MITSUBISHI ELECTRIC

Numerical Protection Relay

MELPRO™-D Series

HMI SOFTWARE

MODEL

PC-HMI

INSTRUCTION MANUAL

INDEX

1. PC Software (PC-HMI)

1.1. Introduction

The MELPRO-D40 Series provides PC-HMI for implementing analog and digital signal supervision and control (DO contact test and circuit breaker control).
This chapter describes the functions of PC-HMI.

1.2. Precautions on software use

Be sure to observe the following precautions when using this software.

Precautions

1) This software and manual are warranted only against damage to the medium, defects in the product and program execution errors.
2) This manual does not give warranty of merchantability or fitness for a particular purpose for the product. No warranty is given with respect to any damage to equipment or business performance.
3) We shall not be liable for use or reliability of other software not created by us.
4) Use of this software requires one license per PC.
   When using the software on another PC, purchase a separate copy.
5) Duplicating this software for any purpose other than making a backup copy is strictly prohibited.
6) Exercise sufficient caution in handling the original medium containing this software.
7) Alteration or modification of this software is strictly prohibited.
8) Lending or taking out any part or all of this software to a third party without prior permission is prohibited.
9) This manual and medium can be used only for this software.
   Sale of this program or any of its modification to a third party is strictly prohibited.

Note) These precautions apply to all of our products.
Some of the product specifications may not apply.

1.3. Compatible models

1.3.1. PC-HMI operation terminal specifications

The recommended and minimum specifications for the operation terminal to install PC-HMI on are as shown below.

Item	Recommended specification	Minimum specification
OS	Windows7	Windows7
CPU	2.5 GHz or higher (4 CPUs or more)	1.5 GHz (2 CPU)
Memory	2 GB or larger	2 GB
Display color	32-bit (16,770,000 colors)	32-bit (16,770,000 colors)

Note) For use with the waveform analysis software (see Chapter 2), available HDD space of 100 MB or more and separate available space for saving waveform data are required.

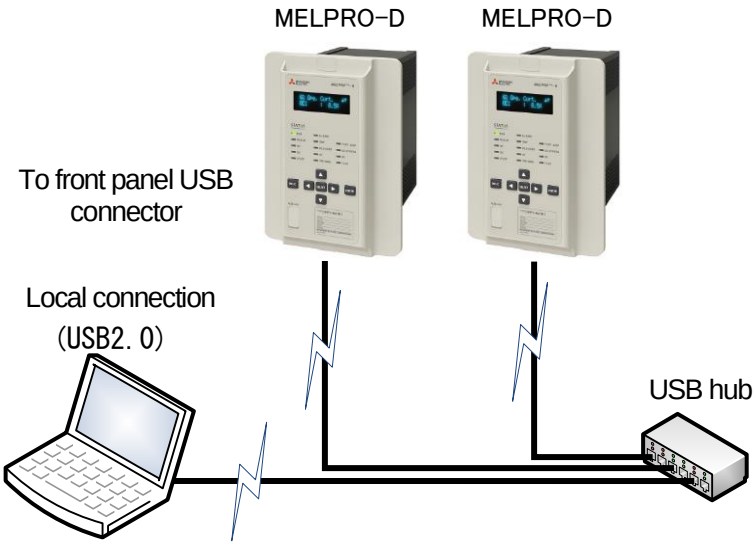
1.3.2. Display

The recommended and minimum specifications for the display for PC-HMI are as shown below.

Item	Recommended specification	Minimum specification
Screen size	15.6 in	11 in
Screen resolution	1366 x 768 WXGA	1366 x 768 WXGA
Dot pitch [mm]	0.253	0.188
Exact size [mm]	W345.598 x H194.304	W243.148 x H136.704

1.4. Basic configuration for PC-HMI

The hardware configuration for PC-HMI is as shown below.



1.5. Basics for operation of PC-HMI

This section provides the knowledge and instructions required for operation of PC-HMI.
For more information about the operation, see the instruction manual of the PC being used.

1.5.1. Mouse operation

This subsection describes the knowledge required for mouse operation.

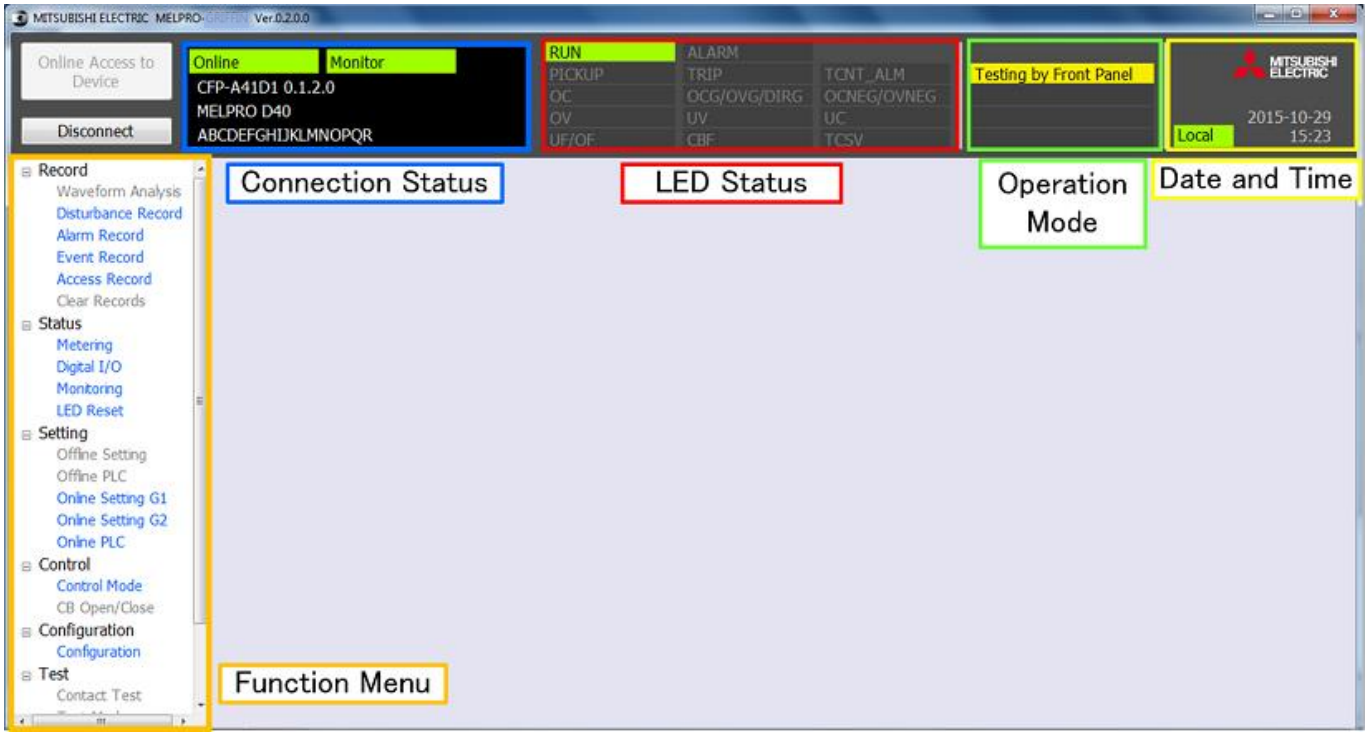
1) Click
   The action of pressing the left mouse button.

2) Double click
   Clicking of a mouse button twice successively.

3) Mouse pointer
   Moving the mouse causes the arrow on the screen to move according to the mouse movement. To select an item on the screen, move the mouse pointer onto the item and click.
   The clicked item is illuminated. When the mouse pointer is moved onto text input, the arrow turns into a cursor.

4) Drag
   Dragging refers to moving the mouse pointer while pressing the mouse button.

1.6. Screen structure of PC-HMI



*The screen shown above is different from how the actual screen looks because the individual menus are outlined with borders for ease of understanding.

The screen structure of PC-HMI is as shown below.

Function Menu	: Clicking the individual items calls the corresponding functions.
Connection Status	: Indicates the connection status and operation permission of devices.
LED Status	: Indicates the operating conditions and failure descriptions of devices.
Operation Mode	: Indicates the operation mode.
Date and Time	: Indicates the time synchronization status and date and time.

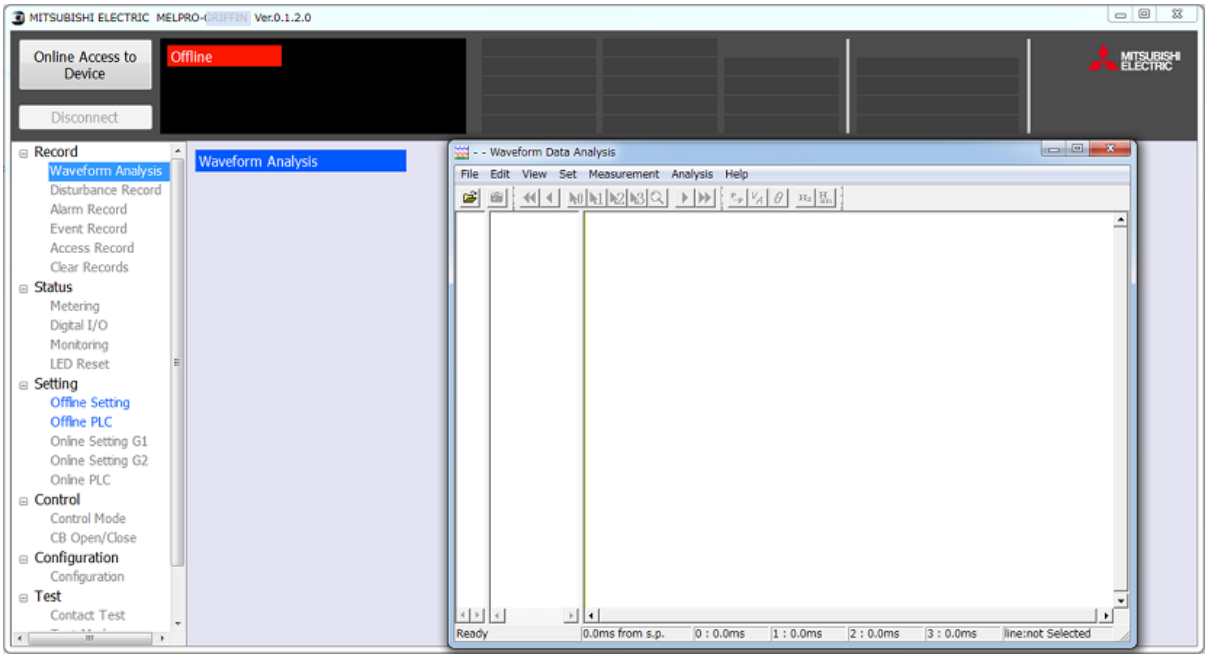
1.7. Operation in offline mode

The Function menu items available in the offline mode are as shown below.

Waveform Analysis : Launches the waveform analysis software.
Offline Setting : Reads, edits and saves setting files.
Offline PLC : Reads, edits and saves PLC configuration files.

1.7.1. Launching the waveform analysis software

1. From the Function menu, click Waveform Analysis.
2. The waveform analysis software is launched in a new window.

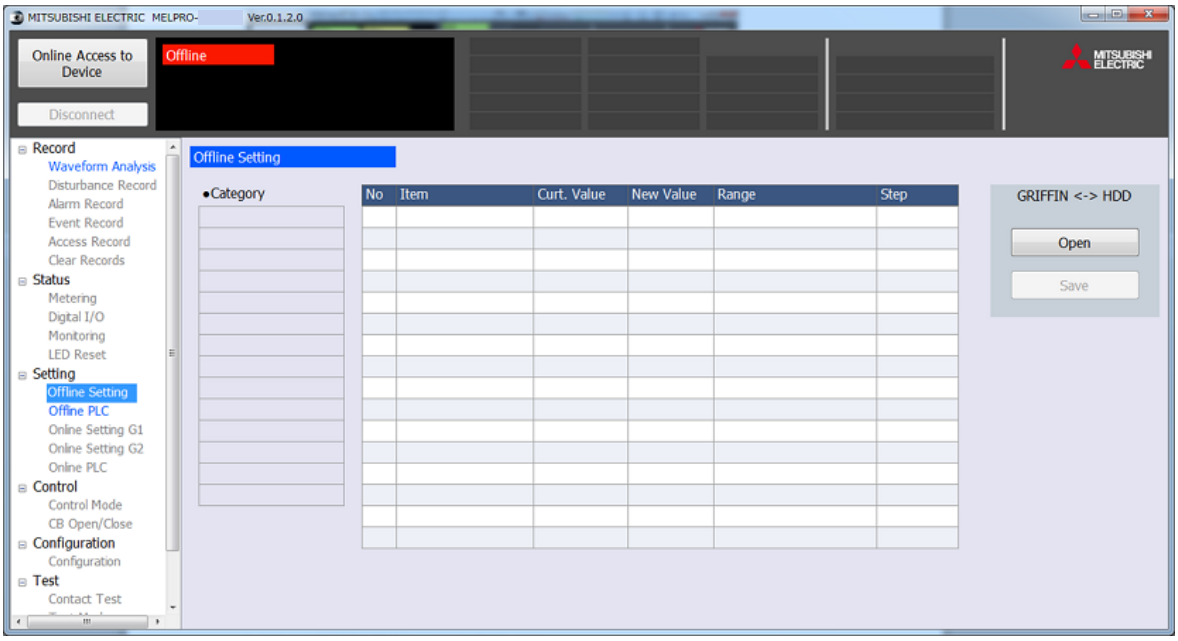


3. From the File menu of the waveform analysis software, select a waveform data file.
   (For the details about the waveform analysis software, see Chapter 2.)

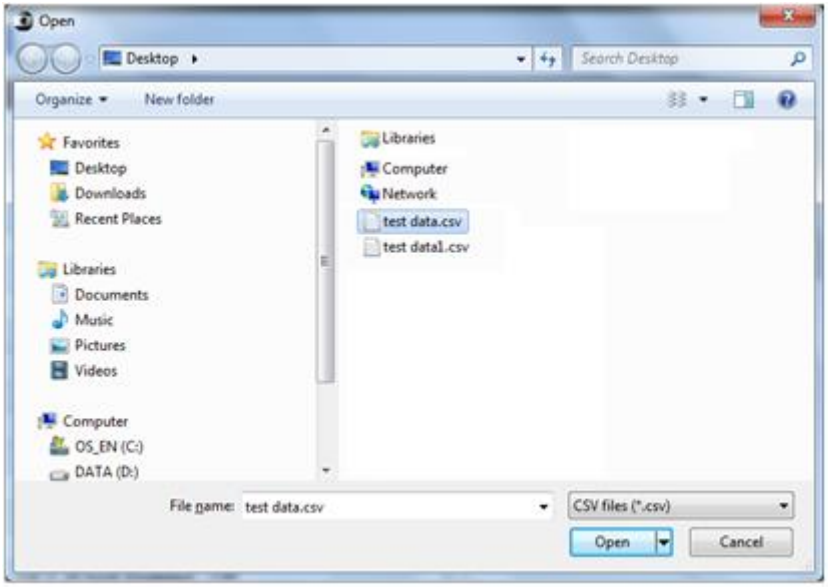
1.7.2. Reading, editing and saving setting files

[Reading setting files]

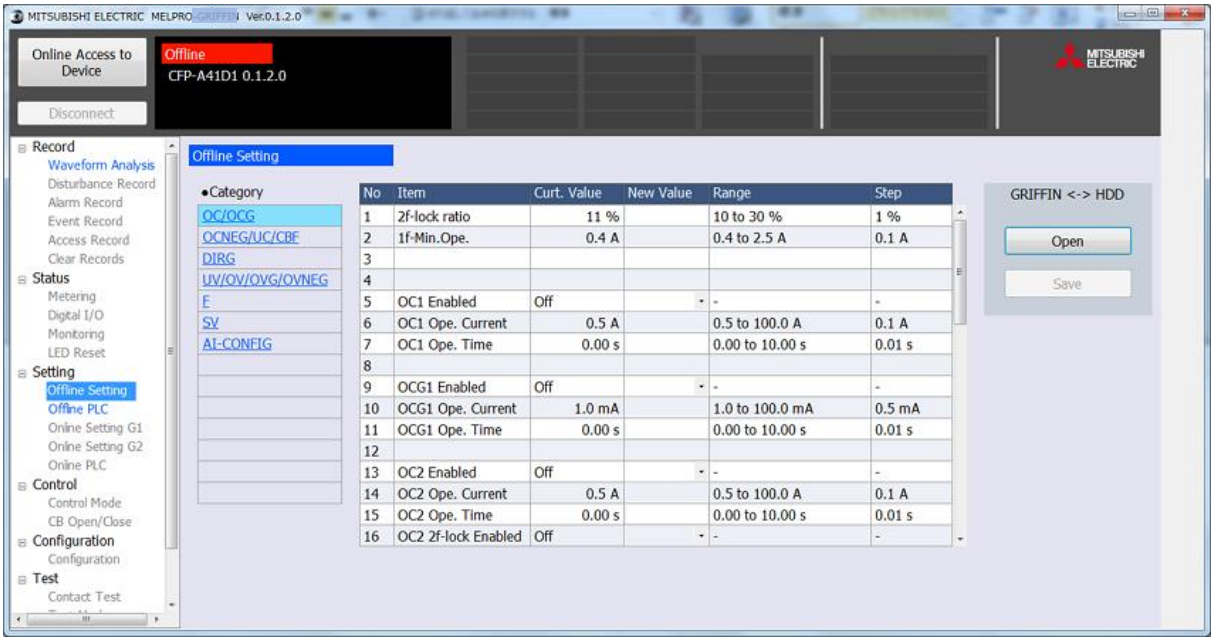
1. From the Function menu, click Offline Setting.
2. From PC-HMI <-> HDD in the upper right part of the main screen, click “Open.”



3. Select the setting file to read from the HDD.
   (Files in the .csv format can be read)

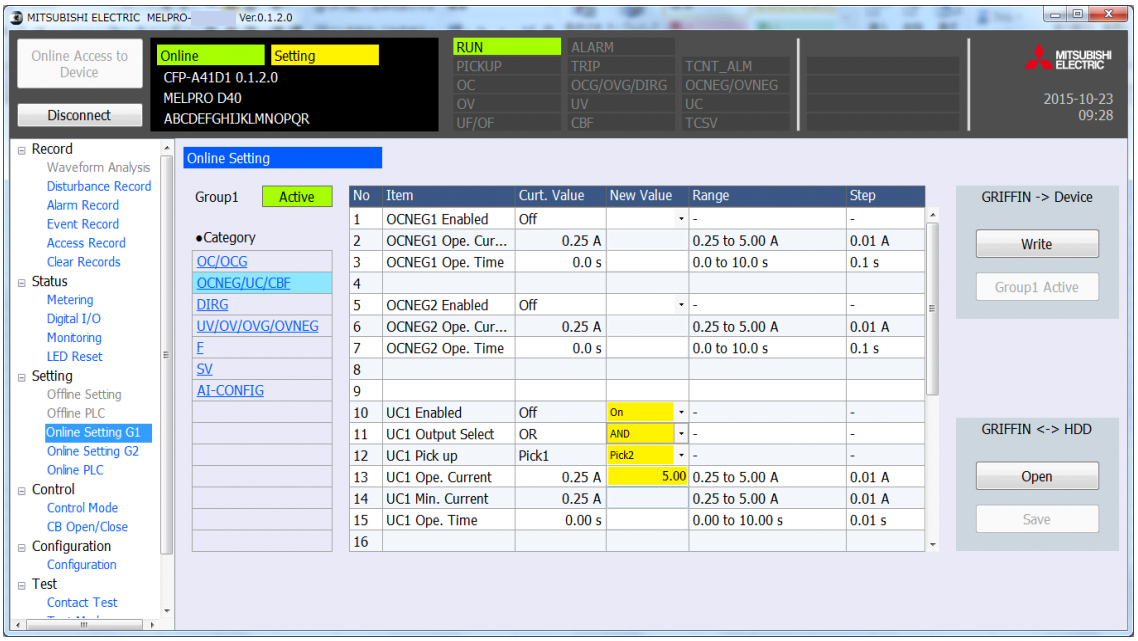


4. The setting file is read as shown below.

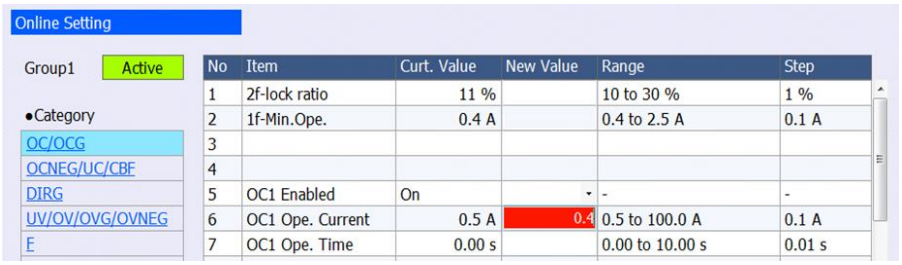


[Editing setting files]

1. Select an item to edit from Category. A list of setting values is shown under Item. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.

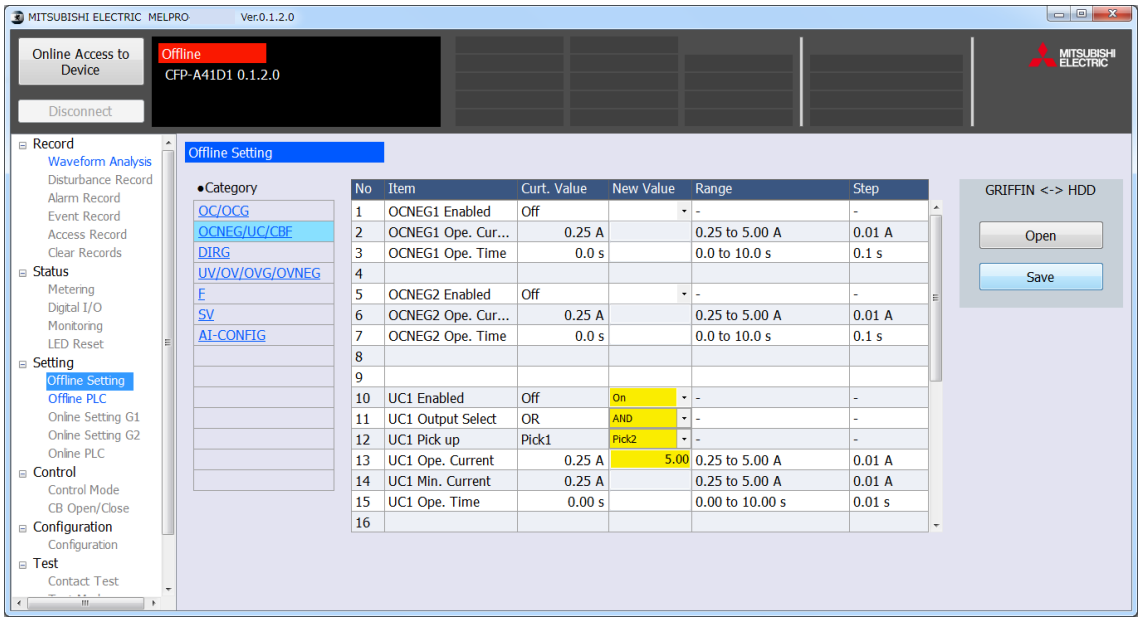


Note) If any value out of the setting range is entered, an error indication as shown below is given.

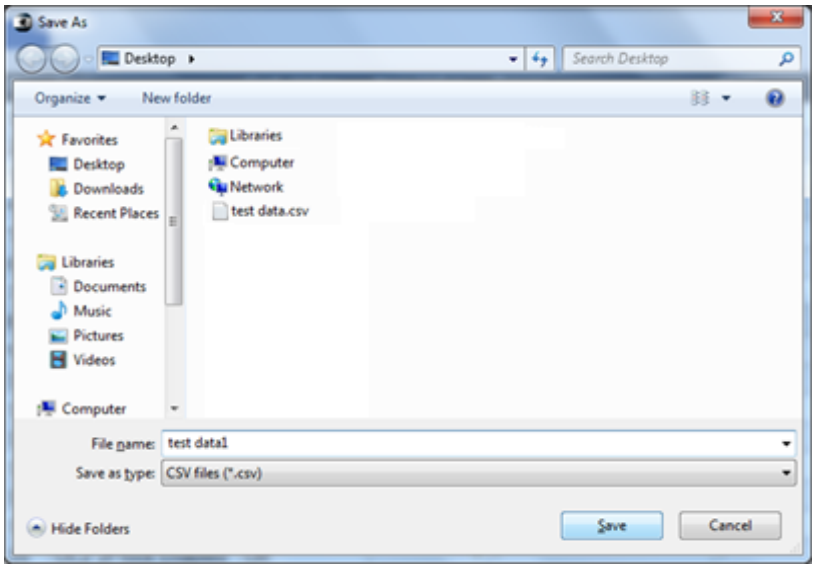


[Saving setting files]

1. From PC-HMI <-> HDD in the upper right part of the main screen, click “Save.”



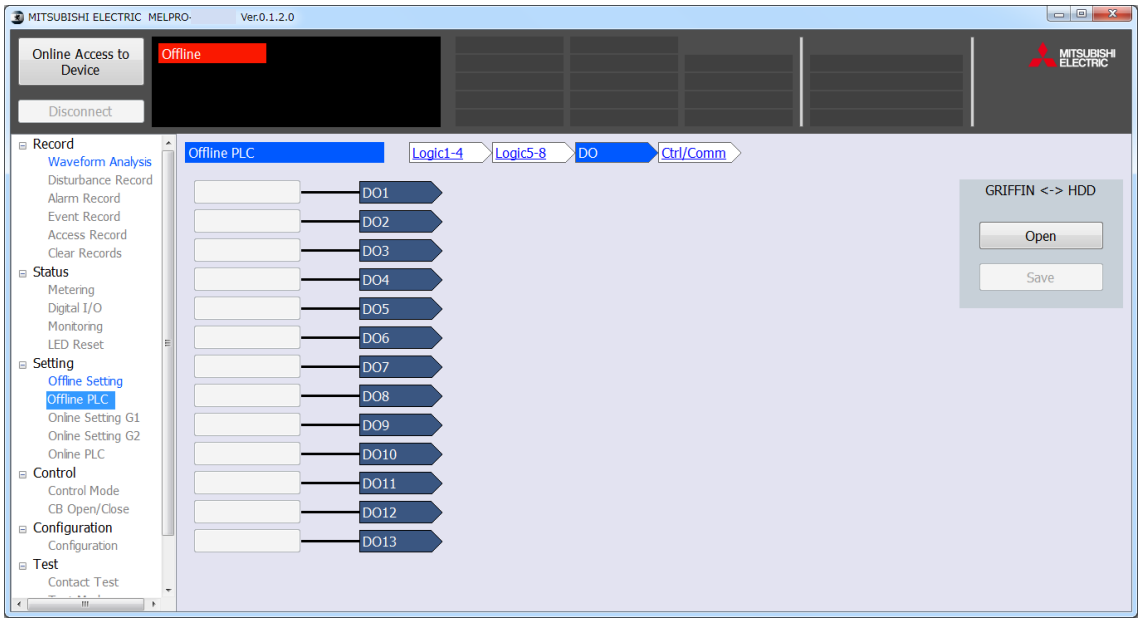
2. Select the destination folder, enter a file name and click “Save.” The setting file is saved.



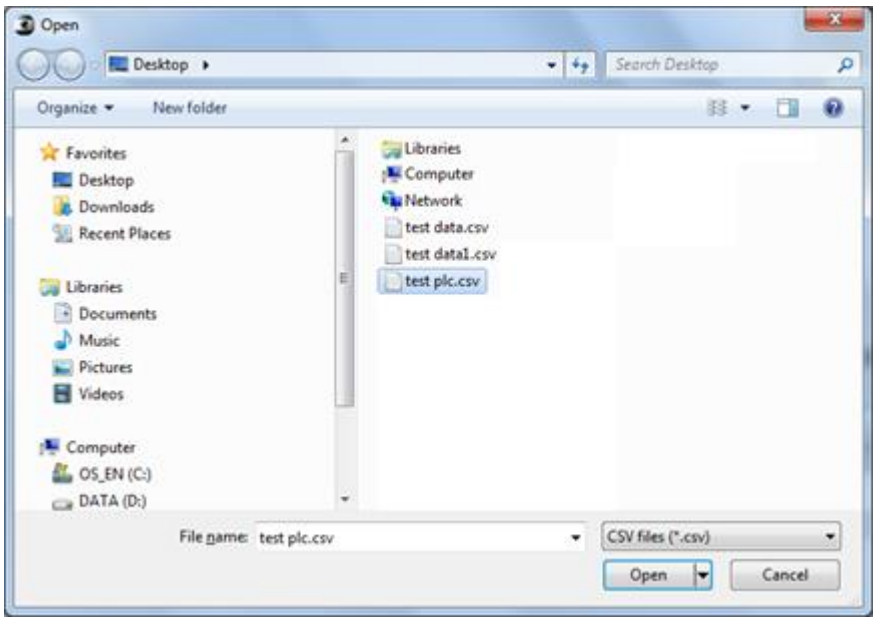
1.7.3. Reading, editing and saving PLC files

[Reading PLC files]

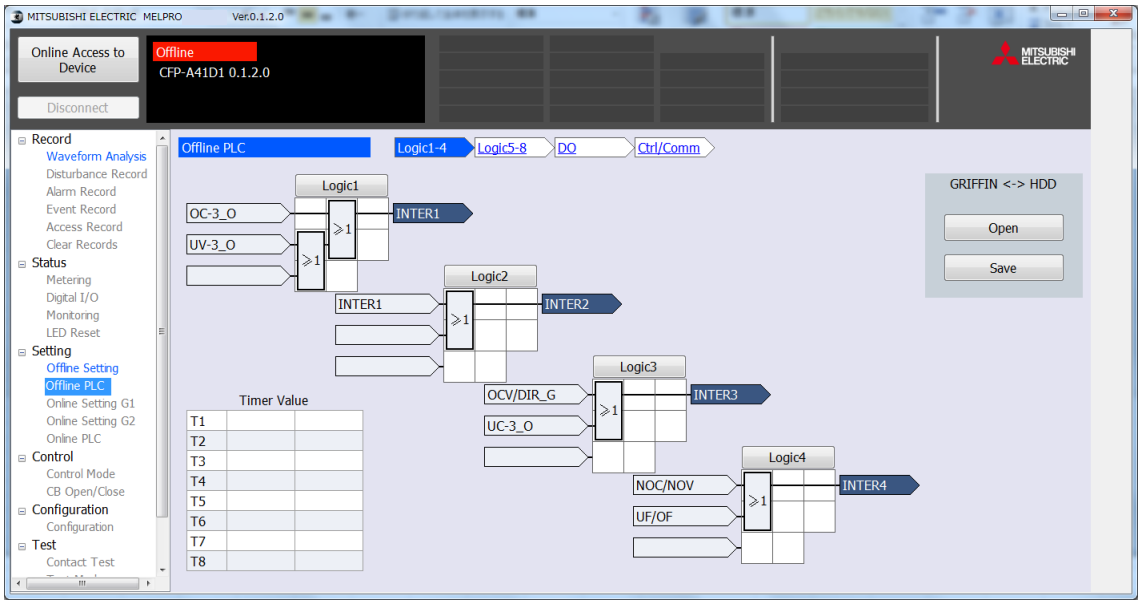
1. From the Function menu, click Offline PLC.
2. From PC-HMI <-> HDD in the upper right part of the main screen, click “Open.”



3. Select the PLC file to read from the HDD.
   (Files in the .csv format can be read)



4. The PLC file is read as shown below.

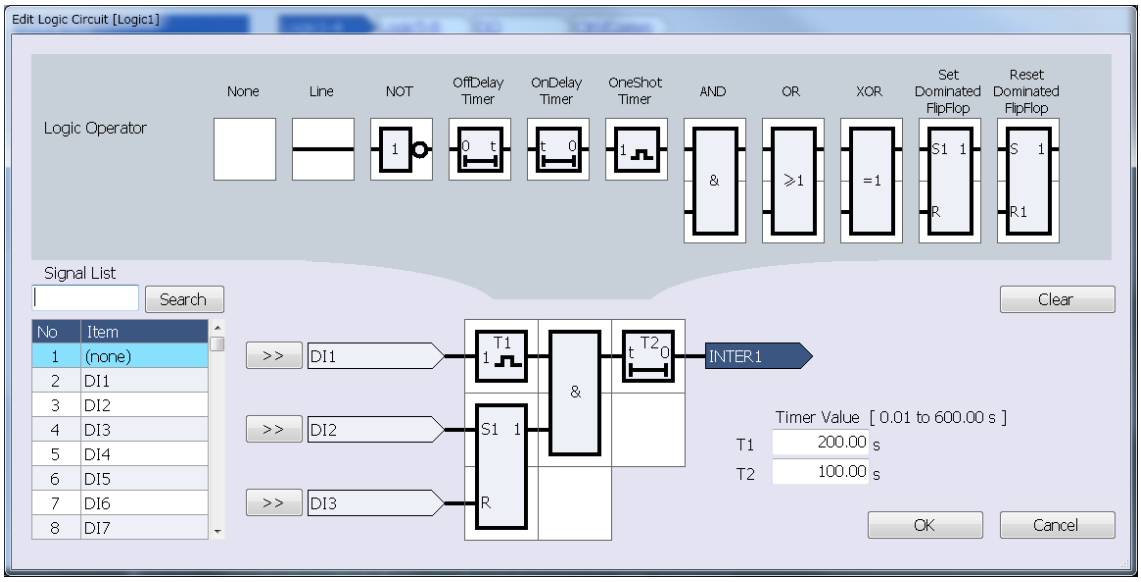

MITSUBISHI ELECTRIC MELPRO
Ver.0.1.2.0
Online Access to Device
Disconnect
Offline
CFP-A41D1 0.1.2.0
MITSUBISHI ELECTRIC
Record
Waveform Analysis
Disturbance Record
Alarm Record
Event Record
Access Record
Clear Records
Status
Metering
Digital I/O
Monitoring
LED Reset
Setting
Offline Setting
Offline PLC
Online Setting G1
Online Setting G2
Online PLC
Control
Control Mode
CB Open/Close
Configuration
Configuration
Test
Contact Test
Offline PLC
Logic1-4
Logic5-8
DO
Ctrl/Comm
Logic1
OC-3_O
UV-3_O
≥1
INTER1
Logic2
INTER1
INTER2
Logic3
OCV/DIR_G
UC-3_O
INTER3
Logic4
NOC/NOV
UF/OF
INTER4
GRIFFIN <-> HDD
Open
Save
Timer Value
T1
T2
T3
T4
T5
T6
T7
T8

[Editing PLC files]

1. Click the Logic group and Logic to edit.

   Logic1-4 : indication and editing screen for logic circuits 1 to 4
   Logic5-8 : indication and editing screen for logic circuits 5 to 8

2. The logic circuit editing screen as shown below appears. (The screen below shows a display example)

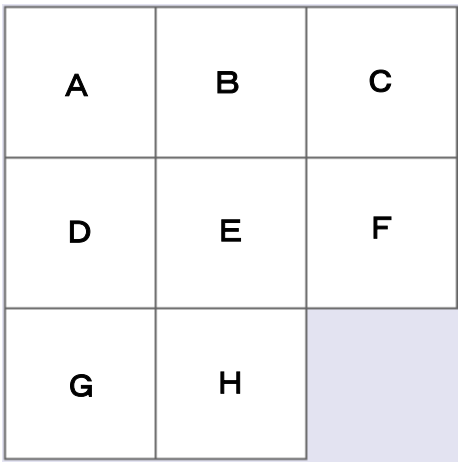


3. From the Item list, select the signal to input and click. The selected signal is shown in light blue. Click “>>” to select the input signal.

Note) The signal name can be searched by entering it on the Signal List by using the keyboard and clicking “Search.”

4. From the list of circuit components, select the logic component to place and click the logic area to place it. The logic component is placed.
   After the placement has been completed, click “OK” to go back to the previous screen.

Note) Logic components that can and cannot be placed in certain areas are as shown below.

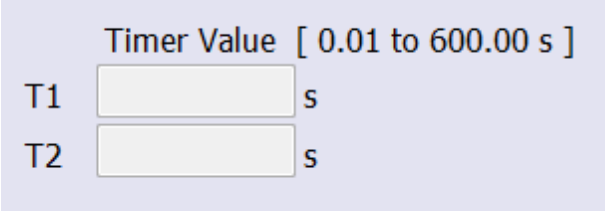


No	Component	A	B	C	D	E	F	G	H	Note
1	None	Y	Y	Y	Y	Y	Y	Y	Y	(*1)
2	Line	Y	Y	Y	Y	Y	N	Y	N	
3	Not	Y	Y	Y	Y	Y	N	Y	N	
4	OffDelay Timer	Y	Y	Y	Y	Y	N	Y	N	(*2)
5	OnDelay Timer	Y	Y	Y	Y	Y	N	Y	N	(*2)
6	OneShot Timer	Y	Y	Y	Y	Y	N	Y	N	(*2)
7	And	Y	Y	Y	Y	Y	N	N	N	
8	Or	Y	Y	Y	Y	Y	N	N	N	
9	Xor	Y	Y	Y	Y	Y	N	N	N	
10	Set FlipFlop	Y	Y	Y	Y	Y	N	N	N	
11	Reset FlipFlop	Y	Y	Y	Y	Y	N	N	N	

(*1): The component needs to have been placed.

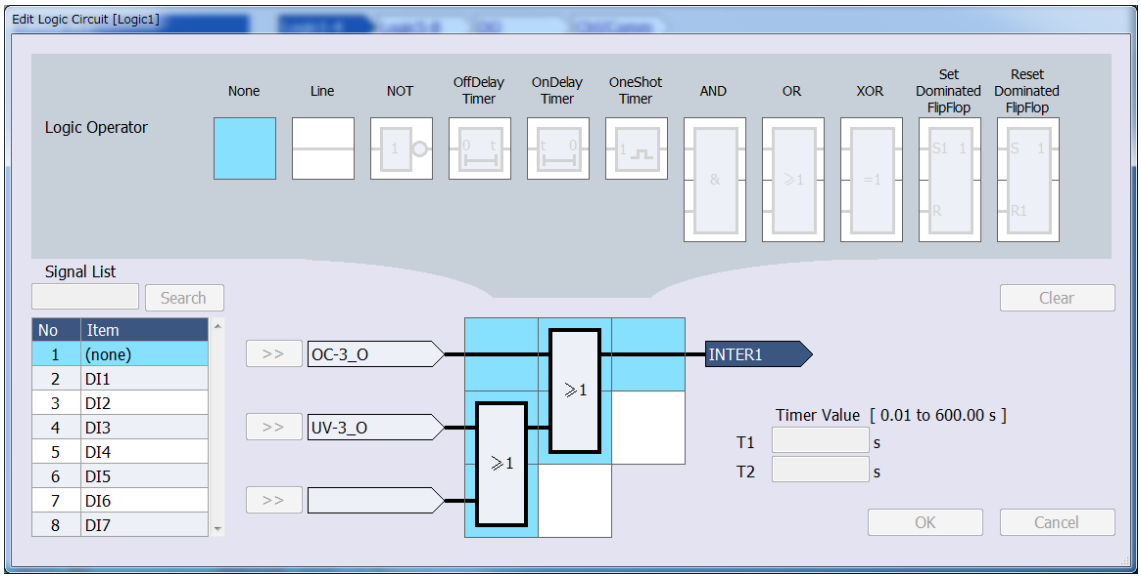
(*2): Up to two timer components can be placed in a logic area.
(More than two timers cannot be placed.)

When providing any timer component, specify the time in the Timer Value field.



Note) Attempting to place a logic component that cannot be placed in a certain logic area generates the error as shown below.

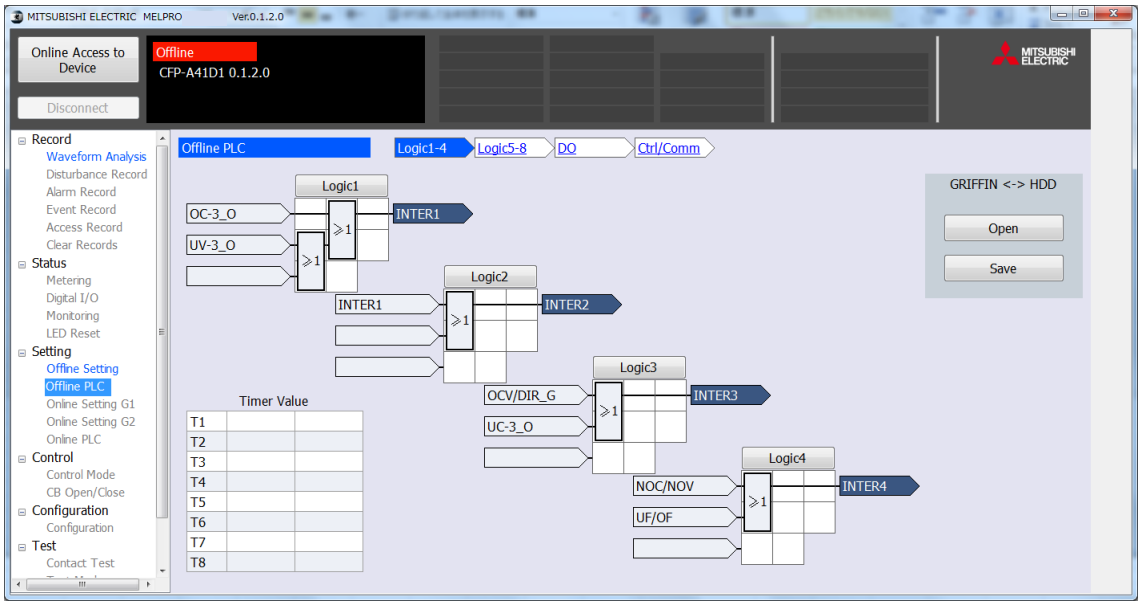
To remove any logic component that has been placed, select a None logic component and click the logic area to remove the component from (shown in light blue).



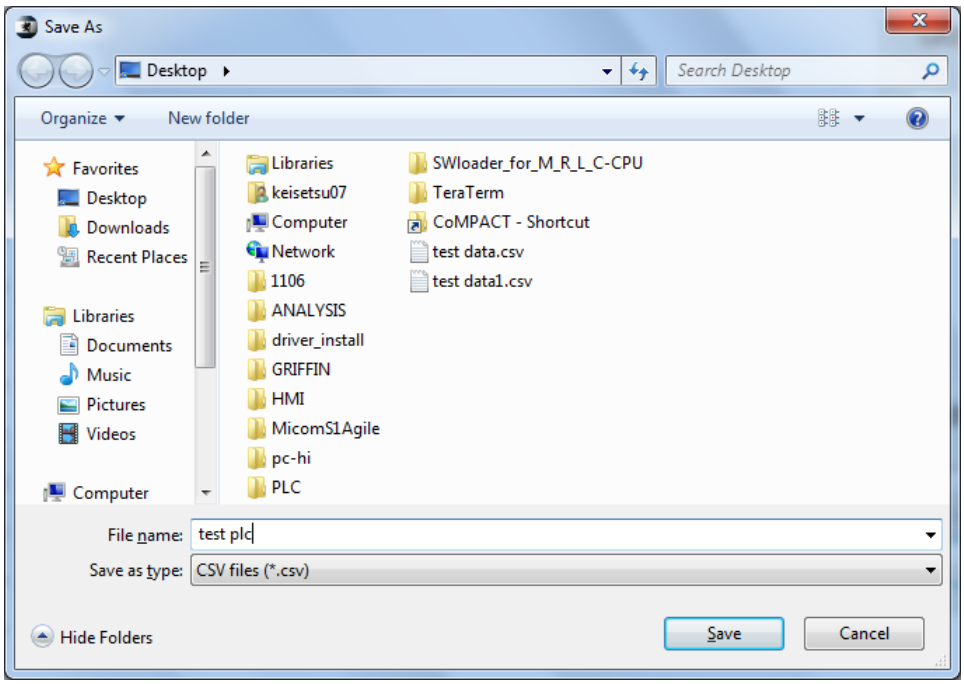
Clicking “Clear” brings back to the initial state with no input signal set, logic component placed or timer setting configured.

[Saving PLC files]

1. To save a PLC file on the HDD, from PC-HMI <-> HDD in the upper right part of the main screen, click “Save.”



2. Select the destination folder, enter a file name and click “Save.” The PLC file is saved.

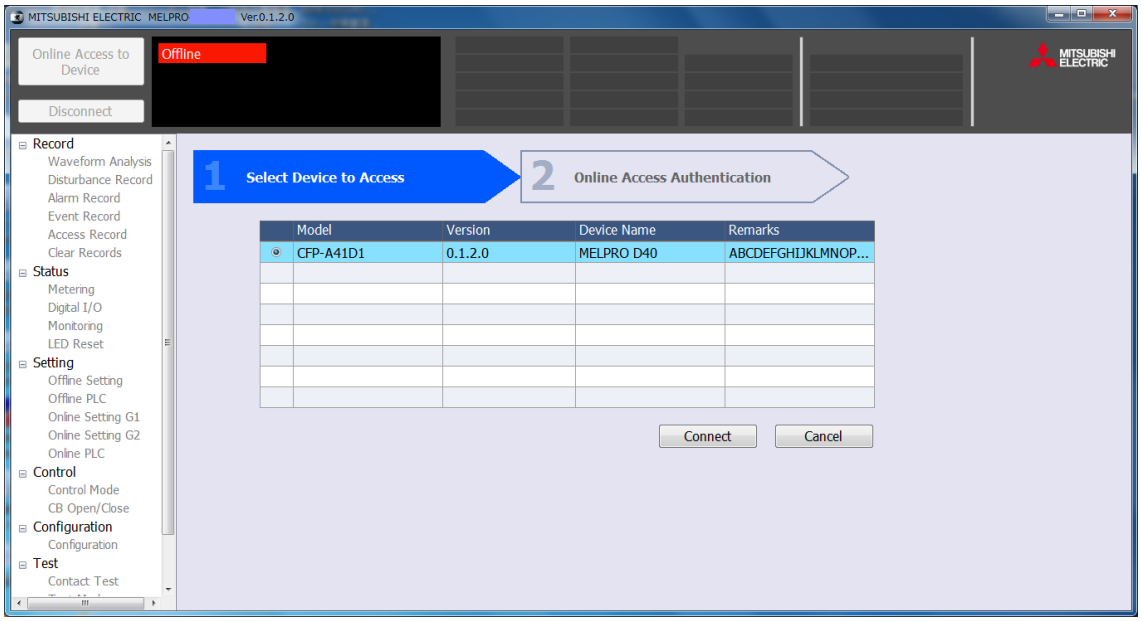


1.8. Logging into and out of the device

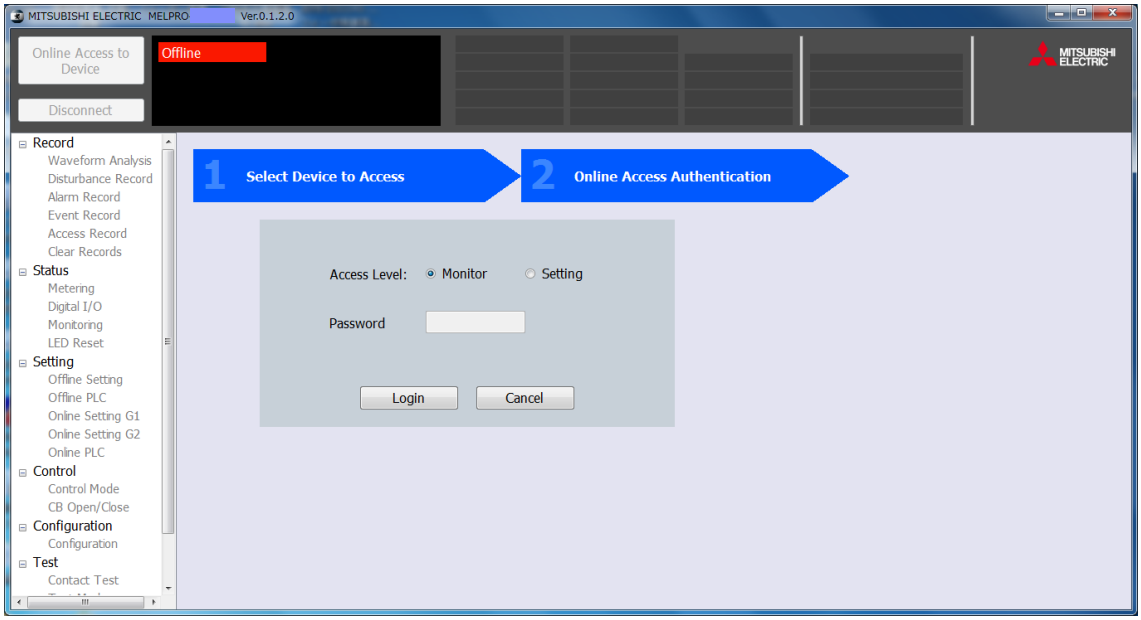
1.8.1. Logging in

1. From the offline screen, click the [Online Access to Device] button. The screen for selecting the device to access appears.

2. A list of devices that can be accessed appears. Click the radio button for the desired device to access under Model and click “Connect.” (To cancel, click “Cancel” to go back to the offline initial screen.)

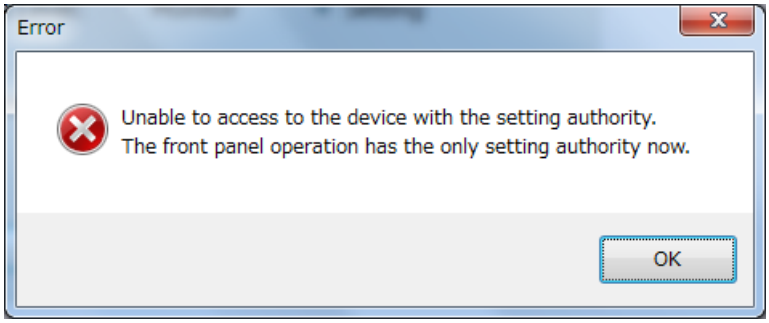


3. The access authentication screen appears. Click the radio button for the desired access level.
(Monitor: view permission, Setting: write permission)



If you do not desire to log in, click “Cancel” to go back to the offline initial screen.

Note) If the Setting permission is selected from the panel, it is not possible to log in from the PC-HMI with the Setting permission.The error message as shown below appears.



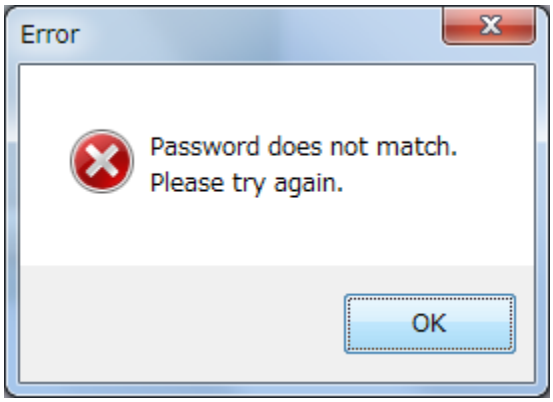
4. Enter the password (when a password is used and the device is accessed with the Setting permission).

Note) This operation is required when the device is accessed with the password use setting and Setting permission.
The password use/unuse setting can be changed by operation from the front panel.

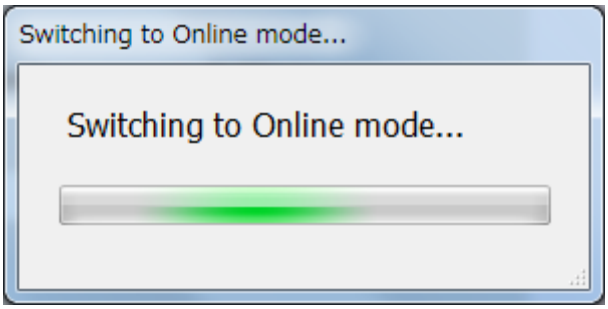
When no password is used or the device is accessed with the Monitor permission, password entry is not required.Simply click “Login” to log in.

After entering the password in the Password field, click “Login.”
Only half-width alphanumeric characters are acceptable to be included in a password.
The default password setting is “0000.”

If a wrong password is given, the error message as shown below appears. Click “OK” and enter the password again.

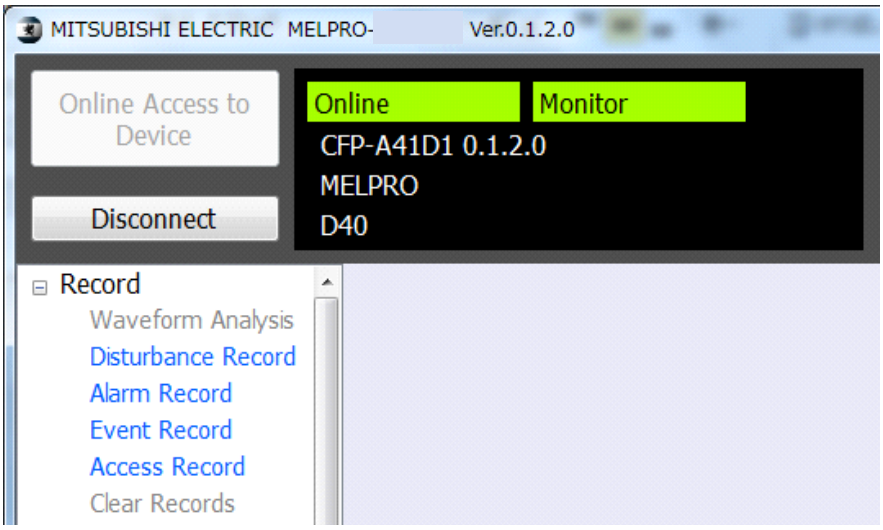


5. Successful password authentication switches the device mode from offline to online.

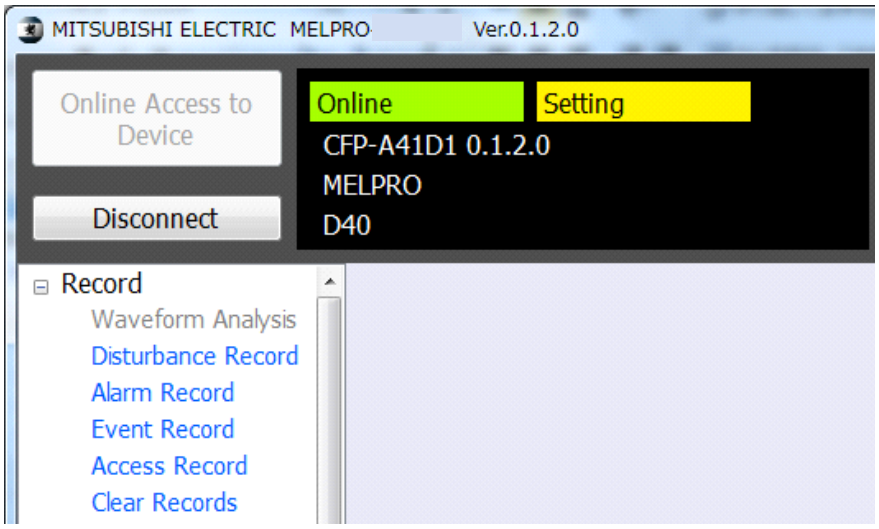


6. After switching to the online mode, the initial screen according to the access level appears.

(1) Online initial screen for the view permission



(2) Online initial screen for the write permission



Operations enabled differ depending on the access level.

Items in blue: enabled

Items in gray: disabled

For operations enabled/disabled depending on the access level, see the list on the next page.

List of operations enabled/disabled for the respective access levels

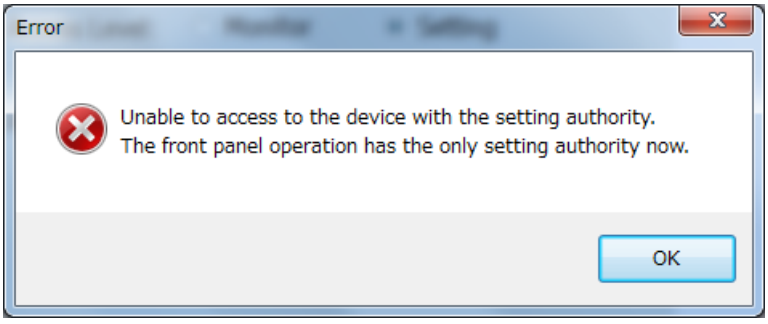
Type	Item	Offline mode	Online mode	
			View permission	Write permission
Record	Waveform Analysis	Y	N	N
	Disturbance Record	N	Y	Y
	Alarm Record	N	Y	Y
	Event Record	N	Y	Y
	Access Record	N	Y	Y
	Clear Records	N	N	Y
Status	Metering	N	Y	Y
	Digital I/O	N	Y	Y
	Monitoring	N	Y	Y
	LED Reset	N	Y	Y
Setting	Offline Setting	Y	N	N
	Offline PLC	Y	N	N
	Online Setting G1	N	Y	Y
	Online Setting G2	N	Y	Y
	Online PLC	N	Y	Y
Control	Control Mode	N	Y	Y
	CB Open/Close	N	N	Y
Configuration	Configuration	N	Y	Y
Test	Contact Test	N	N	Y
	Test Mode	N	N	Y
About	Help	Y	Y	Y

The symbols in the table above have the following meanings.

Y: The menu can be used to access a function screen.
Display of the function screen and operations other than device write are possible.

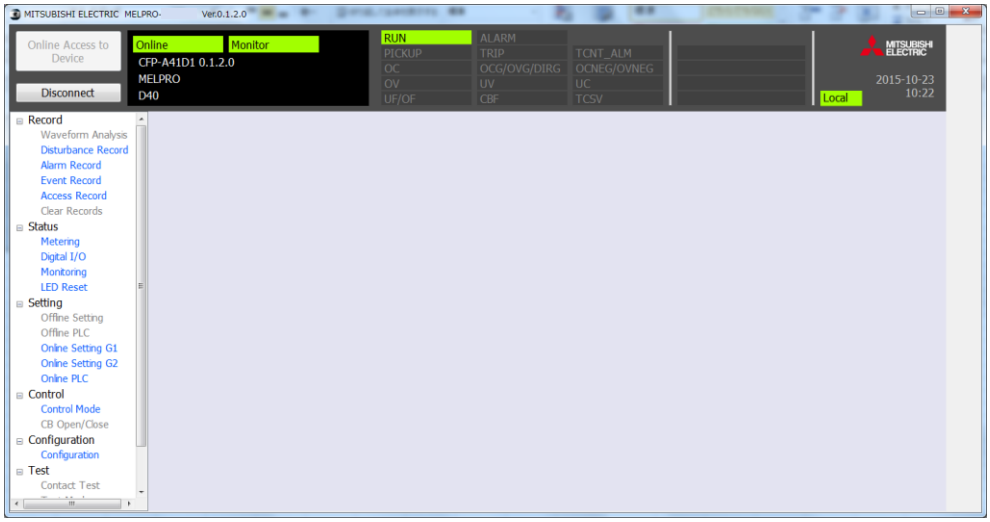
N: The menu is shown but grayed out and does not allow access to a function screen.
Neither display nor operation of the function screen is possible.

Note) Attempting an operation not permitted by the access level generates the error message as shown below.

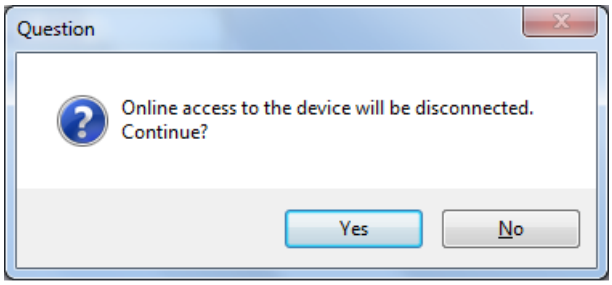


1.8.2. Logging off from the online mode

1. Click the [Disconnect] button in the upper left part of the online mode screen.



2. The dialog to confirm disconnection as shown below appears. Click “Yes.”



3. The device mode is switched to offline.

1.9. PC-HMI operation menu

PC-HMI allows access to the individual items from the list of functions on the left side of the main screen. The name and overview of each item are given in the table below.

No	Type	Name	Description
1	Record	Waveform Analysis	Starts the waveform analysis tool, a separate application (*1)
2		Disturbance Record	Disturbance record screen
3		Alarm Record	Supervision alarm record screen
4		Event Record	Event record screen
5		Access Record	Access record screen
6		Clear Records	Clear record screen
7	Status	Metering	Analog measurement status display screen
8		Digital I/O	DIO status display screen
9		Monitoring	Device supervision status display screen
10		LED Reset	LED reset screen
11	Setting	Offline Setting	Offline setting screen
12		Offline PLC	Offline PLC screen
13		Online Setting G1	Online setting screen (Group 1)
14		Online Setting G2	Online setting screen (Group 2)
15		Online PLC	Online PLC screen
16	Control	Control Mode	CB control mode screen
17		CB Open/Close	CB control execution screen
18	Configuration	Configuration	Configuration screen
19	Test	Contact Test	DO contact test screen
20		Test Mode	Test mode activation screen
21	About	Help	Shows the operation manual as a PDF file in a new window (*2)

Note) Items that cannot be selected are grayed out and not enabled for selection.

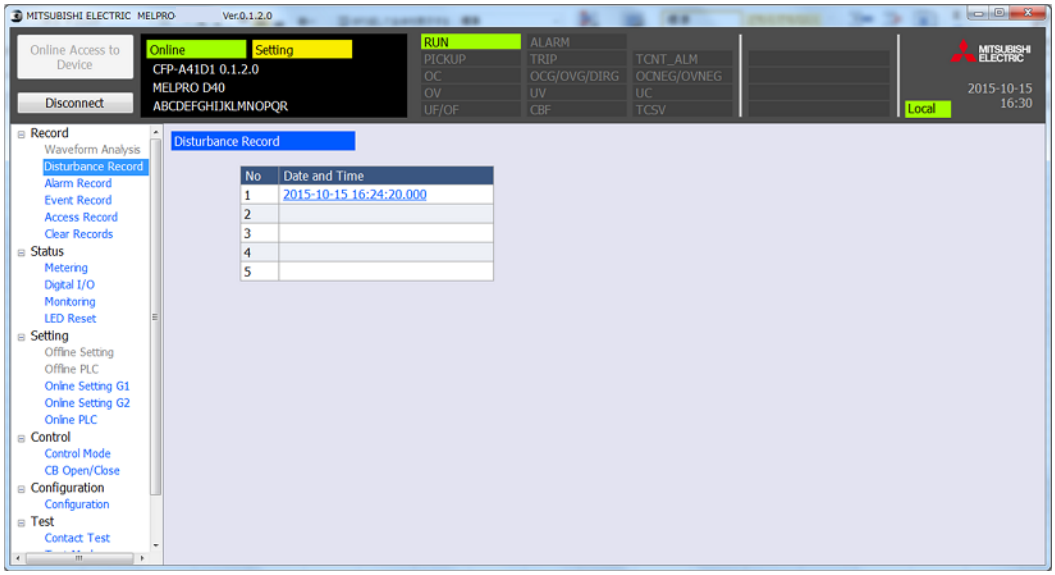
(*1): Implemented by a different application and the menu only allows starting of the application.

(*2): Only allows starting of PDF. If no application is installed that is required for starting PDF, the instruction manual read error message appears.

1.10. Retrieving and clearing record files

1.10.1. Retrieving disturbance record files

1. From the Function menu, select Disturbance Record.



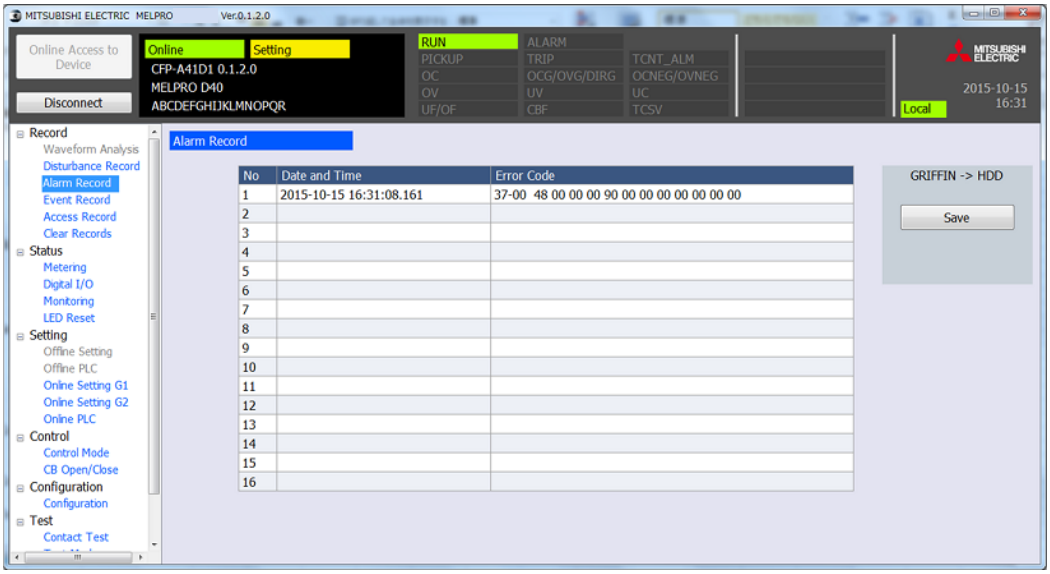
2. The dates and times of disturbance occurrences are listed in the descending order of the date and time. Select the data to retrieve.

3. Save it in an arbitrary location on the HDD.
   (The waveform analysis tool allows analysis of the waveform data saved.)

Note) The dates and times are represented as “-year-month-day- hour:-minute:-second.-millisecond.”
Note) Up to five occurrences can be shown. If the data size is large, the number may be less than five.

1.10.2. Retrieving supervision alarm record files

1. From the Function menu, select Alarm Record.



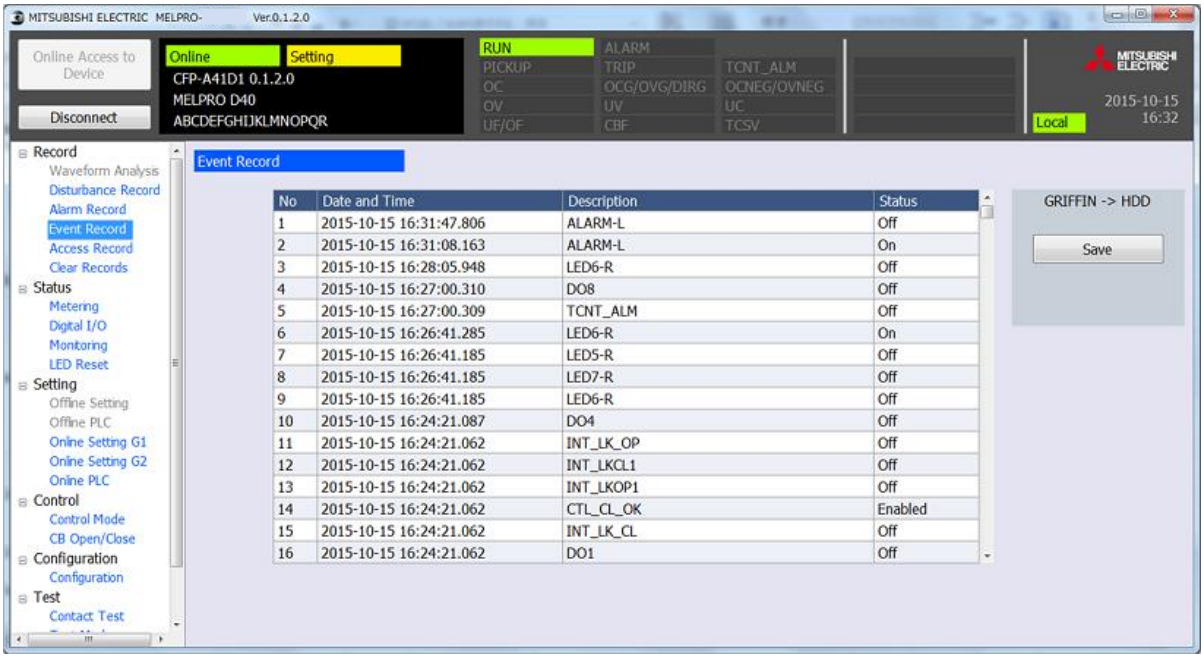
2. The supervision alarm records are listed in the descending order of the date and time. Select the data to retrieve.

3. From PC-HMI -> HDD, click “Save” to save it in an arbitrary location on the HDD.

Note) If the number of record data exceeds 16, use the scroll bar for display.
Up to 200 data can be shown. For the details of the date and time indication, see 1.10.1

1.10.3. Retrieving event record files

1. From the Function menu, select Event Record.



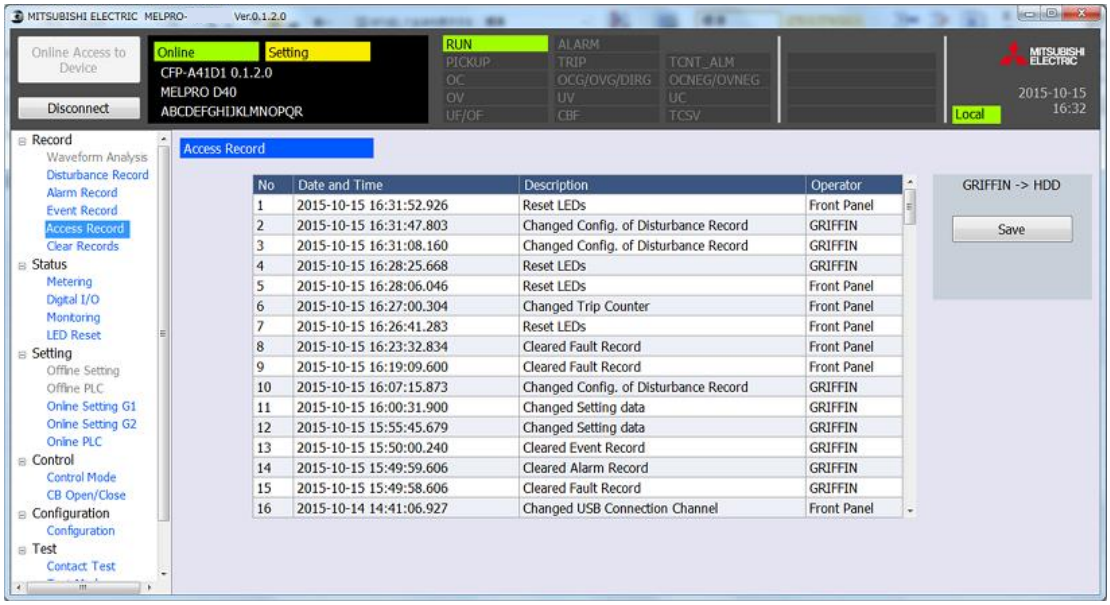
2. The record data relating to preregistered events are listed in the descending order of the date and time.

3. Select the event record to retrieve and, from PC-HMI -> HDD, click “Save” to save it in an arbitrary location on the HDD.

Note) If the number of record data exceeds 16, use the scroll bar for display.
Up to 512 data can be shown. For the details of the date and time indication, see 1.10.1.

1.10.4. Retrieving access record files

1. From the Function menu, click Access Record.



2. The record data relating to access to the preregistered device are listed in the descending order of the date and time.

3. From PC-HMI -> HDD, click “Save” to save it in an arbitrary location on the HDD.

Note) If the number of record data exceeds 16, use the scroll bar for display.
Up to 200 data can be shown. For the details of the date and time indication, see 1.10.1.

Note) For access operator and access record description, see the list below.

Access operator list (Operator)

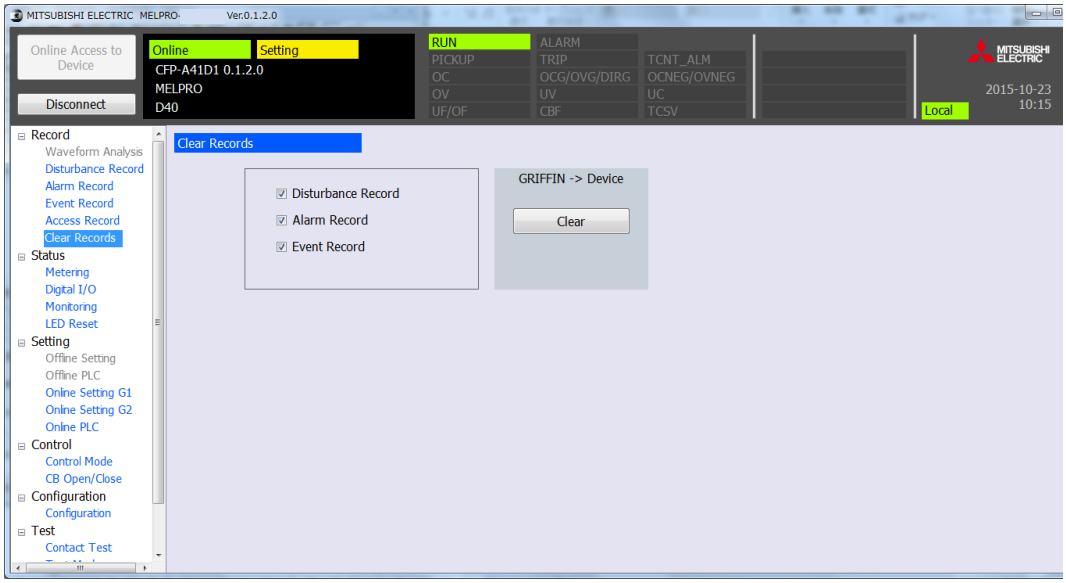
Access operator	PC-HMI indication
Front panel	Front Panel
PC-HMI	PC-HMI
Via Modbus communication I/F	via Modbus
Via TCP/IP communication I/F	via TCP/IP
Via CC-Link communication I/F	via CC-Link
Automatic cancellation on device	Automatic

Access record description list (Description)

Access record description	PC-HMI indication
Change of active setting group	Changed Active Setting Group
Change of DI detection voltage value	Changed DI Voltage
Change of configuration of disturbance record	Changed Config. of Disturbance Record
Change of password use setting	Changed Use of Password
Change of password	Changed Password
Change of USB connection channel	Changed USB Connection Channel
Change of VFD brightness	Changed VFD Brightness
Change of trip counter	Changed Trip Counter
Change of configuration of Modbus	Changed Config. of Modbus
Change of configuration of CC-Link	Changed Config. of CC-Link
Change of configuration of IEC61850	Changed Config. of IEC61850
Change of device name	Changed Device Name
Change of configuration of analog measurement status display	Changed Config. of Metering
Change of configuration of electric energy	Changed Config. of Energy
Change of configuration of time management	Changed Config. of Time Management
Change of CB control mode	Changed CB Control Mode
Change of configuration of DO contact test	Changed Config. of Contact Test
Change of configuration of SNTP	Changed Config. of SNTP
Change of PLC data	Changed PLC data
Change of relay setting	Changed Setting data
Clearing of fault/disturbance record	Cleared Fault/Disturbance Record
Clearing of alarm record	Cleared Alarm Record
Clearing of event record	Cleared Event Record
Adjustment of system clock	Adjusted System Clock
Activation of test mode	Activated Test Mode
Deactivation of test mode	Deactivated Test Mode
LED reset	Reset LEDs
Start of DO contact test	Started Contact Test
Stop of DO contact test	Stopped Contact Test
Locking of supervision	Locked Supervision
Unlocking of supervision	Unlocked Supervision
Start of interface test	Started Interface Test
Stop of interface test	Stopped Interface Test
Operation to open/close CB	Operated to Open/Close CB

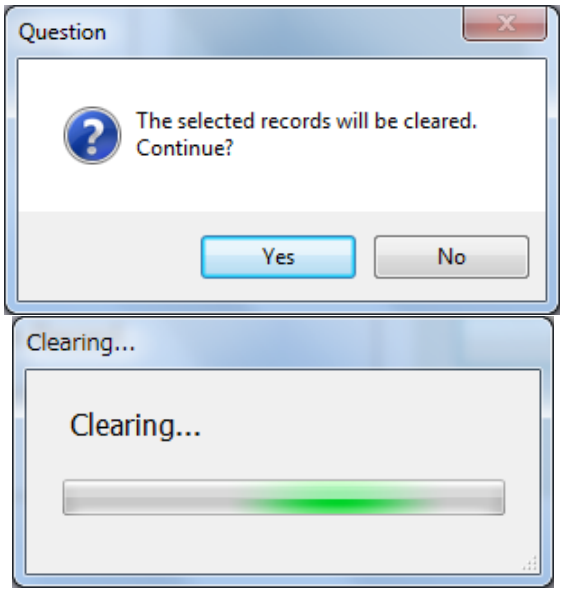
1.10.5. Clearing record files

1. From the Function menu, click Clear Records.

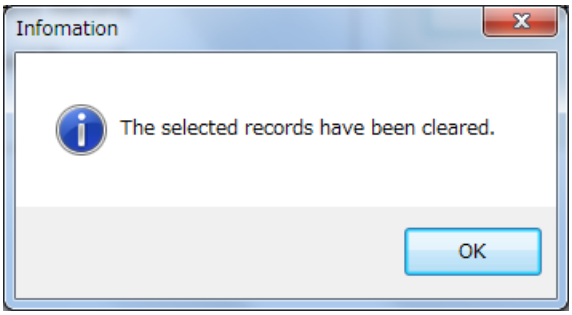


2. Check the box for the record to clear and, from PC-HMI -> Device, click “Clear.”

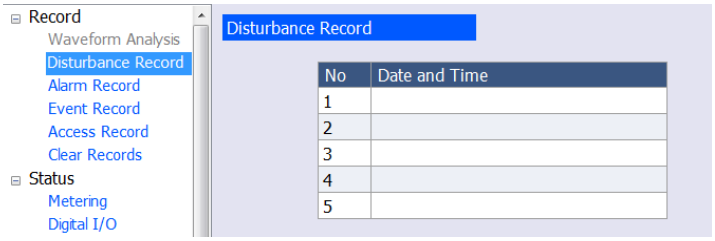
3. The confirmation dialog as shown below appears. Click “Yes” to start clearing.



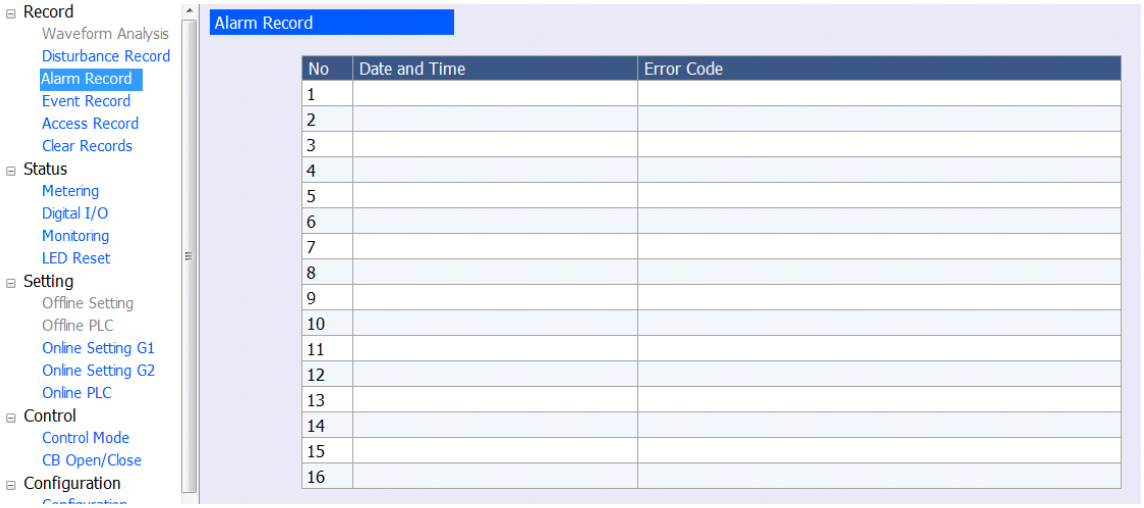
4. The clearing completion dialog appears and the relevant record is cleared.



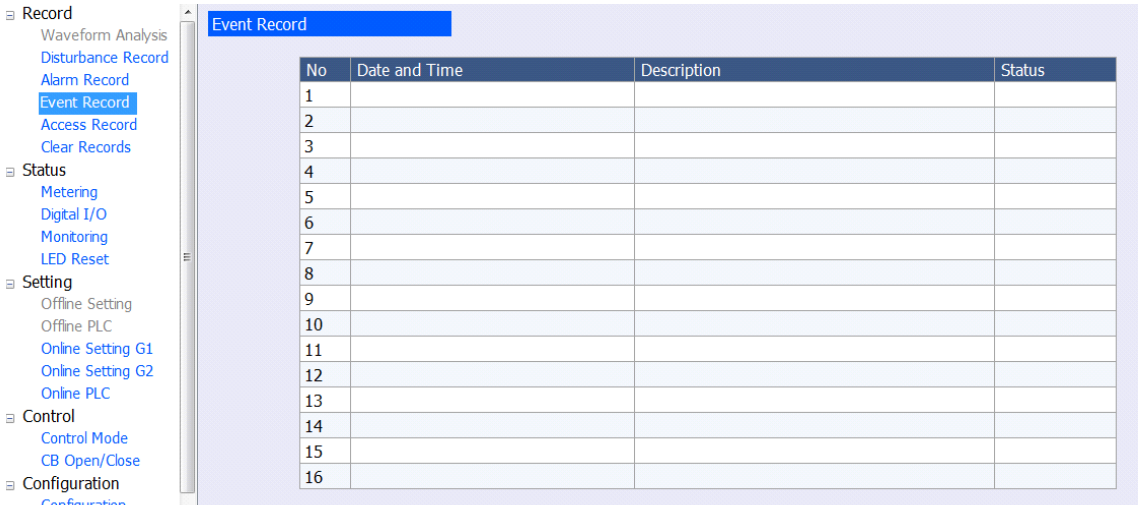
(1) Screen shown after clearing disturbance record data



(2) Screen shown after clearing alarm record data



(3) Screen shown after clearing event record data



Note) The file clearing operation erases the relevant record file
(The system does not allow clearing of access records.)

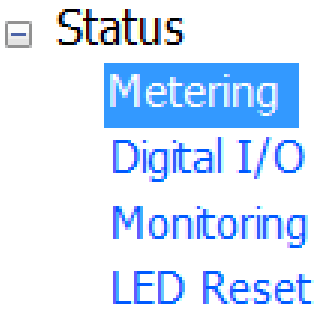
1.11. Showing statuses

1.11.1. Showing analog values measured

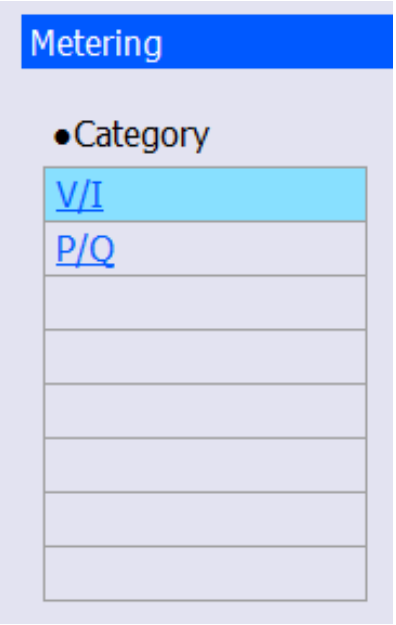
In the analog measurement status mode, the current statuses of analog values measured are listed.

1.11.1.1.Showing the current/voltage

1. From the Function menu, click Metering.

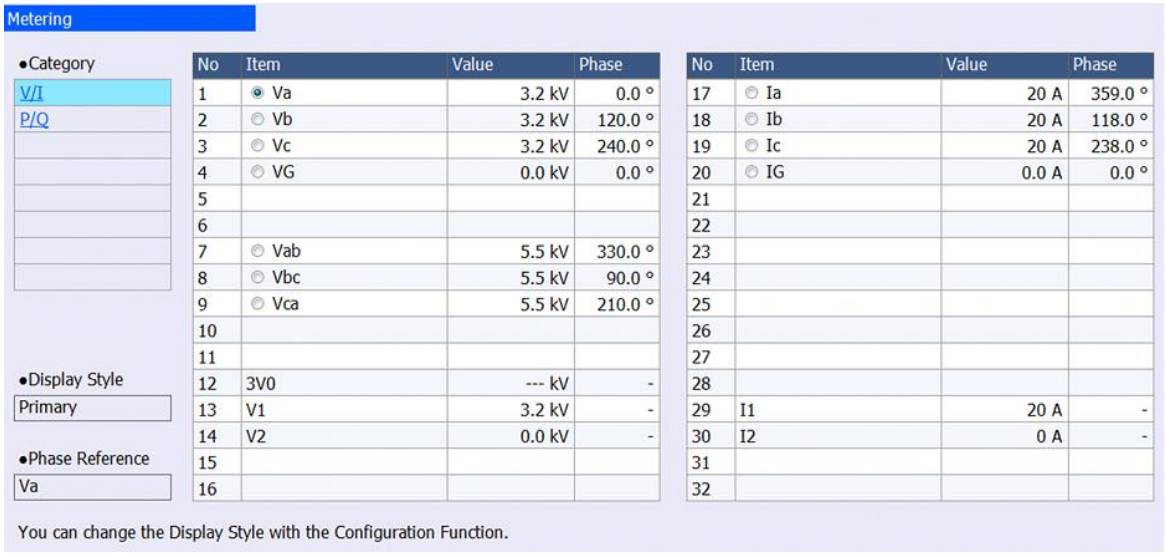


2. From Category, click V/I.



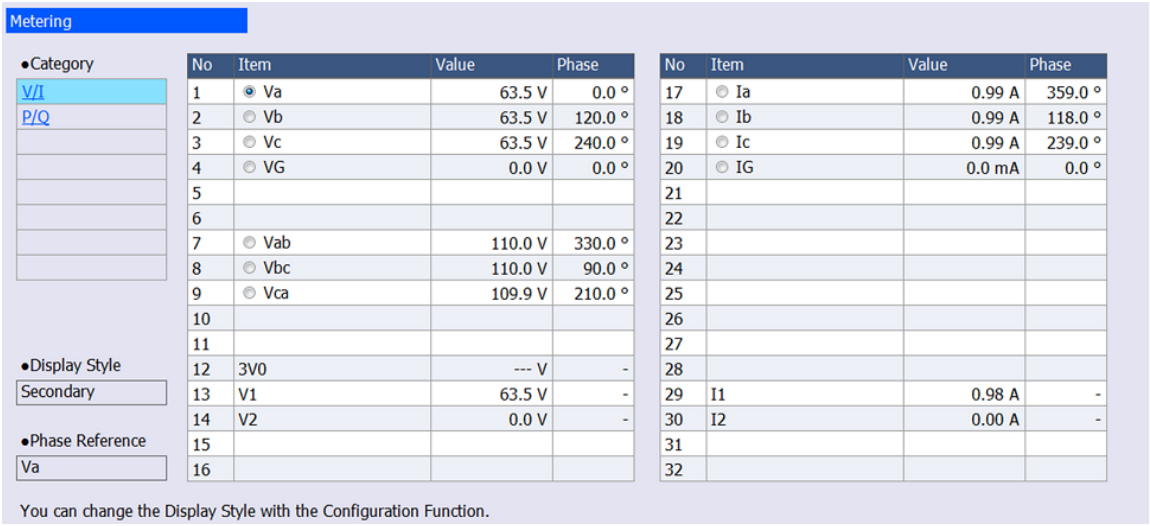
3. The V/I values for the side specified by the configuration are shown.

Primary side



No	Item	Value	Phase	No	Item	Value	Phase
1	Va	3.2 kV	0.0 °	17	Ia	20 A	359.0 °
2	Vb	3.2 kV	120.0 °	18	Ib	20 A	118.0 °
3	Vc	3.2 kV	240.0 °	19	Ic	20 A	238.0 °
4	VG	0.0 kV	0.0 °	20	IG	0.0 A	0.0 °
5				21			
6				22			
7	Vab	5.5 kV	330.0 °	23			
8	Vbc	5.5 kV	90.0 °	24			
9	Vca	5.5 kV	210.0 °	25			
10				26			
11				27			
12	3V0	--- kV	-	28			
13	V1	3.2 kV	-	29	I1	20 A	-
14	V2	0.0 kV	-	30	I2	0 A	-
15				31			
16				32			

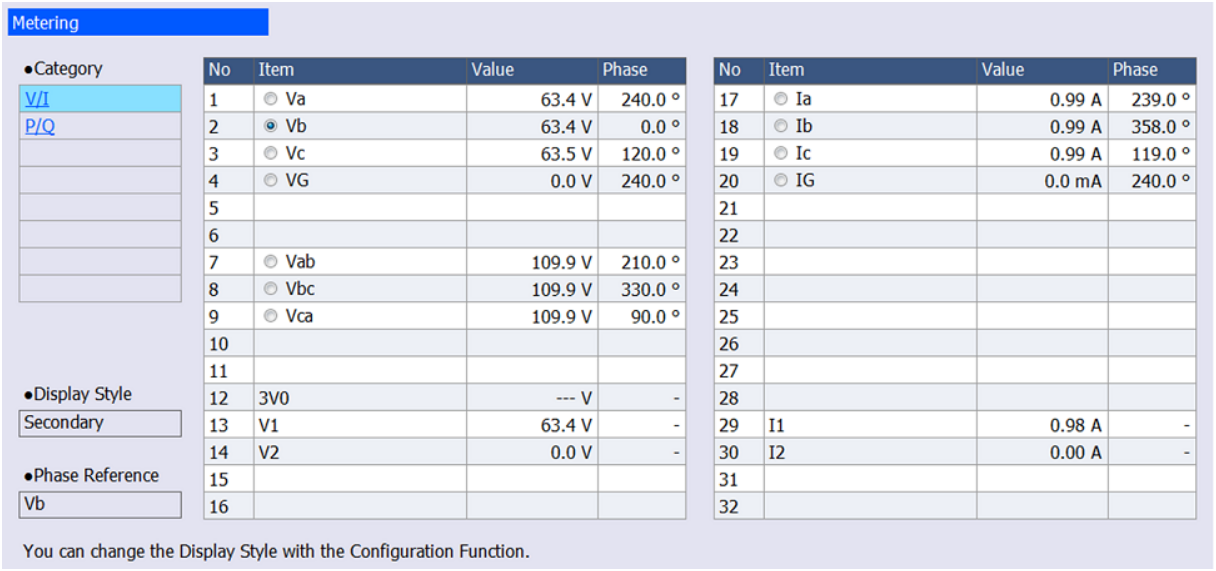
Secondary side



No	Item	Value	Phase	No	Item	Value	Phase
1	Va	63.5 V	0.0 °	17	Ia	0.99 A	359.0 °
2	Vb	63.5 V	120.0 °	18	Ib	0.99 A	118.0 °
3	Vc	63.5 V	240.0 °	19	Ic	0.99 A	239.0 °
4	VG	0.0 V	0.0 °	20	IG	0.0 mA	0.0 °
5				21			
6				22			
7	Vab	110.0 V	330.0 °	23			
8	Vbc	110.0 V	90.0 °	24			
9	Vca	109.9 V	210.0 °	25			
10				26			
11				27			
12	3V0	--- V	-	28			
13	V1	63.5 V	-	29	I1	0.98 A	-
14	V2	0.0 V	-	30	I2	0.00 A	-
15				31			
16				32			

Note) For switching between the primary and secondary indications, see 1.14.4.

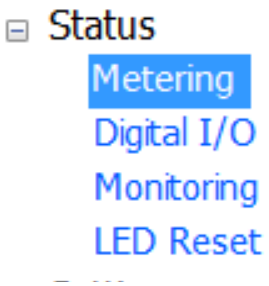
Note) Clicking an Item radio button allows change of the reference phase.
(In the figure below, the reference phase has been changed to Vb.)



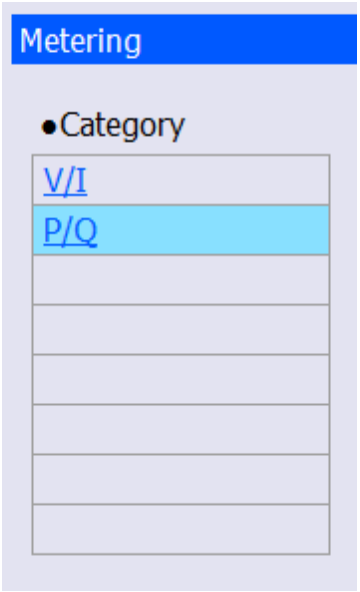
No	Item	Value	Phase	No	Item	Value	Phase
1	Va	63.4 V	240.0 °	17	Ia	0.99 A	239.0 °
2	Vb	63.4 V	0.0 °	18	Ib	0.99 A	358.0 °
3	Vc	63.5 V	120.0 °	19	Ic	0.99 A	119.0 °
4	VG	0.0 V	240.0 °	20	IG	0.0 mA	240.0 °
5				21			
6				22			
7	Vab	109.9 V	210.0 °	23			
8	Vbc	109.9 V	330.0 °	24			
9	Vca	109.9 V	90.0 °	25			
10				26			
11				27			
12	3V0	--- V	-	28			
13	V1	63.4 V	-	29	I1	0.98 A	-
14	V2	0.0 V	-	30	I2	0.00 A	-
15				31			
16				32			

1.11.1.2.Showing active/reactive power

1. From the Function menu, click Metering.

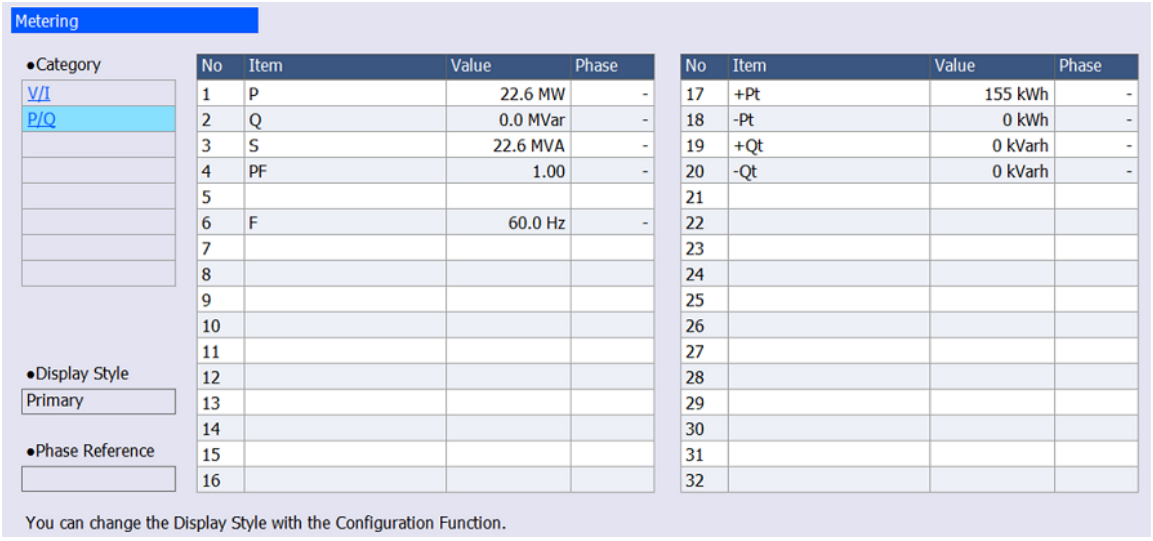


2. From Category, click P/Q.



3. The active/reactive power and other values for the side specified by the configuration are shown.

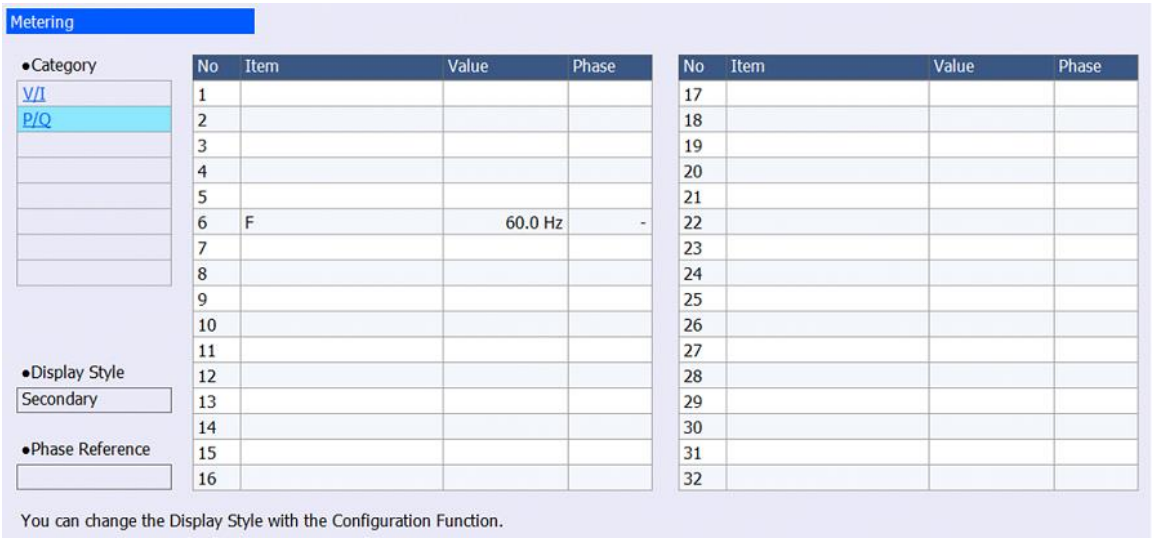
Primary side display



No	Item	Value	Phase
1	P	22.6 MW	-
2	Q	0.0 MVar	-
3	S	22.6 MVA	-
4	PF	1.00	-
5			
6	F	60.0 Hz	-
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

No	Item	Value	Phase
17	+Pt	155 kWh	-
18	-Pt	0 kWh	-
19	+Qt	0 kVarh	-
20	-Qt	0 kVarh	-
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

Secondary side display



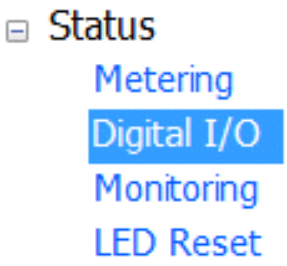
No	Item	Value	Phase
1			
2			
3			
4			
5			
6	F	60.0 Hz	-
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

No	Item	Value	Phase
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

Note) Power and electric energy are not shown for the secondary side.

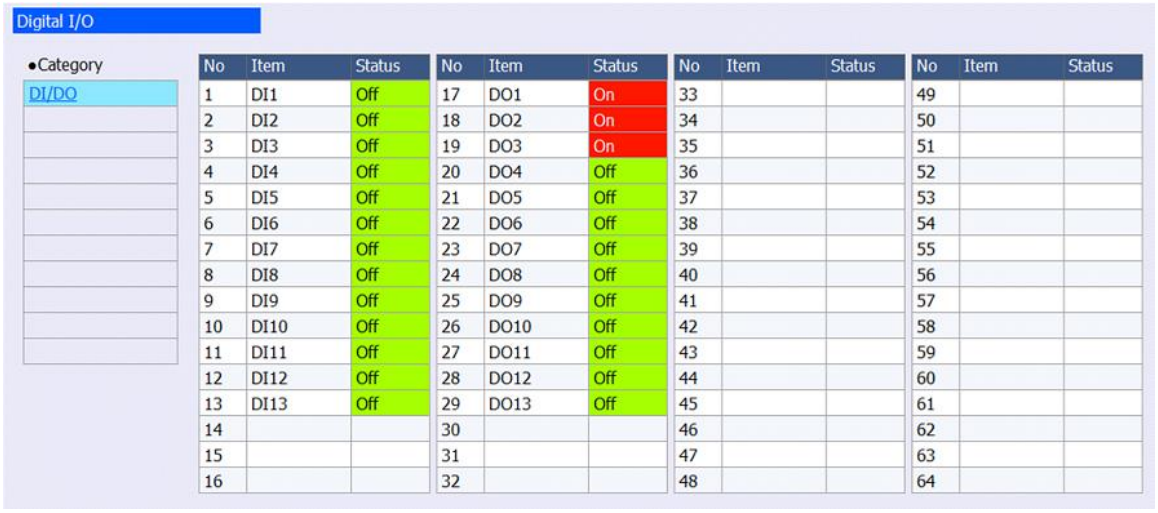
1.11.2. Showing Digital I/O

1. From the Function menu, click Digital I/O.



2. From Category, click DI/DO.

3. The current statuses of DI/DO are listed.



Digital I/O

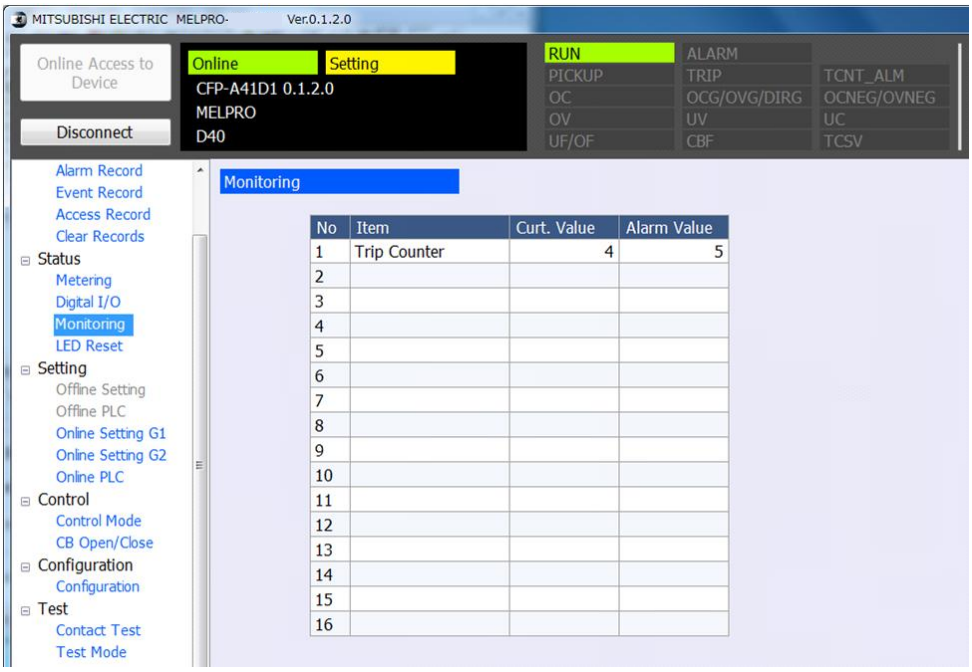
•Category

DI/DO

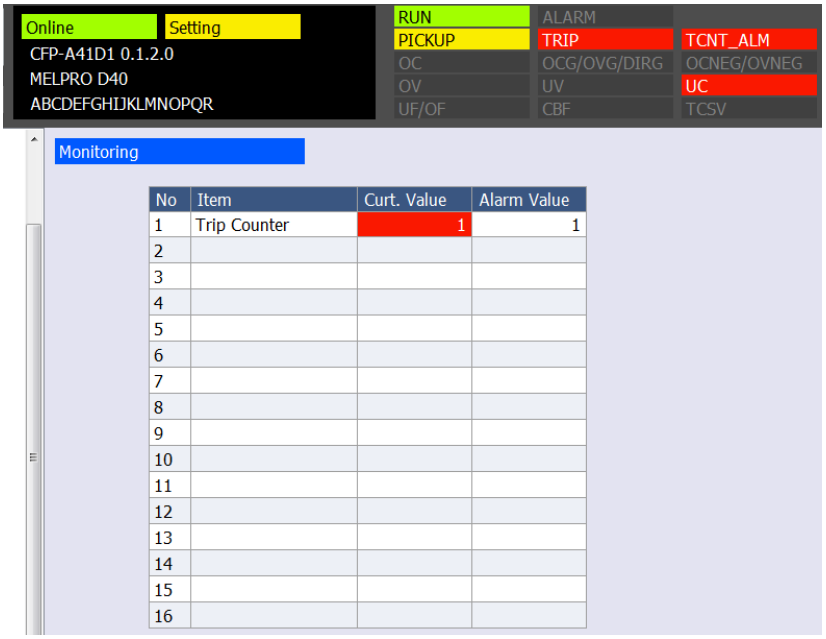
No	Item	Status	No	Item	Status	No	Item	Status	No	Item	Status
1	DI1	Off	17	DO1	On	33			49		
2	DI2	Off	18	DO2	On	34			50		
3	DI3	Off	19	DO3	On	35			51		
4	DI4	Off	20	DO4	Off	36			52		
5	DI5	Off	21	DO5	Off	37			53		
6	DI6	Off	22	DO6	Off	38			54		
7	DI7	Off	23	DO7	Off	39			55		
8	DI8	Off	24	DO8	Off	40			56		
9	DI9	Off	25	DO9	Off	41			57		
10	DI10	Off	26	DO10	Off	42			58		
11	DI11	Off	27	DO11	Off	43			59		
12	DI12	Off	28	DO12	Off	44			60		
13	DI13	Off	29	DO13	Off	45			61		
14			30			46			62		
15			31			47			63		
16			32			48			64		

1.11.3. Showing device supervision status

1. From the Function menu, click Monitoring. The device supervision status values (current and alarm setting values) are listed.



Note) If the current value is equal to or larger than the alarm setting value, an alarm indication is given as shown below.



1.11.4. Resetting LEDs

1. From the Function menu, click LED Reset.
2. From PC-HMI -> Device, click “LED Reset.”

3. The dialog as shown below appears. Click “Yes.”

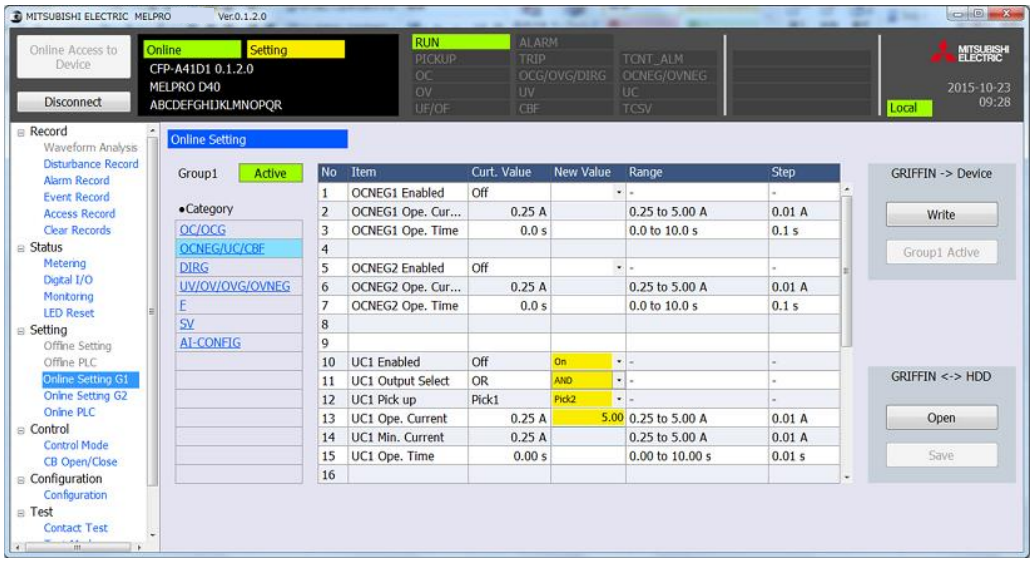
4. The latched LEDs are reset.

1.12. Setting mode

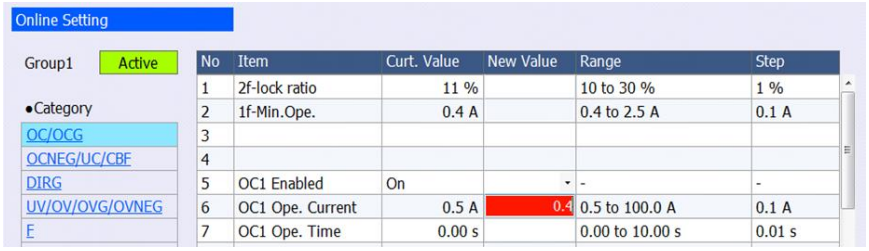
1.12.1. Online setting

1. From the Function menu, click the group to set.
   Online Setting G1: listing and editing of Group 1
   Online Setting G2: listing and editing of Group 2

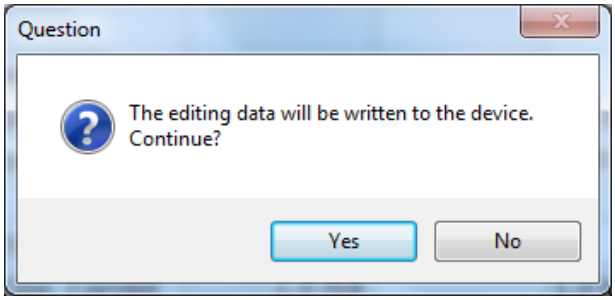
2. Click the item to set from Category. A list of setting values is shown under Item. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.



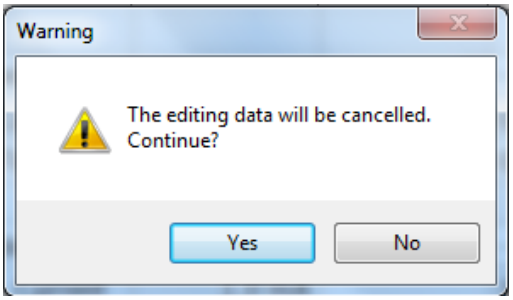
Note) If any value out of the setting range is entered, an error indication as shown below is given.



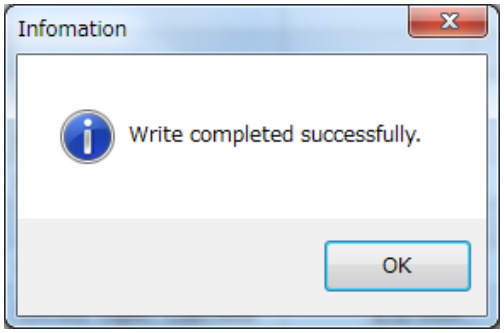
3. From PC-HMI -> Device, click “Write.” The confirmation dialog as shown below appears. Click “Yes.”



Note) To cancel writing of any setting value, click “No.” The confirmation dialog as shown below appears. Click “Yes” to cancel.

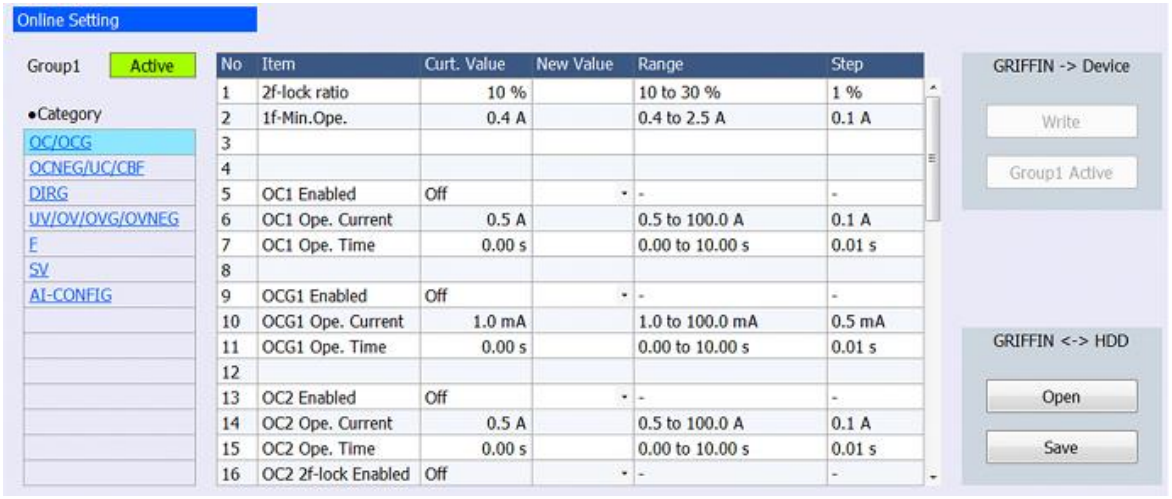


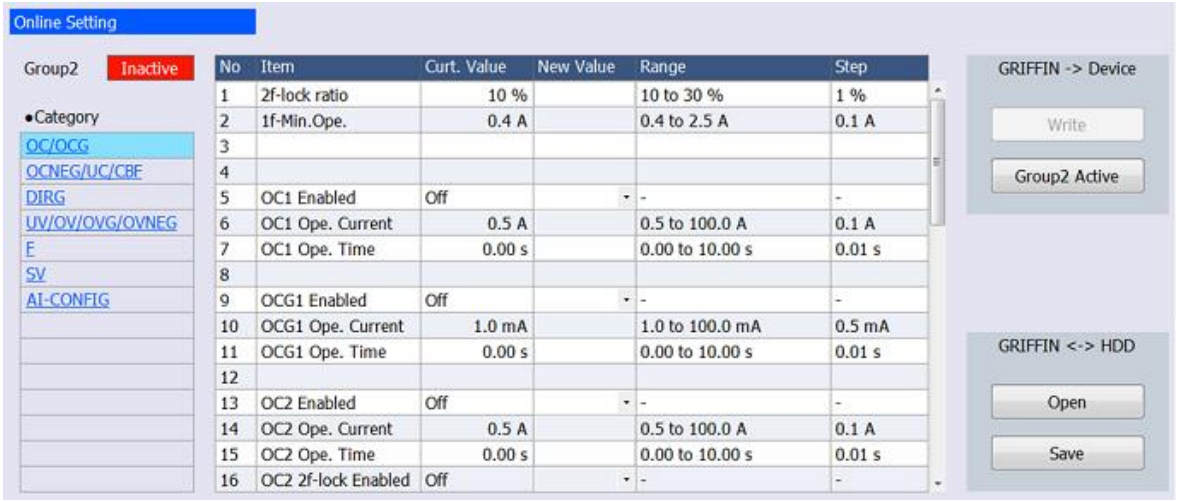
4. Writing of the setting values to the device starts. When it has been completed, the completion message as shown below appears.



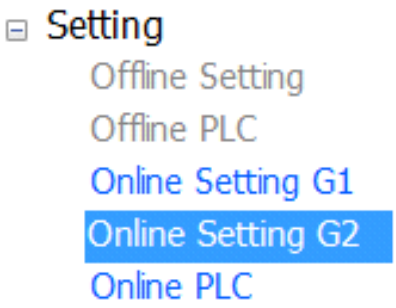
1.12.2. Switching between setting groups to activate

On the Online setting screen, the active group is marked as Active and the inactive group Inactive.



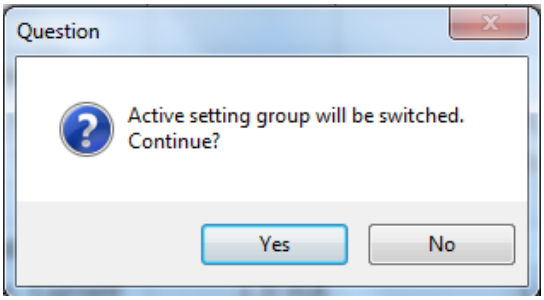


1. From the Function menu, click the setting group to activate.
   (In this example, the active group is switched from Group 1 to Group 2.)

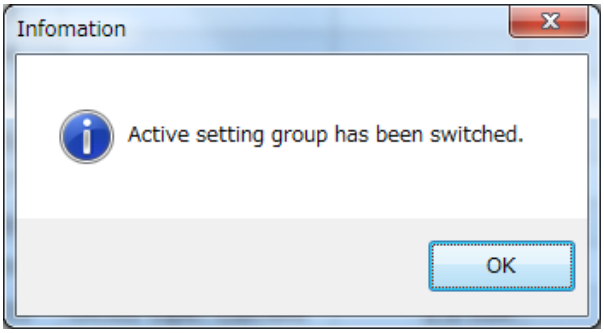


2. From PC-HMI -> Device, click “Group- Active.”

3. The confirmation dialog as shown below appears. Click “Yes.”

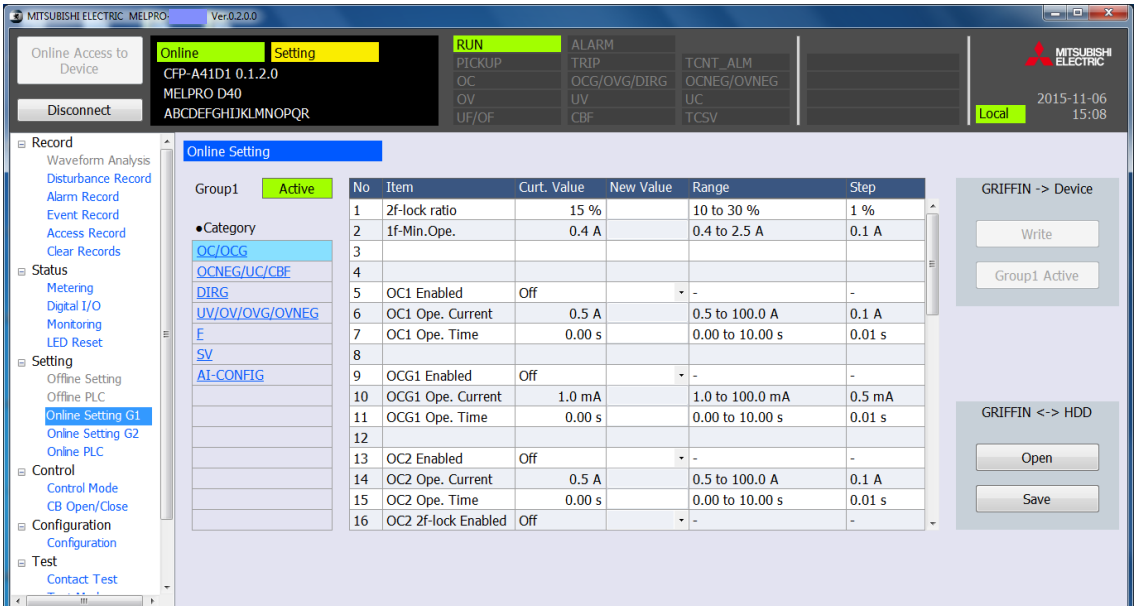


4. The message as shown below appears and the active setting group is switched.

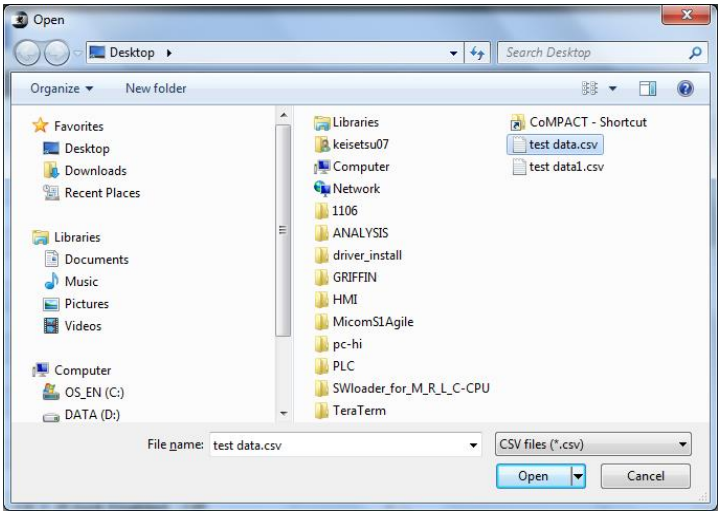


1.12.3. Reading/saving setting files from/to the HDD

1. From the Function menu, click the group to read setting values.
2. From PC-HMI <-> HDD in the lower right part of the main screen, click “Open.”

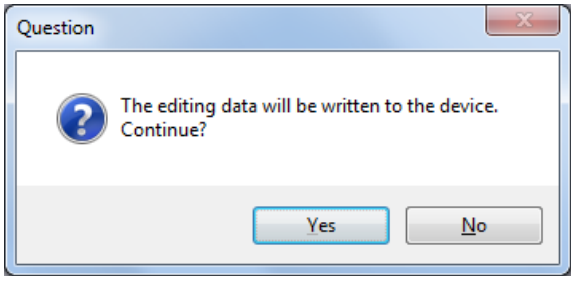


3. Select the file to read and click “Open.”

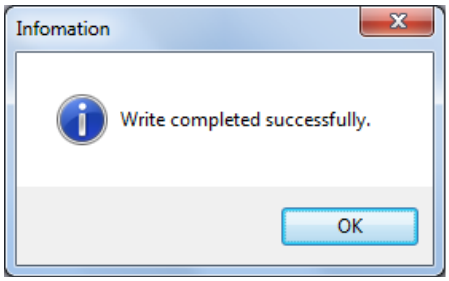


4. The read values are shown on the screen.

5. From PC-HMI -> Device in the upper right part of the main screen, click “Write.” The confirmation dialog appears.

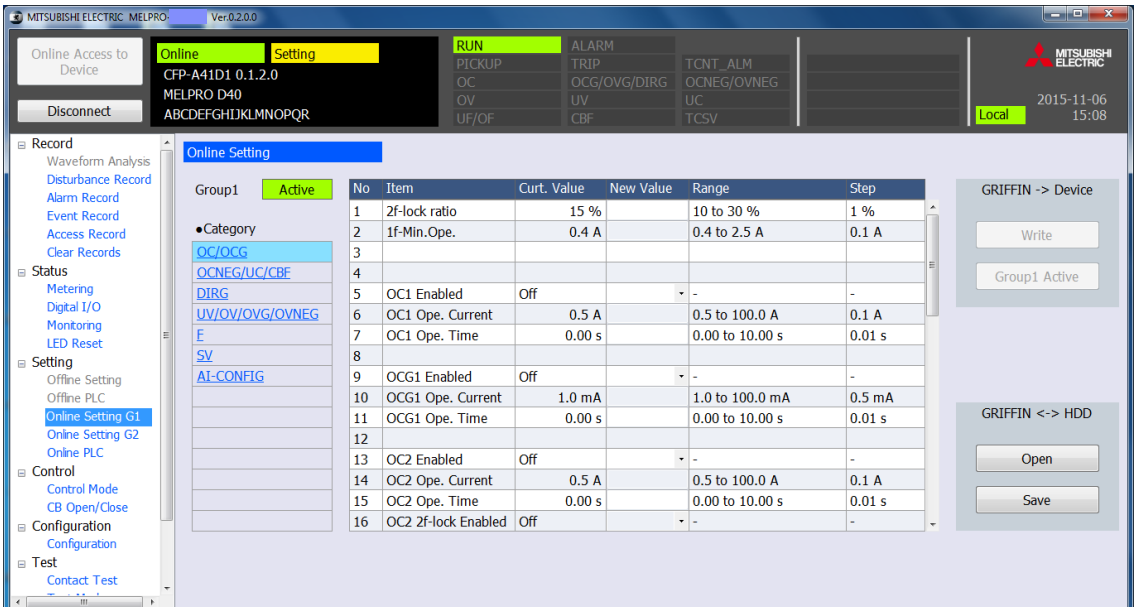


6. Click “Yes” to write the setting values to the device and activate them.

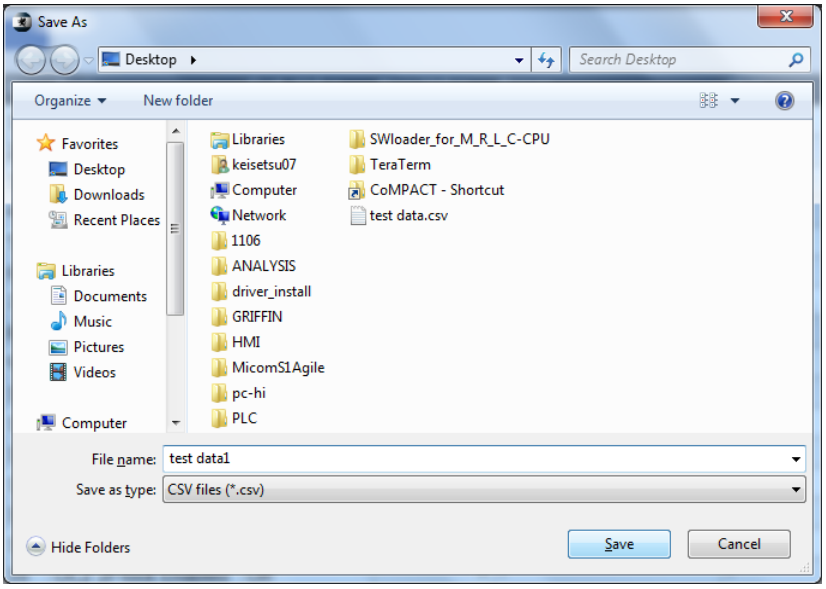


(To save setting value files)

1. From PC-HMI <-> HDD in the lower right part of the main screen, click “Save.”



2. Select the destination folder, enter a file name and click “Save.” The setting file is saved.

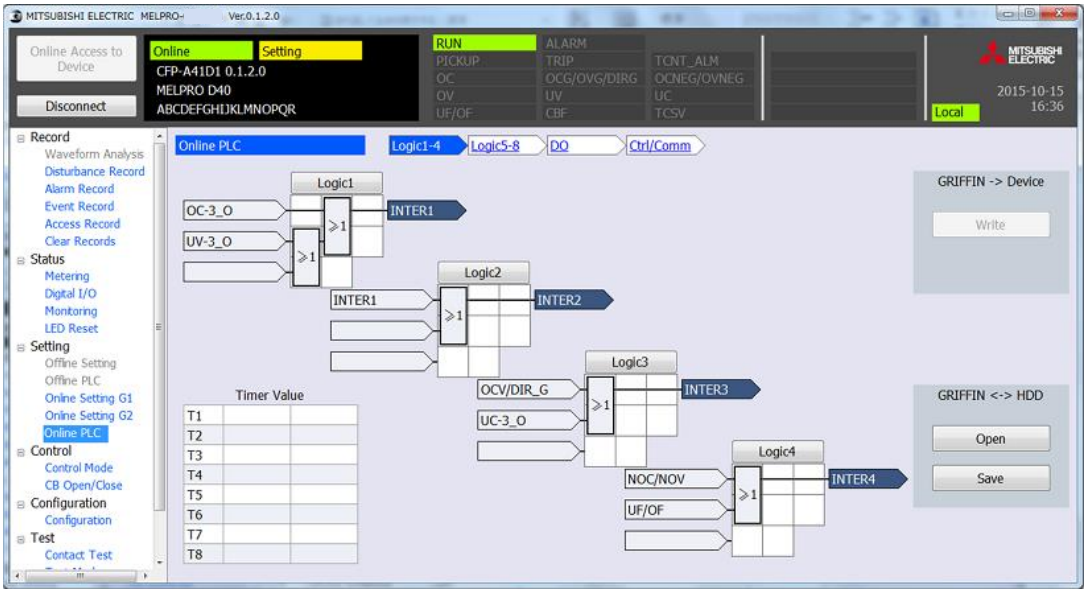


1.12.4. Online PLC

With MELPRO-D40, the PLC function allows the user to configure the sequence in the relay. It is customizable according to the system by assigning the user-configured sequence outputs to contacts, for example.

1.12.4.1.Configuring online PLC (logic circuit)

A sequence can be configured for eight outputs. These sequence outputs can be assigned as DO signals described later.

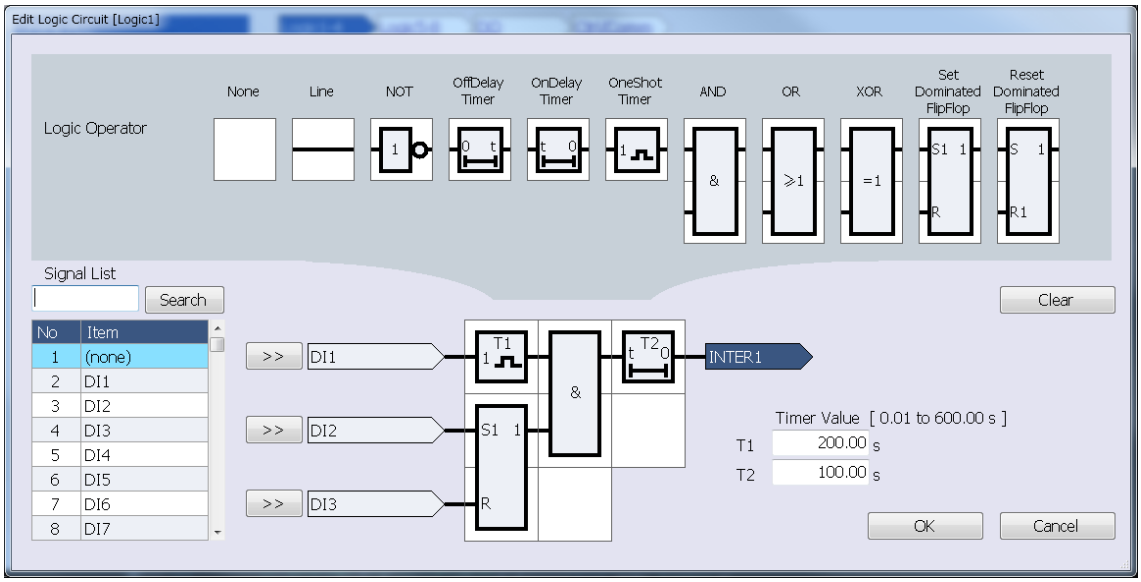


[Adding PLC configuration]

1. From the Function menu, click Online PLC.

2. Click the Logic group and Logic to edit.
   Logic1-4: indication and editing screen for logic circuits 1 to 4
   Logic5-8: indication and editing screen for logic circuits 5 to 8

3. The logic circuit editing screen as shown below appears. (The screen below shows a display example)

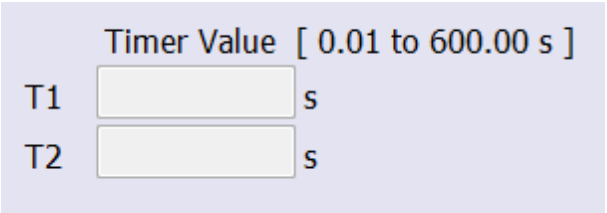


4. From the Item list on the screen above, select the signal to input and click. The selected signal is shown in light blue.
   Click “>>” to select the input signal.

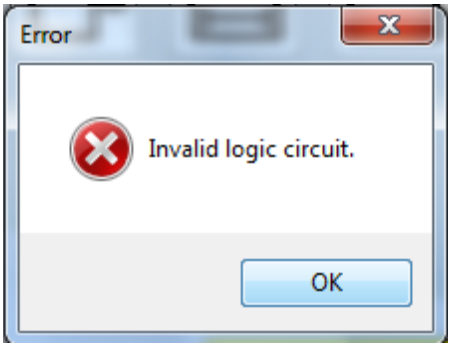
Note) The signal name can be searched by entering it on the Signal List by using the keyboard and clicking “Search.”

5. From the list of circuit components, select the logic component to place and click the logic area to place it. The logic component is placed. After the placement has been completed, click “OK” to go back to the previous screen.

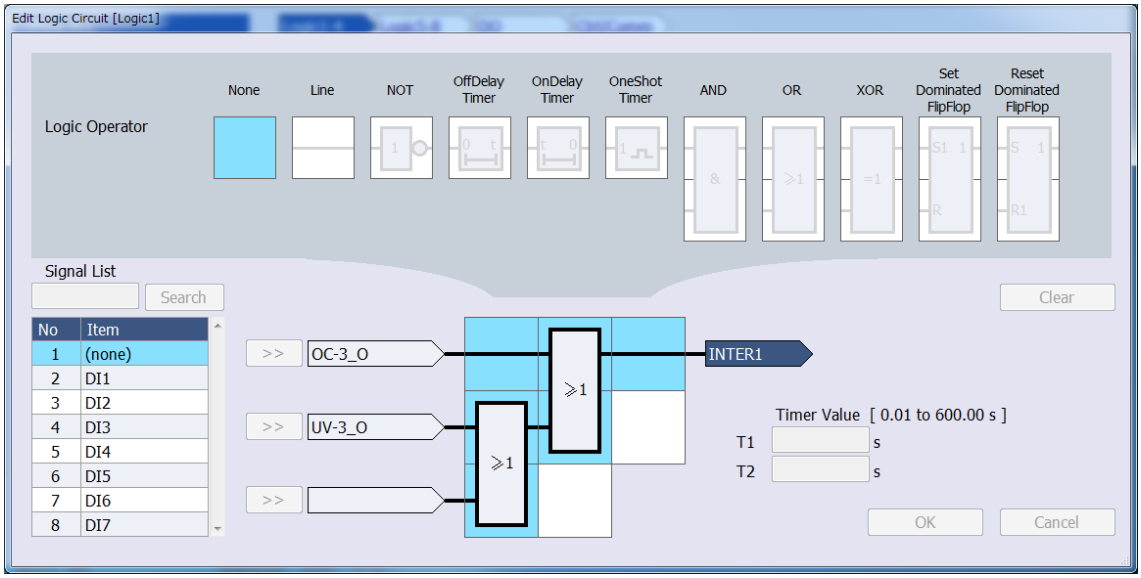
   When providing any timer component, specify the time in the Timer Value field.
   (Up to two timer components can be configured for each of Logics 1 to 8.)



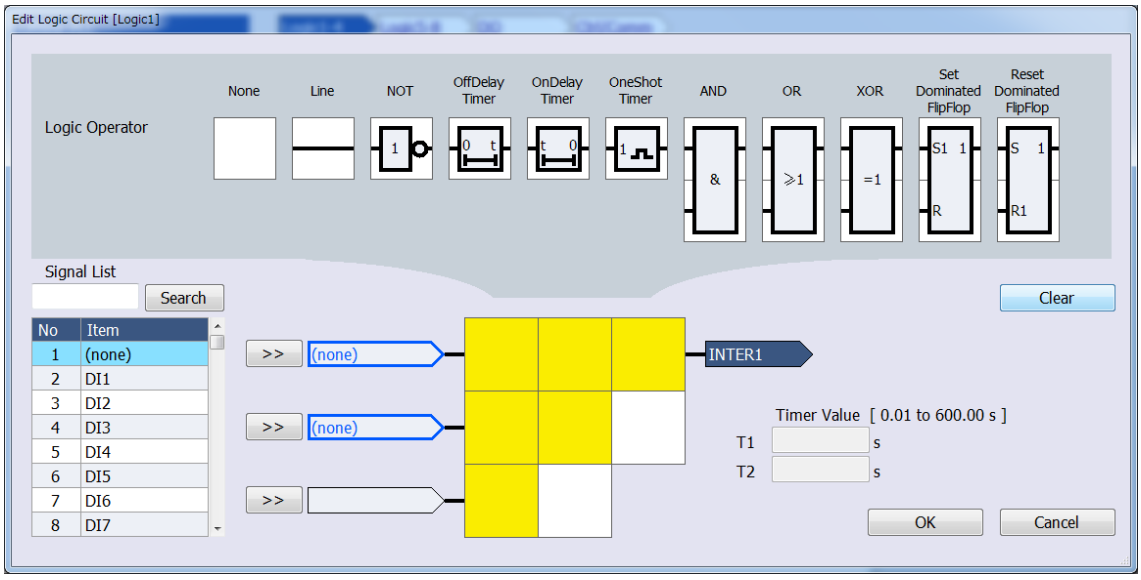
For logic components that can and cannot be placed, see 1.7.3.
Attempting to place a component in an area that does not allow placement, the error message as shown below appears.



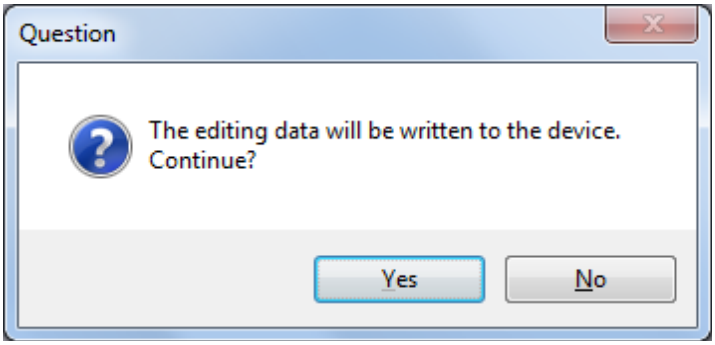
To remove any component that has been placed, select a None logic component and click the logic area to remove the component from (shown in light blue).



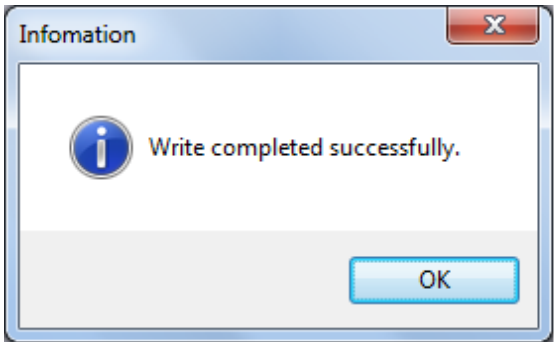
Clicking “Clear” brings back to the initial state with no input signal set, logic component placed or timer setting configured.



6. From PC-HMI -> Device in the upper right part of the main screen, click “Write.” The dialog to confirm writing to the device appears. Click “Yes” to write the setting to the device.



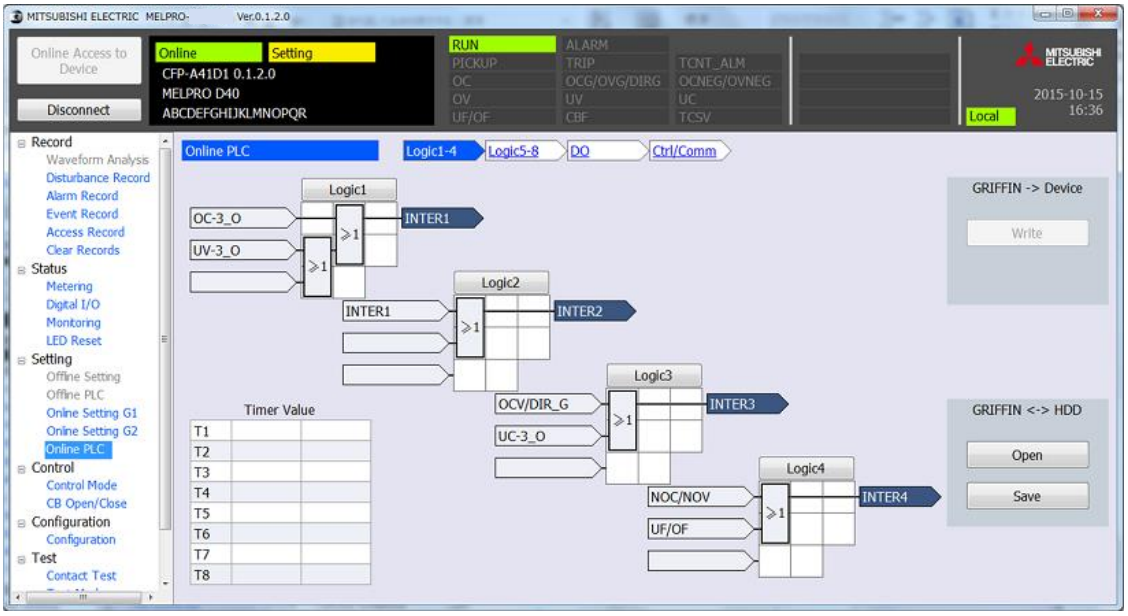
For successful writing, the dialog as shown below appears.



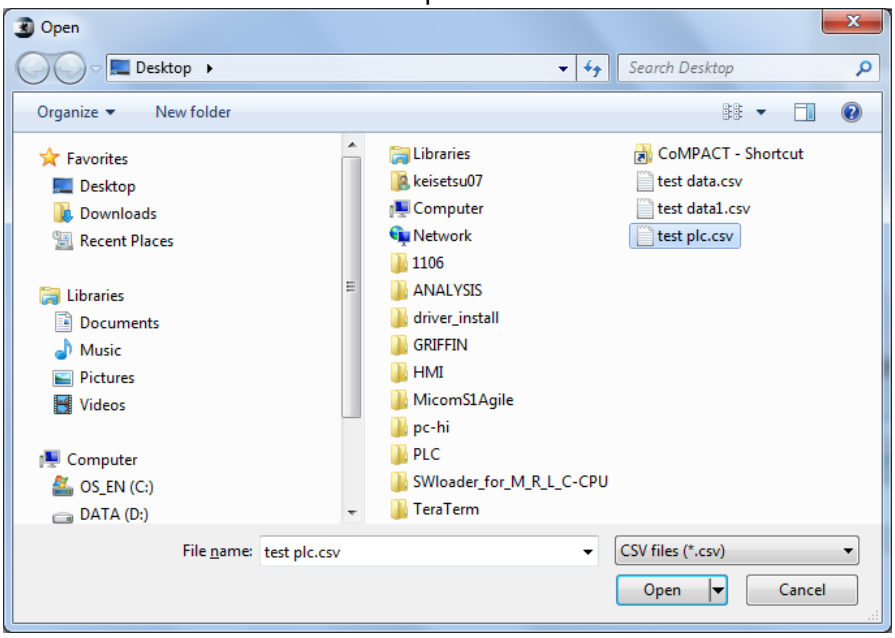
Note) For reading/writing PLC data from/to the PC, perform the following operations.

1) Reading PLC data saved in the PC

1. From PC-HMI <-> HDD in the lower right part of the main screen, click “Open.”



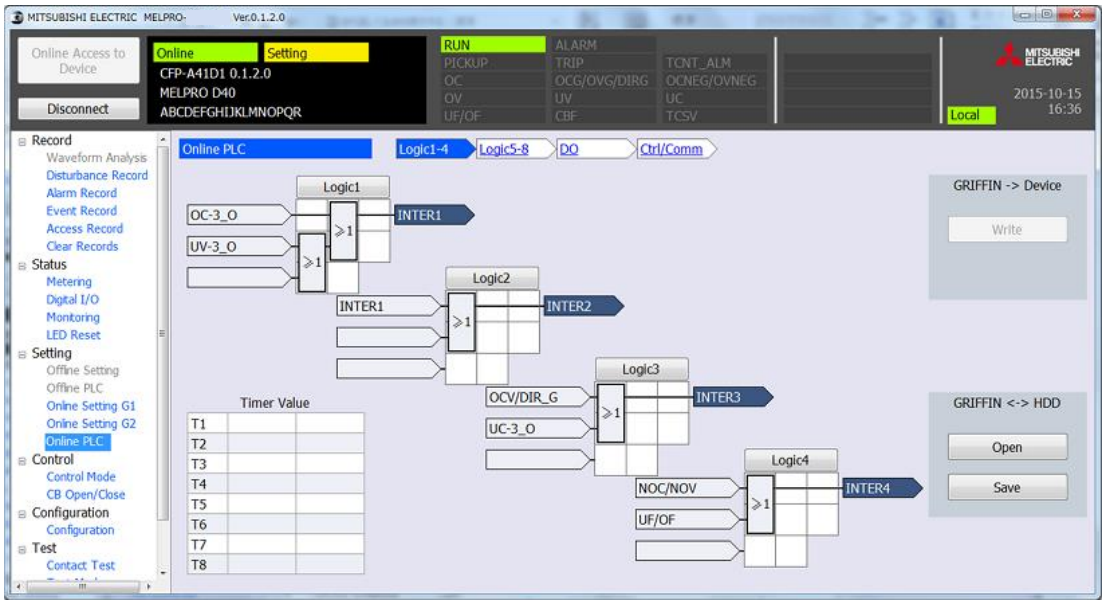
2. Select the folder and the file to read and click “Open.”



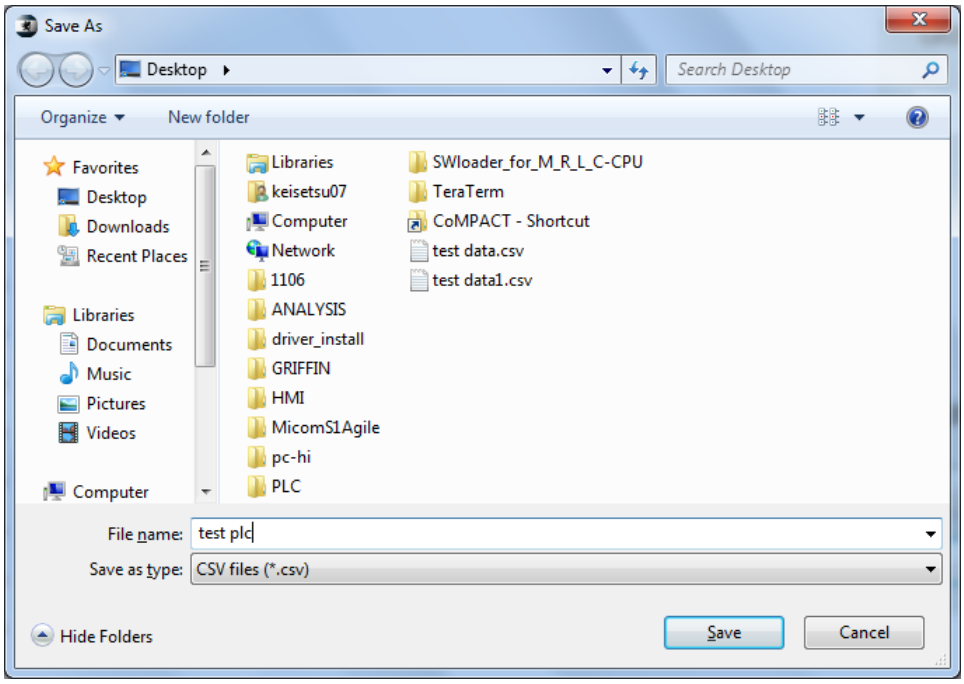
3. The specified PLC data are read to the device.

2) Saving the configured PLC data to the PC

1. From PC-HMI <-> HDD in the lower right part of the main screen, click “Save.”



2. Select the destination folder, enter a file name and click “Save.”

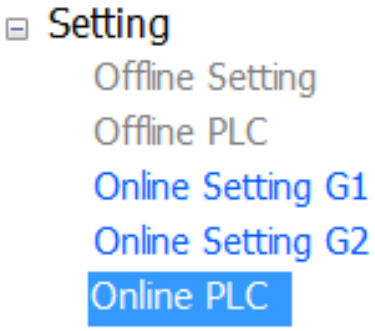


3. The configured PLC data are saved in the specified folder.

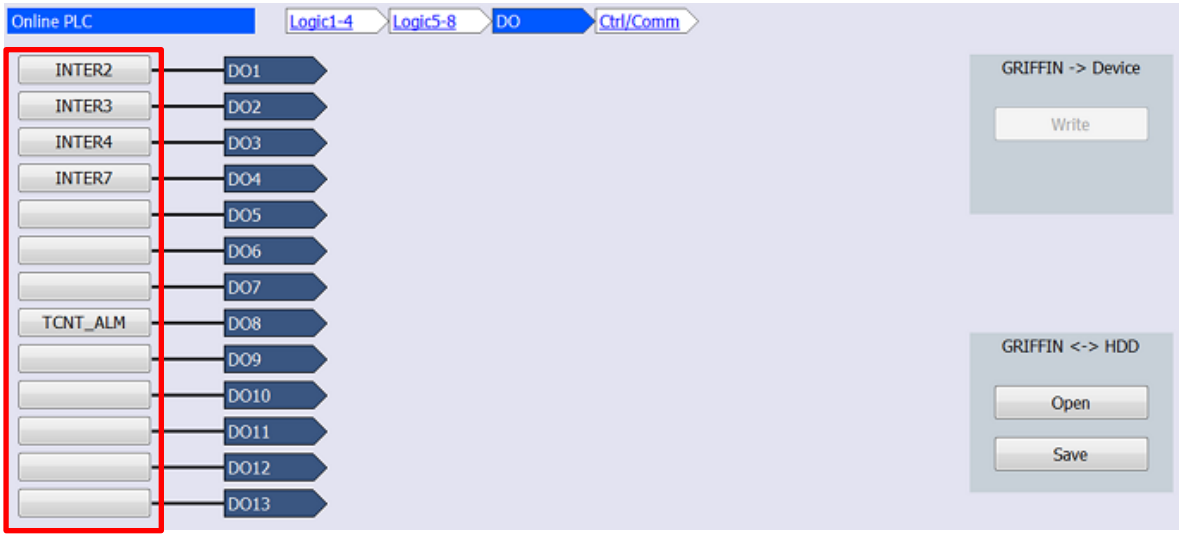
1.12.4.2.DO assignment

DO allows DO configuration of output assignments from the signal list.

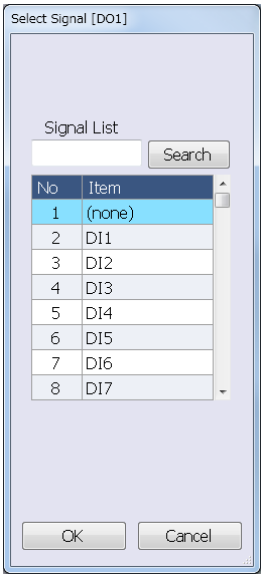
1. From the Function menu, click Online PLC.



2. Click DO. The DO assignment circuit indication and editing screen appears. Click the button in the red frame to assign input signals.



3. Click the input signal button. The signal selection dialog as shown below appears.
   From the list, select the desired signal and click “OK.” (To search for a signal, enter the signal name in the Signal List and click “Search.”)



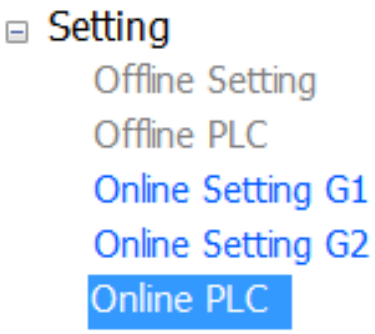
4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) For saving/reading PLC data to/from the PC, perform the same operation as 1.12.4.1.

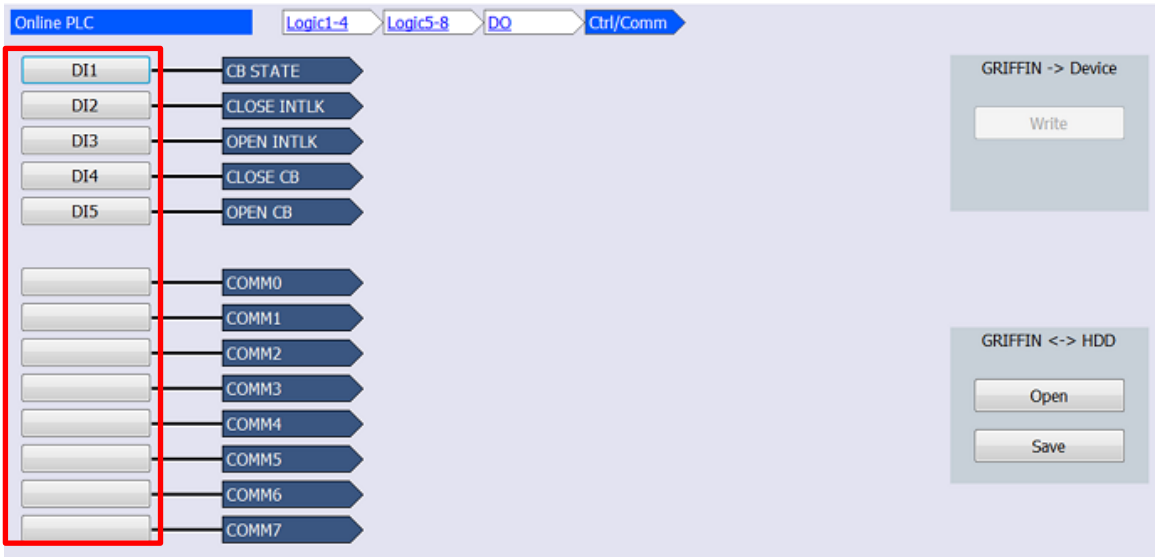
1.12.4.3.Assignment of CB control/communication output signals

Ctrl/Comm allows assignment of the CB control and communication output signals.
(COMM0 to COMM7 are used for assignment of communication outputs (IEC61850).)

1. From the Function menu, click Online PLC.



2. Click Ctrl/Comm. The CB control and communication output signal assignment circuit indication and editing screen appears. Click the button in the red frame to assign input signals.



3. Click the input signal button. The signal selection dialog for selecting a signal to assign appears. From the list, select the signal and click “OK” to assign the signal.
(To search for a signal, enter the signal name in the Signal List and click “Search.”)

   The signal selected from the list and clicked is shown in light blue. Click “OK” to select the signal as an output signal.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) For saving/reading PLC data to/from the PC, perform the same operation as 1.12.4.1.

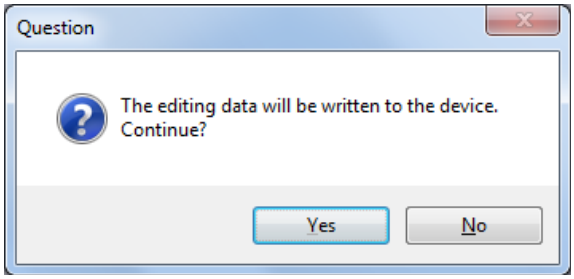
1.13. Control functions

1.13.1. Setting the CB control mode

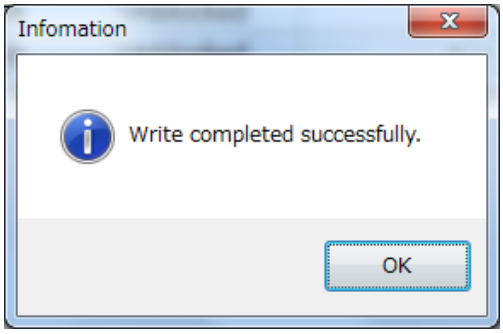
1. From the Function menu, select Control Mode.

2. The list of CB control mode items appears. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.

3. From PC-HMI -> Device, click “Write.” The write confirmation dialog appears. Click “Yes.”



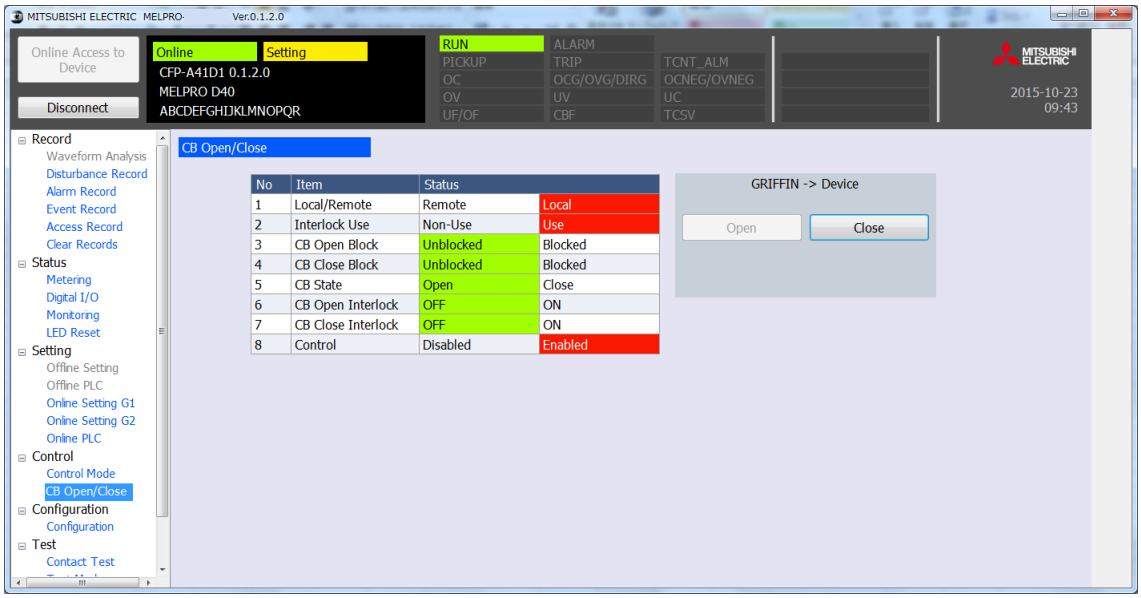
4. The new setting value is written to the device and the write completion message appears.



5. As shown below, the new value is set as the Curt. Value (current setting value).

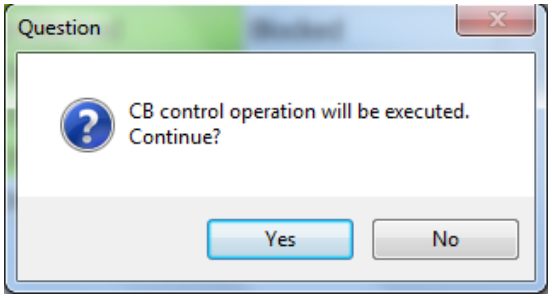
1.13.2. Executing CB control

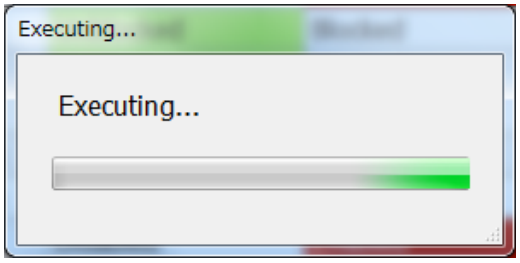
1. From the Function menu, click CB Open/Close.
   CB control can be executed either as open control or close control and the button for the unavailable control operation is disabled.
   Neither of them may be available depending on the addition status of the respective items.



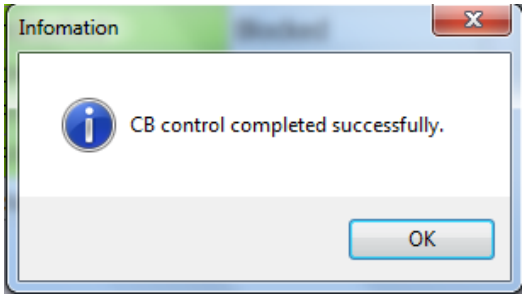
2. From PC-HMI -> Device, click “Open”/“Close.”

3. The dialog to confirm CB control execution appears. Click “Yes” to execute.

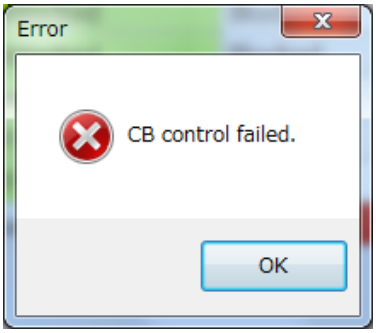




4. For successful CB control, the confirmation dialog as shown below appears.



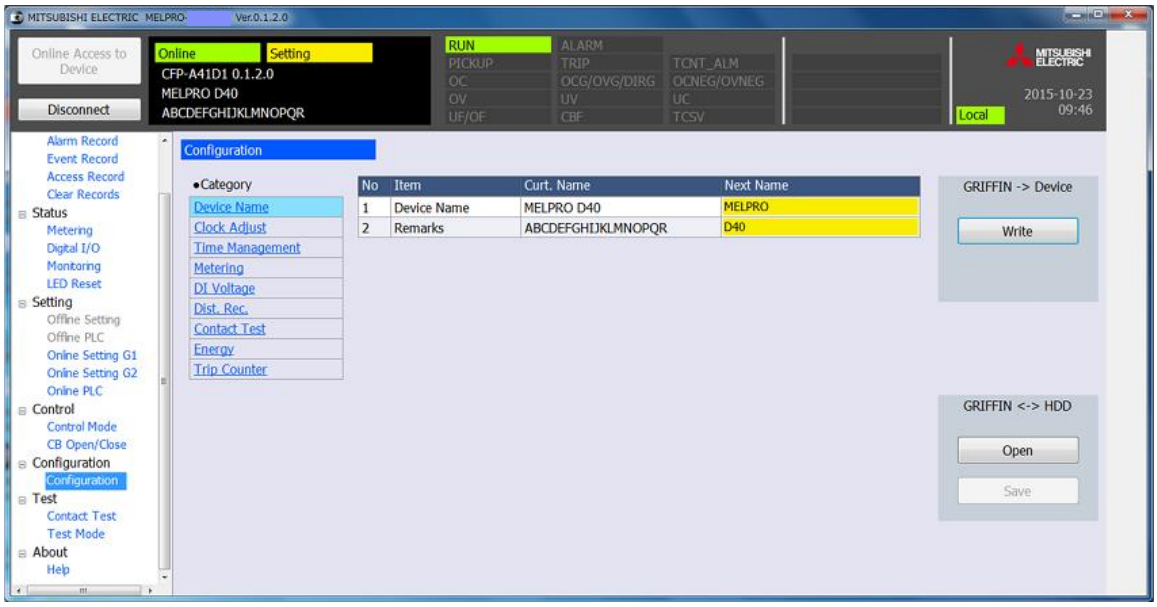
Note) If the selected control failed, the error message as shown below appears.



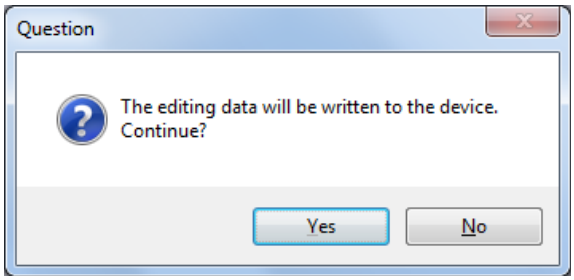
1.14. Device setting

1.14.1. Setting the device name

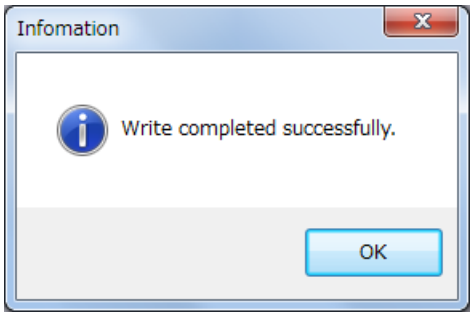
1. From the Function menu, click Configuration.
2. From Category, click Device Name.
3. Enter the new name to set in Next Name.



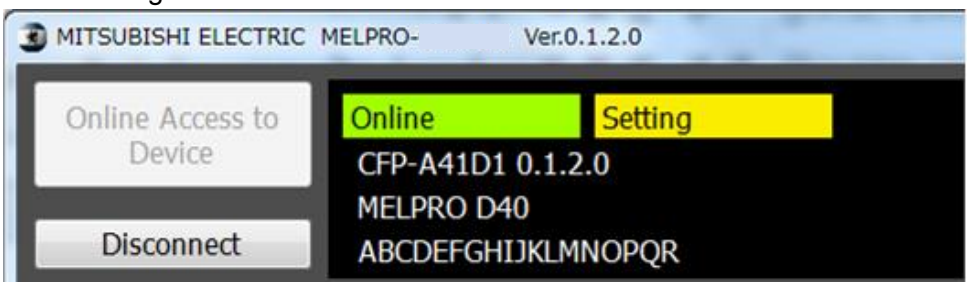
4. From PC-HMI -> Device, click “Write.” The confirmation dialog appears. Click “Yes.”



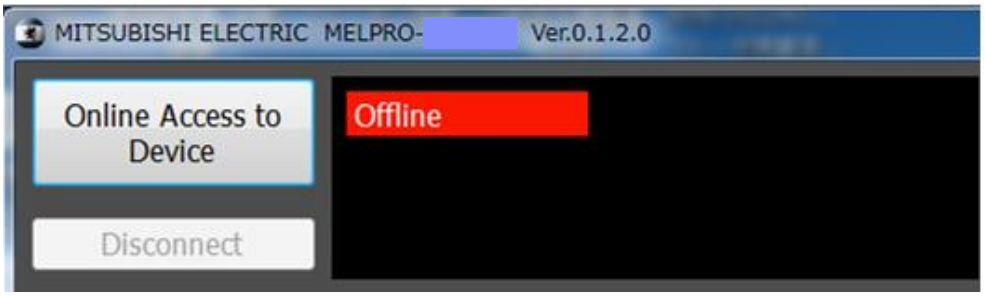
5. The setting is written to the device.



6. The indication is not updated when the setting has been written to the device.
   Click “Disconnect” to log off.



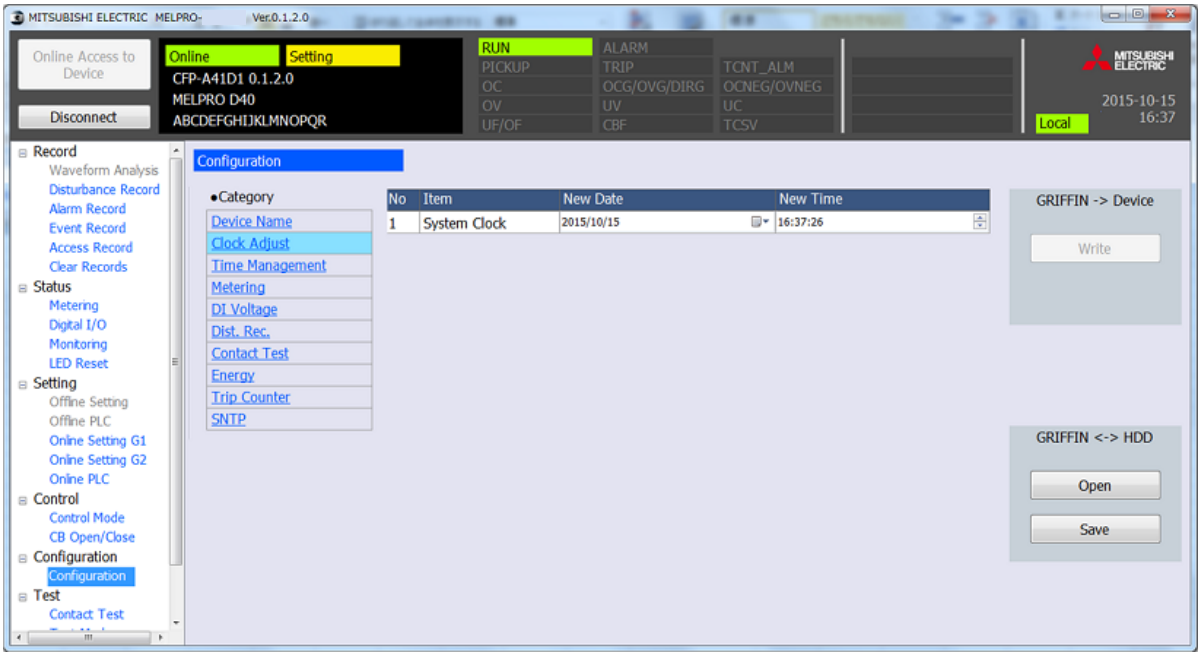
7. Click “Online Access to Device” to log in.
   (For the details about logging in, see 1.8.1.)



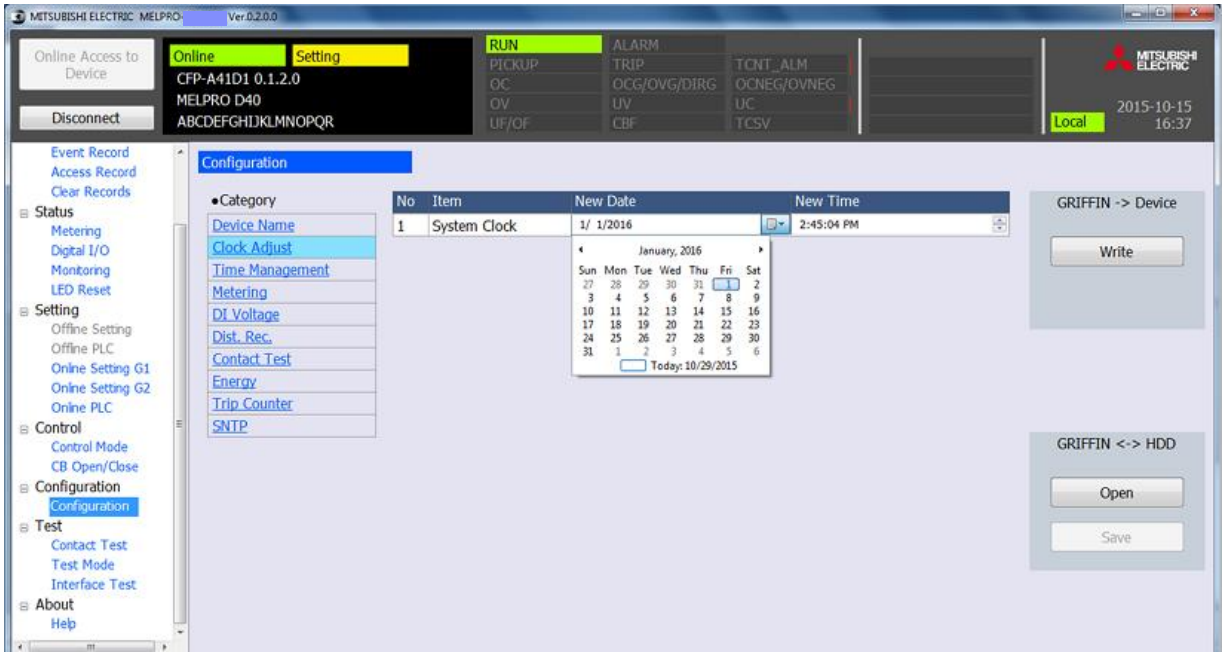
8. The device name indication is updated when the device has been logged in.

1.14.2. Clock Adjust setting

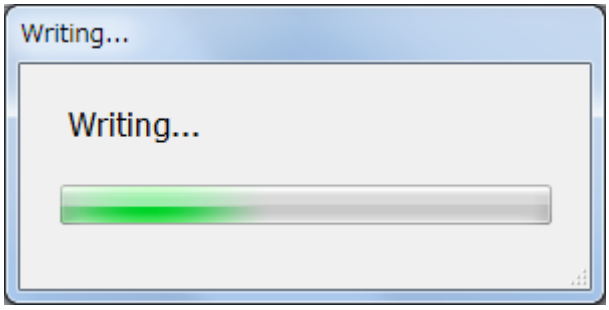
Clock Adjust allows setting of the date and time.



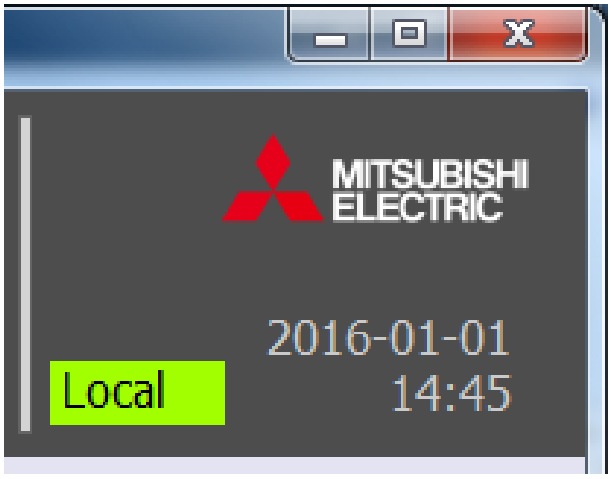
1. From the Function menu, click Configuration.
2. From Category, click Clock Adjust.
3. Select the date and/or time to adjust.
   New Date: year, month and date setting; New Time: hour, minute and second setting
   Use the mouse to bring the cursor to the setting to change and directly enter with the keyboard or click the button on the right side of the cell to adjust the date and time.



4. From PC-HMI -> Device, click “Write” to write the setting to the device.



5. When writing has been completed, the adjusted date and time take effect.



Note) The date and time setting is applied immediately.

1.14.3. Time Management setting

Time Management allows setting of the daylight saving time and time synchronization.

1. From the Function menu, click Configuration.
2. From Category, click Time Management.
3. Select the Next Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) To change a Time Management item, power cycling is required for updating with the new setting.

1.14.4. Metering setting

Metering allows setting of the primary and secondary values of the measurement indication.

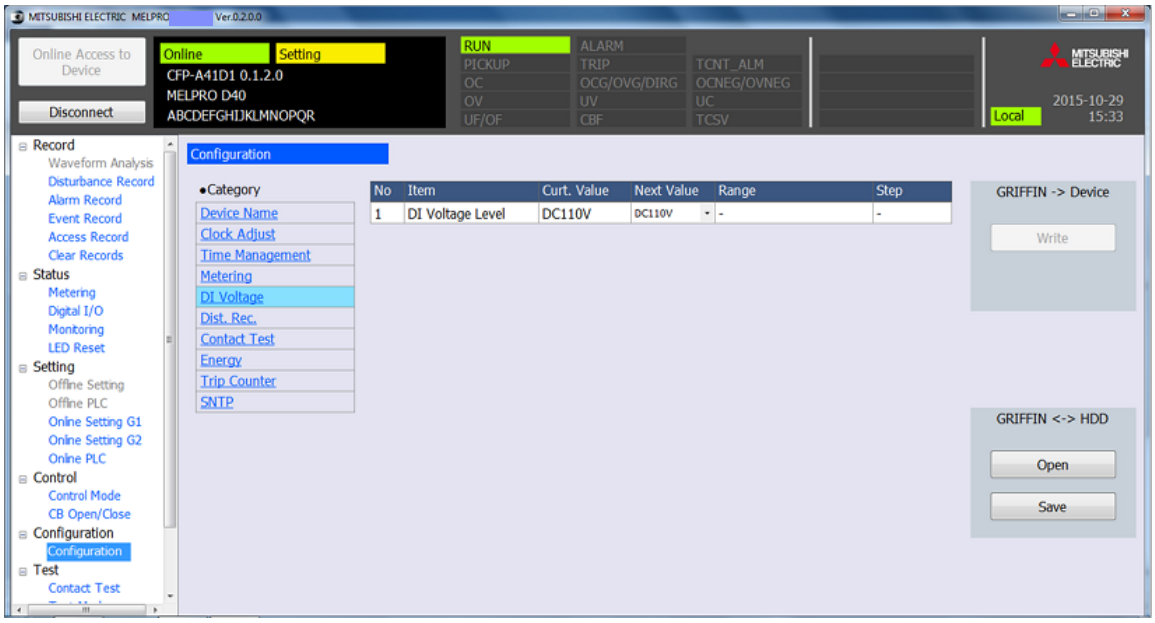
1. From the Function menu, click Configuration.
2. From Category, click Metering.
3. Select New Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

1.14.5. DI Voltage setting

DI Voltage allows setting of the voltage level to detect with DI.

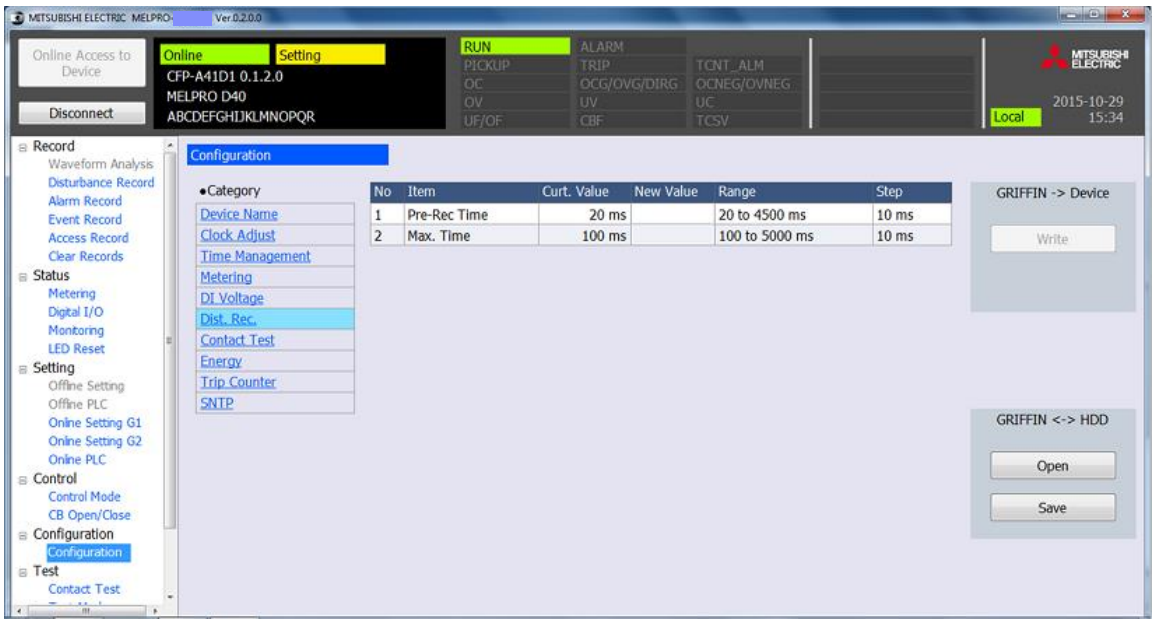


1. From the Function menu, click Configuration.
2. From Category, click DI Voltage.
3. Select a Next Value item.
   Select the value to set from the drop-down list.
4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) To change a DI detection voltage item, power cycling is required for updating with the new setting.

1.14.6. Configuring the disturbance record

Dist. Rec. allows setting of the time before relay operation of the waveform record and the maximum time of one phenomenon.



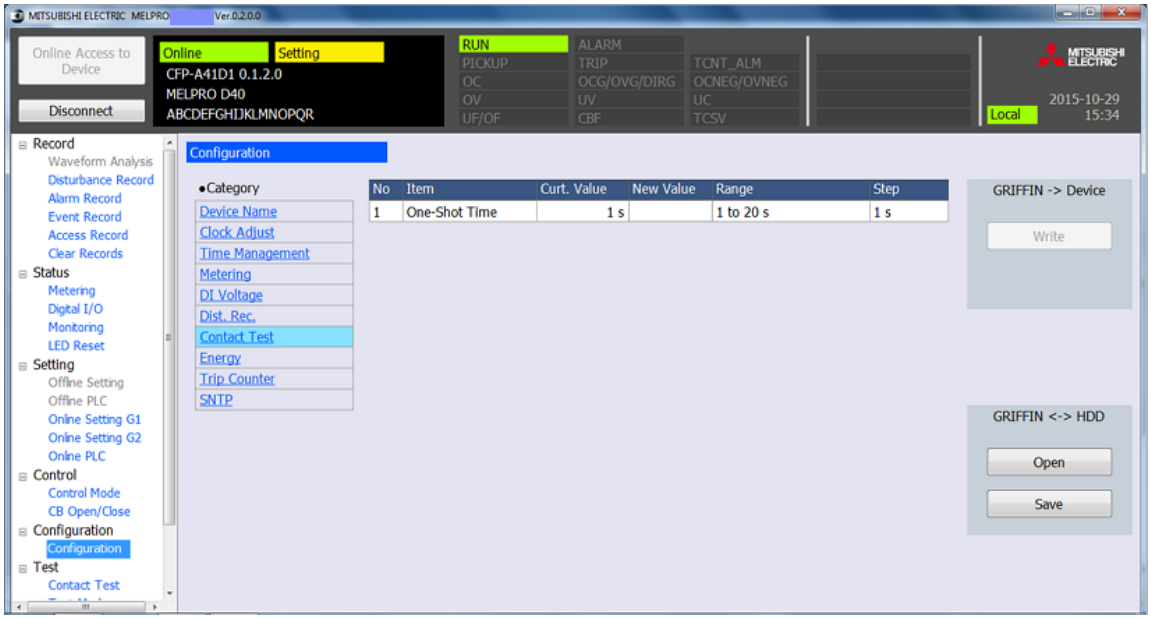
1. From the Function menu, click Configuration.
2. From Category, click Dist. Rec.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

1.14.7. DO Contact Test setting

Contact Test allows setting of the output time of a contact test.



1. From the Function menu, click Configuration.
2. From Category, click Contact Test.
3. Select a New Value item.
   Use the keyboard to directly enter the value to change.

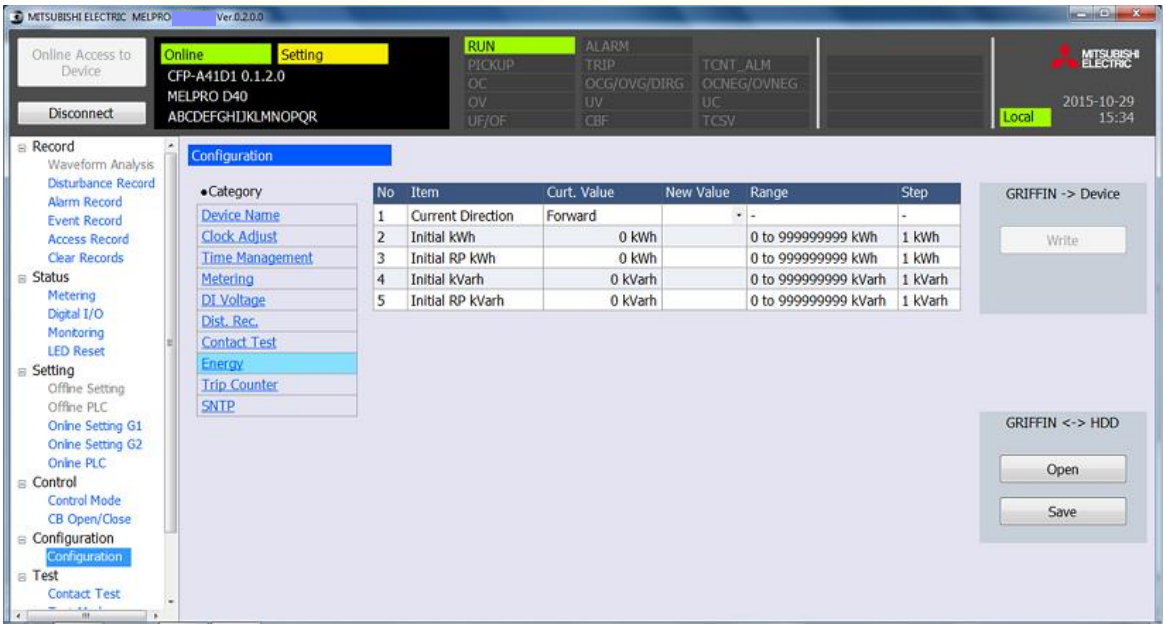
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) The One Shot value set is the operating time for DO contact test in 1.15.1.

1.14.8. Electric Energy setting

Energy allows setting of the power flow direction and the initial values of electric energy, reverse electric energy, reactive electric energy and reverse reactive power.



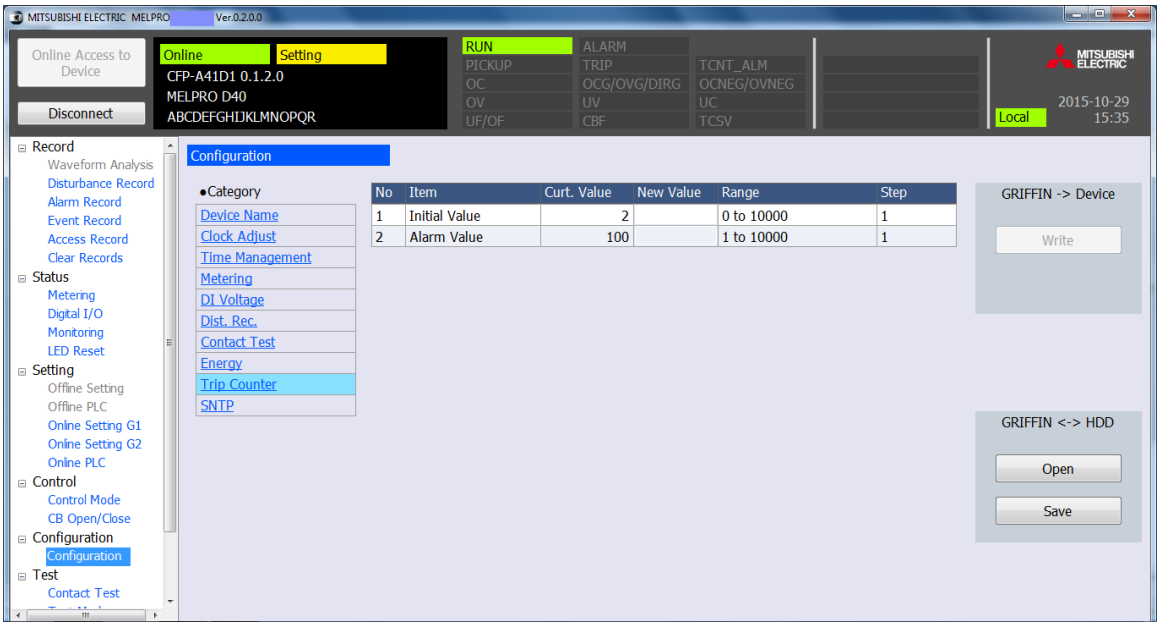
1. From the Function menu, click Configuration.
2. From Category, click Energy.
3. Select New Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

1.14.9. Trip Counter setting

Trip Counter allows setting of the trip count initial value and alarm value.



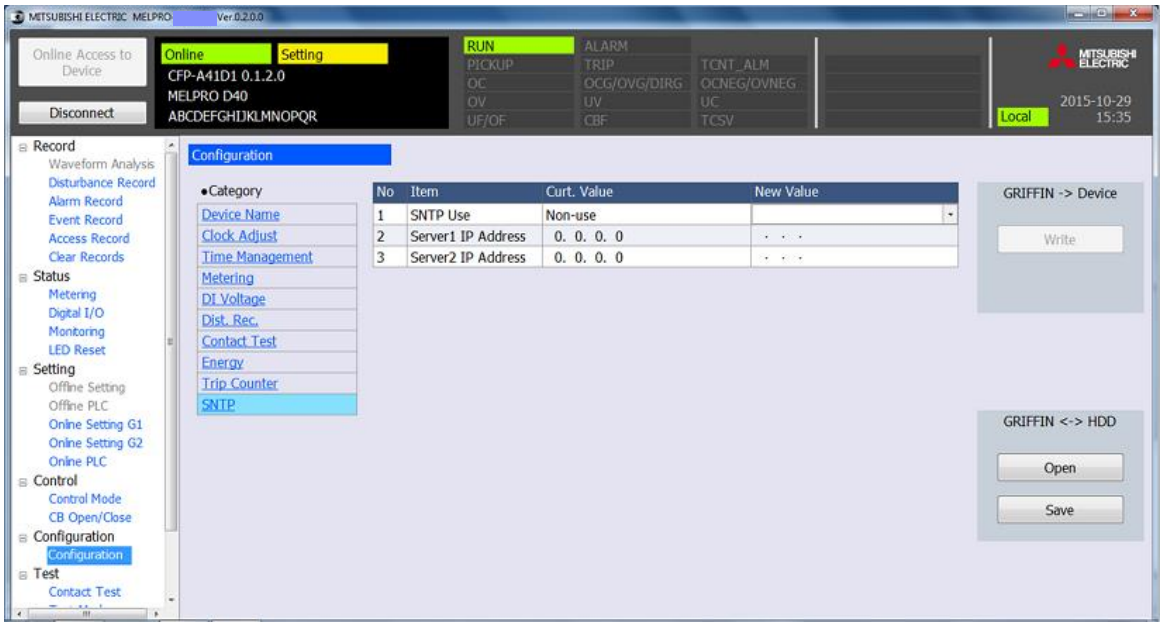
1. From the Function menu, click Configuration.
2. From Category, click Trip Counter.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

1.14.10. SNTP setting

SNTP allows setting of SNTP use/unuse and server IP address.



1. From the Function menu, click Configuration.
2. From Category, click SNTP.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

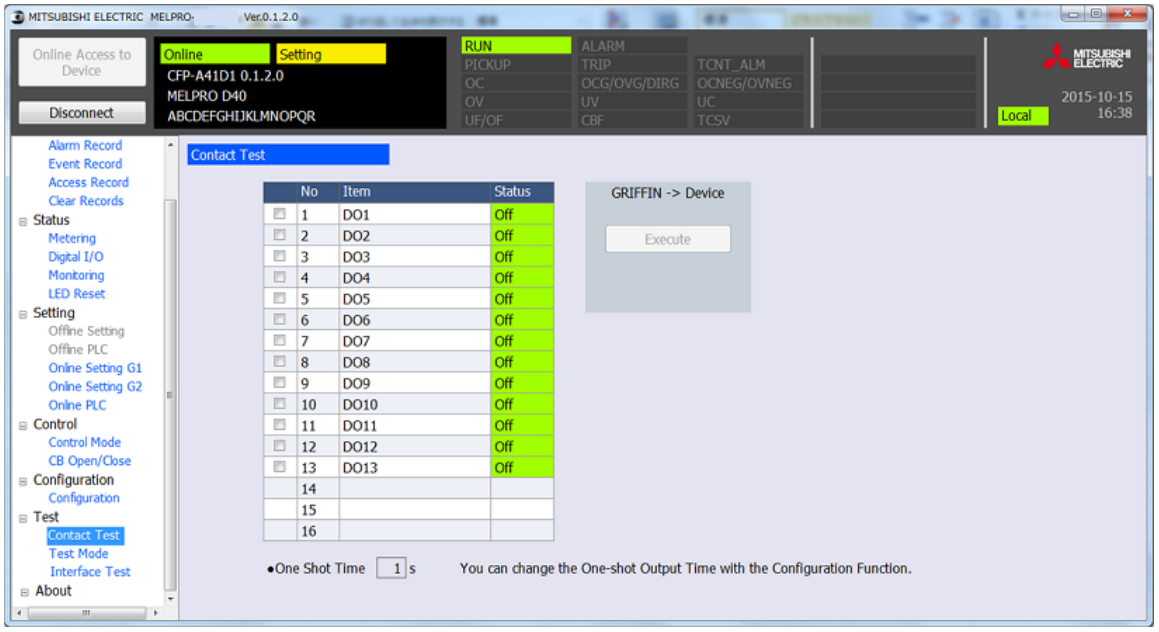
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

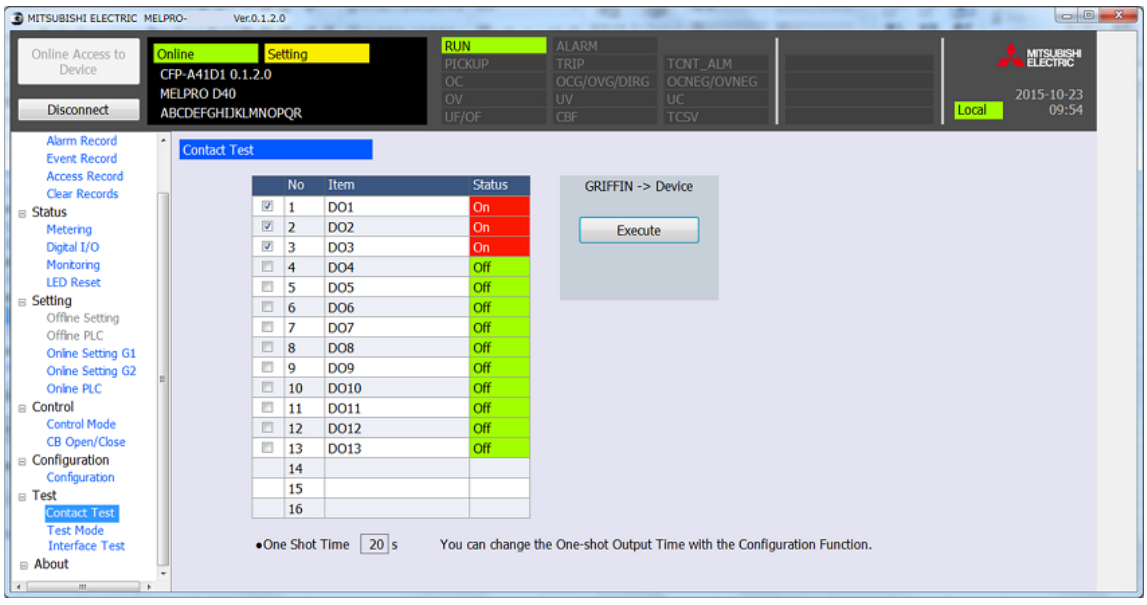
1.15. Test functions

1.15.1. DO Contact Test

Contact Test forces activation of the relay output contact.

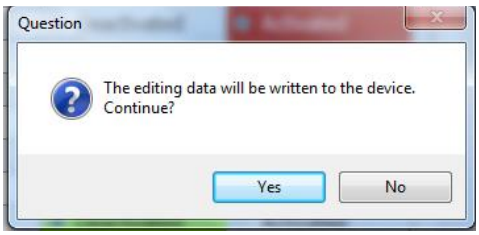


1. From the Function menu, click Contact Test.
2. Click the check box on the left of the item to conduct the DO contact test.
   (The Status of the checked item changes from Off to On.)

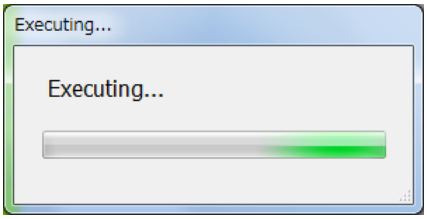


Note) To change the operating time for the contact test, change One Shot Time in 1.14.7.

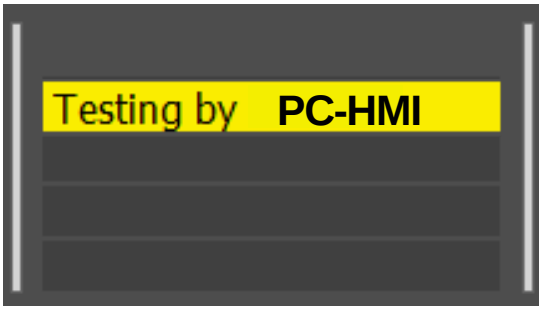
3. From PC-HMI -> Device, click “Execute.” The dialog to confirm execution appears. Click “Yes” to execute.



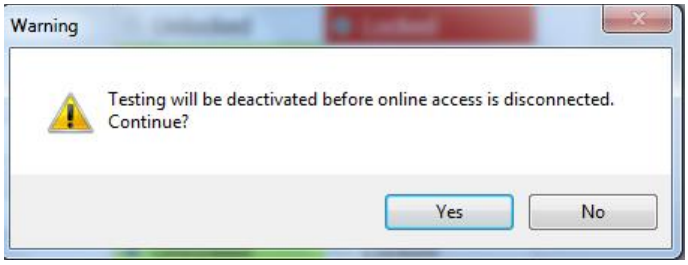
4. The execution dialog as shown below appears and the contact test for the specified DO item is executed.



5. During execution, the Testing indication is given in the status area.



Note) If disconnection or PC-HMI termination is attempted during a contact test, the message to confirm contact test cancellation appears.

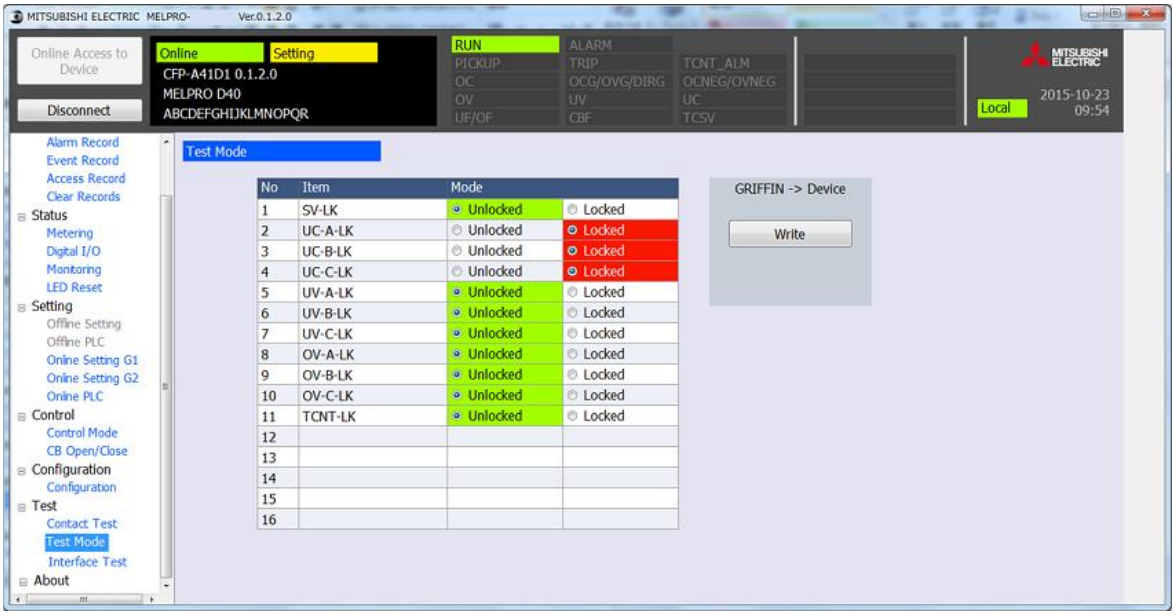


1.15.2. Test Mode

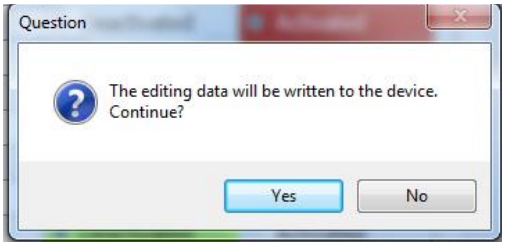
Test Mode allows setting of the temporary test mode for the relay.

1. From the Function menu, click Test Mode.

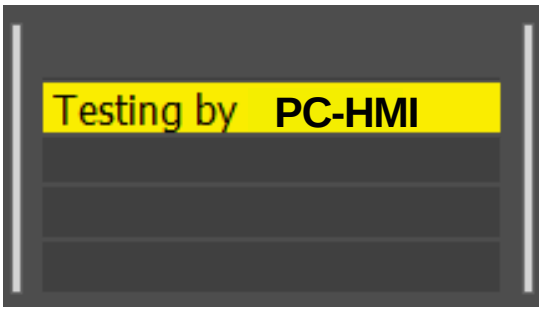
2. Select the mode for each item.
   Unlocked : Test mode disabled
   Locked : Test mode enabled



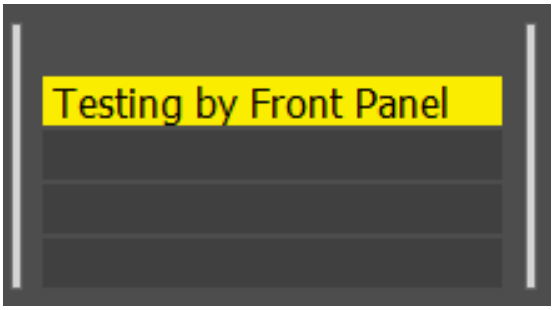
3. From PC-HMI -> Device, click “Write.” The dialog to confirm writing the data to the device appears. Click “Yes” to execute.



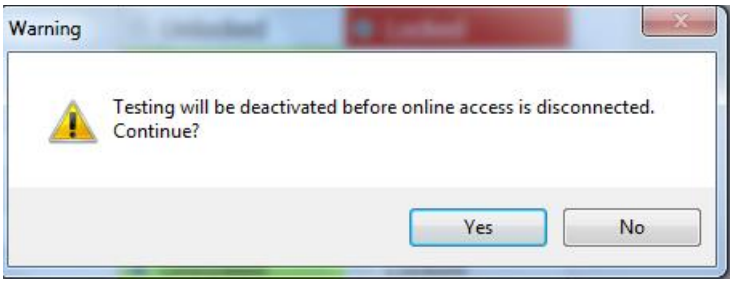
4. During the test, the “Testing by PC-HMI” indication is given in the status area.



Note) During a test from the front panel, the “Testing by Front Panel” indication is given.



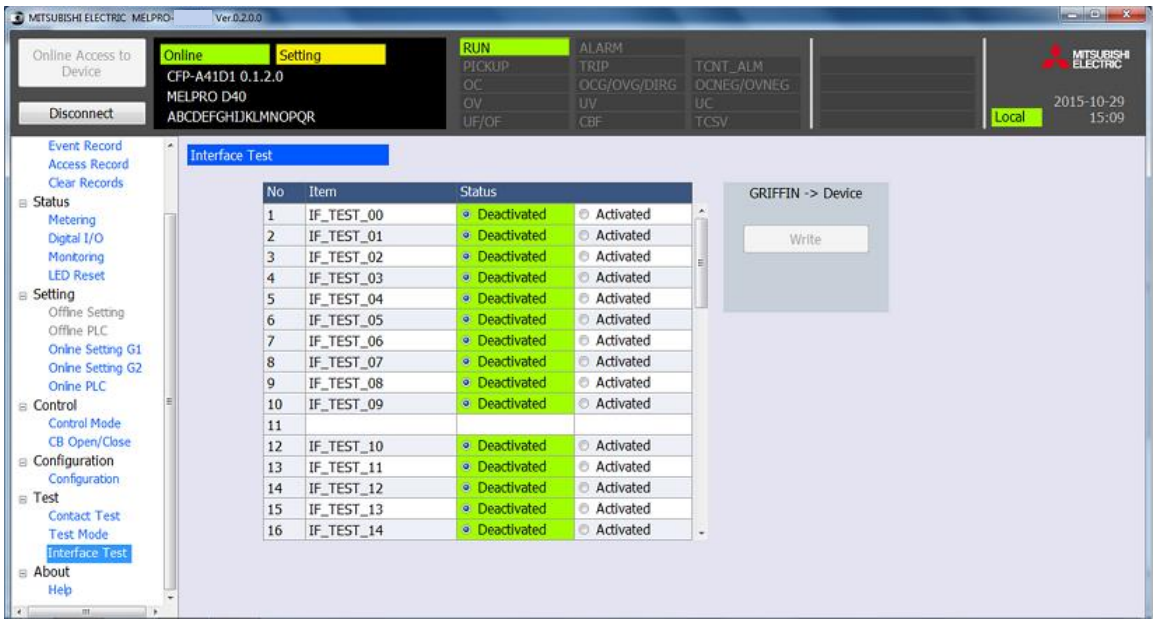
Note) If disconnection or PC-HMI termination is attempted during a contact test, the message to confirm contact test cancellation appears.



1.15.3. Relay Interface Test

Interface Test allows simulated testing of relay operation without inputting any voltage or current.

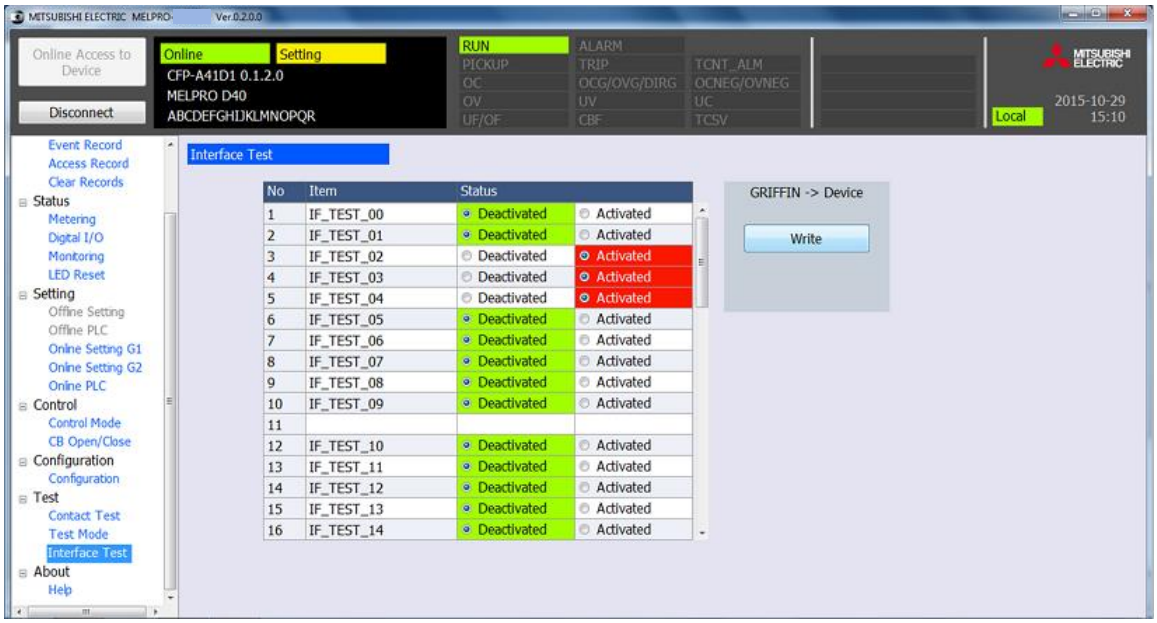
1. From the Function menu, click Interface Test.



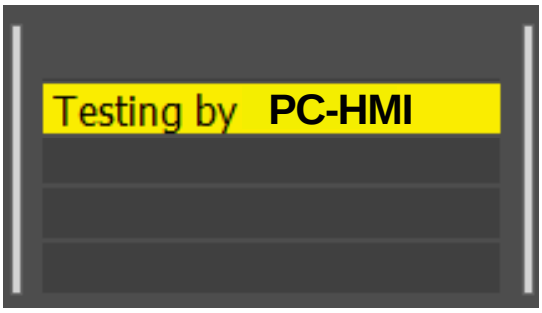
2 . Select the status for each item.

Deactivated : Disables the test.

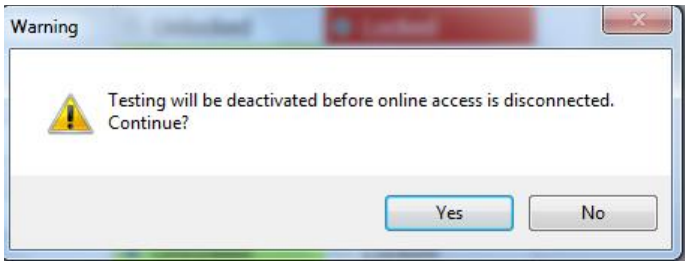
Activated : Enables the test.



3. From PC-HMI -> Device, click “Write” to write the setting to the device.
   During the test, the “Testing by PC-HMI” indication is given in the status area.



Note) If disconnection or PC-HMI termination is attempted during an interface test, the message to confirm interface test cancellation appears. The relay interface test is automatically canceled when 30 minutes have elapsed.



1.16. Showing the PC-HMI operation manual

1. From the menu screen, click Help.
2. Acrobat Reader is launched and the PC-HMI operation manual is shown as a pdf file.

Note) If Acrobat Reader is not installed on the PC, an error message appears.

2. Waveform Analysis

2.1. Introduction

This manual explains the functions and operation of the PC-HMI Software and precautions to be taken when using the software. Please read this manual carefully before using the software and retain it for future reference.

The information given in this manual is subject to change without prior notice.

a) This manual has been created with utmost care. However, if any error or other problem is found, please contact Mitsubishi Electric Corporation.
b) We shall not be liable for any damage caused by erroneous operation.
c) This manual details the functions of this software. It is not intended for specific applications.
d) All company names, product names and other trademarks are properties of their respective owners.
e) Copying all or any part of this manual without permission is prohibited.

2.2. Precautions on software use

Please take the following precautions when using this software.

Precautions

1) This software and manual are warranted only against damage to the medium, defects in the product and program execution errors.
2) This manual does not provide or imply any warranty or guarantee that the product is fit for any particular purpose. No warranty is provided or implied for any consequential damage of impact on business performance.
3) We shall not be responsible for the performance or reliability of any software created by others.
4) A software licence is required for each installation on a hardware platform (PC). Additional licences must be purchased for installation on additional devices..
5) This software may not be copied for any purpose other than making a backup copy.
6) Exercise sufficient caution in handling the original medium containing this software.
7) Alteration or modification of this software is strictly prohibited.
8) Lending or providing all or any part of this software to a third party without prior permission is prohibited.
9) This manual and medium may be used only for this software. Sale of this software or any of its modifications to a third party is strictly prohibited.

Note) These precautions apply to all of our products. Some of the product specifications may not apply.

2.3. Notational conventions

The following conventions are used in this document.

1) Text in double quotation marks (“ ”)
   Indicates a button on a screen or a key on the keyboard.
   Example 1) Press “Shift” on the keyboard.
   Example 2) Click “OK” in the box.

2) Text in square brackets ([ ])
   Indicates text on a screen such as a menu, command and box (except that in single quotation marks (‘ ’), which indicates a button).
   Example 1) Close the [Caution] box.
   Example 2) From the [File] menu, select [END].

3) Text in curly brackets ({ })
   Indicates an example of input from the keyboard. When actually inputting, enter appropriate text. Do not enter the curly brackets.
   Example) Use the keyboard to enter {data_1}.

4) Replace any “arrow key” in the document with the “↑,” “↓”, “→” or “←” key.

2.4. About images and drawings

1) Images and drawings contained in this document may be exaggerated or simplified to provide a simple explanation..

2) The text and positions on a screen given in this document may differ from the actual screen.

2.5. About the waveform analysis tool

This section provides an overview and explains the features of the relay waveform analysis tool.

2.5.1. Overview

The waveform analysis tool is started from PV-HMI and capable of displaying and analyzing waveform data recorded in COMTRADE 2001 format on a hard disk (HD).

2.5.2. Features

1) Fault data can be analyzed in terms of the frequency, harmonics, RMS, active/reactive power, symmetrical component, calculation of the fault location, impedance, etc.
2) Viewing of analog information and relay element operation for faults.
3) Capable of zooming into and editing waveform data
4) Viewing of only the required part of the waveform data by scrolling the screen.
5) Printing of the waveform data and records shown on a screen by connecting a printer.
6) Windows-based software enables complicated analysis by simple mouse control.

2.6. Basics for operation

This section provides information and operating instructions for the relay waveform analysis system.
For more information about the operation, see the instruction manual of the PC being used.

1) Mouse operation
For mouse operation, see Section 1.5.1

2) Data files

2.6.1. Data files and data file names

This sub-section provides a description of the data files and data file names.
The relay waveform analysis software supports the following data types.

1) Folder structure of data files
   a) The waveform data file (COMTRADE format) is saved in files for each relay type for each substation.
   b) The waveform data can be viewed by using Explorer.

2) Data file structure
   The Waveform data consists of three files with the same file name but different file extensions for each record that is kept.

   (COMTRADE format file)
   ********.hdr
   ********.cfg
   ********.dat

2.7. PC configuration

<Before use>
Make sure that PC-HMI Software for MELPRO-D40, is installed.

2.8. Waveform display

The software is capable of analyzing waveform data consisting of instantaneous values of the current and voltage which are recorded by the protection relay when a fault occurs on the power system.

This section gives an explanation about waveform data which can be viewed using the PC-HMI.

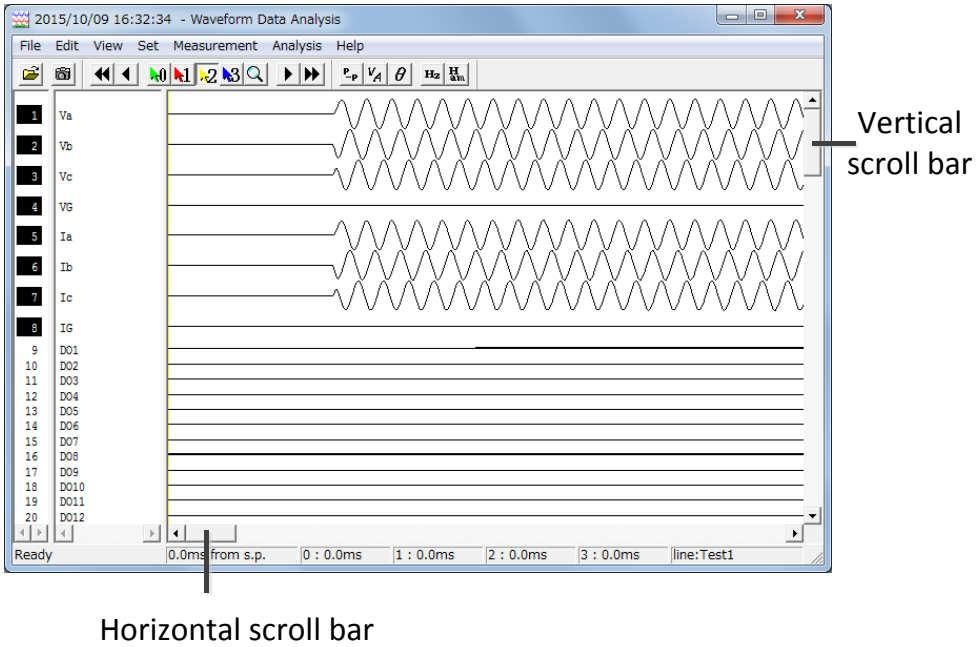
Operation procedure

1. Using the PC-HMI software tool, open waveform data. Fault information and waveforms are displayed.

a) Three cursors appear at the following points of the analogue channel with the largest voltage drop.

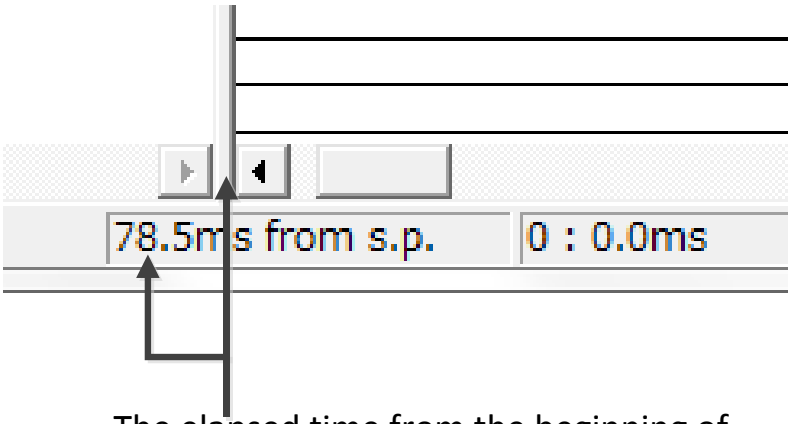
Fault detection point	Cursor 0 (green)
Minimum voltage point	Cursor 1 (red)
Point of recovery from failure	Cursor 2 (yellow)

b) Which failure time to automatically calculate when waveform data are displayed can be selected in advance.



2. To scroll up or down the waveform data, use the vertical scroll bar.
   a) Other analogue channels of the waveform data are displayed.

3. To scroll left to right over the waveform data, use the horizontal scroll bar.
   a) When the waveform data is displayed for the first time, [****ms from s.p.] appears.
   b) The unit of time to use when waveform data is displayed can be set in advance.



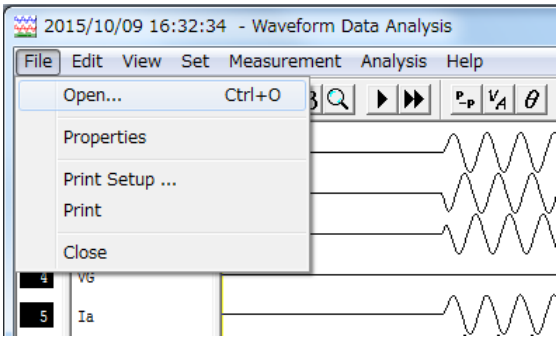
The elapsed time from the beginning of the waveforms to this point is displayed as the waveform display start time.

2.8.1. Opening waveform data

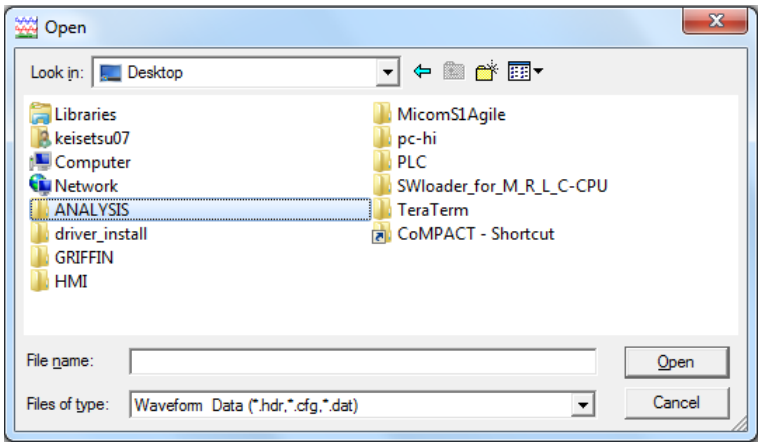
This subsection describes how to open waveform data from the analysis screen.

Operation procedure

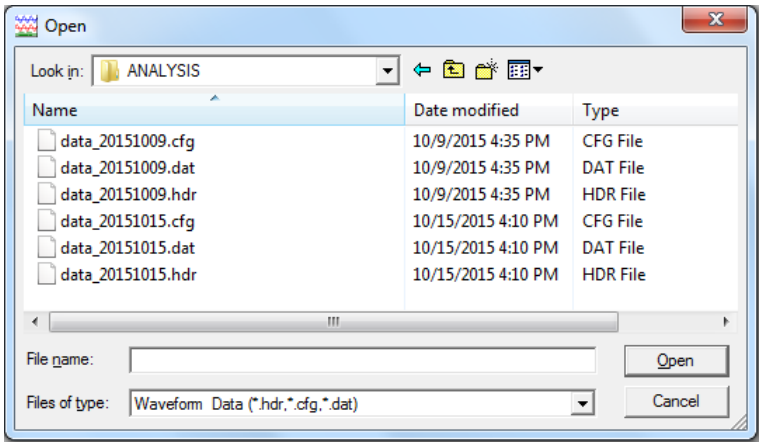
1. From the [File] menu, click [Open].



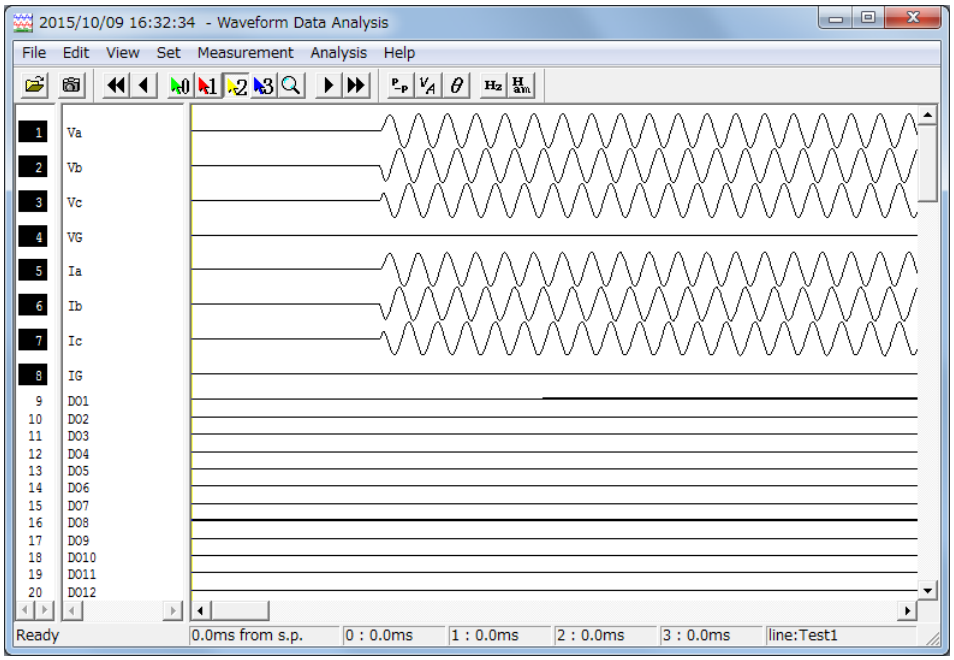
2. Click on the folder containing the waveform data to open and click “Open.”



3. Select the waveform data to open and click “Open.”
   a) The types of waveform data that can be opened are “cfg,” “dat” and “hdr.”



4. The selected waveform data is displayed.

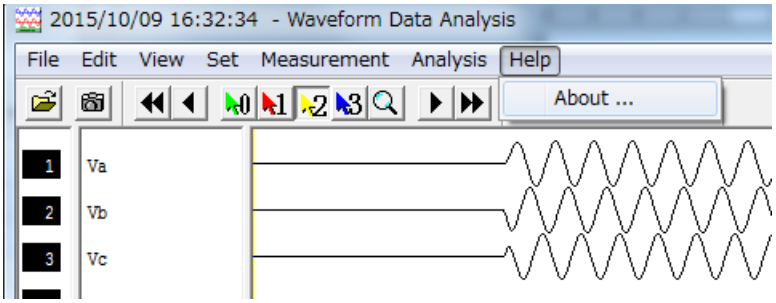


2.8.2. Version information display

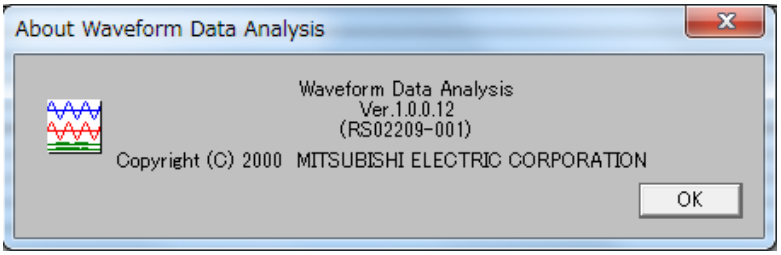
This subsection describes how to show the version information of the waveform analysis software.

Operation procedure

1. From the [Help] menu, click [About].



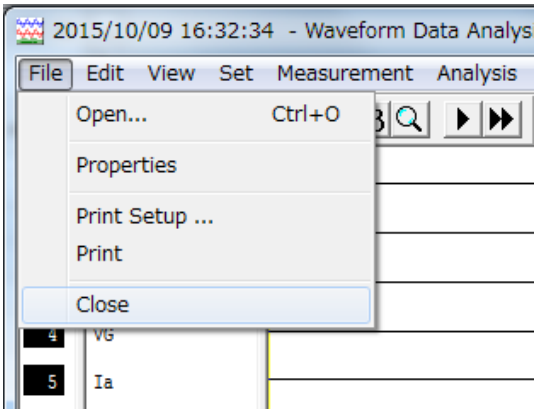
2. The version information of the waveform analysis software is displayed.



2.8.3. Closing the waveform screen

Operation procedure

1. From the [File] menu, click [Close].



2.8.4. Waveform data information display

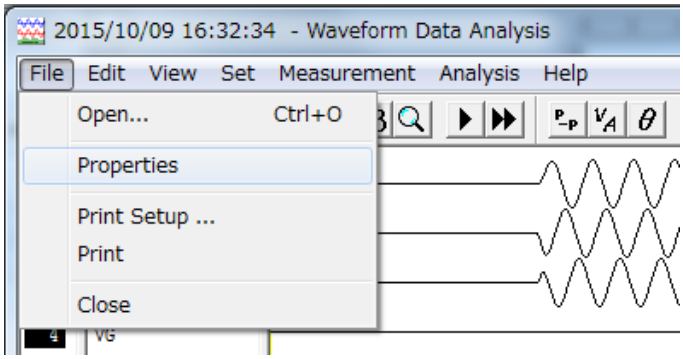
This subsection describes how to show the information about the sampled waveform data.

Notes on operation

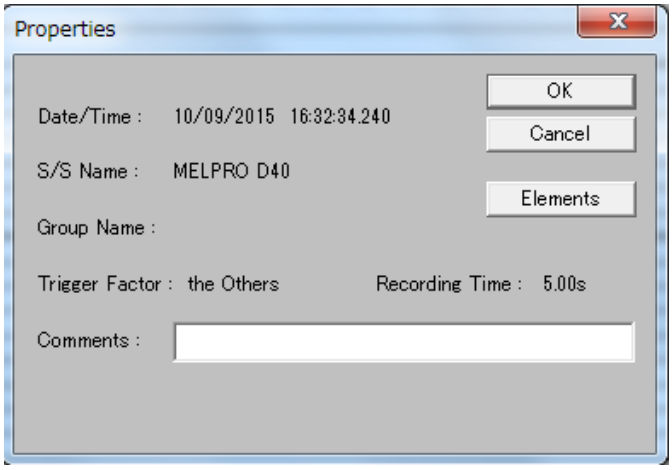
1. Comments can be added to waveform data.

Operation procedure

1. From the [File] menu, click [Properties].



2. The waveform data information is displayed.



3. To add a comment, enter text in the [Comments] text box.
    a) The length of the comment is up to 40 characters.

4. Click “OK.”
    a) The comment is added.

2.8.4.1.Setting values for analog elements

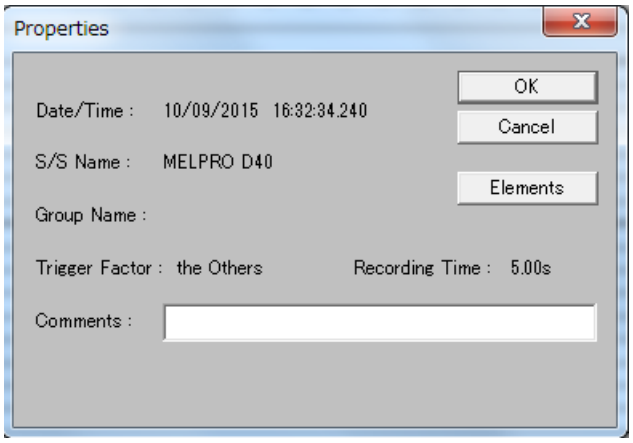
This subsection describes how to set values for analog channels (elements)on the list of waveform data channels.

Notes on operation

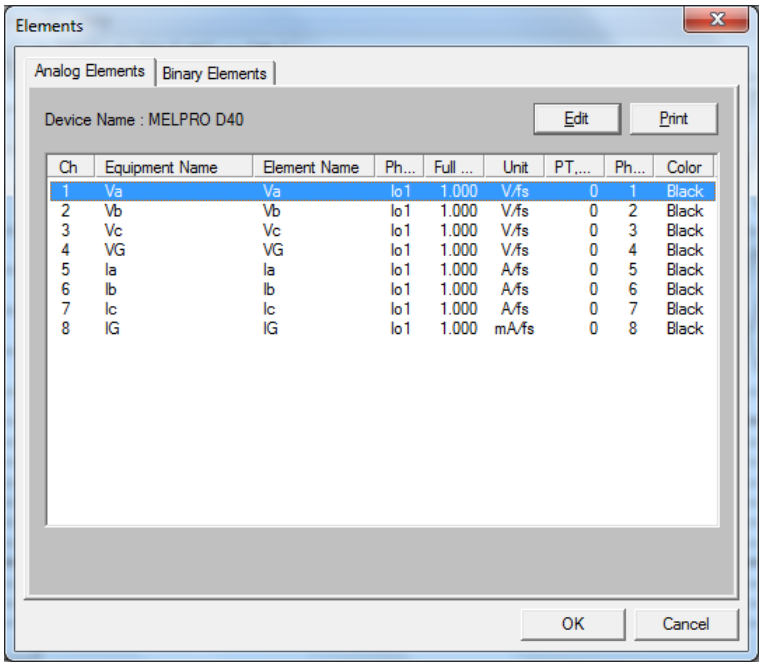
1. It is not possible to set [Phase] and [Phase Group Number].

Operation procedure

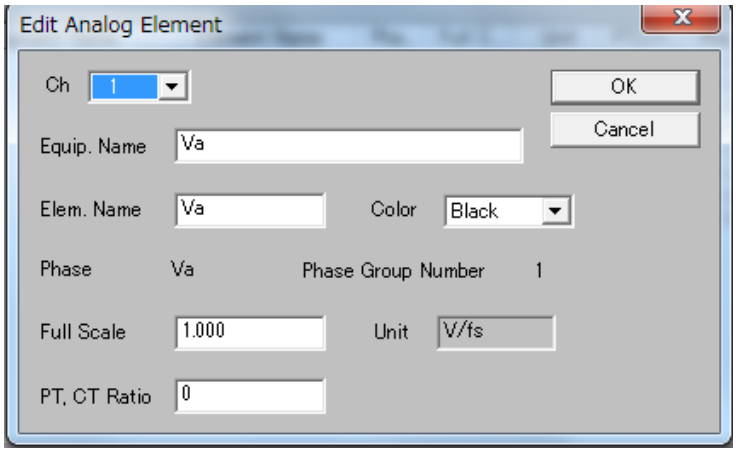
1. Show the waveform data information and click “Elements.”
   (See 2.8.4)



2. The [Elements] box appears.
   Click on the analog element for which to set values.



3. Click “Edit.”
   a) The [Edit Analog Element] dialog box appears.



4. Enter a measurement item name in the [Equip. Name] text box.
   a) The length of the measurement item name is up to 32 characters.

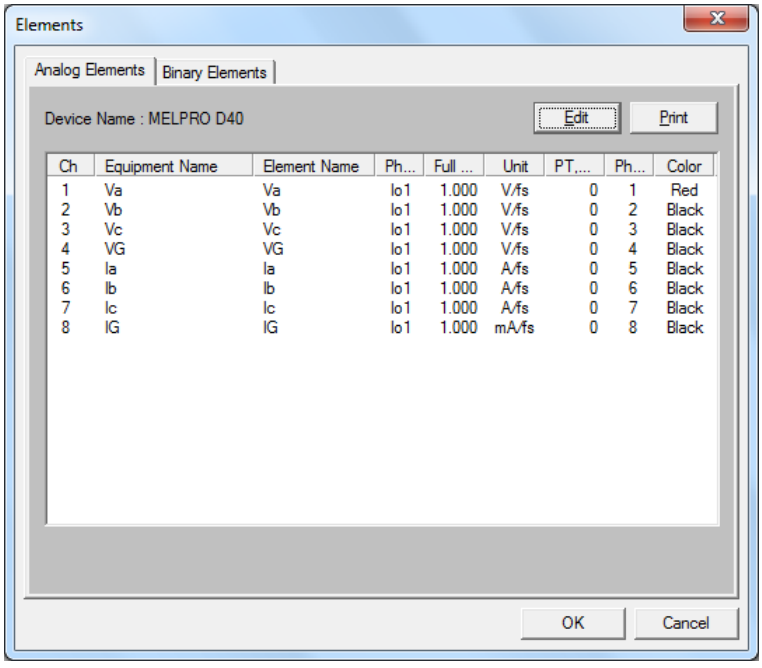
5. Enter a measurement element name in the [Elem. Name] text box.
   a) The length of the measurement element name can be up to 12 characters.

6. Click ▼ on the right side of [Color] and select the color of the waveform to show from the list.

7. Use the [Full Scale] text box to enter the scale factor of the waveform by specifying the full scale.
   a) The value for the full scale that can be entered is between 0 and 100000. (Enter in steps of 0.001)

8. Use the [PT,CT Ratio] text box to enter the scale factor of the PT or CT.
   a) The scale factor that can be input is between 1 and 65535. (Enter in steps of 1)

9. Click “OK.”
   a) The details of the applied setting appear.
      A sample screen with the Color of Va changed to Red is shown below.



10. To set values for other channels, repeat steps 1) to 9).
    a) If the values to set for a channel is mostly the same as those for another channel already set, click “Edit” to show the [Edit Analog Element] dialog and use ▼ on the right side of [Ch] to click on the channel to set. The same values for the channel already set are set for the new channel. Modify only the values that require modification.

11. To print the details of the settings for the element list, click [Print].

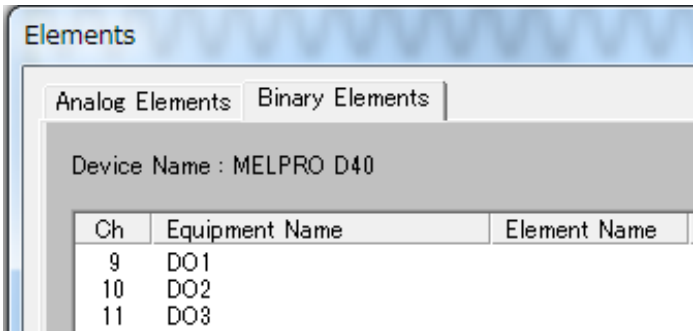
12. Click “OK.”
    a) The values for the analog elements are set.

2.8.4.2.Setting binary elements

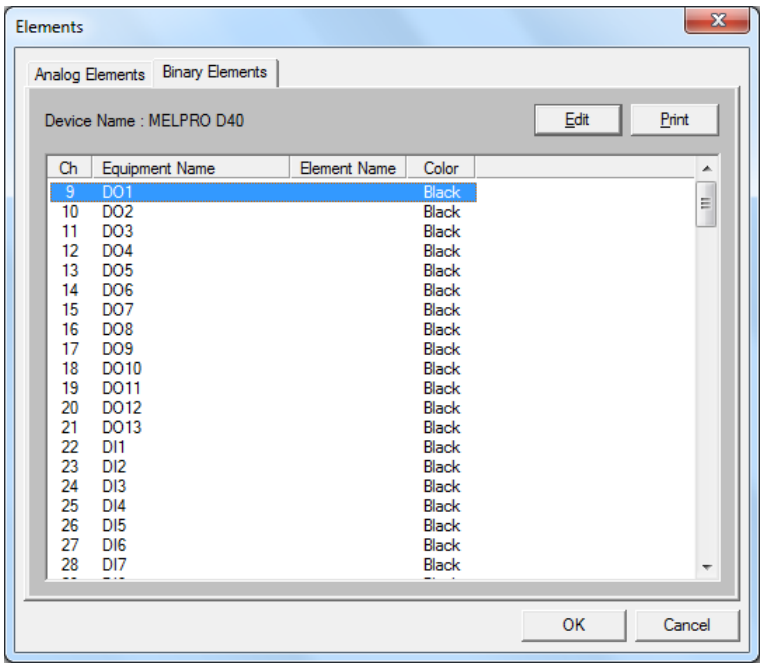
This subsection describes how to set values for binary signals (elements) on the list of waveform data channels..

Operation procedure

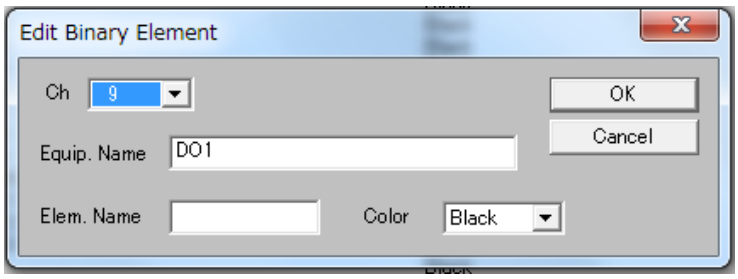
1. Show the [Elements] box and click the [Binary Elements] tab.
   (See 2.8.4.1.)



2. Click on the binary element for which to set values.



3. Click “Edit.”
   a) The [Edit Binary Element] dialog box appears.



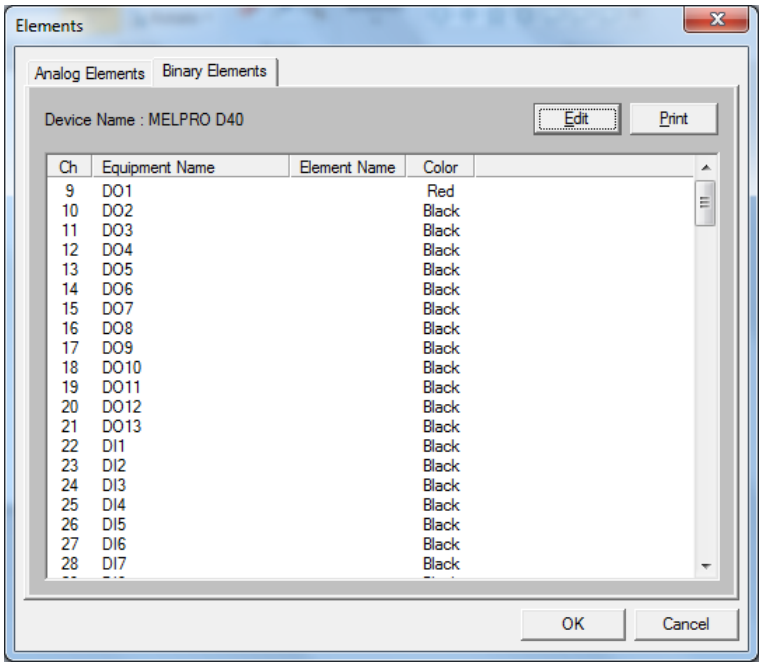
4. Enter a measurement item name in the [Equip. Name] text box.

a) The length of the measurement item name can be up to 32 characters.

5. Enter a measurement element name in the [Elem. Name] text box.
   a) The length of the measurement element name can be up to 12 characters.

6. Use ▼ on the right side of [Color] to click on the color of the waveform to show.

7. Click “OK.”
   a) The details of the applied setting appear.
   A sample screen with the Color of DO1 changed to Red is shown below.



8. To set values for other channels, repeat steps 2) to 7).

   a) If the values of a channel are mostly the same as for another channel which has already been set, the [Edit Binary Element] dialog and use ▼ on the right side of [Ch] to select the channel to set. The existing settings will be applied to the new channel. Modify any settings values that require modification.

9. To print the details of the element list set, click [Print].

10. Click “OK.”
    a) The values for the binary element are set.

2.8.5. Zooming into/out of waveform data

This subsection describes how to zoom into/out of waveform data.

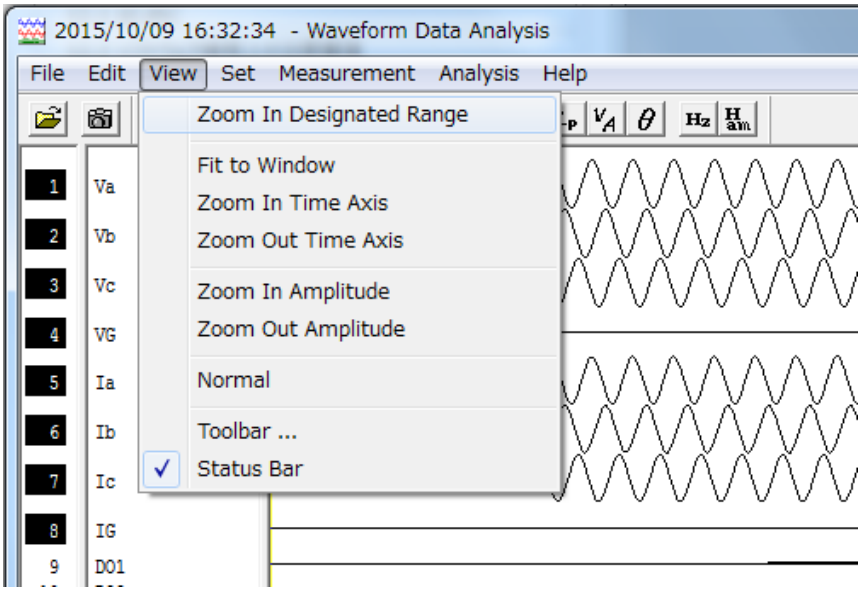
Notes on operation

1. The following operations are available.

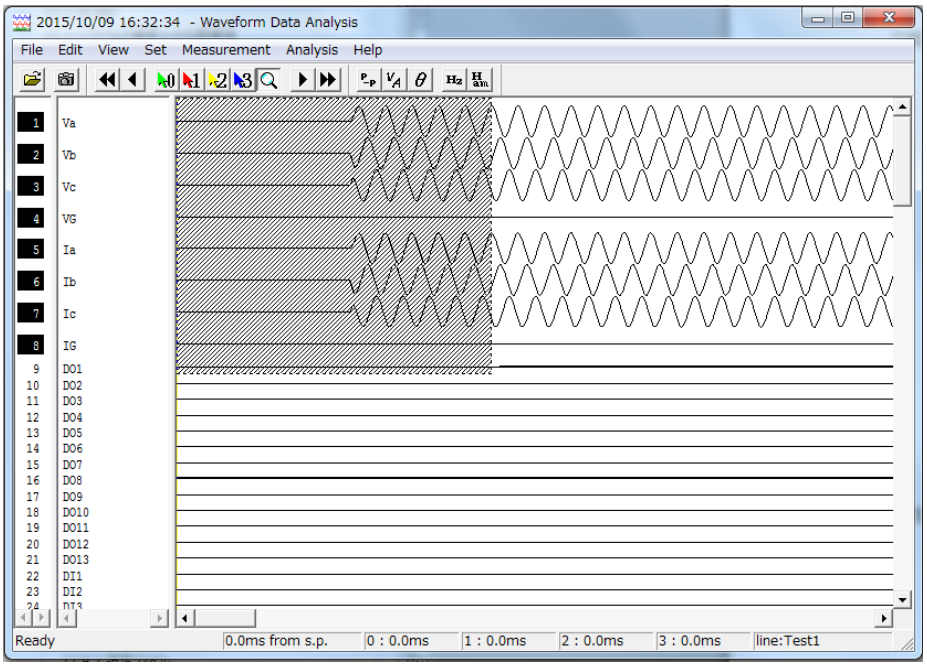
a) Zoom In Designed Range	Allows zooming in with an arbitrary scale factor.
b) Fit to Window	Shows the time axis of the waveform from one end to the other of the screen.
c) Zoom In,Out Time Axis	Allows scaling up (x2) and down (x1/2) along the time axis.
d) Zoom In,Out Amplitude	Allows scaling up (x2) and down (x1/2) of a wave height.
e) Normal	Allows adjustment of the time axis and wave height as described below.
Time axis	Adjustment is made to make the measurement point of the waveform equal to one dot on the screen.
Wave height	When the resolution in the vertical direction of the screen is 768 dots, all measurement points are indicated.
f) With Interval Fixed	Allows scaling up (x2) and down (x1/2) of only the waveform selected. Right-click on the waveform for this operation.

Operation procedure

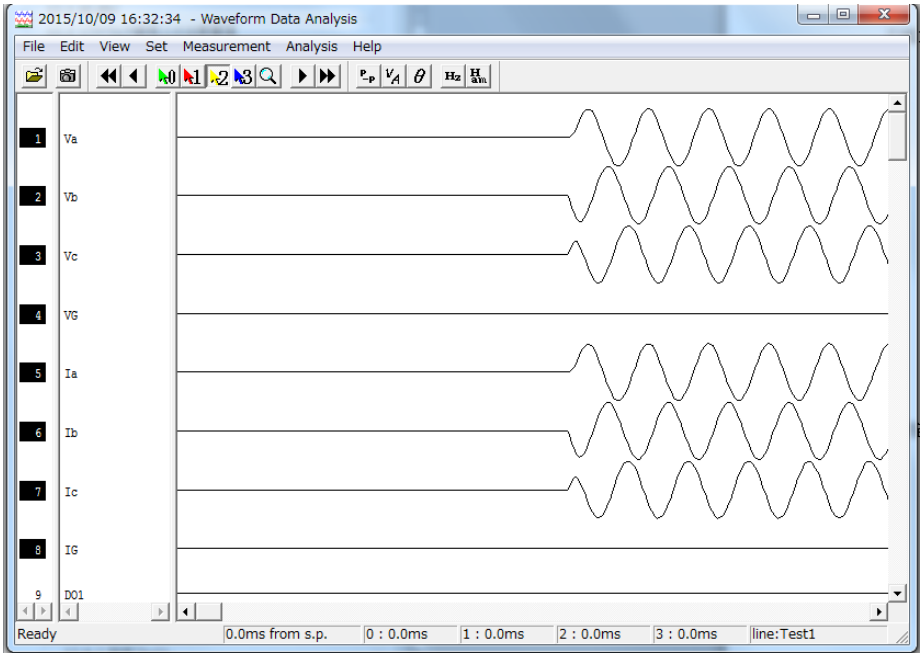
1. To zoom into the specified range, from the [View] menu, click [Zoom In Designated Range].



2. Drag with the mouse across the range to scale up.



3. The specified range is scaled up for display.



4. To show the waveform from one end of the screen to the other, click [View] and click [Fit to Window].

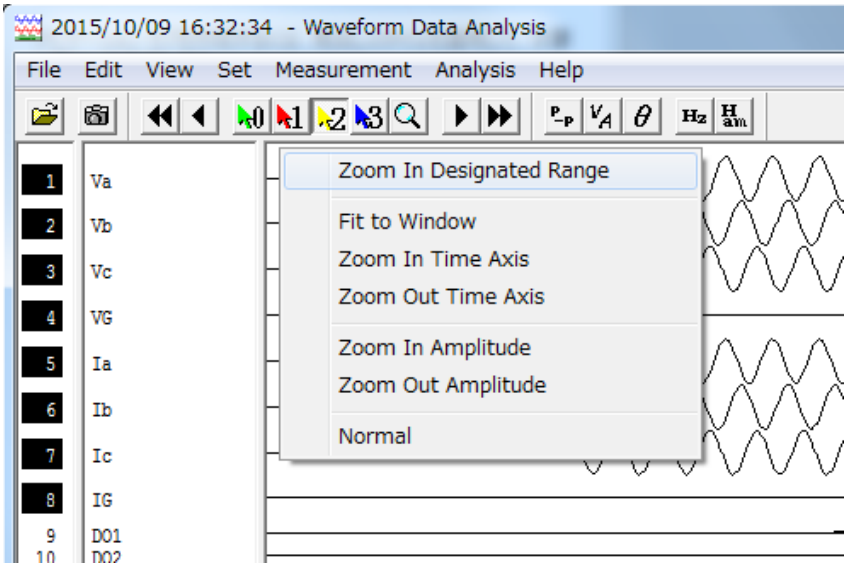
5. To scale up/down the time axis, click [View] and click [Zoom In Time Axis] or [Zoom Out Time Axis].

6. To scale up/down the wave height, click [View] and click [Zoom In Amplitude] or [Zoom Out Amplitude].

7. To show the normal state of the waveform data, click [View] and click [Normal].

Note) These operations can also be obtained by right-clicking the mouse on the analysis screen to make a selection on the menu that appears.

注)この操作は、解析画面でマウスの右クリックをし、表示されたメニューを選択することでも同様にできます。



2.8.6. Moving cursors

This subsection describes how to move the cursors. The cursors are used to select measurement and analysis points.

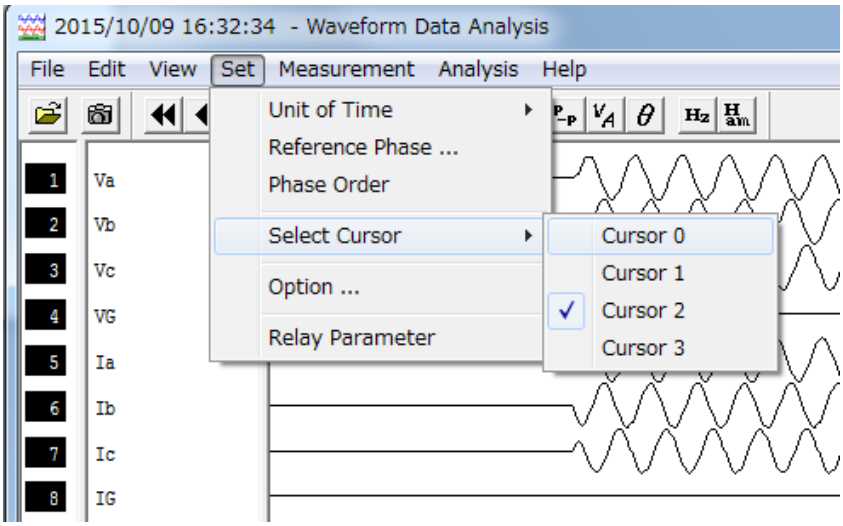
Notes on operation

1. Four cursors (Cursors 0 to 3) are displayed, of which the active one corresponds to the measurement point.

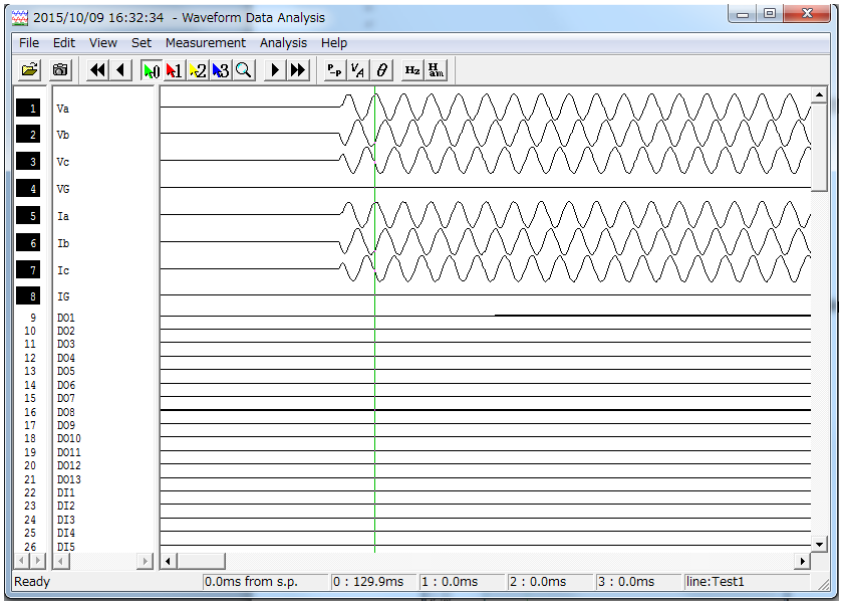
2. Cursor 0 is used also as the reference when the relative time function is used.

Operation procedure

1. From the [Set] menu, select [Select Cursor] and click on the cursor to move.
   a) The selected cursor becomes active.

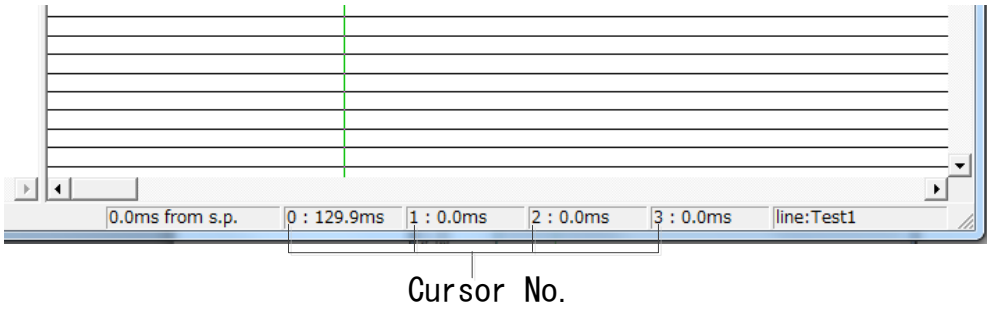


2. Double-click on the position to which to move the cursor.
   a) The selected (active) cursor moves.
   b) The cursor can be moved by dragging. This operation automatically activates an inactive cursor.



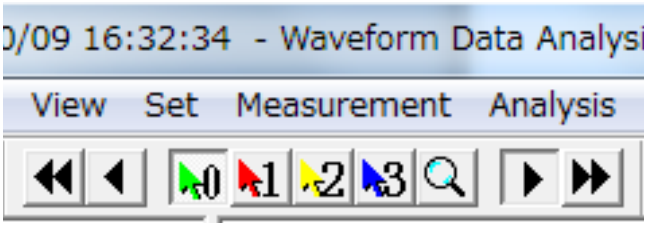
3. At the bottom of the screen, the time elapsed from the beginning of the waveform to the cursor position is

indicated.

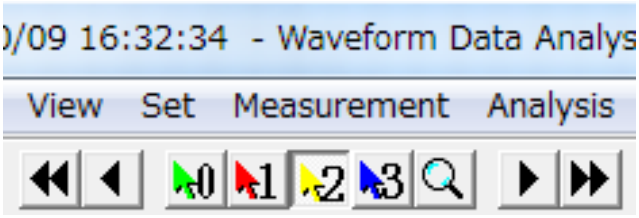


4. In this condition, using the  or  button moves the cursor by one cycle.

   Using the  or  button moves the cursor by one sample.

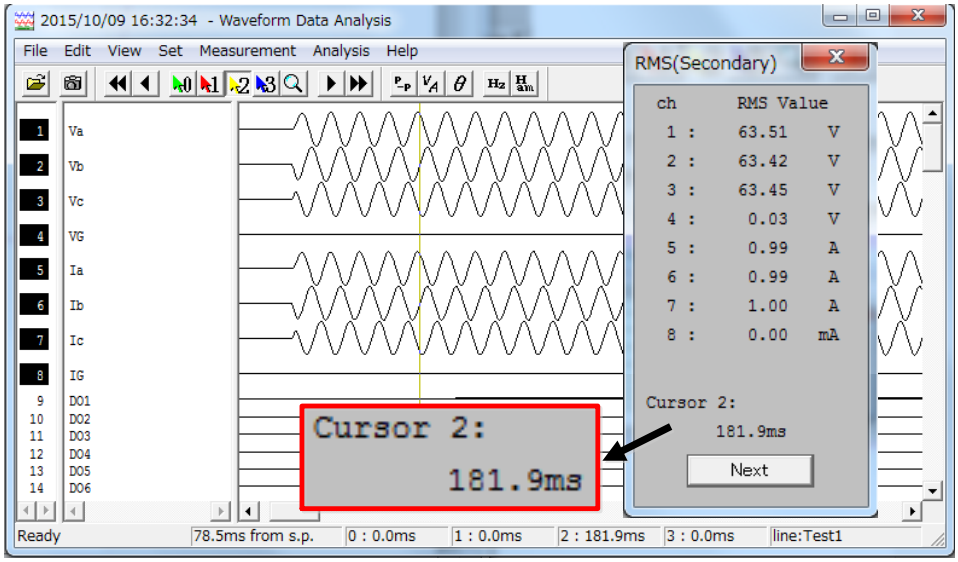


5. In addition to the cursor selection operation in Step 1, clicking a cursor button on the Toolbar also activates another cursor.



6. When the measured or analytical values are displayed, the time elapsed from the beginning of the waveform to the position of the active cursor is indicated.

   a) The time indicated can be replaced by the relative time from Cursor 0.



2.8.7. Editing waveform data

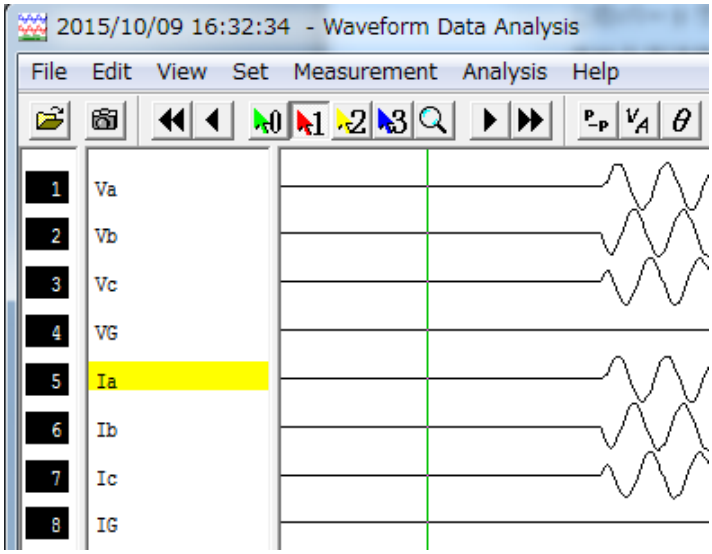
This subsection describes how to move and superimpose waveforms.

2.8.7.1.Moving waveform data

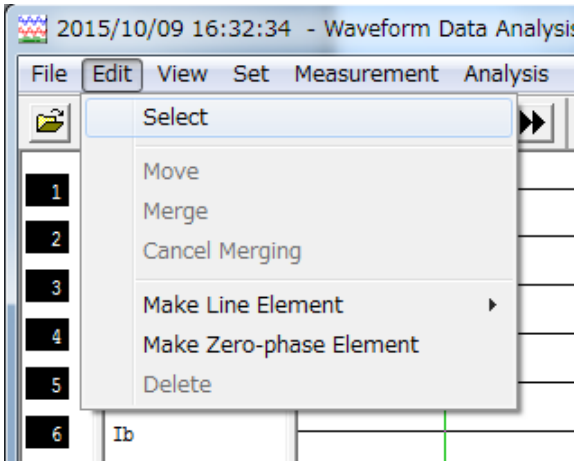
This subsection describes how to move waveform data together with an element from one channel to another. (The content displayed for the channel is changed.)

Operation procedure

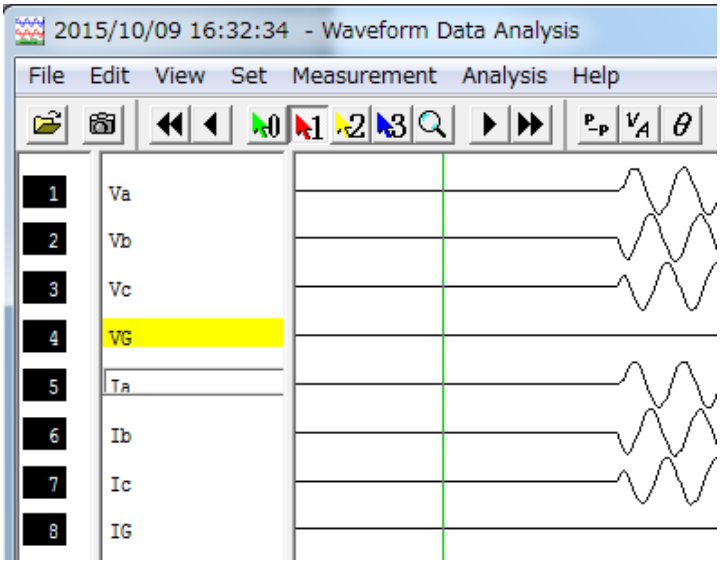
1. Click the element of the waveform data to move. (One element only)



2. From the [Edit] menu, click [Select].



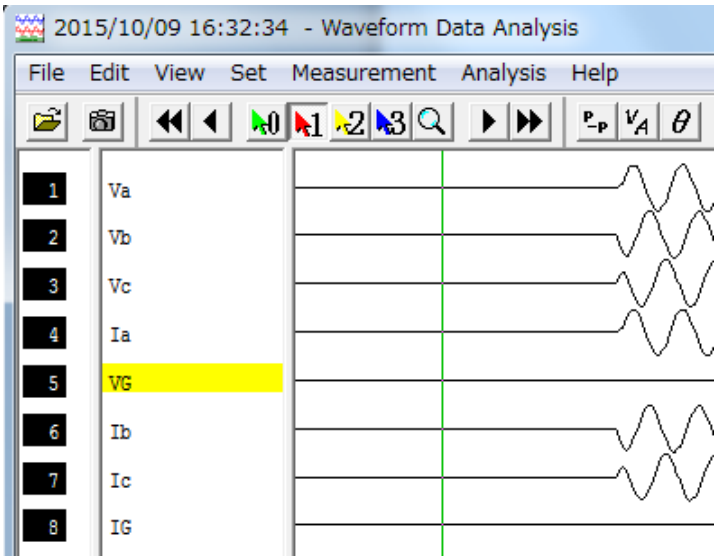
3. Click the element of the waveform data of the destination.



4. From the [Edit] menu, click [Move].

5. The selected waveform data moves to the intended channel.

a) Dragging the waveform data moves the element of the waveform data selected

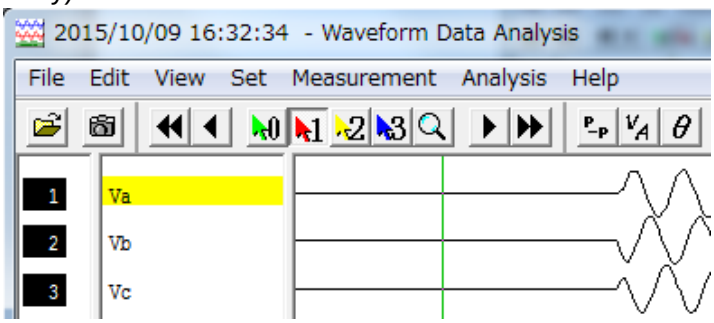


2.8.7.2.Superimposing waveform data

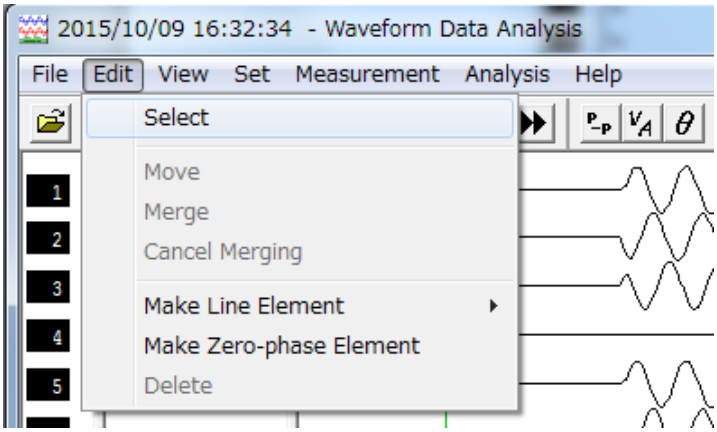
This subsection describes how to superimpose waveform data to show an analog element of another waveform data.

Operation procedure

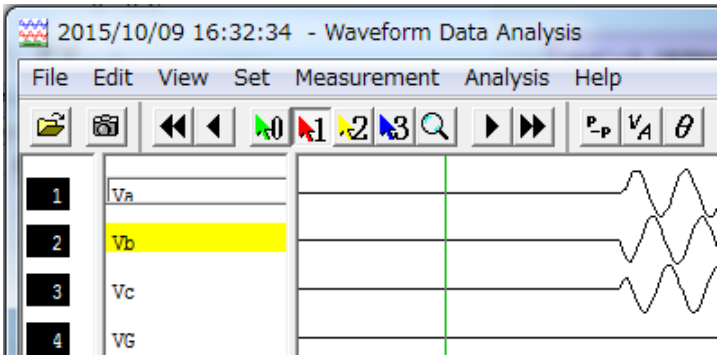
1. Click the element of the waveform data to superimpose on another waveform data.
   (One element only)



2. From the [Edit] menu, click [Select].

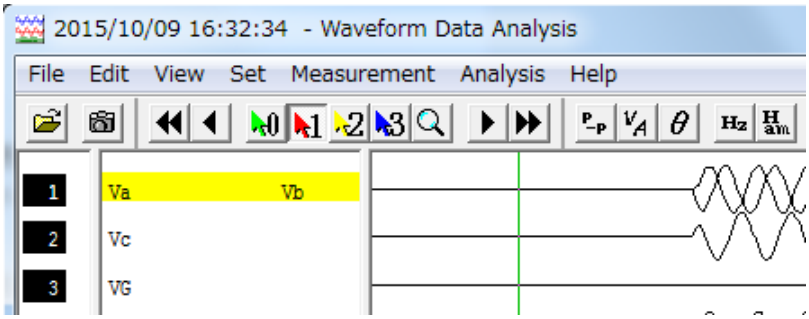


3. Click the element of the waveform to write over.

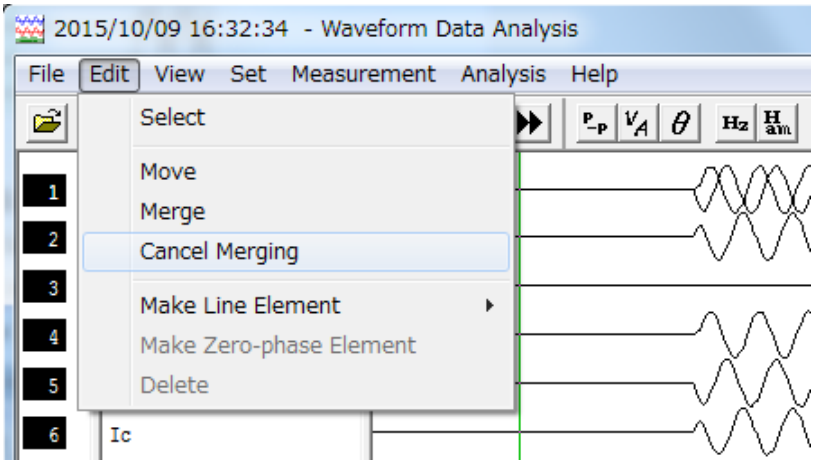


4. From the [Edit] menu, click [Merge].

5. The selected waveform data are superimposed for display.
   a) The same result can be obtained by simply dragging the selected waveform data while holding down “Ctrl.”
   b) The measurement item and element name of the analog element superimposed are shown on the side.



6. To cancel superimposition of waveform data, click the waveform data to cancel, click [Edit] and then click [Select].
   From the [Edit] menu, click [Cancel Merging].
   a) This cancels superimposition of the selected waveform data.



2.8.8. Creating line-line and zero-sequence elements

This subsection describes how to create new line-line and zero-sequence elements from the selected analogue elements.

Notes on operation

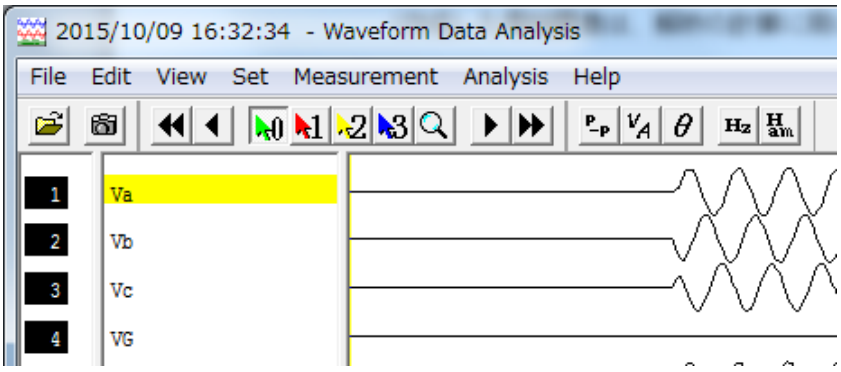
1. Line-Line and zero-sequence elements can be created from the following elements.

V_a-V_b	-->V_{ab}	I_a-I_b	-->I_{ab}
V_b-V_c	-->V_{bc}	I_b-I_c	-->I_{bc}
V_c-V_a	-->V_{ca}	I_c-I_a	-->I_{ca}
V_a-V_b-V_c	-->V_0	I_a-I_b-I_c	-->I_0

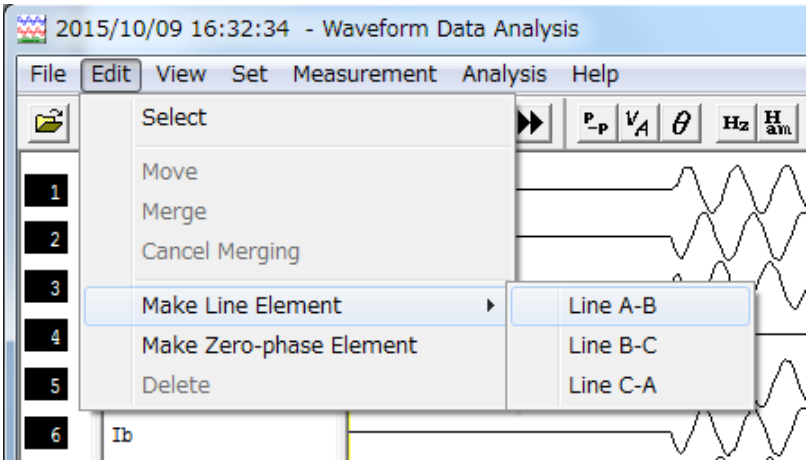
2. When a zero-sequence element is created, the phase order setting is processed and registered internally. (The created zero-sequence element is used for analysis calculation.)

Operation procedure

1. Click the element of the waveform data to create a line-line or zero-sequence element. (One element only)

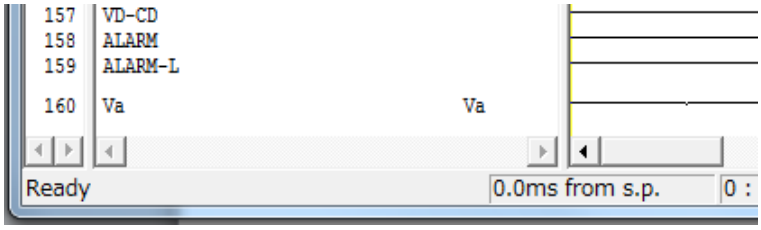


2. From the [Edit] menu, click [Make Line Element] or [Make Zero-phase Element]. Selecting [Make Line Element] causes an additional menu to appear. Select the item to create.

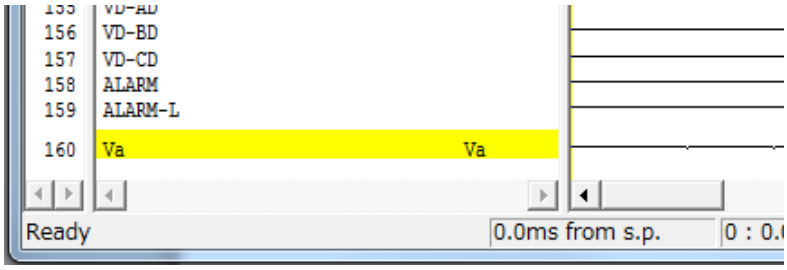


3. A line-line or zero-sequence element is created.

a) The created element is shown at the lowermost part.



4. To delete any element created, click the element to delete, click [Edit] and then click [Delete].



2.8.9. Setting the phase order

This subsection describes how to set the phase order.

Notes on operation

1. When the element list (see 2.8.4) has been set, the phase order is automatically set.
   For example, if the following items are input,

CH1	154 kV	BusA	V_a	Equip.#1
CH1	154 kV	BusA	V_b	Equip.#1
CH1	154 kV	BusA	V_c	Equip.#1
CH1	154 kV	BusA	V_0	Equip.#1

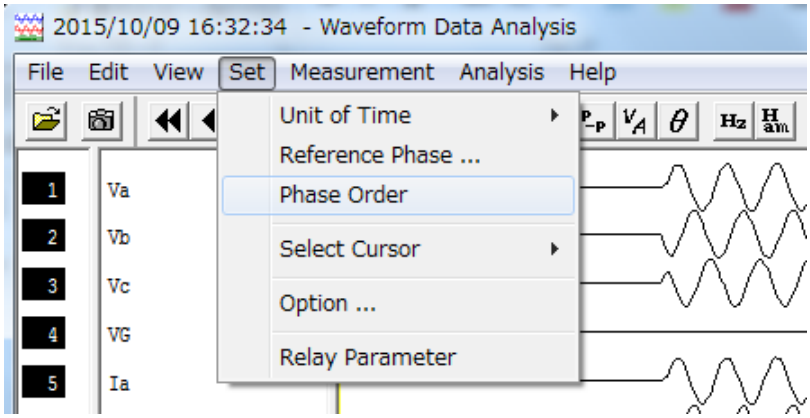
   the voltage phase order is set as [154 kV BusA].

2. The phase order can be freely selected for analysis.

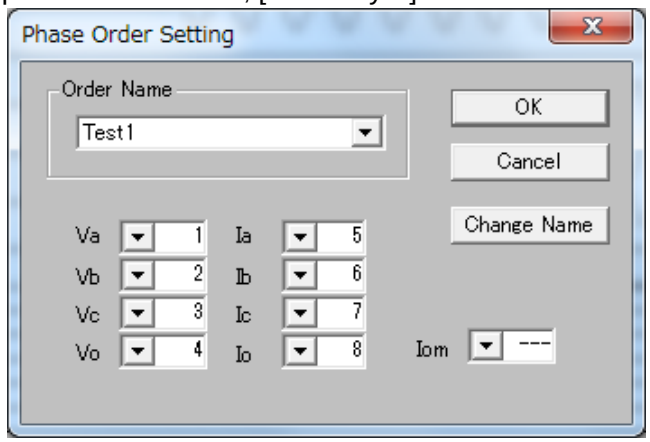
3. Any analog channel can be changed in the order selected.

Operation procedure

1. From the [Set] menu, click [Phase Order].



2. Click ▼ of Order name and select the name required.
   a) For a phase order not set, [Not Entry --] is indicated



3. When the analog channel order is changed, click the ▼ button of the respective phase to select its order.

4. Click “OK.”
   a) The phase order is recorded.

Note) When renaming the phase order currently indicated with Order Name, click the “Change Name” button. Enter a new name and click “OK” to apply it.

2.8.10. Printing waveform data

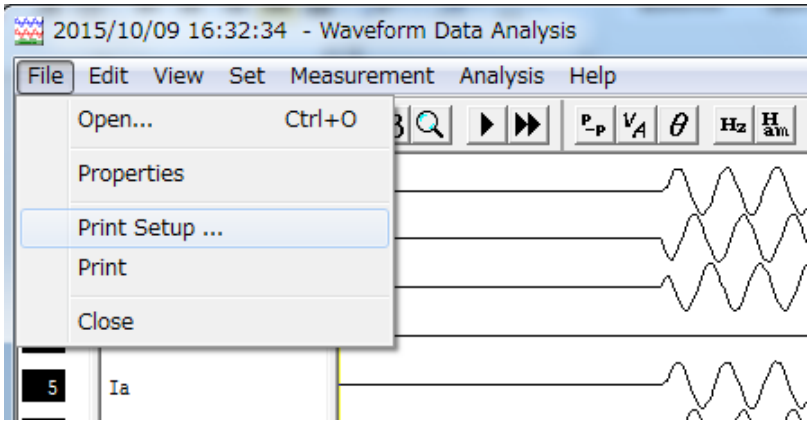
This subsection describes how to print waveform data.

2.8.10.1.Printing the screen displayed

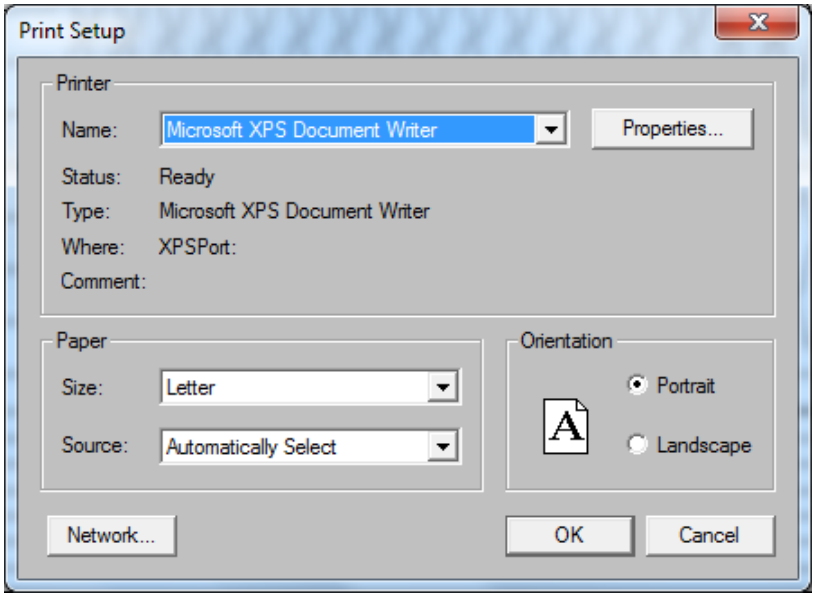
This subsection describes how to print the screen displayed.
(Output a hard copy)

Operation procedure

1. From the [File] menu, click [Print Setup].

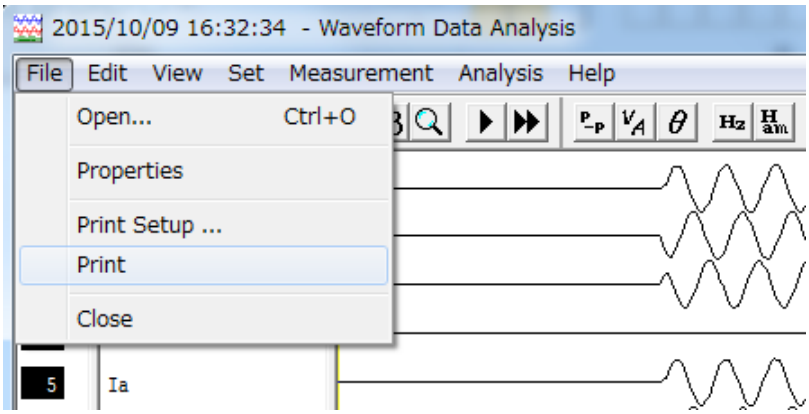


2. Set up the printer and click “OK.”



3. From the [File] menu, click [Print].

a) Printing of the screen displayed is started.



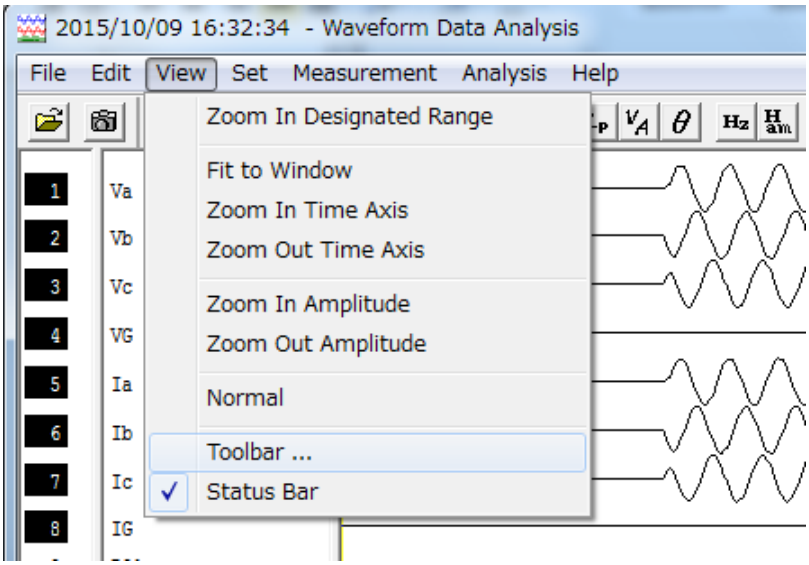
2.8.11. Toolbar and Status Bar

This subsection describes how to show/hide the Toolbar and Status Bar.

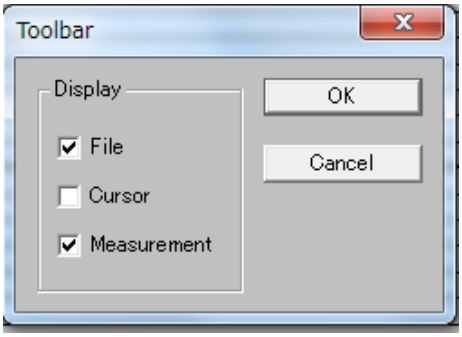
2.8.11.1.Showing and hiding Toolbar and Status Bar

Operation procedure

1. To show or hide the Toolbar, from the [View] menu, click [Toolbar].

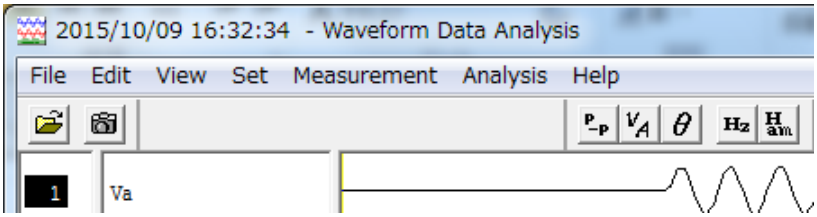


2. Check the box for the item to show.



3. Click “OK.”

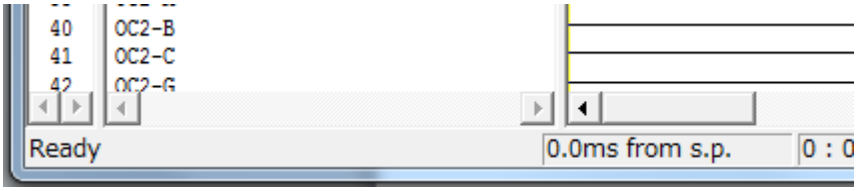
a) The checked Toolbar appears.



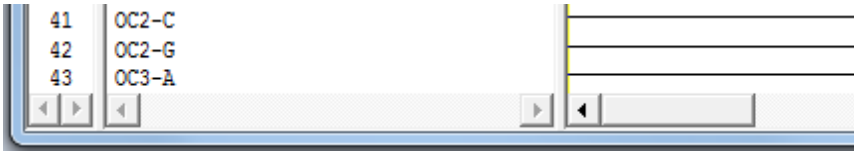
4. To show or hide the Status Bar, from the [View] menu, click [Status Bar].

5. The Status Bar is shown or hidden.

Viewing

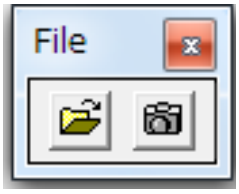


Hiding



2.8.11.2.Toolbar functions

<File>



 Open waveform data

 Print

<Cursor>

 Set the active cursor back by one cycle

 Set the active cursor back by one sample

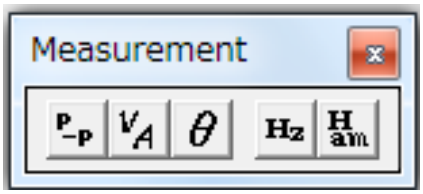
 ~  Select Cursor 0 to 3

 Zoom into the specified range

 Set the active cursor forward by one sample

 Set the active cursor forward by one cycle

<Measurement>



 Show instantaneous values

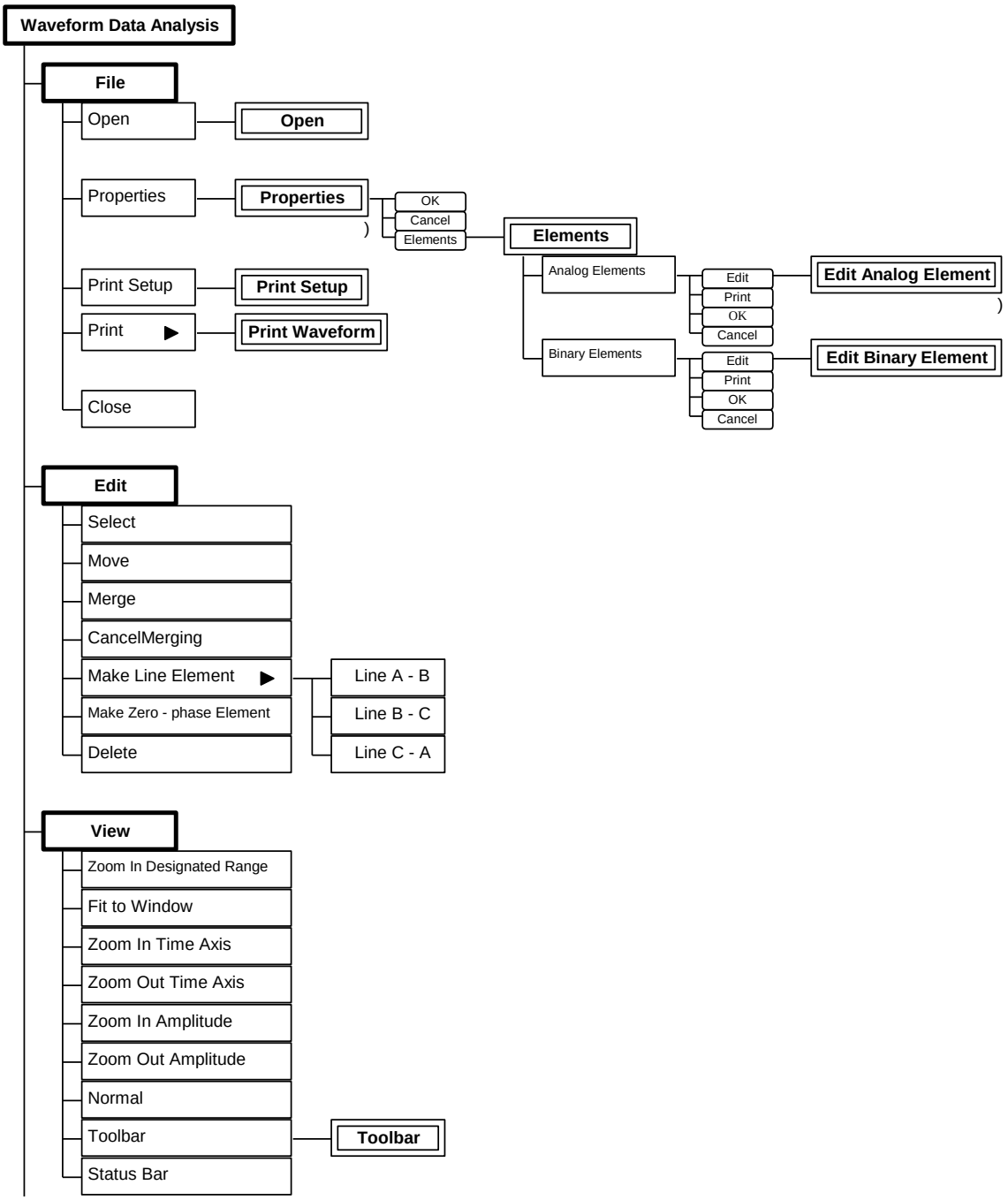
 Show RMS values

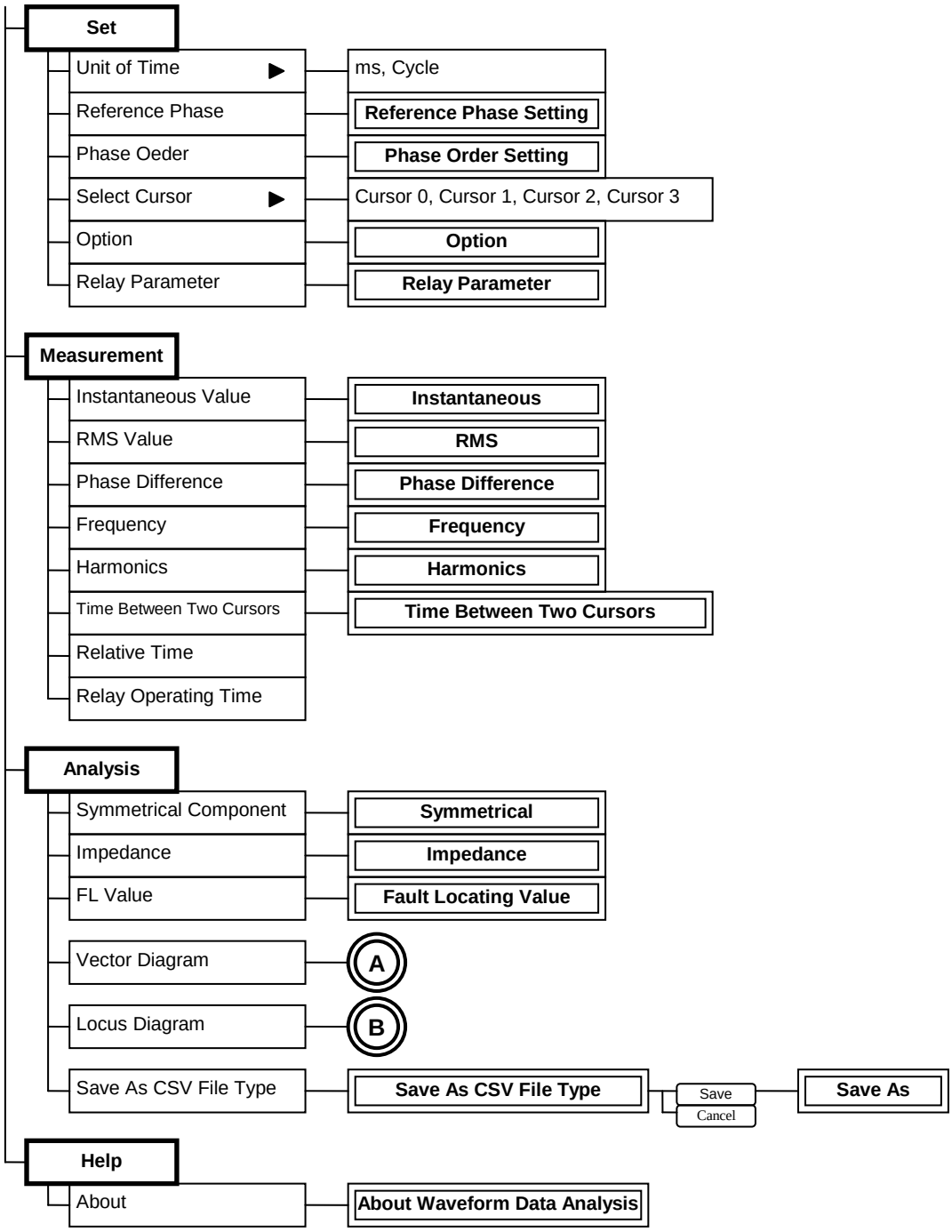
 Show phase differences

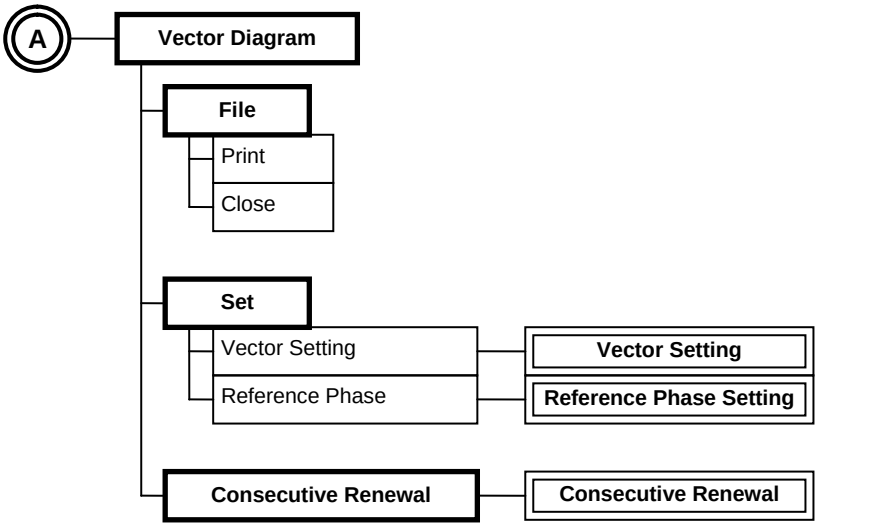
 Show frequencies

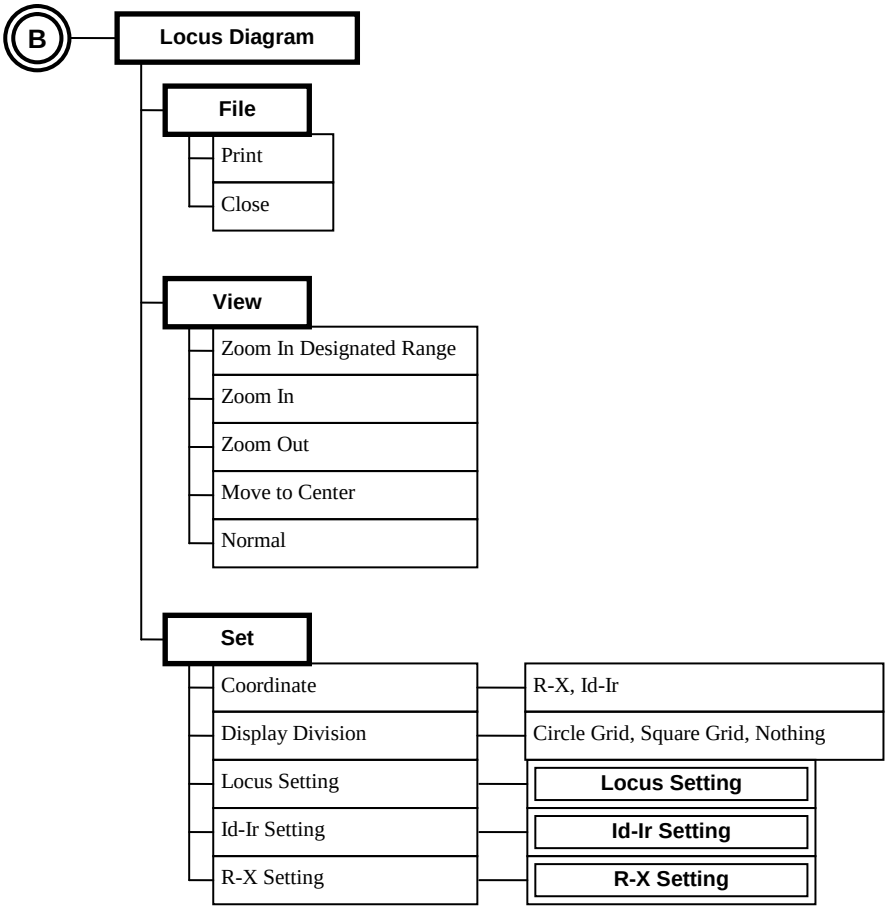
 Show harmonics

2.8.12. Menu hierarchy




Set
Unit of Time
ms, Cycle
Reference Phase
Reference Phase Setting
Phase Oeder
Phase Order Setting
Select Cursor
Cursor 0, Cursor 1, Cursor 2, Cursor 3
Option
Option
Relay Parameter
Relay Parameter
Measurement
Instantaneous Value
Instantaneous
RMS Value
RMS
Phase Difference
Phase Difference
Frequency
Frequency
Harmonics
Harmonics
Time Between Two Cursors
Time Between Two Cursors
Relative Time
Relay Operating Time
Analysis
Symmetrical Component
Symmetrical
Impedance
Impedance
FL Value
Fault Locating Value
Vector Diagram
A
Locus Diagram
B
Save As CSV File Type
Save As CSV File Type
Save
Cancel
Save As
Help
About
About Waveform Data Analysis


A
Vector Diagram
File
Print
Close
Set
Vector Setting
Reference Phase
Vector Setting
Reference Phase Setting
Consecutive Renewal
Consecutive Renewal


B
Locus Diagram
File
Print
Close
View
Zoom In Designated Range
Zoom In
Zoom Out
Move to Center
Normal
Set
Coordinate
Display Division
Locus Setting
Id-Ir Setting
R-X Setting
R-X, Id-Ir
Circle Grid, Square Grid, Nothing
Locus Setting
Id-Ir Setting
R-X Setting

2.8.13. Setting measurement and analysis parameters

This subsection describes how to set the parameters required for value analysis and measured value calculation.

2.8.13.1.Selecting the unit of time

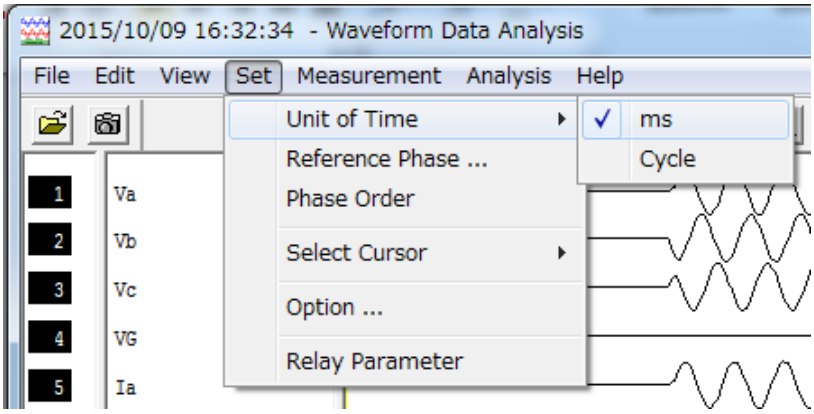
This subsection describes how to select the unit of time used for measurement and analysis operation.

Notes on operation

1. The unit of time to use when waveform data is displayed can be selected in advance.
   (See 2.8.13.4.)

Operation procedure

1. From the [Set] menu, click on the unit of time to use from [Unit of Time].



2. The selected unit of time is displayed.

2.8.13.2.Selecting the reference phase

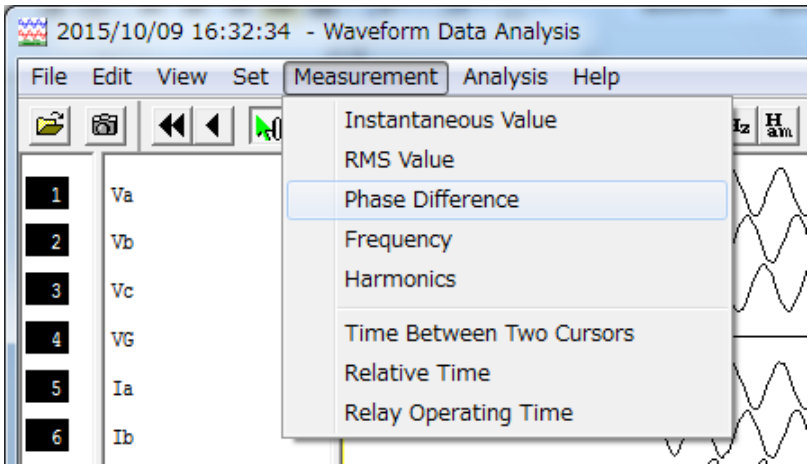
This subsection describes how to select the reference phase for measuring the phase difference and how to show vector diagrams.

Notes on operation

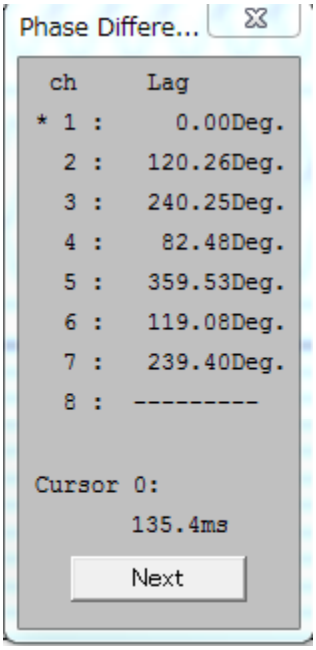
1. For the CH phase reference, the phase of the channel number for the analogue element to show the measured values of the waveform is used as the reference.

Operation procedure

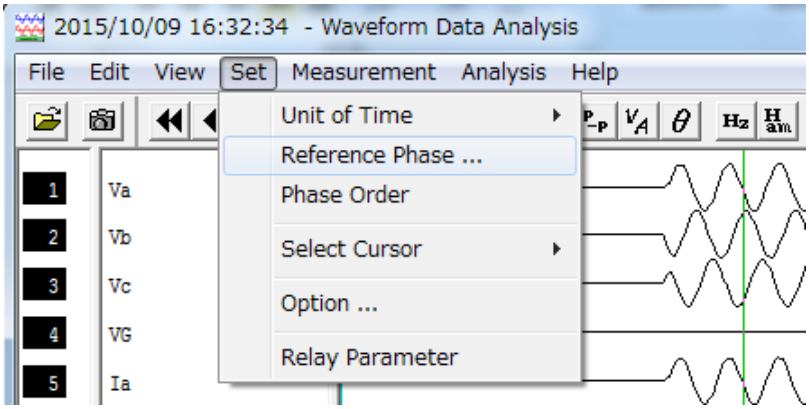
1. From the [Measurement] menu, click [Phase Difference].



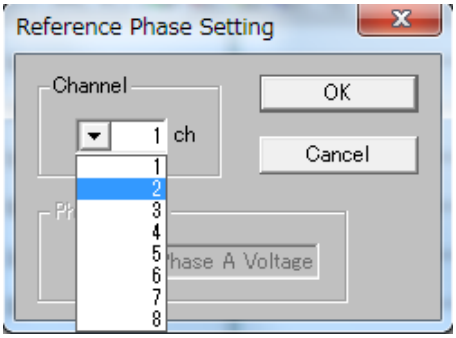
2. The phase difference for the active cursor appears.
   The reference phase is marked with [*].



3. From the [Set] menu, click [Reference Phase].



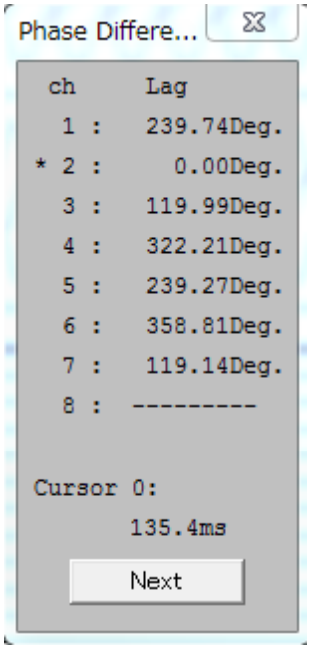
4. From the [Channel] drop-down list, select the channel number for the analog element of the reference phase.



5. Click “OK.”

a) The reference phase is now selected.

The phase newly specified as the reference is marked with [*].



2.8.13.3.Selecting a phase setting

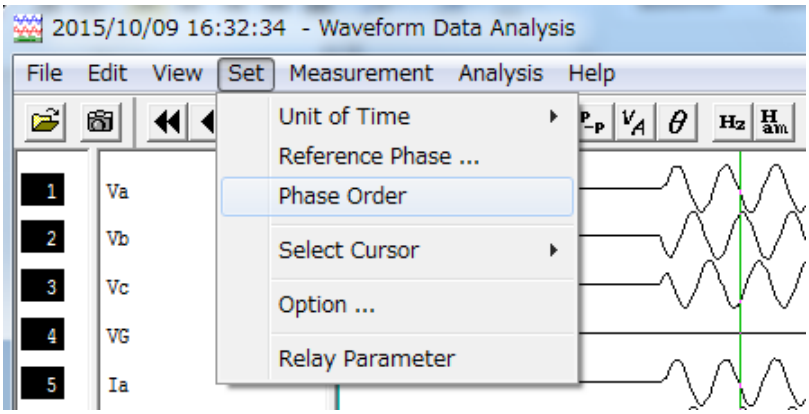
This subsection describes how to change a phase setting.

Notes on operation

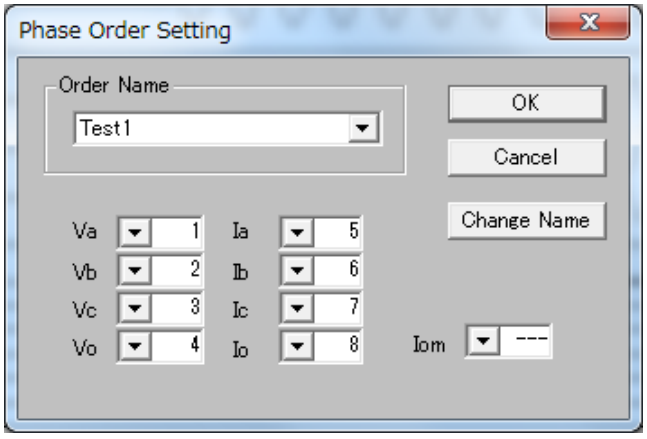
1. An arbitrary phase setting can be selected for analysis.
2. The channel number for an analog element can be changed to the phase setting selected.

Operation procedure

1. From the [Set] menu, click [Phase Order].



2. Click ▼ of [Order Name] and click the desired phase setting.
   a) If no phase setting is specified, [Not Entry --] is indicated.



3. To change the channel number for the analog element of the phase setting selected, select the channel number for the respective analog element.

4. Click “OK.”
   a) The phase setting is now selected.

2.8.13.4.Selecting options

This subsection describes how to select options.

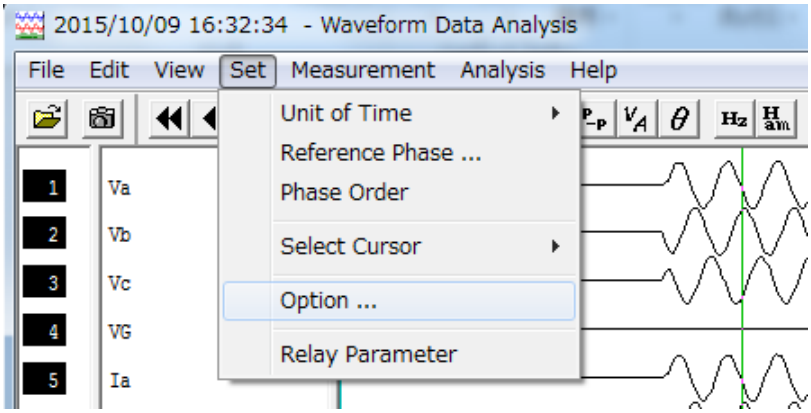
Notes on operation

1. The following options are available for selection.
   a) Hard Copy Mode
      If a colour printer is connected to the PC, this option gives a choice between colour and black-and-white
      printing of a screen copy.
   b) Phase
      Gives a choice of indication of the phase difference of waveform data between lead and lag.
   c) Unit at Start
      Allows selection of the unit of time for waveform data display.
   d) Fault Section Calculation
      This option gives a choice of whether or not to automatically calculate the time of fault when waveform
      data are displayed.
   e) AC/DC Channel
      Gives a choice of whether to show or hide the respective signal in the waveform data.

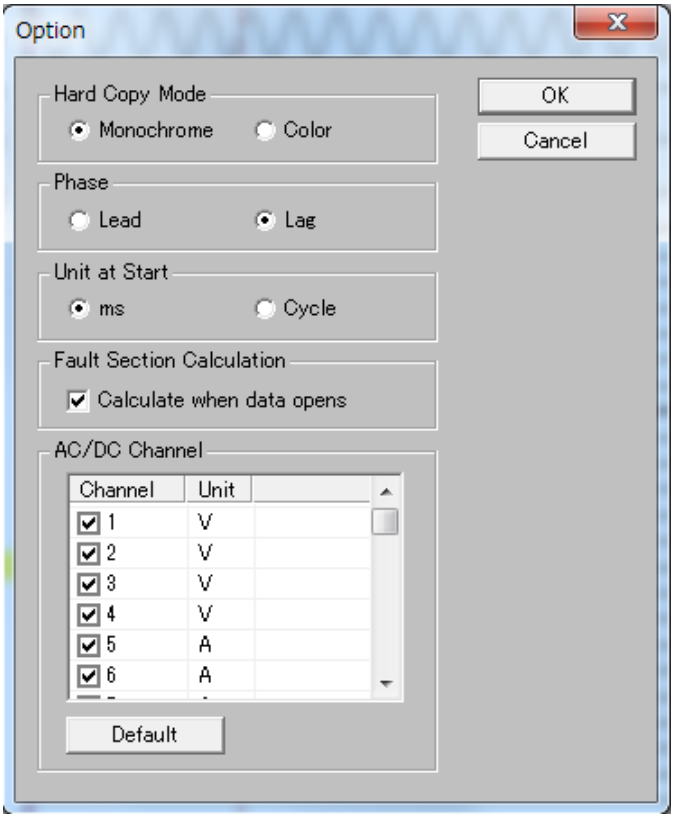
2. The choices of these options are common to all waveform data.

Operation procedure

1. From the [Set] menu, click [Option].



2. Choose the intended option for the respective item.



3. Click “OK.” The options chosen become effective.

4. Clicking “Default” unchecks all of the check boxes of AC/DC Channel.

2.8.13.5.Setting relay values

This subsection describes how to set and show relay elements.

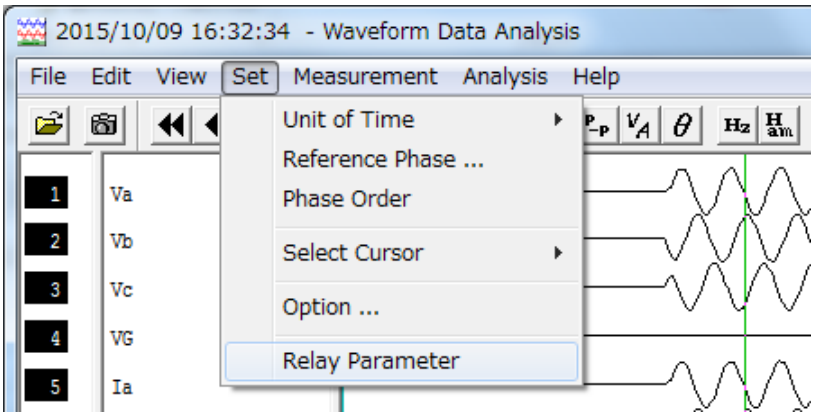
Notes on operation

1. This function can be used to change the values of the respective elements of a COMTRADE file.
   This allows viewing of data based on the values changed at the time of analysis.

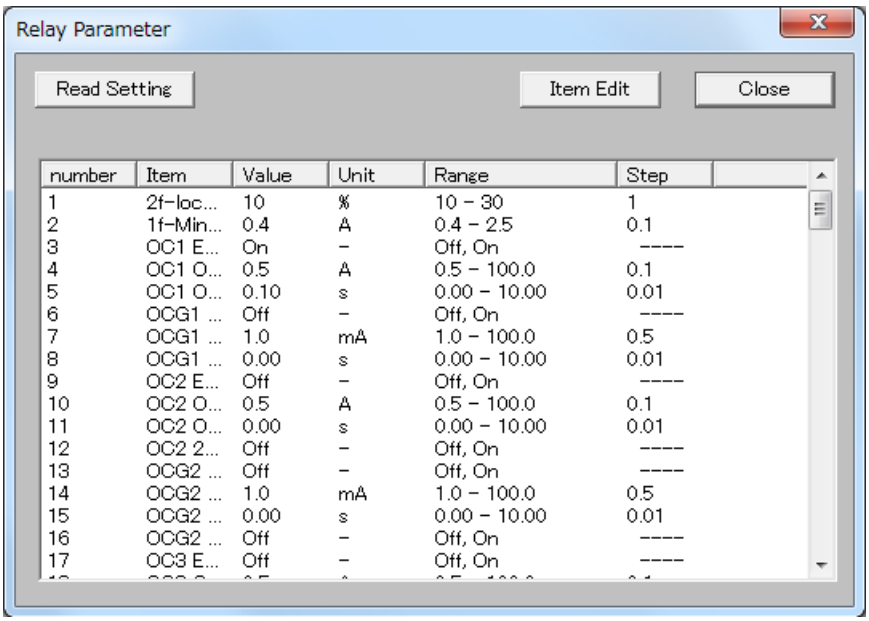
2. Even if the values above are changed, the original relay parameters are not actually changed.

Operation procedure

1. From the [Set] menu, click [Relay Parameter].

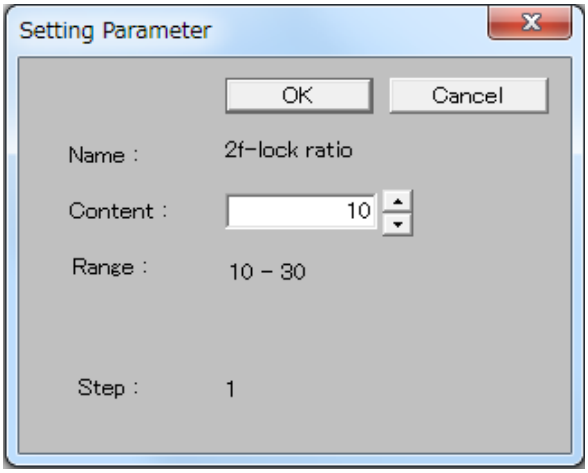


2. Select an item and click the [Item Edit] button.



number	Item	Value	Unit	Range	Step
1	2f-loc...	10	%	10 – 30	1
2	1f-Min...	0.4	A	0.4 – 2.5	0.1
3	OC1 E...	On	–	Off, On	----
4	OC1 O...	0.5	A	0.5 – 100.0	0.1
5	OC1 O...	0.10	s	0.00 – 10.00	0.01
6	OCG1 ...	Off	–	Off, On	----
7	OCG1 ...	1.0	mA	1.0 – 100.0	0.5
8	OCG1 ...	0.00	s	0.00 – 10.00	0.01
9	OC2 E...	Off	–	Off, On	----
10	OC2 O...	0.5	A	0.5 – 100.0	0.1
11	OC2 O...	0.00	s	0.00 – 10.00	0.01
12	OC2 2...	Off	–	Off, On	----
13	OCG2 ...	Off	–	Off, On	----
14	OCG2 ...	1.0	mA	1.0 – 100.0	0.5
15	OCG2 ...	0.00	s	0.00 – 10.00	0.01
16	OCG2 ...	Off	–	Off, On	----
17	OC3 E...	Off	–	Off, On	----

3. Use ▲ and ▼ to change the value of Content and click “OK.”



4. Click the [Close] button and return to 2.

5. Clicking the [Read Setting] button allows the hdr file in the COMTRADE format to be read by using the tool.

2.8.14. Showing measured values of waveform data

This subsection describes how to show the measured values of waveform data.

2.8.14.1.Showing instantaneous values

This subsection describes how to show instantaneous values.

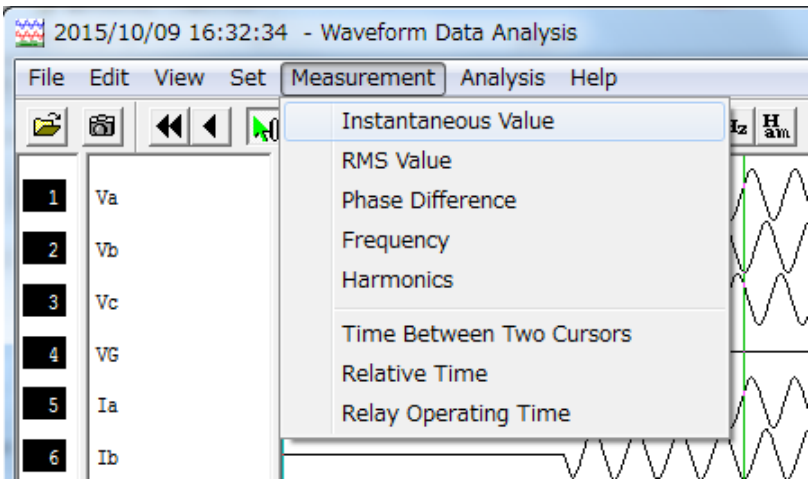
Notes on operation

1. Values shown are secondary quantities..

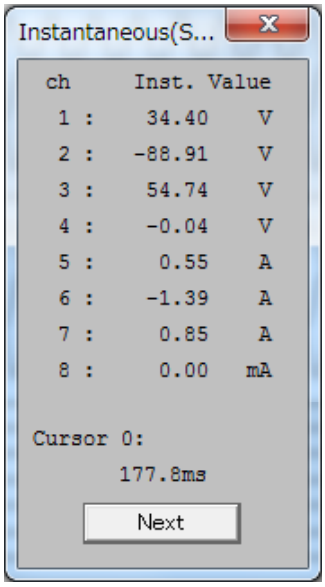
Operation procedure

1. Move the cursor to the point to measure.

2. From the [Measurement] menu, click [Instantaneous Value].



3. The instantaneous values of the analog channels are displayed.
   a) Moving the cursor updates the values.
   b) Clicking the “Next” button more than eight channels to be displayed.



2.8.14.2.Showing RMS values

This subsection describes how to show RMS values.

Notes on operation

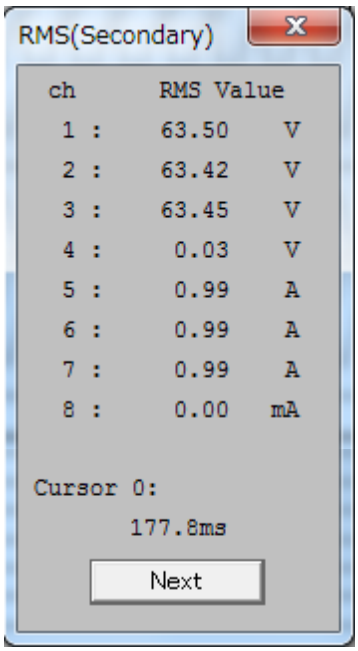
1. Values shown are those on the secondary side of the CT/PT.

Operation procedure

1. Move the cursor to the point to measure.

2. From the [Measurement] menu, click [RMS Value].

3. The RMS values of the analog channels are indicated.
   a) The RMS values one cycle before the cursor position are calculated.
   b) Moving the cursor updates the values.
   c) Clicking the “Next” button allows more than eight channels to be displayed..



2.8.14.3.Showing phase differences

This subsection describes how to show phase differences.

Notes on operation

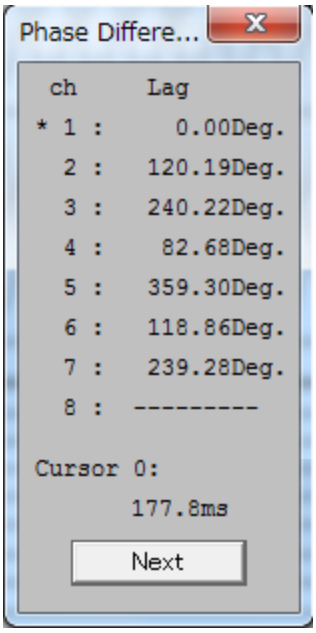
1. For the phase difference, lead indication or lag indication can be selected.

Operation procedure

1. Move the cursor to the point to measure.

2. From the [Measurement] menu, click [Phase Difference].

3. Phase differences of the respective channels from the reference phase are indicated.
   a) The reference phase is marked with [*].
   b) Moving the cursor updates the values.
   c) Where channel values cannot be measured, [--------] is indicated.
   d) Clicking the “Next” button allows more than eight channels to be displayed.



2.8.14.4.Showing frequencies

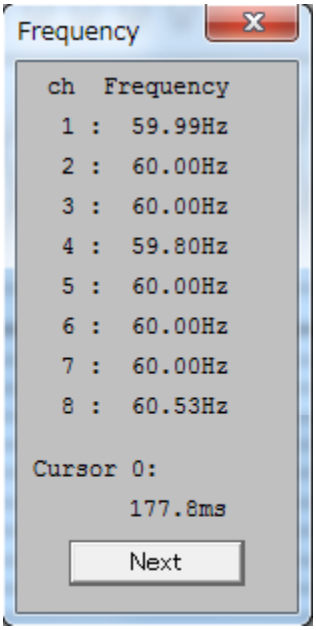
This subsection describes how to show frequencies.

Operation procedure

1. Move the cursor to the point to measure.

2. From the [Measurement] menu, click [Frequency].

3. The frequencies of the respective channels are indicated.
   a) The frequencies for four cycles before and after the cursor position each are calculated.
   b) Moving the cursor updates the values.
   c) Where channel values cannot be measured, [--------] is indicated.
   d) Clicking the “Next” button allows more than eight channels to be displayed..



2.8.14.5.Show harmonics

This subsection describes how to show harmonics.

Notes on operation

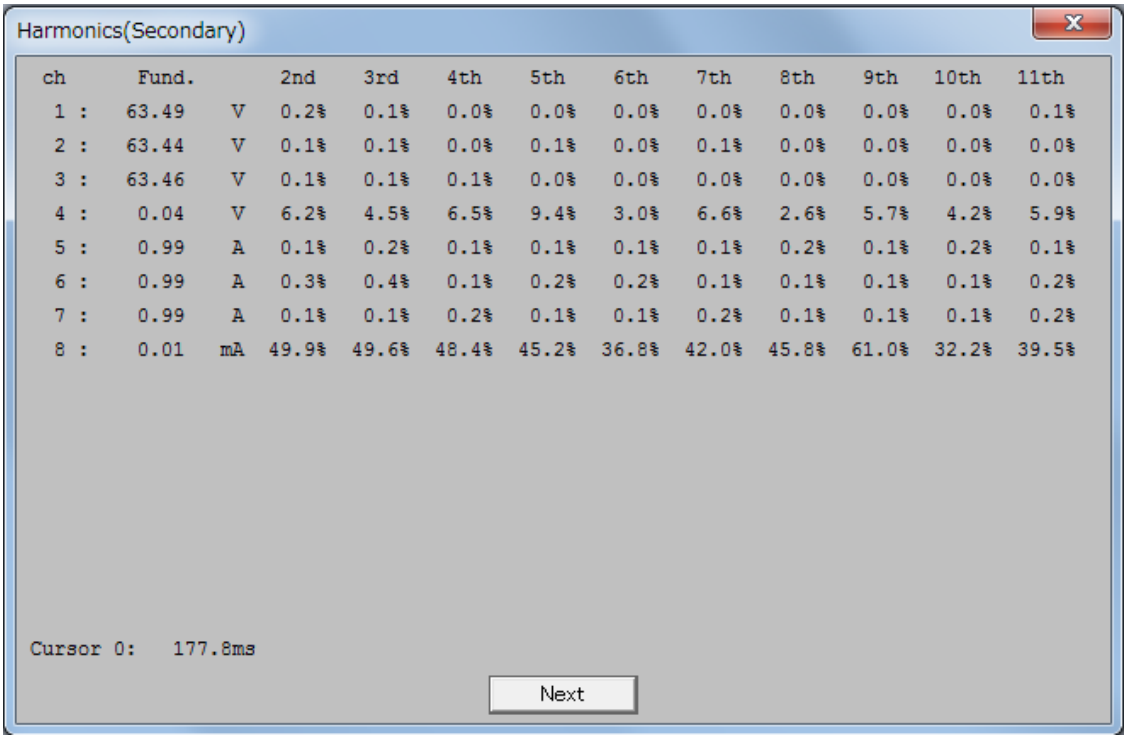
1. Values shown are those on the secondary side of the CT/PT.

Operation procedure

1. Move the cursor to the point to measure.

2. From the [Measurement] menu, click [Harmonics].

3. The harmonics of the respective channels are indicated.
   a) The harmonics for four cycles before and after the cursor position are both indicated.
   b) Clicking the “Next” button allows more than eight channels to be displayed.
   c) Moving the cursor updates the values.
   d) Where channel values cannot be measured, [--------] is indicated.



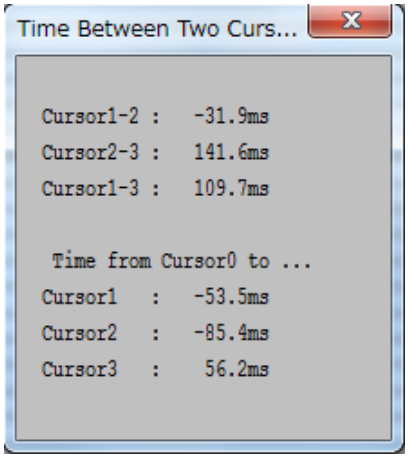
2.8.14.6.Showing the time between cursors

This subsection describes how to show the time between two cursors.

Operation procedure

1. From the [Measurement] menu, click [Time Between Two Cursors].

2. The time between the two cursors is indicated.



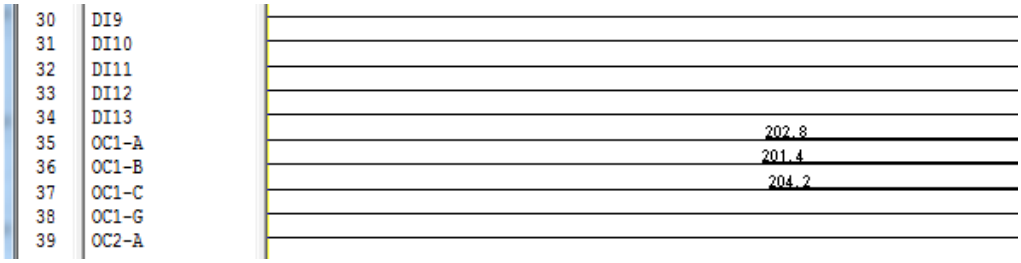
2.8.14.7.Showing the relay operating time

This part describes how to show the relay operating time. (ON/OFF element)

Operation procedure

1. From the [Measurement] menu, click [Relay Operating Time].

2. The relay operating time is indicated.
   a) The operating time is represented as the relative time from the beginning of the waveform data. If the relative time indication is selected, however, the operating time is represented as the relative time from Cursor 0. (-->See relative time)



3. To show the relay operating time, click [Measurement] and then click [Relay Operating Time] again.

2.8.15. Showing analytical values of waveform data

This subsection describes how to show the analytical values of waveform data.

2.8.15.1.Showing symmetrical components

This subsection describes how to show the positive-sequence, negative-sequence and zero-sequence components.

Notes on operation

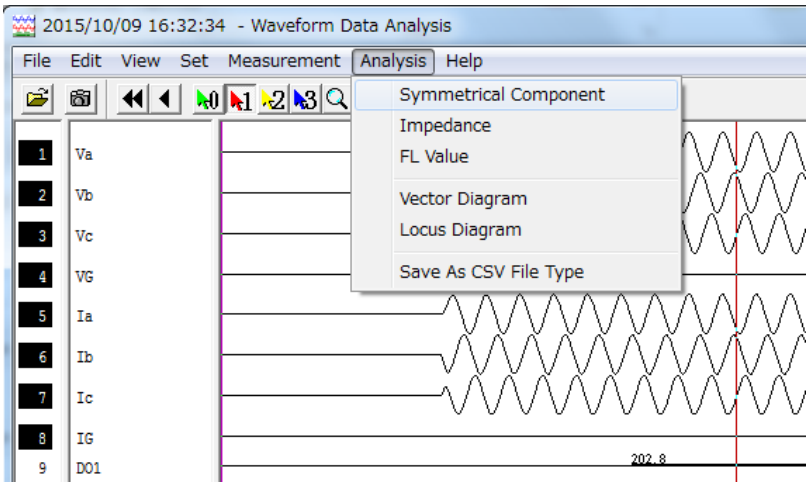
1. Before operation, select a phase order.

2. Values shown are secondary quantities. For the phase difference, lead indication or lag indication can be selected.

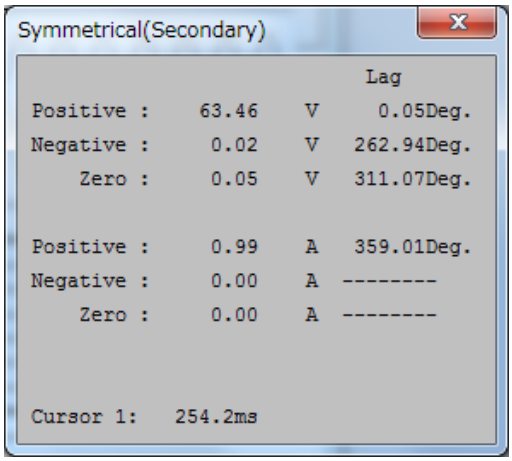
Operation procedure

1. Move the cursor to the point to measure.

2. From the [Analysis] menu, click [Symmetrical Component].



3. The phase differences based on the symmetrical component and current phase setting are indicated.
   a) The phase sequences one cycle before the cursor position are calculated.
   b) Moving the cursor updates the values.
   c) Where a calculation is not possible, [-------] is indicated.



2.8.15.2.Showing impedance values

This subsection describes how to show the impedance values one cycle before the active cursor position.

Notes on operation

1. Before operation, select a phase setting.

2. Values shown are those converted based on the secondary quantities..

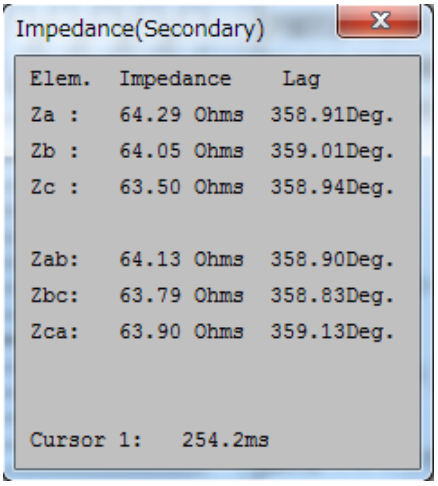
For the phase difference, lead indication or lag indication can be selected.

Operation procedure

1. Move the cursor to the point to measure.

2. From the [Analysis] menu, click [Impedance].

3. The impedance values based on the current phase setting are indicated.
   a) The impedance values from the cursor position to one cycle before the cursor position are calculated.
   b) The phase difference between the actual and imaginary number vectors is indicated.
   c) Moving the cursor updates the values.
   d) Where a calculation is not possible, [-----] is indicated.



2.8.15.3.Fault location function

This subsection describes the fault location (FL) function.

Notes on operation

1. The fault location function provides two methods of fault location. Either method can be selected from the FL Value menu.
   a) Local mode: Uses the voltage and current of the local end relay.
   b) Remote1 mode: Uses the voltages and currents of the local and remote end relays.

2. In the Local mode, there are options that can be enabled or disabled from the menu setting for calculating the fault location.

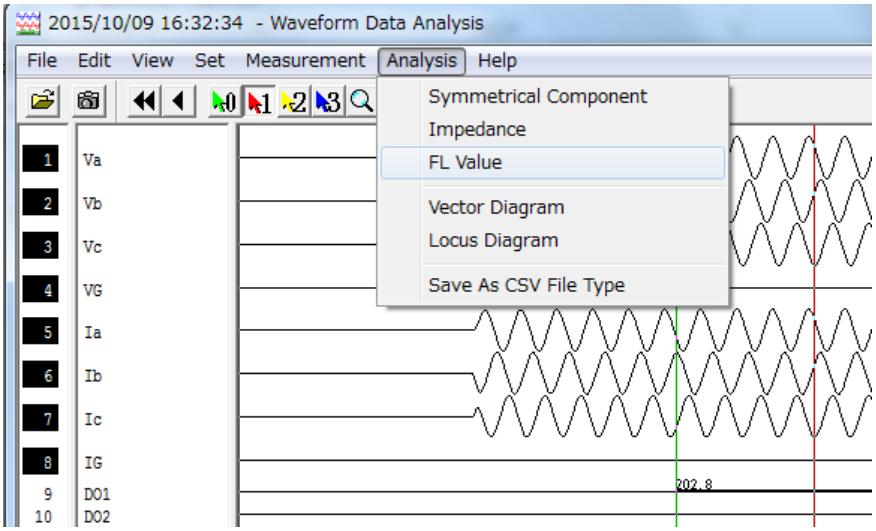
Fault Cursor Set:	Excludes the effect of the load current. When this option is enabled, the load current up to Cursor 0 (point at which the fault occurred) is calculated and subtracted from the calculation of the fault location.
KM Set:	For two parallel lines, compensation can be made for the effect of mutual induction generated when a ground fault occurs.
2CT:	This setting allows for the use of two CTs.

In the Remote1 mode, these option settings are not required.

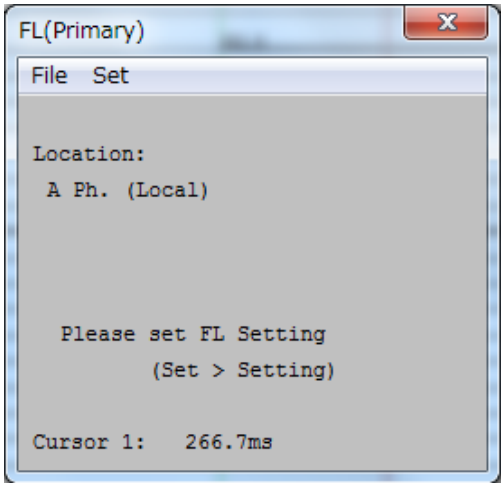
Operation procedure

1. Bring Cursor 0 to the point at which the fault occurred and bring one of Cursors 1 to 3 to the measurement point for FL.
   Of Cursors 1 to 3, only that is active is enabled.
   In the Remote1 mode, it is not necessary to consider the Cursor 0 position because it is not used for calculation of FL.

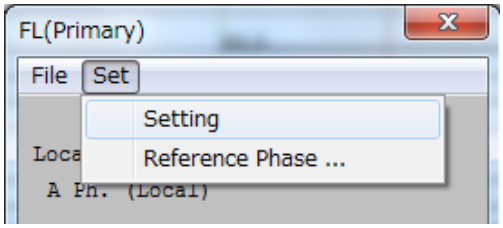
2. From the [Analysis] menu, select [FL Value].



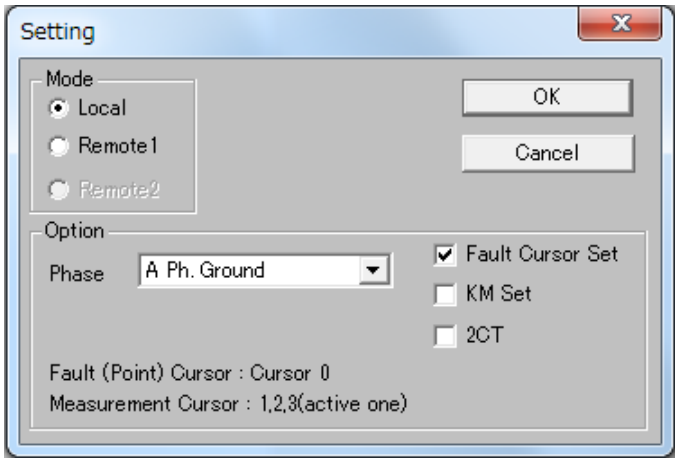
The [FL(Primary)] dialog box appears.



3. From the [Set] menu, select [Setting].



The [Setting] box appears.



4. From the [Mode] menu, select [Local] or [Remote1].

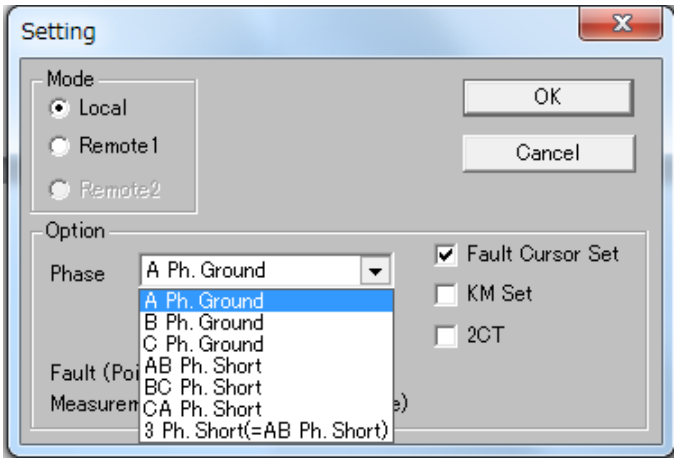
Notes on operation

In either mode, voltage and current quantities are required..

Local mode: Three-phase current and three-phase voltage of the local end relay

Remote1 mode: Three-phase current and three-phase voltage of the local end relay and voltage and three-phase current of the remote end. For synchronization, quantities for the relays at both ends are required.

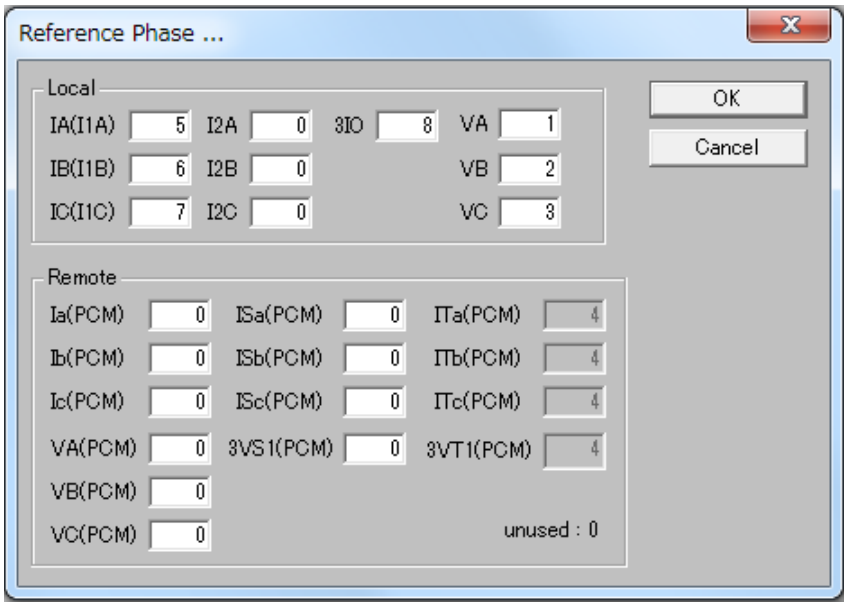
5. If [Local] has been selected, set the following options.
   a) From [Phase], select the type of the fault that has occured. This option must be set correctly or a correct FL value will not be obtained.
   b) Use the [Fault Cursor Set] check box to enable or disable the function to exclude the load current.
   c) Use the [KM Set] check box to enable or disable compensation for the effect of mutual induction.
   d) When using two CTs, check the [2CT] check box.



When setting of these options has been completed, click “OK.”

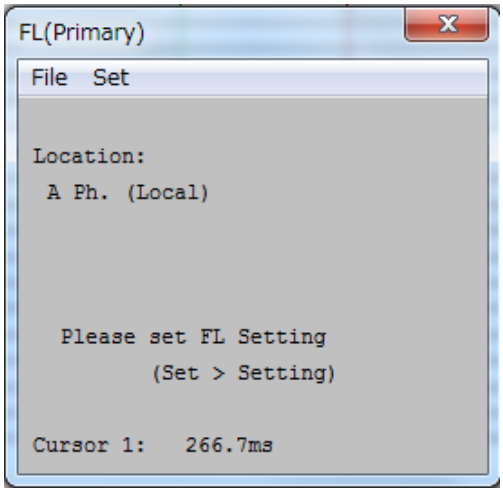
6. If [Remote1] is selected in 4., option setting in 5. is not required.

7. From the [Set] menu of “FL(Primary),” click [Reference Phase].
   The [Reference Phase] box appears.



8. Enter the channel numbers for the voltage and current data of the waveform data opened by using this tool.
   After entering the numbers, click “OK.”

9. When the setting has been completed, the “FL(Primary)” box shows the distance to the fault point. Moving one of Cursors 1 to 3 updates the value for the fault point at the cursor point.



Note) Fault location requires the settings for line length and line impedance to be entered. If these settings are not provided, the FL result will not be displayed (as shown in the figure above).

10. Click “×” to close the FL box.

2.8.15.4.Showing vector diagrams

This subsection describes how to show vector diagrams of waveform data.

2.8.15.4.1.Showing vector diagrams

This part describes how to show a three-phase vector diagram or symmetrical components.

Notes on operation

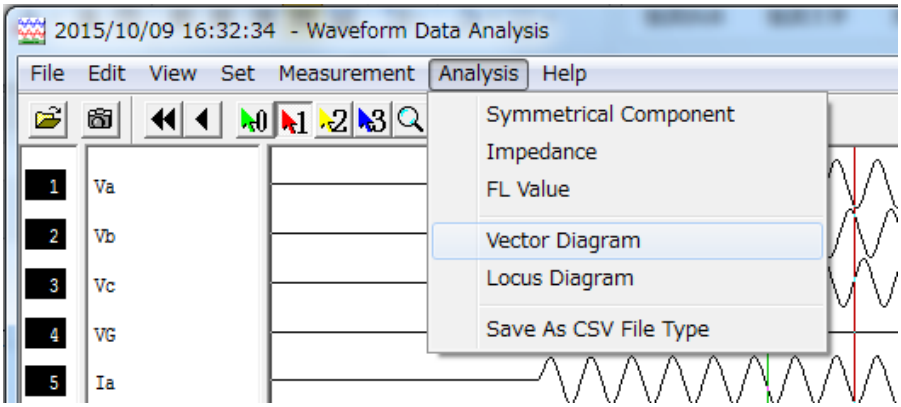
1. Before operation, select a phase setting.

2. Values shown are secondary quantities. For the phase difference, lead indication or lag indication can be selected.

Operation procedure

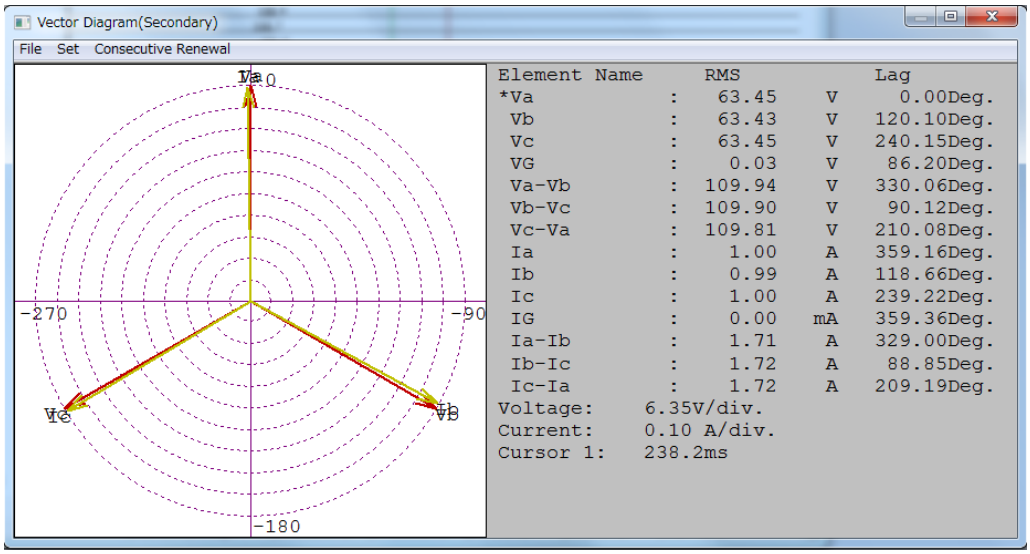
1. Move the cursor to the point to measure.

2. From the [Analysis] menu, click [Vector Diagram].

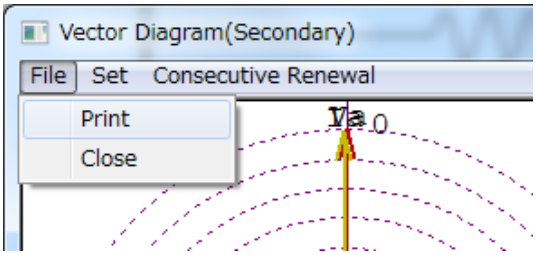


3. A vector diagram with RMS values and phase differences according to the current phase setting is displayed.

a) These values are calculated from one cycle before the cursor position.
b) The reference phase is marked with [*].
c) Moving the cursor updates the vector diagram and values.
d) More than one vector diagram can be displayed at one time. To activate another cursor, from the [Analysis] menu, click [Vector Diagram].



4. To print the vector diagram, click [File] and then click [Print].
a) When printing the vector diagram, ensure that the vector diagram screen is within the main waveform analysis screen.



5. To close the vector diagram screen, click [File] and then click [Close].

2.8.15.4.2.Setting parameters

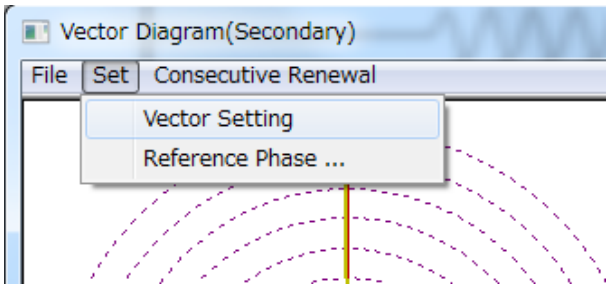
This part describes how to set a vector diagram, reference phase and phase order.

Notes on operation

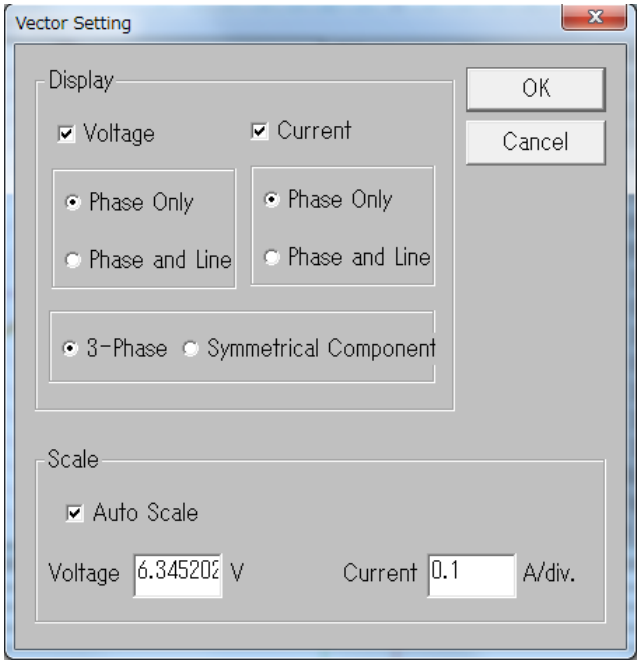
1. The settings must ensure that the contents are indicated and the size fits in the vector diagram.

Operation procedure

1. From the [Set] menu, click [Vector Setting] to set a vector diagram.



2. To select screen elements, click the [Voltage] and [Current] options.
   Select [Phase Only] or [Phase and Line] for each element.
   a) The [Phase Only]/[Phase and Line] selection does not affect the symmetrical component display screen.

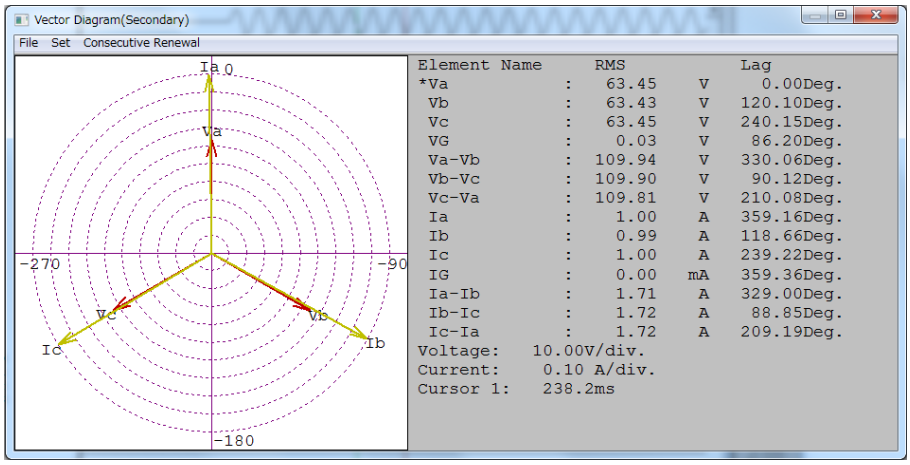


3. Click either [3-phase] or [Symmetrical Component].

4. To automatically adjust the size of the vector diagram, click the [Auto Scale] option to enable automatic size adjustment.

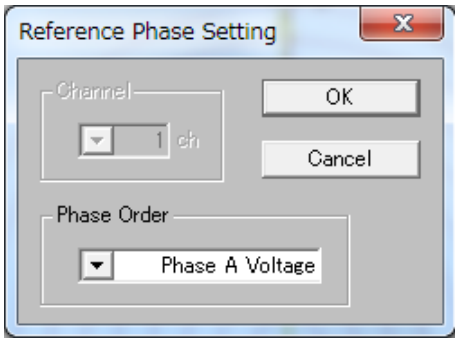
5. To change the size of the vector diagram, click [Auto Scale] to disable automatic scaling.
   Enter the size of the scale unit in the [Voltage] and [Current] text boxes.
   a) Enter the size of one scale unit.

6. Click “OK.”
   a) The vector diagram is displayed together with the settings.



7. To change the reference phase setting, click [Set] and then click [Reference Phase].

8. Click ▼ on the right side of [Phase Order] and select the phase to use as the reference from the list.



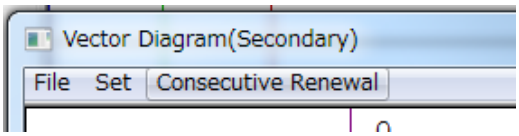
9. Click “OK.”
   a) A vector diagram based on the new reference phase is displayed.
   b) The reference phase selected by this operation is applied to display of other analytical values.

2.8.15.4.3.Consecutively showing vector diagrams

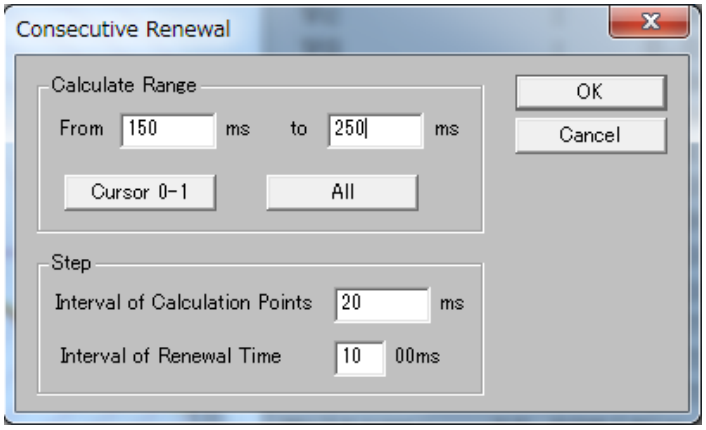
This part describes how to show consecutive changes in a vector diagram within the specified range.

Operation procedure

1. Click the [Consecutive Renewal] menu.



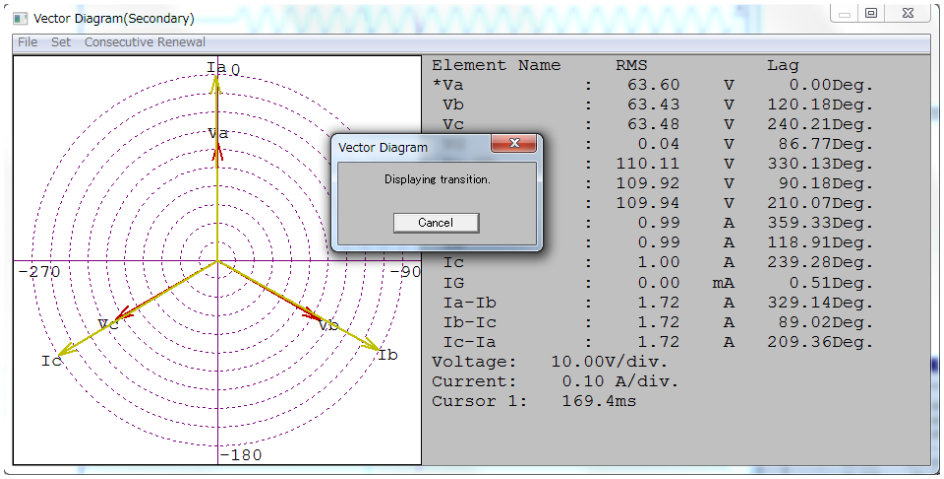
2. Specify the range by entering values for the start and end in the [Calculate Range] text box.
   a) For display between Cursor 0 and the active cursor, click the “Cursor 0-*” button.
   ([*] represents the number for the active cursor.)
   b) If the relative time display is selected, enter the time from the beginning of the waveform data.
   c) To show the entire range, click the “All” button.



3. In the [Interval of Calculation] text box, enter a value for the interval between measurement points at which the vector diagram is displayed.

4. In the [Interval of Renewal] text box, enter the interval of renewal of vector diagram display.

5. Click “OK.”
   a) The [Vector Diagram] box appears and consecutive display is started.

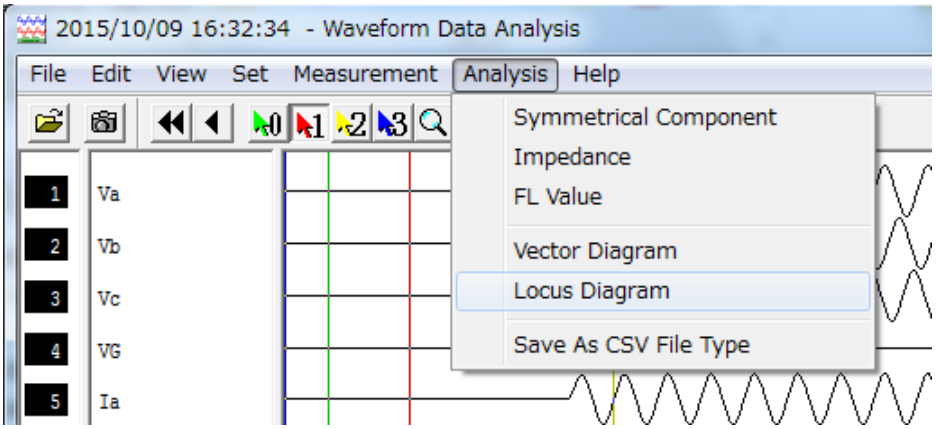


2.8.15.5.Showing locus diagrams

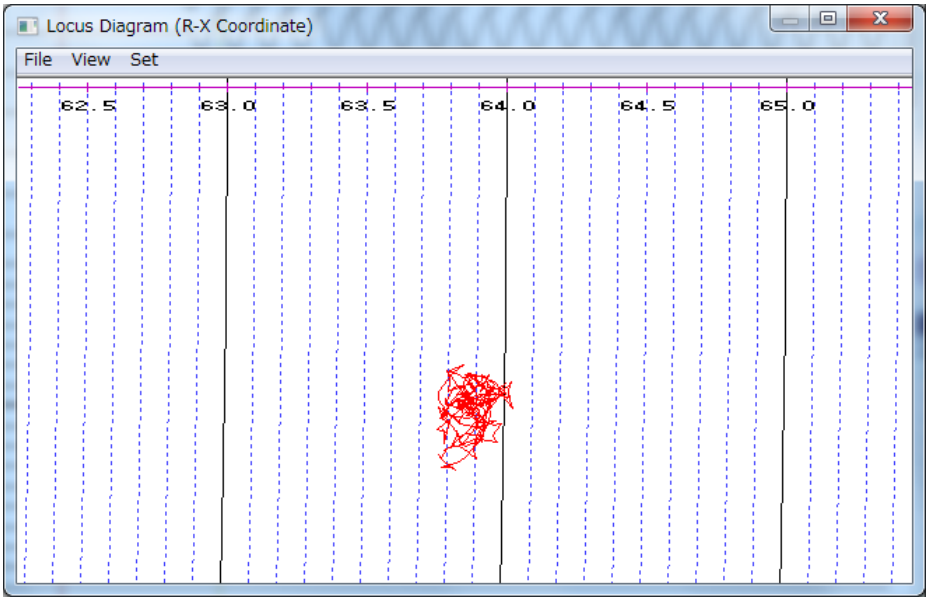
This subsection describes how to show locus diagrams.

Operation procedure

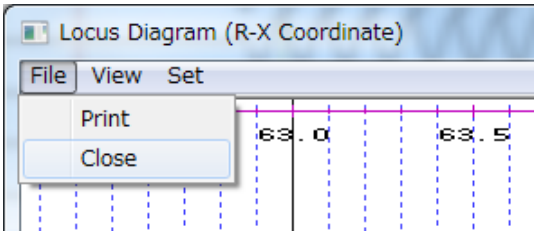
1. From the [Analysis] menu, click [Locus Diagram].



2. The locus diagram screen appears.



3. From the [File] menu, click [Close] to exit the locus diagram screen.



2.8.15.5.1.Setting and showing locus diagrams

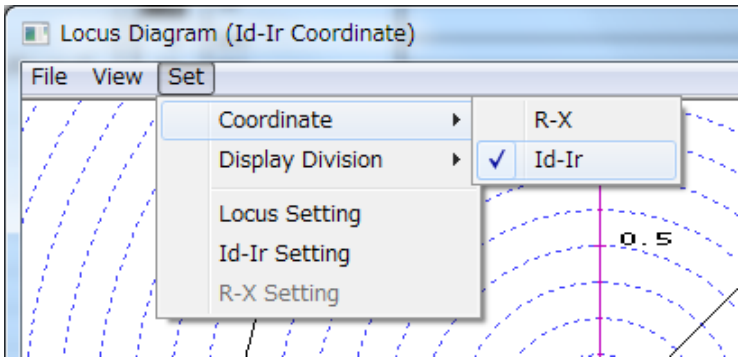
For correct display of a locus diagram, a value setting is required. This subsection describes how to set a locus diagram.

Notes on operation

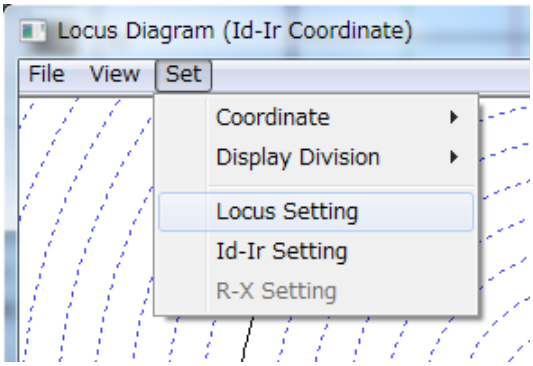
1. For the range of locus diagram calculation, specify 20.0 ms or later from the beginning of the waveform data.

Operation procedure

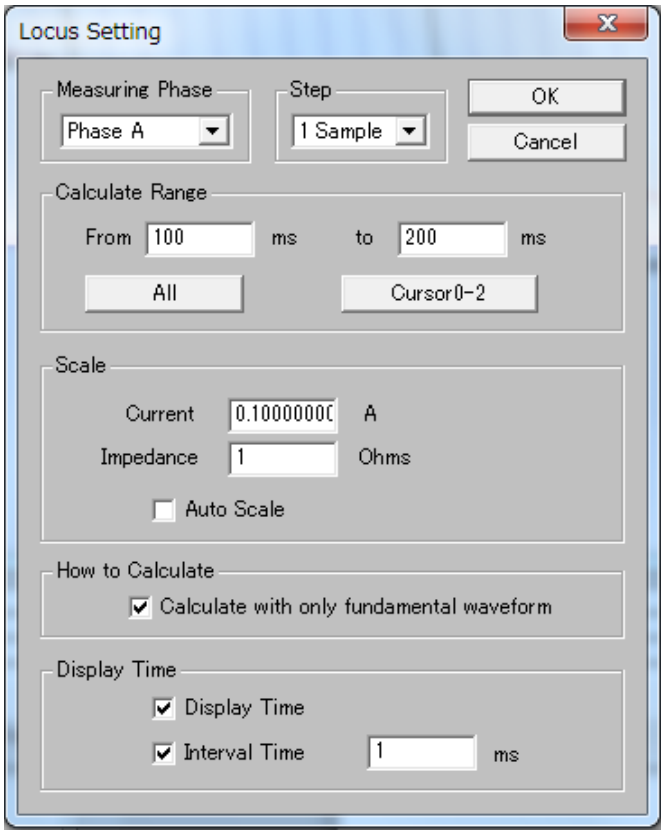
1. From the [Set] menu, click on the view of the intended type:
   - R-X Impedance locus
   - Id-Ir Percentage differential characteristic of the current differential relay



2. From the [Set] menu, click [Locus Setting].



3. Click ▼ of [Measuring Phase] and select the phase to measure.



4. Click ▼ of [Step] to select the interval of locus calculation.

5. From [Calculate Range], enter the range of locus calculation.

6. To optimize the locus screen display, check [Auto Scale].
   • The scale unit is automatically adjusted so that the locus diagram fits the entire screen.

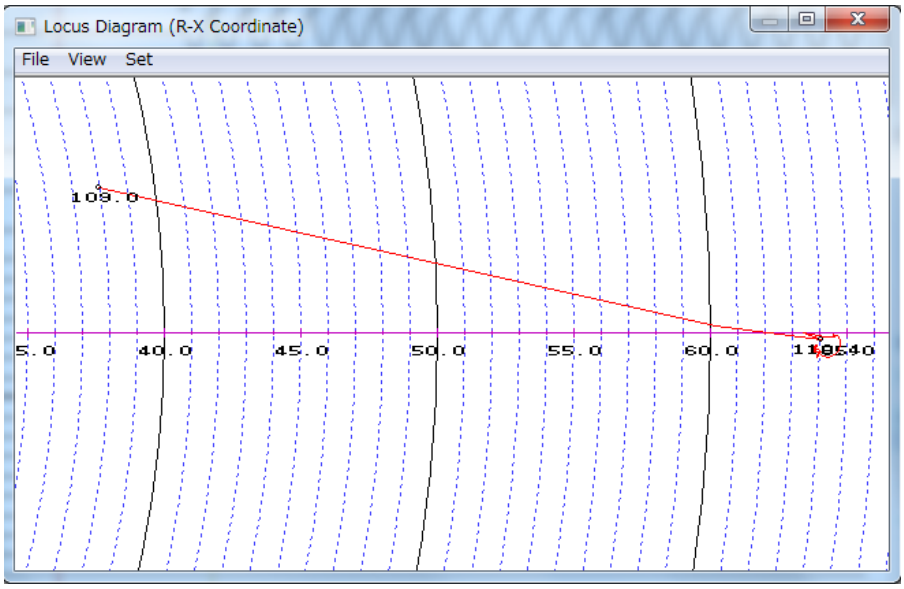
7. To change the scale unit of the locus diagram, uncheck [Auto Scale].
   Then, enter the values for the scale unit in the respective elements under [Scale].
   • Enter a value for one scale unit.

8. When calculating elements of the fundamental wave only, check [Calculate with only fundamental waveform].

9. Checking the [Display Time] check box enables time indication given each time the locus covers a certain distance.

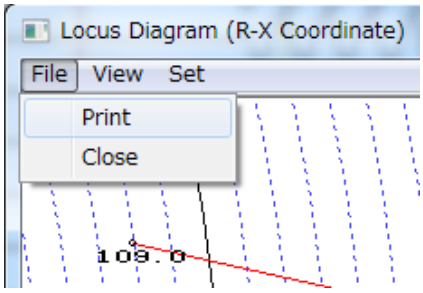
10. Checking [Display Time] and [Interval Time] as well enables time indication given for the locus at the specified intervals.

11. Click “OK.”
    • The locus diagram is displayed together with the set values.

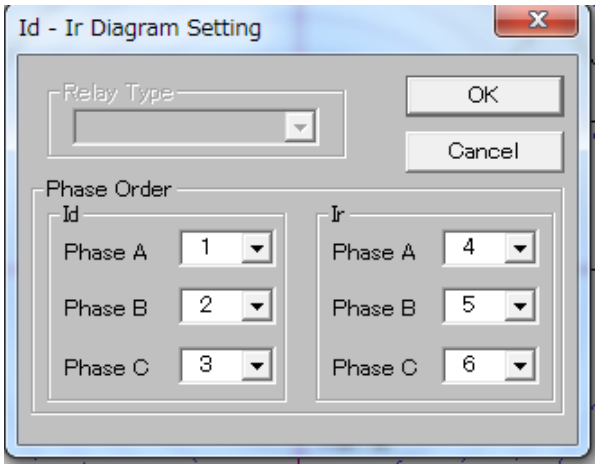


12. Clicking [Display Division] under the [Set] menu allows the grid to be changed to the selected one.
    • circle grid A circular grid is displayed.
    • square grid A regular square grid is displayed.
    • nothing The grid display is cancelled.

13. To print the locus diagram, from the [File] menu, select [Print].



14. To show the Id-Ir characteristics, from the [Set] menu, click [Id-Ir Setting].
    • [Id-Ir Diagram Setting] appears.



15. To print the locus diagram, from the [File] menu, click [Print].

2.8.15.5.2.Zooming into/out of locus diagrams

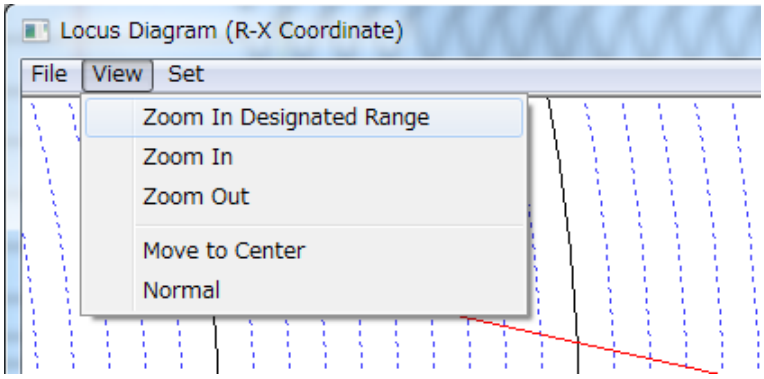
This part describes how to zoom into/out of a locus diagram.

Notes on operation

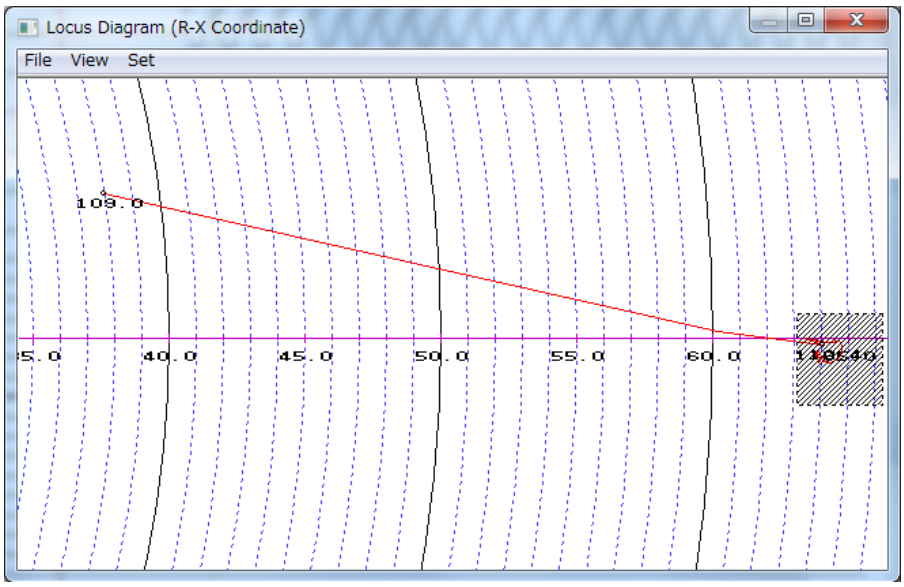
- Zoom In Designed Range — Zoom into the specified range
- Zoom In,Out — Zoom into/out of the locus diagram
- Move to Center — Move the center of the axis to the center of the screen
- Normal — Bring the time and position of the locus diagram back to their initial states displayed

Operation procedure

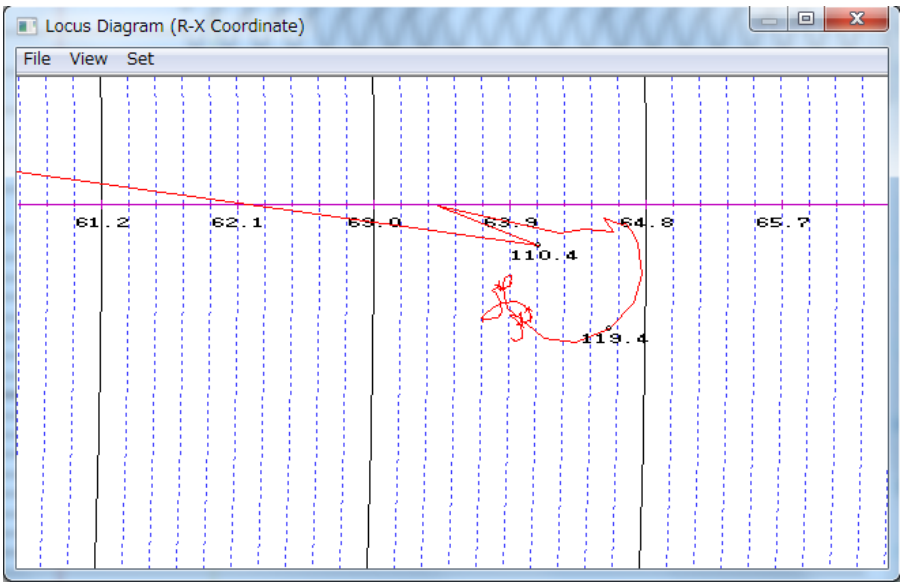
1. From the [View] menu, click [Zoom In Designated Range] to zoom into the specified range.



2. Drag the mouse to specify the range to zoom into.

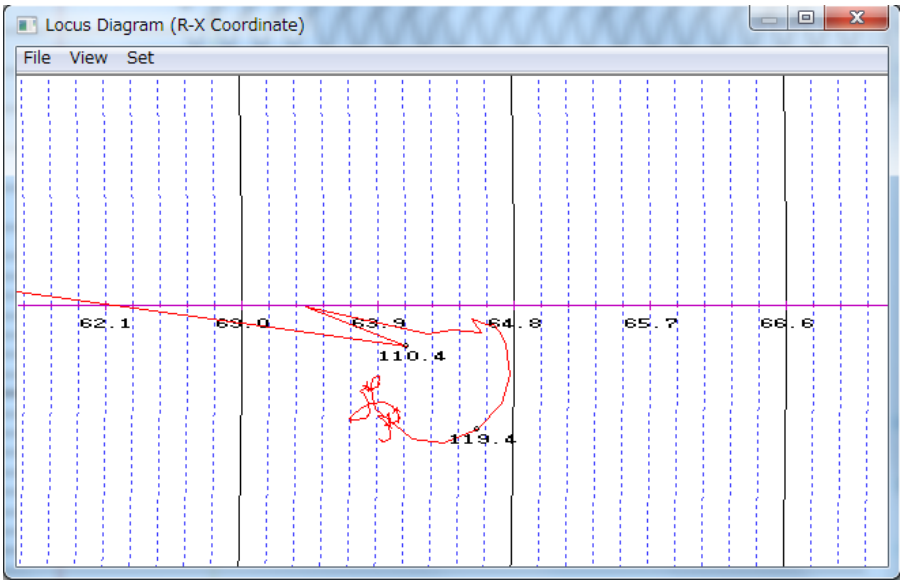


3. The specified range is scaled up for display.



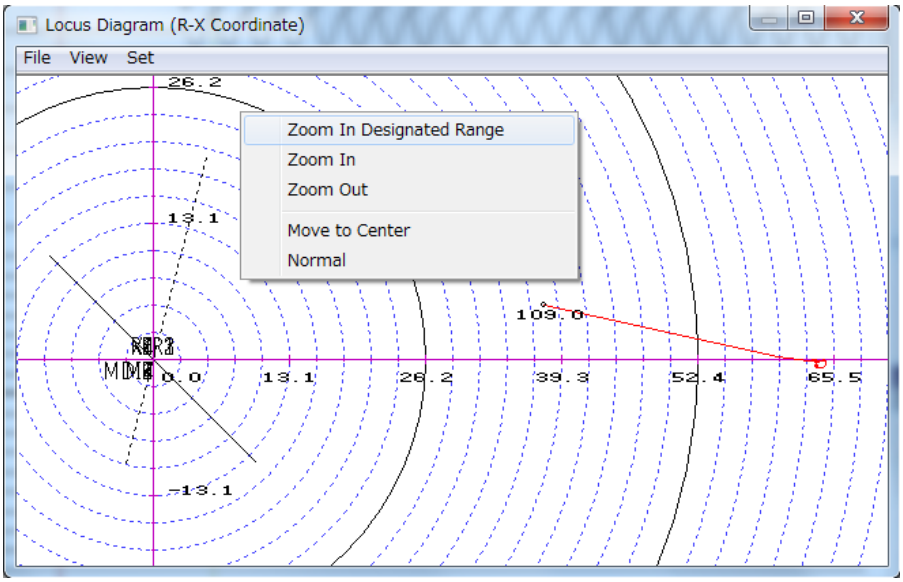
4. From the [View] menu, click [Zoom In]/[Zoom Out] to zoom into/out of the locus diagram.

5. Dragging to an arbitrary position allows adjustment of the center of the axis.



6. From the [View] menu, click [Move to Center] to adjust the center of the axis to the center of the screen.

7. From the [View] menu, click [Normal] to bring the locus diagram back to the initial state displayed.



2.8.15.6.Saving analytical values

This subsection describes how to save analytical values.

Notes on operation

1. This operation allows the saved analytical values to be edited with other software.

2. The data is saved in a CSV file format.

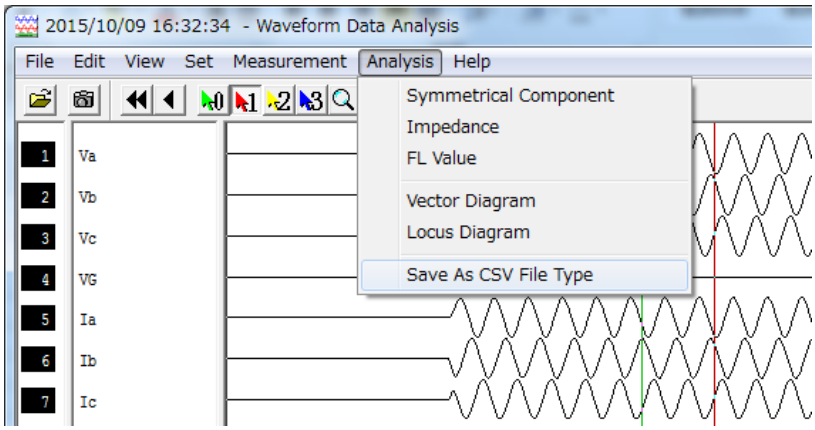
3. A choice is given between saving the analytical values for a specific phase order, all AC channels or a specified channel.

4. The analytical values are saved as secondary quantities..

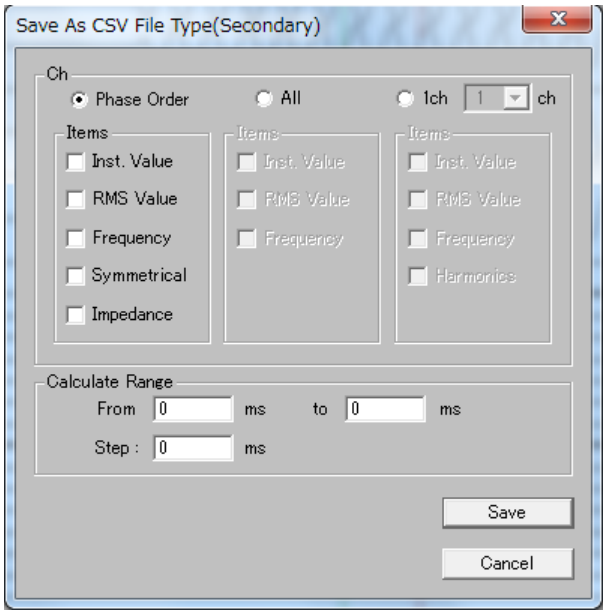
5. The following characters cannot be used for data names.
   ＼ / : * ? “ < > |

Operation procedure

1. From the [Analysis] menu, click [Save As CSV File Type].



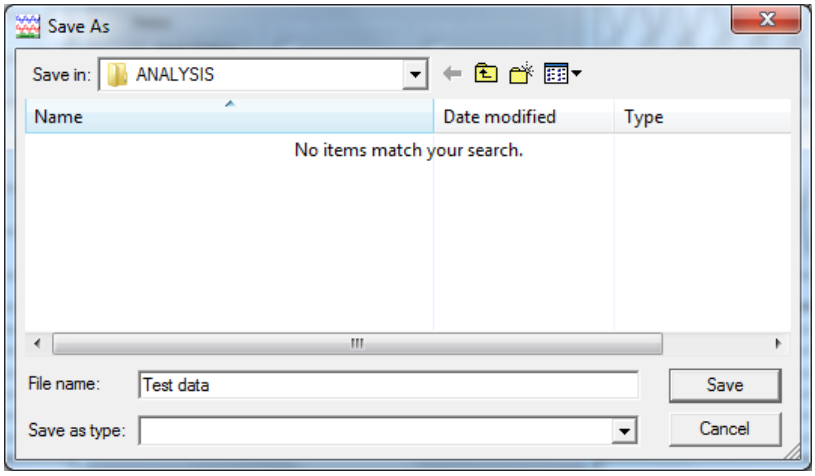
2. Select the items of the analytical values to save.
   a) Select between [Phase Order], [All] and [1ch] and then select the items of the analytical values from [Items].
   b) When [1ch] has been selected, from ▼ of [ch], click the channel number to save.



3. Specify the range of analysis by entering values in the [Calculate Range] text boxes.

4. Click “Save.”

5. Enter a data name in the [File name] text box.
   a) To save the data on another drive or in another folder, from ▼ on the right side of [Save in], select the drive containing the folder to save the data in. Then, click the folder to save the data in.



6. Click “Save.”
   a) The analytical values are saved.

Initial Setting Values

The initial setting values effective when the waveform tool is started are as shown below.

Item	Initial Setting Value
1) Cursor 0 position	Fault detection point
2) Cursor 1 position	Minimum voltage point
3) Cursor 2 position	Point of recovery from fault
4) Cursor 3 position	0 ms
5) Active cursor	Cursor 1
6) Time axis scale up factor	One sample of waveform data corresponding to one dot of screen
7) Unit of time of measured and analytical values	Time elapsed from the beginning of the waveform
8) Relay operating time	No indication
9) Reference phase (CH)	1ch
10) Reference phase (phase order)	A-phase voltage
11) Screen copy mode	Black and white
12) Phase difference indication	Lag indication
13) Unit of time	ms
14) Value indication	Second value
15) Calculation of fault time from read data	Enabled

2.9. COMTRADE file format

One Fault Record is composed of the following three files.

2.9.1. Header file

This file represented by a name “*.hdr” defines in a free format the information desired by the user other than the trip data.However, the format must be compatible with that of the waveform analysis software. Otherwise, it will not function correctly.
The format of the waveform analysis software is as shown below.

<Format>

Server_name LD_name,0<CR> <LF>
IPAddress,subnetmask,gatewayaddress<CR> <LF>
plant_name,remarks<CR> <LF>
[setting_information head]<CR> <LF> (Beginning of the setting information)
nn,id,sno,min,contents,unit,max,step <CR> <LF> (For value setting)
nn,id,sno,name,contents,unit,item1,item2,• • •itemN,step <CR> <LF> (For selection setting)

[setting_information end]<CR> <LF> (End of the setting information)

<Content>

Sever_name	: IED name
LD_name	: logical device name
IPAddress	: IP address
subnetmask	: subnet mask
gatewayaddress	: default gateway address
plant_name	: plant name
remarks	: arbitrary information
nn	: serial number
id	: 000 fixed
sno	: setting value number
name	: setting name
contents	: setting value
unit	: unit of setting value
min	: minimum value for setting value
max	: maximum value for setting value
step	: setting value interval
item	: selection setting item

2.9.2. Configuration file

This file represented by a name “*.cfg” must consist of the information as described below.

1. Substation name, device number and COMTRADE format version
2. Channel number and type
3. Channel information
4. Frequency
5. Information about sampling
6. Information about time
7. File format

The following shows a sample format of this waveform analysis software.

<Format>

station_name,id,rev_year<CR><LF>
TT,nn,t <CR><LF>
nn,id,p,ccbm,uu,a,b,skew,min,max,primary,secondary,PS <CR><LF>

---
nn,id,m <CR><LF>
---
lf <CR><LF>
nrate <CR><LF>
samp,endsamp <CR><LF>
dd/mm/yy,hh:mm:ss.ssssss <CR><LF>
dd/mm/yy,hh:mm:ss.ssssss <CR><LF>
ft <CR><LF>

<Content>

station_name	: substation name
id	: device number
rev year	: COMTRADE format version
TT	: total number of channels
nn	: number of analog data channels
t	: number of digital data channels
nn	: serial channel number
id	: channel signal name
p	: phase type
ccbm	: 0 fixed
uu	: unit
a	: PT scale factor/CT scale factor
b	: 0 fixed
skew	: time difference in sampling cycle (= us)
min	: minimum value of integer
max	: maximum value of integer
primary	: rating on primary side
secondary	: rating on secondary side
PS	: display selection (primary/secondary)
m	: digital data steady state (1: ON, 0: OFF)
lf	: frequency (50/60 Hz)
nrate	: sampling frequency type
samp	: sampling frequency
endsamp	: final number for sampling data
dd	: day
mm	: month
yy	: year
hh	: hour
mm	: minute
ss.ssssss	: second (0 - 59.999999)
ft	: file type (ASCII)

2.9.3. Data file

This file represented by a name “*.dat” must be described in the format as shown below.

<Format>

n,tt,A1,---,An,D1,---,Dn <CR><LF>

<Content>

n	: serial number
tt	: time from top data
A1,---,An	: analog data value (n: analog data number)
D1,---,Dn	: digital data value (n: digital data number)

3. IEC61850 General Description

MELPRO-D Series supports IEC61850 Edition 1 (Ethernet Station Bus). as an optional communication protocol.

The connector is available in two variations: optical 2-port connector and electrical 1-port connector. The selection of the optical 2-port connector permits you to make a redundant configuration setting relative to HSR (High-availability Seamless Redundancy) and PRP (Parallel Redundancy Protocol), achieving an improved reliability in communication.

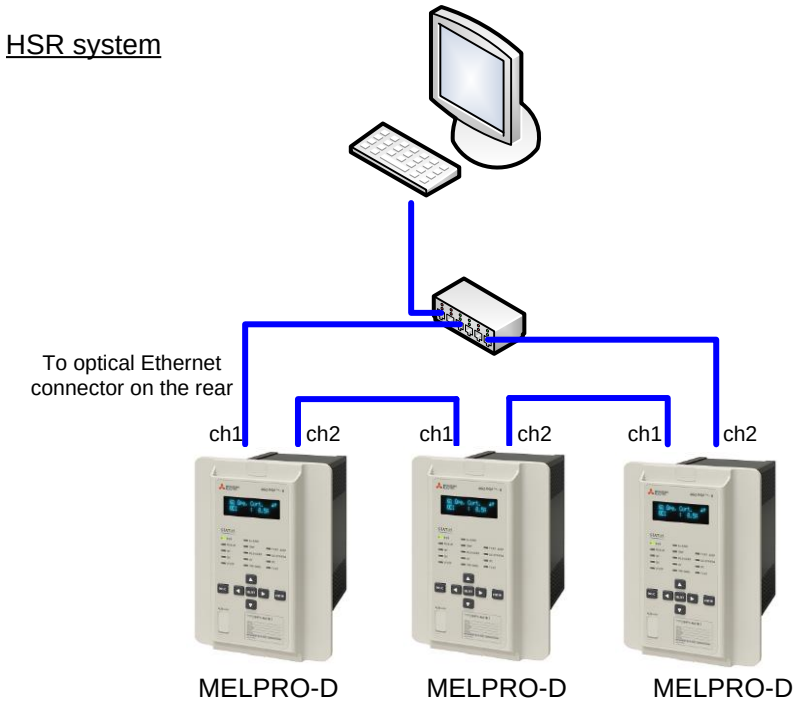


Figure3-1 Connection method for HSR system

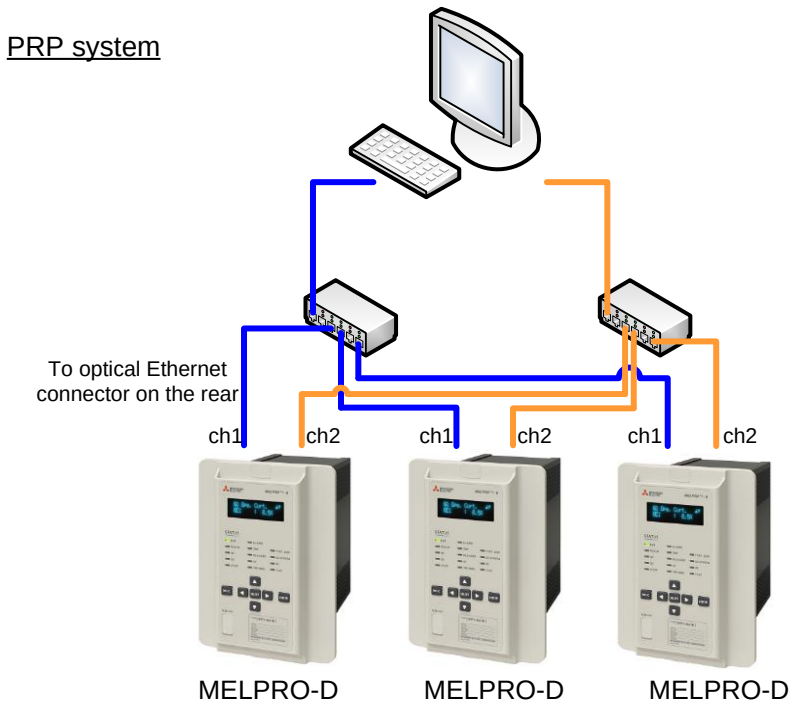


Figure3-2 Connection method for PRP system

4. IEC61850 Functions

4.1. Communication Items

Table 4-1 shows the items of information which can be communicated by the MELPRO-D Series products. For any information which is not found in the table, see MELPRO-D Series - Protocol Implementation Conformance Statement (JFPB-EL2915).

Table4-1 IEC61850 Communication Items

IEC61850 communication service	Item	Contents of communication
Setting Group control	Operational settings	Change between operating groups (G1 and G2) associated with setting value
Reporting	Measured value	Voltage, current, watt-hour, trip counter, etc.
	Actuation signal	DI, DO, relay element signal, relay actuation signal, etc.
Control	Breaker control	Breaker open/close control, interlock, change to operation inhibit settings
	LED reset	LED reset on the front panel
File Transfer	Waveform	Waveform during periods of trip (COMTRADE format [IEC60255-24, 2001])
GOOSE	GOOSE	Goose transmission/reception Inter-relay operating signals can be transmitted or received by means of a communication system. This provides potential for reducing the number of DI/DO points and shortening finishing time for operating signal-based sequence logic.
Time Sync	Time synchronization	Time synchronization over SNTP

4.2. Implementation Model

For details about a model which is installed on MELPRO-D Series product, see Model Implementation Conformance Statement (MICS) for the product concerned.

Table4-2 By-product implementation model

Product type	Function	Reference document number
CFP1-A41D1	Feeder protection	JEPB-EL2904
CMP1-A41D1	Motor protection	JEPB-EL2905
CAC1-A41D1	Transformer protection	JEPB-EL2906

4.3. Configuration Function

To build a system of your own which utilizes the IEC61850 communication protocol, you will have to make a number of system settings. These settings can be accomplished by using the IED Configurator which is installed in the software for use in PC (PC-HMI). This section describes how to use the IED Configurator.

4.3.1. Starting IED Configurator

Actuating the PC-HMI opens a screen shown in Figure 2-1. Click the IED Configurator label.

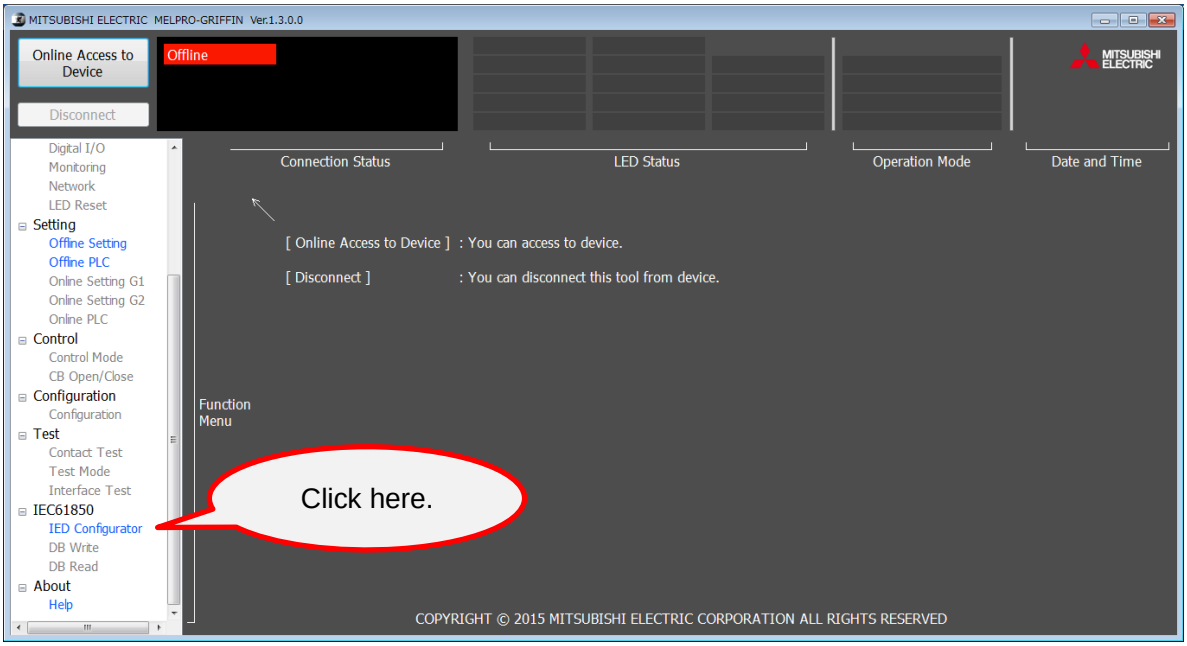


Figure4-1 A screen appearing at the start of PC-HMI

Clicking the IED Configurator label brings up a screen shown in Figure4-2.

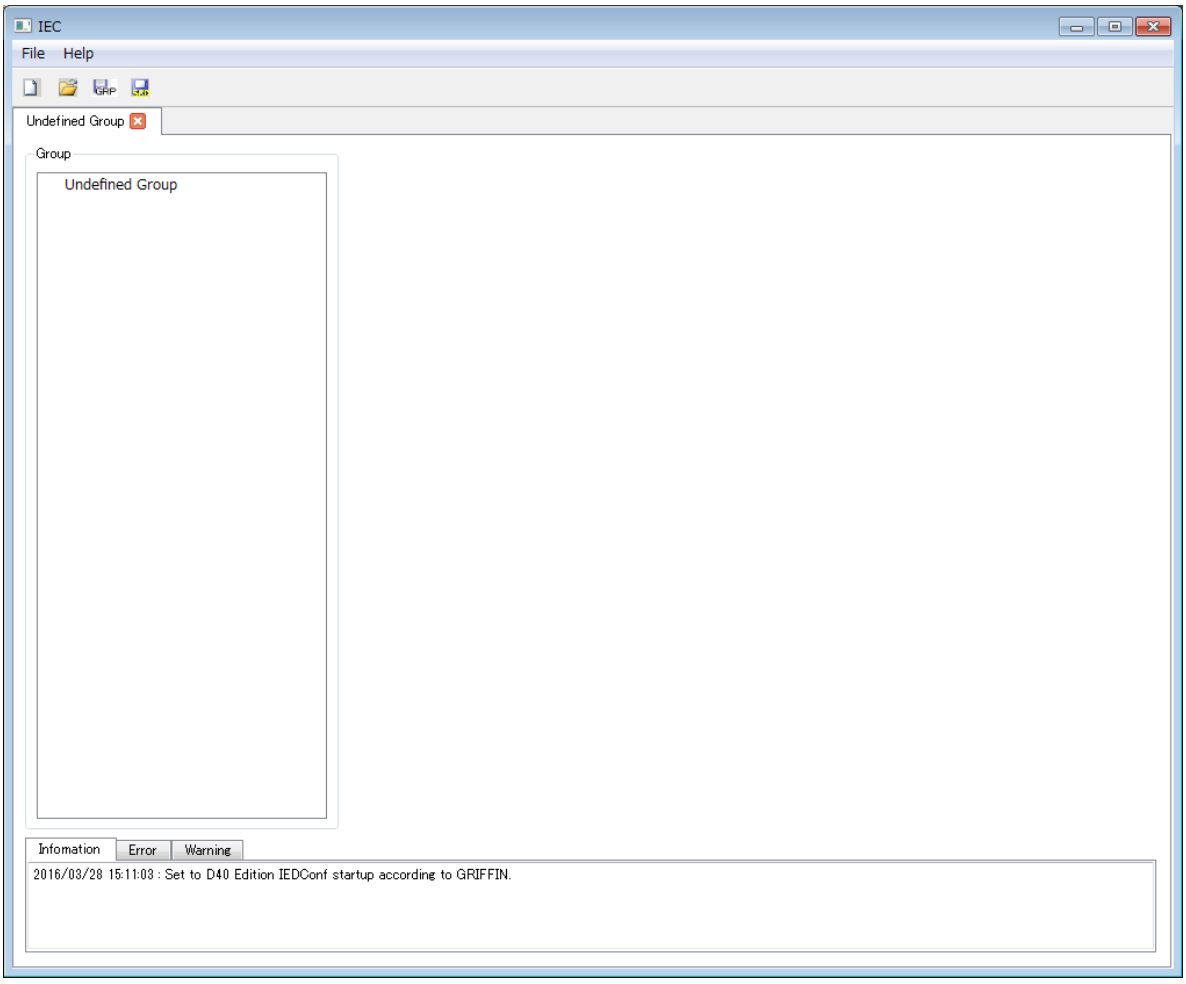


Figure4-2 IED Configurator startup screen

4.3.2. Menu

The IED Configurator comes with a menu shown below. Choose the menu item and make settings as may be necessary.

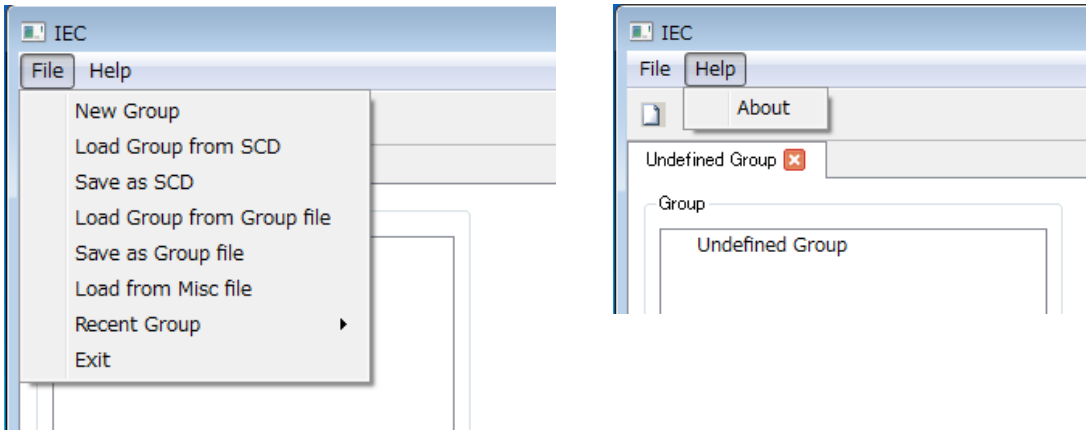


Figure4-3 Menu screen

Table4-3 Contents of menu

Menu	Item	Description
File	New Group	Creates new group(s).
	Load Group from SCD	Loads SCD file.
	Save as SCD	Saves SCD file under a given name
	Load Group from Group file	Loads group file.
	Save as Group file	Saves Group file under a given name
	Load from Misc file	Loads Misc files
	Recent Group	Chooses from among the 5 files which have been worked on most recently (CID, Misc, Group, etc)
	Exit	Closes the tool which is used
Help	About	Version information and copyright information

4.3.3. Loading ICD File

ICD file is available for each product. Right-click the Undefined Group label on the IED Configurator screen and then click ADD IED to the Group menu. Right-click here.

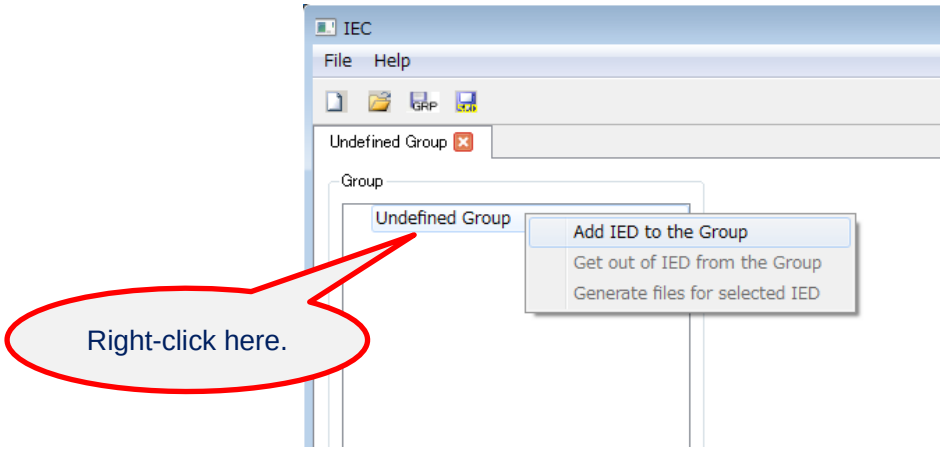


Figure 4-4 Screen for loading ICD file

Clicking the ADD IED to the Group menu brings up the File Open dialog box. Load the ICD file for the model with respect to which you want to make a setting change.
Figure 2-5 shows an example of the initial screen which appears when an ICD file has been loaded.

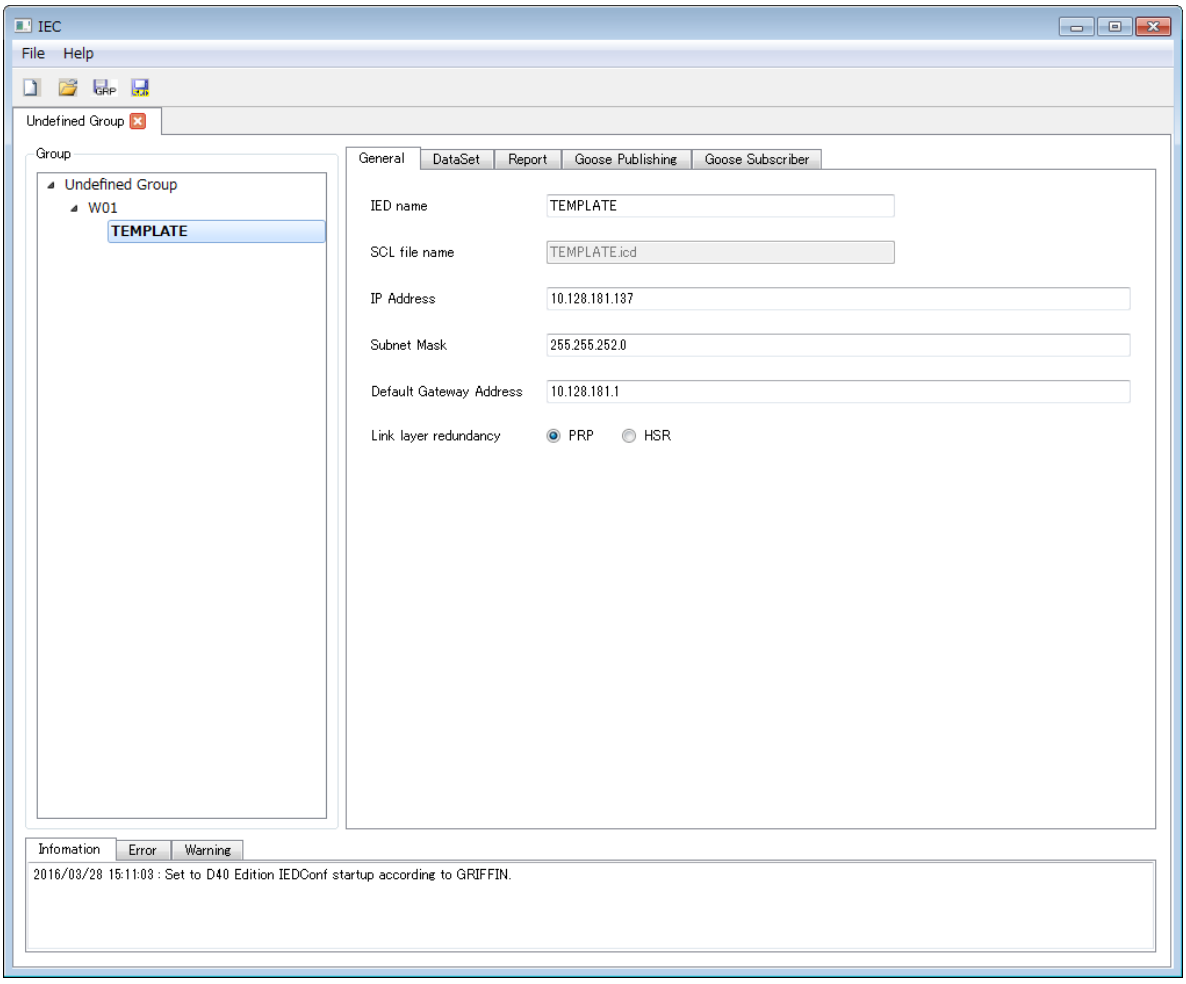


Figure4-5 An example of initial screen appearing after the loading of ICD file

4.3.4. Creating SCD Files

You can load ICD file from a plurality of IEDs and create SCD file therefrom. Because you will need SCD file on which two or more IEDs have been registered to make Goose reception settings (which are described in the subsequent section), register two or more IEDs during the ICD file loading process described in Section 2.3.3.

Figure 2-6 shows an example of screen which appears when two IEDs have been registered.

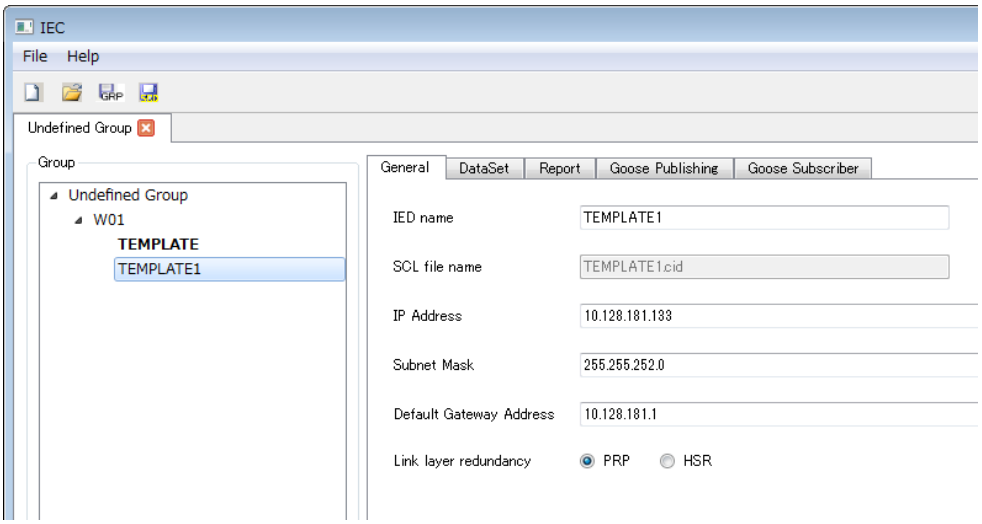


Figure4-6 An example of screen appearing when two IEDs have been registered

Choosing the File – Save as SCD menu on the screen shown in the above Figure4-6 permits you to save the SCD file.

4.3.5. General Tab

On the General tab, you can make settings for the items being listed in Table 4-4. Make change(s) as you see fit for your use environment.

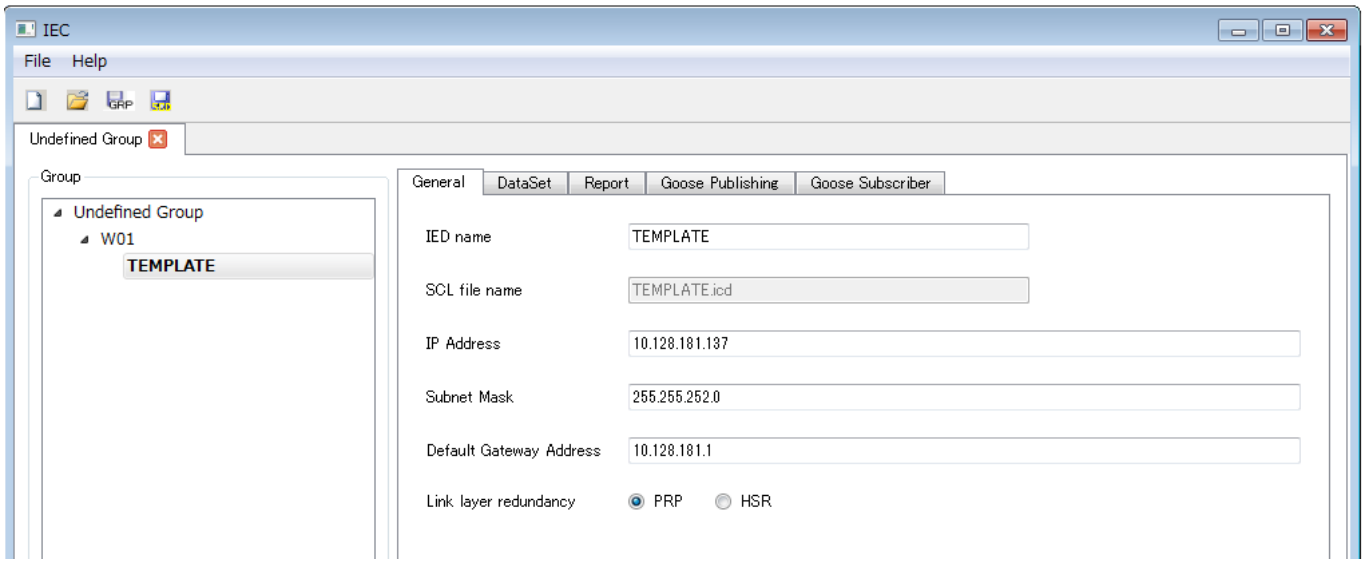


Figure4-7 General tab screen

Table 4-4 Items settable on the General tab

Settable item	Description
IED name	IED name Initial name is “TEMPLATE.”
IP Address	IP address Initial value is 10, 128, 181, or 135.
Subnet Mask	Subnet mask Initial value is 255, 255, 252, or 0.
Default Gateway Address	Default gateway address Initial value is 10, 128, 181, or 1.
Link layer redundancy	Redundant configuration Initial value is “PRP system.”

* For a “SCL file name,” one which has been loaded is shown (this is an unchangeable item).

4.3.6. DataSet Tab

On the DataSet tab, you can make settings for the items being listed in Table4-5Make change(s) as you see fit for your use environment.

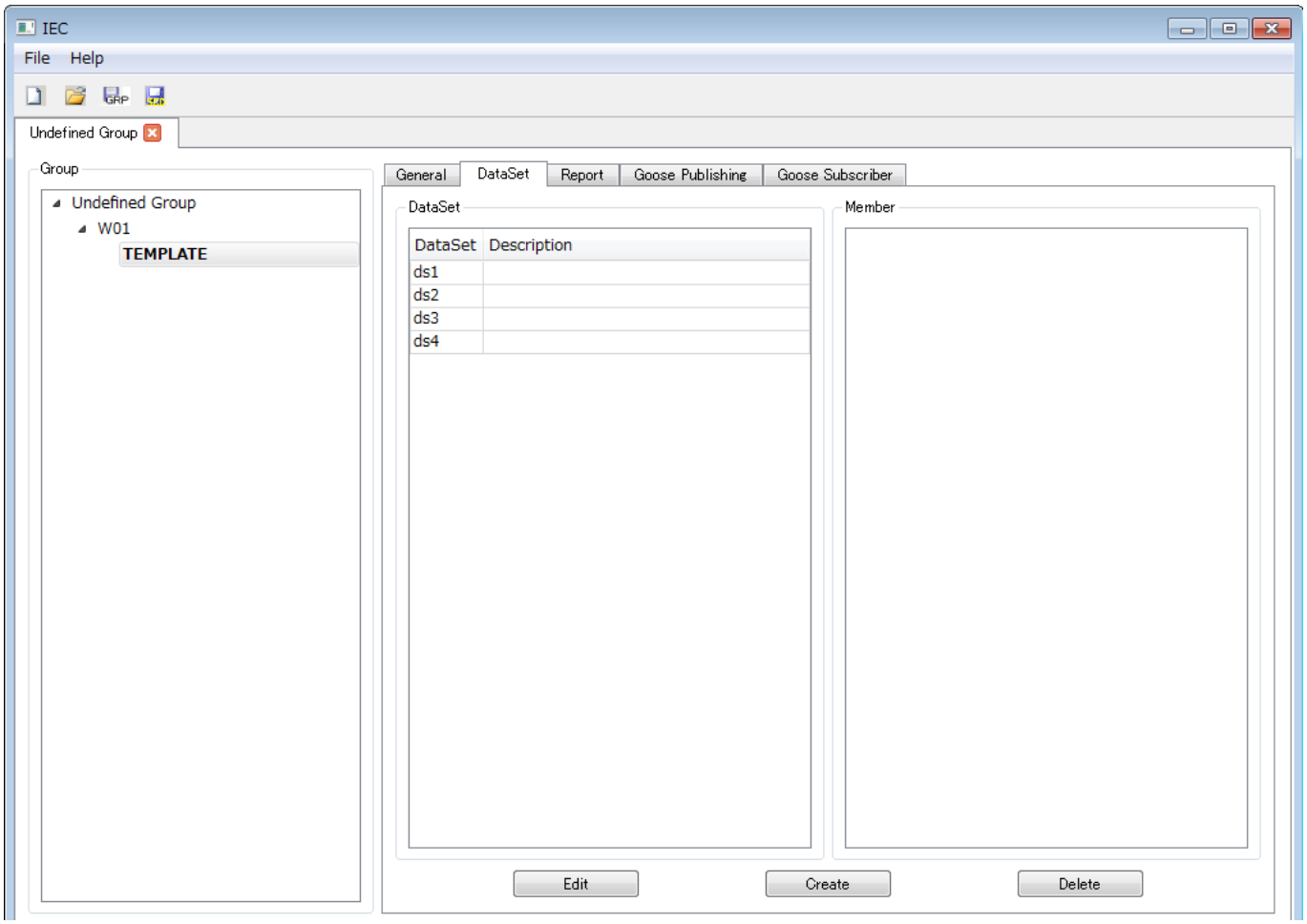


Figure4-8 DateSet tab screen

Table4-5 Items settable on DataSet tab

Settable item	Description
DataSet	Data handled in Report and Goose Publishing operations are edited, created, or deleted. In TEMPLATE file, ds1 through ds4 are registered under the following settings:
ds1	Protection element-related model (PTRC, etc.)
ds2	General-purpose model (GGIO, etc.)
ds3	Measurement-related model (MMXU, etc.)
ds4	Model for use in Goose transmission (PTRC, GGIO, etc.)

4.3.6.1.Editing DataSet

From the DataSet menu on the DataSet tab, point the DataSet (initial settings: ds1 through ds4) which you want to edit and click the Edit button. You will see a model edit screen. Add a model as may be necessary.

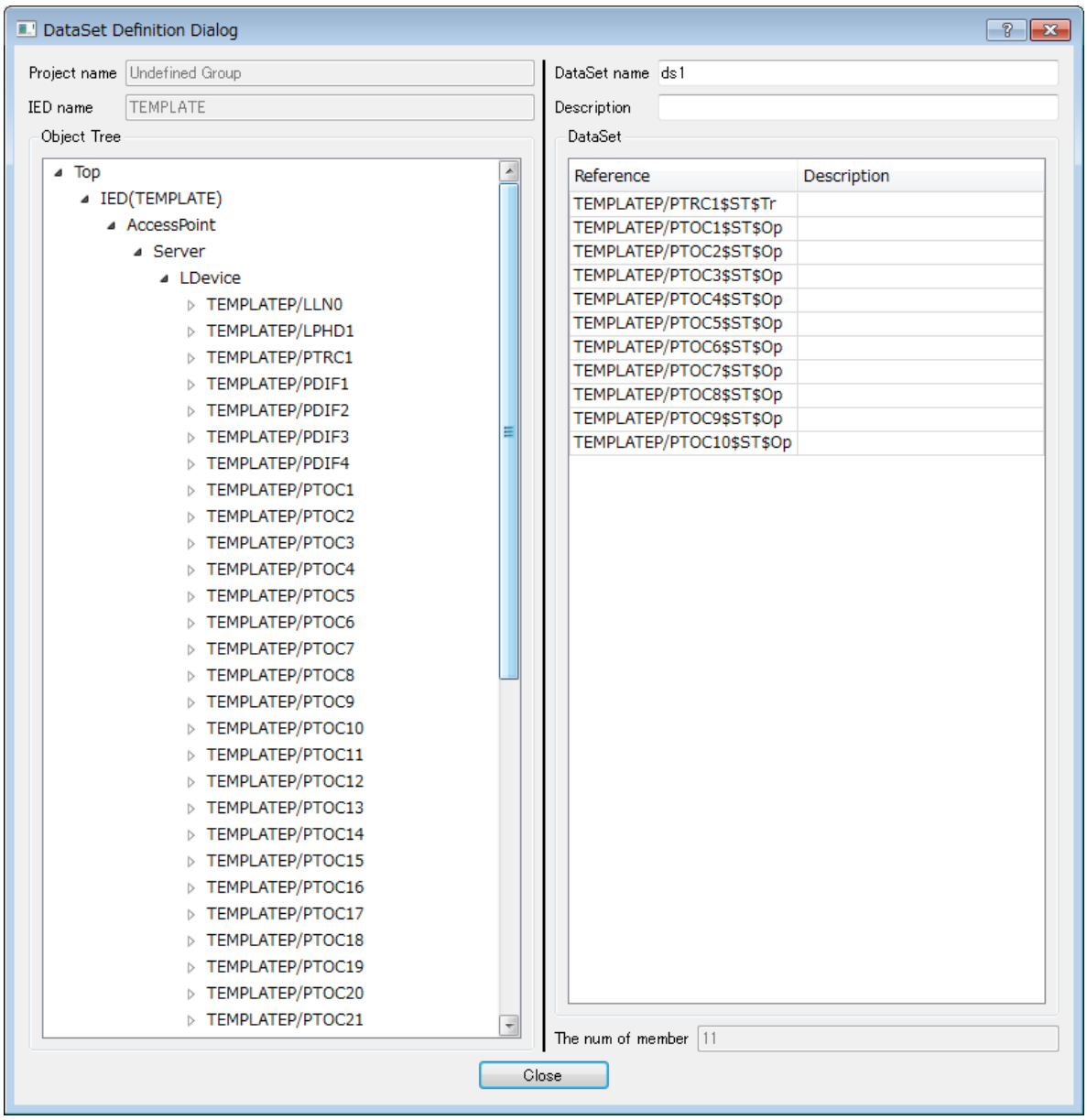


Figure4-9 An example of screen appearing with the click of the Edit button

On this screen, drag the model which you want to add to the DataSet from the object tree in the left-hand field and drop it onto the right-hand DataSet field. This causes that model to be added to DataSet.

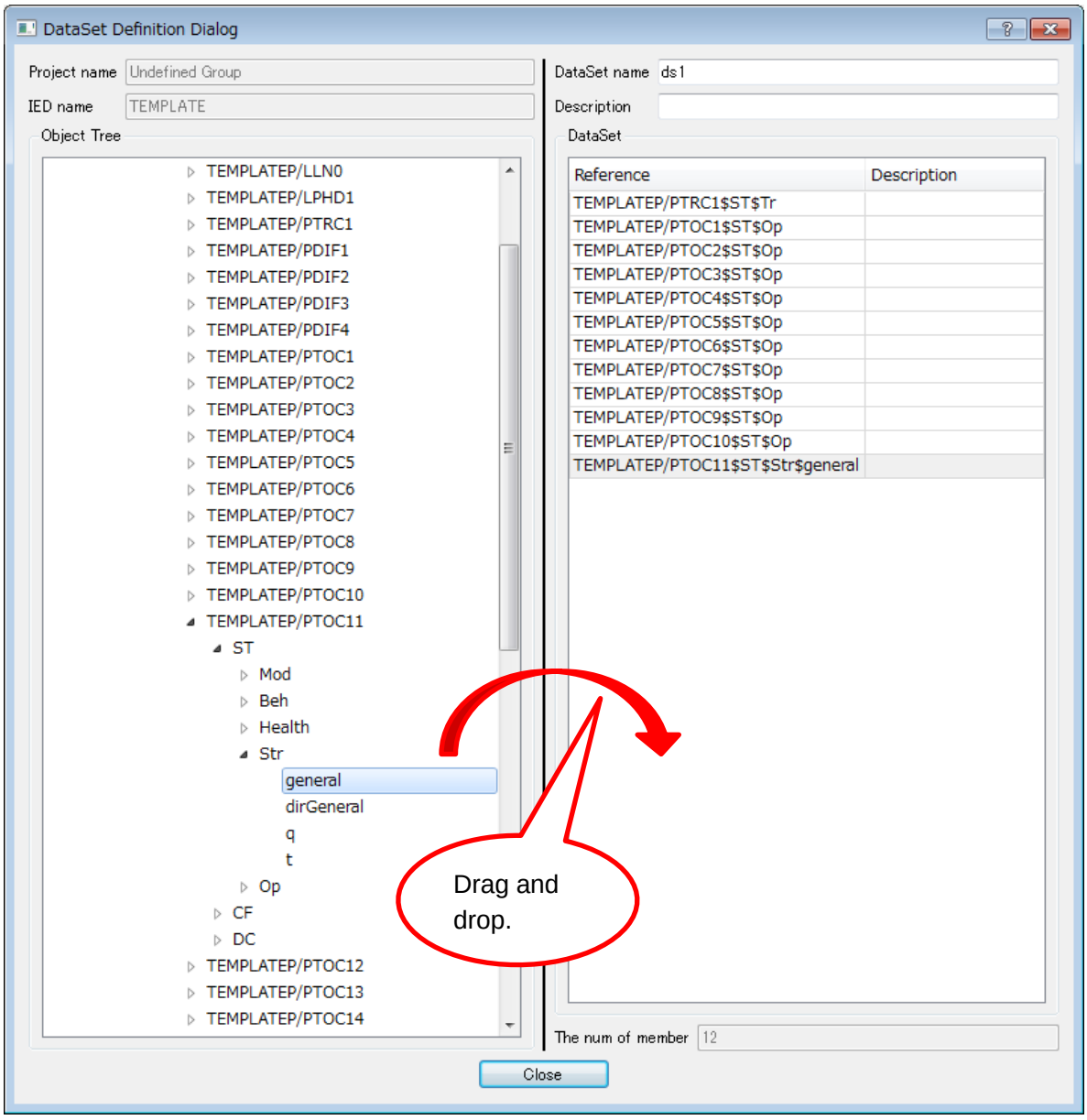


Figure4-10 An example of screen on which to register a model to DataSet

To end the Edit task, click the Close button.

4.3.6.1.1.Posting A Comment to DataSet Member

You can post a comment to a DataSet member.

Right-clicking the member to which you want to post a comment brings up the menu shown in Figure4-11. Click “Input DataSet Member Description.” You will see a screen shown in Figure4-12. Type a comment and click the OK button. This causes the entry to take effect. Figure4-13 shows an example of a comment saying “Relay Trip Signal” being posted to PTRC1STTr.

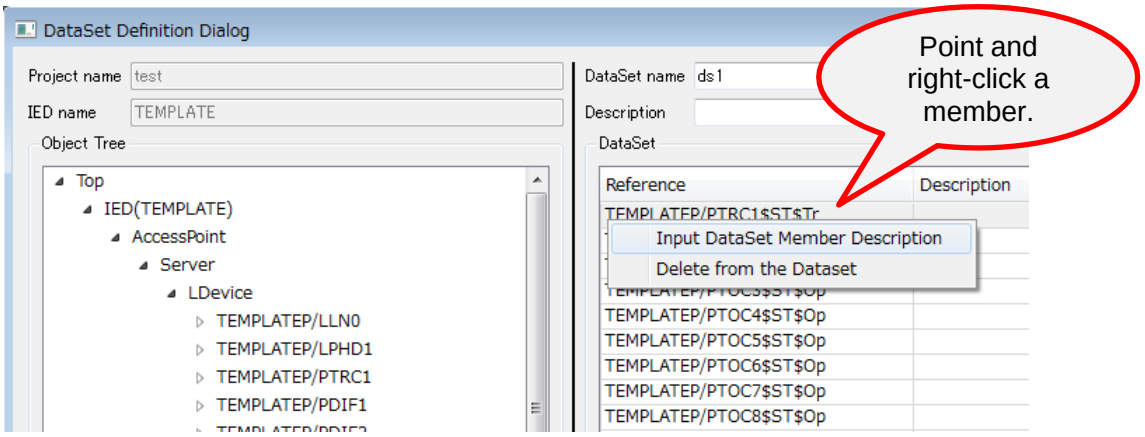


Figure4-11 How to post a comment to a DataSet member

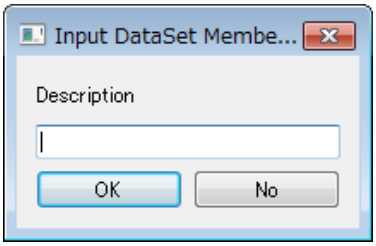


Figure4-12 Screen in which you can post a comment to a DataSet member

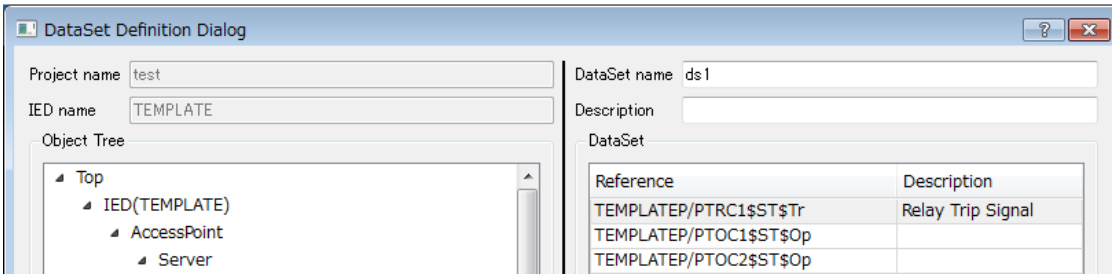


Figure4-13 Screen appearing after a comment has been posted to a DataSet member

4.3.6.1.2.Deleting A DataSet Member

You can delete any DataSet member using the Edit menu.

Right-click a member which you want to delete brings up a menu shown in Figure4-14. Click “Delete from the DataSet.” This causes the chosen member to be deleted. (Deletion takes place without the appearance of a screen asking you if you want to delete the member.)

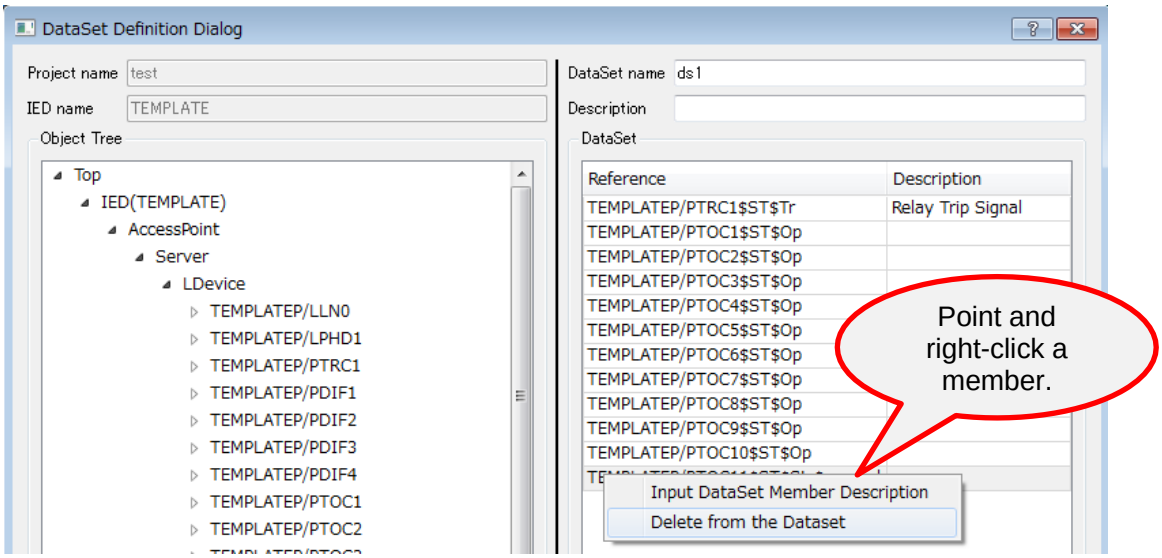


Figure4-14 How to delete a DataSet member

4.3.6.2.Creating DataSet

Clicking the Create button using the DataSet menu on the DataSet tab brings up a screen shown in Figure4-15. Type an appropriate name into the “DataSet name” box and click the OK button. This causes a new “DataSet” to be created.

Figure4-16 shows an example of screen appearing when adding a new DataSet by typing “ds5” into the “DataSet name” box

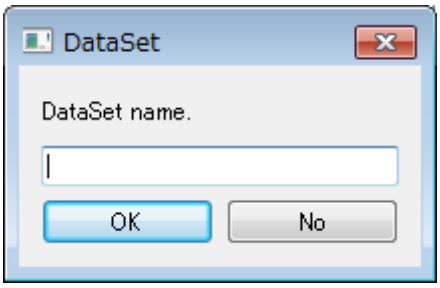


Figure4-15 Screen in which a DataSet is created

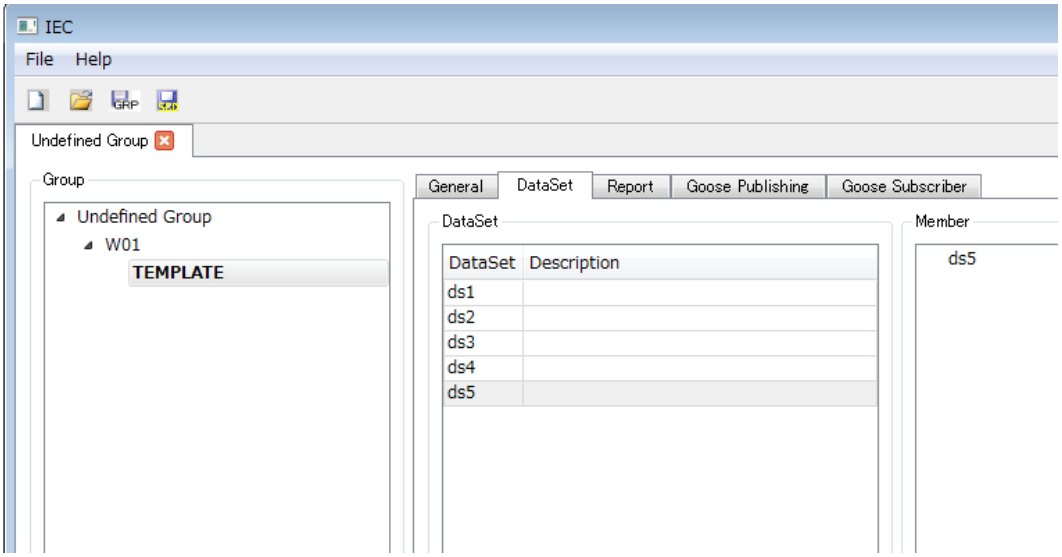


Figure4-16 An example of screen showing the addition of a DataSet

4.3.6.3.Deleting DataSet

Using the DataSet menu on the DataSet tab, point the DataSet which you want to delete and click the Delete button. You will see a screen shown in Figure4-17. If you want to delete, click the OK button.

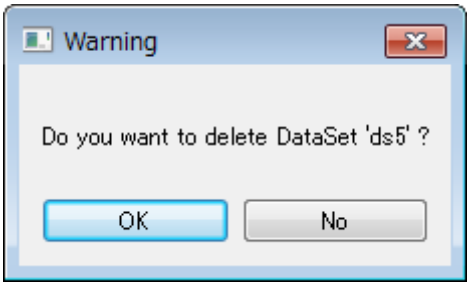


Figure4-17 An example of screen on which to delete a DataSet

4.3.7. Report Tab

On the Report tab, you can make a setting for any of the items which are listed in Table4-6. Make change(s) as you see fit for your use environment.

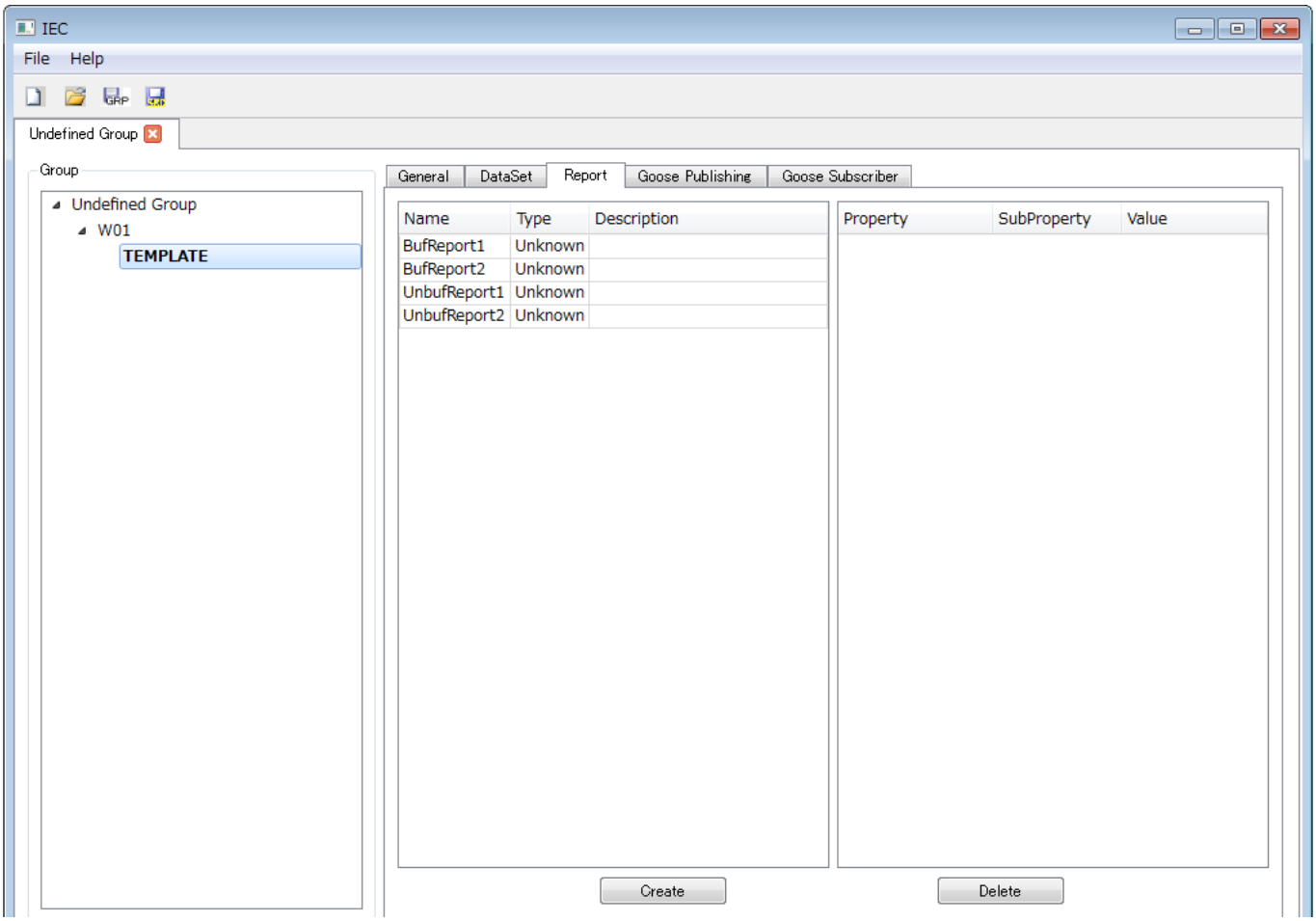


Figure4-18 Report tab screen

Table4-6 Items settable on the Report tab

Items settable	Description
Report	Report data is edited, created, or deleted. In TEMPLATE. ICD file, BufReport 1, BufReport 2, UnbufReport 1, and UnbufReport 2 are registered under the following settings:
BufReport1	ds1 is assigned to reports which are buffered.
BufReport2	ds2 is assigned to reports which are buffered.
UnbufReport1	ds3 is assigned to reports which are unbuffered.
UnbufReport2	ds4 is assigned to reports which are unbuffered.

4.3.7.1.Report Setting

The right-hand entry field on the Report tab permits you to change various kinds of definition. Data definitions listed in Table4-7 are changeable. Make change(s) as you see fit for your use environment.

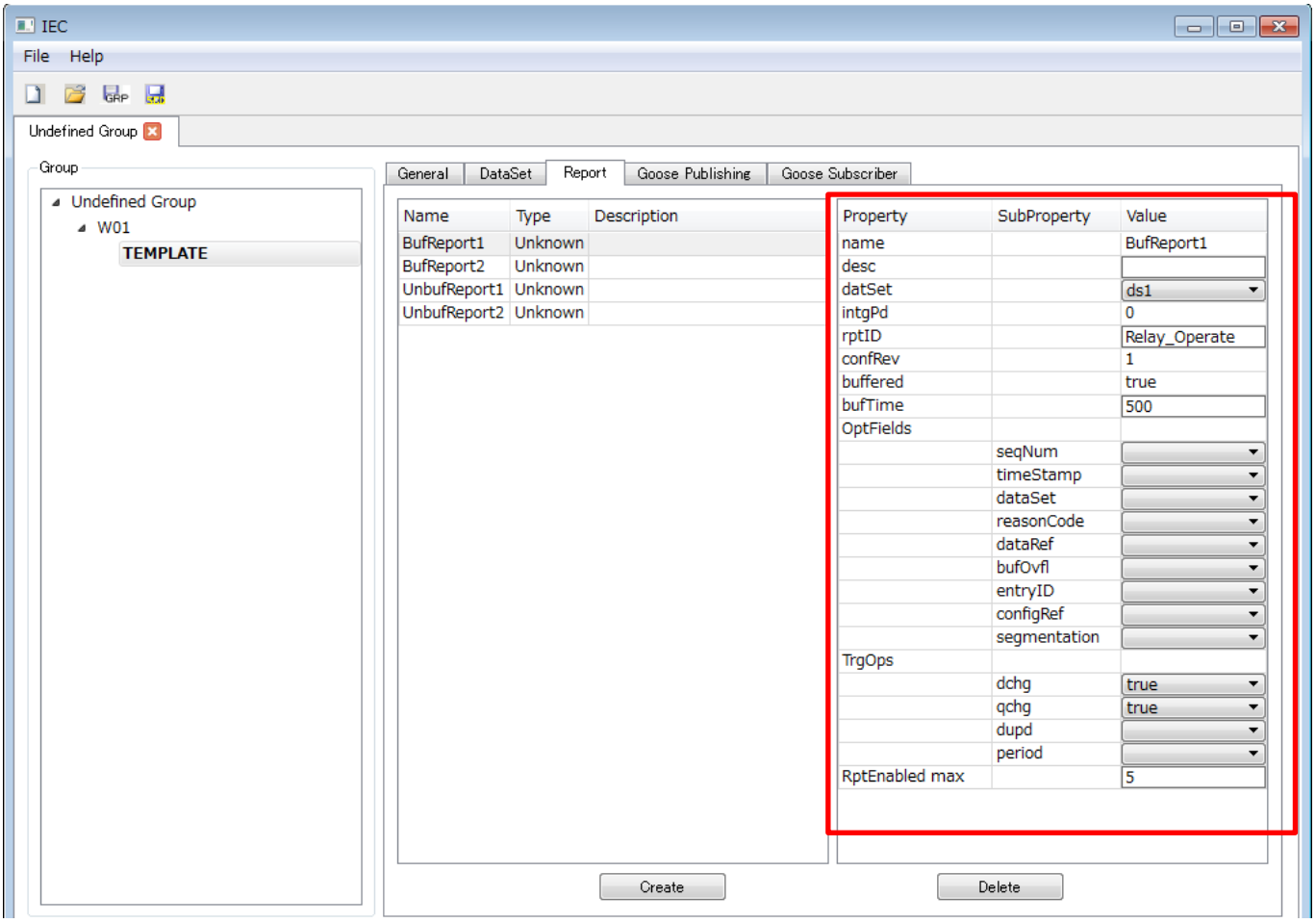


Figure4-19 An example of report setting screen

Table4-7 Changeable items in report setting

Settable items	Description
desc	Description box Type a comment or the like as may be necessary.
datSet	You can select what are to be included in a report from registered DataSet.
rptID	Enter a report ID. Choose a name which corresponds to DataSet attribute.
bufTime	Transmits reports when bufTime (millisecond) has passed after the detection of a change. For reports which are buffered, initial value is 500 ms. For reports which are unbuffered, initial value is 0 ms.
OptFields	Permits you to make setting as to whether to include a sequence number, time stamp, and the like in a report.
TrgOps	Trigger options (changes in data, changes in quality, cyclic transmission, etc.)
RptEnabled max	Number of report amplifications to enable an identical report to be received by multiple clients

4.3.8. Goose Publishing Tab

On the Goose Publishing tab, you can make settings for the items listed in Table4-8. Make change(s) as you see fit for your use environment.

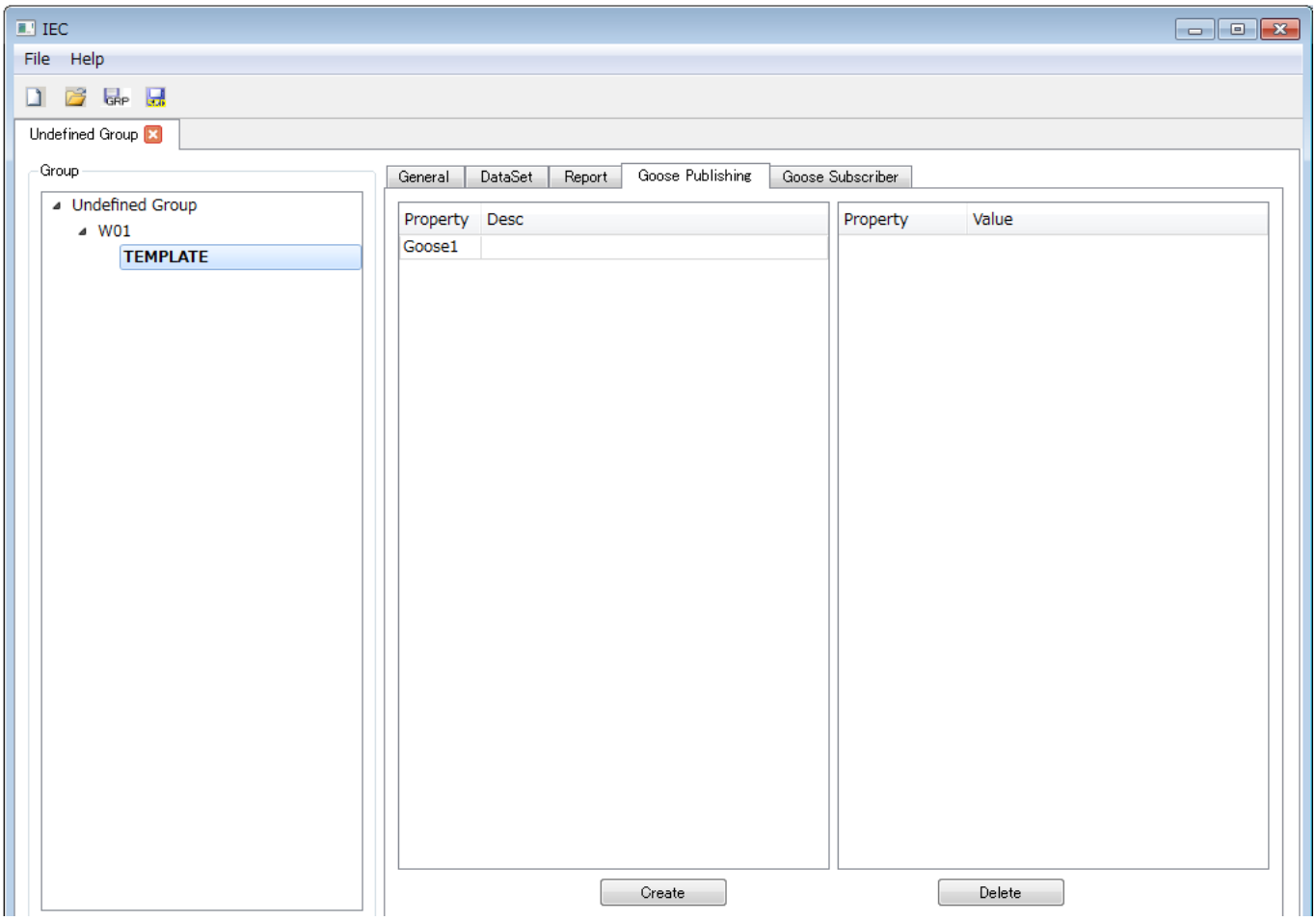


Figure4-20 Goose Publishing tab screen

Table4-8 Items settable on the Goose Publishing tab

Settable item	Description
Goose transmission	Settings for Goose transmission are edited, created, or deleted. In TEMPLATE. ICD file, Goose1 is registered under the following settings:
Goose1	ds4 is assigned to items to be Goose-transmitted.

4.3.8.1.Editing Goose Publishing

The right-hand entry field on the Goose Publishing tab permits you to change various kinds of definition. Data definitions listed in Table4-9 are changeable. Make change(s) as you see fit for your use environment.

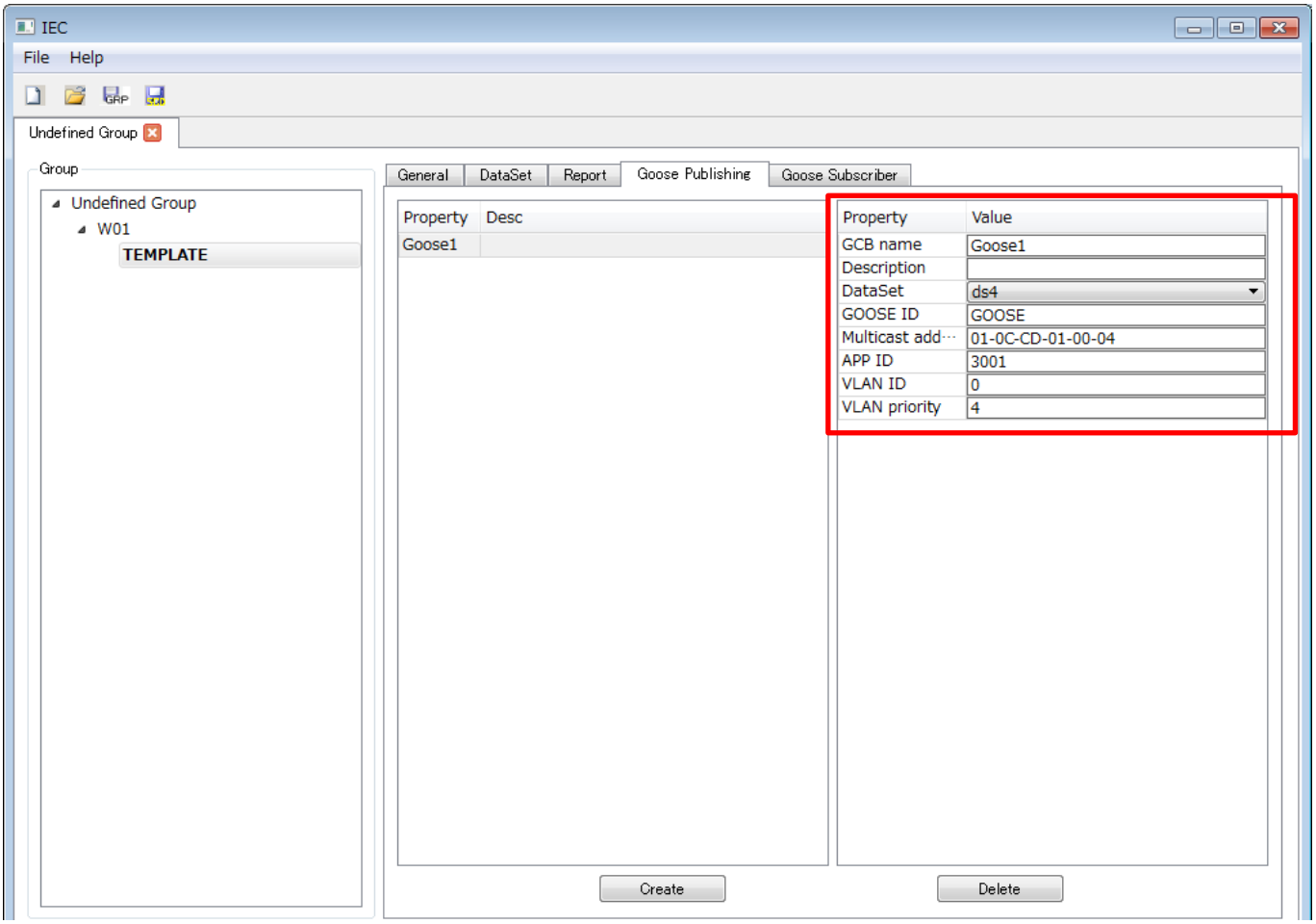


Figure4-21 An example of Goose Publishing setting screen

Table4-9 Changeable items in Goose Publishing setting

Settable item	Description
GCB name	Name of Goose Control Block
Description	Description block Type a comment or the like as may be necessary.
DataSet	You can select what are to be Goose-transmitted from registered DataSet.
GOOSE ID	Goose identifier
Multicast address	MAC address
APP ID	Unique ID number which you specify on your own.
VLAN ID	VLAN identifier
VLAN priority	Degree of VLAN priority

4.3.8.2.Creating Goose Publishing

Clicking the Create button on the Goose Publsihing tab brings up a screen shown in Figure4-22. Type a name into the Input GCB name box and click the OK button. This causes a new Goose Publishing to be created.

Figure4-23 shows an example of screen for a new addition which appears after typing Goose2 under “Input GCB name”

Figure4-22 Goose Publishing creating screen

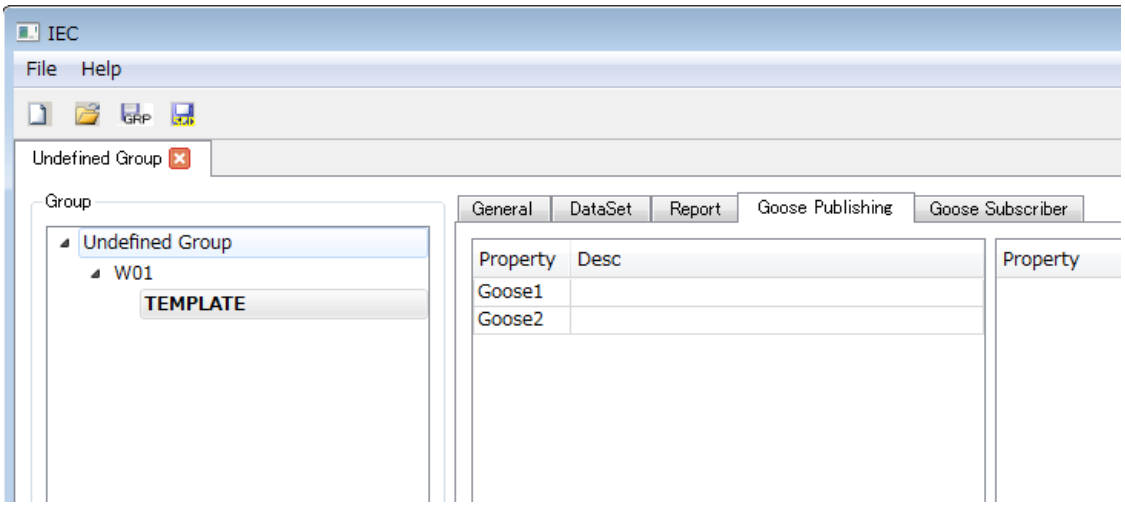


Figure4-23 An example of screen for adding Goose Publishing

4.3.8.3.Deleting Goose Publishing

On the Goose Publishing tab, point the Goose Publishing which you want to delete and click the Delete button. The Goose Publishing which has been chosen will be deleted. (Deletion takes place without the appearance of a screen asking you if you want to delete the item.)

4.3.9. Goose Subscriber Tab

On the Goose Subscriber tab, you can make settings for the items being listed in Table4-10. Make change(s) as you see fit for your use environment.

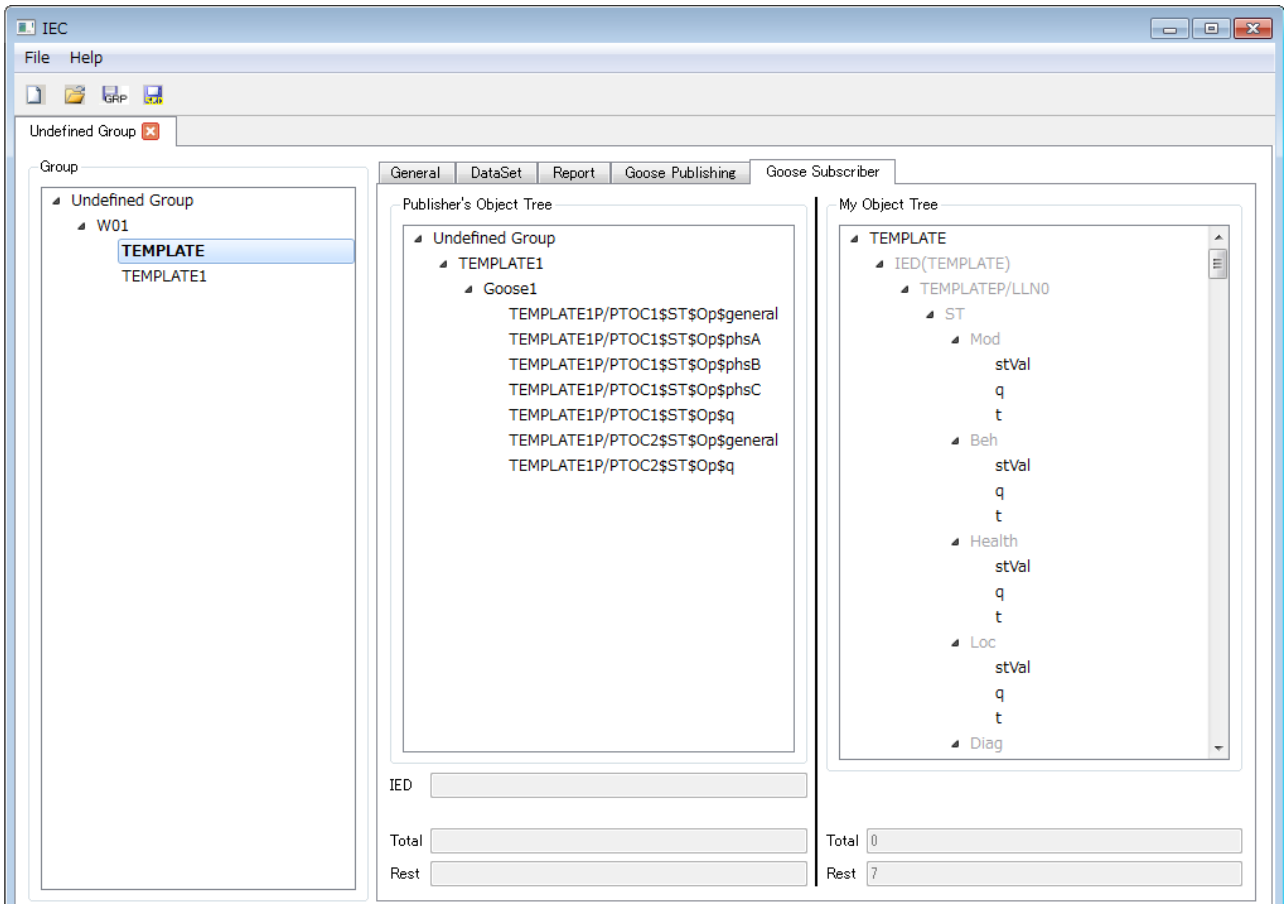


Figure 4-24 Goose Subscriber tab screen

Table4-10 Items settable on the Goods Subscriber tab

Settable item	Description
Goose reception	Settings for Goose reception are made. The settings are such that ICD file in other IED is loaded into the IED Configurator and what are to be Goose-transmitted in other IED are Goose-received in own IED.

4.3.9.1.Setting Goose Subscriber

1. With ICD files held in two or more IEDs being loaded, drag a signal to be Goose-transmitted from the Publisher's Object Tree in the center field opening on the Goose Subscriber tab and drop it onto a respective model of My Object Tree in the right-hand field. This completes Goose reception settings. If you want to undo the settings, do so by double-clicking the appropriate setting data in My Object Tree.

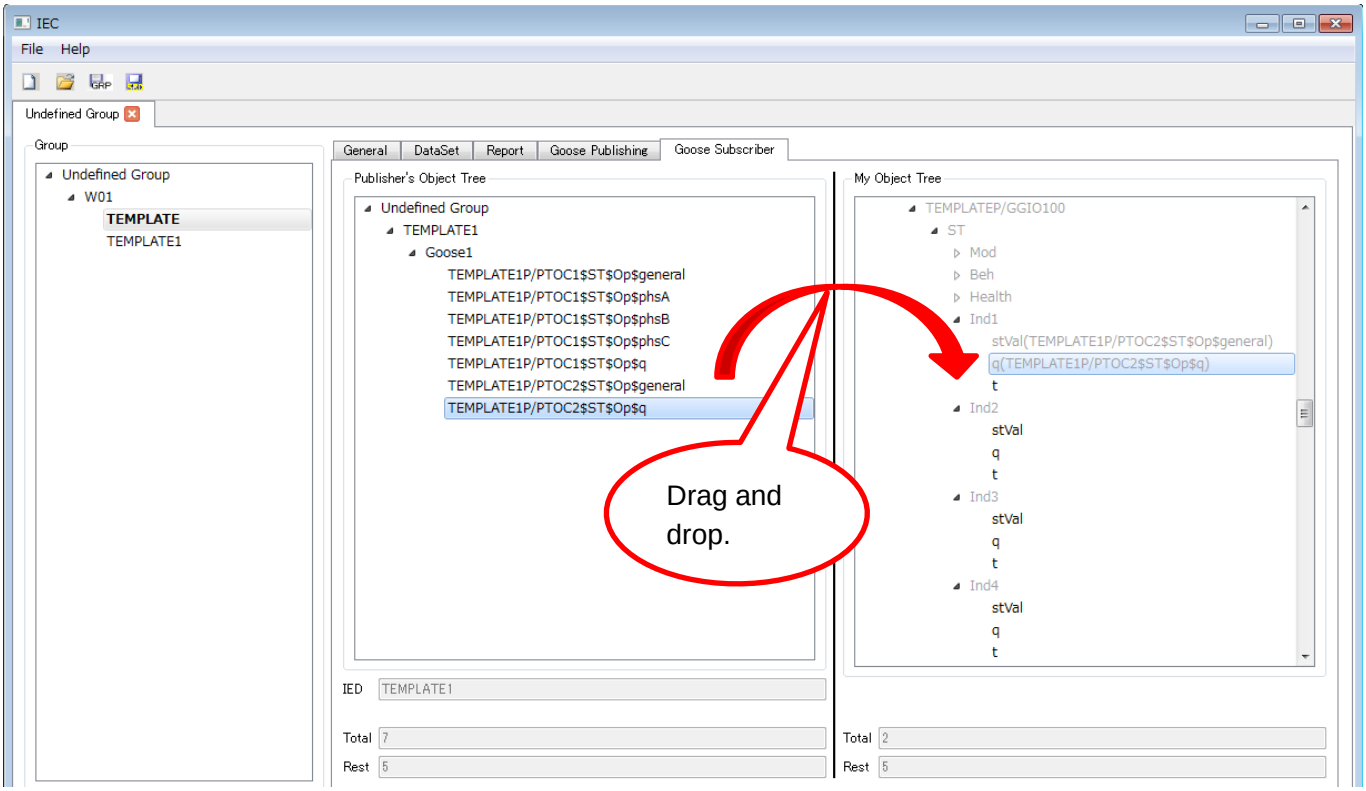


Figure4-25 Goose Subscriber setting screen

4.3.9.2.Storing Goose Subscriber Settings

Use this step to store information including Goose Subscriber settings.

(If you intend not to include Goose Subscriber settings, store such information in a SD file.)

The selection of the File – “Save as Group file” menu in Figure4-26 permits you to store Group file.

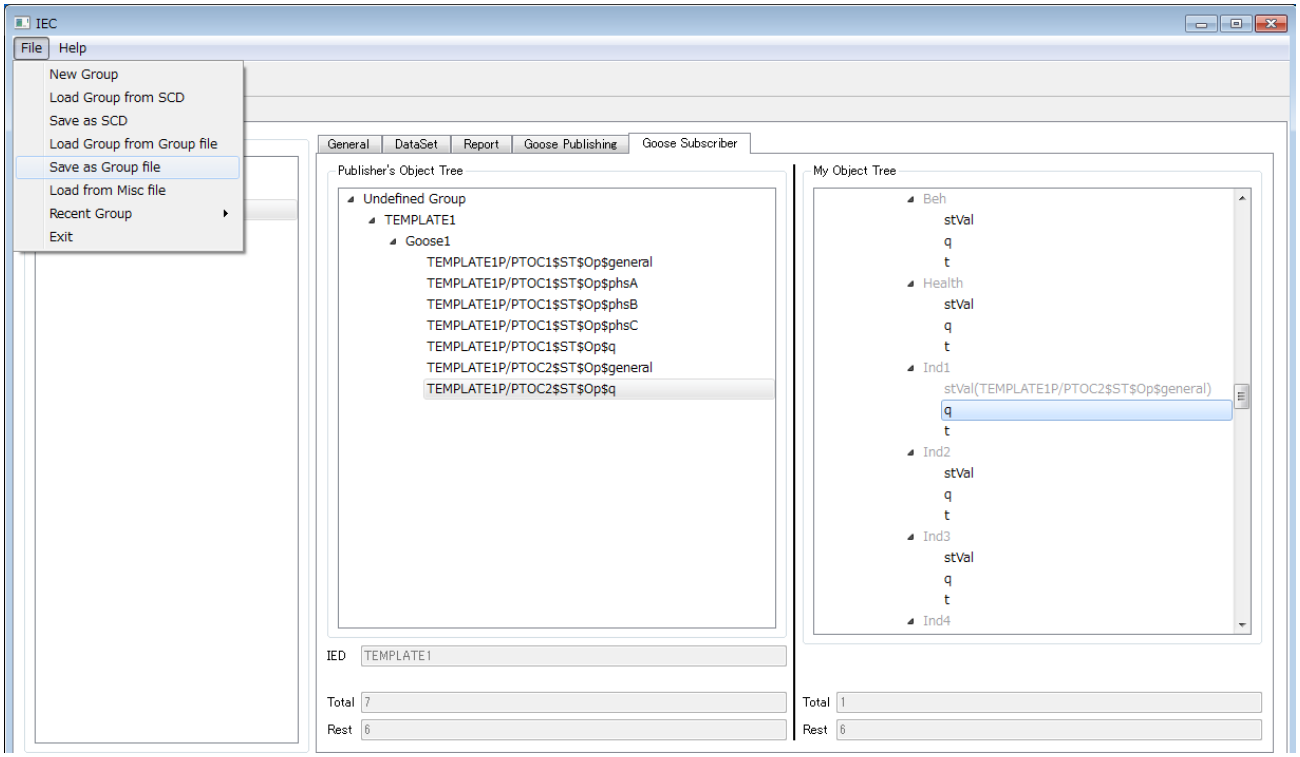


Figure4-26 Storing Group files

4.3.10. Creating Misc Files

Upon the completion of all the settings, you create Misc file to enable the downloading of setting data onto MELPRO-D. Pointing and right-clicking IED on the Group tree in the left-hand field which corresponds to the Misc file to be created brings up a screen shown Figure4-27.

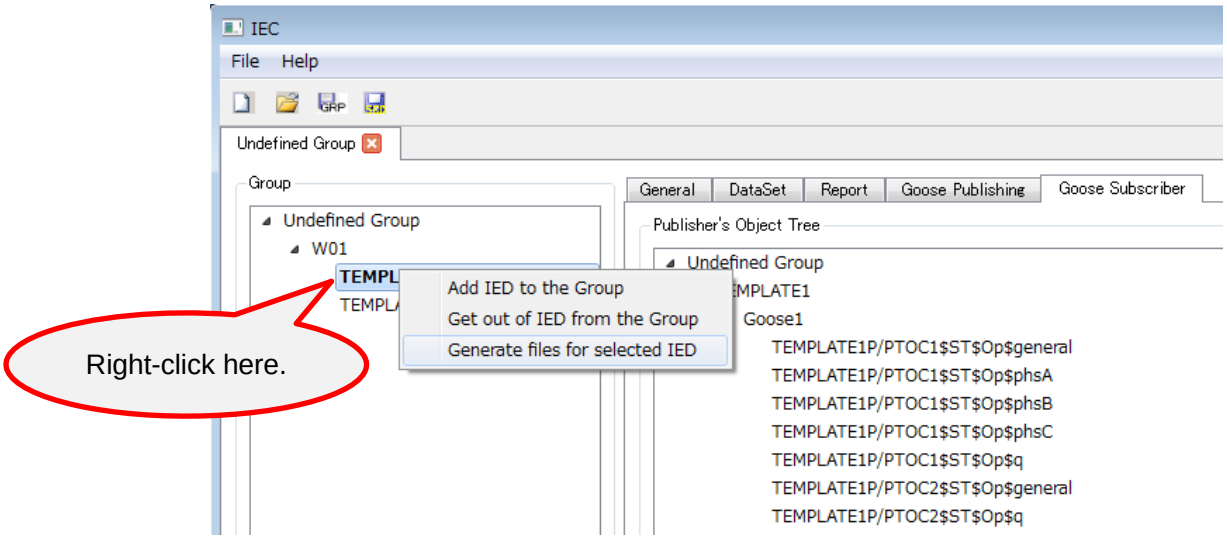


Figure4-27 An example of screen appearing at the time of Misc file generation

Clicking the Generate files for selected IED label on the screen shown in Figure4-27 brings up a screen listing candidate destination folders to store CID file. Designate any folder and store the file. Performing the storing operation ensures that Misc file having an identical file name is generated in the same folder as the destination folder for the CID file.

4.3.11. Writing and Loading Misc File

Writing Misc file into MELPRO-D permits you to ensure that settings residing in the IED Configurator are reflected in your working system. Also, this makes it possible to load (upload) Misc file from MELPRO-D.

Because a connection needs to be established between PC-HMI and MELPRO-D when writing or loading Misc file, perform the following steps.

4.3.11.1. Establishing A Connection between PC-HMI and MELPRO-D

Starting PC-HMI brings up a screen shown in Figure4-28. Click the Online Access to Device button at the upper left corner.

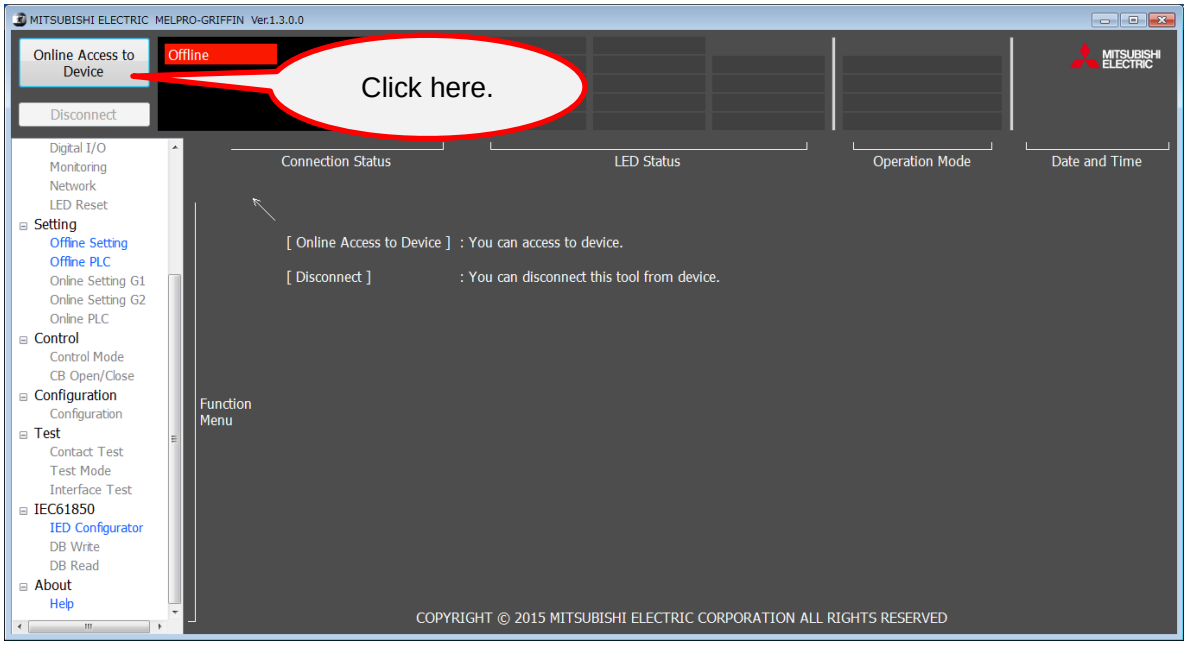


Figure4-28 PC-HMI start screen

Clicking the Online Access to Device button opens up a screen shown below. Click the Connect button. You will be taken to the Login screen shown in Figure4-30.

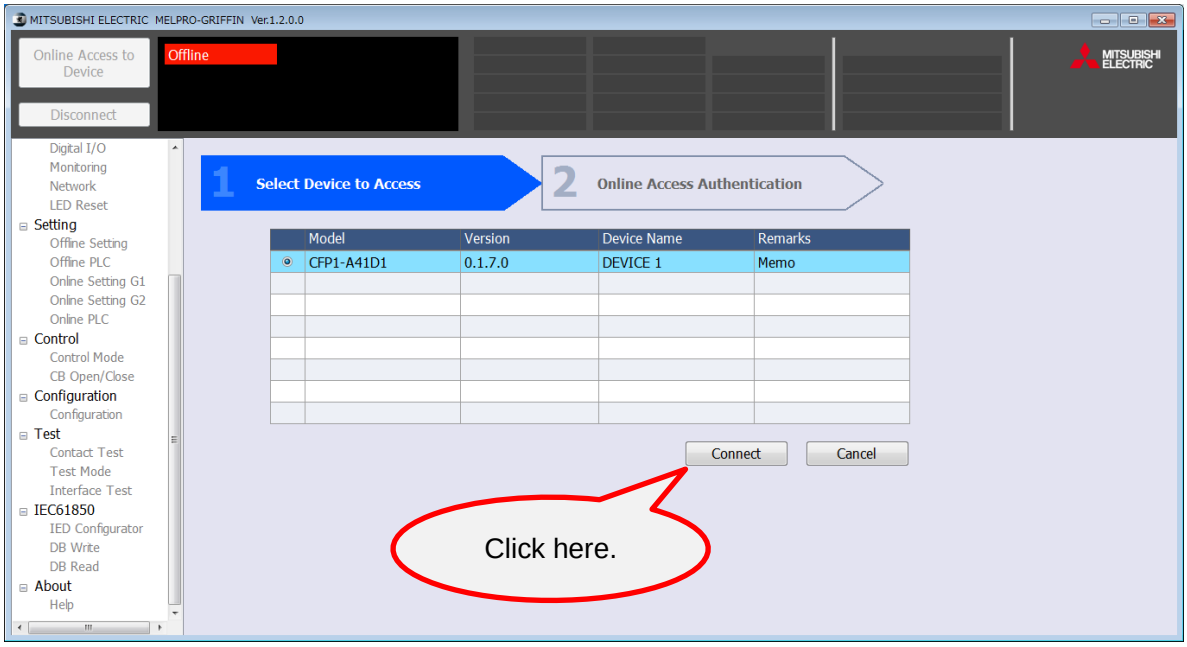


Figure4-29 Connection screen

In the Login screen shown below, after changing the Access Level to Setting, type the password which

you have registered and click the Login button. This completes a connection between PC-HMI and MELPRO-D, as can be seen from Figure4-32, after a screen indicating a connecting process in progress, per Figure4-31, has appeared.
If, at this time, the connection process is aborted, check for likely causes including malfunction on the MELPRO-D side, mistyping of a password, and loose USB cable connection.

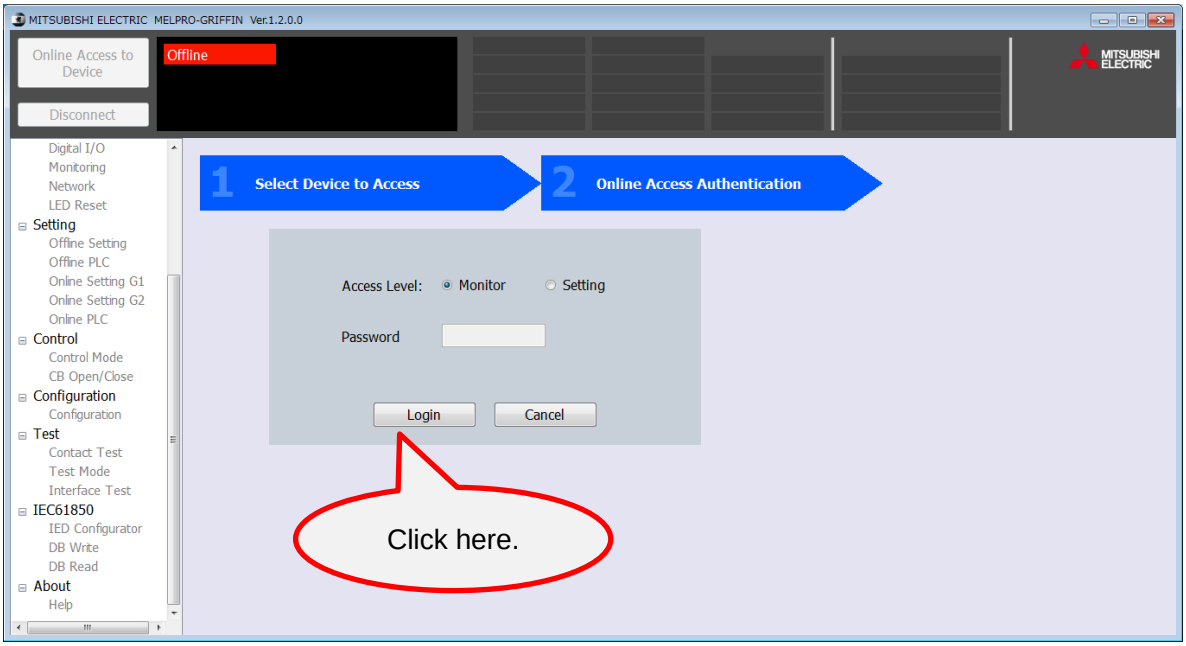


Figure4-30 Login screen

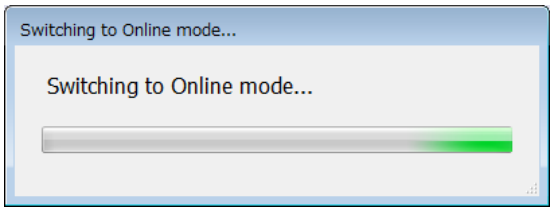


Figure4-31 A screen indicating that Connection process is in progress

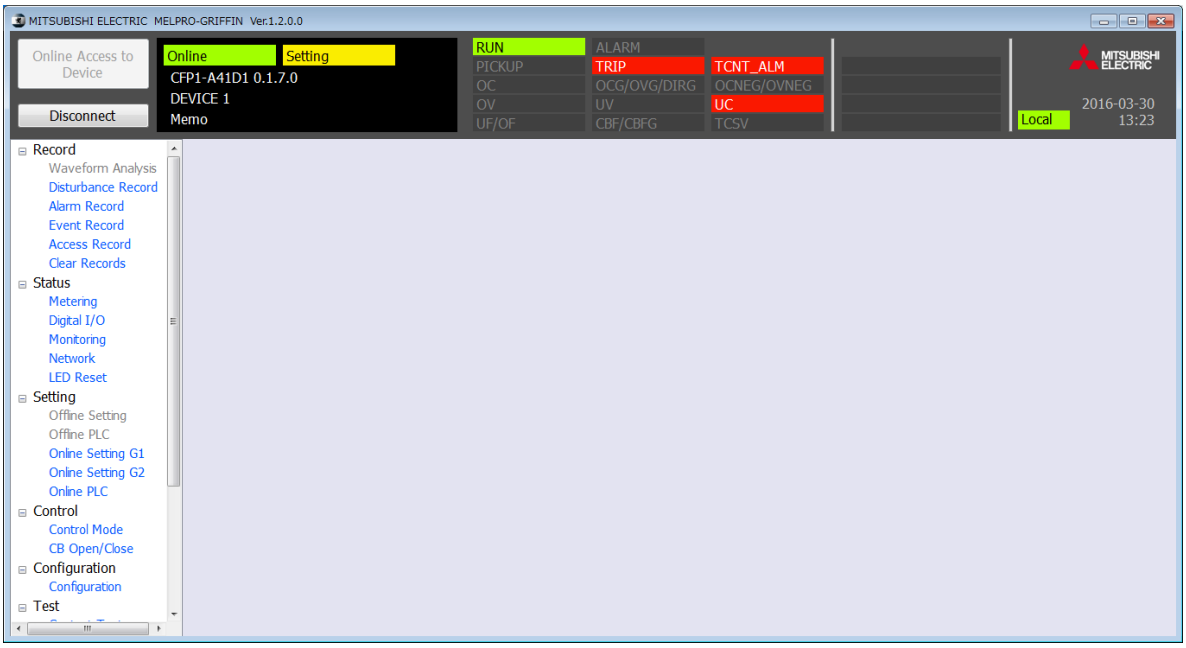


Figure4-32 I nitial screen appearing after the completion of connection

4.3.11.2.Writing DB (Misc File)

Clicking the IEC-61860 - DB Write menu on the PC-HMI brings up a screen which permits you to write Misc file.

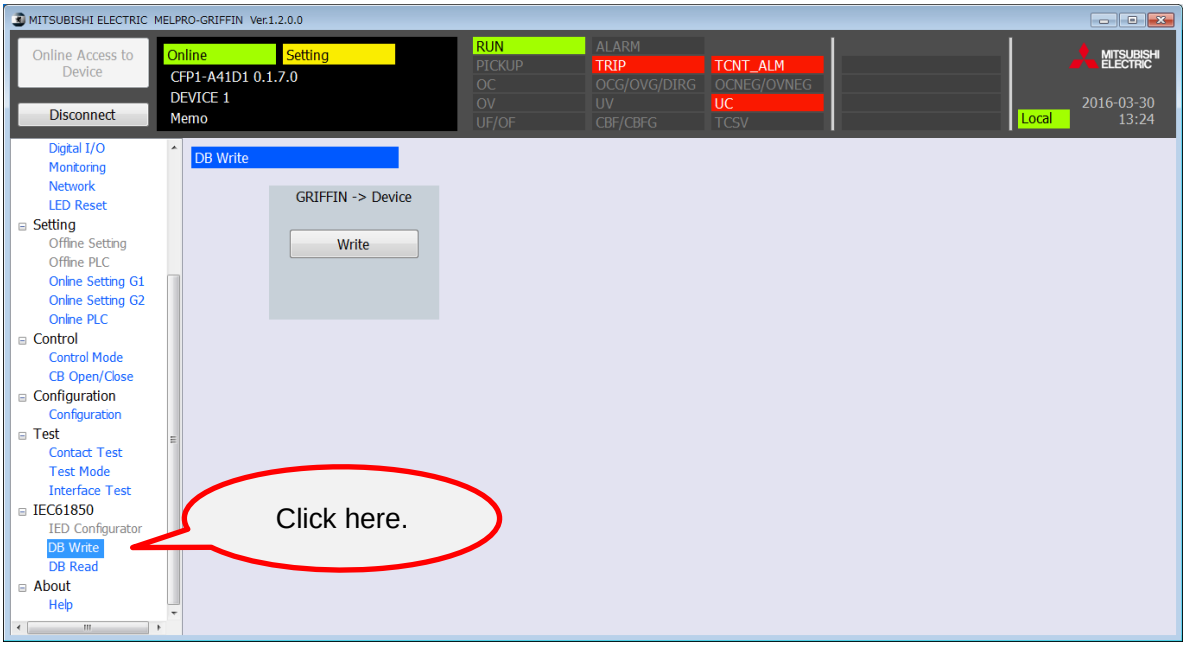


Figure4-33 DB Write screen

Clicking the Write button on the DB Write screen opens up, first, a screen shown in Figure4-344 and then a screen per Figure4-35 asking you if you want to restart MELPRO-D after the completion of DB Write process. Because restarting is essential to have the DB reflected in your system, click the Yes button. Clicking the No button disables the DB write process.

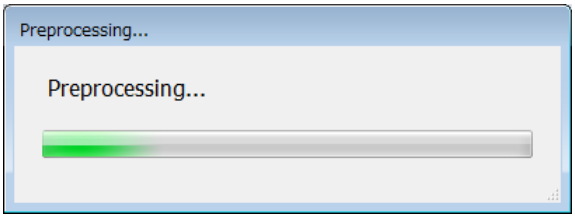


Figure4-34 A screen indicating the progress of preprocessing for DB write process

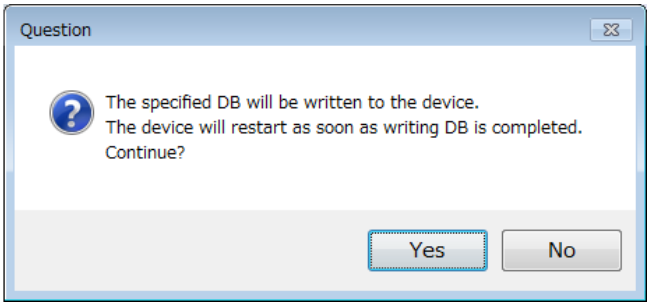


Figure4-35 A screen asking you if you want to restart MELPRO-D

Clicking the Yes button on the screen asking you if you want to restart MELPRO-D (Figure4-35) opens up, first, a screen shown in Figure 4-36 and, after the completion of DB write process and a subsequent restart, a screen per Figure4-37 informing you that the DB write process is completed.

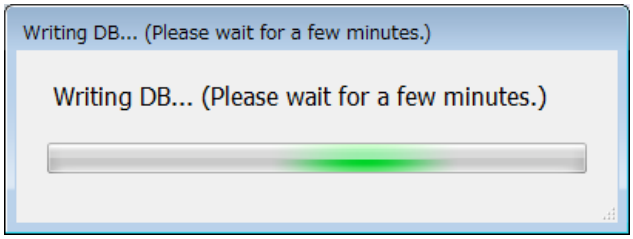


Figure 4-36 A screen indicating that DB Write process is in progress

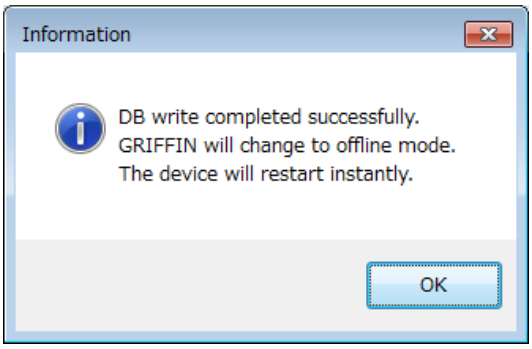


Figure4-37 A screen notifying the completion of DB Write process

4.3.11.3.Reading DB (Misc Files)

Clicking the “IEC-61860 - DB Read” menu on the PC-HMI brings up a screen which permits you to read Misc file.

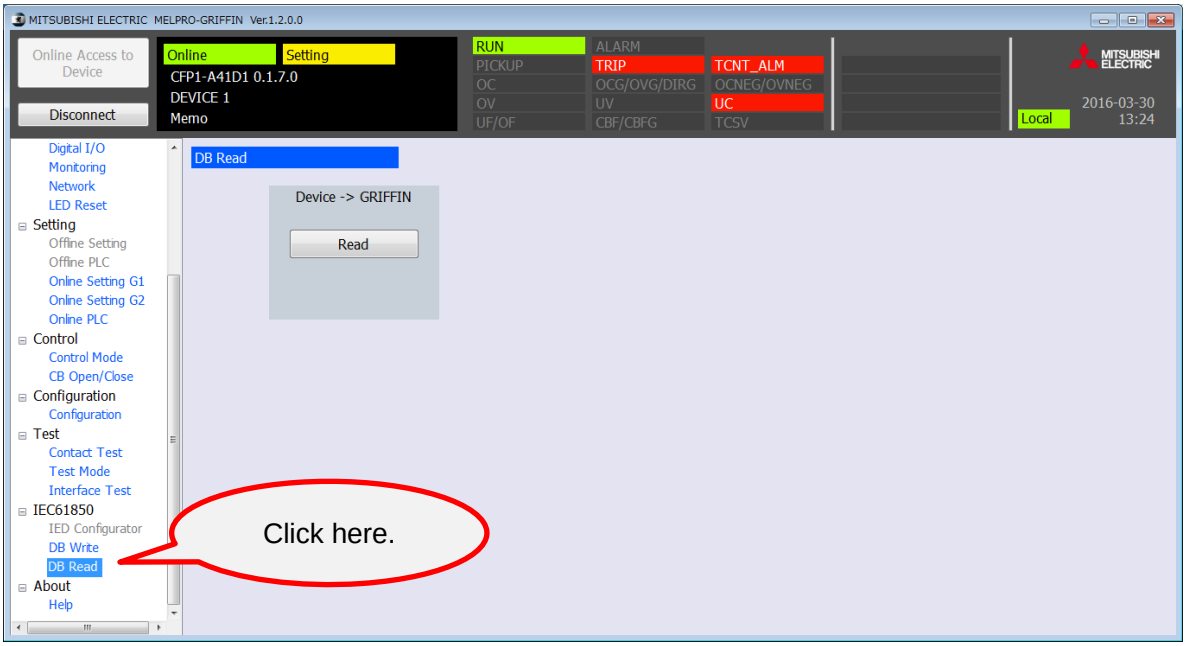


Figure4-38 DB Read screen

Clicking the Read button on the DB Read screen brings up a screen which permits you to specify a destination folder to store the Misc file. Designate any folder with a file name so that storage goes on. After a destination folder is designated, a figure shown in Figure4-39 appears. Upon the completion of the DB Read process, a screen per Figure4-40 shows up, informing you that the process is completed. Click the OK button to end the Read task.

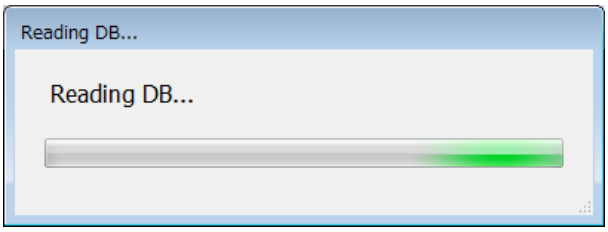


Figure4-39 A screen indicating that DB Read process is in progress

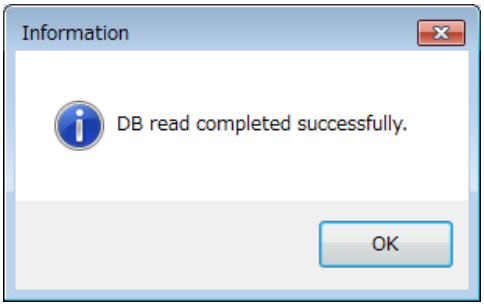


Figure4-40 A screen notifying the completion of DB Read process

4.4. Appendix

About abbreviations used in this manual

Abbreviation	Description
HSR	HSR stands for High-availability Seamless Redundancy, one of the methods used to provide an enhanced tolerance to single communication failures.
PRP	PRP stands for Parallel Redundancy Protocol, one of the methods used to provide an enhanced tolerance to single communication failures.
IED	IED stands for Intelligent Electronic Device, a device having IEC61850 communication capabilities.
ICD File	IICD stands for IED Capability Description. ICD file is one on which all the functions provided in IED, encompassing implementation model and network information, are described.
SCD File	SCD stands for Substation Configuration language (SCL) Description. SCD file is one on which all the IED-related settings, encompassing a complete arrangement information necessary for the building of a substation, are described.
CID File	CID stands for Configured IED Description. CID file is one on which SCD file-originated, discrete information to be furnished to individual IED, is described.
Group File	A file consisting of a SCD file on which Goose reception settings are described (file extension: .grp)
Misc File	A file which is so configured as to permit the downloading of IED Configurator-specified information onto IED. Called DB (database) on the IED Configurator.