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FATEC

Mitsubishi Programmable Controllers Training Manual Q Maintenance (for GX Works2)

● Safety Precautions ●

(Please read the precautions carefully before carrying out practical training.)

Read the relevant manuals and pay careful attention to safety when designing the system.
When carrying out practical work, pay sufficient attention to the following points and handle the device properly.

[Practical training precautions]

◇WARNING
● To avoid electric shock, do not touch the terminal while the power is on.   ● When opening a safety cover, make sure that the power supply is disconnected or ensure sufficient safety before carrying out the work.

⚠CAUTION
● Follow the instructor's instructions to carry out practical training.   ● Do not remove the training machine module or change the wiring without prior consent.   Doing so may cause failure, malfunction, injury, or fire.   ● Turn the power supply OFF before removing or installing a module.   Removing or installing while the power is ON may cause module failure or electric shock.   ● If the training machine emits an abnormal odor or an abnormal sound, press the "Power switch" or "Emergency switch" to stop the device.   ● When an error occurs, contact the instructor immediately.

● Safety Precautions
(Q Series Programmable Controllers) ●

(Please read the precautions carefully before use.)

When using a Q series programmable controller, please read the Q Series Programmable Controller Manual carefully and pay sufficient attention to safety and handle the device properly.
In this manual, the safety precaution levels are classified under "WARNING" and "CAUTION".

◇WARNING	Incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.

Note that the ⚠ CAUTION level may lead to a serious consequence according to conditions.
Please follow the instructions of both levels because they are important to personnel safety.

[Design precautions]

◇WARNING

● Configure a safety circuit outside the programmable controller so that the entire system can operate safely even when an external power supply error or a programmable controller failure occurs. Failure to do so may cause an incorrect output or malfunction, resulting in accidents.
  (1) Configure safety circuits such as an emergency stop circuit, protection circuit, interlock circuit for opposite operations such as forward/reverse rotations or interlock circuit for machine damage protection such as upper/lower limits for positioning outside the programmable controller.
  (2) When the programmable controller detects the following error status, it will stop operations and turn OFF all outputs in the case of (a).
  In the case of (b), it will hold or turn OFF all outputs according to the parameter setting.
  Note that the AnS series module will turn off the output in either case (a) or (b).

	Q series modules	AnS series modules
(a) When overcurrent protection or overvoltage protection of the power supply module works	Output OFF	Output OFF
(b) When the programmable controller CPU detects a watchdog timer error and the like in the self-diagnostics function	All outputs will be retained or OFF, depending on parameter setting	Output OFF

  When an error occurs at the I/O control part where the programmable controller CPU cannot detect, all outputs can be turned ON. Configure a fail-safe circuit or some mechanism outside the programmable controller so that the machine operates safely in such a case. For a fail-safe circuit example, refer to "Safety Design Using a Fail-safe Circuit" on this manual.
  (3) Outputs may remain ON or OFF due to a failure of an output module relay or transistor. Configure an external circuit for monitoring output signals that may lead to a serious accident.

[Design precautions]

⟨!⟩WARNING

- Configure a safety circuit such as a fuse outside the output module because smoke or fire may result if a load current exceeding the rated current or an overcurrent caused by load short flows continuously for a long time.

- Configure a circuit so that an external power supply will be turned on after the start-up of the programmable controller.
  If the external power supply is turned on first, an incorrect output or malfunction may occur, resulting in accidents.

- For the operating status of each station during data link communication error, refer to each data link manual.
  Failure to do so may cause an incorrect output or malfunction, resulting in accidents.

- When controlling (changing data) the running programmable controller from a peripheral connected to the CPU module or from a personal computer connected to an intelligent function module or special function module, configure an interlock circuit in the sequence program to ensure that the entire system will always operate safely.
  For other operations (program modification, operating status change (status control)) to the running programmable controller, read relevant manuals carefully and ensure the safety before operation.
  Ensure the safety especially when controlling the remote programmable controller from eternal devices because trouble occurred on the programmable controller side may not be responded immediately due to data communication error.
  Along with configuring an interlock circuit in a sequence program, determine the system's corrective actions to be taken between external devices and the programmable controller CPU in case of a data communication error.

⚠CAUTION

- Do not bundle or adjacently place the control line or a communication cable with the main circuit or a power cable.
  Keep a distance of approximately 100 mm or more between them.
  Failure to do so may cause malfunction due to noise.

- When a device such as a lamp load, heater, or solenoid valve is controlled through an output module, a large current (approximately 10 times greater than normal) may flow when the output is turned OFF → ON. Take measures such as replacing the module with one having a sufficient rated current.

[Installation precautions]

⚠ CAUTION
● Use the programmable controller in an environment that meets the general specifications described in this manual. Failure to do so may cause electric shock, fire, malfunction, or damage to or deterioration of the product. ● While pressing down the module mounting lever in the lower part of the module, insert the module fixing projections into the fixing holes on the base unit completely. Mount the module as above with the module fixing holes as a support. Incorrect mounting may cause malfunction, failure or drop of the module. When using the programmable controller in an environment of frequent vibrations, fix the module with a screw. Tighten the screws within the specified torque range. A screw that has been tightened too loosely may cause a drop, short-circuit, or malfunction. A screw that has been tightened too tightly may cause a drop, short-circuit, or malfunction due to the screw or module breakage. ● When using an extension cable, connect it to the extension cable connector of the base unit securely. Check it after mounting. Poor connection may cause incorrect input or output. ● When using a memory card, insert it securely, pressing it to the memory card mounting slot. Check it after mounting. Poor connection may cause malfunction. ● Switch off all phases of the external power supply used in the system before mounting or removing a module. Failure to do so may damage the product. A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting online module change is used. Note that there are restrictions on the modules that can be replaced online (while power is on), and each module has its predetermined replacement procedure. For details, refer to the section of online module change in this manual or the manuals of modules that support online module change. ● Do not directly touch any conductive part of the module. Doing so can cause malfunction or failure of the module.

[Wiring precautions]

◇ WARNING
● Be sure to switch off all phases of the external power supply used by the system before wiring work. Failure to do so may cause electric shock or damage the product. ● When turning on the power and operating the module after wiring is completed, always attach the enclosed terminal cover. The absence of the terminal cover may cause electric shock.

[Wiring precautions]

⚠CAUTION

- Ensure to ground the FG and LG terminals of the programmable controller with the ground resistance of 100Ω or less for the exclusive use.
  Failure to do so may cause electric shock or malfunction.

- Before wiring the module, confirm the rated voltage and terminal layout of the product to wire correctly.
  Connection to a power supply with different ratings or incorrect wiring may cause fire or failure.

- Crimp or solder external connectors correctly using tools specified by the manufacturer.
  Incomplete connection may cause short-circuit, fire, or malfunction.

- Tighten the terminal screws within the specified torque range.
  A terminal screw that has been tightened too loosely may cause short-circuit, fire, or malfunction.
  A terminal screw that has been tightened too tightly may cause a drop, short-circuit, or malfunction due to the screw or module breakage.

- Be careful to prevent foreign matter such as sawdust or wiring chips from entering the module.
  Failure to do so may cause fire, failure, or malfunction.

- The top surface of the module is covered with protective film to prevent foreign matter such as wiring chips from entering the module when wiring.
  Do not remove this film during wiring.
  Before operating the system, be sure to remove this film to dissipate heat.

[Startup and maintenance precautions]

◇WARNING

- Do not touch any terminal while power is on.
  Doing so may cause an electric shock.

- Connect the battery correctly.
  Do not charge, disassemble, heat, short-circuit, or solder the battery, or throw it into the fire.
  Mishandling the battery may cause heat, burst, or ignition, resulting in injury or fire.

- Switch off all phases of the external power supply used in the system before cleaning the module or retightening the terminal screws or module fixing screws.
  Failure to do so may cause electric shock.
  A terminal screw that has been tightened too loosely may cause a short circuit or malfunction.
  A terminal screw that has been tightened too tightly may cause a drop, short-circuit, or malfunction due to the screw or module breakage.

[Startup and maintenance precautions]

⚠ CAUTION

- When performing online operations (especially when performing program modification, forced output, and operating status change) for the running CPU from the peripheral device, read the manual carefully and ensure the safety before operation.
  Improper operation may cause machine damage or accident.

- Do not disassemble or modify the modules.
  Doing so may cause failure, malfunction, injury, or a fire.

- Use any wireless communication device such as a cellular phone or PHS (Personal Handy-phone System) more than 25 cm away in all directions from the programmable controller.
  Failure to do so may cause malfunction.

- Switch off all phases of the external power supply used in the system before mounting or removing a module. Failure to do so may cause a failure or malfunction of the module.
  A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting online module change is used.
  Note that there are restrictions on the modules that can be replaced online (while power is on), and each module has its predetermined replacement procedure.
  For details, refer to the section of online module change in this manual or the manuals of modules that support online module change.

- After the first use of the product, do not mount/remove the modules to/from the base unit more than 50 times. (JIS-B3502 compliant)
  Exceeding the limit of 50 times may cause malfunction.

- Do not drop or apply shock to the battery to be installed in the module.
  Doing so may damage the battery, causing the battery fluid to leak inside the battery.
  If the battery is dropped or any shock is applied to it, dispose of it without using.

- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body.
  Failure to do so may cause module failure or malfunction.

[Disposal precautions]

⚠ CAUTION

- Dispose of this product as industrial waste.

[Transportation precautions]

⚠ CAUTION
● When transporting lithium batteries, follow the transportation regulations.

● Safety Precautions (GX Works2) ●

(Please read the precautions carefully before use.)

When using the integrated FA software (GX Works2 Version 1), please read carefully the GX Works2 operating manual and related manuals referenced in this manual. Pay sufficient attention to safety and handle the software properly.
In this manual, the safety precaution levels are classified under "WARNING" and "CAUTION".

| ◇WARNING | Incorrect handling may cause hazardous conditions, resulting in death or severe injury. |
| ⚠CAUTION | Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage. |

Note that the ⚠ CAUTION level may lead to a serious consequence according to conditions.
Please follow the instructions of both levels because they are important to personnel safety.

[Design precautions]

◇WARNING

- When data change, program change, or status control is performed from a personal computer to a running programmable controller, configure an interlock circuit outside the programmable controller system to ensure that the entire system will always operate safely.
  Furthermore, for the online operations performed from a personal computer to a programmable controller CPU, predetermine the system's corrective actions in case of a communication error caused by poor cable connection, etc.

[Startup and maintenance precautions]

⚠CAUTION

- When performing online operations (program change while a programmable controller CPU is running, forced input/output operation, operating status changes such as RUN-STOP, and remote control operation) for the running programmable controller CPU from a personal computer, read the manual carefully and ensure sufficient safety before operation. When changing a program while a programmable controller CPU is running (online program change), a problem such as program corruption may occur depending on operating conditions. Fully understand the precautions described in Section 12.9 of the GX Works2 Version 1 Operating Manual (Common) (refer to Appendix 1 of this school text) before use.
- Refer to the manual of each module before performing online module change because only limited modules allow online module change.

Revisions

Introduction

This text is intended to give necessary background information and how to use a peripheral personal computer (GX Works2) for maintenance of the MELSEC-Q series.

<The following are related materials>

Manual name	Manual number (Model code)
QCPU User's Manual (Hardware Design, Maintenance and Inspection) 　　Description of specifications such as the CPU module, power supply module, base unit, extension cable, and memory card is provided.	SH-080483ENG (13JR73)
GX Works2 Version 1 Operating Manual (Common) 　　Description of common functions between simple project and structured project such as system configuration of GX Works2, parameter setting, operation methods for online functions is provided.	SH-080779ENG (13JU63)
GX Works2 Version 1 Operating Manual (Simple Project) 　　Description of operation methods such as program creation and monitoring in a GX Works2 simple project is provided.	SH-080780ENG (13JU64)

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Chapter 1: Importance of Production Maintenance

If a production system stops because of failure or power failure, a loss proportional to the stop time occurs.
Therefore, it is required to design an equipment system to prevent [stop because of failure] or [stop because of power failure] from occurring.
The important issue is how the production system can quickly be restored if the system stops by any chance. Therefore, the maintenance staff group is assigned to each factory for improving availabilities of the production systems.

1.1 Importance of Maintenance

In recent production systems, a lot more machinery equipment adopts the mechatronics technology and systems are becoming more complex and significantly sophisticated. Also, using black box systems for equipment is becoming increasingly common. For these reasons, the maintenance quality is relatively decreasing, making improvement in system availability difficult.
Therefore, [highly reliable products] and [increased level of maintenance technology] are strongly required.

```
                    Standard production system
                   ┌──────────────┴──────────────┐
                   ▼                              ▼
         Mechatronics of machinery      Complicated and highly-developed
            and equipment                     production system
                   │                              │
                   ▼                              ▼
         Black boxing of the equipment    Decrease in relative
                                            maintenance level
                   │                              │
                   ▼                              ▼
         Highly reliable product          Increasing the level of
               application                 maintenance technology
                   │                              │
                   └──────────────┬──────────────┘
                                  ▼
                        Realization of highly reliable
                             production system
```
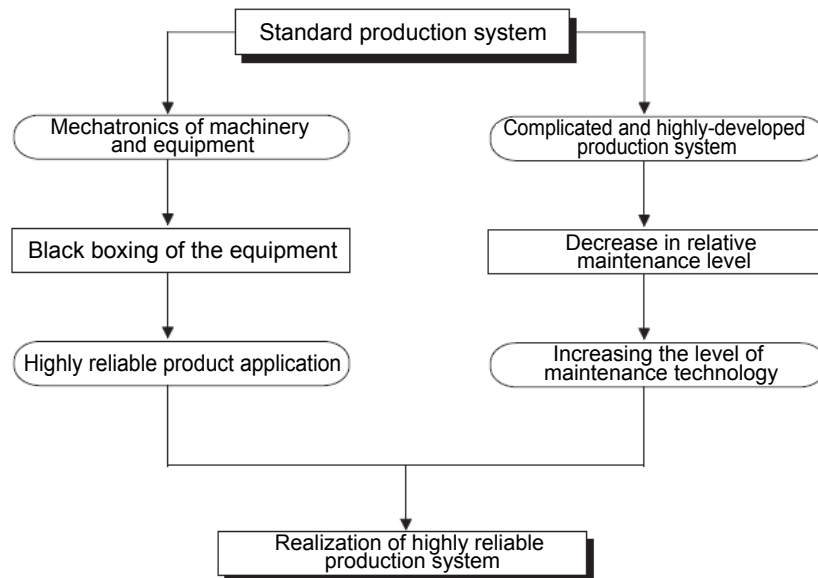
1.2 Maintenance System

In order to achieve a highly reliable production system, it is important to have an established maintenance system in place.
The following shows an outline of a maintenance system.

```
Production
maintenance
    │
    ├── Maintenance        When developing new machinery, give due consideration to
    │   measure            maintenance measures at the designing stage.
    │   design
    │
    ├── Preventive         Preventive maintenance of the machinery is carried out if the
    │   maintenance        machinery is prone to financial losses or serious disasters due to
    │                      failures or accidents, and if it is beneficial to carry out preventive
    │                      maintenance of such machinery. Also perform maintenance actions
    │                      for predictable failures and accidents before such incidents occur.
    │      │
    │      ├── Daily maintenance    Perform daily inspection to detect any dangerous
    │      │   and inspection       conditions that may cause breakdown of the
    │      │                        production system due to failure or any detrimental
    │      │                        decrease in performance.
    │      │
    │      ├── Periodic maintenance  Perform regular inspection to detect any dangerous
    │      │   and inspection        conditions that may cause breakdown of the
    │      │                         production system due to failure or any detrimental
    │      │                         decrease in performance.
    │      │
    │      └── Condition-based      Monitor the status to detect any dangerous
    │          maintenance          conditions that may cause breakdown of the
    │                               production system due to failure or any detrimental
    │                               decrease in performance.
    │
    ├── Corrective         Corrective maintenance is carried out when it is easier to
    │   maintenance        repair equipment after it has broken down (such as digital
    │                      displays, CRTs, all types of lamps) due to accidents.
    │
    └── Maintenance for    This maintenance is carried out to minimize degradation of
        improvement        installed machinery and to simplify the inspection process.
```

1.3 Maintenance Plan

In production systems, the recovery time can be long, and improvements in system availability cannot be expected if repairs are considered only after a failure occurs.

Therefore, a maintenance plan is developed from when a production system is implemented, and efficient maintenance is conducted.

In order to quickly restore the system after a failure occurs, it is necessary to systematically execute the contents of the following table.

Table1-1: Maintenance Plan of the Programmable Controller System

Plan item		Description
Maintenance training	Knowledge of the programmable controller	• Fundamental knowledge of principle, function, performance, etc. of the programmable controller • Characteristics of the programmable controller (difference from a calculator, relay, etc.) • Position of the programmable controller (sequence control, and control function of data collection and distribution) • Introductory state of the programmable controller (usage in your own department etc.) • Description of the type of machine installed (introduced) (model, function, performance, characteristics, etc. of the programmable controller used)
	Maintenance scope and technology	• Knowledge about maintenance related to the programmable controller (characteristics of the programmable controller from a maintenance perspective, and maintenance items of the programmable controller) • Precautions for maintenance of the programmable controller (handling method, key points of maintenance, etc.)
	Training	• Functions related to maintenance of the programmable controller (self-diagnostics function, RAS function, etc.) • Functions related to maintenance of peripherals (troubleshooting function, etc.) • Practical training of troubleshooting (operation of peripherals, replacement of hardware, etc.)
Maintenance timing	Specify the target type, etc., of preventive maintenance and corrective maintenance, and determine the implementation timing.	
Maintenance equipment	Preparation of spare parts, components, measuring instruments, measurement equipment, etc. for maintenance	
Maintenance procedure	Prepare the manuals, etc., and clearly define the implementation method and a description.	
Maintenance staff	Determine the staff procurement, positions, assigned areas, etc.	
Maintenance method improvement	Study to improve the maintenance methods, etc.	
Understanding a service and support system of the programmable controller	After-sales service	• Service base (location, address, person in charge, etc.) • Service range (target model, handling range, etc.) • Service time (start/end time, turnaround time, emergencies, etc.) • Service period (free service period, handling at the time of paid service, etc.) • Spare parts supply period (repair after discontinuing production, supply period, etc.) • Measures against discontinuance of production (contents of discontinuance declaration, repair period, etc.) • Time required for repair (standard delivery, short term/long term deliveries, etc.)
	Technical support	• Support base (location, address, person in charge, etc.) • Support range (target model, hardware/software, and system) • Support method (telephone, FAX, visit, school, and actual machine operation) • Manual (manual effective for maintenance)

1.4 Management of Maintenance Documents

In order to quickly restore after the failure, it is necessary to organize and manage the documents as shown in the following table.

Table 1-2: Maintenance-related Documents to Manage

Document classification	Name of document	Description
System-specific documents	System and control specifications documents	Documents describing the functions and operations of a target system and control (sequence and timing of operation, operation condition, operation procedure, and interlock condition)
	Network connection diagram	Documents illustrating how modules are connected with communication cables
	Electrical wiring diagrams	Schematic diagrams (power supply circuit, motor circuit, control circuit, operating circuit, display circuit, etc.) Connection diagrams among equipment and panels (cable layout diagram, ground wire layout diagram)
	Equipment layout diagrams	Layout diagrams for electrical equipment in the panel, terminal block wiring number layout drawings, connection assignment tables for connector pins (For identifying models and wiring numbers for each equipment)
	List of hardware used	Lists of electrical equipment used in the system (model name and specifications of all the electrical equipment constituting the programmable controller system, such as modules, peripheral equipment, electrical components in the control panel, I/O equipment, and software packages)
	Programmable controller program	Control programs for the programmable controller (ladder diagrams and lists)
	Assignment lists of input/output, etc.	Assignment lists of external I/O signals and internal devices (signal names corresponding to respective device numbers, signal descriptions, and setting values)
	Program descriptions (specifications)	Program configurations, process descriptions, and function descriptions (explanations for operations in programs that are difficult to understand, etc.)
	Instruction manuals of controlled systems • Maintenance and inspection instructions	For handling (operation), maintenance, and inspection of the controlled systems
General documents	Catalogs of hardware used	Identifies configuration, manufacturer of the equipment model
	Instruction manuals and technical documents of hardware used	For troubleshooting of hardware and software

1.5 Maintenance Record

After recovery following a failure, it is necessary to manage the maintenance record as follows for future reference.

Table 1-3: Maintenance Record to Manage

Record item	Description
Occurrence status of error and failure	Name of device/equipment, phenomenon, and environment
System stop time	Time of occurrence and stop time
Impact due to occurrence	Amount of loss, time loss, and other impact
Cause	Method of cause investigation and cause including presumption
Recovery method	Recovery method such as replacement and repair
Measures against re-occurrence	Defensive measures against the re-occurrence of the similar failure and lessons learned
Failure record	Record of failure cause, measures, etc.
Name of a person in charge	

1.6 Tendency of Failure Cause

The following graphs show the ratios of the failed parts and the failure causes of programmable controller troubles.
[Based on the research by the Japan Electrical Manufacturers' Association (JEMA)]
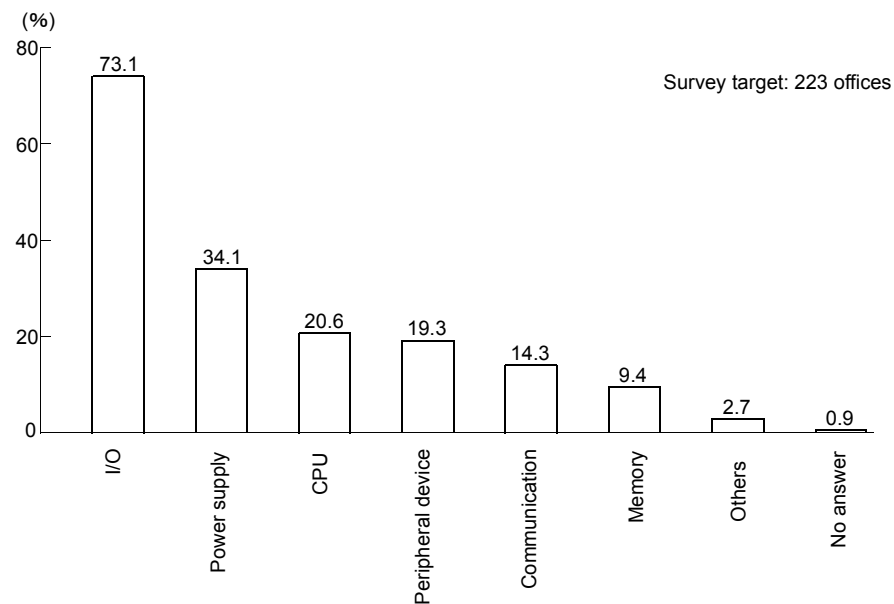
Figure 1-1: Failed Part of the Programmable Controller (Multiple Answers)
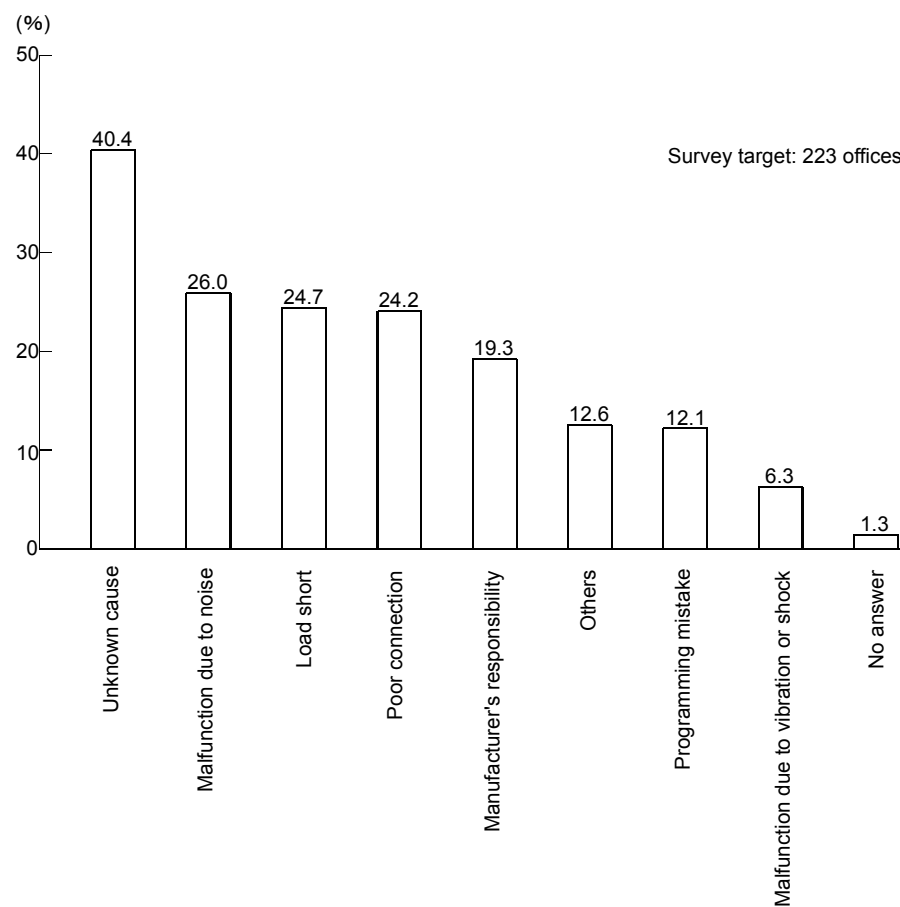
Figure 1-2: Failure Cause of the Programmable Controller (Multiple Answers)

1.7 Failure Modes

In general, failure modes of a complicated system can be classified into three levels recognized as Figure 1-3: initial failure, random failure, and wear-out failure. An initial failure is considered a failure that is removed during the manufacturing process or through inspection by the manufacturer. A random failure is an unexpected failure, which cannot be anticipated and can occur anytime before the wear-out progresses during the life of the equipment. It is difficult to take technical measures against random failures, and at this point, only the measures based on statistical handling can be implemented.

A wear-out failure occurs near the end of the usable life as a result of deterioration or abrasion and increases rapidly with the time. Replacement years mentioned here indicate a point "tb" in Figure 1-3, at which point a specified part is replaced with a new one in order to achieve appropriate preventive maintenance.
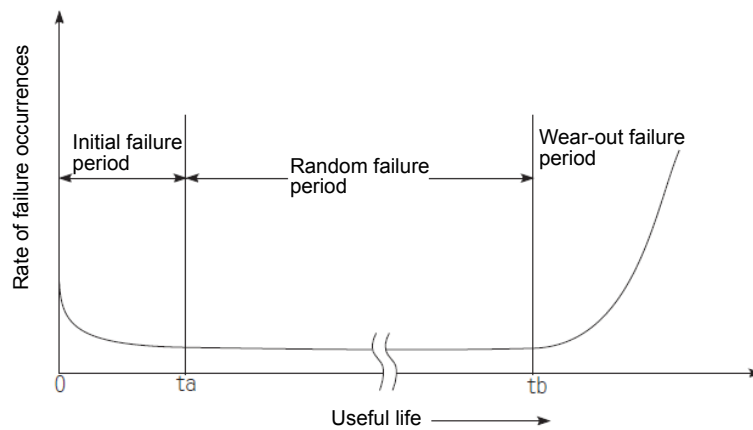
Figure 1-3: Bath-tub Curve

Chapter 2: Understanding Programmable Controller System

A programmable controller system consists of a base unit, power supply module, CPU module, input module, output module, and special function module.

2.1 System Configuration of Training Machine
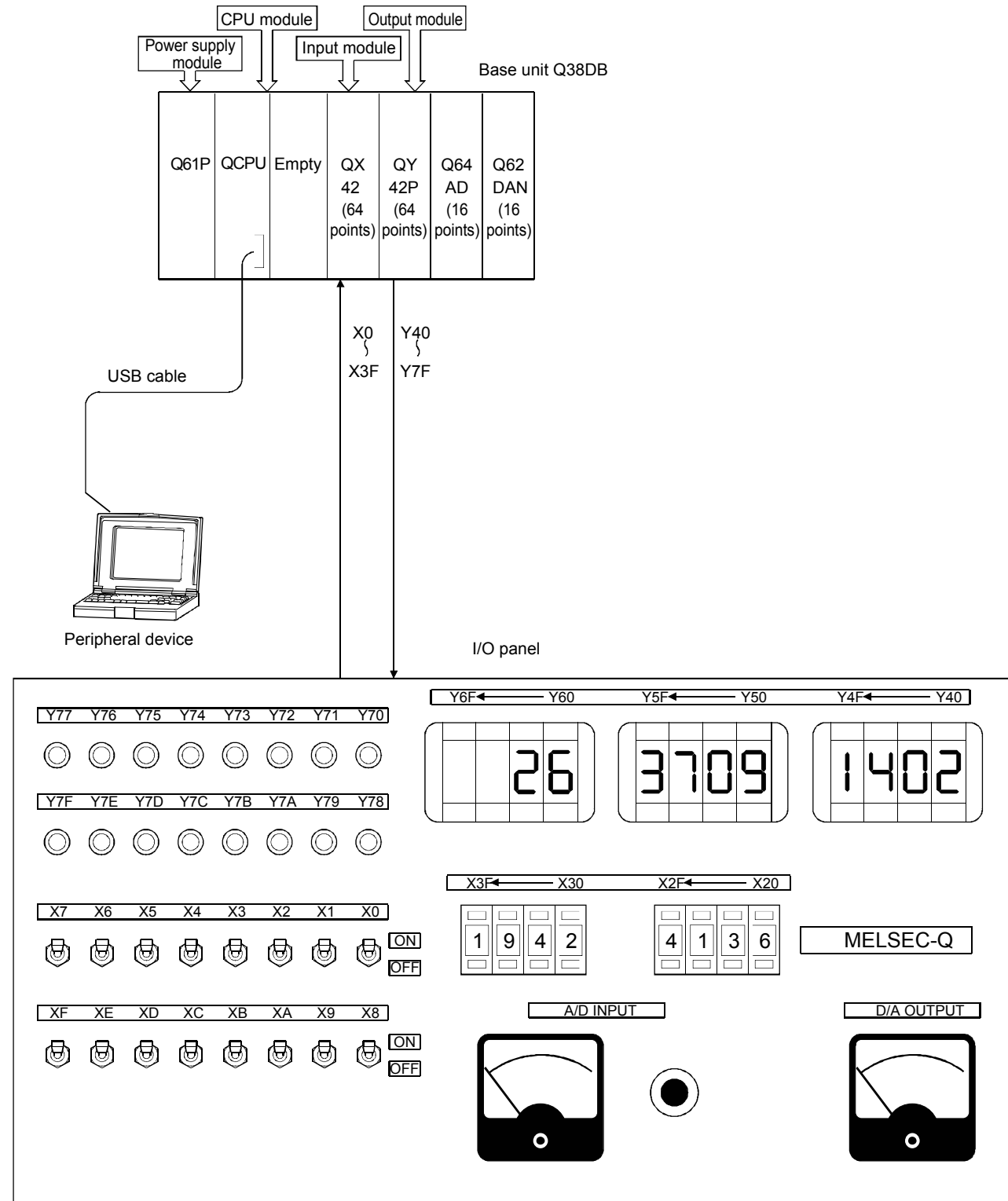
Table 2-1: System Configuration of the Training Machine

2.2 I/O Number Assignment

This section describes I/O number assignment which is necessary for data communication with an I/O module or an intelligent function module in QCPU.

An I/O number is intended to input data from an input module or to output data to an output module in a sequence program.
The I/O number is represented in three-digit hexadecimal.
The I/O numbers of I/O modules all of which have 16 points are shown in Figure 2-2.

Figure 2-2: Concept of I/O numbers

2.2.1 Concept of I/O Number Assignment

I/O number assignment is carried out as shown below when the power turns on or when the CPU module is reset.
Specify I/O numbers that are assigned according to the following items in a sequence program.

(1) The I/O number of Slot 0 of the main base unit (located at the right side of the CPU module) is zero, and numbers are assigned rightward sequentially.

If it is an input module, the number will be "X□□□", and if it is an output module, the number will be "Y □□□ ".
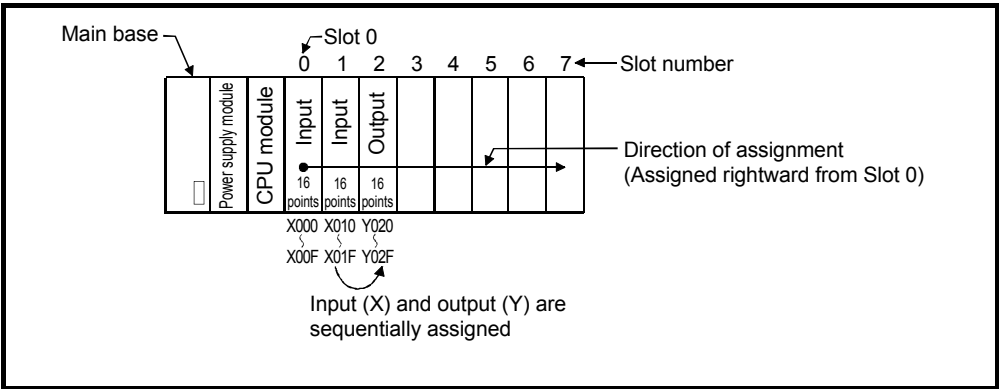
(2) If an extension base unit is connected, the number starts from the next number of the assignment of the main base unit.

A base number (one to seven) is assigned to the extension base unit according to the connection order of extension cables.

Assignment when an extension base unit is used

* The I/O number assignment is carried out sequentially, in the order of (1) → (2) → (3) → (4) → (5) → (6).

In this I/O number assignment example, each module has 16 points.
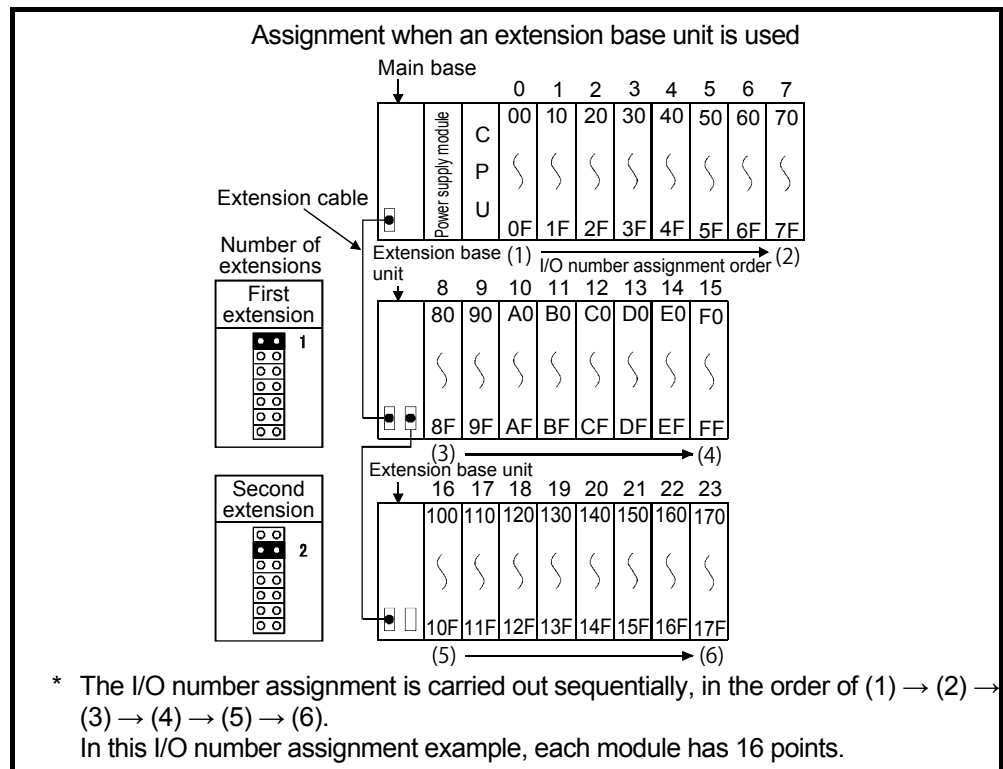
(3) One module occupies I/O numbers equal to its number of I/O points.

For example, if an input module that has 32 points is mounted to Slot 0 of the main base unit, 32 points of I/O numbers, which are X00 to X1F, are occupied.

Each slot occupies 32 points
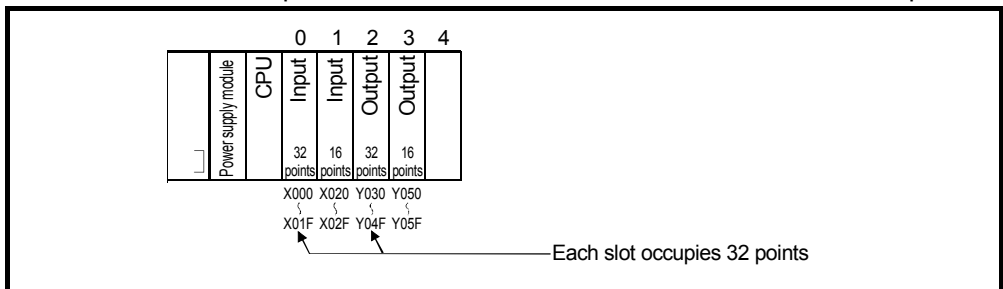
(4) To an empty slot, to which neither an I/O module nor an intelligent function module is mounted, number of points specified in the PLC System Settings in PLC parameters are assigned. (The default is 16 points.)

Slots to which no I/O module and intelligent function module are mounted

To each empty slot, 16 points are assigned
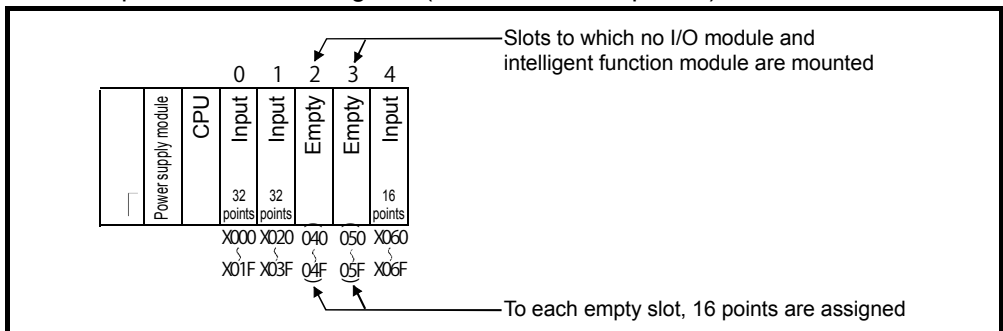
2.2.2 I/O Assignment Using GX Works2

In QCPU, the I/O module or the intelligent function module can be controlled without I/O assignment using GX Works2.
I/O assignment using GX Works2 is effective in the following cases.

(1) Purpose of I/O assignment using GX Works2

    (a) Reservation for replacement to a module other than 16-point modules
        In case replacement of a current module with another that has different points is planned, reservation in advance eliminates the need of future I/O number change.

    (b) Prevention of I/O number change due to module replacement
        In case failure occurs in an I/O module or an intelligent function module other than 16 points and the module is removed, change of I/O numbers can be avoided.

    (c) Change to I/O numbers specified by a program
        In case a designed program uses different I/O numbers from the ones an actual system uses, the I/O numbers of each module of the base unit can be changed to the numbers specified by the program.

    (d) Detailed settings for an I/O module and an intelligent function module
        Selecting "Type" in I/O assignment displays detailed settings below.
- Input response time setting for an input module and an interrupt module (I/O response time)
- Error time output mode setting for an output module and an intelligent function module
- Switch setting for an intelligent function module
- Operation setting for QCPU
  (during hardware error of the intelligent function module)

POINT

(1) I/O assignment is necessary for input module response time change and intelligent function module switch setting.
I/O assignment, input module response time setting, intelligent function module switch setting, and output mode upon error require the programmable controller's power turned OFF and ON (ON → OFF → ON) or resetting QCPU.
(2) If a failure of an I/O module other than 16 points occurs without I/O assignment using GX Works2, the I/O numbers of the following modules may change. This can cause malfunction. I/O assignment using GX Works2 is recommended therefore.

---

(2) Concept of I/O assignment using GX Works2
  (a) I/O assignment per slot
      "Type" (module type), "Number of points" (number of I/O points), and "Start XY" (start I/O number) can be set individually for each slot of the base unit.
      For example, if the number of I/O points of a specified slot is changed, the number of points alone can be set.
      Items that are not specified depend on a mounted status of the base unit.
      I/O assignment can be performed from the I/O assignment setting of the PLC parameter.

1) Slot
   Displays a slot number as well as how many extensions and slots exist in the base unit before a specified slot.
   If the basic setting does not provide the number of slots in the base unit, "*" is displayed as the number of extensions in the base unit, and a serial number from the 0th slot of the main base unit is displayed as the number of slots.
2) Type (used by QCPU)
   Select the type of a mounted module from the following items.
   • Empty (empty slot)
   • Input (input module)
   • High-speed input (high-speed input module)
   • Output (output module)
   • I/O combined (I/O combined module)
   • Intelligent (intelligent function module, or special function module compatible with AnS)
   • Interrupt (interrupt module)
   • Slots without any type specified will be the type of an implemented module.
3) Model name
   Set the model name of a mounted module using up to 16 single-byte characters.
   QCPU does not use the specified model name. (This is regarded as a user's memo.)

2 - 5

4) Points
   When changing the number of I/O points for each slot, select the number of points from below.

   - 0 points
   - 48 points
   - 256 points

   - 16 points
   - 64 points
   - 512 points

   - 32 points
   - 128 points
   - 1024 points

   Slots without any number of points specified will have the number of points for an implemented module.
5) Start XY
   - When changing I/O numbers for each slot, set a new start I/O number.
     To slots without any start XY specified, I/O numbers that start from a specified slot will be assigned sequentially.
   - Set I/O numbers for each slot so that the numbers will not overlap with ones assigned by QCPU.
     A duplicated I/O number causes an error (SP.UNIT LAY ERR.).
   - Assigning I/O numbers for each module in advance prevents the I/O numbers of other modules from being changed during module replacement.

(b) Status of slots to which I/O assignment has done
    Slots to which I/O assignment has done reflect assigned I/O numbers, regardless of module implementation.
    1) When the number of points smaller than the implemented points of an I/O module is set, the available points of the implemented I/O module decrease.
       For example, when a slot implemented with a 32-point input module is configured as a 16-point input module using I/O assignment, the latter 16 points out of the 32 points become unavailable.
    2) When the number of points smaller than the implemented points of an intelligent function module is set, "SP.UNIT LAY ERR." occurs.
       (If number of points larger than the point of the module is set, no error is displayed.)
    3) When the number of points larger than the implemented points of an I/O module is set, points that exceed the available points are regarded as dummy.
    4) Use an identical type as an implemented module for I/O assignment.
       In I/O assignment, if a type is different from an implemented module type, it does not operate properly. For an intelligent function module, number of I/O points must be identical too. (If the number of I/O points is not identical, no error is displayed.)

Implemented module	I/O assignment setting	Result
Input module	Output/Empty	Empty
Output module	Input/Empty	Empty
Input module/output module	Intelligent	Error (SP.UNIT LAY ERR.)
Intelligent function module	Empty	Empty
	Input/Output	Error (SP.UNIT LAY ERR.)
Empty slot	Intelligent	No error

    5) When I/O assignment is done, the last I/O number must be within FFFH. If the last I/O number exceeds FFFH, an error (SP.UNIT LAY ERR.) occurs. (In the system monitor of GX Works2, "***" is displayed as an I/O address.)

(c) To a slot to which I/O assignment using GX Works2 has not done, the number of points identical to an implemented module is assigned.

(d) It is recommended to attach a seal or something that has description of I/O assignment settings to each module for easy recognition from outside, in order not to mount a wrong module during maintenance.

(3) Example of I/O assignment using GX Works2
Consider an example in which I/O assignment is done for the following purposes.

(a) Because no 16-point input module is available at hand, a 32-point input module must be used.

(b) Because delivery of a 32-point output module is behind schedule, an empty slot for 32 points must be temporarily reserved.

Q Parameter Setting

PLC Name | PLC System | PLC File | PLC RAS | Boot File | Program | SFC | Device | I/O Assignment | Multiple CPU Setting | Serial Communication

I/O Assignment(*1)

No.	Slot	Type	Model Name	Points	Start XY
0	PLC	PLC	Q06UDHCPU		
1	0(0-0)	Input	QX41	32Points	
2	1(0-1)	Input	QX41	16Points	
3	2(0-2)	Input	QX40	16Points	
4	3(0-3)	Output	QY40	16Points	
5	4(0-4)	Output	QY40	16Points	
6	5(1-0)	Output	QY41P	32Points	
7	6(1-1)	Empty		32Points	

Switch Setting
Detailed Setting
Select PLC type
New Module

Assigning the I/O address is not necessary as the CPU does it automatically.
Leaving this setting blank will not cause an error to occur.

Base Setting(*1)

	Base Model Name	Power Model Name	Extension Cable	Slots
Main	Q35B	Q61P	QC50B	5
Ext.Base1	Q65B	Q61P		5
Ext.Base2				
Ext.Base3				
Ext.Base4				
Ext.Base5				
Ext.Base6				
Ext.Base7				

Base Mode
○ Auto
● Detail

8 Slot Default
12 Slot Default
Select module name

Export to CSV File   Import Multiple CPU Parameter   Read PLC Data

(*1)Setting should be set as same when using multiple CPU.

Print Window...   Print Window Preview   Acknowledge XY Assignment   Default   Check   End   Cancel

Q35B base unit — Substitute module — Slot number

Number of I/O points according to mounted status
Number of I/O assignment points by GX Works2

| Power supply module | CPU module | 0 Input 32 points X32 points X00 ~ X1F | 1 Input 32 points X16 points X20 ~ X2F | 2 Input 16 points X16 points X30 ~ X3F | 3 Output 16 points Y16 points Y40 ~ Y4F | 4 Output 16 points Y16 points Y50 ~ Y5F |

(a)

Q65B base unit — Mounting a 32-point output module is planned.

| Power supply module | 5 Output 32 points Y32 points Y60 ~ Y7F | 6 Empty 32 points Y32 points 80 ~ 9F | 7 Output 16 points Y16 points YA0 ~ YAF | 8 Output 32 points Y32 points YB0 ~ YCF | 9 Output 32 points Y32 points YD0 ~ YEF |

(b)

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MEMO

Chapter 3: Learning Personal Computer (GX Works2) Operation

3.1 Creation of New Project Using GX Works2
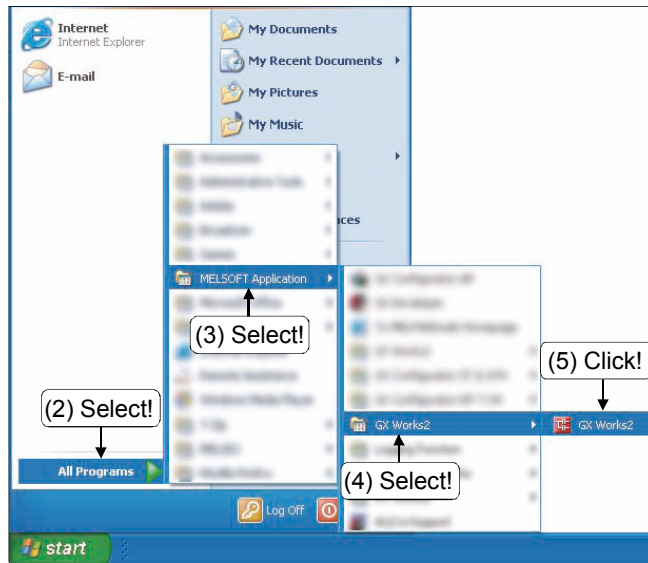
(1) Click the [Start] button.

(2) Select the [All programs] menu.

(3) Select the [MELSOFT application] menu.

(4) Select the [GX Works2] menu.

(5) Click the [GX Works2] menu.
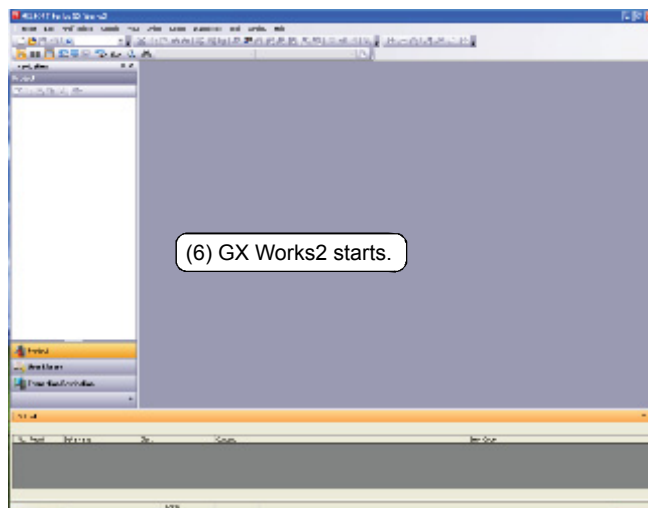
(6) GX Works2 starts.

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(From the previous page)

⇩
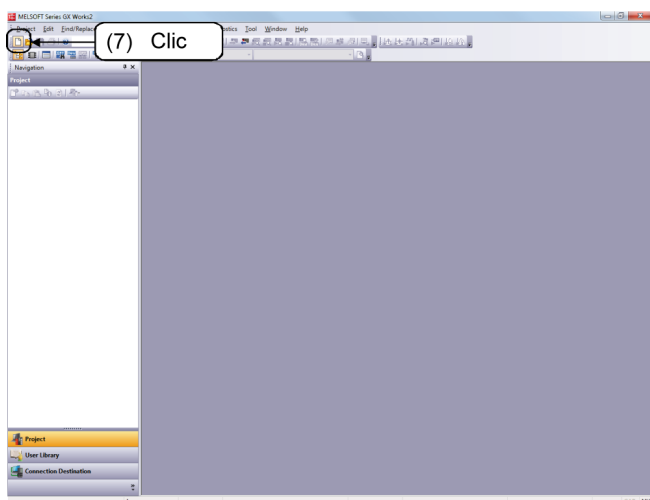
(7) Click [icon] on the toolbar or click the [Project] → [New] menu ($\boxed{\text{Ctrl}}$ + $\boxed{\text{N}}$).

⇩
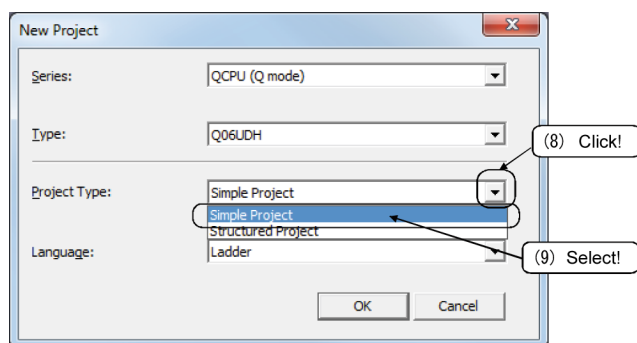
(8) Click the [Project Type] list button.

(9) Click to select "Simple project" from the displayed list box.

⇩
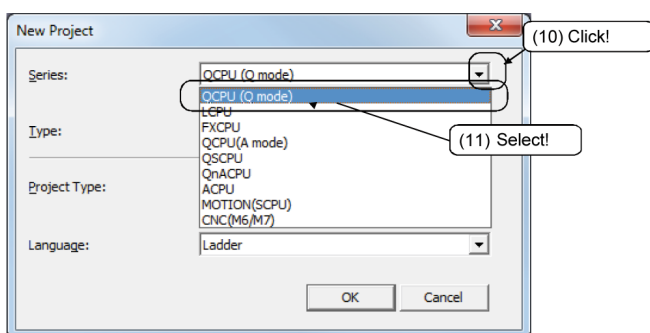
(10) Click the [Series] list button.

(11) Select "QCPU (Q mode)" from the displayed list box.

⇩

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(From the previous page)

⬇
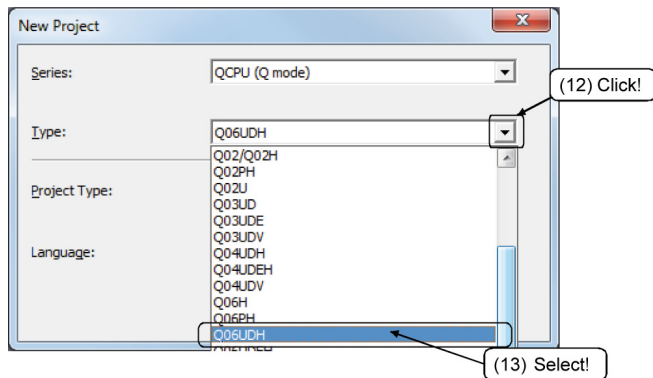
(12) Click the [Type] list button.

(13) Select "Q06UDH" from the displayed list box.

⬇
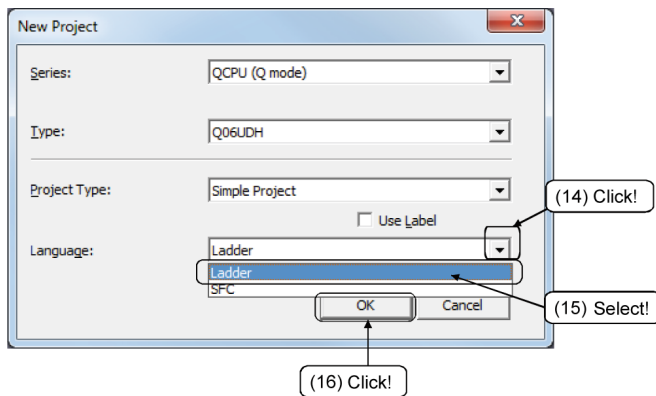
(14) Click the [Language] list button.

(15) Select "Ladder" from the displayed list box.

(16) Click the OK button.

⬇
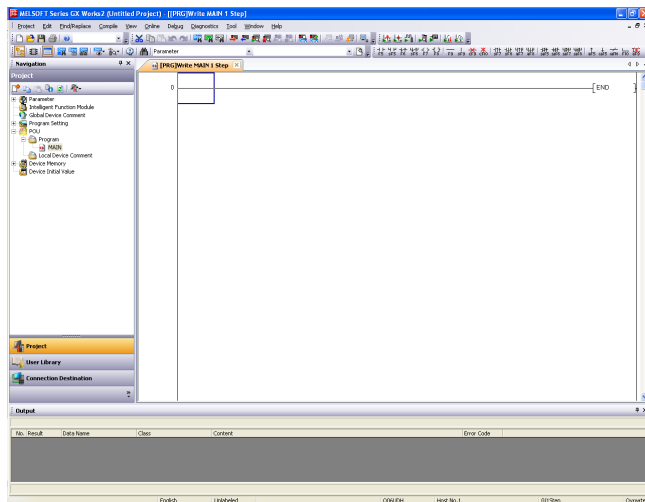
(17) A new project opens.

In GX Works2, shortcut key assignment can be changed using the [Tool] → [Key Customize] menu.
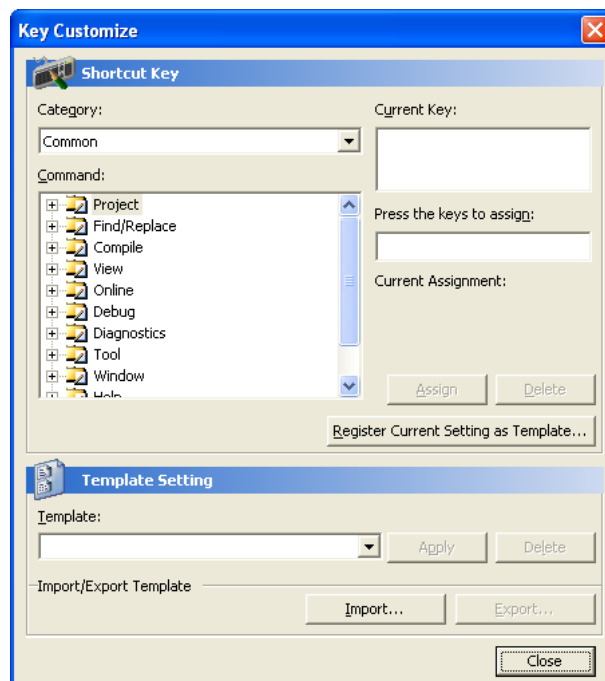
Item		Description
Shortcut Key		-
	Category	Select a classification from a list of groups categorized by each window.
	Command	Select a function name whose shortcut key is to be changed.
	Current key	Shortcut keys currently assigned to a selected command are displayed.
	Press the keys to assign	Specify a shortcut key to be newly assigned. It can be specified by pressing keys of the keyboard. Example) Ctrl + 5
	Currently assignment	The name of a menu assigned to a selected shortcut key is displayed. If the selected shortcut key has already been assigned to another function, the name of the function is displayed.
Template		Select a shortcut key template from the list box. • Default settings Changes to the initial status. • GPPA type setting Collectively changes key assignment to the one same as GPPA during creation of a ladder diagram.

3.2 Programming in Ladder Mode

This section describes practical training for an operation to create and execute a sequence program.

(1) Function key operation during ladder mode

Operation	Key combination	Operation	Key combination
Write Mode	F2	Rising Pulse Branch (└↑┤┘)	Alt + F7
Read Mode	Shift + F2	Statement Display	Ctrl + F7
Start Monitoring	F3	Rising Pulse Close Branch (└↑┤┘)	Shift + Alt + F7
Monitor (write mode)	Shift + F3	Find Contact or Coil	Ctrl + Alt + F7
Stop Monitoring	Alt + F3	Application Instruction (─[ ]─)	F8
Conversion	F4	Falling Pulse (─↓├─)	Shift + F8
Conversion + Online Program Change	Shift + F4	Falling Pulse Branch (└↓┤┘)	Alt + F8
Conversion (All Program)	Shift + Alt + F4	Note	Ctrl + F8
Normally Open Contact (─┤├)	F5	Falling Pulse Close Branch (└↓┤┘)	Shift + Alt + F8
Normally open contact OR (└┤┘)	Shift + F5	Horizontal Line (──)	F9
Operation result rising pulse conversion (↑)	Alt + F5	Vertical Line (│)	Shift + F9
Comment	Ctrl + F5	Delete Line (╳)	Alt + F9
Operation result fall pulse conversion (↓)	Ctrl + Alt + F5	Delete Horizontal Line (╳)	Ctrl + F9
Rising Pulse Close (─↑┤─)	Shift + Alt + F5	Edit Line (└─)	F10
Normally Closed Contact (─┤╱├─)	F6	Delete Vertical Line (╳)	Ctrl + F10
Normally closed contact OR (└┤╱┘)	Shift + F6	Operation Result Inversion (─╱─)	Ctrl + Alt + F10
Falling Pulse Close (─┤╱├─)	Shift + Alt + F6	Insert Row	Shift + Ins
Device Display	Ctrl + Alt + F6	Insert Column	Ctrl + Ins
Coil (─( )─)	F7	Delete Row	Shift + Del
Rising Pulse (─↑├─)	Shift + F7	Delete Column	Ctrl + Del

3 - 5

1) Change to Write Mode using the function key $\boxed{\text{F2}}$.
 (Mode switching can be done using $\boxed{\text{F2}}$ (Write), $\boxed{\text{Shift}}$ + $\boxed{\text{F2}}$ (Read), or $\boxed{\text{F3}}$ (Monitor).)

2) There are three operations for conversion after writing a ladder:
 - $\boxed{\text{F4}}$ (🔄) .... Converts a program currently editing.
 - $\boxed{\text{Ctrl}}$ + $\boxed{\text{Alt}}$ + $\boxed{\text{F4}}$ (🔄) .... Converts all programs currently editing.
 - $\boxed{\text{Shift}}$ + $\boxed{\text{F4}}$ .... Converts an edited program and writes to a programmable controller CPU in a RUN state.

3) Follow the steps below to write instructions using function keys.

 a. Operation for inputting contacts
  Using the keyboard, press the $\boxed{\text{F5}}$ key then input "X1".
  Press the $\boxed{\leftarrow}$ key or the $\boxed{\text{OK}}$ button to write to the editing screen.
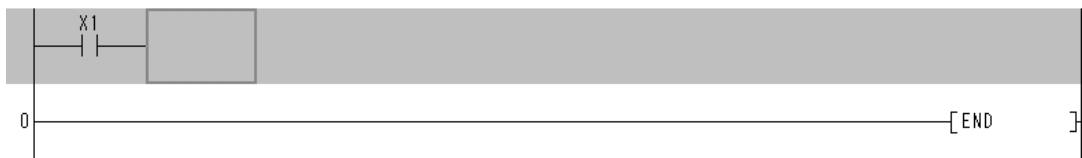
 b. Operation for inputting application instruction
  Using the keyboard, press the $\boxed{\text{F8}}$ key then input "MOV K1 D0".

REFERENCE

The following procedures can also be used for writing instructions:
- By the tool button
 Click 🔲 then input "MOV K1 D0" using the keyboard.

- By the menu bar
 Select the [Edit] → [Ladder Symbol] → [Application Instruction] menu then input "MOV K1 D0" using the keyboard.

Press the $\boxed{\leftarrow}$ key or clicking the $\boxed{\text{OK}}$ button to write to the editing screen.
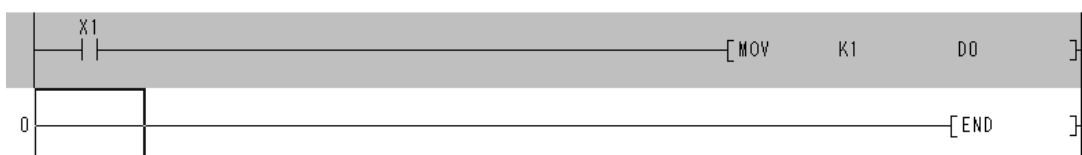
(2) Sequence programming in ladder mode

```
        X2    SM411
  0    ─┤/├────┤ ├──────────────────────────────────────────────(Y70 )
        X2                                                          K200
  3    ─┤ ├──┬───────────────────────────────────────────────────(T1  )
            │                                                      
            └────────────────────────────────────[BCD    T1    K4Y40 ]
        X0
 10    ─┤ ├──────────────────────────────────────────────[RST    T1  ]
       SM400
 16    ─┤ ├──[>      K100    T1   ]──────────────────────────────(Y71 )
            │
            ├──[<=    K100    T1   ]─[>=    K150    T1   ]─────────(Y72 )
            │
            └──[<     K150    T1   ]──────────────────────────────(Y73 )
       SM412  M100
 35    ─┤ ├────┤ ├──┬─────────────────────────────────────────────(Y74 )
                   │                                               K1000
                   ├───────────────────────────────────────────(C0  )
                   │
                   └────────────────────────────────[BCD    C0    K4Y60 ]
        X1
 45    ─┤ ├──────────────────────────────────────────────[RST    C0  ]

 50    ──────────────────────────────────────────────────────────[END ]
```
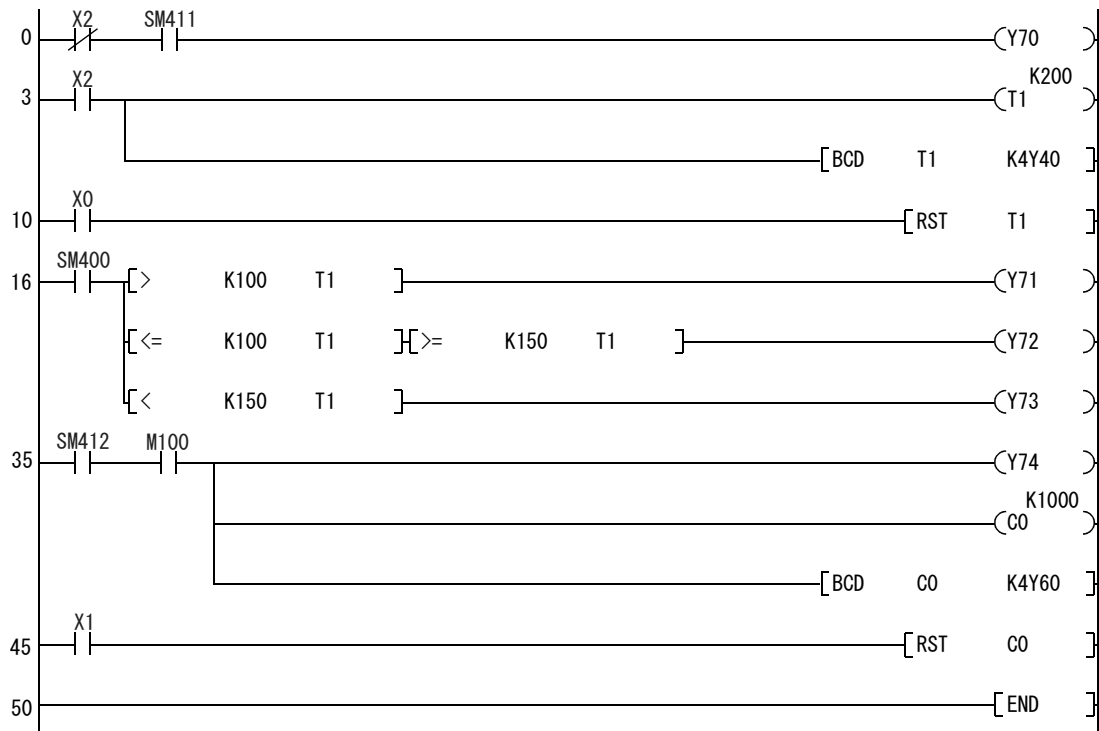
Use the function keys ⎡F5⎤ to ⎡F10⎤ for typing.

1) ⎡F6⎤ ⎡X⎤ ⎡2⎤ ⎡↵⎤ ⎡F5⎤ ⎡S⎤ ⎡M⎤ ⎡4⎤ ⎡1⎤ ⎡1⎤ ⎡↵⎤
   (┤/├)   (┤├)
   ⎡F7⎤ ⎡Y⎤ ⎡7⎤ ⎡0⎤ ⎡↵⎤
   (-( )-)

2) ⎡F5⎤ ⎡X⎤ ⎡2⎤ ⎡↵⎤ ⎡F7⎤ ⎡T⎤ ⎡1⎤ ⎡ ⎤ ⎡K⎤ ⎡2⎤ ⎡0⎤ ⎡0⎤ ⎡↵⎤
   (┤├)   (-( )-)   (Space)
   ⎡→⎤ ⎡↑⎤ ⎡Shift⎤+⎡F9⎤ ⎡↵⎤ ⎡↓⎤ ⎡F8⎤ ⎡B⎤ ⎡C⎤ ⎡D⎤ ⎡ ⎤ ⎡T⎤
              (│)   (-[ ]-)   (Space)
   ⎡1⎤ ⎡ ⎤ ⎡K⎤ ⎡4⎤ ⎡Y⎤ ⎡4⎤ ⎡0⎤ ⎡↵⎤
      (Space)

3) Press the function key ⎡F4⎤ (🖳).

Key input	⎡F5⎤	⎡Shift⎤ + ⎡F5⎤	⎡F6⎤	⎡Shift⎤ + ⎡F6⎤	⎡F7⎤	⎡F8⎤	⎡F9⎤	⎡Shift⎤ + ⎡F9⎤
Ladder symbol	┤├	┘┘	┤/├	┘/┘	-( )-	-[ ]-	—	│

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3.3 Parameter Setting for Multiple CPU (Not Required for Single CPU Configuration)

Two CPUs have been installed in a Q series training machine configured for multiple CPU compatibility.
Parameter setting is required for operation with multiple CPU, although this configuration is not used in this text.

(1) In GX Works2, double-click "PLC parameter" in the project list.
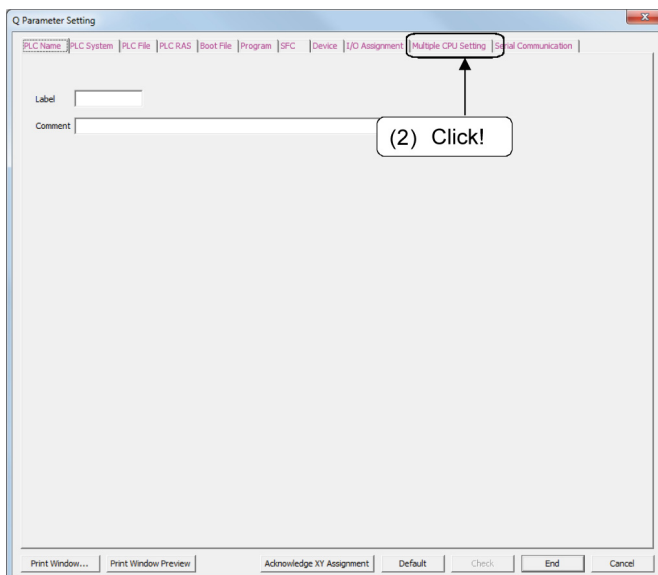
(2) The Q parameter setting dialog box appears. Click the "Multiple CPU setting" tab.
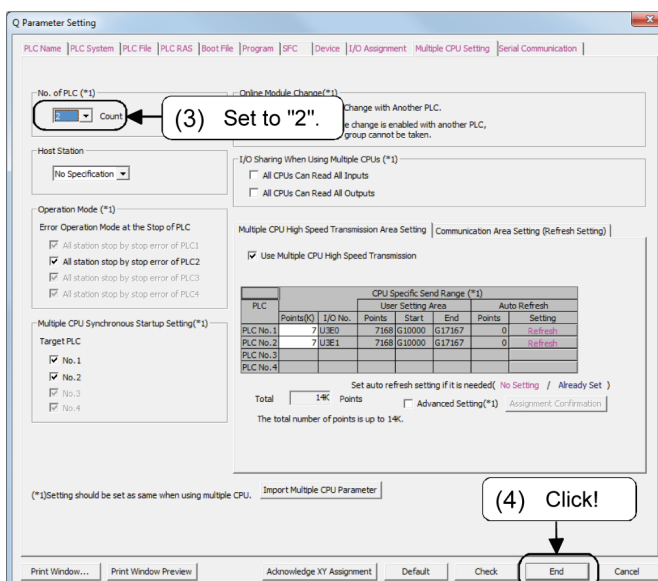
(2) Click!

(3) Set "No. of PLC" to "2".

(4) Click the [End] button.

(3) Set to "2".

(4) Click!

3.4 Storing and Managing Programs

Parameters and sequence programs can be stored as a file with a project name.

① Click!

(1) Select 💾 on the toolbar or select the [Project] → [Save] menu (Ctrl + S).

If a project has already been saved, save operation is completed here.

(Only when saving a project for the first time)

(2) Set a storage location for the project!

(3) Set a project name!

(5) Click!

(4) Set a title! (optional)
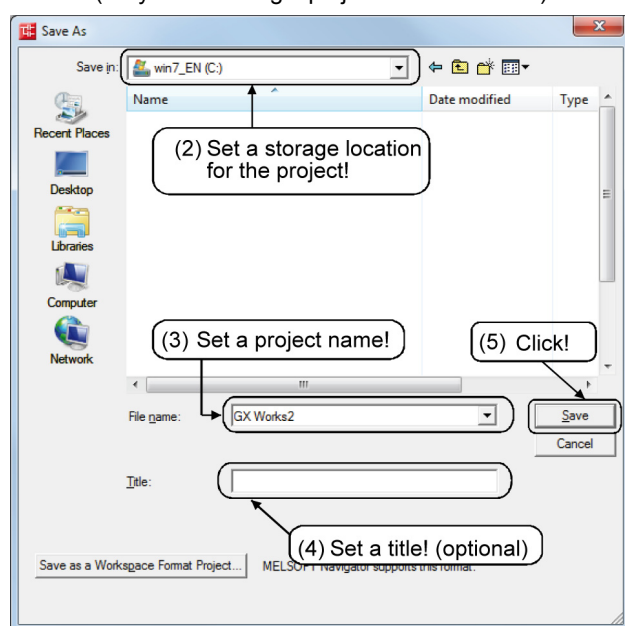
(2) Select a storage location for the project.

(3) Set a project name.

(4) Set a title if needed.

(5) When the setting for each item is completed, click the Save button.
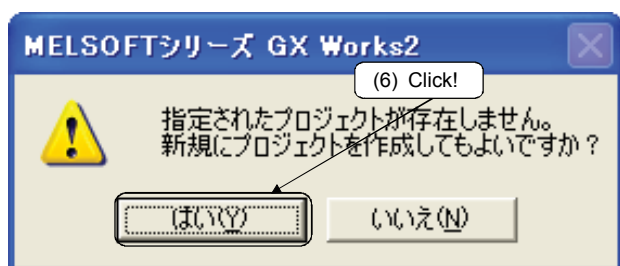
(6) Click!

(6) Click the Yes button.
This completes save operation.

REFERENCE
- Characters such as "%", "'", "*", "/", ":", "<", ">", "?", "\", and "|" are not available. (":" and "\" are available only when specifying a drive)
  Do not use "." (period) at the end of a project name.
- Specify a storage folder path and a project name within 200 single-byte characters (100 double-byte characters) in total.
- Specify a title within 128 single-byte characters (64 double-byte characters).

3.5 Writing Data to Programmable Controller CPU

In this section, a sequence program created in Section 3.2 will be written to the programmable controller CPU.
Connect the personal computer and the programmable controller CPU with a USB cable.

(1) Write to QCPU No. 1
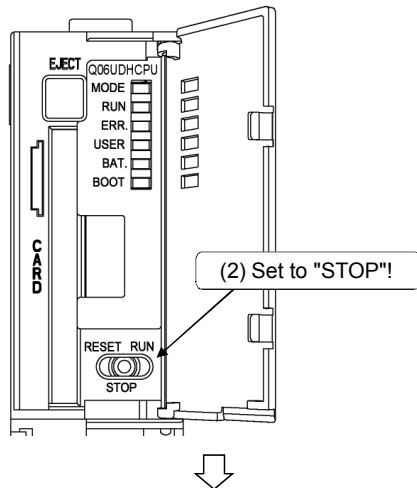
1) Set the "RUN/STOP/RESET" switch to "STOP" in No. 1 and No. 2 QCPU.

(2) Set to "STOP"!

2) Click the "Connection destination" view in the view selection area of the navigation window.
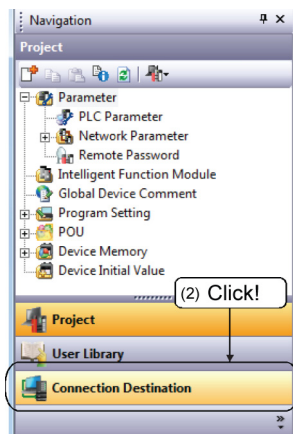
(2) Click!

3) The connection destination view appears. Double-click the current connection "Connection1".

(3) Click!

(4) Click if necessary!

(4) Confirm!

(7) Click to select!

(8) Click!

(5) Click!

MELSOFT Application

Memory will be formatted.
Do you want to continue?

Yes   No

ks2.gxw - [[PRG]Write MAIN 1 Step]

Online Debug Diagnostics Tool Window

Read from PLC...

Write to PLC...

Verify with PLC...

(10) Click!

⇩
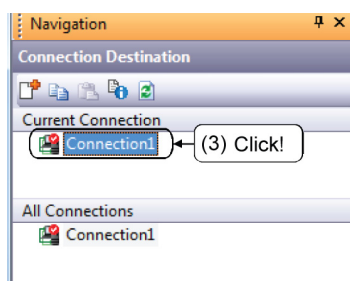
(To the next page)
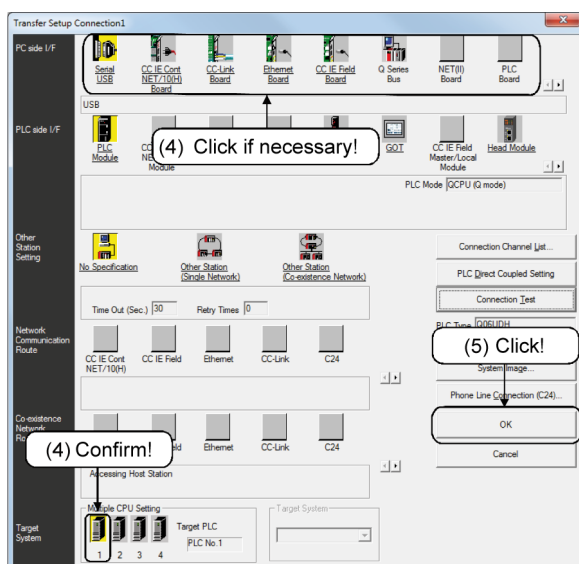
4) The personal computer side I/F is set to "USB" by default.
   If other means are used in order to connect to the programmable controller CPU, double-click an icon that represents each connection type to change the setting.
   In addition, check the connection destination setting screen to make sure that the target system is set to "No. 1".

5) When the setting is completed, click the OK button.
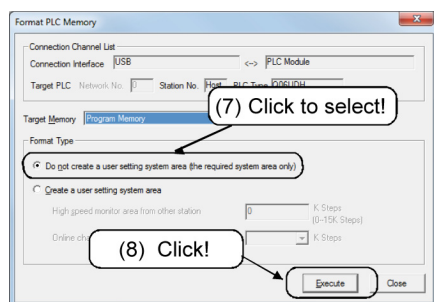
6) The memory of the No.1 QCPU must be formatted.
   Select the [Online] → [Operate on the PLC Memory] → [Format the PLC Memory] menu.

7) Select either one in "Format type" by clicking.
   In this training, select "Do not create a user setting system area".

8) Click the Execute button.
   The memory of the programmable controller CPU is formatted.
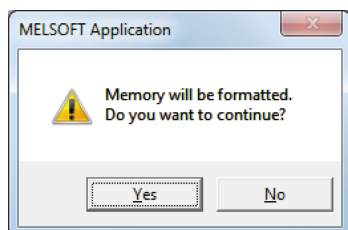
9) Click the Yes button.
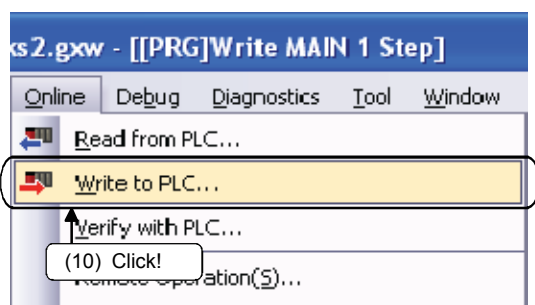
10) Click the [Online] → [Write to PLC] menu.

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⇩
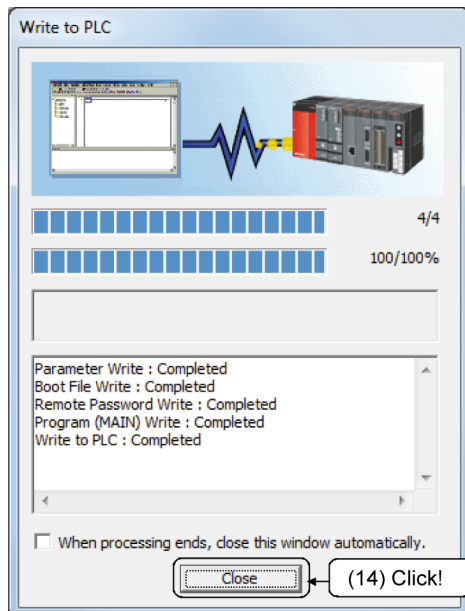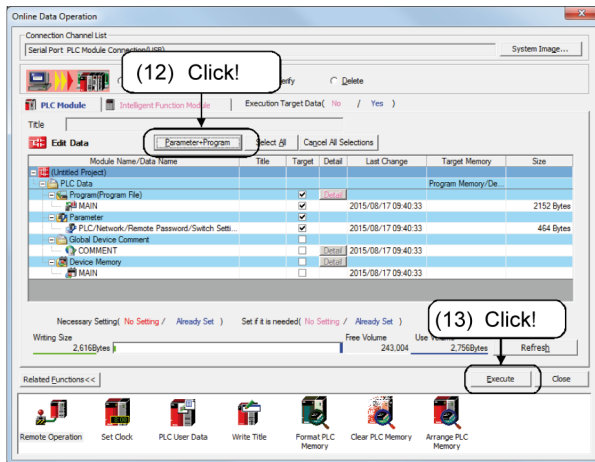
11) The online operation dialog box appears.

12) Click the "Parameter + Program" button.

13) Click the ⎿ Execute ⏌ button.

⇩

14) When the write to QCPU No. 1 is completed, a dialog box on the left appears. Click the ⎿ Close ⏌ button.

(2) Write to QCPU No. 2 (not required for single CPU configuration)

Just like No. 1, data such as parameters must be written to QCPU No. 2.

(1) Confirm!
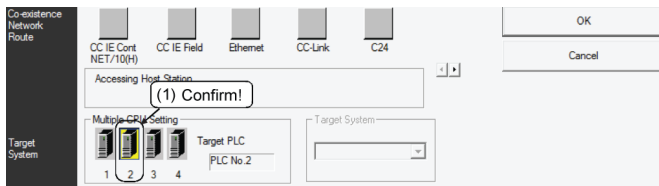
1) Set the target system to "No. 2" in the connection destination setting screen.

Write to PLC

4/4

100/100%

Parameter Write : Completed
Boot File Write : Completed
Remote Password Write : Completed
Program (MAIN) Write : Completed
Write to PLC : Completed

☐ When processing ends, close this window automatically.

Close ← (3) Click!
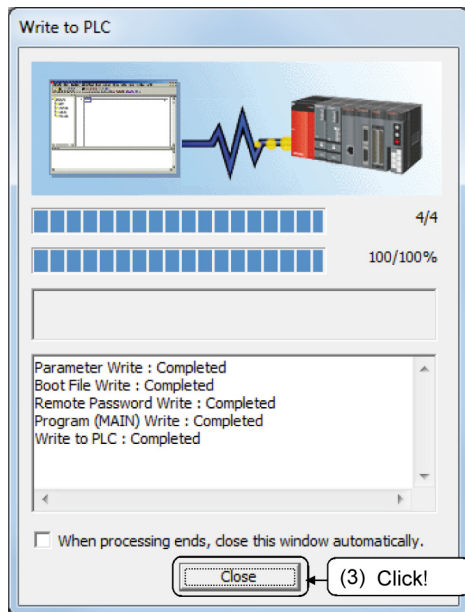
2) Just like QCPU No. 1, complete Step 6) to 13) described in (1) of this section for QCPU No. 2.

• Formatting CPU program memory
• Writing CPU parameters and programs

3) When the write to QCPU No. 2 is completed, a dialog box on the left appears. Click the ☐ Close ☐ button.

Transfer Setup Connection1

PC side I/F

Serial USB | CC IE Cont NET/10(H) Board | CC-Link Board | Ethernet Board | CC IE Field Board | Q Series Bus | NET(II) Board | PLC Board

USB

PLC side I/F

PLC Module | CC IE Cont NET/10(H) Module | CC-Link Module | Ethernet Module | C24 | GOT | CC IE Field Master/Local Module | Head Module

PLC Mode QCPU (Q mode)

Other Station Setting

No Specification | Other Station (Single Network) | Other Station (Co-existence Network)

Connection Channel List...

PLC Direct Coupled Setting

Connection Test

Time Out (Sec.) 30   Retry Times 0

PLC Type Q06UDH

Network Communication Route

CC IE Cont NET/10(H) | CC IE Field | Ethernet | CC-Link | C24

(5) Click!

System Image...

Phone Line Connection (C24)...

Co-existence Network Route

CC IE Field | Ethernet | CC-Link | C24

OK

Cancel

(4) Click!

Accessing Host Station

Multiple CPU Setting

1 2 3 4   Target PLC PLC No.1

Target System

4) In the connection destination setting screen, click "1" in [Multiple CPU Setting] to select it.

5) Click the ☐ OK ☐ button.

(To the next page)

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(From the previous page)

(6) Perform "RESET"!
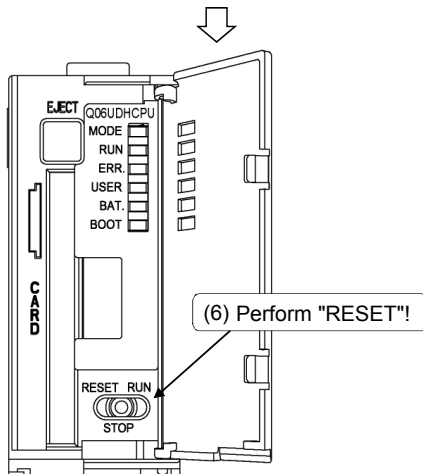
6) Push down the "RUN/STOP/RESET" switch to the "RESET" position once (for about one second) in QCPU No. 1.

The "ERR." LED flashes several (three to four) times. (Reset is accepted and in progress)
Turning off the "ERR." LED means reset operation is completed.

7) Return the RUN/STOP/RESET switch to the "STOP" position.

REFERENCE

Reset the programmable controller CPU after a new parameter or a program is written.
Error and device descriptions before writing must be initialized.

3.6 Monitoring Operation in Ladder Mode

In this section, operation of the CPU executing the program written to the programmable controller CPU in Section 3.5 will be monitored using ladder monitor operation.
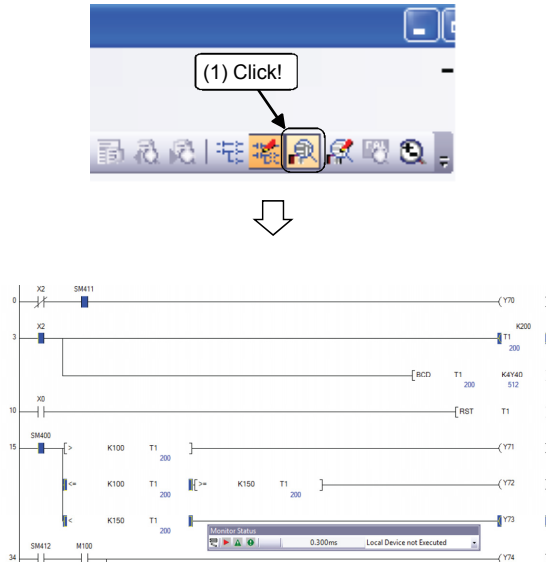
Set the "RUN/STOP/RESET" switch of the CPU to "RUN".

1) Click ![icon] (monitoring mode) on the toolbar.

(1) Click!

2) The monitor status dialog box appears, and the ladder monitor is executed.

(a)(b)(c)(d)   (e)
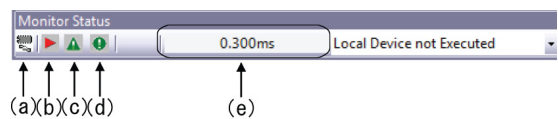
(a) Connection status
Connection status to the programmable controller CPU and simulation function is displayed.

(b) RUN/STOP state
Operating status of the programmable controller CPU, triggered by the key switches of the programmable controller CPU or a remote operation using GX Works2, is displayed.

(c) ERR status (PLC diagnostics)
Error status of the programmable controller CPU is displayed.
The PLC diagnostics screen (*1) appears by clicking the icon.

(d) USER status (PLC diagnostics)
User error status of the programmable controller CPU is displayed.
The PLC diagnostics screen (*1) appears by clicking the icon.

(e) Scan time
Maximum scan time of the monitoring programmable controller CPU is displayed.
In Q series, it is displayed in unit of 0.1 ms.

*1: For PLC diagnostics, refer to Section 6.2.
The ON and OFF status of the ladder is as follows.

OFF   ⎯||⎯   ⎯|/|⎯   ⎯( )⎯   ⎯[ ]⎯

ON   ⎯■⎯   ⎯/⎯   ⎯(●)⎯   ⎯[■]⎯
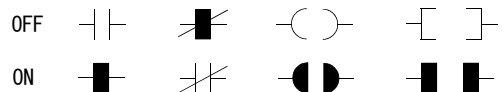
*2: The displayed maximum scan time can be different from an actual value.
(When online program change was carried out, for example, a displayed value becomes larger than an actual scan time.)
The actual scan time can be checked using the program monitor list function (refer to the next page).

1) Turn ON the X2 switch then monitor T1.
2) Check that the timer T1 is reset when the X0 switch turns ON.

REFERENCE

- Program monitor list
  A program monitor list can be used with the following steps.
  1) Click the [Online] → [Monitor] → [Program Monitor List] menu.
  2) The program monitor list appears. Check the actual scan time.

  (a) Execution state for each program
      Displays execution state for each program.
      - Program   : Displays a program name.
      - Execution   : Displays a program type.
      - Scan time   : Displays an actual scan time (current value).
                                When a program is in a stop (standby) state,
                                0.000 ms is displayed as a scan time.
      - Number of executions : Displays the number of executions, which is
                                zero when measurement starts. (It returns to 0
                                when it reaches 65536.) The number of
                                executions is retained after a program stops.

3.7 Entry Ladder Monitor Operation

Multiple relevant ladder blocks can be monitored together by registering a ladder block. Horizontally tiling ladder monitor screens allows monitoring another ladder while monitoring the registered ladder all the time.

In this section, a ladder block is registered from the program written to the programmable controller CPU in Section 3.5 for monitoring.
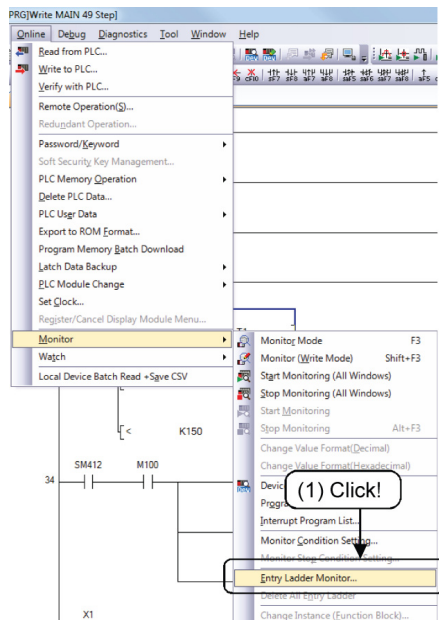
(1) Select [Online] → [Monitor] → [Entry Ladder Monitor].
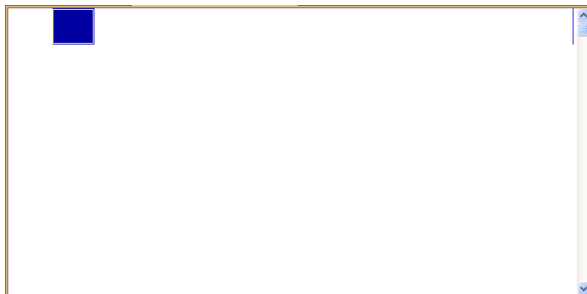
(2) The Entry Ladder Monitor screen is displayed.
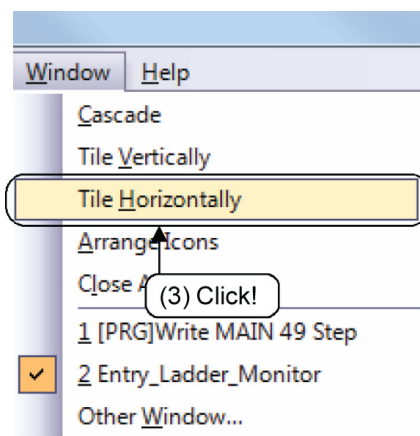
(3) Click the [Window] → [Tile Horizontally] menu.

(To the next page)

(From the previous page)

⬇

(Entry ladder monitor screen)

(5) Paste

(4) Copy
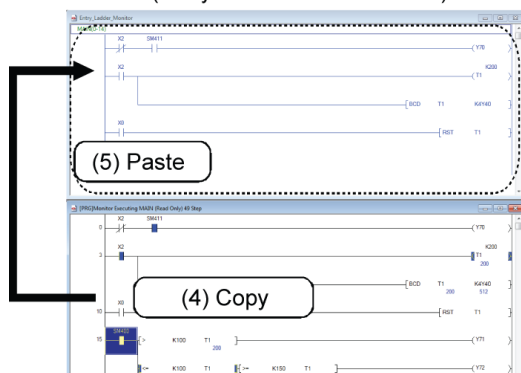
(Ladder monitor screen)

⬇

(6) Click!

⬇

⬇
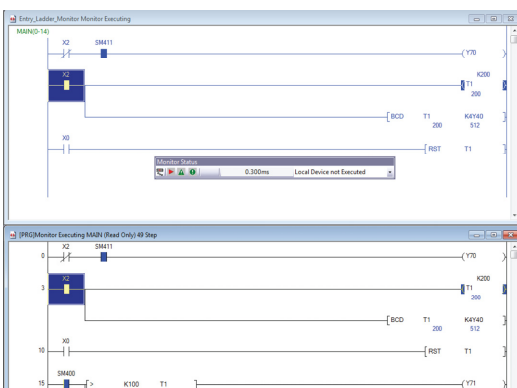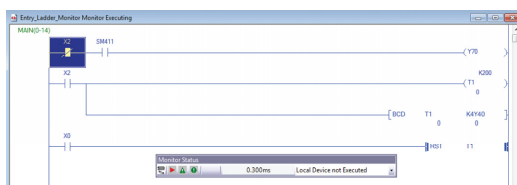
(4) Select a ladder block in the ladder program and select [Edit] → [Copy].

(5) Select [Edit] → [Paste] on the Entry Ladder Monitor screen.
The copied ladder block is pasted.

Set the "RUN/STOP/RESET" switch of the CPU to "RUN".

(6) Select [icon] on the toolbar or the [Online] → [Monitor] → [Monitoring Mode] menu.
Monitoring of the registered ladder block is started.

(7) The entry ladder screen switches to the monitoring mode.

(8) Turn ON/OFF X2.
Change of the current value of the timer can be monitored.

(9) After clicking the title bar on the monitor screen, scroll the ladder monitor so that monitoring any step is possible while monitoring on the entry ladder monitor screen at the same time.

REFERENCE

The following functions can be executed on the entry ladder screen.
   1. Deletion of ladders in increments of ladder blocks   4. Device test
   2. Device search, instruction search, and character string search   5. Zoom in and out on screen
   3. Displaying comments, statements and notes   6. Drag and drop on the entry data monitor

3.8 Device Batch Monitor Operation

Monitor device statuses of the program written to the programmable controller CPU in Section 3.5.

There are two types of device monitors: "Device/Buffer Memory Batch Monitor" and "Watch Window". In this section, perform "Device/Buffer Memory Batch monitor", which is monitoring of a specified one type of device.

Set the "RUN/STOP/RESET" switch of the CPU to "RUN".

(1) Select the [Online] → [Monitor] → [Device/Buffer Memory Batch] menu.
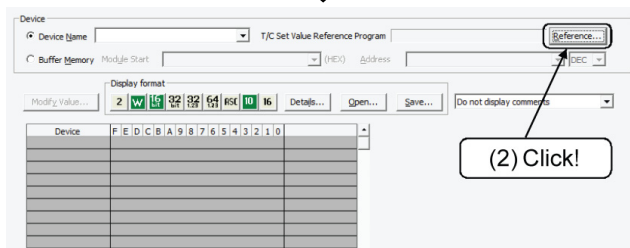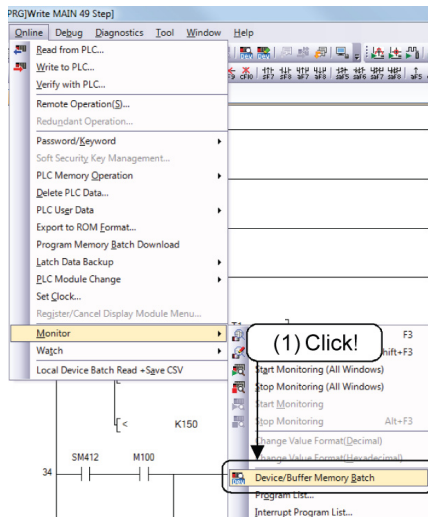
(2) Click the Reference button and select the TC setting value reference.
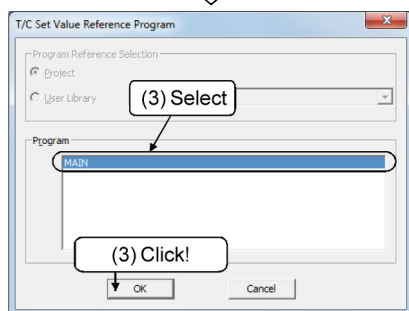
(3) Select "MAIN" and click the OK button.
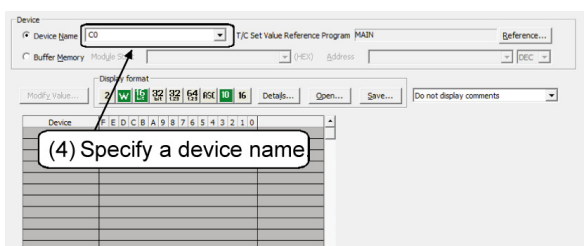
(4) Input "C0" in Device on the device/buffer memory batch monitor dialog box and press ↵ key.

(To the next page)

(From the previous page)
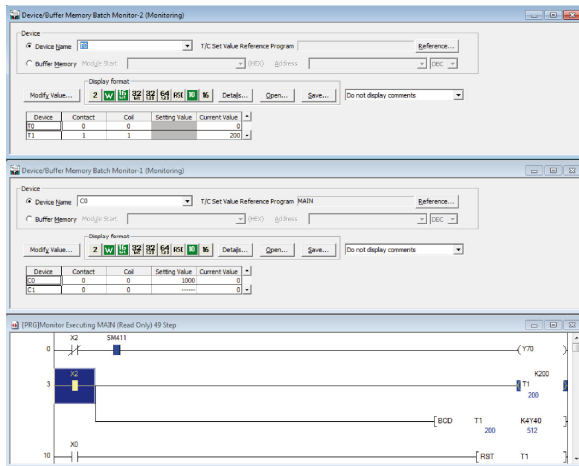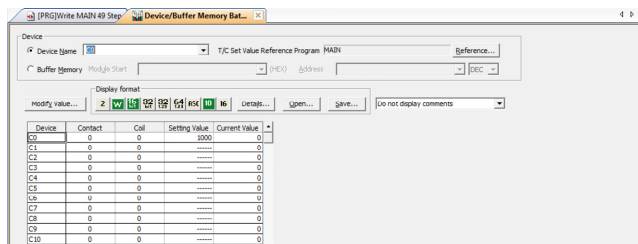
(4) Monitoring of the specified device is started. (C0 and subsequent devices are displayed)

(5) Perform device batch monitoring of T0 in the same way. (T0 and subsequent devices are displayed)

(6) When the screen is tiled horizontally with the ladder monitor screen, device statuses can be checked both on the ladder display and in the list, which facilitates monitoring.
Click the [Window] → [Tile Horizontally] menu.

REMARKS

Device test operation can forcibly change device statuses while monitoring devices by the device/buffer memory batch monitor.
For device test operation, refer to Section 3.10.

3.9 Entry Data Monitor Operation (Watch Window)

Devices which are not monitored on the ladder monitor screen cannot be directly monitored.
Monitor them by either "Device/Buffer Memory Batch Monitor" or "Watch Window".
In this section, perform monitoring by "Watch Window", which is for a device registered by the user.

Set the "RUN/STOP/RESET" switch of the CPU to "RUN".

(1) Click the [Display] → [Docking Window] → [Watch (1) To (4)] menu.

    *   In this training, select (1).
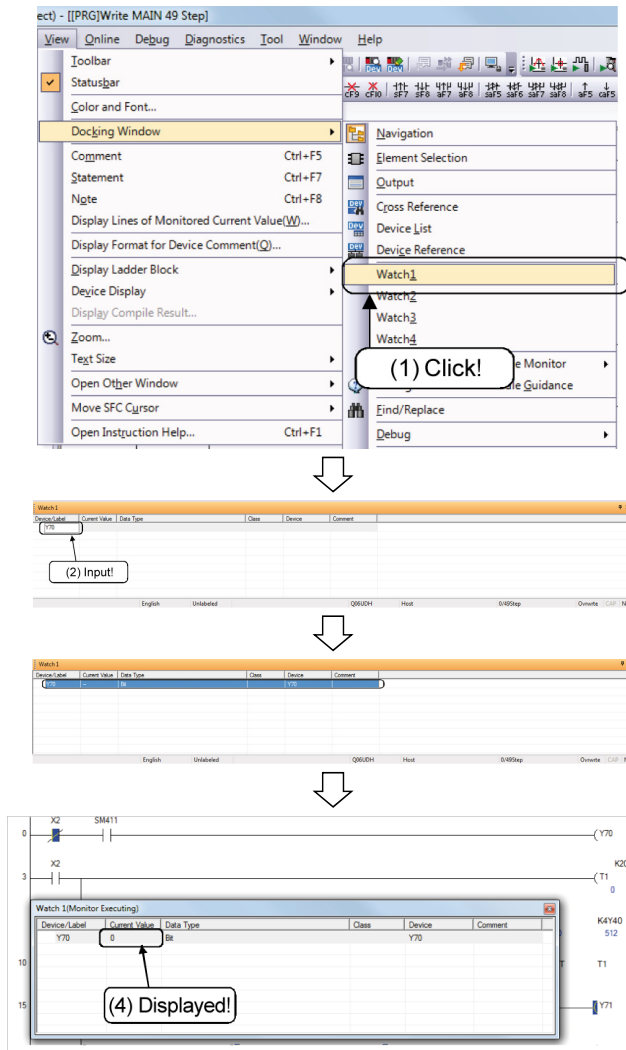
(2) The watch 1 window is displayed. Select the row to be edited, click the Device/Label field, and input "Y70".

(3) The input device/label will be registered.

(4) Click the [Online] → [Watch] → [Start Watching] menu.

    The current value of the registered device/label is displayed on the window.

REMARKS

Device test operation can forcibly change device statuses while monitoring devices by Device/buffer memory batch monitor.
For device test operation, refer to Section 3.10.

3.10 Device Test Operation

Debug operation can forcibly turn ON/OFF bit devices (X, Y, M, L, B, and F) or forcibly change the current values of word devices (D, W, T, C, etc.).

There are two methods of operations. One is double-clicking a device during ladder monitor and the other is using the device test dialog box.

In this section, perform a device test of the program written to the programmable controller CPU in Section 3.5.

Set the "RUN/STOP/RESET" switch of the CPU to "RUN".

Click (monitoring mode) on the toolbar.

Click!

(1) Operation by double-clicking a device during ladder monitor.
  • Turning ON/OFF internal relay M100 or input X1.
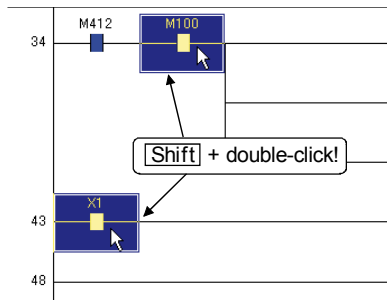
Shift + double-click!

Select M100 on the ladder monitor and double-click it with $\boxed{\text{Shift}}$ pressed.
(Alternatively, $\boxed{\text{Shift}}$+$\boxed{\text{↵}}$ keys)
Select X1 on the ladder monitor and double-click it with $\boxed{\text{Shift}}$ pressed in the same way.
(Alternatively, $\boxed{\text{Shift}}$+$\boxed{\text{↵}}$ keys)

  • Setting the current value of C0 to 990.

(1) $\boxed{\text{Shift}}$ + double-click!
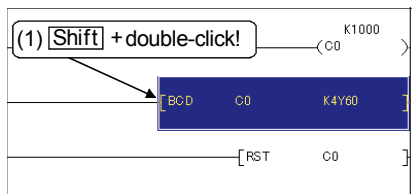
1) Select C0 on the ladder monitor and double-click it with $\boxed{\text{Shift}}$ pressed.
(Alternatively, $\boxed{\text{↵}}$ key)

Modify Value

Device/Label
Device/Label
C0

(2) Select!

Data Type | Word[Signed]

Value | 990

Settable Range
-32768 to 32767

(3) Input "990"!

(4) Click!

DEC
HEX

Set

Execution Result<<

Close

Execution Result

Device/Label	Data Type	Setting Value

Reflect to Input Column   Delete(C)
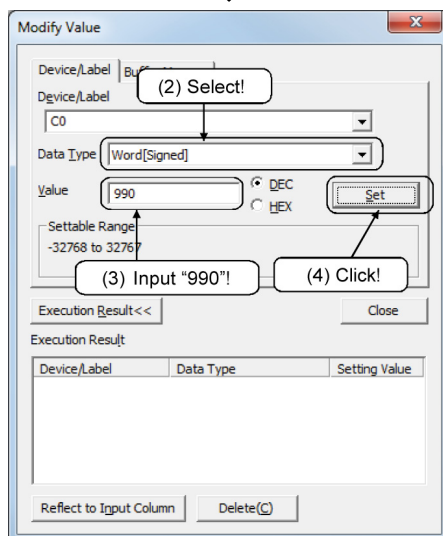
2) Select "Word [Signed]" from the "Data Type" list box.

3) Input "990" in the "Value" list box.
$\boxed{9}$ $\boxed{9}$ $\boxed{0}$

4) After finishing the setting, click the Setting button to change the current value of C0 to 990.

(2) Operation on the Modify Value dialog box
First, follow the procedure below to display the Modify Value dialog box.
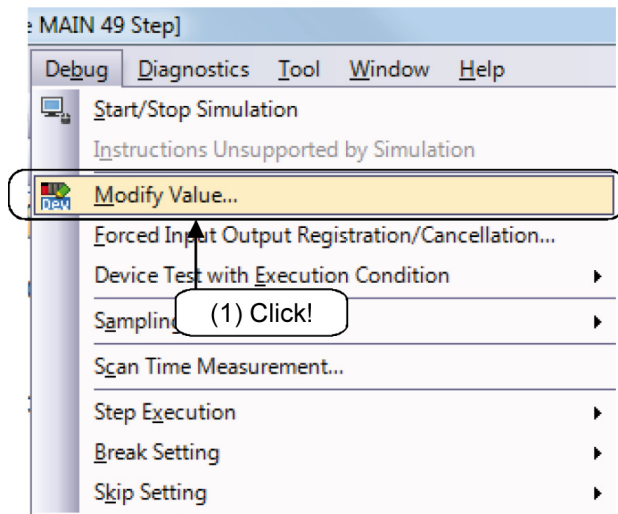
1) Click the [Debug] → [Modify Value] menu.

```
e MAIN 49 Step]
Debug  Diagnostics  Tool  Window  Help
🖳  Start/Stop Simulation
     Instructions Unsupported by Simulation
🔛  Modify Value...
     Forced Input Output Registration/Cancellation...
     Device Test with Execution Condition          ▶
     Sampling                                      ▶
     Scan Time Measurement...
     Step Execution                                ▶
     Break Setting                                 ▶
     Skip Setting                                  ▶
```

(1) Click!

⬇
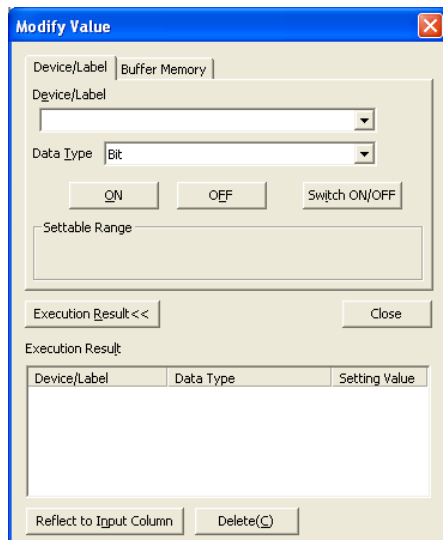
2) The Modify Value dialog box is displayed.

```
Modify Value                               ✕
Device/Label │ Buffer Memory │
Device/Label
[                              ▼]
Data Type  [Bit              ▼]
     ON        OFF      Switch ON/OFF
┌Settable Range──────────────────┐
│                                │
└────────────────────────────────┘
Execution Result<<              Close
Execution Result
Device/Label   Data Type       Setting Value
┌──────────────────────────────────────┐
│                                       │
│                                       │
│                                       │
└──────────────────────────────────────┘
Reflect to Input Column   Delete(C)
```

- Turning ON/OFF output Y75, internal relay M100, or input X1.

```
Modify Value                          ✕
         (1) Specify a bit
              device!
Device/Label │ Buffer Memory │
Device/Label
[M100                        ]  (2) Click!
Data Type  [Bit              ▼]
     ON        OFF .     Switch ON/OFF
```
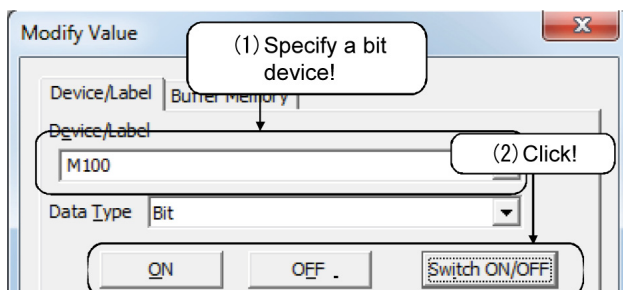
1) Specify the bit device to be turn ON/OFF in "Device/Label". (in the case of M100)

M 1 0 0

2) Turn ON/OFF the specified bit device using the following buttons.
   ON : Forcibly turns ON the specified bit device.
   OFF : Forcibly turns OFF the specified bit device.
   Switch ON/OFF : Forcibly inverses ON/OFF status of the specified bit device.

• Setting the current value of Timer T1 to 100.

(1) Specify "T1"!

(4) Click!

Device/Label

T1

Data Type   Word[Signed]

Value   100   ⊙ DEC
                      ○ HEX   Set
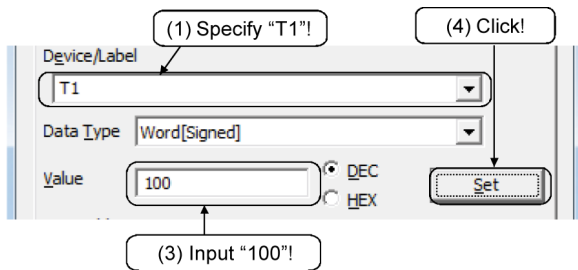
(3) Input "100"!

1) Specify the word device (T1) whose value is going to be changed in the "Device/Label" list.

    T   1

2) Select "Word [Signed]" from the "Data Type" list box.

3) Input "100" in the "Value".

    1   0   0

4) Click the Set button.

┌───┐
│ ┌──────────┐   │
│ │ POINT   │   │
│ └──────────┘   │
│ When the programmable controller CPU is in the RUN status, if a coil whose │
│ input signal of output condition is OFF is forcibly turned ON, the output of the coil │
│ turns ON only for a moment because priority is given to the execution of the │
│ program.   │
└───┘

3.11 Online Program Change

Change a program when the programmable controller CPU is in the RUN status.
There are two types of methods for online program change as follows.

- Online change (ladder mode) : Writes only the changed part of the program
- Online change (files) : Writes programs and files such as device
comments together.

⚠ WARNING	• When data change, program change, or status control is performed from a personal computer to a running programmable controller, configure an interlock circuit outside the programmable controller system to ensure that the entire system will always operate safely. Furthermore, for the online operations performed from a personal computer to a programmable controller CPU, predetermine the system's corrective actions in case of a communication error caused by poor cable connection, etc.

⚠ CAUTION	• When performing online operations (program change while a programmable controller CPU is running, forced input/output operation, operating status changes such as RUN-STOP, and remote control operation) for the running programmable controller CPU from a personal computer, read the manual carefully and ensure sufficient safety before operation. When changing a program while a programmable controller CPU is RUN (online program change), a problem such as program corruption may occur depending on operating conditions. Fully understand the precautions described in this section before use.

POINT
Precautions for online program change • Parameters and programs on the CPU memory before change and ones on GX Works2 must match. • Up to 512 program steps can be written at a time in online program change. • For details of online program change, refer to Appendix 1.

In this section, perform online change (ladder mode).
Change the setting value of Timer T1 to 100 seconds as follows.

Set the "RUN/STOP" switch of the CPU to "RUN".

(1) Click 🔧 (monitor write mode) on the toolbar.

(1) Click!

(To the next page)

(From the previous page)

Monitor (Write Mode)

Execute the function below when mode is changed.

☑ Change the online change setting in Options to 'Execute online change by Compile'.

(Please check the online change setting in Options if you want to edit another program)

☑ Verify PLC and editing target program of GX Works2.

(2) Click!

OK
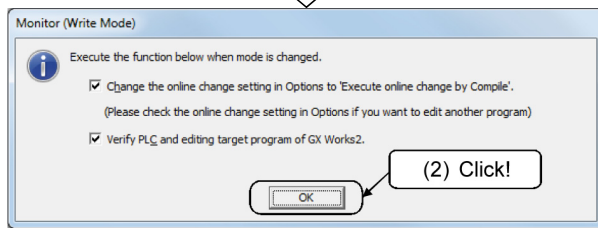
(2) Click the OK button.
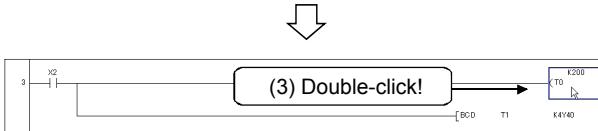
(3) Double-click!

(3) Select T0 on the ladder monitor and double-click it.

Enter Symbol

-( )- T1 K1000 ← (4) Change! OK Exit Help

(4) Change "K200" to "K1000".

ks2 C:\GX Works2.gxw - [[PRG]R Wr

Compile View Online Debug Diag

Build   F4

(5) Click!

Online Program Change   Shift+F4

Rebuild All   Shift+Alt+F4
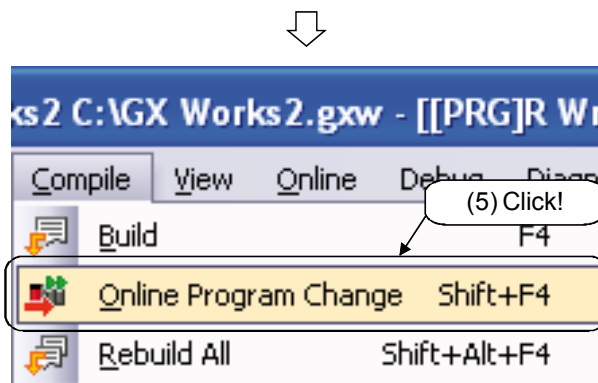
(5) After the change, click the [Conversion/Compilation] → [Conversion + Online Program Change] menu.
(If "Change the optional online change setting to "Execute online change by Conversion (+Compilation)" is checked in step 2, online program change can be executed by the normal conversion process ([Conversion] → [Conversion] menu/Function key F4).)

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⚠ Caution
The operation of online change varies PLC control.
Please ensure the safety before executing.
The target memory is a program on the program memory.

-If rise instruction, fall instruction, SCJ instruction or STMR instruction is given while programming, it cannot work properly.
-Online change to the same program from multiple positions at the same time is prohibited.
-Please make sure that the old program and the program in PLC are identical before executing.

Do you want to continue?

Target Program: MAIN

(6) Click!

Yes   No

(6) A "Caution" message is displayed. Check and understand the description and click the Yes button.

MELSOFT Series GX Works2

ⓘ Online change has completed.
There are 500 online change maintenance steps remaining.

(7) Click!

OK
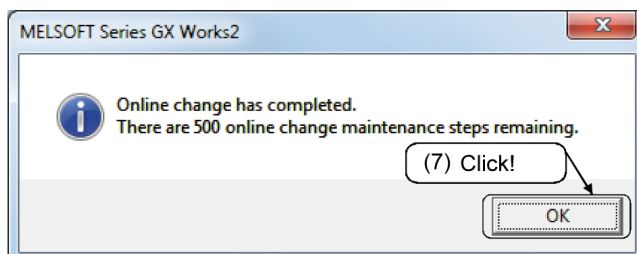
(7) The message "Online program change is completed" is displayed. Click the OK button.

CAUTION

If the program on the programmable controller CPU and that on GX Works2 before modification do not match, online program change cannot be executed. When it is uncertain that they match, conduct verification, make modifications on GX Works2, and then perform online program change.

When turning ON X2, T1 is increased to 1000.

Digital HMI (Human Machine Interface)
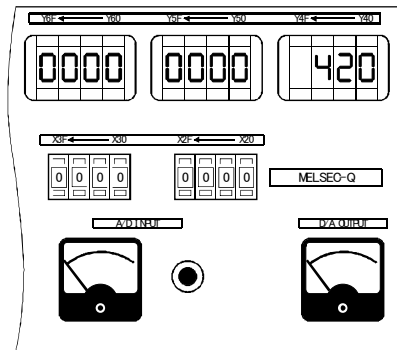
POINT

Precautions for using rise, fall, or SCJ instruction

(1) Fall instruction

Even if the execution condition for a fall instruction in an online changed ladder *1 is not satisfied (in continuity state), the fall instruction is executed.

For fall instructions, refer to the programming manual of QCPU. The following are examples of the instructions.

Fall instruction: PLF, LDF, ANDF, ORF, MEF, FCALLP, EFCALLP, and XCALL

ON/OFF status of contact (Continuity state at online change)	Rise instruction	Fall instruction
OFF	Not executed	Executed
ON	Not executed	Not executed

*1: When a new ladder block is inserted without changing existing programs, the added program is written together with the next ladder block to the programmable controller CPU. (If the next ladder block does not exist, the previous ladder block is written together.)

Thus online program change may not be completed at a time depending on the number of program steps of the added program and the previous or next one. In this case, reduce the number of steps written at a time and perform online program change in several times.

<Example>

(2) Rise instruction

When writing is completed, even if the execution condition for a start-up execution instruction (PLS instruction / □P instruction) is ON, the start-up execution instruction is not executed.

When the execution condition turns OFF → ON again, the start-up execution instruction is executed.

(3) SCJ instruction

When writing is completed, if the execution condition for SCJ instruction is ON, the instruction executes a jump to the specified pointer without waiting for 1 scan.

3.12 PLC Verify Operation

Compare and verify programs, parameters, device comments on the programmable controller CPU with data on GX Works2.
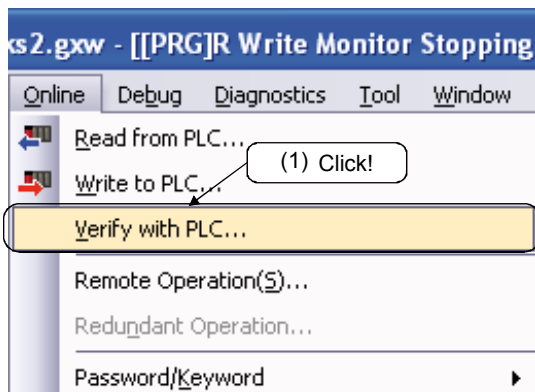
(1) Click the [Online] → [Verify with PLC] menu.
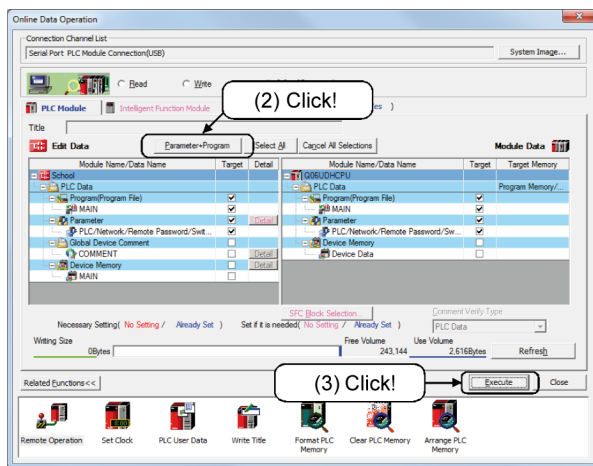
(2) The Online Data Operation dialog box is displayed. Click Parameter + Program.

(3) Click the Execute button.
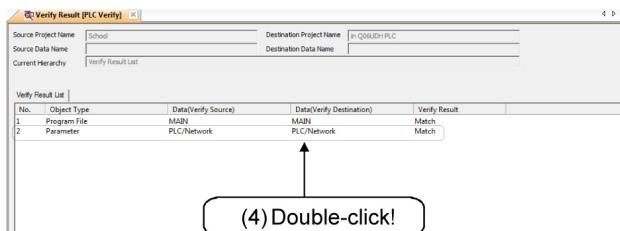
(4) The verification result is displayed.

To check details of data, double-click the corresponding row.
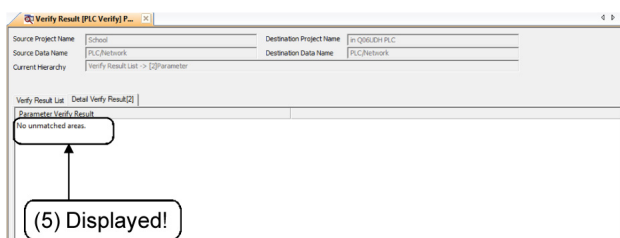
(5) The detailed result is displayed.

3.13 Read from PLC Operation

Read programs, parameters, device comments on the programmable controller CPU.

(1) Click! (on the toolbar image)
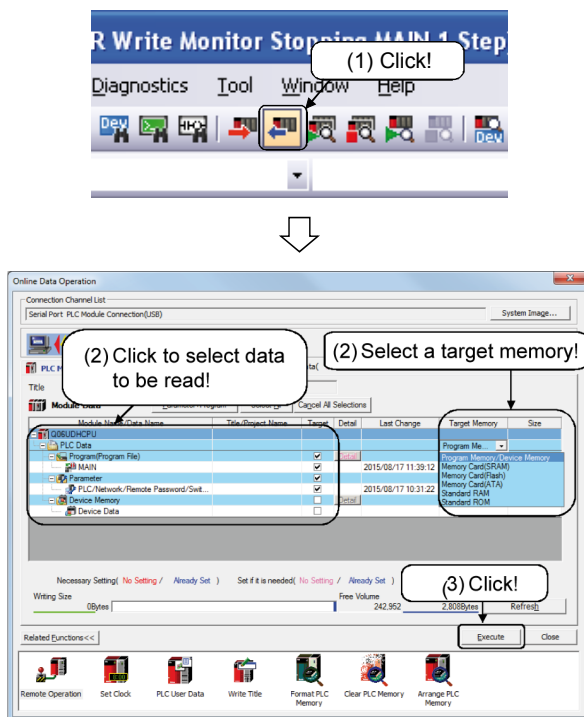
(1) Click 🔙 on the toolbar or the [Online] → [Read from PLC] menu.

(2) Click to select data to be read!

(2) Select a target memory!

(3) Click!

(2) Click to select the program and the parameter to be read on the "CPU module" tab. Alternatively, click "Parameter + Program".

Also, select "Program/Device Memory" in "Target Memory".

(3) After finishing all selections, click Execute .

(4) Click!

MELSOFT Application
Parameter already exists.
Are you sure you want to overwrite the existing file?
Yes   Yes to all   No
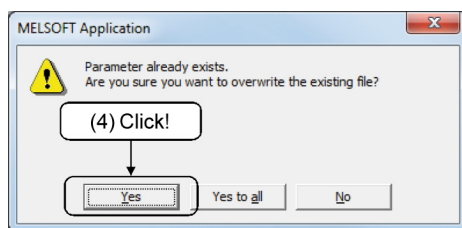
(4) When the project is already under editing, a dialog box asks whether to save changes. Click Yes .

Read from PLC
4/4
100/100%
Parameter Read : Completed
Boot File Read : Completed
Remote Password Read : Completed
Program (MAIN) Read : Completed
Read from PLC : Completed
☐ When processing ends, close this window automatically.
Close
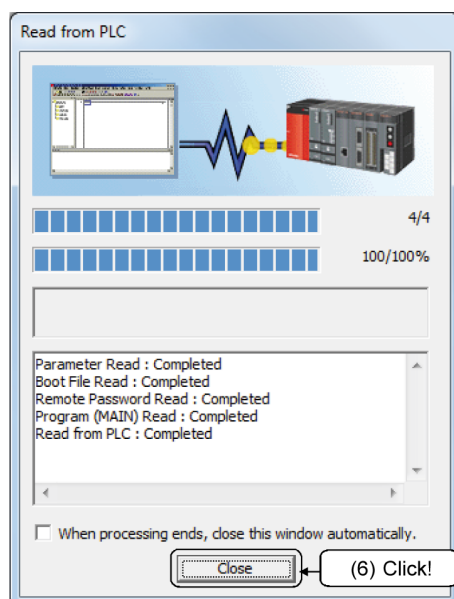
(6) Click!

(5) The dialog box showing the read progress is displayed.

(6) When the read is completed, the message "Completed" is displayed. Click the Close button.

3.14 Termination Operation of GX Works2

(1) Click!

Exit (Q)

(2) Click!

(If the ladder is not converted.)

(If the project is not saved.)
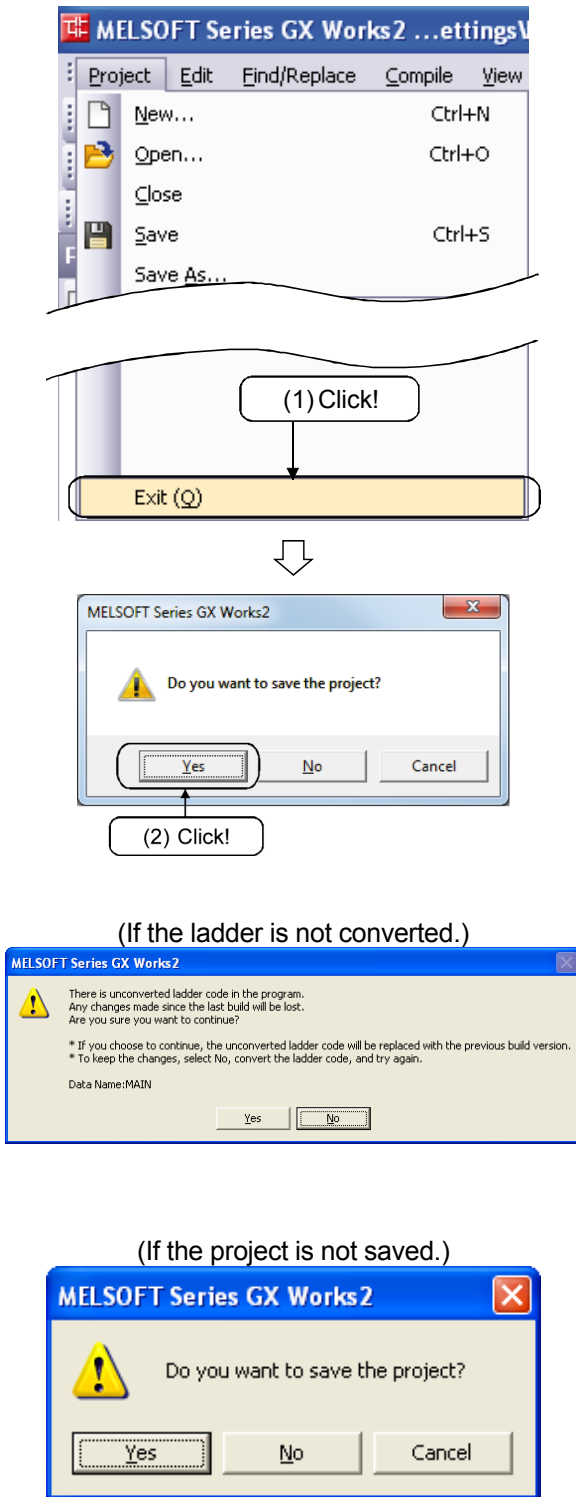
(1) Click the [Project] → [Exit] menu.

(2) A confirmation dialog box is displayed. Click the ⬚Yes⬚ button.
GX Works2 is terminated.

The dialog box on the left will appear depending on the status of the project.

⬚Yes⬚ ················ Exits GX Works2 without conversion.
⬚No⬚ ················ Does not exit GX Works2.

⬚Yes⬚ ················ Exits GX Works2 after saving the project.
⬚No⬚ ················ Exits GX Works2 without saving the project.
⬚Cancel⬚ ············ Does not exit GX Works2.

3.15 New Read from PLC Operation

Newly read programs, parameters, device comments on the programmable controller CPU.
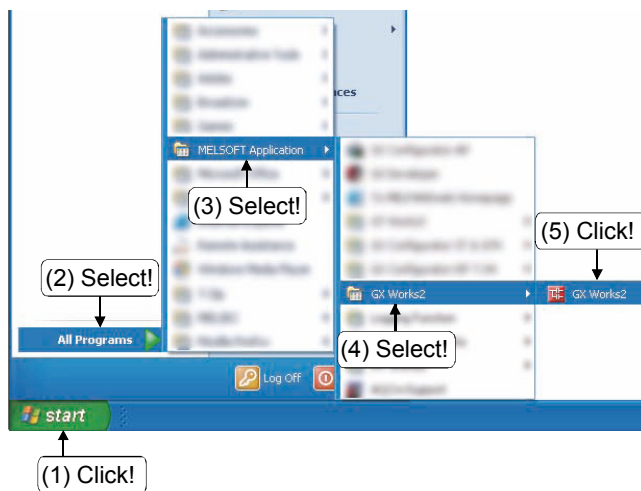
(3) Select!

(5) Click!

(2) Select!

(4) Select!

(1) Click!

(1) Click the [Start] button.

(2) Select the [All programs] menu.

(3) Select the [MELSOFT application] menu.

(4) Select the [GX Works2] menu.

(5) Click the [GX Works2] menu.

> Creating a shortcut of GX Works2 on the desktop will facilitate starting up GX Works2.
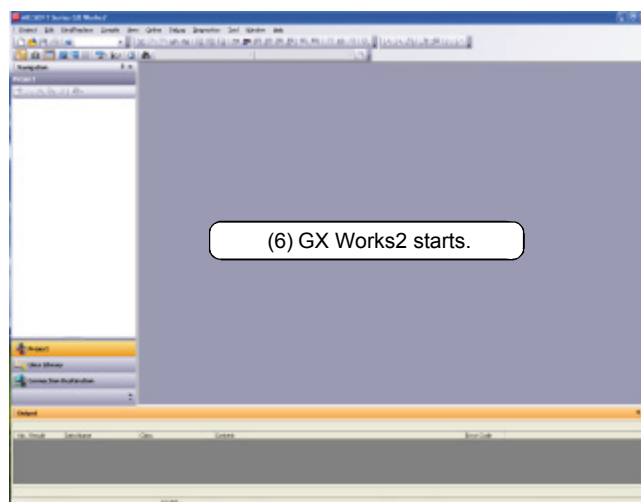
(6) GX Works2 starts.

(6) GX Works2 starts.
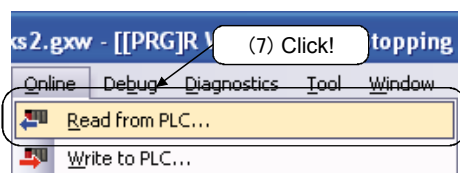
(7) Click!

(7) Click the [Online] → [Read from PLC] menu.

(8) Select "QCPU (Q mode)"!
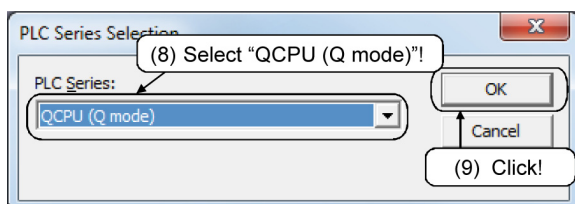
(9) Click!

(8) Select "QCPU (Q mode)" from the "PLC" list box.

(9) Click the OK button.

(To the next page)

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(From the previous page)

⬇
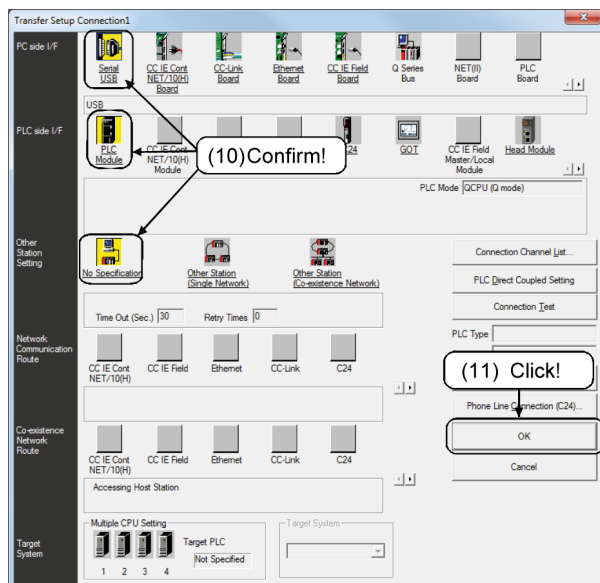
(10) Check that settings in Transfer Setup are as follows.

Personal computer side I/F : Serial (USB)
PLC side I/F : CPU module
  QCPU (Q mode)
Other Station Setting : No Specification

(11) Click the OK button.

⬇
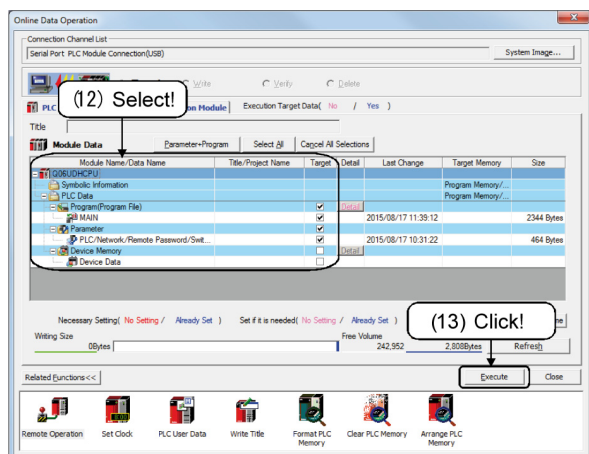
(12) Click to select the program and the parameter to be read on the "CPU module" tab.
Alternatively, click "Parameter + Program".

(13) Click the Execute button.

⬇
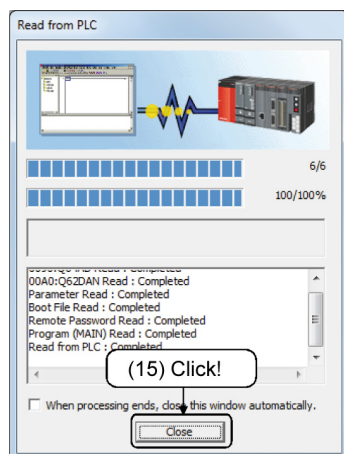
(14) The dialog box showing the read progress is displayed.

(15) When the read is completed, the message "Completed" is displayed. Click the Close button.

⬇

(To the next page)

⇩
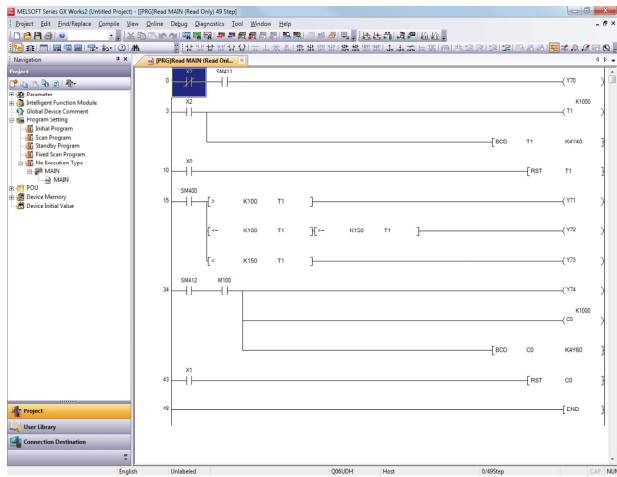
(16) Click the data read from "No Execution Type" in the project list to display the sequence program.

MEMO

Chapter 4 Designing Maintenance Measures

It is necessary to consider the maintenance in the design stages in order to achieve a design that is less susceptible to failure or accidents and is easily maintainable.

4.1 Preliminary Actions to Implement Maintenance Measures

(1) Adopt products with fewer failures
To put it simply, products with high reliability should be used, but the following points should also be considered.
1) Is the manufacturer reliable?
2) Is it accredited by various national and international standards?
3) Is the design simple?
4) Does the product have good performance with low failure rate?
5) Is the industry reputation good?

(2) System design with good serviceability
The following points may be considered to design a system that can be easily maintained.
1) Adopt a programmable controller for which the parts and products are easily available.
2) Adopt a programmable controller having high serviceability with self-diagnostics function, etc.
3) Adopt a programmable controller in which the programs can be easily read, changed and stored.
4) Design the system so as to automatically display the defects.
5) Carry out the design in a space in which maintenance, inspection and repair work can be easily carried out.
6) Design the system such that the parts replacement, product replacement, wiring change etc. can be carried out easily.

(3) Copying sequence programs into ROM
Running a sequence program stored in program memory is convenient and facilitates program changes. However, lightning surge noise, power supply failure, or others can cause loss of the program.
To prevent the trouble, store them in standard ROM or a memory card (ATA/Flash ROM), which ensures safety.

(4) Backup of sequence programs
Be sure to make backups of sequence programs in hard disk drives or CD-ROMs so that they can be easily written when the programmable controller fails and needs restoration.
Describe the day, month and year and details of changes as a comment on a backup file.

4

4.2 Using Programmable Controller with High Serviceability

MELSEC-Q has an excellent RAS function and self-diagnostics function.

4.2.1 RAS Function

RAS function is a generic term for the function improving [product reliability], [equipment availability] and [serviceability].

Table 4-1 RAS Function

	Name	Meaning	RAS function (other than self-diagnostics function) of programmable controller
R	Reliability	Reliability of the hardware or system that relates to failures	Because the required quality is realized during the design, production and quality assurance phases, the product is highly reliable and has a low failure rate
A	Availability	Effectiveness or availability as equipment	• A module can be replaced in a single operation • I/O module working during the power-on • Sampling trace function • Latch function
S	Serviceability	Ease of service Function improving the availability of equipment	• Remote PAUSE function • Multiple-user debug function • Monitor function by peripherals

RAS concepts

If the equipment fails for the first time in five years, R (reliability) can be deemed as high.

On the other hand, if there is no spare part or it takes long because of a lack of experience in recovery, S (serviceability) is deemed as low, thus resulting in A (availability) being poor.

Additionally, if the equipment sometimes fails, but can be recovered in a short time, R (Reliability) may be low, but S (serviceability) is high, causing A (availability) to be excellent. RAS function requires the three functions to be high in a balanced manner.

4.2.2 Self-Diagnostics Function

(1) Self-Detecting the Error Definition of the Programmable Controller
Function that enables the programmable controller CPU to automatically detect an error occurring in the programmable controller and to turn on the predefined bit device (bit signal) or to store an error number in the word device (word signal).

Table 4-2 Self-diagnostics Function

Processing function	Sample error items that can occur

Displays the diagnostics result by turning ON or OFF bit signals
 	
Special relay (SM0 to SM1199)
	• Self-diagnostic error (indicates the total number of self-diagnostic errors)
	• Operation error (indicates that an operation error occurred)
	• Battery voltage drop (warns that the battery for backing up the memory has low capacity now)
	• AC down detection (instantaneous power failure or voltage drop within the specified instantaneous power failure time)
	• I/O module verification error
	  (The mounting status of the I/O module differs from that which was registered during the power-on)
	• Watchdog timer error
	  (Program scan does not complete within the specified time, causing the operation to hang up)
	• Fuse blown detection (detects a fuse blown in the I/O module)

Displays a code number for the diagnostics result using a numerical value (word data) Special register (SD0 to SD1431)	• Fuse blown (I/O number of the output module where the fuse was blown) • I/O module verification error (I/O number of a module whose the state differs from the mounted state when the power supply was turned on) • Number of AC power supply failures (number of instantaneous power failures or voltage drops of AC power supply) • Self-diagnostic error (number of the error when the self-diagnostics detects an error) • Error step (step number of a program that generated an operation error)

1) When a trouble occurs in the programmable controller, trouble contents can determined by using a peripheral to read the contents of the self diagnostics result. Take corrective actions according to the contents to shorten the recovery time.
2) In the event an operation unexpectedly stops, etc., the power failure or voltage drop of AC power supply can be determined to be a cause if AC down detection is turned on.
3) When contacting the manufacturer, informing them of the self diagnostics result (error number) would let them locate the cause faster.

(2) To display the list of error codes in GX Works2

1) Select the [Help] → [GX Works2 Help] menu.
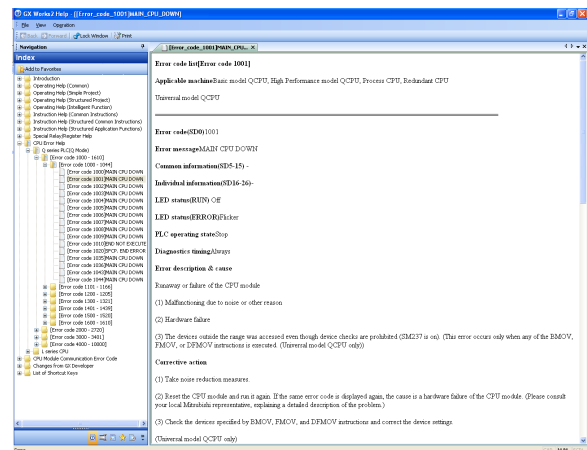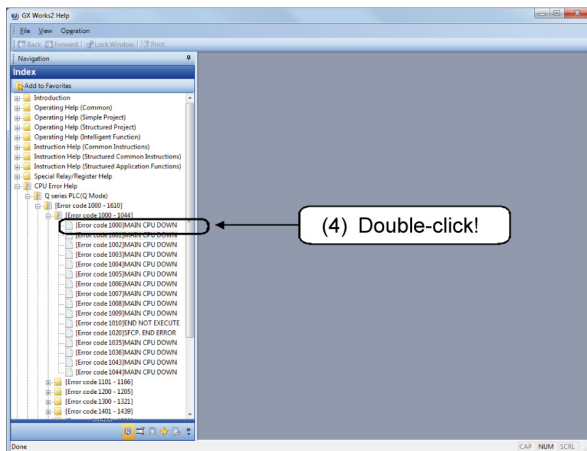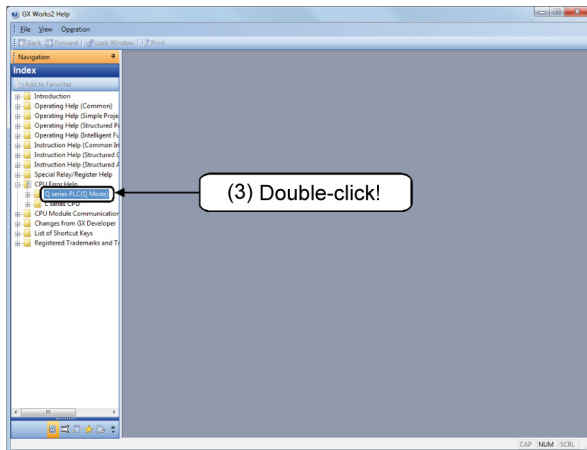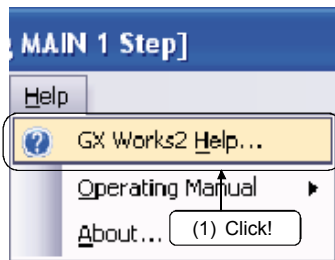
2) The GX Works2 help is displayed.

3) Select "CPU Error Help" and choose your programmable controller CPU from the Help menu.
In this case, double-click "Q series PLC (Q Mode)".

4) The error code list of the chosen programmable controller CPU is displayed.
Double-click the error code whose description you want to check.
In this case, double-click and select [Error Code 1000 to 1610] → [Error Code 1000 to 1035] → [Error Code 1001 MAIN CPU DOWN].

5) The system displays the details such as the cause and corrective action of the selected error code.

(3) What are special relays and special registers?
These are the devices whose applications are fixed in the programmable controller.
They are used for error detection, CPU module operating status and special functions.
(They can be applied or not depending on the CPU type.)

[Sequence program of the application example]
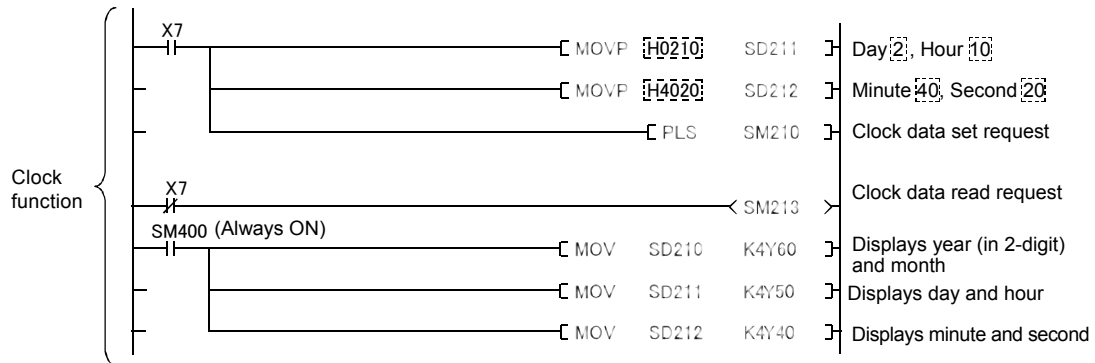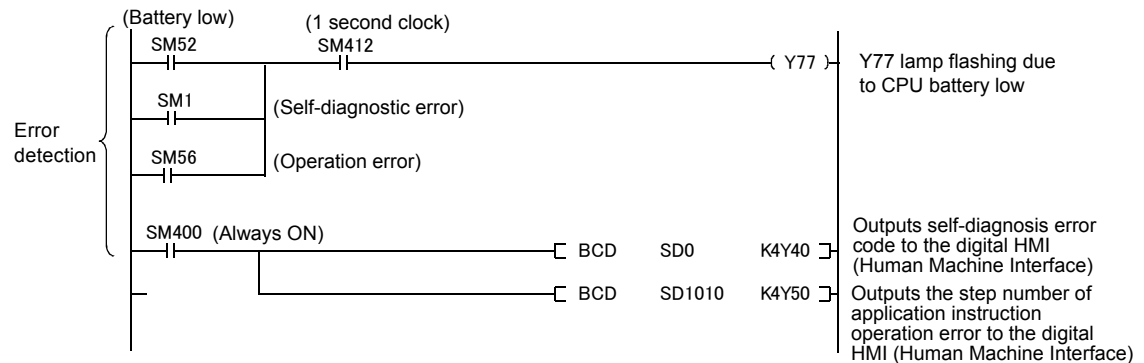
REMARKS

• If the annunciator of the device for failure detection is turned ON, an error code "9000" is stored in SD0.
  Use a peripheral to read the error individual information and check the program of the numerical value (annunciator number).
• The error diagnostics information is stored in the following devices:
  SD0 : Stores the diagnosed error code using a BIN code.
  SD1 to SD3 : Stores the date and time when the SD0 data was updated.
  SD4 : Stores the category codes that determine the description of the error information stored in the common information (SD5 to SD15) and the individual information (SD16 to SD26).
  SD5 to SD15 : Stores the following common information (either of the following "1)" to "5)") corresponding to the error code (SD0):
    1) Module number   4) Program error location
    2) File name/drive name 5) Cause of switching
    3) Time (setting value)
  SD16 to SD26 : Stores the following individual information (either of the following "1)" to "6)") corresponding to the error individual information (SD0):
    1) File name/drive name 4) Parameter number
    2) Time   5) Annunciator number/CHK
       (actual measurement value)   instruction failure number
    3) Program error location 6) Intelligent function module parameter error

(4)   To display the list of special relays and special registers in GX Works2

1)   Select the [Help] → [GX Works2 Help] menu.
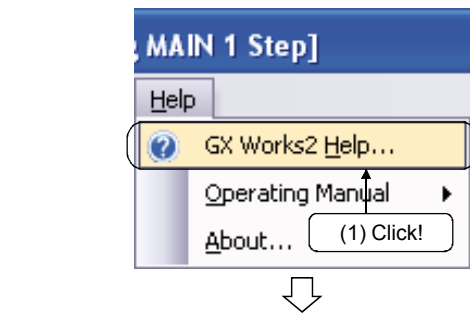
2)   The GX Works2 help is displayed.

3)   Select "Special Relay/Register Help" and choose your programmable controller CPU from the Help menu.
In this case, double-click and select the "Q series PLC (Q Mode)" menu.
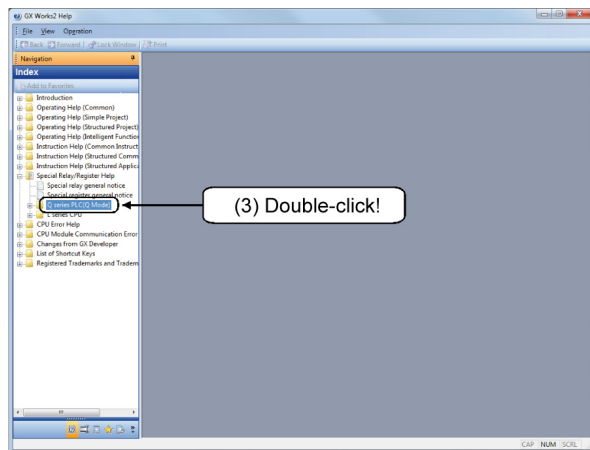
4)   The system displays the error code list of the special relays and special registers for the chosen programmable controller CPU.
Double-click and select the device whose description required you want to check.
In this case, double-click and select the [Special Relay (diagnostics information) [Number SM0 to SM165]] → [Number SM0 to 16] → [Number SM0 Diagnostic errors].
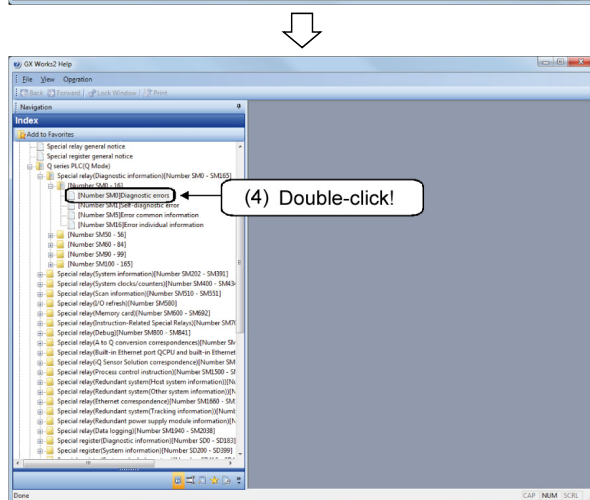
5)   The system displays the detail of the selected special relay device.

⬦WARNING

- Configure a safety circuit outside the programmable controller so that the entire system can operate safely even when an external power supply error or a programmable controller failure occurs. Failure to do so may cause an incorrect output or malfunction, resulting in accidents.
  - (1) Configure safety circuits such as an emergency stop circuit, protection circuit, interlock circuit for opposite operations such as forward/reverse rotations or interlock circuit for machine damage protection such as upper/lower limits for positioning outside the programmable controller.
  - (2) When the programmable controller detects the following error status, it will stop operations and turn OFF all outputs in the case of (a).
    In the case of (b), it will hold or turn OFF all outputs according to the parameter setting. Note that the AnS series module will turn OFF the output in either case (a) or (b).

	Q series modules	AnS series modules
(a) When overcurrent protection or overvoltage protection of the power supply module works	Output OFF	Output OFF
(b) When the programmable controller CPU detects a watchdog timer error and the like in the self-diagnostics function	All outputs will be retained or OFF, depending on parameter setting	Output OFF

      When an error occurs at the I/O control part where the programmable controller CPU cannot detect, all outputs can be turned ON. Configure a fail-safe circuit or some mechanism outside the programmable controller so that the machine operates safely in such a case.
  - (3) Outputs may remain ON or OFF due to a failure of an output module relay or transistor. Configure an external circuit for monitoring output signals that may lead to a serious accident.
- Configure a safety circuit such as a fuse outside the output module because smoke or fire may result if a load current exceeding the rated current or an overcurrent caused by load short flows continuously for a long time.
- Configure a circuit so that an external power supply will be turned on after the start-up of the programmable controller. If the external power supply is turned on first, an incorrect output or malfunction may occur, resulting in accidents.
- For the operating status of each station during data link communication error, refer to each data link manual. Failure to do so may cause an incorrect output or malfunction, resulting in accidents.

<table>
<tr><td>◇WARNING</td><td>● When controlling (changing data) the running programmable controller from a peripheral connected to the CPU module or from a personal computer connected to an intelligent function module, configure an interlock circuit in the sequence program to ensure that the entire system will always operate safely.
For other operations (program modification, operating status change (status control)) to the running programmable controller, read relevant manuals carefully and ensure the safety before operation.
Ensure the safety especially when controlling the remote programmable controller from eternal devices because trouble occurred on the programmable controller side may not be responded immediately due to data communication error.
Along with configuring an interlock circuit in a sequence program, determine the system's corrective actions to be taken between external devices and the programmable controller CPU in case of a data communication error.</td></tr>
</table>

<table>
<tr><td>⚠CAUTION</td><td>● Do not bundle or adjacently place the control line or a communication cable with the main circuit or a power cable.
Keep a distance of approximately 100 mm or more between them. Failure to do so may cause malfunction due to noise.
● When a device such as a lamp load, heater, or solenoid valve is controlled through an output module, a large current (approximately 10 times greater than normal) may flow when the output is turned OFF → ON. Take measures such as replacing the module with one having a sufficient current rating.</td></tr>
</table>

Incorrect process outputs may occur temporarily due to a delay time and difference in rise time between the power supply to the programmable controller and the external power supply to the process (especially in DC) when the programmable controller is turned ON → OFF.

For example, if the power supply to the programmable controller is turned on after the external power supply to the DC output module process is turned on, the DC output module may output instantaneously by mistake when the programmable controller is turned on. Therefore, it is necessary to configure a circuit so that the power is supplied to the programmable controller first.

In addition, faulty operations may occur at the time of external power supply failure or programmable controller failure.

Configure safety circuits (emergency stop circuit, protection circuit, interlock circuit, etc.) that may lead to machine damage or accidents due to faulty operations outside the programmable controller to prevent faulty operations from causing the entire system to operate faulty or from the fail safe aspect.

The following page shows a system design circuit example based on points above.

(1) System design circuit example (when the contact of the power supply module $\overline{ERR}$ is not used)

For AC

Power supply
Transformer
Fuse
CPU module
SM52 — Ym
SM403 — Yn
Program
Start up SW
RA1 — MC
MC Stop SW
Input module
Output module
Ym — L
Yn — RA1
Output module
MC
MC2 — MC1
MC1 — MC2
MC

DC current establishment signal input
Start/stop circuit
Can be started by turning ON RA1, which is the RUN output of the programmable controller

Alarm output (Lamp or buzzer)
ON during RUN due to SM403

Power-off output equipment when stops
Emergency stop or stop at upper limit

Interlock circuit
Configure an external interlock circuit in a part where opposite actions such as forward/reverse rotation is performed or where damage or an accident may occur.

For AC/DC

Power supply
Transformer   Transformer
Fuse   Fuse
CPU module
SM52 — Ym
SM403 — Yn
XM — TM
TM — MC1 NO M10
NO
M10
Program
Start up SW
RA1 — MC
MC Stop SW
RA2 — XM
RA2
Output module
Ym — L
Yn — RA1
Output module
MC MC
MC2 — MC1
MC1 — MC2

DC power supply (−)(+)
Fuse
The time until DC input signal is established shall be set to TM.

A voltage relay is recommended.

Alarm output (Lamp or buzzer)
ON during RUN due to SM403

Power-off output equipment when stops
Emergency stop or stop at upper limit

Start up the power supply in the following procedure:

For AC

[1] Turn "ON" the power.
[2] "RUN" CPU.
[3] Turn "ON" the start-up SW.
[4] Turn "ON" the electromagnetic contactor (MC) to drive the output equipment with a program.

For AC/DC

[1] Turn "ON" the power.
[2] "RUN" CPU.
[3] Turn "ON" RA2 after the DC power supply on.
[4] Turn "ON" the timer (TM) after the DC power supply is completely on. (The setting value of the TM shall be the time between turning "ON" RA2 and the full establishment of the DC voltage. Configure the setting value to 0.5 second.)
[5] Turn "ON" the start-up SW.
[6] Turn "ON" the electromagnetic contactor (MC) to drive the output equipment with a program. (If a voltage relay is used for RA2, the timer (TM) in the program is not required.)

(2) System design circuit example (when the contact of the power supply module $\overline{ERR}$ is used)

Power supply

For AC/DC

Transformer   Transformer

Fuse   Fuse

DC current
establishment

CPU module

Start/stop circuit
Can be started by
turning ON RA1, which
is the RUN output of the
programmable
controller

DC power
supply
−)(+)

SM52 ──┤├── (Ym)

SM403 ──┤├── (Yn)

XM ── (TM)

The time until DC input
signal is established
shall be set to TM.

NO ──TM──┤├── MC1 NO M10

M10
Program

Start up
SW

RA1 RA3
──┤MC├── Stop SW ── (MC)

RA2 — A voltage relay is
recommended.

RA2 ──┤├── ○ XM
              ○
Output module

Ym ──┤├── (L) — Alarm output
(Lamp or buzzer)

Yn ──┤├── (RA1)

Power supply module

$\overline{ERR}$ ──┤├── (RA3) — OFF when a stop error
occurs due to $\overline{ERR}$

Output module

MC MC — Power-off output
equipment when the
$\overline{ERR}$ contact OFF

Emergency stop or
stop at upper limit

Interlock circuit
Configure an external
interlock circuit in a
part where opposite
actions such as
forward/reverse
rotation is performed
or where damage or
an accident may occur.

MC2 ──┤├── (MC1)

MC1 ──┤├── (MC2)

Start up the power supply in the following procedure:

For AC/DC

[1] Turn "ON" the power.
[2] "RUN" CPU.
[3] Turn "ON" RA2 after the DC power supply on.
[4] Turn "ON" the timer (TM) after the DC power supply is completely on. (The setting value of the TM shall be the time between turning "ON" RA2 and the full establishment of the DC voltage. Configure the setting value to 0.5 second.)
[5] Turn "ON" the start-up SW.
[6] Turn "ON" the electromagnetic contactor (MC) to drive the output equipment with a program. (If a voltage relay is used for RA2, the timer (TM) in the program is not required.)

(2) Fail safe measure against programmable controller failures

Although failures of the programmable controller CPU and memory are detected by the self-diagnostics function, a failure may not be detected depending on the CPU when an error occurs at the I/O control part. etc.

In such cases, depending on the failure status, it is expected that all outputs are turned ON or OFF or that the proper operations or safety of the controlled systems cannot be secured.

Although Mitsubishi assures the best quality products, configure a fail-safe circuit outside in order to prevent machine damage and accidents when the programmable controller fails for some reason.

The following illustrates a sample system and its fail safe circuit example:

<Sample system>
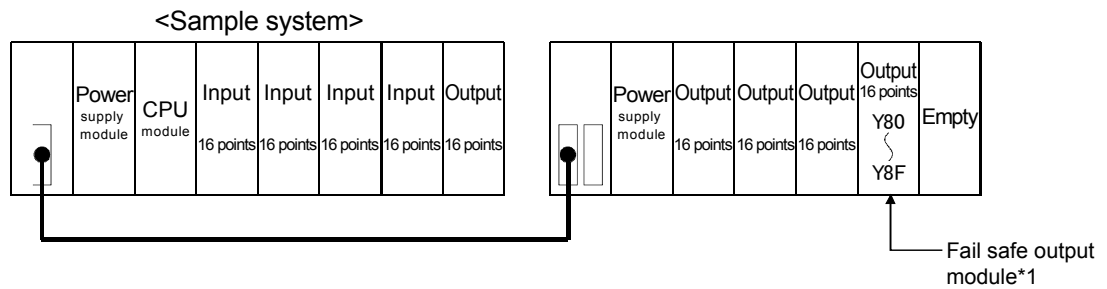
*1: Mount the output module for fail safe in the last slot of the system. (For the above system, the last slot shall contain Y80 to Y8F.)

<Sample fail-safe circuit>
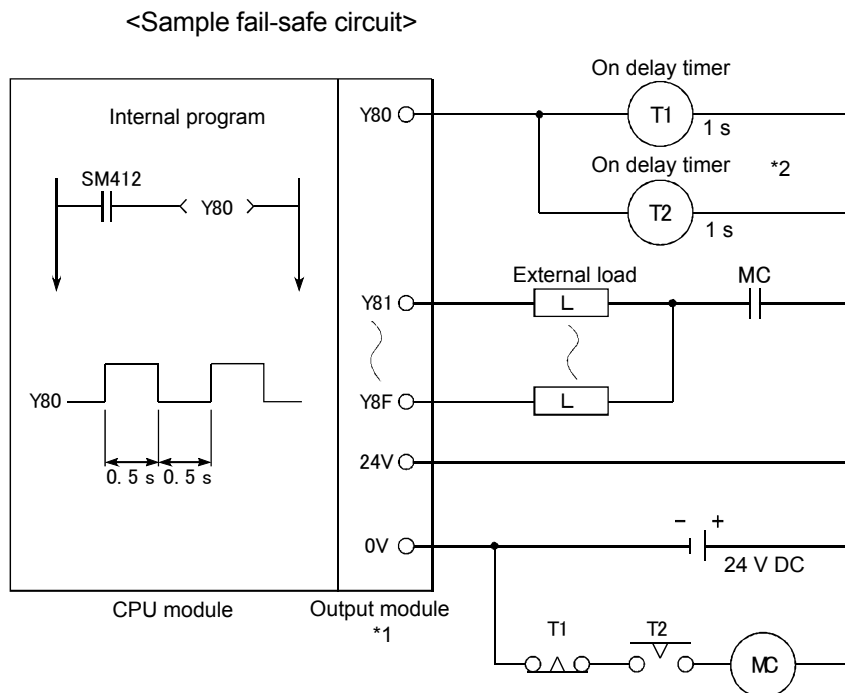
Figure 4-3 Sample fail-safe circuit 1

*1 Since Y80 is repeatedly turned ON and OFF every 0.5 second, use an output module (transistor in the example above) with no contact.

*2 If off delay timers (especially, miniature timer) are difficult to obtain, use on delay timers as shown in the next page to configure a fail-safe circuit.

When configuring a fail-safe circuit using only delay timers
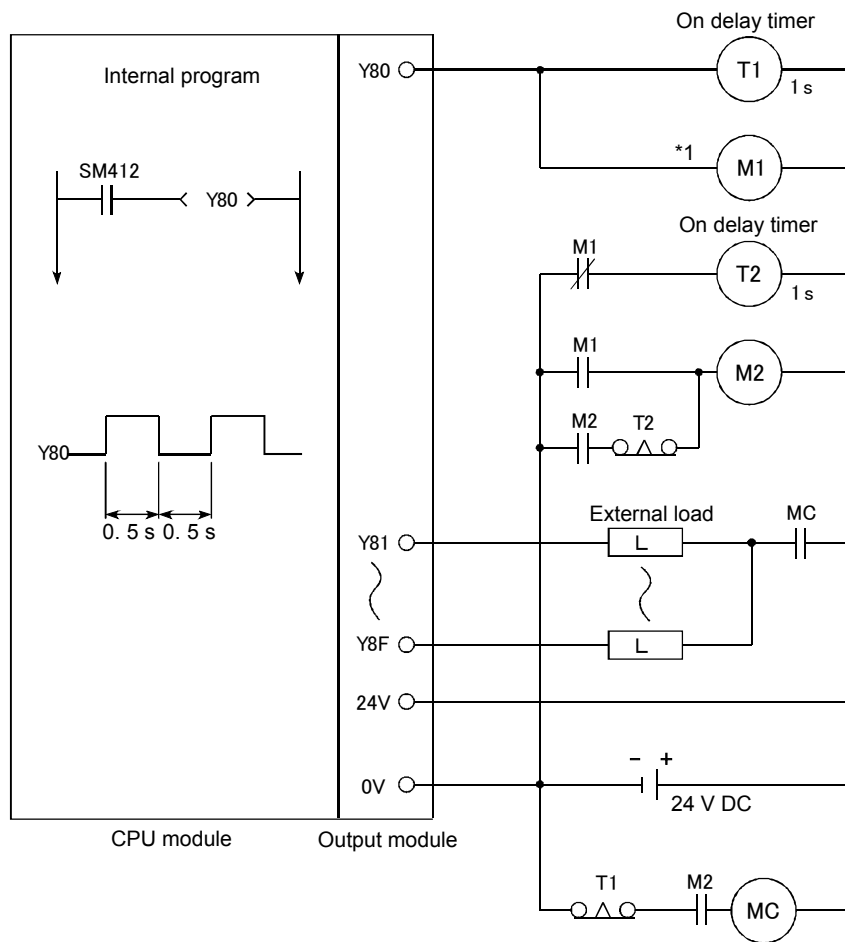
Figure 4-4 Sample Fail-safe Circuit 2

*1   Use a solid state relay for the M1 relay.

Chapter 5 Preventive Maintenance

Preventive maintenance consists of daily maintenance and inspection and periodic maintenance and inspection.

5.1 Necessity of Preventive Maintenance

High availability of equipment cannot be ensured from occurrence of production system failure to its repair.

Because preventing failures and equipment stop are top priorities, if reliable preventive maintenance is performed, prevention of catastrophic failures becomes possible, and recovery from failures will be quick.

5

5.2 Daily Maintenance and Inspection

The following table shows items to be inspected daily to find risks in a production system in advance.

Table 5-1 Daily Maintenance and Inspection

Item	Inspection item		Inspection content	Criterion	Corrective action
1	Mounting condition of base unit		Check that mounting screws are not loosened and the cover is not detached.	They must certainly be fixed.	Drive the screws in tight again.
2	Mounting conditions of I/O modules, etc.		Check that the modules are not likely to come off and module fixing hooks are surely locked.	The module fixing hooks shall be surely locked and fixed.	Be sure to lock the module fixing hooks.
3	Connection status		Looseness of terminal screws	They must not be loosened.	Drive them in tight again.
			Proximity of solderless terminals	They must be at an appropriate interval.	Correct the interval.
			Connector parts of cables	The connectors shall not be loosened.	Drive connector fixing screws in tight again.
4	Main indicator lamp	Power supply "POWER" LED	Check if it is ON	ON (The LED is faulty if is OFF)	Refer to Section 6.4
		CPU "RUN" LED	Check if it is ON in "RUN" state	ON (The LED is faulty if is OFF)	Refer to section 6.5
		CPU "ERR." LED	Check if it is OFF	OFF The LED is faulty if is ON or flashing	
		CPU "BAT." LED	Check if it is OFF	OFF (The LED is faulty if is ON)	
		Input module Input status indicator LED	Check whether it is ON or OFF.	ON when input is ON. OFF when input is OFF. (The LED is faulty if it is in a state other than above)	Refer to Sections 6.6 and 6.7
		Output module Output status indicator LED	Check whether it is ON or OFF.	ON when output is ON. OFF when output is OFF. (The LED is faulty if it is in a state other than above)	
5	Condensation		Check the presence of water droplet and moisture.	Not allowed.	Remove the condensation.

5.3 Regular Maintenance and Inspection

The following table shows items to be inspected once or twice a year to find risks in a production system in advance.

Table 5-2 Regular Maintenance and Inspection

Item	Inspection item		Inspection method	Criterion	Corrective action
1	Environment	Ambient temperature	Measure using thermo-hygrometers. Measure corrosive gases.	0 to 55°C	If a module is used inside a panel, the in-panel temperature must meet the criterion for the ambient temperature.
		Ambient humidity		5 to 95%RH [*1]	
		Atmosphere		No corrosive gases	
2	Power supply voltage check		100/200 V AC, 24 V DC, Measure voltage between terminals	85 to 132 V AC	Change the supply power.
				170 to 264 V AC	
				15.6 to 31.2 V DC	
3	Mounting condition	Looseness and play	Move the modules.	They must firmly be fixed.	Drive the screws in tight again. If the CPU module, the I/O module, or the power supply module is loosened, fix it with screws.
		Adhesion of dirt and foreign matters	Visual inspection	There must be no adhesion of them.	Remove and clean
4	Connection status	Looseness of terminal screws	Retightening the screws using a screwdriver	They must not be loosened.	Drive the screws in tight again.
		Proximity of solderless terminals	Visual inspection	They must be at an appropriate interval.	Correct the interval.
		Looseness of connectors	Visual inspection	They must not be loosened.	Drive connector fixing screws in tight again.
5	Battery		Check that SM51 or SM52 is OFF in the monitoring mode of GX Works2.	(preventive maintenance)	Replace a battery of which specified life is exceeded even if there is no indication of low battery capacity.
6	Fuse		Check that they are not blown with a blown fuse indicator LED.	(preventive maintenance)	Periodically replace them even if they are not blown because the elements are consumed by inrush current.
7	Spare parts		Attach them to the actual module and check the operation.	They must work as the specifications.	Use the parts that attached to the actual module as spare parts.
8	Checking stored programs		Compare with the current programs.	Must be the same.	Correct if they are not the same.
9	Fan (heat exchanger) filter		Rotation status Rotation sound Clogging	It must rotate without abnormal sound and not be clogged.	Clean or replace it if there is a problem.
10	Analog input/output		Checking the offset/gain values	Are they the same as the specifications (designed values)?	Correct if they are not the same.

*1: 10 to 90% RH when a module for AnS series is used for the system.

5.4 Condition Monitoring-based Maintenance

This design achieves maintenance in response to errors and failures by externally monitoring the condition of production system all the time and immediately reporting the occurrence of errors and failures.
The following are examples of condition monitoring.

(1) Example of external display of error code numbers
Connect a digital HMI (Human Machine Interface) to output modules of the programmable controller to display a code number on the HMI (Human Machine Interface) when an error code is detected.

Output module (Y70 to Y8F)

Fault indicator lamp

Error code Error code
| 0 | 0 | | 3 | 2 |

Control panel

SM1

(Error detection)

BCD   SD0   K2Y70

(Error code)

Displays an error code number on the digital indicator when an error is detected

Y80

Turns on the fault indicator lamp when an error is detected
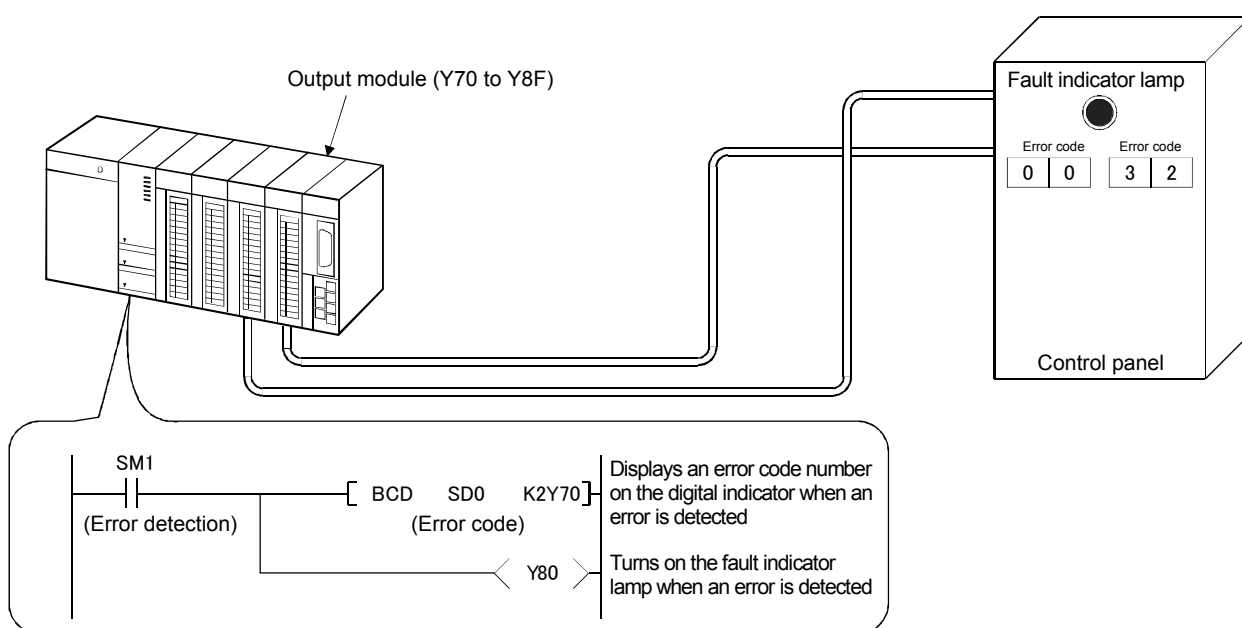
(2) Example of displaying error code numbers on GOT screen
Error report messages and error code numbers are displayed on a liquid crystal screen externally connected to the programmable controller.

	A-1	A-2
9	10	15
10	20	25
11	30	35

エラー発生！＊00070
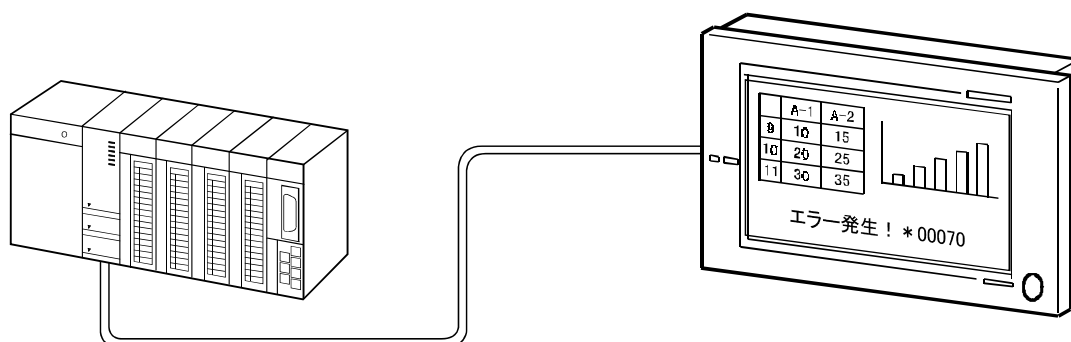
5.5 Checking Operating Environment

When equipment is changed, modified, added, or replaced, the following items must be checked because the usage environment may change.

Table 5-3 Operating Environment

Checkpoint	Check timing
Power supply voltage, voltage drop, instantaneous power failure, frequency fluctuation, waveform distortion, and harmonics	When equipment is changed (especially when equipment which has large power consumption is installed)
Noise and surge levels	When high frequency equipment, large current equipment, or equipment which generates high noise is installed or connected
Temperature	When the environment changes
Humidity	When the environment changes
Vibration and shock	When equipment which generates them is installed

Chapter 6: Corrective Maintenance

Electronic devices such as a programmable controller have fewer consumable parts and those to be deteriorated. However, it does not mean that troubles caused by failures and accidents can always be prevented even if preventive maintenance is not performed. When an unexpected reason causes failure and a production system stops, corrective maintenance will be performed.

There are four types of troubles, and it is necessary to identify causes and take actions quickly.

Table 6-1: Trouble Types

Trouble type	Description
Hardware failure	Error status continues due to reasons such as electronic component failure and pattern disconnection in a module circuit board. Repairing or replacing with a good one will fix it.
Malfunction of a programmable controller system	Error in CPU operation or input/output occurs due to causes such as noise, surge, voltage drop, instantaneous power failure, external radio wave, and static electricity. Identifying the cause and taking measures will restore it.
Trouble due to an accident	Due to an accident such as power supply short, load short, disconnection of signal wire, and faulty operation of a programmable controller main unit or peripherals. Repairing will restore it.
Fault of a sequence program	Due to reasons such as incorrect interlock setting and device number error. Revising it to a correct program will fix it.

> **POINT**
>
> For the life and preventive maintenance of a programmable controller CPU or a module, refer to Mitsubishi programmable controller TECHNICAL BULLETIN "MELSEC A/Q series, preventive maintenance of a programmable controller" (PLC-D-434).
> The TECHNICAL BULLETIN described above can be found at the Mitsubishi Electric FA Global Website.
> (Mitsubishi Electric FA Global Website:
> http://www.mitsubishielectric.co.jp/fa/index.html)

6.1 Important Points in Corrective Maintenance

In corrective maintenance, error is discovered by troubleshooting, and then its cause is identified and repaired. The important points and advance preparations of the corrective maintenance are described below.

(1) Important points

1) Read error codes self-detected by the programmable controller or each module.
   If the error code is identified, the cause can be estimated from the list of error codes.
2) Understand the real cause of the failure.
   Assume it was restored normally after replacing the module suspected to be the cause with a good one. To determine whether the module is the real cause or not, put it back to the previous state. If the trouble occurs again, the executed action is confirmed to be correct.
   In the case that the trouble does not occur, however, the module before the replacement was good and the real cause lies somewhere else.
3) Save the status when the error occurs.
   With GX Works2, the status can be read and stored to a personal computer when an error occurs.
   The cause of the error can be analyzed later using the stored information.
   The following information can be read:
   • Device   • Buffer memory
   • System configuration   • Link memory
4) Minimize the stop time of the production system.
   Long stop time results in larger production loss and bad serviceability.
5) Resume operation carefully while restoration.
   When the operation is resumed, it is necessary to provide sufficient safety confirmation in order to prevent accidents.

(2) Advance preparation

 1) Understand the target equipment and machines well.
  Receiving enough explanations during test operation and reading manuals for deeper understanding is important.

 2) Get to know well about the programmable controller and the related equipment.
  It is important to improve product knowledge on a regular basis, for example, attending manufacturer's training school.
  (For information about a programmable controller, refer to the Mitsubishi Electric FA Global Website.
  (http://www.mitsubishielectric.co.jp/fa/index.html))

 3) Get used to peripheral operation.
  It is important to get used to peripheral operation on a regular basis, for example, attending manufacturer's training school.

 4) Understand the status immediately before the accident.
  It is important to carry out periodic inspection frequently in order to always understand the operating status of the target equipment and machines.

 5) Understand the causes and measures well.
  It is important to learn background information in advance, for example, reading the "Causes and measures" of instruction manuals and attending manufacturer's training school.

6.2 Operation to Read Error Codes Using GX Works2

Current error status or error history can be displayed using the PLC diagnostic function and the system monitor of GX Works2.
In this example, an error is raised intentionally so that an operation to find the cause can be performed using GX Works2.

(1) PLC diagnostics function

This function monitors the error status of the CPU.

(Actual machine operation)

1) Power-off the programmable controller CPU and open the battery holder.

2) Disconnect the battery connector.

3) Close the battery holder and power-on the programmable controller CPU.
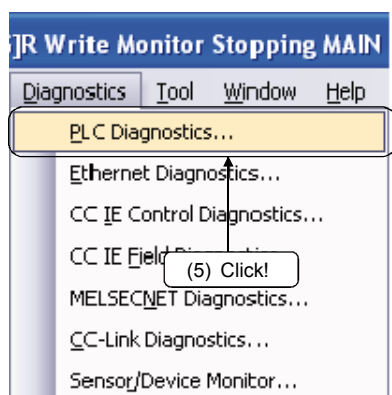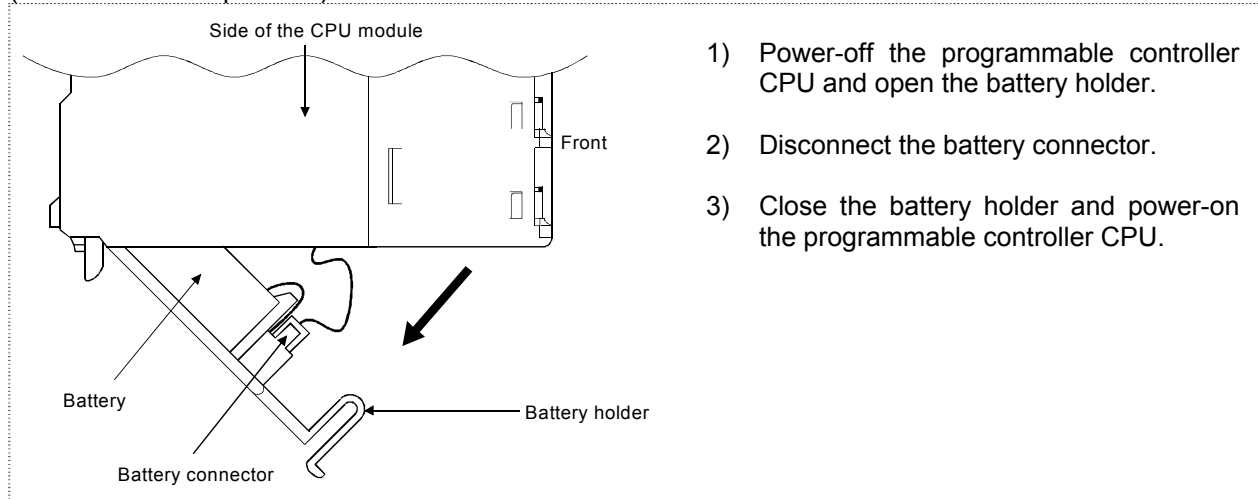
4) Click the [Diagnostics] → [PLC Diagnostics] menu.
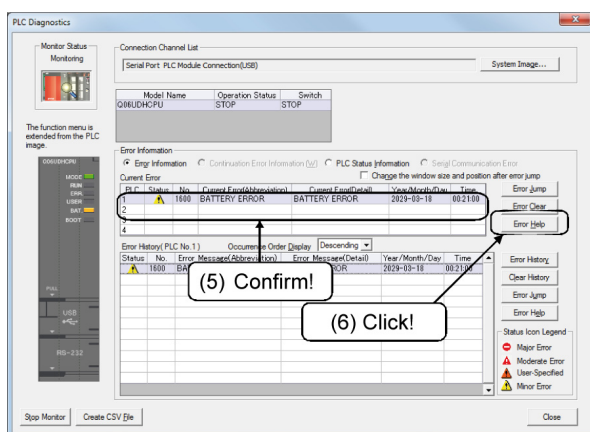
5) The PLC diagnostics dialog box is displayed.
Make sure that "1600 BATTERY ERROR" is displayed in the Current Error.

6) Click the Error Help button.

Error details are displayed. Operate as described in Section 4.2.2 in order to check the error description of the error code 1600.

```
┌──────────┐
│  POINT   │
└──────────┘
When a current error is double-clicked in the error display area, the content of SD5
to 15 (common error information) and SD16 to 26 (error individual information) of
the programmable controller CPU is displayed in the error details dialog box.
```

Current Error							
PLC	Status	No.	Current Error[Abbreviation]	Current Error[Detail]	Year/Month/Day	Time	
1	⚠	1600	BATTERY ERROR	BATTERY ERROR	2029-03-18	00:21:00	← Double-click!
2							
3							
4							

☐ Change the window size and position

⬇

Error Details

Common Error Information

Drive   Program Memory

File Name

Individual Error Information

Nothing

Close

(2) System monitor

The error status of the entire system can be monitored.

Errors diagnosed by the module are displayed as well as ones diagnosed by the CPU.

(a) Writing a test project

To raise an error in the D/A converter module (Q62DAN), open the following project and write it to the CPU.

Project name	System monitor

```
        SM402
  0      | |                                              [SET    M0    ]

CH1 enabled, CH2 disabled setting
        M0      X90
  2      | |     | |           [TO     H9      K0      K2      K1    ]

                                                     [SET    Y99   ]

                                                     [RST    M0    ]

Operating condition setting completed
        Y99     X99
 23      | |     |/|                                   [RST    Y99   ]

CH1 output enabled
        X2
 36      | |                                          (Y91    )

CH1 DA conversion data writing
        X90     X3
 46      | |     | |                         [BINP    K4X20   D30   ]

                         [TO     H9      K1      D30     K1    ]

 71                                                   [END   ]
```
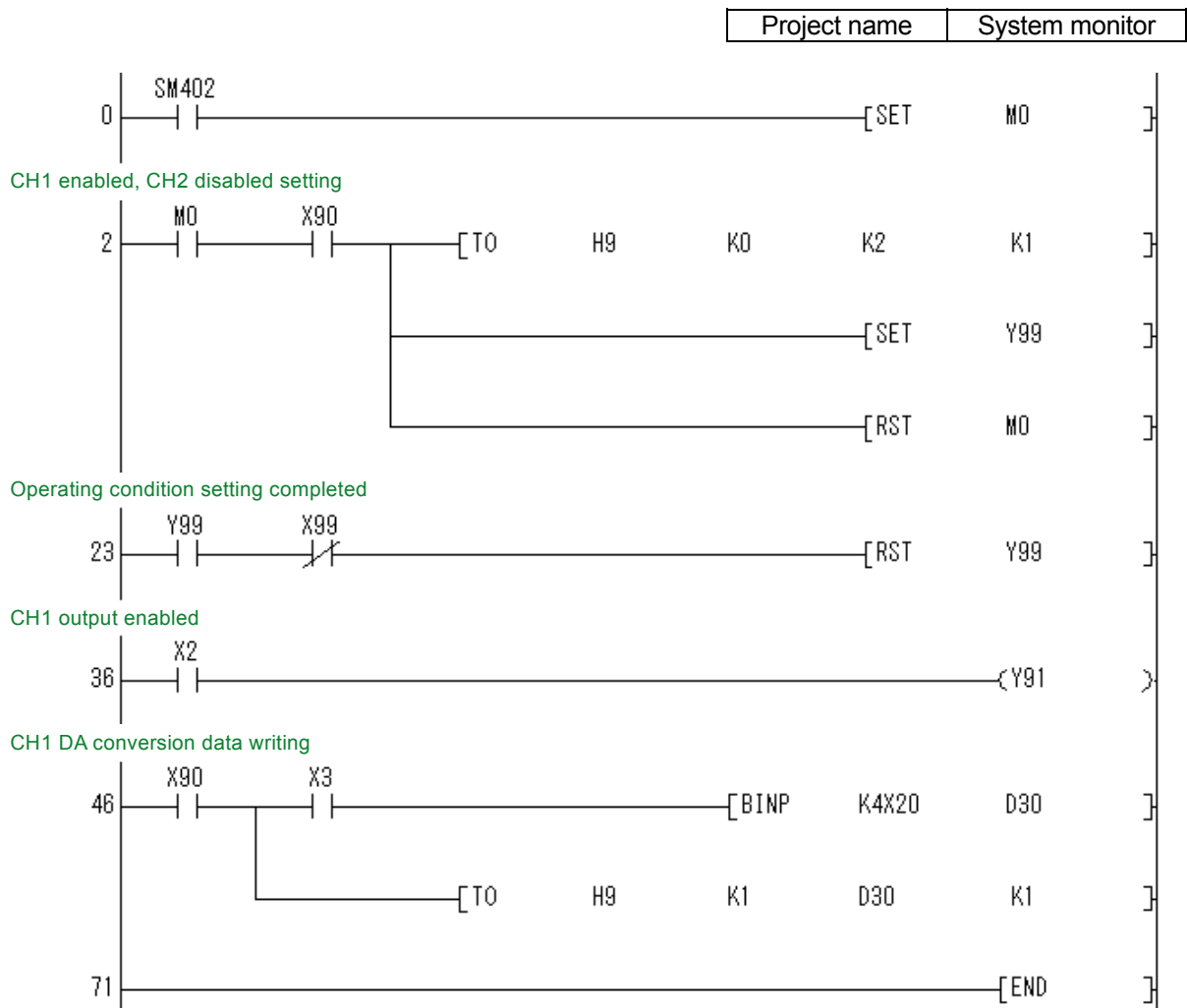
(b) Error confirmation

Operate the training machine to raise an error.

1) Turn ON X2.

2) Set "9999" in the digital switch (X20 to X2F) and turn ON X3.

3) The ERROR lamp of the Q62DAN turns on.

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(c) Launching the system monitor
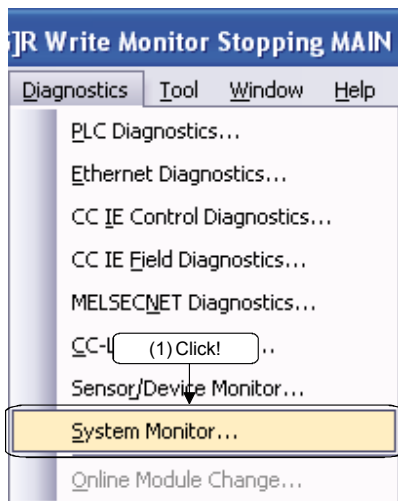
1) Click the [Diagnostics] → [System Monitor] menu.
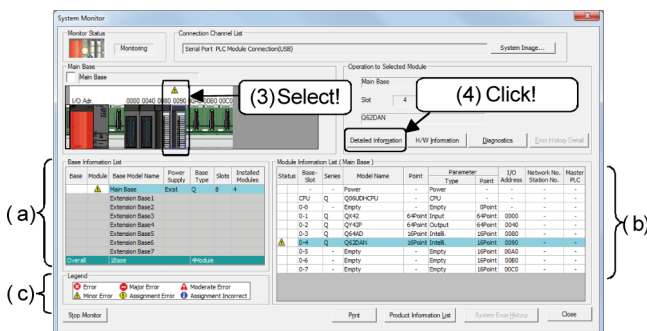
2) The system monitor screen is displayed. The system status is displayed as follows:

   a) Base information list:
      The status of each base unit/block is displayed.

   b) Module information list:
      The module information on the base unit or in the block to which the selected module is attached is displayed.

   c) Legend:
      The legend of screen icons is displayed.

3) Select the Q62DAN.

4) Click the detailed information button.

(To the next page)

(From the previous page)

⬇
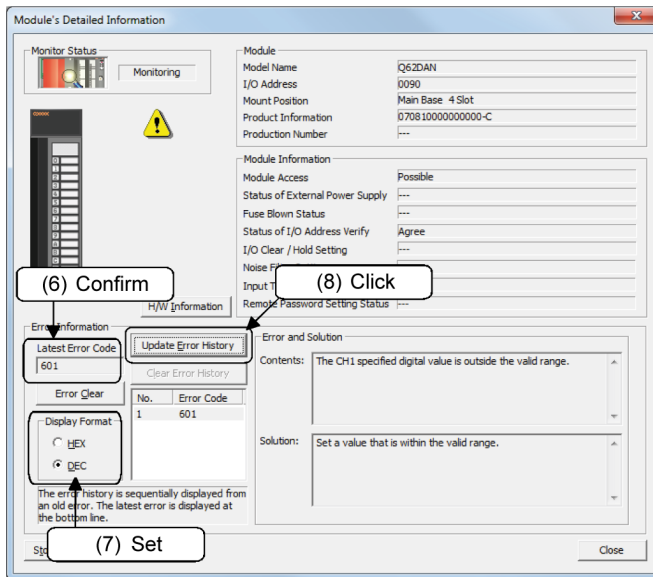
5) The module detailed information screen is displayed.
This shows the information on "Q62DAN".

6) On the "Error Information", check the error code that has been occurred.

On the module detailed information screen, the error code stored in the buffer memory address of the D/A converter module is displayed.

7) Set the "Display Format" of the error code to "Decimal".

8) Click the error history update button to display the "Error description/handling".

The system monitor allows the following system statuses can be monitored:

(1)

(2)

(3)
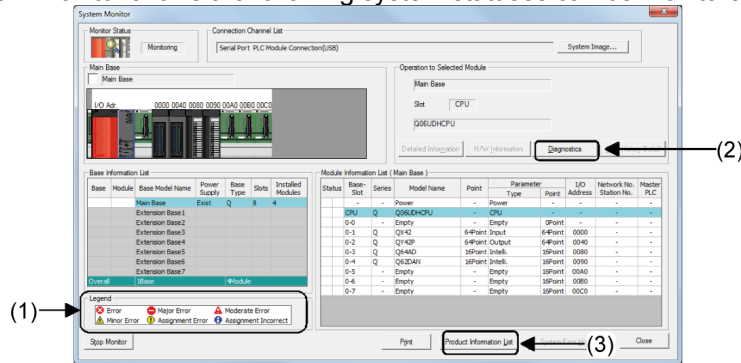
1) The error status of the module is displayed with icons.
   The legend of icons can be found here.

2) Diagnostics button
   The status and the setup content of the module indicated by the cursor can be changed.
   This will not be displayed if the utility package has not been installed.
   For the detailed description, refer to each utility manual.
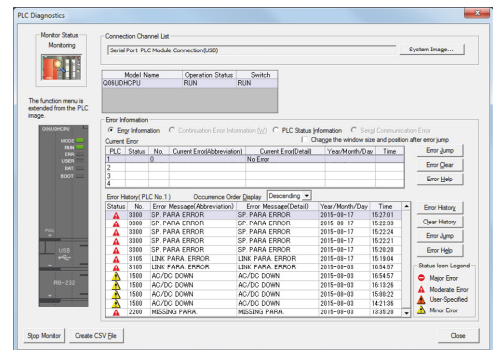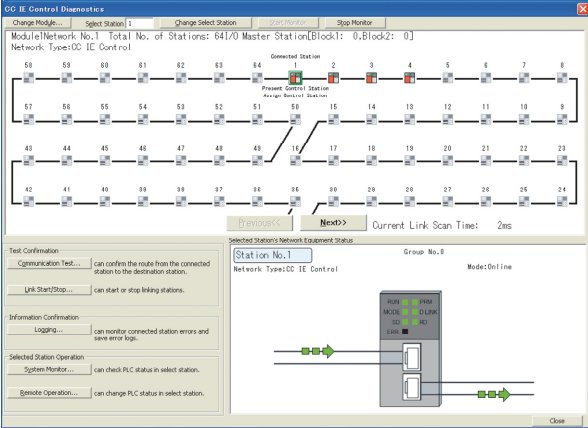
3) Product Information List button
   The product information list of the module installed on the base is displayed.
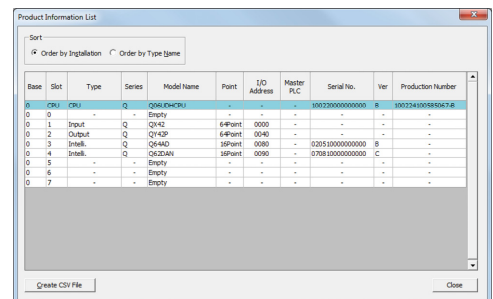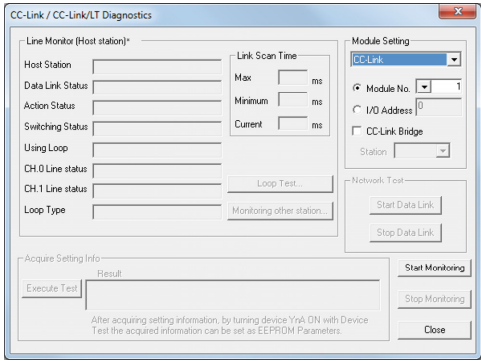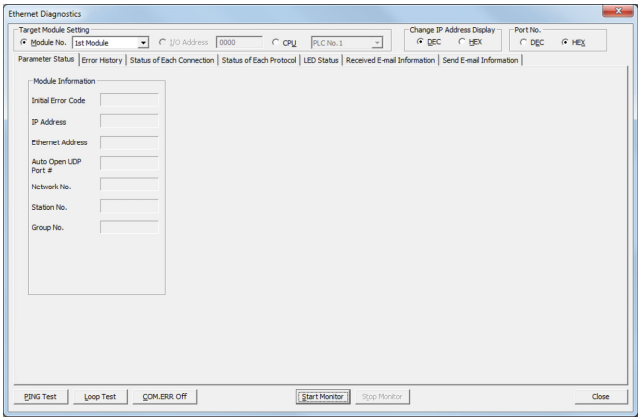
(3) Diagnosing network status

GX Works2 can diagnose the network module and the line status of the network.

The list of the network diagnostic functions is described below.

Network type	Function list
MELSECNET/10 MELSECNET/H CC-Link IE	1) Network diagnostics Click the [Diagnostics] → [CC IE Control Diagnostics]/[CC IE Field Diagnostics]/[MELSECNET Diagnostics] menu to display. This provides the network status of MELSECNET/10, MELSECNET/H, and CC-Link IE, as well as the execution of various tests. <CC IE control diagnostics> • Module change Changes the module to be diagnosed. • Selected station change Click this after inputting a station number to the "Selected Station" so that the selected station is changed to the station specified by the number. The status of the selected station is displayed in the "Display field of network device status on the selected station". • Previous screen ▲/Next screen ▼ Switches the network information screen when the total number of stations is 61 or more. • Communication test Checks the communication route from the connection station to the communication destination specified station. • IP communication test (available for universal model only) Checks the IP communication route from the connection station to the communication destination station. • Link start/stop Starts/stops data link for the specified station. • Logging Monitors the communication route switching information and the transient transmission errors of the connection station. The monitored information can be saved in a file. • System monitor Checks the system status of the selected station. • Remote operation Performs remote operation for the programmable controller CPU of the selected station.

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Network type	Function list

MELSECNET/10 MELSECNET/H CC-Link IE

<CC IE field diagnostics>

- Module change
  Changes the module to be diagnosed.
- Disconnected station deletion
  Deletes disconnected stations from the network map.
- Legend display
  Displays the legend of icons on the diagnostics screen.
- Communication test
  Checks the communication route from the connection station to the communication destination specified station.
- IP communication test (available for universal model only)
  Checks the IP communication route from the connection station to the communication destination station.
- Cable test
  Tests the connection status of the cable.
- Link start/stop
  Starts/stops data link for the specified station.

- Network event history
  Displays the event history and various network information that occur on the host station or the network.
- Temporary clear/cancel of a reserved station
  Clears/cancels a reserved station temporarily.
- Temporary error invalid station setting/clear
  Sets/cancels a temporary error invalid station.
- System monitor
  Checks the system status of the selected station.
- System error history
  Checks the system status of the selected station.
- Remote operation
  Performs remote operation for the programmable controller CPU of the selected station.

<MELSECNET diagnostics>

- Network test
  Tests link status, starting/stopping a link for the network.
- Loop test
  Checks network loop status.
- Setup confirmation test
  Checks the setup contents of the station number, the network number, and the group number of each station.
- Station order setting test
  Checks the forward/reverse loop station order of the network.

- Communication test
  Performs communication test between networks.
- Error history monitor
  Displays error history of the network.
- Network monitor details
  Displays detailed network line status of the network.
- Other station information
  Monitors other stations connected to the network.

Network type	Function list
CC-Link	2) CC-Link/CC-Link/LT diagnostics Click the [Diagnostics] → [CC-Link/CC-Link/LT Diagnostics] menu to display. This function monitors the network information of each station, as well as diagnoses and tests the network status. The CC-Link and CC-Link/LT diagnostic function can be executed only when the programmable controller CPU is directly connected. • Network test Starts/stops data link for a CC-Link module specified by target module specification (all stations specification). • Line test Performs a test with all stations specification or of a specified station. This function is effective only when a master station is specified in transfer setup. • Other station monitor Monitors CC-Link's other station line connected to the programmable controller CPU. This function can be executed only during data link.
Ethernet	3) Ethernet diagnostics Click the [Diagnostics] → [Ethernet Diagnostics] menu to display. It checks the various setting status of the Ethernet module. • Parameter status Monitors the parameter status of the Ethernet module. • Error history Monitors the error log area. • ・Status for each connection Monitors status for each connection. • Status for each protocol Monitors status for each protocol. • LED status Monitors the LED lighting status in front of the Ethernet module. • Received e-mail information Monitors received e-mail information. • Sent e-mail information Monitors sent e-mail information. • PING test Tests and checks the existence of a specified IP address or an Ethernet module on the Ethernet line whose initial processing has ended. • Loopback test Checks whether each module has ended initial processing or not, sequentially sending loopback test transmission to the Q-compatible E71 whose network number and station number are specified.

6.3 Basic Practice of Troubleshooting

The following items are the basic contents that must be kept in mind during troubleshooting.

(1) Visual check
  1) Determine whether the cause of the trouble lies inside of the programmable controller or lies in an external controlled system.
    (Note that usually this cannot be determined only by visual check.)
  2) Watch the operating status of the machine, and take notes of it.

> • In which process of the controlled system does the trouble occur?
> • Is the controlled system in operation or stopped?
> • What is the type of the stop? Is that overrunning, disorder, fire, human error, or other types?

  3) Watch the I/O module and the intelligent function module, and take notes of their status.

> • How is the wiring status of each module?
> • How is the setting switch status of each module?

  4) Watch the LED status of each module, and take notes of it.

> • Is the "POWER" LED of the power supply module on or off?

> • Is the "MODE" LED of the CPU module on, off, or flashing?
> • Is the "RUN" LED of the CPU module on, off, or flashing?
> • Is the "ERR." LED of the CPU module on, off, or flashing?
> • Are the "USER", "BAT.", and "BOOT" LEDs of the CPU module on or off?

> • Is the monitor LED of the I/O module on or off?

> • Is the monitor LED of the intelligent function module on or off?

(2) Checking an error number by reading the error code
  1) Read the error code of the CPU and the error code of each module using GX Works2.
  2) Use the error code that was read in order to check the cause of the error and the corrective action.

(3) Observation of the fault after resetting the CPU
  If it goes back to the normal operation after resetting the CPU, the cause may be noise or temporary fault in the CPU, I/O module, electrical connection part, external devices, etc.
  1) Set the RUN/STOP/RESET switch to [STOP].
  2) Reset using the RUN/STOP/RESET switch.
  3) Turn the power OFF and ON again.

(4) Troubleshooting for each module
  1) Troubleshoot the power supply module.
  2) Troubleshoot the CPU module.
  3) Troubleshoot the input module.
  4) Troubleshoot the output module.
  5) Troubleshoot the intelligent function module.

(5) Narrowing the range of the failure cause
   1) Replace the programmable controller module with a spare module to check whether the trouble occurs again.
   2) Disconnect a ground cable and a control line for a test.

(6) Fault investigation for the failure module
   1) Take notes of the product's serial number and function version.
      The serial number and the function version can be checked on the rating plate or in the system monitor of GX Works2.
      • Check by the rating plate
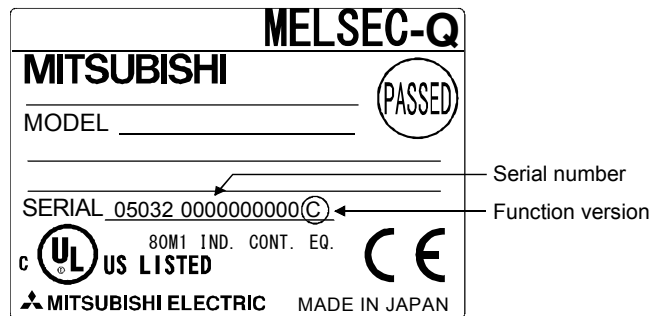
      • Check by the system monitor (product information list) of GX Works2
        Display the system monitor screen using the [Diagnostics] - [System Monitor] menu, then click the product information list button to display the product information list.
        The serial number and the function version of the CPU or the intelligent function module can be checked on the product information list.

      Clicking the CSV file creation button shows the [Save as] screen. Specify a file name here.
      The file can be opened using software such as Excel.

2) Save the device status during an error.
   Read the status of the device, link memory, and buffer memory during an error from the programmable controller CPU and save them.

   • Procedure for reading device status using GX Works2 (read from PLC)
     Click the [Online] - [Read from PLC] menu, and read the device status on the read from PLC screen.
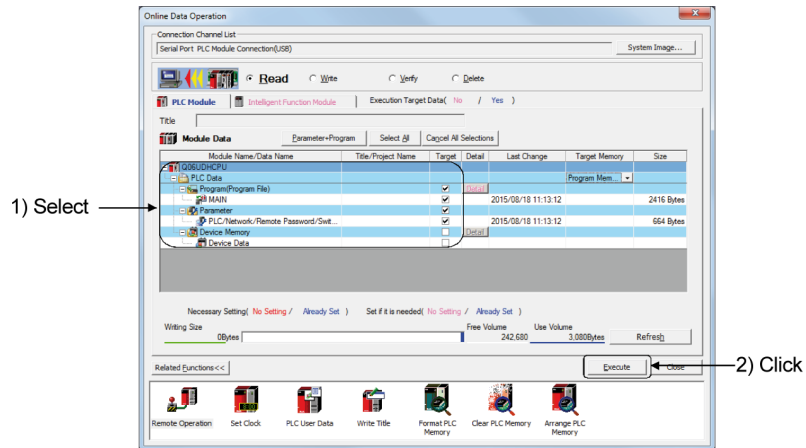
3) Fill out a [Programmable Controller Fault Investigation Report] (refer to Appendix 6), and send the faulty module to the manufacturer with the report to have them investigate the cause of the failure.
   (The programmable controller fault investigation report is in Appendix. Copy and use it.)
4) Carry out sufficient measures for investigation results returned from the manufacturer.

6.4 Troubleshooting for the Power Supply Module

There are two types of troubles regarding the power supply module: a case in which a type of the power supply module was selected incorrectly, and a case in which the POWER LED does not turn on.

Power supply	5 V DC output current
Q61P	6 A
Q62P	3 A
Q63P	6 A
Q64PN	8.5 A
Q61SP	2 A

CPU (power supply integrated type)	
Q00JCPU	0.22 A[*2]

For QA1S65B and QA1S68B	5 V DC rated output current
A1S61PN	5 A
A1S62PN	3 A
A1S63P	5 A

Main base	5 V DC current consumption
Q33B	0.105 A
Q35B	0.110 A (0.074 A)[*1]
Q38B	0.114 A (0.077 A)[*1]
Q312B	0.121 A (0.087 A)[*1]
Q32SB	0.086 A
Q33SB	
Q35SB	0.091 A

Extension base (power supply module unmountable)	
Q52B	0.080 A
Q55B	0.100 A

Extension base (power supply module mountable)	
Q63B	0.105 A
Q65B	0.110 A (0.081 A)[*1]
Q68B	0.114 A (0.087 A)[*1]
Q612B	0.121 A (0.098 A)[*1]

Extension base (power supply module mountable, AnS series) For mounting an input, output, and special function module	
QA1S65B	0.117 A (0.088 A)[*1]
QA1S68B	0.118 A (0.091 A)[*1]

For an AnS series input, output, and special function module available for the QCPU, refer to the user's manual of each CPU.

CPU	5 V DC current consumption
Q00UJCPU	0.37 A
Q00UCPU, Q01UCPU	0.33 A
Q02UCPU	0.23 A
Q03UD(E)CPU	0.33 A
Q04UD(E)HCPU	
Q06UD(E)HCPU	
Q13UD(E)HCPU	0.39 A
Q20UD(E)HCPU	
Q26UD(E)HCPU	
Q50UDEHCPU	0.50 A
Q100UDEHCPU	

Input module	
QX10	
QX28	0.05 A
QX40	
QX40-S1	0.06 A
QX41	
QX41-S1	0.075 A
QX42	
QX42-S1	0.09 A
QX70	0.055 A
QX71	0.07 A
QX72	0.085 A
QX80	0.05 A
QX81	0.075 A
QX82	
QX82-S1	0.09 A

Output module	
QY10	0.43 A
QY18A	0.24 A
QY22	0.25 A
QY40P	0.065 A
QY41P	0.105 A
QY42P	0.15 A
QY50	0.08 A
QY68A	0.11 A
QY70	0.095 A
QY71	0.15 A
QY80	0.08 A
QY81P	0.095 A

I/O combined module	
QH42P	0.13 A
QX48Y57	0.08 A

Interrupt module	
QI60	0.06 A

*1: Values for a non CE compatible product are given in (   ).
*2: Total value of the CPU and the base unit.

6.4.1 Selection of a Power Supply Module

If 5 V DC supply capacity is insufficient because the power supply module was selected incorrectly, devices such as an I/O module and an intelligent function module may malfunction.

Therefore, it is necessary to select a power supply module whose output current is larger than the total current consumption of connected modules.

(1) 5 V DC current consumption of major modules

Intelligent function module					
A/D conversion	Q64AD	0.63 A	ID interface	QD35ID1	0.40 A
	Q68ADV	0.64 A		QD35ID2	0.42 A
	Q68ADI		Web server	QJ71WS96	0.65 A
	Q64AD-GH	0.89 A	Ethernet	QJ71E71-B5	0.50 A
	Q62AD-DGH	0.22 A		QJ71E71-B2	0.60 A[*1]
D/A conversion	Q62DA	0.33 A		QJ71E71-100	0.50 A
	Q64DA	0.34 A	MELSECNET/H	QJ71BR11	0.75 A
	Q68DAV	0.39 A		QJ71LP21-25	0.55 A
	Q68DAI	0.38 A		QJ71LP21G	
	Q62DA-FG	0.37 A		QJ72BR15	1.10 A
Temperature input	Q64TDV-GH	0.50 A		QJ72LP25-25	0.89 A
	Q64TD			QJ72LP25G	
	Q64RD	0.60 A	FL-net	QJ71FL71-F01	0.50 A
	Q64RD-G	0.62 A		QJ71FL71-B2-F01	0.70 A
Temperature control	Q64TCTT	0.55 A	CC-Link	QJ61BT11	0.46 A
	Q64TCTTBW	0.60 A	CC-Link/LT	QJ61CL12	0.13 A
	Q64TCRT	0.55 A	AS-i	QJ71AS92	0.40 A
	Q64TCRTBW	0.60 A	Serial communication	QJ71C24N	0.31 A
High-speed counter	QD62	0.30 A		QJ71C24N-R2	0.26 A
	QD62D	0.38 A	Modem I/F	QJ71CMO	0.46 A
	QD62E	0.33 A	Intelligent communication	QD51	0.26 A
Pulse input	QD60P8-G	0.58 A		QD51-R24	0.31 A
Positioning	QD75P1	0.40 A			
	QD75P2	0.46 A			
	QD75P4	0.58 A			
	QD75D1	0.52 A			
	QD75D2	0.56 A			
	QD75D4	0.82 A			
	QD75M1	0.40 A			
	QD75M2				
	QD75M4				
	QD70P4	0.55 A			
	QD70P8	0.74 A			

*1: For internal current consumption (5VDC) whose the first five digits of the serial number are 04091 or earlier, internal current consumption (5 V DC) is 0.70 A.

(2) Criteria for use of an extension base requiring no power supply module
In the Q52B/Q55B (hereafter, the Q5□B), a voltage drop occurs at an extension cable because a power supply module on a main base unit supplies 5 V DC.
If the "IN" connector of the Q5□B does not supply a specified voltage (4.75 V DC or more), incorrect input or incorrect output may occur.
When using the Q5□B, make sure that the voltage is 4.75 V DC or more at the "IN" connector of the Q5□B.
When using the Q5□B, it is recommended to use an extension cable as short as possible for connection just after the main base unit because of a voltage drop.

(a) When only the Q5□B is connected to an extension base unit
The 5 V DC output voltage minimum value of the power supply module on the main base unit is set to 4.90 V DC. Therefore, if a voltage drop due to an extension cable is 0.15 V (4.9 V - 4.75 V = 0.15 V) or less, the Q5□B is usable.

Extension cable model	Extension cable conductor resistance value (Ω)
QC05B	0.044
QC06B	0.051
QC12B	0.082
QC30B	0.172
QC50B	0.273
QC100B	0.530

Symbol	Description
V1	The voltage drop of the extension cable between the main base unit and the extension base unit
Vn	The voltage drop of the extension cable between the extension base unit ((n-1)th extension) and the extension base unit (nth extension)
R1	The cable resistance between the main base unit and the extension base unit
Rn	The cable resistance between the extension base unit ((n-1)th extension) and the extension base unit (nth extension)
I1 to I7	5 V DC current consumption in the first to seventh extension *1

*1: I1 to I7, which is the current consumption of the Q5□B + the total current consumption of the I/O modules and intelligent function modules mounted to the Q5□B, varies depending on modules mounted to the extension base unit. Refer to the user's manual for the value of each module.

Calculation list of a voltage drop by an extension cable in first to seventh extension system configuration

Q5□B mount position	Voltage drop by an extension cable for each extension base number							Total voltage drop to the Q5□B "IN" connector (V)
	V1	V2	V3	V4	V5	V6	V7	
1st extension	R1·I1	—	—	—	—	—	—	V = V1
2nd extension	R1(I1 + I2)	R2·I2	—	—	—	—	—	V = V1 + V2
3rd extension	R1(I1 + I2 + I3)	R2(I2 + I3)	R3·I3	—	—	—	—	V = V1 + V2 + V3
4th extension	R1(I1 + I2 + I3 + I4)	R2(I2 + I3 + I4)	R3(I3 + I4)	R4·I4	—	—	—	V = V1 + V2 + V3 + V4
5th extension	R1(I1 + I2 + I3 + I4 + I5)	R2(I2 + I3 + I4 + I5)	R3(I3 + I4 + I5)	R4(I4 + I5)	R5·I5	—	—	V = V1 + V2 + V3 + V4 + V5
6th extension	R1(I1 + I2 + I3 + I4 + I5 + I6)	R2(I2 + I3 + I4 + I5 + I6)	R3(I3 + I4 + I5 + I6)	R4(I4 + I5 + I6)	R5(I5 + I6)	R6·I6	—	V = V1 + V2 + V3 + V4 + V5 + V6
7th extension	R1(I1 + I2 + I3 + I4 + I5 + I6 + I7)	R2(I2 + I3 + I4 + I5 + I6 + I7)	R3(I3 + I4 + I5 + I6 + I7)	R4(I4 + I5 + I6 + I7)	R5(I5 + I6 + I7)	R6(I6 + I7)	R7·I7	V = V1 + V2 + V3 + V4 + V5 + V6 + V7

(b) When the Q6□B is connected between the Q3□B and the Q5□B

[When the Q5□B is connected at the second extension]

Extension cable model	Extension cable conductor resistance value (Ω)
QC05B	0.044
QC06B	0.051
QC12B	0.082
QC30B	0.172
QC50B	0.273
QC100B	0.530

Symbol	Description
V	The voltage drop by an extension cable between the main base unit and the extension base unit (Q5□B)
In	The 5 V DC current consumption when the Q5□B is used at the (n+1)th extension, where n = 1 to 6 (n: number of extension bases of the Q6□B) (The current consumption of the Q5□B + the total current consumption of the I/O modules and intelligent function modules mounted to the Q5□B)
Rn	Extension cable resistance value between the main base unit or an extension base unit (Q6□B) and another extension base unit (Q6□B)
R_{n+1}	Extension cable resistance value between the extension base unit (Q6□B) and the extension base unit (Q5□B)

Calculation list of a voltage drop by an extension cable when the Q6□B is connected between the Q3□B and the Q5□B

Mount position of the extension base unit		Voltage drop by an extension cable from the main base unit and the IN connector of the Q5□B (V)
Q6□B	Q5□B	
1st extension	2nd extension	$V = (R1 + R2)I1$
1st and 2nd extension	3rd extension	$V = (R1 + R2 + R3)I1$
1st to 3rd extension	Fourth extension	$V = (R1 + R2 + R3 + R4)I1$
1st to 4th extension	5th extension	$V = (R1 + R2 + R3 + R4 + R5)I1$
1st to 5th extension	6th extension	$V = (R1 + R2 + R3 + R4 + R5 + R6)I1$
1st to 6th extension	7th extension	$V = (R1 + R2 + R3 + R4 + R5 + R6 + R7)I1$

POINT

- An I/O module and an intelligent function module, which have large internal current consumption (internal current consumption (5VDC)), must be mounted to the main base unit or an extension base that requires power supply module (Q63B, Q65B, Q68B, and Q612B) in order to use.
- Overall cable distance of an extension cable must be 13.2 m or less.

(3) 24 V DC current consumption for each module

The 24 V DC output current capacity of the power supply module and the 24 V DC current consumption of each module are described below. Refer to the values below, and when insufficient, use an external DC stabilized power supply.

Power supply module	24 V DC output current
Q62P	0.6 A

Output module		24 V DC current consumption
Transistor output	QY40P	0.01 A
	QY41P	0.02 A
	QY42P	0.04 A
	QY50	0.02 A
	QY70	0.09 A
	QY71	0.17 A
	QY80	0.02 A
	QY81P	0.04 A

Intelligent function module		24 V DC current consumption
A/D conversion	Q62AD-DGH	0.36 A
D/A conversion	Q62DA	0.12 A
	Q64DA	0.18 A
	Q68DAV	0.19 A
	Q68DAI	0.28 A
	Q62DA-FG	0.30 A
High-speed counter	QD62	0.008 A
	QD62E	
	QD62D	
Positioning	QD70P4	0.065 A
	QD70P8	0.12 A
I/D interface	QD35ID1	0.17 A
	QD35ID2	0.33 A

(4) Power supply module selection example
When the sum of the connected modules described below is 5 V DC 2.399 A and 24 V DC 0.48 A, the Q62P (5 V DC 3 A output and 24 V DC 0.6 A output) must be selected.
If an external stabilized power supply is designed to provide 24 V DC, the Q61P (5 V DC 6 A output) is also acceptable.

Base unit

	Q38B	Q62P	Q06UDH	QX41	QX80	QX80	QY42P	QY42P	Q62DA	Q68DAI	QJ61BT11
5 V DC current consumption	0.114	—	0.64	0.075	0.05	0.05	0.15	0.15	0.33	0.38	0.46
24 V DC current consumption	—	—	—	—	—	—	0.04	0.04	0.12	0.28	—

6.4.2 When the "POWER" LED Turns Off

The flow chart below shows causes and measures in the case that the "POWER" LED turns off at power-on or during operation.

```
                    ┌─────────────────────────────┐
                    │  The "POWER" LED turns off   │
                    └─────────────────────────────┘
                                  │
                                  ▼
              ╱─────────────────────╲      NO    ┌──────────────────────┐
             ╱   Is the power supplied? ╲───────▶│   Supply the power    │
              ╲─────────────────────╱            └──────────────────────┘
                        │ YES                                │
                        │                                    ▼
                        │      NO  ╱─────────────────────╲  YES
                        │◀────────╱  Does the "POWER"     ╲──────┐
                        │         ╲   LED turn on?         ╱       │
                        ▼          ╲─────────────────────╱        │
          ╱─────────────────────────╲   NO  ┌──────────────────────────────────────┐
         ╱  Is power supply voltage    ╲────▶│ Control the supply voltage to be      │
        ╱   within the specified        ╲    │ within the rated range                │
         ╲  voltage range?             ╱     └──────────────────────────────────────┘
          ╲─────────────────────────╱                        │
                        │ YES                                 ▼
                        │      NO  ╱─────────────────────╲  YES
                        │◀────────╱  Does the "POWER"     ╲──────┤
                        │         ╲   LED turn on?         ╱       │
                        ▼          ╲─────────────────────╱        │
          ╱─────────────────────────╲   NO  ┌──────────────────────────────────────┐
         ╱  Is the power supply        ╲────▶│ Securely fix the power supply module   │
         ╲  module fixed?             ╱      └──────────────────────────────────────┘
          ╲─────────────────────────╱                        │
                        │ YES                                 ▼
                        │      NO  ╱─────────────────────╲  YES
                        │◀────────╱  Does the "POWER"     ╲──────┤
                        │         ╲   LED turn on?         ╱       │
                        ▼          ╲─────────────────────╱        │
          ╱─────────────────────────╲   YES ┌──────────────────────────────────────┐
         ╱  Is overcurrent             ╲────▶│ (1) Check the current capacity.        │
        ╱   protection or               ╲    │     Suppress the overcurrent.          │
         ╲  overvoltage protection     ╱     │ (2) Turn OFF the input power supply     │
          ╲ working?                  ╱      │     then on again after several minutes.│
           ╲───────────────────────╱        └──────────────────────────────────────┘
                        │ NO                                  │
                        │      NO  ╱─────────────────────╲  YES
                        │◀────────╱  Does the "POWER"     ╲──────┤
                        │         ╲   LED turn on?         ╱       │
                        ▼          ╲─────────────────────╱        │
   ┌──────────────────────────────┐                              ▼
   │ Explain the fault symptoms and│              ┌─────────────────────────────┐
   │ consult with the nearest system│             │            End              │
   │ service, distributor or branch │             └─────────────────────────────┘
   │ office                         │
   └──────────────────────────────┘
```

6.4.3 When the $\overline{\text{ERR}}$ Terminal (Negative Logic) Turns OFF (Opens)

The flow chart below shows causes and measures in the case that the "$\overline{\text{ERR}}$ terminal" of the power supply module turns OFF (opens) at power-on or during operation.

```
┌──────────────────────────────────────┐
│ The ERR terminal turns OFF (opens)    │
└──────────────────────────────────────┘
                  │
                  ▼
          ╱────────────╲        Flashing (CPU
        ╱  The "ERR" LED ╲      module is in stop     ┌────────────────────────────────┐
       ╱   of the CPU      ╲    error)                │ Check the error details and take │
       ╲   module is...    ╱ ──────────────────────►  │ measures according to them       │
        ╲                ╱                            └────────────────────────────────┘
          ╲────────────╱
                  │ Not flashing
                  ▼
          ╱────────────╲
        ╱ ·Is the power  ╲
       ╱   supplied?       ╲      NO                   ┌────────────────────────────────┐
       ╲ ·Is the voltage  ╱ ──────────────────────►   │ Supply the power with a proper  │
        ╲  of the supply  ╱                            │ voltage                          │
          ╲ power proper?╱                             └────────────────────────────────┘
                  │ YES
                  ▼
┌──────────────────────────────────────┐
│ Hardware failure                      │
│ Perform operation check one by one,   │
│ starting from the minimum             │
│ configuration system.                 │
│ For a module that does not work,      │
│ explain the fault symptoms and        │
│ consult with the nearest system       │
│ service, distributor or branch office.│
└──────────────────────────────────────┘
```

*   Detectable error definitions at the $\overline{\text{ERR}}$ terminal
    Detectable error definitions at the $\overline{\text{ERR}}$ terminal of a power supply module are described below.

    1) When a power supply module is the Q61P-A1, Q61P-A2, Q61P, Q62P, Q63P, and Q64P

Base unit	Error definition
Main base unit (Q3☐B)	No AC power supply input, power supply module fuse blown, and CPU module stop error (including when the CPU module is reset) are detectable.
Extension base unit (Q6☐B)	Error definitions are not detectable (always OFF)

    2) When a power supply module is the Q61SP

Base unit	Error definition
Slim type main base unit (Q3☐SB)	No AC power supply input, power supply module fuse blown, and CPU module stop error (including when the CPU module is reset) are detectable.

6.4.4 When Uninterruptible Power Supply (UPS) Is Connected

With a standby UPS, momentarily interruption occurs in timing of power supply relay switching from the battery and AC down (error code: 1500 AC/DC DOWN) may be detected at the time of power failure or a voltage drop.
Therefore, an online inverter UPS or line-interactive UPS whose voltage distortion is 5% or less must be used.

Mitsubishi's recommendation products are described below:
(1) Online inverter UPS   (Example) FREQUPS-V series, FW-V10-0.7K
(2) Line-interactive UPS   (Example) FREQUPS-A series, FW-A10L-0.7K

Note that when a standby UPS is adopted, only Mitsubishi's FREQUPS-F series UPS (serial number P or later) is usable. (Example) FW-F10-0.3K/0.5K

6.5 Troubleshooting for the CPU

> For troubles regarding a CPU module, there are cases in which hardware failure occurs or a program cannot be written.

6.5.1 Troubles regarding Hardware Failure

> Identify a CPU error based on each LED status.

LED type	Status	Reference
"MODE" LED	Not turn on	(1) of this section
	Flashes	(2) of this section
"RUN" LED	Turns off	(3) of this section
	Flashes	(4) of this section
"ERR." LED	Turns on/flashes	(5) of this section
	Turns on/flashes (UNIT VERIFY ERR. occurs)	(6) of this section
	Turns on/flashes (CONTROL-BUS ERR. occurs)	(7) of this section
"USER" LED	Turns on	(8) of this section
"BAT." LED	Turns on	(9) of this section
"BOOT" LED	Flashes	(10) of this section

(1) When the "MODE" LED does not turn on

The flow chart below shows causes and measures in the case that the "MODE" LED does not turn on at power-on.

```
                  ┌─────────────────────────────────────┐
                  │  The "MODE" LED does not turn on     │
                  └─────────────────────────────────────┘
                                    │
                                    ▼
                         ╱ Is the "POWER" LED ╲      NO     ┌──────────────────────────────────────┐
                        ⟨  of the power supply  ⟩──────────▶│ Go to the "when the 'POWER' LED turns │
                         ╲    module on?        ╱           │ off" flow diagram, described in Section│
                                    │                       │ 6.4.2                                 │
                                    │ YES                   └──────────────────────────────────────┘
                                    ▼
                    ╱ Have all the powers of the ╲   NO    ┌──────────────────────────────────────┐
                   ╱ power supply modules been    ╲───────▶│ Check wiring, and turn on all power   │
                  ⟨  turned on? Is the wiring of   ⟩        │ supplies                              │
                   ╲ the power supply module correct?      └──────────────────────────────────────┘
                    ╲                             ╱                            │
                                    │ YES                                     ▼
                                    │            NO           ╱ Does the "MODE" LED turn on? ╲  YES
                                    │◀───────────────────────⟨                               ⟩───▶
                                    ▼                         ╲                             ╱
        ┌──────────────────────────────────────┐
        │ Connect between GX Works2 and the     │
        │ CPU module                            │
        └──────────────────────────────────────┘
                                    │
                                    ▼
                         ╱ Can the CPU module ╲            ┌──────────────────────────────────────┐
                        ⟨ communicate with GX  ⟩──────────▶│ Perform PLC diagnostics, and troubleshoot│
                         ╲    Works2?          ╱           │ according to the diagnostic results.  │
                                    │                      └──────────────────────────────────────┘
                                    │ NO
                                    ▼
                  ╱ Is the connection direction of ╲  NO   ┌──────────────────────────────────────┐
                 ⟨  the extension cable correct?    ⟩─────▶│ Connect the extension cable properly  │
                  ╲ (IN-IN, OUT-OUT, or IN-OUT      ╱      └──────────────────────────────────────┘
                   ╲  connection is not correct)   ╱                          │
                                    │ YES          NO                         ▼
                                    │◀───────────────────────╱ Does the "MODE" LED turn on? ╲  YES
                                    ▼                        ⟨                               ⟩───▶
        ┌──────────────────────────────────────┐            ╲                             ╱
        │ Replace the power supply module       │
        │ and check the "POWER" LED status      │
        └──────────────────────────────────────┘
                                    │
                                    ▼
                         ╱ Does the "MODE" LED ╲   YES    ┌──────────────────────────────────────┐
                        ⟨     turn on?          ⟩────────▶│ Power supply module hardware failure  │
                         ╲                      ╱         └──────────────────────────────────────┘
                                    │ NO
                                    ▼
        ┌──────────────────────────────────────┐
        │ The following hardware failure may have│
        │ occurred.                             │
        │ (1) CPU module                        │
        │ (2) Main base unit or extension base unit│
        │ (3) Extension cable                   │
        │ (4) Network module                    │
        │ Perform operation check one by one,   │
        │ starting from the minimum configuration│
        │ system, which consists of the main base│
        │ unit with the power supply module and the│
        │ CPU module mounted.                   │
        │ For a module that does not work, explain│
        │ the fault symptoms and consult with the│
        │ nearest system service, distributor or │
        │ branch office.                        │
        └──────────────────────────────────────┘

                                               ┌──────────────────────┐
                                               │         End          │
                                               └──────────────────────┘
```

(2) When the "MODE" LED flashes
    The flow chart below shows causes and measures in the case that the "MODE"
    LED flashes at power-on, at the time of starting operation, or during operation.

```
                    ┌─────────────────────────────┐
                    │   The MODE LED flashes       │
                    └─────────────────────────────┘
                                  │
                                  ▼
                      ╱─────────────────────╲                    ┌──────────────────────────────────┐
                     ╱  Has forced ON/OFF     ╲      YES          │ Clear the forced ON/OFF settings   │
                     ╲  settings been done?   ╱────────────▶      └──────────────────────────────────┘
                      ╲─────────────────────╱                                    │
                                  │                                              │
                                 NO                                             ▼
                                  │                            ╱─────────────────────────╲
                                  │          NO               ╱                           ╲      YES
                                  ◀─────────────────────────  ╲   Does the "MODE" LED      ╱──────────┐
                                  │                            ╲      turn on?             ╱           │
                                  ▼                             ╲─────────────────────────╱           │
┌──────────────────────────────────────────┐                                                         ▼
│ Hardware failure                           │                             ┌─────────────────────────────────┐
│ Perform operation check one by             │                             │              End                │
│ one, starting from the minimum             │                             └─────────────────────────────────┘
│ configuration system.                      │
│ For a module that does not work,           │
│ explain the fault symptoms and             │
│ consult with the nearest system            │
│ service, distributor or branch office.     │
└──────────────────────────────────────────┘
```
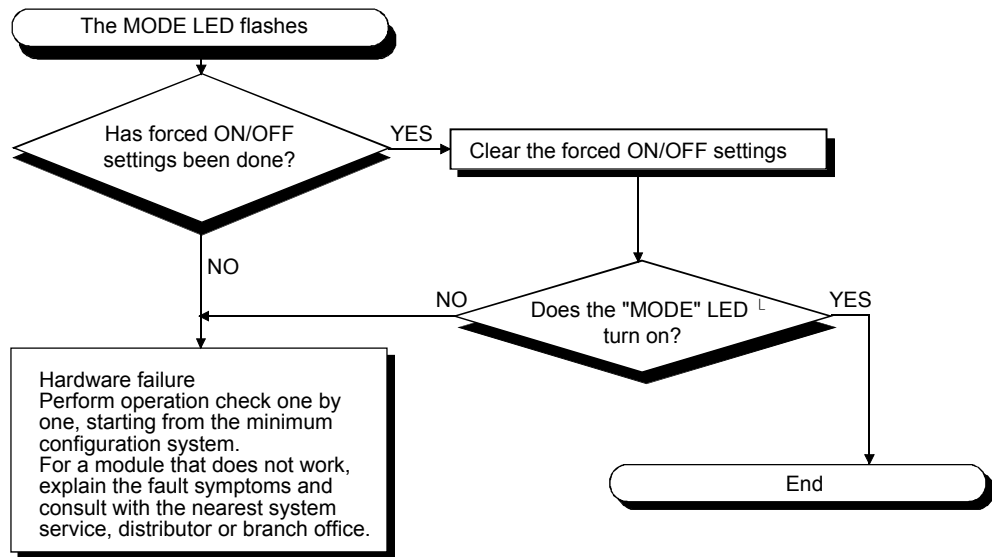
(3) When the "RUN" LED turns off

The flow chart below shows causes and measures in the case that the "RUN" LED turns off at power-on or during operation.

```
┌──────────────────────────────────┐
│  The "RUN" LED turned off         │
└──────────────────────────────────┘
                │
                ▼
       ╱ Is the "POWER" LED ╲       NO      ┌────────────────────────────────┐
      ╱  of the power supply  ╲────────────▶│ Go to the "when the 'POWER' LED │
      ╲      module on?       ╱             │ turns off" flow diagram,        │
       ╲                    ╱               │ described in Section 6.4.2      │
                │ YES                       └────────────────────────────────┘
                ▼
       ╱ Is the "ERR" LED on ╲      YES     ┌────────────────────────────────┐
      ╱    or flashing?       ╲────────────▶│ Go to the "when the 'ERR.' LED  │
      ╲                      ╱              │ turns on or flashes" flow       │
       ╲                   ╱                │ diagram, described in Section   │
                │ NO                        │ 6.5.1 (6)                       │
                ▼                           └────────────────────────────────┘
┌──────────────────────────────┐  "RUN" LED is on  ┌──────────────────────────────┐
│ Reset using the RUN/STOP/RESET│─────────────────▶│ (1) Failure of programmable  │
│ switch of the CPU module      │                   │ controller parts or poor     │
└──────────────────────────────┘                   │ contact                      │
                │ "RUN" LED is off                   │ (2) Due to excessive noise   │
                ▼                                    └──────────────────────────────┘
┌──────────────────────────────┐          In the case of (1)│    │In the case of (2)
│ Set the RUN/STOP/RESET switch │                            ▼
│ of the CPU module to STOP, and│        ┌──────────────────────────────┐
│ write END to Address 0 using  │        │ Explain the fault symptoms   │
│ GX Works2                     │        │ and consult with the nearest │
└──────────────────────────────┘        │ system service, distributor  │
                │                        │ or branch office             │
                ▼                        └──────────────────────────────┘
┌──────────────────────────────┐            ▲
│ Set the RUN/STOP/RESET switch │  "RUN" LED does not
│ to RUN, and operate in the    │  turn on
│ monitoring mode using GX Works2│
└──────────────────────────────┘
                │ "RUN" LED is on
                ▼
┌──────────────────────────────┐
│ Some error in a sequence      │
│ program may be the cause      │
└──────────────────────────────┘
                │
                ▼
┌──────────────────────────────┐        ┌──────────────────────────────┐
│ Check the program and correct │        │ Connect a surge suppressor   │
│ the defective part            │        │ circuit such as CR to a noise │
└──────────────────────────────┘        │ source                        │
                │                        └──────────────────────────────┘
                ▼
  NO   ╱ Does the "RUN" LED ╲
◀─────╱     turn on?         ╲
       ╲                    ╱
                │ YES
                ▼
┌──────────────────────────────────┐
│             End                   │
└──────────────────────────────────┘
```

(4) When the "RUN" LED flashes

When the "RUN" LED flashes during operation, it is presumed that a parameter or program change is in invalid status (operation stop).

If a program was written, perform one of the following operations:
- Reset the CPU using the RUN/STOP/RESET switch
- Turn the power off and on again
- Set the RUN/STOP/RESET switch from STOP → RUN again

If parameters were changed, perform one of the following operations:
- Reset the CPU using the RUN/STOP/RESET switch
- Turn the power off and on again

If the "RUN" LED flashes even after the operation described above was performed, it is presumed to be hardware failure.

POINT
After a program or parameters were written during stop, the QCPU checks programs when setting the RUN/STOP/RESET switch from STOP → RUN. In this state, the CPU has been stopped its operation. (Though it is not an error, the "RUN" LED flashes.) To resume the operation, set the RUN/STOP/RESET switch from STOP → RUN again.

(5) When the "ERR." LED turns on or flashes

The flow chart below shows causes and measures in the case that the "ERR." LED turns on or flashes at power-on, at the time of starting operation, or during operation.

When the "ERR." LED turns on or flashes, it is presumed that an error has occurred.

```
                                   ┌──────────────────────────────┐
                                   │ The "ERR." LED is on or flashing │
                                   └──────────────────────────────┘
                                                  │
                                                  ▼                          ◄─────────────┐
                    Hardware failure   ┌──────────────────────────┐                        │
                    ◄──────────────────│ Check the error definition using │                │
                    │                  │ GX Works2                 │                        │
                    │                  └──────────────────────────┘                        │
                    │                              │                                        │
                    ▼                              ▼                                        │
    ┌──────────────────────────┐   ┌──────────────────────────┐                            │
    │ Explain the fault symptoms and │   │ Set the RUN/STOP/RESET switch to STOP │          │
    │ consult with the nearest system │   └──────────────────────────┘                      │
    │ service, distributor or branch office │           │                                    │
    └──────────────────────────┘               ▼                                            │
                                   ┌──────────────────────────┐                             │
                                   │ Take measures according to the error definition │        │
                                   └──────────────────────────┘                             │
                                                  │                                          │
                                                  ▼                                          │
                                   ┌──────────────────────────┐                             │
                                   │ Reset using the RUN/STOP/RESET switch │                 │
                                   └──────────────────────────┘                             │
                                                  │                                          │
                                                  ▼                                          │
                                   ┌──────────────────────────┐                             │
                                   │ Set the RUN/STOP/RESET switch to RUN │                  │
                                   └──────────────────────────┘                             │
                                                  │                                          │
                                                  ▼                                    NO     │
                                         ╱────────────────╲ ─────────────────────────────────┘
                                        ╱ Does the "ERR." LED ╲
                                        ╲   turn off?       ╱
                                         ╲────────────────╱
                                                  │ YES
                                                  ▼
                                   ┌──────────────────────────┐
                                   │           End            │
                                   └──────────────────────────┘
```
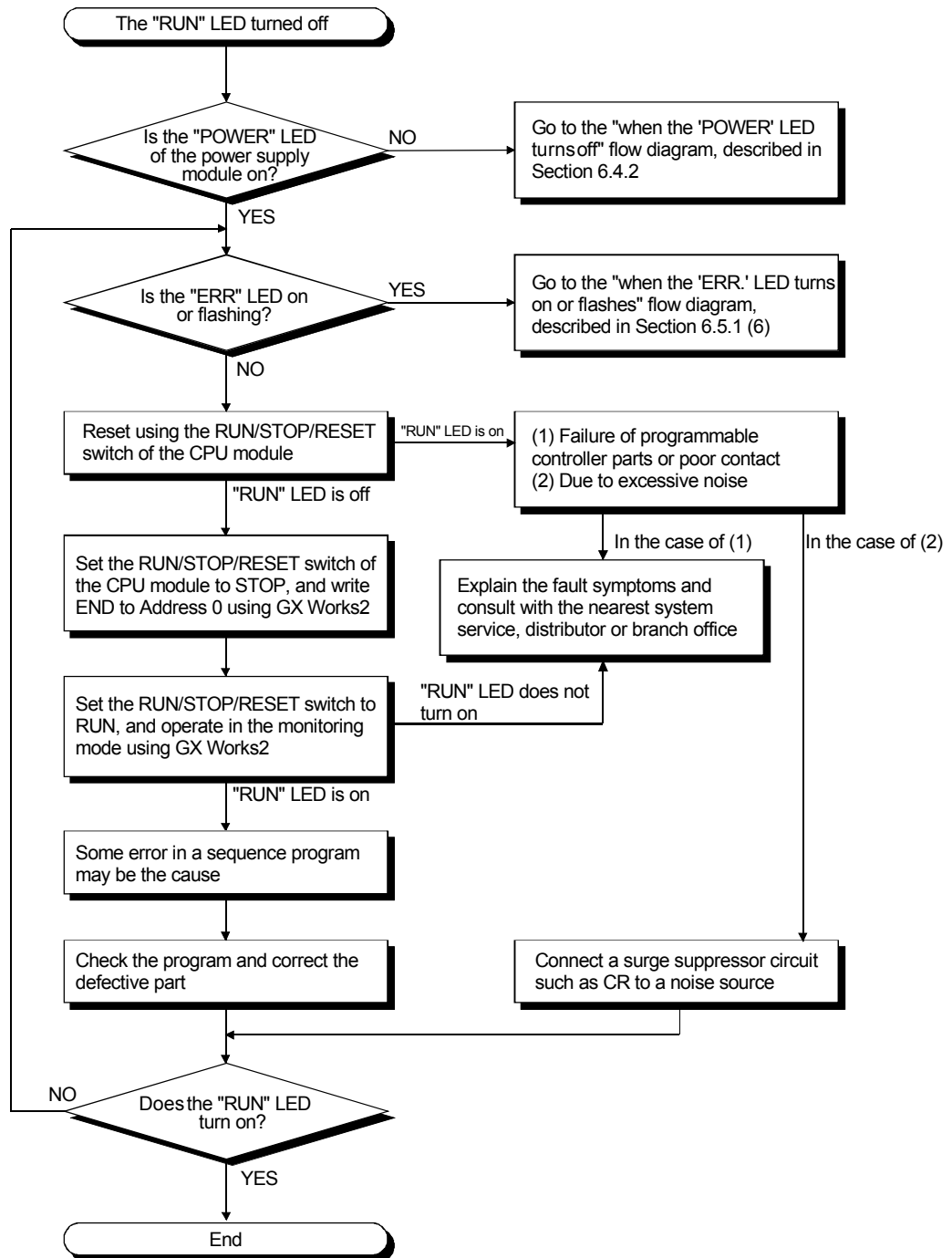
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(6) When the "ERR." LED turns on or flashes (when UNIT VERIFY ERR. occurred)
The flow chart below shows causes and measures in the case that a UNIT VERIFY ERR. occurred and the "ERR." LED turns on or flashes.

```
                    ( UNIT VERIFY ERR. occurred )
                                  │
                                  ▼
                    ┌──────────────────────────┐
                    │ Check the error slot using GX │
                    │ Works2                        │
                    └──────────────────────────┘
                                  │
                                  ▼
              ◇ Check that the module of the ◇─── YES ──────────────────────►  ┌──────────────────────┐
                  slot is connected and                                         │ Reset the CPU module   │
                  disconnected during                                          └──────────────────────┘
                  operation                                                               │
                      │                                                                   ▼
                     NO                                                     ◇ Did the error disappear? ◇─── YES ──┐
                      │                                                                │                          │
                      ▼                                                               NO                          │
              ◇ Check that the module of the ◇── NO ──►  ┌───────────────────────┐    ▼                          │
                  slot is mounted correctly              │ Mount the module properly │  ┌──────────────────┐       │
                      │                                  └───────────────────────┘   │ Replace the module │       │
                     YES                                              │              └──────────────────┘       │
                      │                                               ▼                        │                 │
                      │              ◇ Did the error disappear? ◇── YES ──────────────────────┴─────────────────┤
                      │◄──── NO ─────◇                                                                           │
                      │                                                                                          │
                      ▼                                                                                          │
              ◇ Check that all extension ◇── NO ──►  ┌────────────────────────────┐                             │
                  cables of the base unit have        │ Connect the extension cable properly │                  │
                  been connected properly             └────────────────────────────┘                           │
                      │                                               │                                          │
                     YES                                              ▼                                          │
                      │              ◇ Did the error disappear? ◇── YES ────────────────────────────────────────┤
                      │◄──── NO ─────◇                                                                           │
                      │                                                                                          │
                      ▼                                                                                          │
              ◇ Replace the module ◇─── Normal operation ─────────────────────────────────────────────────────┤
                      │                                                                                          │
               Error detection                                                                                  │
                      ▼                                                                                          │
              ◇ Replace the CPU module ◇─── Normal operation ─────────────────────────────────────────────────┤
                      │                                                                                          │
               Error detection                                                                                  │
                      ▼                                                                                          │
              ◇ Replace the base unit ◇─── Normal operation ──────────────────────────────────────────────────┤
                      │                                                                                          │
               Error detection                                                                                  │
                      ▼                                                                                          ▼
       ┌──────────────────────────────┐                                                          (      End      )
       │ Hardware failure.             │
       │ Explain the fault symptoms and consult │
       │ with the nearest system service, │
       │ distributor or branch office  │
       └──────────────────────────────┘
```
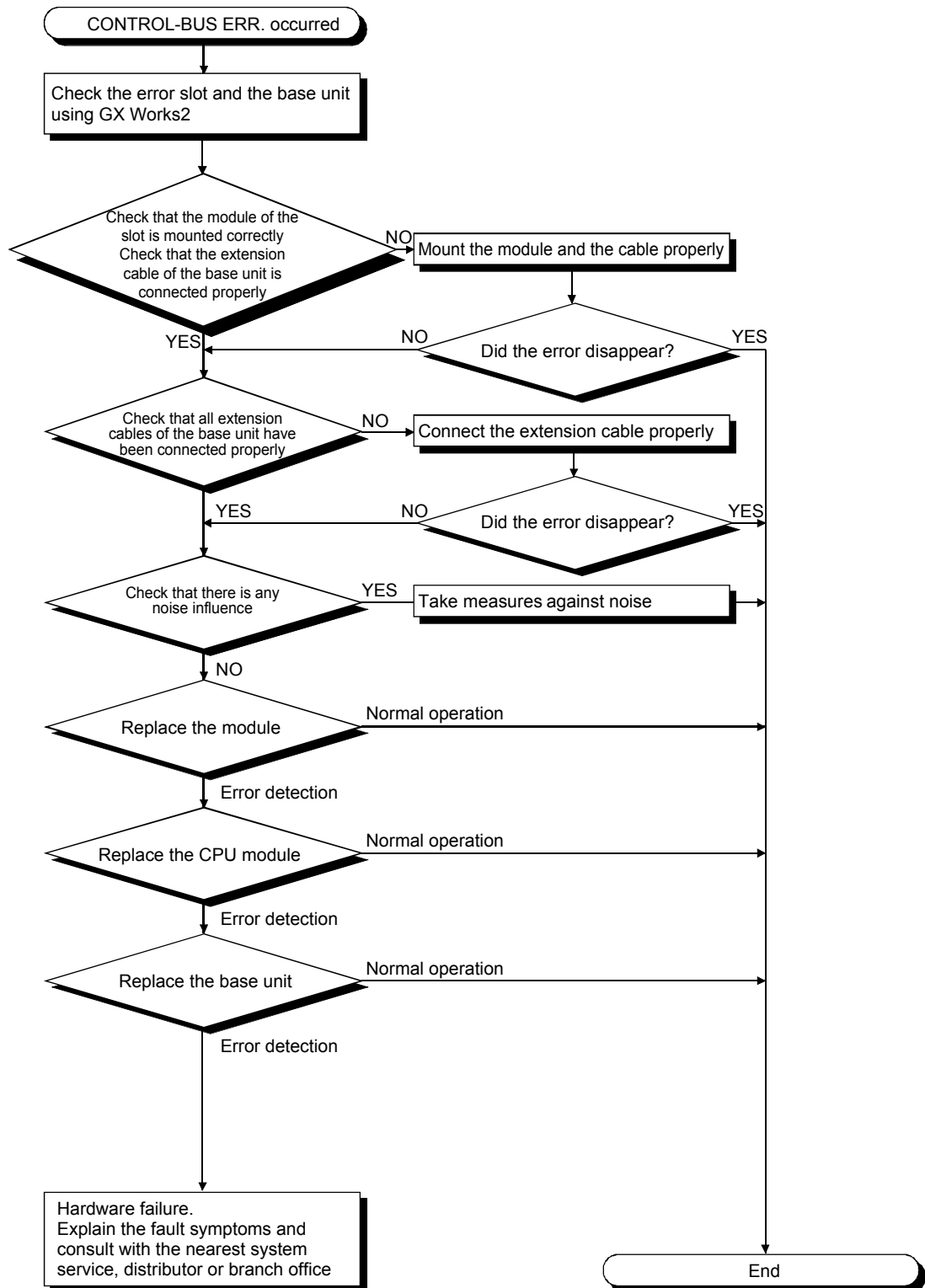
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(7) When the "ERR." LED turns on or flashes (when CONTROL-BUS. ERR. occurred)

The flow chart below shows causes and measures in the case that a CONTROL-BUS. ERR. occurred and the "ERR." LED turns on or flashes.

Note that this flow diagram is available only when a slot/base unit can be specified by an error code.

```
        ( CONTROL-BUS ERR. occurred )
                    |
                    v
     +-----------------------------------+
     | Check the error slot and the base unit |
     | using GX Works2                   |
     +-----------------------------------+
                    |
                    v
         < Check that the module of the
           slot is mounted correctly      >  NO  --> [ Mount the module and the cable properly ]
           Check that the extension                              |
           cable of the base unit is                             v
           connected properly          >       NO  < Did the error disappear? >  YES
                  | YES  <-------------------------------                         |
                  v                                                               |
         < Check that all extension                                              |
           cables of the base unit have  >  NO  --> [ Connect the extension cable properly ]
           been connected properly  >                              |
                  | YES                                            v
                  v                           NO  < Did the error disappear? >  YES
         < Check that there is any  >  YES --> [ Take measures against noise ]   |
           noise influence          >                                           |
                  | NO                                                           |
                  v                                                             |
         < Replace the module >  Normal operation ----------------------------->|
                  | Error detection                                            |
                  v                                                            |
         < Replace the CPU module >  Normal operation --------------------------->|
                  | Error detection                                            |
                  v                                                            |
         < Replace the base unit >  Normal operation --------------------------->|
                  | Error detection                                            |
                  v                                                            v
     +-----------------------------------+                              ( End )
     | Hardware failure.                 |
     | Explain the fault symptoms and    |
     | consult with the nearest system   |
     | service, distributor or branch office |
     +-----------------------------------+
```

(8) When the "USER" LED turns on

The "USER" LED turns on when an error is detected at a CHK instruction or when an annunciator (F) turns on.

When the "USER" LED turns on, monitor SM62 and SM80 of the special relay using the GX Works2 monitoring mode.

- When SM62 is ON

    An annunciator (F) is ON.

    Identify the error cause using SD62 to SD79.

- When SM80 is ON

    Execution of a CHK instruction turns on the "USER" LED.

    Identify the error cause using SD80.

Once an error cause is identified, remove the error cause.

The following operation will turn off the "USER" LED:

- Reset using the RUN/STOP/RESET switch
- Execution of a LEDR instruction by a programmable controller program

REMARKS

To execute latch clear processing, use the remote latch clear operation of GX Works2.

(9) When the "BAT." LED turns on

The "BAT." LED turns on when a battery low is detected.

If the "BAT." LED turns on, monitor special relays and special registers using functions of GX Works2 such as the device batch monitor in order to identify which battery is low, either the CPU module or an SRAM card. (SM51 to SM52 and SD51 to SD52)

After identification and replacement with a new battery, reset using the RUN/STOP/RESET switch or execution of a LEDR instruction will turn off the "BAT." LED.

(10) When the "BOOT" LED flashes

The flow chart below shows causes and measures in the case that the "BOOT" LED of the CPU module flashes at the programmable controller power-on, at the time of starting operation, or during operation.

```
        ╭─────────────────────────────╮
        │   The "BOOT" LED flashes     │
        ╰─────────────────────────────╯
                       │
        ┌─────────────────────────────┐
        │ Turn OFF the power supply of │
        │ the programmable controller  │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │   Detach a memory card       │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │ Turn on the SW2 and SW3 DIP  │
        │ switches                     │
        └─────────────────────────────┘
                       │
        ┌─────────────────────────────┐
        │ Turn ON the power supply of  │
        │ the programmable controller  │
        └─────────────────────────────┘
                       │
                      ◇                    YES    ┌──────────────────────────────┐
        Does the "BOOT" LED turn on?  ──────────▶│ Automatic writing from a      │
                      ◇                           │ memory card to the standard   │
                       │ NO                        │ ROM is completed              │
                       │                           └──────────────────────────────┘
                       ▼                                         │
        ┌─────────────────────────────┐          ┌──────────────────────────────┐
        │ CPU module hardware failure. │          │ Execute boot operation from   │
        │ Explain the fault symptoms   │          │ the standard ROM              │
        │ and consult with the nearest │          └──────────────────────────────┘
        │ system service, distributor  │
        │ or branch office             │
        └─────────────────────────────┘
```

6.5.3 When a Program Cannot Be Read/Written

(1) When a program cannot be written
The flow chart below shows causes and measures in the case that a program cannot be written to the CPU module.

```
              ( A program cannot be written )
                          │
   ┌──────────────────────┼───────────────────────────────────────────┐
   │                      ▼                                             │
   │            <Is the DIP switch 1 OFF?>──ON──> [Set the DIP switch 1 │
   │                      │                        (system protection)  │
   │                      │                        to OFF]              │   Only for high
   │                     OFF                         │                  │   performance models
   │                      │         NO               ▼          YES     │
   │                      │ <──────────< Can a program be written? >────┼──┐
   │                      │                                             │  │
   └──────────────────────┼─────────────────────────────────────────────┘  │
                          ▼                                                  │
            <Has a password been registered?>──YES──> [Clear the password    │
                          │                            using GX Works2]      │
                         NO                              │                    │
                          │              NO              ▼           YES      │
                          │ <───────────< Can a program be written? >────────┤
                          ▼                                                   │
            <Is the memory program    Memory  [Try the following items       │
             memory?>──────────────── card ──> ・Check whether the write     │
                          │                      protect switch is OFF        │
                   Program memory                ・Check whether it is        │
                          │                        formatted                  │
            [Try the following items              ・Check the specification   │
             ・Organize and rearrange files        of a write destination]   │
             ・Check the free space of the          │                         │
               memory                               ▼              YES        │
             ・Check the specification of   <Can a program be written?>───────┤
               a write destination]                 │                         │
                          │                         NO                        │
                          ▼              YES                                  │
            <Can a program be written?>─────────────────────────────────────┤
                          │                                                   │
                         NO                                                   │
                          ▼                                                   │
                 [Format the memory]                                         │
                          │                                                   │
                          ▼              YES                                  │
            <Can a program be written?>─────────────────────────────────────┤
                          │                                                   │
                         NO                                                   ▼
                          ▼                                              ( End )
            [Explain the fault symptoms and
             consult with the nearest system
             service, distributor or branch office]
```

(2) When a program cannot be read
The flow chart below shows causes and measures in the case that GX Works2 cannot communicate with the programmable controller while its power is ON.

```
┌─────────────────────────────────────┐
│  Cannot communicate with GX Works2   │
└─────────────────────────────────────┘
                  │
                  ▼
          ╱─────────────────╲          NO      ┌──────────────────────┐
         ╱ Is memory to be    ╲─────────────────▶│ Choose correct memory│
         ╲ read correct?      ╱                  └──────────────────────┘
          ╲─────────────────╱                               │
                  │ YES                                      ▼
                  │              NO        ╱──────────────────╲      YES
                  ◀─────────────────────── ╱  Can the CPU       ╲──────────▶
                  │                        ╲ module communicate ╱
                  │                         ╲ with GX Works2?   ╱
                  ▼                          ╲─────────────────╱
          ╱─────────────────╲          NO      ┌──────────────────────┐
         ╱ Is the connection  ╲─────────────────▶│ Connect the connection│
         ╲ cable connected    ╱                  │ cable correctly.     │
          ╲ correctly?        ╱                  └──────────────────────┘
           ╲─────────────────╱                              │
                  │ YES                                      ▼
                  │              NO        ╱──────────────────╲      YES
                  ◀─────────────────────── ╱  Can the CPU       ╲──────────▶
                  │                        ╲ module communicate ╱
                  │                         ╲ with GX Works2?   ╱
                  ▼                          ╲─────────────────╱
          ╱─────────────────╲          YES
         ╱ Can it communicate ╲──────────────────────────────────────────▶
         ╲ with GX Works2 after╱
          ╲ the replacement of ╱
           ╲ the connection    ╱
            ╲ cable?           ╱
             ╲────────────────╱
                  │ NO
                  ▼
          ╱─────────────────╲          NO      ┌──────────────────────┐
         ╱ Has a USB driver   ╲─────────────────▶│ Install a USB driver │
         ╲ been installed to   ╱                  │ to the personal      │
          ╲ the personal       ╱                  │ computer.            │
           ╲ computer?         ╱                  └──────────────────────┘
            ╲────────────────╱                              │
                  │ YES                                     ▼
                  │              NO        ╱──────────────────╲      YES
                  ◀─────────────────────── ╱  Can the CPU       ╲──────────▶
                  │                        ╲ module communicate ╱
                  │                         ╲ with GX Works2?   ╱
                  ▼                          ╲─────────────────╱
┌────────────────────────────┐
│ Explain the fault symptoms  │              ┌───────────────────┐
│ and consult with the nearest│              │       End         │
│ system service, distributor │              └───────────────────┘
│ or branch office            │
└────────────────────────────┘
```

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(3) When a program is unexpectedly overwritten

The flow chart below shows causes and measures in the case that a program is unexpectedly overwritten at power-on or reset operation.

```
        ( A program is unexpectedly overwritten )
                        |
                        v
                  / Is SM660 ON? \──────── OFF (Program memory execution)
                  \              /                                   |
                        |                                           |
               ON (Boot operation is going on)                      |
                        |                                           |
        ┌───────────────────────────────┐                          |
        │ Format the program memory that │                          |
        │ is executing boot operation    │                          |
        │ from the standard ROM, and     │                          |
        │ write to the standard ROM      │                          |
        └───────────────────────────────┘                          |
                        |                                           |
        ┌───────────────────────────────┐                          |
        │ Disable the "Execute boot      │                          |
        │ operation from the standard    │                          |
        │ ROM" checkbox in the boot file │                          |
        │ setting of the PLC parameter   │                          |
        └───────────────────────────────┘                          |
                        |                                           |
        ┌───────────────────────────────┐                          |
        │ Write parameters and a         │                          |
        │ sequence program to the        │                          |
        │ program memory                 │                          |
        └───────────────────────────────┘                          |
                        |                                           |
        ┌───────────────────────────────┐                          |
        │ Restart/reset the power supply │                          |
        │ of the programmable controller │                          |
        └───────────────────────────────┘                          |
                        |                                           |
                  / Is a program \──── YES ────────────────────────┤
                  \ overwritten? /                                  |
                        |                                           |
                   ( End )                     ┌─────────────────────────────────┐
                                               │ Hardware failure.               │
                                               │ Explain the fault symptoms and  │
                                               │ consult with the nearest system │
                                               │ service, distributor or branch  │
                                               │ office.                         │
                                               └─────────────────────────────────┘
```

(4) When boot operation from a memory card cannot be executed

The flow chart below shows causes and measures in the case that boot operation of the CPU module from a memory card cannot be executed.

```
┌─────────────────────────────────┐
│ Boot operation cannot be executed│
└─────────────────────────────────┘
                │
                ▼
        ◇ Did CPU fault occur? ◇ ──YES──► [ Remove the error causes ]
                │                                      │
                NO                                     ▼
                │                    ◇ Can boot operation be executed? ◇ ──YES──┐
                │                                      │                          │
                │◄──────────────NO─────────────────────                          │
                ▼                                                                 │
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐                     │
  ◇ Has a parameter-valid drive been specified? ◇ ──NO──► [ Specify a parameter-valid drive using the DIP switches 2 and 3 ]   Only for high performance models
                │                                      │                          │
                YES                                    ▼                          │
                │                    ◇ Can boot operation be executed? ◇ ──YES──► │
                │                                      │                          │
                │◄──────────────NO─────────────────────                          │
└ ─ ─ ─ ─ ─ ─ ─ ┼ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘                   │
                ▼                                                                 │
  ◇ Has a file set in the boot file setting of the parameters? ◇ ──NO──► [ Set a file to the boot file setting ]               │
                │                                      │                          │
                YES                                    ▼                          │
                │                    ◇ Can boot operation be executed? ◇ ──YES──► │
                │                                      │                          │
                │◄──────────────NO─────────────────────                          │
                ▼                                                                 │
  ◇ Has a file set in the program settings of the parameters? ◇ ──NO──► [ Set a file to the program settings ]                 │
                │                                      │                          │
                YES                                    ▼                          │
                │                    ◇ Can boot operation be executed? ◇ ──YES──► │
                │                                      │                          │
                │◄──────────────NO─────────────────────                          │
                ▼                                                                 │
  ◇ Has a file executed by boot operation been stored in the memory card? ◇ ──NO──► [ Write a file to the memory card ]        │
                │                                      │                          │
                YES                                    ▼                          │
                │                    ◇ Can boot operation be executed? ◇ ──YES──► │
                │                                      │                          │
                │◄──────────────NO─────────────────────                          │
                ▼                                                                 ▼
[ Explain the fault symptoms and consult with the nearest system service, distributor or branch office ]        ( End )
```

6.5.3 CPU Troubles and Measures

	Trouble symptom	Measures
Example 1	• Disturbance to the programmable controller such as noise causes unauthorized access to the memory inside the CPU, overwriting data temporarily.	• Fundamentally, various measures against noise are required. For temporary and early restoration, however, avoiding this trouble using boot operation from a flash ROM (standard ROM), which is an internal standard attachment, or from a memory card is useful. Storing programs and parameters into a standard ROM or a memory card in advance enables to perform boot operation triggered by a CPU reset or turning the power OFF and ON again, which transfers data to an internal program memory (SRAM) whenever this happens. (The following figure is a operation image) Furthermore, backing up programs and parameters to a CF card using the backup and restoration function of the GOT also enables this. (The following figure is a operation image) The CPU module processes the operation of programs stored in the program memory. The operation of program stored in the standard ROM and the memory card is not processed. To process the operation of programs stored in the standard ROM or the memory card, configure the module so that programs in the standard ROM and the memory card can be booted (read) into the program memory when the power is turned OFF and ON again or when the CPU module is reset. Boot operation from the standard ROM or the memory card Function to backup and restore connected devices
Example 2	• Once a battery error occurs, the battery error can be displayed after battery replacement.	• There are two types of battery errors depending on a place in which the error occurred. Therefore, perform the PLC diagnostics using peripherals such as GX Works2 to check the error code. (1) Error code 1600: CPU module itself (2) Error code 1601: Memory card * The basic model and the universal model QCPU Q00U(J)CPU and Q01UCPU are not equipped with a memory card.
Example 3	• The programmable controller does not start and the front LED does not turn on, even after power-on.	• The RESET switch may be fixed at the reset position. Check visually to make sure that the RESET switch is not at the reset position. RESET/L.CTR switch * The basic model and universal model QCPU has the RUN/STOP/RESET switch. When the switch is released at the reset position, it automatically goes back to the stop position. Therefore it cannot be fixed at the reset position.

(To the next page)

	Trouble symptom	Measures
Example 4	• When the base is mounted, the base connector can be damaged.	• When the base is mounted, ensure that the module fixing projection and the module fixing hole are fitting into each other, then insert the module.
Example 5	• When a module with USB interface is connected to a personal computer using USB, electric shock or module failure may occur depending on the model of the personal computer and operating conditions.	When using a personal computer with an AC power supply, use one whose power plug has three pins or a grounding wire, or ensure that the ground cable is grounded. When using a battery-driven personal computer, use the computer as is. (For more details, refer to the Mitsubishi programmable controller TECHNICAL BULLETIN No. PLC-D-464.)

In the Example 4 Measures cell diagrams, labels include: Base unit, Module fixing hook, Module connector, Base unit, Module fixing projection, Module mounting lever, Module fixing hole, Module, Base unit, Module mounting lever, Module fixing projection, Module fixing hole.

6.6 Troubleshooting for the Input Module

6.6.1 Troubles regarding Hardware Failure

(1) If external input equipment is OFF and a programmable controller side input signal is ON, it is presumed to be input module failure or a leakage current.

```
┌─────────────────────────────────────┐
│ The input signal is on even though   │
│ the external input device is OFF     │
└─────────────────────────────────────┘
                    │
                    ▼
          ◇ Is the LED of the input ◇───NO───┐
          ◇ module on?            ◇          │
                    │                         ▼
                   YES            ┌──────────────────────────┐
                    │             │ Remove the input module  │
                    ▼             │ from the base unit, and   │
          ◇ Can an external ◇─NO─┐│ monitor the input signal  │
          ◇ factor be the   ◇    ││ using GX Works2           │
          ◇ cause?          ◇    │└──────────────────────────┘
                    │            │             │
                   YES           │             ▼
                    │            │   ◇ Is the input signal ON? ◇──NO──┐
                    ▼            │             │                      │
    ┌──────────────────────┐    │            YES                     ▼
    │ Restart it after     │    │             │          ┌────────────────────┐
    │ removing the error   │    │             ▼          │ Replace the input  │
    │ cause such as a      │    │   ┌──────────────────┐ │ signal cable and   │
    │ leakage current      │    │   │ Reset the CPU    │ │ monitor the signal │
    └──────────────────────┘    │   │ module and       │ │ again using GX     │
                                │   │ monitor the      │ │ Works2             │
                                │   │ signal again     │ └────────────────────┘
                                │   │ using GX Works2  │           │
                                │   │ Check the        │           ▼
                                │   │ program, because │   ◇ Is the input signal ON? ◇─NO─┐
                                │   │ the signal turns │           │                     │
                                │   │ ON after the     │          YES                    │
                                │   │ reset if the     │           │                     │
                                │   │ program          │           │                     │
                                │   │ improperly       │           │                     │
                                │   │ outputs to an    │           │                     │
                                │   │ input            │           │                     │
                                │   └──────────────────┘           │                     ▼
                                │            │                     │      ┌────────────────────┐
                                └────────────┴──────────┐          │      │ The input signal   │
                                                        │          │      │ cable is faulty.   │
                          NO                            │          │      │ Replace it with a  │
              ┌──────────◇ Is the input signal ON? ◇────┘          │      │ new cable.         │
              │                     │                              │      └────────────────────┘
              ▼                    YES                             │
    ┌──────────────────┐           │                              │
    │ Reset has not    │           ▼                              ▼
    │ been performed   │  ┌──────────────────┐          ┌──────────────────┐
    │ after it turned  │  │ The CPU module   │          │ The input module │
    │ ON forcibly in   │  │ may be faulty.   │          │ may be faulty.   │
    │ device test      │  │ Explain the      │          │ Explain the      │
    │ operation        │  │ fault symptoms   │          │ fault symptoms   │
    └──────────────────┘  │ and consult with │          │ and consult with │
                          │ the nearest      │          │ the nearest      │
                          │ system service,  │          │ system service,  │
                          │ distributor or   │          │ distributor or   │
                          │ branch office.   │          │ branch office.   │
                          └──────────────────┘          └──────────────────┘
```

┌───┐
│ POINT   │
├───┤
│ The external factors include external device failure, external power   │
│ supply failure, incorrect wiring, and noise.   │
└───┘

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(2) If external input equipment is ON and a programmable controller side input signal is OFF, it is presumed to be input module failure or disconnection of an input circuit.

```
┌──────────────────────────────┐
│ The input signal is OFF even though │
│ the external input device is on     │
└──────────────────────────────┘
              │
              ▼
         ╱──────────╲              NO   ┌─────────────────────────────┐
        ╱ Is the external ╲ ──────────▶│ Set the input signal of the │
       ╱ input voltage within the ╲     │ programmable controller within │
        ╲ range of input signal? ╱      │ the range of voltage specifications │
         ╲──────────╱                   └─────────────────────────────┘
              │ YES
              ▼
   ┌──────────────────────────┐
   │ Check the external input circuit │
   └──────────────────────────┘
              │
              ▼
         ╱──────────╲              NO
        ╱ Does the LED of ╲ ─────────────────────┐
        ╲ the input module turn ╱                 │
         ╲  on?  ╱                                 ▼
              │ YES                      ┌─────────────────────────┐
              │                          │ Check the "POWER" LED    │
              │                          │ of the power supply module │
              │                          └─────────────────────────┘
              │                                    │
              │                                    ▼
              │                               ╱──────────╲       NO   ┌──────────────────────┐
              │                              ╱ Is the "POWER" ╲ ─────▶│ Go to the "when the 'POWER' │
   ┌──────────────────────────┐             ╲  LED on?  ╱            │ LED turned off" flow diagram │
   │ Monitor the input signal using │ ◀───────╲──────────╱            └──────────────────────┘
   │ GX Works2                     │               │ YES
   └──────────────────────────┘               ▼
              │                      ┌─────────────────────────┐
              │                      │ Replace the input signal cable │
              ▼                      │ and the extension cable       │
         ╱──────────╲       NO       └─────────────────────────┘
        ╱ Is the signal on the ╲ ─────┐        │
        ╲   monitor ON?  ╱            │        ▼
         ╲──────────╱                 │   ╱──────────╲       NO   ┌────────────────────────────┐
              │ YES                   │  ╱ Does the LED ╲ ───────▶│ The input module may be faulty. │
              ▼                       │  ╲ of the input signal ╱   │ If there is an empty input terminal │
   ┌──────────────────────────┐      │   ╲ turn on? ╱            │ on the input module, migrate the │
   │           End            │      │        │ YES              │ wiring of the external input      │
   └──────────────────────────┘      │        ▼                  │ devices and change the input      │
                                      │  ┌──────────────────────┐ │ number. Otherwise, replace the    │
                                      │  │ The input signal cable or the │ │ module.                  │
                                      │  │ extension cable is faulty     │ └────────────────────────────┘
                                      │  └──────────────────────┘
                                      └──────────┘
```

6.6.2 Input Circuit Troubles and Measures

This section explains examples of input circuit troubles and measures.

Table 6-2: Input Circuit Troubles and Measures
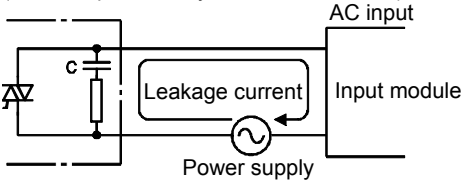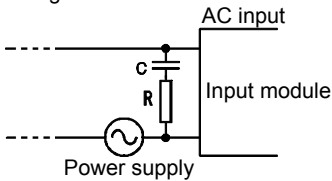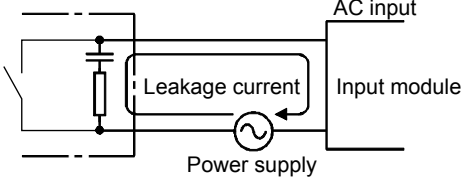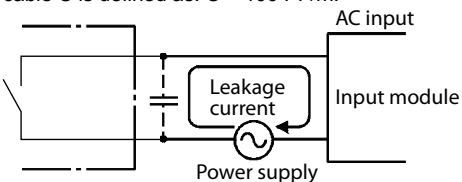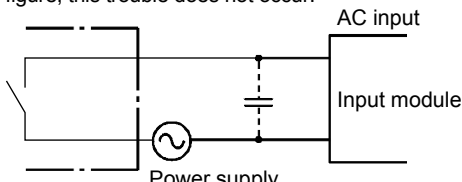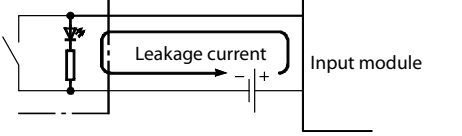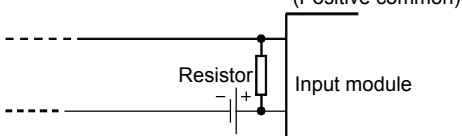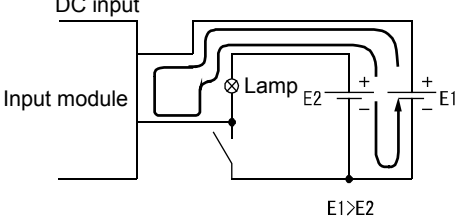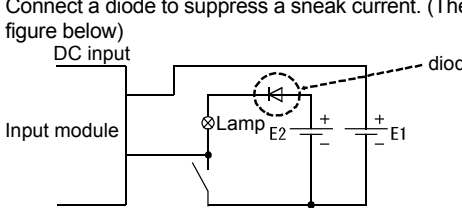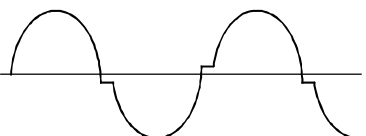
	Condition	Cause	Measures
Example 1	An input signal does not turn OFF.	• Leakage current of the input switch (For example, drive by a contactless switch)	• Connect a proper resistor so that a voltage between input module terminals can be lower than the OFF voltage value. • The recommended CR constant is: • 0.1 to 0.47 µF + 47 to 120 Ω (1/2 W).
Example 2	An input signal does not turn OFF.	• Drive by a limit switch with neon lamp	• Same as Example 1 • Alternatively, make the circuit independent and install a display circuit separately.
Example 3	An input signal does not turn OFF.	• Leakage current due to the line capacity of an connecting cable The approximate line capacity of a twisted pair cable C is defined as: C = 100 PF/m.	• Same as Example 1 • However, when the power supply is located at the side of the input equipment shown as the following figure, this trouble does not occur.
Example 4	An input signal does not turn OFF.	• Drive by a switch with a LED indicator	• Connect a proper resistor so that a current in the input module is lower than the OFF current. * The next page shows the calculation examples for the values of resistance to be connected.
Example 5	An input signal does not turn OFF.	• Sneak current due to usage of two power supplies E1>E2	• Unite two power supplies into one. • Connect a diode to suppress a sneak current. (The figure below)

Table 6-2: Input Circuit Troubles and Measures (Continued)

	Condition	Cause	Measures
Example 6	An input signal does not turn ON. (AC input module)	There exists stepwise distortion near the zero cross voltage in the input signal (AC) as shown below. Zero cross voltage	Improve the waveform of the input signal, for example, using an online inverter UPS.
Example 7	Incorrect input due to noise	Noise is captured as input.	Change the response time setting. [*1] Example: 1 ms → 5 ms If setting the response time longer makes no difference, take measures described below: • Avoid bundling a power cable and an I/O cable to prevent excessive noise. • Take measures against noise. For example, suppress noise by adding a surge absorber to noise sources such as relays and conductors that use the same power supply.

*1: If the noise is periodic and excessive, setting response time short may be more effective.

<Calculation examples for Example 4>

When a switch with LED indicator, through which a 2.33 mA leakage current flows when a 24 VDC power supply is applied to the QX40, is connected:
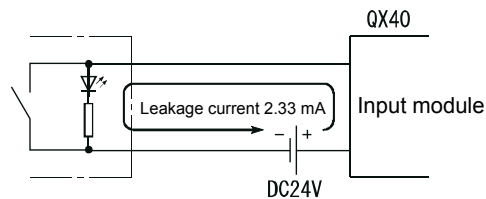
(1) This does not meet the QX40 OFF current, 1.7 mA. Therefore, a resistor must be connected as follows:
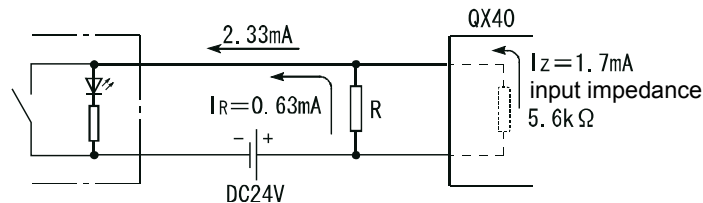
(2) The connection resistance value R is calculated as follows.

The connection of a resistor R by which 0.63 mA or more flows through the connection resistor is required in order to meet the QX40 OFF current of 1.7 mA or less.

$$I_R : I_Z = Z \text{ (Input impedance)} : R$$

$$R \leqq \frac{I_Z}{I_R} \times Z \text{ (Input impedance)} = \frac{1.7}{0.63} \times 5.6 = 15.11 [k\Omega]$$

That is, R < 15.11 kΩ.

When resistor R is 12 kΩ, power capacity W for the resistor R is:

W = (input voltage) 2 ÷ R = 28.82 ÷ 12000 = 0.069 (W)

(3) Because the power capacity of a resistor is three to five times of the actual power consumption, a 12 (kΩ) and 1/4 to 1 (W) resistor must be connected to the issued terminal,

(4) Besides, the OFF voltage when resistor R is inserted is:

$$\frac{1}{\dfrac{1}{12.0[\mathrm{k}\Omega]} + \dfrac{1}{5.6[\mathrm{k}\Omega]}} \times 2.33[\mathrm{mA}] = 8.90[\mathrm{V}]$$

It satisfies the QX40 OFF voltage, which is 11 V or less.

6.6.3 Input Module Terminal Voltage Checking Methods

The input module differs in control voltage, which is 100 V AC, 200 V AC, 5 V DC, 12 V DC, and 24 V DC, and in source/sync input. This offers various combinations. Methods for terminal voltage check for the input module using a tester are described below.
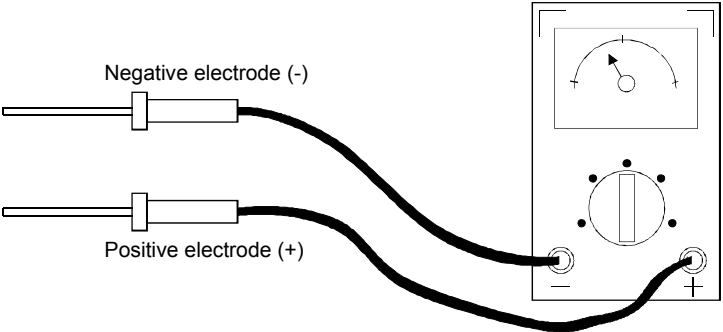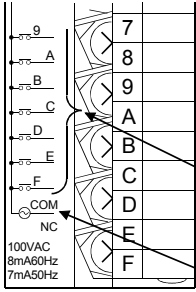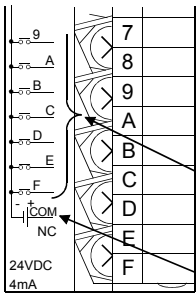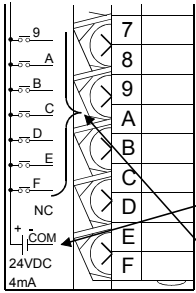
Table 6-3: Terminal Voltage Checking Methods

Control voltage	Module/unit terminal measuring point	
100 V AC 200 V AC		Set the voltage range of the tester to 100 V AC/200 V AC measurement. Connect the negative electrode of the tester to each input terminal Connect the positive electrode of the tester to the COM terminal
5 V DC 12 V DC 24 V DC Positive common		Set the voltage range of the tester to 100 V DC measurement. Connect the negative electrode of the tester to each input terminal Connect the positive electrode of the tester to the COM terminal
5 V DC 12 V DC 24 V DC Negative common		Set the voltage range of the tester to 100 V DC measurement. Connect the negative electrode of the tester to the COM terminal Connect the positive electrode of the tester to each input terminal

6.7 Troubleshooting for the Output Module

6.7.1 Troubles regarding Hardware Failure

(1) When the load of the output module does not turn ON during operation
The flow chart below shows causes and measures in the case that the load of
the output module does not turn ON during operation.
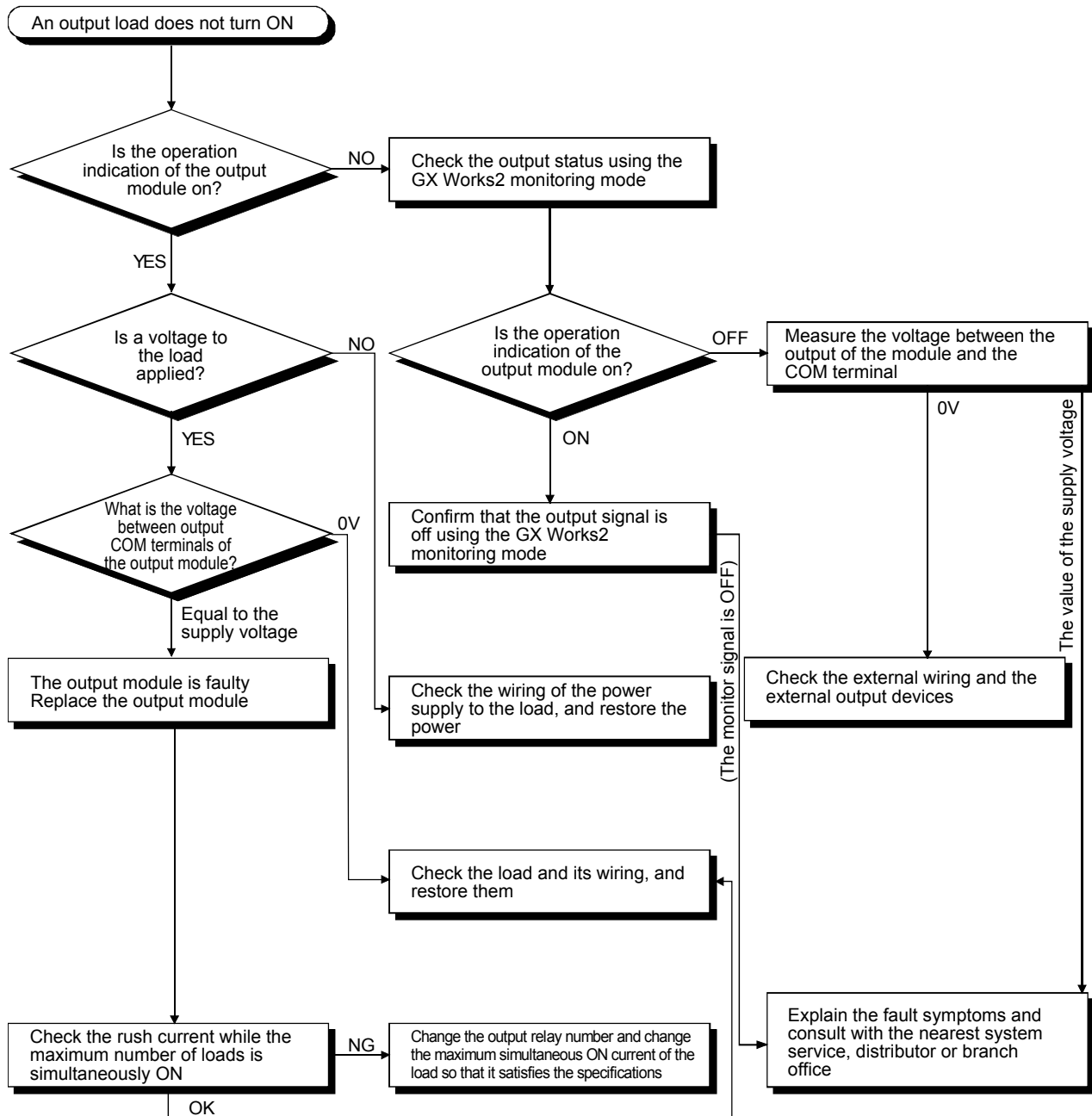
(2) When the LED of the output module does not turn ON during operation
   The flow chart below shows causes and measures in the case that the LED of
   the output module does not turn ON during operation.

```
┌──────────────────────────────────────────────┐
│  The LED of the output module does not turn on │
└──────────────────────────────────────────────┘
                      │
                      ▼
              ╱─────────────╲         NO
             ╱ Is the "MODE"  ╲    (flashing)    ┌──────────────────────────┐
            ╱    LED on?        ╲───────────────▶│  Refer to Section 11.2.3  │
             ╲                 ╱                  └──────────────────────────┘
              ╲───────────────╱
                      │ YES
                      ▼
              ╱─────────────╲
             ╱ Is it ON when   ╲       NO         ┌──────────────────────────┐
            ╱   monitoring       ╲───────────────▶│    Review the program     │
             ╲ using GX Works2? ╱                 └──────────────────────────┘
              ╲───────────────╱
                      │ YES
                      ▼
            ┌───────────────────────┐
            │ Check the I/O number  │
            │ using GX Works2       │
            │ system monitor        │
            └───────────────────────┘
                      │
                      ▼
              ╱─────────────╲
             ╱ Is the output   ╲       NO         ┌──────────────────────────┐
            ╱   number           ╲───────────────▶│  Change the output number │
             ╲   correct?       ╱                 └──────────────────────────┘
              ╲───────────────╱
                      │ YES
                      ▼
              ╱─────────────╲
             ╱ Does the LED    ╲       NO
            ╱ turn ON by turning ╲──────────────┐
            ╲ on forcibly another╱              │
             ╲  output module?  ╱               │
              ╲───────────────╱                 │
                      │ YES                      │
                      ▼                          ▼
              ╱─────────────╲         ┌──────────────────────────────────┐
             ╱ Does the LED    ╲  NO  │ Hardware failure of the CPU       │
            ╱ turn ON after      ╲───▶│ module, base unit, or extension   │
            ╲ replacing with     ╱    │ cable. Explain the fault symptoms │
             ╲ another output  ╱      │ and consult with the nearest      │
              ╲ module and    ╱       │ system service, distributor or    │
              ╲ turning on   ╱        │ branch office                     │
               ╲ forcibly   ╱         └──────────────────────────────────┘
                ╲ again?   ╱
                 ╲───────╱
                    │ YES
                    ▼
        ┌──────────────────────────────────┐
        │ Output module hardware failure.   │
        │ Explain the fault symptoms and    │
        │ consult with the nearest system   │
        │ service, distributor or branch    │
        │ office                            │
        └──────────────────────────────────┘
```

6.7.2 Output Circuit Troubles and Measures

This section explains the examples of output circuit troubles and measures.

Table 6-4: Output Circuit Troubles and Measures
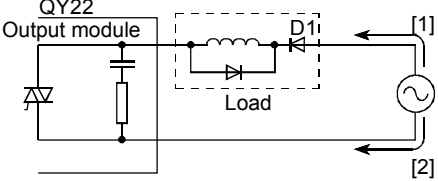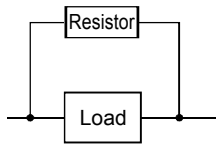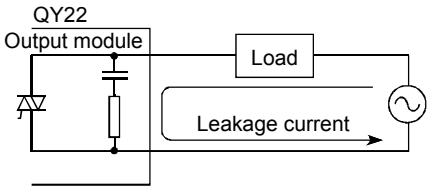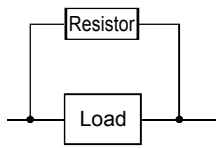
	Condition	Cause	Measures
Example 1	Overvoltage is applied to the load during output OFF.	• When the load is internally half-wave rectified (Some solenoids act like this.) QY22 Output module — D1 — [1] — Load — [2] • C is charged when the polarity of the power supply is [1], and the sum of a voltage charged to C while the polarity is [2] and the power supply voltage is applied across D1. The maximum voltage value is about 2.2 E. (If it is used in this way, although output element does not pose a problem, a built-in diode in the load is deteriorated and accidents such as burnout may occur.)	• Connect a resistor (from 10kΩ to 1000kΩ) on across the load. Resistor / Load
Example 2	The load does not turn OFF. (Triac output)	• Leakage current due to a built-in surge suppressor QY22 Output module — Load — Leakage current	• Connect a resistor across the load. (Caution is required when wiring length between the output module and the load is long, because there is also a leakage current due to line capacity.) Resistor / Load

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Table 6-4: Output Circuit Troubles and Measures (Continued)
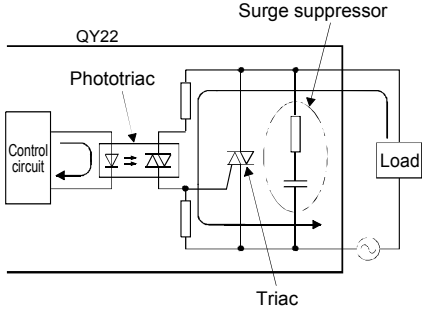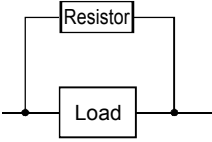
	Condition	Cause	Measures
Example 3	The load does not turn OFF. (Triac output)	• The minimum load current is not satisfied. • If the load current is lower than the minimum load current of the output module, the triac does not work and the load current will flow to the phototriac, as the arrow in the following figure shows. When an inductive load is connected as a load in this state, the off-time surge is applied to the phototriac and the load may not turn OFF. 	• Connect a resistor across the load so that a current equal to or higher than the minimum load current will flow.

Table 6-4: Output Circuit Troubles and Measures (Continued)
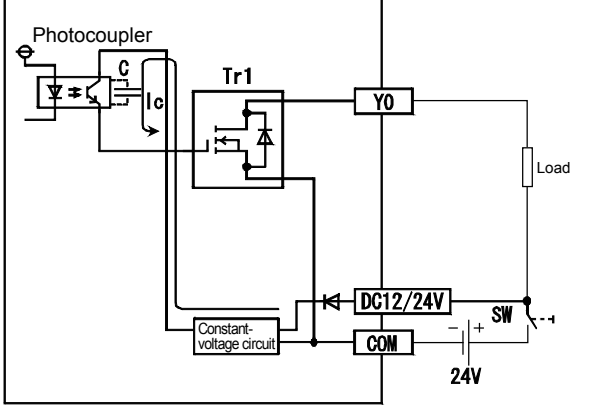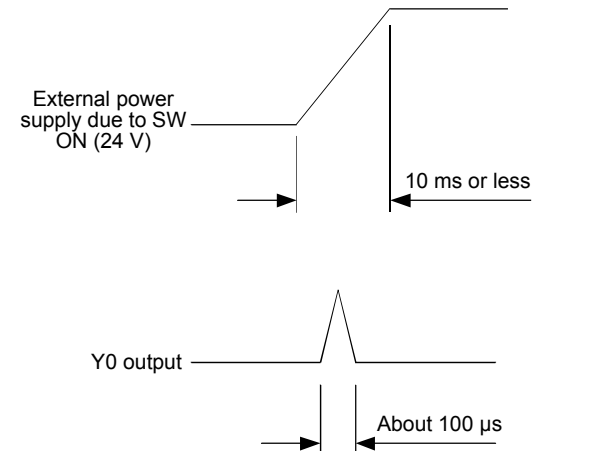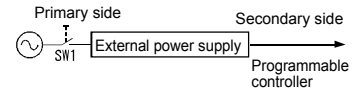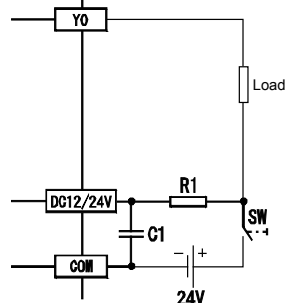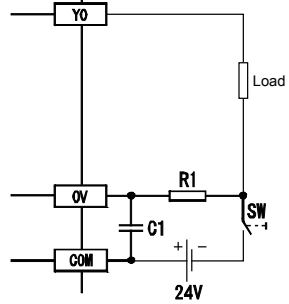
	Condition	Cause	Measures
Example 4	The load turns ON momentarily when an external power supply is started up. (transistor output)	Incorrect output due to floating capacitance (C) between the collector and the emitter of the photocoupler. [Although it poses no problem at a normal load, a sensitive load (such as a solid state relay) may output incorrectly.] Output module/combined module When an external power supply is started up rapidly, a current Ic flows due to floating capacitance (C) between the collector and the emitter of the photocoupler. The current Ic flows into the next stage, the gate of the transistor Tr1, and the output of Y0 turns ON for about 100 µs. 	When the external power supply is turned ON/OFF, make sure that the start-up of the external power supply itself takes 10 ms or more and then insert a switch SW1 into the primary side of the external power supply. If a switch is need to be inserted into the secondary side of the external power supply, connect a capacitor and a resistor so that the start-up of the external power supply becomes slower (10 ms or more). Sink output Source output * The measures have no effect for the module(s) below, due to the characteristics of its/their external power supply circuit. • QY81P R1: Several tens of Ω Power capacity ≥ (External power supply current [1])^2 × Resistance value × (3 to 5) [2] C1: Several hundreds µF 50 V [1]: Refer to the manual of the current consumption for the external power supply of a module to be used. [2]: The power capacity of a resistor is chosen from three to five times of the actual power consumption. (application example) R1 = 40 Ω, C1 = 300 µF Time constant is calculated by the following formula: $C1 \times R1 = 300 \times 10^{-6} \times 40$ $= 12 \times 10^{-3}$ s $= 12$ ms

Table 6-4: Output Circuit Troubles and Measures (Continued)
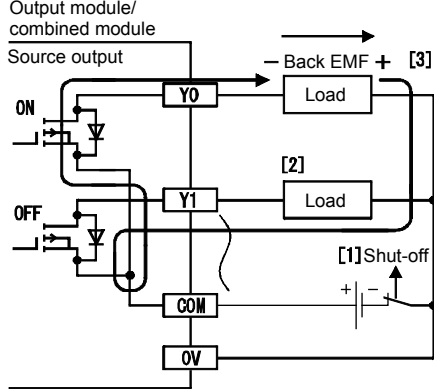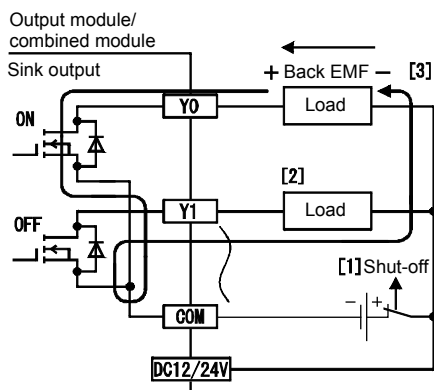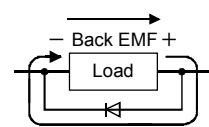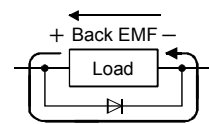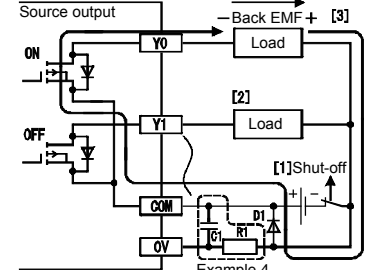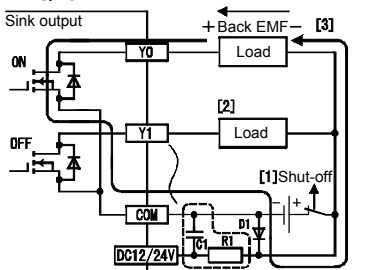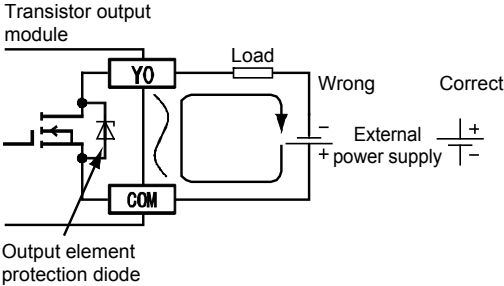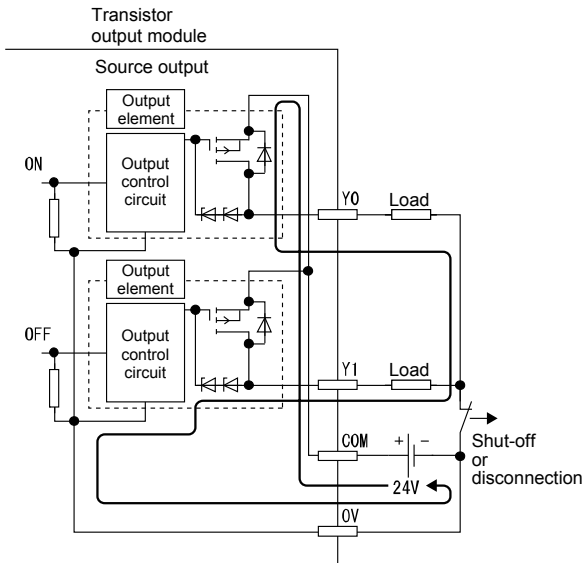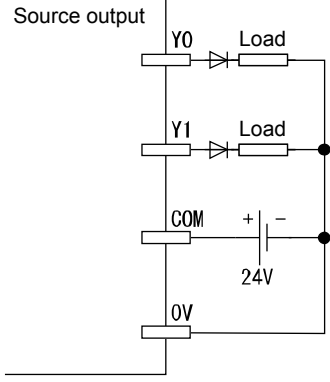
	Condition	Cause	Measures
Example 5	The load that has been OFF turns ON when the power supply is shut off. (transistor output)	When an inductive load is used, the load [2] that has been OFF may turn ON because a back EMF during the power supply shut-off [1] sneaks. 	Take one of the measures described below. 1. Connect a diode parallel to the load in which a back EMF is generated in order to suppress the back EMF. Source output [3] Sink output [3] 2. Make a sneak current path by connecting a diode between (+) and (-) of the external power supply. Note that if Example 4 is implemented simultaneously, connect it parallel to C1 and R1. Example 4 * The measures have no effect for the module(s) below, due to the characteristics of its/their external power supply circuit. • QY81P • QY82P Example 4 D1: Reverse voltage VR (VRM)…*1, Forward current IF (IFM)…*2 *1: Approximately 10 times of the specified rated voltage Example: Approximately 200 V when 24 V DC *2: Equal to or higher than two times of the specified maximum load current (common) Example: More than 4 A when 2 A/1 common

Table 6-4: Output Circuit Troubles and Measures (Continued)

	Condition	Cause	Measures
Example 6	The load operates only by external power supply power-on (transistor output)	The polarity of the external power supply is reversely connected. Transistor output module When the polarity of the external power supply is reversely connected, a current may go through the output element protective diode and flow to the load.	Connect the polarity of the external power supply correctly.
Example 7	When output is ON, a load connected to other output turns ON simultaneously. (transistor output (source type))	When it becomes unwired due to shut-off or disconnection of wiring that connects the 0 V of the external power supply and the common of the load, a current flows to the load of an output element that has been turned ON, passing through the parasitic circuit of an output terminal that has been turned OFF. If it continues to be used in those conditions, it may cause a failure.	Connect the wiring between the external power supply and the load correctly. In addition, prevent the occurrence of the conditions described on the left by attaching diodes to each output terminal as shown below.

REMARKS

When short-circuit occurs in an output module with protection, a programmable controller CPU cannot detect an error because a thermal protection works and prevents fuses from blowing.

Therefore, a check circuit or its equivalent must be made externally.

6.7.3 Output Module Terminal Voltage Checking Methods

The output module, depending on its output, differs from AC and DC, in addition to the difference in control voltage. This offers various combinations.
Methods for terminal voltage check of each output module using a tester are described below.
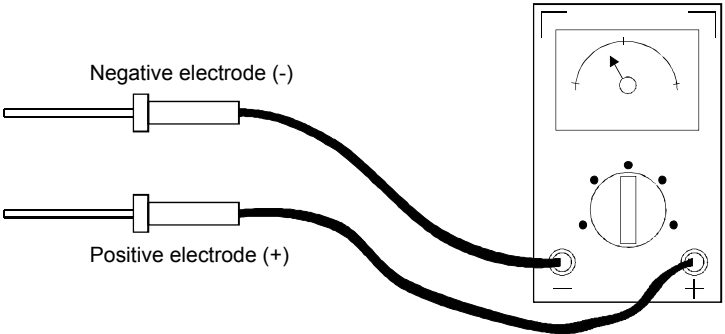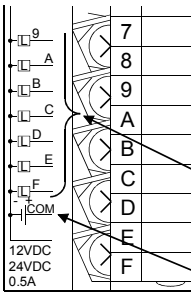
Table 6-5: Terminal Voltage Checking Methods

Control voltage	Module/unit terminal measuring point	
Contact output AC/DC common		Set the voltage range of the tester to AC/DC measurement. Connect the negative electrode of the tester to each output terminal Connect the positive electrode of the tester to the COM terminal
Triac output AC only		Set the voltage range of the tester to AC measurement. Connect the negative electrode of the tester to the COM terminal Connect the positive electrode of the tester to each output terminal
Transistor DC sink output only		Set the voltage range of the tester to DC measurement. Connect the negative electrode of the tester to the COM terminal Connect the positive electrode of the tester to each output terminal

Table 6-5: Terminal Voltage Checking Methods (Continued)

Control voltage	Module/unit terminal measuring point	
Transistor DC source output only		Set the voltage range of the tester to DC measurement. Connect the negative electrode of the tester to each output terminal Connect the positive electrode of the tester to the COM terminal

6.8 Troubleshooting Using Cart Conveying System Training Machine

(1) Explanation of the training machine (operation panel)
This section explains troubleshooting using the training machine system that conveys workpieces.
It contains practical training of moving the conveyance table to the workpiece set position with GOT screen operation.

(2) Explanation of operating procedures
(a) Manual control
1) JOG operation
It moves left and right by touching arrow switches on the operation panel.
It stops by touching the stop switch.
2) Point specification
It can be moved to the workpiece set workpiece set position, inspection position, and pass sensor position.
It starts to move by touching the square switch near the screen center then touching an arrow switch of desirable direction. It stops moving when it reaches a specified point.

(b) Automatic control
Starts automatic operation: Touch…Start (HMI (Human Machine Interface))
Stops automatic operation : Touch…Stop (HMI (Human Machine Interface))
Failure switch (HMI (Human Machine Interface)): Touch…Failure
Pass switch (HMI (Human Machine Interface)): Touch…Pass

[Operation example]
1) Stop the table at the workpiece set position.
2) Touching the start switch on the operation panel starts automatic operation.
First, the table moves to the inspection position. Inspect the workpiece visually.
3) When it fails → Touch the failure switch on the visual inspection panel.
If the result of the visual inspection is failure, it moves back from the inspection position to the workpiece set position and stops automatic operation.
When it passes → Touch the pass switch on the visual inspection panel.
If the result of the visual inspection is passed, the table moves forward from the inspection position to the pass sensor, then moves back to the workpiece set position and stops automatic operation.

* For the safety reasons, the workpiece on the table cannot be removed.
Proceed with the training assuming the workpiece is set.

[Operation panel]
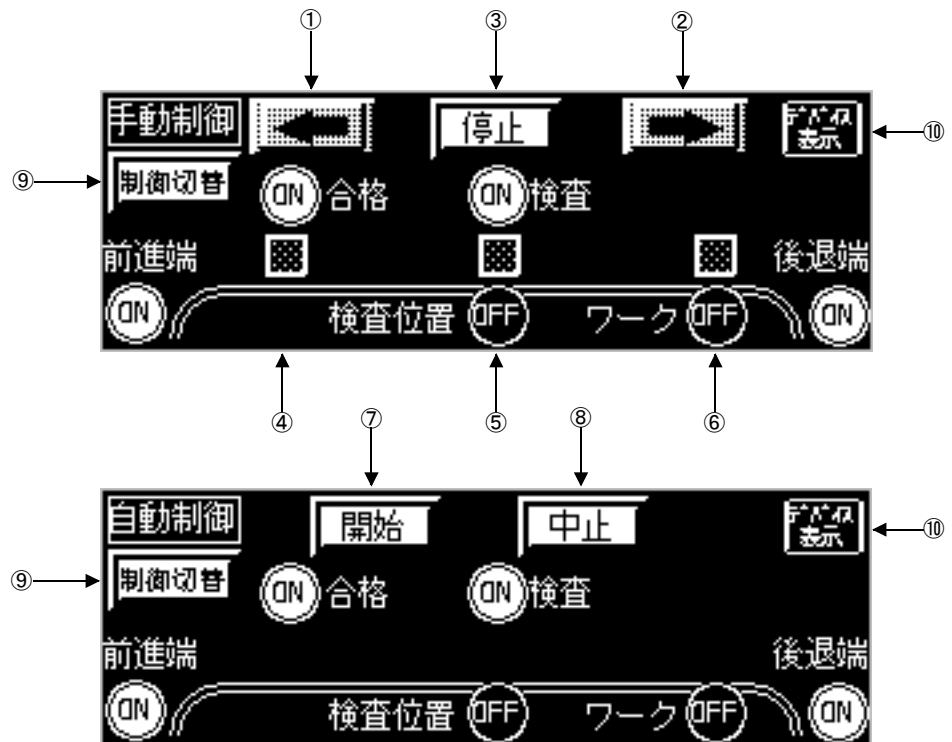
- 1) M0: Move left switch
- 2) M1: Move right switch
- 3) M2: Stop switch
- 4) M20: Point specification switch (pass sensor position)
- 5) M22: Point specification switch (inspection position)
- 6) M24: Point specification switch (workpiece set position)
- 7) M300: Start automatic operation switch
- 8) M300: Stop automatic operation switch
- 9) Control switching switch
- 10)Device display switching switch

To understand the status, check the inspection, passed, and failure lamps under the cart training machine.

[Visual inspection panel]
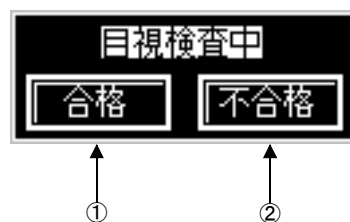
- 1) Passed switch
- 2) Failure switch

[Wiring of the training machine]

Programmable controller
training machine

X20～X3F

Cart training machine

Y60～Y7F

RS-232C

RS-485

USB

Connect the input cable of the training
machine to X20 to X3F of QX42, and the
output cable to Y60 to Y7F of QY42.
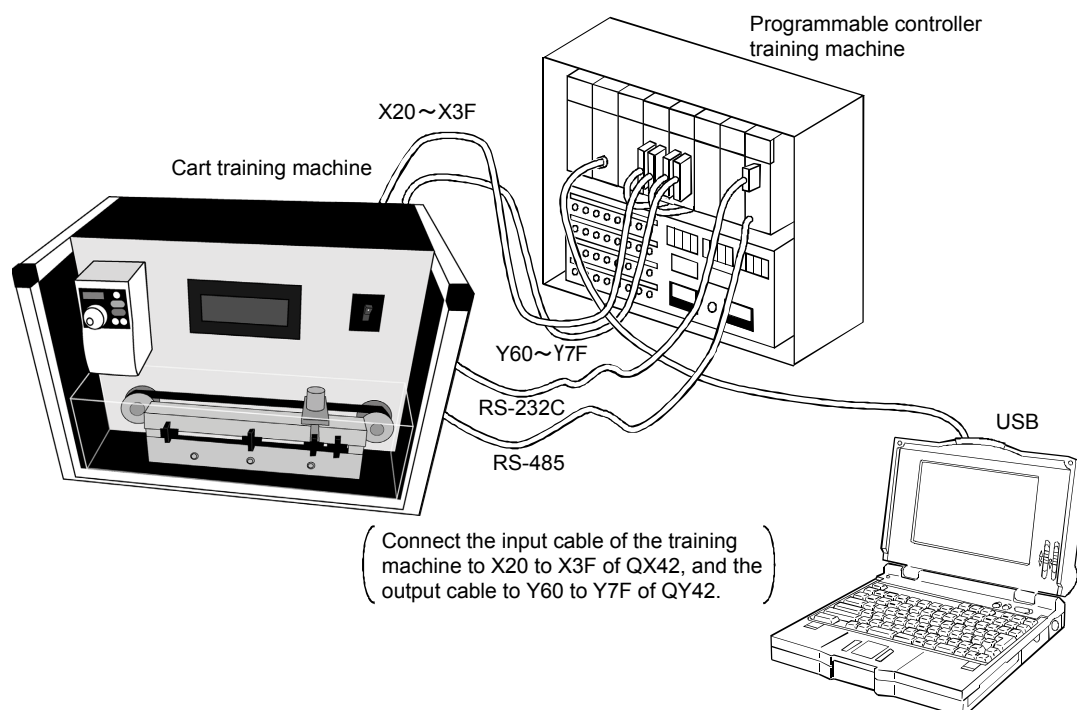
* Before starting-up, set the training programmable controller CPU to STOP first.
  When the cart training machine is started up first, an error may be displayed on
  the GOT.

[Overview of the cart training machine]

Pass LS
(X20)

Inspection LS
(X21)

Workpiece

Table

Advance
end LS
(X24)

Inspection
position LS
(X22)

Workpiece set
position LS
(X23)

Retract
end LS
(X25)
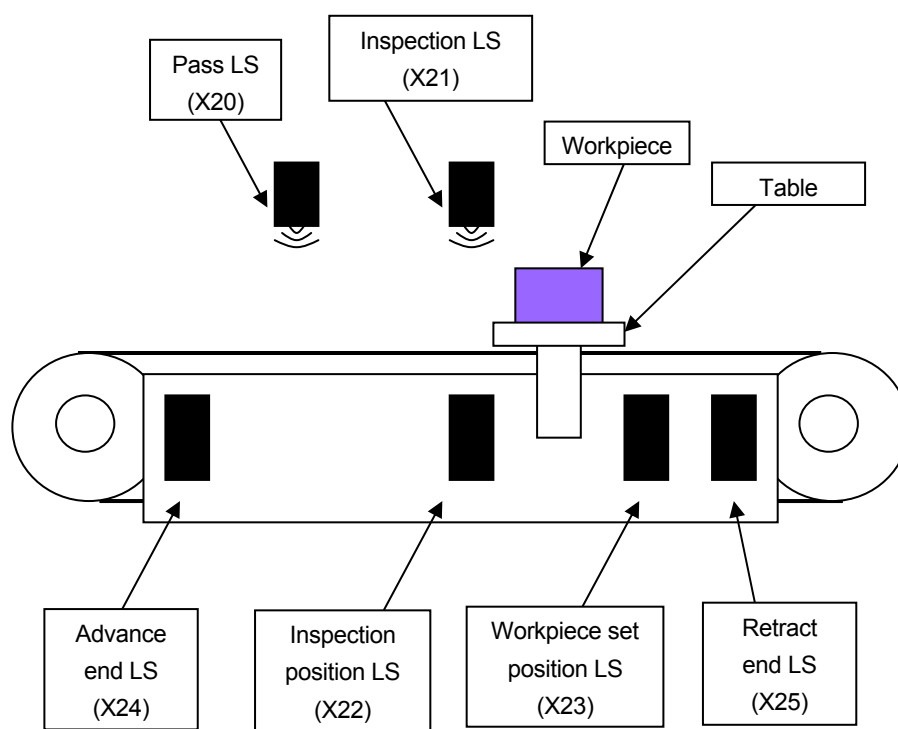
[Assignment of I/O signals]

MELSEC-Q

Input

(Terminal number 4)	Pass LS		X20
(Terminal number 5)	Inspection LS		X21
(Terminal number 7)	Inspection position LS		X22
(Terminal number 9)	Workpiece set position		X23
	Advance end LS		X24
	Backward end LS		X25
(Terminal number 10)	Mock contact 1		X26
(Terminal number 11)	Mock contact 2		X27
(Terminal number 12)	Mock contact 3		X28

Output

Y60		Passed lamp (Terminal number 1)
Y61		Inspection lamp (Terminal number 2)
Y62		Failure lamp (Terminal number 3)

*   The terminal numbers represent the switch numbers on the rear side of the training machine.
(Initial setting) Terminal number 1 to 5, 7, and 9…ON/6, 8, and 10 to 12…OFF

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(3) Sequence program

Manual/automatic   Control mode switching

    The virtual production system starts in the manual mode.

```
        SM401    SM402                                                    ─[SET    M1000    ]
0       ─|/|──────|/|──                                                            Manual
        Always   ON only                                                          mode flag
        OFF      for one
                 scan after
                 RUN
                  M900                                                    ─[RST    M1001    ]
                 ──| |──                                                           Automatic
                 Manual control                                                    flag mode
                 switching request


                  M901                                                    ─[SET    M1001    ]
                 ──| |──                                                           Automatic
                 Automatic                                                         flag mode
                 control
                 switching
                 request

                                                                         ─[RST    M1000    ]
                                                                                  Manual
                                                                                  mode flag
```

Manual control   JOG operation   Forward rotation start

```
        M1000    M0      M2      M30     M11     X24
53      ─| |────| |─────|/|─────|/|─────|/|─────| |──────────────────────────────(M10    )
        Manual   Manual  Manual  Point   Manual  Advance                           Manual
        mode flag forward stop   specification reverse end LS                       forward run
                 run JOG request stop    run JOG                                    JOG
                 request         command command                                   command
                  M10
                 ──| |──
                 Manual
                 forward
                 run JOG
                 command
```

Manual control   JOG operation   Reverse rotation start

```
        M1000    M1      M2      M30     M10     X25
78      ─| |────| |─────|/|─────|/|─────|/|─────| |──────────────────────────────(M11    )
        Manual   Manual  Manual  Point   Manual  Backward                          Manual
        mode flag reverse stop   specification forward end LS                       reverse
                 run JOG request stop    run JOG                                    run JOG
                 request         command command                                   command
                  M11
                 ──| |──
                 Manual
                 reverse run JOG
                 command
```

Manual control   Select a point

Select a stopping point

```
     M1000    M20     M30                                                    (M21    )
103 ──┤├──────┤├──────┤/├──────────────────────────────────────────────────────────
    Manual   Point    Point                                                  Point
    mode     specification:  specification                                   specification:
    flag     Passed   stop instruction                                       Pass flag

              M21
             ─┤├─
             Point
             specification:
             Pass flag


              M22     M30                                                    (M23    )
             ─┤├──────┤/├──────────────────────────────────────────────────────────
             Point    Point                                                  Point
             specification:  specification                                   specification:
             Inspection  stop instruction                                    Inspection
             position                                                        position flag

              M23
             ─┤├─
             Point specification:
             Inspection position
             flag


              M24     M30                                                    (M25    )
             ─┤├──────┤/├──────────────────────────────────────────────────────────
             Point    Point                                                  Point
             specification:  specification                                   specification:
             Workpiece  stop instruction                                     Workpiece
             set                                                             set flag

              M25
             ─┤├─
             Point
             specification:
             Workpiece
             set flag
```

Stop when it reaches a point

```
     M1000    M21     X20                                                    (M30    )
153 ──┤├──────┤├──────┤/├──────────────────────────────────────────────────────────
    Manual   Point    Pass                                                   Point
    mode     specificatio  sensor                                           specification
    flag     Pass flag                                                       stop
                                                                             command

              M23     X22
             ─┤├──────┤├─
             Point    Inspection
             specification:  position
             Inspection  LS
             position flag

              M25     X23
             ─┤├──────┤├─
             Point    Workpiece
             specification:  set position
             Workpiece
             set flag
```

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Automatic control　Operating flag

```
183 ┤├────┤├────┤├────┤/├────┤/├────┤├────┤├────┤/├──────────────────(M310 )
     M1001  M300   X23   M361   M372   X24   X25   M301              Automatic
     Automatic Automatic Workpiece Workpiece Workpiece Advance Backward Automatic  operating flag
     mode flag start    set      set position set position end LS  end LS  stop
             request  position move end: move end:               request
                               Passed   Failure

             ┤├
             M310
             Automatic                                            ──[PLS    M311 ]
             operating flag                                               Automatic
                                                                          start PLS
```

Automatic control　Move to inspection position

```
209 ┤├────┤├────┤├────┤/├──────────────────────────────────────────(M320 )
     M1001  M310   M311   M321                                       Inspection
     Automatic Automatic Automatic Inspection                        position
     mode flag operating start PLS position move                      move
             flag          end pulse

             ┤├
             M320
             Inspection
             position
             move

             ┤├────┤/├────┤├──────────────────────────────────────[PLS    M321 ]
             M320   X21    X22                                            Inspection
             Inspection Inspection Inspection                            position
             position sensor   position LS                               move end
             move                                                        pulse
```

Automatic control　Waiting for passed/failure determination

```
237 ┤├────┤├────┤├────┤/├────┤/├──────────────────────────────────(M330 )
     M1001  M310   M321   M331   M332                                Inspecting
     Automatic Automatic Inspection Inspection Inspection
     mode flag operating position  end pulse: end pulse:
             flag      move end   Passed    Failure
                       pulse

             ┤├
             M330
             Inspecting                                            ──────(Y61 )
                                                                          Inspection
                                                                          lamp

                                                              ──[MOVP    K1    D201 ]
                                                                                Inspection
                                                                                window
                                                                                display

             ┤├────┤├──────────────────────────────────────────[PLS    M331 ]
             M330   M200                                                  Inspection
             Inspecting Touch                                            end pulse:
                     passed                                              Passed

             ┤├──────────────────────────────────────────────[PLS    M332 ]
             M201                                                       Inspection
             Touch                                                      end pulse:
             failure                                                    Failure
```

Automatic control   Determination result: Passed
Move to pass sensor position

```
     M1001      M310       M331       M342                                              (M340    )
272   ┤├────────┤├─────────┤├─────────┤/├───────────────────────────────────────────── Passed
     Automatic  Automatic  Inspection Passed                                            position
     mode flag  operating  end pulse: position                                          move
                flag       Passed     move end
                                      pulse

                           M340                                                         (M341    )
                           ┤├─────────────────────────────────────────────────────────  Passed
                           Passed                                                        lamp
                           position move                                                 output

                           M340       X20                                        [PLS   M342    ]
                           ┤├─────────┤/├────────────────────────────────────────────   Passed
                           Passed     Pass sensor                                        position move
                           position                                                      end pulse
                           move
```

Standby 2 seconds

```
     M1001      M310       M342       M351                                              (M350    )
317   ┤├────────┤├─────────┤├─────────┤/├───────────────────────────────────────────── Standing by
     Automatic  Automatic  Passed     Standby                                           for
     mode flag  operating  position   for 2                                             2 seconds
                flag       move end   seconds
                           pulse      end pulse

                           M350
                           ┤├
                           Standing by for
                           2 seconds

                           M350                                                         K20
                           ┤├─────────────────────────────────────────────────────────(T0      )
                           Standing by for                                              2.0 s timer
                           2 seconds

                           T0                                                    [PLS   M351    ]
                           ┤├───────────────────────────────────────────────────────── Standby for
                           2.0 s timer                                                  2 seconds
                                                                                        end pulse
```

Move to workpiece set position and end

```
     M1001      M310       M351       M361       X3                                     (M360    )
346   ┤├────────┤├─────────┤├─────────┤├─────────┤/├─────────────────────────────────── Workpiece
     Automatic  Automatic  Standby for Workpiece                                        set position
     mode flag  operating  2 seconds  set position                                      move:
                flag       end pulse  move end:                                          Passed
                                      Passed

                           M360
                           ┤├
                           Workpiece
                           set position
                           move:
                           Passed

                           M360       X23        X2                              [PLS   M361    ]
                           ┤├─────────┤├─────────┤/├───────────────────────────────────  Workpiece
                           Workpiece  Workpiece                                          set position
                           set position set                                             move end:
                           move:      position                                          Passed
                           Passed
```

Automatic control   Determination result: Failure
Move to workpiece set position and end

```
        M1001     M310     M332     M372                                              (M370  )
383     ─┤├─     ─┤├─     ─┤├─     ─┤/├──────────────────────────────────────────    Workpiece
        Automatic Automatic Inspection Workpiece                                      set position
        mode flag operating end pulse: set position                                   move:
                  flag     Failure   move end:                                         Failure
                                     Failure

                           M370                                                        (M371  )
                          ─┤├──────────────────────────────────────────────────────   Failure
                          Workpiece                                                     lamp
                          set position                                                  output
                          move: Failure

                           M370      X23                                      ┌PLS    M372  ┐
                          ─┤├─     ─┤/├─────────────────────────────────────             Workpiece
                          Workpiece Workpiece                                            set position
                          set position set position                                      move end:
                          move:                                                          Failure
                          Failure
```

Stroke limit error   Display

```
        X24                                                          ┌MOVP    D200      D210  ┐
434     ─┤/├────────────────────────────────────────────────────              Stroke limit
        Advance                                                                error screen
        end LS                                                                 display


        X25                                                          ┌MOVP    K5        D200  ┐
        ─┤/├────────────────────────────────────────────────────              Stroke limit
        Backward                                                               error
        end LS                                                                 screen
                                                                               display


                                                                     ┌MOVP    K0        D203  ┐
        ────────────────────────────────────────────────────────              Device name
                                                                               screen
                                                                               display
```

Touch panel initial display: Manual control

```
        SM402                                                        ┌MOVP    K1        D200  ┐
459     ─┤├─────────────────────────────────────────────────────              Stroke limit
        ON only for                                                            error screen
        one scan after                                                         display
        RUN
```

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Output processing
Cart forward rotation output

```
         M10                                                    (M100 )
479     ┤├──┬──────────────────────────────────────────────────
        Manual │                                                Cart forward
        forward │                                               rotation
        run     │
        JOG     │
        command │
                │
         M320   │
        ┤├──────┤
        Inspection
        position
        move
                │
         M340   │
        ┤├──────┘
        Passed
        position
        move
```

Cart reverse rotation output

```
         M11                                                    (M101 )
497     ┤├──┬──────────────────────────────────────────────────
        Manual │                                                Cart reverse
        reverse │                                               rotation
        run     │
        JOG     │
        command │
                │
         M360   │
        ┤├──────┤
        Workpiece
        set position
        move:
        Passed
                │
         M370   │
        ┤├──────┘
        Workpiece
        set position
        move:
        Failure
```

Passed lamp output

```
         M341                                                   (Y60 )
509     ┤├──────────────────────────────────────────────────────
        Passed                                                  Passed lamp
        lamp
        output
```

Inspecting lamp output

```
         M330                                                   (Y61 )
520     ┤├──────────────────────────────────────────────────────
        Inspecting                                              Inspection
                                                                lamp
```

Failure lamp output

```
         M371                                                   (Y62 )
532     ┤├──────────────────────────────────────────────────────
        Failure                                                 Failure
        lamp                                                    lamp
        output
```

The following is a communication program between a programmable controller and an inverter.
Do not change this program because it is completed.

Command send preparation

```
      SM402
544 ──┤├──────────────────────────────────────────[MOV    H2      D0    ]
      ON only for
      one scan
      after RUN


                                                   [MOV    K0      D1    ]


                                                   [MOV    K12     D2    ]


                                                   [MOV    H3005   D10   ]
```

Forward rotation start command send

```
      M100
620 ──┤↑├──────────────────────────────────────[$MOV    "1FA10A8A"   D11   ]
      Cart forward
      rotation


                                                [MOV     H0A0D       D15   ]


                                   [G. OUTPUT    U0A      D0      D10     M500 ]
```

Reverse rotation start command send

```
      M101
651 ──┤↑├──────────────────────────────────────[$MOV    "1FA10C8C"   D11   ]
      Cart
      reverse
      rotation


                                                [MOV     H0A0D       D15   ]


                                   [G. OUTPUT    U0A      D0      D10     M510 ]
```

Stop command send

```
      M100
682 ──┤↓├──────────────────────────────────────[$MOV    "1FA10079"   D11   ]
      Cart
      forward
      rotation


      M101
    ──┤↓├──────────────────────────────────────[MOV     H0A0D       D15   ]
      Cart
      reverse
      rotation


                                   [G. OUTPUT    U0A      D0      D10     M520 ]
```

Receive response

```
      X0AA
712 ──┤├──────────────────────────────────────────────────────[MOVP    H2      D20    ]

      X0AB
    ──┤├───────────────────────────────────────────────[FMOVP   K0      D21     K2    ]

    ────────────────────────────────────────────────────[MOVP    K50     D23    ]

    ──────────────────────────────────────[G. INPUT U0A    D20     D30     M530  ]

      M530   M531
740 ──┤├────┤╱├────────────────────────────────────────[MOV     D22     Z0     ]

    ─────────────────────────────────────────[BMOV    D30     D100    K0Z0   ]


749 ──────────────────────────────────────────────────────────[END    ]
```

(4) Practical operation for trouble examples
Mock contacts and switches of an I/O signal disconnection terminal block on the rear side of the training machine are used as a trouble example of the training machine, as shown in the following figure.
1) When a contact does not turn ON

```
  │Fault contact
  ──┤├────┤╱├                                        ─( )─  ─> <─
           ↖ A mock contact that turns non-conductive when it turned ON externally
```

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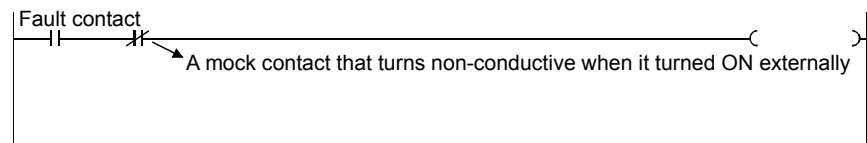
Investigate the cause of Trouble example 1 to 4 described below.

<Trouble example 1>
The cart does not move forward.

<Trouble example 2>
The cart does not stop at the position of the inspection sensor.

<Trouble example 3>
The cart does not move backward.

<Trouble example 4>
The cart does not stop at the workpiece set position.

6.9 Trouble Example: Troubleshooting Using Training Machine

Write the following sequence program to the training programmable controller, make sure it works correctly, and then investigate the occurring troubles and their causes.

Project name	QTORABURU

```
        X0      X1      T3
0     --| |----|/|-----|/|------------------------------------(Y70   )
        Y70                                                            K20
      --| |----------------------------------------------------(T0    )

        T0
9     --| |------------------------------------------------------(Y71   )
                                                                     K20
      ----------------------------------------------------------(T1    )

        T1
15    --| |------------------------------------------------------(Y72   )
                                                                     K20
      ----------------------------------------------------------(T2    )

        T2
21    --| |------------------------------------------------------(Y73   )
                                                                     K20
      ----------------------------------------------------------(T3    )

        X4     SM411                                              K9999
27    --| |----| |----------------------------------------------(C0    )

      ---------------------------------------------[BCD     C0      K4Y40  ]

        X4
38    --|/|----------------------------------------[RST     C0             ]

        X6      T10                                     H    K9999
43    --|/|----|/|-------------------------------------(T10   )

      ---------------------------------------------[BCD    T10      K4Y50  ]

        X7     X80
54    --| |----| |----------------------[FROM    H8      K11     D10    K1    ]

           [<=    K0      D10  ]--------------------[BCD    D10      K4Y60  ]

67    --------------------------------------------------------[END             ]
```

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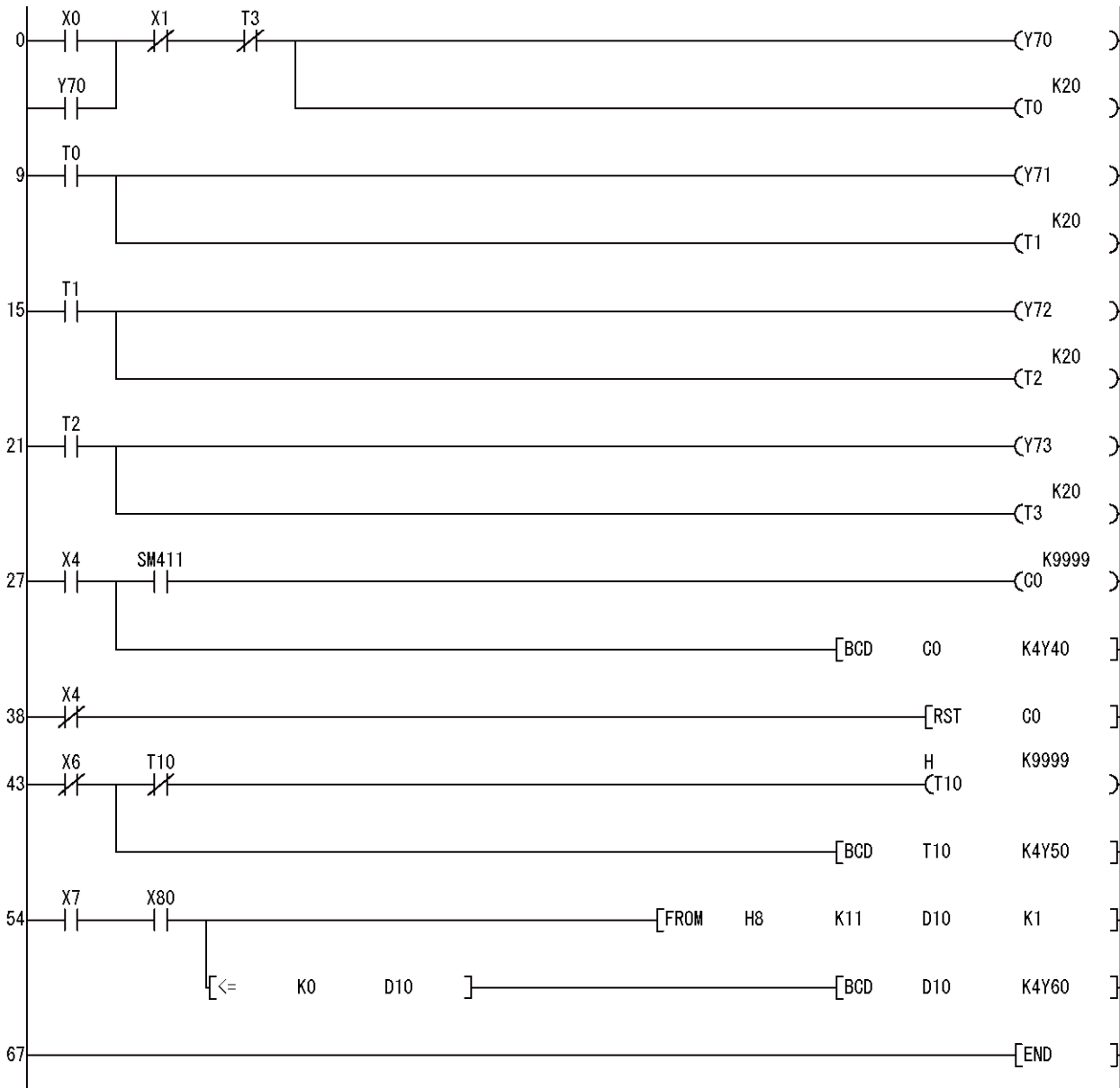
(1) Question 1

    1) Training machine system

Q61P	Q06UDHCPU	Empty	QX42	QY42P	Q64AD	Q62DAN
			64 points	64 points	16 points	16 points
					Occupied	Occupied

X02
X03
X04
X05
X06
+
−

24 V DC
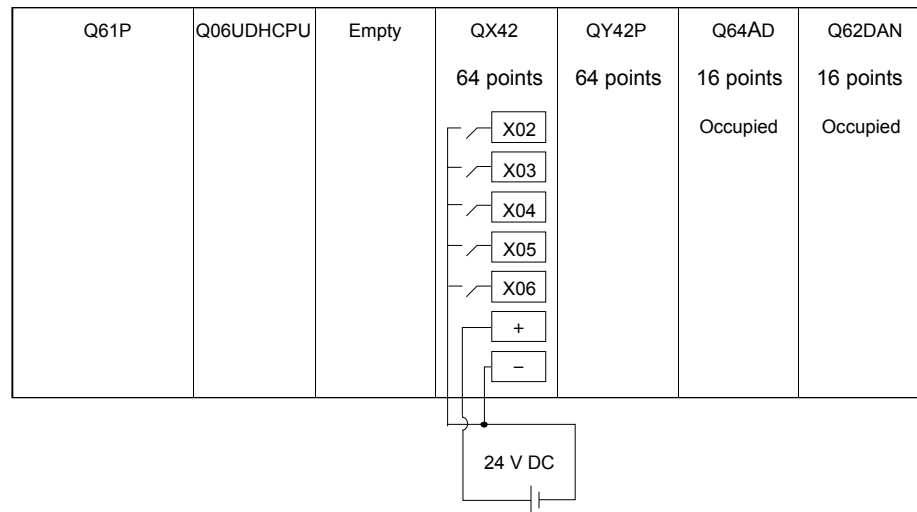
    2) Fault description
       Whichever input signal turns ON, it does not turn ON in the program, even
       though the monitor LED of the input module has turned on.

Input ＼ Target	External device	QX42 monitor LED	Program
X0 to X3F	ON/OFF switching	ON/OFF	Always OFF

    3) How to answer
       Use the flow diagram in troubleshooting (Section 6.6) of the school text to
       find the cause of the trouble, the reason why the CPU does not read the
       signals even though they are input to the input module from outside.

(2) Question 2

1) Training machine system

Q61P	Q06UDHCPU	Empty	QX42	QY42P	Q64AD	Q62DAN
			64 points	64 points	16 points	16 points
					Occupied	Occupied

2) Fault description

When the CPU is set to RUN and Y60, Y61, Y62, and Y63 are turned ON/OFF in the program, nothing is output to the external device even though the monitor LED of the output module QY42P turns on/off.

When Y70, Y71, and Y72 are turned ON/OFF in the program, nothing is output to the external device even though the monitor LED of the QY42P turns on/off.

Assume that external wiring is correct.

Target / Output	Program	QY42P monitor LED	External device
Y60 to Y63	ON/OFF switching	ON/OFF	No output (always OFF)
Y70 to Y72	ON/OFF switching	ON/OFF	No output (always OFF)

3) How to answer

Use the flow diagram in troubleshooting (Section 6.7) of the school text to find the cause of the trouble, the reason why the external device does not turn ON/OFF.

(3) Question 3

1) Training machine system

Q61P	Q06UDHCPU	Empty	QX42	QY42P	Q64AD	Q62DAN
			64 points	64 points	16 points	16 points
					Occupied	Occupied

CPU fault occurs after the sequence program described below is modified.

Ladder diagram

```
54  | X7   X80                                      [FROM   H80    H8    D10    K1    ]
    |  | |  | |
    |       [<=   K0    D10  ]                         [BCD    D10    K4Y60         ]
```
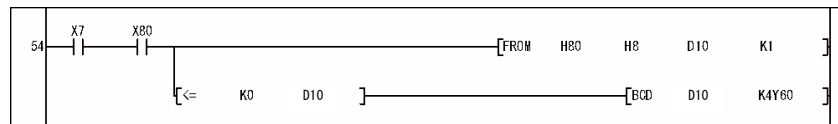
2) Fault description
CPU error occurs.

3) How to answer
Use the flow diagram in troubleshooting (Section 6.5) of the school text to find the cause of the trouble, the reason why the CPU error occurs.

*   For the FROM instruction, refer to Appendix 9.

6.10 Troubleshooting for the Intelligent Function Module

Various intelligent function modules can be used with a programmable controller. This section explains common items that should be known at troubleshooting.

6.10.1 Common Items about Intelligent Function Modules

(1) Type of intelligent function modules
Intelligent function modules are designed to process functions that the programmable controller CPU cannot do or functions whose application is limited. Some typical types are described below:

1) Analog module
- Analog-digital converter module
Receives analog (current/voltage) as input and converts it to digital value.
- Digital-analog converter module
Converts digital value and outputs analog (current/voltage).
- Temperature input module
Connects a temperature sensor and converts to digital value.
- Temperature control module
Connects a temperature sensor and controls a heating/cooling device to keep the temperature of a target object constant.

2) High-speed counter module and positioning module
- High-speed counter module
Receives high speed pulses as input from an encoder in order to count.
- Positioning module
Outputs high-speed pulses to a servo amplifier for positioning.

3) Network module
- MELSECNET/H network module
Performs data communication between programmable controllers using a network.
- Ethernet interface module
Performs data communication between a personal computer and a programmable controller via Ethernet.
- Web server module
Allows a personal computer to monitor a programmable controller via the Internet.
- CC-Link module
Performs data communication of a programmable controller or various devices on a distributed system.
- CC-Link IE
An integrated network which realizes seamless data transfer, from information systems to production sites. This achieves both conventional control information transmission and information processing data transmission, such as equipment information maintenance and device settings.

4) Serial communication module and modem interface module
- Serial communication module
Connects a programmable controller and a calculator, printer, bar code reader, or other devices and performs data communication.

(2) Relation to the programmable controller CPU

An intelligent function module has internal buffer memory to store necessary data.

As needed, a programmable controller CPU can write data to the buffer memory using a TO instruction, and read from the buffer memory using a FROM instruction.

Besides, specifying an intelligent function module device (U□\G□) using a MOV instruction enables writing to and reading from the buffer memory.

Signals are exchanged by setting output signal Y to ON/OFF when the programmable controller CPU commands the intelligent function module, and by setting input signal X to ON/OFF when the intelligent function module answers to the programmable controller CPU.
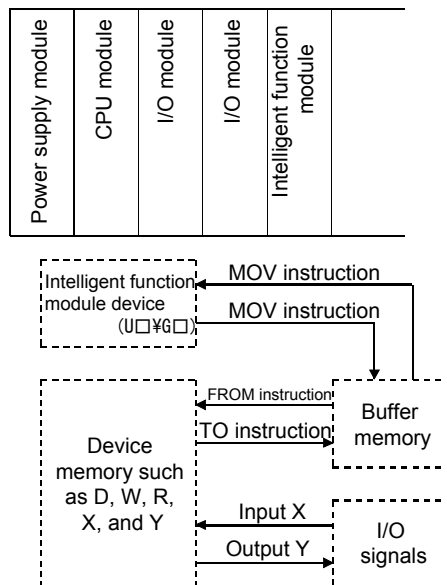
REFERENCE

When an error occurs during the execution of TO/FROM instruction, error code numbers described below are stored to SD0 and the CPU stops.

1412 ··· Cannot be executed.
1402 ··· No answer came. *
2110 ··· No intelligent function module. *

* : If some CPU parameters have been set, operation will not stop but continue.

Assignment of the buffer memory and the I/O signals is explained in the user's manual of each intelligent function module.

REMARKS

• With intelligent function module operation by GX Works2, it is possible to set, monitor, and test functions easily without realizing the I/O signals and the buffer memory. Example functions are intelligent function module parameters of an analog module (initial setting and auto refresh), the system settings of a serial communication module, and the positioning data and parameters of a positioning module.

6.10.2 Buffer Memory Monitor Operation of the Intelligent Function Module

The buffer memory of the intelligent function module can be directly monitored using a personal computer (GX Works2) to check the current value.

(1) Monitoring buffer memory

Set the "RUN/STOP/RESET" key switch of the CPU to "RUN".

1) Click the [Online] → [Monitor] → [Device/Buffer Memory Batch] menu.

(1) Click!
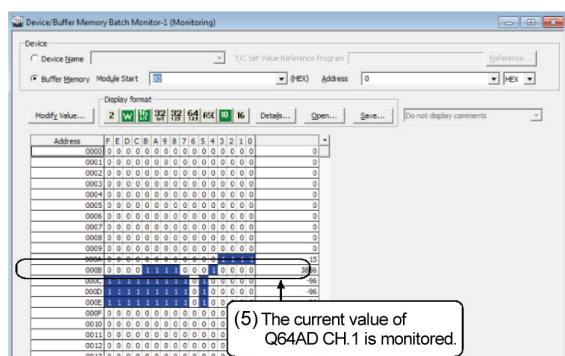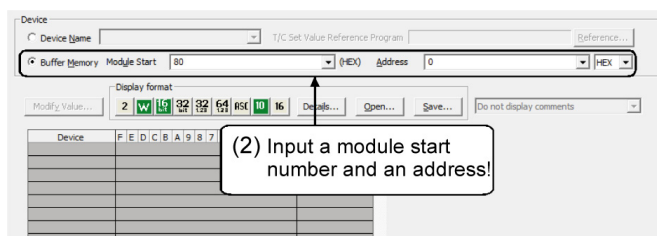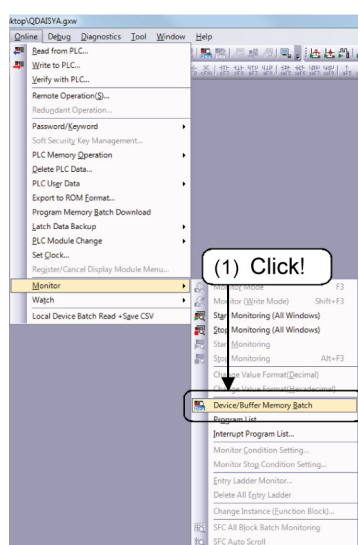
2) Specify a start I/O number (whole digit specification) and a buffer memory address (decimal/hexadecimal) of the intelligent function module to be monitored.
   In this example, specify "80" as a module start number, and "0" as an address.

(2) Input a module start number and an address!

3) Press ⏎ .

4) Monitoring of the specified buffer memory is started.

5) Turn the voltage potentiometer of the training machine to set the meter to 5 to 8 V DC.
   The current value of Q64AD CH.1 can be monitored.

(5) The current value of Q64AD CH.1 is monitored.

(2) Changing a current value of the buffer memory
In this example, a current value of the buffer memory monitored in (1) will be changed.
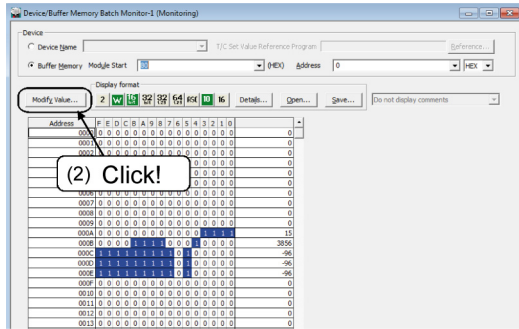
1) Click the [Modify Value] button.

(2) Click!

(2) Input!
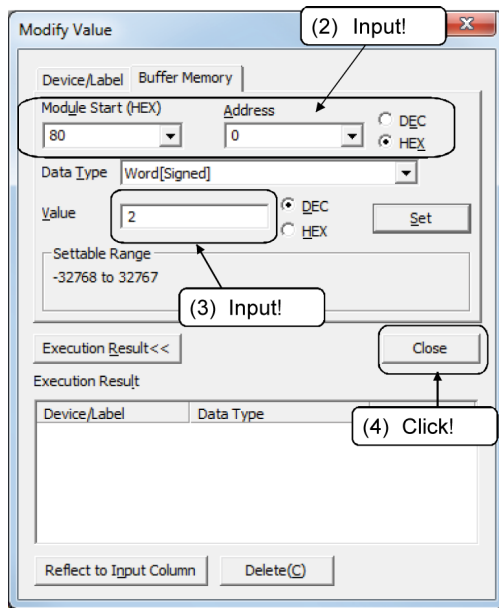
(3) Input!

(4) Click!

2) From the "Buffer memory" tab, specify "80" in the "Module start" and "0" in the "Address".

3) Input "2" in the "Value to be set".

4) Click the [Set] button.
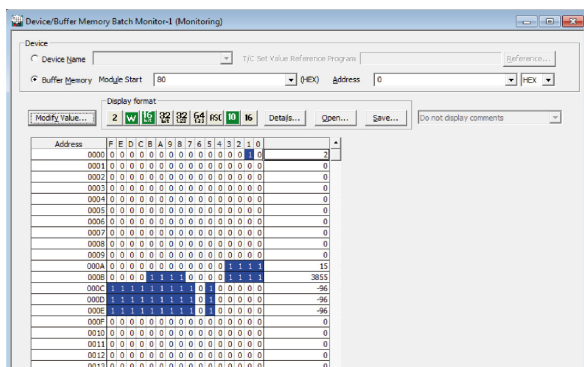
5) The current value is replaced with the specified value.

(3) Saving the buffer memory
In this example, a current value of the buffer memory will be read and saved.

(1) Click!
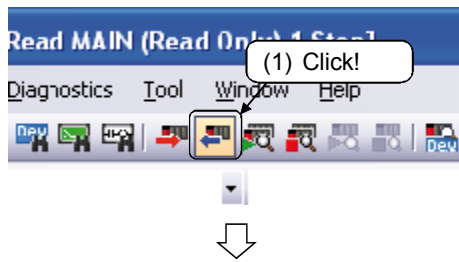
1) Click the [Online] → [Read from PLC] menu.
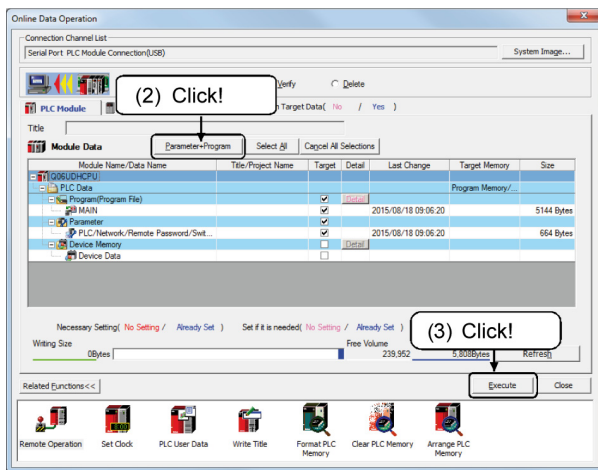
(2) Click!

(3) Click!

2) Click the | Parameter + Program | button.

3) Click the | Execute | button. When the "The parameter exists already. Do you want to overwrite it?" message appears, click the | Yes | button.

4) When the "Operation ended" message appears, click the | OK | button.
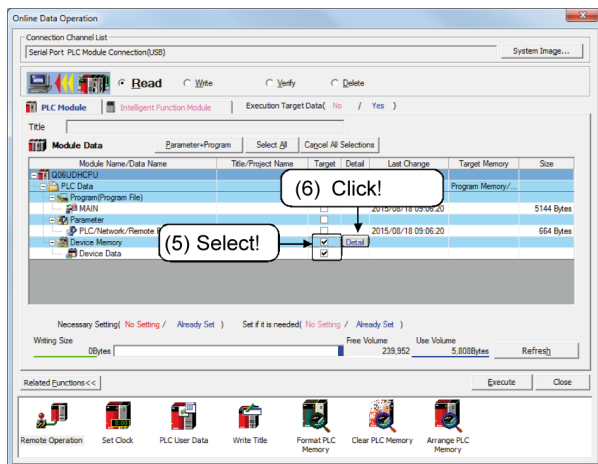
(5) Select!

(6) Click!

5) Check the "Device data" to select it.

6) Click the "Detailed information" button.

(To the next page)
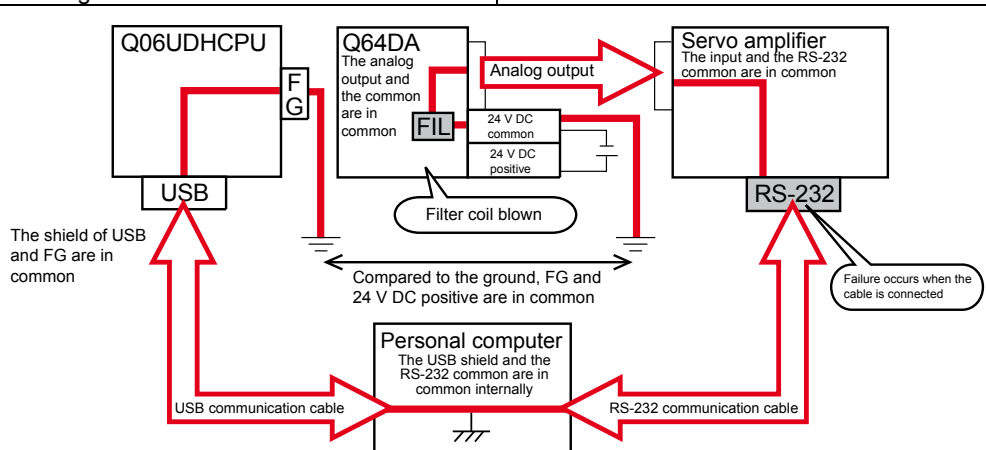
(From the previous page)

⇩
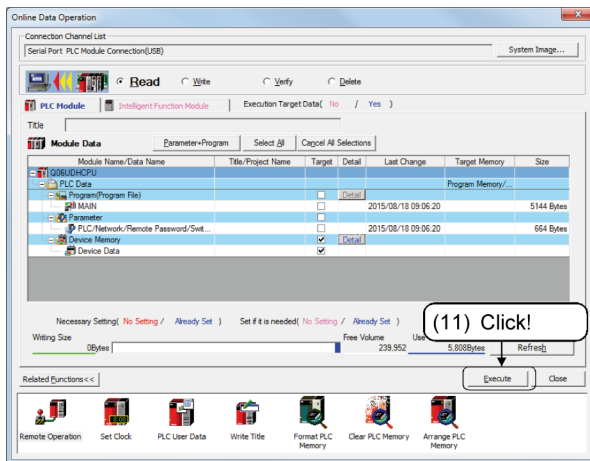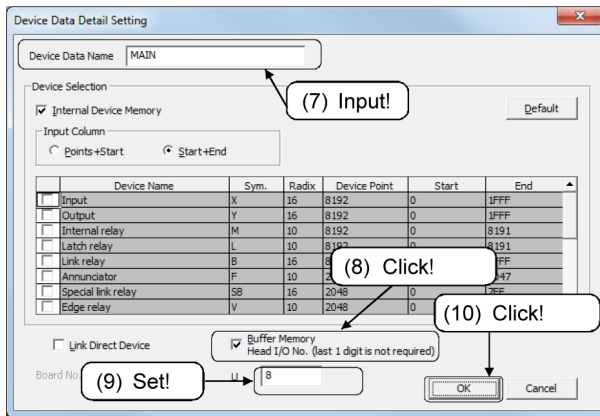
7) Input "MAIN" in the Device data name.

8) Check the "Buffer memory" to select it.

9) Input the address of the module whose buffer memory is read.

10) Click the OK button.

⇩

11) Click the Execute button.
When the "The device memory (MAIN) exists already. Do you want to overwrite it?" message appears, click the Yes button.

12) Click the Close button after reading finished.

13) Click the [Project] → [Save] menu to save the project.
By saving the project, the read device memory is saved.

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6.10 Intelligent Function Module Troubles and Measures

	Product model	Trouble symptom	Measures
Example 1	Q62DA(N) Q64DA(N) Q68DAV(N) Q68DAI(N)	In analog input wiring check, when a wiring conduction test is performed using a checker with a buzzer (6 V, 60 mA) while a programmable controller power supply is being turned on, a operational amplifier IC in analog output circuit may cause a failure.	The cause is presumed as that an excessive surge voltage is applied during a wiring check with a buzzer or current application test using an external device. Take measures described below. (1) Stop using the buzzer used in the test in order not to apply an external voltage. (2) When an external voltage is applied, perform the test holding the terminal block of the module afloat.
Example 2	Q62DA(N) Q64DA(N) Q68DAV(N) Q68DAI(N)	Analog output reduces sometimes.	It is presumed that a poor contact causes unstable analog output because a screw is not tightened enough at the load side (isolator) terminal block connected to the analog output. Tighten the screw at the load side.
Example 3	Q62DA Q64DA Q68DAV Q68DAI	Due to combined use of an RS-232 cable and a USB cable as well as 24 V DC positive grounding specification conditions, a closed loop circuit is formed by 24 VDC power supply, Q64DA (a typical example), servo amplifier, personal computer, Q06UDHCPU, and FG. When the RS-232 cable is connected to the servo amplifier, a voltage is applied between external power supply 24 G and analog output COM, causing a current flow through the filter coil of the Q64DA internal common line and blowing the coil.	(1) Change to the Q64DAN (a typical example), in which a gap between the external power supply and the analog output is isolated. (2) Ensure to avoid combined use of an RS-232 cable and a USB cable in order not to form a closed loop circuit.
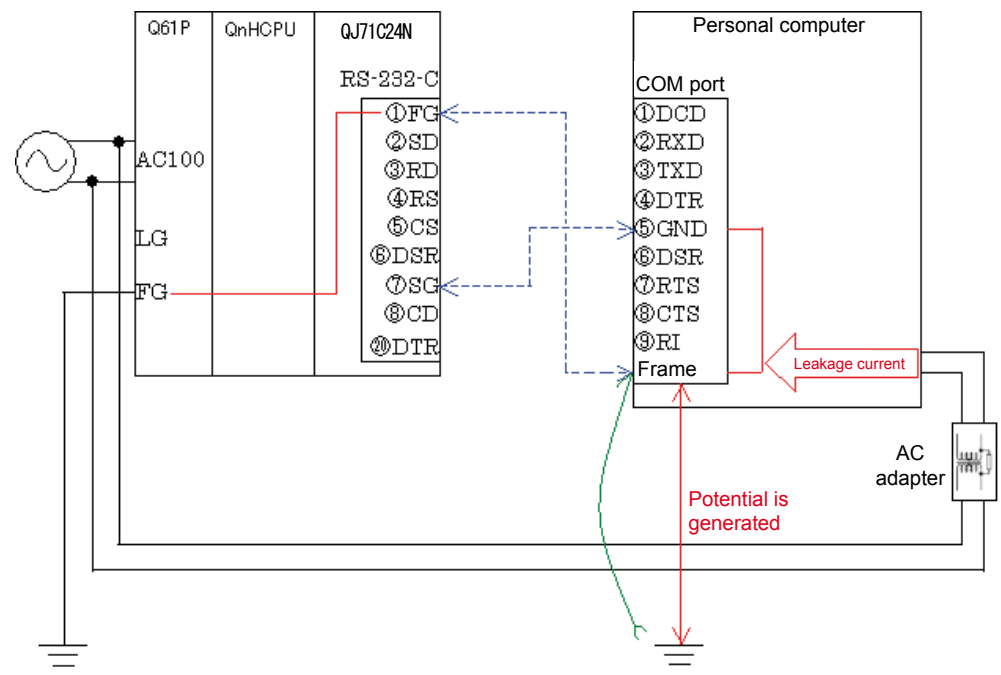
	Product model	Trouble symptom	Measures
Example 4	Q62DA Q64DA Q68DAV Q68DAI	In the Q64DA (a typical example), when 24 V DC is applied to external wiring of the COM terminal, a current flows through the filter coil of the common line, blowing the coil.	(1) Change to the Q64DAN (a typical example), in which a gap between the external power supply and the analog output is isolated. (2) Improve the wiring so that the 24 V DC is not applied to the external wiring.

<Internal ladder block diagram of Q64DA>

To internal control circuit

D/A conversion circuit → Channel switching circuit → Output circuit → V+ / COM / I+ / V+ / COM / I+

It is presumed that 24 V DC is applied to the COM terminal of one of the channels according to external wiring, and an overcurrent flows.

+15V

DC-DC converter → Filter → 24 V DC / 24G

−15V

Analog ground (AG)

	Product model	Trouble symptom	Measures
Example 5	Q68AD Q68ADV Q68ADI	Digital conversion value of analog input is unstable (varies).	Analog/digital conversion value is unstable (varies) due to the influence of superposition of noise generated by the servo to analog input signals. (1) Configure the average processing function using parameters in order to reduce the influence of the input noise. (2) Review wiring so that any cable does not come near to the power cable and is not bundled to it.
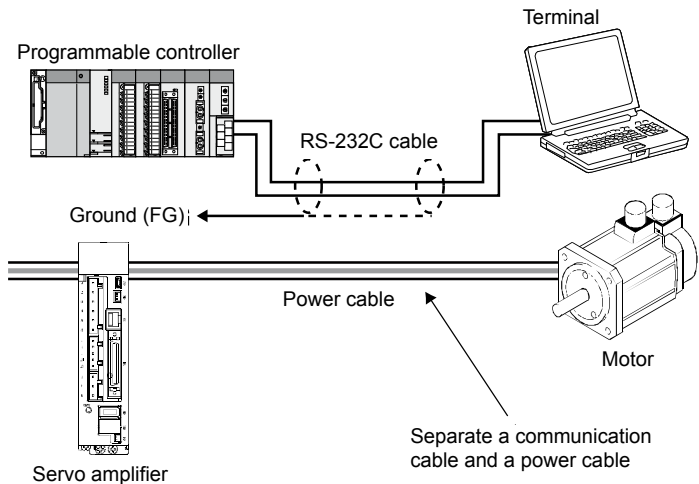
	Product model	Trouble symptom	Measures
Example 6	Q68AD-G Q66AD-DG	When a connector/terminal block converter module and a dedicated cable are used with current input, the accuracy of analog/digital conversion value is not within the specifications.	The factory default setting of offset/gain setting has been adjusted for a single module. Therefore, when the connector/terminal block converter module and the dedicated cable are used, error in conversion property may occur due to influence such as conductor resistance. If the influence such as conductor resistance is a problem, configure the offset/gain setting using user range setting. (For more details, refer to the Mitsubishi programmable controller TECHNICAL BULLETIN No. PLC-D-555.)
Example 7	QJ71C24N QJ71C24N-R2	When a personal computer (with a power supply plug and without a ground cable connected) and the QJ71C24N are connected with an RS-232 cable, the QJ71C24N and the personal computer may cause a failure due to the potential difference of the QJ71C24N and the personal computer.	When the QJ71C24N and a personal computer are connected, ground the ground cable of the personal computer first, then connect the RS-232 cable. If a personal computer with no ground cable is used, check whether it has shock protection with no earthing (grounding) cable. Ensure to use a personal computer with shock protection. Alternatively, use a battery-driven personal computer. (For more details, refer to the Mitsubishi programmable controller TECHNICAL BULLETIN No. PLC-D-464.)
Example 8	QJ71C24N QJ71C24N-R4	When a relay device (intrinsically safe explosion-proof interface) is connected between the QJ71C24N and the measuring equipment, normal communication becomes unavailable.	Remove the relay device and connect the QJ71C24 and the measuring equipment directly.

	Product model	Trouble symptom	Measures
Example 9	QJ71C24N QJ71C24N-R2 QJ71C24N-R4	Because the communication cable and the power cable are bundled together, communication becomes unstable when the servo turns ON.	Separate the communication cable and the power cable.
		Programmable controller — Terminal — RS-232C cable — Ground (FG) — Power cable — Motor — Separate a communication cable and a power cable — Servo amplifier	
Example 10	QJ71E71-100	A self-made communication cable is used, causing the deformation of contact pins of a 10BASE-T connector. After that, communication error occurs due to poor contact between the communication cable and the connector part.	Replace the module, and use a genuine cable specified by Mitsubishi as a communication cable.
Example 11	QJ71E71-100	Communication error occurs in Ethernet communication because noise prevents data from being received correctly.	(1) Ground the shield of the communication cable. (2) Use a HUB designed for FA. (3) Ground the power supply of the HUB. (4) Separate the communication cable from the main circuit and the power cable. (5) When a non-shielded twisted pair cable is used, replace it with a shielded twisted pair cable.

6.11 Sequence Program Troubles

Using ladder monitor, check the relevant ON/OFF status in the program as well as whether program errors like the following exist or not.

(1) Example of normally open/closed contact program error
When an external stop switch is a normally closed contact, because programming is done as a normally closed contact, a stop normally closed contact becomes non-conductive and it cannot be started.

```
 Start      Stop                                              Start output
 ──┤├──────┤/├─────────────────────────────────────────────( Y70 )──
                    ↖ Normally open contact is correct.
 Y70
 ──┤├──
```
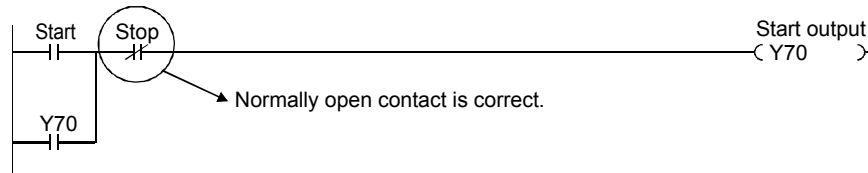
(2) Example of device number program error
Because a start-up Y70 self-holding circuit is programmed as Y07, self-holding cannot be done.

```
 Start      Stop                                              Start output
 ──┤├──────┤├──────────────────────────────────────────────( Y70 )──

   Y7
 ──┤├──
      ↘ Y70 is correct.
```

(3) Example of interlock program error
It does not work when a move-forward command and a move-back command turn ON.

```
 Advance   Advance
 command   end LS    Y71                                      Advance output
 ──┤├──────┤/├──────┤├───────────────────────────────────────( Y70 )──

 Backward  Backward
 command   end LS    Y70                                      Backward output
 ──┤├──────┤/├──────┤├───────────────────────────────────────( Y71 )──
                      ↘ Normally closed contact are correct for these interlocks.
```
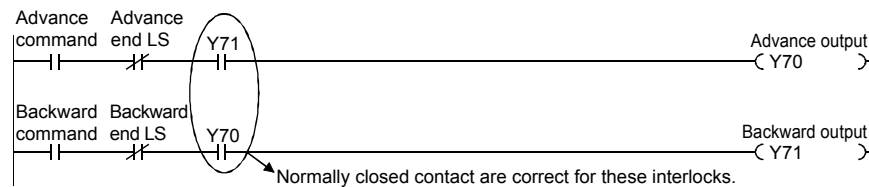
(4) Example of operation program error, such as four arithmetic operations
Multiply C55 by 30 and output the result to the digital HMI (Human Machine Interface).
Because D50 is 32-bit data and exceeds 32767, a 4-digit BCD conversion instruction is not available.
(An operation result of integration of 16-bit and 16-bit may exceed 32767.)

```
 Operation  Execution
 condition  instruction
 ──┤├───────┤/├──────────────────────────[ *P    C55    K30    D50 ]

                                          [ BCD   D50    K4Y40 ]
                                            ↙ Using a DCCD D50 K8Y40 conversion instruction is correct.
```
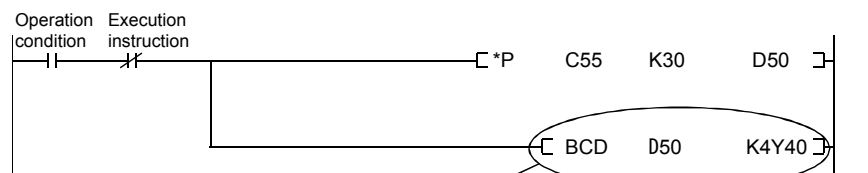
(5) Example of program jump destination error by a CJ and CALL instruction
Programming of jump destination pointer P5 is forgotten.

```
         X0      M2
         ┤├──────┤├──────────────────────────────────────[ CJ      P5    ]

No Pointer P5    X3      M7
        ╭╮       ┤├──────┤/├─────────────────────────────────(  Y77   )
        ││
        ╰╯───────────────────────────────────────────────[ END   ]
```
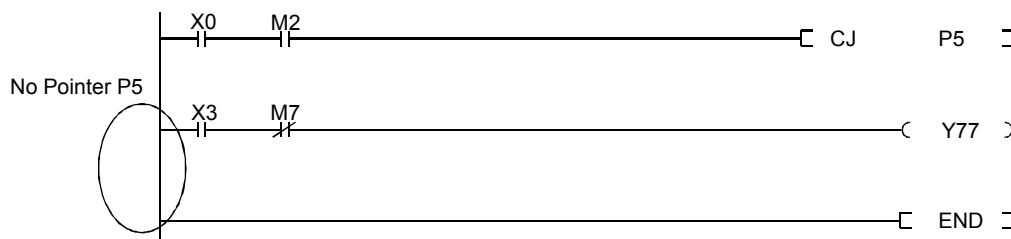
(6) Example of TO instruction program error
Because there is a mistake in a TO instruction when the Q62DA conversion
module is mounted to X/Y0A0, analog output cannot be done.

```
     X0      X0A1
     ┤├──────┤/├────────┬──────────────────────[ BINP    K4X20   D10     ]
                        │
                        └──────────────[TOP ( H0A0 )   K0      D10  K1  ]
```
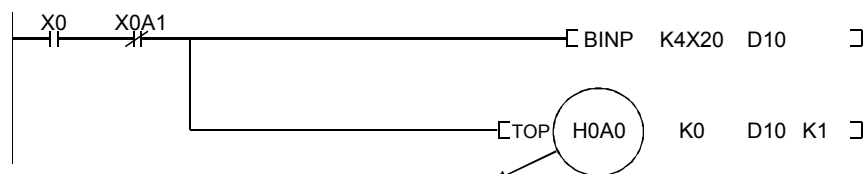
Upper two digit H0A is correct for a mounting address.

6.12 Practical Training in Case of Error

This document is intended for training of reading error descriptions and taking actions by operating a personal computer (with GX Works2). Use the [Project Name: QHOZEN] sequence program for training.

There are training operations from Training 1 to Training 13. Follow instructions for the operations.

6.12.1 Training 1 I/O Number Assignment Mistake Using Personal Computer with GX Works2

Check faults when the parameter I/O number setting differs from that of the mounted module using a personal computer with GX Works2.

(1) Assign a slot to 16 inputs according to the following operations.

<Operation>
(a) Double-click "Parameter" → "PLC parameter" in the project data list.

(b) Click the "I/O assignment setting" tab of the Q Parameter Setting dialog box.
(c) Assign a slot as follows.
  • "Type": Input, "Model Name": QX42, "Points": 16 points

No.	Slot	Type	Model Name	Points	Start XY
0	PLC	PLC	Q06UDHCPU		
1	0(*-0)	Empty		0 Point	
2	1(*-1)	Input	QX42	16Points	0000
3	2(*-2)	Output		64Points	

(d) Click the End Setting button.
(e) Set the CPU to STOP.
(f) Click [icon] (Write to PLC) on the toolbar.
(g) On the Write to PLC dialog box, click to select "Parameter" → "Network/remote password/switch setting" and click the Execute button.
(h) A confirmation dialog box is displayed. Click the Yes button.

(2) Set the CPU to RUN and turn ON X2. The current value of timers is not displayed in the digital HMIs (Human Machine Interfaces) for Y40 to Y4F.

(3) Monitor the ON/OFF statuses of outputs Y40 to Y4F with the following operations.

<Operation>
(a) Click the [Online] → [Monitor] → [Device/Buffer Memory Batch] menu.
(b)Input "Y40" in "Device" on the Device Batch Monitor dialog box.

(c) Click the Start Monitoring button.

Device	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
Y40	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	1	849
Y50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y70	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	8

Turn on X2 and turn ON/OFF X0.
The display shows that the values are normally output to Y40 to Y4F in the program.
It is assumed that the current value of the timer is not output to the output module because of a problem other than the program.

(4) Check that the number of I/O points matches that of the mounted I/O points with the following operation.

<Operation>
(a) Click the [Diagnostics] → [System monitor]menu.
(b) On the System Monitor screen, check that the number of I/O points assigned in parameters matches that of the mounted I/O points.
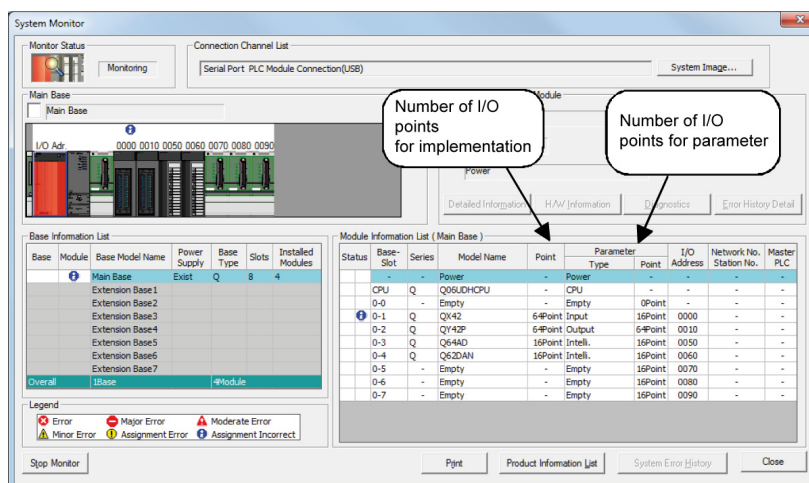
(5) Action
Correct the I/O assignment for the parameters according to the mounted module.

REMARKS
The following examples show possible causes of mismatching between the I/O number and the mounted one.
• Assignment of an I/O numbers is incorrectly set using the personal computer with GX Workers2.
• Connector pins on the back side of the I/O module are bent or faulty.

(6) Set the CPU to STOP and restore the parameters to the original status before the next practical training with the following operations.
    <Operation>
    (a) Double-click "Parameter" → "PLC parameter" in the project data list.

    (b) Click the "I/O assignment setting" tab of the Q Parameter Setting dialog box.
    (c) Click the Default button.
    (e) A confirmation dialog box is displayed. Click the Yes button.
    (f) Click the End Setting button.
    (g) Click 🔳 (Write to PLC) on the toolbar.
    (h) On the Write to PLC dialog box, click to select "Parameter" → "Network/remote password/switch setting" and click the Execute button.
    (i) A confirmation dialog box is displayed. Click the Yes button.
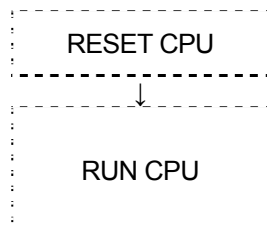
```
┌─────────────────────┐
:      RESET CPU       :
└─────────────────────┘
           ↓
┌─────────────────────┐  The current value of timers are not displayed
:                     :  in the digital indicators for Y40 to Y4F HMIs (Human
:      RUN CPU        :  Machine Interfaces). (Turn ON X2 and turn ON/OFF
:                     :  X0.)
└─────────────────────┘
```

6.12.2 Training 2 Operation Failure Due to Redundant Coil

If there are two or more coils of the same device in a program, executing ON/OFF causes an operation failure.

(1) Create a new project and then create the following program.

```
    X2
────┤ ├──────────────────────────────────────────────────────────────(Y70    )┤
    X3
────┤ ├──────────────────────────────────────────────────────────────(Y70    )┤
```
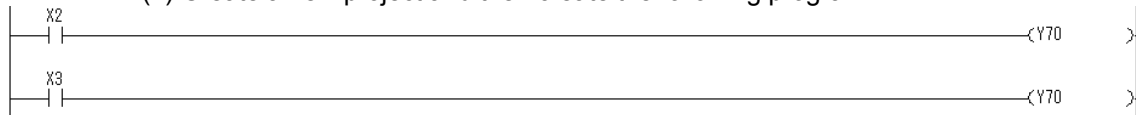
(2) The ON/OFF status of Y70 cannot be changed by operation of X2.

(3) Methods for checking redundant coils are described below.

• Displaying coils in ladder programs
(a) Click [🔳] (read mode) on the toolbar to switch to the read mode.
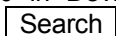
(b) Press the following keys to search coils.
┌─────┐ ┌───┐ ┌───┐ ┌───┐ ┌───┐ ┌───┐ ┌───┐
│ F7 │ │ Y │ │ 7 │ │ 0 │ │ ↵ │ │ ↵ │ │ ↵ │
└─────┘ └───┘ └───┘ └───┘ └───┘ └───┘ └───┘
(-( )-)

Reads the first coil | Reads the second coil | Reads the third coil (Displays "Search completed." when the third coil does not exist.)
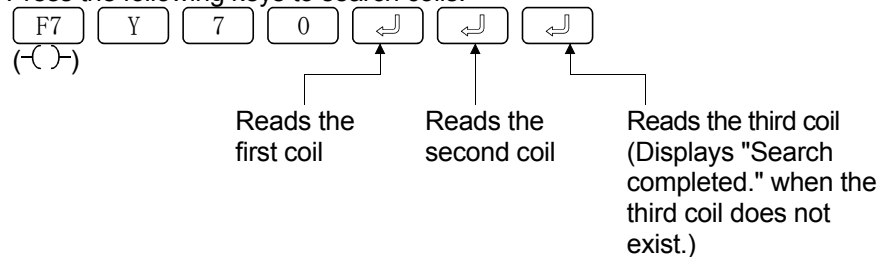
• Displaying coils in the list of used devices
(a) Click to select the [Search/Replace] → [List of used devices] menu.
(b) Input "Y70" in "Device" on the List of Used Devices dialog box.
(c) Click the ⎡Search⎤ button.

[List of used devices]
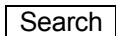
Device	Contact	Coil (counts)	Parameter	Comment
Y70		*(2)		
Y71				
Y72				

This result shows that the -(Y70)- exists in two places.

• Displaying coils in cross reference
(a) Click to select the [Search/Replace] → [Cross Reference] menu.
(b) Input "Y70" in "Device/Label" on the Cross Reference dialog box.
(c) Click the ⎡Search⎤ button.

[Cross Reference]

Device/Label	Instruction	Ladder Symbol	Position	Data Name
Filtering Condition	Filtering Condit...		Filtering Condition	Filtering Condition
Y70	OUT	-( )-	Step No.1	MAIN
Y70	OUT	-( )-	Step No.3	MAIN

This result shows that the Y70 coil exists in two places, step 1 and step 3 of the MAIN program.

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- Executing program check
  (a) Click to select the [Tool] → [Check Program...] the menu.
  (b) Click the [Execute] button.

[Check Program...]

No.	Result	Data Name	Class	Content	Error Code
1	ERROR	MAIN	Program Check	'Y70' is double-coil. Please check the program so that malfunctions will not happen.(Step No.1)	C9300
2	ERROR	MAIN	Program Check	'Y70' is double-coil. Please check the program so that malfunctions will not happen.(Step No.3)	C9300

This result shows that there are two Y70 coils.

(4) Action

Avoid the duplication of coils using an internal relay.
Change the existing program to the following program.
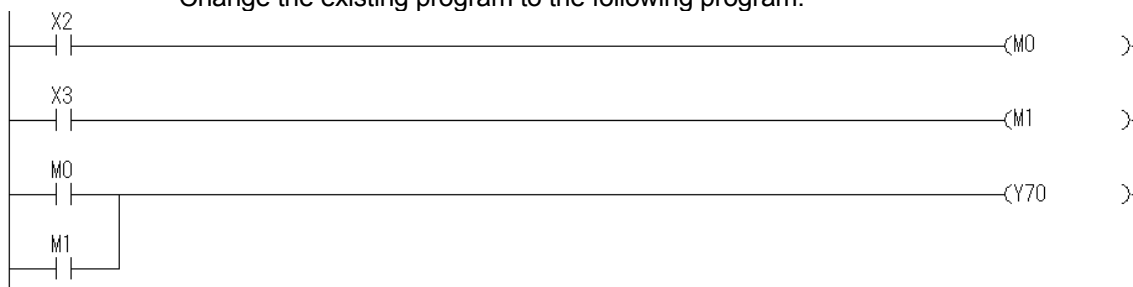
This change enables ON/OFF operation of Y70 with either X2 or X3.

6.12.3 Training 3 Jump Destination Error in Use of CJ instruction

If there is no jump using a branch instruction, the CPU stops.
Confirm the phenomenon.

(1) Add the following program to the existing program.

```
 X4
 ─┤├──────────────────────────────────────────────[CJ      P3    ]

 X5
 ─┤├──────────────────────────────────────────────────────(Y71   )
```
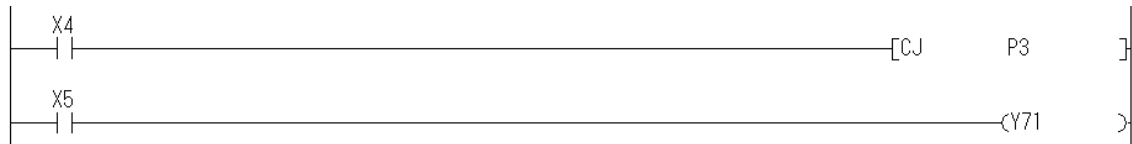
(2) Turn ON X4.
An error occurs and the CPU will stop.

(3) Read the error step and code with the following operation.

<Operation>
(a) Click the [Diagnostics] → [PLC Diagnostics] menu.
(b) Check "Current Error" on the PLC Diagnostics dialog box.

No.	Current error	Year/Month/Day	Time
4210	CAN'T EXECUTE(P)	2013-10-1	9:10:11

For details of errors, click the [Error Help] button on the PLC Diagnostics
dialog box to display details of currently generated errors.

(4) Reset the programmable controller CPU.
(a) Turn OFF X4.
(b) Press the RESET switch of the CPU to reset.

(5) Action
When programming with a CJ, SCJ, JMP, CALL, or CALLP instruction, be sure to
insert the jump destination pointer "P3" as a label before the destination ladder.
(a) In the write mode (🖉), select outside the left rail of the ladder just below the
ladder of the added CJ instruction.

Change the existing program to the following program.

```
        X4
 7 ─────┤├──────────────────────────────────────────[CJ      P3    ]

        X5
10 ─────┤├──────────────────────────────────────────────(Y71   )

 P3     X6
12 ─────┤├──────────────────────────────────────────────(Y72   )
```
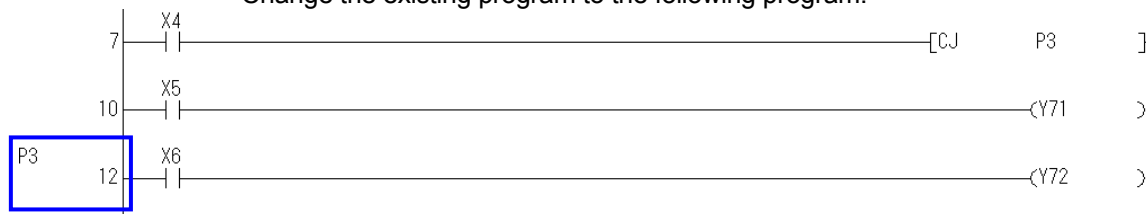
(b) Turn ON X4.
No error will occur.

- CAN'T EXECUTE(P) error occurs when a jump destination specified with a CJ, SCJ, JMP, CALL, or CALLP instruction does not exist.
  "A jump destination does not exist" means that the label from P0 to P4095 has not been input.
- In use of a CJ, SCJ, JMP, CALL, or CALLP instruction, if the same label exists in a program, CAN'T SET(P) error occurs.
- On GX Works2, CAN'T EXECUTE(P) and CAN'T SET(P) errors can be checked by the program check function ([Tool]→[Check Program...] menu) in advance.
- After the timer coil turns on, the current value will not be updated even if the coil is moved by a jump instruction.

6.12.4 Training 4 BCD Code Error

When the input data is not a BCD code at an execution of a conversion instruction (BIN, etc.) or when a value cannot be converted at an execution of a conversion instruction (BCD, etc.), an error occurs.

(1) Add the following program to the existing program.

```
  SM400
  ─┤├─────────────────────────────────────────┤ BIN │ K4X20 │ D1 ├
```
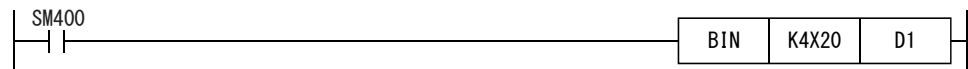
(2) Change the digital switches X20 to X2F to various values until an error occurs.
   (BCD code error does not occur depending on the structure of digital switch.)

(3) Read the error step and code with the following operation.

   <Operation>
   (a) Click the [Diagnostics] → [PLC Diagnostics] menu.
   (b) Check "Current Error" on the PLC Diagnostics dialog box.

No.	Current error	Year/Month/Day	Time
4100	OPERATION ERROR	2013-10-1	9:10:11

   For details of errors, click the │ Error Help │ button on the PLC Diagnostics dialog box to display details of currently generated errors.

(4) Read the program in the error step.
There are two methods to read the program as follows.
- Click the | Error JUMP | button on the PLC Diagnostics dialog box which read the error step in (3).
- Read the error step by the device/buffer memory batch monitor.
  1) Click the [Online] → [Monitor] → [Device/buffer Memory Batch Monitor] menu.
  2) Input "SD4" in "Device Name" on the Device/Buffer Memory Batch Monitor dialog box and press | ↵ |.

Device	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
SD4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4
SD5	0	1	0	0	0	0	0	1	0	1	0	0	1	1	0	1	16717
SD6	0	1	0	0	1	1	1	0	0	1	0	0	1	0	0	1	20041
SD7	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	8224
SD8	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	8224
SD9	0	1	0	1	0	0	0	1	0	0	1	0	1	1	1	0	20782
SD10	0	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	18256
SD11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD14	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	16
SD15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Error step 59 (BIN   K4X20   D1) can be read.

This instruction converts a BCD code into a binary code. When the data is not a BCD code, the error occurs.
The cause is that the program constantly reads BCD-coded values of digital switches and hexadecimal codes A to F are generated when the values of the digital switches is changed.

(5) Action
Modify and make an addition to the program as follows so that signals other than 0 to 9 will not be read.
When a ladder with 12 contacts or more in a line is created as follows, the program automatically loops back (*1) and proceeds to the next line. (It is necessary to insert an empty line to loop the program back in advance.)
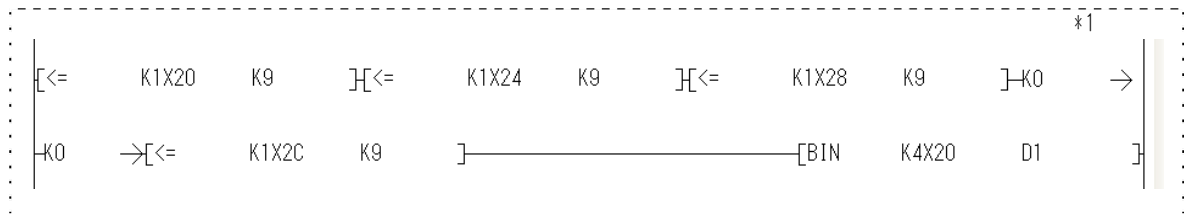
REMARKS
The following cases are examples of BCD code errors.
- When BIN K4M0 D1 is executed, any of the contents of M0 to M15 is not a BCD code (binary-coded decimal).
- When BCD D8 K4Y40 is executed, the content of D8 is a negative value or larger than 9999.
- When DBCD D8 K8Y40 is executed, the content of D8 and D9, which is 32-bit data, is a negative value or larger than 99999999.

6.12.5 | Training 5 | BCD Instruction Error to Minus Data

Check an error phenomenon when BCD instruction is executed to minus data.

(1) Add the following program to the existing program.

```
  X7
 ──┤├──┬───────────────────────────────────────[ MOVP │ D1  │ D2  ]
       │
       │ X8
       ├──┤├────────────────────────────────────[ -P   │ D2  │ K10 │ D2 ]
       │
       └───────────────────────────────────────[ BCD  │ D2  │ K4Y40 ]
```
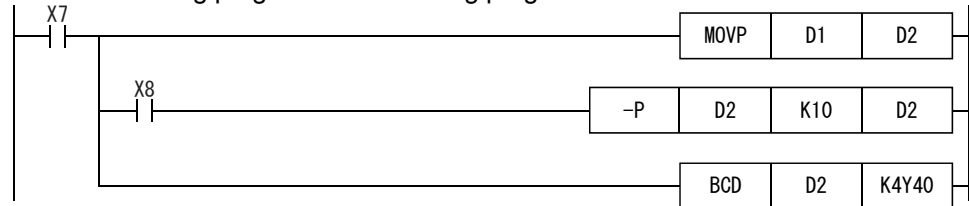
(2) With ladder monitoring, set the programmable controller to RUN, set X20 to X2F digital switches to 0050, turn ON X7, and turn ON/OFF X8 to decrease D1 in increments of 10. When D1 becomes minus data, BCD code error occurs.

(3) Read the error step and code with the following operation.

    <Operation>
    (a) Click the [Diagnostics] → [PLC Diagnostics] menu.
    (b) Check "Current Error" on the PLC Diagnostics dialog box.

No.	Current error	Year/Month/ Day	Time
4100	OPERATION ERROR	2013-10-1	9:10:11

For details of errors, click the | Error Help | button on the PLC Diagnostics dialog box to display details of currently occurring errors.

(4) Action
Insert an interlock as follows so that BCD conversion is not carried out when D1 is minus data.

```
  X7
 ──┤├──┬───────────────────────────────────────[ MOVP │ D1  │ D2  ]
       │
       │ X8
       ├──┤├────────────────────────────────────[ -P   │ D2  │ K10 │ D2 ]
       │
       │ ┌──────────────────┐
       └─│ <= │ K0  │ D2  │───────────────────[ BCD  │ D2  │ K4Y40 ]
         └────────┬─────────┘
                  ▲
              Interlock
```

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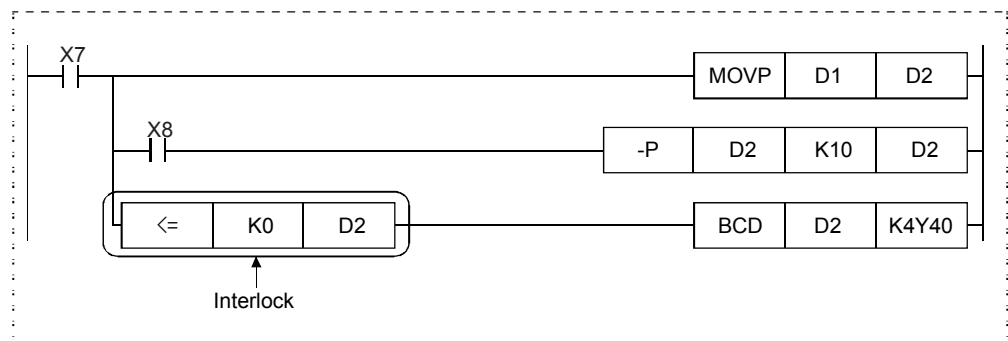
6.12.6 Training 6 How to Use Failure Detection Annunciators (F)

Upon an annunciator (F) receives the failure condition of an external signal, the F numbers to be turned ON are automatically stored in special registers (SD64 to SD79) depending on failures descriptions and the number of detected failures is stored in SD63. The contents can be output to an external HMI (Human Machine Interface) or read by the host computer.

(1) Add the following program to the existing program.

```
 SM52
  | |──────────────────────────────────────────────────────(F1        )
  X9
  | |──────────────────────────────────────────────────────(F2        )
 X0A
  | |──────────────────────────────────────────────────────(F3        )
SM400
  | |─────────────────────────────────────[BCD     SD63    K2Y50    ]
  X0
  | |─────────────────────────────────────────────────────[LEDR     ]
```

When X0 is turned ON, LEDR instruction can be executed to reset the memory.
X9 and XA assume failure conditions of external failure signals such as "stroke limit signal", "blade breakage detection signal", and "arm breakage detection signal" and turn ON annunciators F.

(2) Write the program to the CPU.

    STOP CPU

(a) Click 🔴 (Write to PLC) on the toolbar.
(b) Click the | Parameter + Program | button on the Write to PLC dialog box and then click the | Execute | button.
(c) A confirmation dialog box is displayed. Click the | Yes | button.

    RUN CPU

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(3) Monitor special relays and special registers with the following operation.
    The display shows whether each annunciator (F) is ON, which annunciator turned ON first, and how many annunciators are ON.

<Operation>
(a) Click the [Display] → [Docking window] → [Watch window (1) to (4)] menu.
     * In this training, select (1).
(b) The watch 1 window is displayed. Select the line to be edited, click the Device/Label field, and input the following devices.

SM52	Turns ON when the battery voltage becomes lower than the specified level and turns OFF when it returns to normal.
SM51	Turns ON when the battery voltage becomes lower than the specified level and remains ON even after it returns to normal.
SM1	Turns ON when there is an error as the result of self diagnostic and remains ON even after the condition returns to normal.
SM62	Turns ON when at least one annunciator F turns ON.
SM63	Stores the number of annunciators F which have turned ON.
SD64	Stores the number of the F that turned ON in the first place.
SD65	Stores the number of the F that turned ON in the second place.
SD66	Stores the number of the F that turned ON in the third place.
SD67	Stores the number of the F that turned ON in the fourth place.
SD68	Stores the number of the F that turned ON in the fifth place.
SD69	Stores the number of the F that turned ON in the sixth place.
SD70	Stores the number of the F that turned ON in the seventh place.
SD71	Stores the number of the F that turned ON in the eighth place.

(c) Click the [Online] → [Watch] → [Start Watching] menu.
     The following screen is displayed. Check the contents.

Device/Label	Current Value	Data Type	Class	Device	Comment
SM52	0	Bit		SM52	
SM51	0	Bit		SM51	
SM1	0	Bit		SM1	
SM62	1	Bit		SM62	
SD63	2	Word[Signed]		SD63	
SD64	2	Word[Signed]		SD64	
SD65	3	Word[Signed]		SD65	
SD66	0	Word[Signed]		SD66	
SD67	0	Word[Signed]		SD67	
SD68	0	Word[Signed]		SD68	
SD69	0	Word[Signed]		SD69	
SD70	0	Word[Signed]		SD70	
SD71	0	Word[Signed]		SD71	

6.12.7 Training 7 Setting of Operation Mode When There Is an Error

The operation of CPU after an error occurrence can be selected from "Stop" and "Continue" by setting a parameter.

(1) Setting
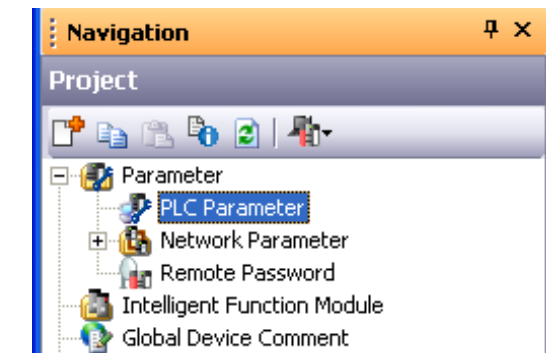
1) Double-click "Parameter" → "PLC parameter" in the project data list.
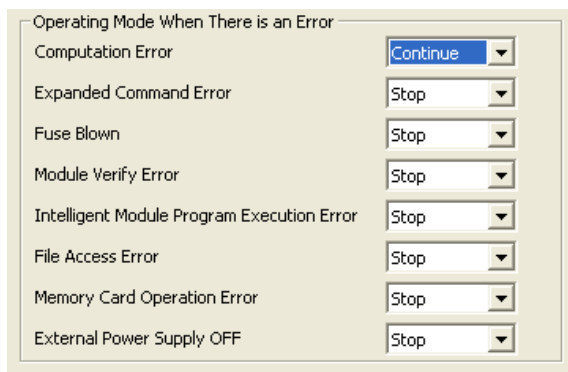
2) On the "PLC RAS setting" tab, change "Operating Mode When there is an Error" → "Computation Error" to "Continue".

3) Write the parameter to the programmable controller using the Write to PLC function to reset.

(2) Operation check
   1) Turn ON XB and operate the digital switch (K4X30).
   2) When the numerical value changes from 7 to 8 or from 8 to 7, an error occurs.
      Check that the CPU does not stop even when the error occurs.

```
    X0B
    ┤├─────────────────────────────────────────[BIN    K4X30    D100    ]
```

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6.12.8 Training 8 Error Check and Error Clean from a Program Using SM and SD

Errors can be checked and cleared by using special relays SM and special registers SD.

- Error check

The number of the occurring error is stored in [SD0] (diagnostic errors). The occurring error can be checked by displaying the current value.

```
     SM400
       | |                                      ─[BCD      SD0        K4Y60      ]─
```
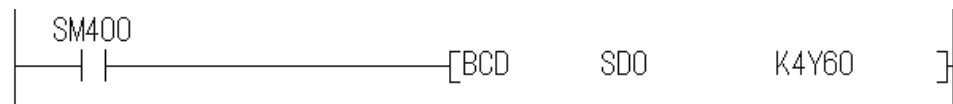
- Error clear

(1) Checking special relays and special registers
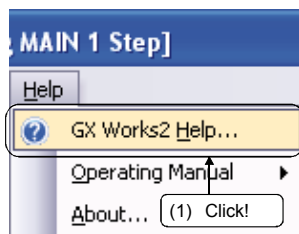
1) Click "Help"→"GX Works2 Help" on the menu bar.
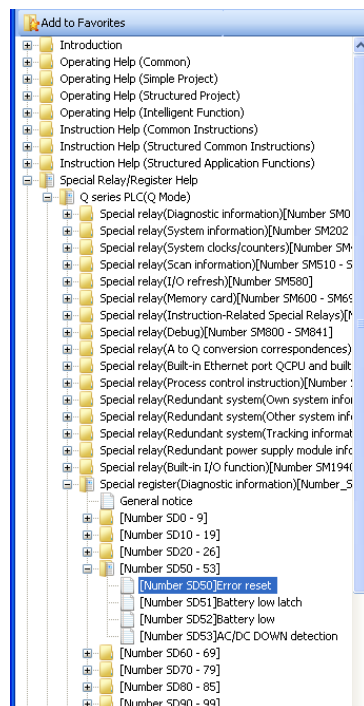
2) Click "Special Relay/Register Help" → "Q series PLC (Q Mode)" → "Special register (Diagnostic information) [Numbers SD0 to SD183]" → "[Numbers SD50 to SD53]" → "[Number SD50] Error reset".

3) Check the content of [SD50].
(Also, check the content of [SM50] in the same way.)

[SD50] (Error reset): Stores the number of the error to be cleared.
[SD50] (Error reset): Clears the error.

(2) Operation check
    1)   Turn ON XB and operate the digital switch (K4X30).
    2)   When the numerical value changes from 7 to 8 or from 8 to 7, an error occurs.
           Check that the CPU does not stop even when the error occurs.
    3)   Turn ON XC and check that the error LED turns off.

```
 X0C
──┤├────────────────────────────────────────────[MOVP    SD0       SD50    ]─┤
   └────────────────────────────────────────────────────────────────(SM50   )─┤
```
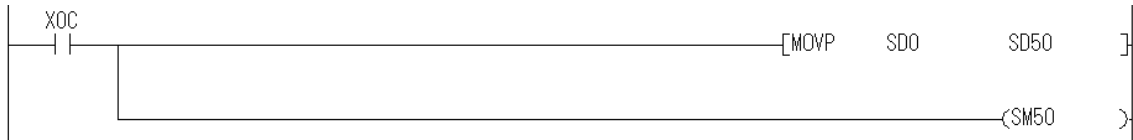
6.12.9 Training 9 Saving of Error Histories

The history of errors which have occurred can be saved in CSV format on the personal computer.

(1)   Operating procedure
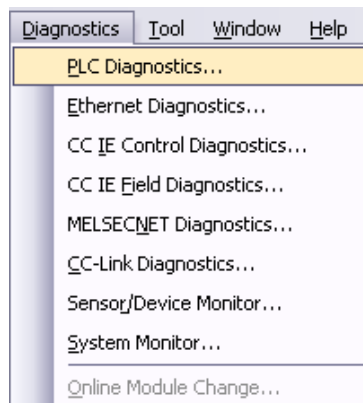
1)   Click [Diagnostics] → [PLC Diagnostics] on the menu bar.
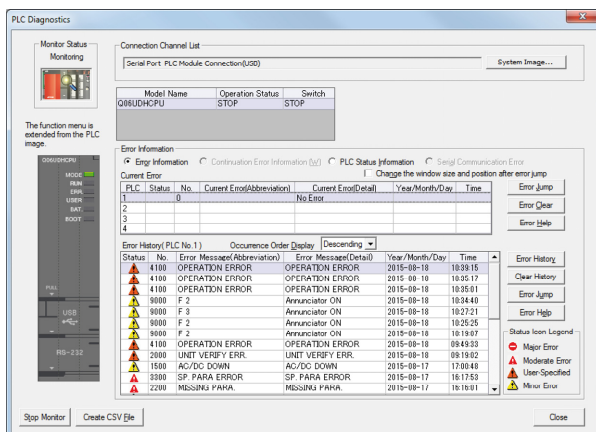
2)   Click "Create CSV file" on "Error History" to save a file on the personal computer.

(2)   Confirmation
      Open and check the saved file on the personal computer.

6.12.10 Training 10 Sampling Trace

What is the sampling trace function?

The sampling trace function sequentially collects contents of specified devices in the CPU module at a specified timing.

Sampling trace samples contents of the specified devices at specified intervals (sampling cycle) and stores the trace results in a sampling trace file.

Application of sampling trace

During debugging, this function allows checking changes of the contents of devices used in a program at a specified timing.

This function also reads contents of devices when a trigger condition is satisfied.

POINT
(1) Sampling trace files can be stored only in standard RAM and SRAM cards.
(2) When storing a sampling trace file in standard RAM, check the versions of the CPU module and GX Works2. [1]
   *1: CPUs whose the first five digits of the serial number are 07032 or later are supported

First, follow the procedure below for preparation.
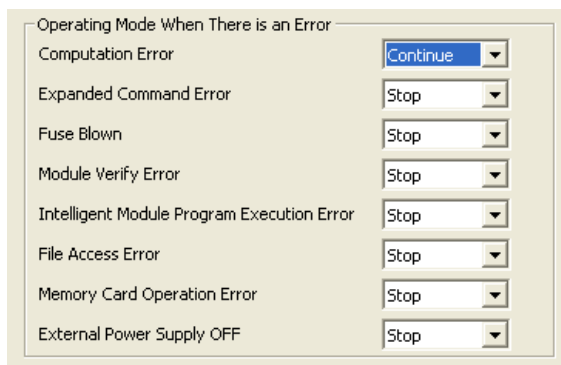
1) Double-click "Parameter" → "PLC Parameter" in the project data list.

2) On the "PLC RAS setting" tab, change "Operating Mode When there is an Error" → "Computation Error" to "Continue".

3) Write the parameter to the programmable controller using the Write to PLC function to reset.

(1) Trace setting
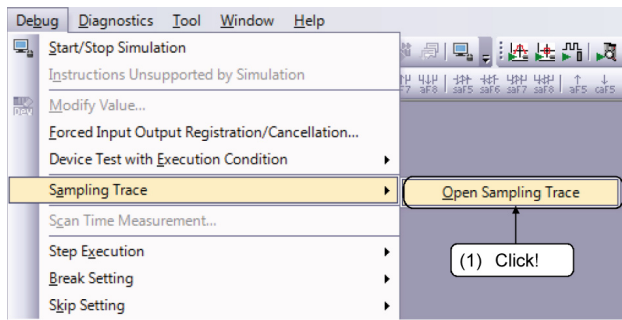
1) Click "Debug" → "Sampling Trace" → "Open Sampling Trace" on the menu bar.
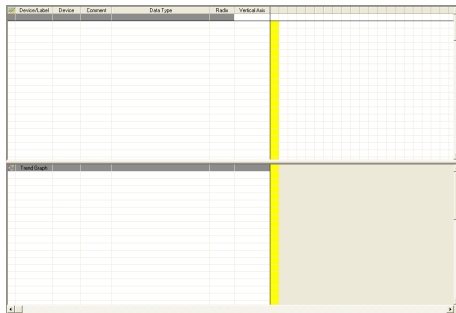
2) The Sampling Trace screen is displayed.
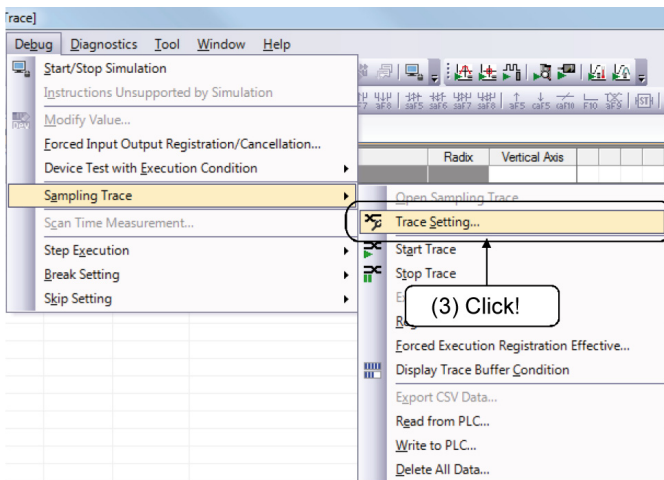
3) Click the [Debug] → [Sampling Trace] → [Trace Setting] menu.

(To the next page)

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(From the previous page)

⬇
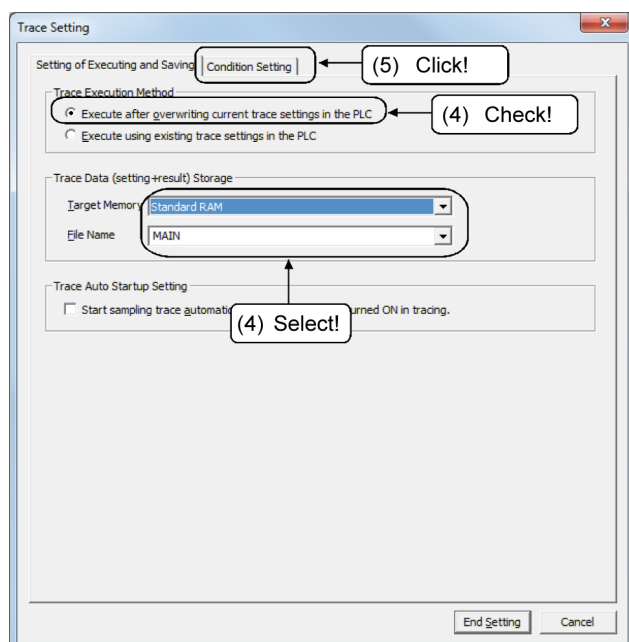
4) Set the trace execution method as follows.

Target memory: Standard RAM
File name: MAIN
Select "Execute after overwriting current trace setting in the PLC".

5) Click the Condition Setting tab.

⬇
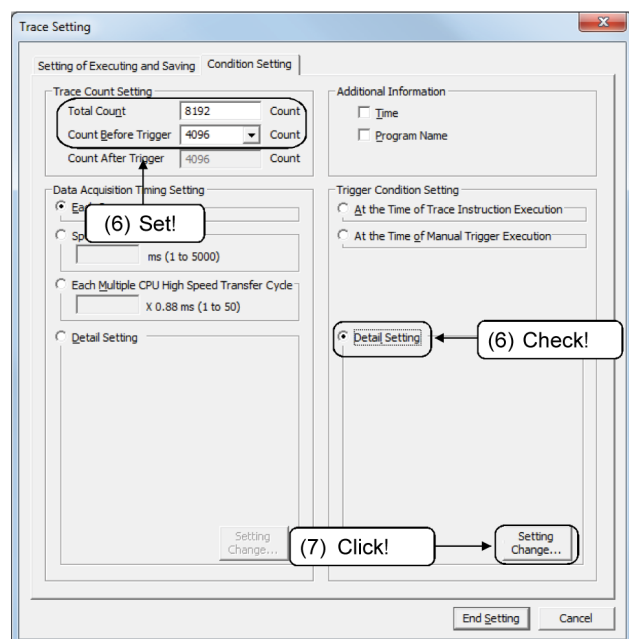
6) Select "Detail Setting" in Trigger Condition Setting and set the Trace Count Setting as follows.

Total Count: 8192 counts
Count Before Trigger: 4096 counts

7) Click the Setting Change button.

⬇

(To the next page)

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⇩

8) The Detail Setting - Trigger Condition dialog box is displayed. Set the following items. In this case, set error occurrence as a trigger condition.
Device/Label: SM0
Condition: ↑

9) Click the End Setting button.

10) The display returns to the Trace Setting dialog box. Click the End Setting button to close the dialog box.

Detail Setting - Trigger Condition

☑ Device
Device/Label
| SM0 | ← (8) Input・Set! |

Device
| SM0 ▼ |

Address

Comment

Condition
| -P- ▼ |

(9) Click! → [End Setting] Cancel

⇩

11) On the Sampling Trace screen, set devices to be traced as follows.

Bit device: X33, X32, X31, X30
Word device: SD0

Device/Label	Device
X33	X33
X32	X32
X31	X31
X30	X30
☐ SD0	SD0	← (12) Check!

12) Place a checkmark in the checkbox to display the trend graph of SD0.

⇩

13) "SD0" is displayed in the trend graph field of the Sampling Trace screen.

	Device/Label	Device	Comment	Data Type	Radix	Vertical Axis	
						1	
	X33	X33		Bit	BIN	-	
	X32	X32		Bit	BIN	-	
	X31	X31		Bit	BIN	-	
	X30	X30		Bit	BIN	-	
☑	SD0	SD0		Word[Signed]	DEC.	-	

	Trend Graph						
	SD0	SD0		Word[Signed]	DEC.	-	
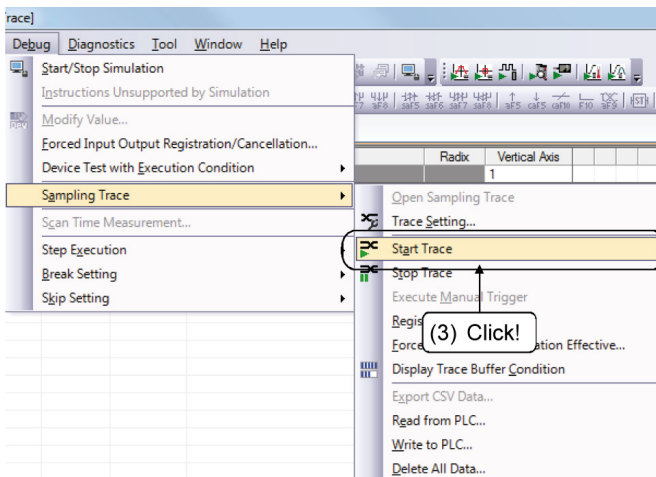
(2) Trace execution

1) Click the [Debug] → [Sampling trace] → [Start Trace] menu.
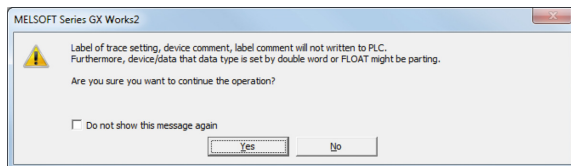
2) The message on the left is displayed. Click the Yes button.
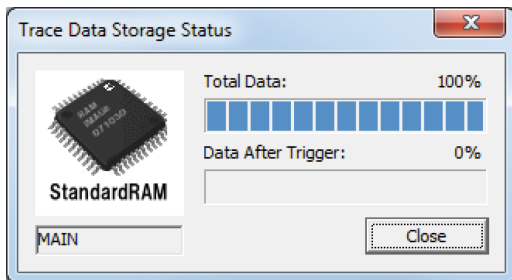
3) When trace execution starts, the trace data storage condition screen is displayed.

After checking that the Total Data reaches 100%, turn ON XB and operate the digital switch (K4) to change 7 to 8 (or 8 to 7).

The trigger condition is satisfied by the error occurrence.
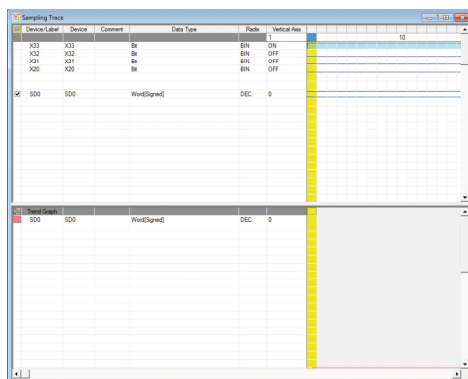
4) The trace result is displayed on the Sampling Trace screen.

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(3) Trace result

1) Scroll down to the trigger point and check that the device value at the time of error occurrence.
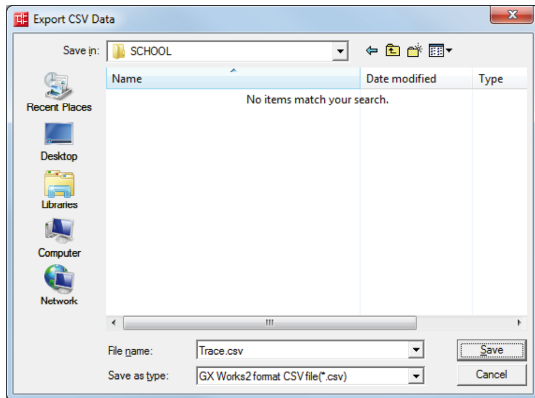
2) Click the [Debug] → [Sampling trace] → [Export CSV Data] menu to display a dialog box to save the trace data on the personal computer.

The saved data can be processed and used for operation check, etc. on a personal computer.

REMARKS

Turning ON SM722 prevents occurrence of OPERATION ERROR at the execution of BIN or DBIN instruction.

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6.12.11 Training 11 Scan Time Measurement

Scan time within the range of specified steps can be measured.

(1) Setting
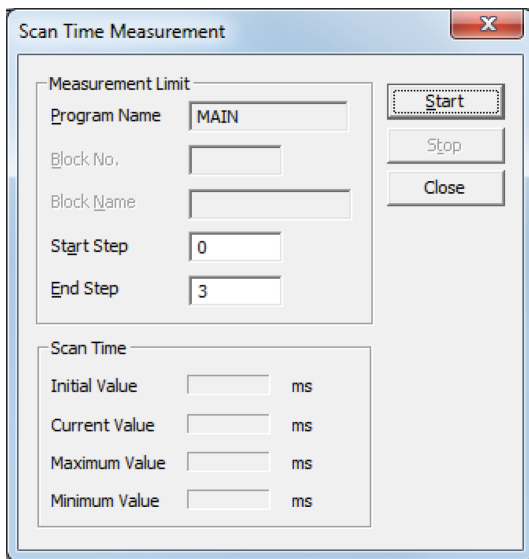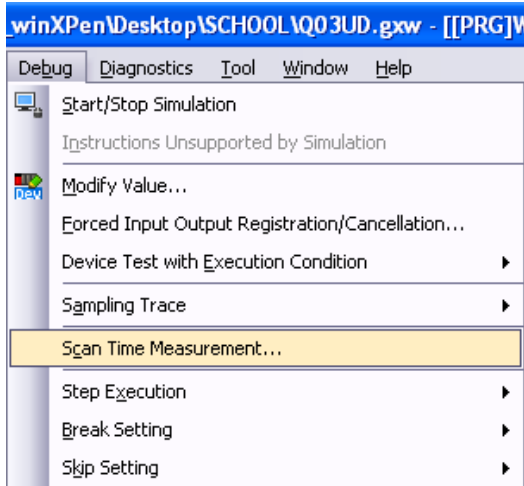
1) Switch to the monitoring mode.

2) Click "Debug" → "Scan Time Measurement" on the menu bar.

3) Set the measurement range as follows.

Start Step: 0
End Step: Step number of END instruction -1

4) Click Start.

(2) Operation check
Check the change of scan time.
Check that scan time changes depending on instruction execution and non-execution in the program.

6.12.12 Training 12 Remote Operation

Remote operation changes the CPU module operating status with external operations.

RUN/STOP state	Remote operation				
	RUN	STOP	PAUSE	RESET	Latch clear
RUN	RUN	STOP	PAUSE	Cannot be operated	Cannot be operated
STOP	STOP	STOP	STOP	RESET	Latch clear

*: Remote RESET requires a parameter setting.

(1) Remote RUN/STOP/PAUSE/latch clear
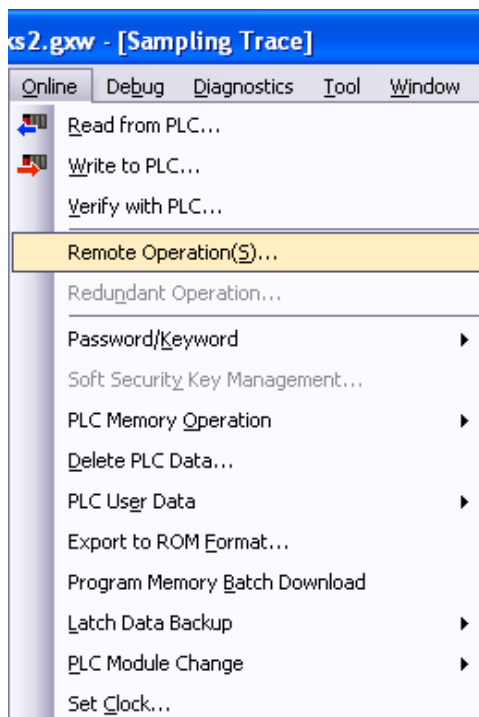
1) Click "Online" → "Remote Operation" on the menu bar.
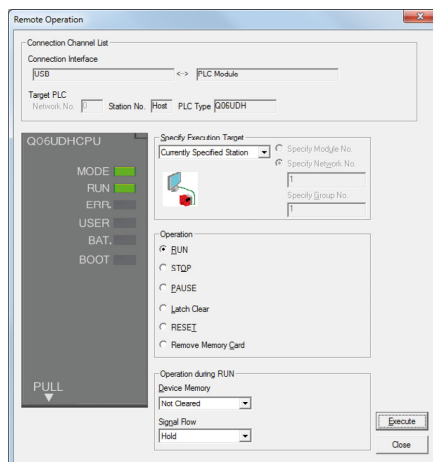
2) Select the operating status to be executed from the "Operation" list box and click the "Execute" button.

*: Remote latch clear can be executed only when the CPU is in the STOP state.

(2) Remote RESET
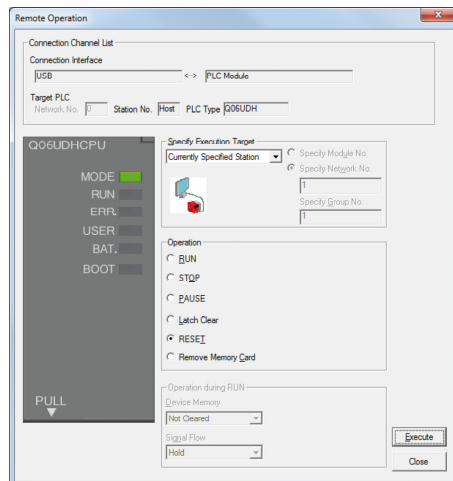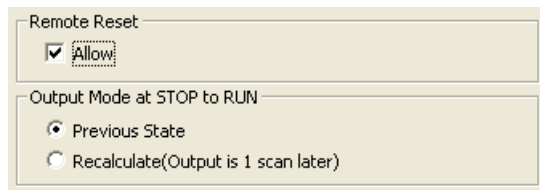
1) Double-click "Parameter" → "PLC parameter" in the project data list.

2) Place a checkmark in the checkbox "Remote Reset" on the "PLC System Setting" tab to permit remote reset operation.

3) Write the parameter to the programmable controller using the "Write to PLC" function to reset.

4) Select "RESET" from the "Operation" list box and click the "Execute" button.

*: Remote RESET clear can be executed only when the CPU is in the STOP state.

6.12.13 Training 13 Forced On/Off Function for External I/O

Select [Debug] → [Modify Value] on GX Works2 to forcibly turn ON/OFF external input and output.
Registered forced ON and OFF information can be cleared by operation on GX Works2.

* Alternatively, selecting [Debug] → [Forced Input and Output Registration/Clear] to forcibly turn ON/OFF external input and output.

Behaviors of devices at forced ON/OFF
Forced ON/OFF registration allows forced ON (Register Forced ON), forced OFF (Register Forced OFF), and clear of forced ON/OFF (Clear Registration).
The behaviors of devices at forced ON, forced OFF, clear of forced ON/OFF are shown below.

Operation	Behavior of input (X)	Behavior of output (Y)
At clear (no operation)	Executes operations of sequence programs by external input.	Externally outputs operation results of sequence programs.
ON	Processes operations of sequence programs in the forced ON status.	Externally outputs "ON" regardless of operation results of sequence programs.
OFF	Processes operations of sequence programs in the forced OFF status.	Externally outputs "OFF" regardless of operation results of sequence programs.

The behaviors of devices forcibly turned ON/OFF are shown below.
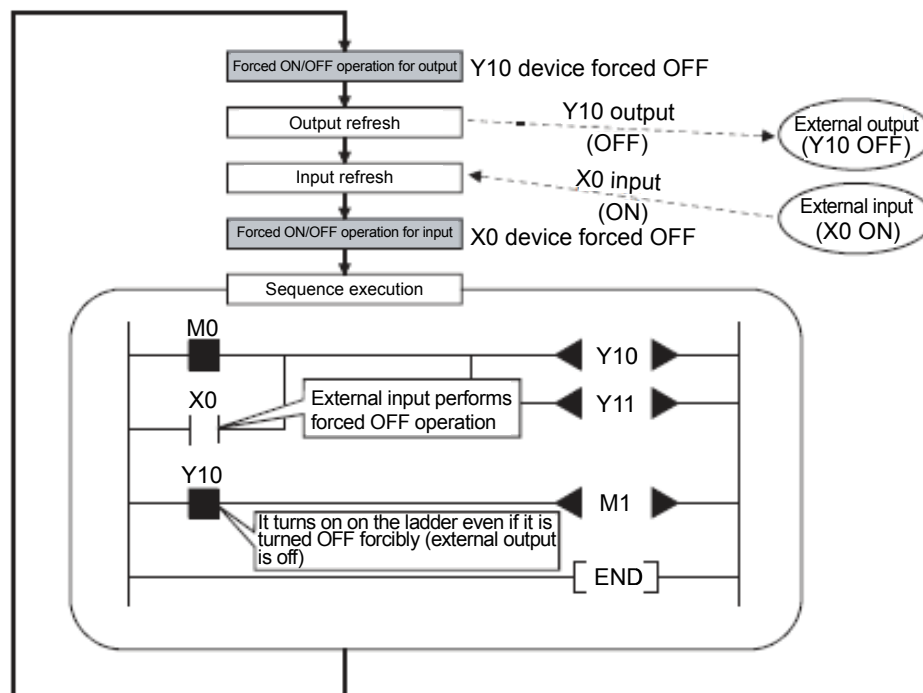
Checking the forced ON/OFF and clear status

The statuses of forced ON/OFF and ON/OFF inversion can be checked on GX Works2.

When at least one device is registered in "Forced Input Output Registration/Clear", the status can be checked by the MODE LED. (The MODE LED flashes.)

In the case of Universal model QCPU, the status can be checked by a special register (SD849).

Forced ON/OFF registrations can be cleared by any of the following operations.

- Power-on → Power-off
- Reset by RESET/L.CLR switch or RUN/STOP/RESET switch of the CPU module
- Reset by remote reset operation

```
 X0D    X0E
 ─┤├────┤/├───────────────────────────────────────(Y78  )
 Y78
 ─┤├──┘

 X0F
 ─┤├──────────────────────────────────────────────(Y79  )
         T10                                          K50
      ┌──┤/├───────────────────────────────────────(T10  )
```

(1) Setting

- [[PRG]Read MAIN (Read Only) 1 Step]

Debug   Diagnostics   Tool   Window   Help

　Start/Stop Simulation

　Instructions Unsupported by Simulation

　Modify Value...

　Forced Input Output Registration/Cancellation...

　Device Test with Execution Condition　▶

　Sampling Trace　▶

　Scan Time Measurement...

　Step Execution　▶

　Break Setting　▶
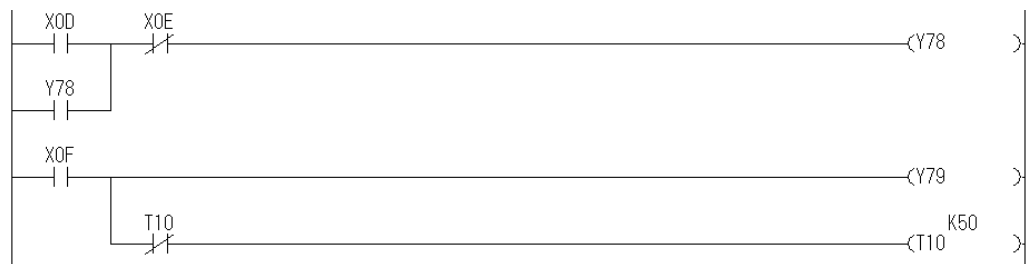
　Skip Setting　▶
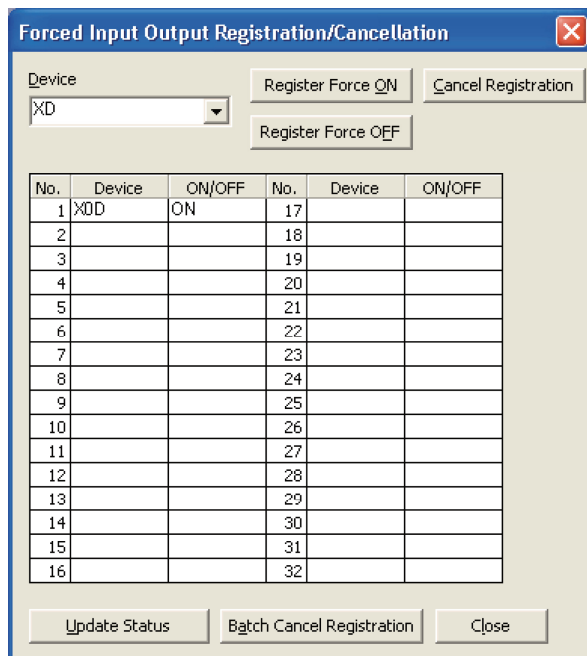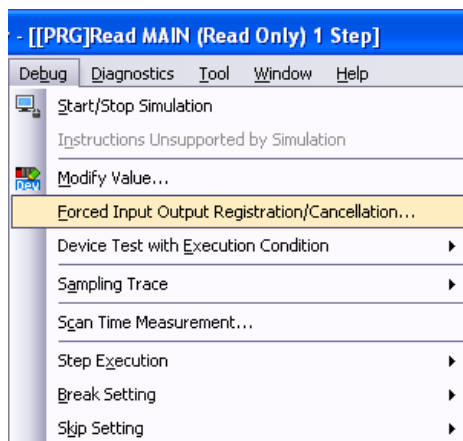
1) Switch GX Works2 to the monitoring mode.

2) Click "Debug" → "Forced Input Output Registration/Cancellation" on the menu bar.

Forced Input Output Registration/Cancellation

Device
XD

[Register Force ON]   [Cancel Registration]

[Register Force OFF]

No.	Device	ON/OFF	No.	Device	ON/OFF
1	X0D	ON	17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		
16			32		

[Update Status]   [Batch Cancel Registration]   [Close]

3) Input "XD" in the Device field and click the "Register Forced ON" button.

The device XD is in ON status regardless of ON/OFF status of the external input XD.

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Forced Input Output Registration/Cancellation

Device
Y79

Register Force ON   Cancel Registration
Register Force OFF

No.	Device	ON/OFF	No.	Device	ON/OFF
1	X0D	ON	17		
2	Y79	ON	18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		
16			32		

Update Status   Batch Cancel Registration   Close

4) Input "Y79" in the Device field and click the "Register Forced ON" button.

The device Y79 is in ON status regardless of operation result of the device Y79.

Forced Input Output Registration/Cancellation

Device

Register Force ON   Cancel Registration
Register Force OFF

No.	Device	ON/OFF	No.	Device	ON/OFF
1			17		
2			18		
3			19		
4			20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		
16			32		

Update Status   Batch Cancel Registration   Close

5) Check that the MODE LED of the CPU is flashing.

6) Click the "Batch Clear Registration" button.

7) Check that the MODE LED of the CPU is turned ON.

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6.12.14 Sequence Program

Sequence program

Operation failure due to duplicated coil

```
          X2
    0 ────┤ ├──────────────────────────────────────────────(M0   )

          X3
   18 ────┤ ├──────────────────────────────────────────────(M1   )

          M0
   20 ────┤ ├──┬───────────────────────────────────────────(Y70  )
          M1  │
        ──┤ ├──┘
```

Jump destination error in use of CJ instruction

```
          X4
   23 ────┤ ├─────────────────────────────────────[CJ      P3    ]

          X5
   41 ────┤ ├──────────────────────────────────────────────(Y71  )

P3        X6
   43 ────┤ ├──────────────────────────────────────────────(Y72  )
```

BCD code error

```
   46 ─[<=    K1X20    K9  ]─[<=    K1X24    K9  ]─[<=    K1X28    K9  ]─K0 →

   ─K0 →─[<=    K1X2C    K9  ]──────────────────[BIN     K4X20    D1    ]
```

BCD instruction error to minus data

```
          X7
   71 ────┤ ├──┬─────────────────────────────────[MOVP    D1      D2    ]
             │
             │  X8
             ├──┤ ├───────────────────────[-P      D2      K10     D2    ]
             │
             └─[<=    K0      D2  ]────────────────[BCD     D2      K4Y40 ]
```

How to use failure detection annunciators (F)

```
          SM52
  105 ────┤ ├──────────────────────────────────────────────(F1   )

          X9
  129 ────┤ ├──────────────────────────────────────────────(F2   )

          X0A
  132 ────┤ ├──────────────────────────────────────────────(F3   )

          SM400
  135 ────┤ ├─────────────────────────────────────[BCD     SD63    K2Y50 ]

          X0
  139 ────┤ ├─────────────────────────────────────────────[LEDR   ]
```

Operation mode setting when there is an error

```
          X0B
  141 ────┤ ├─────────────────────────────────────[BIN     K4X30   D100  ]
```

Sequence program

Error check and error clean from a program using SM and SD

```
       SM400
159  ───┤ ├─────────────────────────────────────────────[BCD    SD0      K4Y60   ]

       X0C
190  ───┤ ├─────────────────────────────────────────────[MOVP   SD0      SD50    ]
              │
              └──────────────────────────────────────────────────────────(SM50   )

       SM400
194  ───┤ ├──────────────────────────────────────────────────────────────(SM722  )
```

Forced ON/OFF function for external I/O

```
       X0D     X0E
196  ───┤ ├─────┤/├────────────────────────────────────────────────────────(Y78   )
       Y78   │
     ───┤ ├──┘

       X0F
213  ───┤ ├──────────────────────────────────────────────────────────────(Y79   )
              │                                                       K50
              │   T10
              └───┤/├──────────────────────────────────────────────────(T10   )

220  ──────────────────────────────────────────────────────────────────[END    ]
```
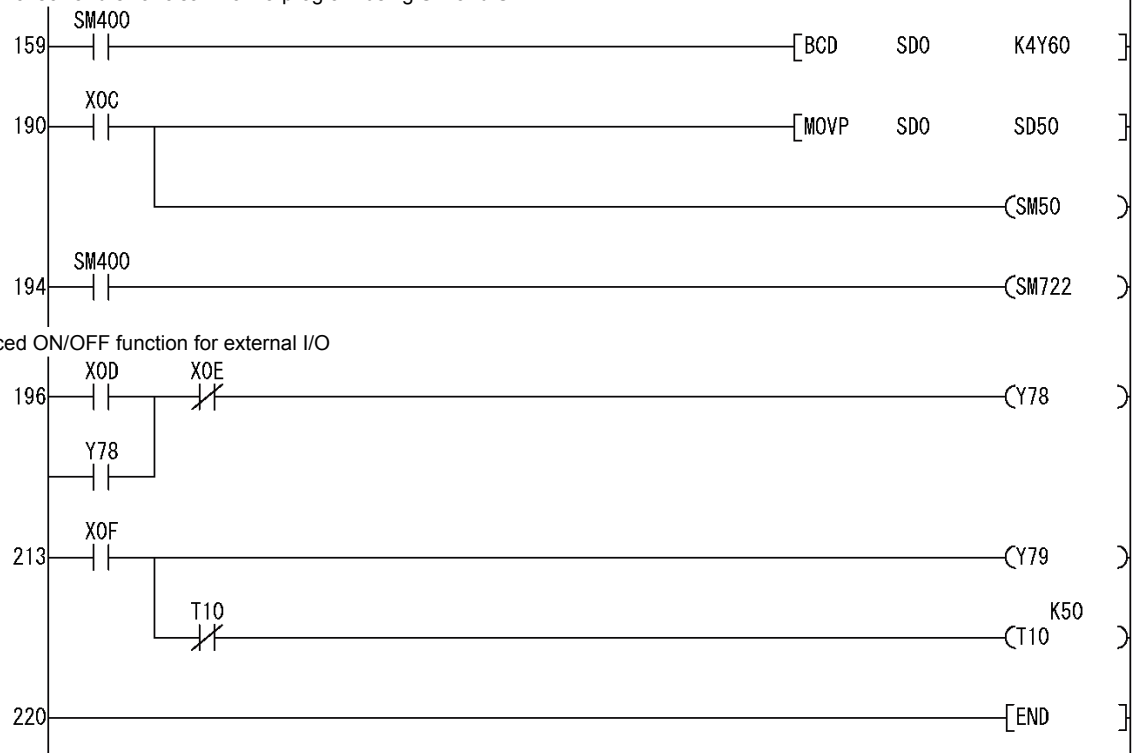
Chapter 7 Improvement Maintenance

In order to improve serviceability of production systems, it is necessary to reduce deterioration of equipment and make maintenance work easier.

7.1 Equipment Serviceability Improvement

(1) Improvement for reducing deterioration of equipment
1) Review the working environment and carry out improvements such as provision of ventilation and air-conditioning so that the equipment does not deteriorate abnormally.
2) Carry out improvements for preventing abnormal deterioration of equipment by taking dust-proof, moisture-proof, and anti-vibration measures.
3) Replace any equipment estimated to deteriorate faster with ones with higher durability.

(2) Carry out improvement to make repair easier
1) Improve the equipment structure.
2) Carry out improvements to secure a repair space.
3) Change to products that can be easily repaired.

(3) Change to products with fewer failures
(1) Change to products with a low failure rate and high reliability.

7.2 Improving Automatic Detection of Equipment Failure

(1) Detection with sequence programs
Change sequence programs so that equipment failures can be detected automatically.

<Program example>
When an LS configured at the limit end is a normally closed contact, an equipment failure is automatically detected with the following ladder because the forward end LS and the backward end LS cannot be non-conductive at the same time.
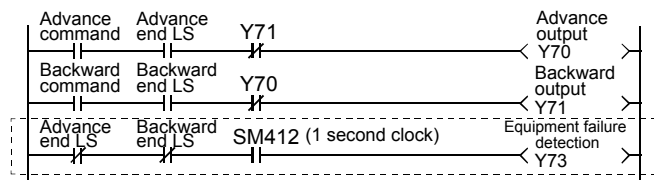
7.3 Enhanced Condition Monitoring-based Maintenance

This section introduces four examples that automatically display or notify of error definitions to improve the function always monitoring the status of the equipment controlled by the programmable controller.

Example 1 Displays detected error descriptions in a character message

Character display

Connect the GOT to the programmable controller and display a message corresponding to detected error descriptions.

Messages registered in advance are displayed for each error detection signal and error code number.
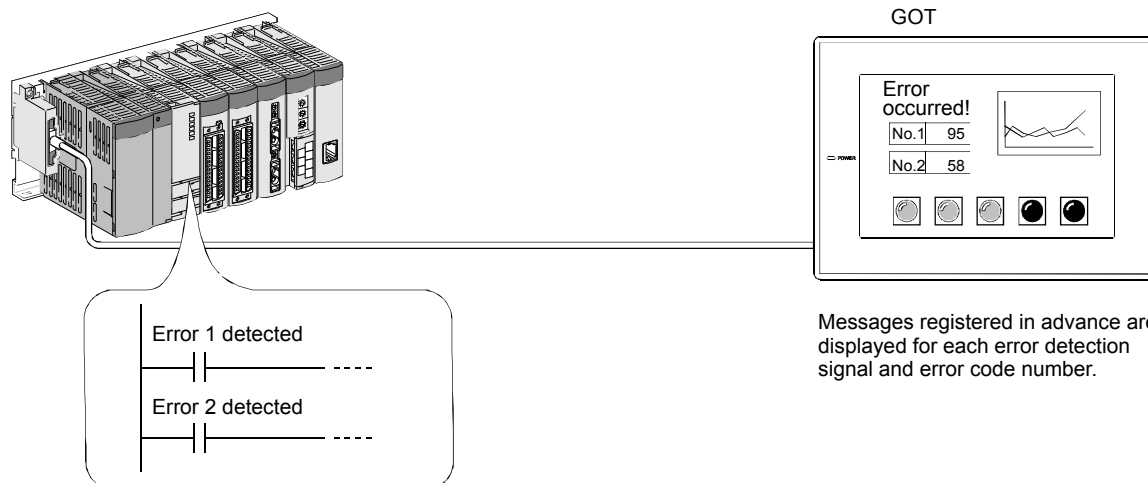
Example 2 Announces voice message of detected error descriptions

Voice announcement

Connect the GOT to the programmable controller and announce voice messages, etc. that have been prerecoded using a microphone from a speaker when an error is detected. (A voice output module and external amplifier speaker are separately required.)

Messages registered in advance are announced from a speaker for each error detection signal and error code number.
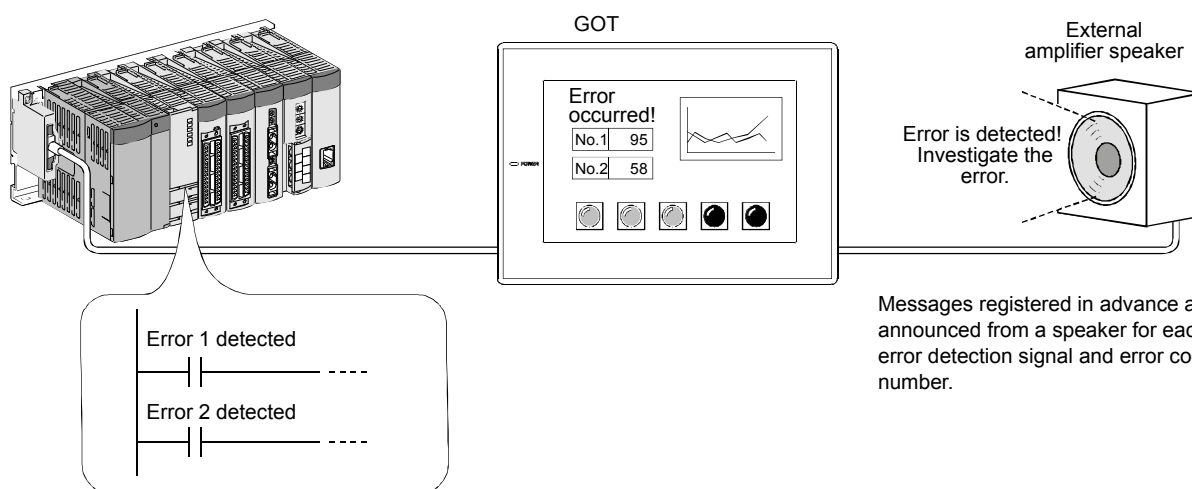
Example 3 Prints out detected error descriptions

| Printing |

Connect a printer to a programmable controller unit that enables the print output and print out error messages and error times.

Error detection

Program to print out a message

A message is printed out

Printer

Fuse blown
'04-04-01
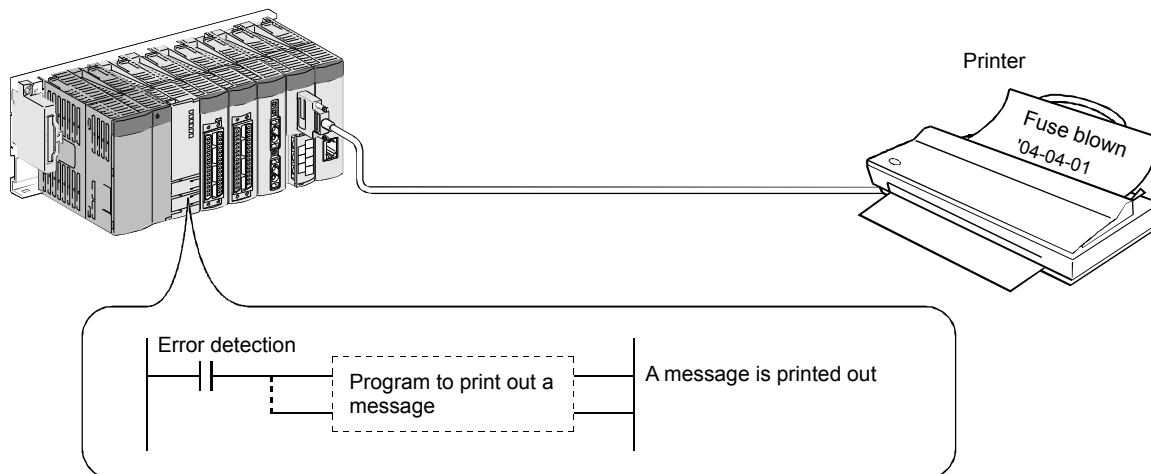
The MELSEC-Q offers various types of intelligent function modules and GOTs that can be connected to a printer.

Modules that enable the print output	Printer type
QJ71C24(N) serial communication QJ71C24(N)-R2 serial communication QD51 serial communication QD51-R24 intelligent communication	RS-232C compliant
GOT1000 series (GT15-PRN)	PictBridge-compatible printer

Example 4 Sends detected error descriptions by email

E-mail

Connect an Internet connectable network cable to the Web server module of the programmable controller and send detected error contents to cellular phones and personal computers by e-mail.

E-mail is sent when an error is detected

Internet

Error is detected! The temperature has become higher than the specified value.

A web server module monitors collected data
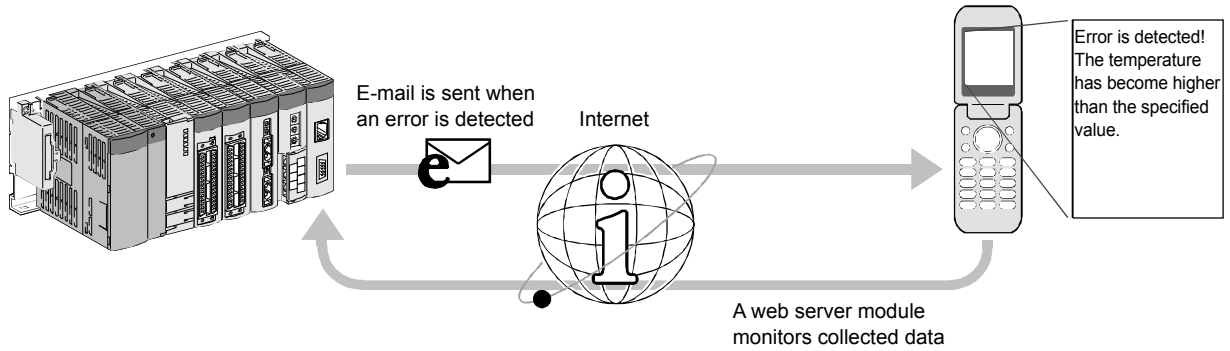
It is also possible to monitor device data, etc. collected by the Web server module on the cellular phones and personal computers via the Internet.

Chapter 8 Reviewing Installation Environment

8.1 Environment

Install the programmable controller while avoiding the following environments:
- (1) Location where the ambient temperature (for a panel, in-panel temperature) exceeds the range of 0 to 55°C
- (2) Location where the ambient humidity exceeds the range of 5 to 95% RH
- (3) Location where a sudden change in temperature causes condensation
- (4) Location where there is corrosive gases or combustible gases
- (5) Location where there are many or much conductive powders such as dust and iron powders, oil mist, sodium, or organic solvent(s)
- (6) Location which receives direct sunlight
- (7) Location where a high electric or magnetic field is generated
- (8) Location where a vibration or shock can be transmitted directly to the main unit

8.2 Electrical Environment

- (1) The fluctuation range of power supply 100 V AC or 200 V AC shall be within a range of -15% to +10%.
  (For 24 V DC (Q63P), it shall be within a range of -35% to +30%.)
- (2) Instantaneous power failure
  If it lasts for 20 ms or shorter, the operation can continue.
  (For 24 V DC (Q63P), if it lasts for 10 ms or shorter, the operation can continue.)
- (3) Power supply waveform distortion
  It shall be a sine wave and its distortion rate shall be within 5%. Take heed of an electric power capacitor and rectifier.
- (4) Wire it as far from a power cable and large-current wire as possible.
  The distance when they are placed in parallel shall be 100 mm or more.
- (5) Do not place it in a panel containing a noise generating equipment, too.
  Install a high frequency equipment, inverter, and electric discharge machine in a separate panel as far as possible. Separate the wiring.
- (6) Install it as far from the equipment generating an arc when it is opened and closed, such as an electromagnetic contactor and breaker, as possible.

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Figure 8-1 Layout in the Control Panel
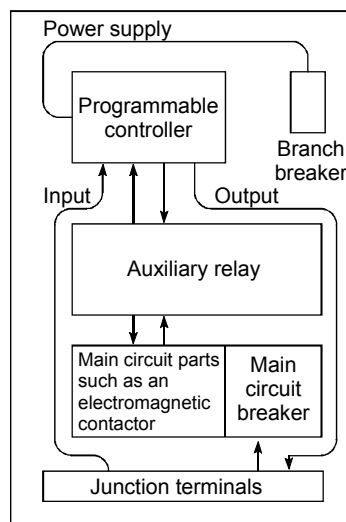
8.3 Mounting Condition

This section describes the installation precautions and installation position of the programmable controller.

When installing a programmable controller in a panel, fully consider the usability, maintainability, and environmental resistance.

(1) Module mounting position

To improve the ventilation and facilitate the module replacement, maintain the following distance between the top/bottom of the module and the structure or parts.

(a) For the main base unit and extension base unit
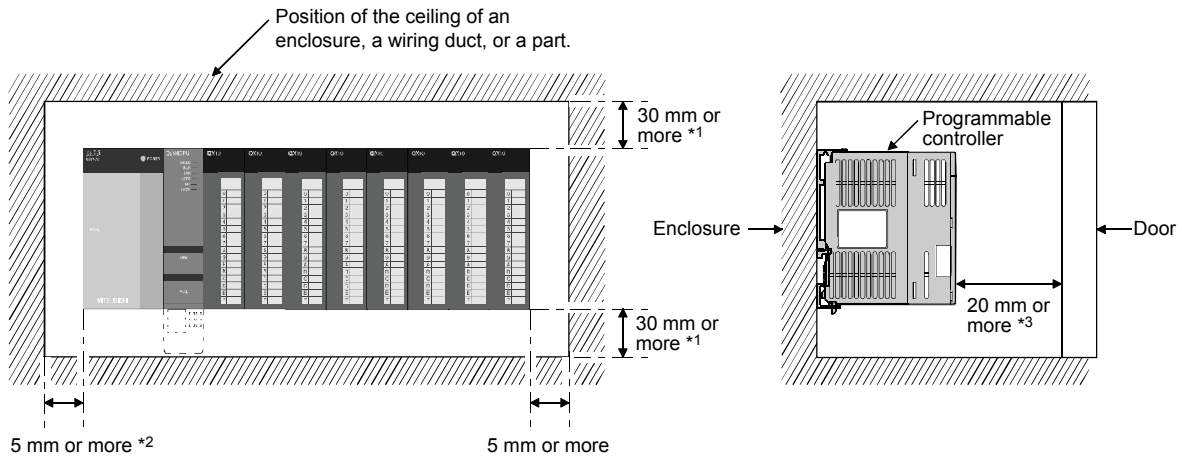
*1: This applies if the height of the wiring duct is 50 mm or lower. Otherwise, the distance shall be 40 mm or more.

*2: When mounting an extension cable without removing an adjacent module, the distance shall be 20 mm or more.

*3: For the connector type, the distance shall be 80 mm or more.

For a network module, maintain the distance considering the F-type connector or cable bending radii.

(b) For the slim type main base unit
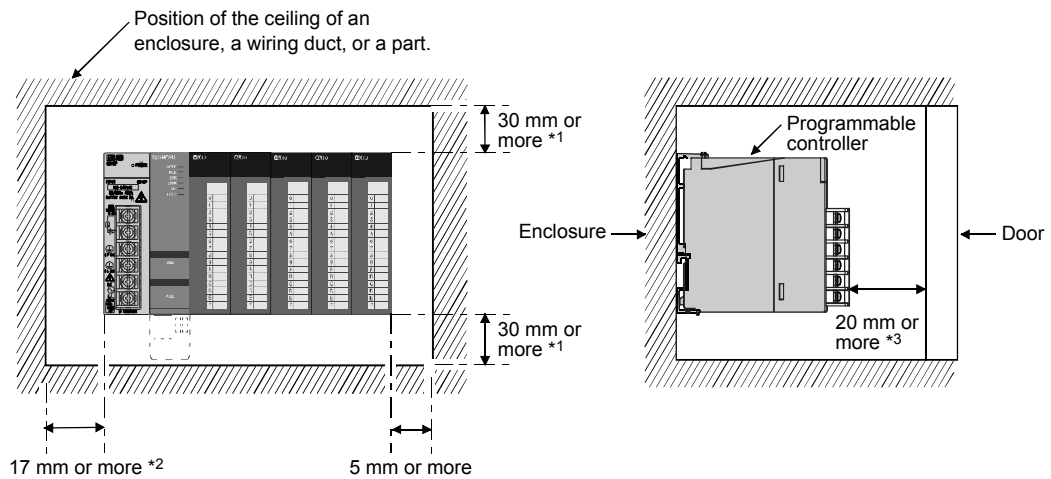
Position of the ceiling of an enclosure, a wiring duct, or a part.

30 mm or more *1

30 mm or more *1

17 mm or more *2

5 mm or more

Programmable controller

Enclosure

Door

20 mm or more *3

*1: This applies if the height of the wiring duct is 50 mm or lower. Otherwise, the distance shall be 40 mm or more.

*2: The slim type main base unit will have the wiring of the power supply module come out from the left end of the module. To reserve wiring space, install the unit apart from the end by 17 mm or more. Additionally, if the structure, equipment, or part on the left side of the unit can damage the coating of electric wires, protect them with insulators such as a spiral tube.

*3: For the connector type, the distance shall be 80 mm or more.
For a network module, maintain the distance considering the F-type connector or cable bending radii.

(2) Module mounting direction
(a) For heat dissipation, use the programmable controller in the mounting direction shown in the following figure, which ventilates the controller well.
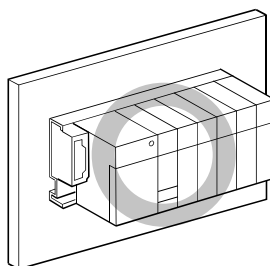
(b) Do not use the module in the mounting direction in the following figure.
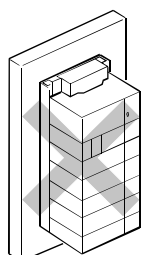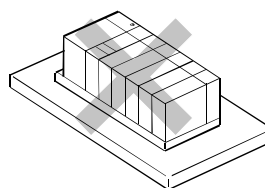
Vertical mounting   Horizontal mounting

8 - 3

(3) Installation surface

Install the base unit on a flat surface.

The uneven installation surface will apply an excessive force to the printed-circuit board, causing trouble.

(4) Coexistence with other equipment

Avoid the co-existence with sources of vibration such as a large electromagnetic contactor and fuse circuit breaker, and install the base unit in another panel or apart from them.

(5) Distances from other instruments

To avoid the impact of radiation noise and heat, maintain the following distance between the programmable controller and instruments (contactors and relays).

• From instruments mounted on the front side of the programmable controller: 100 mm or more

• From instruments mounted on the right and left sides of the programmable controller: 50 mm or more

100 mm or more

Conductor, relay, etc.

50 mm or more

50 mm or more
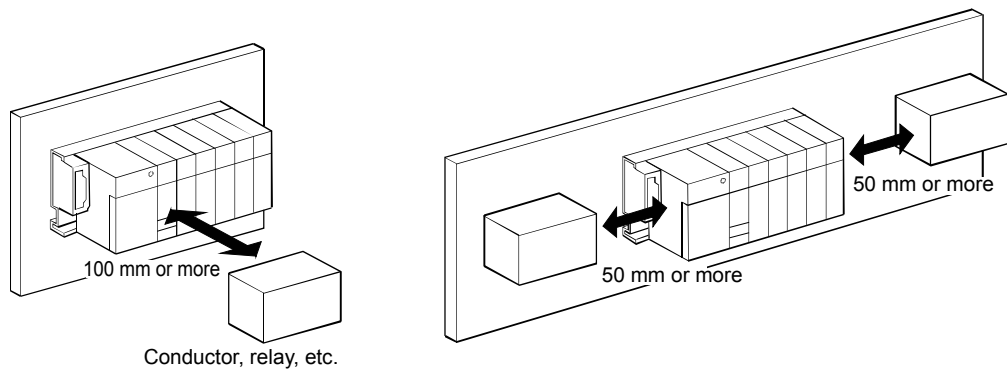
8.4 Wiring

8.4.1 Wiring Precautions

⚠ WARNING	● Be sure to switch off all phases of the external power supply used by the system before wiring work. Failure to do so may cause electric shock or damage the product. ● When turning on the power and operating the module after wiring is completed, always attach the enclosed terminal cover. The absence of the terminal cover can cause electric shock.

⚠ CAUTION	● Be sure to ground the FG and LG terminals of the programmable controller with the ground resistance of 100Ω or less for the exclusive use. Failure to do so may cause electric shock or malfunction. ● Before wiring the module, confirm the rated voltage and terminal layout of the product to wire correctly. Input of voltage or connection to a power supply with different ratings, or incorrect wiring of them may cause fire or failure. ● Crimp or solder external connectors correctly using tools specified by the manufacturer. Incomplete connection may cause short-circuit, fire, or malfunction. ● Tighten the terminal screws within the specified torque range. A terminal screw that has been tightened too loosely may cause short-circuit, fire, or malfunction. A terminal screw that has been tightened too tightly may cause a drop, short-circuit, or malfunction due to the screw or module breakage. ● Be careful to prevent foreign matter such as sawdust or wiring chips from entering the module. Failure to do so may cause fire, failure, or malfunction. ● The top surface of the module is covered with protective film to prevent foreign matter such as wiring chips from entering the module when wiring. Do not remove this film during wiring. Before operating the system, be sure to remove this film to dissipate heat.

The following description is of the precautions for wiring power cables.

(1) Wiring the power supply
    (a) Wire the programmable controller power supply, I/O equipment, and motor equipment in different systems as follows:
        When there are many noises, connect an isolation transformer.
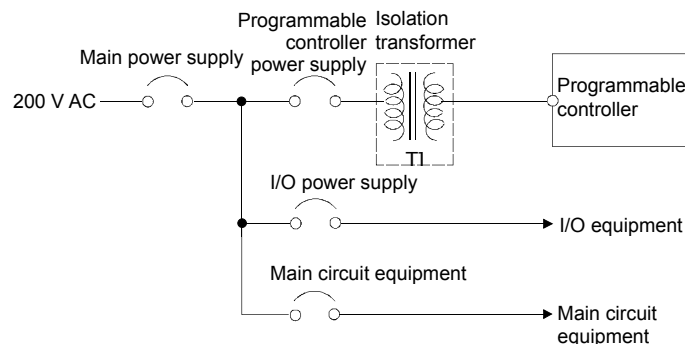
(b) Do not connect the 24 V DC outputs of multiple power supply modules in parallel to supply the outputs to one I/O module.
Parallel connection may break down the power supply module.
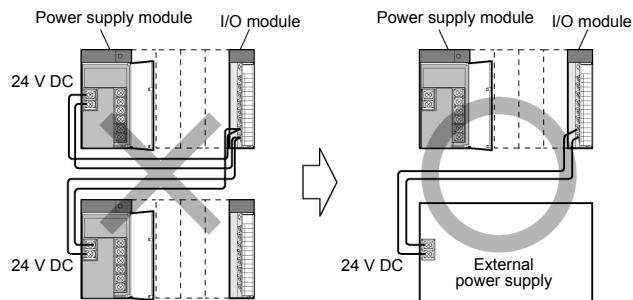
(c) Twist 100 V AC wire, 200 V AC wire, and 24 V DC wire as closely as possible, and use them to connect modules in the shortest distance.
Also, use as thick a wire (MAX. 2 mm^2) as possible to lessen the voltage drop.

(d) Do no bundle or adjacently place the100 V AC wire and 24 V DC wire with the main circuit (high voltage, large current) wire and I/O signal line. Keep a distance of approximately 100 mm or more between them.

(e) As a measure against surge for lightening, connect the surge absorber for lightening as shown in the following figure.
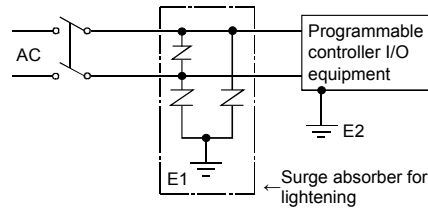
POINT

(1) Separately ground the surge absorber for lightening (E1) and the programmable controller (E2).

(2) Select a surge absorber for lightening that would not exceed its maximum allowable circuit voltage even when line voltage is maximum.

---

(2) Wiring the I/O equipment

    (a) The solderless terminal with an insulation sleeve cannot be used in the terminal block.

        It is recommended to put a mark tube or insulation tube on the cable connection part of a solderless terminal.

    (b) For a cable connected to the terminal block, use a cable having a core of 0.3 mm^2 to 0.75 mm^2 and outer diameter of 2.8mm or less.

    (c) Set up a wiring route separately from the I/O cables and output cables.

    (d) When those cables cannot be separated from the main circuit line or power cable, use the batch shield cable and ground it on the programmable controller side.

        However, in some cases, ground it on the opposite side.
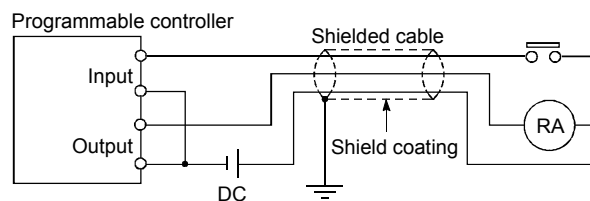
    (e) When piping and wiring, ground the pipes securely.

    (f) Separate the 24 V DC input wire from the 100/200 V AC wires.

    (g) The long distance wiring of 200 m or more causes trouble caused by a leakage current due to the line capacity.

    (h) Provide a means of using a switch to individually disconnect an external power supply of a module relevant for the online module change, in order to avoid electric shock or malfunction of an operating module.

(3) Grounding

For grounding, perform steps (a) to (c) below:

    (a) Use the independent grounding as much as possible.

        Ground with the grounding resistance of 100 Ω or less.

    (b) If the independent grounding cannot be performed, conduct "(2) Shared grounding" in the following figure.
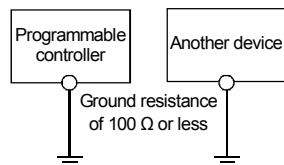
(1) Independent grounding......Ideal   (2) Shared grounding......Acceptable   (3) Common grounding......Not acceptable
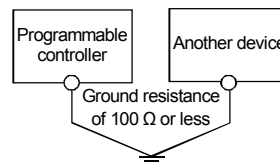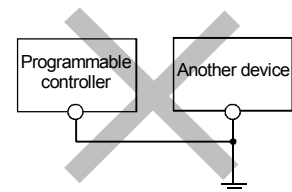
    (c) Use cables with a cross-sectional area of 2 mm^2 or thicker for grounding.

        Set the grounding point as close to this programmable controller as possible, and shorten the length of the ground cable.

8.4.2 Wiring Power Supply Module

This section illustrates wiring examples of the power cables and ground cables, etc. used to connect the main base unit and extension base unit.

(1) For a stand-alone power system
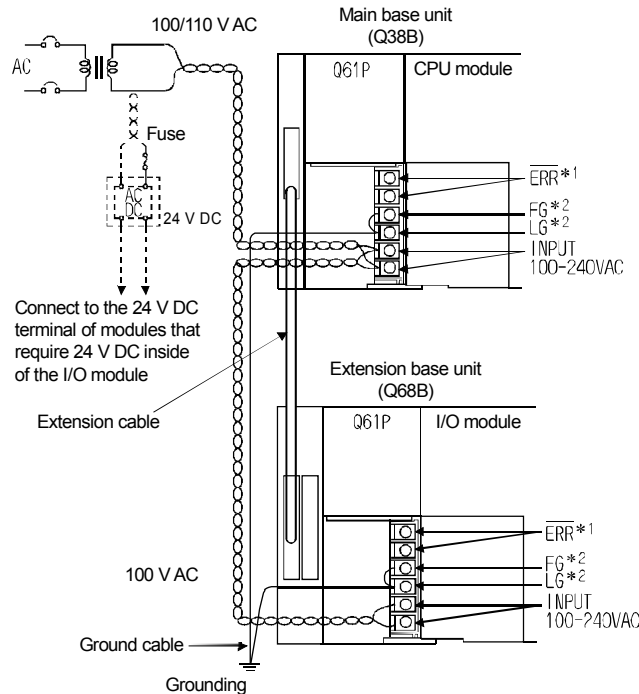
*1: The following is the operation of the $\overline{ERR}$ terminal.
   <When a power supply module is mounted to a main base unit>
   It turns OFF (opens) when an AC power is not supplied, when a CPU module stop error (including reset) occurs, or when the fuse of the power supply module is blown.
   <When a power supply module is mounted to a extension base unit>
   It is alway OFF (open).
*2: Short-circuit between the LG and FG terminals using a ground cable as thick and short as possible (Ø2 mm), and ground it.

POINT

(1) The power cables for 100/200 V AC and 24 V DC shall be as thick cables as possible (a maximum of 2 mm^2) and shall be twisted from a cable connected terminal. For the terminal block wiring, be sure to use solderless terminals. Use the solderless terminal with an insulation sleeve that has a thickness of 0.8 mm or less in order to prevent short-circuit when screws get loosened. In addition, connect up to two solderless terminals for one terminal area.

Solderless terminal with an insulation sleeve   Terminal block
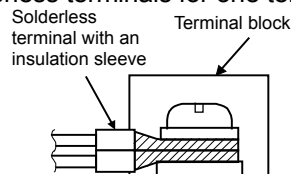
(2) If the LG terminal is connected to the FG terminal, do not forget to perform grounding. If the grounding is not performed, the system will be susceptible to noise. Because the LG terminal has half as high a potential as the input voltage, touching the terminal area may cause electric shock.

(3) The $\overline{ERR}$ terminal on the extension base unit cannot detect errors from the system. (The $\overline{ERR}$ terminal is always turned OFF.)

(2) For a redundant power supply system
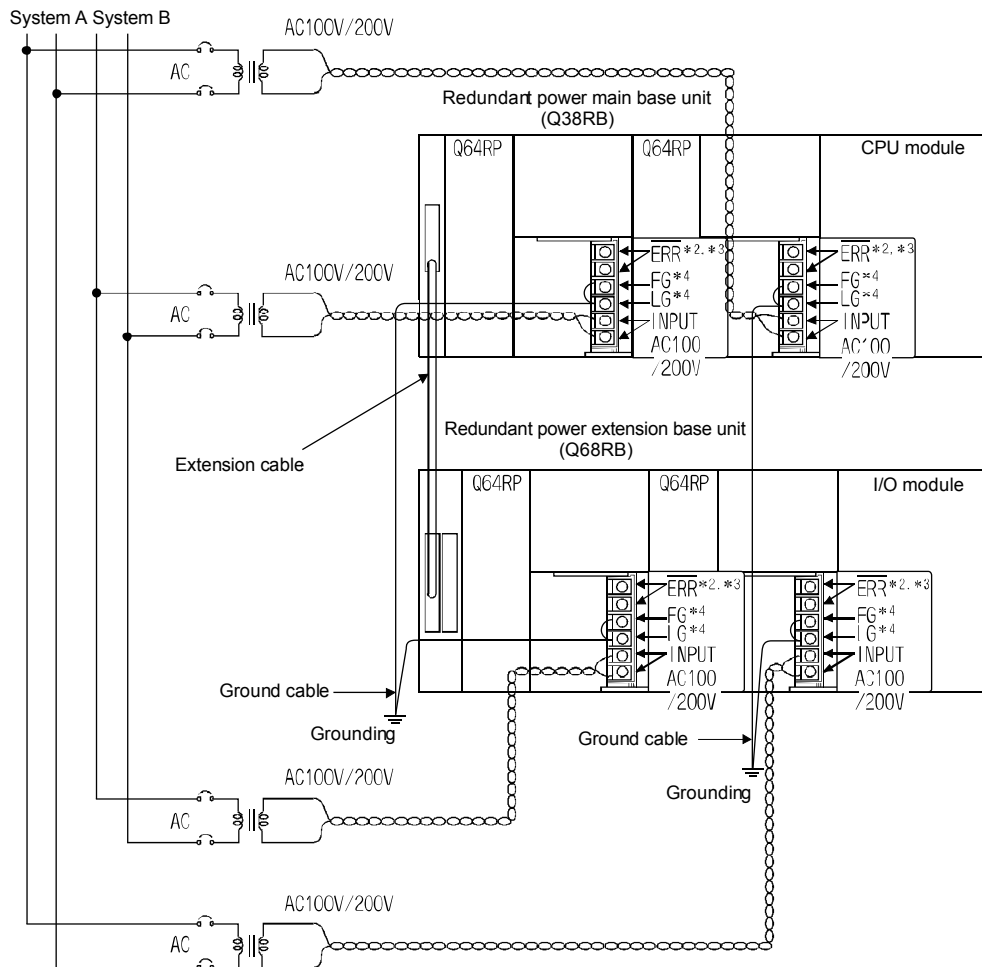
*2: The following is the operation of the $\overline{ERR}$ terminal.

<When a redundant power supply module is mounted to a redundant power main base unit>
It turns OFF (opens) when the AC power is not supplied, when a CPU module stop error (including reset) occurs, when the fuse of the redundant power supply module is blown, or when redundant power supply module failure occurs.

<When a redundant power supply module is mounted to a redundant power extension base unit>
It turns OFF (opens) when the AC power is not supplied, when the fuse of the redundant power supply module is blown, or when redundant power supply module failure occurs.

*3: When both input powers of the redundant power supply modules mounted on the redundant power main base unit and the redundant type extension base unit are supplied simultaneously, the ON (short-circuit) timing of the $\overline{ERR}$ terminal on the redundant power main base unit is delayed from that of the redundant type extension base unit by the time of the initial processing of the CPU module.

*4: Short-circuit between the LG and FG terminals using a ground cable as thick and short as possible (Ø2 mm), and ground it.

```
┌─────────────────────────────────────────────────────────────────────┐
│  ┌──────────┐                                                         │
│  │  POINT   │                                                         │
│  └──────────┘                                                         │
│                                                                       │
│  (1)  The power cables for 100/200 V AC and 24 V DC shall be as thick cables as
│       possible (a maximum of 2 mm²) and shall be twisted from a cable connected
│       terminal.
│       For the terminal block wiring, be sure to use solderless terminals.
│       Use the solderless terminal with an insulation sleeve that has a thickness of
│       0.8 mm or less in order to prevent short-circuit when screws get loosened.
│       In addition, connect up to two solderless terminals for one terminal area.
│
```


Solderless terminal with an insulation sleeve   Terminal block
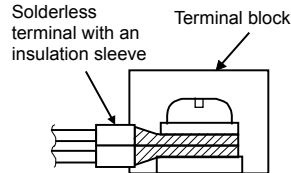
```
│  (2)  Supply the power to the redundant power supply modules via respective
│       systems (duplicate the power system).
│
│  (3)  If two redundant power supply modules (Q64RP) are operated in parallel as a
│       redundant power supply system, it is recommended to use one redundant
│       power supply module to input the AC power supply and the other to connect an
│       uninterruptible power supply (UPS).
│
│  (4)  If the LG terminal is connected to the FG terminal, do not forget to perform
│       grounding.
│       If the grounding is not performed, the system will be susceptible to noise.
│       Because LG terminal has half as high a potential as the input voltage, touching
│       the terminal area may cause electric shock.
└─────────────────────────────────────────────────────────────────────┘
```

Chapter 9 Measures against Noise

9.1 Common Mode Noise and Normal Mode Noise

The causes of troubles occurring while operating the programmable controller include malfunction and stop due to noise.

Measures against noise are essential to maintenance of the programmable controller.

In general, the common mode noise impacts the programmable controller more significantly than normal mode noise. This is because the normal mode noise is line noise that can be filtered out while the common mode noise depends on the floating capacitance that disables it to be easily filtered out. It is also because the measures against normal mode noise can be taken even by the user while common mode noise immunity is a feature that the manufacturer built in, which the user cannot take an effective measure against the actual programmable controller.

9.2 Common Mode Noise

The following figure illustrates the concept of common mode noise.
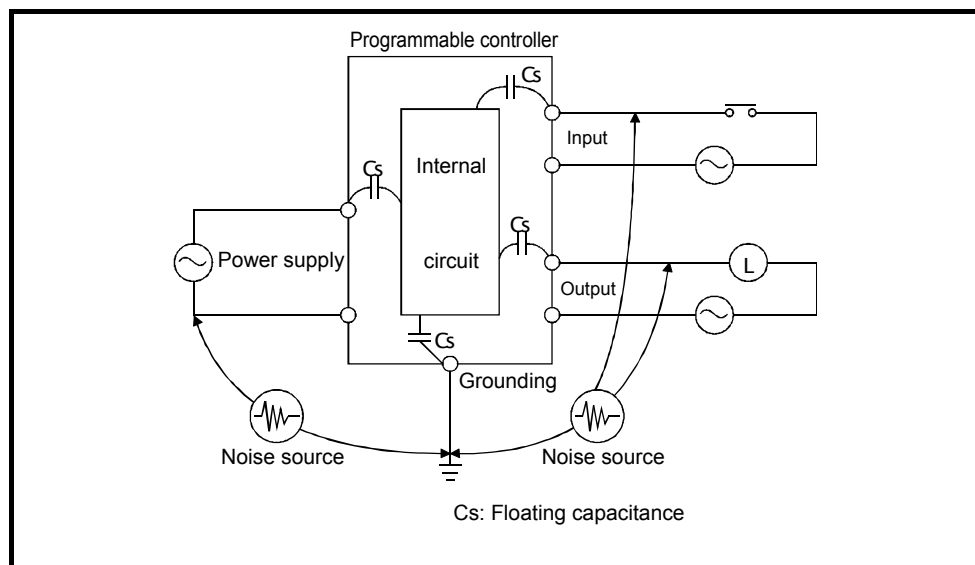
Figure 9-1 Common Mode Noise

Common mode noise may cause malfunctions when the internal circuit is affected by a potential different generated between the grounding (ground) and the power supply or the I/O signal wire due to noise induced from other wires to each wire, induced voltage with high potential, radio waves, or static electricity.

This is because the floating capacitance between each external signal and the internal circuit causes electric charge and discharge, resulting in sudden changes in the internal circuit voltage.

Programmable controllers with a metal case is said to be more susceptible to common mode noise due to floating capacitance Cs.

In addition, grounding is important because it is also a measure against common mode noise.

9

9.3 Normal Mode Noise

The following figure illustrates the idea of normal mode noise.
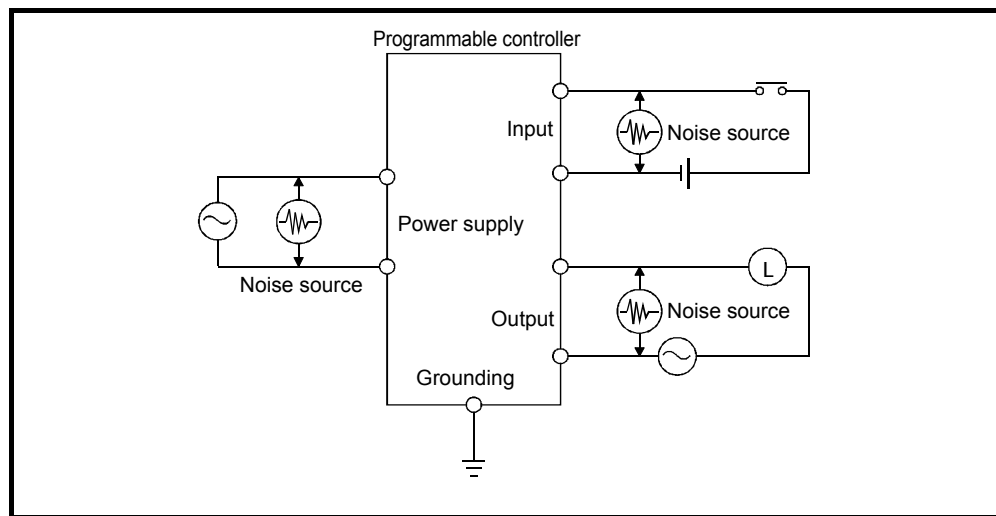
Figure 9-2 Normal mode noise

Most of normal mode noise is generated by the back EMF of inductive load applied to the power supply, input and output cables. For a power supply, normal mode noise is generated from the instrument connected to the power supply system. On the other hand, for an output cable, normal mode noise is generated from the instrument controlled by the programmable controller. All these noises are also referred to as line noises, too.

Consequently, the user can easily take measures against this noise such as suppressing it in the instrument generating the noise, filtering it out in the programmable controller, and installing a transformer and surge (noise) suppressor.

9.4 Measures against Noise in External Input Signal CableH

(1) When an inductive load is connected in parallel with the input module of a programmable controller, as in the following figure, connect a CR surge suppressor for alternating current input and a flywheel diode for direct current input, both in parallel with each load. Connect the surge suppressor as close to the inductive load as possible.
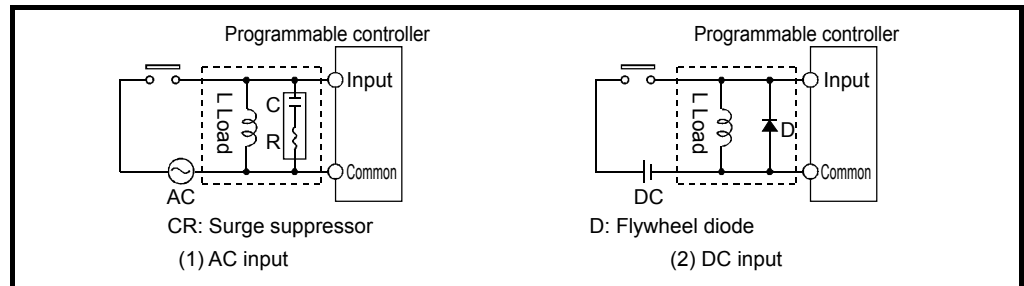
Figure 9-3 When There Is an Inductive Load in Parallel with Input

(2) In the following cases, take measures against induced voltages as in the figure below:
- When an external wiring is 200 m or more long
- When a built-in operation indication neon lamp or an opened contact of a limit switch generate a voltage because of the current of the neon lamp
- When an induced voltage is high for alternating current input signal
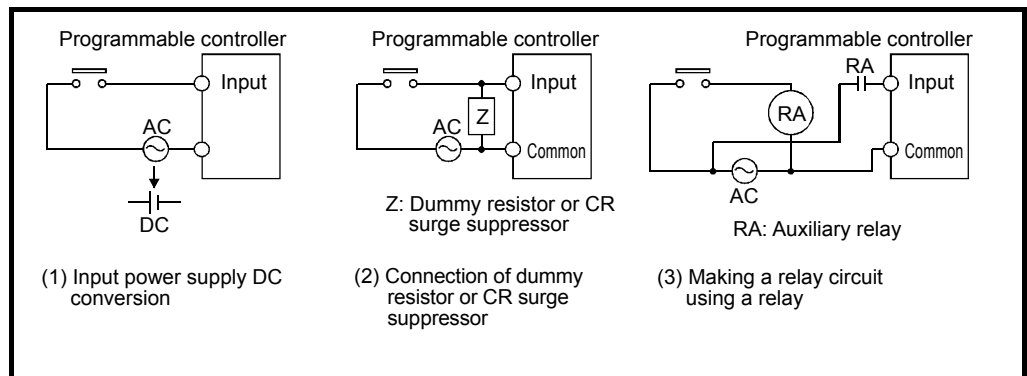
Figure 9-4 Measures against an Induced Voltage for Input

9.5 Measures against Noise in External Output Signal Cable

(1) For an inductive load for an alternating current, connect a CR surge suppressor to the both ends of the load, because noise is generated by an inrush current when an output signal is turned OFF and ON and by back EMF when the signal is turned ON and OFF and because arc noise is generated by a contact such as an electromagnetic contactor.
Use a CR surge suppressor with 0.5 μF + 47 Ω if its specifications are up to about 400 VA for 100/200 V AC. This CR surge suppressor will not be effective unless it is connected most close to the load.
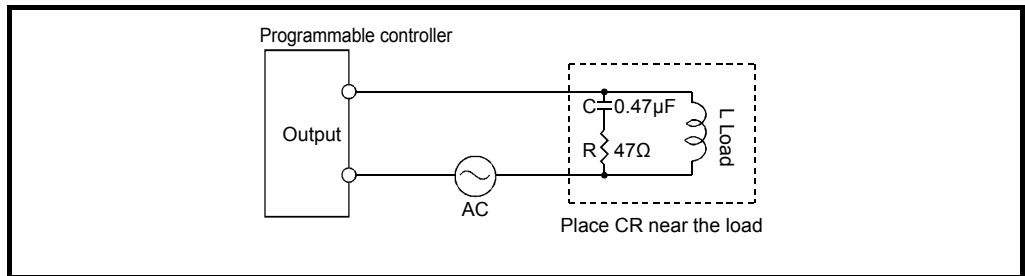
Figure 9-5 Measures against Noise in Alternate Current Inductive Load

(2) For a direct current inductive load, connect flywheel diodes across the load. Ensure to connect these diodes most close to the load. The diodes should have four or more times as high a reverse breakdown voltage as the load voltage.
Connecting flywheel diodes to the direct current inductive load causes the load operation to be delayed due to the current flowing through the diodes during shutdown. When this delay matters, connect a CR surge suppressor as in the alternate current measures described above.
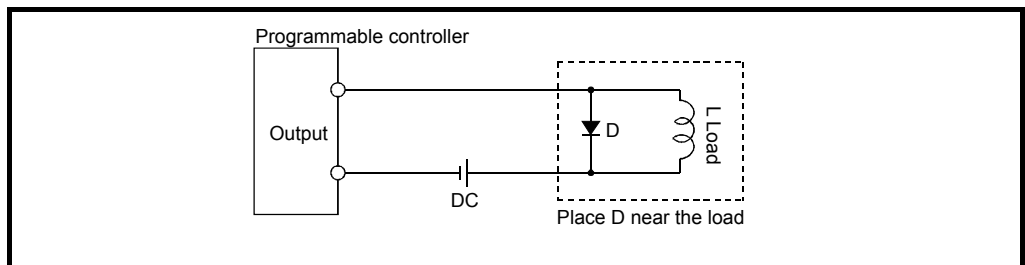
Figure 9-6 Measures against Noise in Direct Current Inductive Load

(3) When an external contact opens and closes a load connected to programmable controller output, ensure to take the measures in the following figure, whether or not the programmable controller provides measures against noise.
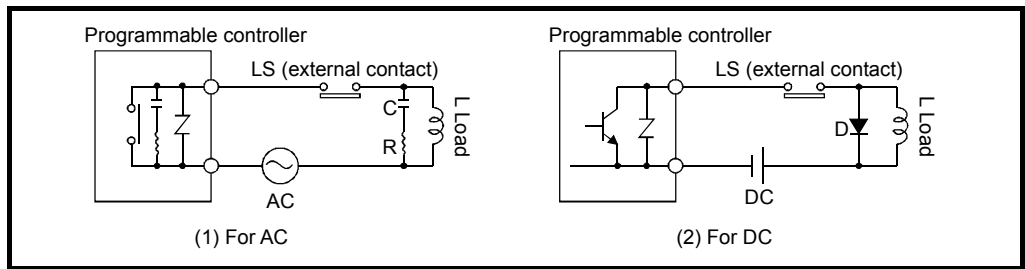
Figure 9-7 When an External Contact Opens and Closes a Load

(4) For an alternating current inductive load where a large amount of noise is generated during shutdown, effective will be the opening and closing of it at a triac that will be shut down by the load current.
(5) For arc noise when opening and closing the contact of an electromagnetic contactor, it would be effective to connect a CR surge suppressor across the contact. Note that, even when the contact is opened, the CR surge suppressor circuit causes a leakage current (part (A) in Figure 9-8).
(6) When the shutdown noise of a motor or transformer matters, connect a CR surge suppressor between phases (part (B) in Figure 9-8).
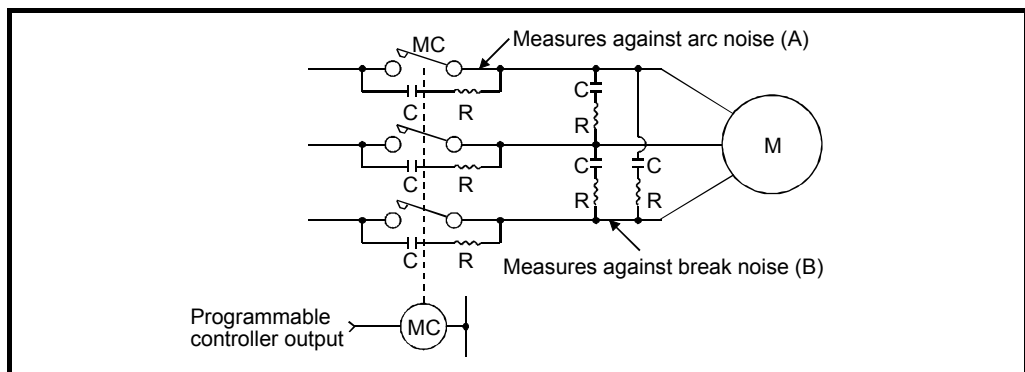
Figure 9-8 Measures against Noise in a High Capacity Load

(7) Relaying in a panel is also effective.
It is desirable to relay those specific outputs of a programmable controller which generate a large amount of noise.
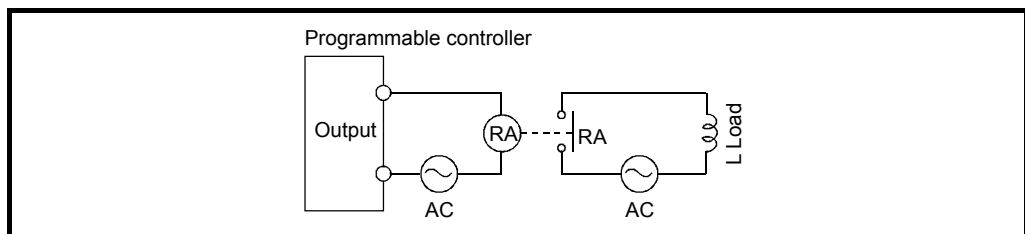
Figure 9-9 Relay-based Load Driving

9.6 Measures against Noise Troubles

When a control trouble occurs, if the following is the case, the possible cause would be an external noise.

Figure 9-1 Measures against Noise Troubles

(1) When noise is generated in sync with the behavior of a specific output equipment	1) Noise or surge from output equipment are considered as the major cause. When the instrument is turned ON and OFF, this trouble always or sometimes occurs and the programmable controller stops. In such cases, measures in Figure 9-5 and 9-6 are usually effective as measures against noise. A surge suppressor and diode are not effective unless they are connected most close to the load. Note that, for a high capacity load, take measures described in Figure 9-8. 2) Possible troubles occurring in sync with the behavior of the instrument include bad connection such as disconnection and slackness of an input cable and bad electrical contact of input equipment. Conduct an inspection thoroughly.
(2) When noise is generated in sync with the behavior of an instrument irrelevant for the programmable controller	1) Such noise is caused by noise or surge from another instrument. Thus, conduct the same measures as for item "(1)" above. 2) Try out measures such as grounding when using the instrument without grounding it and changing to non-grounding when using it by grounding it, set an I/O signal wire apart from the cable laying of the corresponding equipment, or consider the route.
(3) When noise occurs in applying a high capacity load	1) Possible causes include the reduction of the power supply voltage and the rise of the ground potential of shared grounding. If the power supply voltage is reduced to lower than the prescribed value when the load is applied, add a constant-voltage transformer in the power supply and change the power supply systems. 2) When grounding has been done, ungrounding may be an alternative measure.
(4) When the behavior of the programmable controller is unstable at random	1) Either in the event of frequent instantaneous power failures of the power supply, when the waveform is significantly poor, or when there are many power supply noises, it would be effective to add a constant-voltage or only an isolation transformer. 2) When there is impact of a high frequency equipment, ensure to ground the high frequency equipment and the programmable controller storage panel and shield the I/O signal wire of the programmable controller.
(5) When the induced voltage of an input is high	1) The programmable controller will not stop, resulting in false input causing faulty output. Even if the induced voltage is low, it is overlapped with noise, and results to false input. In that case, take the measures described in Figure 9-3.
(6) Others	1) Noise from the ignition system of a forklift: Occurs when a car passes by. 2) Noise affected by radio wave: Occurs when a door of the control panel is opened. 3) Noise generated by radio wave: Occurs when a transceiver or cellular phone are used.

The above measures taken against the noise troubles of the programmable controller should have been conducted when producing a panel or during external wiring construction, in order to reduce the costs. During a system is designed using a programmable controller, the designer should have considered which measure to take,
The designer also must check whether the taken measure is really effective when a trouble occurs, by reproducing the same trouble and omitting that measure.

9.7 Procedure for Noise Measurement

This section describes the measurement procedures of noise and items related to programmable controller power supply 100/200 V AC systems / 24/5 V DC systems.

Table 9-2 Noise Measurement of 100/200 V AC Systems

System	Type	Item	Measuring point	Key point	Measuring instrument	Judgment level	Actual measure-ment value	Check
100/200 V AC systems	Line	Voltage	Input terminals of programmable controller power supply module (e.g. Q61)	Must be within the input voltage range	Digital voltmeter	100 V system 85 to 132 V 200 V system 170 to 264 V		
		Waveform		Must be a waveform similar to a sine wave	Synchroscope Digital scope Memory high coder (for observing repeatedly) + high-pressure probe (for 200 V system and noise observation)	No fluctuation for 85 to 132 V of peak voltage Distortion factor must be 5% or less		
		Period		Must be successfully observed with waveforms stabilized, using the same trigger		Must be between 47.5 Hz and 63 Hz and have no significant fluctuation		
		Noise		No periodic or temporary noise must be observed		-1500 to 1500 V, 1 µs or less		
		Momentary power failure Momentary power sag		No momentary power failure/sag		20 ms or less		
	Against FG terminal	Waveform	One end (with higher voltage) of input terminal and FG terminal	Must be a waveform similar to a sine wave		No fluctuation for 85 to 132 V of peak voltage Distortion factor must be 5% or less		
		Noise		No periodic or temporary noise must be observed		-1500 to 1500 V, 1 µs or less		

Table 9-3 Noise Measurement of 24 V DC System

System	Type	Item	Measuring point	Key point	Measuring instrument	Judgment level	Actual measure-ment value	Check
24 V DC system	Line	Voltage	Input terminals of the module When unmeasurable, use junction terminals or power supply output terminals	Must be within the voltage range of the module	Digital volt-meter	For Q63P: 15.6 to 31.2 V For an I/O module: Example) QX41 10.2 to 26.4 V		
		Waveform		Must be within the voltage range of the module	Synchroscope Digital scope Memory high coder + high-pressure probe	Same as the judgment level of the voltage Must have little fluctuation		
		Noise		No periodic or temporary noise must be observed		-750 to 750 V, 1 µs or less		
		Rise Fall		Overshoot and undershoot when turned ON and OFF must be within the voltage range of the module		Same as the judgment level of the voltage		
		Momentary power failure Momentary power sag		No momentary power failure/sag		0 ms except for specifically disallowed modules		
	Against FG terminal	Waveform	Point of +24 V and against FG terminal	Must be within the voltage range of the module		Same as the judgment level of the voltage Must have little fluctuation		
		Noise		No periodic or temporary noise must be observed		+/-750 V, 1 µs or less		

Table 9-4 Noise Measurement of 5 V DC System

System	Type	Item	Measuring point	Key point	Measuring instrument	Judgment level	Actual measure-ment value	Check
5 V DC system	Line	Voltage	Base power supply Between slot and extension connector Between 5 V pin and SG pin	There is no significant voltage drop	Digital voltmeter Synchroscope	4.75 V to 5.25 V		
		Ripple		There is no significant ripple	Synchroscope Digital scope These should be accessed as needed Probe Within the AC range	300 mVpp or lower Refer to Figure 9-10		
		Spike		There is no significant spike		800 mVpp or lower Refer to Figure 9-10		

Table 9-5 Ground Noise Measurement

System	Type	Item	Measuring point	Key point	Measuring instrument	Judgment level	Actual measure-ment value	Check
Between SG-FG	-	Noise	FG terminal and SG terminal (GND side of measuring points for 5 V DC system)	Whether noise from FG terminal affects the inside of the programmable controller	Synchroscope /digital scope Memory high coder	10 Vpp or lower Even if lower than this, care must be taken if it is obviously noise		
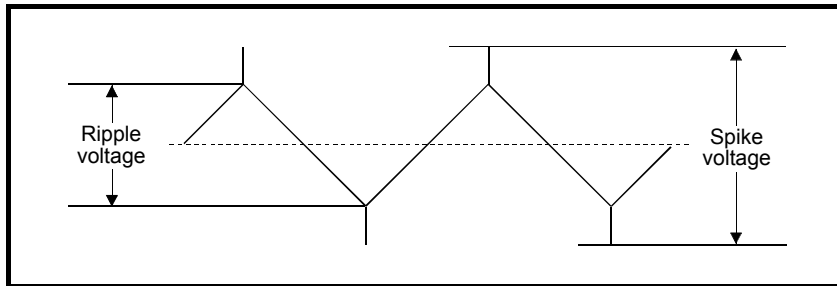
Figure 9-10 Ripple/Spike Waveforms

9.8 Solution Examples for Noise Troubles
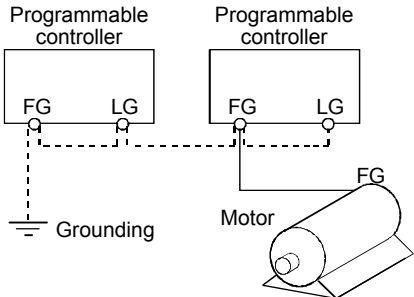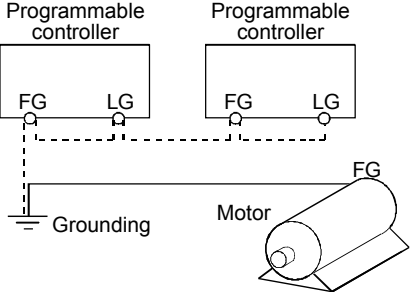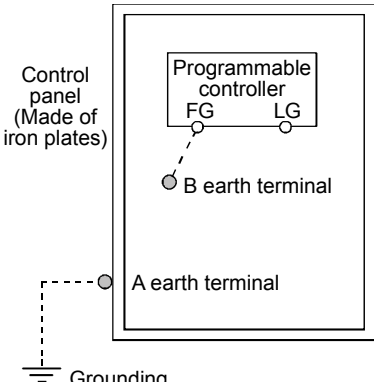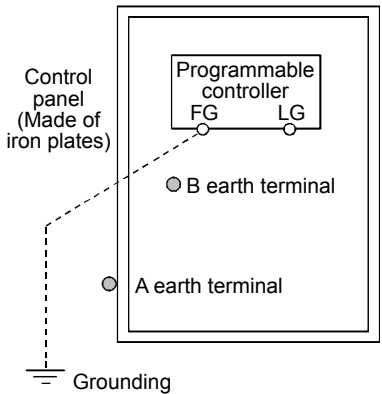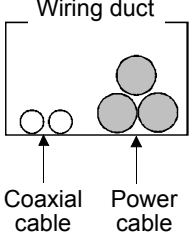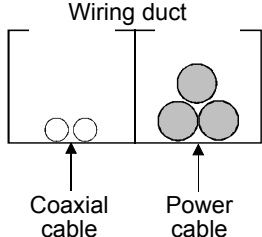
	Before improvement	After improvement
(1) Using different earthing cables	The same cable is used as both a ground cable for power and a ground cable for the programmable controller and leads to power noise so as to make the programmable controller malfunction during motor operation.	The trouble was successfully solved by separating the ground cable for power from that for the programmable controller.
(2) Ground cable dedicated to the programmable controller	Because an iron panel connects ground terminals A and B, the ground cable of the programmable controller has an impedance. As a result, the effect of the ground cable is halved, causing the programmable controller to malfunction.	The trouble was successfully solved by directly grounding the ground cable for the programmable controller.
(3) Separating cables in the duct	The mix of the MELSECNET coaxial cables with the power cables for the motor in the wiring duct causes communication failures for MELSECNET.	The trouble was successfully solved by separating the coaxial cables from the power cables in the wiring duct.

Figure 9-11 Solution Examples 1, 2, and 3
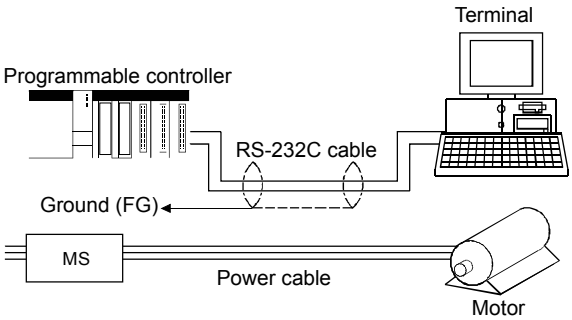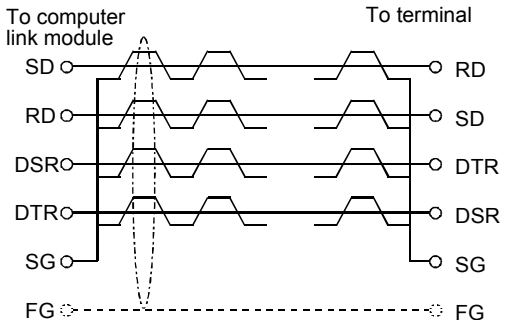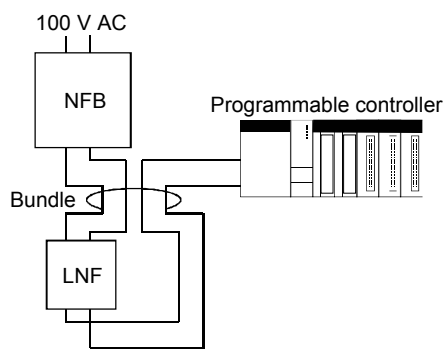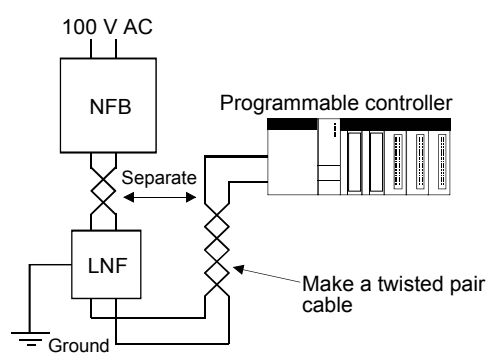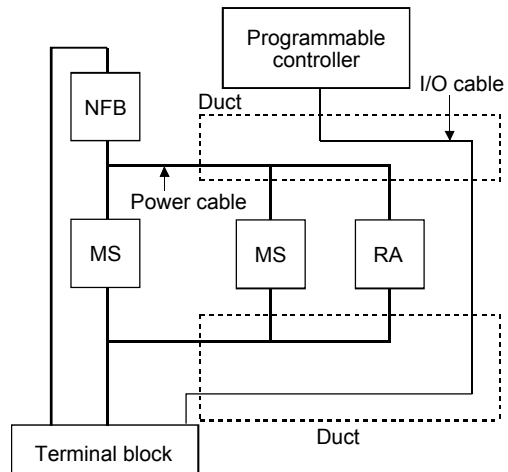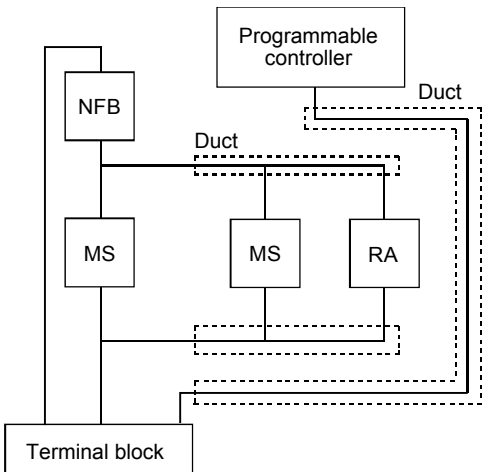
	Before improvement	After improvement
(4) Making signal wires into a twisted pair	The RS-232C cables can sometimes come close to the power cables for the motor, causing the terminal CRT screen to go out of control. Terminal Programmable controller RS-232C cable Ground (FG) MS Power cable Motor	The trouble was successfully solved by making all the signal wires of the RS-232 cable and SG terminal wires into twisted pairs. To computer link module · To terminal SD — RD RD — SD DSR — DTR DTR — DSR SG — SG FG ------------- FG
(5) Separating bundled wires	Having bundled the primary winding and secondary winding for the noise filter (LNF) leads power supply noises to enter the programmable controller, thus causing the controller to malfunction. 100 V AC NFB Programmable controller Bundle LNF	The trouble was successfully solved by setting the bundled primary and secondary windings of the noise filter (LNF) 10 cm or more apart from each other, making them into a twisted pair, and grounding the LNF. 100 V AC NFB Programmable controller Separate LNF Make a twisted pair cable Ground
(6) Separating a control line from a power cable	Having housed the programmable controller I/O cable and power cable in the same duct causes the controller to malfunction. Programmable controller I/O cable NFB Duct Power cable MS MS RA Duct Terminal block	The trouble was successfully solved by moving the programmable controller I/O cable to a different duct from that of the power cable. Programmable controller Duct NFB Duct MS MS RA Terminal block

Figure 9-12 Solution Examples 4, 5, and 6

9 - 11
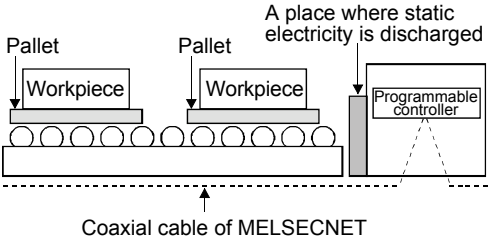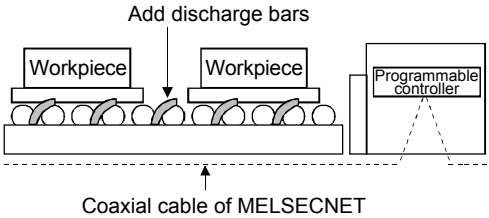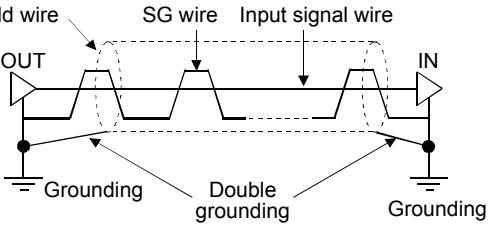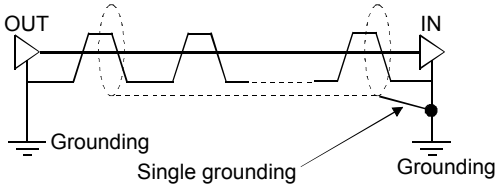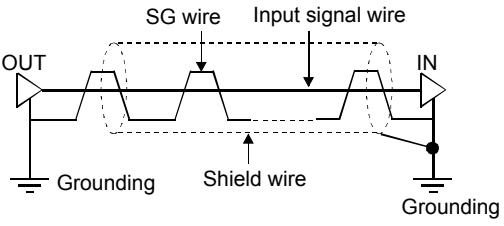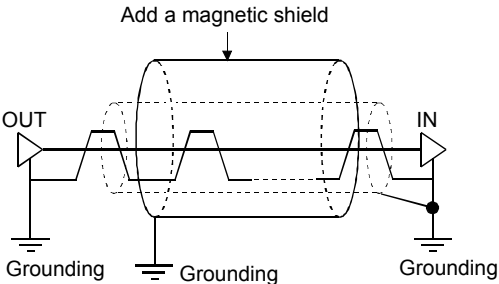
	Before improvement	After improvement
(7) Filtering out static electricity noises	When the static electricity electrified in the pallet was discharged, the discharge noise affected the MELSECNET coaxial cable, causing a communication failure. Coaxial cable of MELSECNET	The trouble was successfully solved by additionally installing a discharge bar in the pallet and eliminating the static electrification. Coaxial cable of MELSECNET
(8) Filtering out relay noises	Relay noises from the control line adjacent to the input signal wire causes the programmable controller to malfunction. 	The trouble was successfully solved by changing the groundings of the shield wire into a single grounding.
(9) Filtering out power noises	Power noises from the main circuit line adjacent to the input signal wire causes the programmable controller to malfunction. 	The trouble was successfully solved by changing the shield wire to a change the shield wire to a magnetic shielded wire.

Figure 9-13 Solution Examples 7, 8, and 9

Chapter 10: Life of Programmable Controller Components

This section describes the lives of a battery, fuse, electrolytic capacitor, and output relay.

> **POINT**
>
> For the lives of a programmable controller CPU and a module, refer to Mitsubishi programmable controller TECHNICAL BULLETIN "Recommendation on preventive maintenance and inspection of MELSEC A/Q series programmable controllers" (PLC-D-434-A).
> The TECHNICAL BULLETIN described above can be found at the Mitsubishi Electric FA Global Website.
> (Mitsubishi Electric FA Global Website: http://www.mitsubishielectric.co.jp/fa/index.html)

10.1 Battery Life

(1) Battery replacement
The voltage drop of the backup battery for the program function and backup power function triggers special relays SM51 and SM52 to be turned ON. Though these special relays being turned ON does not immediately cause the program content saved by the backup power to be lost, missing the special relays being turned ON may result in the contents being lost.
Replace the battery before the total backup power time since SM51 is turned ON reaches the specified time.

> **POINT**
>
> SM51 turns ON when the battery voltage falls below the specified value and maintains ON even after the battery voltage returns to normal. SM52 turns ON when the battery voltage falls below the specified value and turns OFF when the battery voltage returns to normal.
> Replace the battery immediately after SM51 or SM52 turns ON.
> However, it is recommended to replace the battery periodically according to the usage status even before an alarm occurs.

SM51 and SM52 turn ON when any battery voltage for the CPU module and SRAM card drops. To judge the memory battery of which voltage drops, check the contents of special registers SD51 and SD52.
When the battery voltage for each memory drops, an SD51 or SD52 bit corresponding to the memory turns ON.

Bit number of SD51 and SD52	Target memory
Bit 0	CPU module
Bit 1, 2	SRAM card

> **POINT**
>
> The following table explains the relationships of memory backup between a battery mounted on the CPU module and that mounted on the SRAM card.
> There are two points:
> (1) The battery mounted on the CPU module cannot back up the SRAM card memory.
> (2) The battery mounted on the SRAM card memory cannot back up the CPU module memory.
>
> | Power supply of power supply module | Battery of CPU module | Battery of SRAM card | Memory of CPU module | Memory of SRAM card |
> |---|---|---|---|---|
> | ON | Connected | Mounted | ○ | ○ |
> | | | Not mounted | ○ | ○ |
> | | Not connected | Mounted | ○ | ○ |
> | | | Not mounted | ○ | ○ |
> | OFF | Connected | Mounted | ○ | ○ |
> | | | Not mounted | ○ | × |
> | | Not connected | Mounted | × | ○ |
> | | | Not mounted | × | × |
>
> ○: Can be backed up ×: Cannot be backed up

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(2) Battery life
(a) Battery (Q6BAT, Q7BAT) life of the CPU module
The battery life depends on the serial number (the first five digits) and model of the CPU module.
1) For the CPU modules whose the first five digits of the serial number are "05011" or later

Model of CPU module	Power-on time ratio *1	Battery life					
		Q6BAT			Q7BAT		
		Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q02CPU	0%	30,000 h 3.42 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
	30%	42,857 h 4.89 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
	50%	43,800 h 5.00 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
	70%	43,800 h 5.00 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
	100%	43,800 h 5.00 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
Q02HCPU Q06HCPU	0%	2,341 h 0.26 years	18,364 h 2.09 years	120 h 5 days	5,000 h 0.57 years	43,800 h 5.00 years	240 h 10 days
	30%	3,344 h 0.38 years	26,234 h 2.99 years	120 h 5 days	7,142 h 0.81 years	43,800 h 5.00 years	240 h 10 days
	50%	4,682 h 0.53 years	36,728 h 4.19 years	120 h 5 days	10,000 h 1.14 years	43,800 h 5.00 years	240 h 10 days
	70%	7,803 h 0.89 years	43,800 h 5.00 years	120 h 5 days	16,666 h 1.90 years	43,800 h 5.00 years	240 h 10 days
	100%	43,800 h 5.00 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
Q12HCPU Q25HCPU	0%	1,260 h 0.14 years	7,755 h 0.88 years	48 h 2 days	2,900 h 0.33 years	21,107 h 2.40 years	96 h 4 days
	30%	1,800 h 0.20 years	11,079 h 1.26 years	48 h 2 days	4,142 h 0.47 years	30,153 h 3.44 years	96 h 4 days
	50%	2,520 h 0.28 years	15,510 h 1.77 years	48 h 2 days	5,800 h 0.66 years	42,214 h 4.81 years	96 h 4 days
	70%	4,200 h 0.47 years	25,850 h 2.95 years	48 h 2 days	9,666 h 1.10 years	43,800 h 5.00 years	96 h 4 days
	100%	43,800 h 5.00 years	43,800 h 5.00 years	48 h 2 days	43,800 h 5.00 years	43,800 h 5.00 years	96 h 4 days

*1: The power-on time ratio indicates the percentage of the time per day (24 hours) while the programmable controller power supply is turned ON.
(The power-on time ratio will be 50% if the total power-on time is 12 hours and the total power-off time is 12 hours.)
*2: The guaranteed values are the values when the storage ambient temperature is -25 to 75°C (operating ambient temperature is 0 to 55°C).
*3: The actual values are the values when the storage ambient temperature is 40°C (operating ambient temperature is 25°C).

2) For the CPU modules whose the first five digits of the serial number are earlier than "05011".

Model of CPU module	Power-on time ratio *1	Battery life					
		Q6BAT			Q7BAT		
		Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q02CPU	0%	5,433 h 0.62 years	43,800 h 5.00 years	120 h 5 days	13,000 h 1.48 years	43,800 h 5.00 years	240 h 10 days
	30%	7,761 h 0.88 years	43,800 h 5.00 years	120 h 5 days	18,571 h 2.11 years	43,800 h 5.00 years	240 h 10 days
	50%	10,866 h 1.24 years	43,800 h 5.00 years	120 h 5 days	26,000 h 2.96 years	43,800 h 5.00 years	240 h 10 days
	70%	18,110 h 2.06 years	43,800 h 5.00 years	120 h 5 days	43,333 h 4.94 years	43,800 h 5.00 years	240 h 10 days
	100%	43,800 h 5.00 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
Q02HCPU Q06HCPU	0%	2,341 h 0.26 years	14,550 h 1.66 years	120 h 5 days	5,000 h 0.57 years	38,881 h 4.43 years	240 h 10 days
	30%	3,344 h 0.38 years	20,786 h 2.37 years	120 h 5 days	7,142 h 0.81 years	43,800 h 5.00 years	240 h 10 days
	50%	4,682 h 0.53 years	29,100 h 3.32 years	120 h 5 days	10,000 h 1.14 years	43,800 h 5.00 years	240 h 10 days
	70%	7,803 h 0.89 years	43,800 h 5.00 years	120 h 5 days	16,666 h 1.90 years	43,800 h 5.00 years	240 h 10 days
	100%	43,800 h 5.00 years	43,800 h 5.00 years	120 h 5 days	43,800 h 5.00 years	43,800 h 5.00 years	240 h 10 days
Q12HCPU Q25HCPU	0%	1,260 h 0.14 years	6,096 h 0.69 years	48 h 2 days	2,900 h 0.33 years	16,711 h 1.90 years	96 h 4 days
	30%	1,800 h 0.20 years	8,709 h 0.99 years	48 h 2 days	4,142 h 0.47 years	23,873 h 2.72 years	96 h 4 days
	50%	2,520 h 0.28 years	12,192 h 1.39 years	48 h 2 days	5,800 h 0.66 years	33,422 h 3.81 years	96 h 4 days
	70%	4,200 h 0.47 years	20,320 h 2.31 years	48 h 2 days	9,666 h 1.10 years	43,800 h 5.00 years	96 h 4 days
	100%	43,800 h 5.00 years	43,800 h 5.00 years	48 h 2 days	43,800 h 5.00 years	43,800 h 5.00 years	96 h 4 days

*1: The power-on time ratio indicates the percentage of the time per day 24 hours) while the programmable controller power supply is turned ON.
(The power-on time ratio will be 50% if the total power-on time is 12 hours and the total power-off time is 12 hours.)
*2: The guaranteed values are the values when the storage ambient temperature is -25 to 75°C (operating ambient temperature is 0 to 55°C).
*3: The actual values are the values when the storage ambient temperature is 40°C (operating ambient temperature is 25°C).

POINT
The life of batteries (Q6BAT, Q7BAT) when not connected to the CPU module is five years.

(a) Battery (Q6BAT, Q7BAT) life of Universal Model CPU modules
1) Other than QnUDVCPU, QnUDPVCPU

Model of CPU module	Battery usage frequency	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q00U(J)CPU Q01UCPU Q02UCPU Q03UD(E)CPU	1	0%	30,100 h 3.44 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	43,000 h 4.91 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	2	0%	25,300 h 2.89 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	36,100 h 4.12 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
Q04UD(E)HCPU	1	0%	30,100 h 3.44 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	43,000 h 4.91 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	2	0%	4,300 h 0.49 years	32,100 h 3.66 years	384 h 16 days	11,700 h 1.34 years	43,800 h 5.00 years	600 h 25 days
		30%	6,100 h 0.70 years	43,800 h 5.00 years		16,700 h 1.91 years		
		50%	8,600 h 0.98 years			23,400 h 2.67 years		
		70%	14,300 h 1.63 years			39,000 h 4.45 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		

Model of CPU module	Battery usage frequency	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q06UD(E)HCPU	1	0%	25,300 h 2.89 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	36,100 h 4.12 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	2	0%	4,200 h 0.48 years	32,100 h 3.66 years	384 h 16 days	11,400 h 1.30 years	43,800 h 5.00 years	600 h 25 days
		30%	6,000 h 0.68 years	43,800 h 5.00 years		16,200 h 1.85 years		
		50%	8,400 h 0.96 years			22,800 h 2.60 years		
		70%	14,000 h 1.60 years			38,000 h 4.34 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		
	3	0%	2,300 h 0.26 years	19,200 h 2.19 years	192 h 8 days	5,000 h 0.57 years	43,800 h 5.00 years	600 h 25 days
		30%	3,200 h 0.37 years	27,400 h 3.13 years		7,100 h 0.81 years		
		50%	4,600 h 0.53 years	38,400 h 4.38 years		10,000 h 1.14 years		
		70%	7,600 h 0.87 years	43,800 h 5.00 years		16,600 h 1.89 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		

Model of CPU module	Battery usage frequency	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q10UD(E)HCPU Q13UD(E)HCPU Q20UD(E)HCPU Q26UD(E)HCPU	1	0%	22,600 h 2.58 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	32,200 h 3.68 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	2	0%	4,100 h 0.47 years	26,200 h 2.99 years	384 h 16 days	11,100 h 1.27 years	43,800 h 5.00 years	600 h 25 days
		30%	5,800 h 0.66 years	37,400 h 4.27 years		15,800 h 1.80 years		
		50%	8,200 h 0.94 years	43,800 h 5.00 years		22,200 h 2.53 years		
		70%	13,600 h 1.55 years			37,000 h 4.22 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		
	3	0%	2,300 h 0.26 years	18,600 h 2.12 years	192 h 8 days	5,000 h 0.57 years	43,800 h 5.00 years	600 h 25 days
		30%	3,200 h 0.37 years	26,500 h 3.03 years		7,100 h 0.81 years		
		50%	4,600 h 0.53 years	37,200 h 4.25 years		10,000 h 1.14 years		
		70%	7,600 h 0.87 years	43,800 h 5.00 years		16,600 h 1.89 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		
	4	0%	1,500 h 0.17 years	13,800 h 1.58 years	144 h 6 days	3,700 h 0.42 years	36,100 h 4.12 years	432 h 18 days
		30%	2,100 h 0.24 year	19,700 h 2.25 years		5,200 h 0.59 years	43,800 h 5.00 years	
		50%	3,000 h 0.34 years	27,600 h 3.15 years		7,400 h 0.84 years		
		70%	5,000 h 0.57 years	43,800 h 5.00 years		12,300 h 1.40 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		

Model of CPU module	Battery usage frequency	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q50UDEHCPU Q100UDEHCPU	1	0%	19,000 h 2.16 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	27,100 h 3.09 years					
		50%	38,000 h 4.33 years					
		70%	43,800 h 5.00 years					
		100%						
	2	0%	4,000 h 0.45 years	25,000 h 2.85 years	384 h 16 days	10,900 h 1.24 years	43,800 h 5.00 years	600 h 25 days
		30%	5,700 h 0.65 year	35,700 h 4.07 years		15,500 h 1.76 years		
		50%	8,000 h 0.91 years	43,800 h 5.00 years		21,800 h 2.48 years		
		70%	13,300 h 1.51 years			36,300 h 4.14 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		
	3	0%	2,200 h 0.25 years	18,000 h 2.05 years	192 h 8 days	4,900 h 0.55 years	43,800 h 5.00 years	600 h 25 days
		30%	3,100 h 0.35 years	25,700 h 2.93 years		7,000 h 0.79 years		
		50%	4,400 h 0.50 years	36,000 h 4.10 years		9,800 h 1.11 years		
		70%	7,300 h 0.83 years	43,800 h 5.00 years		16,300 h 1.86 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		
	4	0%	1,500 h 0.17 years	13,500 h 1.54 years	144 h 6 days	3,600 h 0.41 years	35,200 h 4.01 years	432 h 18 days
		30%	2,100 h 0.24 years	19,200 h 2.19 years		5,100 h 0.58 years	43,800 h 5.00 years	
		50%	3,000 h 0.34 years	27,000 h 3.08 years		7,200 h 0.82 years		
		70%	5,000 h 0.57 years	43,800 h 5.00 years		12,000 h 1.36 years		
		100%	43,800 h 5.00 years			43,800 h 5.00 years		
	5	0%	1,160 h 0.13 years	10,800 h 1.23 years	120 h 5 days	2,700 h 0.30 years	28,600 h 3.26 years	336 h 14 days
		30%	1,600 h 0.18 years	15,400 h 1.75 years		3,800 h 0.43 years	40,800 h 4.65 years	
		50%	2,300 h 0.26 years	21,600 h 2.46 years		5,400 h 0.61 years		
		70%	3,800 h 0.43 years	36,000 h 4.10 years		9,000 h 1.02 years		
		100%	43,800 h 5.00 years	36,000 h 4.10 years		43,800 h 5.00 years		

*1: The power-on time ratio indicates the percentage of the time per day 24 hours) while the programmable controller power supply is turned ON.
(The power-on time ratio will be 50% if the total power-on time is 12 hours and the total power-off time is 12 hours.)

*2: The guaranteed values are the values when the storage ambient temperature is -25 to 75°C (operating ambient temperature is 0 to 55°C).

*3: The actual values are the values when the storage ambient temperature is 40°C (operating ambient temperature is 25°C).

POINT
The life of batteries (Q6BAT, Q7BAT) when not connected to the CPU module is five years.

2) QnUDVCPU, QnUDPVCPU
The battery life varies by the power-on time ratio and whether an extended SRAM cassette is used or not.

Model of CPU module	Usage of extended SRAM cassette	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q03UDVCPU	Unused	0%	41,400 h 4.72 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	43,800 h 5.00 years					
		50%						
		70%						
		100%						
	Q4MCA-1MBS	0%	26,600 h 3.03 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	38,000 h 4.33 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	Q4MCA-2MBS	0%	23,100 h 2.63 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	33,000 h 3.76 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	Q4MCA-4MBS	0%	17,400 h 1.98 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	24,800 h 2.83 years					
		50%	34,800 h 3.97 years					
		70%	43,800 h 5.00 years					
		100%						
	Q4MCA-8MBS	0%	11,000 h 1.25 years	43,800 h 5.00 years	600 h 25 days	28,500 h 3.25 years	43,800 h 5.00 years	600 h 25 days
		30%	15,700 h 1.79 years			40,700 h 4.64 years		
		50%	22,000 h 2.51 years			43,800 h 5.00 years		
		70%	36,600 h 4.17 years					
		100%	43,800 h 5.00 years					

Model of CPU module	Usage of extended SRAM cassette	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q04UDVCPU Q04UDPVCPU	Unused	0%	31,700 h 3.61 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	43,800 h 5.00 years					
		50%						
		70%						
		100%						
	Q4MCA-1MBS	0%	22,000 h 2.51 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	31,400 h 3.58 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	Q4MCA-2MBS	0%	19,600 h 2.23 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	28,000 h 3.19 years					
		50%	39,200 h 4.47 years					
		70%	43,800 h 5.00 years					
		100%						
	Q4MCA-4MBS	0%	15,300 h 1.74 years	43,800 h 5.00 years	600 h 25 days	36,600 h 4.17 years	43,800 h 5.00 years	600 h 25 days
		30%	21,800 h 2.48 years			43,800 h 5.00 years		
		50%	30,600 h 3.49 years					
		70%	43,800 h 5.00 years					
		100%						
	Q4MCA-8MBS	0%	10,100 h 1.15 years	43,800 h 5.00 years	600 h 25 days	26,500 h 3.02 years	43,800 h 5.00 years	600 h 25 days
		30%	14,400 h 1.64 years			37,800 h 4.31 years		
		50%	20,200 h 2.30 years			43,800 h 5.00 years		
		70%	33,600 h 3.83 years					
		100%	43,800 h 5.00 years					

Model of CPU module	Usage of extended SRAM cassette	Power-on time ratio *1	Battery life					
			Q6BAT			Q7BAT		
			Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)	Guaranteed value (70°C) *2	Actual value (40°C) *3	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q06UDVCPU Q06UDPVCPU Q13UDVCPU Q13UDPVCPU Q26UDVCPU Q26UDPVCPU	Unused	0%	30,600 h 3.49 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	43,700 h 4.98 years					
		50%	43,800 h 5.00 years					
		70%						
		100%						
	Q4MCA-1MBS	0%	21,500 h 2.45 years	43,800 h 5.00 years	600 h 25 days	43,800 h 5.00 years	43,800 h 5.00 years	600 h 25 days
		30%	30,700 h 3.50 years					
		50%	43,000 h 4.90 years					
		70%	43,800 h 5.00 years					
		100%						
	Q4MCA-2MBS	0%	19,100 h 2.18 years	43,800 h 5.00 years	600 h 25 days	43,100 h 4.92 years	43,800 h 5.00 years	600 h 25 days
		30%	27,200 h 3.10 years			43,800 h 5.00 years		
		50%	38,200 h 4.36 years					
		70%	43,800 h 5.00 years					
		100%						
	Q4MCA-4MBS	0%	15,000 h 1.71 years	43,800 h 5.00 years	600 h 25 days	36,200 h 4.13 years	43,800 h 5.00 years	600 h 25 days
		30%	21,400 h 2.44 years			43,800 h 5.00 years		
		50%	30,000 h 3.42 years					
		70%	43,800 h 5.00 years					
		100%						
	Q4MCA-8MBS	0%	10,000 h 1.14 years	43,800 h 5.00 years	600 h 25 days	24,800 h 2.83 years	43,800 h 5.00 years	600 h 25 days
		30%	14,200 h 1.62 years			35,400 h 4.04 years		
		50%	20,000 h 2.28 years			43,800 h 5.00 years		
		70%	33,300 h 3.80 years					
		100%	43,800 h 5.00 years					

*1: The power-on time ratio indicates the percentage of the time per day 24 hours) while the programmable controller power supply is turned ON.
(The power-on time ratio will be 50% if the total power-on time is 12 hours and the total power-off time is 12 hours.)

*2: The guaranteed values are the values when the storage ambient temperature is -25 to 75°C (operating ambient temperature is 0 to 55°C).

*3: The actual values are the values when the storage ambient temperature is 40°C (operating ambient temperature is 25°C).

POINT	
The life of batteries (Q6BAT, Q7BAT) when not connected to the CPU module is five years.	

(c) Battery life of SRAM cards
    Battery life of SRAM cards depends on the serial number (the first five digits) and model of the memory card.
    The following table describes the battery life of SRAM cards.
    1) For the CPU modules whose the first five digits of the serial number are "04012" or later

SRAM card	Power-on time ratio *1	Battery life		
		Guaranteed value (MIN)	Actual value (TYP)	Time since SM52 is turned ON (guaranteed time since an alarm is raised)
Q2MEM-1MBS manufacturer control number "□□A" *2	0%	690 h 0.07 years	6,336 h 0.72 years	8 h
	100%	11,784 h 1.34 years	13,872 h 1.58 years	8 h
Q2MEM-1MBS manufacturer control number "□□B" *2 or "□□B□" *2 (B or later)	0%	2,400 h 0.27 years	23,660 h 2.7 years	20 h
	30%	2,880 h 0.32 years	31,540 h 3.6 years	20 h
	50%	4,320 h 0.49 years	39,420 h 4.5 years	20 h
	70%	6,480 h 0.73 years	43,800 h 5.0 years	20 h
	100%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
Q2MEM-2MBS	0%	2,400 h 0.27 years	23,660 h 2.7 years	20 h
	30%	2,880 h 0.32 years	31,540 h 3.6 years	20 h
	50%	4,320 h 0.49 years	39,420 h 4.5 years	20 h
	70%	6,480 h 0.73 years	43,800 h 5.0 years	20 h
	100%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
Q3MEM-4MBS	0%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	30%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	50%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	70%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	100%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
Q3MEM-8MBS	0%	36,300 h 4.1 years	43,800 h 5.0 years	50 h
	30%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	50%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	70%	43,800 h 5.0 years	43,800 h 5.0 years	50 h
	100%	43,800 h 5.0 years	43,800 h 5.0 years	50 h

2) For the CPU modules whose the first five digits of the serial number are "04011" or earlier

SRAM card	Power-on time ratio *1	Battery life		Time since SM52 is turned ON (guaranteed time since an alarm is raised)
		Guaranteed value (MIN)	Actual value (TYP)	
Q2MEM-1MBS manufacturer control number "□□A" "□□B" }*2 Q2MEM-2MBS	0%	690 h 0.07 years	6,336 h 0.72 years	8 h
	100%	11,784 h 1.34 years	13,872 h 1.58 years	8 h

*1: The power-on time ratio indicates the percentage of the time per day (24 hours) while the programmable controller power supply is turned ON.
(The power-on time ratio will be 50% if the total power-on time is 12 hours and the total power-off time is 12 hours.)
*2: The manufacturer control number (the third digit from the left) is described on the the back label of the SRAM card main unit (refer to the following figure).

Manufacturer control number

注意事項   **-*********
CAUTION   3LBN
・強いショックを与えないこと。
Do not subject to mechanical shock!
・高温・直射日光・水にさらされないこと。
Do not expose to extreme.
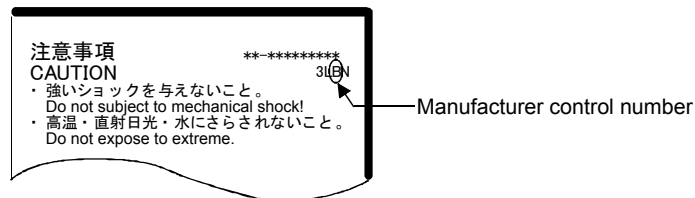
```
POINT
```
Note that the SRAM card consumes the battery even when the battery is connected to the CPU module and the programmable controller is powered ON.

(3) Replacement
In the period after the old battery is removed and before a new battery is connected, the built-in capacitor automatically performs backup. The period should be within three minutes.

```
POINT
```
Replace the battery of the SRAM card while the programmable controller power is ON and the SRAM card is mounted in order to retain data.

10.2 Fuse

The following MELSEC-Q series modules have a built-in fuse to prevent short-circuit current and overcurrent.

Table 10-2 List of Modules with a Built-in Fuse

Module type	Model
Power supply	Q61P, Q61P-A1, Q61P-A2, Q61P-D, Q61SP, Q62P, Q63P, Q63RP, Q64P, Q64PN, Q64RP
CPU module	Q00JCPU, Q00UJCPU
Output module	QY50, QY70, QY71, QY80, QY80-TS
I/O combined module (output)	QX48Y57

POINT
Note that fuses cannot be replaced by users.

For the QY22 and QY68A output modules, it is recommended to install a fuse to an external terminal in order to prevent burnout of an external device and the module in the event of load short.

Module name	Recommended fuse	Fuse model whose operation has been checked	Manufacturer	Distributor
QY22	IEC60127 sheet 1 compliant item	216 02.5	Littelfuse, Inc.	Kuroda Electric Co., Ltd. Headquarters (Tokyo) 03-5764-5500 Osaka 06-6303-1300 Nagoya 052-852-3321
		216 002		
QY68A	Quick action type having a rated current of 3 A	216 3.15		
		312 003		

10.3 Life of Electrolytic Capacitor

The modules using an aluminum electrolytic capacitor has a life of 10 years at an ambient temperature of 40°C, but under a condition of a high ambient temperature, their capacitance may decrease in four to six years.
It is recommended to replace it with a new one or have it overhauled considering the life described below as a preventive maintenance.
• Module using an electrolytic capacitor

In general, aluminum electrolytic capacitors are characterized by extremely varying life according to the ambient temperature (twofold changes in life when the temperature changes by 10°C) become there are chemical reactions inside.
These characteristics are called Arrhenius law, which is illustrated in the following figure.
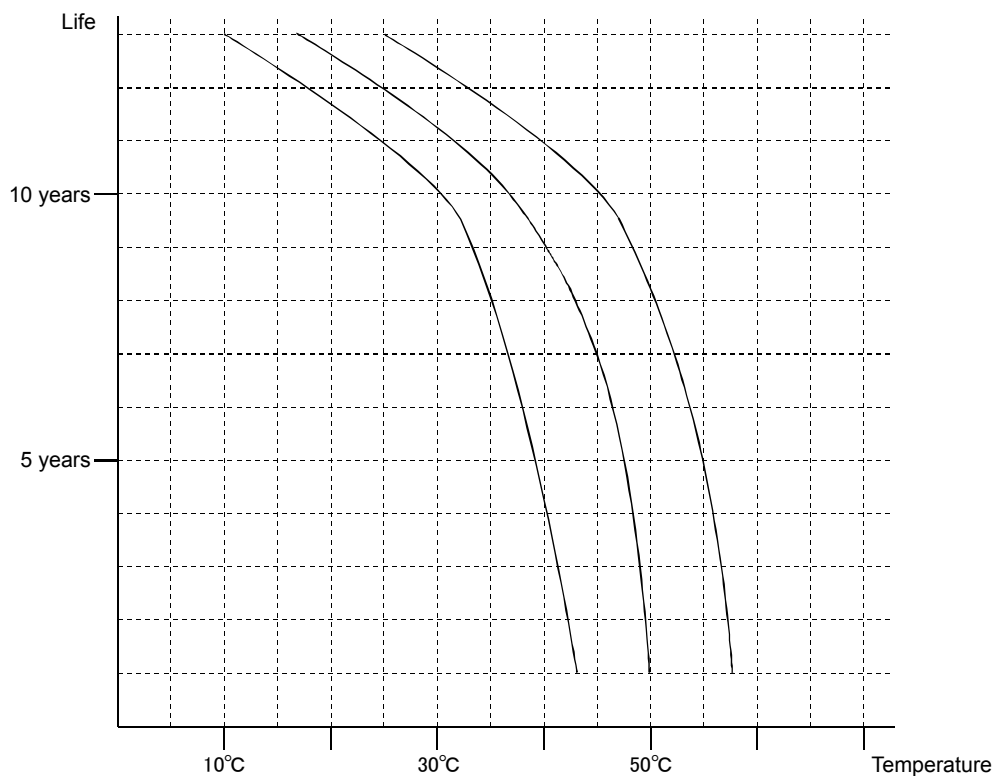
Figure 10-1 Arrhenius Law

10.4 Life of Output Relay

The relays of the contact output module become worn with switching actions.
If the relay mounted directly on the printed-circuit board of the output module becomes worn, the entire output module must be replaced.
As measures against wear, for an alternate current load, change to triac output, for a direct current load, change to transistor output, and thus eliminate the contacts.
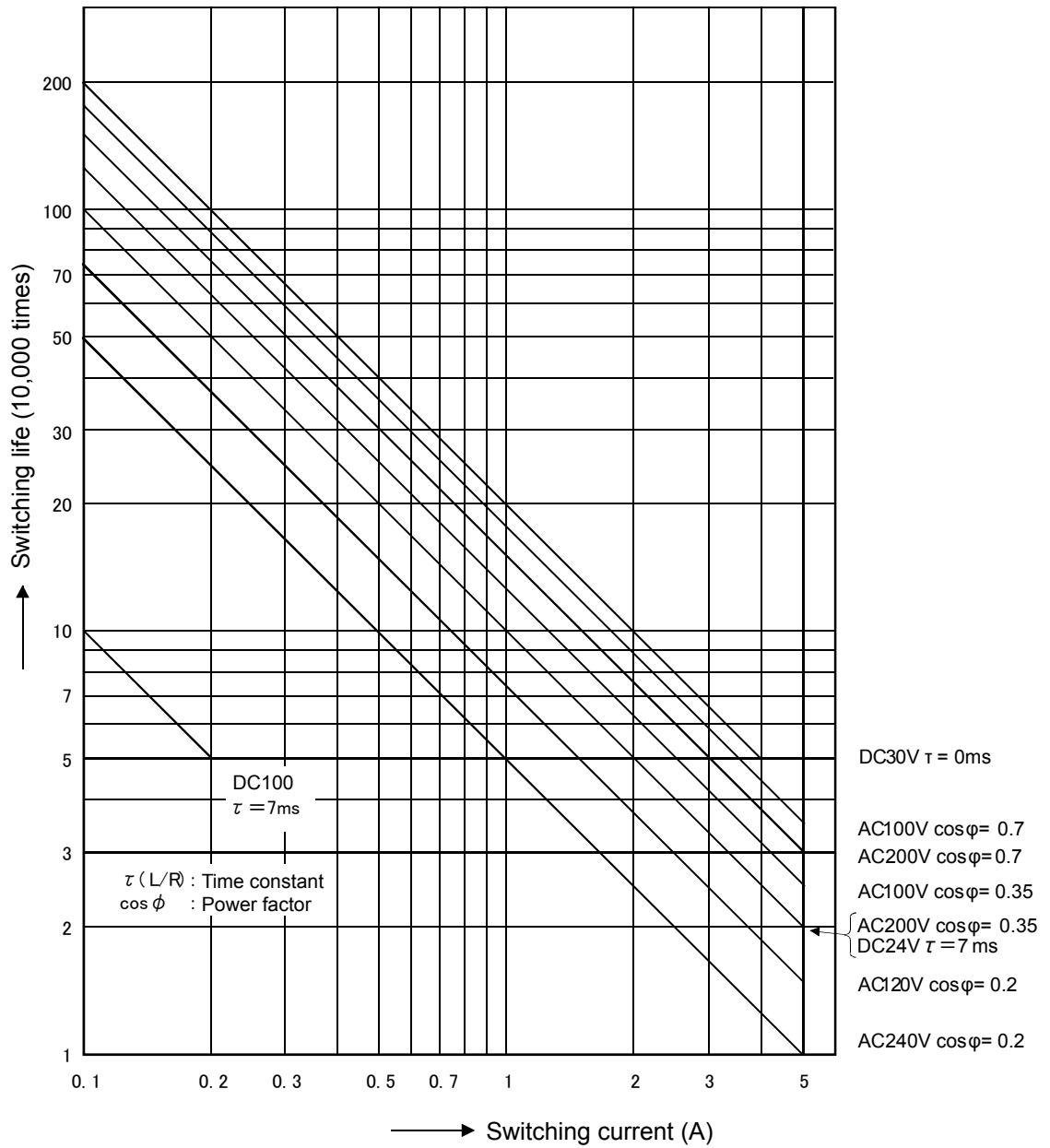
Figure 10-2 Contact Life Characteristics of Output Relay

10.5 Spare Parts

Replacement parts for domestic use can be obtained in a timely manner even after an accident occurs because they are easy to obtain from the system service, branch office, or distributor. On the other hand, replacement parts for overseas be should be shipped beforehand.

Maintenance will become easy if the following points are considered in the design phase:

(1) Adopting quick recovery types
Because Q series programmable controllers are a building-block type where each module is mounted to the base unit, module replacement is easy. Because of the structure, recovery is completed only by replacing the faulty module.

(2) Memory type
The standard RAM or memory card (SRAM) requires a battery for backup.
The standard ROM or memory card (Flash/ATA) does not require a battery and can prevent the program from being changed due to a human error. It is recommended to use the backup memory particularly for exports.

(3) Module types reduced
The number of types of spare parts can be effectively reduced by standardizing module names to be used and reducing the number of types.

(4) Reserving I/O points
Do not use all I/O points of the 16, 32, and 64 I/O modules but reserve 10 to 20% of them. By doing this, faulty modules can be substituted by rewiring and program changes (changes in I/O signals) when there is no spare parts.

(5) Spare parts

Table 10-3 Spare Parts

No.	Product name	Quantity	Remarks
1	Battery	1 to 2 pcs	Since the storage life is about five years, the battery does not need to be always stocked, but should be arranged when the battery in use comes close to the end of life. Prepare the one or two batteries for an unexpected case.
2	Power supply module	1 pc per model in use	The life of this tends to be short when the ambient temperature is high, since it is a part that easily becomes hot.
3	I/O module	1 pc per module model	Consider that it is likely to fail in test operation. Additionally, when it is used for a long time, the contact of the relay output module will be worn.
4	CPU module	1 pc per model in use	Since this is a core part of the programmable controller, if this part should fail, the system will go down. Prepare upper compatible spare models.
5	Memory card	1 pc per model in use	

MEMO

Chapter 11: Preparing for Test Operation

When starting operation after new installation or modification of a programmable controller, if the safety checks are not carried out sufficiently, an accident may result.
This section describes the check items to proactively prevent accidents and the preparation procedure for test operation.

11.1 Check Items before Starting Test Operation

The following table describes the check items regarding the programmable controller.

Table 11-1 Check Items

No.	Check item	Description
1	Setting the CPU	• Is the memory capacity to be used correct? • Is the type (RAM/ROM) correct? • Is the system protection not turned ON? * • Is the parameter-valid drive set correctly? *
2	Mounting a battery	• Is the connector for the lead wire of the removed battery when shipped inserted securely into the connector pin on the CPU side?
3	Mounting and setting up memory cards	• Are memory cards securely mounted onto the mounting connector? • Is the memory capacity to be used correct? • Is the type (RAM/ROM) correct? • Is the write protect not turned ON? (only for SRAM card, Flash card, SD memory card) • Is the battery holder securely inserted? (only for SRAM card)
4	Connecting an extension cable	• Are the connectors of the main/extension bases well fitted with the connectors of the extension cable? • Is the connectors of the extension base positioned correctly (IN/OUT)?
5	Setting the extension base numbers for extension bases	• Are the numbers set? • Is the same number set for multiple bases? • Are jumpers inserted into several positions for one base?
6	Mounting modules	• Are the module models mounted on each slot of the main/extension bases correct? • Does the module configuration use a larger number of I/O points than that in the CPU specifications?
7	Fuses	• Are fuses blown or damaged?
8	Connecting the power supply and I/O cables	• Do the cables connected to each terminal of the terminal blocks correspond to signal names? • Are the terminal screws of the terminal blocks for power supply module, I/O module and intelligent function module well tightened? • Do the cables have a proper wire size?

* For high performance models only

11.2 Preparation Procedure for Test Operation

The following shows a flowchart from a completion of installation until test operation of a programmable controller.

```
                    ┌──────────────────────┐
                    │        Start         │
                    └──────────────────────┘
                               │
    ┌──────────────────────────────────────┐        ┌──────────────────────────────────────┐
    │ Power-on                              │        │ Test operation                        │
    │  1. Confirm voltage input from power  │        │  1. Set the RUN/STOP/RESET switch     │
    │     supply.                           │        │     of the CPU module to RUN.          │
    │  2. Confirm power supply voltage for  │        │  2. Confirm that the "RUN" LED is on.  │
    │     I/O equipment.                    │        └──────────────────────────────────────┘
    │  3. Set the RUN/STOP/RESET switch     │                      │
    │     of the CPU module to [STOP].      │        ┌──────────────────────────────────────┐
    │  4. Turn on the power.                │        │ Sequence check                        │
    │  5. Confirm that the "POWER" LED of   │        │                                        │
    │     the power supply module is on.    │        │  Check sequence operations.            │
    └──────────────────────────────────────┘        └──────────────────────────────────────┘
                               │                                   │
    ┌──────────────────────────────────────┐        ┌──────────────────────────────────────┐
    │ Programming                           │        │ Program modification                  │
    │  Write a sequence program that has    │        │                                        │
    │  been programmed with GX Works2       │        │  Modify a sequence program if it       │
    │  to the CPU.                          │        │  causes a trouble.                     │
    └──────────────────────────────────────┘        └──────────────────────────────────────┘
                               │                                   │
    ┌──────────────────────────────────────┐        ┌──────────────────────────────────────┐
    │ External output wiring check          │        │ Program protection                    │
    │  Check external output wiring by      │        │  1. Save programs on hard disk or      │
    │  forcibly turning ON using device test│        │     a CD-ROM.                          │
    │  operation in GX Works2 with a        │        │  2. Print a ladder diagram and a list  │
    │  personal computer.                   │        │     using a printer.                   │
    └──────────────────────────────────────┘        └──────────────────────────────────────┘
                               │                                   │
    ┌──────────────────────────────────────┐        ┌──────────────────────────────────────┐
    │ External input device wiring check    │        │                 End                   │
    │  Check the wiring of input devices in │        └──────────────────────────────────────┘
    │  the monitoring mode of GX Works2     │
    │  with a personal computer.            │
    └──────────────────────────────────────┘
```

Chapter 12: CPU Replacement Procedure during Operation

When replacing the programmable controller CPU while operating the system and machineries and continuing operation, it is necessary to read the sequence program and device data (latch data, etc.) out to peripherals and mount a new CPU. The procedure is as follows:

```
( Stop during operation. )
          │
          ▼
STOP the CPU.
          │
          ▼
Start GX Works2 on a personal computer. Refer to Section 3.1.
          │
          ▼
Connect the personal computer and the CPU using a cable.
          │
          ▼
Read a sequence program and device data. Refer to Section 3.13.
          │
          ▼
Save the program. Refer to Section 3.4.
          │
          ▼
Turn OFF the power supply of the programmable controller.
          │
          ▼
Replace the CPU.
          │
          ▼
STOP the CPU.
          │
          ▼
Turn ON the power supply of the programmable controller.
          │
          ▼
Connect the personal computer and the CPU using a cable.
          │
          ▼
Format the memory of the programmable controller. Refer to Section 3.5.
          │
          ▼
Write the sequence program and the device data. Refer to Section 3.5.
          │
          ▼
RUN the programmable controller CPU.
          │
          ▼
( Continuous operation starts. )
```

```
┌─────────────────────────────────────────────────────────────────────┐
│  POINT                                                                │
│ ─────────────                                                         │
│  Precautions for module/unit replacement                             │
│  • For an intelligent function module                                │
│    The intelligent function module may contain data such as          │
│    parameters in E²PROM or EROM.                                      │
│    In such cases, it is necessary write the same data to the          │
│    replacement module.                                                │
│  • For an Ethernet interface module                                  │
│    If the Ethernet module has also been replaced, reset the external  │
│    device as well.                                                    │
│    (If the external device retains the Ethernet address of another   │
│    external device, communication may be disconnected because         │
│    replacing Ethernet module changes the Ethernet addresses.)         │
│    Likewise, an external device (e.g. personal computer) is replaced, │
│    start up the Ethernet module again.                                │
└─────────────────────────────────────────────────────────────────────┘
```

12.1 Universal Model QCPU Replacement Procedure

Use the QnU(D)(E)(H)CPU Replacement Checklist described in Appendix 7.2 together.

12.1.1 Preparation

(1) Enter the date, operator, panel name, and CPU model name in the QnU(D)(E)(H)CPU Replacement Checklist.

(2) In the checklist, enter the switch setting of the CPU to be removed and whether there is a memory card.

(3) As needed, for identification, stick a panel name label on the surface of the CPU to be removed.

(4) When replacing QnUCPU module, use the "CPU module replacement" function. For details on how to use, refer to Section 12.1.2.

12.1.2 Data Backup

(1) Connect GX Works2 to the CPU to be removed, and set the PLC type and transfer setup to "Programmable Controller Side I/F: CPU Module".
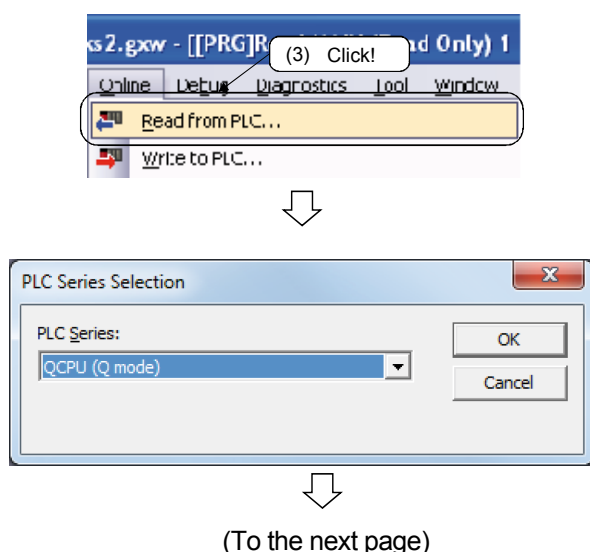
1) Connect the CPU with a personal computer using an RS-232C, USB or Ethernet cable. (This textbook illustrates the example where a USB cable is used.)

2) Start up GX Works2.

3) Click the [Online] → [Read from PLC] menu.

4) Set the PLC series to [QCPU(Q Mode)] and click the OK button.

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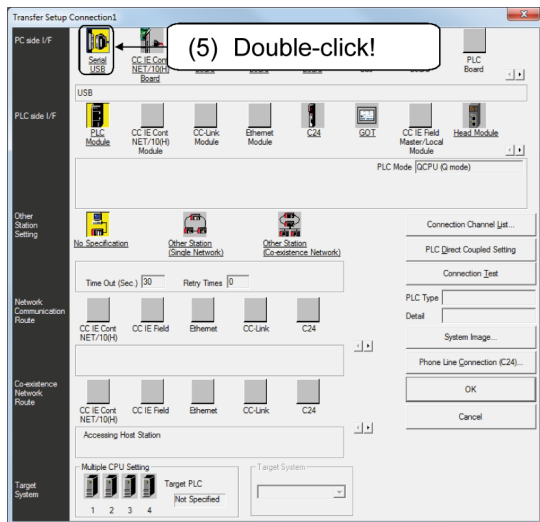
5) Double-click [Serial/USB] on the PC side I/F.
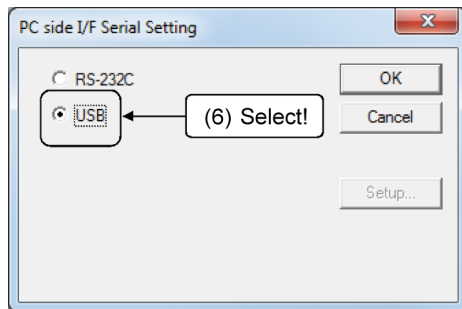
6) Select the cable used for connection and click the OK button.
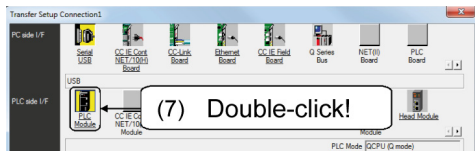
7) Double-click the PLC Module on the PLC side I/F.
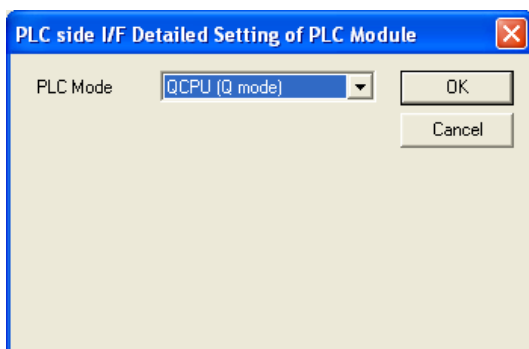
8) Select "QCPU(Q module)" for the PLC Mode and click the OK button.

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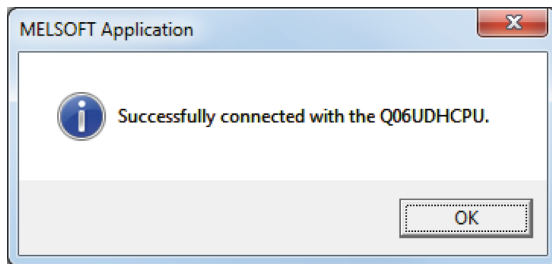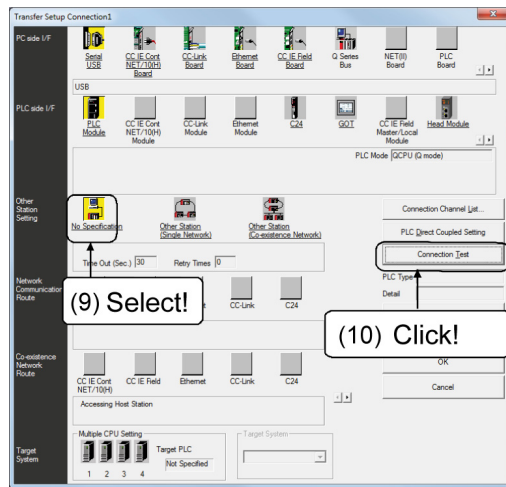
(9) Select!

(10) Click!

9) Select "No Specification" for Other Station Setting.

10) Click the $\boxed{\text{Connection Test}}$ button.

11) If properly connected, the screen on the left is displayed. Click the $\boxed{\text{OK}}$ button.

If not properly connected, the following screen is displayed. Check the connection and conduct the communication test again.
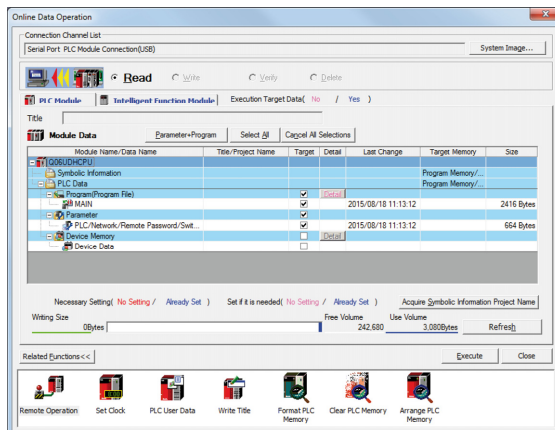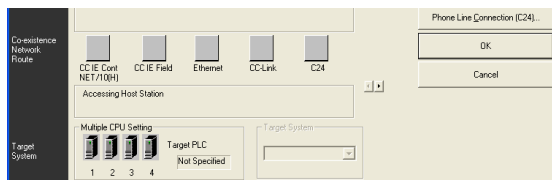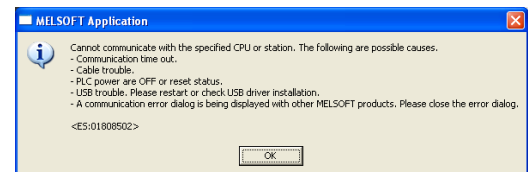
12) Click the $\boxed{\text{OK}}$ button.

13) The Read from PLC dialog box is displayed. Click the $\boxed{\text{Close}}$ button.

(2) Delete the program name "MAIN" from the project data.
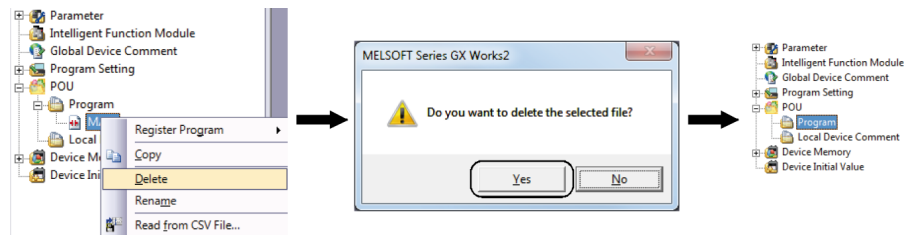
(3) Delete Global Device Comment from the project data.
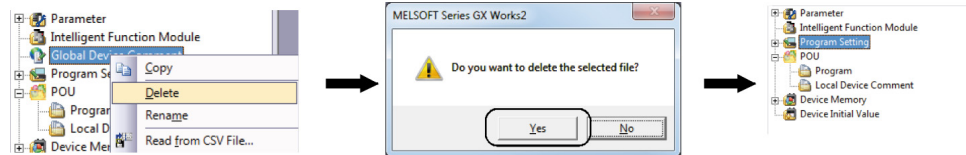
(4) Delete the device memory "MAIN" from the project data.

(5) Check that there is no error for the CPU to be removed.   In addition, create a new project after starting up GX Works2 and use the system monitor to check that there is no error for the mounted module.
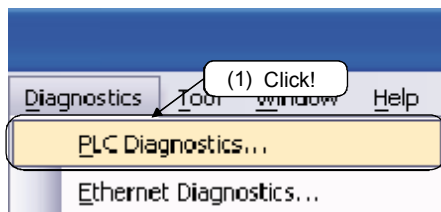
1) In the LED on the front of the CPU, check that the ERR.LED is turned OFF.

2) If the ERR.LED is turned ON or flashes, click the [Diagnostics] → [PLC Diagnostics] menu.
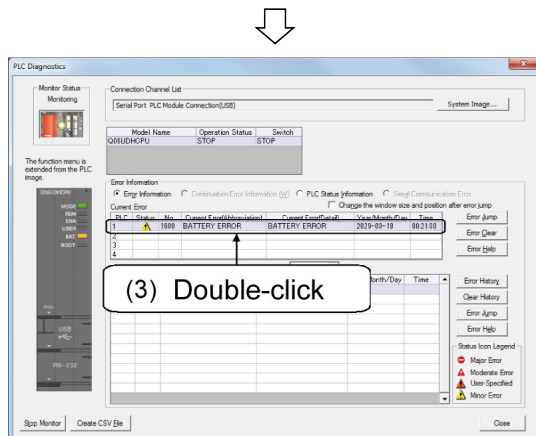
3) Double-click an error code in [Current Errors].

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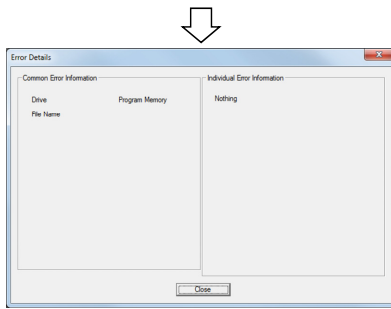
4) Check the error details to enter the common error information and individual information in the checklist.

As needed, click the Error JUMP and Error Help buttons to enter the error details in the checklist.
Also, ask the user for check.
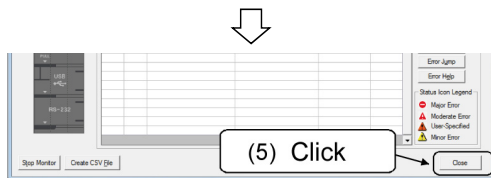
(5) Click

5) Click the Close button to close the PLC diagnostics dialog box.
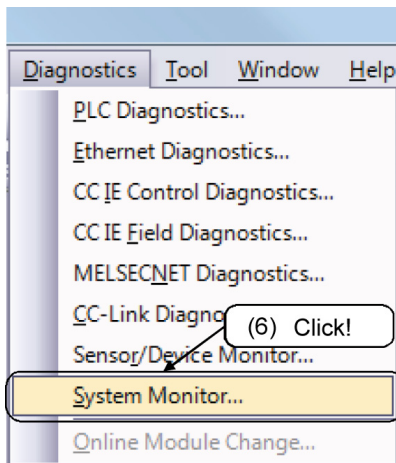
(6) Click!

6) Click the [Diagnostics] → [System Monitor] menu.
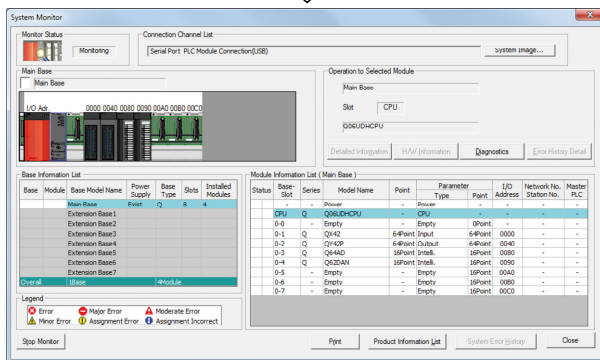
7) Check that there is no error for the mounted module.

If there is no error, the screen on the left is displayed.

(To the next page)

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(From the previous page)
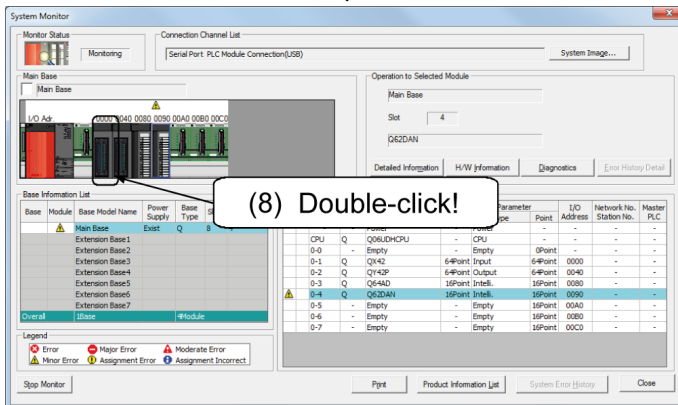
8) If there is any error for the mounted module, double-click the erroneous module to check the error history of the module detailed information and enter in the checklist.
Also, check with the user.

Click the [Close] button to close the system monitor dialog box.

(8) Double-click!

Click
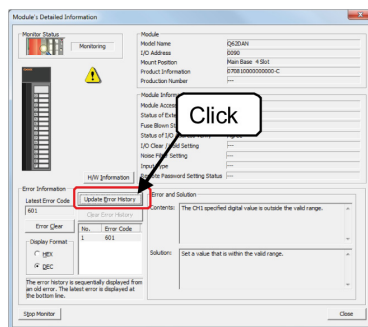
(6) Before setting RUN/STOP/RESET switch of the CPU to be removed to STOP, check with the administrator.

(7) After entering the file content of the program memory in the checklist, select all programs, parameters (only for PLC/network), device comments, initial device values and so on, and check [Also read the remaining reserved capacity for writes during RUN]. Then, save the project after reading from the PLC.

* Please change the intelligent function module parameters (hereafter referred to as intelligent parameters) to non-device data because they can be read.

(1) Click!

1) Click the [Online] → [Read from PLC] menu.

(2) Set!

2) Set the target memory to [Program memory/Device memory].
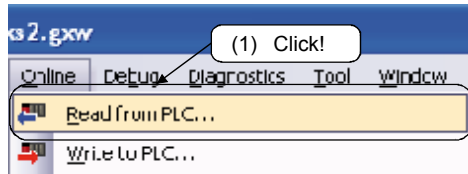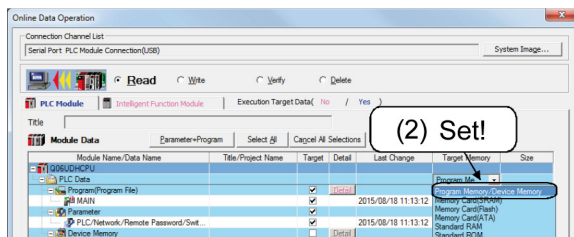
File name

3) In the [Program memory] field in the checklist, enter file names, whether there is any parameter, and so on.
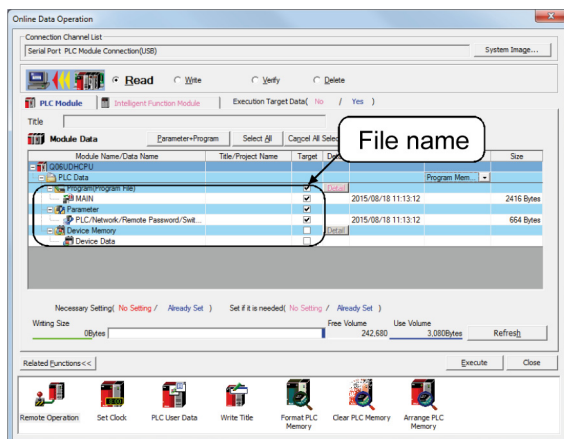
Write all save destinations and file names to frames
Circle either of [Applicable/Not applicable]

Program memory [Save destination:			]
Parameter	Program	Program	Comment
(Applicable)/Not applicable]			COMMENT
Intelligent parameter			
(Applicable)/Not applicable]			
Device data			
Initial device value			
(Applicable)/Not applicable]			
INIT			

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⬇
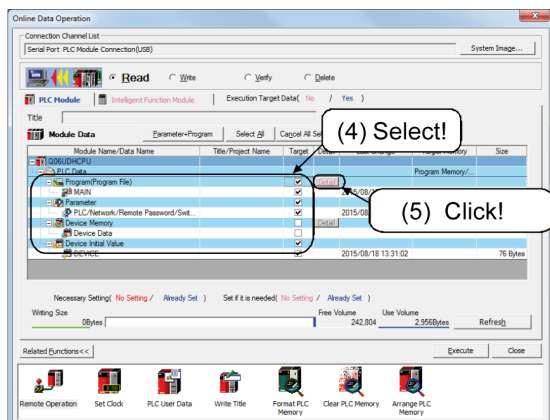
4) From the file selection, select (check) all programs, parameters (PLC/Network/Remote password/Switch setting), device comments (global/local), and initial device values.

    * Select non-device data.

5) Click the ▢Detail button of the program.

⬇
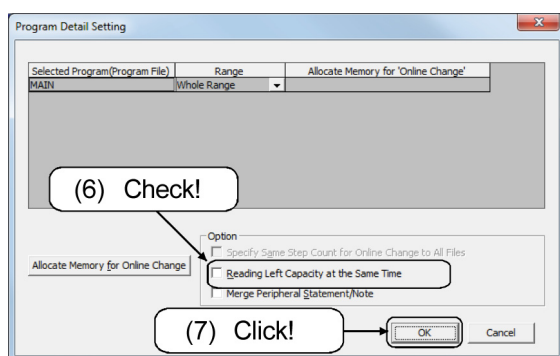
6) Check [Also read the remaining reserved area for online change].

7) Click the ▢Execute button.

⬇
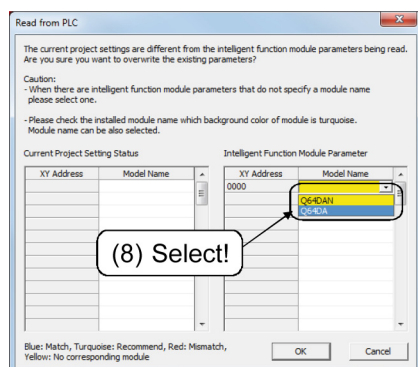
8) If the dialog on the left is displayed, double-click and select the model name of the actual device mounted on the target system.

9) Click the ▢OK button.

⬇

10) Click the ▢OK button.

⬇

(To the next page)

(From the previous page)

⇩

MELSOFT Application ⚠ Parameter already exists. Are you sure you want to overwrite the existing file?

(11) Click!

Yes   Yes to all   No
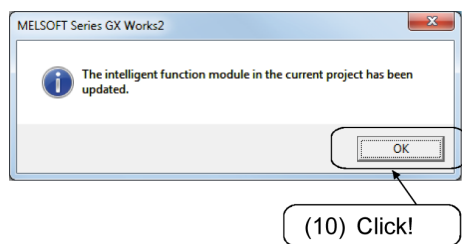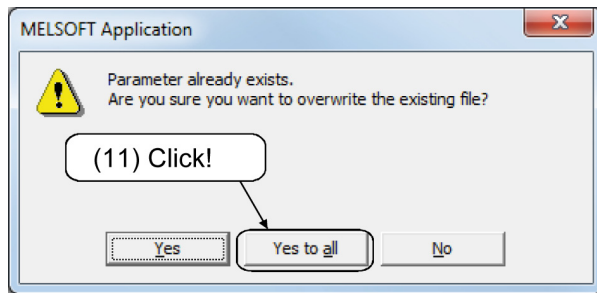
11) A dialog box that asks whether to save changes is displayed. Click the ⌐Yes for All⌐ button.
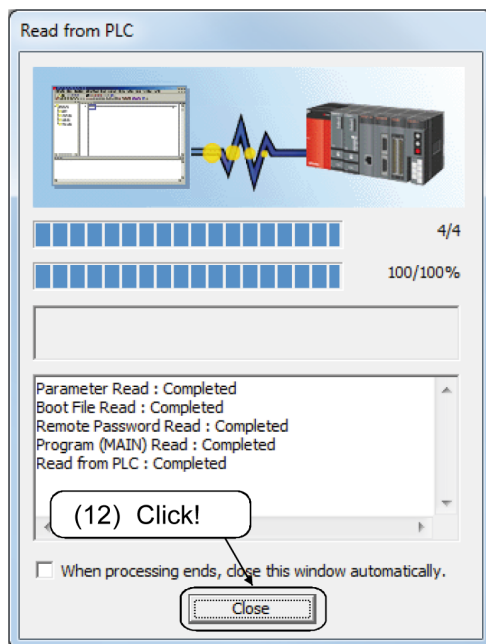
⇩

Read from PLC

4/4

100/100%

Parameter Read : Completed
Boot File Read : Completed
Remote Password Read : Completed
Program (MAIN) Read : Completed
Read from PLC : Completed

(12) Click!

☐ When processing ends, close this window automatically.

Close

12) When the read is completed, the dialog box on the left is displayed. Click the ⌐OK⌐ button.

⇩

MELSOFT Series GX Works2 (Untitled P

Project Edit Find/Replace Compile View

New...   Ctrl+N
Open...   Ctrl+O
Close
                (14) Click!
Save   Ctrl+S

Save As...

Compress/Unpack   ▶
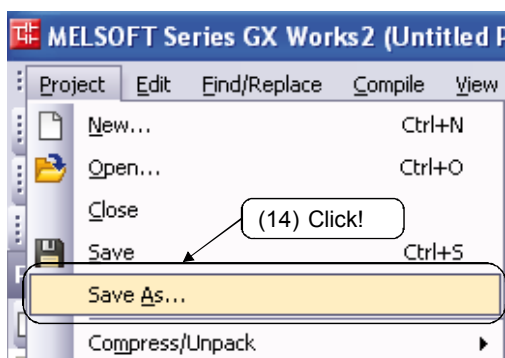
13) Close the Read from PLC dialog box.

14) Click the [Project] → [Save as] menu to name the project.

⇩

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(From the previous page)

⇩

15) Enter the save destination in the [Program memory] field in the QnU(D)(E)(H)CPU Replacement Checklist.

Write all save destinations and file names to frames
Circle either of [Applicable/Not applicable]

Program memory [Save destination: D:\Program_memory_read**]**

Parameter		Program	Program	Comment
[Applicable/Not applicable]		MAIN		COMMENT
Intelligent parameter				
[Applicable/Not applicable]				
Device data				
Initial device value				
[Applicable/Not applicable]				
INIT				

(8) Select device data in the program memory and name a file. (Example: DEVICE)
Click the "Default" button in "Device data" to select X and Y (☑), as well.
After reading from PLC, confirm that there is the data and then save the project.
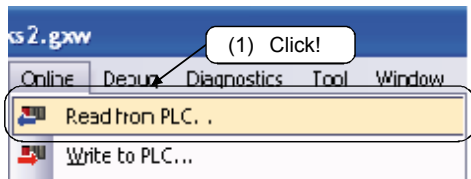
1) Click the [Online] → [Read from PLC] menu.
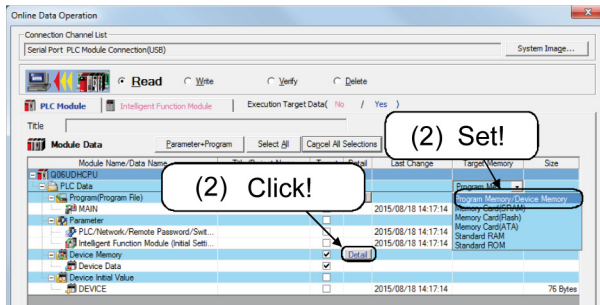
2) Set the target memory to [Program memory/Device memory] and click the Detail button of the device memory.

3) Click the Default button.
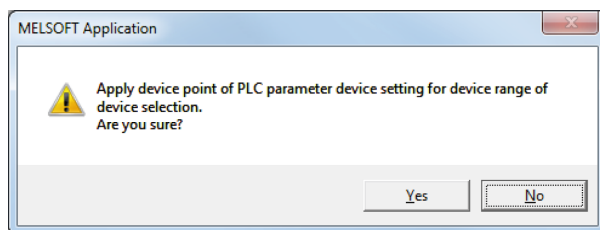
4) The message box on the left is displayed. Click the Yes button.
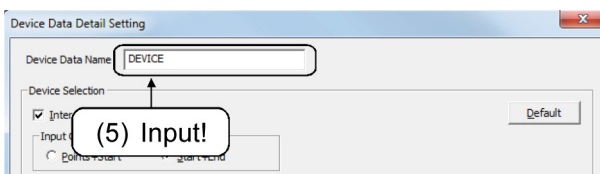
5) Select a device data and name a device data name.

Device data name: DEVICE (example)

(To the next page)

(From the previous page)
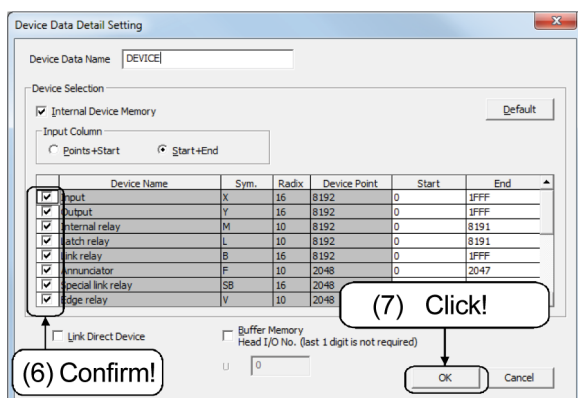
6) Check that all the current devices (except for the retentive timer) are selected (☑).

7) Click the OK button to read from PLC.
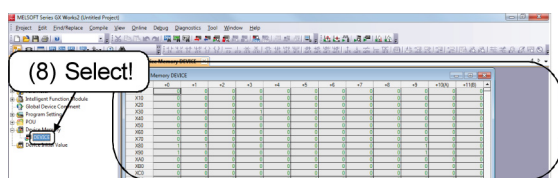
(6) Confirm!

(7) Click!

8) Select the read file.

9) Confirm that the device data exists.
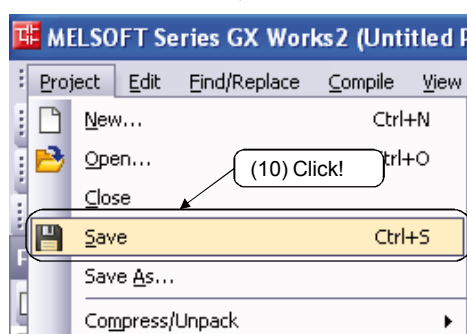
(8) Select!

(9) Confirm!

10) Close the Read from PLC dialog box, and then click the [Project] → [Save] menu to save the project.

(10) Click!

11) Enter the device data name in the [Device data] field in the QnU(D)(E)(H)CPU Replacement Checklist.

Write all save destinations and file names to frames
Circle either of [Applicable/Not applicable]

Program memory [Save destination: D:\Program_memory_read]			
Parameter	Program	Program	Comment
[Applicable/Not applicable]	MAIN		COMMENT
Intelligent parameter			
[Applicable/Not applicable]			
Device data			
DEVICE			

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(9) If a file register exists in the standard RAM, enter the file name and file size (in bytes) in the checklist, read the entire range into the same project and then save it.
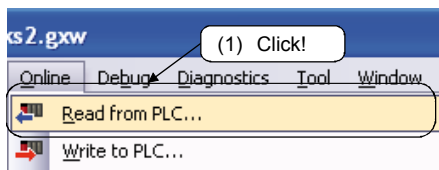
1) Click the [Online] → [Read from PLC] menu.

2) Set the target memory to [Standard RAM].

Check that the file register exists.

3) Select a file and click the Detail button.

Check that the entire range is selected and click the OK button.
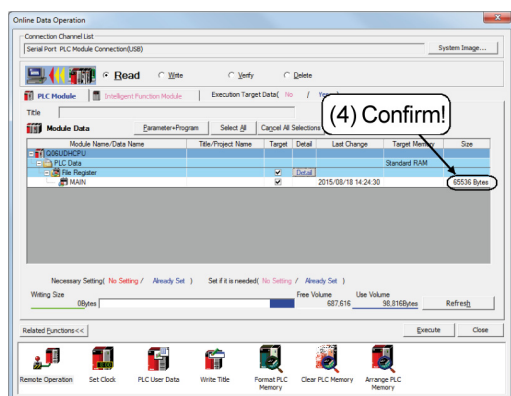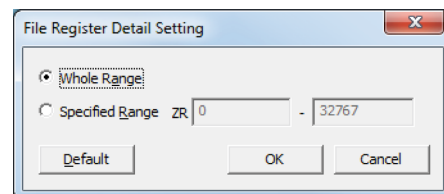
4) Check the file size.

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⇩

5) Enter the file name and file size in the [Standard RAM] field in the QnU(D)(E)(H)CPU Replacement Checklist.

Standard RAM	
File register	File size
MAIN	2048 byte

Note) Use the same project as the program memory. Before write to PLC, ensure that the destination and the file name are correct. Writing to the PLC shall be done to the standard RAM.

⇩
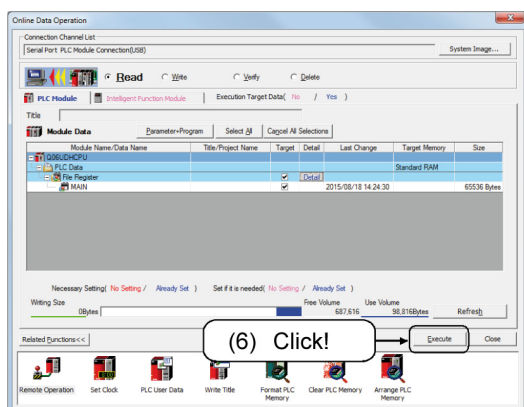
6) Click the Execute button to read from PLC.

⇩
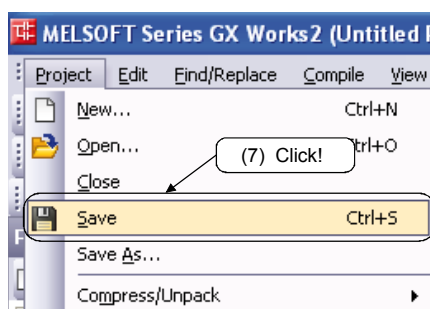
7) After closing the Read from PLC dialog box, click the [Project] → [Save] menu to save the project.

(10) If files exist in the standard RAM, after entering the file contents in the checklist, start up new GX Works2, read the files in the same way as reading the program memory from PLC, and save it with another project name.

However, if they are device comments or likewise, and there is no same file as that in the program memory, there is no problem in saving in the same project as in (7).

1) Click the [Online] → [Read from PLC] menu.

⇩

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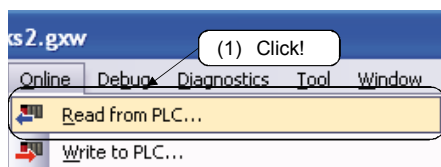
(From the previous page)

⇩
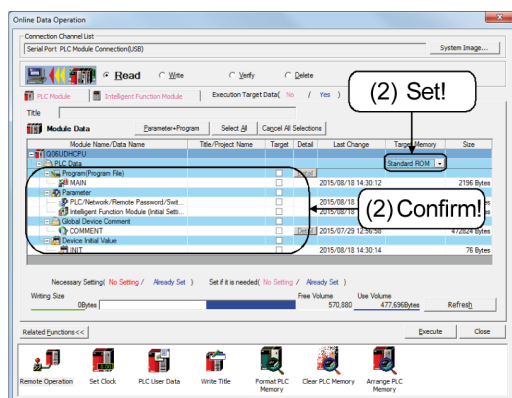
2) Set the target memory to [Standard RAM] and check for the file.

⇩

3) Enter the file names and others in the [Standard ROM] field in the QnU(D)(E)(H)CPU Replacement Checklist.

Standard ROM [Save destination:				]
Parameter		Program	Comment	Initial device value
[Applicable/Not applicable]	File name	MAIN	COMMENT	INIT
Intelligent parameter				
[Applicable/Not applicable]				

4) Use the checklist and others to check whether these files are same as those in the program memory (7).
If no same files as in the program memory exist, save in the same project as in (7) after reading from PLC, and then enter the project name in the checklist.

Standard ROM [Save destination: D:\Program_memory_read			]
Parameter		Comment	
[Applicable/Not applicable]	File name	COMMENT	
Intelligent parameter			
[Applicable/Not applicable]			

⇩

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⬇

* If there exist the same files as in the program memory, follow the procedures below
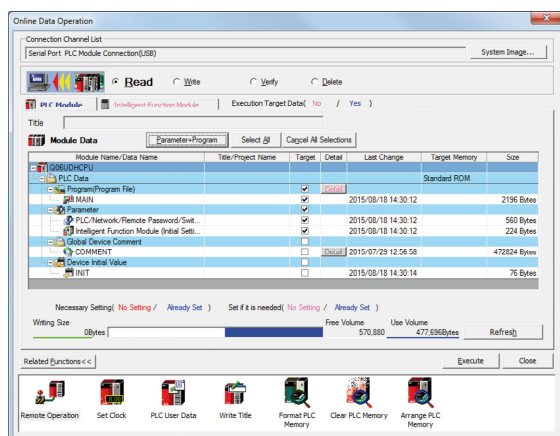
1) Start up new GX Works2.

2) Set the target memory to [Standard ROM] and read from PLC in the same way as for the program memory.

⬇
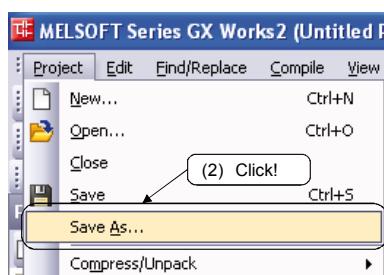
3) Click the [Project] → [Save as] menu to newly save the project.

⬇

4) Enter the project name in the checklist.

Standard ROM [Save destination: D:\Standard_rom_read			]
Parameter	Program	Comment	Initial device value
[Applicable/Not applicable]	MAIN	COMMENT	INIT
Intelligent parameter			
[Applicable/Not applicable]			

(Note: "File name" label appears vertically along the left side of the Program/Comment/Initial device value columns)

(11) If a memory card is used or if files exist, after entering the file contents in the checklist, start up new GX Works2, read the files in the same way as in reading the program memory from PLC, and save it with another project name.
However, if it is a file register or likewise, and there is no same file as that in the program memory, it is possible to save them to the same project as in (7).
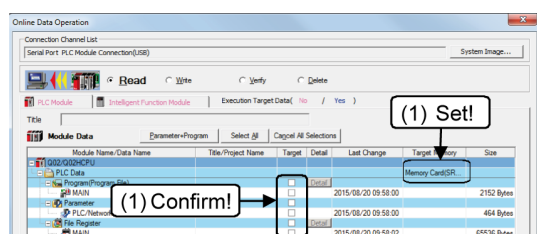
1) Check if files exist, and if they do, perform the same procedure as in (10).

(12) From GX Works2, run [Online] → [Program memory batch transfer] and check whether the content of the program cache memory matches that of the program memory.

* If the contents do not match, or if the user cannot check due to the CPU version, a message "Do you transfer...?" will appear. Then, click the | Yes | button to perform the batch transfer.
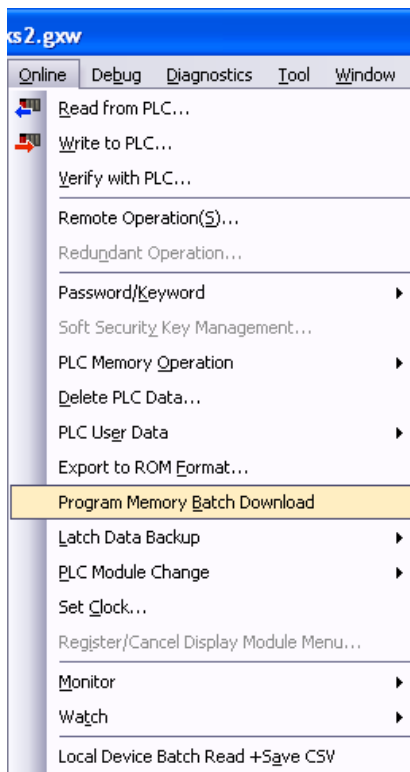
1) Click the [Online] → [Program Memory Batch Download] menu.
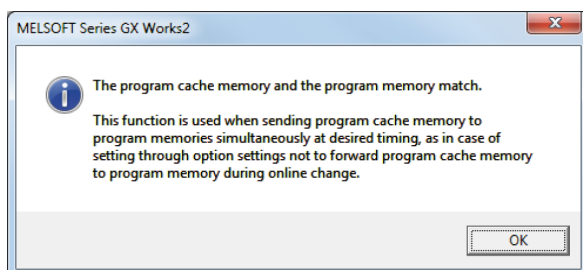
If it matches

2) Check whether the content of the program cache memory matches that of the program memory and, if it does, click the | OK | button.

Otherwise, click the | Yes | button so that the content of the program cache memory will match that of the program memory.
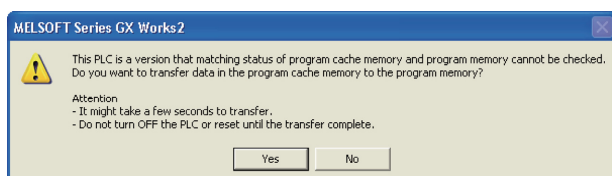
If it does not match

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(13) When replacing the QnUCPU module, use the "CPU module replacement" function to back up the module to a memory card.
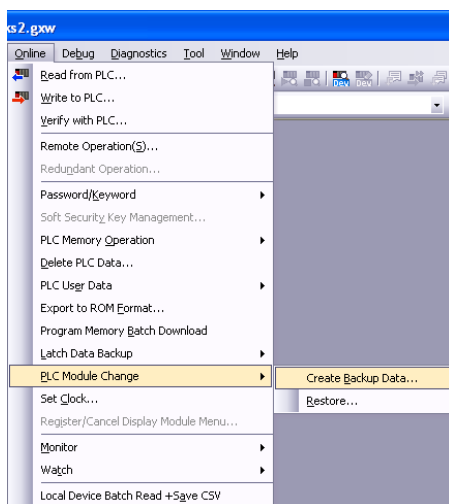
1) Click the [Online] → [PLC Module Change] → [Create Backup Data] menu.
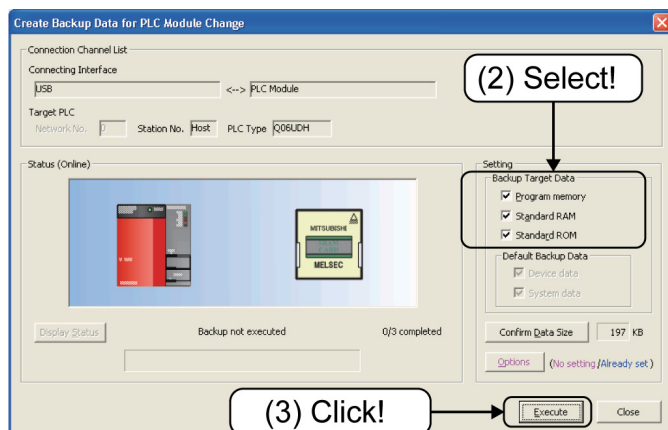
2) In "Data for backup", select data to be backed up from "Program memory", "Standard RAM" or "Standard ROM".

   * "Default backup data" is selected by default. It cannot be changed.

3) Click the Execute button. The data backup starts.

(2) Select!

(3) Click!
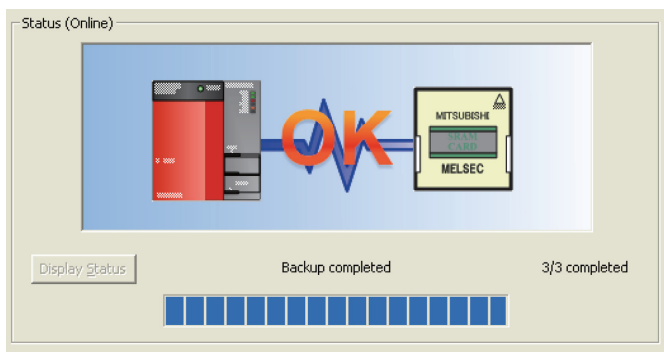
4) When the backup is normally completed, the [Status] screen changes as in the image on the left.

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12.1.3 Replacement

(1) In the checklist, enter the <u>SERIAL number</u> and MAC address (only for the CPU board with Ethernet enabled) on the side of, or under the face plate of, the CPU to be mounted.
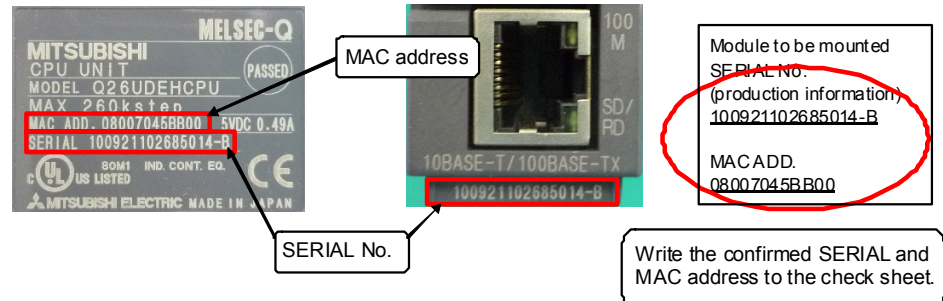
(2) Set the RUN/STOP/RESET switch of the CPU to be mounted to "STOP". Also, mount the battery connector at the bottom of the module.
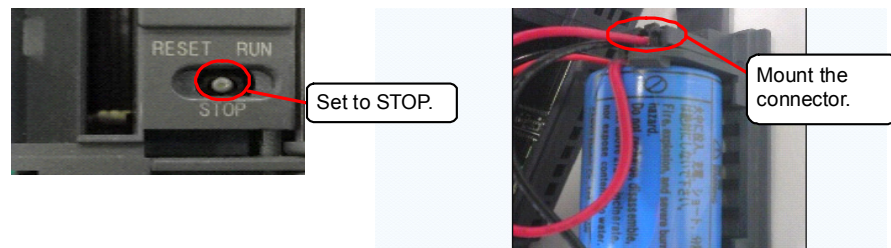
(3) Before powering OFF the programmable controller, check with the administrator.

(4) Remove the target CPU from the base and, in the checklist, enter the SERIAL number and MAC address (only for the CPU board with Ethernet enabled) on the side or under the face plate.

(5) If an identification seal is put, move it to the CPU to be mounted.

(6) If a memory card is mounted on the removed CPU, move it on the CPU to be mounted.

(7) Mount the target CPU on the base in the mounting panel and, if it is to be fixed with screws, tighten the screws.

(8) Confirm again that the RUN/STOP/RESET switch of the mounted CPU is set to "STOP".

(9) Before powering ON the programmable controller, check with the administrator.

* An error may be displayed on the CPU, but please continue with the task.

12.1.4 Data Restoration

(1) Check the product information of the corresponding module in the GX Works2 system monitor, and enter in the check sheet.
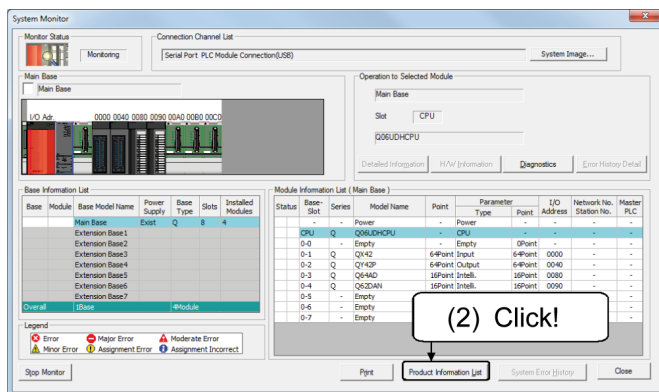
1) Click the [Diagnostics] → [System monitor] menu to display the system monitor dialog box.

2) Click the | Product Information List | button.
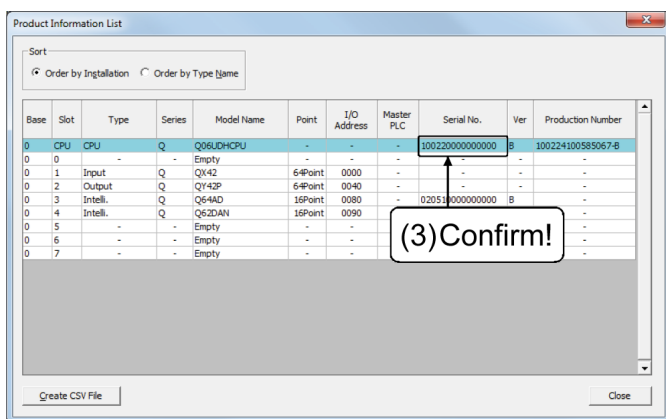
3) The product information list dialog box is displayed. Check the product information (serial number, etc.) of the corresponding module.

4) Enter the product information in the [Product information of the CPU (replacement)] field in the QnU(D)(E)(H)CPU Replacement Checklist.

5) Close the product information list dialog box and the system monitor dialog box.

(2) Format the program memory/device memory, standard RAM, and standard ROM to be used for the PLC memory.

At this point, check whether it is necessary to allocate the system area and, if it is, configure the settings.

However, because this area is set only when formatting, if you are not sure, there is no problem leaving it as the default.
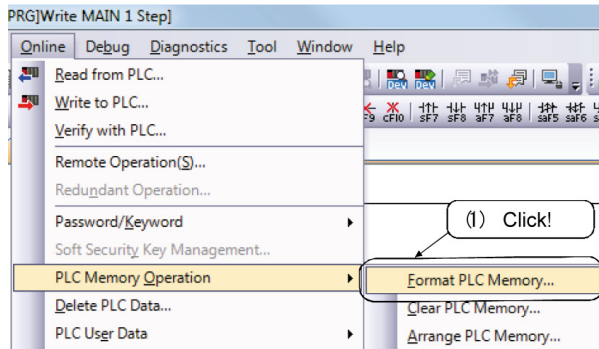
1) Click the [Online] → [PLC Memory Operation] → [Format PLC Memory] menu.
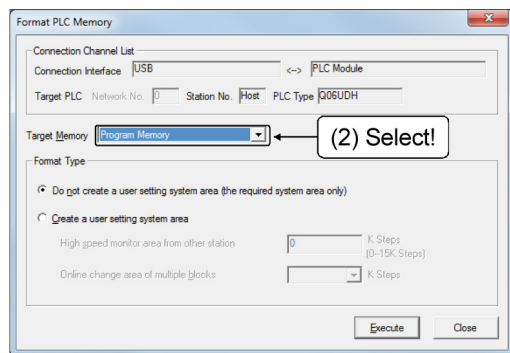
2) Since the Format the PLC memory dialog box is displayed, set the target memory to either "Program memory" or "Device memory".
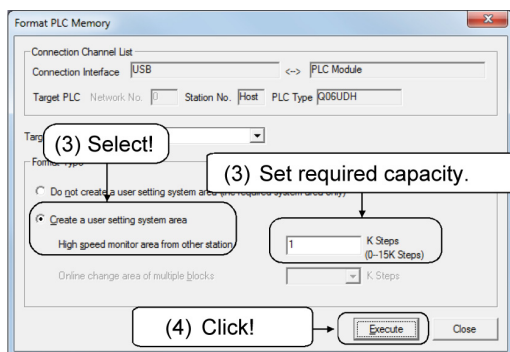
3) Select the format.

* Set the system area if it is necessary to allocate the area.

If it is not necessary, select "Do not create a user setting system area (only the required field)".

4) Click the Execute button.
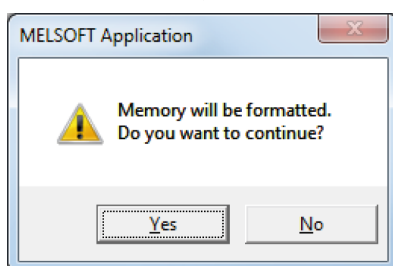
5) The message box on the left is displayed. Click the Yes button.

The program memory or device memory is formatted.

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(From the previous page)

⇩

Format PLC Memory

Connection Channel List

Connection Interface USB <--> PLC Module

Target PLC Network No. 0 Station No. Host PLC Type Q06UDH

Target Memory Standard RAM ← (6) Select!

Format Type

◉ Do **n**ot create a user setting system area (the required system area only)

○ **C**reate a user setting system area

High **s**peed monitor area from other station 1 K Steps (0--15K Steps)

Online change area of multiple **b**locks ▢ K Steps

(6) Click! → Execute Close
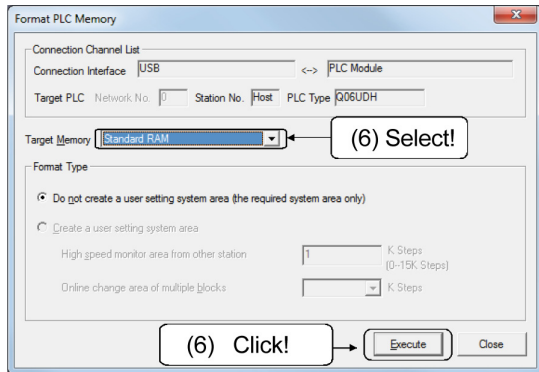
6) Format the target memory "standard RAM" or "Standard ROM" as with "Program memory/Device memory".

7) Close the Format the PLC memory dialog box.

(3) Select "Include latches" and clear the CPU to be mounted from the PLC memory.

PRG]Write MAIN 1 Step]

Online Debug Diagnostics Tool Window Help

Read from PLC...
Write to PLC...
Verify with PLC...

Remote Operation(S)...
Redundant Operation...

Password/Keyword ▶
Soft Security Key Management...

(1) Click!

PLC Memory Operation ▶ Format PLC Memory...
Delete PLC Data... Clear PLC Memory...
PLC User Data ▶ Arrange PLC Memory...

1) Click the [Online] → [PLC Memory Operation] → [Clear PLC Memory] menu.

⇩

Clear PLC Memory

Connection Channel List

Connection Interface USB <--> PLC Module

Target PLC Network No. 0 Station No. Host PLC Type Q06UDH

Device Memory

☑ Clear **D**evice's whole Memory [Point]
☑ Include **L**atch ← (2) Check! onitor status "local device monitor d when executing device memory

File Register

☐ Clear all **F**ile Registers Target Memory Memory Card(SRAM) ▾
○ **A**ll Files
○ **S**pecific File ▢ ▾

(3) Click! → Execute Close

2) The Clear the PLC memory dialog box is displayed. Select "Include latches".

3) Click the Execute button.

⇩

MELSOFT Application

⚠ Memory will be cleared.
Do you want to continue?

Yes No

4) The message box on the left is displayed. Click the Yes button.

The PLC memory is cleared.

5) Close the Clear the PLC memory dialog box.

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(4) To the program memory/device memory in the PLC, write the files saved earlier (except the device memory) such as parameters and programs by referring to the [Program memory] field in the checklist.
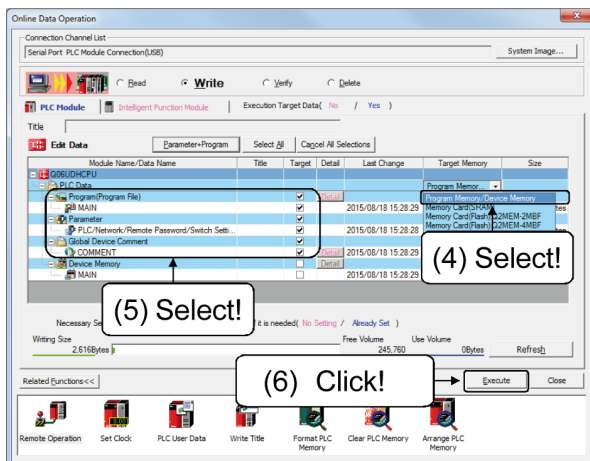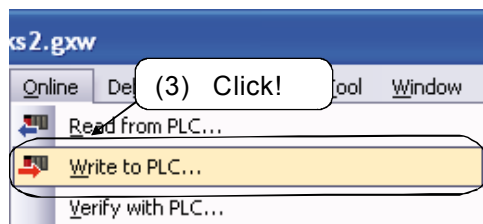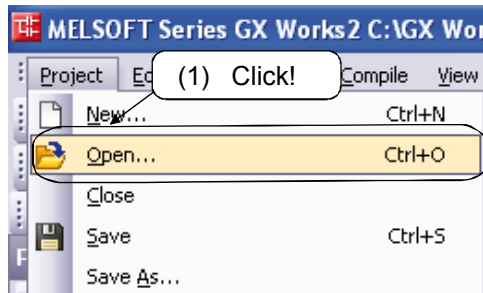
1) Click the [Project] → [Open] menu.

2) Open the project saved in (6) in 12.1.2.

* Be careful not to open a wrong project.

3) Click the [Online] → [Write to PLC] menu.

4) The Write to PLC dialog box is displayed. Set the target memory to "Program memory/Device memory".

5) Click the [File selection] tab and select programs, parameters and so on (except for the device memory) by referring to the "Program memory" field in the checklist.

6) Click the Execute button to write to the PLC.

(5) To the standard RAM in the PLC, write the files saved earlier referring to the [Standard RAM] field in the checklist.
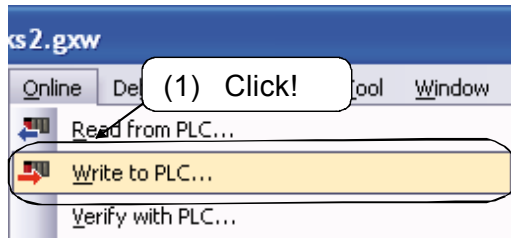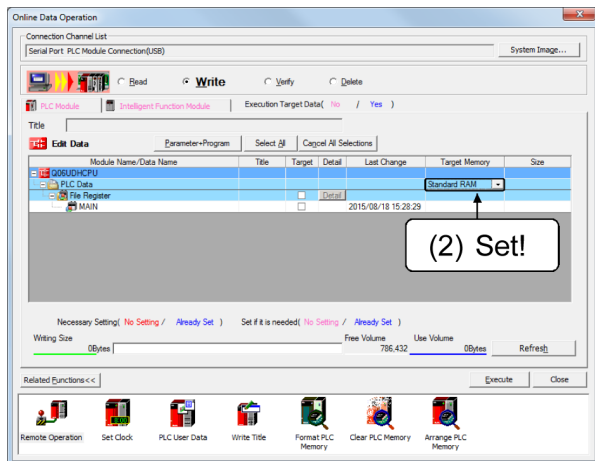
1) Click the [Online] → [Write to PLC] menu.

2) The Write to PLC dialog box is displayed.

Set the target memory to [Standard RAM].
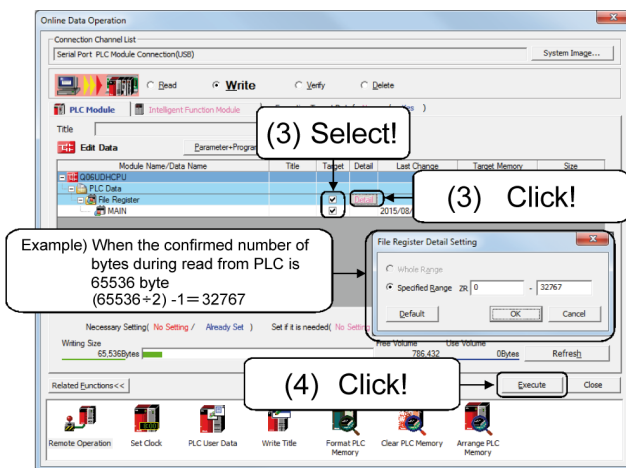
3) Check the write range ((The number of bytes checked during PLC read ÷ 2) - 1) and click the Detail button for the file register.

Select a file by referring to the [Standard RAM] field in the attached checklist.

4) Click the OK button and then click the Execute button to write to the PLC.

(6) To the standard ROM in the PLC, write only the stored files by referring to the [Standard ROM] field in the checklist.
Open the project saved in (10) of 12.1.2 and write the stored files to the PLC by referring to the [Standard ROM] field in the attached checklist.

(7) For the memory card, verify all the files with those in the PLC by referring to the [Memory card] field in the checklist.
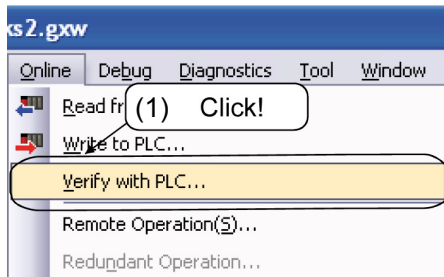
(1) Click!

1) As in (4), open the project saved in "(11)" in 12.1.2.

2) Click the [Online] → [Verify with PLC] menu.

(3) Select either of Memory card (SRAM), (Flash), or (ATA)!
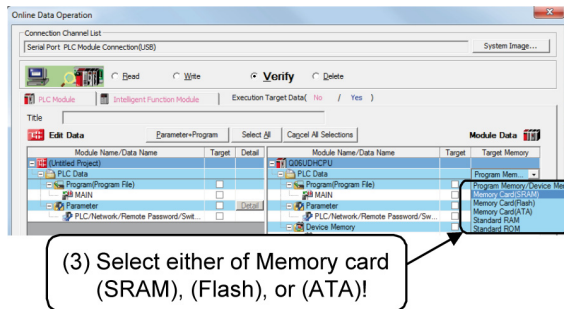
3) The Verify PLC dialog box is displayed.

Set the target memory to [Memory card (SRAM), (Flash) or (ATA)].
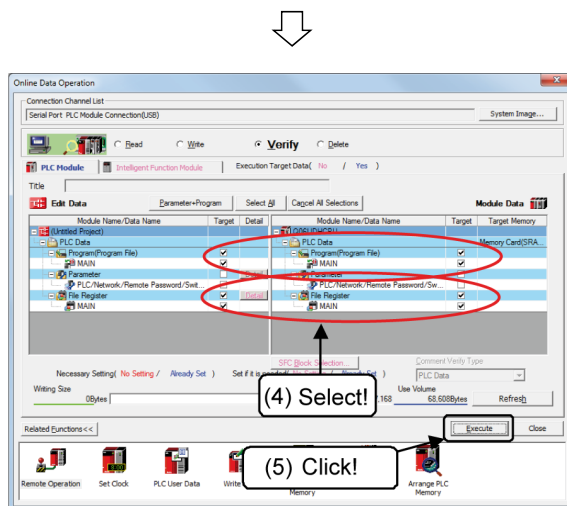
(4) Select!

(5) Click!

4) Refer to the [Memory card] field in the checklist and select the same data in the verify source and destination.

5) Click the Execute button to verify the data in the PLC.
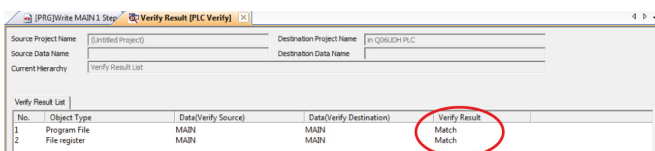
6) Confirm that there is no mismatch.

(8) Check with the administrator and set the clock if needed.
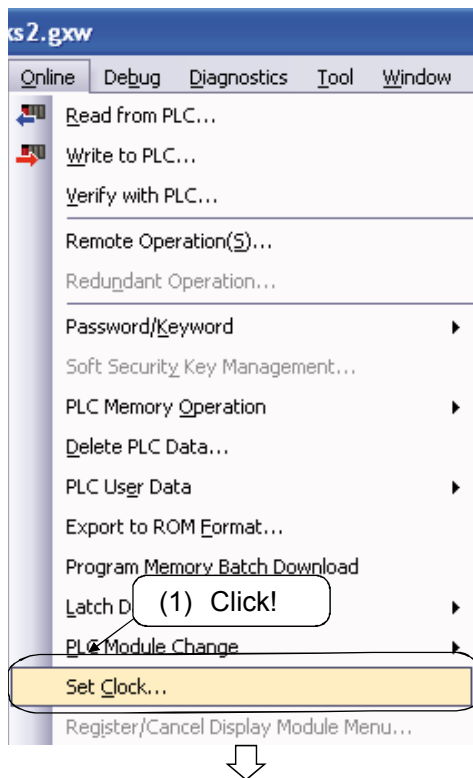
1) Click the [Online] → [Set Clock] menu.
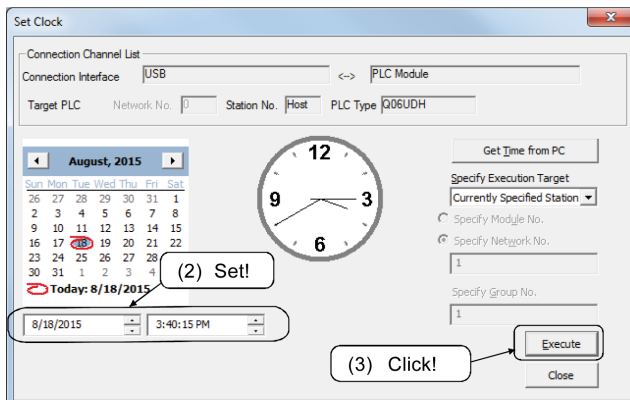
2) The Clock setting dialog box is displayed.

Set the year/month/day, time, and day of the week.

3) Click the Set button.

(9) Before powering OFF/ON theprogrammable controller, check with the administrator.
Power OFF the programmable controller once, and then turn ON the power again.

(10) Select "Detail" for the device memory and click "Default" in the "Device detailed setting". Then,after confirming that S (Step relay) is deselected, write to the PLC and verify the data.

<<* Deselect S in the device setting.>>

(A verification error may occur for the SM, SD or refresh device.)
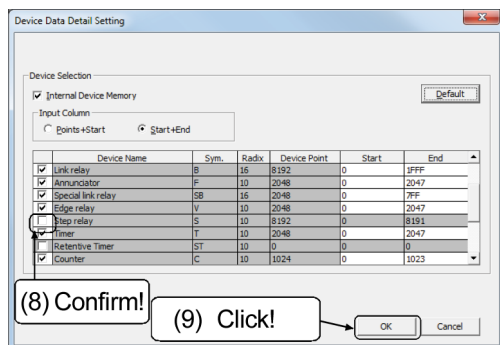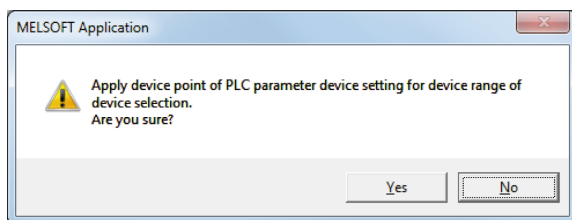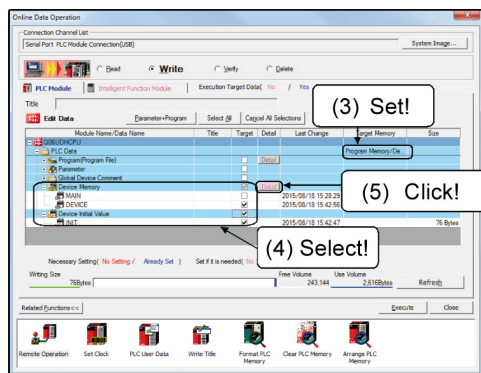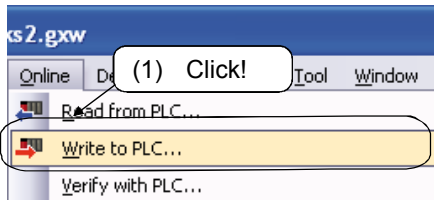
(1) Click!

1) As in (4), open the project saved in (8) of 12.1.2.

2) Click the [Online] → [Write to PLC] menu.

(3) Set!
(5) Click!
(4) Select!

3) The Write to PLC dialog box is displayed.

Set the target memory to [Program memory/Device memory].

4) Use the file selection to select files for the device memory.

* Be careful not to select wrong file names.

5) Click the Detail button.

(6) Click!

6) Click the Default button.

7) The message box on the left is displayed. Click the Yes button.

(8) Confirm!
(9) Click!

8) Check that the step relay (S) is deselected ( ).

9) Click the Execute button to write to the PLC.

(To the next page)

(From the previous page)

⬇
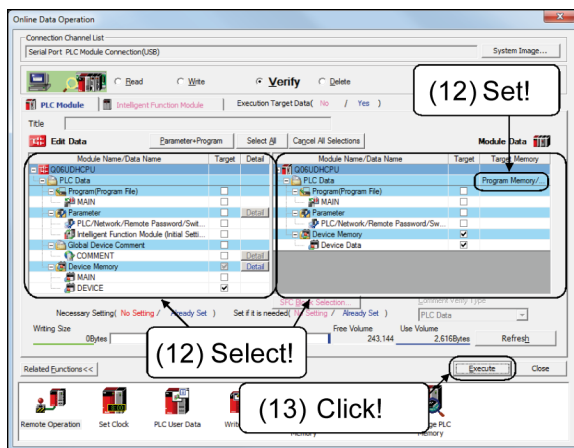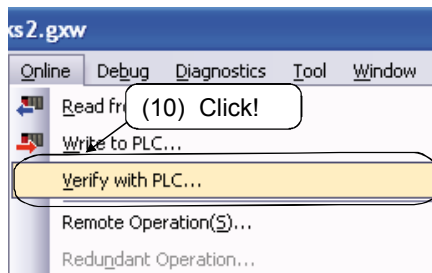
10) As in (7), click the [Online] → [Verify PLC] menu.

11) The Verify PLC dialog box is displayed.

Set the target memory to [Program memory/Device memory].

12) Select a file by referring to the [Device data] field in the attached checklist.

13) Click the │ Execute │ button to verify the data in the PLC.

14) Confirm that the device data matches.

* The SM, SD and device used for link refresh may be mismatched.

(11) If SFC is used for the program, reset the CPU.
   → If there is data being processed, malfunction may occur because SFC starts up from the initial step.
   → If there is necessary data outside the latch range, select only that device and write it to the PLC.
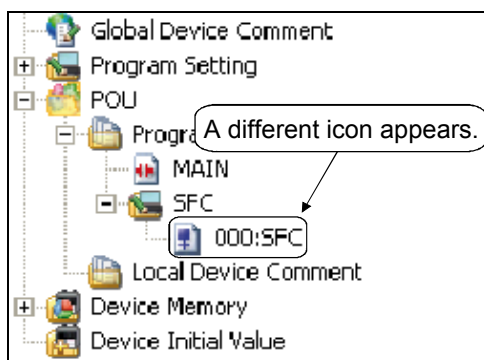
1) Check if an SFC program is used.

2) If an SFC program is used, reset the CPU.

   (a) Push down the RUN/STOP/RESET switch on the front of the CPU towards the RESET side for one second or more.
   (b) Remove the hand from the switch after ERR.LED flashes and then turns off.

⬇

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(12) When using the "CPU module replacement" function to restore data, follow the procedure below:
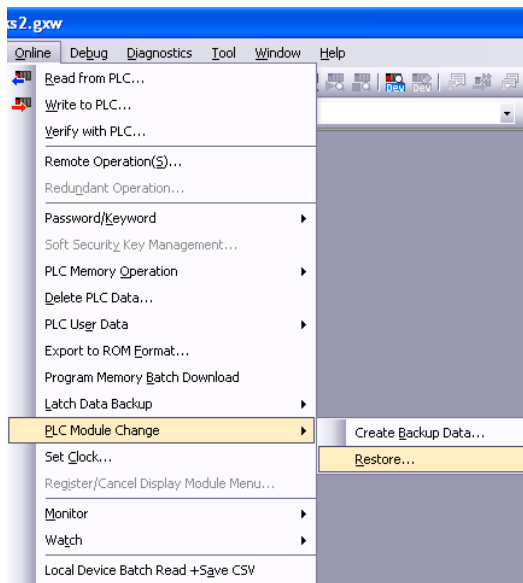
1) Click the [Online] → [CPU Module Change] → [Restore] menu.
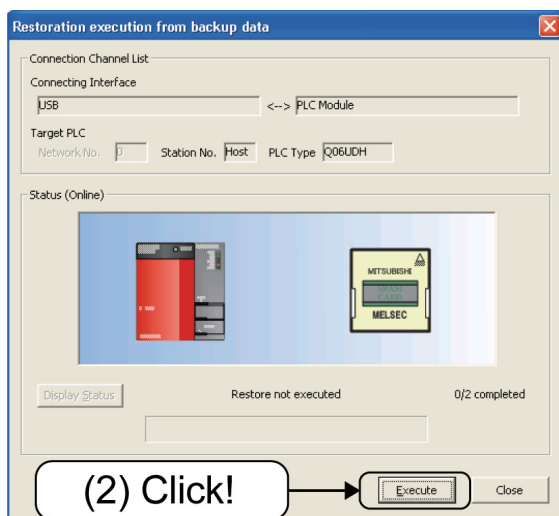
2) Click the Execute button. The data restoration starts.
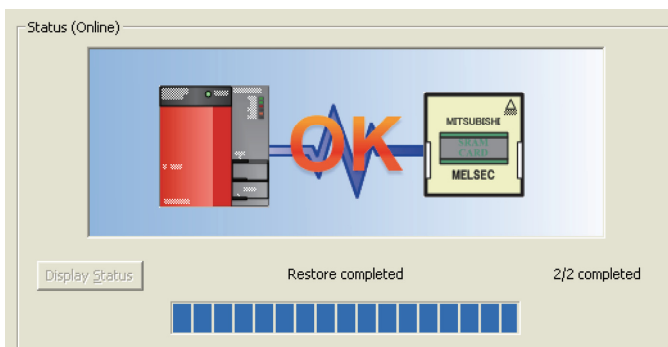
3) Once the restoration is normally completed, the [Status] screen is displayed as in the image on the left.

12 - 30

12.1.5 Operation Check

(1) Check that there is no error for the CPU. Also, check that there is no error for the module mounted on the system monitor.
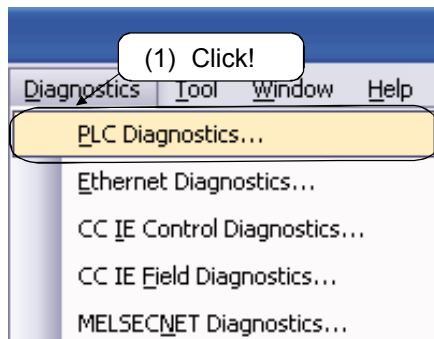
1) Click the [Diagnostics] → [PLC Diagnostics] menu.
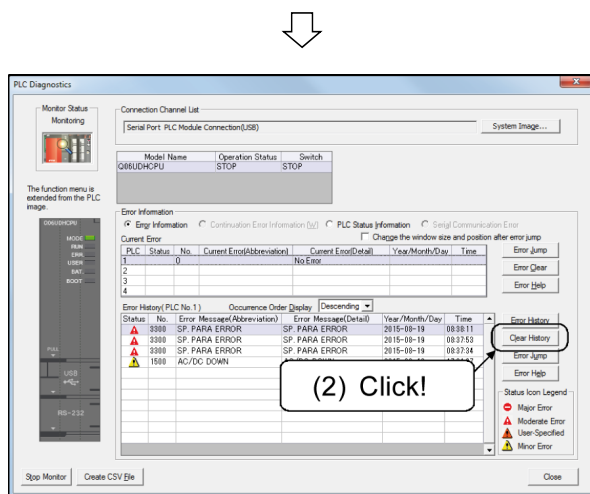
(1) Click!

2) Click the [Clear History] button.
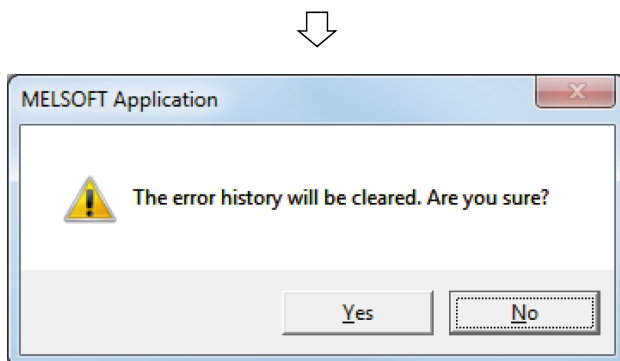
(2) Click!

3) The message box on the left is displayed. Click the [Yes] button.

4) Confirm that the error history has disappeared and then close the PLC diagnostics dialog box.

MELSOFT Application
The error history will be cleared. Are you sure?
Yes   No

(2) Before setting RUN/STOP/RESET switch of the CPU to RUN, check with the administrator.
   * The user should have checked the start-up procedure of the system. (Some applications may require to reset again → RUN.)

(3) Check that there is no error for the CPU. If any faults are found in the replacement, return the removed CPU to the original place.
   In the LED on the front of the CPU, check that there is no error for the CPU.

MEMO

This section describes the operation to change programs or data (Online Program Change) when the programmable controller CPU is in the RUN status.

There are two types of Online Program Changes: online change of a program in unit of ladder block and the one in unit of files.
When performing online program change, have a good understanding of the following and the descriptions in Appendix 1.3 and operate carefully.

Appendix

⚠WARNING	• When data change, program change, or status control is performed from a personal computer to a running programmable controller, configure an interlock circuit outside the programmable controller system to ensure that the entire system will always operate safely. Furthermore, for the online operations performed from a personal computer to a programmable controller CPU, predetermine the system's corrective actions in case of a communication error caused by poor cable connection, etc.

⚠CAUTION	• When performing online operations (program change while a programmable controller CPU is running, forced input/output operation, operating status changes such as RUN-STOP, and remote control operation) for the running programmable controller CPU from a personal computer, read the manual carefully and ensure sufficient safety before operation. When changing a program while a programmable controller CPU is RUN (online program change), a problem such as program corruption may occur depending on operating conditions. Fully understand the precautions described in this section before use.

Appendix 1.1 Online Program Change in Unit of Ladder Blocks

[Purpose of setting]

To change a part of a program when the programmable controller CPU is in the RUN status.

[Operating procedure]

Check that the program matches the one on the programmable controller CPU using the Verify with PLC function in advance.

If the part to be written does not match with the program on the programmable controller CPU, online program change cannot be performed.

1. Change or modify the program.
2. Select [Conversion] → [Conversion (Online Program Change)] (Shift + F4) to execute online change. *

    *: With the following setting, online program change can be executed by selecting [Conversion] (or pressing F4). This setting is useful if programs are always changed by online change.
    <Setting>
      Select the [Tool] → [Option] → [Program Common] tab screen, and select "Execute online change after conversion" in the online program change setting.

[Description]

Online program change can be performed when the mode is Write Mode or Monitor (Write Mode).

When the programmable controller CPU is in the STEP-RUN status, online program change is not allowed.

An attempt to execute online program change will display the following dialog box.

Carefully read the displayed message and execute online change.
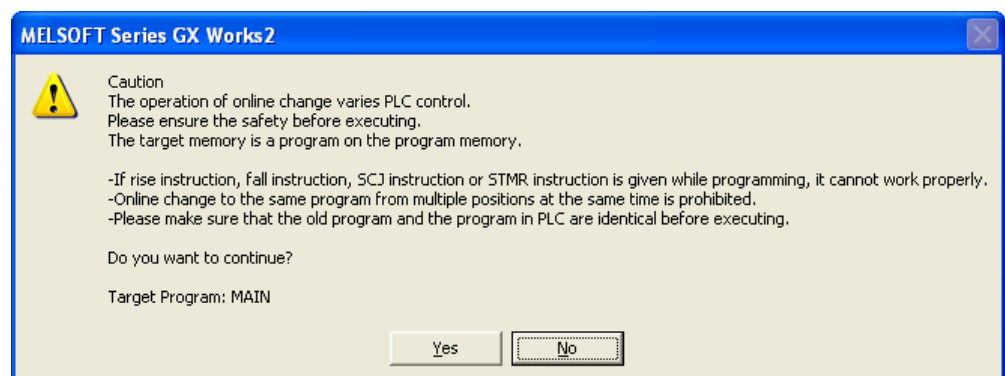
Click the Yes button to write the changed program to the programmable controller CPU.

```
┌─────────────────────────────────────────────────────────────────────┐
│  ┌──────────────┐                                                     │
│  │   POINT      │                                                     │
│  └──────────────┘                                                     │
│  • When performing Online program change to a programmable controller │
│    CPU for the first time, or an error occurs during Online program   │
│    change, check the programs with the Verify with PLC function.      │
│  • When the number of steps exceeds the writable range for online     │
│    change as NOP instructions exist                                   │
│    When the number of steps exceeds the writable range for online     │
│    change as NOP instructions exist after a ladder block, select "Do  │
│    not shift the program forward" before executing online change. For │
│    setting to move programs forward, refer to the GX Works2 Operating │
│    Manual.                                                            │
│    When changing the step 0 (LD X1) of the following program to LD X3,│
│    if "Shift the program forward" is selected, online program change  │
│    cannot be performed.                                               │
│    Ladder mode                            List mode                   │
│       X1                                      0 LD X1                  │
│    0 ─┤├─────────────────────────( M0 )─      1 OUT M0                 │
│                                               2 NOP                   │
│       X2                                      3 NOP                   │
│  601 ─┤├─────────────────────────( M10 )─       ⌇                    │
│                                             600 NOP                   │
│                                             601 LD X2                 │
│                                             602 OUT M10               │
│    When programs are shifted forward                                 │
│      Online program change cannot be performed because steps 0 to 600 │
│      are the target.                                                 │
│    When programs are not shifted forward                             │
│      Online program change can be performed because steps 0 to 1 are  │
│      the target.                                                     │
│                                                                       │
│  • For precautions for and restrictions on label programs, refer to   │
│    the GX Works2 Operating Manual.                                    │
└─────────────────────────────────────────────────────────────────────┘
```
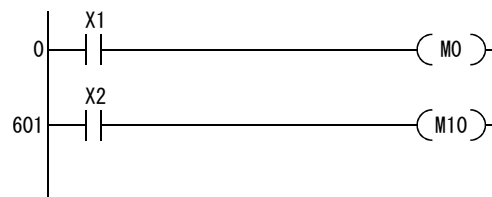
[Purpose of setting]

To execute batch writing of programs and data in unit of files when the programmable controller CPU is in the RUN status.

[Operating procedure]

[Online] － [Write to PLC]

[Description]

Data such as sequence programs and device comments can be written with online program change.

The data that can be written with Online program change differs depending on the write target memory.

For details, refer to the following manual.

• QCPU User's Manual (Function Explanation, Program Fundamentals)

An attempt to execute online program change in unit of files will display the following dialog box.

Read and understand precautions shown as messages and execute online change.
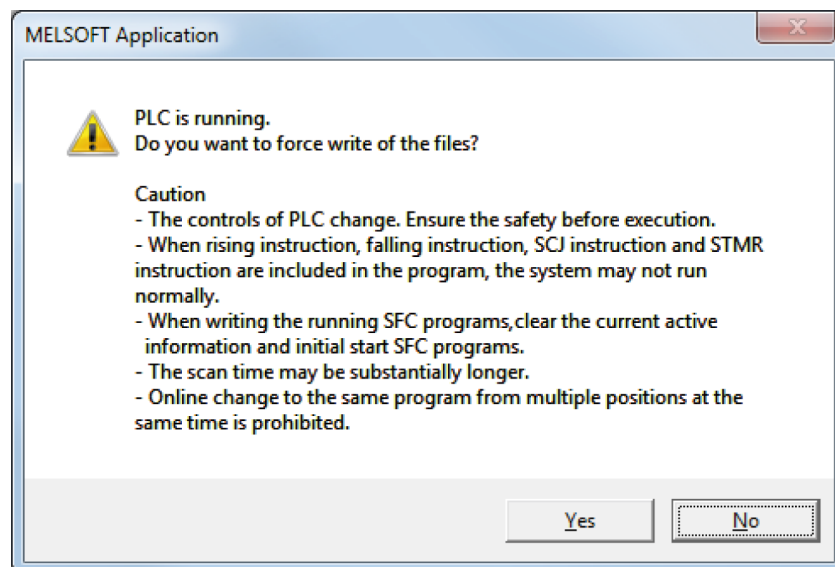
Click the Yes button to write the data specified on the Write to PLC screen to the programmable controller CPU.

```
POINT
• When the capacity of the programmable controller CPU is not enough, switch
  the programmable controller CPU to STOP status, delete unnecessary
  programs written in it, and then write the program using the Write to PLC
  function.
• After online change of a SFC program is executed in unit of files, the CPU
  module the program is initialized and starts up.
```

Appendix1.3 Precautions for Online Program Change

Precautions for online change are described below.

(1) Precautions for using rise, fall, or SCJ instruction

1) Fall instruction

Even if the execution condition for a fall instruction in an online changed ladder *1 is not satisfied (in continuity state), the fall instruction is executed.

For fall instructions, refer to the programming manual of each series. The following are examples of the instructions.

Fall instruction: PLF, LDF, ANDF, ORF, MEF, FCALLP, EFCALLP, and XCALL

ON/OFF status of contact (Conductive status at online change)	Rise instruction	Fall instruction
OFF	Not executed	Executed
ON	Not executed	Not executed

*1: When a new ladder block is inserted without changing existing programs, the added program is written together with the next ladder block to the programmable controller CPU. (If the next ladder block does not exist, the previous ladder block is written together.)

Thus online program change may not be completed at a time depending on the number of program steps of the added program and the previous or next one. In this case, reduce the number of steps written at a time and perform online program change in several times.

*2: The execution of fall instruction can be disabled from Online Program Change setting, which is displayed by selecting "Tool option".

<Example>

Programs added by pasting and inserting a row

Programs on the left is also written to the programmable controller

2) Rise instruction

When writing is completed, even if the execution condition for a start-up execution instruction (PLS instruction / □P instruction) is ON, the start-up execution instruction is not executed.

When the execution condition turns OFF → ON again, the start-up execution instruction is executed.

3) SCJ instruction

When writing is completed, if the execution condition for SCJ instruction is ON, the instruction executes a jump to the specified pointer without waiting for 1 scan.

(2) Precautions for Q/AnA series

Precautions for online change are described below.

Item	Description
Online program change to another station	• Online program change to another station is possible via MELSECNET (II, /10, H) or Ethernet.
During boot operation	
Online program change to the built-in RAM (QnA series)	• When performing online change to the built-in RAM during a boot operation, after the status is switched to STOP, write the changed program to the IC memory card.
Online program change in the backup mode (redundant CPU)	• Online change during boot operation in the backup mode is performed on the program memory and transfer source drive of both systems (connective system and target system). (The transfer source drive can be a memory card (RAM or ROM) or standard ROM.)
Deletion of a corresponding device from a program	• When the corresponding device no more exists in the program due to deletion in an OUT instruction or device number change, the output status is retained. Select [Debug] → [Forced input output registration/cancellation] and forcibly turn OFF coil outputs unnecessary in control.
Number of steps can be written in online program change	When the number of program steps after editing (addition / deletion) is within 512, the program can be written. However, if a new program is added by pasting or inserting a row without changing existing programs, the maximum number of steps cannot be written at a time. In this case, reduce the number of steps written at a time and perform online program change in several times. In addition, be careful of modifications as follows. When step 2 of the program is modified and step 540 is added, online program change cannot be performed because steps 2 to 540 are the target to be written at a time. In this case, perform online program change for each modification.
Online program change while low-speed execution type programs are running	If low-speed execution type programs are running, online change starts when the execution of all the programs is completed. During online change, the execution of low-speed execution type programs is suspended. However, if "PRG TIME OVER(5010)" keeps occurring while a low-speed execution type program is executed, online program change cannot be performed. In this case, set the programmable controller CPU to STOP, and increase the constant scan time and low-speed program execution time in the PLC Parameter setting, then execute online program change again.

Item		Description
Reserved area for online change		
	For Q series	• If the currently set number of secured steps is exceeded during online program change, the following dialog box is displayed. Set a new number of reserved steps. • When the number of secured steps is set to 0 on the dialog box below, only sequence programs which exceed the secured range will be written. • When performing online change to a sequence program protected by a password, the Input Disable Password dialog box is displayed. Disable the password before executing online program change. Online change cannot be executed without disabling the password. • The number of secured steps newly set on the following dialog box is not displayed on the <<Program>> tab of the Write to PLC screen. When connecting to a Basic model QCPU function version A, steps for online change are automatically secured and the above dialog box is not displayed.
	Redundant CPU	When re-securing steps for online program change in the backup mode, the maximum number of steps is based on either the capacity of the control system or that of the standby system, whichever is smaller. Example) When the empty capacity of control system is 100 steps and the empty capacity of standby system is 50 steps The maximum number of steps which can be reserved for online program change again is 50.
For system configured with a redundant CPU		
	Backup mode	Online change is performed on both systems (connective system and target system). However, if the target system fails (communication cannot be established with the target system), online program change is not performed on either of the systems.
	Separate mode/debug mode	Online change is only performed on the programmable controller CPU specified in the redundant CPU setting field on the Transfer Setup screen.

[Description]

The following error message may be displayed during online program change because of timeout of the check time. Follow the message to take actions.

(1) If the following dialog box is displayed, the program on GX Works2 is not converted but the program on the programmable controller CPU may be changed.

In this case, convert the program on GX Works2 and verify it against the program on the programmable controller CPU to confirm that these programs match.

If the programs do not match, write the program to the programmable controller CPU using the Write to PLC function to match them.
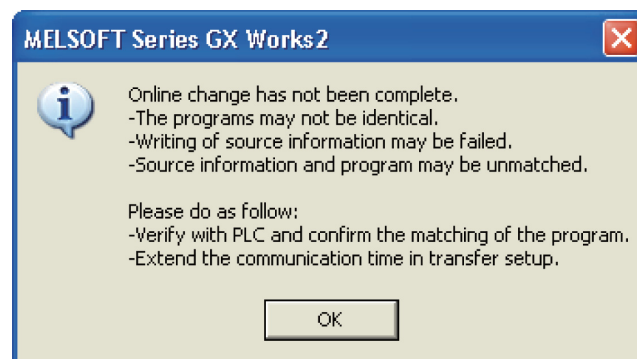
(2) The following dialog box may be displayed if the time check time set in Transfer Setup is short.

Select [Online] - [Transfer Setup] and set a longer time check time on the screen. During online program change, time check is carried out at intervals of 90 seconds even if the time check time set on the Transfer Setup screen is less than 90 seconds. Set a time check time longer than 90 seconds.
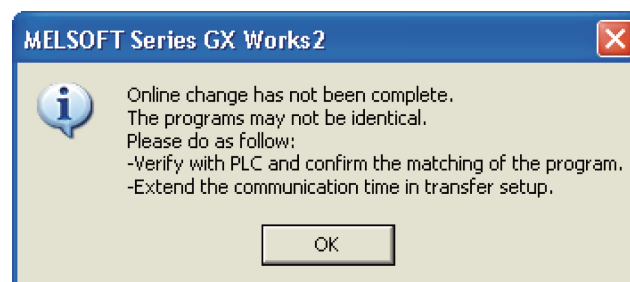
Appendix 2 Index Modification

Appendix 2.1 Index Modification Overview

(1) Index modification is an indirect setting using an index register.
    When index modification used in a sequence program, the device to be used is indicated by the directly specified device number plus the content of the index register. For example, when D2Z2 is specified and the content of Z2 is 3, the target device is D(2 + 3) = D5.

(2) Only Universal model QCPUs allow modification with 32-bit values as well as 16-bit values.

Appendix 2.2 16-bit Index Modification

(1) Modifying with 16-bit values
    Each index register can be set to a value between -32768 to 32767.
    The following is an example of index modification.

X0 —[MOV K−1 Z0]—	Store -1 to Z0.
X0 —[MOV D10Z0 D0]—	Store data "D10Z0 = D {10 + (-1)} = D9" to D0.

→ Index modification
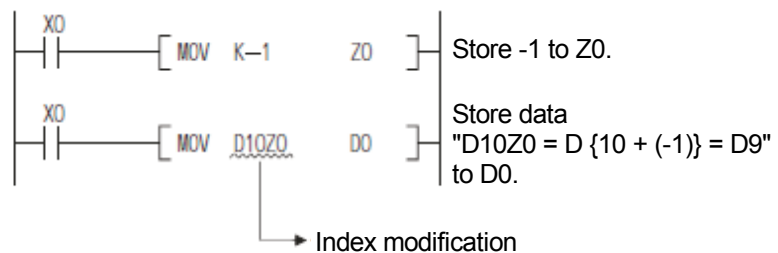
(2) Devices to which index modification can be made
    With the exception of the restrictions noted below, index modification can be made to devices used with contacts, coils, basic instructions, and application instructions.

    (a) Devices to which index modification cannot be made

Device	Description
K, H	32-bit constant
E	Floating-point data
$	Character string data
⬚.⬚	Bit-specified word device
FX, FY, FD	Function device
P	Pointers used as labels
I	Interrupt pointers used as labels
Z	Index register
S	Step relay
TR	SFC transition device [1]
BL	SFC block device [1]

*1: SFC transition device and SFC block device are devices for SFC.
    For how to use, refer to the following manual.
    • QCPU (Q mode) / QnACPU Programming Manual (SFC)

(b) Devices to which index modification is not allowed

Device	Description	Application example
T	• Only Z0 and Z1 can be used for timer contacts and coils	
C	• Only Z0 and Z1 can be used for counter contacts and coils	

REMARKS

There is no restriction on index register numbers used for the current values of timers and counters.
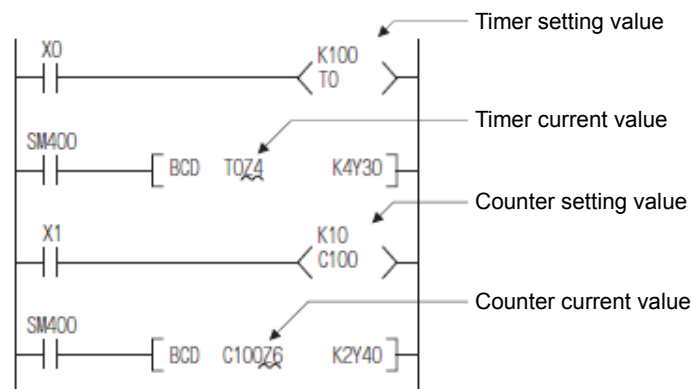
(3) The following are examples of index modifications and actual process devices.
(When Z0 = 20, Z1 = -5)

Ladder example	Actual process device

For 32-bit index modification, the following two options are available as specification methods of index registers.
- Specifying the range of index registers used for 32-bit index modification.
- Specifying 32-bit index modification using "ZZ".

POINT

32-bit index modification using "ZZ" is allowed only for the CPU modules described below.
- QnU(D)(H)CPU whose the first five digits of the serial number are "10042" or later.
- QnUDE(H)CPU

---

(1) Specifying the range of index registers used for 32-bit index modification

  (a) Devices to which index modification is not allowed

   Each index register can be set to a value between -2147483648 to 2147483647.

   The following is an example of index modification.

   Stores 40000 to Z0.

   Stores data "ZR10Z0 = ZR{10 + 40000} = ZR40010" to D0.

   Index modification
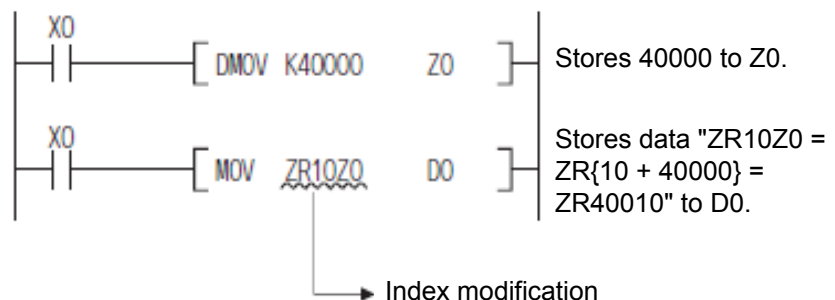
  (b) Specification method

   For modification with a 32-bit value, specify the start number of the index registers to be used in the Device setting of the PLC Parameter setting of GX Works2.

POINT

When the start number of the index registers to be used is changed in the Device setting of the PLC Parameter setting, do not change the parameter only or do not write only the parameter into the programmable controller. Be sure to write the parameter into the programmable controller together with the program.
Forcibly writing the parameter causes CAN'T EXE.PRG. error (Error code: 2500).

(c) Devices to which index modification can be made

Index modification can be made only to devices described below.

Device	Description
ZR	File register in the serial number access method
D	Extended data register
W	Extended link register

(d) Range of usable index registers

The following table shows the range of usable index registers for 32-bit index modification.

For 32-bit index modification, the specified index register (Zn) and the next index register (Zn+1) are used. Be sure not to overlap index registers to be used.

Set value	Index registers to be used	Set value	Index registers to be used
Z0	Z0, Z1	Z10	Z10, Z11
Z1	Z1, Z2	Z11	Z10, Z11
Z2	Z2, Z3	Z12	Z12, Z13
Z3	Z3, Z4	Z13	Z13, Z14
Z4	Z4, Z5	Z14	Z14, Z15
Z5	Z5, Z6	Z15	Z15, Z16
Z6	Z6, Z7	Z16	Z16, Z17
Z7	Z7, Z8	Z17	Z17, Z18
Z8	Z8, Z9	Z18	Z18, Z19
Z9	Z9, Z10	Z19	Cannot be used.

(e) The following are examples of index modifications and actual process devices.

(When Z0 (32 bits) = 100000, Z2 (16 bits) = -20)

Ladder example	Actual process device
XD ┤├──[DMOV K100000 Z0] ├──[MOV K—20 Z2] X1 ┤├──[MOV ZR1000Z0 D30Z2]	X1 ┤├──[MOV ZR101000 D10] Description ZR1000Z0···ZR(1000+100000)=ZR101000 D30Z2······D(30−20)=D10

(2) Specifying 32-bit index modification using "ZZ"

(a) By using "ZZ" like "ZR0ZZ4", 32-bit index modification can be specified with a desired index register.

The following is an example of 32-bit index modification using "ZZ".

Ladder	Description
M0 ┤├──[DMOVP K100000 Z4]	100000 to Z4 and Z5
M0 ┤├──[MOVP K100 ZR0ZZ4]	Modifies ZR with 32 bits (Z4 and Z5). It shows ZR (0 + 100000) → ZR100000.

(b) Specification method

To enable 32-bit index modification using "ZZ", set "Use ZZ" in "Indexing Setting for ZR Device" in the PLC Parameter setting of GX Works2.

(c) Devices to which index modification can be made

Index modification can be made only to devices described below.

Device	Description
ZR	File register in the serial number access method
D	Extended data register
W	Extended link register

(d) Range of usable index registers

The following table shows the range of usable index registers for 32-bit index modification using "ZZ".

For 32-bit index modification using "ZZ", specify in a format of ZRmZZn.

Specifying in the format of ZRmZZn modifies the device number ZRm with a 32-bit value in Zn and Zn+1.

"ZZ" specification[*1]	Index registers to be used	"ZZ" specification[*1]	Index registers to be used
☐ZZ0	Z0, Z1	☐ZZ10	Z10, Z11
☐ZZ1	Z1, Z2	☐ZZ11	Z10, Z11
☐ZZ2	Z2, Z3	☐ZZ12	Z12, Z13
☐ZZ3	Z3, Z4	☐ZZ13	Z13, Z14
☐ZZ4	Z4, Z5	☐ZZ14	Z14, Z15
☐ZZ5	Z5, Z6	☐ZZ15	Z15, Z16
☐ZZ6	Z6, Z7	☐ZZ16	Z16, Z17
☐ZZ7	Z7, Z8	☐ZZ17	Z17, Z18
☐ZZ8	Z8, Z9	☐ZZ18	Z18, Z19
☐ZZ9	Z9, Z10	☐ZZ19	Cannot be used.

*1: ☐ indicates the target device name (ZR, D, or W) to be modified.

(e) The following are examples of 32-bit index modifications with "ZZ" and actual process devices.
(When Z0 (32 bits) = 100000, Z2 (16 bits) = -20)

Ladder example	Actual process device
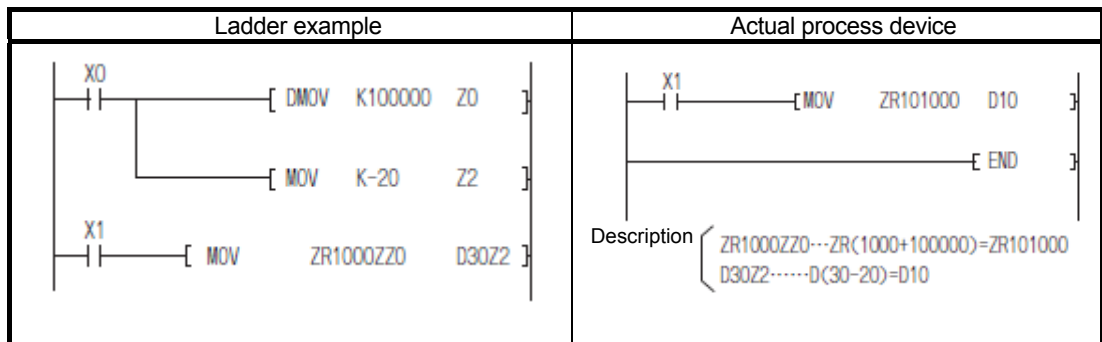
(f) Functions which allow modification with "ZZ"
The following list shows functions of GX Works2 which allow 32-bit index modification using "ZZ".

No.	Function name and description
1	Device specification in program instruction
2	Entry data monitor
3	Device test
4	Executional conditioned device test
5	Monitor condition setting
6	Sampling trace (Trace point (device specification), Trace target device)

POINT

ZZn cannot be used alone as a device like "DMOV K100000 ZZ0". When setting a value in an index register for 32-bit index modification using "ZZ", set it in Zn (Z0 to Z19).
ZZn alone cannot be input to each function.

For details, refer to QCPU User's Manual (Function Explanation, Program Fundamentals) and QCPU Programming Manual (Common Instructions).

Appendix 2.4 Index Modification to Extended Data Registers (D) or Extended Link Registers (W)
          (Universal Model QCPU)

Like index modification to data registers (D) and link registers (W) which are internal user devices, index modification to extended data registers (D) or extended link registers (W) is allowed in device specification.
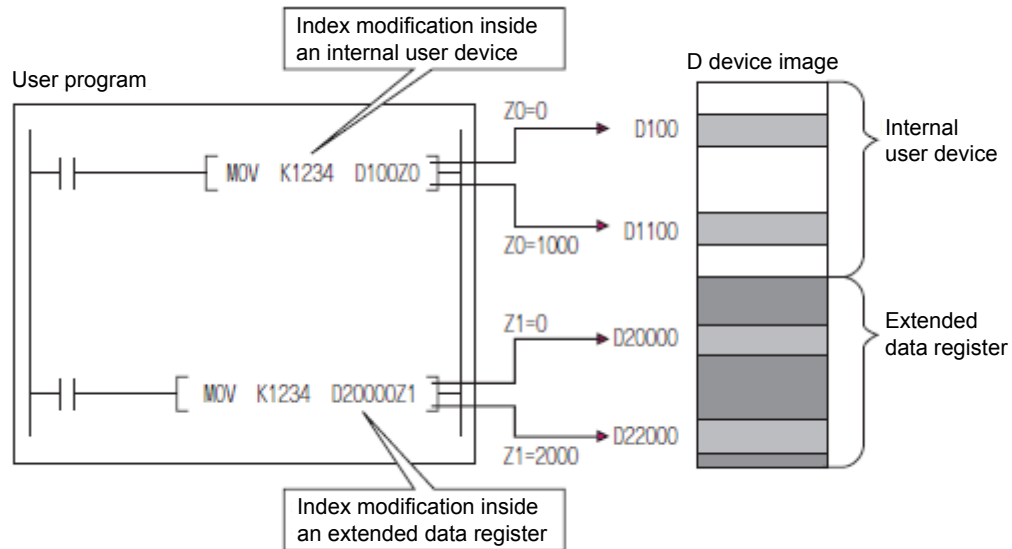
(a) Index modification where the device number crosses over the boundary between the internal user device and the extended data register (D) or extended link register (W)

The specification of index modification where the device number crosses over the boundary between the internal user device and the extended data register (D) or extended link register (W) cannot be made. If device range check is enabled for index modification, an error occurs.
(Error code: 4101)
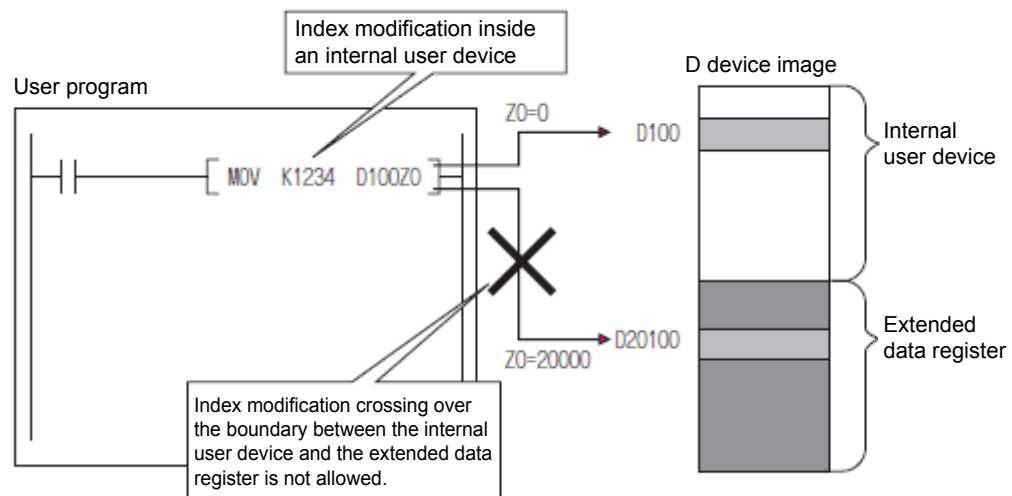
(b) Index modification where the device number crosses over the boundary among the file register (ZR), extended data register (D), and extended link register (W)

Index modification where the device number crosses over the boundary among the file register (ZR), extended data register (D), and extended link register (W) will not cause an error.

However, if the result of index modification to a file register (ZR), extended data register (D), or extended link register (W) changes the file register range, an error occurs. (Error code: 4101)
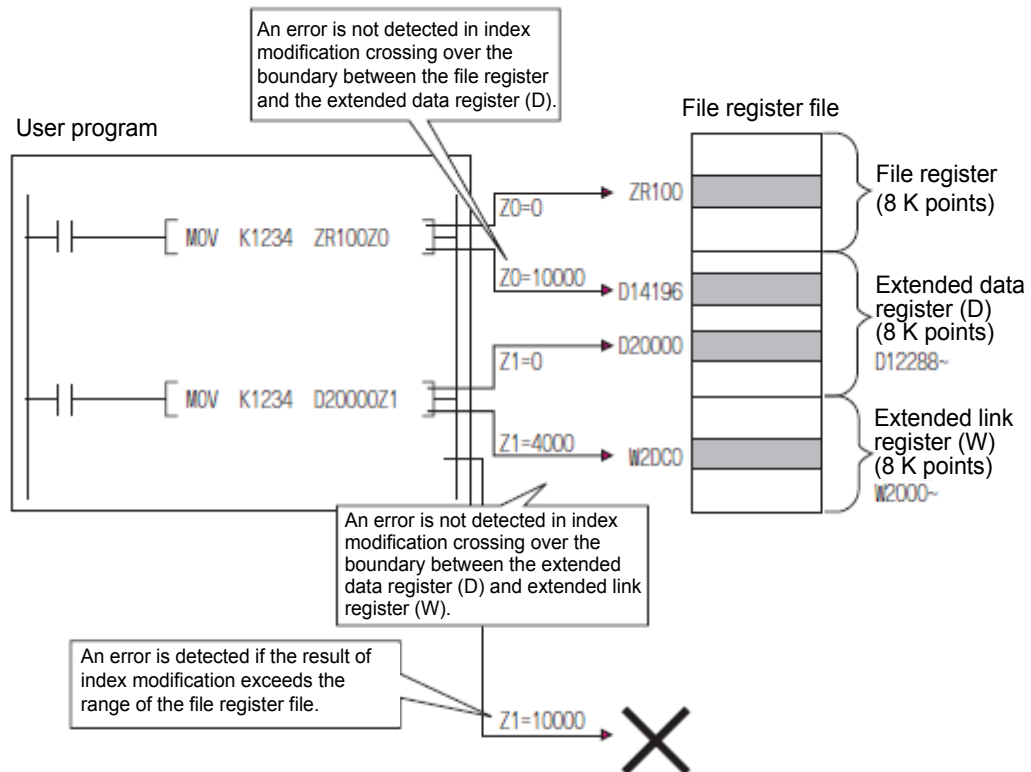
Appendix 2.5 Other Index Modifications

(1) Bit data
Index modification to a device number with digit specification is allowed.
However, index modification to a digit specification is not allowed.

Acceptable because it is index modification to a device number
If Z2 = 3, it will be X (0 + 3) = X3.

Not acceptable because it is index modification to a digit specification
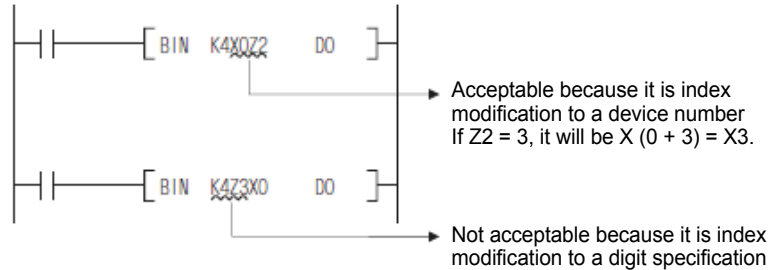
(2) For an intelligent function module device [1], index modification to both the start I/O number of intelligent function module and the buffer memory address is allowed.

If Z1 = 2 and Z2 = 8, it will be U(10 + 2)\G(0 + 8) = U12\G8.
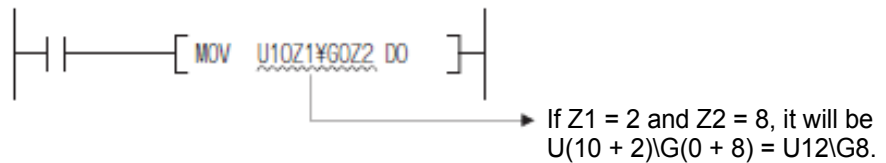
(3) For a link direct device [1], index modification to both the network number and the device number is allowed.

If Z1 = 2 and Z2 = 8, it will be J(1 + 2)\K4X(0 + 8) = J3\K4X8.
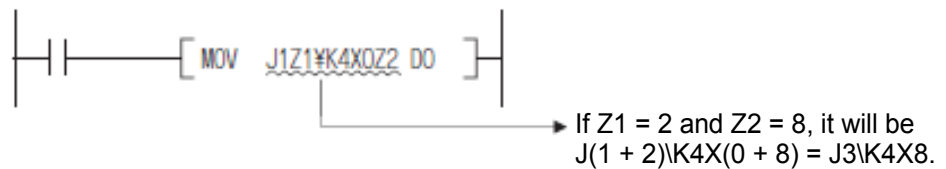
*1: For intelligent function module devices and link direct devices, refer to the following manuals.
• QCPU User's Manual (Function Explanation, Program Fundamentals)
• QnACPU Programming Manual (Fundamentals)

(4) For a cyclic transmission area device [1], index modification to both the start I/O number of CPU module and the CPU shared memory address is allowed.

If Z1 = 2 and Z2 = 8, it will be U3E(0 + 2)\G(0 + 8) = U3E2\G8.
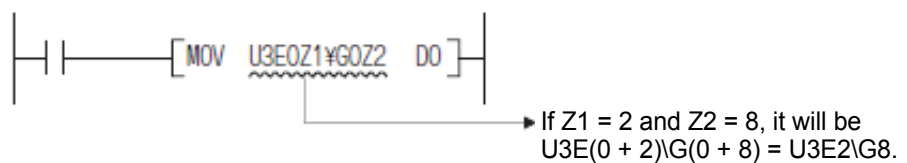
*2: For cyclic transmission area devices, refer to the following manual.
• QCPU User's Manual (Function Explanation, Program Fundamentals)

(5) 32-bit index modification to extended data registers (D) or extended link registers (W)
   (Universal model QCPU)
   For index modification to extended data registers (D) or extended link registers (W), the following 2 options are available as specification methods of index registers as in the case of index modification to file registers (ZR).
   • Specifying the range of index registers used for 32-bit index modification.
   • Specifying 32-bit index modification using "ZZ".

Appendix 2.6 Precautions

(1) Index modification between FOR to NEXT instructions
   Pulse output is possible between FOR to NEXT instructions by using an edge relay (V).
   However, pulse output using the PLS/PLF/pulse conversion (□P) instruction is not allowed.

[When an edge relay is used]
(M0Z1 provides normal pulse output.)

```
SM400
─┤ ├──────────────────────{MOV    K0    Z1   }
                                    {FOR    K10  }
X0Z1 V0Z1
─┤ ├─┤ ├──────────────────────────{M0Z1      }
SM400
─┤ ├────────────────────────{INC    Z1   }
                                    {NEXT       }
```

[When no edge relay is used]
(M0Z1 does not provide normal pulse output.)
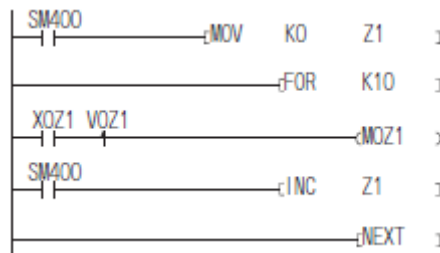
```
SM400
─┤ ├──────────────────────{MOV    K0    Z1   }
                                    {FOR    K10  }
X0Z1
─┤ ├──────────────────────────{PLS    M0Z1 }
SM400
─┤ ├────────────────────────{INC    Z1   }
                                    {NEXT       }
```
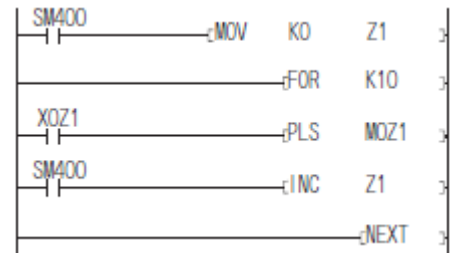
┌─────────┐
│ REMARKS │
└─────────┘

The ON/OFF information of X0Z1 is stored in the edge relay V0Z1.
For example, the ON/OFF information of X0 is stored in V0, and that of X1 in V1.

(2) Index modification in CALL instruction

Pulse output is possible in CALL instruction by using an edge relay (V).

However, pulse output using the PLS/PLF/pulse conversion (□P) instruction is not allowed.

[When an edge relay is used]
(M0Z1 provides normal pulse output.)

```
 SM400
──┤├──────────────────────[MOV    K0     Z1   ]
                           ─[CALL   P0          ]
                                ⌇
 SM400
──┤├──────────────────────[MOV    K1     Z1   ]
                           ─[CALL   P0          ]
                                ⌇
                           ─[FEND              ]
       X0Z1  V0Z1
P0 ────┤├────┤↑├───────────[M0Z1              ]
                           ─[RET               ]
```

[When no edge relay is used]
(M0Z1 does not provide normal pulse output.)

```
 SM400
──┤├──────────────────────[MOV    K0     Z1   ]
                           ─[CALL   P0          ]
                                ⌇
 SM400
──┤├──────────────────────[MOV    K1     Z1   ]
                           ─[CALL   P0          ]
                                ⌇
                           ─[FEND              ]
       X0Z1
P0 ────┤├──────────────────[PLS    M0Z1       ]
                           ─[RET               ]
```
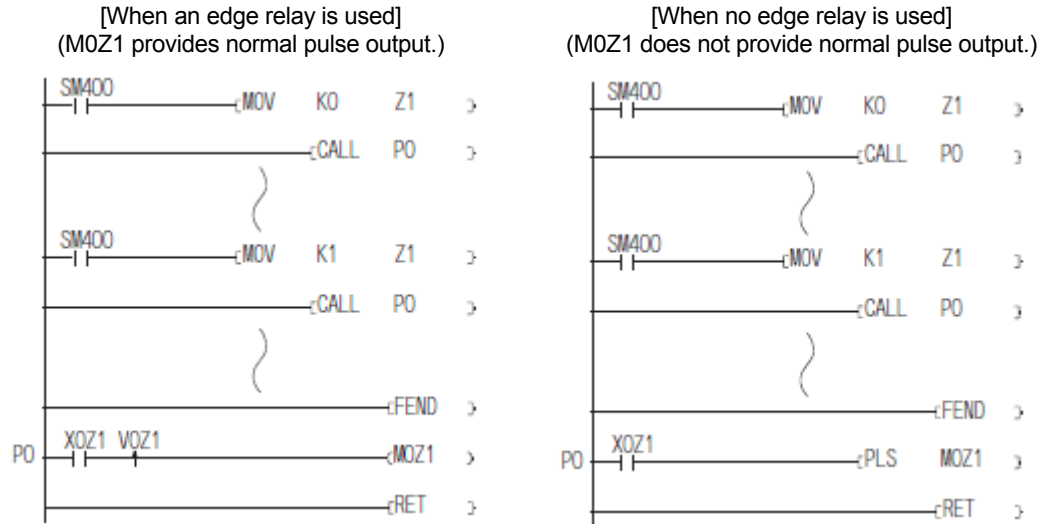
(3) Device range check in index modification

(a) Other than Universal model QCPU

Device range check is not carried out for index modification.

Thus if the result of an index modification is out of the device range specified by the user, no error occurs and the data is written in another device. (However, if the result of an index modification is out of the range of user devices and the data is written in a system device, an error occurs. (Error code: 1103))

Carefully create programs with index modifications.

(b) Universal model QCPU

Device range check is carried out for index modification.

In addition, device range check can be disabled in the PLC Parameter setting of GX Works2.

(4) Changing the index modification range from 16 bits to 32 bits or from 32 bits to 16 bits

When changing the index modification range from 16 bits to 32 bits or from 32 bits to 16 bits, review index modifications in the program.

For 32-bit index modification, the specified index register (Zn) and the next index register (Zn+1) are used. Be sure not to overlap index registers to be used.

Appendix 3 Questions and Answers regarding Personal Computer

This section describes basic knowledge regarding personal computer as questions and answers. Use the information as necessary.

Q1. What happens if the resolution of the display is less than 800 × 600?

A1. "Icons", which should be displayed at the top end of the screen, may not be displayed and operations using the "icons" are not possible.
The screen is designed to display all "icons" in the resolution specified in the manual.

Q2. What is operating environment?

A2. It means the combination of hardware configuration and basic software which can make full use of GX Works2. Models of personal computers of which operations are confirmed by Mitsubishi are described in "Models of personal computers of which operations are confirmed" (PLC-D-375) of Mitsubishi Electric FA Global Website.
[Programmable controller (Q, QnA, A)] → [Product Details] → [Models of personal computers of which operations are confirmed]
http://www.nagoya.melco.co.jp/details/plc/confirm/index_j.htm
(Basically, the product operates in the operating environment described in this manual.)

Q3. What kind of phenomenon occurs when the CPU is Pentium$^®$ 133MHz or lower?

A3. When the CPU is Pentium$^®$ 133MHz or lower, as the processing speed is slow and it takes a long time to display a screen after an operation, which interferes with smooth operations.

Appendix 4 Questions and Answers regarding GX Works2

This section describes questions and answers to solve problems in using GX Works2.

Q1. During editing of a ladder diagram, each ladder is sometimes enclosed in a white frame depending on the type of the video card (card which for stores characters, figures, and pictures to be displayed as data). How can I remove the frame?

A1. Change setting as follows on the "Control panel" of Windows® 2000/Windows® XP/Windows® Vista® /Windows® 7.
<Operating procedure>
(1) Open the "Control panel".
↓
(2) Open "System".
↓
(3) Open the "Performance" tab.
↓
(4) Press the "Graphics" button.
↓
(5) Set the "Hardware acceleration" setting to the next to "None" (second mark).
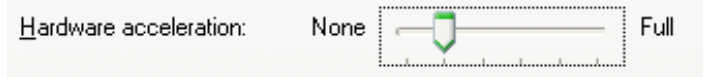
Q2. What should I do if error messages "Can not allocate Share memory" and "Initialization failed" are displayed at the start-up of GX Works2?

A2. Restart GX Works2. Alternatively, restart Windows® 2000/Windows® XP/Windows® Vista® /Windows® 7/Windows® 8 and then start GX Works2.

Q3. Why does it take a long time since Setup.exe is started until the dialog box is displayed?

A3. It may take a long time if a resident program such as antivirus software is running.

Q4. Are there any matters to keep in mind if commercially available antivirus software application is installed in the personal computer?

A4. 1) When antivirus software is started
   (1) As the initialization process of the software at start-up takes some time, other applications launched from the "Startup" folder may not run properly. In addition, the computer may not accept operations for a while after the antivirus software is contained in the system tray because of the initialization process.
   These phenomena vary depending on specifications of the use environment (CPU, memory, etc.).
   It has been confirmed that they are likely to occur when the CPU is Pentium® 100 MHz or lower.

   (2) If the antivirus software is running on Windows® Me, be sure to close the antivirus software before installation of the product.
   If the installation of GX Works2 is started with the antivirus software in the "real-time" monitoring mode, the following dialog box is displayed after 2 to 3 seconds.

   ┌───┐
   │ _delis   │
   │ エラーが発生しました。このまま続けるには，「無視」を   │
   │ クリックして作業中のデータを新しいファイルに保存してください。「閉じる」を │
   │ クリックすると，このプログラムは終了します。   │
   │   │
   │   │
   │   ┌──────────────┐   ┌──────────────┐   │
   │   │ 閉じる(C)   │   │ 無視(I)   │   │
   │   └──────────────┘   └──────────────┘   │
   └───┘
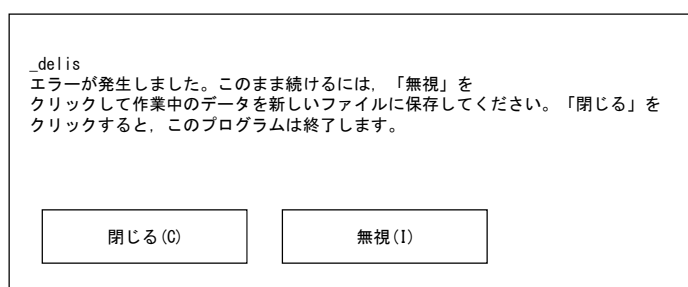
   Close the error dialog box, uninstall the product, and then reinstall the product.

   2) Effects on the system
   When the antivirus software is running, the software places burden on the system as it inspects files.
   Thus, depending on the use environment, every operation, such as start-up of an application, may take a long time.
   These phenomena vary depending on specifications of the use environment (CPU, memory, etc.).
   It has been confirmed that they are likely to occur when the CPU is Pentium® 100 MHz or lower.

3) Effects on applications
   If an application does not start up or run properly after installation of the antivirus software or has a problem of the same sort, follow the steps below to check the operation.
   (1) Uninstall the antivirus software, restart the system, and check how the application runs again. If the problem still occurs, it is considered not to be caused by the influence of the antivirus software.
       Contact the technical support of the application.
   (2) If the application properly runs after the uninstallation of the antivirus software, install the software again and switch the software to custom monitoring mode. In addition, remove or place checkmarks in checkboxes for specifying file extension and monitoring function setting.

   If the system does not start up properly even after taking steps (1) and (2), reinstall Windows®
   95/Windows® 98/Windows® Me/WindowsNT® Workstation4.0/Windows® 2000 Professional and the application.

Appendix 5 Warranty

Please confirm the following product warranty details before using this product.

1. Gratis warranty period and gratis warranty range

If any failure found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty period, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.
However, if repairs require traveling overseas from a domestic location or traveling to a remote island or an equivalent remote location, expenses to send an engineer will be solely at the customer's discretion.

[Gratis warranty period]

The gratis warranty period of the product shall be for 36 months after the date of purchase or delivery to a designated place.
Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be 6 months, and the longest gratis warranty term after manufacturing shall be eighteen 42 months. The gratis warranty period of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis warranty range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
 1) Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
 2) Failure caused by unapproved modifications, etc., to the product by the user.
 3) When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
 4) Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
 5) Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
 6) Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 7) Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair period after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for 7 years after production of the product is discontinued.
Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including spare parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty period, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Conditions of use for the product

(1) Mitsubishi MELSEC programmable controller shall be used in conditions where any problem, fault or failure occurring in the product, if any, shall not lead to any major or serious accident and where the backup and fail-safe functions are systematically provided outside of the product for the case of any problem, fault or failure occurring in the product.

(2) The programmable controller has been designed and manufactured for the purpose of being used in general industries. Thus Mitsubishi does not authorize the use of the product in Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the product or the use of the product in railway companies, national security or defense organizations, and/or any other cases in which establishment of a special quality assurance system is required.
Notwithstanding the above, Mitsubishi may authorize use of the product in one or more of these applications, provided that the usage of the product is limited only for the specific applications agreed to by Mitsubishi and provided further that the user agrees that no special quality assurance is required.
In addition, if the user is considering the use of the product for aircraft or aerospace, medical applications, train equipment, transport equipment, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, and/or other applications where there is a significant risk of injury to the public or property and especially high reliability is required for safety and control systems, the user shall contact the Mitsubishi representative to exchange necessary specification documents.

Appendix 6 Programmable Controller Fault Investigation Report

/   /   (Month/Day/Year)

Programmable controller fault report / investigation request

Be sure to attach the document to the product to be sent.

No.	Item		Description
1	Model		
2	Product number / Version		
3	Number of modules		
4	Customer name	Company name	Enter the proper name (of the report's recipient).
		Person in charge	☎
5	Place of occurrence	Company name	
		Person in charge	☎
6	Prepared by	Company name	
		Person in charge	☎
7	Contact for inquiries		(1) 4 (2) 5 (3) 6
8	Report		(1) Attached report (2) Repair slip required (3) Not necessary
9	Request number		
10	Construction number		
11	Arrival number		
12	Branch in charge		Sales area code

No.	Item	Description
13	Handling of the product	(1) Return after repair (2) No need to return (3) Return after investigation without repair
14	Address to return the product after repair / investigation	(Company name) (Address) ☎
15	Date of occurrence	/ / (Month/Day/Year)
16	Date of installation	/ / (Month/Day/Year)
17	Operation period	
18	Ambient temperature	(1) Normal (2) High (3) Low (4) Others ( )°C
19	Memory in use	(1) RAM (2) ROM
20	System configuration	
	Appendix	(1) Yes (2) No

No.	Item	Description
21	Fault description	
		Appendix | (1) Yes (2) No
22	Usage conditions of surrounding devices	(SV/MC/INV)
23	Stage of occurrence	(1) Installation and adjustment (2) In operation (3) Others ( )
24	Timing of occurrence	(1) During energization (2) During power-on (3) During operation (4) At program change (5) Random (6) Others ( )
25	Frequency of occurrence	(1) Always (2) Only once (3) In each operation (4) ( ) times each month week day cycle (5) Others ( )
26	Process for recovery	(1) Pressing RESET switch (2) Power OFF/ON (3) Restarting the system (4) Rewriting program (5) Rewriting parameters (6) Module replacement (7) Repair of wiring (8) Reinstallation of module (9) Others ( )

Items to be checked on CPU

No.	Item	Description
27	Error message (code) (time)	( ) (/ / , : :)
28	Detailed error information	
29	Other error histories Saving of error histories	Check: □ (File name: .csv)
30	LED lighting status	MODE : ON (Color:) Flash OFF RUN : ON Flash OFF ERR. : ON Flash OFF USER : ON Flash OFF BAT. : ON Flash OFF BOOT : ON Flash OFF
31	Connection to peripheral (personal computer)	RS232 : Possible Not possible USB : Possible Not possible
32	Backups of programs, parameters, device memories, and others	Check: □
33	Saving of system information	Check: □ (File name: .csv)

Other information

Appendix 7 QCPU Replacement Checklist

Appendix 7.1 Qn(H)CPU Replacement Checklist (One Document for Each Machine)

Work	No.	Item	Check
Preparation	1	Write the date, operator, panel name, and CPU model name to the right column.	
	2	Write the switch setting of the CPU to be removed and whether there is a memory card to the right column.	
	3	Attach a panel name label to the surface of the CPU to be removed.	
Data backup	4	Connect GX Developer to the CPU to be removed, and set the PLC type and transfer setup to "PLC Side/F: CPU Module".	
	5	Check that there is no error for the CPU to be removed. In addition, create a new project after starting up GX Developer and use the system monitor to check that there is no error for the mounted module. If some error occurred, write the error code and the error step to the right column and contact the user.	
	6	Have the user set the RUN/STOP switch of the CPU to remove to "STOP".	
	7	(1) Read all programs in the CPU program memory, parameters (PLC/network), and device comments from PLC, and save the project. Write the project name and file contents to the next page.	
		(2) If the intelligent parameter is used, read it from PLC after saving the project above, and save the project again.	
		(3) Select device data and initial device value in the CPU and assign it a file name. (Example: DEVICE; Write to the next page) Click the [Default] button in [Device data]. (Scroll the screen to ensure that all devices are selected) After reading from PLC, confirm that there is the data and then save the project.	
		(4) If a file register or a local device exists in the CPU standard RAM, write the file name to the next page, read the entire range into the same project and then save it.	
		(5) If the file exists in the CPU standard ROM, start up a project newly, as above, read the files, and save it using another project name. Write the project name and file contents to the next page.	
		(6) If a memory card is used, read the files and save them using another project as above. However, when an SRAM card and a file register or local device are used, if the same file name is not used, it is possible to save them to the same project as in (1). Write the file contents to the next page.	
Replacement	8	Write the SERIAL number, which is on the side of the module to be mounted, to the right column.	
	9	Set the RUN/STOP switch of the CPU to be mounted to STOP, and set other switches as described. Mount the Q6BAT connector.	
	10	Have the user turn OFF the power supply of the programmable controller.	
	11	Remove the target CPU from the base, and write the SERIAL number on the side to the right column.	
	12	If the user's identification label is attached to it, move the label to the CPU to be mounted.	
	13	If a memory card is mounted on the removed CPU, move it on the CPU to be mounted.	
	14	Mount the target CPU on the base in the mounting panel and, if it is to be fixed with screws, tighten the screws.	
	15	Confirm that the key switch of the mounted CPU is set to "STOP" and that other switch settings are as in the check sheet.	
	16	Have the user turn ON the power supply of the programmable controller.	
Data restoration	17	Check the product information of the relevant module in GX Developer system monitor, and write it to the right column.	
	18	(1) Format the program memory/device memory, and standard RAM to be used for the PLC memory. At this point, consult the user whether it is necessary to reserve the system area, and if it is, configure the setting. However, because this area is only set when it is formatted, if the user is not sure, do not configure it. [ ] K steps	
		(2) Select [Include latches] and clear the CPU to be mounted from the PLC memory.	
		(3) Change reserved steps for online program change. Ask the user the capacity of the reserved steps for online program change in advance. Reserved step: [ ] steps	
		(4) To the PLC's program memory/device memory, write the files saved earlier (except the device memory) such as parameters and programs to the PLC, by referring to the next page.	
		(5) To the PLC's standard RAM, write the files saved earlier such as a file register and a local device to the PLC, by referring to the next page.	
		(6) To the PLC's standard ROM, start up the saved project, refer to the next page, and write only the stored files to the PLC (flash ROM).	
		(7) To the memory card, verify all the files against those in the PLC by referring to the next page.	
		(8) Consult the user and, if needed, set the clock.	
	19	Reset the CPU.	
	20	To program memory/device memory, click the [Default] button in the [Device data], write PLC's device memory (except "S" (step relay)) to the CPU and verify the PLC. <<* Unset "S" in the device setting.>> The SM, SD or link device may have a verify error.	
	21	If SFC is used for the user's program, consult the user and reset the CPU again. → This is because the existing intermediary data may cause malfunction since SFC starts up from the initial step. → If there is necessary data for the user outside the latch range, select only that device and write it to the PLC.	
Operation check	22	Check that there is no error for the CPU. Also, check that there is no error for the module mounted on the system monitor.	
	23	Check the error history and, if no user error exists, clear the error history.	
	24	Have the user set the RUN/STOP switch of the mounted CPU to "RUN". * The user should have checked the start-up procedure of the system. (Some applications may require to reset again → RUN.)	
	25	If the relevant CPU is connected to a GOT additionally, power OFF and ON the GOT.	
	26	Check that there is no error for the CPU. If the user finds the replacement faulty, return the removed CPU to the original place.	

Year: Month: Date:

Operator: _____

Panel name: _____

CPU model name Q CPU

Settings of switch etc.

Memory card: Applicable/Not applicable

→ON SW
1
2
3
4
5

STOP   RUN

RESET   (N) LCLR

Module to be mounted
SERIAL No.
(production information)
_____

Module to remove
SERIAL No.
(production information)
_____

Product information of
the CPU (replacement)
0000000000-

Error description
before replacement

Remarks

Write all project names and file names to frames
Circle either of [Applicable/Not applicable]

Program memory [Project name:		]		
Parameter		Program	Device comment	Initial device value
[Applicable/Not applicable]				
Intelligent parameter				
[Applicable/Not applicable]				
Device data				
	File name			

Note 1) Before writing to the PLC, ensure that the file register, local device, and name are correct.
Note 2) A verification error for some special device (SM/SD) and link fresh device (on a target station) data may occur during PLC verification.

Standard RAM	
File register	Local device

Note) Use the same project as the program memory.
Before write to PLC, ensure that the destination and the file name are correct. Writing to the PLC shall be done to the standard RAM.

Standard ROM [Project name:		]		
Parameter		Program	Device comment	Initial device value
[Applicable/Not applicable]				
Intelligent parameter				
[Applicable/Not applicable]				
	File name			

Memory card [Project name:		]		
Memory card name				
Q2MEM−				
	File name			

Appendix 7.2 QnU(D)(E)(H)CPU Replacement Checklist (One ocument for Each Machine)

Work	No.	Item	Check
Preparation	1	Write the date, operator, panel name, and CPU model name to the right column.	
Preparation	2	Write the switch setting of the CPU to be removed and whether there is a memory card to the right column.	
Preparation	3	Attach a panel name label to the surface of the CPU to be removed.	
Data backup	4	(1) Start new GX Works2, connect it to the CPU to be removed, select the PLC series (QCPU (Q mode)), and configure the transfer setup to "Programmable Controller Side I/F: CPU Module". * PLC direct connection	
Data backup	4	(2) Delete the program "MAIN" from the project data.	
Data backup	4	(3) Delete global device comments from the project data.	
Data backup	4	(4) Delete the device memory "MAIN" from the project data.	
Data backup	5	Check that there is no error for the CPU to be removed, and use the system monitor to check that there is no error for the mounted module. If some error occurred, write the error code and the error step to the right column and consult the customer.	
Data backup	6	Have the customer set the RUN/STOP/RESET switch of the CPU to remove to "STOP".	
Data backup	7	(1) Write file contents in the program memory to the next page. Select all of the program range, parameters (PLC/Network/Remote password/Switch setting/Intelligent function module parameters), global device comment, and initial device values. Select [Also read the remaining reserved step capacity for online program change] in the program "details" to read from PLC. Finally, save the project (in a single file format). (If the "Select read module model name" dialog appears after the "Execution" of the read from PLC, select the implemented model.) Write the save destination to the next page. * Read data other than device data.	
Data backup	7	(2) Select device data (device memory) in the program memory. Select the device memory "details", and click "Default" on the "Device data detailed setting". (Scroll the screen to ensure that all available devices are selected) Assign a file name for a device data name. (Example: DEVICE; Write to the next page) After the read from PLC, confirm that there is the data and then save the project.	
Data backup	7	(3) If a file register exists in the standard RAM, write the file name and file size (in bytes) to the next page, read the entire range into the identical project and then save it. (Select "details" to select the entire range.)	
Data backup	7	(4) If files exist in the standard ROM, write the file content to the next page, start up new GX Works2, read the files in a similar way to the above 4-(1) and its following steps, and save them using another project name. However, if it is device comments or likewise, and there is no similar file to the program memory, the user can save them to the same project as in (1).	
Data backup	7	(5) If a memory card is used or files exist, write the file content to the next page, start up new GX Works2, read the files in a similar way to the above 4-(1) and its following steps, and then save it using another project name. However, if it is a file register or likewise, and there is no similar file to the program memory, the user can save them to the same project as in (1).	
Data backup	7	(6) From GX Works2, run [Online] → [Program memory batch transfer] and check whether the content of the program cache memory matches that of the program memory. * If it does not, or if the user cannot check the whether or not it does depending on the CPU version, a message "Do you transfer...?" may appear. Then, click the "Yes" button to perform the batch transfer so that they will match.	
Replacement	8	Write the SERIAL number and MAC address (only for the CPU board with Ethernet enabled), which are on the side or under the face plate of the CPU to be mounted, to the right column.	
Replacement	9	Set the RUN/STOP/RESET switch of the CPU to be mounted to "STOP". Also, connect the battery connector at the bottom of the module.	
Replacement	10	Have the customer turn OFF the power supply of the programmable controller.	
Replacement	11	Remove the target CPU from the base, and write the SERIAL number and MAC address (only for the CPU board with Ethernet enabled), which are on the side or under the face plate, to the right column.	
Replacement	12	If the customer's identification label is attached, move it to the CPU to be mounted.	
Replacement	13	If a memory card is mounted on the removed CPU, move it on the CPU to be mounted.	
Replacement	14	Mount the target CPU on the base in the mounting panel, and if it is to be fixed with screws, tighten the screws.	
Replacement	15	Confirm again that the RUN/STOP/RESET switch of the mounted CPU is set to "STOP".	
Replacement	16	Have the customer turn ON the power supply of the programmable controller.	
Data restoration	17	Check the product information of the mounted CPU in GX Works2 system monitor, and write it to the right column.	
Data restoration	18	(1) Format the program memory, standard RAM, and standard ROM to be used for the PLC memory. At this point, consult the user whether it is necessary to reserve the system area, and if it is, configure the setting. However, because this area is only set when it is formatted, if the customer is not sure, leave it as the default. [ ] K steps	
Data restoration	18	(2) Select "Include latches" and clear the CPU to be mounted from the PLC memory.	
Data restoration	18	(3) To the PLC's program memory/device memory, write the files saved earlier (except the device memory) such as parameters and programs to the PLC, by referring to the next page.	
Data restoration	18	(4) To the PLC's standard RAM, write the files stored before by referring to the next page.	
Data restoration	18	(5) To the PLC's standard ROM, write only the stored files by referring to the next page.	
Data restoration	18	(6) To the memory card, verify all the files against those in the PLC by referring to the next page.	
Data restoration	18	(7) Consult the customer and, if needed, set the clock.	
Data restoration	19	Have the customer turn OFF/ON the power supply of the programmable controller.	
Data restoration	20	To the PLC's program memory/device memory, select the device memory "Details", and click "Default" on the "Device data detailed setting". Confirm that "S" (Step relay) is deselected, write to the PLC, and verify it. <<* Unset "S" in the device setting.>> The SM, SD or link fresh device may have a verify error.	
Data restoration	21	If SFC is used for the user's program, consult the customer and reset the CPU again. → This is because the existing intermediary data may cause malfunction since SFC starts up from the initial step. → If there is necessary data for the user outside the latch range, select only that device and write it to the PLC.	
Operation check	22	Check that there is no error for the CPU and use the system monitor to check that there is no error for the mounted module.	
Operation check	23	Check the error history and, if no customer error exists, clear the error history.	
Operation check	24	Have the customer set the RUN/STOP/RESET switch of the mounted CPU to "RUN". * The user should have checked the start-up procedure of the system. (Some applications may require to reset again → RUN.)	
Operation check	25	Check that there is no error for the CPU. If the user finds the replacement faulty, return the removed CPU to the original place.	

Year: Month: Date:

Operator:

Panel name:

CPU model name Q   CPU

Settings of switch etc.

Memory card : Applicable/Not applicable

RESET   RUN

STOP

Module to be mounted
SERIAL No.
(production information)

MAC ADD.

Module to remove
SERIAL No.
(production information)

MAC ADD.

Product information of the
CPU (module to be mounted)
0000000000−

Error description
before replacement

Remarks

Write all project names and file names to frames
Circle either of [Applicable/Not applicable]

Program memory [Project name:]

Parameter	File name	Program	Program	Comment
[Applicable/Not applicable]				
Intelligent parameter				
[Applicable/Not applicable]				
Device data				
Initial device value				
[Applicable/Not applicable]				

Standard RAM

File register	File size
	byte

Note) Use the same project as the program memory. Before write to PLC, ensure that the destination and the file name are correct. Writing to the PLC shall be done to the standard RAM.

Standard ROM [Save destination:]

Parameter	File name		
[Applicable/Not applicable]			
Intelligent parameter			
[Applicable/Not applicable]			

Memory card [Save destination:]

Memory card name	File name		
Q MEM−			

Appendix 8 Reference Material for Cart Conveying System Training Machine

The following describes how to check problems and how to take corrective actions in the practical training in cart conveying system (Section 6.8).

<Fault example 1>
The cart does not move forward. (No.9 terminal of I/O signal disconnection terminal block is OFF)
(1) Checking the normal operation → Press the start-up switch.
(2) Assuming the failure → Turn OFF the No.9 terminal.
(3) Producing faulty operation → Press the start-up switch. (It will not operate properly.)
(4) Investigating the cause of faulty operation → Find the cause of the faulty operation by ladder monitor.
(5) Restoring the normal condition → Turn ON the No.9 terminal.

<Fault example 2>
The cart does not stop at the position of inspection sensor (No.7 terminal of I/O signal disconnection terminal block is OFF)
(1) Checking the normal operation → Press the start-up switch.
(2) Assuming the failure → Turn OFF the No.7 terminal.
(3) Producing faulty operation → Press the start-up switch. (It will not operate properly.)
(4) Investigating the cause of faulty operation → Find the cause of the faulty operation by ladder monitor.
(5) Restoring the normal condition → Turn ON the No.7 terminal.

<Fault example 3>
The cart does not move backward.
(1) Checking the normal operation → Press the start-up switch.
(2) Assuming the failure → Turn ON X3.
(3) Producing faulty operation → Press the start-up switch. (It will not operate properly.)
(4) Investigating the cause of faulty operation → Find the cause of the faulty operation by ladder monitor.
(5) Restoring the normal condition → Turn OFF X3.

<Fault example 4>
The cart does not stop at the workpiece set position.
(1) Checking the normal operation → Press the start-up switch.
(2) Assuming the failure → Turn ON X2.
(3) Producing faulty operation → Press the start-up switch. (It will not operate properly.)
(4) Investigating the cause of faulty operation → Find the cause of the faulty operation by ladder monitor.
(5) Restoring the normal condition → Turn OFF X2.

Appendix 9 Buffer Memory Access Instruction (Abstract from MELSEC-Q/L Programming Manual (Common Instructions))

Appendix 9.1 Reading One-word or Two-word Data from an Intelligent Function Module (FROM(P), DPRO(P))

means FROM/DFRO.
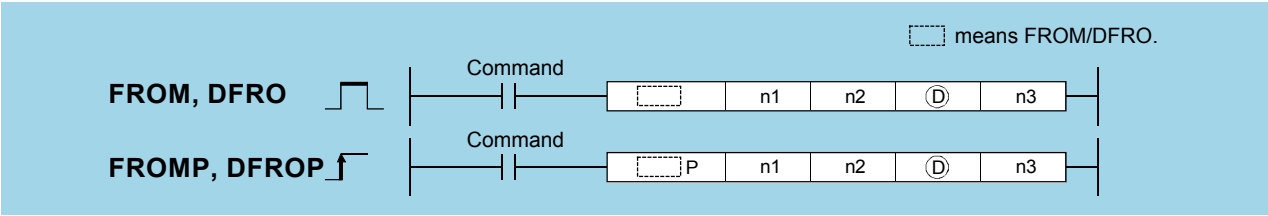
n1: Start I/O number [1] of the intelligent function module (BIN 16 bits)

n2: Start address of the buffer memory in which data to be read is stored (BIN 16 bits)

$\textcircled{D}$: Start number of the devices where the read data will be stored (BIN 16/32 bits)

n3: Number of data blocks to be read (BIN 16 bits)

Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constants K, H	Others U
	Bit	Word		Bit	Word				
n1		○				○			○
n2		○				○			―
$\textcircled{D}$		○				―			―
n3		○				○			―

*1: Specify the first three digits of the start I/O number in four-digit hexadecimal notation.

(1) Function

(a) FROM
Reads the data in n3 words from the buffer memory address specified by n2 of the intelligent function module specified by n1 and stores it in the device specified by $\textcircled{D}$ and later.
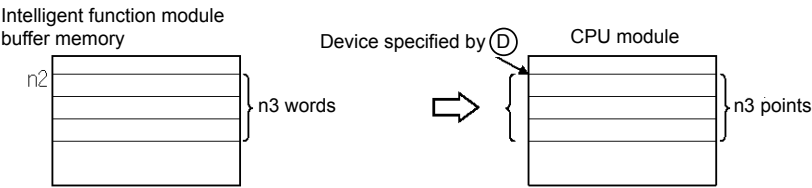
(b) DFRO
Reads the data in (n3 × 2) words from the buffer memory address specified by n2 of the intelligent function module specified by n1 and stores it in the device specified by $\textcircled{D}$ and later.

```
┌─────────────────────────────────────────────────────────────────────┐
│  POINT                                                                │
│  Data read from intelligent function modules is also possible with the│
│  use of an intelligent function module device.                        │
│  For intelligent function module devices, refer to the user's manual  │
│  (Function Explanation, Program Fundamentals) of the CPU module to be  │
│  used.                                                                 │
└─────────────────────────────────────────────────────────────────────┘
```

(2) Error

In the following cases, an operation error occurs, the error flag (SM0) turns on and an error code is stored in SD0.

Error code	Error description	Q00J/ Q00/ Q01	QnH	QnPH	QnPRH	QnU	LCPU
1402	An error is detected in the intelligent function module at the instruction execution.	○	○	○	○	○	○
1412	Cannot communicate with the intelligent function module at the instruction execution.	○	○	○	○	○	○
2110	The I/O number specified by n1 does not indicate an intelligent function module.	○	○	○	○	○	○
4101	The range of n3 points (2 × n3 points for DFRO) from the device specified by ⒟ exceeds the specified device range. The address specified by n2 is outside the buffer memory range.	○	○	○	○	○	○

(3) Program example

(a) The following program reads CH1 digital output value of the Q68ADV at I/O numbers 040 to 04F to D0 when X0 is turned on. (reads data by 1 word from the buffer memory address 11)

[Ladder mode]

```
     X0
0 ───┤├───────────[FROMP  H4      K11     D0      K1 ]
6 ──────────────────────────────────────────[END ]
```
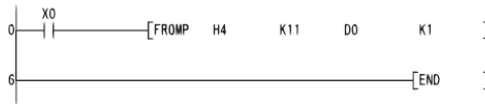
[List mode]

Step	Instruction	Device
0	LD	X0
1	FROMP	H4 K11 D0 K1
6	END	

(a) The following program reads the current feed value of axis 1 of the QD75P4 at I/O numbers 040 to 05F to D0 and D1 when X0 is turned on. (reads data by two word from the buffer memory address 800)

[Ladder mode]

```
     X0
0 ───┤├───────────[DFROP  H4      K800    D0      K1 ]
6 ──────────────────────────────────────────[END ]
```
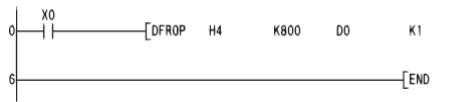
[List mode]

Step	Instruction	Device
0	LD	X0
1	DFROP	H4 K800 D0 K1
6	END	

REMARKS

1. Specify the first three digits of the start I/O number in four-digit hexadecimal notation as n1.

QCPU

Power supply	CPU	QX10	QX10	QX10	QX10	Q68 ADV	QY41 P	QY10	QY10
	0000H	0010H	0020H	0030H	0040H	0050H	0070H	0080H	

········ Start I/O number of I/O assignment setting

→ Specify K4 and H4 for read start I/O number.

LCPU

CPU module (L26CPU-BT)

Power supply	CPU		Built-in CC-Link	LX40 C6	LX40 C6	LX40 C6	L60 AD4	LY41 NT1P	LY10 R2	LY10 R2	LY10 R2
	0000H	0010H	0030H	0040H	0050H	0060H	0070H	0090H	00A0H	00B0H	

········ Start I/O number of I/O assignment setting

→ Specify K6 and H6 for read start I/O number.
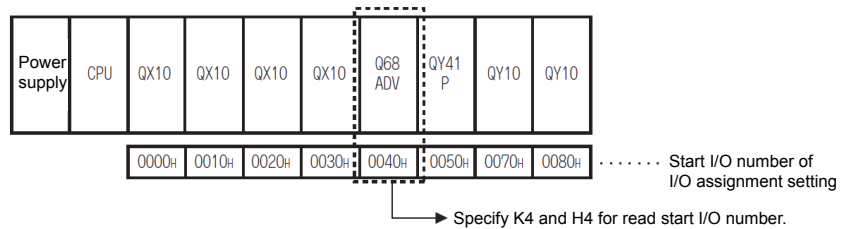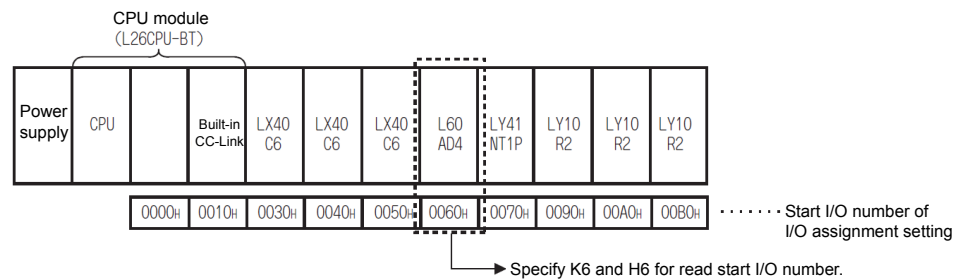
2. QCPU and LCPU offer automatic interlock of FROM and DFRO instructions.

Appendix 9.2 Writing One-word or Two-word Data to an Intelligent Function Module (TO(P), DTO(P))

means TO/DTO.
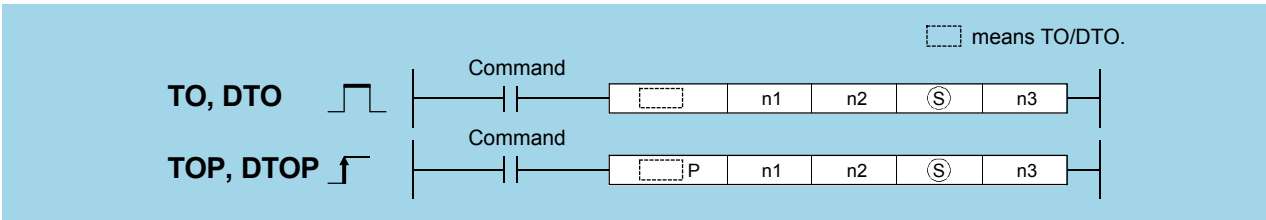
n1: Start I/O number [1] of the intelligent function module (BIN 16 bits)

n2: Start address of the area where data is written (BIN 16 bits)

Ⓢ: Start number of the data to be written or the devices in which the data is stored (BIN 16/32 bits)

n3: Number of data blocks to be written (BIN 16 bits)

Setting data	Internal device		R, ZR	J☐\☐		U☐\G☐	Zn	Constants K, H	Others U
	Bit	Word		Bit	Word				
n1		○				○		○	○
n2		○				○		○	─
Ⓢ		○				─		○	─
n3		○				○		○	─

*1: Specify the first three digits of the start I/O number in four-digit hexadecimal notation.

(1) Function

(a) TO

Writes the data stored in n3 points from the device specified by Ⓢ to the buffer memory address specified by n2 and later of the intelligent function module specified by n1.
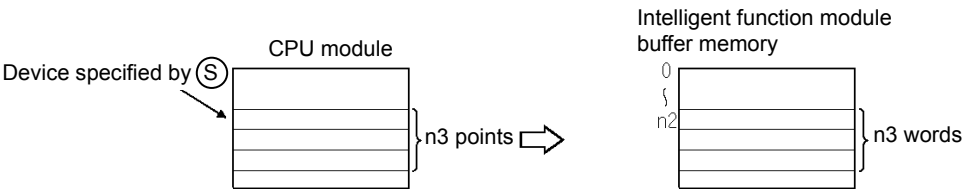
When a constant is designated to Ⓢ, writes the same data (value designated to Ⓢ) to the area of n3 words starting from the specified buffer memory. (A value between -32768 and 32767 or 0_H and $FFFF_H$ can be designated to Ⓢ.)
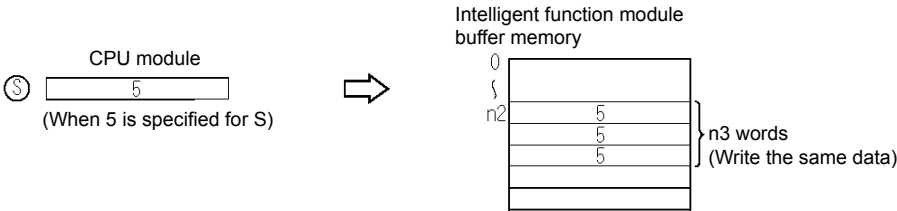
(b) DTO

Writes the data stored in (n3 × 2) points from the device specified by Ⓢ to the buffer memory address specified by n2 and later of the intelligent function module specified by n1.
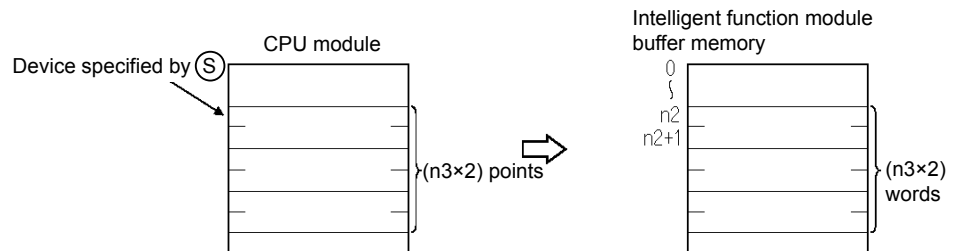
When a constant is designated to Ⓢ, writes the same data (value designated to Ⓢ) to the area of (n3 × 2) words starting from the specified buffer memory. (A value between -2147483648 and 2147483647 or 0H and FFFFFFFFH can be designated to Ⓢ.)
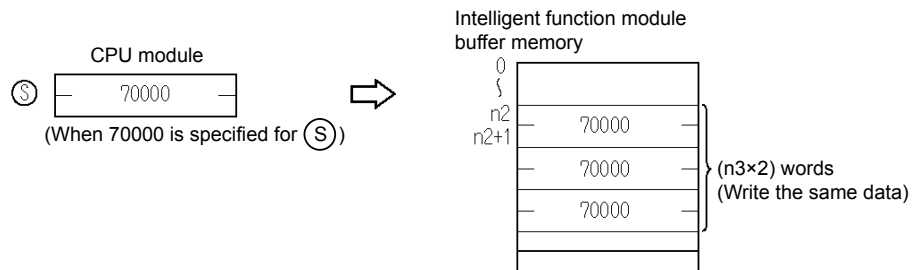
POINT

Data write to intelligent function modules is also possible with the use of an intelligent function module device.
For intelligent function module devices, refer to the user's manual (Function Explanation, Program Fundamentals) of the CPU module to be used.

---

(2) Error

In the following cases, an operation error occurs, the error flag (SM0) turns on and an error code is stored in SD0.

Error code	Error description	Q00J/ Q00/ Q01	QnH	QnPH	QnPRH	QnU	LCPU
1402	An error is detected in the intelligent function module at the instruction execution.	○	○	○	○	○	○
1412	Cannot communicate with the intelligent function module at the instruction execution.	○	○	○	○	○	○
2110	The I/O number specified by n1 does not indicate an intelligent function module.	○	○	○	○	○	○
4101	The range of n3 points (2 × n3 points for DTO) of data from the device specified by Ⓢ exceeds the specified device range. The address specified by n2 is outside the buffer memory range.	○	○	○	○	○	○

(3) Program example

(a) The following program sets the CH1 and CH2 of the Q68ADV at I/O numbers 040 to 04F to "A/D conversion disabled" when X0 is turned on. (writes "3" to the buffer memory address 0.)

[Ladder mode]

```
       X0
  0 ───┤├──────────────[TOP   H4   K0   K3   K1 ]

  6 ──────────────────────────────────────[END ]
```

[List mode]

Step	Instruction	Device
0	LD	X0
1	TOP	H4 K0 K3 K1
6	END	
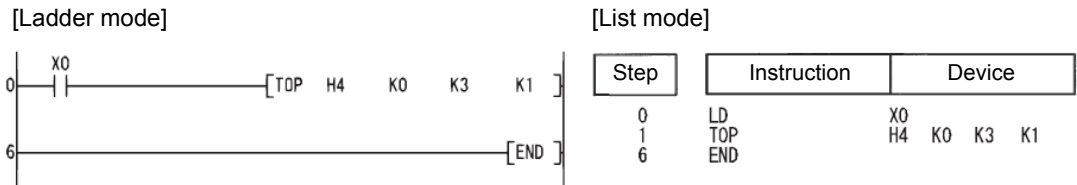
(b) The following program sets the positioning address/movement amount of axis 1 of the QD75P4 at I/O numbers 040 to 05F to 0 when X0 is turned on. (writes 0 to the buffer memory addresses 2006 and 2007.)

[Ladder mode]

```
       X0
  0 ───┤├──────────[DTOP   U4    K2006    K0    K1 ]

  7 ──────────────────────────────────────────[END ]
```

[List mode]

Step	Instruction	Device
0	LD	X0
1	DTOP	U4 K2006 K0 K1
7	END	

REMARKS

1. Specify the first three digits of the start I/O number in four-digit hexadecimal notation as n1.

QCPU

Power supply	CPU	QX10	QX10	QX10	QX10	Q68 ADV	QY41 P	QY10	QY10

| 0000H | 0010H | 0020H | 0030H | 0040H | 0050H | 0070H | 0080H |

······· Start I/O number of I/O assignment setting

→ Specify K4 and H4 for read start I/O number.

LCPU

CPU module (L26CPU-BT)

Power supply	CPU	Built-in I/O	Built-in CC-Link	LX40 C6	LX40 C6	LX40 C6	L60 AD4	LY41 NT1P	LY10 R2	LY10 R2	LY10 R2

| 0000H | 0010H | 0030H | 0040H | 0050H | 0060H | 0070H | 0090H | 00A0H | 00B0H |

······· Start I/O number of I/O assignment setting

→ Specify K6 and H6 for read start I/O number.

2. QCPU and LCPU offer automatic interlock of TO and DTO instructions.

Appendix 10: High Performance Model QCPU Replacement Procedure

Use Qn(H)CPU Replacement Checklist described in Appendix 7.1 together.

> | POINT |
> | --- |
> | This QCPU replacement procedure describes a referential procedure for a scenario where the following application programs are installed. |
> | <Application programs> |
> | • All of the program memory, standard RAM, standard ROM and memory cards are used |
> | • Intelligent parameters (set via GX Configurator) are used. |
> | • An SFC program is used |

Appendix 10.1 Preparation

(1) Enter the date, operator, panel name, and CPU model name in QnU(H)CPU Replacement Checklist.

(2) In the checklist, enter the switch setting of the CPU to be removed and whether there is a memory card.
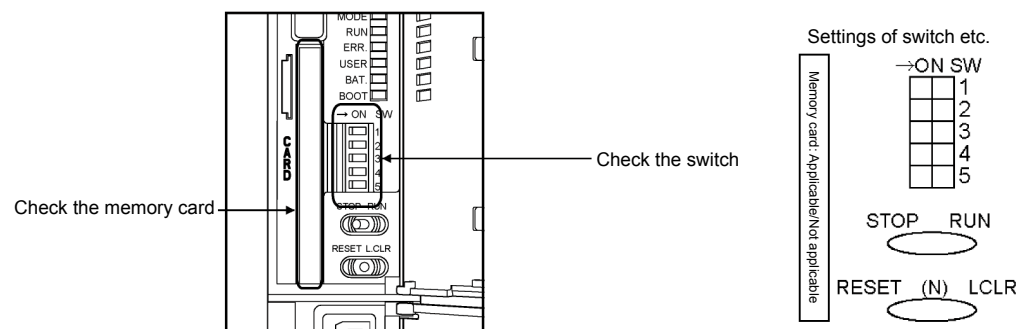
(3) For identification, attach a panel name label on the surface of the CPU to be removed, as needed.

(1) Connect GX Works2 to the CPU to be removed, and set the PLC type and transfer setup to "Programmable Controller Side I/F: CPU Module".
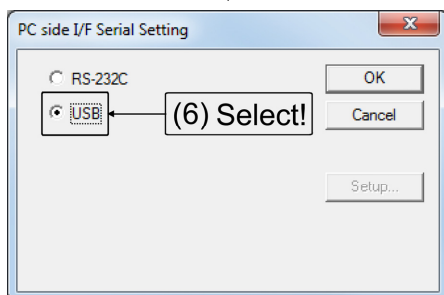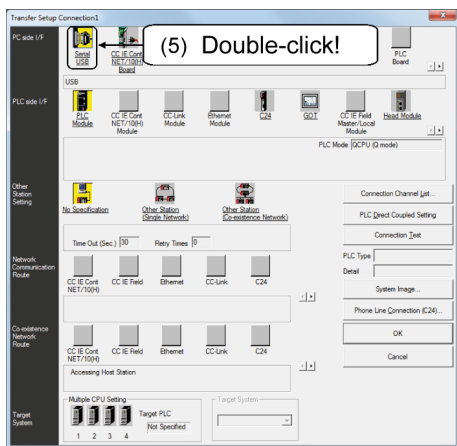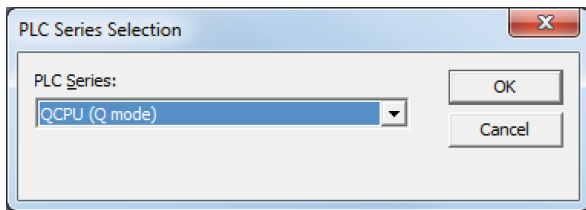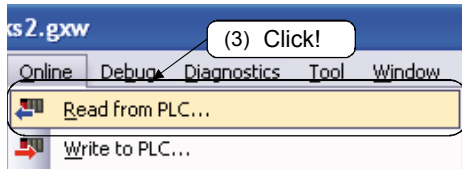
1) Connect the CPU with a personal computer using an RS-232C or USB cable.

2) Start up GX Works2.

3) Click the [Online] → [Read from PLC] menu.

4) Set the PLC series to [QCPU(Q Mode)] and click the ⌷OK⌷ button.

5) Select PC side I/F.

6) Select the cable used for connection and click the ⌷OK⌷ button.
    *   In this case, we use USB connection as an example for description.

(To the next page)

(From the previous page)

7) Set PLC side I/F to the PLC Module.

8) Click the | Connection Test | button.

(7) Select!

(8) Click!

9) If properly connected, the screen on the left is displayed. Click the | OK | button.

If not properly connected, the following screen is displayed. Check the connection and conduct the communication test again.

10) Click the | OK | button.

(10) Click!

11) The Read from PLC dialog box is displayed. Click the | Close | button.

(2) Check that there is no error for the CPU to be removed. In addition, create a new project after starting up GX Works2 and use the system monitor to check that there is no error for the mounted module.
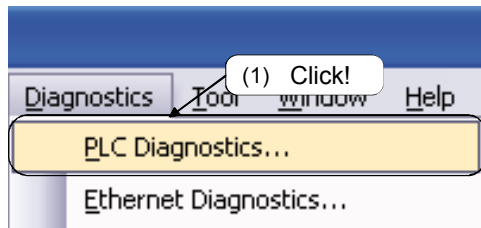
(1) Click!

1) Click the [Diagnostics] → [PLC Diagnostics] menu.
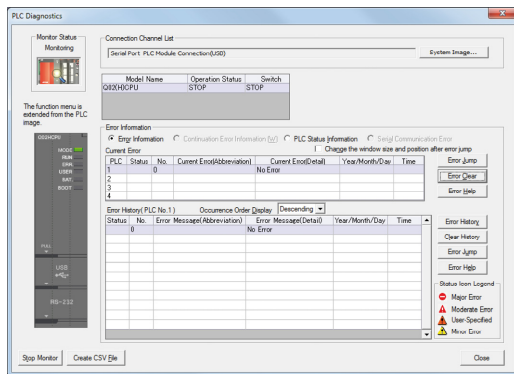
2) Check for errors.

If there is no error, the screen on the left is displayed.
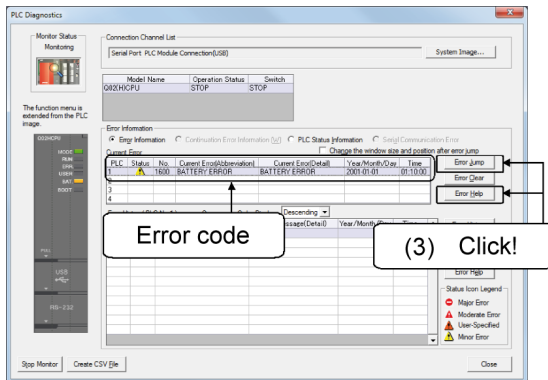
Error code

(3) Click!

3) If there is any error, click the Error JUMP and Error Help buttons to enter the error details in the check sheet.
Also, check with the user.

Click the Close button to close the PLC diagnostics dialog box.
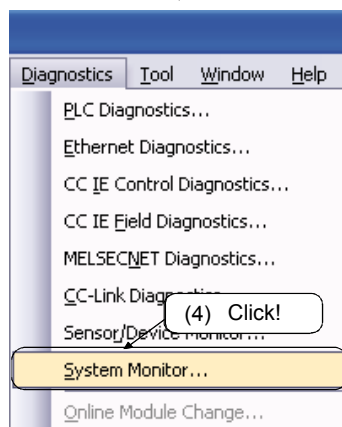
(4) Click!

4) Click the [Diagnostics] → [System Monitor] menu.

(To the next page)
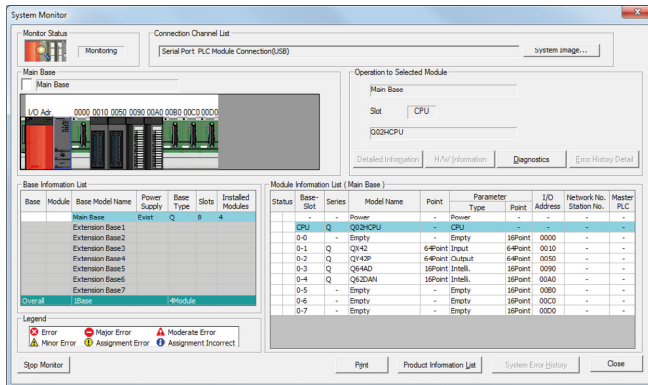
5) Check that there is no error for the mounted module.

If there is no error, the screen on the left is displayed.

If there is any error for the mounted module, check with the user.

Click the Close button to close the system monitor dialog box.

(3) Set the RUN/STOP switch of the CPU to be removed to "STOP".

(4) Choose all the programs, parameters (only for PLC/network), and device comments, select [Also read the remaining reserved capacity for online program change] in the program tab, read from PLC, and enter the project name and file contents in the checklist.
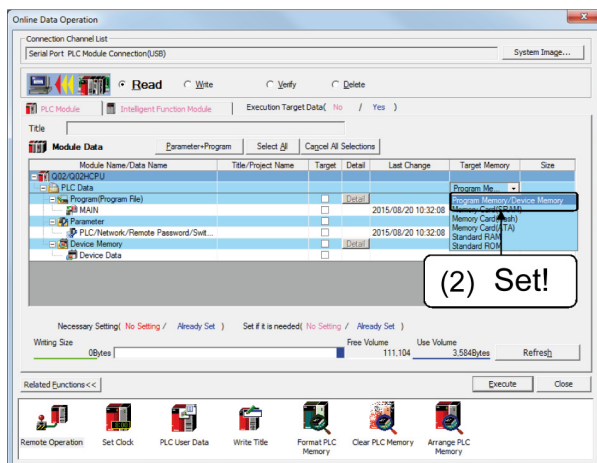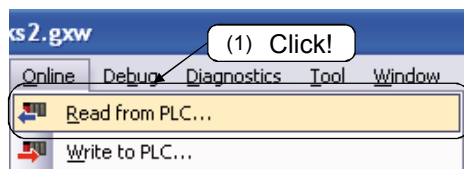
1) Click the [Online] → [Read from PLC] menu.

2) Set the target memory to [Program memory/Device memory].

(From the previous page)
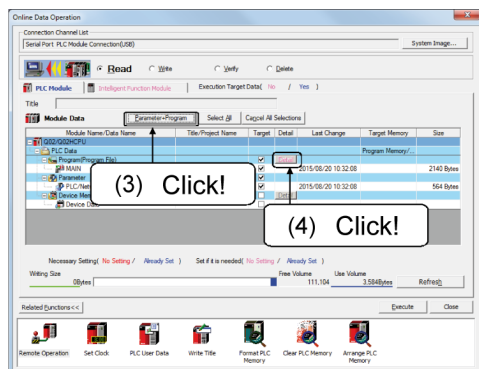
3) From file selection, click "Parameter + Program".

* Even if the intelligent parameter exists, do not select it.

4) Click the Detail button of the program.
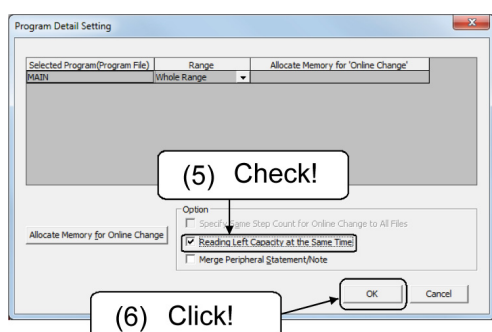
5) Select [Also read the remaining reserved step capacity for online program change].

6) Click the OK button.
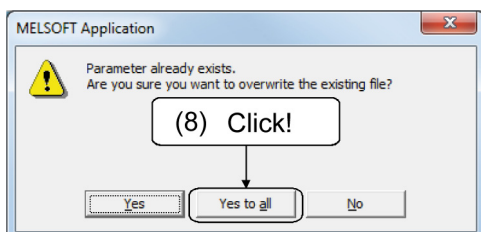
7) After the display returns to the Read from PLC dialog box, click the Execute button.

8) The message box is displayed. Click the Yes for All button.
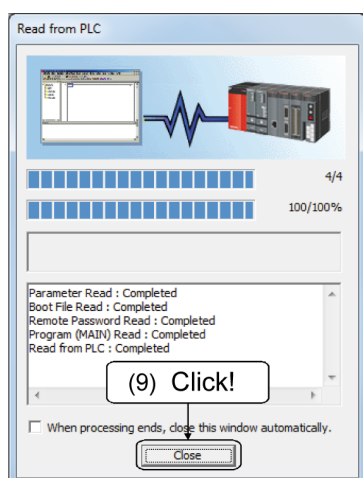
9) When the read is completed, the dialog box on the left is displayed. Click the OK button.

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⬇
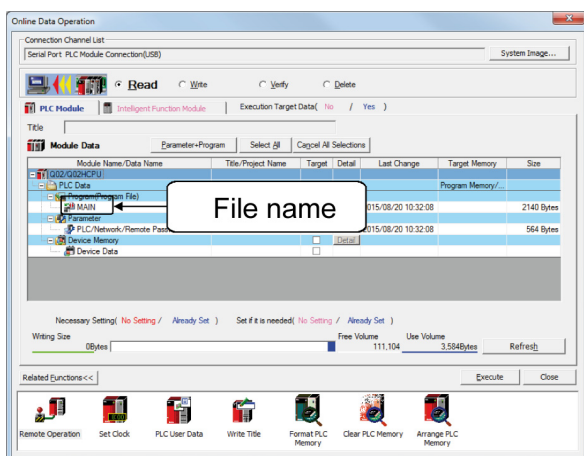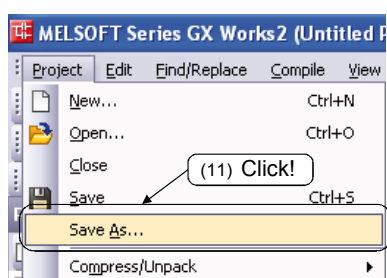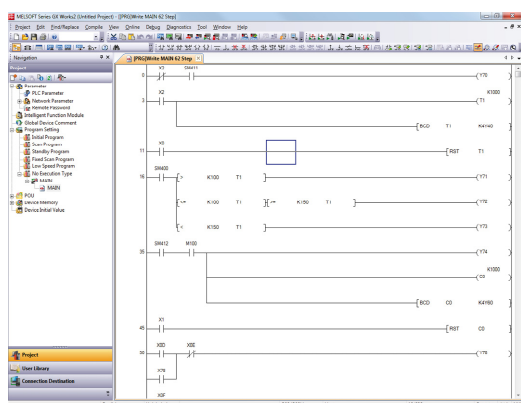
10) Close the Read from PLC dialog box.

From the project data list, double-click "Program settings" → "No execution type" → "(program name)".

The read program is displayed.

⬇

11) After reading from PLC, click the [Project] → [Save as] menu to name the project.

* Be careful not to forget the save location.

⬇

12) In the "Program memory" field in the Qn(H)CPU Replacement Checklist, enter the project name and file contents (files read).

Also, enter whether or not there is a parameter.

Write all project names and file names to frames
Circle either of [Applicable/Not applicable]

Program memory [Project name:]				
Parameter		Program	Device comment	Initial device value
[Applicable/Not applicable]				
Intelligent parameter				
[Applicable/Not applicable]				

Enter

(5)   If the intelligent parameter is used, save the project, read from PLC, and save the project again.
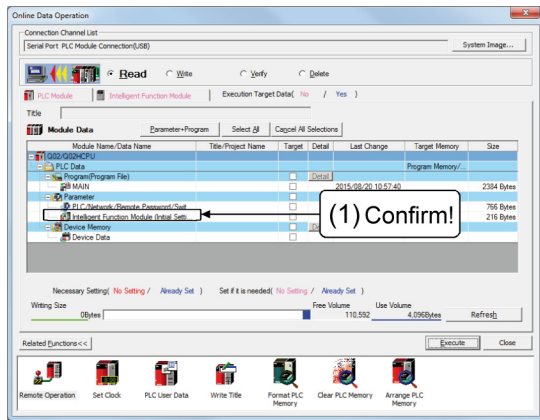
1)   Confirm that the intelligent parameter is used.
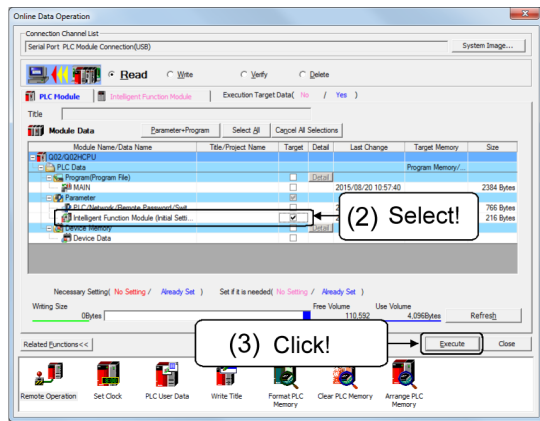
2)   Select the intelligent parameter.

3)   Click the [Execute] button.
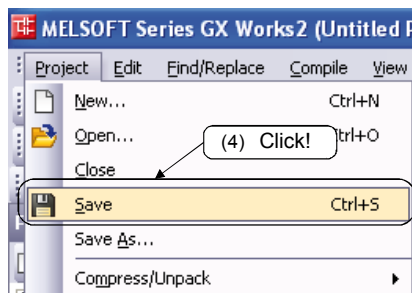
4)   Close the Read from PLC dialog box, and then click the [Project] → [Save] menu to save the project.

5)   Enter whether the intelligent parameter is selected in [Intelligent parameter] field in Qn(H)CPU Replacement Checklist.

Enter

(6) Select a device data and initial device value in the CPU and name a file.
Click the [Default] button in the [Device data] tab. (Scroll down to confirm that all the devices (including X/Y) are selected.)
After reading from PLC, confirm that there is the data and then save the project.
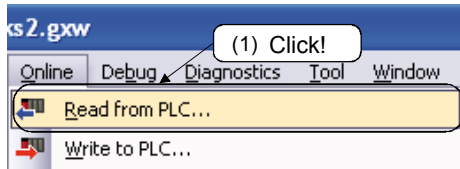
1) Click the [Online] → [Read from PLC] menu.
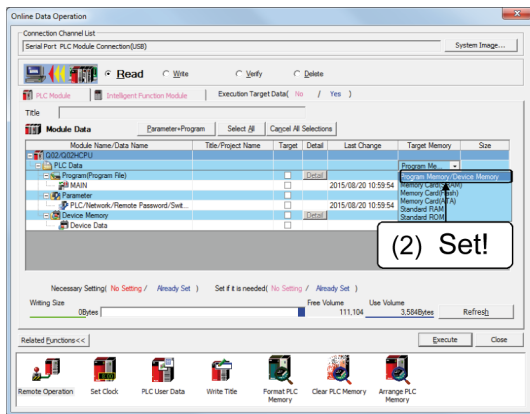
2) Set the target memory to [Program memory/Device memory].
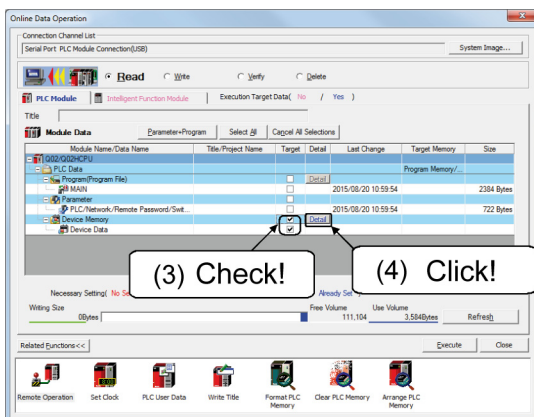
3) Select device data and an initial device value (if any).

4) Press the Detail button for the device memory.
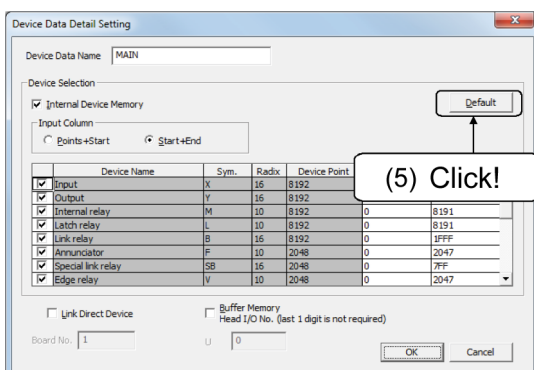
5) Click the Default button.

(To the next page)
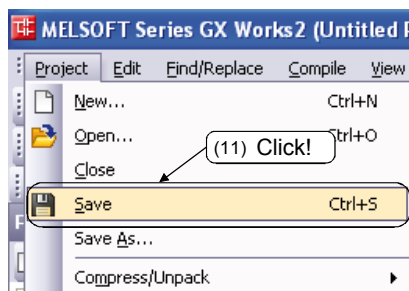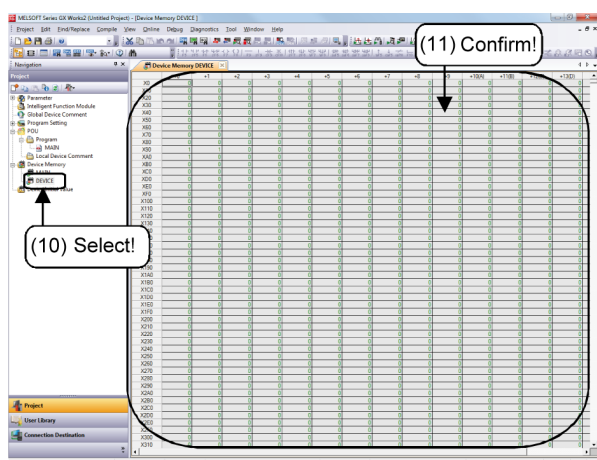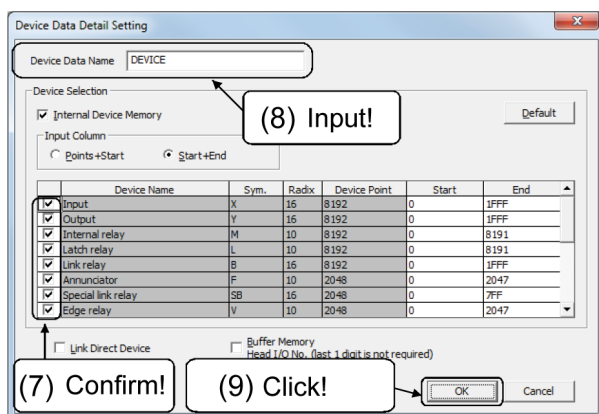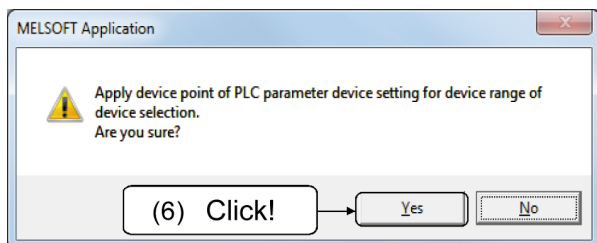
(From the previous page)

⇩

6) The message box on the left is displayed. Click the [Yes] button.

⇩

(7) Confirm!   (9) Click!

7) Check that all the devices (except the retentive timer) are selected (☑).

8) Name a device data name.

   Example of device data name: DEVICE

6) Click the [Execute] button to read from PLC.

⇩

(10) Select!

10) Select the read file.

11) Confirm that the device data exists.

⇩

(11) Click!

12) Close the Read from PLC dialog box, and then click the [Project] → [Save] menu to save the project.

⇩

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⇩

13) Enter the device data name and initial device value name in [Device data] and [Program memory] fields in Qn(H)CPU Replacement Checklist.

Write all project names and file names to frames Circle either of [Applicable/Not applicable]				
Program memory [Project name:			]	
Parameter [Applicable/Not applicable]		Program	Device comment	Initial device value
Intelligent parameter [Applicable/Not applicable]				
Device data				
Note 1) Before writing to the				

Enter

(7) If a file register exists in the CPU standard RAM, enter the file name and file size (in bytes) in the checklist, read the entire range into the identical project and then save it.

1) Click the [Online] → [Read from PLC] menu.

⇩
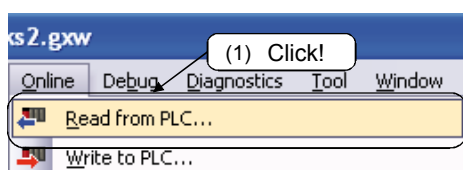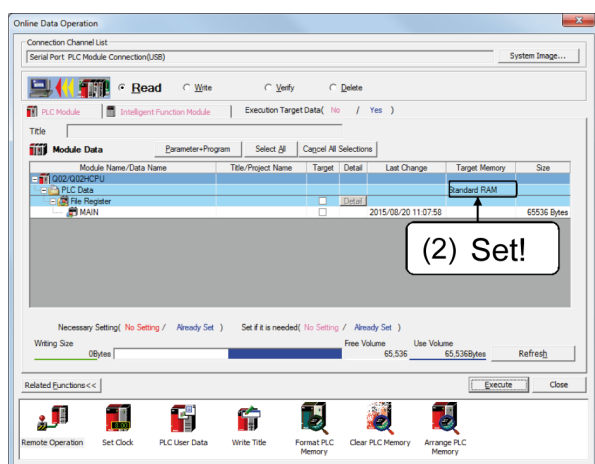
2) Set the target memory to [Standard RAM].

Check that the file register exists.

⇩

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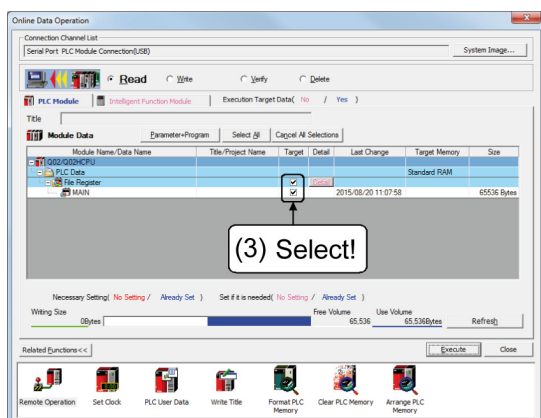
(3) Select!

3) Select a file and check that the entire range is selected.

⇩

4) Enter the file name and file size in the [Standard RAM] field in Qn(H)CPU Replacement Checklist.

PLC verification.				
Standard RAM				
File register	File size			
	byte			
Standard ROM [Project name:]				
Parameter		Program	Device comment	Initial device value

Note) Use the same project as the program memory. Before write to PLC, ensure that the destination and the file name are correct. Writing to the PLC shall be done to the standard RAM.

Enter

⇩

(5) Click!

5) Click the ⌜Execute⌟ button to read from PLC.

⇩

MELSOFT Series GX Works2 (Untitled P

Project   Edit   Find/Replace   Compile   View

New...   Ctrl+N
Open...   trl+O
(6) Click!
Close
Save   Ctrl+S
Save As...
Compress/Unpack   ▶

6) Close the Read from PLC dialog box, and then click the [Project] → [Save] menu to save the project.

(8) If the file exists in the CPU standard RAM, start up a project newly, as above, read the files, and save it as another project.
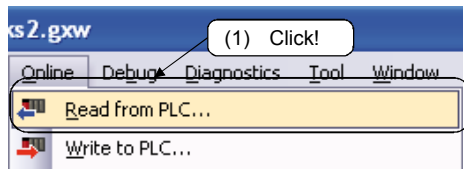
1) Click the [Online] → [Read from PLC] menu.
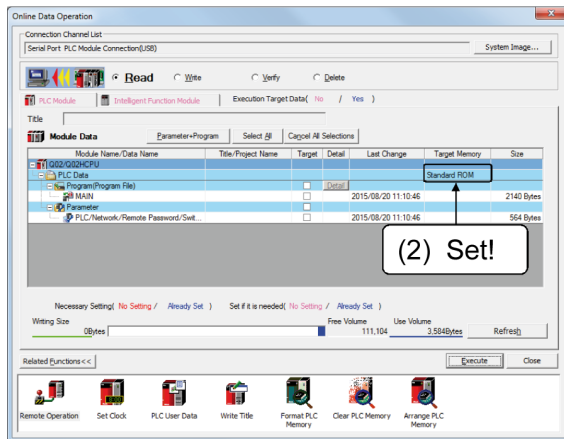
2) Set the target memory to [Standard RAM] and check for the file.

* If the file exists, the tasks are as follows:
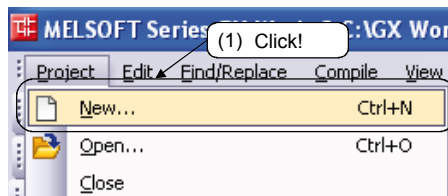
1) Click the [Project] → [New] menu.
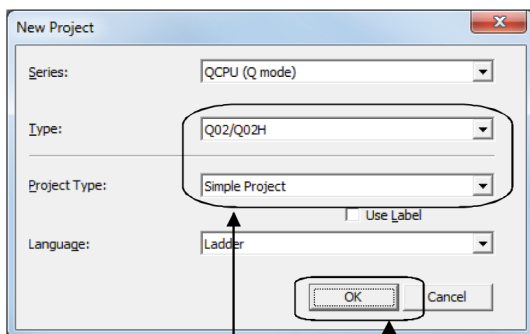
2) Set the PLC series and PLC type and click the OK button.

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⇩
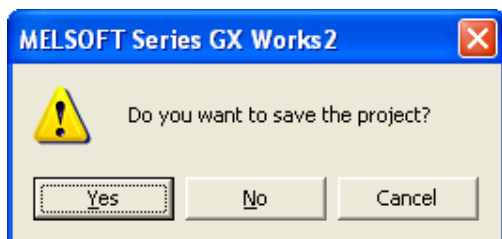
3) The message box on the left is displayed. Click the [No] button.

⇩

(5) Set!
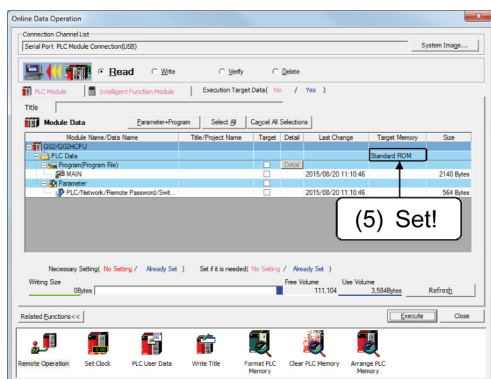
4) A new project starts up.

5) Click the [Online] → [Read from PLC] menu and set the target memory to [Standard ROM].

⇩
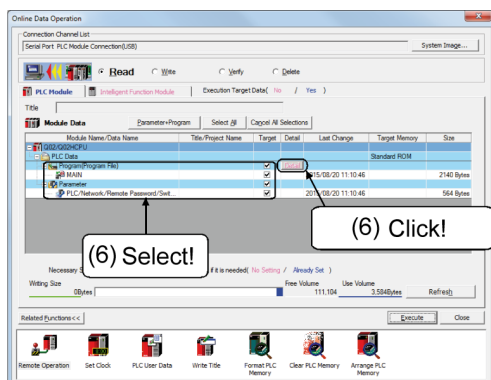
(6) Select!

(6) Click!

6) From the file selection, select all of the program, parameters (PLC/Network/Remote password/Switch setting), and global device comments and click the [Detail] button for the program.

* Even if the intelligent parameter exists, do not select it.

⇩

(7) Check!
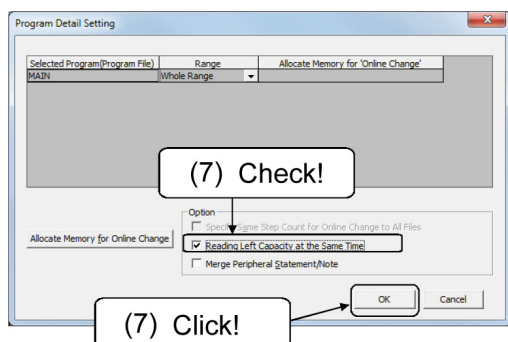
(7) Click!

7) Select [Also read the remaining reserved step capacity for online program change] to read from PLC.

⇩

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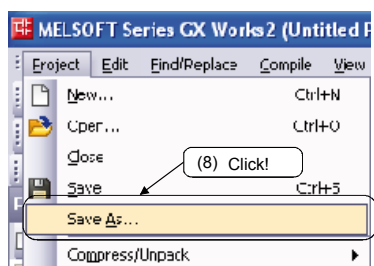
8) After reading from PLC, click the [Project] → [Save as] menu to name the project.

9) In the [Standard ROM] field in the Qn(H)CPU Replacement Checklist, enter the project name, file names and whether one or more parameters exist.

Standard ROM [Project name:]

Parameter [Applicable/Not applicable]		Program	Device comment	Initial device value
Intelligent parameter [Applicable/Not applicable]				

← Enter

10) If the intelligent parameter exists, select "Online" → "Read from PLC" and set the target memory to [Standard ROM].
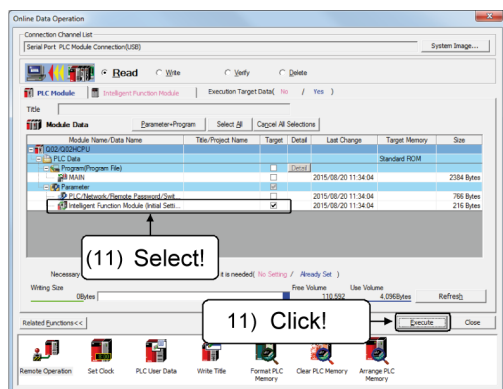
11) Select the intelligent parameter and read from PLC.
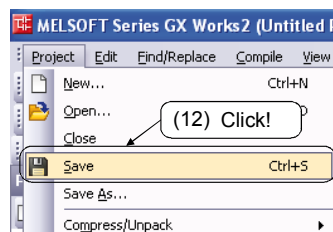
12) Close the Read from PLC dialog box, and then click the [Project] → [Save] menu to save the project.

13) Enter whether the intelligent parameter is selected in [Intelligent parameter] field in Qn(H)CPU Replacement Checklist.

Standard ROM [Project name:]

Parameter [Applicable/Not applicable]		Program	Device comment	Initial device value
Intelligent parameter [Applicable/Not applicable]				

← Enter

(9) If you use a memory card, read the files and save them as another project as above.

However, when an SRAM card and a file register or local device are used, if the same file name is not used, it is possible to save them to the same project as in (4).

Enter the file content in the checklist.
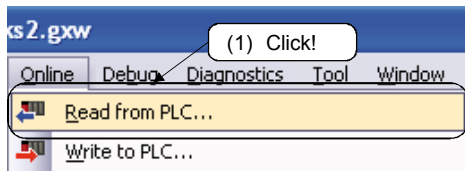
1) Click the [Online] → [Read from PLC] menu.

(1) Click!

2) Set the target memory to [Memory card (SRAM), (Flash) or (ATA)].
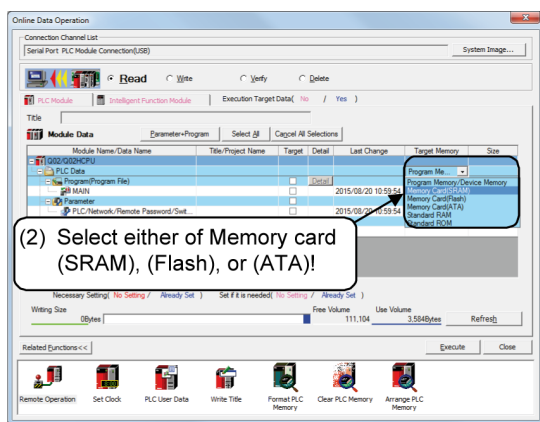
(2) Select either of Memory card (SRAM), (Flash), or (ATA)!

3) Enter the file names in [Memory card] field in Qn(H)CPU Replacement Checklist.

Memory card [Project name:]

Memory card name			
Q2MEM-			

← Enter

4) Check if the file names are the same as those in (4).

Program memory [Project name:]

Parameter		Program	Device comment	Initial device value
[Applicable/Not applicable]		MAIN		
Intelligent parameter				
[Applicable/Not applicable]				

Memory card [Project name:]

Memory card name				
Q2MEM-		MAIN		

Check whether they are the same

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⬇
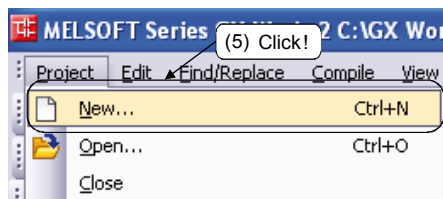
5) Click the [Project] → [New] menu.

⬇
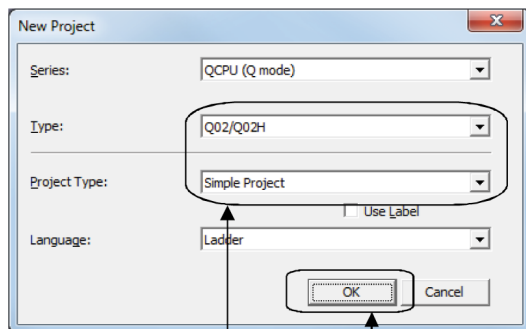
6) Set the PLC series and PLC type and click the OK button.

⬇
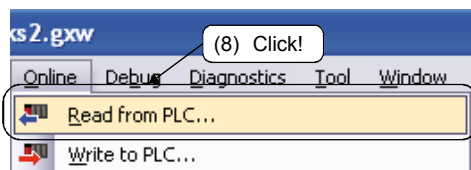
7) A new project starts up.

8) Click the [Online] → [Read from PLC] menu.

⬇
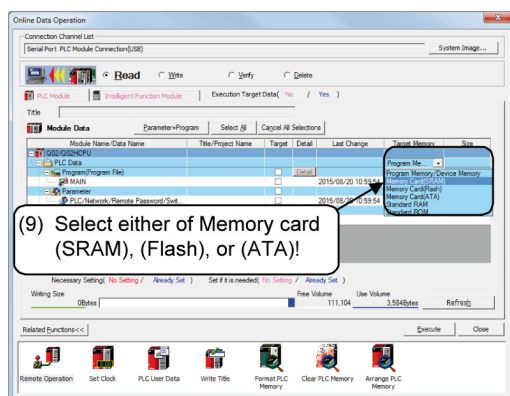
9) Set the target memory to [Memory card (SRAM), (Flash) or (ATA)].

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⬇
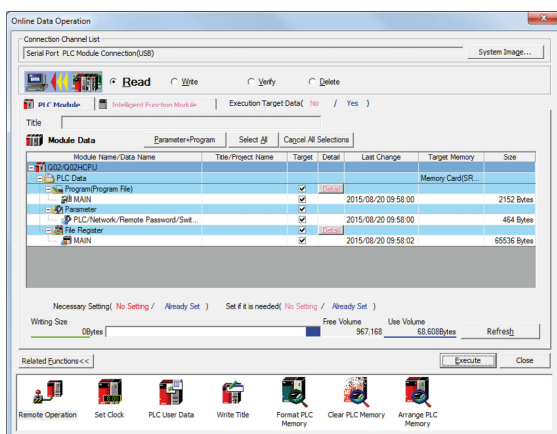
10) Read the files.

   * If a file register exists, check that the entire range is selected.

11) If "The parameters and device memory..." screen is displayed, click the ⎡OK⎤ button.

⬇

(12) Select!
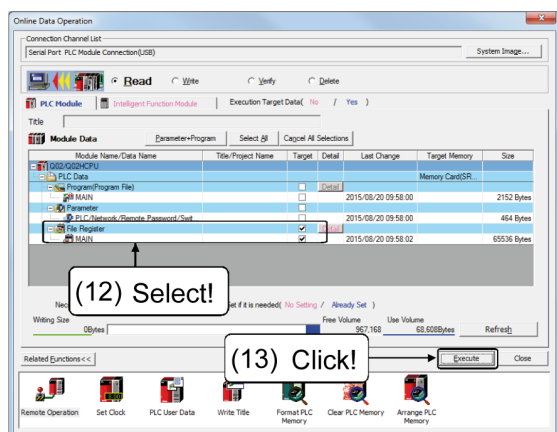
(13) Click!

12) Read only the file register.

13) Close the Read from PLC dialog box.

⬇

(14) Click!
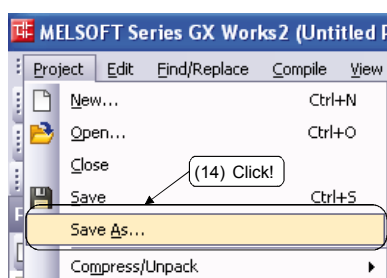
14) After reading from PLC, click the [Project] → [Save as] menu to newly save the project.

⬇

15) Enter the project name in the [Memory card] field in Qn(H)CPU Replacement Checklist.

Enter

(1) Enter the <u>SERIAL number</u> on the side or front (N/A in some cases) of the module to be mounted in the checklist.

(2) Set the RUN/STOP switch of the CPU to be mounted to "STOP", and set other switches in the same way as for the removed CPU. Also mount the battery connector.

(3) Turn OFF the power supply of the programmable controller.

(4) Remove the target CPU from the base and enter the SERIAL number on the side or front in the checklist.

(5) If an identification label is put, move it to the CPU to be mounted.

(6) If a memory card is mounted on the removed CPU, move it on the CPU to be mounted.

(7) Mount the target CPU on the base in the mounting panel and, if it is to be fixed with screws, tighten the screws.

(8) Confirm that the RUN/STOP/RESET switch of the mounted CPU to "STOP" and that other switch settings are as in the check sheet.

(9) Turn ON the power supply of the programmable controller.

* An error may be displayed for the CPU, but please continue with the task.

(1) Check the product information of the corresponding module in the GX Works2 system monitor, and enter in the check sheet.
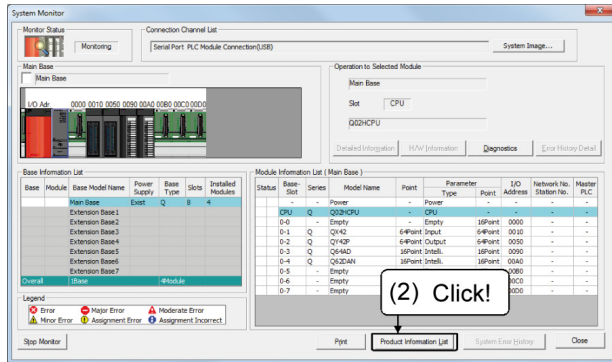
1) Click the [Diagnostics] → [System monitor] menu to display the system monitor dialog box.

2) Click the | Product Information List | button.
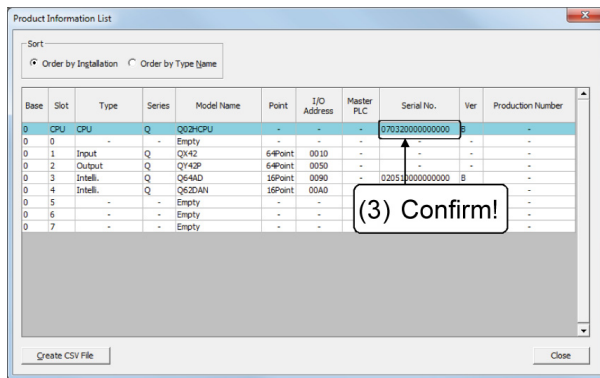
3) The product information list dialog box is displayed. Check the product information (serial number, etc.) of the corresponding module.

4) Enter the product information in the [Product information of the CPU (replacement)] field in Qn(H)CPU Replacement Checklist.

Enter

5) Close the product information list dialog box and the system monitor dialog box.

(2) Format the program memory/device memory, and standard RAM to be used for the PLC memory.

At this point, check whether it is necessary to allocate the system area and, if it is, configure the settings.

However, because this area is set only when formatting, if you are not sure, there is no need to configure it.

1) Click the [Online] → [PLC Memory Operation] → [Format PLC Memory] menu.
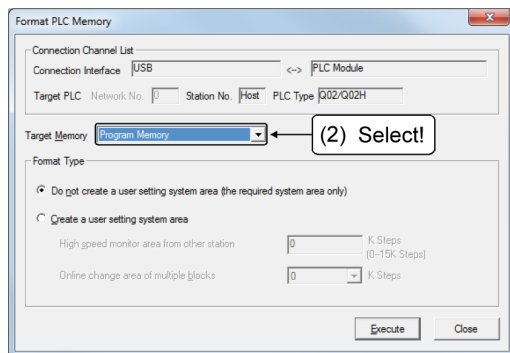
2) The Format the PLC memory dialog box is displayed. Set the target memory to "Program memory".
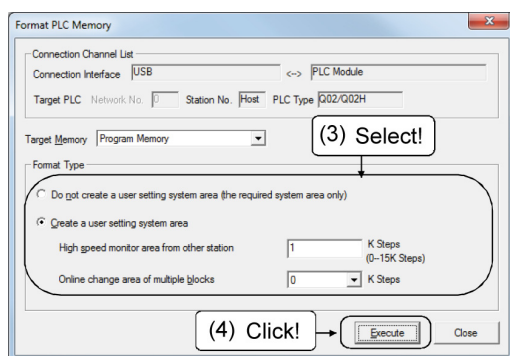
3) Select the format.

* Set the system area if it is necessary to allocate the area.

4) Click the [Execute] button.
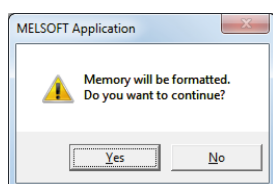
5) The message box on the left is displayed. Click the [Yes] button.

The program memory or device memory is formatted.

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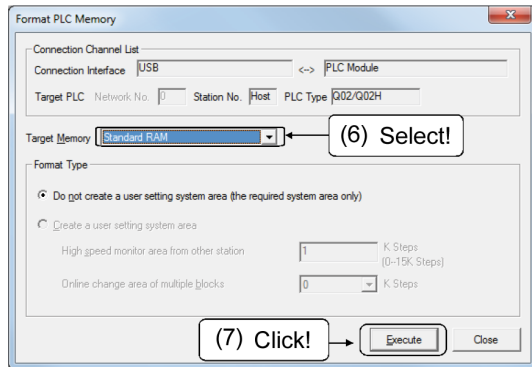
6) Set the target memory to [Standard RAM], and format it likewise.

7) Close the Format the PLC memory dialog box.

(6) Select!

(7) Click!

(3) Select "Include latches" and clear the CPU to be mounted from the PLC memory.

1) Click the [Online] → [PLC Memory Operation] → [Clear PLC Memory] menu.
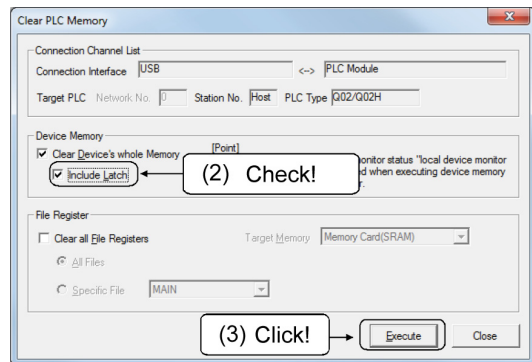
(1) Click!

2) The Clear the PLC memory dialog box is displayed. Select "Include latches".

3) Click the Execute button.

(2) Check!
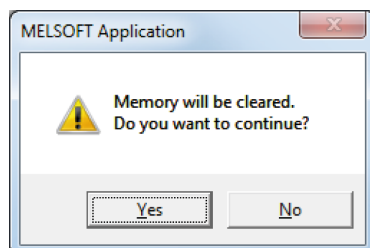
(3) Click!

4) The message box on the left is displayed. Click the Yes button.

The PLC memory is cleared.

5) Close the Clear the PLC memory dialog box.

(4) To the program memory/device memory of the PLC, write the files saved earlier (except for the device memory) such as parameters and programs by referring to the checklist.
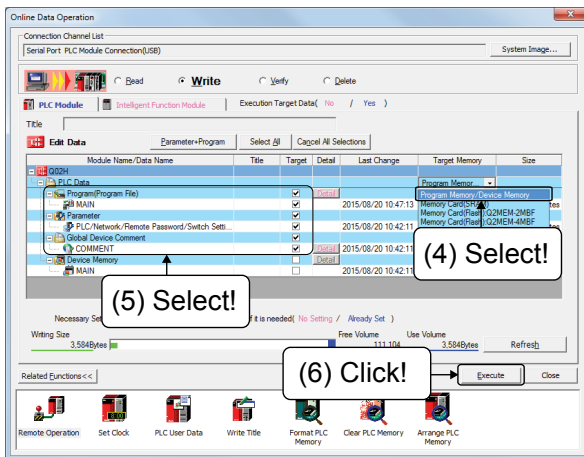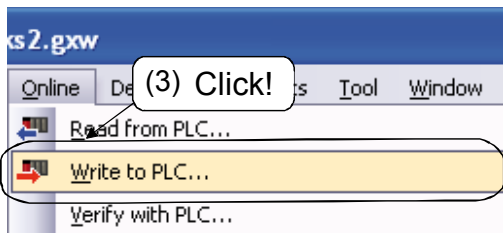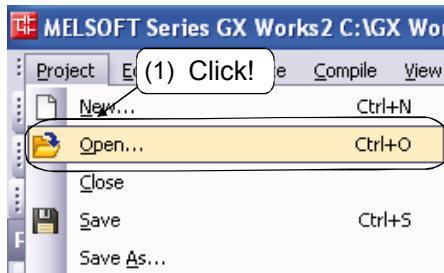
1) Click the [Project] → [Open] menu.

2) Open the project saved in (4) to (7) items in Appendix 10.2.

* Be careful not to open a wrong project.

3) Click the [Online] → [Write to PLC] menu.

4) The Write to PLC dialog box is displayed. Set the target memory to "Program memory/Device memory".

5) Click the [File selection] tab and select programs, parameters and so on (except for the device memory) by referring to the "Program memory" field in the checklist.

6) Click the Execute button to write to PLC.
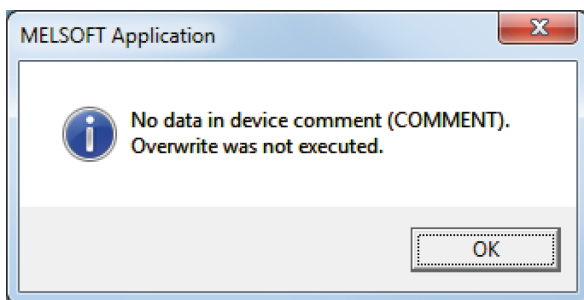
* If there is no device comment, the message box on the left is displayed. Click the OK button.

(5) To the PLC's standard RAM, write the files saved earlier such as a file register (check the capacity: write range ((The number of bytes checked during PLC read ÷ 2) - 1) by referring to the [Standard RAM] field in the checklist.
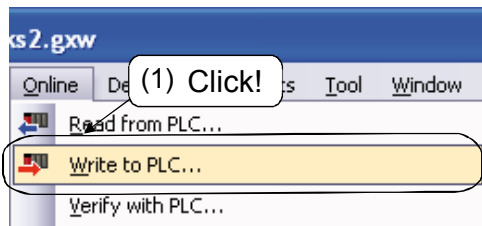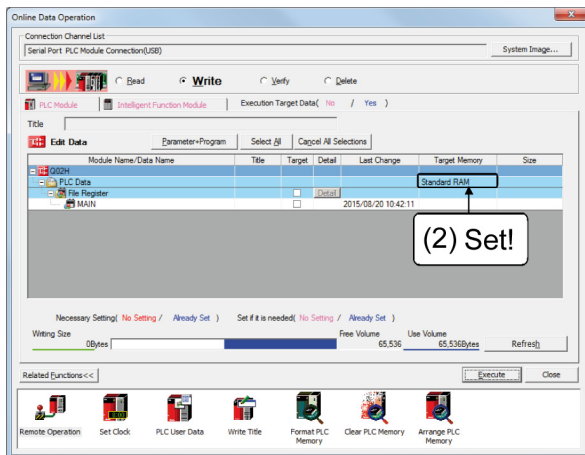
1) Click the [Online] → [Write to PLC] menu.

2) The Write to PLC dialog box is displayed.

   Set the target memory to [Standard RAM].
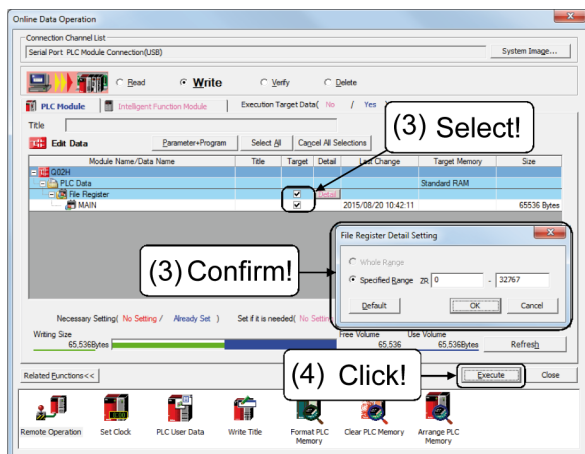
3) Check the write range ((The number of bytes checked during PLC read ÷ 2) - 1) and click the Detail **button for the file register.**

   Select a file by referring to the [Standard RAM] field in the attached checklist.

*   Be careful not to select a wrong file.

4) Click the OK button and then click the Execute button to write to PLC.

(6) For the standard ROM, start up the project to which data was saved, refer to the [Standard ROM] field in the checklist and write only the stored files to PLC.
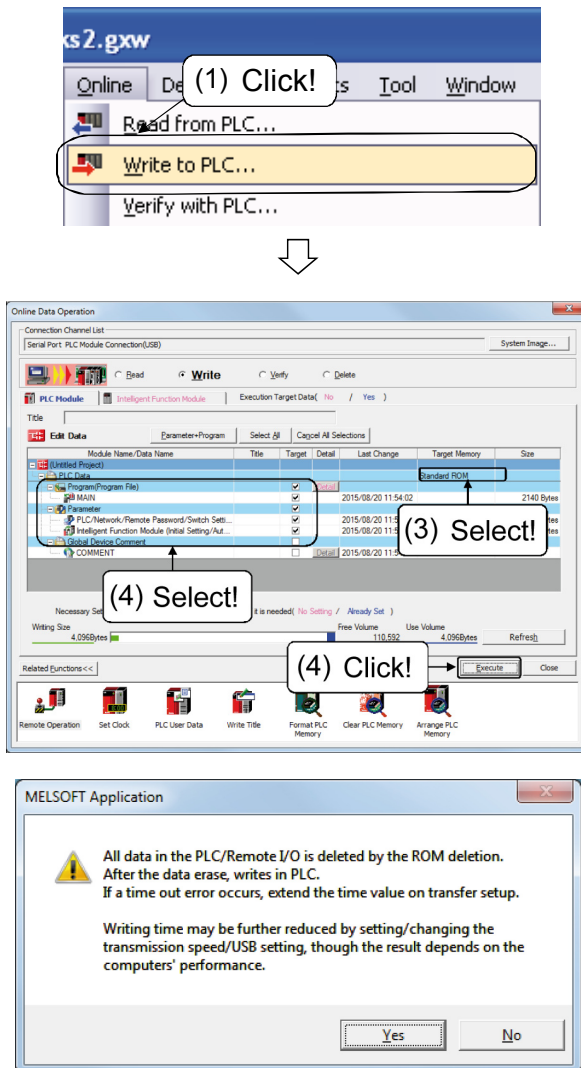
1) As in (4), open the project saved in (8) of Appendix 10.1.2.

2) Click the [Online] → [Write to PLC] menu.

3) The Online data operation (Write) screen is displayed.

Set the target memory to [Standard ROM].

4) Refer to the [Standard ROM] field in the attached checklist and write the stored files to PLC.

5) The message box on the left is displayed. Click the Yes button.

(7) For the memory card, verify all the files with those in the PLC by referring to the [Memory card] field in the checklist.
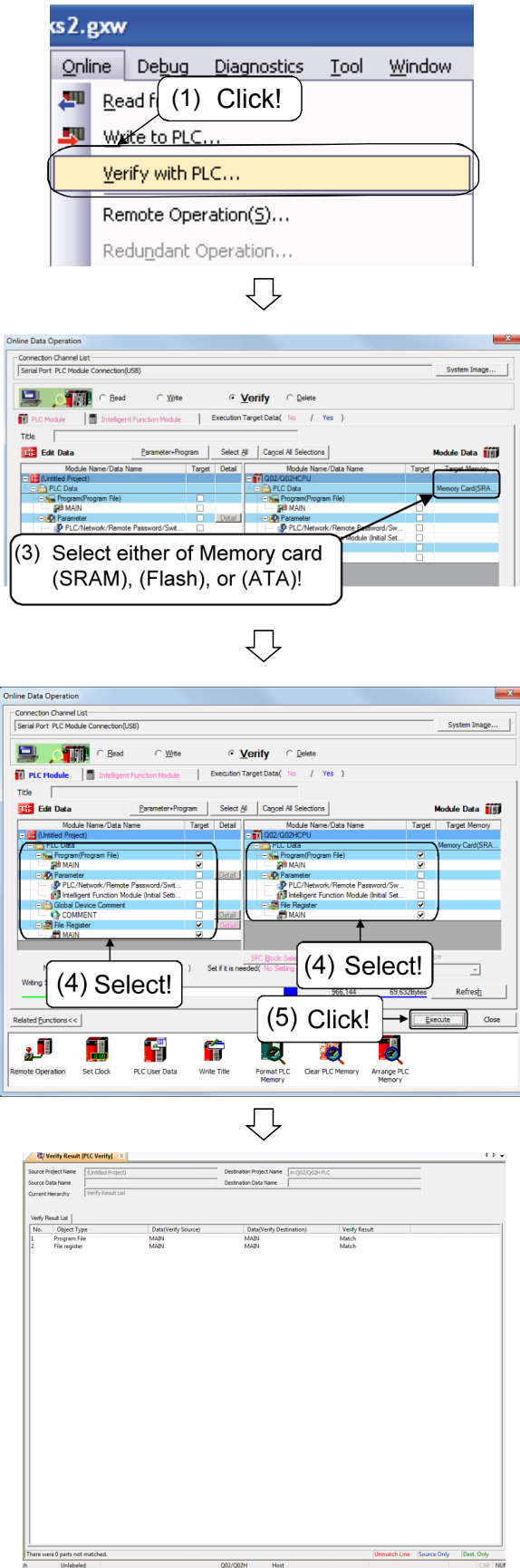
1) As in (4), open the project saved in (9) of Appendix 10.2.

2) Click the [Online] → [Verify with PLC] menu.

3) The Online data operation (Verify) screen is displayed.

Set the target memory to [Memory card (SRAM), (Flash) or (ATA)].

4) Refer to the [Memory card] field in the checklist and select the same data in the verify source and destination.

* If a file register exists, check that the entire range is selected.

5) Click the ☐ Execute ☐ button to verify the data in the PLC.

6) Confirm that there is no mismatch.

(8) If needed, set the clock.
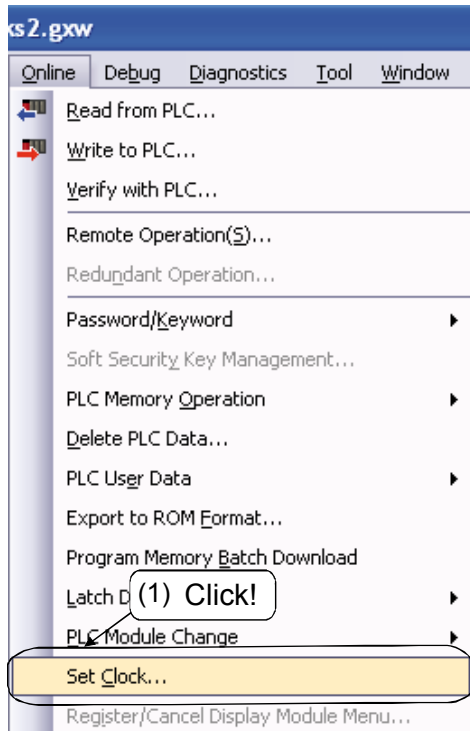
1) Click the [Online] → [Set Clock] menu.
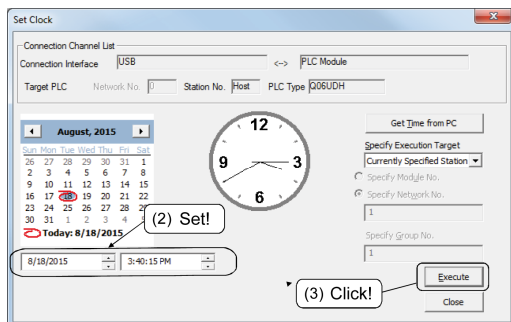
2) The Clock setting dialog box is displayed.

Set the year/month/day, time, and day of the week.

3) Click the ☐Set☐ button.

(9) Reset the CPU.
Push down the switch to the reset position, and then return it to the original central position.
* An error may be displayed for the CPU, but please continue with the task.

(10) To program memory/device memory, write the device memory (except "S" (step relay)) to the CPU in the PLC after clicking the [Default] button in the [Device data] tab and verify the data. <<* Unset "S" in the device setting.>>
(A verification error may occur for the SM, SD or refresh device .)
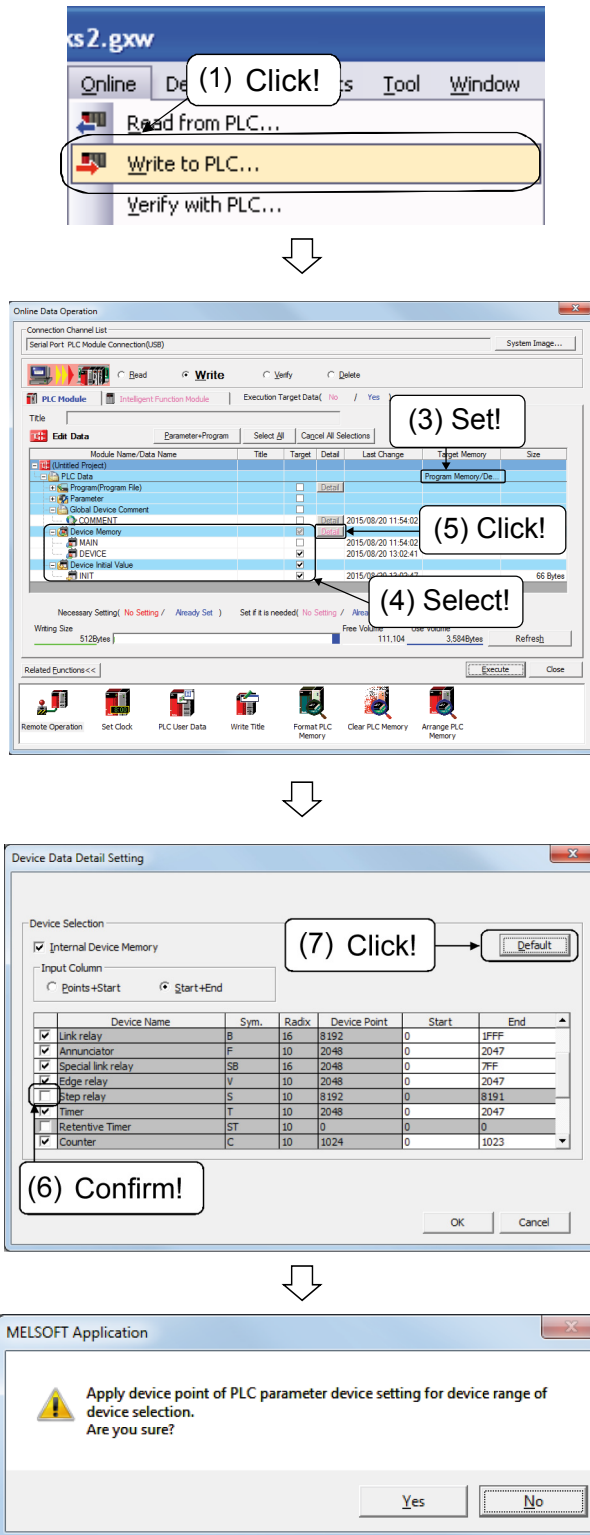
1) As in (4), open the project saved in (6) of Appendix 10.2.

2) Click the [Online] → [Write to PLC] menu.

3) The Write to PLC dialog box is displayed.

   Set the target memory to [Program memory/Device memory].

4) Use the file selection to select the read device data and initial device value.

* Be careful not to select wrong device data.

5) Click the ▣ Detail button.

6) Check that the step relay (S) is deselected (▢).

7) Click the Default button.

8) The message box on the left is displayed. Click the Yes button.

(To the next page)

(From the previous page)

(9) Click!

(10) Click!

(12) Select!

(13) Click!
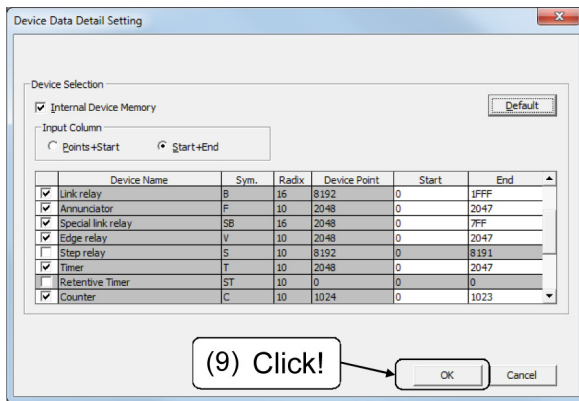
9) Click the OK button to write to PLC.
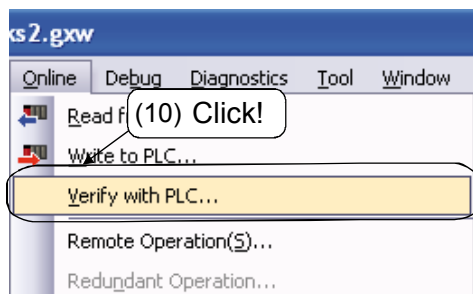
10) As in (7), click the [Online] → [Verify with PLC] menu.
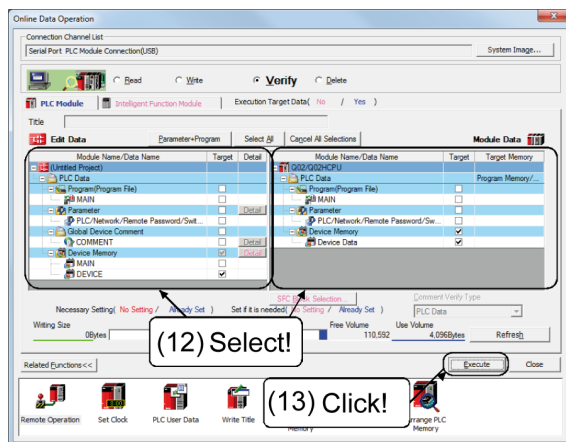
11) The Verify PLC dialog box is displayed.

Set the target memory to [Program memory/Device memory].

12) Refer to the [2) Device data] field in the attached checklist and select the same data in the verify source and destination.
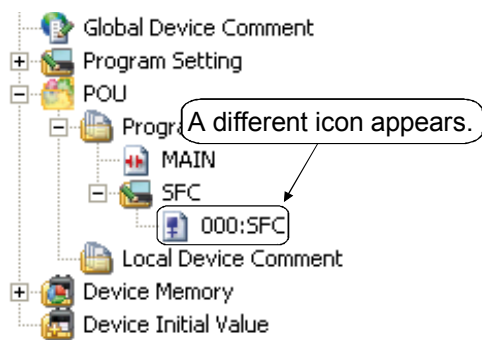
* Be careful not to select a wrong device data.

13) Click the Execute button to verify the data in the PLC.
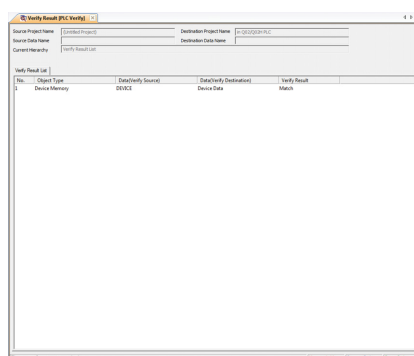
14) Confirm that the device matches.

* The SM, SD or refresh device may be mismatched.

(11) If SFC is used for the program, please check and reset the CPU again.

Global Device Comment
Program Setting
POU
  Progr[A different icon appears.]
    MAIN
    SFC
      000:SFC
  Local Device Comment
Device Memory
Device Initial Value

1) Check if SFC is used.

2) If SFC is used, check and reset the CPU again.

* If an error is displayed for the CPU, reset it.

Appendix 10.5 Operation Check
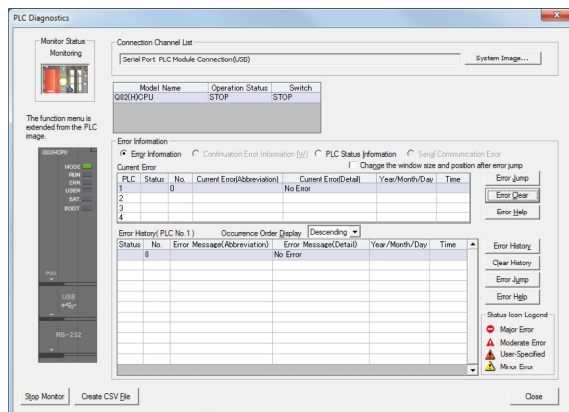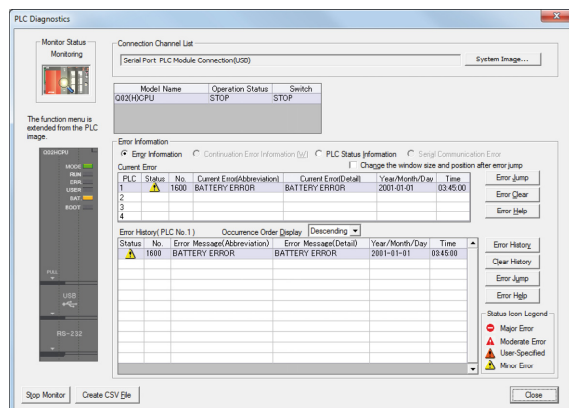
(1) Check that there is no error for the CPU. Also, check that there is no error for the module mounted on the system monitor.
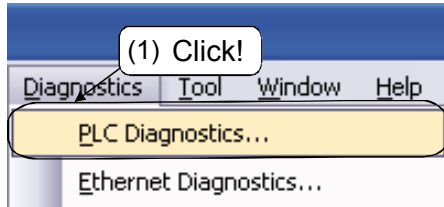
(1) Click!

1) Click the [Diagnostics] → [PLC Diagnostics] menu.

2) The PLC diagnostics dialog box is displayed. Check for an error. (The screen on the left is displayed when there is no error.)

3) If there is any error, click the Error JUMP and Error Help buttons to check the error.

(2) Check the error history and, if no current error exists, clear the error history.
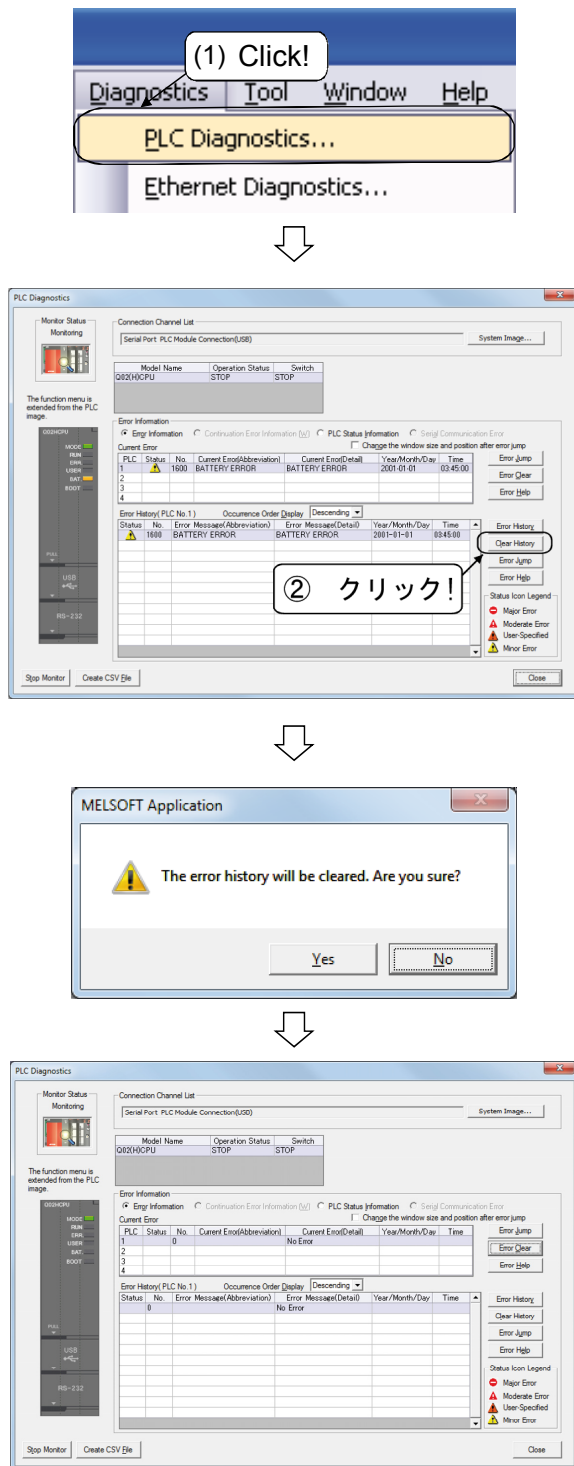
1) Click the [Diagnostics] → [PLC Diagnostics] menu.

2) The PLC diagnostics dialog box is displayed. Click the | Clear History | button.

3) The message box on the left is displayed. Click the | Yes | button.

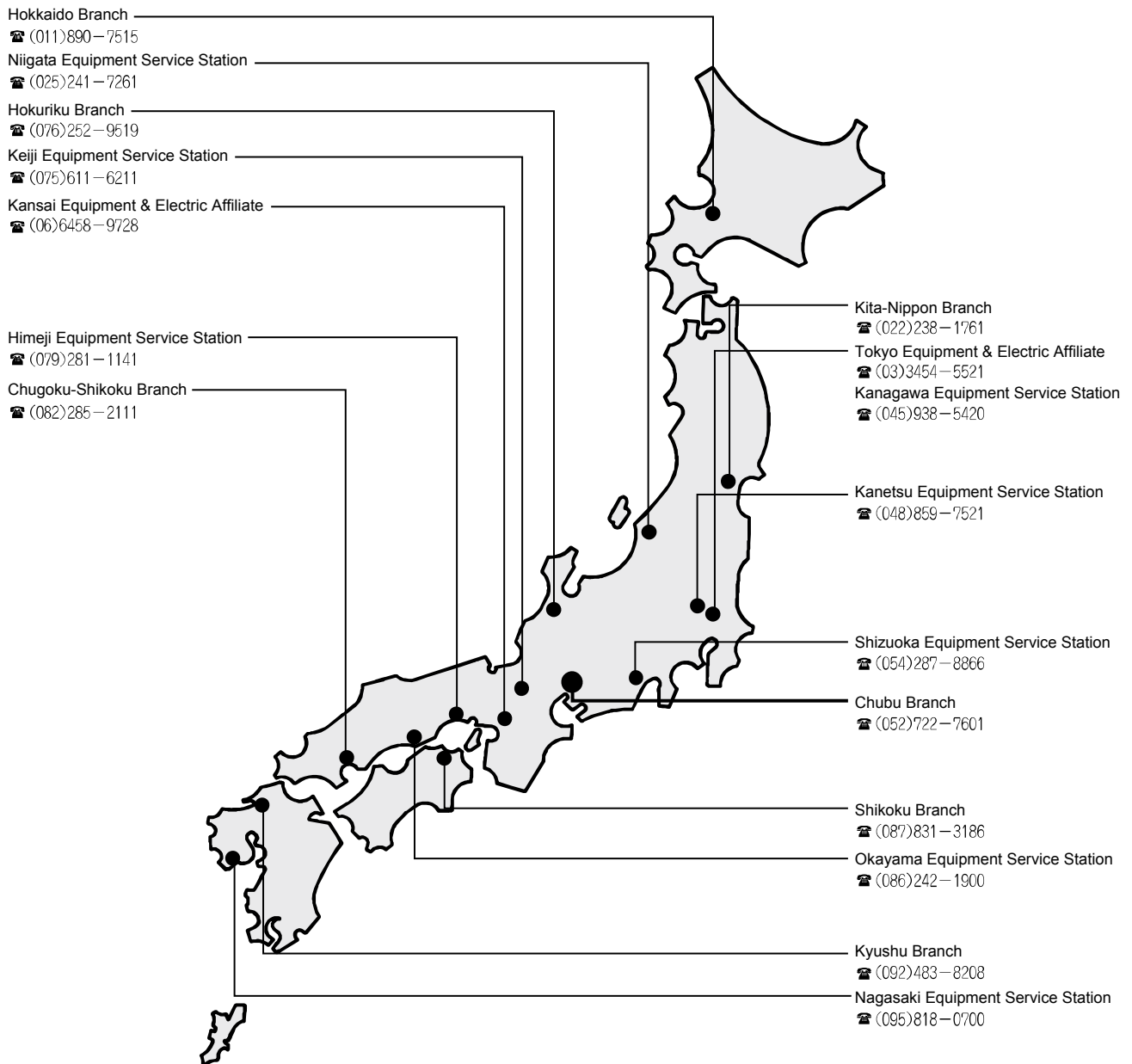4) Confirm that the error history has been deleted and then close the dialog box.

(3) Set the RUN/STOP switch of the mounted CPU to RUN.

(4) If the corresponding CPU is connected to the GOT, turn ON → OFF the power supply to the GOT.

(5) Check that there is no error for the CPU. If any faults are found in the replacement, return the removed CPU to the original place.

    (a) As in 1) to 3) in (2) of Appendix 10.2, check that there is no error.

    (b) If any faults are found in the replacement (including errors), return the removed CPU to the original place.

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Mitsubishi Programmable Controllers Training Manual
Q Maintenance (for GX Works2)

MODEL	
MODEL CODE	
SH-081374ENG-A (1403) MEE	

MITSUBISHI ELECTRIC CORPORATION

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