

iQ Platform-compatible PAC System Recorder

e-Factory

Total maintenance solution

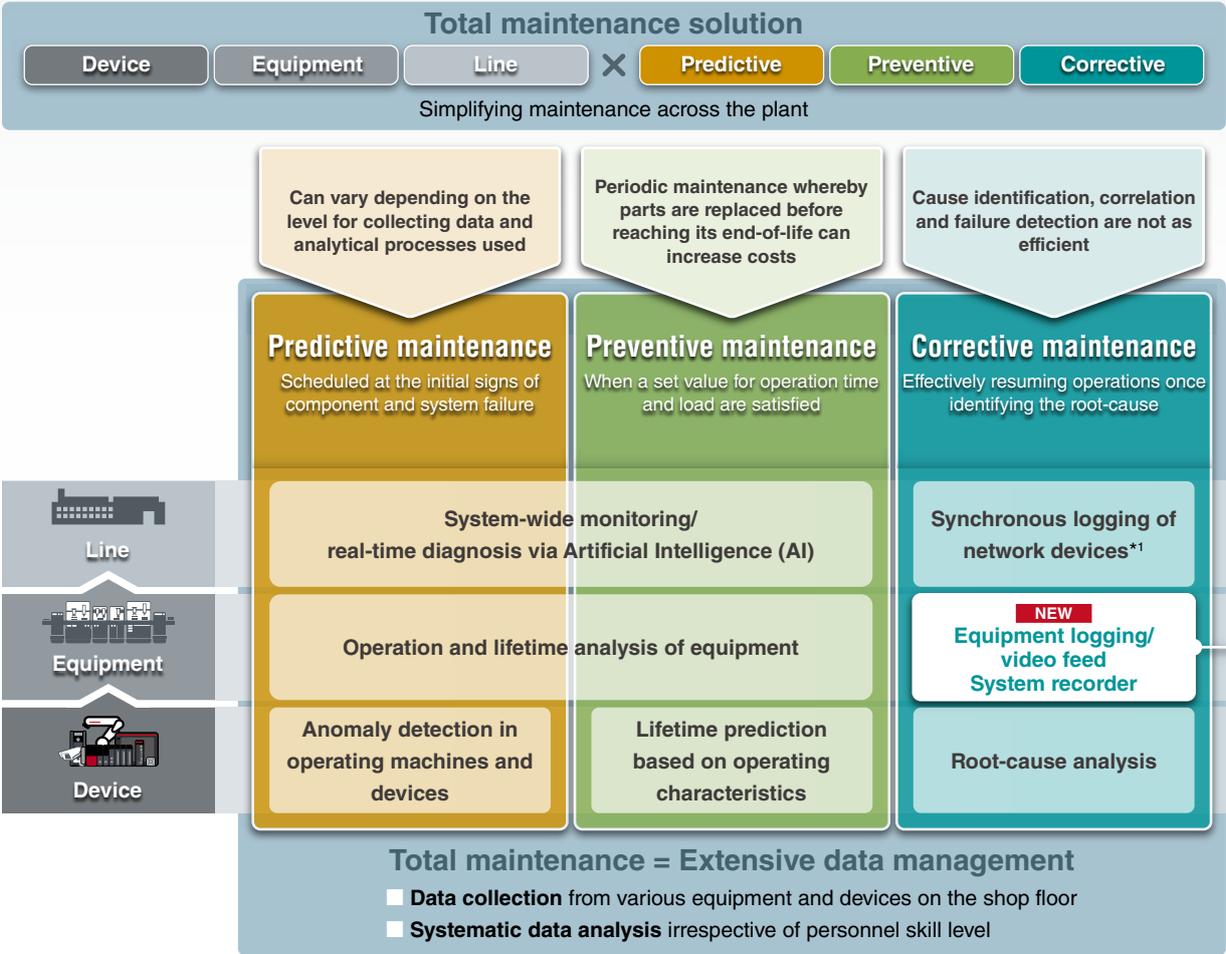


Bringing maintenance data
management to the next level

MELSEC iQ-R
series

Mitsubishi Electric's solution for improving productivity through easier data management

Ensuring continuous production is a key factor in manufacturing from **device**, to **equipment** and across **multiple lines**. This can be achieved in various ways by recording and sampling production and machine operating data and utilizing this data within various stages of maintenance; from ① **predictive maintenance** to detect signs of error, periodical ② **preventive maintenance**, and ③ **corrective maintenance** for prompt troubleshooting at the time of failure. Having an enhanced maintenance solution is Mitsubishi Electric's goal of empowering the customer to reduce downtime and to ensure a manufacturing plants efficiency is running at optimum resulting in reduced operating and maintenance cost.



System recorder

System-wide recording

■ Data recording and video feed

- Extensive data logging of device and labels ⑧ ⑩
- Logging of safety device and label data*1 ⑧ ⑩
- Event history recording ⑩
- Network camera image recording (program) ⑧ ⑪ ⑫ ⑬
- Network camera image recording (module)*1 ⑩ ⑫ ⑬
- Automatic saving to network storage*1 ⑩ ⑬

● Drives status recording

- Servo system recording ⑥ ⑨

● GOT (HMI) operation recording

- Recording of log and alarm data ⑦

*1. Soon to be released

Simplified analysis

■ Data analysis with video feed

- Offline monitoring ① ② ④ ⑤ ⑧
- Log marker ③

■ Comprehensive device relationship mapping

- Data flow analysis ②

System recorder

The system recorder is a corrective maintenance solution that ensures effective resumption of operations reducing downtime through its extensive system-wide data recording and simplified analysis software features.

System-wide recording and simplified analysis

System-wide recording

Extensive recording ensures simpler cause analysis

Error cause identification is made simpler by the extensive recording of various equipment and device data together with a real-time video feed reducing the need for multiple retesting due to insufficient data.

System-wide

Irregularities between various equipment including control and drive systems together with operations are all linked.

Long duration system-wide recording

Recording of errors that can occur outside standard operating shifts.



- A Programmable controller CPU (entire bit/word data)
- B Servo status (command position, actual position, speed, torque)
- C Network camera video feed
- D Operation log of GOT (HMI)

Simplified analysis

Extensive data shown in the same timeline

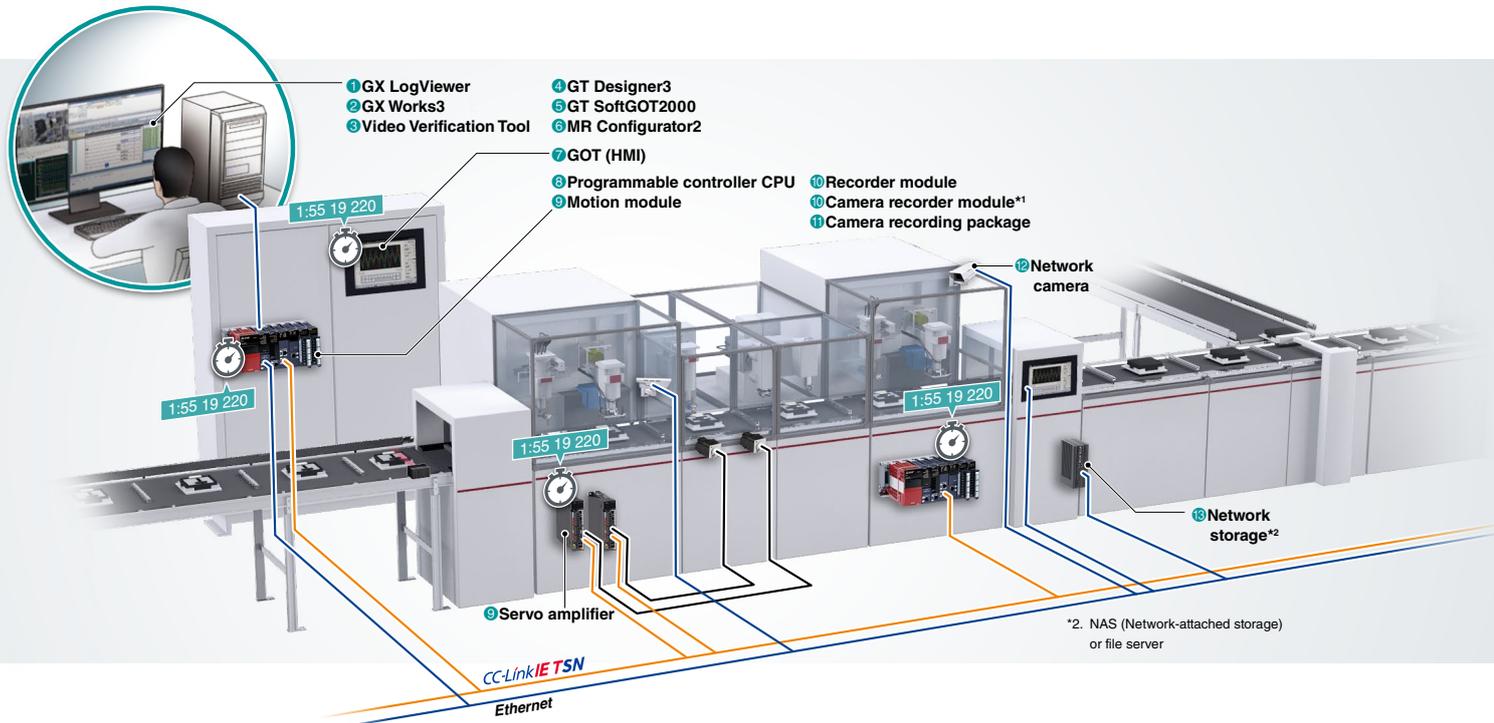
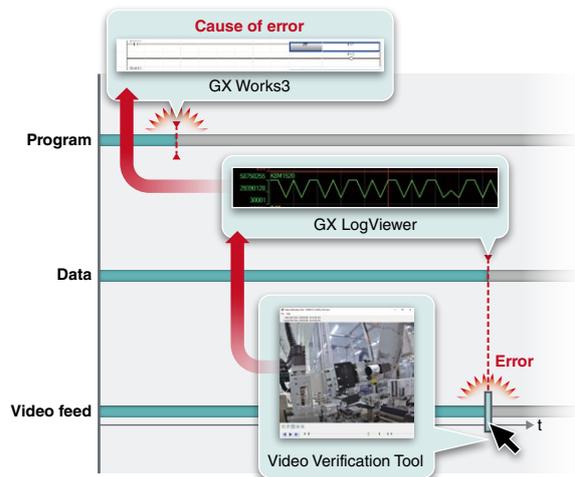
Waveform, data, program and video feeds are shown in sequence ready for analysis.

Easier cause identification

Data flow analysis makes understanding the root-cause of failures easier by showing the relationship between failed and normal devices.

Structured program ensures easier troubleshooting

Supports structured programs and device labels enabling easier resolution of problems.



- 1 GX LogViewer
- 2 GX Works3
- 3 Video Verification Tool
- 4 GT Designer3
- 5 GT SoftGOT2000
- 6 MR Configurator2
- 7 GOT (HMI)
- 8 Programmable controller CPU
- 9 Motion module
- 10 Recorder module
- 11 Camera recorder module*1
- 12 Camera recording package

*2. NAS (Network-attached storage) or file server

System-wide recording



When equipment fails or fall into an error status it can be quite difficult to highlight which components or process had caused the initial failure leading to a detailed fault-cause analysis prior to and after the event. In addition, documenting each component or devices can lead to an immense use of resources with no guarantee that the actual cause of the initial failure will be evident to ascertain especially if the machine is quite complex. In contrast, Mitsubishi Electric's system recorder can record the entire process condition and offer an operations log for control data of multiple equipment and devices, allowing the reproduction (or playback) of the process offline, helping to highlight and show the actual cause of failure. The system recorder is very simple to use, and recording can be initiated by simple settings from the module and associated engineering tools.

■ Data recording and video feed

Device logging every (programmable controller) scan

The MELSEC iQ-R Series recorder module enables complete collection of all device changes per controller scan time, therefore the error cause can be identified quickly. Logging of all device data related to system modules and network in addition to the programmable controller CPU is possible. Recorded data is stored in the SD memory card of the recorder module.

Label and function block logging (programmable controller)

Supporting structured programming enables the recording of not only devices but also labels. This eliminates concerns about physical device addresses and system configuration, easily identifying the errors point of origin.

Event operation log

Device and label operation from external devices can be recorded as historical events. This enables to accurately understand status changes specifically for each device and label.

Network camera video feed

The network camera is used to record a live feed of the actual behavior and status of the machine. Any problems specific to the manufacturing process can be visualized easily. Standard network cameras are supported with no proprietary hardware required enabling the choice to select the ideal product for the application.

Automatic saving to network-attached storage*1

Logging data can be stored in the SD memory card of the recorder module and network storage such as NAS/computer automatically. This eliminates the need for being aware of the data being logged into the SD memory card and for the distribution of log files to various personnel within the support chain.

● Drives status recording

Collecting servo axis data in real-time

Servo systems tend to operate at a much faster cycle time compared with a programmable controller making it difficult to capture. Collecting data using a time-stamp ensures that detailed positional data from the servo can be recorded.

● GOT (HMI) operation recording

Record operation log and alarm history

Operation logs can be recorded in the GOT (HMI) and MELIPC MI3000 in sequence. Alarms related to various devices can be checked and archived.

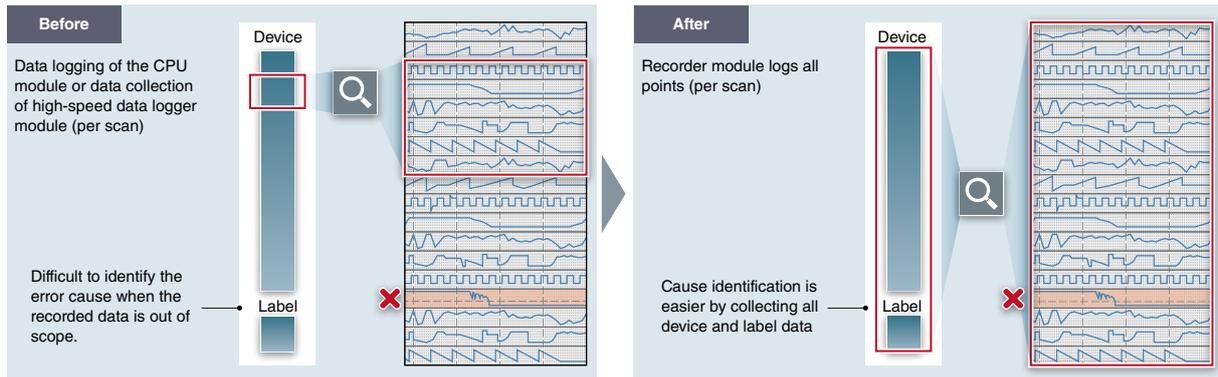
*1. Soon to be released

System-wide recording Control data

Device logging every (programmable controller) scan

① Logging of all device and label data

The MELSEC iQ-R Series recorder module collects all data per controller scan prior to and after an error event (together with a time-stamp). The cause of the error can be identified quickly since individual settings for recording specific devices and labels are unnecessary. Safety device logging will be supported.*1



② Minimal impact on the scan time

The recorder module is designed for logging of all device and label data before and after a trigger occurs. Influence on the CPU scan time is minimal as the execution load is separated. This can be ideal for ensuring determinism in a control system.

③ Easy setting

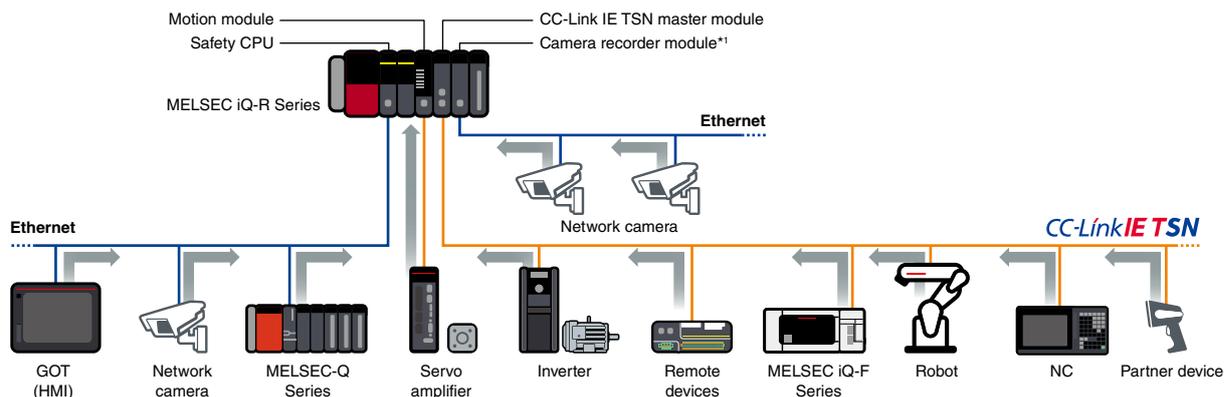
Setting of the trigger device to start recording before and after the event is only required irrespective of the device target recording range.

Label and function block logging (programmable controller)

Supporting structured programming enables the recording of not only devices but also labels. This eliminates concerns about physical device addresses and system configuration, easily identifying the errors point of origin.

CC-Link IE TSN networked device data with time-stamp*1

Manufacturing machines are equipped with various components consisting of servos, robots, inverters and remote devices in addition to the programmable controller. To facilitate the error cause identification between these networked devices, data (device data and labels) can be reproduced or played back in sequence by including a time-stamp. Making it is easier to understand and check the situation of these devices throughout the network.



*1. Soon to be released

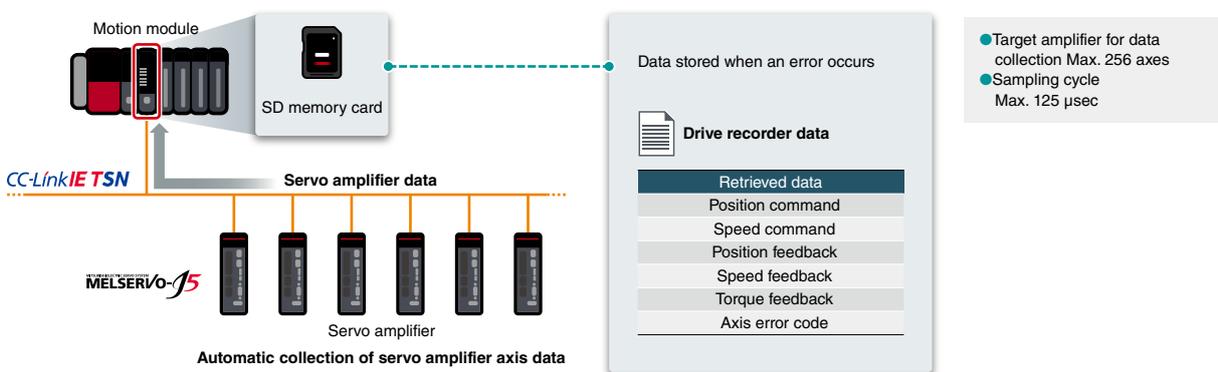
Collecting servo axis data in real-time

① Record all servo movement

Control data from the motion module can be collected even at high operating speeds. The data is collected using a time-stamp ensuring that detailed positional data can be grasped.

② Automatic collection without requiring a program

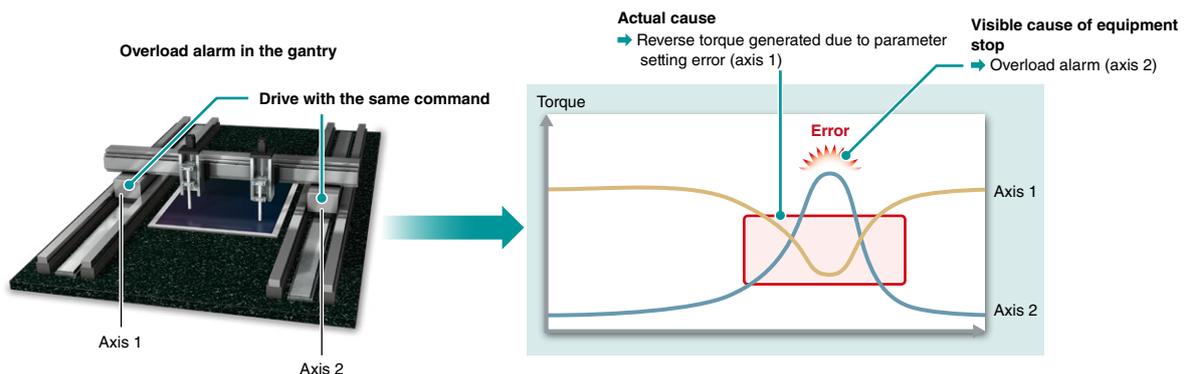
Motion data (speed, torque, and position) are automatically collected as log data between the MELSERVO-J5 Series servo amplifier and MELSEC iQ-R Series motion module without requiring any additional registration of parameters. Time-stamped data is saved in the motion modules SD memory card.



③ Troubleshooting utilizing entire system data

Troubleshooting is easier by collecting the entire systems servo axis data instead of just concentrating on one servo.

In the system below, when the equipment stops from an overload alarm in axis 2, an error cause can be found by checking the axis 1 data. It is apparent that the equipment stops due to reverse torque generated because of parameter setting error of axis 1.



Automatic saving to network-attached storage*1

As a logging data storage, a SD memory card of the recorder module and network storage such as NAS/computer can be selected. Extra tasks such as extracting logging data from the SD memory card and sending large-scale data in a separate file for engineers remotely are no longer required.

*1. Soon to be released

System-wide recording Event history

Event operation log

Sometimes an error may arise from sudden changes in data value from an external device or due to a mistake with an operator's procedure. Device and label operation from external devices can be recorded as historical events. This enables to accurately understand status changes specifically for each device and label.

No.	Occurrence Date	Event Type	Status	Event Code	Overview	Source	Start I/O No.
0000	2020/04/23 17:47:26.970	Operation	↓	H04011	Recording File Saving Completion	R08RCM6	0080
0007	2020/04/23 17:47:26.219	Operation	↓	H04030	File Saving Trigger Establishment	R08RCM6	0080
0008	2020/04/23 17:47:26.219	Operation	↓	H04040	Write Device in word unit(s) points	R32CPU	3E00
0009	2020/04/23 17:47:26.809	Operation	↓	H04031	Recording File Saving Completion	R08RCM6	0080
0010	2020/04/23 17:47:13.146	Operation	↓	H04030	File Saving Trigger Establishment	R08RCM6	0080
0011	2020/04/23 17:47:13.146	Operation	↓	H04040	Write Device in word unit(s) points	R32CPU	3E00
0012	2020/04/23 17:47:06.442	Operation	↓	H04030	Recording Operation Start	R08RCM6	0080
0013	2020/04/23 17:47:06.161	Operation	↓	H04030	Recording Operation Start	R32CPU	3E00

Recorded items
Operation from engineering tool
Device and label data registration via SLMP*1 Ethernet protocol
Device and label data registration using instructions (from external station or machine)
Device and label registration using "Simple CPU communications" (from external device)

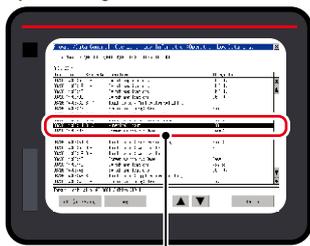
*1. SLMP: Seamless Message Protocol

Record operation log and alarm history

① Easier to identify error cause from operation log

Operation logs can be recorded in a SD or USB memory card from the GOT (HMI) in sequence. These logs can then be confirmed in the GOT (HMI) or MELIPC MI3000 on the shop floor. In addition to authentication, recording of specific operator logs can be identified easily.

Operation log list



Check log profile

Focus on log

Detailed log information

Date/Time	: 08/28/2014 14:06:11
Function	: NLM_VAL
Numerical Input	:
Screen No	: Base_2
Operation	:
Torque 1 set value	:
Operator	: Chiba (ID:1)
User ID	: -
Action No	: 1
Data Type	: BIN16
Device	: 6D1000
Change To	: 100
Change To(Oper.)	: 100
Chng From	: 10
Chng From(Disp)	: 10

Information showing operation logs

② Recording of system alarm history

System errors that have occurred are logged in the GOT (HMI) situated on the shop floor. Alarms related to each device with detailed logs showing specific network station number are supported. These features are ideal for large-scale systems.

System-wide recording Camera images

Utilize readily available network cameras

① Select network camera according to applications

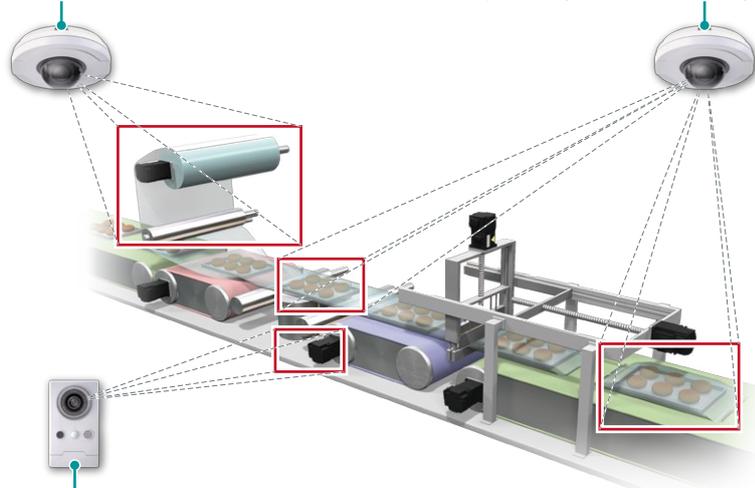
In addition to operation and alarm logs, visual representation of errors in the form of a video feed are useful for showing actual processes in operation enabling quick identification of a specific error or process issue. Network cameras can be installed around equipment and/or processes enabling a real-time video feed close to the application. By supporting readily available network cameras offers a broad choice of functions that maybe specific to an application, such as for process speed and environment (ambient temperature, humidity, and installation space).

Wide angle/fish-eye lens type:

Enables panoramic view of an entire production line

Optical zoom type: Provides detailed and vivid images

PTZ (Pan-Tilt-Zoom) type: Pre-registered positions allowing multiple areas with a single camera.



Modular type: Installable within control enclosures with limited space

Wireless type: Greater installation flexibility as communication cables are not required

Installation environment	Applicable cameras
<ul style="list-style-type: none"> Wide-area coverage capturing entire process area Recording personnel operations 	Wide angle/fish-eye lens type
<ul style="list-style-type: none"> Detailed view Multiple viewing positions 	Optical zoom type PTZ (Pan-Tilt-Zoom) type
<ul style="list-style-type: none"> Limited installation space Difficulty installing communications cabling 	Modular type Wireless type

Recommended network cameras:

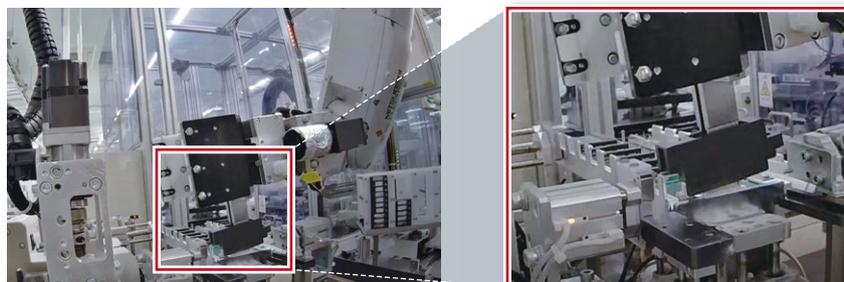
- AXIS COMMUNICATIONS (AXIS) Network camera^{*1}
- ONVIF Profile S compliant network camera^{*2}

*1. For more information, please contact your local Mitsubishi Electric sales office or representative.

*2. Soon to be released

② Enlarge images with optical zoom

Optical zooming of camera images enables more detail when images are unclear because of a lower resolution. Networked cameras can be installed at a distance from the process and zoom-in to specific areas of an application to provide higher resolutions when required.



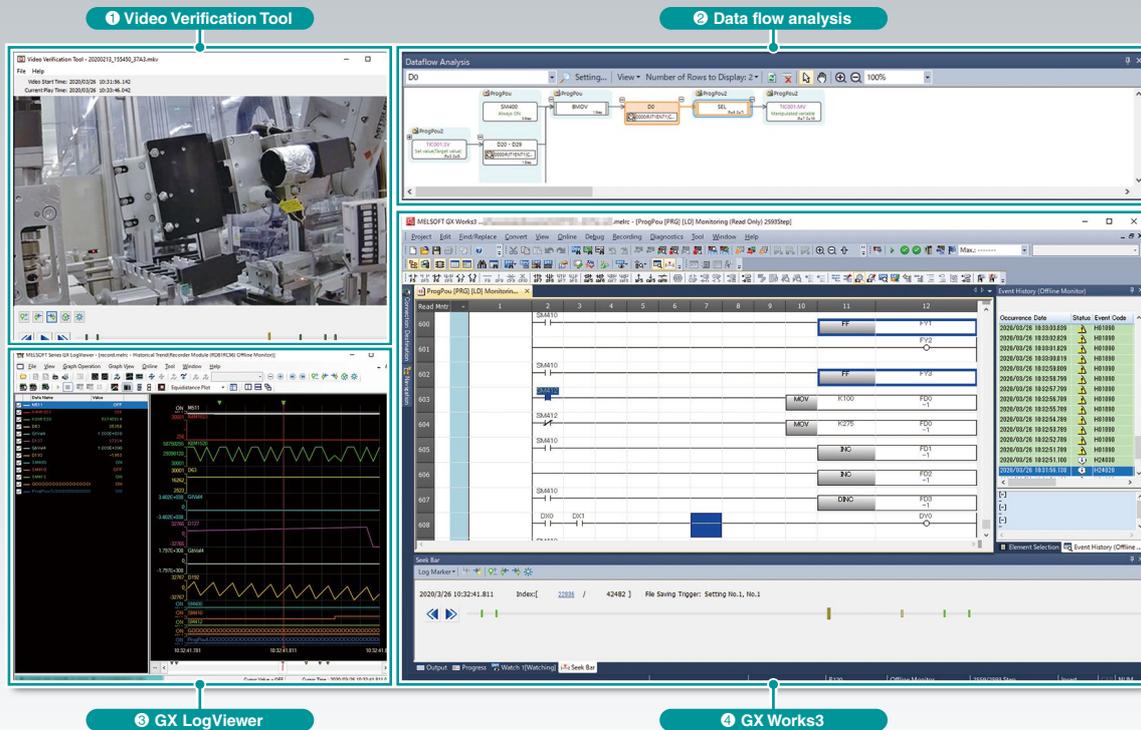
③ Long duration recording

Recording video feeds can require large storage capacity considering the frequency and amount of data being recorded. To overcome this the system recorder stores video feeds using the h.264 codec which compresses the data making space utilization more efficient. Together with the "video verification tool" feeds can be confirmed immediately.

④ Use external storage such as a NAS or computer

Network storage such as a NAS or computer can be used as storage for camera images on the shop floor.

Simplified analysis



Finding the root-cause for errors in manufacturing can be a laborious process involving many areas of the support chain. One of the difficult aspects of fault finding is to find out why a specific process or application is behaving irregularly and to pinpoint the cause of these faults. The system recorder has a range of tools that simplify analysis and enables the support engineer to understand the process clearly. Data (such as control data and device values in waveform) can be recorded in real-time and for long durations. In addition to this, camera video feeds are recorded. The relationship between data can be visually shown in a state representational diagram (data flow analysis) allowing the support engineer to playback or return to a specific timeline and confirm the behavior of devices. All software screens are synchronized providing a clear timeline of events. To further expand the scope of support, recording files can be accessed locally onsite or remotely and distributed to various key personnel within the support chain.

1 Video Verification Tool Visual confirmation of irregular process behavior

Recorded video feeds taken from networked cameras can be confirmed on either readily available video playback software or the dedicated video verification tool. The dedicated software is intuitive in its design with minimum risk of exposure to non-authorized personnel as it is separate from GX Works3.

2 Data flow analysis Relationship mapping between devices

Relationships between device and label data are shown as a flowchart on GX Works3. From here, engineers can highlight an area of concern and drill down to devices that are related to the original issue. Rather than combing through lines of logic program code, specific changes can be singled out pinpointing the actual code which is causing the data value.

3 GX LogViewer Device change analysis

Monitoring of device statuses can be done similar to an oscilloscope showing various data in waveform highlighting when a process is developing a fault.

4 GX Works3 Check between data changes and program offline

Relationship between changes in data values and the program can be easily confirmed offline.

Log marker function

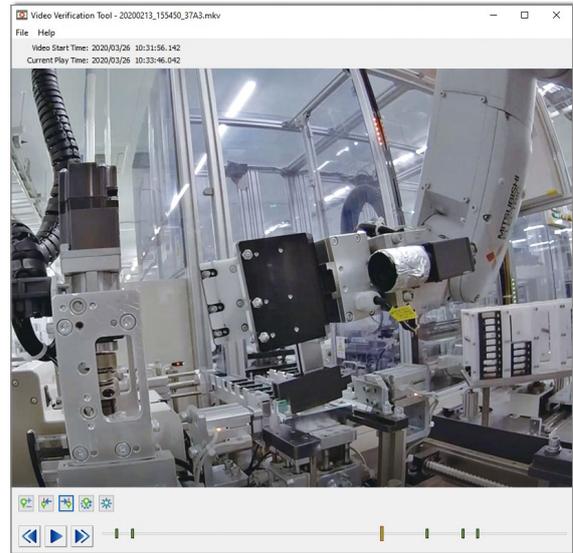
Faster cause analysis by synchronized video feed, program and waveform monitoring

1 Register milestone points on the timeline

Milestone points (log marker) can be added to the main video timeline enabling reference points for areas of concern. These points can be saved for later use or for distributing amongst other support personnel enabling multiple teams to analyze the problem area of the application.

2 Confirming video feed with collected data

Video feeds can be used to visually confirm areas that maybe causing errors together with the program. The milestone points (log marker) are synchronized with both GX Works3 and GX LogViewer including the Video Verification Tool offering a realistic view of the process together with the control data collected.

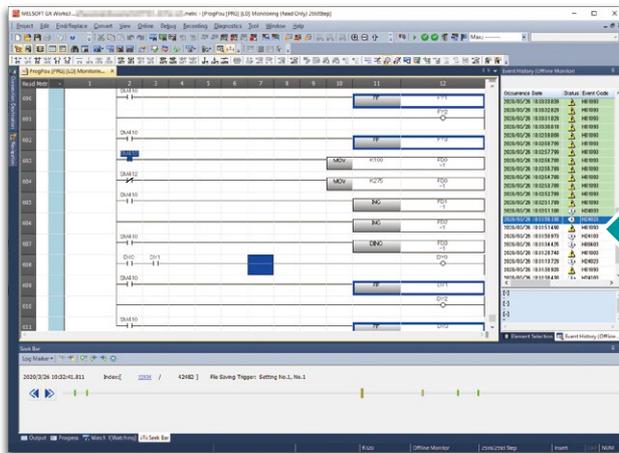


Camera video feed

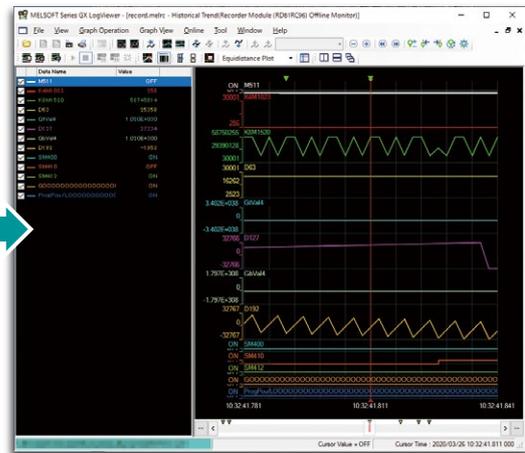
Offline monitoring

Synchronized playback of program and waveform data

Playback of data can be done very simply just by loading the recorded data into the engineering tool GX Works3, automatically executing all other necessary tools. Using the "seek bar" enables to jump back and forth within the timeline synchronizing data between both GX Works3 program monitoring (circuit monitor) and GX LogViewer (waveform display).



Program monitoring (circuit monitor)



Waveform display

② Data flow analysis

Data flow analysis function

① Device, label, and comments in flowchart format

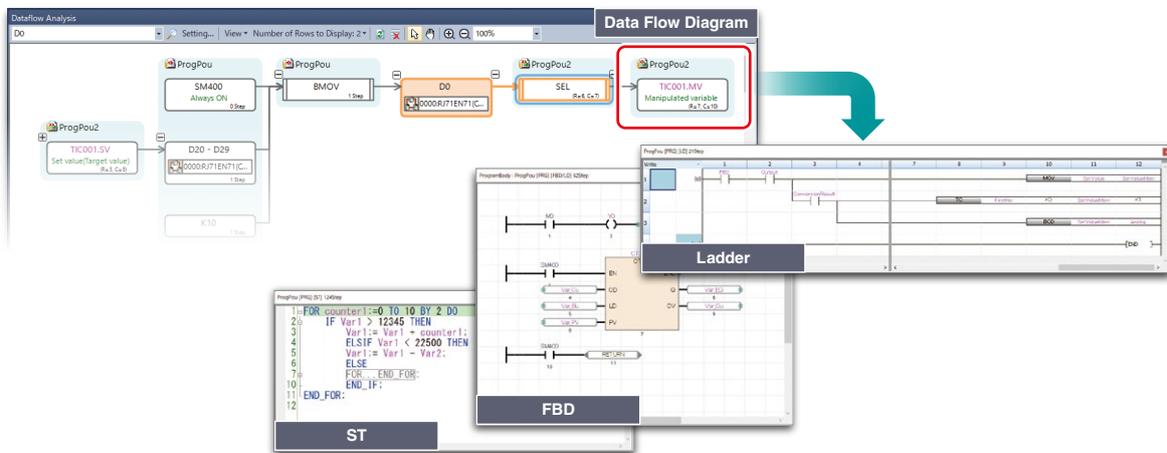
Device and label comments can be checked easily within the flowchart without needing to go to a separate screen.

② Display instruction name

The flow of the program can be tracked easily as instruction names are also displayed.

③ Main program languages supported

Analysis can be done for not only ladder programs but also for function block diagram (FBD), SFC (within ZOOM) and ST language programs.

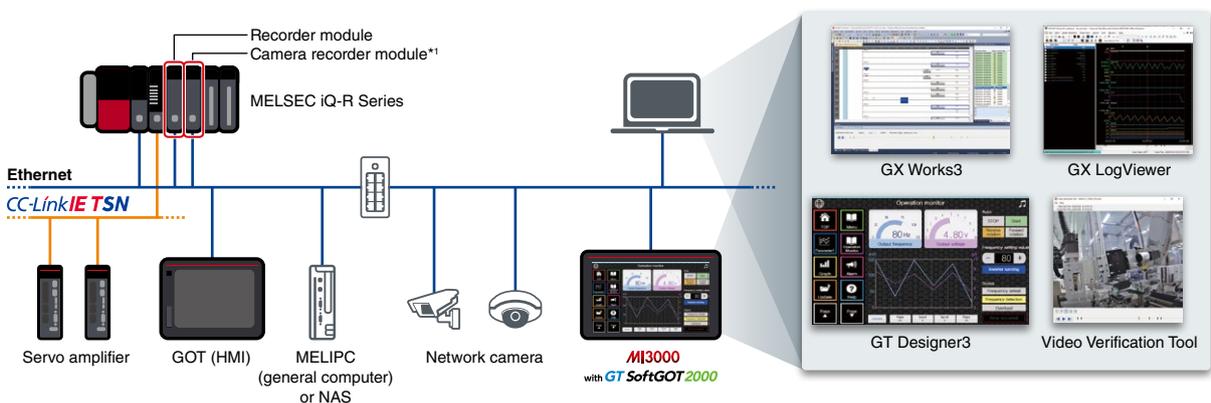


Troubleshooting using servo (axis) data

Troubleshooting of servo data can be done by correlation of the motion module and recorder module data. Certain alarms can be triggered where the torque limit is reached due to an irregular value change (of 0), for example.

Simplified analysis using panel computer

Multiple data can be reproduced on a panel computer such as the MELIPC MI3000 (embedded Windows® OS). Considering the panel computer is situated on the shop floor, various historical alarms and operation logs can be confirmed efficiently at the point where a problem occurs.



*1. Soon to be released

System recorder related products specifications

System-wide recording Recording function

Recorder module RD81RC96

Automatic collection of all device changes per controller scan time (with time-stamp) prior to and after an error occurs.

- Collect all device/label and event history data
- Easily register event trigger devices for logging and recording



RD81RC96

Recording function specifications

Item		RD81RC96
Number of settings		Up to 4
Save destination		SD memory card capacity (fixed), network storage*1
Recording method	Recording startup	File saving trigger, recording startup trigger
File saving trigger	Number of file saving trigger	Max. 16 per setting (4 settings x 16)
	File saving trigger	Device of the control CPU, elapsed time after completion of data collection
Recording target		Device/label, event history
Sampling time interval	Sampling method	Each scan, time specification, trigger instruction
Number of connectable modules		One recorder module per control CPU
Compatible CPU module		R04/08/16/32/120CPU, R04/08/16/32/120ENCPU*2

*1. Soon to be released

*2. Compatible CPU modules can be checked from product information. Please refer to System recorder device configuration on P.15, relevant manual, or technical news.

System-wide recording Servo system recorder

Motion module RD78GH RD78G

Servo amplifier MR-J5 Series

Automatic collection of all servo control system drive axes data from the motion module and servo amplifier when an error occurs. Can be used for easy troubleshooting based on command and feedback values.

- Collect servo system recorder data without programming
- Data collection of all drive system axes



MR-J5-G

RD78G

System-wide recording Network camera image recording

Camera recording package*3

The package consists of dedicated function blocks (FB) used for triggering the camera to initiate recording, saving the video files to network storage and a connection users guide.

Camera recording package specifications

Item		Camera recording package
Applicable cameras	Applicable cameras	AXIS COMMUNICATIONS (AXIS) Network camera*4
	Number of connectable cameras	Max. 16 (depending on the number of simultaneous open storage memory for sending/receiving data)*5
Save destination		Network storage
Included item	FB	Time setting, recording direction, virtual input port control
	Connection guideline	Commercially available network camera and connection and setup guideline for included FBs
Compatible CPU module	Embedded Ethernet port	R00/01/02CPU*6, R04/08/16/32/120CPU
	Embedded Ethernet port (CPU part only)	R04/08/16/32/120ENCPU

*3. For information on obtaining the package, please contact your local Mitsubishi Electric sales office or representative.

*4. For details of compatible camera, please refer to the technical news (FA-A-0306).

*5. For more information, please refer to MELSEC iQ-R Ethernet/CC-Link IE User's Manual (Startup) (SH-081256ENG).

*6. R00/01/02CPU do not support recording function of the RD81RC96, therefore linkage with the camera recording images is not supported.

System-wide recording Camera recorder module*1

Recorder module with embedded camera recording function.

Camera recorder module specifications

Item		Camera recorder module
Recording function		Equivalent to recorder module RD81RC96
Applicable cameras	Applicable cameras	ONVIF Profile S compliant network camera
	Number of connectable cameras	Not yet determined
Save destination		SD memory card, network storage

*1. Soon to be released

Simplified analysis Offline monitor

■ GX Works3, GX LogViewer, GT Designer3

Programmable controller program, GOT (HMI) operation log and servo axis data recorded in the motion module can be synchronized (event sequence) making it easier to visualize an error.

Offline monitor specifications

Item		Offline monitor
Play	Waveform data	Selected device, label (GX LogViewer*2)
	Control program	Ladder diagram, ST, FBD/LD program (GX Works3*2)
	Axis data	Drive recorder data*3 (GX LogViewer*2)
	Operation log of GOT (HMI)	Resource data (GT Designer3*2)
Operation bar/seek bar		Move by seek bar
Monitor function		Device block monitor, watch window, program monitor
Change point search		Conditional search, display in a list (GX LogViewer*2)
Waveform display		Selected device/label displayed in waveform (GX LogViewer*2)
	Device/label to be displayed	Max. 32

*2. GX Works3 Ver.1.065T or later, GX LogViewer Ver.1.106K or later, GT Designer3 Ver.1.236W or later

*3. MR Configurator2 is required for setting motion module axis data collection.

Simplified analysis Camera image replay function

■ Video Verification Tool*4

Recorded video feeds taken from networked cameras can be confirmed on either readily available video playback software or the dedicated Video Verification Tool.

Camera image replay function specifications

Item	Camera image replay function
Camera image replay	Play/pause, play forward/backward one frame, jump to the marked image, specify the image to play by moving the slider (Video Verification Tool)
Compatible file format	.mkv
Image resolution (pixel)	320 x 240, 640 x 480, 1280 x 720, 1920 x 1080

*4. For information on how to obtain the software, please contact your local Mitsubishi Electric sales office or representative.

Simplified analysis Log marker function

■ GX Works3, GX LogViewer, Video Verification Tool

Milestone points (log marker) can be added to the main video timeline enabling reference points for areas of concern. These points are synchronized with both GX Works3 and GX LogViewer including the Video Verification Tool.

Log marker function specifications

Item	Log marker function
Marking	Add/delete marking position, read log marker information, jump to the marking position (Video Verification Tool, GX Works3, GX LogViewer*1)

*1. GX Works3 Ver.1.065T or later, GX LogViewer Ver.1.106K or later

Simplified analysis Data flow analysis

■ GX Works3*2

Device/label data that have an area of concern can be easily selected from the flowchart, highlighting the relevant part of the program affecting the data value change.

Data flow analysis specifications

Item	Data flow analysis	
Analysis target device	User device, system device, link direct device, module access device, CPU buffer memory access device, index register, file register, refresh data register, nesting, pointer, etc.	
Analysis target label	Label	Global label, local label, module label, system label
	Modified label	Structure, array
Analysis target program	Programming language	Ladder diagram, ST, FBD/LD, SFC (within ZOOM)
	POU	Function block, function

*2. GX Works3 Ver.1.065T or later, GX LogViewer Ver.1.106K or later

System recorder device configuration

Basic configuration

Logging of all device and label data

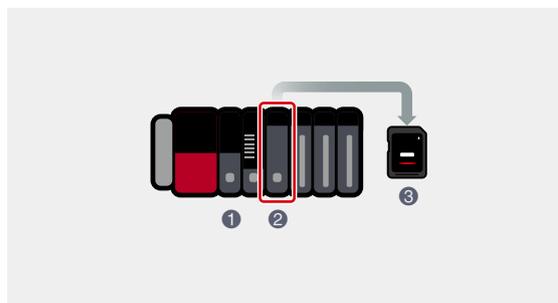
- ① MELSEC iQ-R Series CPU module*1
- ② Recorder module*2
- ③ SD memory card

*1. CPU modules with product information (first four digits) stated below support logging of all device and label data.

Model	Product information	Model	Product information
R04CPU	##19 or later	R04ENCPU	##32 or later
R08CPU	##20 or later	R08ENCPU	##30 or later
R16CPU	##20 or later	R16ENCPU	##27 or later
R32CPU	##17 or later	R32ENCPU	##30 or later
R120CPU	##17 or later	R120ENCPU	##22 or later

For how to check product information, please refer to the MELSEC iQ-R Module Configuration Manual SH-081262ENG.

*2. GX Works3 (Ver.1.065T or later) is necessary for recording setting and module setting.



Basic configuration + Camera recording package

Recording by logging + program

- ① MELSEC iQ-R Series CPU module*3
- ② Network camera*4
- ③ Camera recording package (FB and guideline)
- ④ Recorder module
- ⑤ SD memory card
- ⑥ Network storage (such as NAS)
- ⑦ PoE switching hub (IEEE802.3at (PoE+) compliant)*5

*3. CPU modules with product information (first four digits) stated below support logging of all device and label data.

Model	Product information	Model	Product information
R04CPU	##19 or later	R04ENCPU	##32 or later
R08CPU	##20 or later	R08ENCPU	##30 or later
R16CPU	##20 or later	R16ENCPU	##27 or later
R32CPU	##17 or later	R32ENCPU	##30 or later
R120CPU	##17 or later	R120ENCPU	##22 or later

For how to check product information, please refer to the MELSEC iQ-R Module Configuration Manual SH-081262ENG.

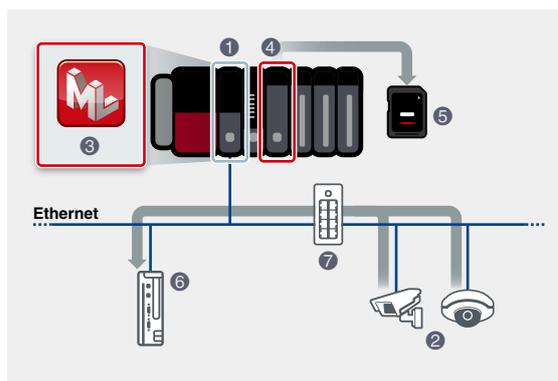
To use camera image recording only, below CPU modules can be used.

• R00/01/02/04/08/16/32/120CPU, R04/08/16/32/120ENCPU (no restriction to product information)

To use R□ENCPU, connect to the Ethernet port on the CPU side.

*4. For details of compatible AXIS COMMUNICATIONS (AXIS) Network cameras, please refer to the technical news (FA-A-0306).

*5. PoE: Power over Ethernet



Basic configuration + Camera recorder module*6

Easier recording by logging + module*6

- ① MELSEC iQ-R Series CPU module*7*8
- ② Network camera*9
- ③ Camera recorder module*8
- ④ SD memory card or network storage (such as NAS)
- ⑤ PoE switching hub (IEEE802.3at (PoE+) compliant)

*6. Soon to be released

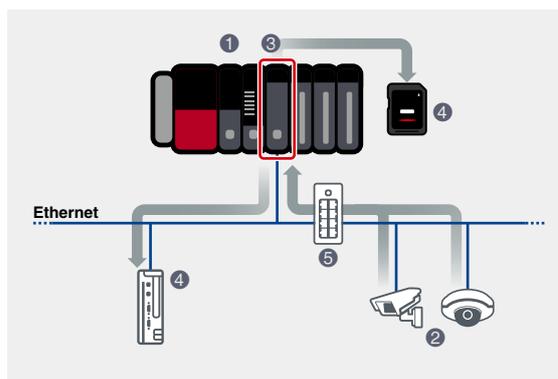
*7. CPU modules with product information (first four digits) stated below support logging of all device and label data.

Model	Product information	Model	Product information
R04CPU	##19 or later	R04ENCPU	##32 or later
R08CPU	##20 or later	R08ENCPU	##30 or later
R16CPU	##20 or later	R16ENCPU	##27 or later
R32CPU	##17 or later	R32ENCPU	##30 or later
R120CPU	##17 or later	R120ENCPU	##22 or later

For how to check product information, please refer to the MELSEC iQ-R Module Configuration Manual SH-081262ENG.

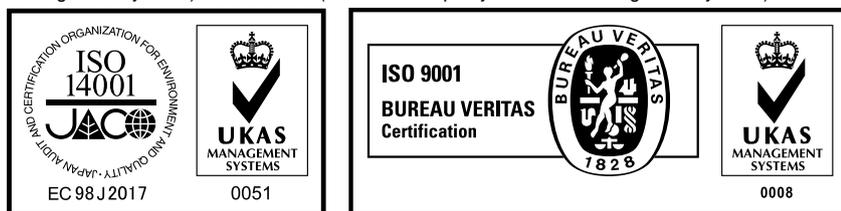
*8. GX Works3 is necessary for recording setting and module and camera setting (not yet supported).

*9. ONVIF Profile S compliant network camera



Country/Region	Sales office	Tel/Fax
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.	Tel : +1-847-478-2100 Fax : +1-847-478-2253
Mexico	MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch Boulevard Miguel de Cervantes Saavedra 301, Torre Norte Piso 5, Ampliacion Granada, Miguel Hidalgo, Ciudad de Mexico, Mexico, C.P.115200	Tel : +52-55-3067-7512
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMERCIO E SERVICOS LTDA. Avenida Adelino Cardana, 293, 21 andar, Bethaville, Barueri SP, Brasil	Tel : +55-11-4689-3000 Fax : +55-11-4689-3016
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-7780
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, UK-Hatfield, Hertfordshire, AL10 8XB, U.K.	Tel : +44-1707-28-8780 Fax : +44-1707-27-8695
Ireland	MITSUBISHI ELECTRIC EUROPE B.V. Irish Branch Westgate Business Park, Ballymount, Dublin 24, Ireland	Tel : +353-1-4198800 Fax : +353-1-4198890
Italy	MITSUBISHI ELECTRIC EUROPE B.V. Italian Branch Centro Direzionale Colleoni - Palazzo Sirio, Viale Colleoni 7, 20864 Agrate Brianza (MB), Italy	Tel : +39-039-60531 Fax : +39-039-6053-312
Spain	MITSUBISHI ELECTRIC EUROPE, B.V. Spanish Branch Carretera de Rubi, 76-80-Apdo. 420, E-08190 Sant Cugat del Valles (Barcelona), Spain	Tel : +34-935-65-3131 Fax : +34-935-89-1579
France	MITSUBISHI ELECTRIC EUROPE B.V. French Branch 25, Boulevard des Bouvets, 92741 Nanterre Cedex, France	Tel : +33-1-55-68-55-68 Fax : +33-1-55-68-57-57
Czech Republic	MITSUBISHI ELECTRIC EUROPE B.V. Czech Branch, Prague Office Pekarska 621/7, 155 00 Praha 5, Czech Republic	Tel : +420-255-719-200
Poland	MITSUBISHI ELECTRIC EUROPE B.V. Polish Branch ul. Krakowska 48, 32-083 Balice, Poland	Tel : +48-12-347-65-00
Sweden	MITSUBISHI ELECTRIC EUROPE B.V. (Scandinavia) Hedvig Mollersgata 6, 223 55 Lund, Sweden	Tel : +46-8-625-10-00 Fax : +46-46-39-70-18
Russia	MITSUBISHI ELECTRIC (RUSSIA) LLC St. Petersburg Branch Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; 195027 St. Petersburg, Russia	Tel : +7-812-633-3497 Fax : +7-812-633-3499
Turkey	MITSUBISHI ELECTRIC TURKEY A.S Umraniye Branch Serifali Mahallesi Nutuk Sokak No:5, TR-34775 Umraniye/Istanbul, Turkey	Tel : +90-216-526-3990 Fax : +90-216-526-3995
UAE	MITSUBISHI ELECTRIC EUROPE B.V. Dubai Branch Dubai Silicon Oasis, P.O.BOX 341241, Dubai, U.A.E.	Tel : +971-4-3724716 Fax : +971-4-3724721
South Africa	ADROIT TECHNOLOGIES 20 Waterford Office Park, 189 Witkoppen Road, Fourways, South Africa	Tel : +27-11-658-8100 Fax : +27-11-658-8101
China	MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Shanghai, China	Tel : +86-21-2322-3030 Fax : +86-21-2322-3000
Taiwan	SETSUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. 7F to 9F, Gangseo Hangang Xi-tower A, 401, Yangcheon-ro, Gangseo-Gu, Seoul 07528, Korea	Tel : +82-2-3660-9569 Fax : +82-2-3664-8372
Singapore	MITSUBISHI ELECTRIC ASIA PTE. LTD. 307 Alexandra Road, Mitsubishi Electric Building, Singapore 159943	Tel : +65-6473-2308 Fax : +65-6476-7439
Thailand	MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD. 12th Floor, SV.City Building, Office Tower 1, No. 896/19 and 20 Rama 3 Road, Kwaeng Bangpongpan, Khet Yannawa, Bangkok 10120, Thailand	Tel : +66-2092-8600 Fax : +66-2043-1231-33
Vietnam	MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED Unit 01-04, 10th Floor, Vincom Center, 72 Le Thanh Ton Street, District 1, Ho Chi Minh City, Vietnam	Tel : +84-28-3910-5945 Fax : +84-28-3910-5947
Indonesia	PT. MITSUBISHI ELECTRIC INDONESIA Gedung Jaya 8th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia	Tel : +62-21-31926461 Fax : +62-21-31923942
India	MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune-411026, Maharashtra, India	Tel : +91-20-2710-2000 Fax : +91-20-2710-2100
Australia	MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD. 348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia	Tel : +61-2-9684-7777 Fax : +61-2-9684-7245

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MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
www.MitsubishiElectric.com