setting with antivirus software

Antivirus software may affect the operation of this product. Therefore, exclude the following folder from the monitoring targets in the antivirus software setting:

For the setting method, refer to the manual for each antivirus software.

- The path of a folder set as an output data stream

Connection method (Mitsubishi Electric FA connector)

Data is acquired from a block connected to the input of an output data stream block, and output to a MELSEC device.

Only devices in a single network can be accessed. (Stations in co-existence network cannot be accessed.)

For accessible devices (products) and routes, refer to the following:

☞ Page 375 Accessible devices (products)

☞ Page 377 Accessible routes

For accessible devices, refer to the following:

☞ Page 379 Accessible devices

Precautions

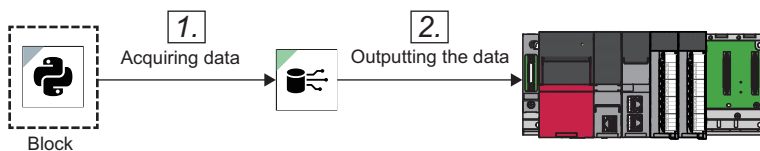
- If a remote password is set for an access target device, it cannot be accessed.
- Some devices may be accessible besides the ones listed in the following section. However, their operation is not guaranteed.

☞ Page 375 Accessible devices (products)

- When the same access target device is connected from multiple diagnosis terminals via TCP, set MELSOFT connection modules for the number of diagnosis terminals to be connected in the parameters for a access target device. (To connect MELSOFT other than this product, it also needs to be set as a MELSOFT connection module.)

For details, refer to the manual for a target Mitsubishi Electric product.

Operational specifications



1. Acquiring data

Data is acquired from a block connected to the input of an output data stream block.

2. Outputting the data

The data is output to a MELSEC device according to the settings.

However, when multiple units of data are output from the block, the value of an output destination device is updated in real time and the latest output value is output as the final device value.

- Data of which the output is disabled in the output variable settings is not output.
- When data input by an output data stream block does not match with the range of data type specified in the output variable settings, the data is output according to the following specifications of the specified data type. (The following input data

refers to the data input by an output data stream block.)

Data type	Case where input data does not match with the data type range (—: Cannot happen)			
	Unavailable		Out of range	
	Specification	Example	Specification	Example
BOOL	<ul style="list-style-type: none"> Input data: Numerical value type <ul style="list-style-type: none"> '0' is output when input data is '0.' '1' is output when input data is not '0.' Input data: Category type <ul style="list-style-type: none"> When input data is a character string representing a BOOL value^{*1} <ul style="list-style-type: none"> '1' is output for "True." '0' is output for "False." '1' in output for "1." '0' in output for "0." When input data is not a character string representing a BOOL value^{*1} <ul style="list-style-type: none"> '0' is output for a null character. '1' is output for the other characters. 	<ul style="list-style-type: none"> '1' is output when input data is '0.123.' '0' is output when input data is '0.' '0' is output when input data is '0.' '0' is output when input data is "False." '1' is output when input data is "True." '0' is output when input data is a null character. '1' is output when input data is "AB." '1' is output when input data is "1." '0' is output when input data is "0." 	<ul style="list-style-type: none"> '0' is output when input data is '0.' '1' is output when input data is not '0.' 	'1' is output when input data is '70000.'
WORD	Input data is converted into a specified data type, then output. (The value after the decimal point is rounded off.)	'12' is output when input data is '12.678.'	<ul style="list-style-type: none"> When input data is larger than the maximum value^{*2}, it will be rounded to the maximum value.^{*3} When input data is smaller than the minimum value^{*2}, it is rounded to the minimum value.^{*3} 	'65535' is output when input data is '70000.'
INT		'-12' is output when input data is '-12.678.'		'32767' is output when input data is '70000.'
UINT				'65535' is output when input data is '70000.'
DWORD				'4294967295' is output when input data is '4500000000.'
DINT				'2147483647' is output when input data is '4500000000.'
UDINT				'4294967295' is output when input data is '4500000000.'
LINT				'9223372036854775807' is output when input data is '9300000000000000000.'
ULINT				'184467440737095516157' is output when input data is '20000000000000000000.'
REAL	—	—	'3.40282346e+38' is output when input data is '3.40282e+39.'	
LREAL			'1.7976931348623158e+308' is output when input data is '+Inf.'	
STRING			—	
WSTRING			—	

*1 "True" or "False" (Characters are not case-sensitive.)

For details, refer to the description for a category type variable shown in the following:

☞ Page 85 Variable types

*2 For details, refer to the following:

☞ Page 417 Data type range

*3 Specifications are as follows when input data is '+inf,' '-inf,' or 'NaN.'

+Inf: Input data is rounded to the maximum value.

-Inf: Input data is rounded to the minimum value.

NaN: The output of a diagnosis result is skipped.

■ Data type range

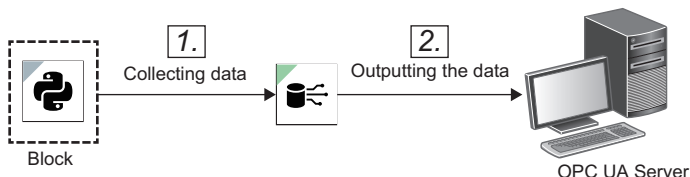
The following table shows the supported data types and value ranges.

Data type	Description	Value range
BOOL	Binary (0 or 1)	0, 1
WORD	Unsigned 16-bit integer	0 to 65535
INT	Signed 16-bit integer	-32768 to 32767
UINT	Unsigned 16-bit integer	0 to 65535
DWORD	Unsigned 32-bit integer	0 to 4294967295
DINT	Signed 32-bit integer	-2147483648 to 2147483647
UDINT	Unsigned 32-bit integer	0 to 4294967295
LINT	Signed 64-bit integer	-9223372036854775808 to 9223372036854775807
ULINT	Unsigned 64-bit integer	0 to 18446744073709551615
REAL	32-bit real number	-3.40282346e+38 to 3.40282346e+38
LREAL	64-bit real number	-1.7976931348623158e+308 to 1.7976931348623158e+308
STRING	Character string (ASCII)	—
WSTRING	Character string (UNICODE(UTF-16))	—

Connection method (OPC UA server connection)

Data is acquired from a block connected to the input of an output data stream block, and output to an OPC UA server.

Operational specifications



1. Acquiring data

Data is acquired from a block connected to the input of an output data stream block.

2. Outputting the data

The data is output to an OPC UA server according to the settings.

However, when multiple units of data are output from the block, the data of an OPC UA server of the output destination is updated in real time and the latest output value is output as the final value.

- Data of which the output is disabled in the output variable settings is not output.
- When data input by an output data stream block does not match with the range of data type specified in the output variable settings, the data is output according to the following specifications of the specified data type. (The following input data refers to the data input by an output data stream block.)

Data type	Case where input data does not match with the data type range (—: Cannot happen)			
	Unavailable		Out of range	
	Specification	Example	Specification	Example
BOOL	<ul style="list-style-type: none"> ■ Input data: Numerical value type <ul style="list-style-type: none"> • '0' is output when input data is '0.' • '1' is output when input data is not '0.' ■ Input data: Category type <ul style="list-style-type: none"> • When input data is a character string representing a BOOL value*1 <ul style="list-style-type: none"> '1' is output for "True." '0' is output for "False." '1' in output for "1." '0' in output for "0." • When input data is not a character string representing a BOOL value*1 <ul style="list-style-type: none"> '0' is output for a null character. '1' is output for the other characters. 	<ul style="list-style-type: none"> • '1' is output when input data is '0.123.' • '0' is output when input data is '0.' • '0' is output when input data is "False." • '1' is output when input data is "True." • '0' is output when input data is a null character. • '1' is output when input data is "AB." • '1' is output when input data is "1." • '0' is output when input data is "0." 	<ul style="list-style-type: none"> • '0' is output when input data is '0.' • '1' is output when input data is not '0.' 	'1' is output when input data is '70000.'

Data type	Case where input data does not match with the data type range (—: Cannot happen)					
	Unavailable		Out of range			
	Specification	Example	Specification	Example		
SINT	Input data is converted into a specified data type, then output. (The value after the decimal point is rounded off.)	<ul style="list-style-type: none"> '12' is output when input data is '12.678.' '-12' is output when input data is '-12.678.' 	<ul style="list-style-type: none"> When input data is larger than the maximum value^{*2}, it will be rounded to the maximum value.^{*3} When input data is smaller than the minimum value^{*2}, it is rounded to the minimum value.^{*3} 	'127' is output when input data is '300.'		
USINT				'255' is output when input data is '300.'		
INT				'32767' is output when input data is '70000.'		
UINT				'65535' is output when input data is '70000.'		
DINT				'2147483647' is output when input data is '4500000000.'		
UDINT				'4294967295' is output when input data is '4500000000.'		
LINT				'9223372036854775807' is output when input data is '9300000000000000000.'		
ULINT				'184467440737095516157' is output when input data is '2000000000000000000.'		
REAL				—	—	'3.40282346e+38' is output when input data is '3.40282e+39.'
LREAL				—	—	'1.7976931348623158e+308' is output when input data is '+Inf.'
WSTRING	—	—	—			

- *1 "True" or "False" (Characters are not case-sensitive).
For details, refer to the description for a category type variable shown in the following:
☞ Page 85 Variable types
- *2 For details, refer to the following:
☞ Page 419 Data type range
- *3 Specifications are as follows when input data is '+inf,' '-inf,' or 'NaN.'
+Inf: Input data is rounded to the maximum value.
-Inf: Input data is rounded to the minimum value.
NaN: The output of a diagnosis result is skipped.

■Data type range

The following table shows the supported data types and value ranges.

Data type	Description	Value range
BOOL	Binary (0 or 1)	0, 1
SINT	Signed 8-bit integer	-128~127
USINT	Unsigned 8-bit integer	0 to 255
INT	Signed 16-bit integer	-32768 to 32767
UINT	Unsigned 16-bit integer	0 to 65535
DINT	Signed 32-bit integer	-2147483648 to 2147483647
UDINT	Unsigned 32-bit integer	0 to 4294967295
LINT	Signed 64-bit integer	-9223372036854775808 to 9223372036854775807
ULINT	Unsigned 64-bit integer	0 to 18446744073709551615
REAL	32-bit real number	-3.40282346e+38 to 3.40282346e+38
LREAL	64-bit real number	-1.7976931348623158e+308 to 1.7976931348623158e+308
WSTRING	Character string	—

■Connection to or disconnection from an OPC UA server

Refer to the following:

☞ Page 384 Connection to or disconnection from an OPC UA server

■Connectable OPC UA server

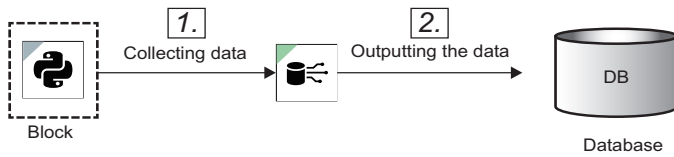
Refer to the following:

☞ Page 384 Connectable OPC UA server

Connection method (DB connection)

Data is acquired from a block connected to the input of an output data stream block, and output to a database.

Operational specifications



1. Acquiring data

Data is acquired from a block connected to the input of an output data stream block.

2. Outputting the data

The data is output to a database according to the settings.

For the correspondence between the data types for this product and those for a database, refer to the following:

📖 Page 422 Correspondence between the data types for this product and those for a database

■Correspondence between the data types for this product and those for a database

Operations are guaranteed with the combinations in the following table.

Values output by a task must be within the range of each data type.

For database behavior when values out of the range are output, refer to the manual for the database.

• MySQL

○: Supported, —: Unsupported

Output data stream	tinyint smallint mediumint int bigint	float double decimal numeric	char varchar text	datetime timestamp
Numerical value type	○*1	○*1	○*1	—
Category type	○*2	○*3*4	○*3	○*2*4
Timestamp type	—	—	○*3	○*3

*1 Missing or infinity values cannot be used.

*2 Character strings with decimal places cannot be used.

*3 Missing values cannot be used.

*4 All category levels must be character strings that can be recognized or parsed as values within the range of each data type. For details, refer to the manual for a database.

• PostgreSQL

○: Supported, —: Unsupported

Output data stream	smallint integer bigint	real double precision	decimal numeric	character varying varchar character char text	timestamp timestamp with time zone
Numerical value type	○*1	○	○*2	○	—
Category type	○*3*4*5	○*4	○*4	○	○*3*4
Timestamp type	—	—	—	○*3	○*3

*1 Missing or infinity values cannot be used.

*2 Infinity values cannot be used.

*3 Missing values cannot be used.

*4 All category levels must be character strings that can be recognized or parsed as values within the range of each data type. For details, refer to the manual for a database.

*5 Character strings with decimal places cannot be used.

• SQL Server

○: Supported, —: Unsupported

Output data stream	tinyint smallint int bigint	float real numeric decimal	char varchar text nchar nvarchar ntext	datetime datetime2 smalldatetime
Numerical value type	○*1	○*1	—*1*2	—
Category type	○*3*4*5	○*3*4	○*3	○*3*4
Timestamp type	—	—	○*3	○*3

*1 Missing or infinity values cannot be used.

*2 To store numerical value type data of this product in a database, use the CAST syntax in a query to convert it into a character string.

*3 Missing values cannot be used.





*4 All category levels must be character strings that can be recognized or parsed as values within the range of each data type. For details, refer to the manual for a database.

*5 Character strings with decimal places cannot be used.

Output data stream screen

The following shows the screen for setting a data output method (connection method).

Settings differ depending on the connection method.

- When the connection method is "Text file": ( Page 424 When the connection method is "Text file")
- When the connection method is "Mitsubishi Electric FA Connector": ( Page 431 When the connection method is "Mitsubishi Electric FA Connector")
- When the connection method is "OPC UA server connection": ( Page 433 When the connection method is "OPC UA server connection")
- When the connection method is "DB connection": ( Page 436 When the connection method is "DB connection")

■When the connection method is "Text file"

The contents to be set when the connection method is "Text file" are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Displayed items

Item	Description	
Connection method	Select "Text file."	
Saving file path setting	Folder path	Set the absolute path (1 to 197 characters) of a folder for a saved file. A relative path cannot be set.
	Prefix of file name	Set a prefix (1 to 32 characters) for a saved file.
	File path example	A saving file path is displayed based on settings of "Folder path," "Prefix of file name," and "File extension."
File output conditions ^{*1}	Number of diagnosis execution	Set the number of times to execute a diagnosis (1 to 6000). Diagnosis execution results for the set number of times are output to one file.
	Number of maximum records	Set the maximum number of records (1 to 864000) to be output to one file.
File setting	File extension ^{*2}	Select a file extension. <ul style="list-style-type: none"> • CSV • TSV
	File format	Select a file format. <ul style="list-style-type: none"> • Shift_JIS • UTF-8
Cooperation option	Select a cooperation option. <ul style="list-style-type: none"> • None • Edgexross cooperation When selecting "Edgexross cooperation," the setting of "File extension" is set to "CSV" according to the format of a response data file that is required for cooperation with Edgexross Basic Software. For the format of a response data file, refer to the following. Page 413 Output format of a file For the procedure for cooperating with Edgexross Basic Software, refer to the following: Page 572 Cooperation with Edgexross Basic Software	
[Output condition setting] button	Click this to display the output condition setting screen. (Page 426 Output condition)	
[Missing value processing setting] button	Click this to display the missing value processing setting screen. (Page 428 Missing value processing setting)	

Item	Description
[Next] button	Click this to display the output variable setting screen (for "Text file"). (☞ Page 430 Output variable setting (for "Text file"))

- *1 A file is output when a condition for the number of diagnosis executions or the maximum number of records is satisfied.
By these settings, a file can be output per data for the set number of diagnosis executions or per the set number of records.
- *2 Can be set when selecting "None" for "Cooperation option."

Precautions

'NaN,' '+Inf,' and '-Inf' cannot be handled as real number type values in Edgecross Basic Software.

An error occurs if the above values are output in this product and imported in Edgecross Basic Software.

In this case, configure settings in the output condition setting screen so that the above values are not output.

☞ Page 426 Output condition

■ Output condition

The following shows the screen for displaying the list of set output conditions.

Up to five conditions can be set.

Window

Condition	Setting	Delete
Data2 < 10	...	

Displayed items

Item	Description
Condition convergence method	Select a method for combining output conditions. <ul style="list-style-type: none">• AND• OR
(Add condition) ^{*1}	Click this to add a condition. (Page 427 Condition settings)
Condition	An output condition set in the condition setting screen is displayed.
Setting	Click the icon displayed in this column to change settings for an output condition. (Page 427 Condition settings)
Delete	Click the icon displayed in this column to delete a condition.

*1 Can be clicked when the number of output conditions is less than its maximum number.

■Condition settings

The following shows the screen for setting a data output condition.

10

Window

Condition setting

Judgment target variable: Data2
Operator: <
Comparison target: Constant
Setting value: 10

OK CANCEL

Displayed items

Item	Description
Judgment target variable	Select a variable to be judged. A variable other than the timestamp type variables can be selected among the ones input to this block.
Operator	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." • Numerical value type variable: <, ≤, >, ≥, =, ≠ • Category type variable: =, ≠
Comparison target	Select a comparison target from the following options: • "Constant" • Variable with the same type as a variable selected for "Judgment target variable" among explanatory variables of an AI*1
Setting value*2	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." • Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) • Category type variable: All categories in the variable

*1 Excluding a variable selected for "Judgment target variable"

*2 Displayed when selecting "Constant" for "Comparison target."

Missing value processing setting

The following shows the screen for setting the method for processing missing values when they are included in data.

Window

Missing value processing setting

Don't output record containing missing value
 Output missing value without processing
 Set by variable

Variable name	Processing method	Specified output value
id	Don't output missing value ▾	<input type="text"/>
datetime_value	Don't output missing value ▾	<input type="text"/>
string_value	Don't output missing value ▾	<input type="text"/>
float_value	Don't output missing value ▾	<input type="text"/>
New AI_FLG	Don't output missing value ▾	<input type="text"/>
New AI_SEPN	Don't output missing value ▾	<input type="text"/>
New AI_SELSIMVV	Don't output missing value ▾	<input type="text"/>
New AI_DIAG	Don't output missing value ▾	<input type="text"/>
New AI_SIMSCORE	Don't output missing value ▾	<input type="text"/>

OK CANCEL

Displayed items

Item	Description																																																																								
Don't output record containing missing value	<p>■When the connection method is "Text file" or "DB connection" If a missing value is included in any of output data, output of the record is skipped.</p> <table border="1"> <thead> <tr> <th>Input1</th> <th>Input2</th> <th>Diag1</th> <th>Diag2</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>Class_0</td> <td>2</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> <tr> <td>5</td> <td>4.3</td> <td></td> <td>4</td> </tr> </tbody> </table> <p>→</p> <table border="1"> <thead> <tr> <th>Input1</th> <th>Input2</th> <th>Diag1</th> <th>Diag2</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> </tbody> </table> <p>↓</p> <p>■When the connection method is "Mitsubishi Electric FA Connector" or "OPC UA server connection" If a missing value is included in any of output data, output of the record is skipped. (If skipped, the device value is not updated.)</p> <table border="1"> <thead> <tr> <th>Input1</th> <th>Input2</th> <th>Diag1</th> <th>Diag2</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>Class_0</td> <td>2</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> <tr> <td>5</td> <td>4.3</td> <td></td> <td>4</td> </tr> </tbody> </table> <p>→</p> <table border="1"> <thead> <tr> <th>D1</th> <th>D2</th> <th>D3</th> <th>D4</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td>1</td> </tr> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td>1</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> </tbody> </table> <p>↓</p>	Input1	Input2	Diag1	Diag2	3	7.5	Class_1		2		Class_0	2	5	1.4	Class_1	3	5	4.3		4	Input1	Input2	Diag1	Diag2					5	1.4	Class_1	3	Input1	Input2	Diag1	Diag2	3	7.5	Class_1		2		Class_0	2	5	1.4	Class_1	3	5	4.3		4	D1	D2	D3	D4	3	7.5	Class_1	1	3	7.5	Class_1	1	5	1.4	Class_1	3	5	1.4	Class_1	3
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Set by variable	Don't output missing value	Output of a variable is skipped.																																																																															
	Output missing value without processing ^{*1}	A missing value is output as empty data without processing.																																																																															
	Output specified value	<p>A missing value is replaced with a value set in "Specified output value" and output.</p> <p>■When the connection method is "Text file" or "DB connection"</p> <p>(Example)</p> <p>(A): When setting "Don't output missing value" or "Output missing value without processing" for Input2</p> <p>(B): When setting "Output specified value" (specified output value: Class_NaN) for Diag1</p> <p>(C): When setting "Output specified value" (specified output value: -1) for Diag2</p> <table border="1" style="margin-bottom: 10px;"> <thead> <tr> <th>Input1</th> <th>Input2</th> <th>Diag1</th> <th>Diag2</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>Class_0</td> <td>2</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> <tr> <td>5</td> <td>4.3</td> <td></td> <td>4</td> </tr> </tbody> </table> <div style="display: flex; align-items: center; justify-content: center;"> <table border="1" style="margin-right: 20px;"> <thead> <tr> <th>Input1</th> <th>Input2</th> <th>Diag1</th> <th>Diag2</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>Class_0</td> <td>2</td> </tr> <tr> <td>5</td> <td>1.4</td> <td></td> <td>3</td> </tr> <tr> <td>5</td> <td>4.3</td> <td>Class_NaN</td> <td>4</td> </tr> </tbody> </table> <div style="text-align: center;"> <p>(A) (B) (C)</p> </div> </div> <p>■When the connection method is "Mitsubishi Electric FA Connector" or "OPC UA server connection"</p> <p>(Example)</p> <p>(A): When setting "Don't output missing value" for Input2</p> <p>(B): When setting "Output specified value" (specified output value: Class_NaN) for Diag1</p> <p>(C): When setting "Output specified value" (specified output value: -1) for Diag2</p> <table border="1" style="margin-bottom: 10px;"> <thead> <tr> <th>Input1</th> <th>Input2</th> <th>Diag1</th> <th>Diag2</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>Class_0</td> <td>2</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> <tr> <td>5</td> <td>4.3</td> <td></td> <td>4</td> </tr> </tbody> </table> <div style="display: flex; align-items: center; justify-content: center;"> <table border="1" style="margin-right: 20px;"> <thead> <tr> <th>D1</th> <th>D2</th> <th>D3</th> <th>D4</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>7.5</td> <td>Class_1</td> <td></td> </tr> <tr> <td>2</td> <td></td> <td>Class_0</td> <td>2</td> </tr> <tr> <td>5</td> <td>1.4</td> <td>Class_1</td> <td>3</td> </tr> <tr> <td>5</td> <td>4.3</td> <td>Class_NaN</td> <td>4</td> </tr> </tbody> </table> <div style="text-align: center;"> <p>(A) (B) (C)</p> </div> </div>	Input1	Input2	Diag1	Diag2	3	7.5	Class_1		2		Class_0	2	5	1.4	Class_1	3	5	4.3		4	Input1	Input2	Diag1	Diag2	3	7.5	Class_1		2		Class_0	2	5	1.4		3	5	4.3	Class_NaN	4	Input1	Input2	Diag1	Diag2	3	7.5	Class_1		2		Class_0	2	5	1.4	Class_1	3	5	4.3		4	D1	D2	D3	D4	3	7.5	Class_1		2		Class_0	2	5	1.4	Class_1	3	5	4.3	Class_NaN
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*1 Cannot be selected for the Mitsubishi Electric FA connector and OPC UA server connection.
 Select "Don't output record containing missing value" or "Set by variable"; otherwise, change the connection method.

■Output variable setting (for "Text file")

The following shows the screen that appears when selecting "Text file" for the connection method. Data to be output can be selected. In addition, any variable names can be set for the data to be output.

Window

Output variable setting

Please set the variable name of the output data.

Variable	Output data	Output
Timestamp	<input type="text" value="Timestamp"/>	<input checked="" type="checkbox"/>
Data2	<input type="text" value="Data2"/>	<input checked="" type="checkbox"/>
Data3	<input type="text" value="Data3"/>	<input checked="" type="checkbox"/>
Data4	<input type="text" value="Data4"/>	<input checked="" type="checkbox"/>
Data5	<input type="text" value="Data5"/>	<input checked="" type="checkbox"/>
Data6	<input type="text" value="Data6"/>	<input checked="" type="checkbox"/>
ID	<input type="text" value="ID"/>	<input checked="" type="checkbox"/>

Add File Output Time to First Column

Displayed items

Item	Description
Variable	A variable name input to this block is displayed.
Output data ^{*1}	Set a name for data to be output. ^{*2} The available number of characters is as follows: <ul style="list-style-type: none"> • When selecting "Edgecross cooperation" for "Cooperation option" in the output data stream screen: Up to 32 characters • Other cases: Up to 256 characters
Output	Select data to be output by turning the switch ON.
[Response data definition file output] button	Click this to output a response data definition file for cooperating with Edgecross Basic Software when selecting "Edgecross cooperation" for "Cooperation option" in the output data stream screen. For the format of a response data definition file, refer to the following: ☞ Page 414 Output of a response data definition file The file is output by the download function of a web browser.
Add File Output Time to First Column ^{*3}	Select the checkbox to add the output time in the first column of an output file. ☞ Page 413 Addition of the output time column

*1 Can be set when "Output" of the line is ON.

*2 'TIME' is not available since it is a reserved word for the output time column.

*3 The selection status of this checkbox can be changed when selecting "None" for "Cooperation option" in the output data stream screen. (The checkbox is selected when selecting "Edgecross cooperation.")

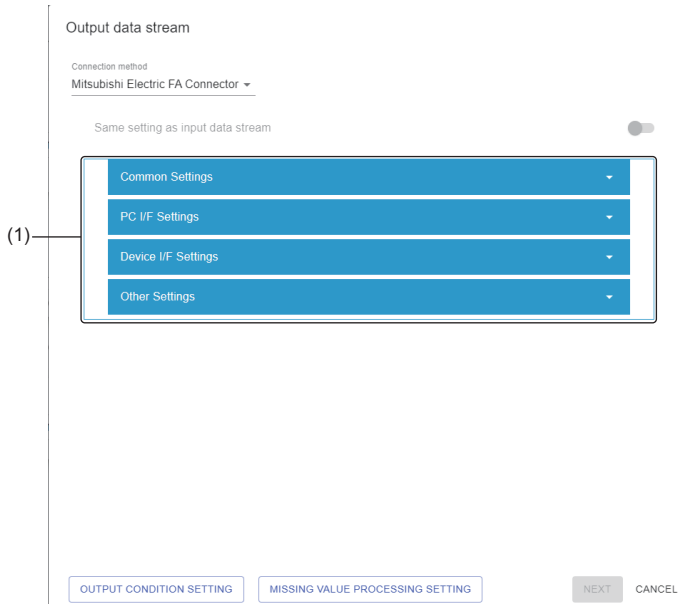
■When the connection method is "Mitsubishi Electric FA Connector"

The contents to be set when the connection method is "Mitsubishi Electric FA Connector" are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
Connection method	Select "Mitsubishi Electric FA Connector."
Same setting as input data stream	Turn this ON to apply the target device settings of an input data stream to an output data stream when "Mitsubishi Electric FA Connector" is selected for the connection method in the input data stream screen and also the settings are completed.
(1) Target device settings ^{*1}	Settings are the same as the target device settings of an input data stream. ☞ Page 392 When the connection method is "Mitsubishi Electric FA Connector"
[Output condition setting] button	Click this to display the output condition setting screen. (☞ Page 426 Output condition)
[Missing value processing setting] button	Click this to display the missing value processing setting screen. (☞ Page 428 Missing value processing setting)
[Next] button	Click this to display the output variable setting screen (for "Mitsubishi Electric FA Connector"). (☞ Page 432 Output variable setting (for "Mitsubishi Electric FA Connector"))

*1 Can be set when "Same setting as input data stream" is OFF.

Point

- When changing the target device settings of an input data stream while "Same setting as input data stream" is ON, changes are also applied to the settings of an output data stream.
- When changing the connection method of an input data stream from "Mitsubishi Electric FA Connector" to another method, an error occurs.

■Output variable setting (for "Mitsubishi Electric FA Connector")

The following shows the screen that appears when selecting "Mitsubishi Electric FA Connector" for the connection method. Data to be output can be selected. In addition, any variable names can be set for the data to be output.

Window

Output variable setting

Please set the device to be output in the output data column and the data type to be output in the data type column.

Variable name	Variable type	Output data	Data type	Number of char...	Output
Timestamp	Timestamp				<input type="checkbox"/>
Data2	Number	X101	BOOL		<input checked="" type="checkbox"/>
Data3	Number	Y101	BOOL		<input checked="" type="checkbox"/>
Data4	Number	R20	WORD		<input checked="" type="checkbox"/>
Data5	Number				<input type="checkbox"/>
Data6	Number				<input type="checkbox"/>
ID	Category	D100	WSTRING	16	<input checked="" type="checkbox"/>
New AI_DIAG	Number	X100	BOOL		<input checked="" type="checkbox"/>

Displayed items

Item	Description
Variable name	A variable name input to this block is displayed.
Variable type	The type of a variable is displayed. For details on the type of a variable created or output by each block, refer to the input/output specifications (output) of each block.
Output data ^{*1}	Set a device to be output. For the devices that can be output, refer to the following: Page 379 Accessible devices
Data type ^{*1}	Set the data type of a device to be output. The data types that can be set differ depending on the data type of the explanatory variable in a target line. <ul style="list-style-type: none"> • When the data type of an explanatory variable is 'numerical value' BOOL, WORD, INT, UINT, DWORD, DINT, UDINT, LINT, ULINT, REAL, LREAL, STRING, WSTRING • When the data type of an explanatory variable is 'category' BOOL, STRING, WSTRING When the variable type and the data type range do not match, data is output according to the specifications shown in the following: When data input by an output data stream block does not match with the range of data type specified in the output variable settings
Number of characters	Set the number of characters in the following range when selecting "STRING" or "WSTRING" for "Data type." <ul style="list-style-type: none"> • "STRING": 1 to 32 • "WSTRING": 1 to 16
Output	Select data to be output by turning the switch ON. This switch is always OFF when the data type of an explanatory variable is timestamp.

*1 Can be set when "Output" of the line is ON.

■When the connection method is "OPC UA server connection"





The contents to be set when the connection method is "OPC UA server connection" are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Displayed items

Item	Description
Connection method	Select "OPC UA server connection."
Same setting as input data stream	Turn this ON to apply the OPC UA server authentication settings of an input data stream to an output data stream when "OPC UA server connection" is selected for the connection method in the input data stream screen and the settings are completed.
(1) OPC UA server setting	Setting contents are the same as the OPC UA server connection settings of an input data stream.* ¹  Page 396 When the connection method is "OPC UA server connection"
[Output condition setting] button	Click this to display the output condition setting screen. ( Page 426 Output condition)
[Missing value processing setting] button	Click this to display the missing value processing setting screen. ( Page 428 Missing value processing setting)
[Next] button	Click this to display the "Output variable setting" screen (for "OPC UA server connection"). ( Page 434 Output variable setting (for "OPC UA server connection"))

*1 When "Same setting as input data stream" is ON, the settings cannot be changed even if the [Change] button is clicked. (Only browsing is available.)

Point

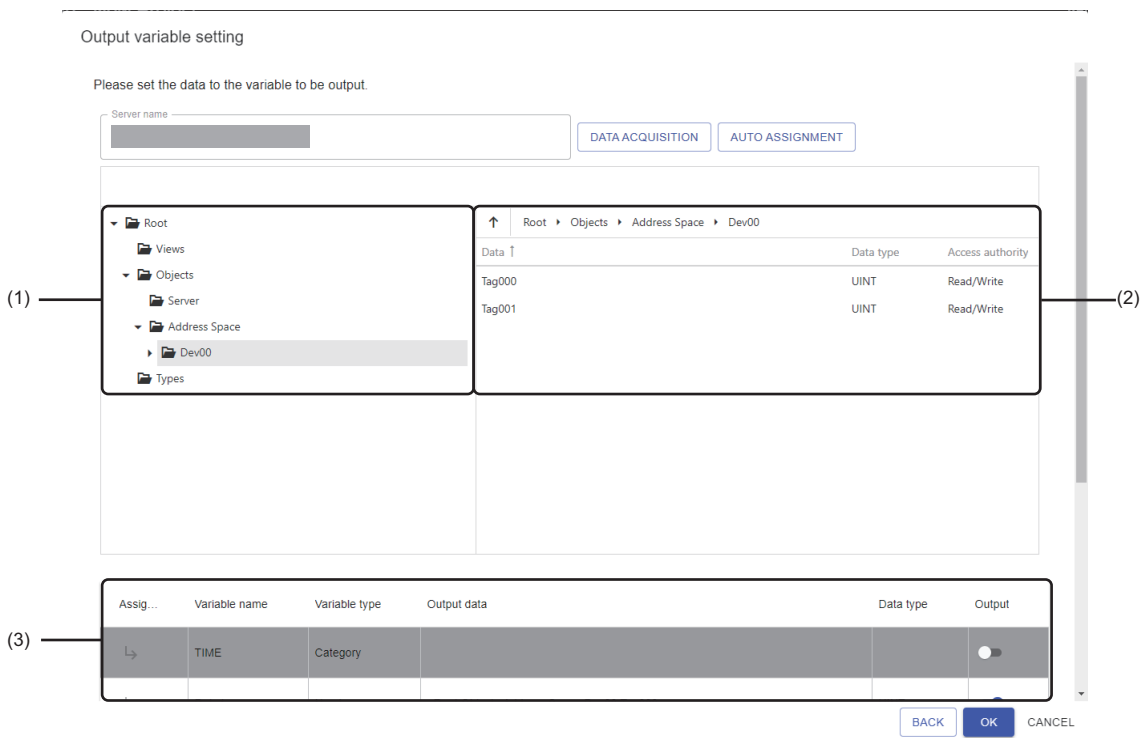
When changing the OPC UA server authentication settings of an input data stream while "Same setting as input data stream" is ON, changes are also applied to the settings of an output data stream.

When changing the connection method of an input data stream from "OPC UA server connection" to another method, an error occurs.

■Output variable setting (for "OPC UA server connection")



The following shows the screen that appears when selecting "OPC UA server connection" for the connection method. Data to be output can be selected. In addition, any variable names can be set for the data to be output.

Window



Displayed items

Item	Description	
Server name	A server name acquired from the server authentication is displayed.	
[Data acquisition] button	Click this to acquire data from the OPC UA server and display it in a tree view and data list.	
[Auto assignment] button ^{*1}	Click this to assign data automatically to a target variable, when the variable that has the same name (characters are case-sensitive) as the one displayed in the data list exists in the output variable setting. However, the variables of which the "Output" column is OFF are excluded. In addition, when data is already assigned to the target variable, the data is overwritten.	
(1) Tree view	The acquired data hierarchy of an OPC UA server is displayed in a tree format.	
(2) Data list	—	The data in the items selected in the tree view is listed.
	Data	A data name is displayed.
	Data type	A data type is displayed. "----" is displayed for unavailable data type in this function.
	Access authority	The data access authority type is displayed.

Item	Description
(3) Output variable setting	—
Assignment*2	Click this to assign data selected in the data list to the "Output data" column.
Variable name	A variable name input to this block is displayed.
Variable type	The type of a variable is displayed.
Output data	Data of an OPC UA server to be set as a variable is displayed. Data names are connected from the start to the end of the item names, and displayed in a layer structure accordingly. (Example) Root.Objects.Dev000.Node01 If an error occurs,  is displayed.
Data type	The type of data set in "Output data" is displayed. "---" is displayed for unavailable data type in this function. When the variable type and the data type range do not match, data is output according to the specifications shown in the following:  When data input by an output data stream block does not match with the range of data type specified in the output variable settings
Output	Select data to be output by turning the switch ON. This switch is always OFF when "Variable type" is "Timestamp."

*1 Can be clicked when at least one unit of data is displayed in the data list.

*2 Can be clicked when "Output" of the line is ON.

• The following shows the available data types for this function and the corresponding data types of the OPC UA server.

Data type	Data type of OPC UA server	Description
BOOL	UA_BOOLEAN	Binary (0 or 1)
SINT*1	UA_SBYTE	Signed 8-bit integer
USINT*1	UA_BYTE	Unsigned 8-bit integer
INT*1	UA_INT16	Signed 16-bit integer
UINT*1	UA_UINT16	Unsigned 16-bit integer
DINT*1	UA_INT32	Signed 32-bit integer
UDINT*1	UA_UINT32	Unsigned 32-bit integer
LINT*1	UA_INT64	Signed 64-bit integer
ULINT*1	UA_UINT64	Unsigned 64-bit integer
REAL*1	UA_FLOAT	32-bit real number
LREAL*1	UA_DOUBLE	64-bit real number
WSTRING*2	UA_String	Character string (Unicode)

*1 Can be set only when "Variable type" is "Numerical value."

*2 Can be set only when "Variable type" is "Category."

Point 

When the screen is displayed, data is acquired from an OPC UA server and displayed in a tree view and data list.

Precautions

• The settings cannot be changed during the acquisition of the data.

In this case, the following is displayed:



• When the data settings of an OPC UA server are changed after configuring the output variable settings, click the [Data acquisition] button to check that there are no errors in the settings.

■When the connection method is "DB connection"

The contents to be set when the connection method is "DB connection" are as follows.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Output data stream

Connection method
DB connection

Output variable
! Not set CHANGE

DB connection
! Not set CHANGE

Query
! Not created CHANGE

OUTPUT CONDITION SETTING MISSING VALUE PROCESSING SETTING OK CANCEL

Displayed items

Item	Description
Connection method	Select "DB connection."
Output variable	The setting status of a variable to be output is displayed. Click the [Change] button to set this item. (Page 437 Output variable setting (for "DB connection"))
DB connection	The status of the database connection setting is displayed. Click the [Change] button to set this item. (Page 438 DB connection setting)
Query	The creation status of a query is displayed. Click the [Change] button to create a query. (Page 439 Query)
[Output condition setting] button	Click this to display the output condition setting screen. (Page 426 Output condition)
[Missing value processing setting] button	Click this to display the missing value processing setting screen. (Page 428 Missing value processing setting)

■Output variable setting (for "DB connection")

The following shows the screen that appears when selecting "DB connection" for the connection method. Data to be output can be selected.

Window

Output variable setting [?](#)

Please select the variable to be used for output.

Variable	Query vari...	Variable type	Output
id	id	Number	<input checked="" type="checkbox"/>
datetime_val...	datetime_value	Timestamp	<input checked="" type="checkbox"/>
string_value	string_value	Category	<input checked="" type="checkbox"/>
float_value	float_value	Number	<input checked="" type="checkbox"/>
New AI_FLG	New AI_FLG	Category	<input checked="" type="checkbox"/>
New AI_SEPN	New AI_SEPN	Category	<input checked="" type="checkbox"/>
New AI_SEL...	New AI_SEL...	Number	<input checked="" type="checkbox"/>

Displayed items

Item	Description
Variable	A variable name is displayed.
Query variable name	A variable name available when creating a query is displayed. (Page 439 Query)
Variable type	The type of a variable under "Variable" is displayed.
Output	Select data to be output by turning the switch ON.

■DB connection setting

The following shows the screen for setting connection information to connect to a database.

Window

DB connection setting

Same setting as input data stream

DB type
SQL Server

Destination address *

Port number *


DB name

User name *

Password *

CONNECTION CHECK OK CANCEL

Displayed items

Item	Description
Same setting as input data stream	Turn this ON to apply the DB connection settings of an input data stream to an output data stream when "DB connection" is selected for the connection method in the input data stream screen and also the settings are completed.
(1) Connection information*1	Settings are the same as the DB connection settings of an input data stream.  Page 407 DB connection setting
[Connection check] button	Click this to check whether a database can be connected.

*1 Can be set when "Same setting as input data stream" is OFF.

Point

When changing the database connection settings of an input data stream while "Same setting as input data stream" is ON, changes are also applied to the settings of an output data stream.

When changing the connection method of an input data stream from "DB connection" to another method, an error occurs.

■Query


The following shows the screen for creating a query to output data to a database.

Window



Displayed items

Item	Description						
(Template insertion)	<p>Click this to insert a template.</p> <pre>INSERT INTO "__sample_table__"("Database column name") VALUES (%(Query variable name)s)</pre> <table border="1"> <tr> <td>"__sample_table__"</td> <td>Replace '__sample_table__' with the table name of a data output destination.</td> </tr> <tr> <td>"Database column name"</td> <td>It is inserted with delimited by commas and line feeds for the number of output variables. If the column name in "database column name" differs from that of a database, replace it with a target one.</td> </tr> <tr> <td>%(Query variable name^{*1})s</td> <td>It is inserted with delimited by commas and line feeds for the number of output variables.</td> </tr> </table>	"__sample_table__"	Replace '__sample_table__' with the table name of a data output destination.	"Database column name"	It is inserted with delimited by commas and line feeds for the number of output variables. If the column name in "database column name" differs from that of a database, replace it with a target one.	%(Query variable name ^{*1})s	It is inserted with delimited by commas and line feeds for the number of output variables.
"__sample_table__"	Replace '__sample_table__' with the table name of a data output destination.						
"Database column name"	It is inserted with delimited by commas and line feeds for the number of output variables. If the column name in "database column name" differs from that of a database, replace it with a target one.						
%(Query variable name ^{*1})s	It is inserted with delimited by commas and line feeds for the number of output variables.						
(Test execution)	<p>Click this to test if a query works. (No commit is executed during test execution.) (A value is stored in each variable as follows during test execution.) Numerical value type: 1 (numerical value) Category type: 1 (character string) Timestamp type: Time at test execution An error may occur for some data types in the columns of output destinations.)</p>						
(1) Query editor	An area for creating a query. (Number of characters: up to 600000, number of lines: up to 3000) Enter only one query.						
(2) Execution result	[Console] tab An error occurred in test execution is displayed.						

*1 Use a variable name displayed under the query variable name in the output variable setting. ( Page 437 Output variable setting (for "DB connection"))

Precautions

Data in a database may be rewritten depending on the content of a query. Check the content, then click the [OK] button.

Point

- A commit is automatically executed during task execution and it is not required to be included in a query to be created.
- For errors returned by a database, refer to the manual for each database to take corrective action.

10

10.8 Diagnosis Execution Category

An extension block of the diagnosis execution category outputs a diagnosis result when a task is executed.

This block is available in the task editor screen.

For operations that can be performed by right-clicking a block, refer to the following:

☞ Page 231 Right-click menus

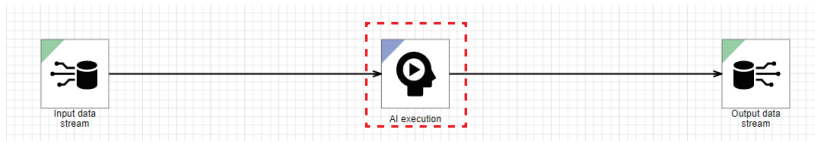
AI execution block

An AI execution block outputs a diagnosis result when a task is executed.

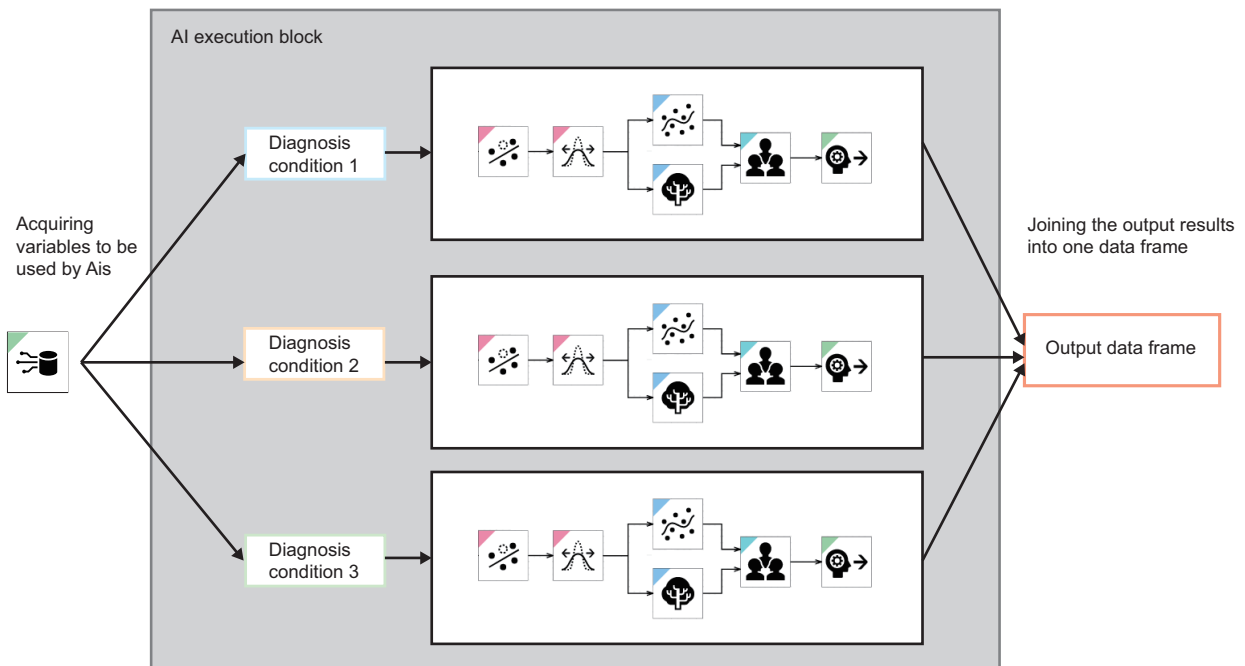
A diagnosis is performed by using an AI in the "Complete" state.

Up to 64 AIs can be used if the variable names and variable types of data sets that these AIs use completely match.

In addition, conditions to perform a diagnosis can be set for each AI used. (Up to eight conditions)



- Processing image



Input/output specifications

Input

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 256 Type of each variable: Any types

Output

Missing values are output for the variables in the diagnosis result from an AI that does not satisfy diagnosis execution conditions.

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 1024 Type of each variable: Any types

Variable to be output					
No.	Number of columns	Variable name	Variable type	Description	Range
1	Number of explanatory variables ^{*1}	Explanatory variable name ^{*1}	Any types	Explanatory variable ^{*1}	Any ranges
2	Number of diagnosis results set in the output setting screen	Output variable name set in the output setting screen	Any types	Diagnosis result ^{*2}	Any ranges
3	Number of additional features set in the output setting screen	Output variable name set in the output setting screen	Any types	Additional feature ^{*2}	Any ranges

*1 Output only when outputting explanatory variables (no AIs include a section generation block).

*2 Added in columns from the oldest AI based on the creation date and time.

Explanatory variable, diagnosis result, and additional feature

The explanatory variable, diagnosis result, and additional feature handled on a task refer to the following variables:

Item	Description
Explanatory variable	A variable collected by an input data stream and output to the next block. This variable is basically output to the next block of an AI execution block as well; therefore, it can be used for an output condition of an output data stream.
Diagnosis result	A variable to store a diagnosis result from each AI during processing of the AI. This variable is basically output to the next block of an AI execution block as well; therefore, it can be used to judge the pass or fail, etc. by setting a threshold in a block of the diagnosis category. This variable refers to an inference result for supervised learning and a calculated error level for unsupervised learning, for example.
Additional feature	A variable added during processing of each AI and input to a block of the analysis method category. This variable is output to the next block as well by selecting the variable manually on an AI execution block; therefore, a feature added by an AI can be output.

Operational specifications

The following processing is performed when performing a diagnosis.

1. Judging diagnosis execution conditions

Whether data input in a diagnosis cycle satisfies the set diagnosis execution conditions is judged.

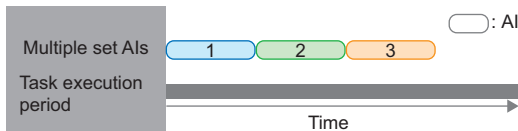
Only records that satisfy the diagnosis execution conditions are diagnosed by AIs added to an AI execution block.

An event occurs if the diagnosis conditions are satisfied and also the input includes a missing value, 'inf,' or '-inf.' However, a diagnosis continues even if an event occurs.

2. Performing a diagnosis

The input data is diagnosed in order.

AIs receive data required for a diagnosis from the input data, and perform a diagnosis.



3. Outputting a diagnosis result

Diagnosis results and additional features set in the output setting screen are output to the next block of the AI execution block.

When no AIs include a section generation block, explanatory variables input to the AI execution block are also output.

Data is output in the data frame type that joins the outputs of AIs horizontally.

In addition, if no AIs include a section generation block and also the number of records does not match among output results, data is joined for each record matching the output conditions. For the shortage, a missing value is output.

Ex.

Data join example in the following case:

- AI 1: All records satisfy the diagnosis execution conditions.
- AI 2: The record in the third line does not satisfy the diagnosis execution conditions.
- AI 3: Only the record in the last line satisfies the diagnosis execution conditions.

Diagnosis result of AI 1	Diagnosis result of AI 2	Diagnosis result of AI 3
30	17	NaN
28	15	NaN
8	NaN	NaN
24	22	NaN
22	20	NaN
20	18	NaN
7	5	5

In addition, when any AIs include a section generation block, data is joined to fit the size of the output result with the most number of records, and records of a missing value are added to the end for the shortage.

Ex.

Data join example in the following case:

- AI 1: Three records are output.
- AI 2: One record is output.
- AI 3: Five records are output.

Diagnosis result of AI 1	Diagnosis result of AI 2	Diagnosis result of AI 3
30	5	0.1
28	NaN	2.5
8	NaN	1.1
NaN	NaN	5.3
NaN	NaN	0.9

AI execution screen

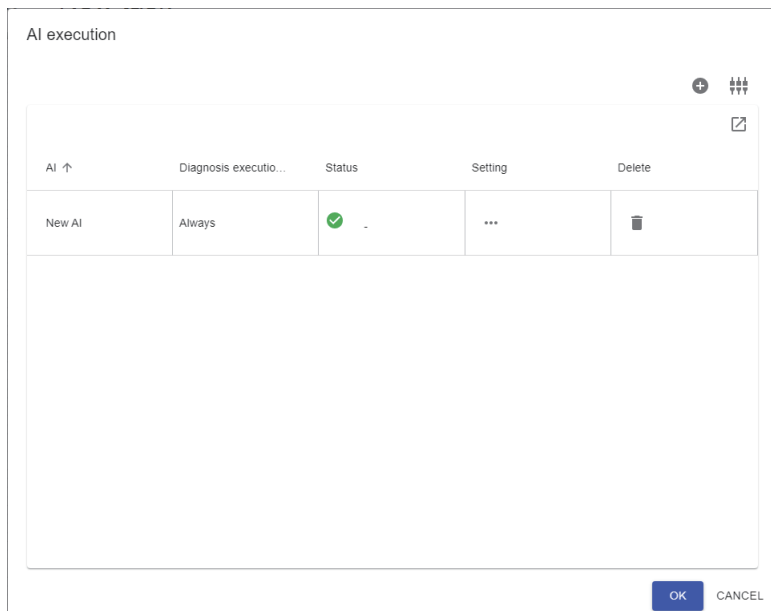
The following shows the screen for displaying the list of set AIs.

Up to 64 AIs can be set.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Displayed items

Item	Description
(Add AI)* ¹	Click this to add an AI. (Page 446 Adding an AI)
(Output setting)	Click this to display the output setting screen. (Page 449 Output settings)
(Expand)/ – (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
AI	The name of an added AI is displayed.* ²
Diagnosis execution condition	A set diagnosis execution condition is displayed. "Always" is displayed when a diagnosis condition is not set or when an analysis method is not used. "Multiple conditions (set condition convergence method)" is displayed when two or more diagnosis conditions are set.
Status	The status of an AI is displayed. <ul style="list-style-type: none"> • : The AI is in the "Completed" state. • Delete: The AI does not exist. • Editing: The AI is in a state other than "Completed."
Setting* ³	Click the icon displayed in this column to display the diagnosis execution condition screen. (Page 447 Diagnosis execution condition)
Delete	Click the icon displayed in this column to delete an AI.

*¹ Can be clicked when the number of set AIs is less than its maximum number.

*² "Undefined" is displayed when the set AI is deleted and an error occurs.

*³ Can be clicked for an AI using an analysis method.

Precautions

The [OK] button cannot be clicked when "Status" of at least one AI is other than .

■ Adding an AI

The following shows the screen for adding an AI to an AI execution block.

Select the checkbox of an AI to be added.

Window

<input checked="" type="checkbox"/>	Name ↑	Data set	Status	Score	Comment
<input checked="" type="checkbox"/>	New AI(001)	New data set	Complete	-	

OK CANCEL

Displayed items


Als that satisfy all the following conditions are displayed.


However, the displayed contents shows information of when this screen appears, and they are not updated.

- The status is "Completed."
- It is not set in an AI execution block.
- The names and types of variables excluding objective variables in a data set used completely match with an AI selected when creating the task.

Item	Description
(Expand)/ – (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header
Name	An AI name is displayed. The AI editor screen can be opened in another tab by clicking the name. (Page 175 AI editor screen)
Data set	The name of a data set selected to create an AI is displayed. is displayed when the data set is being edited or deleted. is displayed when the data set is changed after starting learning.
Diagnosis target ^{*1}	The name of an objective variable specified for learning is displayed. ^{*2}
Status	The status of an AI is displayed.
Model type ^{*1}	The model type of an AI that completes learning is displayed. "Others" is displayed for a model type other than a classification or regression model.
Score	The learning performance (overview score) is displayed. ^{*3} An overview score is an evaluation index that shows the accuracy of an AI which completes learning with a value between 0 and 100. This score indicates the prediction accuracy of an AI. When the score is 80, the AI can predict a result for input data correctly at approximately 80%. The score is calculated as follows: <ul style="list-style-type: none"> • For a classification model: An integer value obtained by multiplying the F1 score by 100 • For a regression model: An integer value obtained by multiplying R2 by 100 (When R2 has a negative value, the score will be '0' regardless of the value. If R2 cannot be calculated, the overview score cannot be calculated either.)
Learning time ^{*1}	Time required for entire learning processing is displayed.
Diagnosis time (reference) [ms] ^{*1}	Time taken to diagnose one record on the learning station is displayed. ^{*4}
Update date and time ^{*1}	The date and time when an AI was updated is displayed. This item is not updated by editing an AI name or comment.

Item	Description
Creation date and time ^{*1}	The date and time when an AI was created is displayed. For an AI created as a copy, the date and time when the copy was created is displayed.
Comment	A set comment is displayed.
Size [MB] ^{*1}	The file size of an AI is displayed.

*1 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

 Page 56 Switching to show or hide

*2 "-" is displayed for unsupervised learning.

*3 "-" is displayed when learning is performed with an analysis method of unsupervised learning.

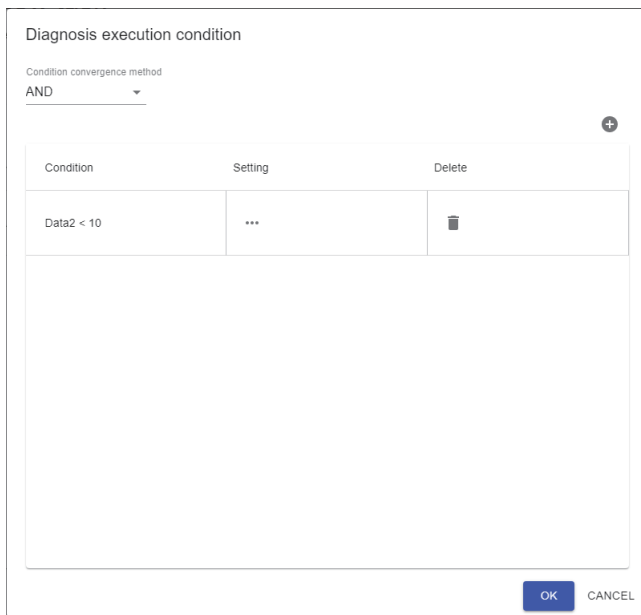
*4 "-" is displayed when the model type of the AI is a similar waveform recognition model.

■Diagnosis execution condition




The following shows the screen for setting a diagnosis execution condition to diagnose data with a learned model.

Up to eight conditions can be set.

Window



Displayed items

Item	Description
Condition convergence method	Select a convergence method for diagnosis execution conditions. • AND • OR
 (Add condition) ^{*1}	Click this to add a condition. ( Page 448 Condition settings)
Condition	A comparison condition set in the condition setting screen is displayed.
Setting	Click the icon displayed in this column to change settings for a comparison condition. ( Page 448 Condition settings)
Delete	Click the icon displayed in this column to delete a condition.

*1 Can be clicked when the number of execution conditions is less than its maximum number.

■Condition settings

The following shows the screen for setting a comparison condition.

Window

Condition setting

Judgment target variable: Data2
Operator: <
Comparison target: Constant
Setting value: 10

OK CANCEL

Displayed items

Item	Description
Judgment target variable	Select a variable to be judged. A variable other than the timestamp type variables can be selected among the explanatory variables of an AI.
Operator	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." • Numerical value type variable: <, ≤, >, ≥, =, ≠ • Category type variable: =, ≠
Comparison target	Select a comparison target from the following options: • "Constant" • Variable with the same type as a variable selected for "Judgment target variable" among explanatory variables of an AI*1
Setting value*2	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." • Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) • Category type variable: All categories in the variable


*1 Excluding a variable selected for "Judgment target variable"

*2 Displayed when selecting "Constant" for "Comparison target."

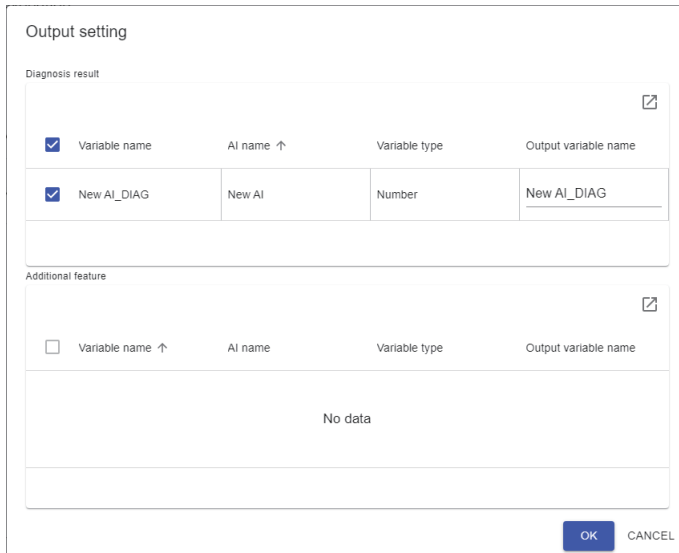
Output settings

The following shows the screen for setting data to be output to the next block.







For details on the additional feature and diagnosis result to configure the output settings in this screen, refer to the following:

 Page 443 Explanatory variable, diagnosis result, and additional feature

Window



Displayed items

Item		Description
Diagnosis result	—	A variable in a diagnosis result output by an AI set in the AI list is displayed. When an AI outputs multiple diagnosis results, they are displayed in separate lines. Select the checkbox of a variable to be output.
	 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
	Variable name	A variable name is displayed.
	AI name	An AI name is displayed.
	Variable type	A variable type is displayed. ( Page 85 Variable types)
	Output variable name* ¹	Set a variable name to be used when outputting a variable (up to 256 characters).
Additional feature	—	The additional feature variable of an AI set in the AI list is displayed. When an AI outputs multiple additional features, they are displayed in separate lines. Select the checkbox of a variable to be output.
	 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
	Variable name	A variable name is displayed.
	AI name	An AI name is displayed.
	Variable type	A variable type is displayed. ( Page 85 Variable types)
	Output variable name* ¹	Set a variable name to be used when outputting a variable (up to 256 characters).

*1 Can be set when the checkbox of the line is selected.

10.9 Diagnosis Category

Extension blocks of the diagnosis category output a diagnosis result of monitored input data. These blocks are available in the task editor screen.

For operations that can be performed by right-clicking a block, refer to the following:

☰ Page 231 Right-click menus

Comparison judgment block

A comparison judgment block compares and judges data output by an AI execution block.

This block judges a variable under a set comparison condition, and outputs a result.

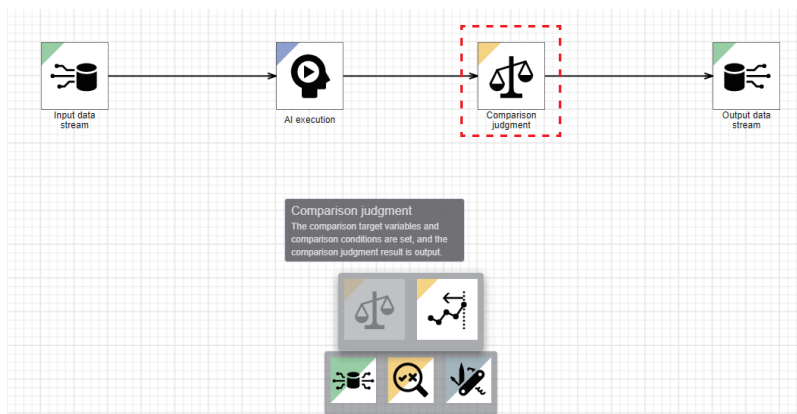
Multiple (up to 64) conditions can be set. The judgment results for all settings are integrated into input data, then output.

A condition can be set not only for a numerical value type variable but also for a category type variable.

An error value can be detected by monitoring a variable and outputting its judgment result.

Restriction

This block can be placed only the next of an AI execution block.



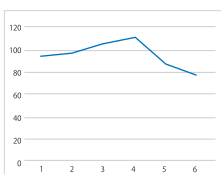
- Processing image

Ex.

When setting 'value > 100' for setting 1, and 'value < 80' for setting 2 as comparison judgment conditions

Waveform data

Timestamp	value
2021/2/5 14:00:00.01	93
2021/2/5 14:00:00.02	95
2021/2/5 14:00:00.03	105
2021/2/5 14:00:00.04	109
2021/2/5 14:00:00.05	89
2021/2/5 14:00:00.06	78



Comparing and judging data

Setting 1 Judgment result	Setting 2 Judgment result
0	0
0	0
1	0
1	0
0	0
0	1

Joining data

Timestamp	value	Setting 1 Judgment result	Setting 2 Judgment result
2021/2/5 14:00:00.01	93	0	0
2021/2/5 14:00:00.02	95	0	0
2021/2/5 14:00:00.03	105	1	0
2021/2/5 14:00:00.04	109	1	0
2021/2/5 14:00:00.05	89	0	0
2021/2/5 14:00:00.06	78	0	1

Results acquired by joining data logically are joined into input data, then output.

Ex.

When setting 'department = general affairs, development' for setting 1, and 'position ≠ unit head, manager' for setting 2 as comparison judgment conditions

Category data

Name	Position	Department
Tanaka	Section head	Sales
Hayashi	Unit head	Sales
Kojima	Manager	Sales
Ito	Regular employees	General affairs
Yamada	Regular employees	Development
Saito	Supervisor	Development
Yamamoto	Supervisor	Development

Comparing and judging data

Setting 1 Judgment result	Setting 2 Judgment result
0	1
0	0
0	0
1	1
1	1
1	1
1	1

Joining data

Name	Position	Department	Setting 1 Judgment result	Setting 2 Judgment result
Tanaka	Section head	Sales	0	1
Hayashi	Unit head	Sales	0	0
Kojima	Manager	Sales	0	0
Ito	Regular employees	General affairs	1	1
Yamada	Regular employees	Development	1	1
Saito	Supervisor	Development	1	1
Yamamoto	Supervisor	Development	1	1

Results acquired by joining data logically are joined into input data, then output.

Input/output specifications

Input

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 1024 Type of each variable: At least one column must include a numerical value type or category type variable.

Output

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of input variables + number of comparison condition settings (up to 64) Type of each variable: Any types

Variable to be output					
No.	Number of columns	Variable name	Variable type	Description	Range
1	Number of input variables	Name of an input variable	Any types	Input variable	Range of an input variable
2	Number of comparison condition settings	(Name of a selected judgment target variable)_(index (01 to 64) of a comparison condition setting)_COMP ^{*1}	Category	Judgment result for each comparison condition setting	<ul style="list-style-type: none"> 0: Condition not matched 1: Condition matched

*1 When a variable name has more than 255 characters, characters in the name of the judgment target variable are deleted from the end to fit within 255 characters in total.

Point

If a variable name is duplicate with an existing variable, the name is suffixed with '_001.'. If the name is still duplicate, the number will be incremented. If a suffixed name has more than 255 characters, characters in the judgment target variable name will be deleted to fit within 255 characters in total.

Operational specifications

The processing is performed in the following order:


1. A target variable is judged under a set condition.
 - When a judgment target variable is of the numerical value type

Condition	Description
Judgment target variable > comparison condition value	The latest record has a value larger than a comparison condition value.
Judgment target variable < comparison condition value	The latest record has a value smaller than a comparison condition value.
Judgment target variable = comparison condition value	The latest record has a value equal to a comparison condition value.

- When a judgment target variable is of the category type

Condition	Description
Judgment target variable = comparison condition value	The latest record has a value equal to a comparison condition value.
Judgment target variable ≠ comparison condition value	The latest record has a value different from a comparison condition value.

2. A result is output.

 Page 451 Input/output specifications

Comparison judgment screen

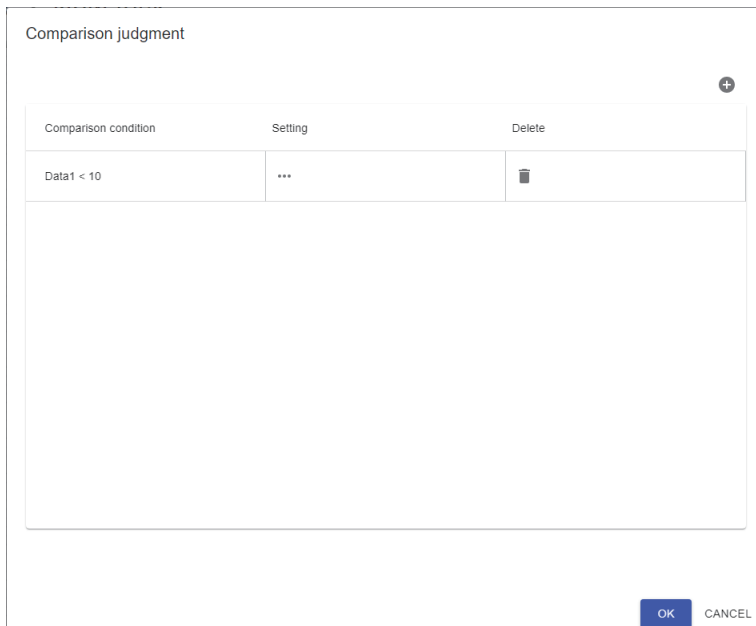
The following shows the screen for displaying the list of set comparison conditions.


Up to 64 conditions can be set.

Window



Perform either of the following operations:


- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.



Comparison condition	Setting	Delete
Data1 < 10	...	

Displayed items

Item	Description
 (Add comparison condition setting)*1	Click this to add a comparison condition. ( Page 454 Condition settings)

Item	Description
Comparison condition	A comparison condition set in the condition setting screen is displayed.
Setting	Click the icon displayed in this column to change settings for a comparison condition. ( Page 454 Condition settings)
Delete	Click the icon displayed in this column to delete a condition.

*1 Can be clicked when the number of set comparison conditions is less than its maximum number.

■Condition settings

The following shows the screen for setting a comparison condition.

Window

Condition setting

Judgment target variable: Data1
Operator: <
Comparison target: Constant
Setting value: 10

OK CANCEL

Displayed items

Item	Description
Judgment target variable	Select a variable to be judged. A variable can be selected from the variables input to this block. However, a timestamp type variable cannot be selected.
Operator	Select a comparison operator. Available operators differ depending on the type of a variable selected for "Judgment target variable." • Numerical value type variable: <, ≤, >, ≥, =, ≠ • Category type variable: =, ≠
Comparison target	Select a comparison target from the following options: • "Constant" • Variable with the same type as a variable selected for "Judgment target variable" among the variables input to this block*1
Setting value*2	Specify a constant value. Values that can be specified differ depending on the type of a variable selected for "Judgment target variable." • Numerical value type variable: Setting value (-1.79769313486231e+308 to 1.79769313486231e+308) • Category type variable: All categories in the variable

*1 Excluding a variable selected for "Judgment target variable"

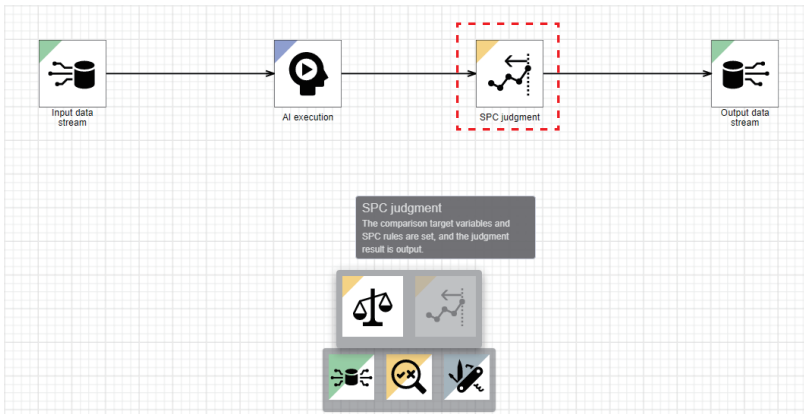
*2 Displayed when selecting "Constant" for "Comparison target."

SPC judgment block

An SPC judgment block judges data output by an AI execution block in the SPC method. This block judges a variable from a rule based on Statistical Process Control (SPC), and outputs a result. Multiple (up to 64) SPC rules can be set. The judgment results are integrated into input data, then output. An error value can be detected by monitoring a variable and outputting its judgment result.

Restriction

This block can be placed only the next of an AI execution block.



- Processing image

Ex.

When configuring the SPC rule settings as shown below

Setting 1:

Judgment target variable: value, SPC rule: Continuous fall

Setting 2:

Judgment target variable: value, SPC rule: Out of $\pm 1 \sigma$

Input data

rowid	Timestamp	value
2761	2021/2/1 14:00:00.00	93
2762	2021/2/1 14:00:01.00	156
2763	2021/2/1 14:00:01.99	148
2764	2021/2/1 14:00:02.99	63
2765	2021/2/1 14:00:03.98	37
2766	2021/2/1 14:00:04.98	25
2767	2021/2/1 14:00:05.97	23
2768	2021/2/1 14:00:06.97	38
2769	2021/2/1 14:00:07.96	129

Setting 1 Result	Setting 2 Result
0	0
0	0
0	1
0	1
0	0
0	0
1	0
1	0
0	0
0	1

Output data

rowid	Timestamp	value	Setting 1 Result	Setting 2 Result
2761	2021/2/1 14:00:00.00	93	0	0
2762	2021/2/1 14:00:01.00	156	0	0
2763	2021/2/1 14:00:01.99	148	0	1
2764	2021/2/1 14:00:02.99	63	0	1
2765	2021/2/1 14:00:03.98	37	0	0
2766	2021/2/1 14:00:04.98	25	1	0
2767	2021/2/1 14:00:05.97	23	1	0
2768	2021/2/1 14:00:06.97	38	0	0
2769	2021/2/1 14:00:07.96	129	0	1

Acquired results are joined into input data, then output.

Input/output specifications

■Input

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Integer between 1 and 86400 Number of variables: Integer between 1 and 1024 Type of each variable: At least one column must include a numerical value type variable.

■Output

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none"> Number of records: Same as the number of input records Number of variables: Number of input variables + number of SPC rule settings (up to 64) Type of each variable: Any types

Variable to be output					
No.	Number of columns	Variable name	Variable type	Description	Range
1	Number of input variables	Name of an input variable	Any types	Input variable	Range of an input variable
2	Number of SPC rule settings	(Name of a selected judgment target variable)_(index (01 to 64) of an SPC rule setting)_SPC ^{*1}	Category	Judgment result for each SPC rule setting	<ul style="list-style-type: none"> 0: SPC rule not matched 1: SPC rule matched

*1 When a variable name has more than 255 characters, characters in the name of the judgment target variable are deleted from the end to fit within 255 characters in total.

Point

If a variable name is duplicate with an existing variable, the name is suffixed with '_001.' If the name is still duplicate, the number will be incremented. If a suffixed name has more than 255 characters, characters in the judgment target variable name will be deleted to fit within 255 characters in total.

Operational specifications

The SPC judgment processing is performed in the following order:

1. Statistics (average, standard deviation, upper control limit, lower control limit) to be used for an SPC rule are acquired. If a judgment target variable was used for learning, the value can be acquired from an AI execution block. Alternatively, it can be acquired from the value set by a user in the SPC rule setting screen.
2. A target variable is judged according to an SPC rule specified by a user. (📖 Page 457 SPC rule)
3. A result is output.

For variables to be output, refer to the input/output specifications. (📖 Page 451 Input/output specifications)

Values of the latest records are acquired for the set judgment record range as shown in the example below. '1' is output when the number of records meeting the SPC rule is equal to or larger than the set number of error judgment records within the range. In other cases, '0' is output.

When the total number of records is less than the judgment record range, whether the number of records meeting the SPC rule is equal to or larger than the number of error judgment records is judged in the range of all records.

Ex.

SPC rule: Out of $\pm 1 \sigma$

Judgment record range: 4

Number of error judgment records: 1

	Judgment target variable		Judgment result
	value		result
Error	170	}	1
	33		1
	45		1
	87		1
	94	}	0
Error	165		1
	143		1
	21		1
	147	}	1
	154		0
	80		0

	Judgment target variable		Judgment result
	value		result
Error	170	}	1
	33		1
	45		1

When the total number of records is less than the judgment record range, data is judged in the range of all records.

SPC rule

The following table shows available SPC rules and the conditions to use each of the SPC rules.

SPC rule	Condition ($n \leq m$): judgment record range, n: number of error judgment records
Out of $\pm 1 \sigma$	Among continuous 'm' records, 'n' records are out of range of $\pm 1 \sigma$.
Out of $\pm 2 \sigma$	Among continuous 'm' records, 'n' records are out of range of $\pm 2 \sigma$.
Out of $\pm 3 \sigma$	Among continuous 'm' records, 'n' records are out of range of $\pm 3 \sigma$.
Out of $\pm 4 \sigma$	Among continuous 'm' records, 'n' records are out of range of $\pm 4 \sigma$.
Out of $\pm 5 \sigma$	Among continuous 'm' records, 'n' records are out of range of $\pm 5 \sigma$.
Control limit level 1	Among continuous 'm' records, 'n' records exceeds the upper/lower limit value of the control limit.
Alternate increase and decrease	Among continuous 'm' records, 'n' records alternately increase and decrease.
Rise/fall	Among continuous 'm' records, 'n' records increase or decrease.
Central tendency	Among continuous 'm' records, continuous 'n' records are within the range of 1σ .
Consecutive	Among continuous 'm' records, continuous 'n' records are on the same side towards the center line.
Rise	Among continuous 'm' records, continuous 'n' records increase.
Fall	Among continuous 'm' records, continuous 'n' records decrease.

Value range for the number of error judgment records and the judgment record range

The number of error judgment records and the judgment record range can be set within a range that satisfies the following condition:

- Number of error judgment records \leq judgment record range \leq 20

The minimum value that can be set varies depending on the SPC rule.

SPC rule	Minimum value	Maximum value
Out of $\pm 1 \sigma$, Out of $\pm 2 \sigma$, Out of $\pm 3 \sigma$, Out of $\pm 4 \sigma$, Out of $\pm 5 \sigma$, Control limit level 1, Central tendency	1	20
Rise/fall, Rise, Fall, Consecutive	2	
Alternate increase and decrease	3	

In addition, the following default values are set for the number of error judgment records and the judgment record range depending on the selected SPC rule.

SPC rule	Default value	
	Number of error judgment records	Judgment record range
Out of $\pm 1 \sigma$	2	5
Out of $\pm 2 \sigma$		3
Out of $\pm 3 \sigma$	1	1
Out of $\pm 4 \sigma$		
Out of $\pm 5 \sigma$		
Control limit level 1		
Alternate increase and decrease		
Rise/fall	6	6
Central tendency	15	15
Consecutive	9	9
Rise	10	10
Fall		

Judgment record range

The following shows an example of the latest record range judged according to an SPC rule.

Ex.

Judgment record range: 9

Data at the last time	
idx	value
1	124
2	33
3	45
4	97
5	94
6	166
7	143
8	21
9	147
10	154
11	80

Data at this time	
idx	value
1	124
2	154
3	89
4	75

Values are retained by tracking back previous data in the judgment record range.

SPC judgment screen

The following shows the screen for displaying the list of set SPC rule settings.
Up to 64 SPC rule settings can be set.

10

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.

Judgment target variable	SPC rule	Setting	Delete
Data1	Control limit level 1 (1/1)	...	

Displayed items

Item	Description
(Add SPC rule setting) ^{*1}	Click this to add an SPC rule. (Page 460 SPC rule settings)
Judgment target variable	A judgment target variable set in the SPC rule setting screen is displayed.
SPC rule	An SPC rule set in the SPC rule setting screen is displayed in the following format: <ul style="list-style-type: none"> • SPC rule (number of error judgment records/judgment record range)
Setting	Click the icon displayed in this column to change an SPC rule setting. (Page 460 SPC rule settings)
Delete	Click the icon displayed in this column to delete an SPC rule setting.

*1 Can be clicked when the number of the set SPC rules is less than its maximum number.

■SPC rule settings

The following shows the screen for setting an SPC rule.

Window

SPC rule setting

Judgment target variable: Data1
 Target value: 18.9225664575512
 Control limit upper limit value: 89.59982570565674
 Number of error judgment records: 2

SPC rule: Out of $\pm 1\sigma$
 σ : 23.559086416035182
 Control limit lower limit value: -51.754692790554344
 Judgment record range: 5

Preview data: New data set(003)

Statistic

Average value: 18.9
 Standard deviation: 23.6
 Minimum value: -34.2
 Maximum value: 81.5

APPLY TO SETTING

Value







Index

Legend: Variable value, Target value, $\pm 1\sigma$, $\pm 2\sigma$, Upper limit value, Lower limit value, Error value

OK CANCEL

Displayed items

Item	Description
Judgment target variable	Select a variable to be judged. A variable can be selected from the variables input to this block. However, only a numerical value type variable can be selected.
SPC rule	Select an SPC rule to be used for judgment. (Page 457 SPC rule)
Target value	Specify a target value to be used in an SPC rule (-1.79769313486231e+308 to 1.79769313486231e+308). The following value is set by default. (In a case other than the ones shown below, this item is blank.) <ul style="list-style-type: none"> When an explanatory variable is set in "Judgment target variable": The statistic of a data set used by the AI with the oldest creation date and time among AIs set in an AI execution block is set. When a feature variable is set in "Judgment target variable": The statistic of a feature used for learning in the corresponding AI is set. When a diagnosis result variable is set in "Judgment target variable" and an AI uses supervised learning: The statistic of a diagnosis target used for learning in the corresponding AI is set.
σ	Specify σ to be used in an SPC rule (0 to 1.79769313486231e+308). The following value is set by default. (In a case other than the ones shown below, this item is blank.) <ul style="list-style-type: none"> When an explanatory variable is set in "Judgment target variable": The statistic of a data set used by the AI with the oldest creation date and time among AIs set in an AI execution block is set. When a feature variable is set in "Judgment target variable": The statistic of a feature used for learning in the corresponding AI is set. When a diagnosis result variable is set in "Judgment target variable" and an AI uses supervised learning: The statistic of a diagnosis target used for learning in the corresponding AI is set.

Item	Description
Control limit upper limit value	<p>Specify the upper limit value for the control limit to be used in an SPC rule (-1.79769313486231e+308 to 1.79769313486231e+308).</p> <p>The following value is set by default. (In a case other than the ones shown below, this item is blank.)</p> <ul style="list-style-type: none"> • When an explanatory variable is set in "Judgment target variable": Based on the statistic of a data set used by the AI with the oldest creation date and time among AIs set in an AI execution block, the value of 'average value + 3 × standard deviation' is set. • When a feature variable is set in "Judgment target variable": Based on the statistic of a feature used for learning in the corresponding AI, the value of 'average value + 3 × standard deviation' is set. • When a diagnosis result variable is set in "Judgment target variable" and an AI uses supervised learning: Based on the statistic of a diagnosis target used for learning in the corresponding AI, the value of 'average value + 3 × standard deviation' is set.
Control limit lower limit value	<p>Specify the lower limit value for the control limit to be used in an SPC rule (-1.79769313486231e+308 to 1.79769313486231e+308).</p> <p>The following value is set by default. (In a case other than the ones shown below, this item is blank.)</p> <ul style="list-style-type: none"> • When an explanatory variable is set in "Judgment target variable": Based on the statistic of a data set used by the AI with the oldest creation date and time among AIs set in an AI execution block, the value of 'average value - 3 × standard deviation' is set. • When a feature variable is set in "Judgment target variable": Based on the statistic of a feature used for learning in the corresponding AI, the value of 'average value - 3 × standard deviation' is set. • When a diagnosis result variable is set in "Judgment target variable" and an AI uses supervised learning: Based on the statistic of a diagnosis target used for learning in the corresponding AI, the value of 'average value - 3 × standard deviation' is set.
Number of error judgment records	<p>Specify the number of error judgment records.</p> <p>For the available value range, refer to the following:</p> <p> Page 458 Value range for the number of error judgment records and the judgment record range</p>
Judgment record range	<p>Specify a judgment record range.</p> <p>For the available value range, refer to the following:</p> <p> Page 458 Value range for the number of error judgment records and the judgment record range</p>
Preview data	<p>Select a data set to be used in the preview display.</p> <p>A data set that satisfies both of the following conditions when this screen is displayed can be selected:</p> <ul style="list-style-type: none"> • The status is "Completed." • Variable information except for diagnosis target variables in a data set that was used for learning of the AI to be used in the task is included.*1 <p>The selected data set is used as input, and the processing until the SPC judgment block is performed according to the current settings. Then, the result is displayed in "Statistic" and "Preview."</p> <p>However, when the number of records in the data set exceeds the maximum number of records that can be collected in the input data stream ( Page 203 Task), the records in the data set are sampled.</p> <p>When sampling the records, each data source is read as one text file so that the operation becomes almost the same as the one for when the connection method of an input data stream is "Text file." ( Page 370 Connection method (text file)) In particular, test data is divided by the AI test function( Page 193 Testing an AI), and only data to be used in the first diagnosis is used.</p>
 (Update)	Click this to update displayed contents of "Preview" according to the current settings.

Item	Description	
(1) Preview display ^{*2}	Statistic	Statistics of data displayed in "Preview" is displayed. Each statistic is displayed up to three significant digits. Among the target data, the data excluding the missing values is used to calculate statistic. If all the values are missing, '0' is displayed. <ul style="list-style-type: none"> • Average value • Standard deviation • Minimum value • Maximum value
	Preview	The results and the values of variables after the SPC judgment using a data set selected in "Preview data" are displayed as line charts and markers. However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.
	[Apply to setting] button	Click this to update the various settings by statistics of data displayed in "Preview." <ul style="list-style-type: none"> • "Target value": Average value • "σ": Standard deviation • "Control limit upper limit value": The value calculated by adding 1% margin to the maximum value (When the value exceeds the maximum value that can be set as "Control limit upper limit value," the value is updated by the maximum value that can be set.) • "Control limit lower limit value": The value calculated by subtracting 1% margin from the minimum value (When the value falls below the minimum value that can be set as "Control limit lower limit value," the value is updated by the minimum value that can be set.)

*1 Refers to a case where names and types of some variables in the data set completely match with the ones in the data set used for learning.

*2 Displayed when other than "Not use" is selected in "Preview data."

Point 

If a setting for the combination of selected variable and SPC rule has already been in the list, the old setting will be deleted when adding a new setting for the combination.

 Page 459 SPC judgment screen

10.10 Utility Category

An extension block of the utility category performs unique processing that cannot be implemented by other blocks. This block is available in the AI editor screen or task editor screen.

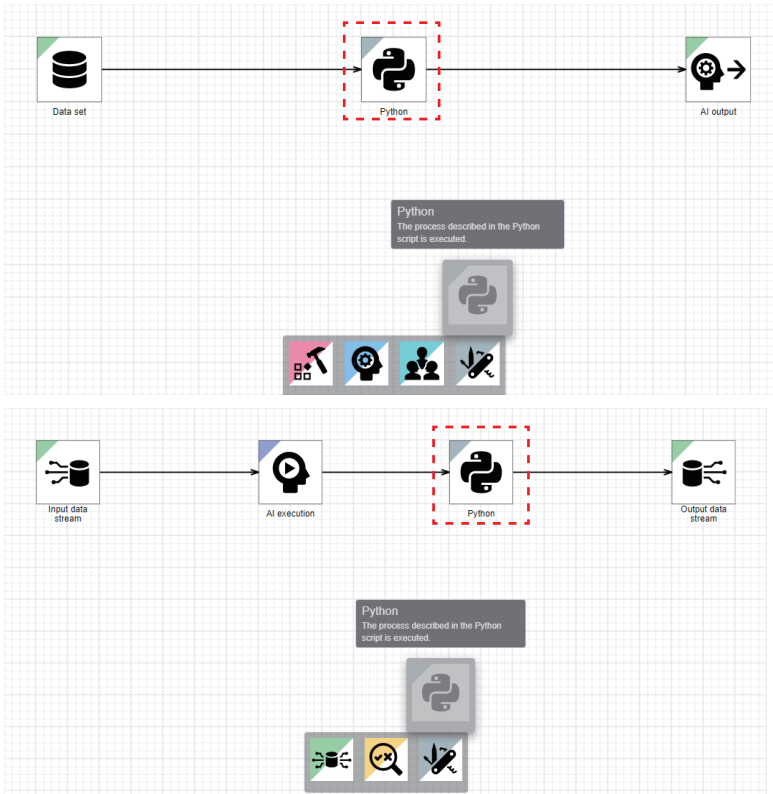
For operations that can be performed by right-clicking a block, refer to the following:

 Page 231 Right-click menus

Python block

A Python block performs processing described in Python.

Use this block to perform unique processing that cannot be implemented by other blocks.



Restriction

In the task editor screen, this block can be placed only the next of an AI execution block.

Precautions

- Description on a Python script to be performed by this block is left up to its creator. Therefore, MaiLab does not guarantee the operation when performing the Python script. The creator must verify the operation properly in advance on own responsibility.
- In this product, to confirm the description on a Python script to be performed in this block, processing may be performed with using input data that a user did not prepare. In this case, the number of records in input data may not be the same as the one input when learning or a task is executed. Therefore, a Python script processing is required to be set so that it can be performed in a data frame that has any number of records.

Input/output specifications

Input

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none">• Number of records: Integer between 1 and 864000• Number of variables: Integer between 1 and 1024• Type of each variable: Any types

Output

Item	Description
Input/output type	Data frame type
Detailed information on the type	<ul style="list-style-type: none">• Number of records: Integer between 1 and 864000, determined by processing of a script• Number of variables: Integer between 1 and 1024, determined by processing of a script• Type of each variable: Any types determined by processing of a script

Restrictions

The following shows the restrictions on a Python script.

Modules, packages, and libraries

Modules, packages, and libraries that can be imported on a script are as follows:

Library	Version
numpy	1.19.5
pandas	1.2.4
scipy	1.6.2
scikit-learn	0.24.2
tensorflow	2.5.2
datetime	— (Standard library of Python3.8.9)

Note that modules, packages, and libraries created by a user cannot be imported^{*1}.

*1 That is, do not write a Python script in the format of 'import {module, package, library name}.'

Built-in functions

The built-in functions shown in the following table are not available on a script. Special methods^{*1} are not available either.

*1 Refers to the functions with names in the '__{any character string}__' format on a Python script.

Built-in function name
breakpoint
compile
delattr
dir
eval
exec
getattr
globals
help
locals
open
setattr
vars
__import__

■File access

When describing processing to access a file and folder in a Python block, describe it with an UNC path so that the same file and folder can be referenced even when executing the processing on another personal computer.

If a path is set incorrectly, accessing a file and folder fails and a task does not run properly when executing the task on another computer.

■Change of a default function

A Python execution error occurs when the name or argument of a function prepared by default is changed and the function can no longer be executed.

■Data type

Output a script in the following data types:

float32, float64, int64, object, category, bool, datetime64

For the data types other than the above, the operation of the next block cannot be guaranteed.

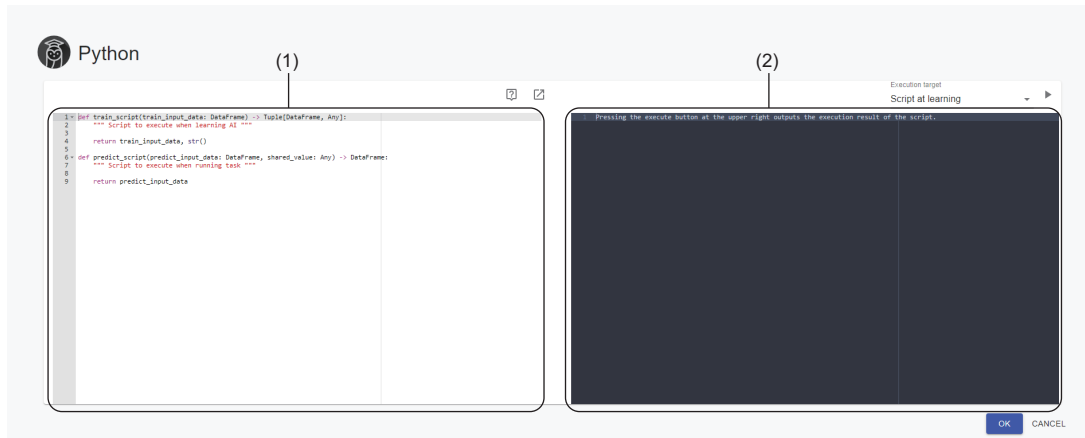
Python screen

The following shows the screen for editing and executing a Python script.

Window

Perform either of the following operations:

- Double-click a placed block.
- Right-click a placed block, and select [Open] from the right-click menu.




Displayed items

Item	Description
Execution target*1	Select a script to be executed. <ul style="list-style-type: none">• Script when learning: train_script function• Script when executing a task: predict_script function
▶ (Execute)	Click this to execute a script created in the script editor.
(1) Script editor	Create a script. (Up to 65535 characters and 1000 lines)
(2) Output editor	The execution result of a script is displayed. Description output with a print function, an error that occurred when executing a script, and description for an exception are displayed.

*1 Can be selected when the Python block is placed in AI editor screen.

Point

- When a Python script of this block is executed, the Python environment in this product is used, not the Python in an environment where this product is installed.
- Specifications of the Python script in this block can be checked in a help displayed in another tab by clicking  (Python script help).
- For an error that occurred when executing a script and description for an exception, the content equivalent to the one when executing a Python script in a normal Python environment is displayed.

Precautions

Note that when executing a script that takes a long time for processing, this product will not respond.


11 MONITOR

There are two types of monitors.

Monitor	Application
Real-time monitor	The following items can be checked in a real-time monitor: <ul style="list-style-type: none">• Diagnosis result from an AI used in a task• Execution status of a task (execution status of an input data stream, usage of a data buffer, diagnosis execution time of a task, execution status of an output data stream, etc.)^{*1}
Historical monitor ^{*2}	Data (monitor data) of a saved diagnosis result can be checked later. The following is included in the monitor date: <ul style="list-style-type: none">• Information of an AI when executing a task• A diagnosis result when executing a task

*1 Errors and warnings that occur while running can also be checked.

*2 Enable a historical monitor before starting a task to execute a historical monitor.

 Page 224 Execution setting screen

Point

Considering a diagnosis result can be a hint to improve the production, and can be utilized for investigating an error cause.

(Example)

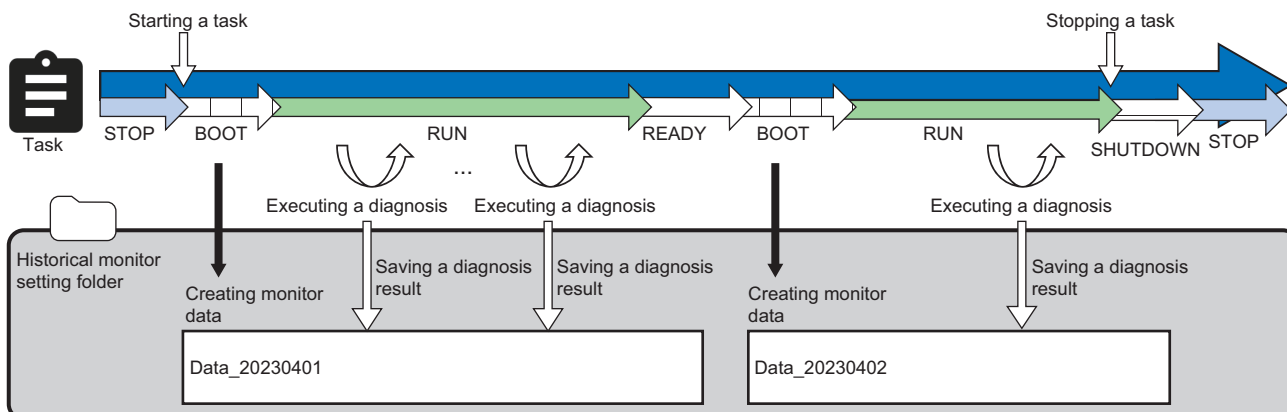
(AI) An equipment is diagnosed as in an error status → (User) Check and inspect the equipment

(AI) A malfunction of an equipment is predicted → (User) Repair or exchange the equipment

(AI) The quality of a product being produced is diagnosed as a low status → (User) The product is inspected by a veteran operator

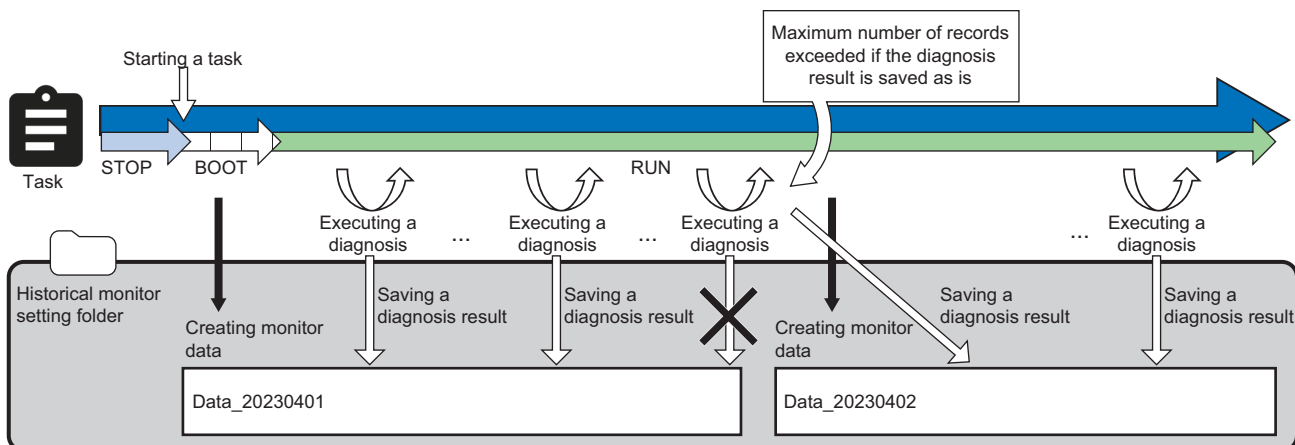
Monitor data saving flow

Monitor data of a historical monitor is created when the execution status of a task is changed to "BOOT," and a diagnosis result is saved when a diagnosis is executed.



If the number of records in a diagnosis result saved in the monitor data exceeds the maximum number^{*1}, monitor data is newly created.

*1 The maximum number of records is 10800 to 86400, and it varies depending on the diagnosis condition.



Precautions

The performance is not guaranteed if any of the following operations is performed:


- Changing a folder name or access authority, etc. for the monitor data in which a task is being executed
- Changing the internal part of the monitor data (deleting or moving a file, changing a file name, changing a folder structure, adding another file, etc.)
- Placing a folder with the same name as the monitor data name in a monitor data save folder

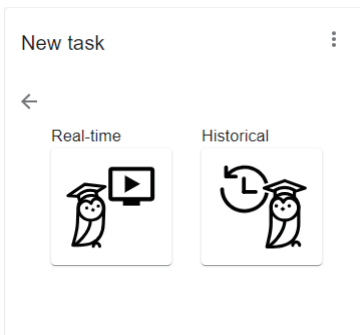
11.1 Starting a Monitoring

The following shows the procedure to start a monitor.

Operating procedure

■To monitor the status from the side bar

1. Click  (Monitor) on the side bar. (☞ Page 49 Side bar)
2. Select a diagnosis terminal to be monitored in the diagnosis terminal list screen.
☞ Page 471 Diagnosis Terminal List Screen
3. Select a task to be monitored in the diagnosis terminal monitoring screen.
☞ Page 474 Diagnosis Terminal Monitoring Screen
4. Select [Real-time] or [Historical].



● For a real-time monitor

Monitor a diagnosis result and execution status of the task.

Displayed contents differ depending on the version of this product on a diagnosis terminal of the connection destination.

- The version is 1.02C or earlier: ☞ Page 478 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.02C or Earlier)
- The version is 1.03D or later: ☞ Page 493 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later)

● For a historical monitor

Check the saved monitor data in the historical monitor screen.

☞ Page 506 Historical monitor Screen

■ To monitor from the task management screen

1. Select a task to be monitored in the task management screen. (☞ Page 207 Task Management Screen)
2. Click the [Historical monitor] button or the [Real-time monitor] button.

The screenshot shows a task management interface with a table of tasks and two monitoring buttons. The table has columns for Name, Execution status, Error status, Task type, AI, and Comment. There are two sections: 'Local diagnosis terminal' and 'New diagnosis terminal'. The 'New diagnosis terminal' section contains one task, 'New task(007)', which is selected and has a 'RUN' status. Below the table are two buttons: 'HISTORICAL MONITOR' and 'REAL-TIME MONITOR'.

Name ↑	Execution status	Error status	Task type	AI	Comment
Local diagnosis terminal					
<input type="checkbox"/> New task	STOP	Normal	Simple task	New AI	
New diagnosis terminal					
<input checked="" type="checkbox"/> New task(007)	RUN	Normal	Simple task	New AI	

HISTORICAL MONITOR REAL-TIME MONITOR

● For a historical monitor

Check the saved monitor data in the historical monitor screen.

☞ Page 506 Historical monitor Screen

● For a real-time monitor

Monitor a diagnosis result and execution status of the task.


Displayed contents differ depending on the version of this product on a diagnosis terminal of the connection destination.

- The version is 1.02C or earlier: ☞ Page 478 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.02C or Earlier)
- The version is 1.03D or later: ☞ Page 493 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later)

11.2 Diagnosis Terminal List Screen


This section shows the screen for displaying the list of diagnosis terminals and the operating status of each diagnosis terminal.



Window


Click  (Monitor) on the side bar. (☞ Page 49 Side bar)



Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. • Current project name > Monitor By clicking a project name, the screen returns to the home screen. (☞ Page 76 Home screen)
 (List view)	Turn this ON to display diagnosis terminals in the list format.

Item	Description
(2) Diagnosis terminal list (widget format)	— Diagnosis terminals are displayed in the widget format. For details on the widget, refer to the following: ☞ Page 473 Diagnosis terminal widget By selecting a connectable diagnosis terminal, the diagnosis terminal monitoring screen is displayed in another tab. ☞ Page 474 Diagnosis Terminal Monitoring Screen
Refining condition selection	Select a condition to refine diagnosis terminals to be displayed. When selecting multiple conditions, only diagnosis terminals that satisfy all the conditions are displayed. ■Diagnosis terminal connection status (only one selection available) <ul style="list-style-type: none"> • Connect • Disconnect ■Diagnosis terminal system status (only one selection available) <ul style="list-style-type: none"> • Normal • Warning • Error ■Task execution status (only one selection available) <ul style="list-style-type: none"> • RUN • BOOT • SHUTDOWN • READY • STOP • EDIT
(3) Diagnosis terminal list (list format)	— Diagnosis terminals are displayed in the list format by turning ON  (List view). By selecting a diagnosis terminal, the diagnosis terminal monitoring screen is displayed in another tab. ☞ Page 474 Diagnosis Terminal Monitoring Screen
 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. ☞ Page 56 Expanding the header
Name	A diagnosis terminal name is displayed.
Address ^{*1}	The address of a diagnosis terminal is displayed in either of the following formats: <ul style="list-style-type: none"> • IP address:port number • Host name:port number
Connection status	The connection status of a diagnosis terminal is displayed. <ul style="list-style-type: none"> • Connect: The diagnosis terminal is connected. • Disconnect: The diagnosis terminal is not connected.
Error status	The error status of a diagnosis terminal is displayed. <ul style="list-style-type: none"> • Normal: No warnings or errors have occurred in any tasks. • Warning: No errors have occurred, however a warning has occurred in any of the tasks.^{*2*3} • Error: An error has occurred in any of the tasks.^{*4}
Task execution status	The operation status of tasks on a diagnosis terminal is displayed. <ul style="list-style-type: none"> • Disconnect: The diagnosis terminal cannot be connected. • RUN: A running task exists. • BOOT: No running tasks exist but a booting one exists. • READY: No running or booting tasks exist but a stand-by one exists. • SHUTDOWN: No running, booting, or stand-by tasks exist but a shutting down one exists. • STOP: No running, booting, stand-by, or shutting down tasks exist but a stopped one exists. • EDIT: Only tasks being edited exist. • No task: No tasks exist in the diagnosis terminal.
Update date and time	The date and time when a diagnosis terminal was updated by changing properties or registering/deleting a task is displayed. This item is not updated by editing a diagnosis terminal name or comment.
Registration date and time ^{*1}	The date and time when a diagnosis terminal was registered is displayed.
Image ^{*1}	Whether an image is set for a diagnosis terminal is displayed.
Comment	A set comment is displayed.

*1 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

☞ Page 56 Switching to show or hide

*2 Once a warning occurs, this "Warning" state remains as long as "Execution status" of a task is "RUN."

*3 This state is cleared when "Execution status" of a task changes from "RUN."

*4 This state is cleared by performing the start operation for a task again.

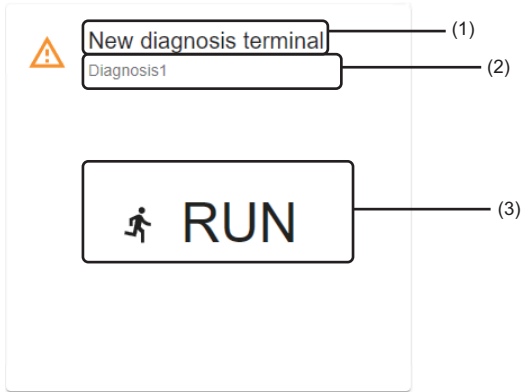
Diagnosis terminal widget

The current status overview of a diagnosis terminal is displayed.

Either of the following icons is displayed when an error or warning occurs in a task on the diagnosis terminal:

- : Error
- : Warning

Window



11

Displayed items

Item	Description
(1) Diagnosis terminal name	A diagnosis terminal name is displayed.
(2) Comment	A set comment is displayed.
(3) Task operation status	<p>The operation status of tasks on a diagnosis terminal is displayed.</p> <ul style="list-style-type: none"> • Disconnect: The diagnosis terminal cannot be connected. • RUN: A running task exists. • BOOT: No running tasks exist but a booting one exists. • READY: No running or booting tasks exist but a stand-by one exists. • SHUTDOWN: No running, booting, or stand-by tasks exist but a shutting down one exists. • STOP: No running, booting, stand-by, or shutting down tasks exist but a stopped one exists. • EDIT: Only tasks being edited exist. • No task: No tasks exist in the diagnosis terminal.

11.3 Diagnosis Terminal Monitoring Screen

This section shows the screen for displaying the list of tasks on a target diagnosis terminal and the execution status of each task.

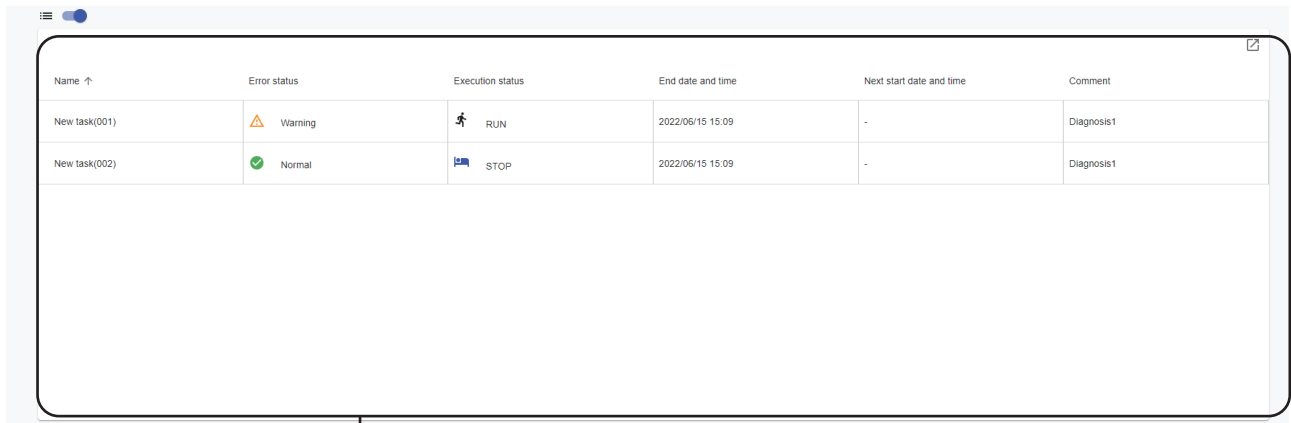
Window

Select a diagnosis terminal in the diagnosis terminal list screen. (☞ Page 471 Diagnosis Terminal List Screen)

The diagnosis terminal monitoring screen is displayed in another tab.



(1)














(2)

Displayed items

Item	Description
☰ (List view)	Turn this ON to display tasks in the list format.

Item		Description
(1) Task list (widget format)	—	<p>Tasks are displayed in the widget format.</p> <p>For details on the widget, refer to the following:</p> <ul style="list-style-type: none"> ☞ Page 477 Task widget <p>A monitor can be executed by selecting a task and clicking [Real-time] or [Historical].</p> <p>■Real-time monitor</p> <p>A monitor can be executed by selecting a task of which "Execution status" is other than "EDIT."</p> <p>Displayed contents differ depending on the version of this product on a diagnosis terminal of the connection destination.</p> <ul style="list-style-type: none"> • The version is 1.02C or earlier: ☞ Page 478 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.02C or Earlier) • The version is 1.03D or later: ☞ Page 493 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later) <p>■Historical monitor</p> <ul style="list-style-type: none"> ☞ Page 506 Historical monitor Screen
	Refining condition selection	<p>Select a condition to refine tasks to be displayed.</p> <p>When selecting multiple conditions, only tasks that satisfy all the conditions are displayed.</p> <p>■System status (only one selection available)</p> <ul style="list-style-type: none"> • Normal • Warning • Error <p>■Execution status (only one selection available)</p> <ul style="list-style-type: none"> • RUN • BOOT • READY • SHUTDOWN • STOP • EDIT

Item	Description
(2) Task list (list format)	<p>Tasks are displayed in the list format by turning ON  (List view).</p> <p>By selecting a task of which "Execution status" is other than "EDIT," the real-time monitor screen is displayed.</p> <p>Displayed contents differ depending on the version of this product on a diagnosis terminal of the connection destination.</p> <ul style="list-style-type: none"> • The version is 1.02C or earlier:  Page 478 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.02C or Earlier) • The version is 1.03D or later:  Page 493 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later)
 (Expand)/  (Collapse)	<p>Click either of these to expand or collapse the header.</p> <p>Operations such as search can be performed by expanding the header.</p> <p> Page 56 Expanding the header</p>
Name	A task name is displayed.
Error status	<p>The current error status is displayed.</p> <ul style="list-style-type: none"> • Normal: No warnings or errors have occurred. • Warning: A warning has occurred.*1*2 • Error: A task is stopped due to an error.*3
Execution status	<p>The execution status is displayed.</p> <ul style="list-style-type: none"> • EDIT: Setting a task is not completed. • RUN: Processing of a task is running. • BOOT: Processing to change from "READY" to "RUN" is in progress.*4 • READY: A task is started but the execution period has not started yet. • SHUTDOWN: Processing to change from "RUN" to "STOP" or "READY" is in progress.*5*6 • STOP: A task is not started or it is stopped.*7 <p>The execution status restarts from "READY" in the following cases. (If the operations described below is performed during the execution period, the status changes from "READY" to "RUN.")</p> <ul style="list-style-type: none"> • When "Execution status" is "READY," "BOOT," or "RUN," the operating status of this product on a diagnosis terminal is changed to "Stop" then to "Run" again.
Task type*8	A task type is displayed. ( Page 205 Task types)
AI*8	<p>The name of an AI used in a task is displayed.</p> <p>"Multiple AI" is displayed when using multiple AIs.</p> <p> is displayed when an AI used is changed.*9</p> <p> is displayed when an AI used is not in the "Complete" state or is deleted.*9</p>
Number of AI used*8	The number of AIs used in a task is displayed.
Diagnosis cycle [ms]*8	A set diagnosis cycle is displayed in milliseconds. ( Page 224 Execution setting screen)
Task execution period*8	A set execution period ("Always," "Date and time specification," or "Periodic") is displayed. ( Page 224 Execution setting screen)
End date and time	The date and time when a task was ended the last time is displayed.*10*11
Next start date and time	The date and time to start a task the next time is displayed.*11*12
Update date and time*8	<p>The date and time when a task was updated is displayed.</p> <p>This item is not updated by editing a task name or comment.</p>
Creation date and time*8	The date and time when a task was created is displayed.
Image*8	Whether an image is set for a task is displayed.
Comment	A set comment is displayed.
Project name*8	The name of a project that a task belongs to is displayed.*13
Size [MB]*8	The file size of a task is displayed.

*1 Once a warning occurs, this "Warning" state remains as long as "Execution status" of a task is "RUN."

*2 This state is cleared when "Execution status" of a task changes from "RUN."


*3 This state is cleared by performing the start operation for a task again.


*4 Once the processing is completed, the status changes to "RUN."

*5 Once the processing is completed, the status changes to "STOP" or "READY."


*6 If an error occurs while the status is "RUN" or "BOOT" and then the status changes to "SHUTDOWN," only errors that occur while the status is "RUN" or "BOOT" are notified. Warnings and errors that occur while the status is "SHUTDOWN" are not notified.


*7 Includes the case when a task is started but the next execution period does not exist.


*8 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

 Page 56 Switching to show or hide

*9 When two or more warnings or errors occur while using multiple AIs, only one of them is displayed in the following priority order:

 ("AI has been deleted.")

 ("AI is not in the completed state.")

 ("AI has been changed.")

*10 Displayed when the execution status of a task becomes "RUN" at least once after starting the task and currently "READY" or "STOP." Otherwise, "-" is displayed.

*11 If the time (UTC) is different between Windows and the personal computer on which the diagnosis terminal monitoring screen is

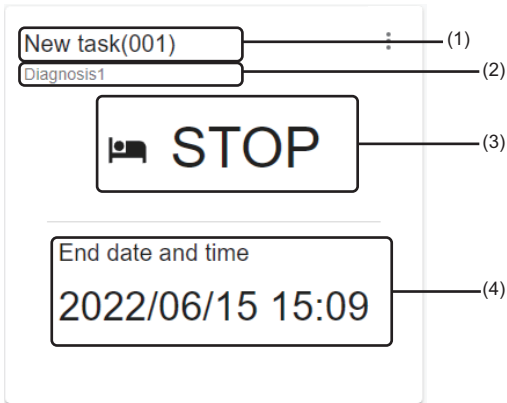
displayed, the actual execution timing may differ from the displayed content.
 *12 "-" is displayed when "Execution status" of a task is not "READY."
 *13 It is blank when the project is deleted.

Task widget

The current status of a task is displayed.
 Either of the following icons is displayed when an error or warning occurs:

- : Error
- : Warning

Window



Displayed items

Item	Description
(1) Task name	A task name is displayed.
(2) Comment	A set comment is displayed.
(Menu)	Open the task management screen*1 To display the task management screen for the project that a task belongs to. (Page 207 Task Management Screen)
(3) Operation status	The operation status of a task is displayed. <ul style="list-style-type: none"> • RUN: A task is running. • BOOT: A task is booting. • READY: A task is standing by. • SHUTDOWN: A task is shutting down. • STOP: A task is stopped. • EDIT: A task is being edited. • Error end: A task is stopped due to an error.
(4) Date and time information*2	The start or end date and time for a task is displayed. <ul style="list-style-type: none"> • READY: The next start date and time is displayed. • STOP: The end date and time is displayed. • Error end: The date and time when a task was ended due to an error is displayed.

*1 Can be selected when a signed-in user can access the project that a task belongs to.

*2 Displayed when the execution status of a task is "READY" or "STOP."

11.4 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.02C or Earlier)

This section shows the screen for monitoring the diagnosis results and execution status of a task.

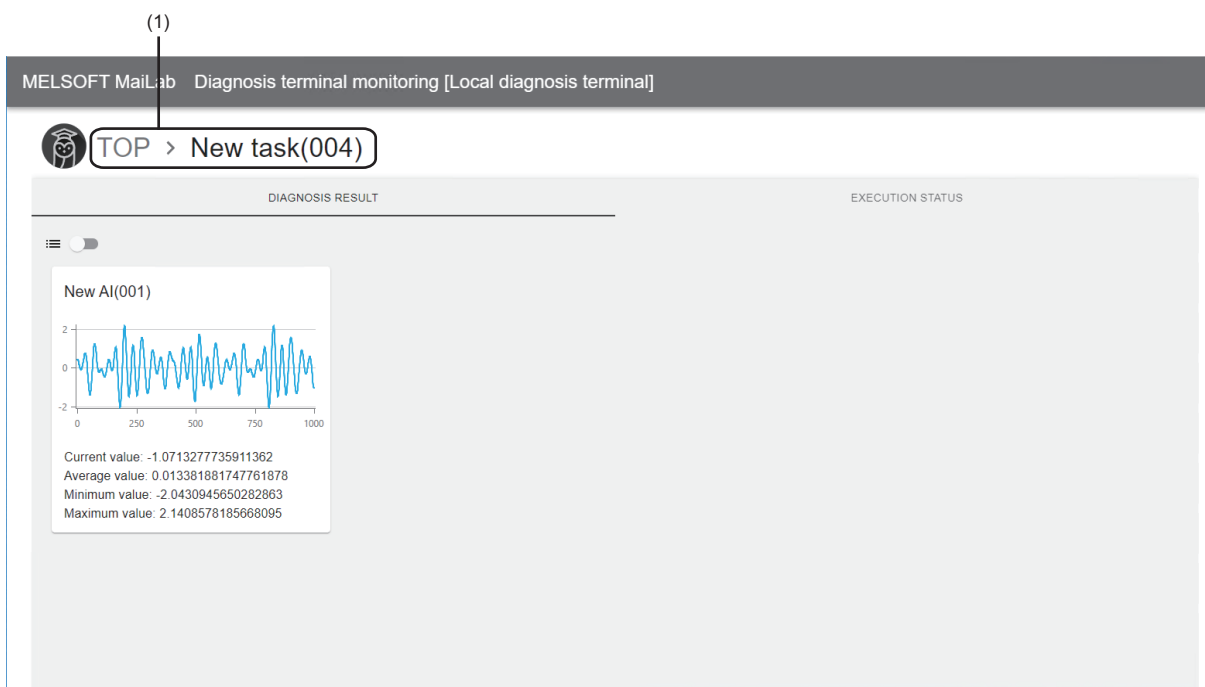


Up to four real-time monitor screens can be displayed at the same time per user.

Window

- Select a task in the diagnosis terminal monitoring screen. (Page 474 Diagnosis Terminal Monitoring Screen)
- Select a task in the task management screen, and click the [Monitoring start] button. (Page 207 Task Management Screen)

When opening the real-time monitor screen from the task management screen, it opens in another tab.



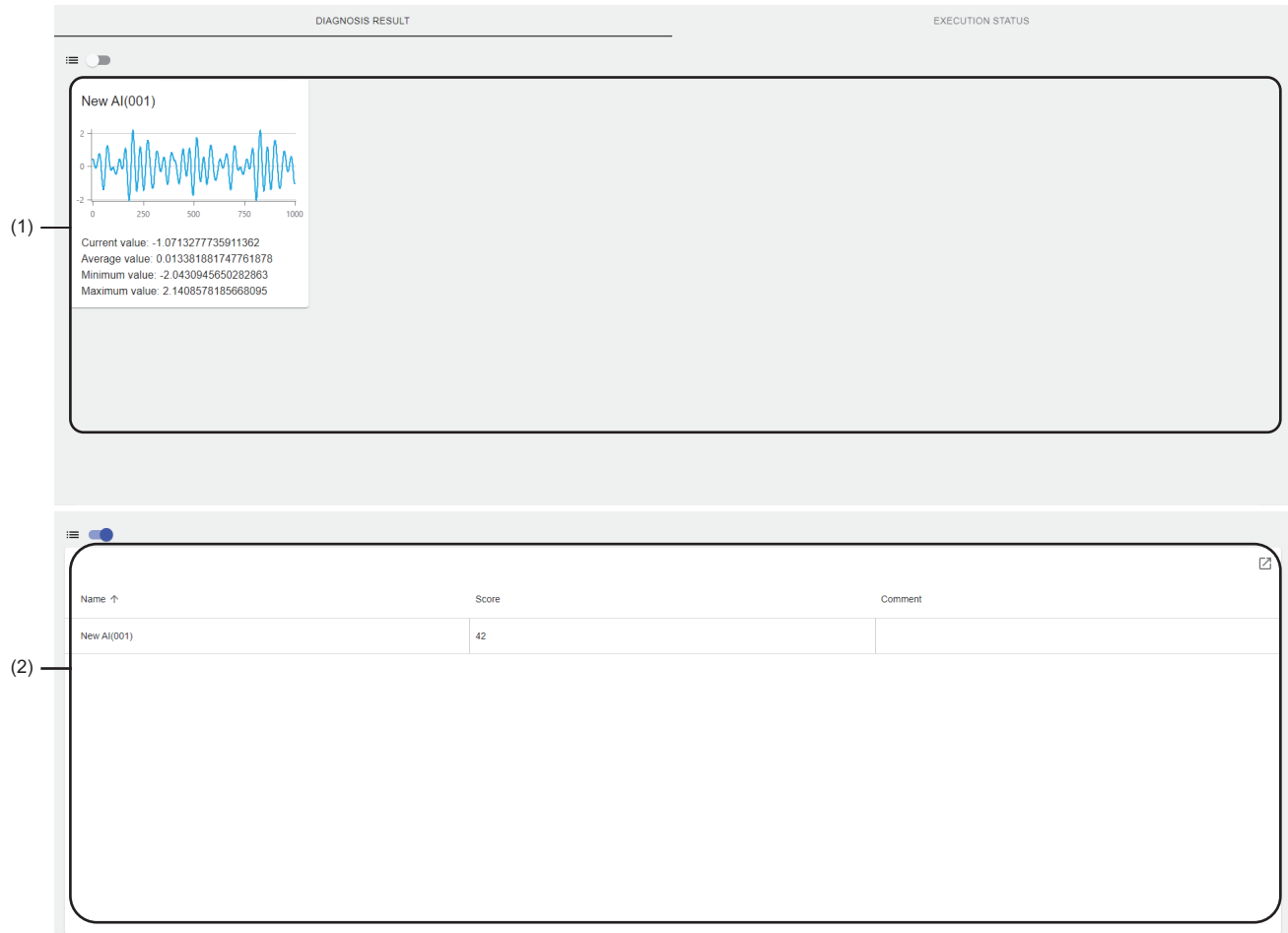
Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> • TOP > Current task name By clicking "TOP," the screen returns to the diagnosis terminal monitoring screen. (Page 474 Diagnosis Terminal Monitoring Screen)
[Diagnosis result] tab	The diagnosis results from AIs set in a task can be monitored. Page 479 Diagnosis results
[Execution status] tab	The execution status of a task can be monitored. Page 485 Execution status

Diagnosis results





The following shows the screen for monitoring the diagnosis results from AIs set in a task.


Window




Displayed items

Item	Description
☰ (List view)	Turn this ON to display AIs in the list format.
(1) AI list (widget format)	AIs are displayed in the widget format. For details on the widget, refer to the following: ☞ Page 481 AI widget By selecting an AI, the detailed diagnosis result screen is displayed. ☞ Page 482 Detailed diagnosis result

Item	Description	
(2) AI list (list format)	—	AIs are displayed in the list format by turning ON  (List view). Information of an AI used in a task when the creation of the task was completed is displayed. By selecting an AI, the detailed diagnosis result screen is displayed.  Page 482 Detailed diagnosis result
	 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
	Name	An AI name is displayed.
	Diagnosis target ^{*1}	The name of an objective variable specified for learning is displayed. ^{*2}
	Model type ^{*1}	The model type of an AI that completes learning is displayed. "Others" is displayed for a model type other than a classification or regression model.
	Score	The learning performance (overview score) is displayed. ^{*2} An overview score is an evaluation index that shows the accuracy of an AI which completes learning with a value between 0 and 100. This score indicates the prediction accuracy of an AI. When the score is 80, the AI can predict a result for input data correctly at approximately 80%. The score is calculated as follows: <ul style="list-style-type: none"> • For a classification model: An integer value obtained by multiplying the F1 score by 100 • For a regression model: An integer value obtained by multiplying R2 by 100 (When R2 has a negative value, the score will be '0' regardless of the value. If R2 cannot be calculated, the overview score cannot be calculated either.)
	Learning time ^{*1}	Time required for entire learning processing is displayed.
	Diagnosis time (reference) [ms] ^{*1}	Time taken for an AI to diagnose one record on the learning station is displayed.
	Update date and time ^{*1}	The date and time when an AI was updated on the learning station is displayed. This item is not updated by editing an AI name or comment.
	Creation date and time ^{*1}	The date and time when an AI was created is displayed.
	Comment	A comment set on the learning station is displayed.
	Size [MB] ^{*1}	The file size of an AI is displayed.

*1 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

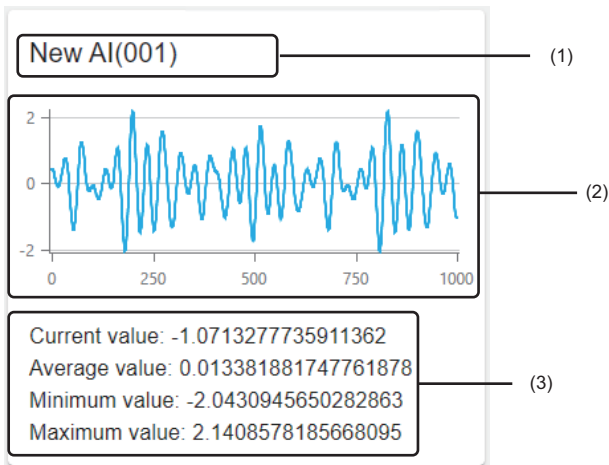
 Page 56 Switching to show or hide

*2 "-" is displayed when learning is performed with an analysis method of unsupervised learning.


AI widget

The overview of diagnosis results from an AI is displayed.

Window



Displayed items

Item	Description
(1) AI name	An AI name is displayed.
(2) Graph ^{*1}	The graph of the diagnosis results is displayed. The graph shows results for the number of displayed records set in the display setting from the latest diagnosis result. ( Page 484 Display setting)
(3) Overview ^{*2}	The overview of the diagnosis results is displayed. Displayed contents differ depending on the type of a variable output as a diagnosis result. <ul style="list-style-type: none"> ■ Numerical value type variable The following values are displayed: <ul style="list-style-type: none"> • Current value: Value of the latest diagnosis result • Average value: Average value in the diagnosis results^{*3} • Minimum value: Minimum value in the diagnosis results^{*3} • Maximum value: Maximum value in the diagnosis results^{*3} ■ Category type variable Categories output as diagnosis results^{*3} and their numbers of records are listed. The list is displayed in descending order of the number of records. When five or more types of categories are output, the number of records for the 4th and later categories is displayed together as "Others." The displayed order and contents are updated every time a diagnosis result is output.

*1 "No Graph" is displayed for an AI without an analysis method.

*2 Displayed only for an AI with an analysis method other than a similar waveform recognition model.

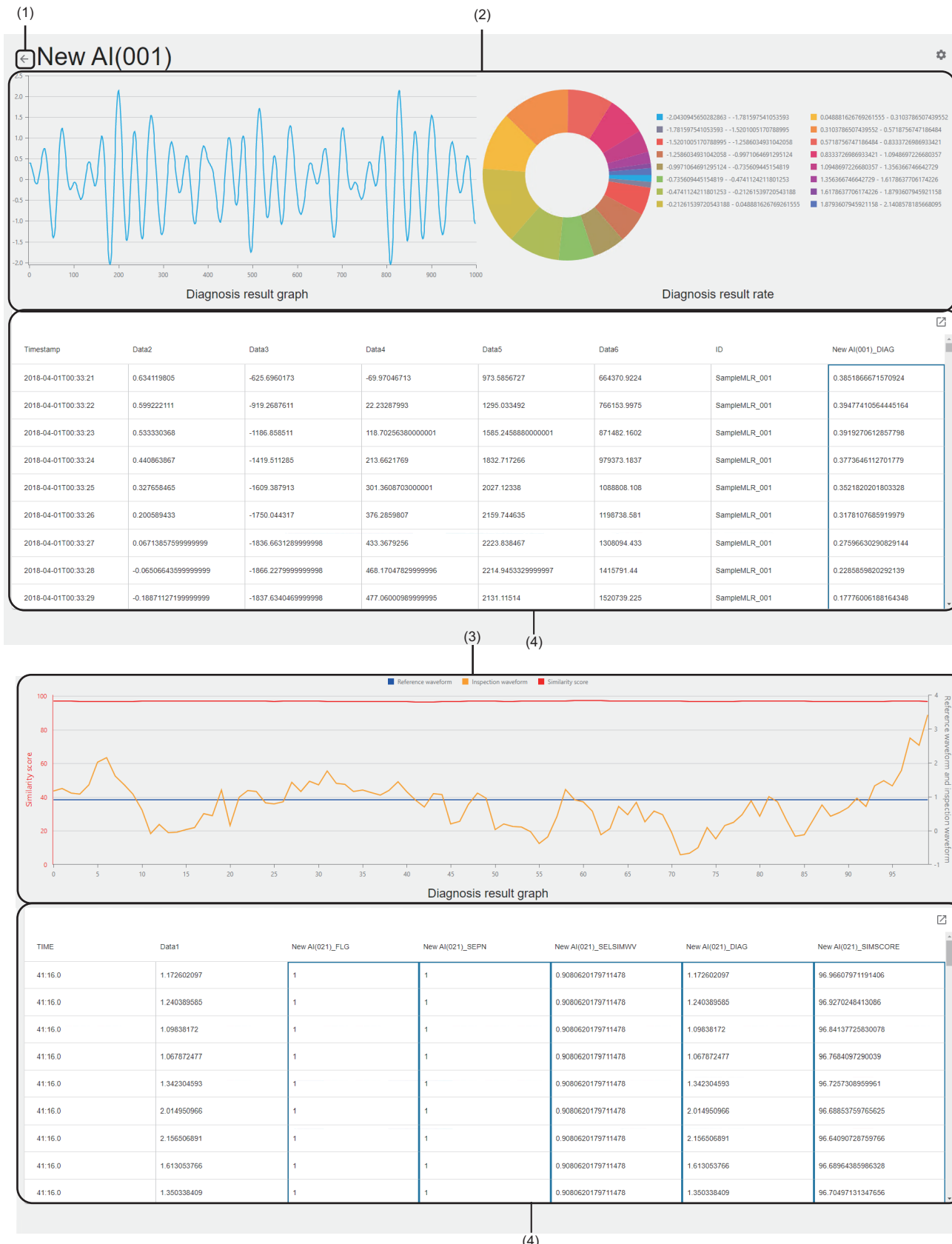
*3 For the number of records set in the display setting ( Page 484 Display setting)

Detailed diagnosis result

The following shows the screen for monitoring the details on diagnosis results from an AI.

Window

Select an AI in the diagnosis result screen. (☞ Page 479 Diagnosis results)



Displayed items

Item		Description
(1) (Back to AI list)		Click this to return to the diagnosis result screen. Page 479 Diagnosis results
(Display setting)		Click this to set contents to be displayed in the diagnosis result screen and detailed diagnosis result screen. Page 484 Display setting
(2) Diagnosis results (for an AI other than a similar waveform recognition model) ^{*1}	Diagnosis result graph	The graph of the diagnosis results is displayed. The graph shows results for the number of displayed records set in the display setting from the latest diagnosis result. (Page 484 Display setting) However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.
	Diagnosis result rate	The proportion of the diagnosis results ^{*2} is displayed. ^{*3} A missing value is also displayed as one of the components. An infinity value is treated as a missing value.
(3) Diagnosis results (for an AI of a similar waveform recognition model) ^{*1}	Diagnosis result graph	The graph of the diagnosis results is displayed. The graph shows results for the number of displayed records set in the display setting from the latest diagnosis result. (Page 484 Display setting) A similarity score is displayed in a range of 0 to 100 regardless of the output value. For a similarity score, even if a missing value (NaN) or infinity value (Inf) exists, the part is treated and displayed as a unit of data. Otherwise, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.
(4) AI output result	—	Output results ^{*2} of an AI are displayed. The order cannot be sorted. When an explanatory variable is in an output result, only the column for the diagnosis result is framed with a bold line. When a missing value (NaN) or infinity value (Inf) exists, the cell is displayed blank.
	(Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. Page 56 Expanding the header

*1 Displayed only for an AI with an analysis method.



*2 For the number of records set in the display setting (Page 484 Display setting)

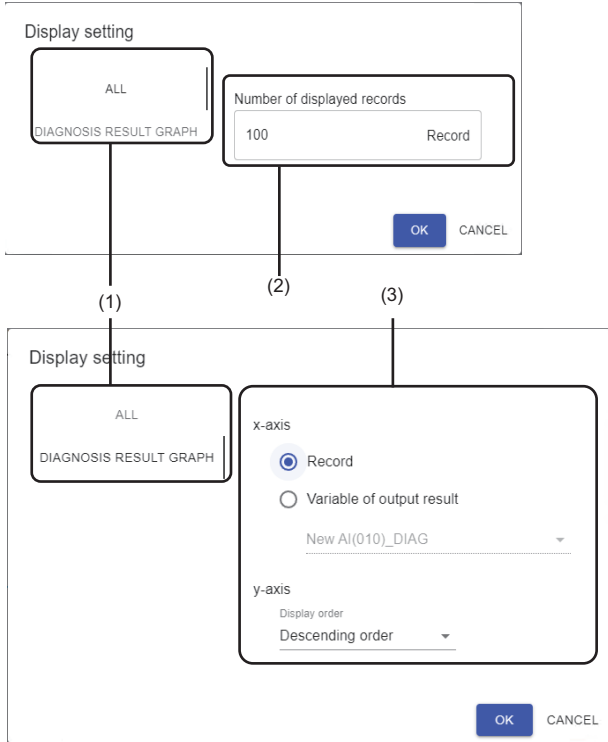
*3 For a numerical value type variable, when the number of unique elements is 16 or more, the whole numerical range is binned into 16 sections and displayed as 16 components.

■ Display setting

The following shows the screen for setting contents to be displayed in the diagnosis result screen and the detailed diagnosis result screen.

Window

Click  (Display setting) in the detailed diagnosis result screen. ( Page 482 Detailed diagnosis result)



Displayed items

Item		Description
(1) Setting item switching		Setting items (for "All" or "Diagnosis result graph" ^{*1}) can be switched.
(2) All	Number of displayed records	Set the number of records to be displayed (1 to 1000).
(3) Diagnosis result graph ^{*1*2}	x-axis	Set the x axis of a graph ("Record" or "Variable of output result"). When selecting "Variable of output result," select a variable to be the x axis from the output results of an AI.
	y-axis	Select the display order ("Descending order" or "Ascending order") for the y axis.

*1 Displayed only for an AI with an analysis method.

*2 For an AI of a similar waveform recognition model, the graph is displayed with the following settings regardless of the options selected in this setting:

x-axis: Record

y-axis: Descending order

Execution status

The following shows the screen for monitoring the execution status of a task.

Any of the icons shown below is displayed when an error, warning, or information occurs.

When multiple errors, warnings, or pieces of information occur, only the newest error, warning, or information is displayed. In addition, when a warning, error, and information occur at the same time, only one icon is displayed in the following priority order:

- : Error
- : Warning
- : Information

By clicking these icons, the error/warning/information screen is displayed and the description can be checked.

Page 492 Error/warning/information screen

Window



Displayed items

Item	Description
[Check event log] button	Click this to display the event log screen.*1 Page 511 EVENT LOG CHECK
Input	The execution status of an input data stream can be monitored. Page 486 Input
Diagnosis	The execution status of diagnosis processing of an AI can be monitored. Page 488 Diagnosis
Output	The execution status of the entire output data stream can be monitored. Page 490 Output

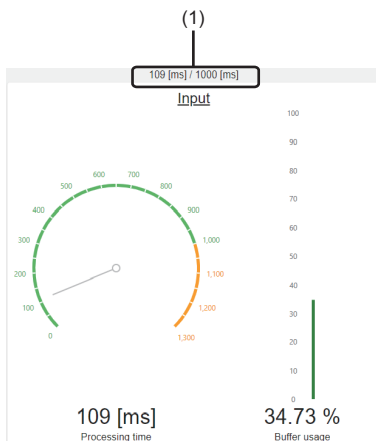
*1 A diagnosis terminal being monitored is selected in the displayed screen.

Input

The execution status of an input data stream can be monitored.

The input processing time displayed in this item indicates the processing time of an input data stream.

Window



Displayed items

Item	Description
(1) Ratio of input processing time	The ratio of input processing time to the set collection cycle is displayed in the following format: ^{*1} <ul style="list-style-type: none">• Input processing time / set collection cycle
Processing time	The input processing time is displayed by a numerical value ^{*1} and a gauge ^{*2} .
Buffer usage	The buffer usage is displayed by a numerical number and a gauge ^{*3} .

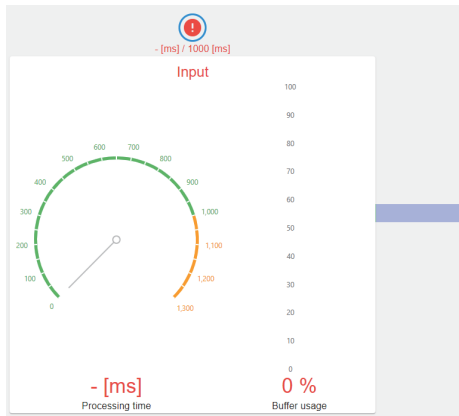
*1 "-" is displayed when the execution status of a task is not "RUN."

*2 Displayed in yellow when the value is equal to or more than the set collection cycle.

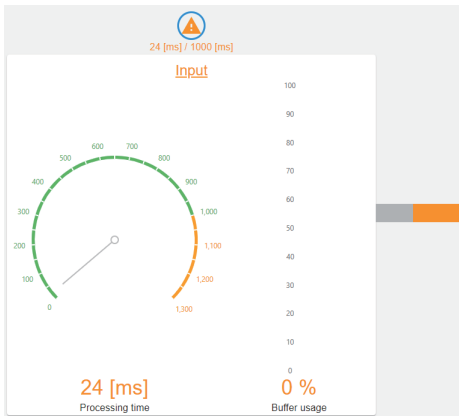
*3 Displayed in yellow when the usage is 80% or more.

The color of texts or progress bar changes depending on the occurrence of an error or warning.

- Error



- Warning

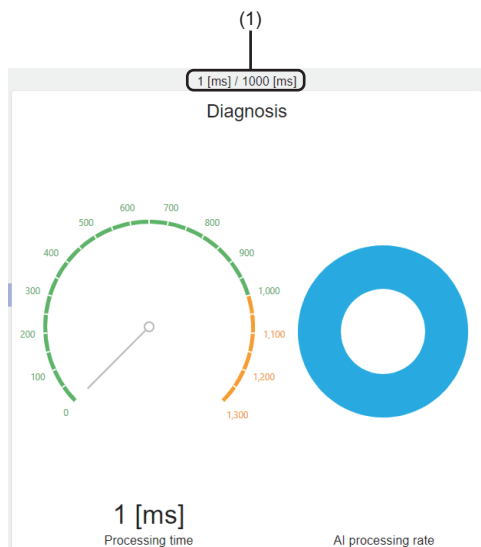


Diagnosis

The execution status of diagnosis processing of an AI can be monitored.

The AI processing time displayed in this item indicates the time for processing other than input and output data streams.

Window



Displayed items

Item	Description
(1) Ratio of AI processing time + output processing time	The ratio of the AI processing time + output processing time to the set diagnosis cycle is displayed in the following format: ^{*1} <ul style="list-style-type: none"> • AI processing time + output processing time / set diagnosis cycle
Processing time	The AI processing time is displayed by a numerical value ^{*1} and a gauge ^{*2} .
AI processing rate	The proportion of processing time of each AI to the entire AI processing time is displayed as a pie chart. ^{*3} Processing time and proportion of each AI can be checked by placing the cursor on the pie chart.

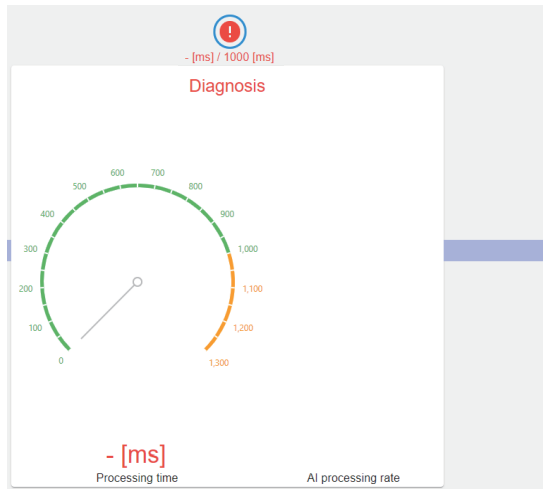
*1 "-" is displayed when the execution status of a task is not "RUN."

*2 Displayed in yellow when the value is equal to or more than the set diagnosis cycle.

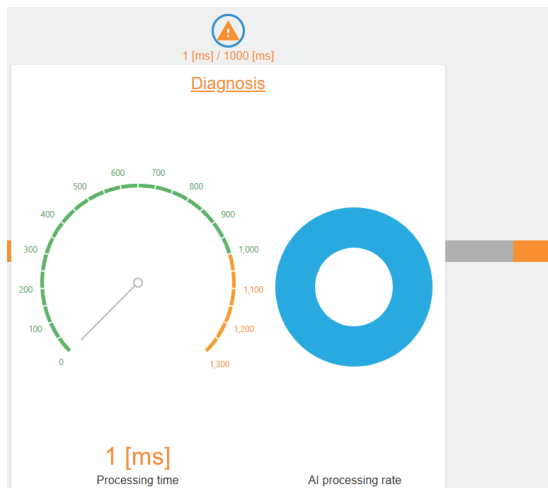
*3 Displayed when the execution status of a task is "RUN."

The color of texts or progress bar changes depending on the occurrence of an error or warning.

- Error



- Warning

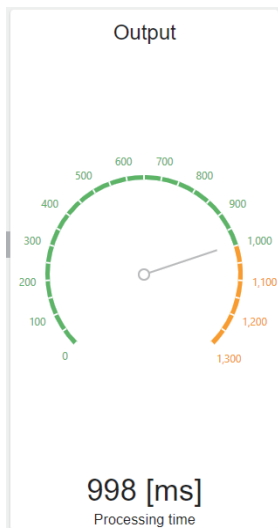


Output

The execution status of the entire output data stream can be monitored.

The output processing time displayed in this item indicates the maximum processing time of all the output data streams in a task.

Window



Displayed items

Item	Description
Processing time	The output processing time is displayed by a numerical value ^{*1} and a gauge ^{*2} .

*1 "-" is displayed when the execution status of a task is not "RUN."

*2 Displayed in yellow when the value is equal to or more than the set diagnosis cycle.

The color of texts changes depending on the occurrence of an error or warning.

- Error



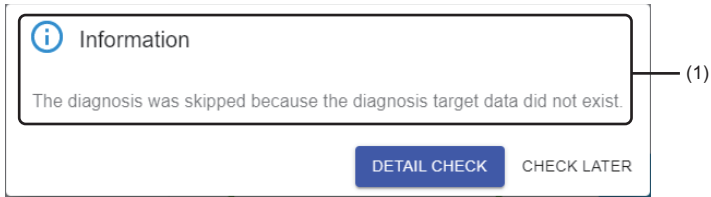
- Warning



Error/warning/information screen

The following shows the screen for checking the description for an error, warning, or information.

Window



Displayed items

Item	Description
(1) Description of an error, warning, or information	The description of an error, warning, or information is displayed.
[Detail check] button	Click this to display the event log screen.*1 Page 511 EVENT LOG CHECK
[Check later] button	Click this to close this screen.

*1 A diagnosis terminal being monitored is selected in the displayed screen.

When the corresponding event exists, the event log screen is displayed with the event selected and also the details on the event displayed.

11.5 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later)

This section shows the screen for monitoring the diagnosis results and execution status of a task.

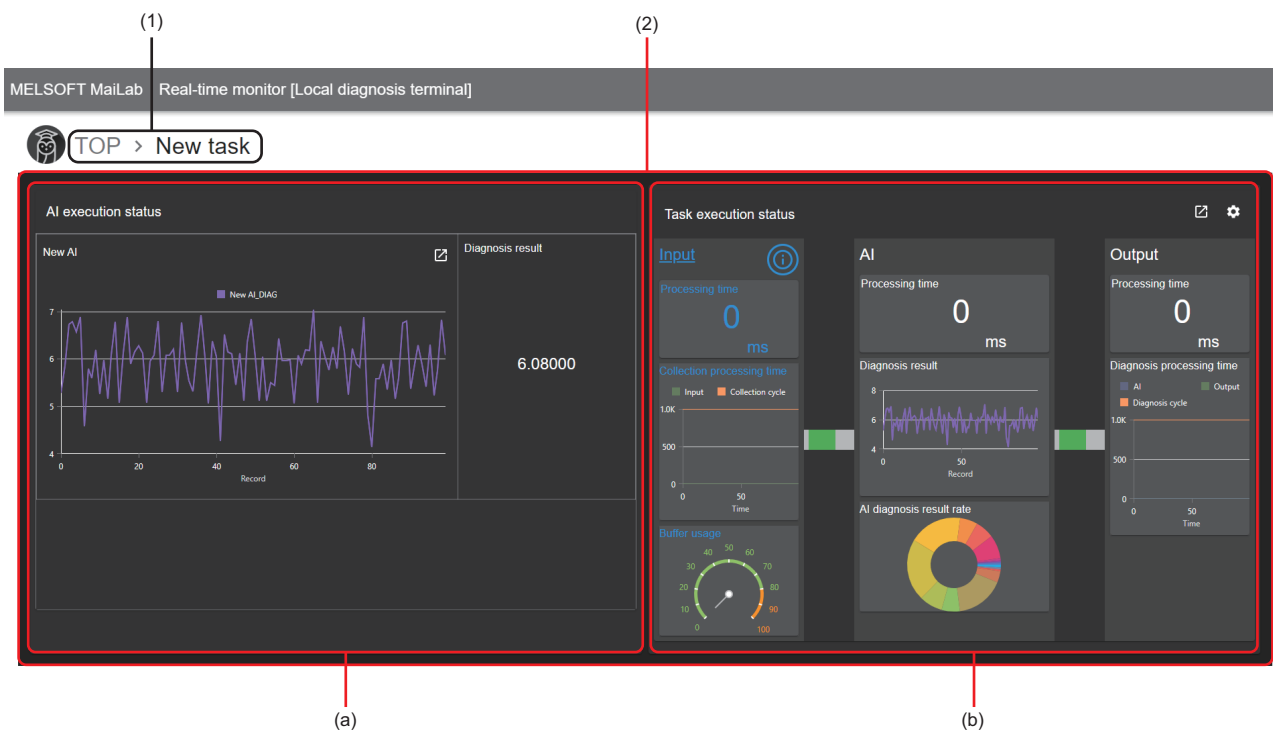
Restriction

Up to four real-time monitor screens can be displayed at the same time per user.

Window

- Select a task in the diagnosis terminal monitoring screen, and click [Real-time]. ([Page 474 Diagnosis Terminal Monitoring Screen](#))
- Select a task in the task management screen, and click the [Real-time monitor] button. ([Page 207 Task Management Screen](#))

When opening the real-time monitor screen from the task management screen, it opens in another tab.



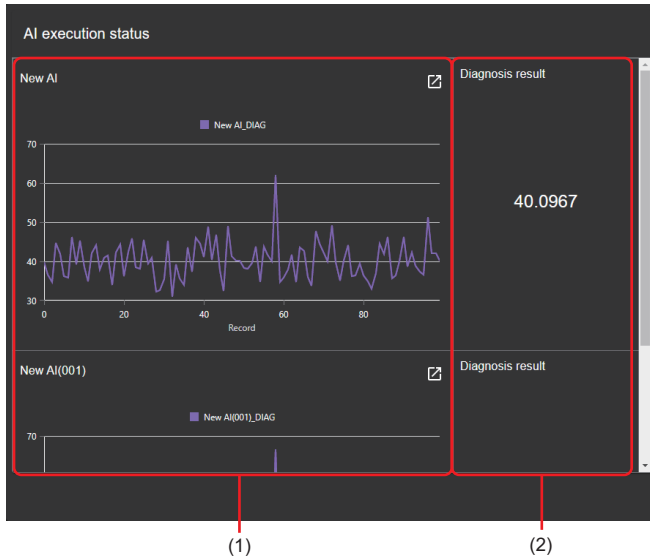
Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. • TOP > Current task name By clicking "TOP," the screen returns to the diagnosis terminal monitoring screen. (Page 474 Diagnosis Terminal Monitoring Screen)
(2) Monitoring dashboard	The diagnosis results and execution status of a task are displayed in the widget format. For details on the widget, refer to the following: (a) AI execution status monitoring widget: Page 494 AI execution status monitoring widget (b) Task execution status monitoring widget: Page 498 Task execution status monitoring widget


AI execution status monitoring widget

The following shows the screen for monitoring the execution status and diagnosis results from AIs set in a task. The diagnosis results are displayed with the settings of a comparison judgment block or SPC block; therefore, the settings of AIs can be checked and the execution status and diagnosis results can be monitored easily. When monitoring the execution status and diagnosis results under complicated condition, such as comparing the diagnosis results from multiple AIs, use SCADA software.

Window



Displayed items

Item	Description
(1) AI output	<p>A graph of the diagnosis results from AIs can be monitored. Displayed contents are the same as the graph displayed in detailed information. Detailed information is displayed by clicking  (Open). Page 495 Detailed information</p>
(2) Diagnosis result	<p>The diagnosis results of an AI can be monitored. However, "Missing value" is displayed when input data is a missing value (NaN) or infinity value (Inf).</p> <ul style="list-style-type: none"> ■For similar waveform recognition The values of the similarity score are displayed.*1 ■Other cases The variable values of a diagnosis result are displayed.*1 <p>When any analysis methods are not used by an AI, the variable value selected in "Variable" in detailed information is displayed.*1 Page 495 Detailed information</p> <p>If either a comparison judgment block or SPC judgment block and at least one condition are selected in "Block" and "Condition" in detailed information, when any of the conditions in the condition list is satisfied, "Error" is displayed. When all the conditions are not satisfied, "Normal" is displayed.*2 (In this case, the variable value is not displayed.)</p>

*1 Displayed in the following format for a numerical value type:

When an exponent of floating point numbers is in '-3' to '4': Displayed by fixed point notation (up to six digits).

(Example) '1.234567' is displayed as '1.23457.'

When an exponent of floating point numbers is not in '-3' to '4': Displayed by floating point notation (two digits after the decimal point).

(Example) '1.234567' is displayed as '1.23e+5.'

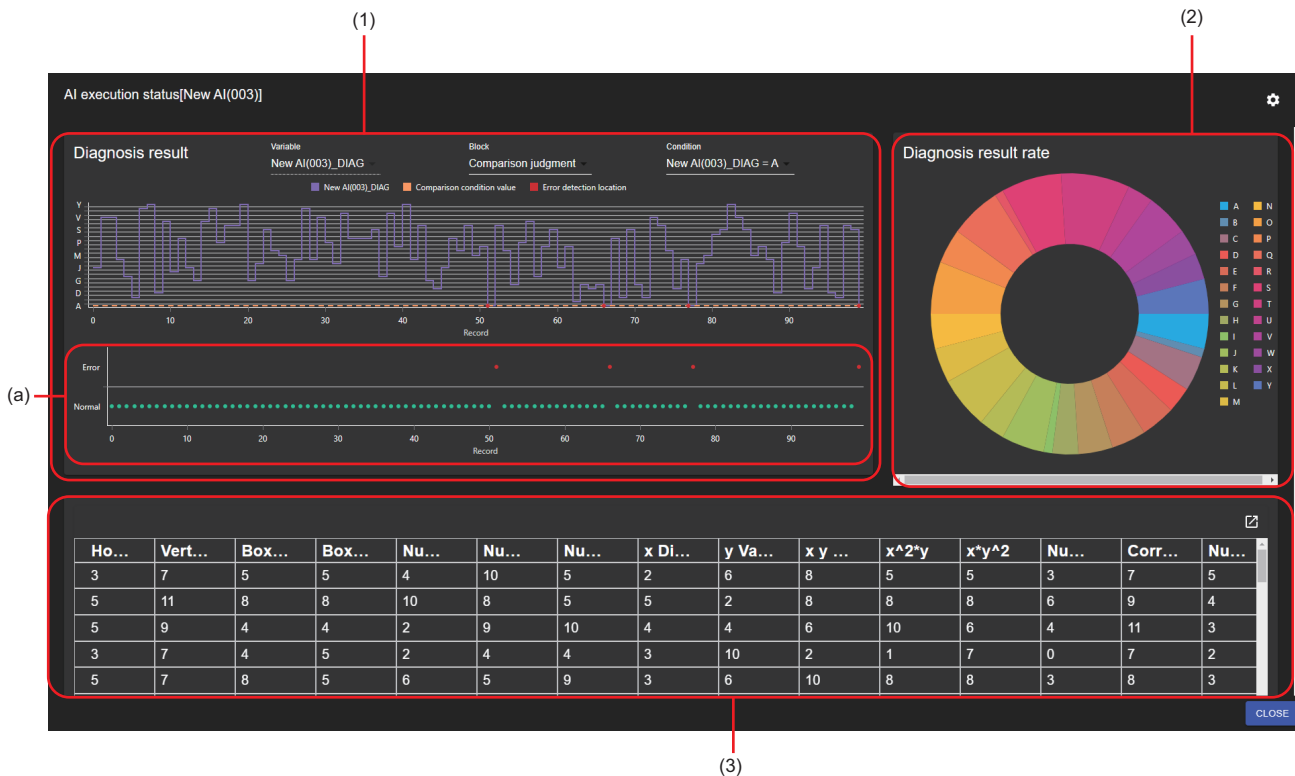
*2 Nothing is displayed when any judgment target variable does not exist.

Detailed information



The following shows the screen for displaying detailed information of an AI execution status monitoring widget.




Window

Click  (Open) in an AI execution status monitoring widget. ( Page 494 AI execution status monitoring widget)




Displayed items

Item	Description
 (Setting)	Click this to set the display method of the AI execution status monitoring widget. ( Page 497 Set monitoring widget)



Item		Description
(1) Diagnosis result	—	<p>A diagnosis result graph is displayed.*¹*²</p> <p>The graph shows results for the number of the target records set in the following from the latest output result:  Page 497 Set monitoring widget</p> <p>Displayed contents differ depending on the analysis method used by an AI.</p> <p>■For similar waveform recognition</p> <p>The values of the inspection waveform, reference waveform, and similarity score of similar waveform recognition are displayed as line charts.</p> <p>A similarity score is displayed in a range of 0 to 100 regardless of the output value.</p> <p>For a similarity score, even if a missing value (NaN) or infinity value (Inf) exists, the part is treated and displayed as a unit of data.</p> <p>Otherwise, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.</p> <p>■Other cases</p> <p>The variable values of a diagnosis result are displayed as a line chart.</p> <p>When any analysis methods are not used by an AI, the variable values selected in "Variable" are displayed as a line chart.</p> <p>When a comparison judgment block or SPC judgment block and its condition are selected in "Block" and "Condition," the diagnosis result is also displayed.*³ (When a variable displayed in the graph is a category type variable, by selecting a comparison judgment block in "Block," (a) Judgment result is also displayed.)</p> <p>However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.</p>
	Variable	<p>A variable name displayed in the graph is displayed.*⁴</p> <p>Only when any analysis methods are not used by an AI, a variable to be displayed in a graph can be selected from the output results of an AI.*⁵</p> <p>However, a timestamp type variable cannot be selected.</p>
	Block	<p>This can be selected when a comparison judgment block or SPC judgment block is used in an AI, and the judgment target variable exists in a graph.*⁶</p>
	Condition* ⁷	<p>Select a condition to display the diagnosis result in a graph.*⁸</p> <p>In the conditions set in a block selected in "Block," multiple conditions that a variable displayed in a graph is a variable to be judged can be selected.</p>
(2) Diagnosis result rate		<p>Displayed only when the type of the variable displayed in a graph is category.</p> <p>The proportion of the diagnosis results is displayed.*⁹</p> <p>A missing value is also displayed as one of the components.</p>
(3) AI output result	—	<p>Output results of an AI are displayed.</p> <p>The graph shows results for the number of the target records set in the following from the latest output result:  Page 497 Set monitoring widget</p> <p>The order cannot be sorted.</p> <p>When an explanatory variable is in an output result, only the column for the diagnosis result is framed with a bold line.</p> <p>When a missing value (NaN) or infinity value (Inf) exists, the cell is displayed blank.</p>
	<input checked="" type="checkbox"/> (Expand) <input type="checkbox"/> (Collapse)	<p>Click either of these to expand or collapse the header.</p> <p>Operations such as search can be performed by expanding the header.</p> <p> Page 56 Expanding the header</p>

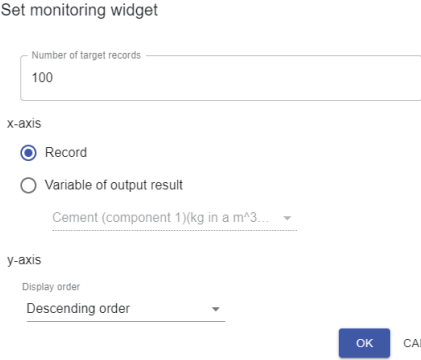
- *1 When the configured setting contents of monitoring ("Variable," "Block," and "Condition") cannot be referred to because of editing an AI or task, or a graph cannot be drawn because of changing the setting, monitoring setting contents are changed to the default, and then a graph is shown.
- *2 The variable value to be displayed in the graph is output results of an AI.
- *3 For a comparison judgment block, only when a comparison target set in a condition is a constant or variable included in output results of an AI, a comparison condition value is displayed.
- *4 For similar waveform recognition, the variable name of a similarity score is displayed.
- *5 A variable at the beginning in ascending order of the variable names of output results (except for a timestamp type variable) is selected in the default.
- *6 A block at the beginning in ascending order of the corresponding block names is selected in the default.
- *7 Displayed when "Block" is selected.
- *8 The following is selected in the default:
 When a comparison judgment block is selected in "Block": All the corresponding conditions
 When an SPC judgment block is selected in "Block": A condition at the beginning in ascending order of the corresponding conditions, and a condition in which the same statistics (target value, standard deviation, control limit upper limit value, and control limit lower limit value) as the former one is set.
- *9 Due to the factors, such as the number of characters of legends or screen size, the legends may not be displayed.

Set monitoring widget

The following shows the screen for setting the display method of an AI execution status monitoring widget.
The setting target is AIs displayed in detailed information. ( Page 495 Detailed information)

Window

Click  (Setting) in detailed information. ( Page 495 Detailed information)



Set monitoring widget

Number of target records
100

x-axis

Record
 Variable of output result

Cement (component 1)(kg in a m³...

y-axis

Display order
Descending order

OK CANCEL

11

Displayed items

Item	Description
Number of target records	Set the number of records to be displayed (1 to 1000).
x-axis	Set the x axis of a graph ("Record" or "Variable of output result"). When selecting "Variable of output result," select a variable to be the x axis from the output results of an AI.
y-axis	Select the display order ("Descending order" or "Ascending order") for the y axis.

Task execution status monitoring widget

The following shows the screen for monitoring the execution status of a task.

Any of the icons shown below is displayed when an error, warning, or information occurs.

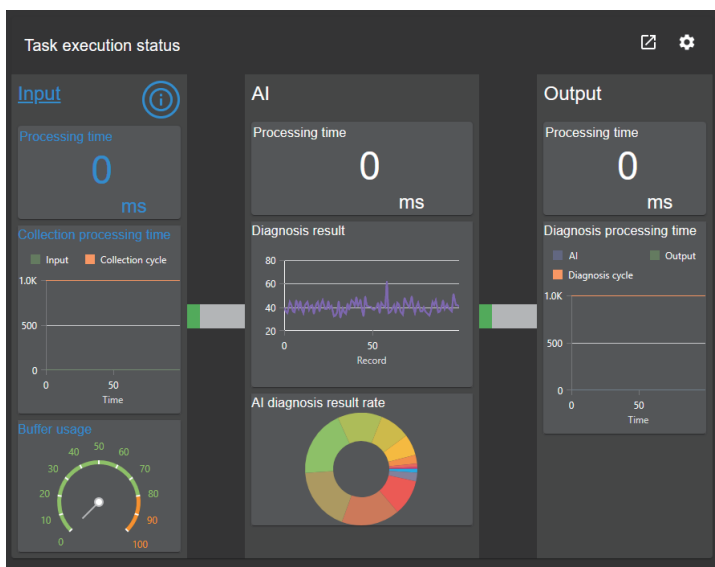
When multiple errors, warnings, or pieces of information occur, only the newest error, warning, or information is displayed. In addition, when a warning, error, and information occur at the same time, only one icon is displayed in the following priority order:

- : Error
- : Warning
- : Information

By clicking these icons, the error/warning/information screen is displayed and the description can be checked.

Page 505 Error/warning/information screen

Window





Displayed items

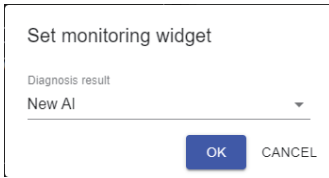
Item	Description
(Open)	Click this to expand the displayed contents.
(Setting)	Click this to set the display method of the task execution status monitoring widget. (Page 499 Set monitoring widget)
Input	The execution status of an input data stream can be monitored. Page 500 Input
AI	The execution status of diagnosis processing of an AI can be monitored. Page 502 AI
Output	The execution status of the entire output data stream can be monitored. Page 504 Output

Set monitoring widget


The following shows the screen for setting the display method of the task execution status monitoring widget.

Window

Click  (Setting) in the task execution status monitoring widget. ( Page 498 Task execution status monitoring widget)



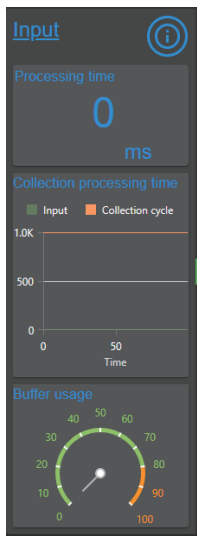
Displayed items

Item	Description
Diagnosis result	Select an AI to be displayed in the diagnosis result graph shown in the following:  Page 502 AI

Input

The execution status of an input data stream can be monitored.

Window



Displayed items

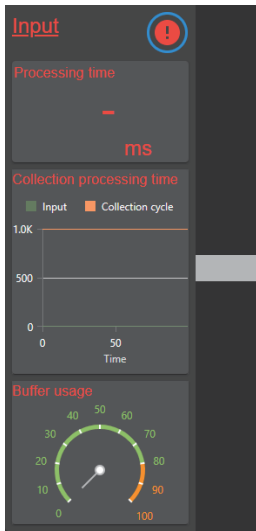
Item	Description
Processing time	The processing time is displayed. ^{*1}
Collection processing time	Processing time that has been displayed in "Processing time" until now (up to 100 times) is displayed as a graph.
Buffer usage	The buffer usage is displayed by a gauge ^{*2} .

*1 "-" is displayed when the execution status of a task is not "RUN."

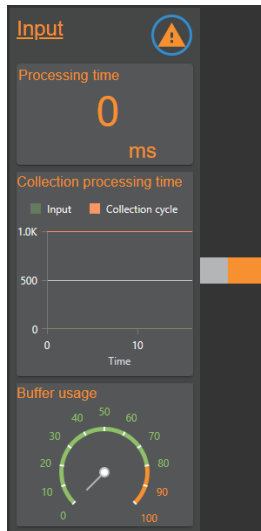
*2 Displayed in yellow when the usage is 80% or more.

The color of progress bar changes depending on the occurrence of an error or warning.

- Error



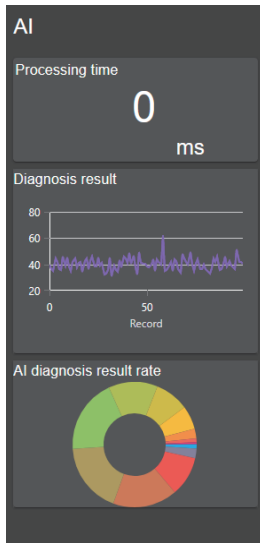
- Warning



AI

The execution status of diagnosis processing of an AI can be monitored.

Window



Displayed items

Item	Description
Processing time	The processing time is displayed.*1
Diagnosis result	The output results of an AI selected in the setting shown in the following are displayed as a graph. ☞ Page 499 Set monitoring widget Displayed contents are the same as the graph displayed in detailed information of an AI execution status monitoring widget. However, the setting contents such as "Variable" or "Block" configured in detailed information are not applied to this graph, and the graph is displayed with all the values set by default. ☞ Page 495 Detailed information
AI diagnosis result rate	The proportion of the diagnosis results is displayed.*2*3*4 A missing value is also displayed as one of the components. An infinity value is treated as a missing value.

*1 "-" is displayed when the execution status of a task is not "RUN."

*2 For similar waveform recognition, the proportion of the similarity score is displayed.

When any analysis methods are not used by an AI, the proportion of the variable value set in "Variable" in detailed information of the AI execution status monitoring widget by default is displayed:

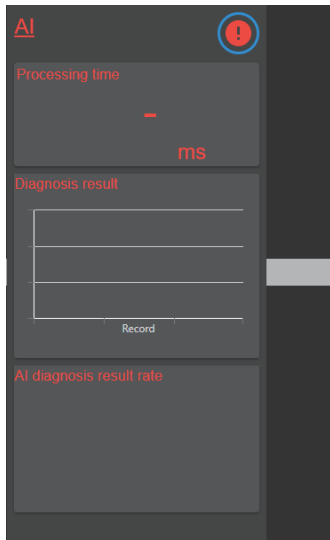
☞ Page 495 Detailed information

*3 For a numerical value type variable, when the number of unique elements is 16 or more, the whole numerical range is binned into 16 sections and displayed as 16 components.

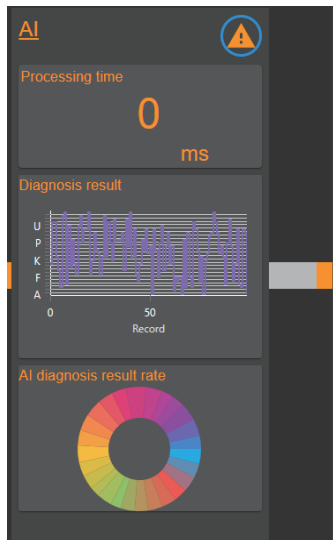
*4 Due to the factors, such as the number of characters of legends or screen size, the legends may not be displayed.

The color of progress bar changes depending on the occurrence of an error or warning.

- Error



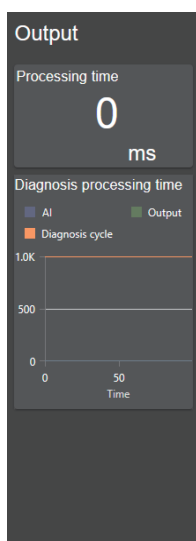
- Warning



Output

The execution status of the entire output data stream can be monitored.

Window



Displayed items

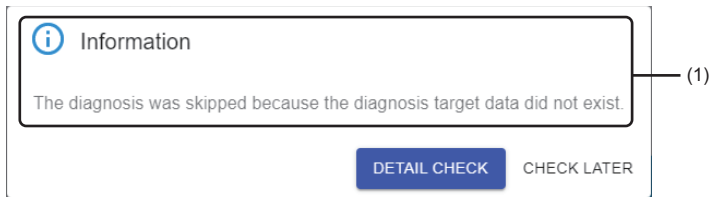
Item	Description
Processing time	The processing time is displayed. *1
Diagnosis processing time	Processing time that has been displayed in "Processing time" of an AI (Page 502 AI) or output until now (up to 100 times) is displayed as a graph.

*1 "-" is displayed when the execution status of a task is not "RUN."

Error/warning/information screen

The following shows the screen for checking the description for an error, warning, or information.

Window



11

Displayed items

Item	Description
(1) Description of an error, warning, or information	The description of an error, warning, or information is displayed.
[Detail check] button	Click this to display the event log screen in another tab. <ul style="list-style-type: none">• For this product on the learning station*1: Page 511 EVENT LOG CHECK• For this product on a diagnosis terminal: Page 540 EVENT LOG CHECK
[Check later] button	Click this to close this screen.

*1 A diagnosis terminal being monitored is selected in the displayed screen.
When the corresponding event exists, the event log screen is displayed with the event selected and also the details on the event displayed.

11.6 Historical monitor Screen

This section shows the screen for displaying the past diagnosis result.

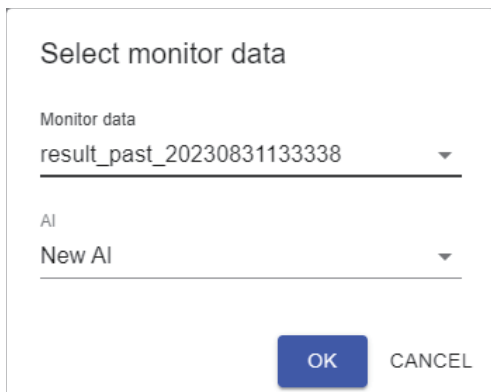
Operating procedure

1. Select a task in the diagnosis terminal monitoring screen (widget format), and click [Historical]. (☞ Page 474 Diagnosis Terminal Monitoring Screen)

Alternatively, select a task in the task management screen, and click the [Historical monitor] button. (☞ Page 207 Task Management Screen)

When opening the historical monitor screen from the task management screen, it opens in another tab.

2. Select monitor data^{*1} and AI.



Select monitor data

Monitor data
result_past_20230831133338

AI
New AI

OK CANCEL

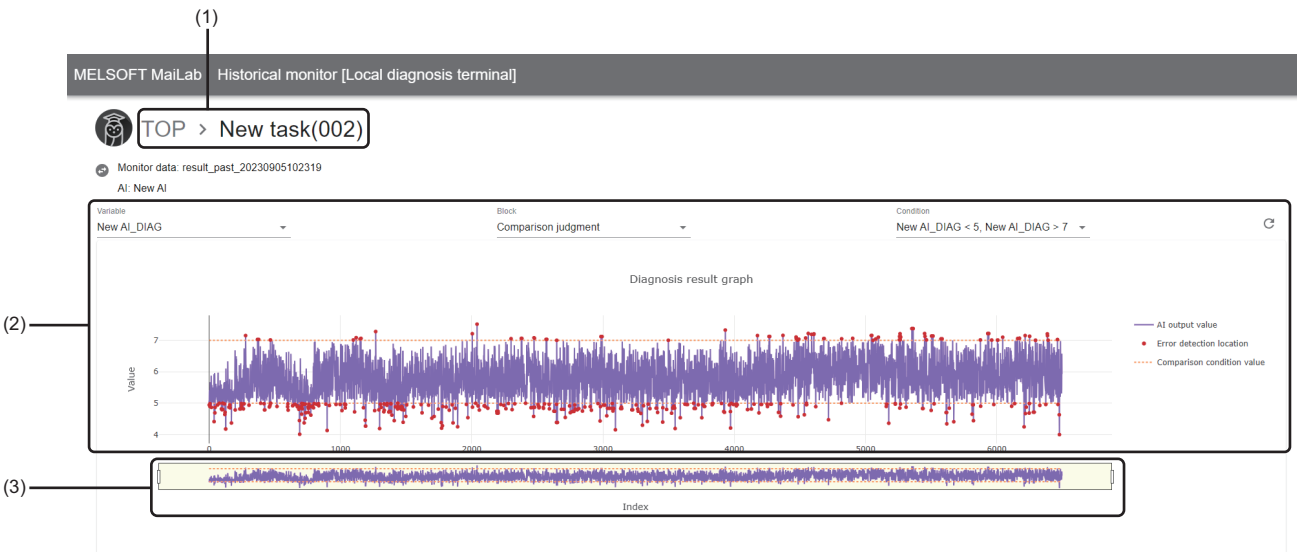
^{*1} Up to 1000 most recent current units of monitor data is displayed.

To display older monitor data older than that, leave 1000 units of monitor data to be displayed in a folder specified in the execution setting (☞ Page 224 Execution setting screen), and move other monitor data to another location.

3. Check the diagnosis result.

By clicking a part to check the details, how much each variable value affects the diagnosis result can be displayed.

☞ Page 509 Historical monitor details screen



Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> • TOP > Current task name By clicking "TOP," the screen returns to the diagnosis terminal monitoring screen. (☞ Page 474 Diagnosis Terminal Monitoring Screen)
🔄 (Change monitor target)	Click this to display the "Select monitor data" screen and change the monitor data.
Monitor data	A name of the selected monitor data is displayed.
AI	A name of a selected AI is displayed.
(2) Diagnosis result graph	A diagnosis result is displayed. A whole diagnosis result is displayed by default. The detailed transition of values can be checked by zooming in the graph. Displayed contents differ depending on the analysis method used by an AI. However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn. ■For similar waveform recognition The values of the inspection waveform, reference waveform, and similarity score of similar waveform recognition are displayed as line charts. A similarity score is displayed in a range of 0 to 100 regardless of the output value. ■For other analysis methods The variable values of a diagnosis result are displayed as a line chart. When a comparison judgment block or SPC judgment block and its condition are selected in "Block" and "Condition," a diagnosis result is also displayed.*1
Variable*2	A variable name displayed in a graph is displayed. ■For an AI with an analysis method A variable to be displayed in a graph can be selected from the variable name list of a diagnosis result. ■For an AI without an analysis method A variable to be displayed in a graph can be selected from the variable name list of the output results of an AI.
Block*2	This can be selected when a comparison judgment block or SPC judgment block is used in an AI, and the judgment target variable exists in a graph.*3
Condition*4	Select a condition to display a diagnosis result in a graph. Up to 10 conditions can be selected among the ones set in a block.
🔄 (Update)	Click this to update a diagnosis result to the latest one saved in a selected monitor data. In addition, click this to update the display when changing "Variable," "Block," and "Condition."

Item	Description
(3) Display range slider	<p>By dragging the slider, the display range of a graph changes.</p>  <p>By dragging the range in the slider, the display area of a graph moves while the width is maintained.</p> 

- *1 For a comparison judgment block, only when a comparison target set in a condition is a constant or variable included in output results of an AI, a comparison condition value is displayed.
- *2 Not displayed for an AI that uses similar waveform recognition.
- *3 A block at the beginning in ascending order of the corresponding block names is selected in the default.
- *4 Displayed when selecting a block.

Historical monitor details screen

The diagnosis contribution ratio, which indicates how much each variable affects a diagnosis result is displayed. A hint for assumption of the causes of a diagnosis result and feedback for the production sites can be obtained by comparing or checking the diagnosis contribution ration and variable value.


Ex.

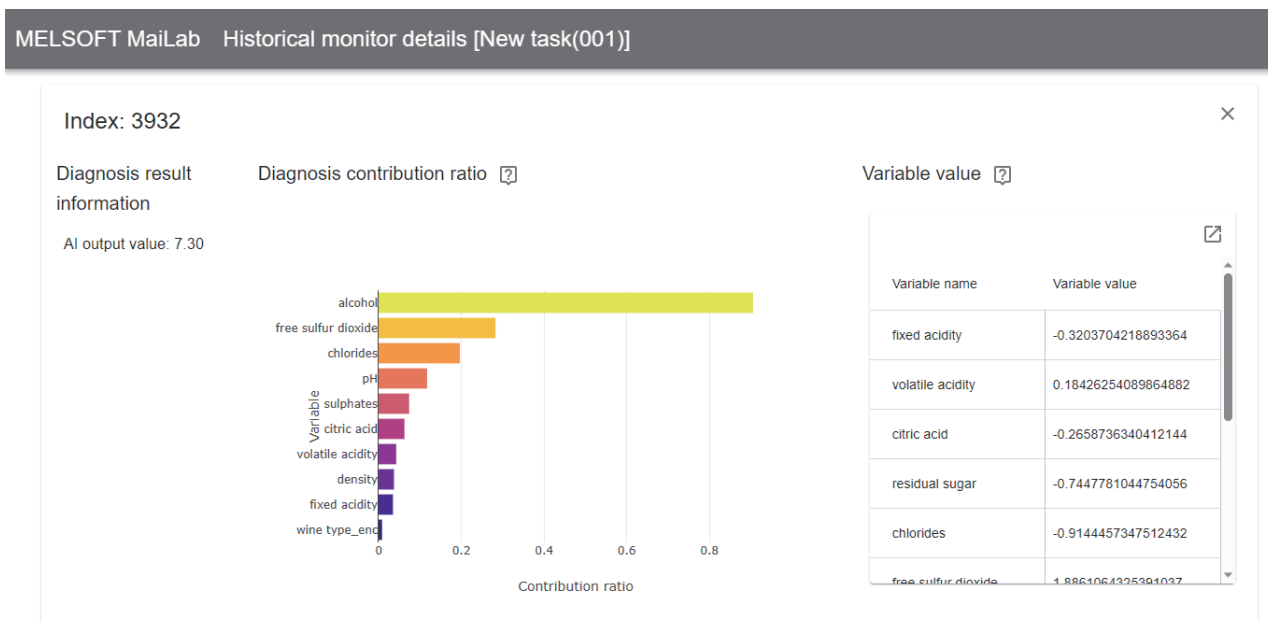
Check the diagnosis contribution ration of the error data, and adjust an equipment so that the value of a variable with high contribution ratio is close to the normal data.

Precautions


- An AI that uses similar waveform recognition cannot be supported.
- When displaying the historical monitor details screen, diagnosis processing of the target AI is executed for calculating the diagnosis contribution ratio. For an AI that uses a Python block (including the processing to access or change an external file), an external file may be accessed or changed at the timing when the diagnosis contribution ratio is displayed.

Window

Click a part to check the details in a diagnosis result graph. ( Page 506 Historical monitor Screen)



Displayed items

Item	Description
Index	An index value is displayed.
Diagnosis result information	AI output value A value of a variable selected for "Variable" in the historical monitor screen is displayed.  Page 506 Historical monitor Screen
Diagnosis contribution ratio* ¹	The contribution ratios of up to top 10 explanatory variables of which contribution ratio is '0' or more are displayed as a horizontal bar chart graph.* ² Whole data is displayed by default. The detailed distribution of values can be checked by zooming in a scatter plot.
Variable value* ¹	Variable name A variable name is displayed.
	Variable value A variable value is displayed.

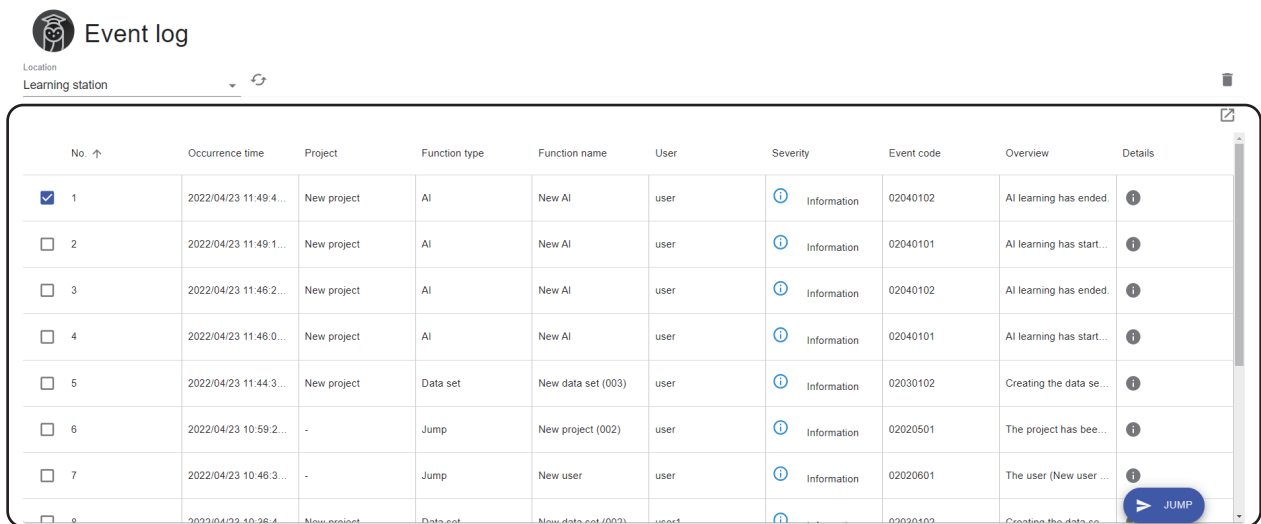
- *1 Displayed for an AI that satisfies all the following conditions:
 - AI that completes learning in this product with version 1.05F or later
 - AI with an analysis method
 - AI does not use a guard band block
 - AI does not use a section generation block (when multiple AIs are included in a task, a section generation block is not used in all AIs)
- *2 When an MT method block or autoencoder block is used in an AI, for a category type variable, the displayed variable name or value may not match with the data set.

12 EVENT LOG CHECK

This chapter shows the screen for checking event logs such as for errors that occur while this product is running. Up to 10000 event logs are saved for each learning station or diagnosis terminal. If the number of event logs exceeds 10000, logs are deleted in chronological order.

Window






Click the [View event log list] button in the notification list. (🔍 Page 49 Notification list)




(1)

Displayed items

Item	Description
Location	Select a device to check event logs.
(Update)	Click this to update the list of event logs.
(Delete all)*1	Click this to delete all event logs for a selected device. Filtered logs are also deleted.

Item	Description
(1) Event log list	— Event logs for a selected device are listed. For event logs for projects (or data sets, AIs, or tasks in the projects), only logs for projects that a signed-in user can access are displayed. Multiple event logs cannot be selected.
	 (Expand)/ — (Collapse) Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 514 Expanding the header
	Occurrence time ^{*2} The time when an event occurred is displayed.
	Occurrence start time ^{*3} The time when an event occurred for the first time is displayed. If all event logs are deleted while a task is running, the occurrence start time for each event will show the time when the event occurs for the first time after deleting all the logs.
	Latest occurrence time ^{*3} The time when an event occurred the last time is displayed.
	Project ^{*2} The name of a project managing a function in the "Function name" column is displayed. "-" is displayed when the function is not managed by a project.
	Function type The type of a function where an event occurred is displayed. "Unsupported function" is displayed when an event for a function that is not supported by the learning station occurred on a diagnosis terminal.
	Function name The name of a function where an event occurred is displayed. "-" is displayed when a function name does not exist.
	User The name of a user who was using the function where an event occurred is displayed. "-" is displayed when a user name does not exist.
	Severity The severity of an event is displayed. <ul style="list-style-type: none"> •  : Information •  : Warning •  : Error
	Event code An event code is displayed.
	Overview The overview of an event is displayed.
	Details Click the icon displayed in this column to display the details on an event.
[Jump] button ^{*4}	Click this to display the page for a selected function where an event occurred in another tab.

*1 Displayed when signing in as the administrative user. ( Page 53 User types)

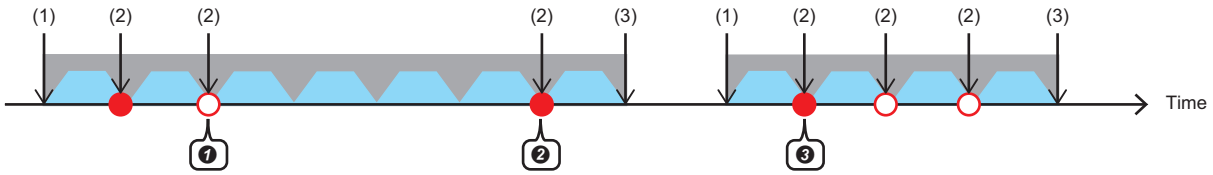
*2 Displayed only when selecting "Learning station" for "Location."

*3 Displayed only when selecting a diagnosis terminal for "Location."

*4 Displayed when an event is selected in the event log list and also the jump destination for the selected event exists.

Precautions

- If an event with the same event code occurs twice or more in the continuous diagnoses from when a task is started until when it is stopped, the second and later events are not added but the latest occurrence time of the first event is updated instead. (An event with the same code is added if it does not occur in the continuous diagnoses or it occurs after a task is stopped once then restarted.)



No.	Occurrence start time	Latest occurrence time
<input type="checkbox"/> 1	2020-11-11 10:10.111	2020-11-11 10:40.111
<input type="checkbox"/> 2	2020-11-11 09:09.111	2020-11-11 09:09.111
<input type="checkbox"/> 3	2020-11-11 08:08.111	2020-11-11 08:15.111

- : Event that is added as an event log
- : Event that is not added as an event log but updates the latest occurrence time

▲ : One diagnosis

■ : Task execution time

(1) A task is executed.

(2) Event 1 occurs.

(3) The task is stopped.

① The event occurs in the continuous diagnoses; therefore, only the latest occurrence time is updated.

② The event does not occur in continuous diagnoses; therefore, it is newly added.

③ The event occurs after the task is stopped once then restarted; therefore, it is newly added (then, the latest occurrence time is updated).

- When a user is signed in as a standard user and a project that the user has the access right to is deleted, logs for the project are no longer displayed in a list. When a user is signed in as the administrative user, all the logs including the ones for deleted projects are displayed.

📖 Page 53 User types

Expanding the header

The following operations can be performed by expanding the header.

- Searching (🔍 Page 56 Searching)
- Switching to show or hide (🔍 Page 56 Switching to show or hide)
- Filtering (🔍 Page 57 Filtering)
- Downloading (📄 Page 514 Downloading)

■ Downloading

A list of event logs can be output as a CSV file (delimiter: comma).

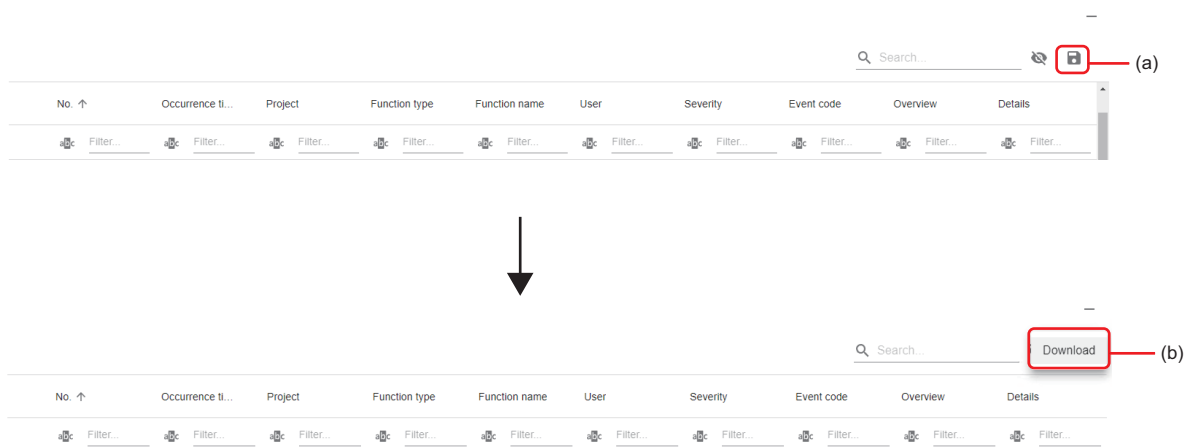
Data is output in the default sort order even when it is sorted.

Hidden items and filtered lines are also output.



A CSV file is output by the download function of a web browser.

Ex.



(a) Click .

(b) Click the [Download] button.

File name

eventlog_("Learning station" or a diagnosis terminal name)_(download date(YYYYMMDD)).csv^{*1}

*1 Windows has a limit of the path length; therefore, a file name is shortened by a web browser. In addition, when a shortened file name is duplicate, the name is also changed according to the specifications of the web browser function.

Character code

The character code for a CSV file to be output is UTF-8 (with BOM).

Output contents

Content of each column is output in the default sort order.

However, the severity icons and the details column are not output.


Ex.

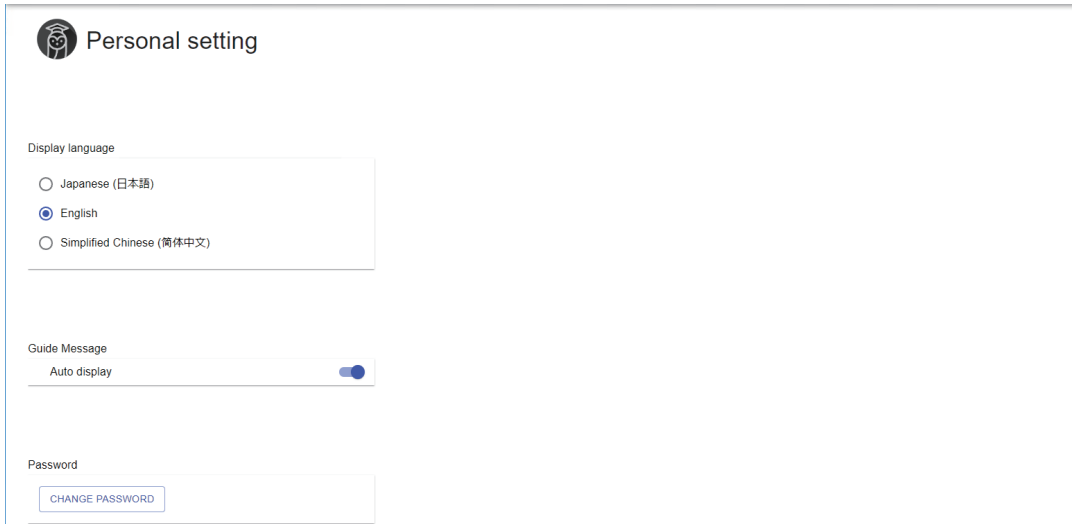
```
No., Occurrence time, Project, Function type, Function name, User, Severity, Event code, Overview
1,2022/07/01 09:22:36.558,-,Project,New Project,user2,Information,02020509,Succeeded to export.
2,2022/07/01 09:22:33.626,-,Project,New Project,user2,Information,02020510,Preparing the export file has been started.
3,2022/07/01 09:22:18.592,-,Project,New Project(001),user1,Information,02020503,The project has been copied.
4,2022/07/01 09:22:14.218,-,Project,New Project,user1,Information,02020501,The project has been created.
```

13 PERSONAL SETTINGS


This chapter shows the screen for changing personal settings for a signed-in user.

Window

Click a user name on the main bar, and select [User setting]. ( Page 48 Main bar)

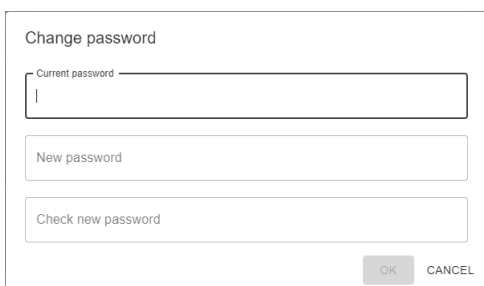


Displayed items

Item	Description
Display language	Switch a display language. The language of a web browser used when a user was signed in is set by default. (English is set when a language of the web browser was not Japanese, English, or Chinese.) The change of the display language is applied immediately. However, it is not applied to a screen that is opened in a tab different from the one where the personal setting screen is opened until the display contents of the screen are updated.
Guide message	Turn this ON to display guide messages.
Password	Click the [Change password] button to change a password.  Page 515 Changing a password

Changing a password

The following shows the screen for changing a password.



Item	Description
Current password	Enter the current password.
New password	Set a new password (8 to 64 characters).
Check new password	Enter the password again for verification.

Point

When a password is changed, a user is signed out.

MEMO

This part explains the operation methods of MELSOFT MaiLab on a diagnosis terminal.

14 OPERATION SCREEN

15 TASK MANAGEMENT

16 MONITOR

17 EVENT LOG CHECK

18 PERSONAL SETTINGS

14 OPERATION SCREEN

This chapter shows the operation screen of MELSOFT Mailab.

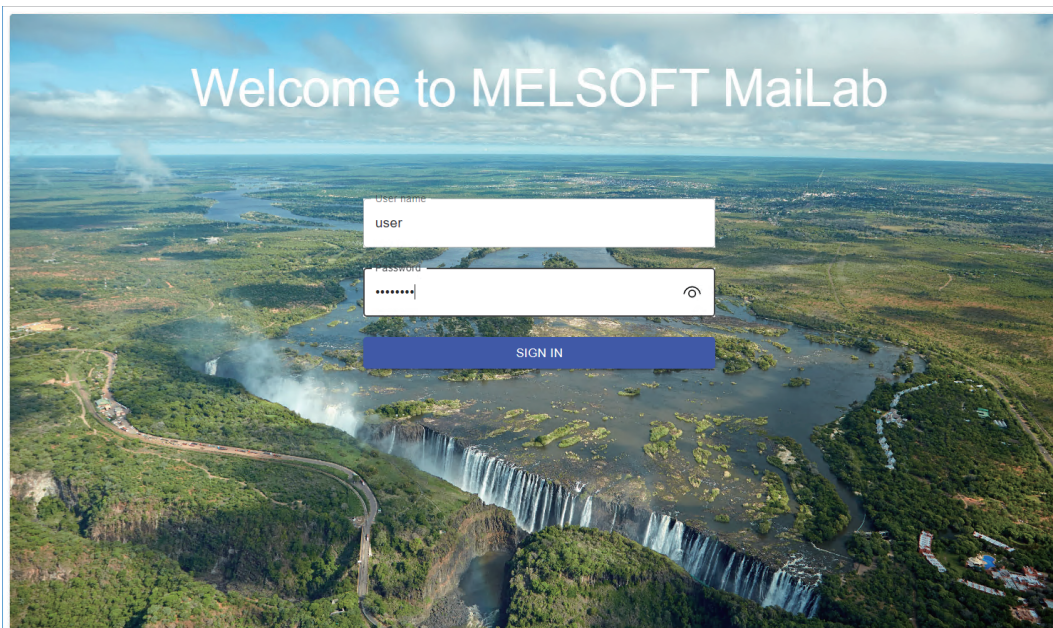
For the procedure for opening the operation screen, refer to the following:

☞ Page 34 Opening the Operation Screen (Diagnosis Terminal)

Window

■Before signing in

☞ Page 522 Signing in



■After signing in

- When the event log screen or personal setting screen is opened

No. ↑	Occurrenc...	Latest occ...	Function t...	Function n...	User	Severity	Event code	Overview	Details
<input type="checkbox"/> 1	2023/01/27 14...	2023/01/27 14...	Task	New task(009)	-	Information	05050819	The diagnosis...	i
<input type="checkbox"/> 2	2023/01/27 14...	2023/01/27 14...	Task	New task(001)	-	Information	05050819	The diagnosis...	i
<input type="checkbox"/> 3	2023/01/27 14...	2023/01/27 14...	Task	New task(009)	-	Information	05050819	The diagnosis...	i
<input type="checkbox"/> 4	2023/01/27 14...	2023/01/27 14...	Task	New task(001)	-	Information	05050819	The diagnosis...	i
<input type="checkbox"/> 5	2023/01/27 14...	2023/01/27 14...	Task	New task(001)	-	Warning	05050832	The input proc...	i

- When the other screen is opened

(3)

- (1) Main bar (☞ Page 520 Main bar)
 (2) Setting screen (☞ Page 520 Setting screen)
 (3) Side bar (☞ Page 520 Side bar)

Displayed items

■ Main bar



Item	Description
(Expand/Collapse)	Click this to expand or collapse the side bar when a screen other than the event log screen and personal setting screen is opened. ☞ Page 520 Side bar
① Product name	"MELSOFT MaiLab" is displayed. The home screen is displayed by clicking the name. ☞ Page 523 Home screen
② Diagnosis terminal name	A diagnosis terminal name is displayed.*1 The home screen is displayed by clicking the name. ☞ Page 523 Home screen
② (Help)	Click this to display the help menu. <ul style="list-style-type: none"> • Open manual: To display the manual for this product in another tab • Connect to MITSUBISHI ELECTRIC FA Global Website: To display the MITSUBISHI ELECTRIC FA Global website in another tab*2
③ User name	The name of a signed-in user is displayed. The user menu is displayed by clicking the name. <ul style="list-style-type: none"> • User setting: To display the personal setting screen (☞ Page 542 PERSONAL SETTINGS) • Sign out: To sign out and display the sign-in screen (☞ Page 522 Signing in)
(Notify)	Notifications for events that occur on a diagnosis terminal are displayed. (Up to 100 notifications) ☞ Page 521 Notification list The number of notifications is displayed on the upper right of this button. (If there are 100 or more notifications, "+99" is displayed.)

- *1 Only when any of the following conditions is satisfied on the learning station using this product with version 1.03D or later, the set diagnosis terminal name is saved on the diagnosis terminal. Otherwise, "Diagnosis terminal" is displayed.
- Registering the diagnosis terminal using this product with version 1.03D or later
 - Changing properties of the diagnosis terminal using this product with version 1.03D or later
 - Succeeding in communication with the diagnosis terminal using this product with version 1.03D or later

- *2 When setting Simplified Chinese for a display language, the MITSUBISHI ELECTRIC FA Global website is displayed in English.

■ Setting screen

Various setting screens are displayed.

■ Side bar

Displayed when a screen other than the event log screen and personal setting screen is opened.



Item	Description
(Home)	Click this to display the home screen. ☞ Page 523 Home screen
(Task)	Click this to display the task management screen. ☞ Page 524 Task Management Screen
(Monitor)	Click this to display the task list screen. ☞ Page 531 Task List Screen

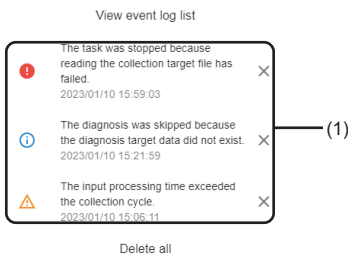
Notification list

Notifications for events that occur on a diagnosis terminal are displayed. (Up to 100 notifications)







When the number of notifications exceeds 100, up to 100 notifications are displayed from the newest one.

Window

Click  (Notify) on the main bar. ( Page 520 Main bar)



Displayed items

Item	Description
[View event log list] button	Click this to display the event log screen in another tab.  Page 540 EVENT LOG CHECK
(1) Notification list	Notifications are listed. <ul style="list-style-type: none"> : Information : Warning : Error The event log screen is displayed in another tab by clicking a notification. *1*2  Page 540 EVENT LOG CHECK A notification is deleted by clicking  (Delete).
[Delete all] button	Click this to delete all notifications.

*1 A clicked notification will be deleted.

*2 When the corresponding event exists, the event log screen is displayed with the event selected and also the details on the event displayed.

Precautions

- Even if communication with a diagnosis terminal is disconnected temporarily while the main bar is displayed, events that occur while disconnected are not displayed in the notification list. To acquire the notification list of all the diagnosis terminals being connected, refresh the web browser.
- When communication with a diagnosis terminal is disconnected, a notification can be deleted only on the screen. However, the notification itself is not deleted and displayed when connected in the next time.
- When all notifications are deleted, notifications exceeding the maximum number to be displayed are also deleted.
- When notifications are deleted one by one, notifications exceeding the maximum number to be displayed are not displayed on the screen. To display these notifications, refresh the web browser.

14.1 Signing in

This section shows the screen for signing in to this product with a user name and password to access a diagnosis terminal. A user name and password can be set in the diagnosis terminal management screen of this product on the learning station.

☞ Page 61 Diagnosis terminal management screen

After sign-in, the home screen is displayed.

☞ Page 523 Home screen

Window



Displayed items

Item	Description
User name	Enter a user name (up to 128 characters). ^{*1}
Password	Enter a password (8 to 64 characters).
[Sign in] button	Click this to sign in to this product with the entered user name and password.

*1 Alphabetical characters are case-sensitive.

Restriction



Only one user can access a diagnosis terminal at a time.

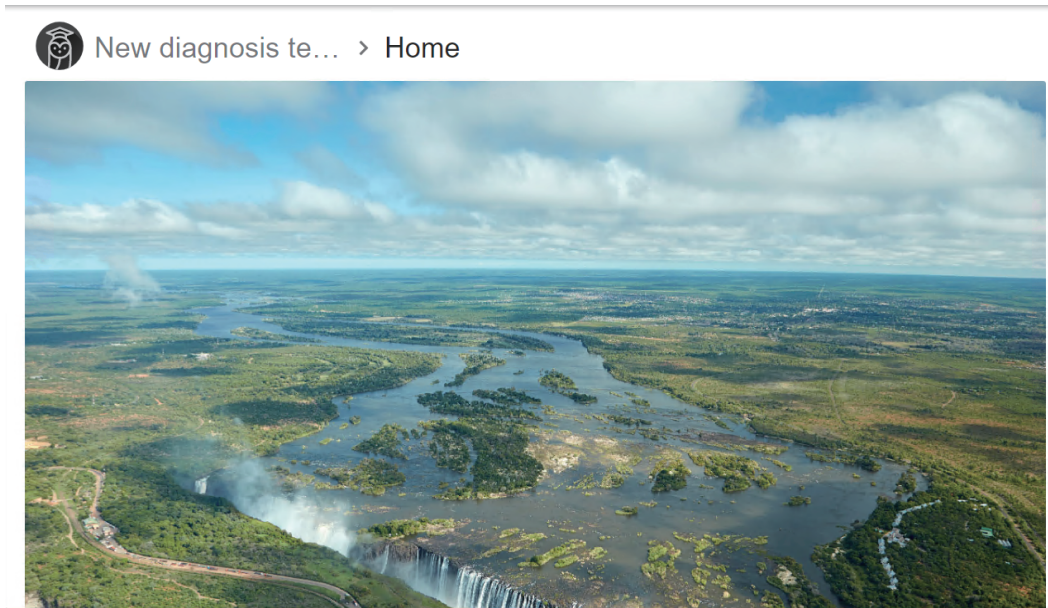
Point

- A user remains signed in for 24 hours from the last operation.
- When a signed-in user is already signed in in another environment (another personal computer or another web browser), sign-in in a new environment is enabled and the user is signed out in another environment.
- If the function to save passwords is enabled in a browser, a password entered in another setting screen of this product may be displayed.

14.2 Home screen

Window

Click  (Home) on the side bar. ( Page 520 Side bar)




14

Point

Only when any of the following conditions is satisfied on the learning station using this product with version 1.03D or later, the set diagnosis terminal name is saved on the diagnosis terminal. Otherwise, "Diagnosis terminal" is displayed.

- Registering the diagnosis terminal using this product with version 1.03D or later
- Changing properties of the diagnosis terminal using this product with version 1.03D or later
- Succeeding in communication with the diagnosis terminal using this product with version 1.03D or later

 > Home

15 TASK MANAGEMENT

This section shows the screen for managing tasks.

15.1 Task

For details, refer to the following:

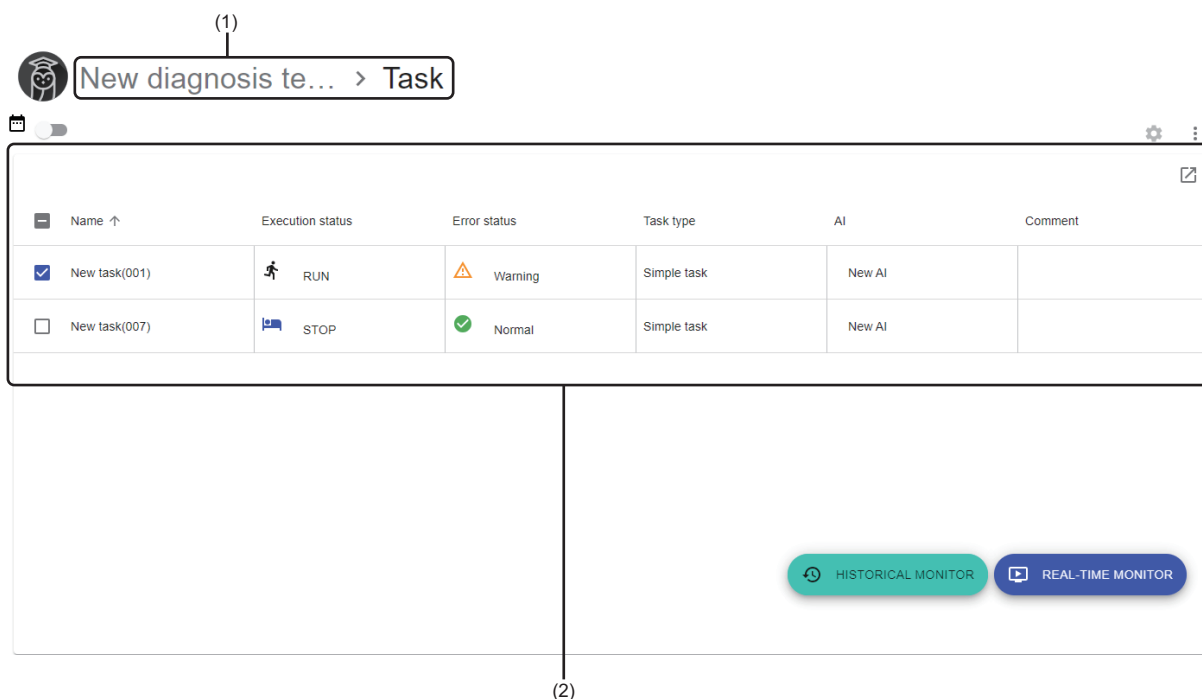
Page 203 Task

15.2 Task Management Screen

This section shows the screen for managing tasks.











Window

Click (Task) on the side bar. (Page 520 Side bar)



Displayed items

Item	Description	
(1) Breadcrumb bar	A breadcrumb bar is displayed. • Diagnosis terminal name ^{*1} > Task By clicking a diagnosis terminal name, the screen returns to the home screen. (Page 523 Home screen)	
(Calendar view)	Turn this ON to switch the task list to the calendar view. The execution schedule of tasks can be checked by switching to the calendar view. (Page 526 Calendar view)	
(Display setting) ^{*2}	Click this to set tasks to be displayed in the task management screen. (Page 527 Display setting)	
(Menu) ^{*3*4}	Start ^{*5}	To start a selected task. (Page 528 Starting and Stopping a Task)
	Stop ^{*6}	To stop a selected task. (Page 528 Starting and Stopping a Task)

Item	Description
(2) Task list	Tasks are listed. Among tasks on a diagnosis terminal, only the ones of which "Execution status" in a diagnosis terminal is not "EDIT" are displayed. This list is switched to a calendar by turning ON  (Calendar view). ( Page 526 Calendar view)
 (Expand)/ – (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
Name	A task name is displayed.
Execution status	The execution status of a task is displayed. <ul style="list-style-type: none"> • RUN: Processing of a task is running. • BOOT: Processing to change from "READY" to "RUN" is in progress.*7 • READY: A task is started but the execution period has not started yet. • SHUTDOWN: Processing to change from "RUN" to "STOP" or "READY" is in progress.*8*9 • STOP: A task is not started or it is stopped.*10 The execution status restarts from "READY" in the following cases. (If the operations described below is performed during the execution period, the status changes from "READY" to "RUN.") <ul style="list-style-type: none"> • When "Execution status" is "READY," "BOOT," or "RUN," the operating status of this product on a diagnosis terminal is changed to "STOP" then to "RUN" again.
Error status	The current error status is displayed. <ul style="list-style-type: none"> • Normal: No warnings or errors have occurred. • Warning: A warning has occurred.*11*12 • Error: A task is stopped due to an error.*13
Task type	A task type is displayed. ( Page 205 Task types)
AI	The name of an AI used in a task is displayed. "Multiple AI" is displayed when using multiple AIs. By clicking  (Details), the AIs used are displayed as a list.
Number of AI used*14	The number of AIs used in a task is displayed.
Diagnosis cycle [ms]*14	A set diagnosis cycle is displayed in milliseconds. ( Page 224 Execution setting screen)
Task execution period*14	A set execution period ("Always," "Date and time specification," or "Periodic") is displayed. ( Page 224 Execution setting screen)
Update date and time*14	The date and time when a task was updated is displayed. This item is not updated by editing a task name or comment.
Creation date and time*14	The date and time when a task was created is displayed. For a task created as a copy, the date and time when the copy was created is displayed.
Comment	A set comment is displayed.
Size [MB]*14	The file size of a task is displayed.
[Historical monitor] button*15	Click this to display the past diagnosis result of a selected task in another tab.  Page 535 Historical monitor Screen
[Real-time monitor] button*15	Click this to display the task monitoring screen for a selected task in another tab.  Page 534 Real-time monitor Screen

*1 Only when any of the following conditions is satisfied on the learning station using this product with version 1.03D or later, the set diagnosis terminal name is saved on the diagnosis terminal. Otherwise, "Diagnosis terminal" is displayed.

- Registering the diagnosis terminal using this product with version 1.03D or later
- Changing properties of the diagnosis terminal using this product with version 1.03D or later
- Succeeding in communication with the diagnosis terminal using this product with version 1.03D or later

*2 Can be clicked when the calendar view is ON.

*3 Can be clicked when selecting a task with the calendar view turned OFF.

*4 The context menu can be displayed also by right-clicking on the task list.

*5 Can be selected when "Execution status" of a selected task is "STOP."

*6 Can be selected when "Execution status" of a selected task is "READY," "BOOT," or "RUN."

*7 Once the processing is completed, the status changes to "RUN."

*8 Once the processing is completed, the status changes to "STOP" or "READY."


*9 If an error occurs while the status is "RUN" or "BOOT" and then the status changes to "SHUTDOWN," only errors that occur while the status is "RUN" or "BOOT" are notified. Warnings and errors that occur while the status is "SHUTDOWN" are not notified.


*10 Includes the case when a task is started but the next execution period does not exist.

*11 Once a warning occurs, this "Warning" state remains as long as "Execution status" of a task is "RUN."

*12 This state is cleared when "Execution status" of a task changes from "RUN."

*13 This state is cleared by performing the start operation for a task again.

*14 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.

 Page 56 Switching to show or hide


*15 Displayed when selecting only one task with the calendar view turned OFF.

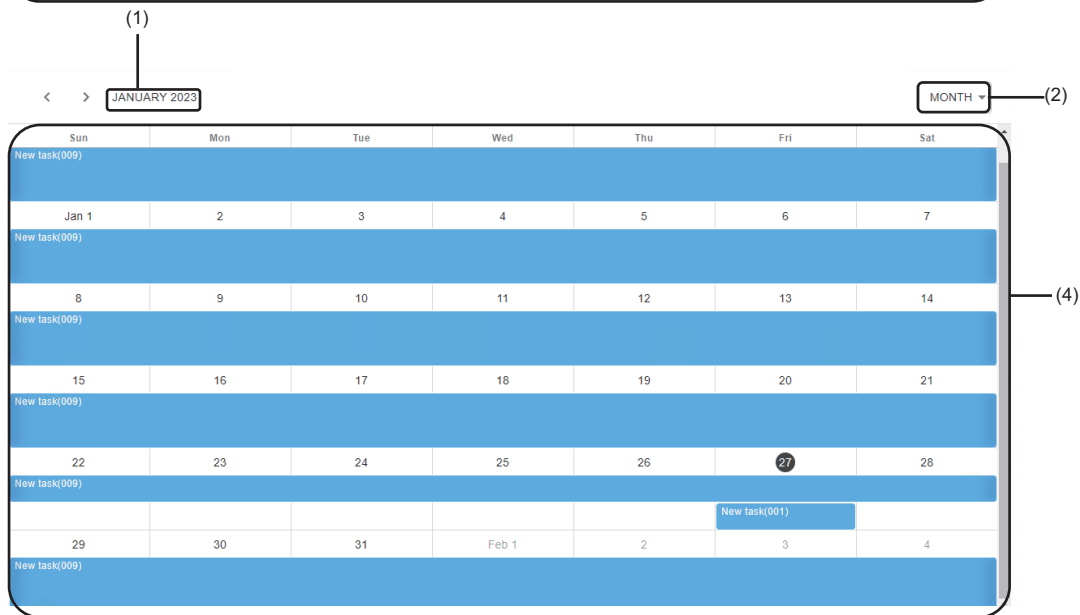
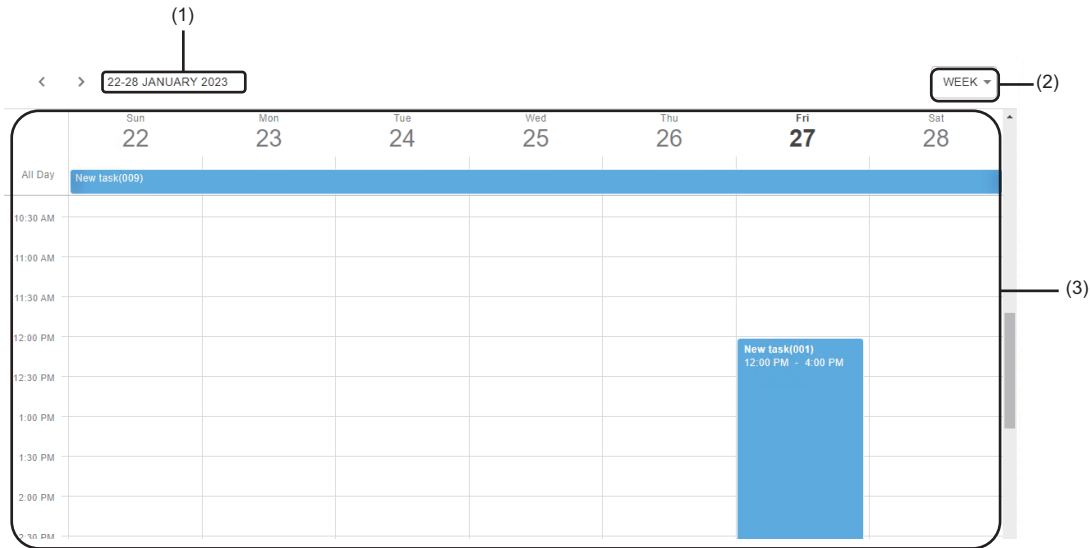
Calendar view

The execution schedule of tasks are displayed on a calendar.
 Tasks to be displayed on a calendar can be set in the screen shown in the following.
 Note that up to five tasks can be displayed at the same time.

☞ Page 527 Display setting

Window

Turn ON  (Calendar view) in the task management screen. (☞ Page 524 Task Management Screen)





Displayed items

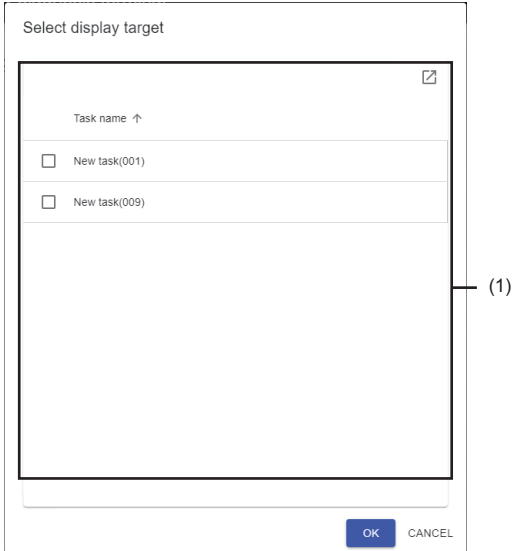
Item	Description
(1) Year and date	The year and date being displayed on a calendar is displayed. A small calendar is displayed by clicking the string. The year and date on a calendar can be changed by selecting a year and date on the small calendar.
(2) Display switching	The display format of a calendar can be switched between the week view (WEEK) or month view (MONTH).
(3) Week view	A calendar is displayed per week. By clicking a schedule, its detailed information can be checked on the tooltip.
(4) Month view	A calendar is displayed per month. By clicking a schedule, its detailed information can be checked on the tooltip.

Display setting



The following shows the screen for setting tasks to be displayed in the task management screen.

Window

Click  (Display setting) in the task management screen. ( Page 524 Task Management Screen)



Displayed items

Item		Description
(1) Select display target	—	Select the checkbox of a task to display its execution schedule on a calendar. (Up to five tasks)
	 (Expand)/ — (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header.  Page 56 Expanding the header
	Task name	A task name is displayed.

15.3 Starting and Stopping a Task

This section shows the procedures for starting and stopping a task.

Starting a task

The following shows the procedure for starting a task.

Operating procedure

1. Select a task to be started in the task management screen. (👉 Page 524 Task Management Screen)
2. Click ⋮ (Menu), and select [Start].

The execution status of the task becomes "READY."

It will be "RUN" when the set execution period starts. (👉 Page 224 Execution setting screen)

Name ↑	Execution status	Error status	Task type	AI	Comment
<input type="checkbox"/> New task(001)	STOP	Error	Advanced task	New AI(002)	
<input checked="" type="checkbox"/> New task(009)	STOP	Normal	Advanced task	New AI	

Stopping a task

The following shows the procedure for stopping a task.

Operating procedure

1. Select a task to be stopped in the task management screen. (👉 Page 524 Task Management Screen)
2. Click ⋮ (Menu), and select [Stop].

The execution status of the task becomes "STOP."

Name ↑	Execution status	Error status	Task type	AI	Comment
<input type="checkbox"/> New task(001)	STOP	Error	Advanced task	New AI(002)	
<input checked="" type="checkbox"/> New task(009)	RUN	Normal	Advanced task	New AI	

16 MONITOR

For details on the monitor, refer to the following:


☞ Page 467 MONITOR

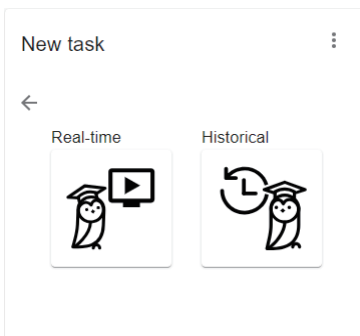
16.1 Starting a Monitor

The following shows the procedure to start a monitor.

Operating procedure

■ To monitor the status from the side bar

1. Click  (Monitor) on the side bar. (☞ Page 520 Side bar)
2. Select a task to be monitored in the task list screen.
☞ Page 531 Task List Screen
3. Select [Real-time] or [Historical].



● For a real-time monitor

Monitor a diagnosis result and execution status of the task in the real-time monitor screen.

☞ Page 534 Real-time monitor Screen

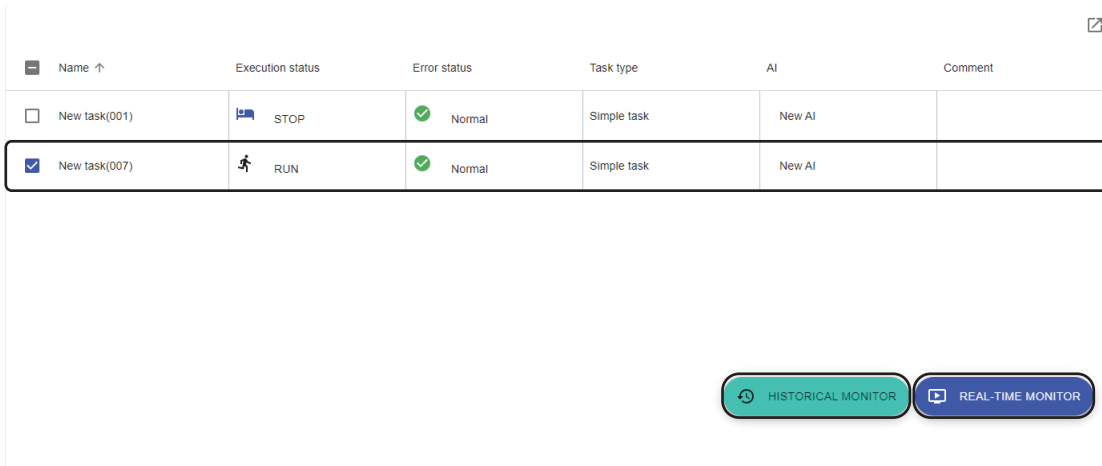
● For a historical monitor

Check the saved monitor data in the historical monitor screen.

☞ Page 535 Historical monitor Screen

■ To monitor from the task management screen

1. Select a task to be monitored in the task management screen. (📖 Page 524 Task Management Screen)
2. Click the [Historical monitor] button or the [Real-time monitor] button.



Name ↑	Execution status	Error status	Task type	AI	Comment
<input type="checkbox"/> New task(001)	🚩 STOP	✅ Normal	Simple task	New AI	
<input checked="" type="checkbox"/> New task(007)	🚶 RUN	✅ Normal	Simple task	New AI	

[HISTORICAL MONITOR](#) [REAL-TIME MONITOR](#)

● For a historical monitor

Check the saved monitor data in the historical monitor screen.

📖 Page 535 Historical monitor Screen

● For a real-time monitor



Monitor a diagnosis result and execution status of the task in the real-time monitor screen.

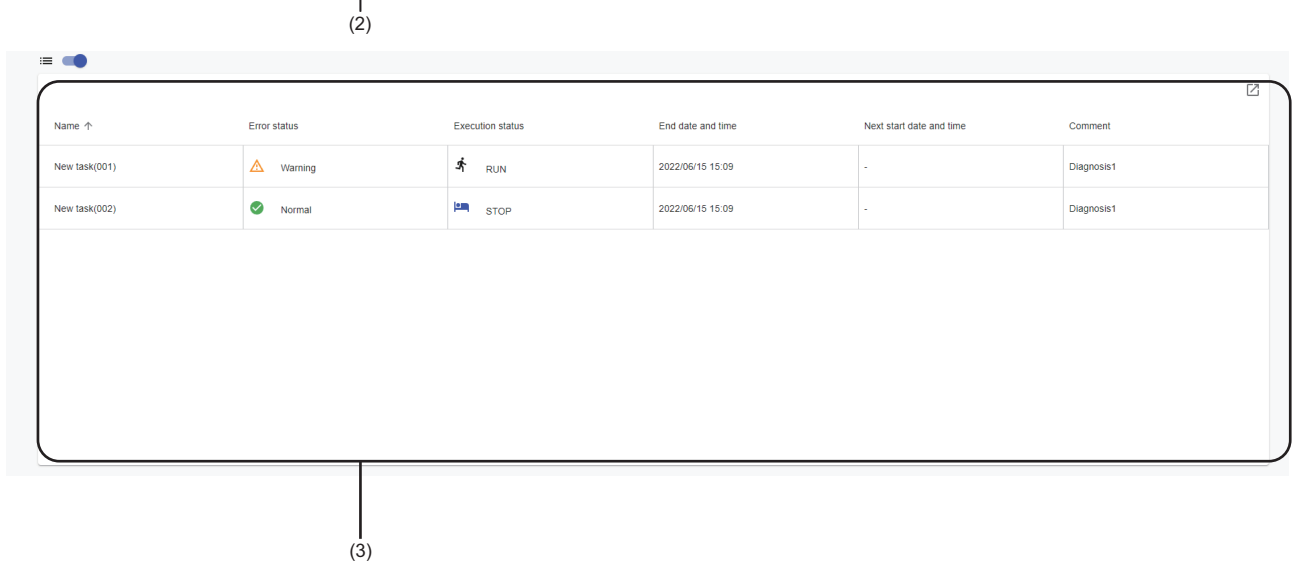
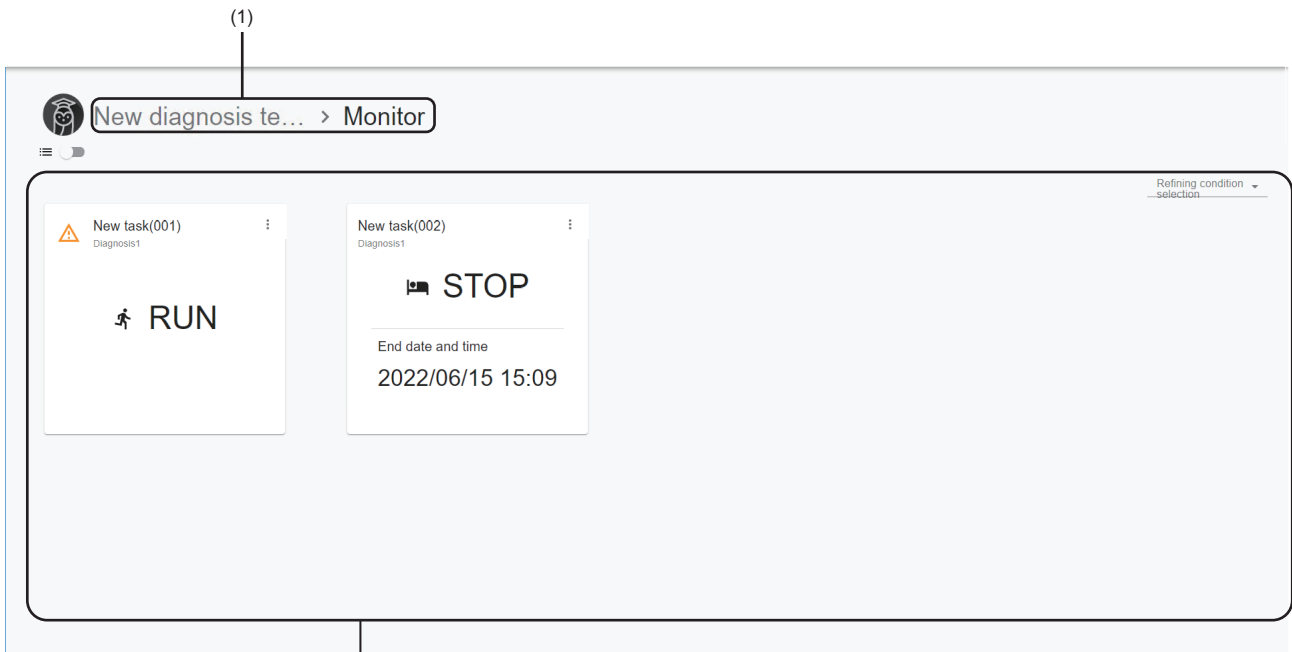
📖 Page 534 Real-time monitor Screen

16.2 Task List Screen



This section shows the screen for displaying the list of tasks on a target diagnosis terminal and the execution status of each task.



Window

Click  (Monitor) on the side bar. ( Page 520 Side bar)





Displayed items

Item	Description
(1) Breadcrumb bar	A breadcrumb bar is displayed. <ul style="list-style-type: none"> Diagnosis terminal name^{*1}>Monitor By clicking a diagnosis terminal name, the screen returns to the home screen. ( Page 523 Home screen)
 (List view)	Turn this ON to display tasks in the list format.

Item	Description
(2) Task list (widget format)	<p>Tasks are displayed in the widget format.</p> <p>For details on the widget, refer to the following:</p> <ul style="list-style-type: none"> ☞ Page 533 Task widget <p>By selecting a task and clicking [Real-time] or [Historical], a monitor screen opens in another tab.</p> <ul style="list-style-type: none"> ☞ Page 534 Real-time monitor Screen ☞ Page 535 Historical monitor Screen
Refining condition selection	<p>Select a condition to refine tasks to be displayed.</p> <p>When selecting multiple conditions, only tasks that satisfy all the conditions are displayed.</p> <p>■System status (only one selection available)</p> <ul style="list-style-type: none"> • Normal • Warning • Error <p>■Execution status (only one selection available)</p> <ul style="list-style-type: none"> • RUN • BOOT • SHUTDOWN • READY • STOP
(3) Task list (list format)	<p>Tasks are displayed in the list format by turning ON  (List view).</p> <p>By selecting a task, the real-time monitor screen opens in another tab.</p> <ul style="list-style-type: none"> ☞ Page 534 Real-time monitor Screen
 (Expand)/ – (Collapse)	<p>Click either of these to expand or collapse the header.</p> <p>Operations such as search can be performed by expanding the header.</p> <ul style="list-style-type: none"> ☞ Page 56 Expanding the header
Name	A task name is displayed.
Error status	<p>The current error status is displayed.</p> <ul style="list-style-type: none"> • Normal: No warnings or errors have occurred. • Warning: A warning has occurred.*²³ • Error: A task is stopped due to an error.*⁴
Execution status	<p>The execution status is displayed.</p> <ul style="list-style-type: none"> • RUN: Processing of a task is running. • BOOT: Processing to change from "READY" to "RUN" is in progress.*⁵ • READY: A task is started but the execution period has not started yet. • SHUTDOWN: Processing to change from "RUN" to "STOP" or "READY" is in progress.*⁶⁷ • STOP: A task is not started or it is stopped.*⁸ <p>The execution status restarts from "READY" in the following cases. (If the operations described below is performed during the execution period, the status changes from "READY" to "RUN.")</p> <ul style="list-style-type: none"> • When "Execution status" is "READY," "BOOT," or "RUN," the operating status of this product on a diagnosis terminal is changed to "Stop" then to "Run" again.
Task type* ⁹	A task type is displayed. (☞ Page 205 Task types)
AI* ⁹	<p>The name of an AI used in a task is displayed.</p> <p>"Multiple AI" is displayed when using multiple AIs.</p>
Number of AI used* ⁹	The number of AIs used in a task is displayed.
Diagnosis cycle [ms]* ⁹	A set diagnosis cycle is displayed in milliseconds. (☞ Page 224 Execution setting screen)
Task execution period* ⁹	A set execution period ("Always," "Date and time specification," or "Periodic") is displayed. (☞ Page 224 Execution setting screen)
End date and time	The date and time when a task was ended the last time is displayed.* ¹⁰ ¹¹
Next start date and time	The date and time to start a task the next time is displayed.* ¹¹ ¹²
Update date and time* ⁹	<p>The date and time when a task was updated is displayed.</p> <p>This item is not updated by editing a task name or comment.</p>
Creation date and time* ⁹	<p>The date and time when a task was created is displayed.</p> <p>For a task created as a copy, the date and time when the copy was created is displayed.</p>
Image* ⁹	Whether an image is set for a task is displayed.
Comment	A set comment is displayed.
Size [MB]* ⁹	The file size of a task is displayed.

*1 Only when any of the following conditions is satisfied on the learning station using this product with version 1.03D or later, the set diagnosis terminal name is saved on the diagnosis terminal. Otherwise, "Diagnosis terminal" is displayed.

- Registering the diagnosis terminal using this product with version 1.03D or later

- Changing properties of the diagnosis terminal using this product with version 1.03D or later
- Succeeding in communication with the diagnosis terminal using this product with version 1.03D or later
- *2 Once a warning occurs, this "Warning" state remains as long as "Execution status" of a task is "RUN."
- *3 This state is cleared when "Execution status" of a task changes from "RUN."
- *4 This state is cleared by performing the start operation for a task again.
- *5 Once the processing is completed, the status changes to "RUN."
- *6 Once the processing is completed, the status changes to "STOP" or "READY."
- *7 If an error occurs while the status is "RUN" or "BOOT" and then the status changes to "SHUTDOWN," only errors that occur while the status is "RUN" or "BOOT" are notified. Warnings and errors that occur while the status is "SHUTDOWN" are not notified.
- *8 Includes the case when a task is started but the next execution period does not exist.
- *9 Hidden by default. Click  (Expand) to expand the header, and switch the item to be shown as necessary.
 Page 56 Switching to show or hide
- *10 Displayed when the execution status of a task becomes "RUN" at least once after starting the task and currently "READY" or "STOP." Otherwise, "-" is displayed.
- *11 If the time (UTC) is different between Windows and the personal computer on which the task list screen is displayed, the actual execution timing may differ from the displayed content.
- *12 "-" is displayed when "Execution status" of a task is not "READY."

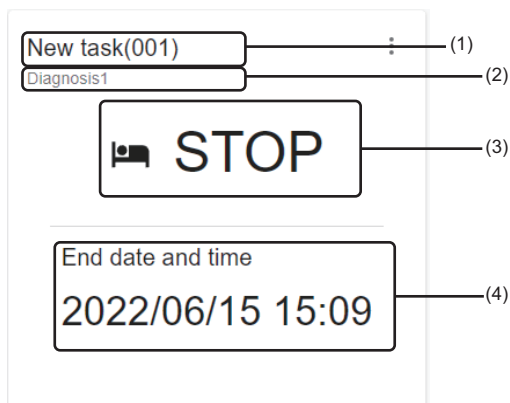
Task widget

The current status of a task is displayed.



Either of the following icons is displayed when an error or warning occurs:

- : Error
- : Warning

Window



Displayed items

Item	Description
(1) Task name	A task name is displayed.
(2) Comment	A set comment is displayed.
 (Menu)	Open the task management screen. ( Page 524 Task Management Screen)
(3) Operation status	The operation status of a task is displayed. <ul style="list-style-type: none"> • RUN: A task is running. • BOOT: A task is booting. • READY: A task is standing by. • SHUTDOWN: A task is shutting down. • STOP: A task is stopped. • Error end: A task is stopped due to an error.
(4) Date and time information*1	The start or end date and time for a task is displayed. <ul style="list-style-type: none"> • READY: The next start date and time is displayed. • STOP: The end date and time is displayed. • Error end: The date and time when a task was ended due to an error is displayed.

*1 Displayed when the execution status of a task is "READY" or "STOP."

16.3 Real-time monitor Screen

This section shows the screen for monitoring the diagnosis results and execution status of a task.

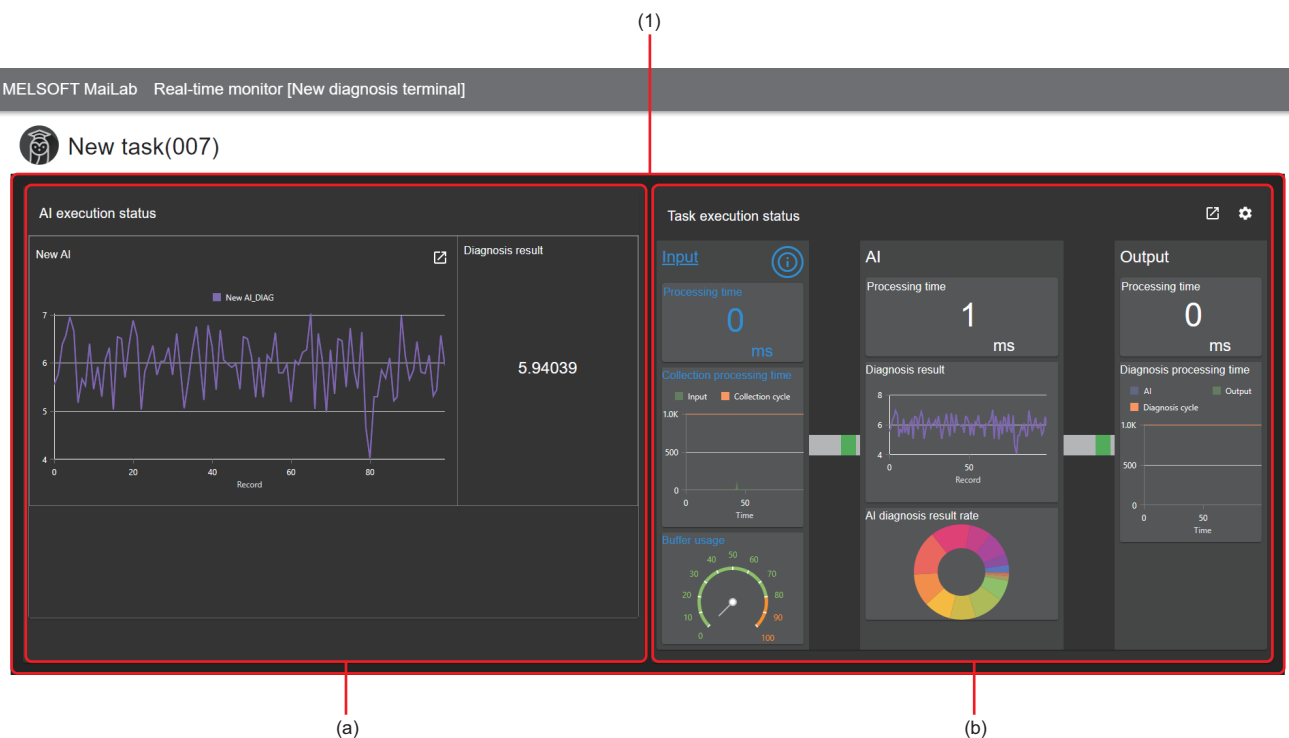
Restriction

Up to four real-time monitor screens can be displayed at the same time per user.

Window

- Select a task in the task list screen and click [Real-time]. (☞ Page 531 Task List Screen)
- Select a task in the task management screen, and click the [Real-time monitor] button. (☞ Page 524 Task Management Screen)

The real-time monitor screen opens in another tab.



Displayed items

Item	Description
(1) Monitoring dashboard	The diagnosis results and execution status of a task are displayed in the widget format. For details on the widget, refer to the following: (a) AI execution status monitoring widget: ☞ Page 494 AI execution status monitoring widget (b) Task execution status monitoring widget: ☞ Page 498 Task execution status monitoring widget

Point

Only when any of the following conditions is satisfied on the learning station using this product with version 1.03D or later, the set diagnosis terminal name is saved on the diagnosis terminal. Otherwise, "Diagnosis terminal" is displayed on the title bar.

- Registering the diagnosis terminal using this product with version 1.03D or later
- Changing properties of the diagnosis terminal using this product with version 1.03D or later
- Succeeding in communication with the diagnosis terminal using this product with version 1.03D or later

MELSOFT MaiLab Diagnosis terminal monitoring (Diagnosis terminal)

16.4 Historical monitor Screen

This section shows the screen for displaying the past diagnosis result.

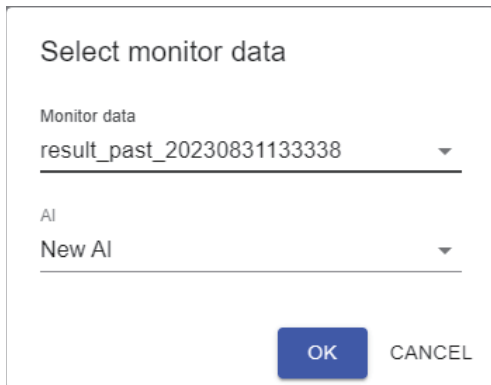
Operating procedure

1. Select a task in the task list screen and click [Historical]. (📄 Page 531 Task List Screen)

Alternatively, select a task in the task management screen, and click the [Historical monitor] button. (📄 Page 207 Task Management Screen)

The historical monitor screen opens in another tab.

2. Select monitor data*1 and AI.



Select monitor data

Monitor data
result_past_20230831133338

AI
New AI

OK CANCEL

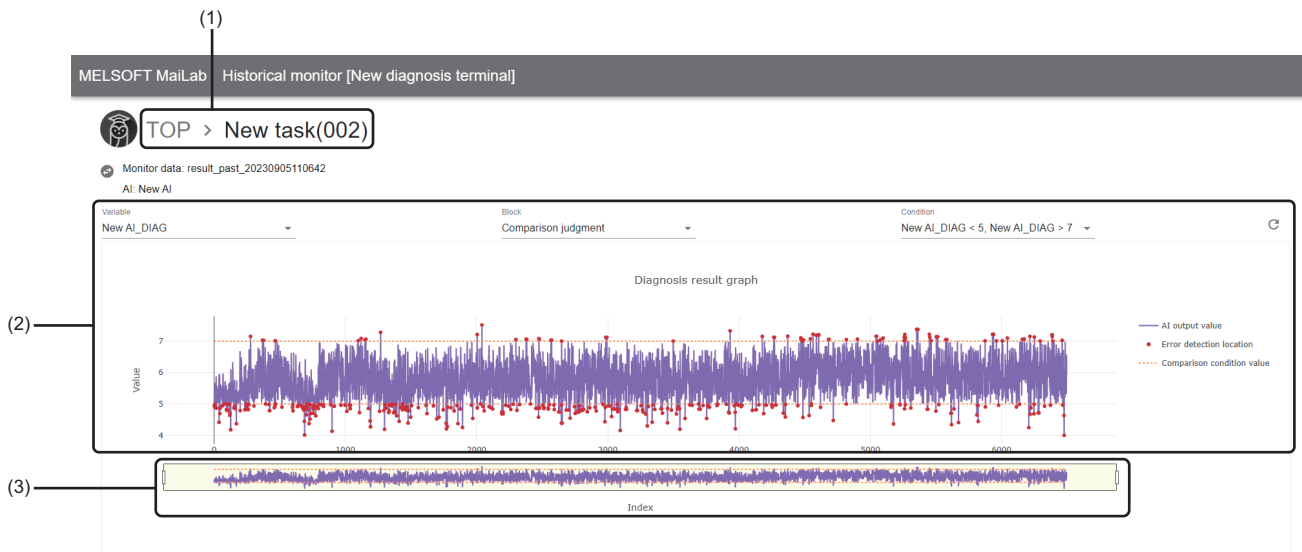
*1 Up to 1000 most recent current units of monitor data is displayed.

To display older monitor data older than that, leave 1000 units of monitor data to be displayed in a folder specified in the execution setting (📄 Page 224 Execution setting screen), and move other monitor data to another location.

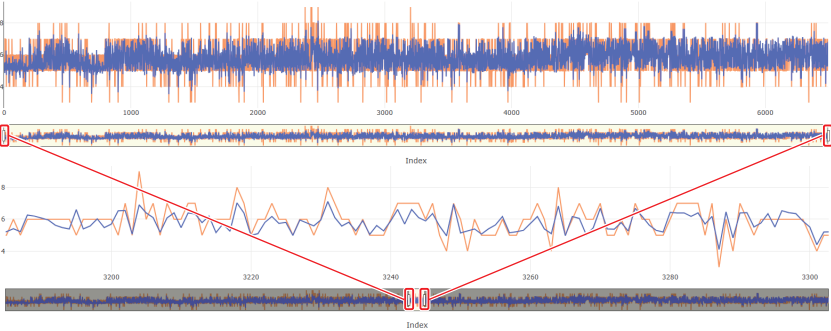
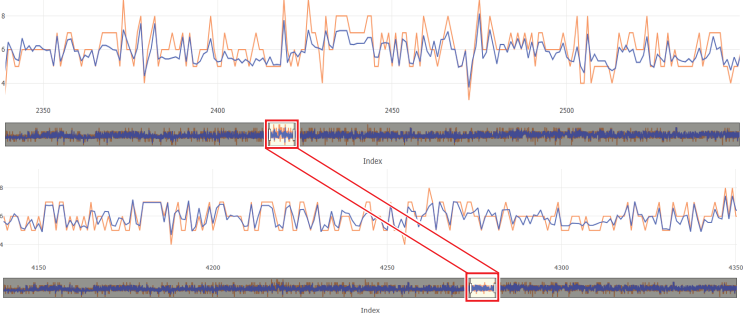
3. Check the diagnosis result.

By clicking a part to check the details, how much each variable value affects the diagnosis result can be displayed.

Page 538 Historical monitor details screen



Item	Description
(1) Breadcrumb bar	A current task name is displayed.
(Change monitor target)	Click this to display the "Select monitor data" screen and change the monitor data.
Monitor data	A name of the selected monitor data is displayed.
AI	A name of a selected AI is displayed.
(2) Diagnosis result graph	<p>A diagnosis result is displayed.</p> <p>A whole diagnosis result is displayed by default. The detailed transition of values can be checked by zooming in the graph.</p> <p>Displayed contents differ depending on the analysis method used by an AI.</p> <p>However, when a missing value (NaN) or infinity value (Inf) exists, the part is not drawn.</p> <p>■For similar waveform recognition The values of the inspection waveform, reference waveform, and similarity score of similar waveform recognition are displayed as line charts. A similarity score is displayed in a range of 0 to 100 regardless of the output value.</p> <p>■For other analysis methods The values of a diagnosis result are displayed as a line chart.</p> <p>When a comparison judgment block or SPC judgment block and its condition are selected in "Block" and "Condition," a diagnosis result is also displayed.^{*1}</p>
Variable ^{*2}	<p>A variable name displayed in a graph is displayed.</p> <p>■For an AI with an analysis method A variable to be displayed in a graph can be selected from the variable name list of a diagnosis result.</p> <p>■For an AI without an analysis method A variable to be displayed in a graph can be selected from the variable name list of the output results of an AI.</p>
Block ^{*2}	This can be selected when a comparison judgment block or SPC judgment block is used in an AI, and the judgment target variable exists in a graph. ^{*3}
Condition ^{*4}	<p>Select a condition to display a diagnosis result in a graph.</p> <p>Up to 10 conditions can be selected among the ones set in a block.</p>
(Update)	<p>Click this to update a diagnosis result to the latest one saved in a selected monitor data.</p> <p>In addition, click this to update the display when changing "Variable," "Block," and "Condition."</p>

Item	Description
(3) Display range slider	<p>By dragging the slider, the display range of a graph changes.</p>  <p>By dragging the range in the slider, the display area of a graph moves while the width is maintained.</p> 

- *1 For a comparison judgment block, only when a comparison target set in a condition is a constant or variable included in output results of an AI, a comparison condition value is displayed.
- *2 Not displayed for an AI that uses similar waveform recognition.
- *3 A block at the beginning in ascending order of the corresponding block names is selected in the default.
- *4 Displayed when selecting a block.

Historical monitor details screen

The diagnosis contribution ratio, which indicates how much each variable affects a diagnosis result is displayed.

A hint for assumption of the causes of a diagnosis result and feedback for the production sites can be obtained by comparing or checking the diagnosis contribution ratio and variable value.

Ex.


Check the diagnosis contribution ratio of the error data, and adjust an equipment so that the value of a variable with high contribution ratio is close to the normal data.

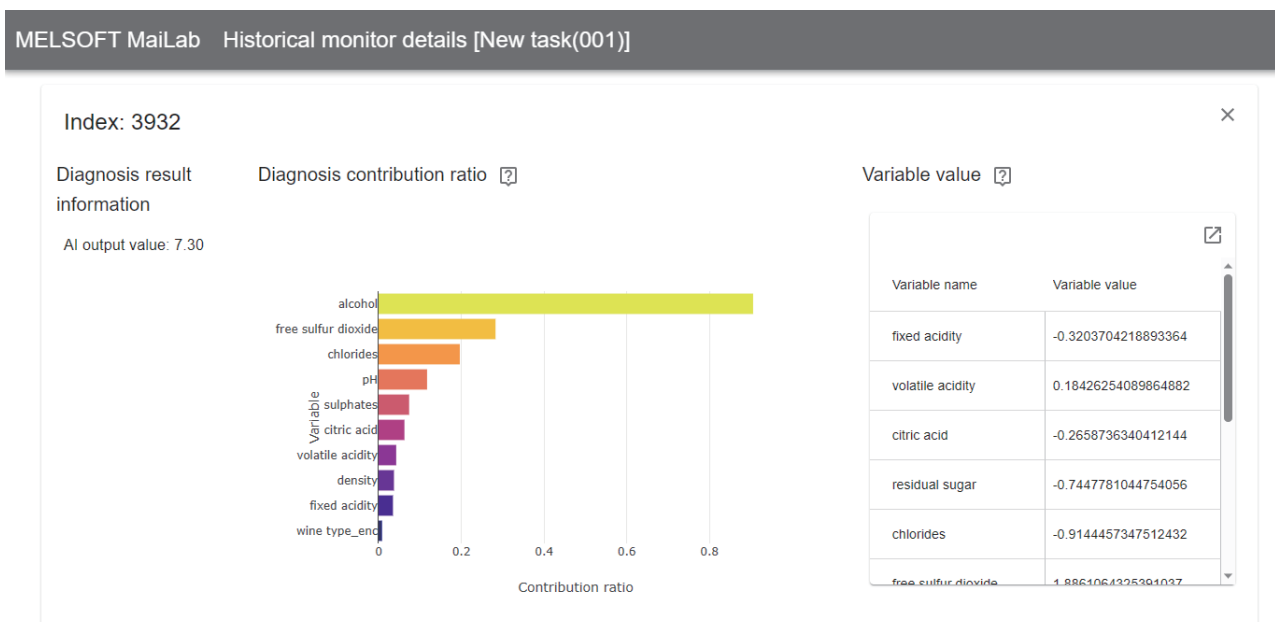
Precautions

- An AI that uses similar waveform recognition cannot be supported.
- When displaying the historical monitor details screen, diagnosis processing of the target AI is executed for calculating the diagnosis contribution ratio.


For an AI that uses a Python block (including the processing to access or change an external file), an external file may be accessed or changed at the timing when the diagnosis contribution ratio is displayed.

Window

Click a part to check the details in a diagnosis result graph. ( Page 535 Historical monitor Screen)



Displayed items

Item	Description
Index	An index value is displayed.
Diagnosis result information	AI output value A value of a variable selected for "Variable" in the historical monitor screen is displayed.  Page 535 Historical monitor Screen
Diagnosis contribution ratio ^{*1}	The contribution ratios of up to top 10 explanatory variables of which contribution ratio is '0' or more are displayed as a horizontal bar chart graph. ^{*2} Whole data is displayed by default. The detailed distribution of values can be checked by zooming in a scatter plot.
Variable value ^{*1}	Variable name
	Variable value

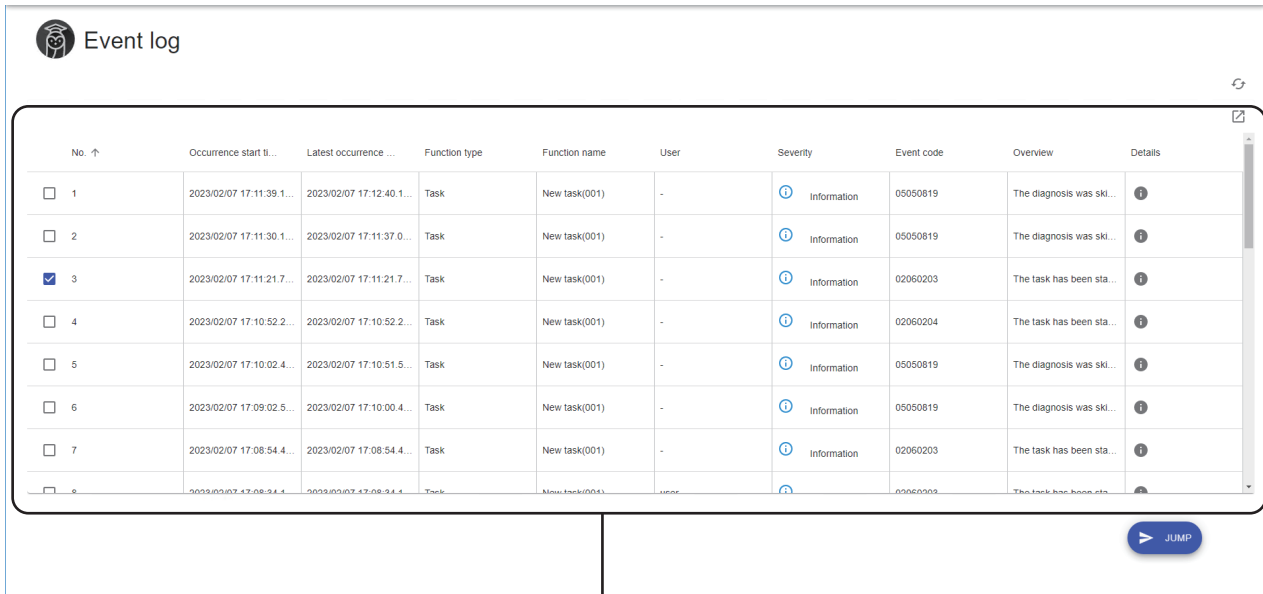
- *1 Displayed for an AI that satisfies all the following conditions:
 - AI that completes learning in this product with version 1.05F or later
 - AI with an analysis method
 - AI does not use a guard band block
 - AI does not use a section generation block (when multiple AIs are included in a task, a section generation block is not used in all AIs)
- *2 When an MT method block or autoencoder block is used in an AI, for a category type variable, the displayed variable name or value may not match with the data set.

17 EVENT LOG CHECK

This chapter shows the screen for checking event logs such as for errors that occur on a diagnosis terminal. Up to 10000 event logs are saved. If the number of event logs exceeds 10000, logs are deleted in chronological order.

Window

Click the [View event log list] button in the notification list. (☞ Page 521 Notification list)



(1)

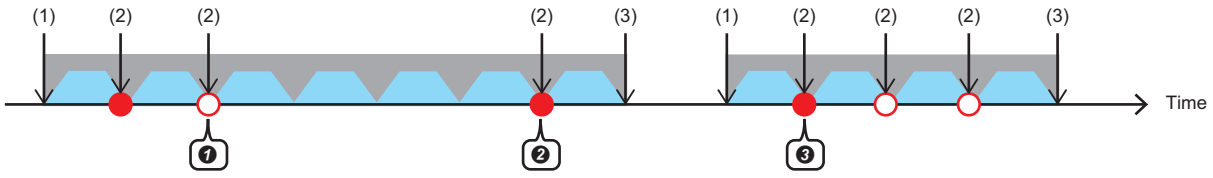
Displayed items

Item	Description
(Update)	Click this to update the list of event logs.
(1) Event log list	Event logs that occur on a diagnosis terminal are listed. Multiple event logs cannot be selected.
(Expand)/ (Collapse)	Click either of these to expand or collapse the header. Operations such as search can be performed by expanding the header. ☞ Page 514 Expanding the header
Occurrence start time	The time when an event occurred for the first time is displayed.
Latest occurrence time	The time when an event occurred the last time is displayed.
Function type	The type of a function where an event occurred is displayed. "Unsupported function" is displayed when an event for a function that is not supported by the learning station occurred on a diagnosis terminal.
Function name	The name of a function where an event occurred is displayed. "-" is displayed when a function name does not exist.
User	The name of a user who was using the function where an event occurred is displayed. "-" is displayed when a user name does not exist.
Severity	The severity of an event is displayed. <ul style="list-style-type: none"> : Information : Warning : Error
Event code	An event code is displayed.
Overview	The overview of an event is displayed.
Details	Click the icon displayed in this column to display the details on an event.
[Jump] button ^{*1}	Click this to display the page for a selected function where an event occurred in another tab.

*1 Displayed when an event is selected in the event log list and also the jump destination for the selected event exists.

Precautions

- If an event with the same event code occurs twice or more in the continuous diagnoses from when a task is started until when it is stopped, the second and later events are not added but the latest occurrence time of the first event is updated instead. (An event with the same code is added if it does not occur in the continuous diagnoses or it occurs after a task is stopped once then restarted.)



No.	Occurrence start time	Latest occurrence time
<input type="checkbox"/> 1	2020-11-11 10:10.111	2020-11-11 10:40.111
<input type="checkbox"/> 2	2020-11-11 09:09.111	2020-11-11 09:09.111
<input type="checkbox"/> 3	2020-11-11 08:08.111	2020-11-11 08:15.111



- : Event that is added as an event log
- : Event that is not added as an event log but updates the latest occurrence time

- ▲ : One diagnosis
- : Task execution time

(1) A task is executed.

(2) Event 1 occurs.

(3) The task is stopped.

❶ The event occurs in the continuous diagnoses; therefore, only the latest occurrence time is updated.


❷ The event does not occur in continuous diagnoses; therefore, it is newly added.

❸ The event occurs after the task is stopped once then restarted; therefore, it is newly added (then, the latest occurrence time is updated).

18 PERSONAL SETTINGS


This chapter shows the screen for changing personal settings for a signed-in user.

Window

Click a user name on the main bar, and select [User setting]. ( Page 520 Main bar)

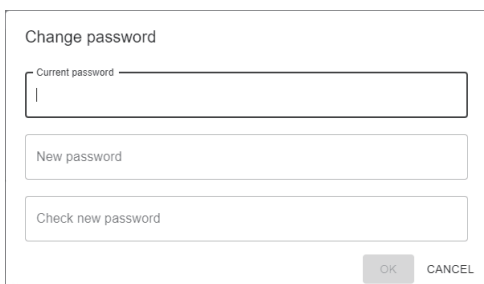


Displayed items

Item	Description
Display language	Switch a display language. The language of a web browser used when a user was signed in is set by default. (English is set when a language of the web browser was not Japanese, English, or Chinese.) The change of the display language is applied immediately. However, it is not applied to a screen that is opened in a tab different from the one where the personal setting screen is opened until the display contents of the screen are updated.
Guide message	Turn this ON to display guide messages.
Password	Click the [Change password] button to change a password.  Page 542 Changing a password

Changing a password

The following shows the screen for changing a password.



Item	Description
Current password	Enter the current password.
New password	Set a new password (8 to 64 characters).
Check new password	Enter the password again for verification.

Point

When a password is changed, a user is signed out.

MEMO

This part explains the troubleshooting of MELSOFT MaiLab.

19 TROUBLESHOOTING BY SYMPTOM

19 TROUBLESHOOTING BY SYMPTOM

If this product does not run properly, check the applicable items in the following and troubleshoot the error.




19.1 Learning Station

This section shows the troubleshooting on using this product on a learning station.


Common

Symptom	Check item	Corrective action
Unable to access a file/folder.	Is the network highly loaded?	Refer to the manual for the personal computer and reduce the load on the network.
	Is it written on the Windows system drive?	Change the writing destination drive.
	Does the file path exceed 259 characters?	Set the file path to save, export, read, or import data within 259 characters.
	Is the path of the access target an external folder such as a shared folder?	Check whether the external folder is accessible.
	Is there sufficient free space on the drive?	Secure free space on the drive.


Installation of this product

Symptom	Check item	Corrective action
Fails to install this product.	Is the operating system of a personal computer attempting the installation supported?	Install this product on a personal computer with a supported operating system.  MELSOFT MaiLab Installation Instructions
	Is there sufficient free space on the installation destination drive?	Delete files on the drive to secure free space required for installation.  MELSOFT MaiLab Installation Instructions
	Is another installer running?	Wait for the installation to be completed, then install this product again.  MELSOFT MaiLab Installation Instructions
Fails to install Google Chrome.	Is Google Chrome already installed?	Failing to install Google Chrome does not affect the installation of this product. Use this product in Google Chrome that is already installed.

Registration of a license

Symptom	Check item	Corrective action
Unable to register a license.	Is the license file for another personal computer specified?	Register the correct license file that is issued for the personal computer in use.  Page 26 License Manager
	After registering the license file for the first time to the personal computer in use, is the date and time changed and is the time on Windows shifted before the license issue date and time?	Change the time on Windows to the time after the license issue date and time.
	Is an Ethernet port on the personal computer or a wireless LAN disabled?	Enable the Ethernet port or wireless LAN.
	Is an external Ethernet adapter in use removed?	Connect the external Ethernet adapter.
	After registering the license file for the first time to the personal computer in use, is the date and time changed and is the time on Windows shifted forward or backward for 24 hours or more?	Contact your local Mitsubishi Electric sales office or representative to acquire a new license, and register the license.

Operation start of this product

Symptom	Check item	Corrective action
The operating status of this product on the learning station or a diagnosis terminal does not switch to RUN.	Is any of the licenses valid?	Check the license statuses in License Manager.
	Is the server certificate valid?	Execute 'install_cert.bat' in the MailLabCert folder with an administrator authority to install the server certificate in the operating environment. Then, start the operation of this product. <ul style="list-style-type: none"> Storage location: (Installation destination of this product)\MailLabCert
	Is the port number used by another application?	Review the port number in the connection settings of the setting management tool.
	Is the set IP address correct?	Set the IP address that exists on the operating environment in the connection settings of the setting management tool.
	Is the set IP address available?	<ul style="list-style-type: none"> Contact the network administrator to check whether the IP address is available. When using this product as a standalone product, change the IP address to '127.0.0.1' in the connection settings, then try again.
	Is a proxy server used?	<ul style="list-style-type: none"> If multiple network adapters are enabled, set an IP address connectable to the proxy server in the connection settings of the setting management tool. When a proxy server is not required for the IP address set in the connection settings of the setting management tool, set an exception in the proxy settings in the internet options. Select [Internet Options] ⇒ [Connections] tab ⇒ [LAN settings] ⇒ [Advanced] in the control panel of Windows, and specify the IP address set in the connection settings of the setting management tool as an exception.
	Is the load on the personal computer high?	<ul style="list-style-type: none"> Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications. Install this product on a personal computer that satisfies requirements and recommendations for the operating environment.  IMELSOFT MailLab Installation Instructions
	Is a non-ASCII character used in the name of the folder where the installer is stored?	Move the installer to a folder of which the name consists of ASCII characters only, then install this product again.
	Is Windows Defender enabled?	Install antivirus software, then disable Windows Defender.

Display in a web browser

Symptom	Check item	Corrective action
A message indicating that a URL cannot be found, such as 'Can't open this page,' is displayed in a web browser when attempting to open the operation screen in the case where an operation terminal and learning station are built in the same environment.	Is the operation screen attempted to be opened immediately after starting the personal computer?	Close the web browser once, then open the operation screen again after a few minutes. ☞ Page 31 Opening the Operation Screen (Learning Station)
	Is the port number to be used for this product already used by another application on the personal computer?	Change the port number to unused one in the setting management tool. ☞ Page 37 Setting Management Tool (Learning Station)
	Is a proxy server used?	<ul style="list-style-type: none"> If multiple network adapters are enabled, set an IP address connectable to the proxy server in the connection settings of the setting management tool. When a proxy server is not required for the IP address set in the connection settings of the setting management tool, set an exception in the proxy settings in the internet options. Select [Internet Options] ⇒ [Connections] tab ⇒ [LAN settings] ⇒ [Advanced] in the control panel of Windows, and specify the IP address set in the connection settings of the setting management tool as an exception.
A message indicating that a URL cannot be found, such as 'Can't open this page,' is displayed in a web browser when attempting to open the operation screen in the case where an operation terminal and learning station are built in different environments.	Is the URL for opening the operation screen correct?	Acquire the correct URL in the setting management tool. ☞ Page 37 Setting Management Tool (Learning Station)
	Is the personal computer where this product is installed running?	Start the personal computer.
	Is the operation screen attempted to be opened immediately after starting the personal computer where this product is installed?	Close the web browser once, then open the operation screen again after a few minutes. ☞ Page 31 Opening the Operation Screen (Learning Station)
	Is the port number to be used for this product already used by another application in the personal computer where this product is installed?	Change the port number to unused one in the setting management tool. ☞ Page 37 Setting Management Tool (Learning Station)
	Is a proxy server used?	<ul style="list-style-type: none"> If multiple network adapters are enabled, set an IP address connectable to the proxy server in the connection settings of the setting management tool. When a proxy server is not required for the IP address set in the connection settings of the setting management tool, set an exception in the proxy settings in the internet options. Select [Internet Options] ⇒ [Connections] tab ⇒ [LAN settings] ⇒ [Advanced] in the control panel of Windows, and specify the IP address set in the connection settings of the setting management tool as an exception.
A message indicating that communication is not secure, such as 'privacy is not secured' or 'connection is not private,' is displayed.	Is the server certificate installed in the environment where operations are currently performed?	Install the server certificate of the learning station in the environment. ☞ Page 32 Installing a server certificate
	Is the IP address of the learning station changed?	Install the server certificate of the learning station created after the IP address was changed in the environment where operations are currently performed. ☞ Page 32 Installing a server certificate
A screen turns white and nothing is displayed.	Does it take time to display the screen?	Wait for a while. If it is still not displayed, reload the page by using the web browser function.
	Is the web browser supported?	Use a supported web browser. ☞ Page 17 Operation terminal
	Does it take time to execute a Python block?	Open the setting management tool, stop the operation of this product, then start the operation again.

Symptom	Check item	Corrective action
A screen is not refreshed with the set or created contents.	Does it take time to display the screen?	Wait for a while. If it is still not displayed, reload the page by using the web browser function.
	<ul style="list-style-type: none"> Is the network in use switched during operation? Is the communication environment stable? 	Wait for a while. If it is still not displayed, reload the page by using the web browser function. If the same symptom often occurs, operate this product in the stable communication environment where the network is not switched frequently.
	Does it take time to execute a Python block?	Open the setting management tool, stop the operation of this product, then start the operation again.
The project management screen is displayed with a specified URL.	<ul style="list-style-type: none"> Is the URL specified directly in a web browser? Is a page other than the sign-in screen specified for a shortcut or the favorites function? 	Open a target data set or AI from the management screen for each function.  Page 86 Data Set Management Screen  Page 137 AI Management Screen
The display language is different from the one displayed used when installing this product.	Is this product used for the first time after the installation?	Sign in to this product, then change the display language in the personal settings.  Page 515 PERSONAL SETTINGS
The sign in information is not retained.	Is the web browser set to not use Cookie?	Enable Cookie in the web browser settings.
	Was Cookie deleted in the web browser settings while using this product?	Sign in again. In addition, do not delete Cookie while using this product.
Contents in the screen are not displayed properly. (For example, overlapping of icons, text overflowing from the frame of a button, etc.)	Is a value other than 100% set for "Change the size of text, apps, and other items" in Windows?	Change the value to 100%. ^{*1}
	Is the zoom level set to a value other than 100% in the web browser?	Set an appropriate zoom level. ^{*1}
Displayed screens or items are different from the ones shown in this manual.	Is old browsing data cached in the web browser?	Delete browsing data cached in the web browser, and display the screen again.
The screen is not displayed properly (for example, an unexpected error occurs).	Can operations proceed in the screen?	<ul style="list-style-type: none"> Reload the page by using the web browser function. Alternatively, restart the web browser. Delete browsing data cached in the web browser, and display the screen again.
	Are there any problems with communication of the learning station and diagnosis terminal?	<ul style="list-style-type: none"> Check that this product is running. Review the route to the learning station and diagnosis terminal.
	Is there sufficient free space on the drive of the learning station and diagnosis terminal?	Delete unnecessary files to secure free space on the drive.
	Is the load on the learning station and diagnosis terminal high?	Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product.
	Is antivirus software interfering with this product?	Change settings of the antivirus software to exclude the following folder from the virus search targets: <ul style="list-style-type: none"> C:\ProgramData\MELSOFT\MaiLab
	Is the error cleared after taking the above corrective actions?	Contact your local Mitsubishi Electric sales office or representative.
An error message indicating that memory in a web browser is insufficient is displayed.	Are multiple tabs opened?	Close unnecessary tabs.
	Is there sufficient free space on the memory of the operation terminal?	Reduce the load by closing other applications.
Unable to sign in because a sign-in password is forgotten.		<ul style="list-style-type: none">  To sign in as a standard user Sign in to this product as the administrative user, and change the password of the target user in the user management screen.  Page 54 User management screen  To sign in as the administrative user Uninstall this product from the learning station, then install this product again.  MELSOFT MaiLab Installation Instructions

*1 When setting 100% for "Change the size of text, apps, and other items" in Windows, the contents in the screen are displayed properly with the display resolution of 1920 × 1080 px.

In other cases, the contents in the screen may not be displayed properly depending on the zoom level of a web browser.

The following shows the recommended zoom level for each display resolution:

Zoom: 75%, display resolution: 1024 × 768 px or more

Zoom: 75%, display resolution: 1280 × 800 px or more

Zoom: 75%, display resolution: 1280 × 1024 px or more

Zoom: 100%, display resolution: 1920 × 1080 px or more (recommended)

Registration and management of a diagnosis terminal

Symptom	Check item	Corrective action
Diagnosis terminals are not displayed in the diagnosis terminal list.	Is the learning station changed?	Register diagnosis terminals again on the new learning station. 📖 Page 61 Diagnosis terminal management screen
Unable to register a diagnosis terminal.	Is the diagnosis terminal already in the list of diagnosis terminals?	Use the registered diagnosis terminal.
	Is a diagnosis terminal that exists on the local host in the list of diagnosis terminals?	Open the setting management tool, stop the operation of this product, then start the operation again.
	Was the diagnosis terminal registered on the learning station before?	Delete project data in the setting management tool on the diagnosis terminal.
	Do the input destination address and port number match with the ones of the diagnosis terminal?	Input the destination address and port number set in the setting management tool on the diagnosis terminal.
	Is the version of this product on the learning station older than the one on the diagnosis terminal?	Upgrade the version of this product on the learning station to be the same as or later than the one on the diagnosis terminal.
A diagnosis terminal cannot be connected after updating.	Is the version of this product on the learning station older than the one on the diagnosis terminal?	Upgrade the version of this product on the learning station to be the same as or later than the one on the diagnosis terminal.

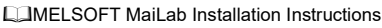


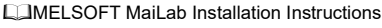
Creation and management of a project


Symptom	Check item	Corrective action
Fails to create, import, or export a project.	Is there sufficient free space on the drive of the learning station?	Secure free space on the drive. 📖 MELSOFT MaiLab Installation Instructions
	Is the network highly loaded?	Refer to the manual for the personal computer and reduce the load on the network.
A created project is not displayed in the management screen.	Does a signed-in user have the access right to the project?	Sign in to this product as the administrative user, and set users that can access the project in the project management screen. 📖 Page 69 Project Management Screen
'Unable to open the project.' is displayed though another user is not signed in.	Did another user close a web browser or shut down a personal computer while remaining signed in?	Ask the user to sign in again. Alternatively, open the project again after up to 15 minutes.


Creation and management of a data set

Symptom	Check item	Corrective action
Fails to upload a data source.	Is there sufficient free space on the drive of the learning station?	Secure free space on the drive. 📖 MELSOFT MaiLab Installation Instructions
Fails to complete creating a data set.	Does any of the variables in the data set include both a numerical value and character string?	Change the type of such variable to category. 📖 Page 102 Data check
Fails to download a data set.	Is the operating system used on the learning station different from the one used on an operation terminal?	Download a data set by accessing from an operation terminal using the same kind of operating system as the learning station.

Creation and management of an AI

Symptom	Check item	Corrective action
Learning stops due to an error.	Is an error output as an event log?	Check "Corrective action" for the event log, and clear the error.
	Is any of the extension blocks in the error state?	Click the error icon on the extension block to check the description, and clear the error.
	Does a numerical value type variable include a value close to the boundary value for the numerical values available in this product?	<ul style="list-style-type: none"> Review the data being used. Modify the numerical value type variable with a preprocessing block so that it does not include a value close to the boundary value.
	Is the load on the personal computer high?	<ul style="list-style-type: none"> Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product. Install this product on a personal computer that satisfies requirements and recommendations for the operating environment. 
When an unexpected error occurs, check the following:  Page 552 When an unexpected error occurs		
A value is predicted in spite of intending to classify a class. A class is predicted in spite of intending to predict a value.	Is the type of a variable to be predicted changed?	Edit the data set to be learned in the data set management screen so that the type of a variable to be predicted is set as follows: <ul style="list-style-type: none"> To classify a class: Category To predict a value: Numerical value  Page 86 Data Set Management Screen
Fails to save the AI editor screen.	Is the editor screen for the same AI opened in multiple windows at the same time?	Close all the windows, and open the editor screen again in one window only.
	Is the learning station offline?	Connect the terminals to display a web browser on the same network as the learning station.
The operation is slow while learning.	Is the load on the personal computer high?	<ul style="list-style-type: none"> Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product. Install this product on a personal computer that satisfies requirements and recommendations for the operating environment. 
An unexpected error occurs in the preview screen.	Is any of the blocks in the error state in the AI editor screen? ^{*1}	Click the error icon on the block to check the description, and clear the error.
	Does an error occur when learning?	Check "Corrective action" for the event log, and clear the error.
	Is the error cleared after taking the above corrective actions?	Contact your local Mitsubishi Electric sales office or representative.
An error occurs in a dimensionality compression block, and 'Please review the data to be used.' is displayed.	Does the input of the dimensionality compression block include a value close to the maximum or minimum value that is available in this product?	Standardize a variable with a scaling block before inputting the variable to the dimensionality compression block.
The property screen of a section generation block or sub-section forming block is not updated, or an error is displayed in a web browser.	Are there too many points to be drawn?	Reduce the number of variables or sections to be displayed.
	Is there sufficient free space on the memory of the learning station and diagnosis terminal?	Close other applications.

Symptom	Check item	Corrective action
Fails to test an AI.	Has an error occurred in a Python block or its next block?	Check whether processing that causes an error is described in the script of a Python block. If not, refer to the following:  Has an error occurred in a Python block or its next block?
	Has an error occurred in any blocks?	Check whether the settings of any blocks result in the following conditions or whether any data sets that result in the following conditions are used: <ul style="list-style-type: none"> • A value becomes too large during processing. • A value becomes too small during processing. • The number of missing values increases during processing.
	Has an error occurred in a section generation block?	Check whether the settings of any blocks result in the following conditions or whether any data sets that result in the following conditions are used: <ul style="list-style-type: none"> • The number of records in one section is too large. • The number of records in one section is too small. • The number of sections is too large. • The number of sections is too small.

*1 If no blocks are in the error state, click  (Update).

■When an unexpected error occurs

No.	Check item	Corrective action
1	Is there sufficient free space on the memory area of the learning station?	<ul style="list-style-type: none"> • Close other running applications. • If there is another AI that is learning, wait until the AI completes learning. • If a task is executed on the local host diagnosis terminal, stop the running task. • Increase the virtual memory size and physical memory size on the learning station. • Reduce the number of records for data to be used for learning.
2	Is there sufficient free space on the hard disk area of the learning station?	Delete unnecessary files.
3	Are there sufficient input records and variables?	Use a data set with more records and variables.
4	Are the specified variable type and data set type of a data set appropriate?	Open a data set in use, and change the data set type and variable type to appropriate ones in the data check screen.
5	Are the variables that are not used, such as an ID, set as ones not to be used in the settings for a data set?	Open the data set in use, and change the setting of 'use of a variable' for the variable to "Not use" in the data check screen.
6	Is a too large or small value included?	Perform the following procedure: <ol style="list-style-type: none"> ① Open a data set or the preview screen for a block previous to the one where an error has occurred. ② Check the maximum and minimum values in the data overview. ③ Change the setting of 'use of a variable' for the variable to "Not use." ④ If the variable is the one newly added by a block such as a preprocessing block, delete its settings.
7	Does an input include any variables that have almost the same value?	Perform the following procedure: <ol style="list-style-type: none"> ① Open a data set or the preview screen for a block previous to the one where an error has occurred. ② Check whether there is a variable that has a lot of same values in a histogram. ③ Change the setting of 'use of a variable' for the variable to "Not use." ④ If the variable is the one newly added by a block such as a preprocessing block, delete its settings.
8	Are a lot of unnecessary variables which can be noise for learning included?	Perform the following procedure: <ol style="list-style-type: none"> ① Open a data set or the preview screen for a block previous to the one where an error has occurred. ② Check whether there is a variable of which the correlation value to a target variable is almost '0' in a correlation matrix heat map. ③ Change the setting of 'use of a variable' for the variable to "Not use." ④ If the variable is the one newly added by a block such as a preprocessing block, delete its settings.
9	Is an AI set to include a value of No.6, 7, or 8 in the waveform data modification setting or preprocessing block?	Check the screen for the waveform data modification setting or the preview screen for a preprocessing block, and delete the settings for the variable.
10	Is a useful waveform feature extracted by the settings of section generation or section feature generation?	Change settings in the setting screen for section generation or section feature generation to extract a feature that becomes a waveform feature.

Creation, management, and execution of a task

Symptom	Check item	Corrective action
Fails to create a task.	Is there sufficient free space on the drive of a diagnosis terminal?	Secure free space on the drive.  MELSOFT MaiLab Installation Instructions
A diagnosis terminal is not displayed.	Is the diagnosis terminal displayed in the diagnosis terminal management screen?	Add the diagnosis terminal in the diagnosis terminal management screen.  Page 61 Diagnosis terminal management screen
	Is the diagnosis terminal offline?	Connect the diagnosis terminal on the same network as the learning station.
Unable to perform a diagnosis.	Has an error occurred in a Python block or its next block?	<ul style="list-style-type: none"> • Check whether the name or argument of a function prepared by default changed. • Check the reference of Python or a library used, and check whether it is used correctly. • Check whether the format of data to be output differs between the script used when learning and the one used when executing a task due to an operation such as addition or deletion of a variable. • Contact your local Mitsubishi Electric sales office or representative.
	Has an error occurred in a dimensionality compression block?	A missing value may be included in input data; therefore, place a missing value processing block previous to the dimensionality compression block to exclude the missing value.
	Is an error output as an event log?	Check "Corrective action" for the event log, and clear the error.
	Is any of the extension blocks in the error state?	Click the error icon on the extension block to check the description, and clear the error.
	Does a numerical value type variable include a value close to the boundary value for the numerical values available in this product?	<ul style="list-style-type: none"> • Review the data being used. • Modify the numerical value type variable with a preprocessing block so that it does not include a value close to the boundary value.
	Is an AI output result displayed in the real-time monitor screen?	Check the settings for an input data stream and the execution conditions of an AI execution block, and correct them as necessary.  Page 368 Input data stream block  Page 442 AI execution block
	Is there sufficient free space on a drive specified as the storage destination for files of diagnosed data?	Delete or move files on the storage destination drive periodically to secure free space on the drive.
	Is the load on the personal computer high?	<ul style="list-style-type: none"> • Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product. • Install this product on a personal computer that satisfies requirements and recommendations for the operating environment.  MELSOFT MaiLab Installation Instructions
Fails to save the task editor screen.	Is the editor screen for the same task opened in multiple windows at the same time?	Close all the windows, and open the editor screen again in one window only.
	Is the learning station offline?	Connect the terminals to display a web browser on the same network as the learning station.
	Is the target diagnosis terminal offline?	Connect the diagnosis terminal on the same network as the learning station.
An error occurs in property settings in the task editor screen.	Has displaying preview failed in property settings of an SPC judgment block?	 Unable to perform a diagnosis.
The operation is slow while diagnosing.	Is the load on the personal computer high?	<ul style="list-style-type: none"> • Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product. • Install this product on a personal computer that satisfies requirements and recommendations for the operating environment.  MELSOFT MaiLab Installation Instructions

Symptom	Check item	Corrective action
An assigned task remains as an unregistered one in an unregistered task group though the task is added to the tasks on the assignment destination diagnosis terminal.	Is the diagnosis terminal name in the list displayed as the detailed information on an event which occurs when a diagnosis terminal is disconnected while assigning tasks?	The assignment is properly completed, and the task has no problems with its performance; therefore delete the unassigned task.

Mitsubishi Electric FA connector

Symptom	Check item	Corrective action
An unintended value is read.	Is a file register address that does not exist in a connection destination device specified?	Review the address of the file register. (If the address is not in the connection destination device, an invalid value (such as 'FFFFH' or '-1') may be read.)
	Is a device number that does not exist in a connection destination device specified?	Check the device number range of the connection destination device, and correct the number to one within the range. (If the device number is not in the connection destination device, an invalid value (such as 'FFFFH' or '-1') may be read.)
An unintended value is written to a connection destination device.	Does another device write a value to the device set as the output destination?	Change the device.
	Does a program write a value to the device set as the output destination?	Change the device.
Unable to acquire data in the intended cycle.	Are the access cycle of Mitsubishi Electric FA connector and collection cycle of a task the intended setting?	If different values are set unintentionally, same data may be diagnosed many times or data to be diagnosed may be missed. To diagnose all acquired data in the access cycle, set the same value for the collection cycle. ☞ Page 373 Operational specifications
Unable to read and write data.	Is a remote password set in a connection destination device?	Unlock the remote password for the connection destination device.
	Does a set device range match with the one for a connection destination device?	<ul style="list-style-type: none"> • Check the device range setting for the connection destination device, and set devices within the range. • Change the device range for a connection destination device.
	<ul style="list-style-type: none"> • Is any missing value included in data to be output? • Is "Don't output record containing missing value" selected in the missing value processing setting? 	Review the missing value processing setting.
	Are any packets lost in UDP communication when Ethernet is used for the communication route?	<ul style="list-style-type: none"> • Change the communication to TCP communication. • Review the connection destination device or communication route. • Reduce the communication data amount or the frequency to connect to the connection destination device. • Divide the communication route to this product and other software. • Reduce simultaneous communications for one connection destination device.
No response is returned from a connection destination device.	Has a timeout occurred?	<ul style="list-style-type: none"> • Review the collection cycle or diagnosis cycle. • Reduce the processing load on the connection destination device.
	Are any packets lost in UDP communication when Ethernet is used for the communication route?	<ul style="list-style-type: none"> • Change the communication to TCP communication. • Review the connection destination device or communication route. • Reduce the communication data amount or the frequency to connect to the connection destination device. • Divide the communication route to this product and other software. • Reduce simultaneous communications for one connection destination device.
	Are a lot of inputs/outputs set for the same simulator when GX Simulator2 or GX Simulator3 is used for the communication route?	Reduce the number of inputs/outputs for the simulator. *1*2
An unexpected error occurs.	Is a device number that is not supported by a connection destination device specified?	Check the device number range of the connection destination device, and specify a number within the range.
	Is antivirus software interfering with this product?	Change settings of the antivirus software to exclude the following folder from the virus search targets: <ul style="list-style-type: none"> • Installation folder of this product • C:\ProgramData\MELSOFT\MaiLab

- *1 The maximum number of connections for GX Simulator2 and its counting system are as follows:
- Maximum number of connections: 16
 - Counting system: GX Simulator2 restricts the connection patterns. When all OPEN structures (connection routes) are the same, the connections are not counted; therefore, they are counted as one connection in one diagnosis terminal.
- *2 The maximum number of connections for GX Simulator3 and its counting system are as follows:
- Maximum number of connections: 32
 - Counting system: GX Simulator3 counts each EasySocket communication as one connection. Input and output data streams operate in different EasySocket communications in this product; therefore, setting the same simulator for both the input and output in one task is counted as two connections.
- In addition, starting GX Simulator3 from GX Works3 is also counted as one connection; therefore, up to 15 tasks (30 connections) can be set when setting the input and output for the same simulator.

OPC UA server connection

Symptom	Check item	Corrective action
An OPC UA server cannot be connected.	Is a client certificate trusted on the OPC UA server?	Trust the client certificate on the OPC UA server. For the method for trusting the client certificate, refer to the manual of the OPC UA server to be used.
	Is the expiration date for a client certificate correct?	Create a client certificate with a correct expiration date again.
	Is the time on a diagnosis terminal where a client certificate was created later than the one in the environment where the OPC UA server is running?	Make sure that the time in the environment where the OPC UA server is running is the same as the one on the diagnosis terminal, and then create a client certificate again.
	Is a user signed in as an anonymous user attempting to access a server though the server cannot be accessed by an anonymous user?	<ul style="list-style-type: none"> • Allow access of an anonymous user on the OPC UA server. • Change a user token type on this product.
	Are the user name and password correct when connecting with a user name/password?	Correct and set the user name and password.
	Is a user certificate trusted on the OPC UA server when connecting with the user certificate?	Trust the user certificate on the OPC UA server. For the method for trusting the user certificate, refer to the manual of the OPC UA server to be used.
	Is the expiration date for a user certificate correct when connecting with the user certificate?	Set a user certificate with a correct expiration date in the server authentication setting, and perform server authentication again to complete the setting.
	Are the settings of the OPC UA server changed after the setting on this product?	Configure the server connection setting and server authentication setting of this product again to complete the setting.
Data is not written to an OPC UA server.	Is a data name, access authority, or data type different from the one set in the OPC UA server specified in the output variable settings?	Check the output variable settings, and correct the settings to be the same as the actual ones in the OPC UA server.
	<ul style="list-style-type: none"> • Is any missing value included in data to be output? • Is "Don't output record containing missing value" selected in the missing value processing setting? 	Review the missing value processing setting.
Data cannot be read from/written to an OPC UA server.	Are data settings changed on the OPC UA server after configuring the data assignment settings or output data settings?	Assign data changed on the OPC UA server again in the data assignment setting screen or output variable setting screen to complete the setting.


Database connection

Symptom	Check item	Corrective action
Unable to connect to a database.	Has an error occurred in the database?	<p>■If an error has occurred Refer to the manual for each database to take corrective action.</p> <p>■If no error has occurred</p> <ul style="list-style-type: none"> • Check the DB connection setting, and correct it as necessary. • Check whether the database is supported by this product. • Review the connection route to the database. • Check the setting for the database to make sure that the database is accessible from this product.
Fails to acquire or output data.	Has an error occurred in the database?	<p>■If an error has occurred Refer to the manual for each database to take corrective action.</p> <p>■If no error has occurred</p> <ul style="list-style-type: none"> • Check the DB connection setting, and correct it as necessary. • Check whether the database is supported by this product. • Review the connection route to the database. • Make sure that the database is accessible. • Check the setting for the database to make sure that the database is accessible from this product.
	Has a value close to the boundary value for the data type of the database been output?	Change the data type to one with a larger range.
	Has time-series data been acquired in the timestamp type?	<ul style="list-style-type: none"> • If the data is with a time zone, change it to a UTC time. • Check whether the data is within the following range: 1900-01-01 00:00:00 to 2100-01-01 00:00:00
Acquired data is garbled.	Is the character code of the data other than Unicode when using SQL Server?	<p>Edit the query for the data set or input data stream to convert the garbled data type in the column into a Unicode character string.</p> <p>■Example: If data is garbled when __sample_column__ in __sample_table__ is acquired</p> <pre>SELECT CAST("__sample_column__" AS NVARCHAR) AS "__sample_column__" FROM "__sample_table__"</pre>
Integer type data is in decimal notation (example: 1.0) when acquired and converted into the category type.	Is the acquired data of integer type?	Use the CAST syntax in the query for the data set or input data stream to convert the data into a character string.

Real-time monitor

Symptom	Check item	Corrective action
The AI output result is not displayed.	Is a diagnosis performed?	Check the settings for an input data stream and the execution conditions of an AI execution block, and correct them as necessary. ☞ Page 368 Input data stream block ☞ Page 442 AI execution block
	Is there sufficient free space on a drive specified as the storage destination for files of diagnosed data?	Delete or move files on the storage destination drive periodically to secure free space on the drive.
The AI output result is not updated in real time.	Is the network highly loaded?	<ul style="list-style-type: none"> Refer to the manual for the personal computer and reduce the load on the network. Reduce the number of records to be displayed in the display setting. The setting screen differs depending on the version of this product on a diagnosis terminal of the connection destination. The version is 1.02C or earlier: ☞ Page 484 Display setting The version is 1.03D or later: ☞ Page 497 Set monitoring widget
	Is the operating system switched to the sleep state after displaying the screen?	Reload the page by using the web browser function. Alternatively, restart the web browser.
	Is the screen in any of the following state for five minutes or more with the power saving function of the web browser enabled? <ul style="list-style-type: none"> The screen is hidden (for example, the web browser is minimized). The screen is locked on the operating system. 	Disable the function of the web browser to reduce memory usage amount and save power, or specify a URL of the learning station to be excluded. After completing the setting, reload the page by using the web browser function. Alternatively, restart the web browser.
The operation is slow while displaying the screen of an AI output result.	Is the screen in any of the following state for five minutes or more with the power saving function of the web browser enabled? <ul style="list-style-type: none"> The screen is hidden (for example, the web browser is minimized). The screen is locked on the operating system. 	Disable the function of the web browser to reduce memory usage amount and save power, or specify a URL of the learning station to be excluded. After completing the setting, reload the page by using the web browser function. Alternatively, restart the web browser.
A diagnosis result graph is not displayed or the contents displayed in the graph are not the diagnosis result.	Is an AI using an analysis method is included in a task?	Check the output setting in the AI execution block and make sure that a variable in the diagnosis result is output. ☞ Page 449 Output settings Make sure that the values of the reference waveform, inspection waveform, and similarity score are output in the setting when an analysis method being used is similar waveform recognition. For variables output in similar waveform recognition, refer to the following: ☞ Page 354 Output

Historical monitor

Symptom	Check item	Corrective action
<p>Fails to acquire a diagnosis result or to calculate the diagnosis contribution ratio.</p>	<p>Has an error occurred in a Python block or its next block?</p>	<p>Check whether processing that causes an error is described in the script of a Python block. If not, refer to the following:  Has an error occurred in a Python block or its next block?</p>

Error page

Symptom	Check item	Corrective action
<p>A page showing 'Error404 Not Found' is displayed.</p>	<p>Is the page displayed by selecting an event in the event log screen then clicking the [Jump] button?</p>	<ul style="list-style-type: none"> • Check whether the administrative user has changed the access right for the project during the operation in the event log screen. • Check whether a project, data set, AI, or task related to the event has been deleted. If so, the target page is not displayed from the event log screen.
	<p>Is the page displayed directly by the favorites function of a web browser or a URL saved in the past?</p>	<ul style="list-style-type: none"> • Check whether the address is correct. • Check whether the administrative user has changed the access right for the project. • Check whether the target project, data set, AI, or task has been deleted. If so, the target page is not displayed from the event log screen.

19.2 Diagnosis Terminal

This section shows the troubleshooting on using this product on a diagnosis terminal.

Common

Symptom	Check item	Corrective action
Unable to access a file/folder.	Is the network highly loaded? (Check the writing destination on the learning station.)	Refer to the manual for the personal computer and reduce the load on the network.
	Is it written on the Windows system drive? (Check the access target on the learning station.)	Change the writing destination drive.
	Does the file path exceed 259 characters?	Set the file path to save, export, read, or import data within 259 characters.
	Is the path of the access target an external folder such as a shared folder?	Check whether the external folder is accessible.
	Is there sufficient free space on the drive? (Check the drive on the learning station.)	Secure free space on the drive.

Installation of this product

Same as the ones for the learning station.

 Page 546 Installation of this product

Display in a web browser

Symptom	Check item	Corrective action
A message indicating that a URL cannot be found, such as 'Can't open this page,' is displayed in a web browser when attempting to open the operation screen in the case using an operation terminal as a diagnosis terminal.	Is the operation screen attempted to be opened immediately after starting the personal computer?	Close the web browser once, then open the operation screen again after a few minutes. ☞ Page 34 Opening the Operation Screen (Diagnosis Terminal)
	Is the port number to be used for this product already used by another application in the personal computer where this product is installed?	Change the port number to unused one in the setting management tool. ☞ Page 41 Setting Management Tool (Diagnosis Terminal)
	Is a proxy server used?	<ul style="list-style-type: none"> • If multiple network adapters are enabled, set an IP address connectable to the proxy server in the connection settings of the setting management tool. • When a proxy server is not required for the IP address set in the connection settings of the setting management tool, set an exception in the proxy settings in the internet options. Select [Internet Options] ⇒ [Connections] tab ⇒ [LAN settings] ⇒ [Advanced] in the control panel of Windows, and specify the IP address set in the connection settings of the setting management tool as an exception.
A message indicating that a URL cannot be found, such as 'Can't open this page,' is displayed in a web browser when attempting to open the operation screen in the case where an operation terminal and a diagnosis terminal are built in different environments.	Is the URL for opening the operation screen correct?	Acquire the correct URL in the setting management tool. ☞ Page 41 Setting Management Tool (Diagnosis Terminal)
	Is the personal computer where this product is installed running?	Start the personal computer.
	Is the operation screen attempted to be opened immediately after starting the personal computer where this product is installed?	Close the web browser once, then open the operation screen again after a few minutes. ☞ Page 34 Opening the Operation Screen (Diagnosis Terminal)
	Is the port number to be used for this product already used by another application in the personal computer where this product is installed?	Change the port number to unused one in the setting management tool. ☞ Page 41 Setting Management Tool (Diagnosis Terminal)
	Is a proxy server used?	<ul style="list-style-type: none"> • If multiple network adapters are enabled, set an IP address connectable to the proxy server in the connection settings of the setting management tool. • When a proxy server is not required for the IP address set in the connection settings of the setting management tool, set an exception in the proxy settings in the internet options. Select [Internet Options] ⇒ [Connections] tab ⇒ [LAN settings] ⇒ [Advanced] in the control panel of Windows, and specify the IP address set in the connection settings of the setting management tool as an exception.
A message indicating that communication is not secure, such as 'privacy is not secured' or 'connection is not private,' is displayed.	Is the server certificate installed in the environment where operations are currently performed?	Install the server certificate of the diagnosis terminal in the environment where operations are currently performed. ☞ Page 35 Installing a server certificate
	Is the IP address of an operation terminal changed?	Install the server certificate of the operation terminal created after the IP address was changed in the environment where operations are currently performed. ☞ Page 35 Installing a server certificate
A screen turns white and nothing is displayed.	Does it take time to display the screen?	Wait for a while. If it is still not displayed, reload the page by using the web browser function.
	Is the web browser supported?	Use a supported web browser. ☞ Page 17 Operation terminal

Symptom	Check item	Corrective action
A screen is not refreshed with the set or created contents.	Does it take time to display the screen?	Wait for a while. If it is still not displayed, reload the page by using the web browser function.
	<ul style="list-style-type: none"> Is the network in use switched during operation? Is the communication environment stable? 	Wait for a while. If it is still not displayed, reload the page by using the web browser function. If the same symptom often occurs, operate this product in the stable communication environment where the network is not switched frequently.
	Does it take time to execute a Python block?	Open the setting management tool, stop the operation of this product, then start the operation again.
The display language is different from the one displayed used when installing this product.	Is this product used for the first time after the installation?	Sign in to this product, then change the display language in the personal settings. ☞ Page 542 PERSONAL SETTINGS
The sign in information is not retained.	Is the web browser set to not use Cookie?	Enable Cookie in the web browser settings.
	Was Cookie deleted in the web browser settings while using this product?	Sign in again. In addition, do not delete Cookie while using this product.
Contents in the screen are not displayed properly. (For example, overlapping of icons, text overflowing from the frame of a button, etc.)	Is a value other than 100% set for "Change the size of text, apps, and other items" in Windows?	Change the value to 100%. ^{*1}
	Is the zoom level set to a value other than 100% in the web browser?	Set an appropriate zoom level. ^{*1}
Displayed screens or items are different from the ones shown in this manual.	Is old browsing data cached in the web browser?	Delete browsing data cached in the web browser, and display the screen again.
The screen is not displayed properly (for example, an unexpected error occurs).	Can operations proceed in the screen?	<ul style="list-style-type: none"> Reload the page by using the web browser function. Alternatively, restart the web browser. Delete browsing data cached in the web browser, and display the screen again.
	Are there any problems with communication of a diagnosis terminal?	<ul style="list-style-type: none"> Check that this product is running. Review the route to the diagnosis terminal.
	Is there sufficient free space on the drive of a diagnosis terminal?	Delete unnecessary files to secure free space on the drive.
	Is the load on the diagnosis terminal high?	Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product.
	Is antivirus software interfering with this product?	Change settings of the antivirus software to exclude the following folder from the virus search targets: <ul style="list-style-type: none"> C:\ProgramData\MELSOFT\MaiLab
	Is the error cleared after taking the above corrective actions?	Contact your local Mitsubishi Electric sales office or representative.
An error message indicating that memory in a web browser is insufficient is displayed.	Are multiple tabs opened?	Close unnecessary tabs.
	Is there sufficient free space on the memory of the operation terminal?	Reduce the load by closing other applications.
Unable to sign in because a sign-in password is forgotten.		Sign in to this product on the learning station as the administrative user, and change the password of the user of the target diagnosis terminal in the diagnosis terminal management screen. ☞ Page 61 Diagnosis terminal management screen

*1 When setting 100% for "Change the size of text, apps, and other items" in Windows, the contents in the screen are displayed properly with the display resolution of 1920 × 1080 px.

In other cases, the contents in the screen may not be displayed properly depending on the zoom level of a web browser.

The following shows the recommended zoom level for each display resolution:




Zoom: 75%, display resolution: 1024 × 768 px or more

Zoom: 75%, display resolution: 1280 × 800 px or more

Zoom: 75%, display resolution: 1280 × 1024 px or more

Zoom: 100%, display resolution: 1920 × 1080 px or more (recommended)

Task management and execution

Symptom	Check item	Corrective action
Unable to perform a diagnosis.	Is an error output as an event log?	Check "Corrective action" for the event log, and clear the error.
	Has an error occurred in a Python block or its next block?	<ul style="list-style-type: none"> • Check whether the name or argument of a function prepared by default changed on the learning station. • Check the reference of Python or a library used, and check whether it is used correctly on the learning station. • Check whether the format of data to be output differs between the script used when learning and the one used when executing a task due to an operation such as addition or deletion of a variable on the learning station. • Contact your local Mitsubishi Electric sales office or representative.
	Is an AI output result displayed in the real-time monitor screen?	Check the settings for an input data stream and the execution conditions of an AI execution block on the learning station, and correct them as necessary.  Page 368 Input data stream block  Page 442 AI execution block
	Is there sufficient free space on a drive specified as the storage destination for files of diagnosed data? (Check the storage destination for files of diagnosed data on the learning station.)	Delete or move files on the storage destination drive periodically to secure free space on the drive.
The operation is slow while diagnosing.	Is the load on the personal computer high?	<ul style="list-style-type: none"> • Reduce the load (CPU and memory usage rate or disk drive load) by closing other applications or change settings of this product. • Install this product on a personal computer that satisfies requirements and recommendations for the operating environment.  MELSOFT MaiLab Installation Instructions

Mitsubishi Electric FA connector

Symptom	Check item	Corrective action
An unintended value is read.	Is a file register address that does not exist in a connection destination device specified? (Check the connection destination device on the learning station.)	Review the address of the file register. (If the address is not in the connection destination device, an invalid value (such as 'FFFFH' or '-1') may be read.)
	Is a device number that does not exist in a connection destination device specified?	Check the device number range of the connection destination device, and specify a number within the range on the learning station. (If the device number is not in the connection destination device, an invalid value (such as 'FFFFH' or '-1') may be read.)
An unintended value is written to a connection destination device.	Does another device write a value to the device set as the output destination?	Change the device on the learning station.
	Does a program write a value to the device set as the output destination?	Change the device on the learning station.
Unable to acquire data in the intended cycle.	Are the access cycle of Mitsubishi Electric FA connector and collection cycle of a task the intended setting?	If different values are set unintentionally, same data may be diagnosed many times or data to be diagnosed may be missed. To diagnose all acquired data in the access cycle, set the same value for the collection cycle on the learning station. ☞ Page 373 Operational specifications
Unable to read and write data.	Is a remote password set in a connection destination device? (Check the connection destination device on the learning station.)	Unlock the remote password for the connection destination device.
	Does a set device range match with the one for a connection destination device?	<ul style="list-style-type: none"> • Check the device range setting for the connection destination device, and set devices within the range on the learning station. • Change the device range for a connection destination device.
	<ul style="list-style-type: none"> • Is any missing value included in data to be output? • Is "Don't output record containing missing value" selected in the missing value processing setting? 	Review the missing value processing setting on the learning station.
	Are any packets lost in UDP communication when Ethernet is used for the communication route? (Check the connection destination device on the learning station.)	<ul style="list-style-type: none"> • Change the communication to TCP communication. • Review the connection destination device or communication route. • Reduce the communication data amount or the frequency to connect to the connection destination device. • Divide the communication route to this product and other software. • Reduce simultaneous communications for one connection destination device.
No response is returned from a connection destination device.	Has a timeout occurred?	<ul style="list-style-type: none"> • Review the collection cycle or diagnosis cycle on the learning station. • Reduce the processing load on the connection destination device.
	Are any packets lost in UDP communication when Ethernet is used for the communication route? (Check the connection destination device on the learning station.)	<ul style="list-style-type: none"> • Change the communication to TCP communication. • Review the connection destination device or communication route. • Reduce the communication data amount or the frequency to connect to the connection destination device. • Divide the communication route to this product and other software. • Reduce simultaneous communications for one connection destination device.
	Are a lot of inputs/outputs set for the same simulator when GX Simulator2 or GX Simulator3 is used for the communication route?	Reduce the number of inputs/outputs for the same simulator on the learning station. *1*2

Symptom	Check item	Corrective action
An unexpected error occurs.	Is a device number that is not supported by a connection destination device specified?	Check the device number range of the connection destination device, and specify a number within the range on the learning station.
	Is antivirus software interfering with this product?	Change settings of the antivirus software to exclude the following folder from the virus search targets: <ul style="list-style-type: none"> • Installation folder of this product • C:\ProgramData\MELSOFT\MaiLab

*1 The maximum number of connections for GX Simulator2 and its counting system are as follows:

- Maximum number of connections: 16
- Counting system: GX Simulator2 restricts the connection patterns. When all OPEN structures (connection routes) are the same, the connections are not counted; therefore, they are counted as one connection in one diagnosis terminal.

*2 The maximum number of connections for GX Simulator3 and its counting system are as follows:

- Maximum number of connections: 32
- Counting system: GX Simulator3 counts each EasySocket communication as one connection. Input and output data streams operate in different EasySocket communications in this product; therefore, setting the same simulator for both the input and output in one task is counted as two connections.

In addition, starting GX Simulator3 from GX Works3 is also counted as one connection; therefore, up to 15 tasks (30 connections) can be set when setting the input and output for the same simulator.

OPC UA server connection

Symptom	Check item	Corrective action
An OPC UA server cannot be connected.	Is a client certificate trusted on the OPC UA server? (Check the OPC UA server of the connection destination on the learning station.)	Trust the client certificate on the OPC UA server. For the method for trusting the client certificate, refer to the manual of the OPC UA server to be used.
	Is the expiration date for a client certificate correct?	Create a client certificate with a correct expiration date again.
	Is the time on a diagnosis terminal where a client certificate was created later than the one in the environment where the OPC UA server is running?	Make sure that the time in the environment where the OPC UA server is running is the same as the one on the diagnosis terminal, and then create a client certificate again.
	Is a user signed in as an anonymous user attempting to access a server though the server cannot be accessed by an anonymous user? (Check the OPC UA server of the connection destination on the learning station.)	<ul style="list-style-type: none"> • Allow access of an anonymous user on the OPC UA server. • Change a user token type on this product.
	Are the user name and password correct when connecting with a user name/password?	Correct and set the user name and password on the learning station.
	Is a user certificate trusted on the OPC UA server when connecting with the user certificate? (Check the OPC UA server of the connection destination on the learning station.)	Trust the user certificate on the OPC UA server. For the method for trusting the user certificate, refer to the manual of the OPC UA server to be used.
	Is the expiration date for a user certificate correct when connecting with the user certificate?	Set a user certificate with a correct expiration date in the server authentication setting on the learning station, and perform server authentication again to complete the setting.
	Are the settings of the OPC UA server changed after the setting on this product?	Configure the server connection setting and server authentication setting of this product on the learning station again to complete the setting.
Data is not written to an OPC UA server.	Is a data name, access authority, or data type different from the one set in the OPC UA server specified in the output variable settings?	Check the output variable settings on the learning station, and correct the settings to be the same as the actual ones in the OPC UA server.
	<ul style="list-style-type: none"> • Is any missing value included in data to be output? • Is "Don't output record containing missing value" selected in the missing value processing setting? 	Review the missing value processing setting on the learning station.
Data cannot be read from/written to an OPC UA server.	Are data settings changed on the OPC UA server after configuring the data assignment settings or output data settings?	Assign data changed on the OPC UA server again in the data assignment setting screen or output variable setting screen on the learning station to complete the setting.

Database connection

Symptom	Check item	Corrective action
Unable to connect to a database.	Has an error occurred in the database?	<p>■If an error has occurred Refer to the manual for each database to take corrective action.</p> <p>■If no error has occurred</p> <ul style="list-style-type: none"> • Check the DB connection setting on the learning station, and correct it as necessary. • Check whether the database is supported by this product. • Review the connection route to the database. • Check the setting for the database to make sure that the database is accessible from this product.
Fails to acquire or output data.	Has an error occurred in the database?	<p>■If an error has occurred Refer to the manual for each database to take corrective action.</p> <p>■If no error has occurred</p> <ul style="list-style-type: none"> • Check the DB connection setting on the learning station, and correct it as necessary. • Check whether the database is supported by this product. • Review the connection route to the database. • Make sure that the database is accessible. • Check the setting for the database to make sure that the database is accessible from this product.
	Has a value close to the boundary value for the data type of the database been output?	Change the data type to one with a larger range.
	Has time-series data been acquired in the timestamp type?	<ul style="list-style-type: none"> • If the data is with a time zone, change it to a UTC time. • Check whether the data is within the following range: 1900-01-01 00:00:00 to 2100-01-01 00:00:00
Acquired data is garbled.	Is the character code of the data other than Unicode when using SQL Server?	<p>Edit the query for the data set or input data stream on the learning station to convert the garbled data type in the column into a Unicode character string.</p> <p>■Example: If data is garbled when __sample_column__ in __sample_table__ is acquired</p> <pre>SELECT CAST("__sample_column__" AS NVARCHAR) AS "__sample_column__" FROM "__sample_table__"</pre>
Integer type data is in decimal notation (example: 1.0) when acquired and converted into the category type.	Is the acquired data of integer type?	Use the CAST syntax in the query for the data set or input data stream on the learning station to convert the data into a character string.

Real-time monitor

Symptom	Check item	Corrective action
The AI output result is not displayed.	Is a diagnosis performed?	Check the settings for an input data stream and the execution conditions of an AI execution block on the learning station, and correct them as necessary. Page 368 Input data stream block Page 442 AI execution block
	Is there sufficient free space on a drive specified as the storage destination for files of diagnosed data? (Check the storage destination for files of diagnosed data on the learning station.)	Delete or move files on the storage destination drive periodically to secure free space on the drive.
The AI output result is not updated in real time.	Is the network highly loaded?	<ul style="list-style-type: none"> Refer to the manual for the personal computer and reduce the load on the network. Reduce the number of records to be displayed in the display setting. Page 497 Set monitoring widget
	Is the operating system switched to the sleep state after displaying the screen?	Reload the page by using the web browser function. Alternatively, restart the web browser.
	Is the screen in any of the following state for five minutes or more with the power saving function of the web browser enabled? <ul style="list-style-type: none"> The screen is hidden (for example, the web browser is minimized). The screen is locked on the operating system. 	Disable the function of the web browser to reduce memory usage amount and to save power, or specify a URL of a diagnosis terminal to be excluded. After completing the setting, reload the page by using the web browser function. Alternatively, restart the web browser.
The operation is slow while displaying the screen of an AI output result.	Is the screen in any of the following state for five minutes or more with the power saving function of the web browser enabled? <ul style="list-style-type: none"> The screen is hidden (for example, the web browser is minimized). The screen is locked on the operating system. 	Disable the function of the web browser to reduce memory usage amount and to save power, or specify a URL of a diagnosis terminal to be excluded. After completing the setting, reload the page by using the web browser function. Alternatively, restart the web browser.
A diagnosis result graph is not displayed or the contents displayed in the graph are not the diagnosis result.	Is an AI using an analysis method is included in a task? (Check the output settings of an AI execution block on the learning station.)	Check the output setting in the AI execution block and make sure that a variable in the diagnosis result is output. Page 449 Output settings Make sure that the values of the reference waveform, inspection waveform, and similarity score are output in the setting when an analysis method being used is similar waveform recognition. For variables output in similar waveform recognition, refer to the following: Page 354 Output

Historical monitor

Symptom	Check item	Corrective action
Fails to acquire a diagnosis result or to calculate the diagnosis contribution ratio.	Has an error occurred in a Python block or its next block?	Check whether processing that causes an error is described in the script of a Python block on the learning station. If not, refer to the following: Has an error occurred in a Python block or its next block?

APPENDIX

Appendix 1 Unusable Characters for this Product

This section shows the characters that cannot be used in this product.

- Control character codes (U+0000 to U+0009, U+000B to U+000C, U+000E to U+001F, U+007F to U+00A0, U+00AD, U+2028 to U+2029)
- Surrogate pair characters (U+D800 to U+DBFF, U+DC00 to U+DFFF)

Characters that cannot be used in each setting item are displayed in an error message if any of the unusable characters is entered.

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A

Appendix 2 Cooperation with Edgecross Basic Software

This section shows the procedure for cooperating with Edgecross Basic Software.


—: No operation required

Step	Edgecross Basic Software	This product
1	Create a data logging flow setting. (Page 573 Creating the data logging flow setting)	—
2	Perform a data logging flow to output a CSV file. (Page 573 Outputting a CSV file)	—
3	—	Upload the output CSV file, and create a data set. (Page 78 DATA SET CREATION AND MANAGEMENT) For the 'INDEX' column included in the CSV file, set 'use of a variable' to "Not Use." Page 102 Data check
4	—	Create an AI with the created data set. (Page 135 AI CREATION AND MANAGEMENT)
5	—	Create a task with the created AI. (Page 203 TASK CREATION AND MANAGEMENT) Set an input data stream and output data stream as shown in the following: Page 574 Setting an input data stream Page 574 Setting an output data stream
6	Create a data diagnosis flow setting. (Page 575 Creating the data diagnosis flow setting)	—
7	Perform a diagnosis by cooperating with Edgecross Basic Software. (Page 576 Performing a diagnosis)	—

Creating the data logging flow setting

A data logging flow setting can be created by using Real-time Flow Designer.

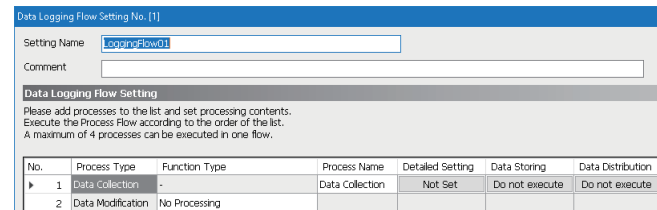
For details on each setting, refer to the following:

 Edgecross Basic Software for Windows User's Manual

Operating procedure

1. Start Real-time Flow Designer.
2. Click "Data Logging Flow Setting" in the edit item tree.
3. Click the [Edit] button.

The "Data Logging Flow Setting" screen appears.



No.	Process Type	Function Type	Process Name	Detailed Setting	Data Storing	Data Distribution
1	Data Collection	-	Data Collection	Not Set	Do not execute	Do not execute
2	Data Modification	No Processing				

4. Set the setting for data collection.
5. Set the data modification setting as necessary.
6. Set the data storing setting.


The following table shows the considerations for the setting.

Item	Consideration
Executable form	Select "File."
File format	Select "CSV file (UTF-8)."
Output format	Specify a format as follows according to the data type of data to be output. <ul style="list-style-type: none">• UINT, UDINT, ULINT: Integer Format• REAL, LREAL: Decimal Format
Date and time format	Set "YYYY/MM/DD hh:mm:ss.sss."
Save destination folder	Set a folder (1 to 199 characters).
File name prefix	Set a prefix (1 to 32 characters).

Outputting a CSV file

A CSV file can be output by performing a data logging flow with the created data logging flow setting.

For performing a data logging flow, refer to the following:


 Edgecross Basic Software for Windows User's Manual

Setting an input data stream

An input data stream block can be set as follows:

Item	Description
Connection method	Select "Text file."
Folder path	Set a folder.* ¹
Prefix of file name	Set a prefix.* ¹

*¹ Match the setting with the one for a data diagnosis flow.

 Page 575 Creating the data diagnosis flow setting

Setting an output data stream

An output data stream can be set by the procedure below.

For the format of a response data file and response data definition file to be output, refer to the following:

 Page 413 Output format of a file


 Page 414 Output of a response data definition file

1. Set the file saving path setting, file setting, and cooperation option as follows:

Item	Description	
Saving file path setting	Folder path	Specify the storage destination folder for response data of Edgecross Basic Software* ¹ .
	Prefix of file name	Set a prefix.* ²
File setting	File format	Select "UTF-8."
Cooperation option		Select "Edgecross cooperation."

*¹ (Installation destination of Edgecross Basic Software)\Edgecross\Edgecross Basic Software\RDDIF_Output

*² Match the setting with the one for a data diagnosis flow.

 Page 575 Creating the data diagnosis flow setting

2. Click the [Next] button.

3. Set variable names for data to be output.

- Up to 256 variables can be selected, which is the maximum number that can be handled in Edgecross Basic Software.
- Data is output according to the data type that can be handled in Edgecross Basic Software.

If the maximum number of characters for the data type is exceeded, characters are deleted from the end when data is output.

- The output date and time column (TIME column) to be used in Edgecross Basic Software is added as the first column when data is output.

4. Click the [Response data definition file output] button to output a response data definition file.

5. Click the [OK] button to complete the setting.

Precautions

- In a data diagnosis flow, make sure that a folder to exchange files with an edge application exists in an industrial PC where Edgecross Basic Software is installed.
- When cooperating with Real-time Flow Manager installed on another industrial PC, set the storage destination folder for the response data file of the industrial PC as a shared folder (a readable and writable folder).

Creating the data diagnosis flow setting

A data diagnosis flow setting can be created by using Real-time Flow Designer.

For details on each setting, refer to the following:

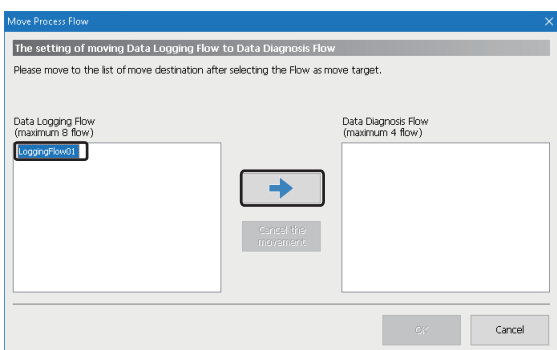
📖 Edgexross Basic Software for Windows User's Manual

Operating procedure

1. Start Real-time Flow Designer.
2. Click "Data Diagnosis Flow Setting" in the edit item tree.
3. Click the [Move from Data Logging Flow] button.



4. Select a flow set in "Data Logging Flow Setting" and click the [=>] button.

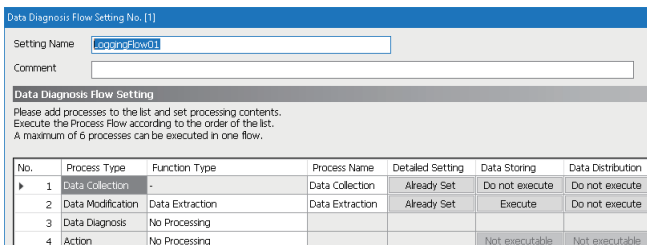


5. Click the [OK] button.

The flow set in "Data Logging Flow Setting" moves to "Data Diagnosis Flow Setting".

6. Click the [Edit] button.


The "Data Diagnosis Flow Setting" screen appears.





7. Select "Edge Application Diagnosis (file)" in the "Function Type" column of a data diagnosis, then click the cell of the "Detailed Setting" column.

No.	Process Type	Function Type	Process Name	Detailed Setting	Data Storing	Data Distribution
1	Data Collection	.	Data Collection	Already Set	Do not execute	Do not execute
2	Data Modification	Data Extraction	Data Extraction	Already Set	Do not execute	Do not execute
3	Data Diagnosis	Edge Application Diagnostics (file)	Edge Applicati...	Not Set	Do not execute	Do not execute
4	Action	No Processing			Not executable	Not executable


8. Match the settings for the [Output Data] tab and [Output Option] tab of the edge application diagnosis (file) setting with the data storing setting created in the following:

 Page 573 Creating the data logging flow setting

9. Set the items in the [Save File] tab of the edge application diagnosis (file) setting as follows:

Item	Description
Save destination folder	Set the same folder as the one set for the input data stream. ( Page 574 Setting an input data stream)
File name prefix	Set the same file name prefix as the one set for the input data stream. ( Page 574 Setting an input data stream)

10. Click the [Get Response Result Definition] button in the [Response Data] tab of the edge application diagnosis (file) setting to select a response data definition file that is output in the following section.

 Page 574 Setting an output data stream

11. Click the [OK] button.

12. Set the settings for feedback.


13. Click the [OK] button.

Performing a diagnosis


A diagnosis can be performed by cooperating with Edgecross Basic Software.

1. Perform a data diagnosis flow with the created data diagnosis flow setting by using Real-time Flow Designer.

For performing a data diagnosis flow, refer to the following:

 Edgecross Basic Software for Windows User's Manual

2. Start a task of MELSOFT MailLab.

 Page 228 Starting and Stopping a Task

Appendix 3 Cooperation with GX Simulator2 or GX Simulator3

This section show the procedure for performing a diagnosis by cooperating with GX Simulator2 or GX Simulator3.

Cooperation with GX Simulator2

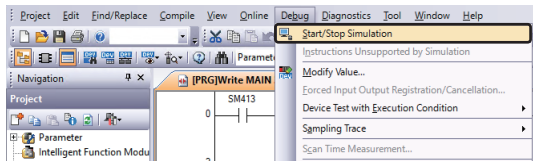
The following shows the procedure for performing a diagnosis by cooperating with GX Simulator2.

For the operation methods of GX Simulator2, refer to the following:

GX Works2 Version 1 Operating Manual (Common)

Operating procedure

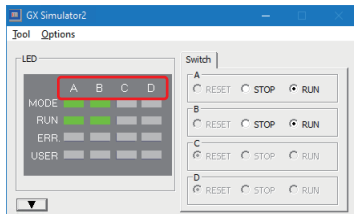
1. In GX Works2, select [Debug] ⇒ [Start/Stop Simulation] to start GX Simulator2.



2. In this product, configure settings for an input data stream or output data stream as follows:

Item		Description
Connection method		Specify "Mitsubishi Electric FA Connector."
Common Settings	CPU Series	Set the same CPU series as the one for a project created in GX Works2.
	CPU Type	Set the same CPU type as the one for a project created in GX Works2.
PC I/F Settings	PC I/F	Select "GX Simulator2."
	Target Simulator	Specify an alphabetic letter corresponding to a target simulator.*1

*1 An alphabetic letter to be specified for a simulator is as follows:



3. Start a task of MELSOFT MailLab.

Page 228 Starting and Stopping a Task

When GX Simulator2 is not started yet, start GX Simulator2 before starting a task.



Cooperation with GX Simulator3

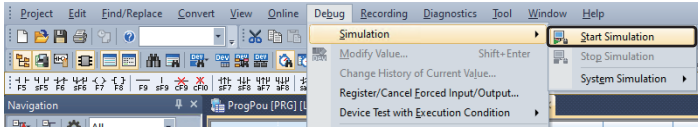
The following shows the procedure for performing a diagnosis by cooperating with GX Simulator3.

For the operation methods of GX Simulator3, refer to the following:

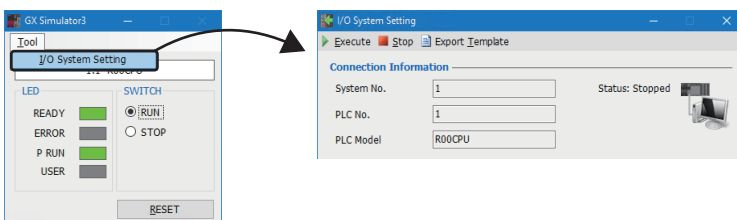
GX Works3 Operating Manual

Operating procedure

1. In GX Works3, select [Debug] ⇒ [Simulation] ⇒ [Start Simulation] to start GX Simulator3.



2. In GX Simulator3, select [Tool] ⇒ [I/O System Setting] to display the "I/O System Setting" screen.



3. In this product, configure settings for an input data stream or output data stream as follows:

Item	Description	
Connection method	Specify "Mitsubishi Electric FA Connector."	
Common Settings	CPU Series	Specify the same CPU series as the one for a model set in "PLC Model" of the "I/O System Setting" screen.
	CPU Type	Specify the same CPU type as the one set in "PLC Model" of the "I/O System Setting" screen.
PC I/F Settings	PC I/F	Select "GX Simulator3."
	System Number	Set the same value as the one set in "System No." of the "I/O System Setting" screen.
	CPU Number*1	Set the same value as the one set in "PLC No." of the "I/O System Setting" screen.

*1 Setting is not required for the FX5U series.

4. Start a task of MELSOFT Mailab.

Page 228 Starting and Stopping a Task

When GX Simulator3 is not started yet, start GX Simulator3 before starting a task.

Appendix 4 Software Licenses

This software consists of multiple software components. Each of them is copyrighted by Mitsubishi Electric and/or third parties.

Open source software used in this software and its conditions are described in a file in the installation folder.

Ex.

File location for the default installation folder

- C:\Program Files\MELSOFT\MaiLab\Doc\Info.txt

Source codes are not distributed for the software of Mitsubishi Electric and/or third parties.

Please refrain from inquiring about the source codes of this open source.

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Appendix 5 Added and Changed Functions

This section shows the added and changed functions of this product.

Added/changed contents	Reference	Version
The test function that uses a learned AI is supported.	Page 193 Testing an AI	1.02C
A project can be imported or exported with tasks included.	Page 74 Exporting and Importing a Project Page 204 Tasks added by importing a project Page 207 Task Management Screen	
A variable deletion block is added as an extension block.	Page 316 Variable deletion block	
The simulator function of GX Works2 or GX Works3 is supported for "Mitsubishi Electric FA connector."	Page 392 When the connection method is "Mitsubishi Electric FA Connector" Page 577 Cooperation with GX Simulator2 or GX Simulator3	
A diagnosis terminal can be accessed directly, and this product can be operated or monitored on a web browser.	Page 16 Components Page 24 Adding a Diagnosis Terminal with an Additional Diagnosis License Page 34 Opening the Operation Screen (Diagnosis Terminal) Page 41 Setting Management Tool (Diagnosis Terminal) Page 63 Changing properties Page 65 Registering a new diagnosis terminal Page 518 OPERATION SCREEN Page 524 TASK MANAGEMENT Page 529 MONITOR Page 540 EVENT LOG CHECK Page 542 PERSONAL SETTINGS Page 561 Diagnosis Terminal	1.03D
Displayed contents and display method of the real-time monitor screen are improved.	Page 493 Real-time monitor Screen (the Version of This Product on a Diagnosis Terminal is 1.03D or Later)	
In a variable deletion block, unnecessary variables can be deleted automatically.	Page 167 Learning result (classification or regression model (overview)) Page 316 Variable deletion block	
For an input or output data stream block, OPC UA server connection is supported.	Page 384 Connection method (OPC UA server connection) Page 396 When the connection method is "OPC UA server connection" Page 418 Connection method (OPC UA server connection) Page 433 When the connection method is "OPC UA server connection"	
Windows 11 is supported.	MEASOFT MailLab Installation Instructions	
Collected files can be saved by an input data stream block.	Page 370 Connection method (text file) Page 388 When the connection method is "Text file"	
Preview can be displayed in the SPC rule setting screen of an SPC judgment block.	Page 460 SPC rule settings	
Data can be acquired from a database and used for learning and diagnoses.	Page 103 Creating a New Data Set (Database) Page 386 Connection method (DB connection) Page 406 When the connection method is "DB connection" Page 421 Connection method (DB connection) Page 436 When the connection method is "DB connection"	1.04E
Methods for outputting missing values can be selected for an output data stream.	Page 428 Missing value processing setting	
A basis for diagnosis of an AI (diagnosis contribution ratio) can be indicated.	Page 201 AI test details check screen Page 223 Execution Setting Page 467 MONITOR Page 506 Historical monitor Screen Page 529 MONITOR Page 535 Historical monitor Screen	1.05F
A block for analyzing vibrations is added as an extension block.	Page 320 Digital filter block Page 327 FFT block	

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REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
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SH(NA)-082446ENG-G(2310)

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