MITSUBISHI ELECTRIC

MELSEC System Q

Programmable Logic Controllers

User's Manual
(Application)

Serial Communications Modules
QJ71C24(-R2),
QJ71C24N(-R2)/(-R4)

Art. no.: 130025
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SH(NA)-080007
Version E

MITSUBISHI ELECTRIC INDUSTRIAL AUTOMATION

• SAFETY PRECAUTIONS •

(Always read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
The instructions given in this manual are concerned with this product. For the safety instructions of the programmable controller system, please read the user's manual for the PLC module to use.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

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

Please save this manual to make it accessible when required and always forward it to the end user.

[Design Precautions]

DANGER

- See manuals of each data link for the operating status of each station when there is a communication error in the data link.
  There is the risk of an accident occurring due to output error or malfunctioning.
- When using the notification function, the pager receiver may not be contacted due to the frequency transmission status from the system setup environment and error on the receiver side.
  To ensure the safety of the PLC system, install a call circuit with a lamp display or buzzer sound.
- When performing the control of the PLC in operation (changing data) by connecting a peripheral devices to the CPU module or personal computer, etc. to the intelligent device module, configure an interlock circuit in a sequence program so the safety of the overall system is always maintained.
  Also when performing other controls of the PLC in operation (changing program and operation status (status control)), read this manual carefully and confirm if the overall safety is maintained.
  Especially, when this control is performed to a remote PLC from an external device, troubles that have occurred on the PLC side may not be able to immediately be handled if there is a data communication error.

  Define a troubleshooting agreement between external devices and the PLC CPU for data communication error occurrences, as well as construct an interlock circuit in the sequence program.
- Do not write data into the "system area" of the buffer memory of intelligent function modules.
  Also, do not use any "prohibited to use" signals as an output signal to an intelligent function module from the PLC CPU.
  Writing data into the "system area" or outputting a signal for "prohibited to use" may cause a PLC system malfunction.

[Design Precautions]

⚠ CAUTION

- Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
  They should be installed 100mm(3.9inch) or more from each other.
  Not doing so could result in noise that may cause malfunction.
- When using the module while values, such as buffer memory set values, are registered in the Flash ROM, do not turn off the power supply for the module loading station nor reset the PLC CPU.
  If the power supply for the module loading station is turned off or the PLC CPU is reset while any values are registered, the data contents in the Flash ROM become inconsistent and as a result the values must be set again in the buffer memory, etc. and reregistered to the Flash ROM.
  Also, this may cause failure and malfunction of the module.

[Installation Precautions]

⚠ CAUTION

- Use the PLC in an environment that meets the general specifications contained in the user's manual for the CPU module to use.
  Using this PLC in an environment outside the range of the general specifications may cause electric shock, fire, malfunction, and damage to or deterioration of the product.
- When installing the module, securely insert the module fixing tabs into the mounting holes of the base unit while pressing the installation lever located a t the bottom of the module downward.
  Securely fix the module with screws if it is subject to vibration during use.
- Tighten the screws within the range of specified torque.
  If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
  If the screws are tightened too much, it may cause damage to the screw and/or the module, resulting in fallout, short circuits or malfunction.
- Switch all phases of the external power supply off when mounting or removing the module.
  Not doing so may cause damage to the module.
- Do not directly touch the conductive area or electronic components of the module.
  Doing so may cause malfunction or failure in the module.

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[Wiring Precautions]

⚠ CAUTION

- When turning on the power and operating the module after installation and wiring are completed, always attach the terminal cover that comes with the product.
  There is a risk of electric shock if the terminal cover is not attached.
- Perform correct pressure-displacement, crimp-contact or soldering for external wire connections using the tools specified by the manufactures.
  Incorrect connection may cause short circuits, fire, or malfunction.
- Attach connectors to the module securely.
- Be sure to fix communication cables or power supply cables leading from the module by placing them in the duct or clamping them.
  Cables not placed in the duct or without clamping may hang or shift, allowing them to be accidentally pulled, which may cause a module malfunction and cable damage.
- Before connecting the cables, check the type o f interface to be connected.
  Connecting or erroneous wiring to the wrong interface may cause failure to the module and external devices.
- Tighten the terminal screws within the range of specified torque.
  If the terminal screws are loose, it may result in short circuits or malfunction.
  If the screws are tightened too much, it may cause damage to the screw and/or the module, resulting in fallout, short circuits or malfunction.
- When removing the communication cable or power supply cable from the module, do not pull the cable. When removing the cable with a connector, hold the connector on the side that is connected to the module.
  When removing the cable connected to the terminal block, first loosen the screws on the part that is connected to the terminal block.
  Pulling the cable that is still connected to the module may cause malfunction or damage to the module or cable.
- Be careful not to let foreign matters such as sawdust or wire chips get inside the module.
  They may cause fires, failure or malfunction.
- The top surface of the module is covered with protective film to prevent foreign objects such as cable offcuts from entering the module when wiring.
  Do not remove this film until the wiring is complete.
  Before operating the system, be sure to remove the film to provide adequate heat ventilation.

[Starting and Maintenance Precautions]

⚠ CAUTION
• Do not disassemble or modify each module. Doing so could cause failure, malfunction injury or fire. • Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause failure or malfunction of the module. • Do not touch the connector while the power is on. Doing so may cause malfunction. • Switch all phases of the external power supply off when cleaning or retightening terminal screws and module installing screws. Not doing so may cause failure or malfunction of the module. If the screws are loose, it may cause the module to fallout, short circuits, or malfunction. If the screws are tightened too much, it may cause damages to the screws and/or the module, resulting in the module falling out, short circuits or malfunction. • Always make sure to touch the grounded metal to discharge the electricity charged in the body, etc., before touching the module. Failure to do so may cause a failure or malfunctions of the module.

[Operation Precautions]

⚠ CAUTION
• When performing the control of the PLC in operation (especially changing data, program, and operation status (status control)) by connecting a personal computer, etc. to the intelligent function module, read this manual carefully and confirm if the overall safety is maintained. Failure to perform correct operation s to change data, program, or the status may result in system malfunction, machine damage, or an accident.

[Disposal Precautions]

⚠ CAUTION
• When disposing of this product, treat it as industrial waste.

REVISIONS

＊The manual number is given on the bottom left of the back cover.

Print Date	＊Manual Number	Revision
Dec., 1999	SH (NA)-080007-A	First Printing
Oct., 2000	SH (NA)-080007-B	Add the contents of the function version B. Put Windows® base software products together from Mitsubishi Programmable Logic Controller MELSEC series to Mitsubishi integrated FA software MELSOFT series. Standardize the name from software package (GPP function) to product name (GX Developer). Correction Entire manual (change MELSECNET/10H to MELSECNET/H), Contents, About the Manuals, About the Generic Terms and Abbreviations, Section 1.1, 1.2 POINT, Section 2.1, 2.2.1, 2.2.3, 2.2.5, 2.2.6, 2.3.1, 2.3.2, Section 3.1.1, 3.2.3, 3.2.4, 3.3.1, 3.3.4, 3.3.5, 3.3.6, 3.4 (entire), Section 4.3, Chapter 9 (entire), Chapter 11 (entire), Section 12.2, 12.3, 12.4 (entire), 12.6 (entire), Section 13.3, 13.4, 13.6 (entire), Section 15.3, Section 16.2 (entire) to 16.7 Addition Section 2.4(9), Section 3.2.3 POINT
Jun., 2001	SH (NA)-080007-C	Standardize the name from utility package (QSCU) to product name (GX Configurator-SC). Correction About the Manuals, The Manual's Use and Structure, About the Generic Terms and Abbreviations, Program example (Section 9.4.1, 9.4.2, 9.4.3, Section 11.5 (1) (2), Section 16.5, 16.6, 16.7), Section 1.1 (2) (diagram), 1.2, Chapter 3 (entire), Section 4.1 (2), Section 9.1.1 (4) 5), Section 11.3.2 (3), 11.3.3 (3), Section 13.6.1 (diagram) Addition Section 3.3.4, 3.3.6 (4), 3.4.5 (4)
Jan., 2003	SH(NA)-080007-D	Additional model QJ71C24N,QJ71C24N-R2, QJ71C24N-R4 Correction SAFETY PRECAUTIONS, About the Manuals, The Manual's Use and Structure, About the Generic Terms and Abbreviations, Section 1.2, Section 2.2.4 (2) (c), Section 3.3.1, 3.3.5, 3.3.6, 3.4.2, 3.4.3, 3.4.7, 3.4.8 (3), 3.5, Section 6.1, Section 7.1, 7.2, Section 9.1.1 (4), Section 10.4.1 (2) 1), Section 11.2.4 (2), 11.4.3 (a), 11.5, Section 15.1, 15.2, 15.3, 15.4.2, Section 17.1, 17.3, 17.4 Addition Section 4.4.2 (6), Chapter 16 (entire)
Dec., 2003	SH(NA)-080007-E	Correction About the Generic Terms and Abbreviations, Section 3.4.6 (4), Section 6.1, 6.3 (1) (b), Section 9.1.1 (4), Section 11.2.4 (2)

Japanese Manual Version SH-080002-H

INTRODUCTION

Thank you for purchasing the MELSEC-Q series PLC.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Q series PLC you have purchased, so as to ensure correct use.
Please forward a copy of this manual to the end user.

CONTENTS (This manual)

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(Related Manual-1) … Q Corresponding Serial Communication Module User's Manual (Basic)

SH-080006-F

(Related Manual-2) … Q Corresponding MELSEC Communication Protocol Reference Manual
SH-080008-E

About the Manuals

The following manuals are available for this product.
Please order the desired manuals using the chart below.

Related Manuals

Manual name	Manual number (Model code)
Q Corresponding Serial Communication Module User's Manual (Basic) This manual explains an overview of the module and describes the applicable system configuration, the specifications, the procedures prior to operations, the basic methods of communicating with the external device, maintenance and inspection, and the troubleshooting of the Q-series serial communication module. (Sold separately)	SH-080006 (13JL86)
Q Corresponding MELSEC Communication Protocol Reference Manual This manual explains information on how the external device reads data from and writes data to the PLC CPU through communication using the MC protocol by utilizing the Q series C24/Q series E71. (Sold separately)	SH-080008 (13JF89)
GX Configurator-SC Version 2 Operating Manual (Protocol FB support function) This manual explains the function and usage of the protocol FB support function that supports the creation of the data communication program of the module and set up of each parameter. (Sold separately)	SH-080393E (13JU46)

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● How to use this manual

This manual describes the use of special functions for the Q series C24 (QJ71C24N, QJ71C24N-R2, QJ71C24N-R4, QJ71C24, QJ71C24-R2), with each chapter covering a specific function. Please read this manual and use the contents below as a reference.

(1) To read an overview of special functions

- An overview of the major special functions is describes in Chapter 1.

(2) To use the function that monitors errors in the PLC CPU

- Chapter 2 describes the PLC CPU monitoring function, which monitors the PLC CPU status and devices and automatically sends status information to the opposite communicating device upon the occurrence of an error.

  ∗ To use the PLC CPU monitoring function from the external device using the MC protocol, refer to the reference manual for details on how to start and cancel PLC CPU monitoring.

(3) To use the data communication function for the exchange of data with an external device at a remote location

- Chapter 3 describes the specifications, procedures and other items regarding communication using a modem function in order to exchange of data with an external device at a remote location.

(4) To use the function for reading received data from the external device using an interrupt program in order to reduce the scan time

- Chapter 4 describes the programming for execution of a receiving program only when data from the external device is received.

(5) To use the function for monitoring the data communication time with the external device

- Chapter 6 describes the function that monitors the data communication time with the external device, along with the reception-interval time and the response-reception time for transmission.

(6) To use the transmission control function to control data transmission/reception with the external device.

- Chapter 7 describes the DTR/DSR control and the DC code function to control the data communication with the external device.

(7) To use the function for simplifying the data communication program with the registration data when preregistering the fixed-format section of the communication message

- Chapters 9 to 11 describe the data transmission/reception function with user frames in which the fixed-format section of the communication message has been preregistered.

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(8) To use the function that performs the data communication in ASCII code with the external device

- Chapter 13 describes the handling of binary code on the PLC CPU and ASCII-BIN conversion function for communicating ASCII code data for an external device.

(9) To use dedicated instructions

- Chapter 17 describes the dedicated instructions that are used to execute the functions explained in this manual.

● Structure of this manual

This manual describes how to use the utility package for the Q series C24 (GX Configurator-SC) in order to perform the initial settings used to execute special functions.
For details on the screens used for entering setting values, see Chapter 8 of User's Manual (Basic).

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About the Generic Terms and Abbreviations

This manual uses the following generic terms and abbreviations to describe the Q series C24 unless otherwise specified.

(1) Generic terms and abbreviations

In this manual, the following generic terms and abbreviations are used to indicate the PLC CPU and the Q series C24 used for the data-communication functions of the serial communication modules. The model names of serial communication modules are used to identify the specific models.

Generic term/abbreviation	Description of generic term/abbreviation	
Ethernet modules Q series E71 (E71)	Abbreviations for Q series Ethernet interface modules QJ71E71-100, QJ71E71-B5, QJ71E71-B2 (Indicated as "E71" in the diagrams)	
Q series C24 (C24)	Abbreviations for Q series serial communication modules QJ71C24N, QJ71C24N-R2, QJ71C24N-R4, QJ71C24, QJ71C24-R2 (Indicated as "C24" in the diagrams)	
QC24	Generic term for AJ71QC24, AJ71QC24-R2, AJ71QC24-R4, A1SJ71QC24, A1SJ71QC24-R2	
QC24N	Generic term for AJ71QC24N, AJ71QC24N-R2, AJ71QC24N-R4, A1SJ71QC24N, A1SJ71QC24N-R2	
QC24(N)	Generic term for QC24, QC24N	
QCPU	Q mode	Generic term for Q00JPUC, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q12PHCPU, Q25PHCPU
QCPU station	Abbreviation for PLC installed QCPU.	
QnACPU	Generic term for Q2ACPU, Q2ACPU-S1, Q2ASCPU, Q2ASCPU-S1, Q2ASHCPU, Q2ASHCPU-S1, Q3ACPU, Q4ACPU, Q4ARCPU	
QnACPU station	Abbreviation for PLC installed QnACPU.	
Q/QnACPU	Generic term for QCPU, QnACPU	
UC24 Computer link modules	Generic term for AJ71UC24, A1SJ71UC24-R2, A1SJ71UC24-R4, A1SJ71UC24-PRF, A1SJ71C24-R2, A1SJ71C24-R4, A1SJ71C24-PRF, A2CCPUC24, A2CCPUC24-PRF ＊ A series computer link modules	
Serial communication modules	Generic term for the module below.	
	QnA series	AJ71QC24, AJ71QC24-R2, AJ71QC24-R4, A1SJ71QC24, A1SJ71QC24-R2, AJ71QC24N, AJ71QC24N-R2, AJ71QC24N-R4, A1SJ71QC24N, A1SJ71QC24N-R2
	Q series	QJ71C24N, QJ71C24N-R2, QJ71C24N-R4, QJ71C24, QJ71C24-R2

(2) Other generic terms and abbreviations

This manual uses the following generic terms and abbreviations to explain the data-communication devices for the Q series C24. The names/model names are provided when it is necessary to explicitly identify the model being discussed.

Generic term/abbreviation	Description of generic term/abbreviation
Buffer memory	Generic term for buffer memory of the intelligent function modules/special function modules used for storing data sent to or received from the PLC CPU (setting values, monitor values, etc.)
Computer	Generic term for the external devices with which data can be sent/received using the MC protocol or the bidirectional protocol.
Data communication functions	Generic term for MC protocol, non procedure protocol, and bidirectional protocol
GX Configurator-SC	Abbreviation for GX Configurator-SC (SW0D5C-QSCU-E or later). • Initial settings for the module, monitoring and testing can be performed without using a sequence program and without considering I/O signals or buffer memory. (Intelligent function utility) • Converting sequence programs necessary for data communication processing into FB can shorten program production man-hours. In addition, the monitoring and analysis of the transmitted/received data by the communication network can shorten the system start-up time. (Protocol FB support function)
GX Developer	Abbreviation for GX Developer (SWnD5C-GPPW-E) (n in the model should be 4 or greater)
I/F	Abbreviation for Interface
Intelligent function modules	Generic terms for the Q series PLC modules that are operated by commands from the PLC CPU (equivalent to the A series PLC special function modules). Examples: • CC-Link interface module • A/D and D/A conversion modules • Ethernet interface module • Serial communication module
Intelligent function module devices	Generic terms for buffer memory of the intelligent function modules used for storing data sent to or received from the PLC CPU (setting values, monitor values, etc.)
MELSECNET/10	Abbreviation for MELSECNET/10 network system
MELSECNET/H	Abbreviation for MELSECNET/H network system
MX Component	Abbreviation for MX Component (SWnD5C-ACT-E or later)
Operating Manual (Protocol FB support function)	GX Configurator-SC Version 2 Operating Manual (Protocol FB support function)
Opposite devices External devices	Generic term for Computers, indicators, measuring instruments, ID modules, bar code readers, regulators, other serial communication modules, C24, etc. that are connected to the Q series C24 for data communication.
Reference manual	Q corresponding MELSEC communication protocol reference manual
RS-232 (Interface)	Abbreviation for Interface conforming to RS-232
RS-422/485 (Interface)	Abbreviation for Interface conforming to RS-422 and RS-485
Special function modules	Generic term for the A/QnA series PLC modules that are operated by commands from the PLC CPU (equivalent to the Q series PLC intelligent function modules). Examples: • CC-Link interface module • A/D and D/A conversion modules • High-speed counter module • Ethernet interface module • Computer link module and serial communication module
Switch setting	Generic term for intelligent function module switch setting
User's manual (Basic) or Basic	Q corresponding serial communication module user's manual (Basic)
User's manual (Application) or Application	Q corresponding serial communication module user's manual (Application)

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Definitions and Descriptions of Terminology

The following table lists the definitions and descriptions of terminology used in this manual and related manuals for the Q series C24.

Terminology	Description
A compatible 1C frame (Formats 1 to 4)	One of the message formats for the serial communication modules for performing communication using the MC protocol and ASCII code data. This is the same message format as when communicating using the protocol for the A series computer link modules. Device memory read/write operations for the QCPU are allowed within the device range of the AnACPU. Details are explained in Chapter 5 of the Reference Manual.
Bidirectional protocol	A communication procedure for the serial communication modules and one of the data communication functions for communicating any data between the PLC CPU and an opposite device. Details are explained in Chapter 7.
Independent operation	A mode of interface operation to communicate data with external devices using a function specified in each communication protocol setting. Two interfaces of serial communication modules do not interact.
Linked operation	The operation mode of each of the two interfaces for a serial communication modules that are connected to external devices and linked to one another in order to communicate data to/from the external devices. The two interfaces communicate data using the identical data-communication function (MC protocol (identical format) or non procedure protocol) and the identical transmission specifications. (Linked operation using the bidirectional protocol is not allowed.)
MELSEC communication protocol (MC protocol)	A communication procedure for the Q series serial communication modules or the Ethernet interface modules, and a name of communication method for accessing to the PLC CPU from an external device. (This is called the MC protocol in this manual.) There are two communication methods; one uses ASCII code data and the other uses binary code data. Details are explained in the Reference Manual.
Message send function (Printer function)	This function registers character data (messages) to be sent to external devices (mainly printers) in the serial communication modules as an user frame in advance, and sends the registered data for multiple user frames using the non procedure protocol (sent by an instruction from the PLC CPU).
Multidrop connection	A name of the connection when multiple external devices or other serial communication modules are connected in a 1:n or m:n mode using the serial communication module's RS-422/485 interface.
Non procedure protocol	An user's communication procedure and one of the data communication functions for communicating any data between the PLC CPU and an external device. Details are explained in Chapter 6.
QnA compatible 2C frame (Formats 1 to 4)	One of the message formats for the serial communication modules for performing communication using the MC protocol and ASCII code data. This is the same message format as the communication frame using the protocol for the QnA series serial communication modules. • QnA compatible 2C frame (Formats 1 to 4): QnA simplified frame (Formats 1 to 4) Details are explained in Chapter 4 of the Reference Manual.
QnA compatible 3C frame (Formats 1 to 4) QnA compatible 4C frame (Formats 1 to 4)	One of the message formats for the serial communication modules for performing communication using the MC protocol and ASCII code data. This is the same message format as the communication frame using the protocol for the QnA series serial communication modules. • QnA compatible 3C frame (Formats 1 to 4): QnA frame (Formats 1 to 4) • QnA compatible 4C frame (Formats 1 to 4): QnA extension frame (Formats 1 to 4) Details are explained in Chapter 3 of the Reference Manual.

Terminology	Description
QnA compatible 4C frame (Format 5)	One of the message formats for the serial communication modules for performing communication using the MC protocol and binary code data. This is the same message format as the communication frame using the protocol for the QnA series serial communication modules. • QnA compatible 4C frame (Format 5): QnA extension frame (Format 5) Details are explained in Chapter 3 of the Reference Manual.
User frame	Data name when the fixed format portion of messages to be sent or received between a serial communication module and an external device is registered in the module and used for sending and receiving data with the functions listed below. (The contents of a user frame data should conform to the specifications of the external device.) The data array of the head and tail sections of a message (transmission control code, C24 station number, sum check, fixed data, etc.) to be sent and received is registered in the serial communication module before use. • MC protocol on-demand function. • Data-communication function using the non procedure protocol. Details are explained in Chapter 9 of the User's Manual (Applications).

1 OVERVIEW

1.1 Overview

This manual explains special functions of the MELSEC-Q series C24.
This chapter provides an overview of these special functions. The primary special functions of the Q series C24 and a functional overview are indicated below.

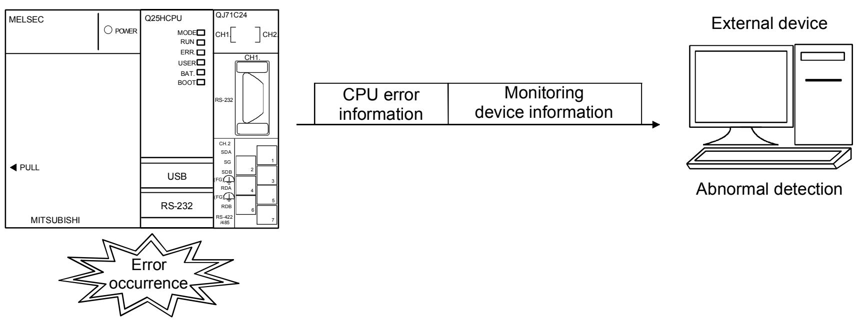
(1) Monitoring the PLC CPU (detailed explanation in Chapter 2)

(a) The local station PLC CPU can be monitored at time intervals set by the user without a sequence program.

1) The following information can be registered as items to be monitored.
   (Monitoring a device for the local station PLC CPU)
   - A numeric value stored in a word device
   - The ON/OFF status of a bit device
     (Monitoring the status of the local station PLC CPU)
   - Monitoring the status of the local station CPU module
2) For the results of the PLC CPU monitoring, the following monitored information can be transmitted/notified.
   - Transmission of information on the device to be monitored and status of the PLC CPU (Monitoring information obtained through combined use of the modem function can also be transmitted.)
   - Notification of notification messages (character string data) registered for connecting the modem function when using with the modem function together
3) The user can select one of the following as transmission timing for the PLC CPU monitoring results to the external device.
   - Transmission/notification each time the PLC CPU is monitored. (Constant cycle transmission)
   - Transmission/notification when the information read from the PLC CPU agrees with conditions set by the user. (Condition agreement transmission)

(b) The PLC CPU monitoring function can be used in communication using MC protocol or non procedure protocol.

(c) Using the PLC CPU monitoring function makes it possible to do the following:
   - Sends device data without using a sequence program
   - Simplifies the device monitor procedure
   - Sends CPU module error information

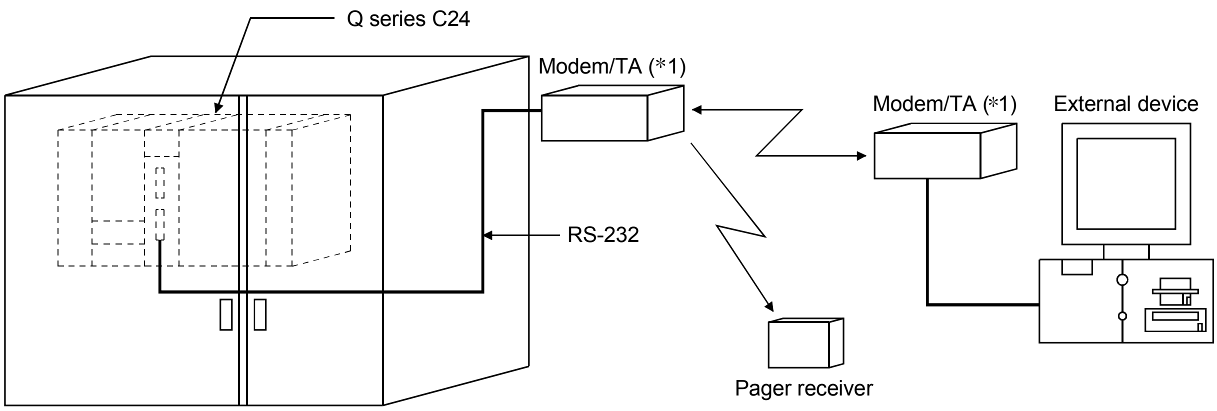


(2) Communicating with the external device at a remote location via a modem (detailed explanation in Chapter 3)

1) Connecting a modem or TA (terminal adapter) to the RS-232 interface facilitates communication via a public line/private line/digital line (ISDN), such as data communication with a device at a remote location (listed below) and calling a pager device.
   - Data communication using the MC protocol
   - Data sending and receiving using the non procedure protocol
   - Data communication using the bidirectional protocol
   - PLC access using the GX Developer
2) Initialization of a modem or TA, line connection (dialing), and line disconnection are performed by the PLC CPU.

3) When a remote password is set in the QCPU with the GX Developer, the following access from the external device to QCPU using the Q series C24 modem function can be performed by executing the unlock processing to the remote password.
   - Data communication using MC protocol
   - Accessing the PLC using the GX Developer

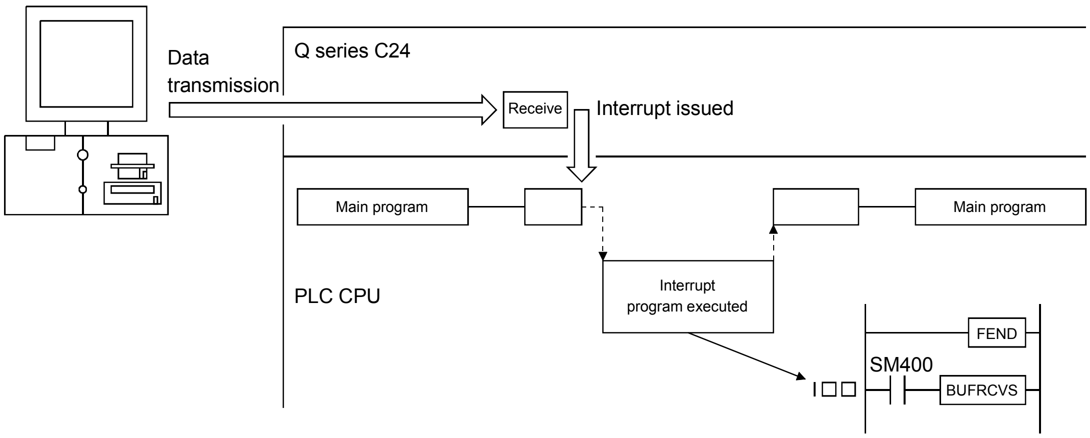
   ∗ The remote password function is a QCPU function designed to prevent improper access to the QCPU by users.
   The QCPU remote password function can be used by setting a remote password in the QCPU with the GX Developer.



∗1 TA is an abbreviation for Terminal Adapter.

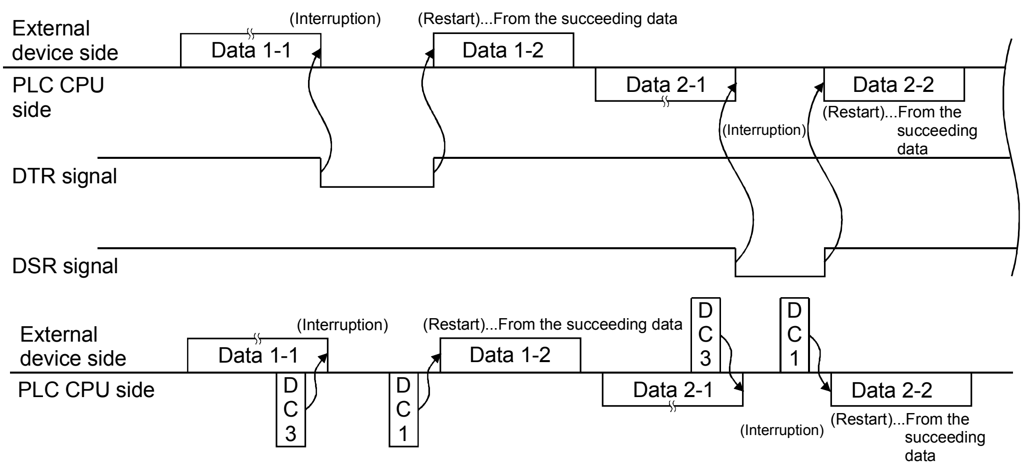
(3) Receiving data with an interrupt program (detailed explanation in Chapter 4)

1) In data communication between the Q series C24 and the external device, data can be received using an interrupt program with the following data communication functions.
   - Data reception during communication using the non procedure protocol
   - Data reception during communication using the bidirectional protocol
2) Receiving data using an interrupt program expedites data reception by the PLC CPU.



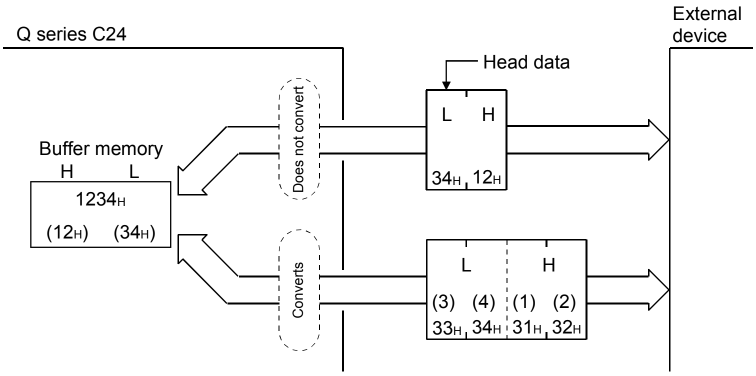
(4) Controlling data communication in accordance with the external device (detailed explanation in Chapter 7)

1) The Q series C24 controls data communication with the external device by turning ON/OFF the DTR/DSR signal and sending/receiving the DC code.
2) DTR/DSR signal control
   Using the DTR (ER) and DSR (DR) signals, the external device is notified of whether or not data communication can be performed.
3) DC code control
   By sending/receiving the DC1 and DC3 code data, the external device is notified of whether or not data can be received. By enclosing the user data with the DC2 and DC4 code data, the external device is notified of the valid transmission data range.



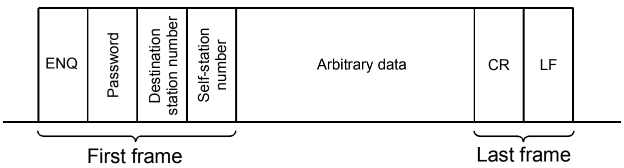
(5) Converting binary code data to ASCII code data to communicate with the external device specification (detailed explanation in Chapter 13)

1) Binary code data that is processed by the PLC CPU can be converted to ASCII code data for communication.
2) ASCII-BIN conversion is performed by the Q series C24 according to user settings.



(6) Sending/receiving data in a message format tailored to the external device (detailed explanation in Chapters 9 to 11)

1) By preregistering the data arrangement (user frames) of the messages to be sent and received by the external device, to the Q series C24, the following data communications can be performed using registered frames.
   • MC protocol: Data transmission from the PLC CPU to the external device using the on-demand function
   • Non procedure protocol: Data communication between the PLC CPU and the external device
2) For example, multiple first frames and last frames (called user frames) with the definition shown in the diagram below can be preregistered in the Q series C24. When sending data to the external device, the data that is arranged as shown in the diagram below can be sent by designating the preregistered user frame numbers and arbitrary data. When receiving data from the external device, by setting the preregistered user frame numbers for reception at the startup of the Q series C24, the arbitrary data section can be read to the PLC CPU when the message with the registered content is received.



∗ Before sending data, the Q series C24 adds the first frame and last frame to arbitrary data. When data is received, the arbitrary data section is stored in the buffer memory as receive data.

3) User frames and various setting values for data communication with the external device can be preregistered to the Q series C24 flash ROM.

The following table shows which special functions are available for the main data communication functions of the Q series C24.

Special functions \ Main data communication functions		MC protocol	Non procedure protocol	Bidirectional protocol	Reference section
Monitoring of the PLC CPU using the PLC CPU monitoring function		○	○	×	Chapter 2
Data communication to a remote location using the modem function		○	○	○	Chapter 3
Reading received data using an interrupt program		×	○	○	Chapter 4
Changing the unit of the data length for communication data		○	○	○	Chapter 5
Changing the monitoring time for data communication		○	○	○	Chapter 6
Transmission control for data communication • DC code control (Including Xon/Xoff control) • DTR/DSR (ER/DR) control		○	○	○	Chapter 7
Data communication using half-duplex communication		○	○	○	Chapter 8
Data communication using user frames	Registration	○	○	×	Chapter 9
	Transmission, reception	○	—	×	Chapter 10
		—	○	×	Chapter 11
Data communication using the transparent code		×	○	○	Chapter 12
Communication using ASCII code data by ASCII-BIN conversion		×	○	○	Chapter 13
Data communication with multiple external devices using a multi-drop connection (m:n connection)		○	×	×	Chapter 14
Changing the interface mode after starting data communication (Changes to communication protocol and transmission specifications)		○	○	○	Chapter 15

○ : Available × : Not available

1.2 Functions Added/Changed by Function Version B

Of the special functions for the Q series C24 described in this manual, functions added/changed in the Q series C24 of the function version B and communication functions that can use those functions are listed below.
See Section 2.7 for the function version, serial NO. and software version of products (CPU module, GX Developer, GX Configurator-SC) related to the Q Series C24 which can use added/changed functions.
See Appendix 1.1 concerning a comparison of functions in the different Q Series 24 function versions.

Function	Description of function	MC	Non procedure	Bidirectional	Explanation chapter
Transmission of PLC CPU monitoring information through combined use of the modem function	In the PLC CPU monitoring function, PLC CPU monitoring information is transmitted to the external device via a modem.	○	○	×	Chapter 2
Remote password check	When accessing the QCPU from a remote location for the following data communication using the Q series C24 modem function, data communication is enabled after the unlock processing to a remote password set in the QCPU is completed normally from the external device. • Communication using MC protocol • Communication using the GX Developer	○	×	×	Chapter 3
Automatic initialization for modem	Initializes the modem automatically when Q Series C24 starts up.	○	○	○	
Callback	After line connection from the GX Developer, access to the QCPU from the GX Developer is made possible through line reconnection from the Q Series C24 (callback). Transmission costs after line connection from the Q Series C24 side are borne by the Q Series C24 side.	×	×	×	
Addition of non reception monitoring time format in non procedure protocol	This function allows messages to be received in the non reception protocol by time-out in non reception monitoring time (timer 0) if the received complete code and received data count have been not determined.	×	○	×	Chapter 6
Transmission control start/end free area designation	This function allows the designation of the available capacity of the OS area that notifies the data reception failure at the time of transmission control (DTR/DSR signal control and DC code control).	○	○	○	Chapter 7
Adding changeable user frame data	The following codes can be registered as changeable data for user frames for data communication: • Horizontal parity code • Sum check code of two's-complement number	○	○	×	Chapter 9
Adding the receive function using user frames	When specifying the first frame and executing data reception, a message comprised of the first frame and arbitrary data can be received. For each combination of receiving user frame that the user has set, any data length can be specified for the arbitrary data. (Setting the data length for the arbitrary data to "0" makes it possible to receive 1 byte only such as ACK/NAK).	×	○	×	Chapter 11
Multiple designations of send transparent codes	When executing data transmission using the following protocol, it is possible to designate a maximum of 10 types of sending transparent codes for each interface. • Non procedure protocol • Bidirectional protocol	×	○	○	Chapter 12
Switching to the GX Developer connection mode by switching the mode	This functions allows the GX Developer connection mode to be switched by an external device or the PLC CPU.	○	○	○	Chapter 15
Communication data monitoring function	This function allows the monitoring of communication data transmitted on the communication network of the Q series C24 and an external device.	○	○	○	Chapter 16

○ : Can be used × : Cannot be used

2 USING THE PLC CPU MONITORING FUNCTION

This chapter explains the PLC CPU monitoring function with which the Q series C24 monitors the PLC CPU based on the monitoring information reregistered by the user.

2.1 Overview

The following explains an overview of the PLC CPU monitoring function:

(1) Transmission without using a sequence program

1) The PLC CPU monitoring function enables the Q series C24 to monitor the local station's PLC CPU at time intervals set by the user by reregistering data to be used for the PLC CPU monitoring function.
Data transmission and notification to the external device is possible by communication using the MC or non procedure protocol without using a sequence program.

2) The following monitoring information selected by the user can be sent or notified to the external device as the PLC CPU monitoring results.

	Monitoring result		Without the modem function	Combined use of the modem function (modem communication)
Data transmission	Local station PLC CPU device (information on the device to be monitored)	Numeric value stored in a word device	○	○
		ON/OFF status for a bit device		
	Status of the local station PLC CPU module			
Notification	Notification message registered in data for connection (character string data)		×	○

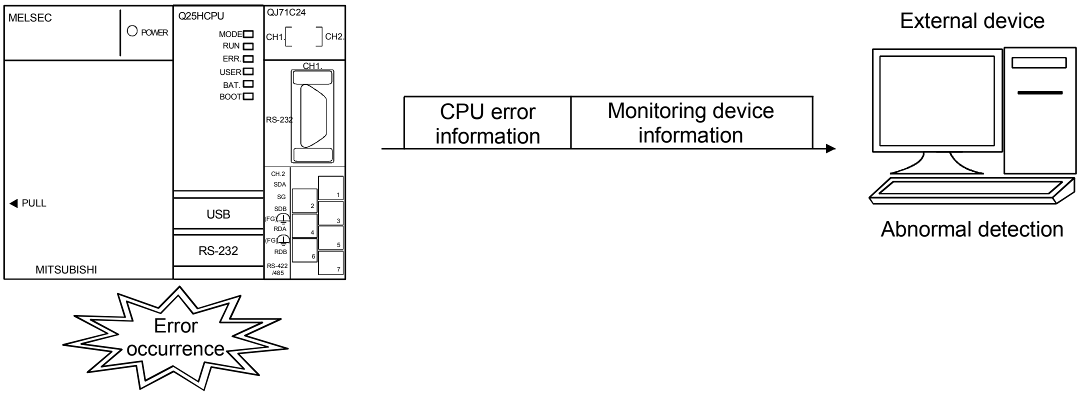
3) Two separate timings--constant-cycle transmission and condition-agreement transmission--are used to transmit and notify the PLC CPU monitoring results to the external device.
   - In the constant cycle transmission, transmission and notification are performed each time the PLC CPU is monitored.
   - In the condition agreement transmission, transmission and notification are performed when the information read from the PLC CPU satisfies the user-defined conditions and an error is detected in the PLC CPU.

(2) Simplifying the device monitoring procedure

When device monitoring is performed by communication using the MC protocol, the external device must repeatedly perform monitor request transmission and monitor data reception processing after it executes monitor registration.
By designating the constant cycle transmission for the PLC CPU monitoring function, the device data can be monitored without performing the monitor request reception processing.

(3) Notification of an error in the PLC CPU

In the condition agreement transmission and notification, error information can be sent to the external device without a sequence program whenever a PLC CPU error occurs.



2.2 About the PLC CPU Monitoring Function

This section explains the PLC CPU monitoring function.

2.2.1 Data registration for using the PLC CPU monitoring function

The following explains the data registration by the user to use the PLC CPU monitoring function.

(1) PLC CPU monitor registration for the Q series C24 that is required to use the PLC CPU monitoring function is described in the following sections. The registration can be performed using one of the following methods:
   1) Registration using the Q series C24 dedicated utility package (GX Configurator-SC)
      (Detailed explanation is found in Chapter 8 of the User's Manual (Basic))
   2) Registration using the PLC CPU monitoring registration command (0630) for communication with the MC protocol
      (Detailed explanation is found in Section 3.17 of the Reference Manual)
   3) Registration using the PLC CPU "CSET" instruction
      (Detailed explanation found in Chapter 17 of the User's Manual (Application))

(2) When this function is used with the modem function and data is transmitted or a notification message is notified as a PLC CPU monitoring result, register the connection data for the modem function on the "PLC CPU monitoring system setting" screen of the GX Configurator-SC.

(3) By registering the data for using the above PLC CPU monitoring function, the Q series C24 begins monitoring the PLC CPU.

2.2.2 PLC CPU monitoring information

This section explains the monitoring target information used to execute the PLC CPU monitoring function.

(1) The following information can be registered as the target of the PLC CPU monitoring function.
   1) Device monitoring for the local station's PLC CPU
      • Monitoring of the numeric values stored in the word device
      • Monitoring of the bit device ON/OFF status
   2) Monitoring of the local station's PLC CPU status

(2) In monitoring word and bit devices, a maximum total device point value of 960 (equivalent to a maximum of 15360 bits for only bit devices), or a total of 10 blocks when any continuous device range comprises one block, can be registered.
Since monitoring of the local station's PLC CPU status will also be registered as a one-block portion, up to 11 blocks can be registered.

11 ≧ (Number of word device blocks registered + number of bit device blocks registered)
+ CPU status monitoring (1 block)

960 points ≧ (Total number of all word device block points + total number of all bit device block points)
(1 point = 1 word) (1 point = 16 bits)

(3) With device monitoring of the blocks for which the word and bit devices are registered, the head device of each block becomes the monitoring target.

(Example1) For a block in which 10 points of word devices from D100 to D109 are registered
Monitoring target: Numeric value stored in D100
Data transmitted: Numeric values stored in D100 to D109

(Example2) For a block in which two points of bit devices from M100 to M131 are registered
Monitoring target: ON/OFF status of M100
Data transmitted: ON/OFF status of M100 to M131

(4) The word and bit devices that can be designated as the monitoring targets and the device codes that are used to register the monitoring devices are shown in the table below.
Register the devices using the existing device ranges.

Classification	Device		Device type		Device code		Device range (Default)
			Bit	Word	ASCII	Binary	
Internal system	Special relay		○		SM	91H	0 to 2047
	Special register			○	SD	A9H	
Internal user	Input		○		X *	9CH	0 to 1FFFH
	Output		○		Y *	9DH	
	Internal relay		○		M *	90H	0 to 8191
	Latch relay		○		L *	92H	
	Annunciator		○		F *	93H	0 to 2047
	Edge relay		○		V *	94H	
	Link relay		○		B *	A0H	0 to 1FFFH
	Data register			○	D *	A8H	0 to 12287
	Link register			○	W *	B4H	0 to 1FFFH
	Timer	Contact	○		TS	C1H	0 to 2047
		Coil	○		TC	C0H	
		Current value		○	TN	C2H	
	Retentive timer	Contact	○		SS	C7H	
		Coil	○		SC	C6H	
		Current value		○	SN	C8H	
	Counter	Contact	○		CS	C4H	0 to 1023
		Coil	○		CC	C3H	
		Current value		○	CN	C5H	
	Link special relay		○		SB	A1H	0 to 7FFH
	Link special register			○	SW	B5H	
	Step relay		○		S *	98H	0 to 8191
	Direct input		○		DX	A2H	0 to 1FFFH
	Direct output		○		DY	A3H	0 to 15
	Index register			○	Z *	CCH	
Register	File register			○	R *	AFH	0 to 32767
				○	ZR	B0H	0 to FE7FFH

POINT

(1) Designating a non-existent device code will result in an error.

(2) When the device range in the parameter setting has been changed, the new device range can be set as the PLC CPU's monitoring target.

2.2.3 Timing for PLC CPU monitoring

The following explains the timing for PLC CPU monitoring when the PLC CPU monitoring function is executed.

(1) PLC CPU monitoring using the Q series C24 is performed continuously at cycle time intervals registered by the user.

(2) Values from 1 to 65535 (unit: 100ms/s/min) can be registered as the cycle time. Use the following expressions as a reference when registering the cycle time.

(a) When sending device data or the PLC CPU status
Cycle time designation > K + sequence scan time + processing time
+ data transmission time

(b) When notifying through combined use of the modem function
(when notifying)
Cycle time designation > K + sequence scan time + processing time
+ data transmission time
+ data transmission delay time of the modem
+ modem connection and disconnection time

(when sending data)
Cycle time designation > K + sequence scan time + processing time
+ data transmission time
+ data transmission delay time of the modem
+ modem connection and disconnection time
+ circuit disconnection wait time

* When modem initialization has not been performed, the modem initialization time will be added. (We recommend that the modem initialization be performed in advance.)

The items that appear in the above expressions are explained below:

- K : 60 ms constant (internal processing time of the Q series C24)
- Processing time: Processing time for the "Multiple block batch read word unit command 0406"
  For 1 point : 11.3 ms
  For 480 points: 23.4 ms
  For 960 points: 36.2 ms
- Data transmission time = 1 / transmission rate × bit count for one byte portion during transmission × byte count for transmission data
- Bit count for one byte portion during transmission =
  1 + data bit count + parity bit + stop bit count
  (parity bit = 1, no parity bit = 0)
- Data transmission delay time by the modem: Depends on the modem specifications, line specifications and line status.
- Modem connection and disconnection time: Depends on the modem specifications, line specifications and line status.
- Modem initialization time: Depends on the modem specifications.

(3) To monitor the PLC CPU, the Q series C24 reads monitoring information (device information, PLC CPU status information) from the PLC CPU at time intervals set by the user.

POINT

(1) Since the Q series C24 reads the monitoring information (device data, PLC CPU status) at the time of the next PLC CPU END process after the cycle time elapses, make the cycle time as long as possible.

(2) The following should be considered if the cycle time is short.
- The scan time of the PLC CPU is longer and the number of scan cycles has increased.
- The increase in the processing time of the Q Series C24 PLC CPU monitoring function has increased causing an increase in the processing time of other data communication functions.
- The load on the external device has increased.

2.2.4 Timings of transmission and notification of monitoring results to the external device

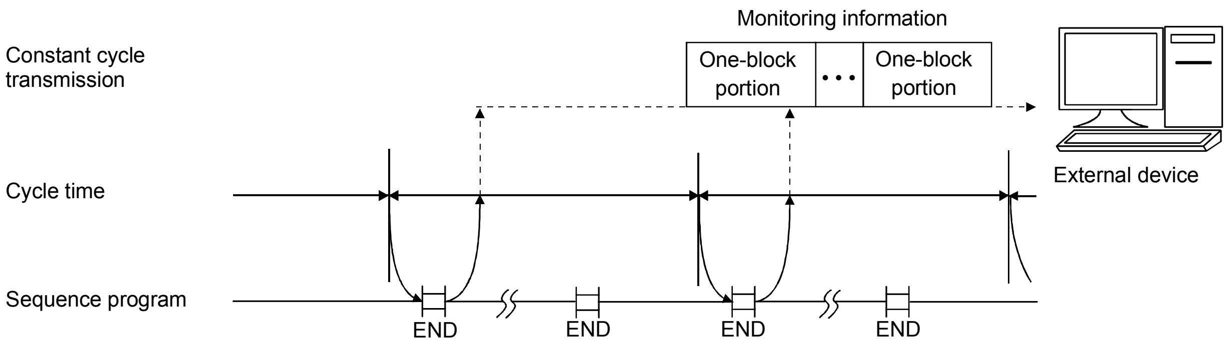
The following explains the timings for the transmission and notification of the PLC CPU monitoring results.

There are two transmission methods for transmitting and notifying the monitoring results of the local station PLC CPU to the external device. These include constant cycle transmission and condition agreement transmission. One of these methods must be selected by the user during PLC CPU monitoring registration.

(1) Constant cycle transmission

The monitoring results are transmitted and notified each time monitoring information is read from the PLC CPU.

(Timing to transmit data)



(2) Condition agreement transmission

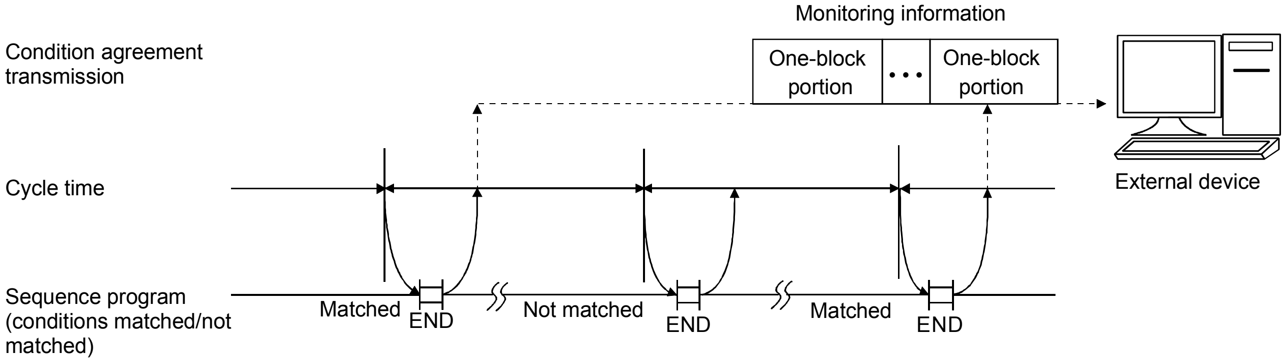
(a) For device monitoring, the monitoring conditions registered by the user (conditions for sending monitoring results), the monitoring condition values and the monitoring information read from the PLC CPU are compared. The monitoring results are sent or notified when there is a block where the monitoring conditions match.
For PLC CPU status monitoring, the monitoring results are sent or notified only once when an error is detected for the first time from the status information read from the PLC CPU. (This corresponds to the edge triggered transmission noted below).

(b) Two transmission methods of the monitoring results are available for the condition agreement transmission for device monitoring. These include edge triggered transmission and level triggered transmission.

1) Edge triggered transmission
The monitoring conditions registered by the user (conditions for sending monitoring results), the monitoring condition values and the monitoring information read from the PLC CPU are compared. The monitoring results are sent or notified only once when an agreement of the monitoring conditions is detected for the first time. After that, when the monitoring information read from the PLC CPU does not match the monitoring conditions and then it matches the monitoring conditions once again, the monitoring results are sent or notified.

2) Level triggered transmission
The monitoring conditions registered by the user (conditions for sending monitoring results), the monitoring condition values and the monitoring information read from the PLC CPU are compared. While the monitoring conditions agree, the monitoring results are sent or notified at each cycle time.

(Timing to transmit data)



(c) In the condition agreement transmission for device monitoring, the head device for each block is the monitoring target for condition monitoring of each block device.
For the condition agreement transmission, the monitoring conditions that can be designated for the device to be registered by the user and the registration values when designating the monitoring condition are shown in the table below.
Register the monitoring conditions for the head device of each block using the following table.

Monitoring condition (item to be judged)		Registration value		Valid designated device	
		For edge triggered transmissions	For level triggered transmissions	Bit	Word
Device value or status = device monitoring condition value or status		0001_H	0101_H	○	○
Device value or status ≠ device monitoring condition value or status		0002_H	0102_H		
Unsigned	Monitoring device ≤ monitoring condition value	0003_H	0103_H	×	
	Monitoring device < monitoring condition value	0004_H	0104_H		
	Monitoring device ≥ monitoring condition value	0005_H	0105_H		
	Monitoring device > monitoring condition value	0006_H	0106_H		
Signed	Monitoring device ≤ monitoring condition value	0007_H	0107_H		
	Monitoring device < monitoring condition value	0008_H	0108_H		
	Monitoring device ≥ monitoring condition value	0009_H	0109_H		
	Monitoring device > monitoring condition value	$000A_H$	$010A_H$		

(d) In device monitoring, register the monitoring condition value or status when the Q series C24 judges that the numeric value/status of the monitoring device for condition agreement transmission (head device of each block) agrees with the condition using the registration values shown below.

Type of monitoring device	Monitoring condition value or status	Registration value
Bit device	OFF	0000_H
	ON	0001_H
Word device	Numerical value	0000_H to $FFFF_H$

(Example 1) When M0 = ON is the condition agreement
Monitoring condition registration value : 0001_H
Registration value for the monitoring condition value or status: 0001_H
(Example 2) When D0 > 100 (signed) is the condition agreement
Monitoring condition registration value : $000A_H$
Registration value for the monitoring condition value or status: 100(64_H)

REMARK

In status monitoring for the PLC CPU, the monitoring conditions and condition values for condition agreement transmission are not registered. Instead, it is registered as whether or not PLC CPU status monitoring will be performed.
Monitoring results in condition agreement transmission are sent or notified only once when an error is detected by the status information read from the PLC CPU for the first time.

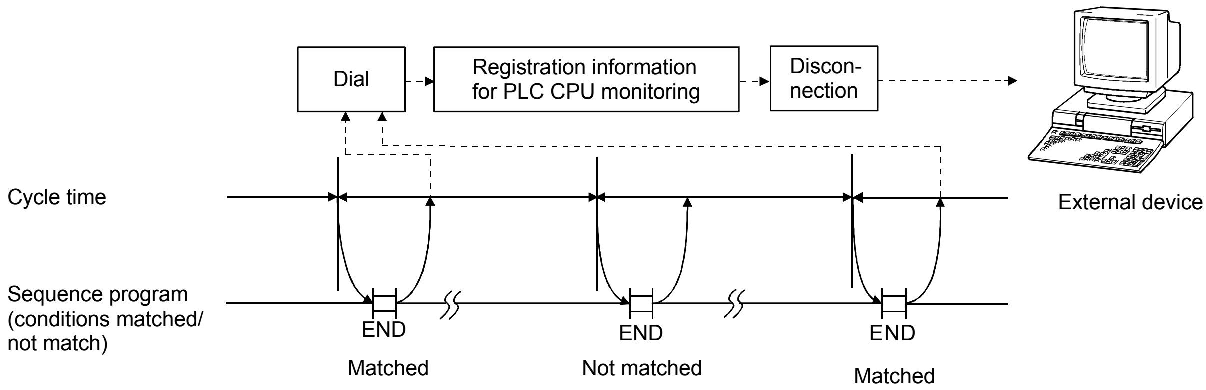
2.2.5 Transmission methods of monitoring results and transmission data to the external device

The following explain the method of transmitting the PLC CPU monitoring results and data to the external device.

(1) Data transmission to the external device while performing communication using the MC protocol

(a) The same format as for the messages sent with the on-demand function is used to transmit data, except that the on-demand data section is replaced with the device information and PLC CPU status information. The data is sent as explained in (c) and (d) below.
(Detailed explanation is found in Section 3.17 of the Reference Manual)
When the interface that is to use the modem function is set in the MC protocol, connection processing and disconnection processing to the modem are performed when the PLC CPU monitoring results are transmitted.

(Example) Data transmission by MC protocol with modem function (condition agreement transmission)



(b) When the transmission of on-demand data using user frames is designated, the same format as for sending on-demand data using user frames is used to transmit data, except that the on-demand data section is replaced with the device information and PLC CPU status information. The data is sent as explained in (c) and (d) below.
＊ See the following explanatory items for data reception by the external device side.
- Device information, PLC CPU status information arrangement: Section 3.17 of the Reference Manual
- Arrangement of data in the user frame section to be sent: Chapter 10

(c) When sending the monitoring results as data during constant cycle transmission, the entire block portion of the monitoring target device information and PLC CPU status information is transmitted in batch mode.

(d) When sending the monitoring results as data during condition agreement transmission, head data (header) and end data (footer) for the on-demand function are added to the device information for a block with matched monitoring conditions and the PLC CPU status information upon the occurrence of an error. The header and footer are added to each clock, and then the monitoring result data is transmitted.

∗ Transmission is performed in the following order: the PLC CPU status information, then the device information registered in the word block, and then the device information registered in the bit block.

POINT
When there is communication using the MC protocol form 1) to 4), all of the device monitoring head device number will be converted to hexadecimal ASCII data and sent. (The same conversion is performed during either constant cycle transmission or condition agreement transmission.)

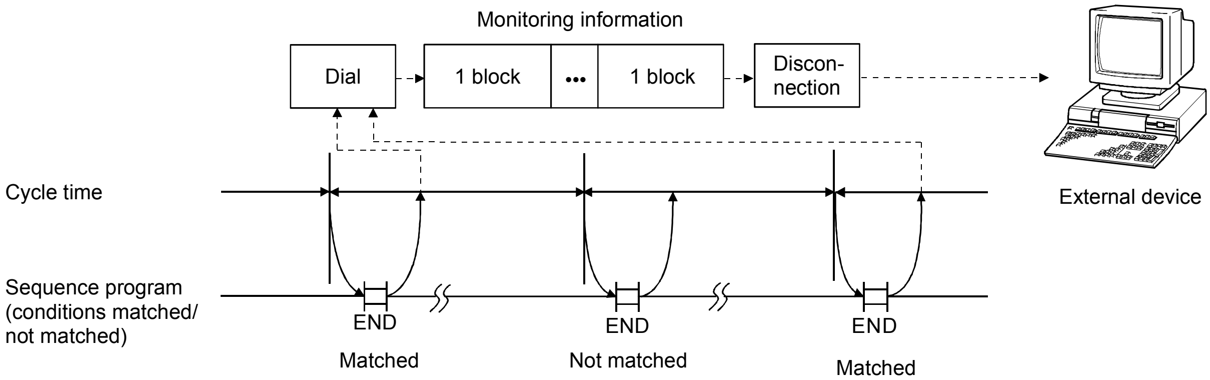
(2) Data transmission to the external device while performing communication using the non procedure protocol

(a) The device information and CPU information are sent by the word/byte unit designations.
When the communication data ASCII-BIN conversion is designated, it is converted to ASCII code data and sent. (Examples are shown in (f)).

1) When the word/byte unit designation is word unit, the device information a and CPU information are each sent in one-word segments in a (H) (L) sequence.

2) When the word/byte unit designation is byte, the device information and CPU information are each sent in one-word segments in a (L) (H) sequence.
When the interface that is to use the modem function is set in the non procedure protocol, connection processing and disconnection processing to the modem are performed when the PLC CPU monitoring results are transmitted.

(Example) Data transmission by non procedure protocol with modem function (condition agreement transmission)



(b) When sending monitoring results as data during constant cycle transmission, the device information of two or more user frame No. and PLC CPU status information that have been currently designated for the constant cycle transmission by the Q series C24.

(c) When sending the monitoring results as data during condition agreement transmission, the device information of two or more user frame No. and PLC CPU status information that have been currently designated by the Q series C24 for the condition agreement transmission of the block where the monitoring conditions match are transmitted in batch mode.
When the monitoring conditions of two or more block match, the device information and PLC CPU status information are transmitted for each block.

POINT

When there is an ASCII-BIN conversion of communication data using non procedure protocol, all of the device monitoring head device number will be converted to hexadecimal ASCII data and sent. (The same conversion is performed during either constant cycle transmission or condition agreement transmission.)

(d) The user frame numbers that can be designated for data transmission of PLC CPU monitoring results are listed below.
- 1H to 3E7H (Default registration frame numbers)
- 3E8H to 4AFH (Frame numbers registered by the user in the flash ROM)
- 8001H to 801FH (Frame numbers registered by the user in the buffer memory)
- B001H to B01FH (Dedicated frame numbers for this function listed in (e) below)

For details on how to designate user frame numbers, see Transmission using user frames in Chapter 11.

(e) For instructing to transmit the device information and PLC CPU status information when sending monitoring results as data, use the following dedicated user frame numbers.

Frame number	Information to be transmitted		Valid function	
			Constant cycle transmission	Condition agreement transmission
B001H	Device information for the block registered in number n	Number 1	○	○
B002H		Number 2		
B003H		Number 3		
B004H		Number 4		
B005H		Number 5		
B006H		Number 6		
B007H		Number 7		
B008H		Number 8		
B009H		Number 9		
B00AH		Number 10		
B061H	PLC CPU status information (CPU abnormal monitoring data)		○	○
B080H	Number of blocks sent		○	○
B081H	Monitoring result information for all blocks			
B082H	Monitoring result information for blocks satisfying the conditions		×	○

(f) Device information and PLC CPU status information are sent using the data arrangement shown below.

∗ The ASCII-BIN conversion designation is designated in buffer memory address 121H/1C1H. Note that when the user frame has been designated by setting to on the value for bit 14, which indicates the user frame No., there will be ASCII-BIN conversion of corresponding send data. It will be sent as binary data. (See Section 13.3 ∗)

1) When user frame numbers B001H to B00AH are designated (example of a one-block portion)

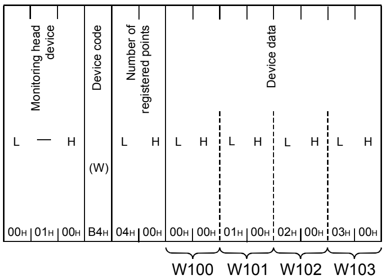
- When word device data (W100 to W103, (4 points)) is sent

  ∗ When the word/byte unit designation is word unit, the device data will be sent in a (H) → (L) sequence.
  The number of registered points is the number of points in word units.

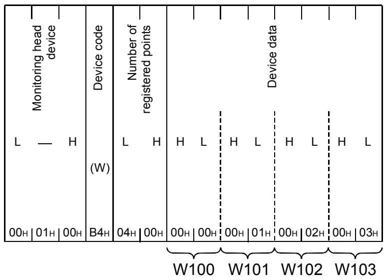
  (When ASCII-BIN conversion is not performed)

  ∗ The total number of bytes for the device data section is the number of device points × 2.

When the word/byte unit designation is byte



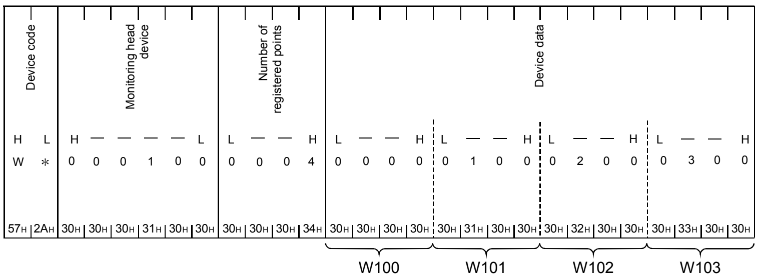
When the word/byte unit designation is word



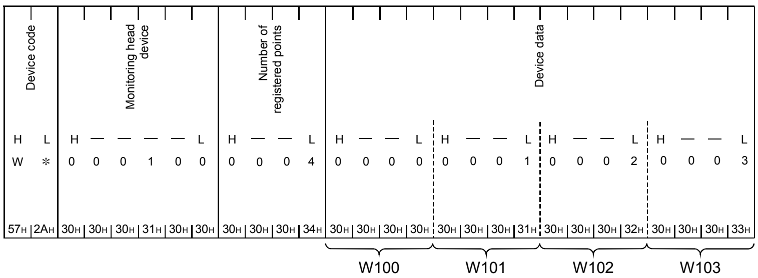
(When ASCII-BIN conversion is performed)

∗ The total number of bytes for the device data section is the number of device points × 4.

When the word/byte unit designation is byte



When the word/byte unit designations word



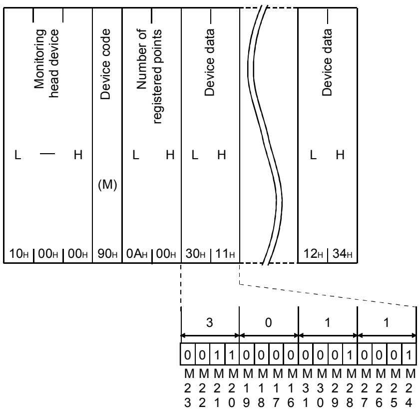
- When data for bit device (M16 to M175, (10 point)) is sent

* When the word/device unit designation is word unit, the device data will be sent in a (H) → (L) sequence.
The number of registered points is the number of points in word units.

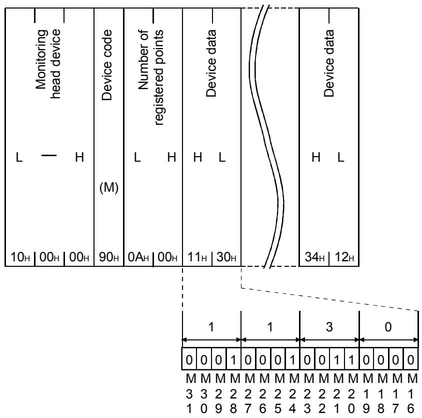
(When ASCII-BIN conversion is not performed)

* The total number of bytes for the device data section is the number of device points × 2.

When the word/byte unit designation is byte



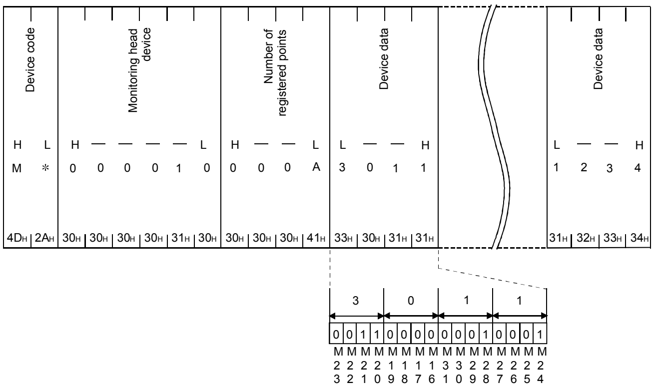
When the word/byte unit designation is word



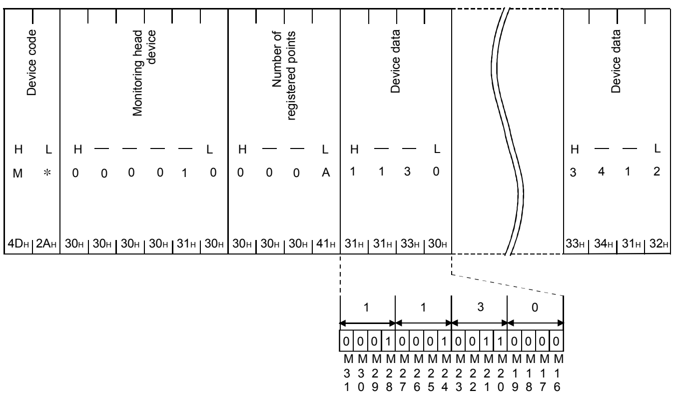
(When ASCII-BIN conversion is performed)

* The total number of bytes for the device data section is the number of device points × 4.

When the word/byte unit designation is byte



When the word/byte unit designation is word

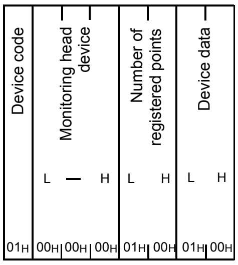


2) When user frame No. B061H is designated
PLC CPU status information (for one block) is sent as the following data:

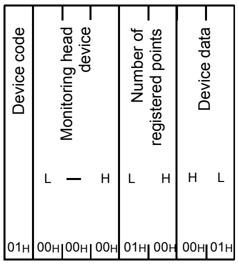
		when communicating with ASCII code	when communicating with binary code	Remark
Device code		"01"	01H	All fixed value
Number of registered points		"0001"	0001H	
Monitoring head device		"000000"	000000H	
Device data	During normal operation	"0000"	0000H	
	Module warning occurring	"0001"	0001H	
	Module error/module system error occurring	"0002"	0002H	

(When ASCII-BIN conversion is not performed)
* The total number of bytes for the device data section is the number of device points × 2.

When the word/byte unit designation is byte

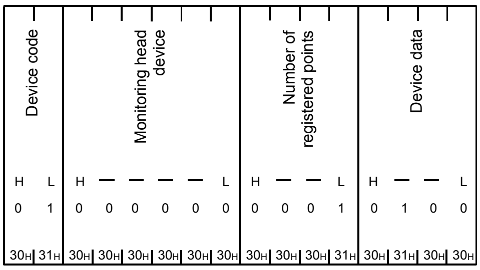


When the word/byte unit designation is word

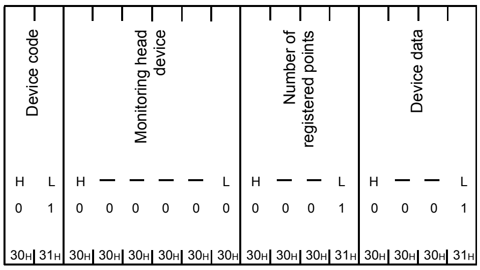


(When ASCII-BIN conversion is performed)
* The total number of bytes for the device data section is the number of device points × 4.

When the word/byte unit designation is byte

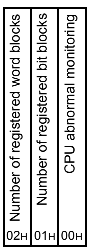


When the word/byte unit designation is word

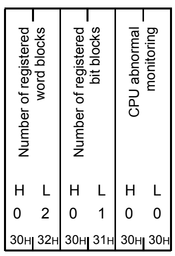


3) When user frame No. B080H is designated
The transmission block count will be sent as follows:
(Example)
Number of registered word blocks: 2 (D0 to D3 (4 points), W100 to W107 (8 points))
Number of registered bit blocks : 1 (M0 to M31 (2 points))

(When ASCII-BIN conversion is not performed)



(When ASCII-BIN conversion is performed)



4) When user frame No. B081H is designated

Information on monitoring results for all blocks are sent as follows:

* Results are sent in the following order: the device information registered in the word block, the device information registered in the bit block and then PLC CPU status information.

(Example)

Number of registered word blocks: 1 (W100 to W103 (4 points))

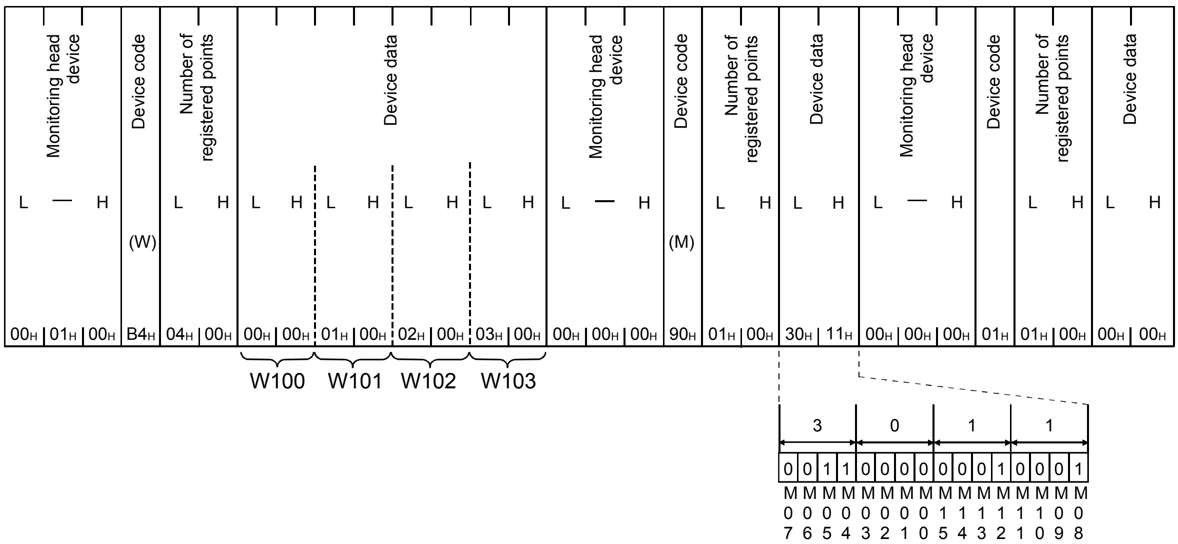
Number of registered bit blocks : 1 (M0 to M15 (1 point))

Perform CPU status monitoring : 1 (1 point)

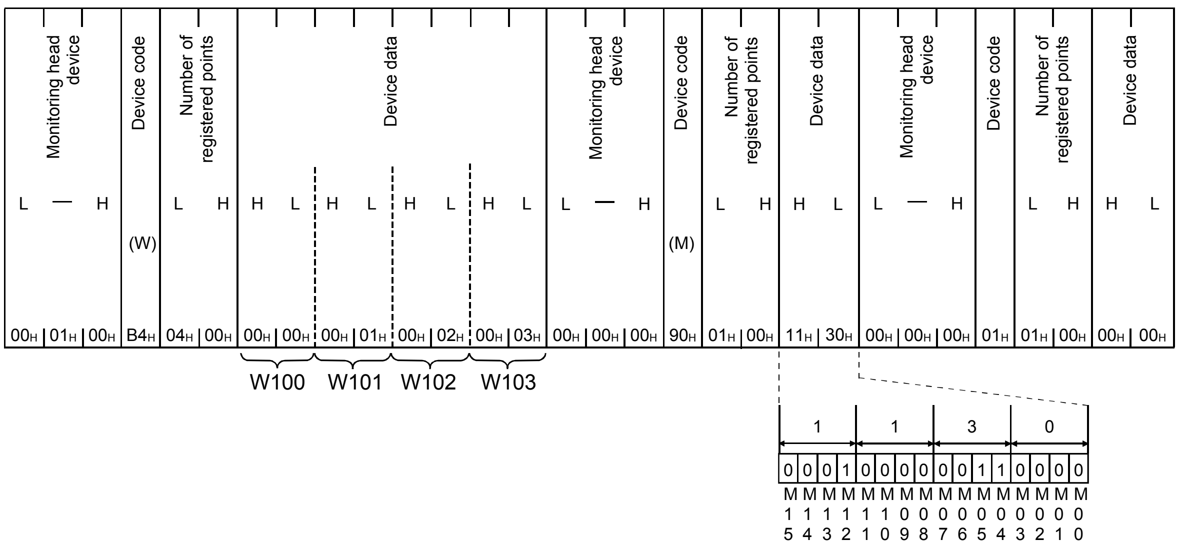
(When ASCII-BIN conversion is not performed)

* The total number of bytes for the device data section is the number of device points × 2.

When the word/byte unit designation is byte



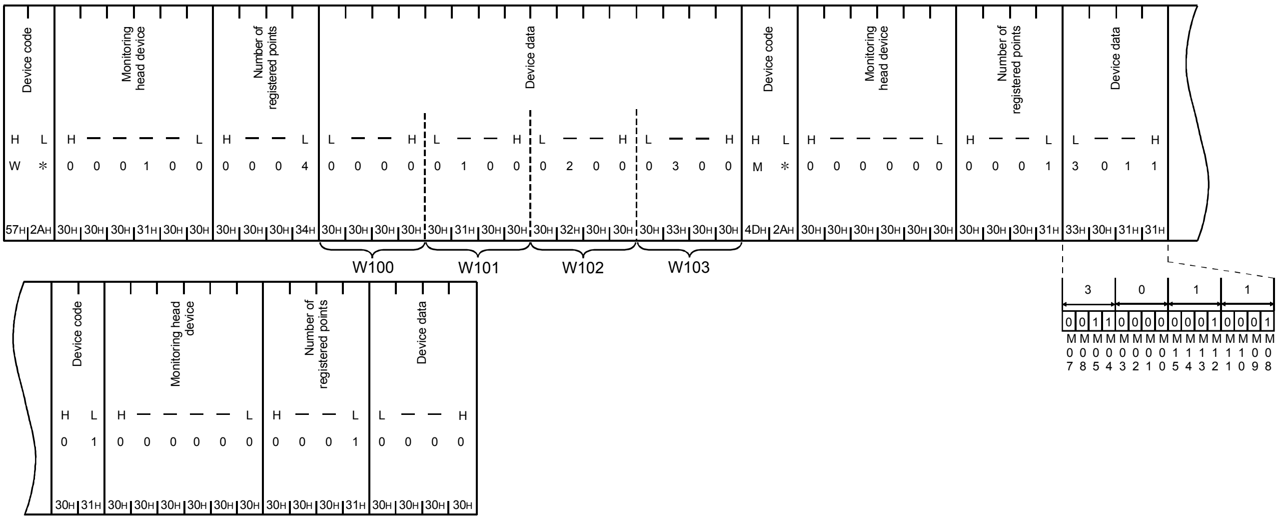
When the word/byte unit designation is word



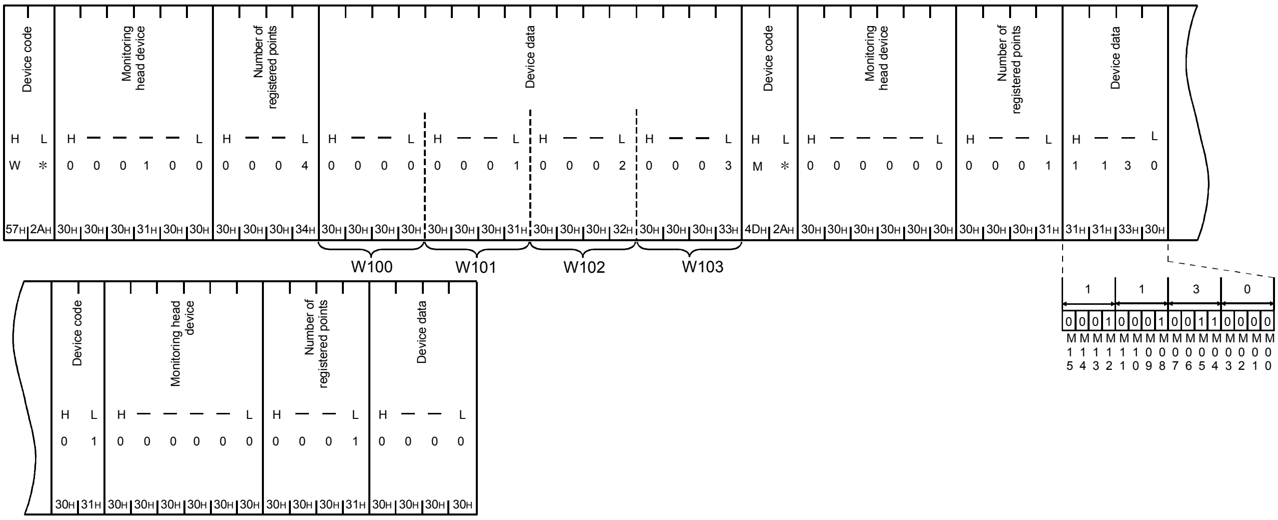
(When ASCII-BIN conversion is performed)

∗ The total number of bytes for the device data section is the number of device points × 4.

When the word/byte unit designation is byte



When the word/byte unit designation is word

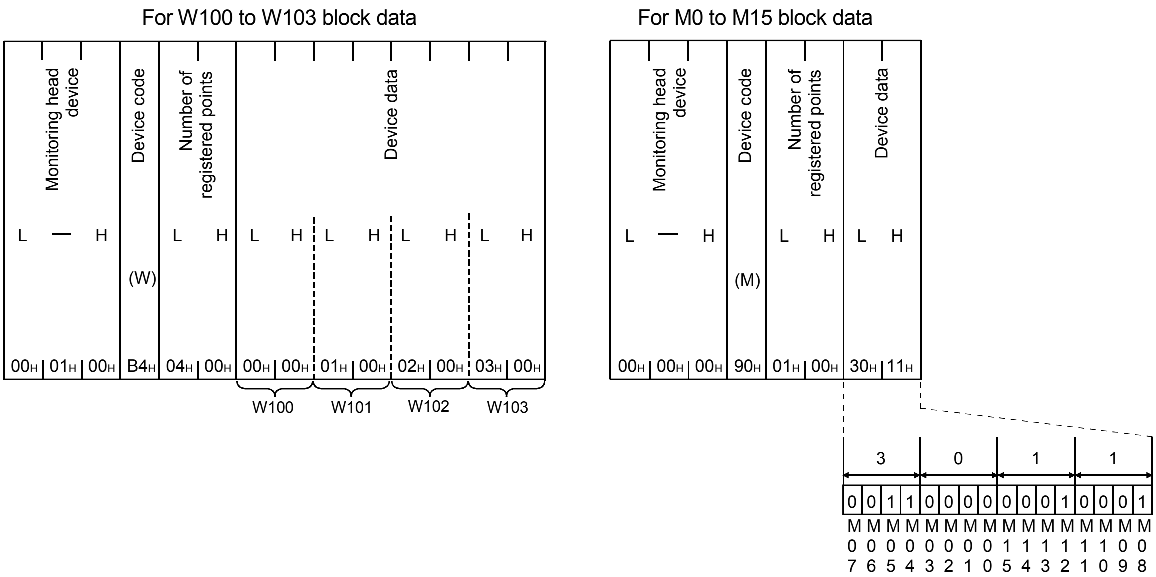


5) When user frame No. B082H is designated
Information on the monitoring results for the condition agreement blocks are sent for each block.
＊ Results are sent in the following order: The PLC CPU status information, the device information registered in the word block and then the device information registered in the bit block.

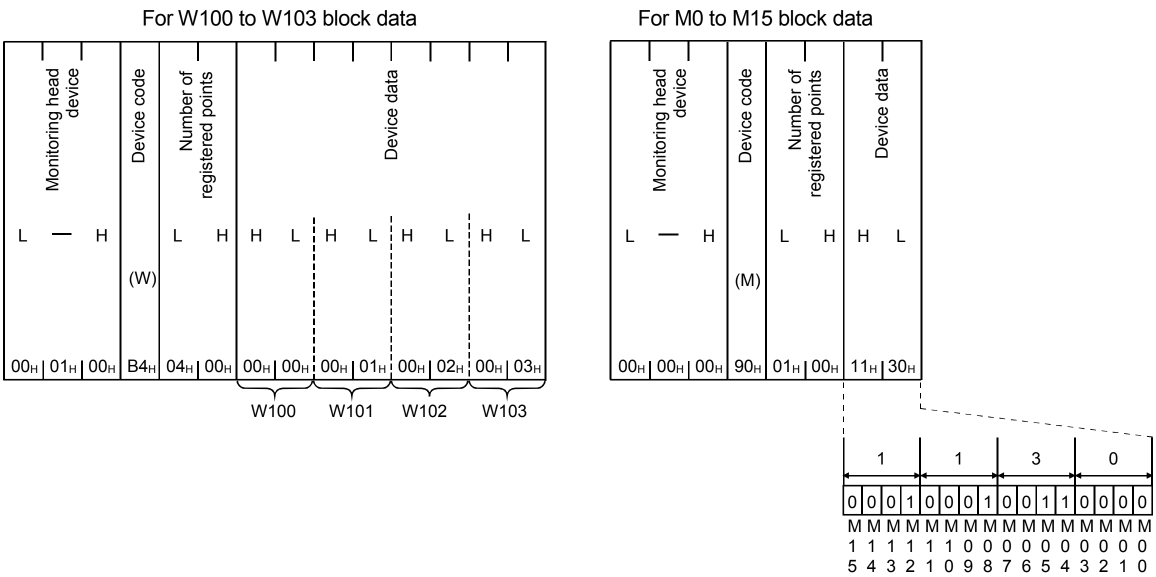
(Example)
Number of registered word blocks: 2 (D0 to D3 (4 points), W100 to W103 (4 points))
Number of registered bit blocks : 1 (M0 to M15 (1 point))
When the condition satisfied monitoring device is W100 = 0 and M0 ≠ ON

(When ASCII-BIN conversion is not performed)
∗ The total number of bytes the device data section is the number of device points × 2.

When the word/byte unit designation is byte



When the word/byte unit designation is word

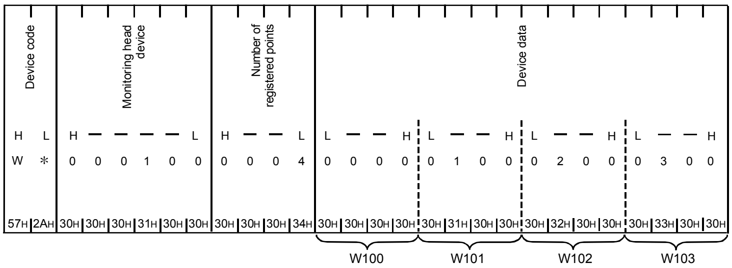


(When ASCII-BIN conversion is performed)

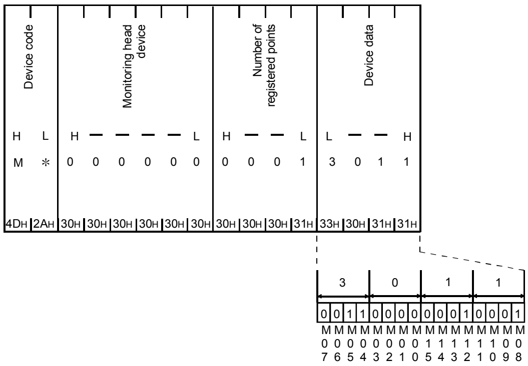
∗ The total number of bytes for the device data section is the number of device points × 4.

When the word/byte unit designation is byte

For W100 to W103 block data

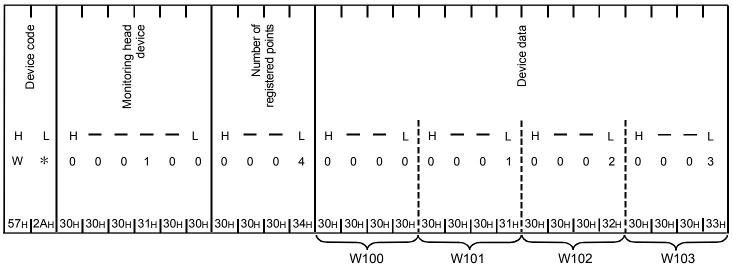


For M0 to M15 block data

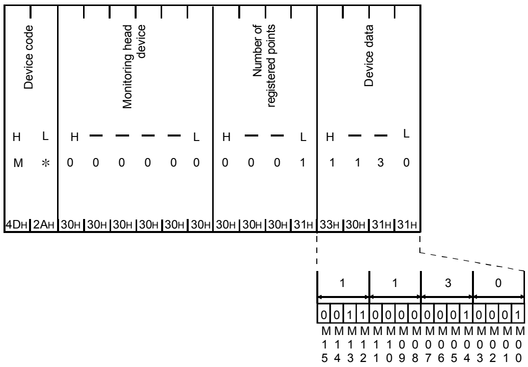


When the word/byte unit designation is word

For W100 to W103 block data



For M0 to M15 block data



(3) Notification to the interface side using the modem function

(a) The notification message (text string data) contained in the user registered data for connecting the modem function is conveyed using the modem function.

＊ The device information and the CPU status information read from the PLC CPU are not sent to the external device in the notification message. Include the device information and the CPU status information by which the PLC CPU status can be checked in the preregistered notification message.

(b) The method for message notification is functionally the same as the notification using the modem function described in Chapter 3.
The difference is that notification is performed with Y14 OFF when using the modem, whereas for notification using PLC CPU monitoring, notification is performed for whenever the PLC CPU error is detected or the designated device status is matched with the monitoring conditions (see Section 2.2.4).

(c) During constant-cycle transmission, a notification message for one connection data registered for notifying constant-cycle transmission is sent.

(d) During condition agreement transmission, a notification message for connection data registered in the block where the monitoring conditions match is sent in block units.
When there are multiple blocks where the monitoring conditions match, notification is performed at the "Wait time of notification" interval (notification interval) set by the user for use with the modem function. The PLC CPU monitoring stops until notification has been performed to all blocks where the monitoring conditions match.

POINT

(1) When performing message notification using the PLC CPU monitoring function, set the corresponding interface side as the target of the modem function.

(2) When setting data for the PLC CPU monitoring function with GX Configurator-SC, PLC CPU monitoring begins immediately when the Q series C24 starts up.

2.2.6 Execution sequence for using the PLC CPU monitoring function

The following explains the execution sequence for using the PLC CPU monitoring function.

(1) When transmitting the monitoring results through data transmission/notification messages using the modem function, perform the following settings in order to use the modem function.

Setting item	Explanation section
Initial setting using the GX Configurator-SC	Section 3.4.2
Registration of data No. for initialization and data No. for connection	Sections 3.4.3 and 3.4.4
Initialization of the Q series C 24 modem/TA	Section 3.4.5

(2) Register PLC CPU monitoring for the Q series C24 using one of the methods described in Section 2.2.1.

(3) By registering PLC CPU monitoring, the Q series C24 monitors the local station's PLC CPU regardless of the RUN/STOP status and sends the monitoring information to the external device.

(4) When reregistering PLC CPU monitoring in order to change the registration data for the PLC CPU monitoring, reregister after canceling the PLC CPU monitoring.

1) When registering with communication using the MC protocol (detailed explanation found in Section 3.17 of Reference Manual)

2) When registering with the PLC CPU's "CSET" instruction (detailed explanation found in Chapter 17 of User's Manual (Application))

* To cancel when using GX Configurator-SC, change the PLC CPU to the STOP status, redo the settings, and then restart the QCPU.

2.3 Settings for Using the PLC CPU Monitoring Function

This section describes system settings required for constant cycle transmission and condition agreement transmission.

2.3.1 System setting items for the PLC CPU monitoring function

The following explains system setting items for the PLC CPU monitoring function.

POINT

The PLC CPU monitoring function setting screens from the GX Configurator-SC are shown.

(1) For the PLC CPU monitoring system settings, perform the settings on the screens shown in Section 8.4.9 of the User's Manual (Basic).

(2) Register transmission user frames on the screens shown in Section 8.4.10 of the User's Manual (Basic) after checking the specifications and setting methods explained in Chapters 9 to 11 of this manual.

(3) Register the data for connecting the modem function on the screens shown in Section 8.4.3 of the User's Manual (Basic) after checking the specifications described in Section 3.4.4 of this manual.

(1) Setting items and requirement when performing communication using the MC protocol

<table>
<tr><th rowspan="2">Setting item</th><th colspan="2">Constant cycle transmission</th><th colspan="2">Condition agreement transmission</th><th rowspan="2">Reference section</th></tr>
<tr><th>Data transmission</th><th>Notification</th><th>Data transmission</th><th>Notification</th></tr>
<tr><td>Cycle time units</td><td colspan="2">○</td><td colspan="2">○</td><td>(3) (a) of this section</td></tr>
<tr><td>Cycle time</td><td colspan="2">○</td><td colspan="2">○</td><td>(3) (b) of this section</td></tr>
<tr><td>PLC CPU monitoring function</td><td colspan="2">○(1H: Constant cycle)</td><td colspan="2">○(2H: Condition agreement)</td><td>(3) (c) of this section</td></tr>
<tr><td>PLC CPU monitoring transmission measure</td><td>○(Data)</td><td>○(Notification)</td><td>○(Data)</td><td>○(Notification)</td><td>(3) (d) of this section</td></tr>
<tr><td>Constant cycle transmission Transmission pointer</td><td rowspan="2">×</td><td rowspan="2">×</td><td rowspan="3">×</td><td rowspan="3">×</td><td rowspan="2">(4) of this section
Section 11.4.2 (2)</td></tr>
<tr><td>Output count</td></tr>
<tr><td>Data No. for connection</td><td>○</td><td>○</td><td>Section 2.2.5 (3)
Section 3.4.4</td></tr>
<tr><td>Number of registered word blocks</td><td rowspan="6">○</td><td rowspan="14">×</td><td rowspan="8">○</td><td rowspan="8">○</td><td rowspan="2">(3) (e) of this section</td></tr>
<tr><td>Number of registered bit blocks</td></tr>
<tr><td>PLC CPU abnormal monitoring</td><td>(3) (f) of this section</td></tr>
<tr><td>No. n block monitoring device Monitoring device</td><td rowspan="3">(3) (g) of this section</td></tr>
<tr><td>Head device No.</td></tr>
<tr><td>Read point</td></tr>
<tr><td>Condition agreement transmission Monitoring condition</td><td rowspan="8">×</td><td>(3) (h) of this section</td></tr>
<tr><td>Monitoring condition value</td><td>(3) (i) of this section</td></tr>
<tr><td>Transmission pointer</td><td rowspan="2">×</td><td rowspan="2">×</td><td rowspan="2">(4) of this section
Section 11.4.2 (2)</td></tr>
<tr><td>Output count</td></tr>
<tr><td>Data No. for connection</td><td>○</td><td>○</td><td>Section 2.2.5 (3)
Section 3.4.4</td></tr>
<tr><td>PLC CPU abnormal monitoring designation
Condition agreement transmission Transmission pointer</td><td rowspan="2">×</td><td rowspan="2">×</td><td rowspan="2">(4) of this section
Section 11.4.2 (2)</td></tr>
<tr><td>Output count</td></tr>
<tr><td>Data No. for connection</td><td>○</td><td>○</td><td>Section 2.2.5 (3)
Section 3.4.4</td></tr>
</table>

○ : Setting required × : Setting not required

POINT

While using the notification function, the device information and the CPU status information cannot be transmitted.

(2) Setting items and requirement when performing communication using the non procedure protocol

<table>
<tr><th rowspan="2">Setting item</th><th colspan="2">Constant cycle transmission</th><th colspan="2">Condition agreement transmission</th><th rowspan="2">Reference section</th></tr>
<tr><th>Data transmission</th><th>Notification</th><th>Data transmission</th><th>Notification</th></tr>
<tr><td>Cycle time units</td><td colspan="2">○</td><td colspan="2">○</td><td>(3) (a) of this section</td></tr>
<tr><td>Cycle time</td><td colspan="2">○</td><td colspan="2">○</td><td>(3) (b) of this section</td></tr>
<tr><td>PLC CPU monitoring function</td><td colspan="2">○(1H: Constant cycle)</td><td colspan="2">○(2H: Condition agreement)</td><td>(3) (c) of this section</td></tr>
<tr><td>PLC CPU monitoring transmission measure</td><td>○(Data)</td><td>○ (Notification)</td><td>○(Data)</td><td>○(Notification)</td><td>(3) (d) of this section</td></tr>
<tr><td>Constant cycle transmission Transmission pointer</td><td rowspan="2">○</td><td rowspan="2">×</td><td rowspan="3">×</td><td rowspan="3">×</td><td rowspan="2">(4) of this section
Section 11.4.2 (2)</td></tr>
<tr><td>Output count</td></tr>
<tr><td>Data No. for connection</td><td>○</td><td>○</td><td>Section 2.2.5 (3)
Section 3.4.4</td></tr>
<tr><td>Number of registered word blocks</td><td rowspan="6">○</td><td rowspan="14">×</td><td rowspan="8">○</td><td rowspan="8">○</td><td rowspan="2">(3) (e) of this section</td></tr>
<tr><td>Number of registered bit blocks</td></tr>
<tr><td>PLC CPU abnormal monitoring</td><td>(3) (f) of this section</td></tr>
<tr><td>No. n block monitoring device Monitoring device</td><td rowspan="3">(3) (g) of this section</td></tr>
<tr><td>Head device No.</td></tr>
<tr><td>Read point</td></tr>
<tr><td>Condition agreement transmission
Monitoring condition</td><td rowspan="8">×</td><td>(3) (h) of this section</td></tr>
<tr><td>Monitoring condition value</td><td>(3) (i) of this section</td></tr>
<tr><td>Transmission pointer</td><td rowspan="2">○</td><td rowspan="2">×</td><td rowspan="2">(4) of this section
Section 11.4.2 (2)</td></tr>
<tr><td>Output count</td></tr>
<tr><td>Data No. for connection</td><td>○</td><td>○</td><td>Section 2.2.5 (3)
Section 3.4.4</td></tr>
<tr><td>PLC CPU abnormal monitoring designation
Condition agreement transmission Transmission pointer</td><td rowspan="2">○</td><td rowspan="2">×</td><td rowspan="2">(4) of this section
Section 11.4.2 (2)</td></tr>
<tr><td>Output count</td></tr>
<tr><td>Data No. for connection</td><td>○</td><td>○</td><td>Section 2.2.5 (3)
Section 3.4.4</td></tr>
</table>

○ : Setting required × : Setting not required

POINT

While using the notification function, the device information and the CPU status information cannot be transmitted.

(3) Contents of setting items

The data items to be set by the GX Configurator-SC in order to use the PLC CPU monitoring function and the setting contents are explained below.

(a) Cycle time units

- Designates the unit for "(b) cycle time" below for reading information from the PLC CPU using the PLC CPU monitoring function.
- The cycle time units and the cycle time designated using this unit can also be used as the transmission time interval for constant cycle communication.

(b) Cycle time

Designates the time for one cycle when reading information from the PLC CPU in order to perform PLC CPU monitoring.

(c) PLC CPU monitoring function

Designates the timing (constant cycle transmission or condition agreement transmission) when sending/notifying information on the PLC CPU monitoring results (device information/CPU status information) to the external device.

- The time interval designated in data items (a) and (b) above for reading information from the PLC CPU can also be used as the transmission time interval for constant cycle communication.
- The conditions for condition agreement transmission are designated using data items (h) and (i) below.

(d) PLC CPU monitoring transmission measure

Designates the means by which the PLC CPU monitoring results are conveyed to the external device.

- Data transmission
  The device information and the PLC CPU status information are sent as the monitoring results.
- Notification
  Notification message is sent as the monitoring results.

(e) Number of registered word blocks, number of registered bit blocks

Designates the number of word device blocks (number of registered word blocks) and the number of bit device blocks (number of registered bit blocks) registered in the Q series C24 as the target when performing device data monitoring or transmission.

(f) CPU abnormal monitoring

Designates whether or not the Q series C24 monitors abnormality of the local station PLC CPU (status monitoring) in the PLC CPU monitoring.

(g) Monitoring device, head device No., read point (Number of registered points)
When performing device data monitoring or transmission, designate the device range for each block for the number of blocks designated by setting item (e), number of registered word blocks and number of registered bit blocks.
* The target of device data monitoring for condition agreement transmission is the head device for each block.
Word device designated block: Head word device (for one word)
Bit device designated block : Head bit device (for one bit)

1) The monitored device is the item that indicates the target device of the corresponding block and designated with the codes listed in Section 2.2.2 (4).
2) The head device is the data that designates the head of the target device range for the corresponding block.
3) The read point is the item that indicates the target device range for the corresponding block which designate points from the head device No.. The bit device designates points in word units (1 point = 16 bits)
4) The methods for designating these data are the same as the designation methods when reading from or writing to the device memory described in Section 3.3 of the Reference Manual. Designate according to the explanations of items 2) through 4) in Section 3.3.1 (2) (c) of the Reference Manual.

REMARK

When the user performs the PLC CPU monitoring registration, the device will designate either a decimal or hexadecimal device No.. The read points (registration points) are designated as hexadecimal. However, if this is done by either MC protocol communication (form 1) to 4)) or non procedure protocol communication, when ASCII-BIN conversion of the communication data has been designated, the head device No. for all devices to be sent to external devices as the monitoring results will be converted to hexadecimal ASCII data and sent.

(h) Monitoring condition
When condition agreement transmission is designated with the PLC CPU monitoring function (c), designate the conditions for transmitting information for the monitoring condition value (i).

(i) Monitoring condition value
When condition agreement transmission is designated with the PLC CPU monitoring function (c), this item designates the status/numeric value of the monitoring condition (h).
- When the monitoring device is a word device: Designate the monitoring condition value with a numeric value
- When the monitoring device is a bit device : Designate the monitoring condition with a numeric value (1/0) corresponding to ON/OFF.

(4) The following is an example of setting items and data transmission when sending the monitoring results of the PLC CPU monitoring function execution to the external device using the non procedure protocol.

(Example)

This example shows a case in which the D0 to D3 device information and user frame data are sent by the edge trigger method using a condition of D0 = 0.

* Perform the settings on the "PLC CPU monitoring system setting" screen and the "Transmission user frame No. designation monitor" screen described in Sections 8.4.9 and 8.4.10 of the User's Manual (Basic).

1) PLC CPU monitoring system setting

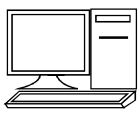
Setting item	Set data	Remarks
Cycle time units	min	Settings other than those listed at left are not required
Cycle time	3	
PLC CPU monitoring function	Condition agreement	
PLC CPU monitoring transmission measure	Data transmission	
Number of registered word blocks	1	
Number of registered bit blocks	0	
PLC CPU abnormal monitoring	0	
No. 1 block monitoring device Monitoring device	D	
Head device No.	0	
Read point	4	
Condition agreement transmission Monitoring condition	Edge =	
Monitoring condition value	0	
Transmission pointer	49	
Output count	3	

2) Setting the transmission user frames

Output frame No. designation 46th	User frame number	
Output frame No. designation 47th	User frame number	
Output frame No. designation 48th	User frame number	
Output frame No. designation 49th	User frame number (02_H)	← Set the user frame data (STX)
Output frame No. designation 50th	User frame number ($B001_H$)	← Set the first block (from D0 to D3)
Output frame No. designation 51st	User frame number (03_H)	← Set the user frame data (ETX)
Output frame No. designation 52nd	User frame number	
Output frame No. designation 53rd	User frame number	
Output frame No. designation 54th	User frame number	
Output frame No. designation 55th	User frame number	
Output frame No. designation 56th	User frame number	
Output frame No. designation 57th	User frame number	

Data sent when the condition D = 0 is satisfied

ETX	Device data (D3)	Device data (D2)	Device data (D1)	Device data (D0)	Number of registered points	Device code	Monitoring head device	ETX



External device

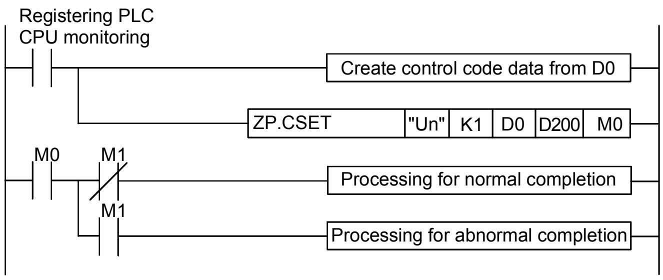
2.3.2 How to register and cancel the PLC CPU monitoring function

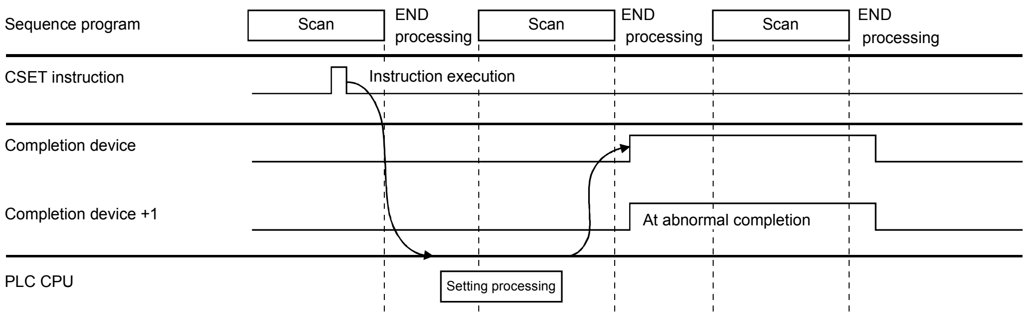
The following describes the method for registering and canceling the PLC CPU monitoring function from the PLC CPU.

> **POINT**
>
> (1) For details on the method for registering and canceling the PLC CPU monitoring function with the GX Configurator-SC, see Section 8.4.9 of the User's Manual (Basic).
>
> (2) For details on the method for registering and canceling the PLC CPU monitoring function with an MC protocol command, see Section 3.17 of the Reference Manual.

(When registering or canceling from the PLC CPU)

* For details on the CSET command, see Section 17.3.



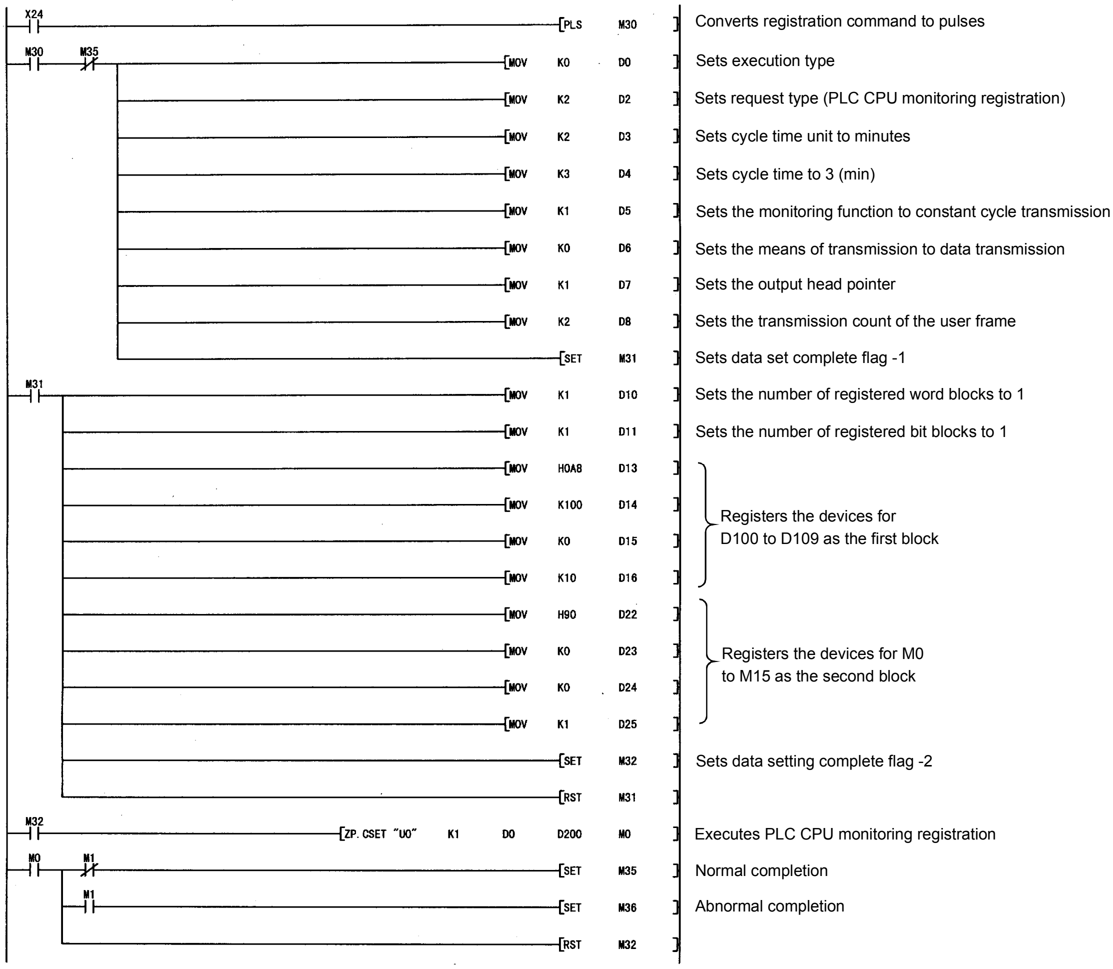


1) Stores the data for PLC CPU monitoring registration in the device that designates the control data for the CSET instruction.

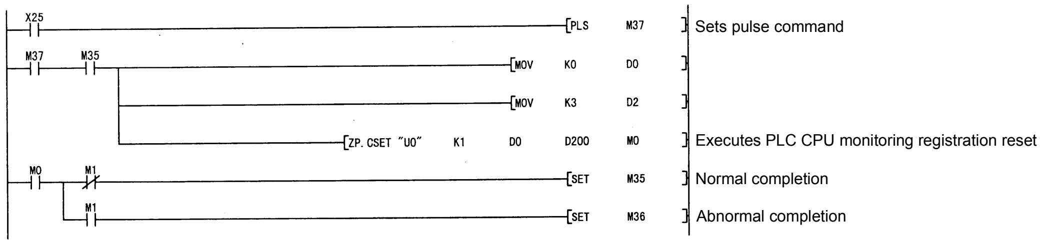
2) Executes the CSET instruction.
   At the end of the scan in which the CSET instruction was completed, the completion device (M0) designated by (D2) turns ON and then turns OFF at the next END processing.

3) When there is an error, (D2) + 1 turns ON and the error code in stored in the completion status (S2) + 1.

(a) Example of a program for performing PLC CPU monitoring registration
This example shows a program that registers PLC CPU monitoring for the CH1 side interface.
* This registration is for transmitting the contents of M0 to M15 and D100 to D109 to the external device using constant cycle transmission (cycle time is 3 min).



(b) Example of a program for executing PLC CPU monitoring cancellation
This example shows a program that cancels PLC CPU monitoring for the CH1 side interface.



2.4 Precautionary Notes for Using the PLC CPU Monitoring Function

(1) The cycle time will be affected by the following factors.
Keep these in mind when setting the cycle time.
1) When the PLC CPU is accessed by a module other than the Q series C24.
2) When a data communication function other than the PLC CPU monitoring function is used.
3) When transmission stops by DTR/DSR control.

(2) Both the constant cycle transmission and the condition agreement transmission cannot be designated together for the same interface.

(3) Only the local station's PLC CPU can be the target for the PLC CPU monitoring function.

(4) A new PLC CPU monitoring registration cannot be performed while the PLC CPU monitoring function is in operation. In this case,
1) Perform the new PLC CPU monitoring registration after canceling the PLC CPU monitoring.
2) If the new PLC CPU monitoring registration is performed without canceling the PLC CPU monitoring, an error will occur.
Also, for PLC CPU monitoring registration using GX Configurator-SC, perform the registration after placing the PLC CPU in the STOP status, and then restart QCPU.

(5) While the PLC CPU monitoring function is in operation, even if an error occurs with transmission/notification of the PLC CPU monitoring results or reading of data from the PLC CPU, the PLC CPU monitoring function operation will not stop.

(6) The PLC CPU monitoring function can only be used when the system configuration is 1:1.

(7) The following describes how the Q series C24 operates when the PLC CPU monitoring result information cannot be sent to the external device due to line disconnection or other reason.
＊ Even if an error occurs while the PLC CPU monitoring function is in operation, the ERR LED does not light up. (This is the same as when using the on-demand function of the MC protocol).

(a) When the setting for the transmission monitoring time designation (timer 2) is an infinite wait (0_H)
1) Reading of monitoring data from the PLC CPU stops until the transmission of monitoring data completes.
2) When transmission resumes, reading of monitoring data from the PLC CPU resumes and monitoring data and information are transmitted.

(b) When the setting for the transmission monitoring time designation (timer 2) is other than an infinite wait (0_H)
1) A transmission timeout error occurs, monitoring information read from the PLC CPU, and transmission of monitoring information resumes.
2) The error code is stored in the PLC CPU monitoring function error code storage area (address: 2205_H).

(8) When device data for the PLC CPU cannot be read because of a PLC CPU error (hardware failure, etc.), the error code is stored in the PLC CPU monitoring function error code storage area and the Q series C24 performs the monitoring processing based on previously read data.

(9) When transmitting the monitoring information as data using the modem function, a modem connection error will occur if a modem connection is requested for the following reasons.
- A connection request by Y11
- A notification-issued request by Y14

If possible, provide a dedicated Q series C24 for using the PLC CPU monitoring function.
When using both the PLC CPU monitoring function and data communication function with a single Q series C24 and one of the above modem connection errors occurs, re-execute a connection request in consideration of the transmission timing set by the user for the PLC CPU monitoring function.

3 COMMUNICATIONS BY THE MODEM FUNCTION

This chapter explains the overview and how to use the modem function, which can be used for data communication with remote external devices and paging pager terminals.

3.1 Overview

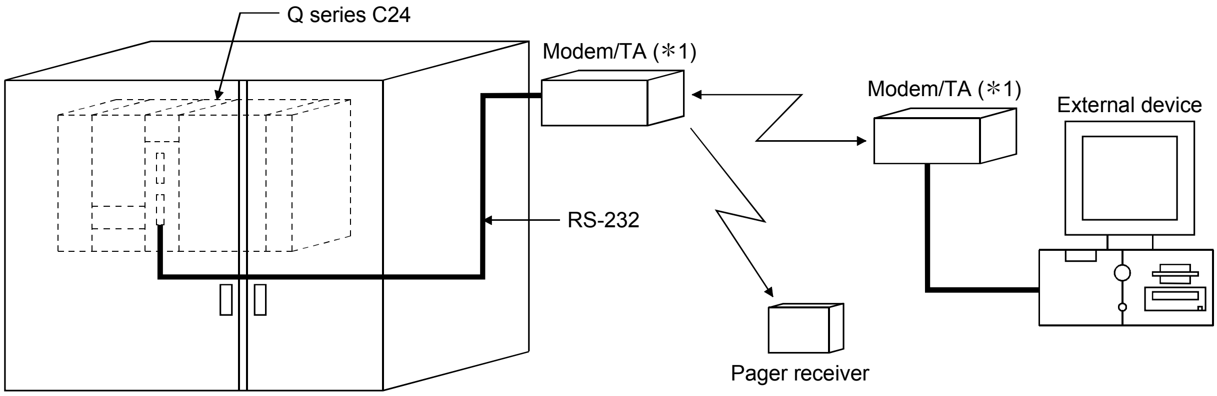
The overview of the modem function is described below:

(1) The modem function easily performs data transmission/reception to remote devices via public lines/office telephone systems/digital lines (ISDN) by connecting a modem or TA (terminal adapter) to the Q series C24's RS-232 interface.

1) Communicating arbitrary data with an external device
2) Call pager receiver (beeper) to notify the PLC’s system maintenance information.

(2) Initialization of the modem or TA, line connection (dialing), and line disconnection are performed using the PLC CPU.

(3) Once the line is connected, data communication with the external device via public line/office telephone system/digital line, or a call to pager receiver can be made.



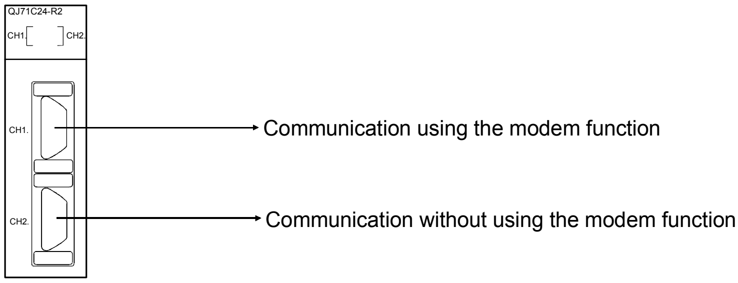
∗1 TA: terminal adapter

3.1.1 Features

The following explains the features of the modem function.

(1) Interface that can use the modem function

1) The modem function can be used with the Q series C24 using an RS-232 interface.
2) For the QJ71C24(N)-R2, the modem function can only be used by one of the two existing RS-232 interfaces.
   With the interface of the Q series C24, which does not use the modem function, direct data communication with an external device can be performed using an MC protocol, non procedure protocol or bidirectional protocol (independent operation).



(2) Initialization, line connection and disconnection of the modem or TA

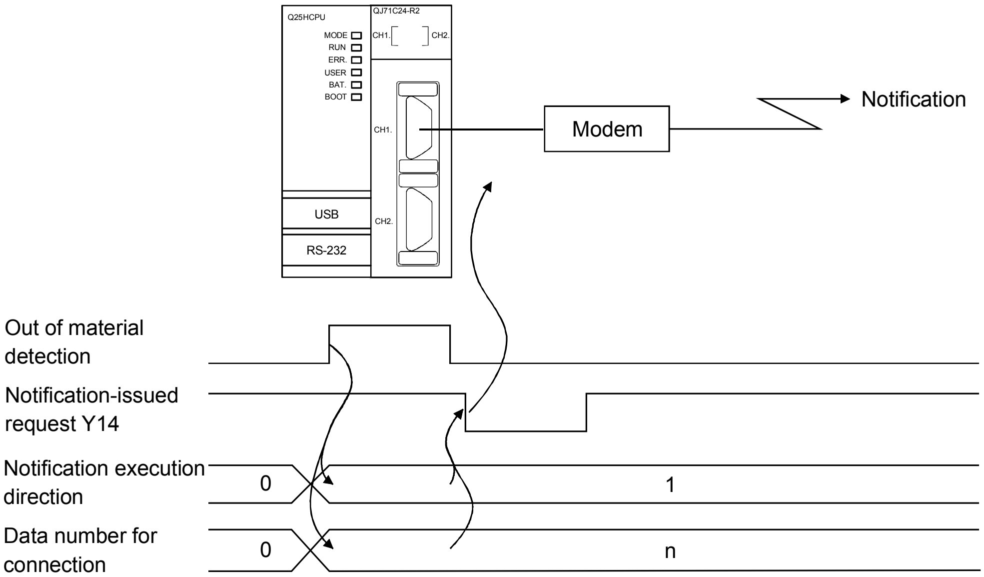
1) The following set values for line connection can be used by storing to the Q series C24 Flash ROM in multiple sets.
   - Modem/TA initialization data (AT command)
     User setup: 30 sets (78 bytes/set); default value: 13 sets
   - Connection data
     User setup: 30 sets (80 bytes/set)
     (Telephone number of the connection destination and display message to the pager receiver.)
2) By registering the above data to the Q series C24 ahead of time, the modem/TA (terminal adapter) initialization, line connection (dialing), and line disconnection can be performed with ease.
3) When the no-communication interval time (1 min to 120 min) is set, the Q series C24 disconnects the line when a no-communication condition has occurred for the set period of time following the line connection.

(3) Communication between a remote external device and PLC CPU

1) Data communication can be performed via full-duplex communication.
2) From the external device to the PLC CPU, communication using the MC protocol, non procedure protocol and bidirectional protocol can be performed.
3) From the PLC CPU to the external device, communication using the MC protocol (transmission by the on-demand dedicated-protocol function only), the non procedure protocol and bidirectional protocol can be performed.

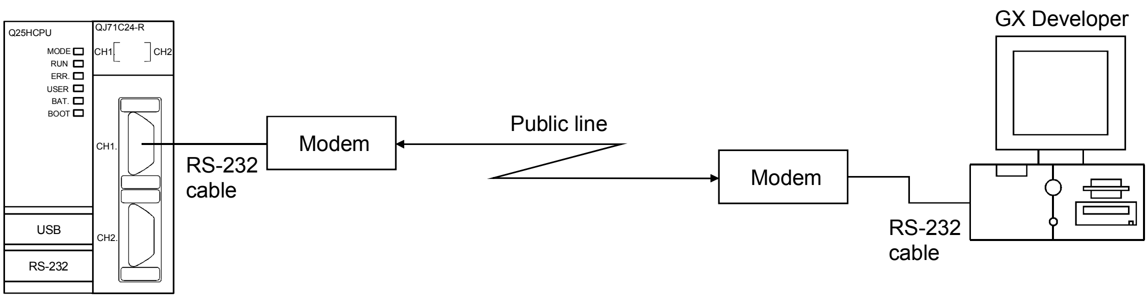
(4) Notification to the pager receiver

1) In order to notify to the pager receiver of the PLC system maintenance information, the Q series C24 performs calling and message transmission according to the user-designated connection data when the output signal from PLC CPU is turned from ON to OFF.
2) Because Q series C24 notification processing is performed while the output signals from PLC CPU are turned OFF from ON, dedicated notification can be performed when the PLC CPU enters the STOP state due to an error, etc.



(5) Communication from the GX Developer

1) Access from the GX Developer to the remote PLC CPU can be made. (read and write from/to the device data and sequence program)
2) The QCPU can be accessed after reconnection from the Q Series C24 side using the callback function.



＊ Transmission costs after line connection by callback from the Q Series C24 side are borne by the Q Series C24 side.

(6) Remote password check

If the remote password check has been set for the Q series C24 installed in the QCPU, the Q series C24 executes a remote password check when the PLC is accessed from an external device using the Q series C24 modem function.
The following is an overview of the QCPU remote password function. See Section 3.3.3 for more details.

(a) Remote password function

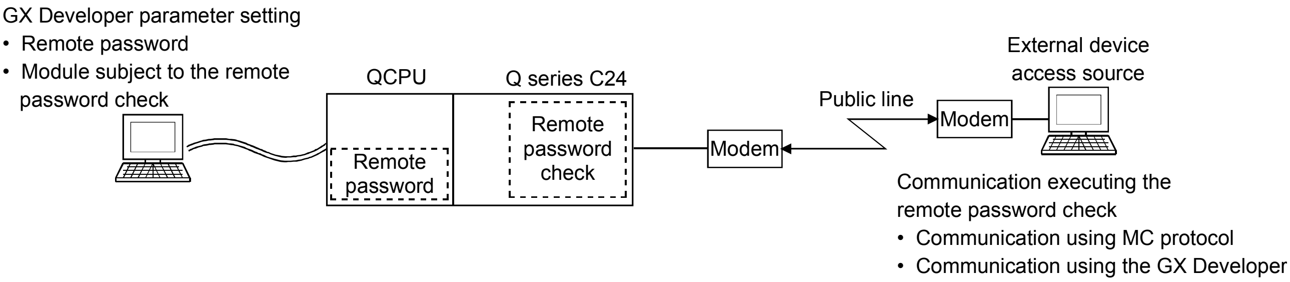
The remote password function allows / prohibits access to the QCPU from an external device via the following modules.

- Q Series C24
- Ethernet module

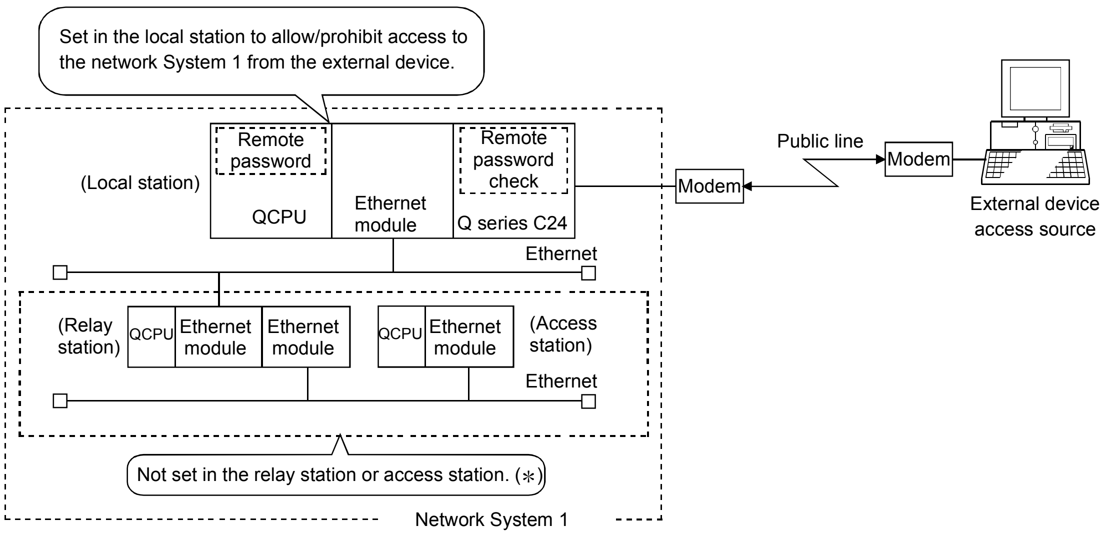
＊ In the case of the Ethernet module, the remote password function can be used for data communications connections with an external device. For details, see the User's Manual (Basic) for the Ethernet module.

(b) Station where the remote password and remote password check are set

1) In the case of a PLC system with one QCPU station



2) In the case of a PLC system consisted of multiple QCPU stations
Set in the QCPU station which is the entrance of the PLC system as viewed from the external device (the local station QCPU in the diagram below).



＊ When set in a station other than the QCPU which is the entrance of the PLC system (relay station or access station in the above diagram), access to other stations beyond the set station is prohibited.

3.1.2 Function list

The following describes the overview of the modem function:

<table>
<tr><th>Function</th><th colspan="2">Overview</th></tr>
<tr><td>Modem/TA initialization</td><td colspan="2">Initializes the modem/TA using the user-designated initialization data (AT command). (Auto initialization of the modem / TA is possible.)</td></tr>
<tr><td>Line connection (dialing)</td><td colspan="2">Dials the partner telephone number according to the user-designated connection data and enables data communication after establishing the line connection. When the modem/TA is not initialized, performs initialization.</td></tr>
<tr><td rowspan="3">Data communication</td><td>Performs communication with an external device using the MC protocol, non procedure protocol or bidirectional protocol.</td><td rowspan="4">Communication method: full-duplex communication
Synchronization method: start-stop synchronous system (asynchronous)</td></tr>
<tr><td>Performs communication with the partner Q series C24-installed station by modem/TA connection using non procedure protocol or bidirectional protocol. (Station-to-station communication.)</td></tr>
<tr><td>Enables the communication between GX Developer and PLC via Q series C24.</td></tr>
<tr><td>Notification</td><td>Calls and transmits messages to the pager receiver.</td></tr>
<tr><td>Line disconnection</td><td colspan="2">Forcefully disconnects the line from the connected destination device.</td></tr>
<tr><td>Flash ROM reading, writing (registration) and deletion</td><td colspan="2">Reads, writes (registers) and deletes the initialization data (AT command) and data for connection from/to the Flash ROM in the Q series C24 according to the request from PLC CPU.</td></tr>
<tr><td>Remote password check</td><td colspan="2">Allows the Q series C24 to execute the remote password check set in the QCPU when there is communication from the external device to the Q series C24 using MC protocol or the PLC is accessed using the GX Developer.</td></tr>
<tr><td>Callback</td><td colspan="2">After line connection from the GX Developer, access to the QCPU from the GX Developer is made possible through line reconnection from the Q Series C24 (callback). Transmission costs after line connection from the Q Series C24 side are borne by the Q Series C24 side.</td></tr>
</table>

3.1.3 Comparisons with related devices

The following shows a comparison with the related products which supports data communication with the PLC using the modem and public line, etc., similarly to the communication performed via the modem function.

Communication function name		Q series C24 (modem function) B	Q series C24 (modem function) A	QC24N (modem function)	Q6TEL (for QnACPU/ACPU)	A6TEL (for ACPU)
Modem/TA initialization	Sequence program	○		○	○	
	GX Configurator-SC	○ (＊1)	×	—	—	
Line connection (dialing)		○		○	(Performed on the external device side)	
Communication between same products (such as C24-C24)	MC protocol	×		×	×	
	Non procedure protocol	○		○	×	
	Bidirectional protocol	○		○	×	
Communication between Q series C24 and other products		—		○	—	—
Remote communication from GX Developer		○		○	○	○
	Callback function	○	×	×	×	×
Remote communication from peripheral device for GPPQ		×		○	○	×
Remote communication from peripheral device for GPPA		×		×	○	○
Notification	Pager receiver	○		○	○	○
Remote password check		○ (＊3)	×	×	×	×
Line disconnection		○		○	(Performed on the external device side)	
Data setting • Data for modem initialization • Data for connection	Sequence program	○		○	×	×
	GX Developer	×		×	○	○
	GPPQ	×		×	○	×
	GPPA	×		×	×	○
	GX Configurator-SC	○		—	—	—
Number of connectable modems/TAs		1				
Transmission type		Pulse/tone				
Connectable lines	Analog 2-line method	○		○	○	○
	Analog 4-line method	○		○	×	×
	Digital line (ISDN)	○		○	○	×

○ : enable
× : disable

＊1 Modem initialization is executed automatically when the Q Series C24 starts up.
＊2 The internal modem is automatically initialized.
＊3 Prior to data communication, the Q series C24 checks whether the remote password specified by the user and the remote password set in the QCPU agree or not. If they agree, it allows access to the specified station.
＊4 When starting data communication, designate the connection data with the buffer memory.

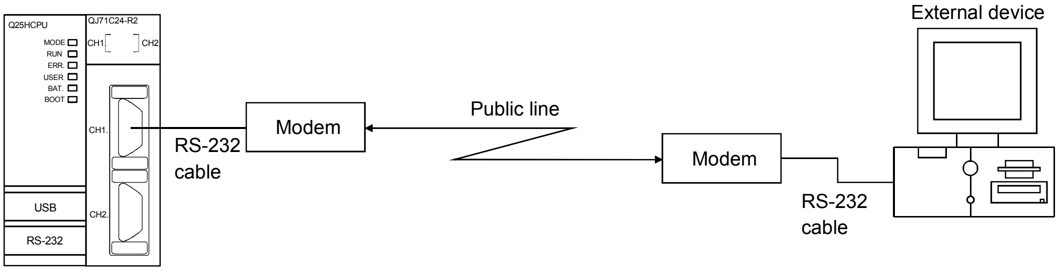
3.2 System Configuration

This section describes system configurations when the modem function is used to call a pager receiver or to perform data communication with an external device via public lines.

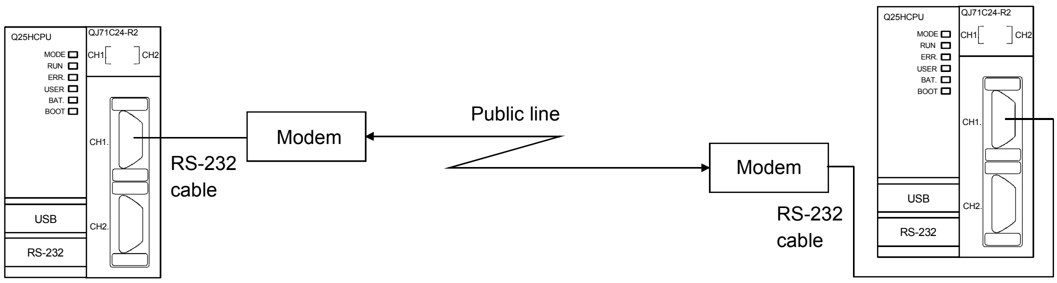
3.2.1 System configuration when performing data communication with an external device

The following describes the system configuration examples used when performing data communication between the external device and PLC using the Q series C24's MC protocol/non procedure protocol/bidirectional protocol.

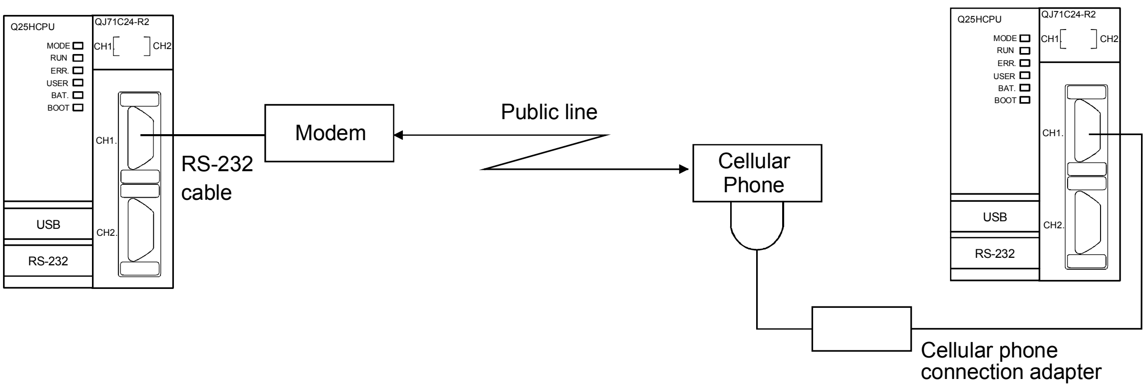
(1) Connection example with an external device



(2) Connection example with a Q series C24



(3) Connection example with a Q series C24 via cellular phone

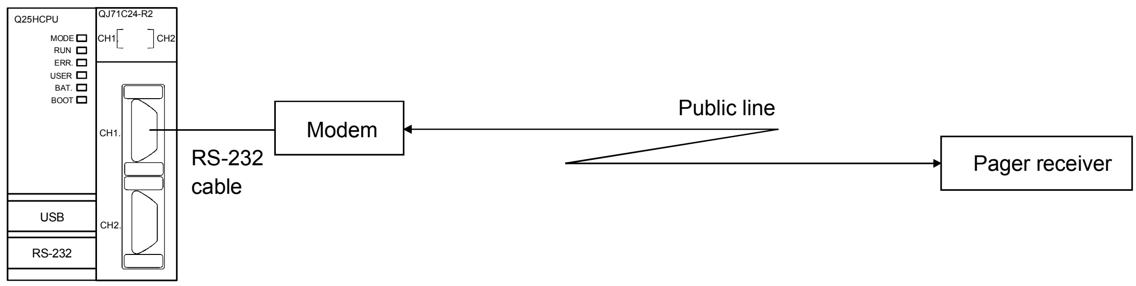


＊ The public lines indicated in (1) to (3) above are compatible with the office telephone system as well.

＊ In the system configurations shown in (1) and (2) above, the digital line (ISDN) can replace the public line.
When connecting via a digital line, a TA (terminal adapter) and a DSU (digital service module) are used instead of a modem.

3.2.2 System configuration when using the notification function

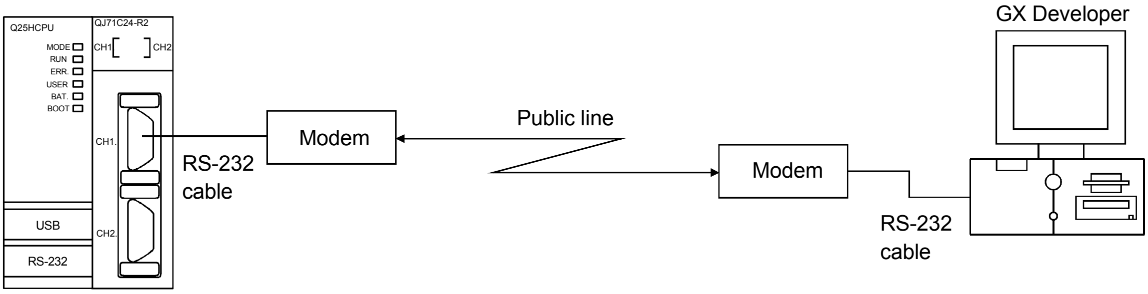
The following describes the system configuration example when calling the pager receiver by the notification function.



＊ The public line indicated above is compatible with the office telephone system as well.

3.2.3 System configuration when connecting GX Developer

The following describes the system configuration when GX Developer performs data communication with a remote station PLC via Q series C24.



✻ The above public lines is compatible with the office telephone system as well.
✻ The following settings are performed in the items below when setting the connection destination using the GX Developer. See the GX Developer manual for details.

Personal computer-side interface	: Serial
PLC-side interface	: C24
Telephone line connection (Q/A6TEL, C24)	: Data for line connection

For other items, settings are performed according to the access destination station.

POINT

When the GX Developer is connected, perform the settings and operations described in Section 3.3.7 to prevent a line to the modem from disconnecting even if communication between the GX Developer and PLC is interrupted.

3.2.4 Precautions for system configurations

The following describes the precautionary items when configuring the system to perform data communication with an external device or call a pager receiver via public line, an office telephone system or digital line (ISDN) using the Q series C24 modem function.

(1) Usable Q series C24 interface

1) The modem function can be used with the RS-232 interface only.
2) For QJ71QC24(N)-R2, the modem function can only be used with one of the two existing RS-232 interfaces.
3) It is not possible to perform data communication via two interface of Q series C24 (linked operation).

(2) Connectable modem/TA

Only the modems/TA indicated in Section 3.3.2 can be used for the Q series C24 RS-232 interface using the modem function.

(3) Number of connectable modems/TA's

Only one modem/TA can be connected to the Q series C24 RS-232 interface that uses the modem function.

(4) Modem/TA connection cables

1) The RS-232 cable supplied with the modem/TA or the designated modem/TA cable can be used for connection between the Q series C24 and modem/TA.
2) RS-232 interface connector of the Q series C24 has D-sub 9 pins (female). For the Q series C24 side of the connection cable, use the connector shell indicated in Section 3.2.1 (3) of the User's Manual (Basic).

(5) Modem/TA installation

1) Install the modem/TA according to the modem/TA manual.
   When installed in an area in which a lot of noises exists, malfunctions may occur.
2) In order to prevent the effects of noise and power surges, do not connect near or tie the cable together with a main circuit line, high-voltage line or load line other than for the PLC with the modem/TA connection cable.

(6) Connectable lines

1) The connections can be made with the following lines.
   Perform connection tests beforehand and confirm that connection is possible.
   - Public line or office telephone system of analog two-line method
   - Digital line (ISDN)
2) It is not possible to connect to call-waiting lines, in order to avoid data errors or automatic line disconnection due to the call-waiting interrupt tone.
3) Avoid connections with party-line telephones to avoid interrupted calls during communication.
4) If an alert sound is sent at fixed intervals from the communication machine to prevent long-term calls, data may experience errors.
   It is recommended to check the normality/abnormality of data reception between devices, and perform transmission-retry processing when an abnormality is detected.
5) See the modem/TA manual regarding the connection from a modem to public line/office telephone system, or from a TA (terminal adapter) to a digital line.

(7) Communication system

Communication via the modem function is performed using full-duplex communication.
Connections cannot be made devices designed for half-duplex communication.

(8) Data communication and notification to external devices

1) Data communication with external devices and notification to a pager receiver are performed using the public line or electric wave transmitted from the electric wave transmission base.
   There might occur a condition in which correct data communication or notification cannot be carried out due to an error from the system's setup environment, electric-wave transmission status, error in the partner device, etc.
   Perform a connection test beforehand, and confirm that connection is possible.
2) In notification processing via electric-wave transmission, errors from the pager receiver cannot be detected.
   Setup a separate call circuit with a lamp display or buzzer to ensure the safety of the PLC system.

3.3 Specifications

This section explains the transmission specification on the Q series C24 side, connectable modems/TA's (terminal adapter), I/O signals related to the modem function, and buffer memory for the usage of the modem function.

3.3.1 Transmission specifications

The transmission specifications on the Q series C24 side for use of the modem function are as shown below.
The transmission specifications between Q series C24 and a modem/TA (local station Q series C24) that are not provided in this table are shown in User's Manual (Basic).

Item		QJ71C24N QJ71C24	QJ71C24N-R2 QJ71C24-R2	QJ71C24N-R4
Modem function		Available		Not available
Interface that can use the modem function		RS-232		—
Linked operation between CH1 and CH2 of the Q series C24		Not available		
Communication method		Full duplex communication		
Synchronization method		Asynchronous method		
Transmission speed (Unit: bps)		1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200, 230400 (selectable)		
Data format	Start bit	1		
	Data bit	7 / 8		
	Parity bit	1 (On) / 0 (Off)		
	Stop bit	1 / 2		
Error detection	Parity check	On (odd/even selectable) / Off		
	Sum check code	On / Off		
Transmission control		RS · CS control / not-control (selectable)		
Data communication	No procedure protocol	Available		
	Bidirectional protocol	Available		
	MC protocol	Available		
Line connection (Q series C24: modem)		1:1		

*1 When the first five digits of the serial No. are 03042 or earlier, the transmission speed cannot be set to 115200 bps for connection between the Q series C24 and the GX Developer via a modem.

3.3.2 Specification of connectable modems/terminal adapters

The specification of modems/TA's that can be connected to the Q series C24 side when using the modem function is shown below.

(1) Specification and precautions for the connectable modems

(a) Modem specification

Item			Specification		Remarks
			When using the subscriber's telephone line/office telephone system	When using a manual line connection/cellular phone	
Modem-to-modem communication specification	Connection line		Analog 2-line		—
	Initialization		Hayes AT command compatible		See Section 3.4.3
	Telephone line		A line compatible with NTT communication protocol		See Section 3.2.4 regarding the restrictions
	Communication standard	ITU-T	V. 34/V.32bis/V.32/V. 22bis/V. 22/V. 21/V. fc		—
		Bell	212A/103		
	Error correction (＊1)	MNP	Class 4 and 10 compliant		
		ITU-T	V.42 compliant		
	Data compression (＊1)	MNP	Class 5 compliant		
		ITU-T	V.42bis compliant		
	ANS-ORG mode switch		—	Mode switching required	
Q series C24-to modem communication specification	Q series C24-side connector (RS-232)		9-pin (female) D sub		See Section 3.2 of User's Manual (Basic)
	DR signal control		Only the DR (DSR) signal must be able to turn on		(＊2)
	Other		Compatible with the Q series C24 specification		See Chapter 3, Section 3.3.1 of User's Manual (Basic)

＊1 The following are the functions of the modem itself that become available by issuing the AT commands to the modem. See the modem manual for details.

(1) Error correction

1) When a noise occurs on the line, scrambled data may appear due to interrupted communication data.
The error correction function is intended to suppress effects from such noises.

2) If an error such as scrambled data is detected by the error correction, the modem retries the transmission.
When the number of retries has exceeded the modem's limit, the modem determines that communication cannot be performed in that environment and disconnects the line.

3) Both modems must support the MNP4 or V.42 protocol.

(2) Data compression

1) This function compresses data to be sent prior to transmission, and inflates the compressed data upon reception, then forwards to the terminal.

2) The data compression is effective for the execution speed at a maximum of 200 % for the MNP5 and 300 % for the V.42bis.

3) Both modems must support the MNP5 or V.42bis protocol.

(3) Flow control (RS · CS control)
When communication between a modem and terminal is faster than between two modems, the flow control is performed in the following order:

1) The modem transmits data to the partner by storing the data from the terminal in the modem buffer.
2) When the buffer in the modem becomes almost full, the modem outputs a data-transmission temporary stop request (CS signal = OFF) to the terminal.
   The terminal then stops data transmission to the modem when the data-transmission temporary stop request (CS signal = OFF) is received.
   ＊ Even while the terminal pauses data transmission, the modem continues to send data to the partner.
3) When a free space is present in the modem buffer, the modem outputs the data-transmission resume request (CS signal = ON) to the terminal.
   The terminal then resumes data transmission to the modem when the data-transmission resume request (CS signal = ON) is received.

＊2 Modems that turn on the CD signal simultaneously cannot be used.

(b) Precautions for selecting a modem

1) When using a cellular phone
   A modem with the error correction function of MNP class-10 is recommended. However, note that communication may not be established depending on the line condition.
2) Modem setting
   • Set the modem on the Q series C24 side as shown below:

Setting item		Setting range
Communication rate		Depends on the modem in use (＊1)
Modem command		Hayes AT command
SI/SO control		None
Communication method		No procedure
Data format	Data bit	Match the Q series C24 (＊2) (＊3)
	Stop bit	
	Parity bit	

＊1 When using different modems, the slower communication rate will be in effect.
＊2 Some modems may transmit one character as 10 bits.
Check the modem specifications when setting the Q series C24 transmission specifications.
＊3 Some modems may switch the communication rate following the start of data communication.
Since the Q series C24 cannot switch the communication rate, set the modem side so that its communication rate does not switch.

• When using a modem whose DR terminal (signal) is set by a switch, set the DR-terminal (modem output) switch level to high.
  When using a modem whose DR terminal is set by a software, write the command that turns on the DR terminal into the data for initialization.
  Set the "Modem initialization time DR signal valid/invalid designation" to "Invalid" during modem function system settings with GX Configurator-SC.

(2) Specification and precautions for the connectable TA's (terminal adapters)

(a) TA specification

Item		Specification	Remarks
TA-to-TA communication specification	Connection line	ISDN (INS net 64) equivalent High-speed digital dedicated line	DSU and TA are required
	Initialization	Hayes AT command compatible	See Section 3.4.3
	Communication standard	B-channel line exchange (V.110) D-channel packet exchange	—
	Electrical condition	V.28 compliant	
Q series C24-to-TA communication specification	Circuit definition	V.24 compliant	
	Q series C24-side connector (RS-232)	9-pin (female) D sub	See Section 3.2 of User's Manual (Basic)
	DR signal control	Only the DR (DSR) signal must be able to turn on	(＊1)
	Other	Compatible with the Q series C24 specification	See Chapter 3, Section 3.3.1 of User's Manual (Basic)

＊1 TA's that turn on the CD signal simultaneously cannot be used.
Use a TA capable of flow control as described in (1) (a) in this section also for the communication between the TA and terminal.
control is a function of the TA itself that becomes available by issuing the AT commands to the modem. See the TA manual for details.

(b) Precautions for selecting a TA

1) Set the TA on the Q series C24 side as shown below:

Setting item		Setting range
Communication rate		Depends on the TA in use
TA command		Hayes AT command
SI/SO control		None
Communication method		No procedure
Data format	Data bit	Match the Q series C24 (＊1) (＊2)
	Stop bit	
	Parity bit	

＊1 Some TAs may transmit one character as 10 bits.
Check the TA specifications when setting the Q series C24 transmission specifications.
＊2 Some TAs may switch the communication rate following the start of data communication.
Since the Q series C24 cannot switch the communication rate, set the TA side so that its communication rate does not switch.

2) When using a TA whose DR terminal (signal) is set by a switch, set the DR-terminal (TA output) switch level to high.
When using a TA whose DR terminal is set by a software, write the command that turns on the DR terminal into the data for initialization.
Set the "Modem initialization time DR signal valid/invalid designation" to "Invalid" during modem function system settings with GX Configurator-SC.

3.3.3 Compatibility with the QCPU remote password function

This section explains the Q series C24 data communication for the QCPU remote password function.
See Section 3.1.1 (6) for an overview of the Q series C24 check function for the QCPU remote password.

The remote password function is a function that has been added to the QCPU as a means of preventing improper access (such as destroying a program or data) from an external device. However, this function cannot completely prevent improper access.
The user should incorporate his/her own safeguards when it is necessary to protect the security of the PLC system from improper access from an external device.
The company cannot assume any responsibility for any problems that may arise from system troubles caused by improper access.

＊ An example of a safeguard on the PLC CPU with respect to improper access
One example is shown in Section 3.3.6, in which the PLC CPU disconnects a line to the external device when the number of times a "remote password mismatch" is detected exceeds the number set by the user with regard to the Q series C 24 remote password check explained in this section.

(1) Data communication during remote password setting

This section explains the use and setting of the QCPU remote password function and data communication between the external device and the QCPU when a remote password has been set.

(a) Allowing/prohibiting access to the PLC from the external device

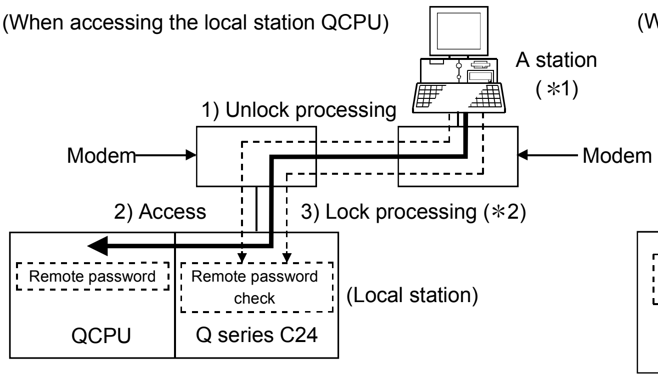
1) Access allow processing (unlock processing)
   - To access the specified QCPU, the external device performs the remote password unlock processing with respect to the Q series C24 (＊) of the directly connected station (local station) after line connection for the modem function.
   - If the unlock processing has not been performed, the remote password check performed by the Q series C24 (＊) that has received a communication request prohibits access to the specified station. (See (2).)
   - All data communication before the unlock processing is performed will be processed as an error.

   ＊ The Q series C24 of the QCPU station for which a remote password is set will be indicated.

2) Access processing
   Normal completion of the remote password unlock processing allows the specified station to be accessed.
   - Perform communication using MC protocol.
     (Perform on-line operation when the GX Developer is connected.)

3) Access prohibition processing (lock processing)
   - When the specified station access is completed, the process for disconnecting the line for the modem function is performed in order to disable further access.
   - When line disconnection is completed, the remote password lock processing is performed automatically.

(When accessing the local station QCPU)

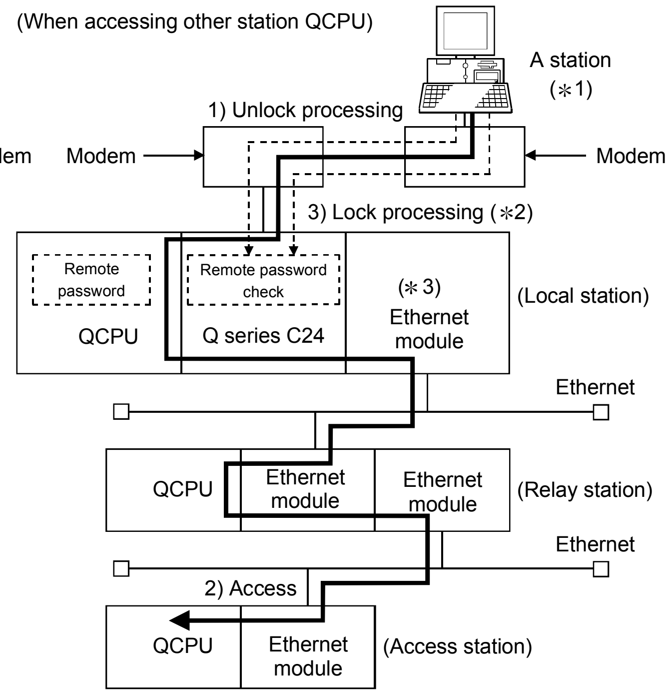


∗1 Unlock and lock processing for the local station remote password is possible.
Remote password unlock and lock processing for the relay station and access station cannot be performed

∗2 Lock processing is performed when a line for the modem function is disconnected.

∗3 Even if the Ethernet module that transmits a communication request to other Ethernet is set as a module subject to the remote password check, unlock and lock processing is not necessary.

(When accessing other station QCPU)



POINT
(1) The remote password unlock and lock processing can be performed only for the Q series C24 of the local station directly connected to the external device. The remote password unlock and lock processing cannot be performed for the Ethernet module of the other stations (relay station and access station). (2) The remote password unlock processing from the external device is performed using dedicated commands for MC protocol communication. (3) See Section 3.3.7 (8) for what to do when the remote password unlock processing is completed abnormally.

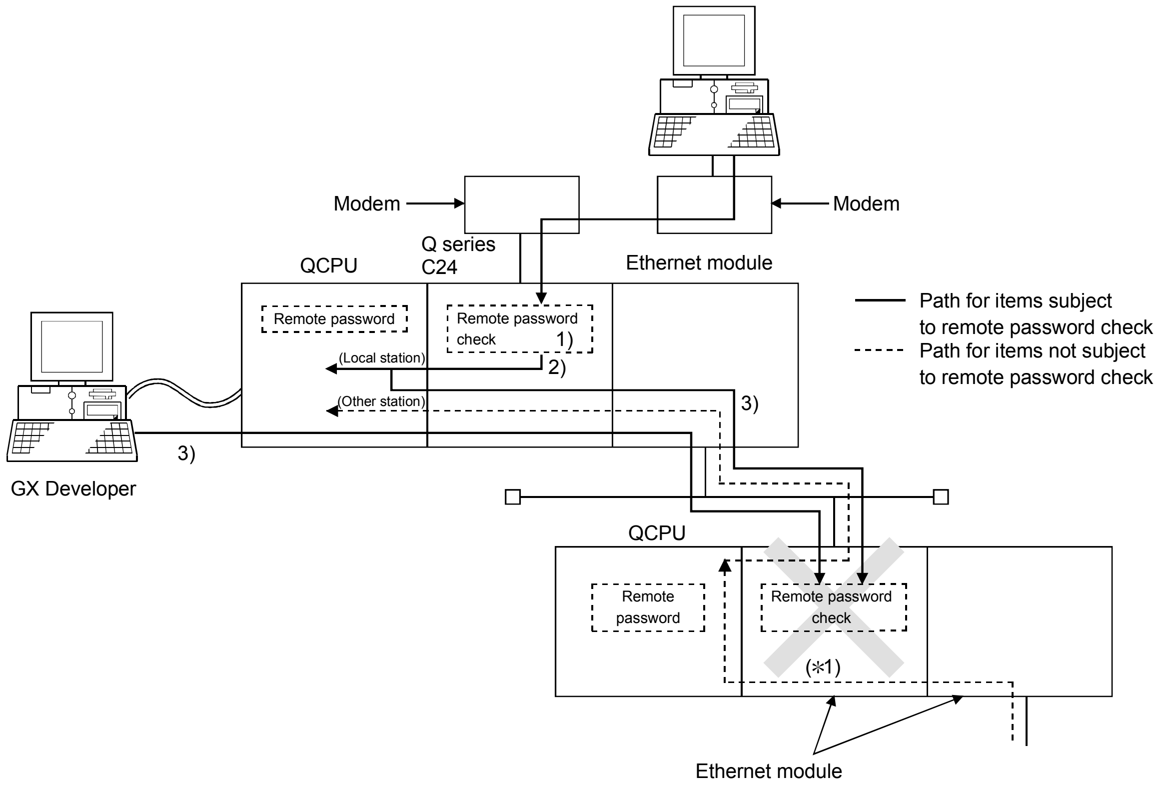
(2) Remote password check processing performed by the Q series C24

(a) Communication in which a remote password check is performed

1) When the following parameters are set for the Q series C24 installed in the QCPU station, the Q series C24 performs a remote password check for communication requests listed below.
   - When a remote password is set in the QCPU
   - When the Q series C24 that is communicating data with the external device has been set as a module subject to the remote password check

2) The Q series C24 performs a remote password check with respect to a communication request to the local station/other station received from the external device.

3) The Q series C24 does not perform a remote password check for the following communication requests.
   - Transmission request from the local station QCPU (such as transmission using non procedure protocol)
   - Communication request from the external device (including the GX Developer connected to the local station QCPU) transmitted to other station upon request from the QCPU



*1 In the above diagram, a communication request from the external device cannot be received since the remote password check setting has been executed.
If the remote password check setting has not been executed, a communication request can be received and data communication from the external device is possible.

(b) Selecting modules subject to the remote password check
The user can select any Q series C24 to perform the remote password check and set this using QCPU parameters.
(This is set on the GX Developer remote password setting screen.)

(c) Stations that can be accessed when the remote password check is performed

1) If the external device performs the remote password unlock processing with respect to the Q series C24 of the directly connected station (local station) after line connection for the modem function, it can access the local station QCPU.

2) When accessing the PLC of other station via the Ethernet module of a relay station or access station, the following settings determine whether access is allowed/prohibited.
    • To prohibit access to other station from an external device using the MELSECNET/H or MELSECNET/10 relay communication function of the Ethernet module, place a check mark at the following setting items in the remote password setting for the relay station or access station. "GX Developer communication port (UDP/IP) (＊), dedicated commands, MELSECNET/H, MELSECNET/10 relay communication port"
    ＊ Set on the GX Developer remote password setting screen.
    If a check mark is not placed at the above setting items, access to other station will be allowed.

3) See the user's manual (basic) for the Ethernet module for stations that can be accessed when accessing other station PLCs via the Ethernet module. (When reading the manual, substitute the Q series C24 with the station connected to the external device).

(3) Data communication procedure

This section explains the procedure when the external device performs data communication via the Q series C24 in which the remote password check is performed.

1) Initialization of the modem of the Q series C24 side and external device side is performed at each device sides.

2) The line is connected from the external device.

3) The external device performs the remote password unlock (release) processing for the QCPU of the station where the Q series C24 is installed using dedicated commands for MC protocol communication. (The unlock processing cannot be performed for the QCPU of other station.)
    ＊ See Section 3.3.7 (8) for what to do when the remote password unlock processing is completed abnormally.

4) Data communication is performed from the external device using MC protocol.

5) When data communication using MC protocol is completed, a line for the modem is disconnected from the external device.
    When line disconnection is completed, the remote password lock processing is performed automatically.

REMARK

(1) See Section 3.18 of Reference Manual for the unlock processing for the remote password.
(2) When accessing the PLC from the GX Developer connected to the Q series C24, the remote password unlock processing is performed when on-line operation begins.

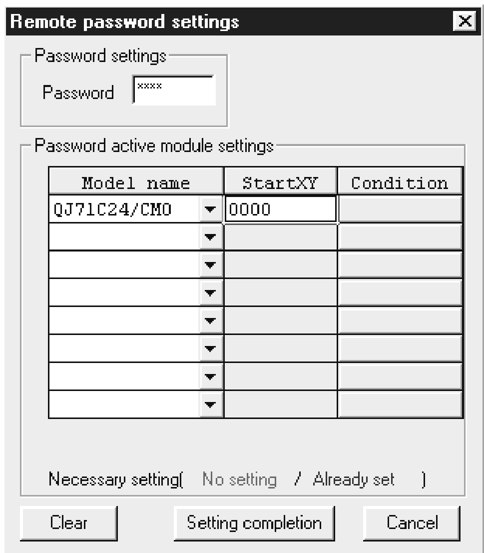
(4) How to set the remote password

On the screen below for setting parameters (remote password) using the GX Developer, set the remote password in the QCPU and specify the Q series C24 that performs the check.
Set the remote password as the following instructions.

[Start procedure]

"GX Developer" → Remote password → "Remote password setting" screen

[Setting screen]



[Setting item]

Item name		Set data	Setting range/choices
Password settings		Enter the remote password to be set in the QCPU (*1)	4 bytes
Password active module settings	Model name	Select the type of module that checks the remote password set in the QCPU	QJ71C24/CMO
	Start XY	Set the head address of the module that checks the remote password	0000_H to $0FE0_H$
	Conditions	(No setting required)	—

*1 Consider the following when setting the remote password.
- Avoid using a character string of simple numbers or letters only.
- Mix numbers, letters and special characters (?, ., !, &, %, etc.).
- Avoid using a character string that represents the user's name or date of birth.

POINT

(1) When using the Q series C24 in a multiple CPU system, write the remote password setting in the control PLC of the Q series C24.
(2) After setting the remote password in the QCPU, reboot the QCPU (PLC No. 1 in a multiple CPU system). (Reset/power reset using the RESET/L.CLR switch)
By rebooting the QCPU, the remote password becomes valid.
(3) The password supported by the QCPU function version A is used to prohibit reading/writing of file data in the QCPU using the GX Developer.
Dual access control can be provided by using the remote password described in this section and password for file access.

(5) Setting from the GX Configurator-SC

When the Q series C24 performs a remote password check for the remote password set in the QCPU, the remote password check setting as well as the present check results can be monitored with respect to the screen items listed in the table below.

See Section 3.3.6 for an explanation of each area.

GX Configurator-SC setting/monitor screen	Setting/monitor items for the remote password check	Buffer memory address
"Modem function system setting" screen	Remote password mismatch notification count designation	8204 (200CH)
	Remote password mismatch notification accumulated count designation	8205 (200DH)
"Modem function monitor/test" screen	Remote password mismatch notification count designation	8204 (200CH)
	Remote password mismatch notification accumulated count designation	8205 (200DH)
	Accumulated count of unlock process normal completion	8955 (22FBH)
	Accumulated count of unlock process abnormal completion	8956 (22FCH)
	Accumulated count of lock process based on circuit disconnection	8959 (22FFH)

3.3.4 Compatibility with the callback function

The following describes the Q Series C24 callback function that can be used when accessing the QCPU from the GX Developer connected to the Q Series C24.

(1) About the Callback function

(a) What is the Callback function

The callback function is a function that makes it possible to access the QCPU from the GX Developer by reconnection (callback) of the line from the Q Series C24. Transmission costs after line connection from the Q Series C24 side are borne by the Q Series C24 side.

(b) Settings in order to use the callback function

The callback function can be used by setting it through the GX Configurator-SC, then registering it in the Q Series C24. (See (4).)

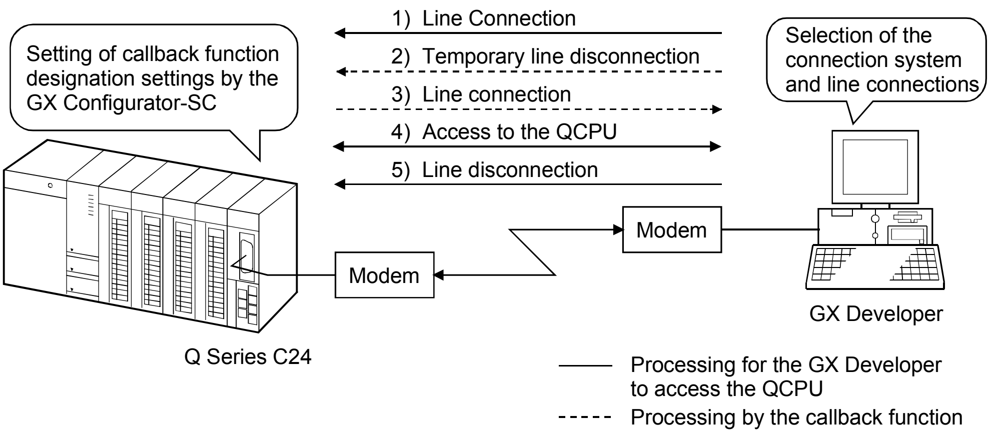
(c) Selecting the callback destination GX Developer

The GX Developer that can be called back in accordance with the settings in the Q Series C24 can be selected as shown below.

1) If the callback destination GX Developer is fixed (1 module) (Callback connection (during fixed))
Connection can be made to only the fixed GX Developer (1 module) registered in the Q Series C24.

2) If it is being made possible to change the callback destination GX Developer (Callback connection (during designated number))
It is possible to connect to the GX Developer when the callback destination telephone number (Call number) is specified.

3) If the maximum number of callback destination GX Developers is limited to 10 modules.
(Callback connection (during max. designated number is 10))
Connection is possible with only those GX Developers (max. 10 modules) with a callback destination telephone No. registered in the Q Series C24.
* A description of the callback operation in 1) to 3) is shown in (4) (b).



POINT

See Section 2.7 of the User's Manual (Basic) for Q Series C24 and GX Developer versions that are compatible with the callback function.

(2) Data communications procedure

Here, the procedure for data communications when using the callback function is shown.

(a) Q series C24 side procedure

Carry out procedure of starting the modem function and data communications in accordance with Section 3.4.1.

1) Set the callback function by the GX Configurator-SC. (See (4).)
2) Initialize the Q Series C24 side modem. (See Section 3.4.)
3) The modem's initialization completed signal (X10) goes On when modem initialization is completed.
   Wait for the line connection from the GX Developer.
   ✻ Select the connection system (connect way) from the GX Developer, then make line connection.
   ✻ When the Q Series C24 callback processing is completed normally, the line connection signal (X12) is in the ON state.

POINT

See the GX Developer's Operating Manual for details of the line connection screen from the GX Developer when using the callback function.

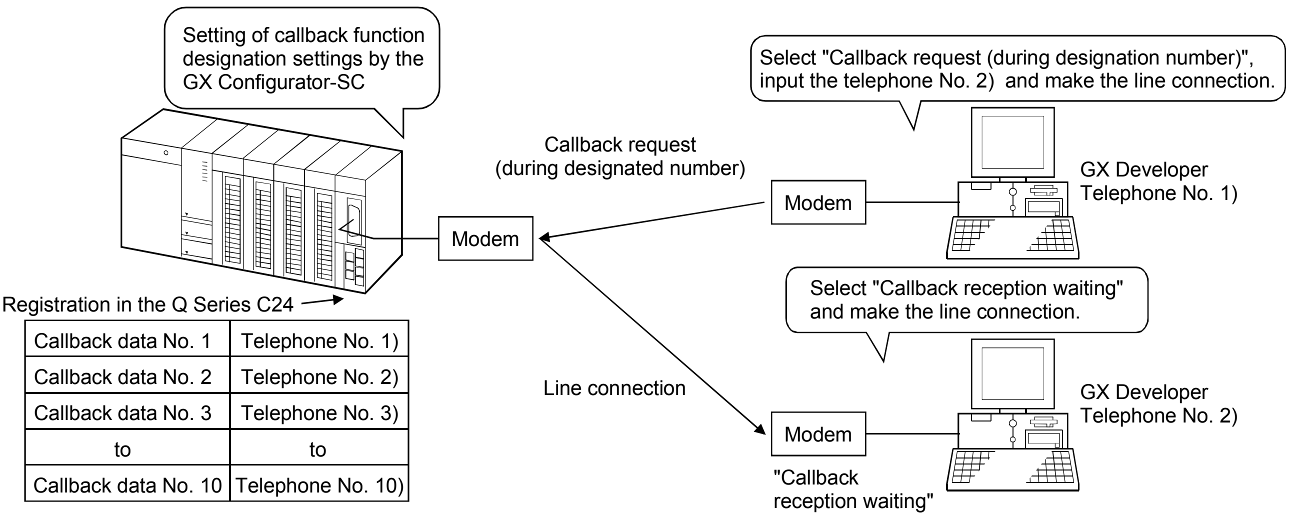
(3) Cautions during data communications

(a) Set the GX Developer side modem which the Q Series C24 is to reconnect to (callback) on "with Auto Reception. " (With Auto Reception: This setting enables line connection from the external device.)

(b) When a request is issued for a line connection from another GX Developer during a temporary line disconnection from the GX Developer side by callback processing, the Q Series C24 executes a callback operation for the latter connection request.
The Q Series C24 terminates callback processing to the GX Developer that it received a connection request from earlier.

(c) If you are making a line connection to the GX Developer by the following connection system, select "callback reception waiting" as the connection system for the GX Developer that the Q Series C24 is reconnecting to (callback) and make the connection.

• Callback request (during fixed/during designated number)
  (Example) In the case of line connections with "Callback request (during designated number)" as the connection system.



Callback data No. 1	Telephone No. 1)
Callback data No. 2	Telephone No. 2)
Callback data No. 3	Telephone No. 3)
to	to
Callback data No. 10	Telephone No. 10)

(d) If callback processing was not executed normally, an error message screen is displayed on the GX Developer side. Perform the processing operation (reconnection operation, etc.) corresponding to the displayed message.
＊ The operating state on the Q Series C24 side can be confirmed by the following items in the GX Configurator-SC monitor/test screen.

GX Configurator-SC Monitor / test screen	Monitor item	Buffer memory address	Description
X•Y monitor/test	X10: Modem initialization completion	—	Section 3.3.5
	X12: Connection in progress	—	
Modem function monitor/test	Modem function sequence status	222H	Section 3.3.6

(e) Set the settings related to the callback function in the following areas of the GX Developer.

[Starting Procedure]
GX Developer → [Tools] → [Options] → TEL

1) Line callback cancel wait time
(Setting range: 1 to 180 s. (Default: 90 s.))
This specifies the waiting time after sending a response to a callback request from the Q Series C24, until the line is disconnected from the GX Developer.
If the line is not disconnected from the GX Developer within the specified time in this area, the Q Series C24 forcibly disconnects the line, terminating callback processing.

2) Callback delay time
(Setting range: 1 to 999 s. (Default: 20 s.))
This specifies the time from the temporary line disconnect on the GX Developer side until the Q Series C24 reconnects (callback).

POINT

See the troubleshooting section of the User's Manual (Basic) for the symptoms of trouble that may occur during access from the GX Developer to the QCPU using the callback function, the causes and remedies.

(4) Setting and monitoring by the GX Configurator-SC for use of the callback function

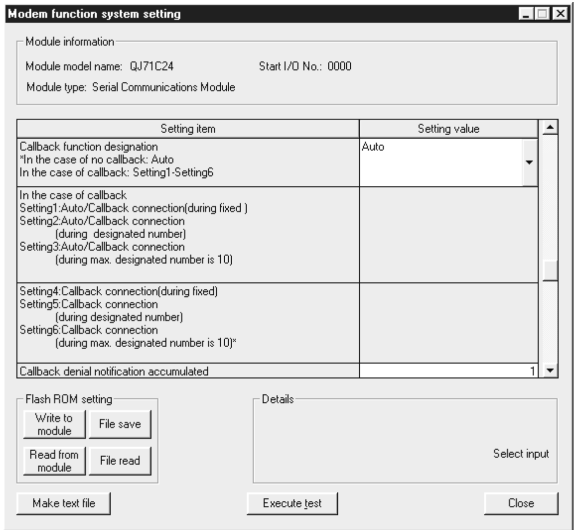
(a) Setting, monitoring / test items

Carry out setting, monitoring and testing of the callback function using the following GX Configurator-SC screen.

1) Setting items through the "modem function system setting" screen

This shows the callback function setting items.

See Section 3.3.6 for the modem function setting items, including the following items.



Setting Item	Setting value	Setting possible / impossible	Description
GX Developer connection designation	Connect	●	Be sure so specify “Connect” when using the callback function.
Callback function designation	Settings 1 to 6 (See (b).)	●	Select according to the callback operation.
Callback denial notification accumulated count designation	0 to 65535	○	Specify the accumulated count value informed to the user.
Data No. for Callback designation 1 to 10	$BB8_H$ to $801F_H$	●	Specify the connection data No. See Section 3.4.4 for setting values.

●: Must be set ○: Set as necessary

2) Monitoring / Testing through the "modem function monitor / test" screen

This shows the callback function monitoring and testing.

See Section 3.3.6 for monitoring and testing of the modem function, including the following items.

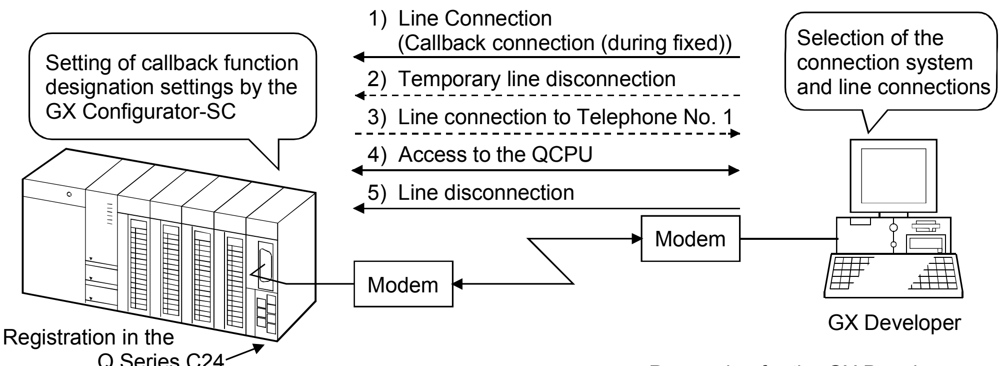
Callback function monitoring / test items	Buffer memory address
Callback permit accumulated count	8944 ($22F0_H$)
Callback denial accumulated count	8945 ($22F1_H$)
Auto (callback) connection permit accumulated count	8946 ($22F2_H$)
Auto (callback) connection denial accumulated count	8947 ($22F3_H$)
Accumulated count of callback receive procedure cancel	8948 ($22F4_H$)

(b) Callback function designation and callback operation outline
Here the setting values for "Callback function designation" items in the "Modem function system setting" screen and an outline of the corresponding Q Series C24 callback operation are explained.
* Values in parentheses are values when the set values are stored in buffer memory (Address: 2001H).
* If the connection system is set on "Auto (Callback: during fixed/Callback : during designated number)" and line connection is executed, (Setting 1 to Setting 3) are explained in 5).

Function	Setting values for "Callback function designation" items.	
	If you desire to set the connection system on "auto" and carry out line connection.	If you set the connection system on "auto" and do not carry out line connection.
1) If the callback function is not used.	Auto (0H)	—
2) If the callback destination GX Developer is fixed (1 module) (Callback connection (during fixed))	Setting 1 (9H)	Setting 4 (1H)
3) If it is being made possible to change the callback destination GX Developer (Callback connection (during designated number))	Setting 2 (BH)	Setting 5 (3H)
4) If the maximum number of callback destination GX Developers is limited to 10 modules. (Callback connection (during max. designated number is 10)	Setting 3 (FH)	Setting 6 (7H)

1) If the callback function is not used (Auto (0H): (Default Value)
   • Select this if the callback function is not being used.
   • Data communications becomes possible after line connection from the GX Developer.
2) If the callback destination GX Developer is fixed (1 module)
   (Setting 1 (9H) or setting 4 (1H))
   • Select this if the Q Series C24 fixes the telephone No. (1 module) of the GX Developer side that is being called back.
   • The Q Series C24 executes callback to the GX Developer side using connection data set in the following data No. 1 for callback, shown below. At this time, the external line dialing, line types and telephone number in the connection data become valid.
   • Set callback data number 1 in the "Modem function system settings" screen.

   (Example) If line connections are being made with "Callback connection (during fixed)" as the connection system



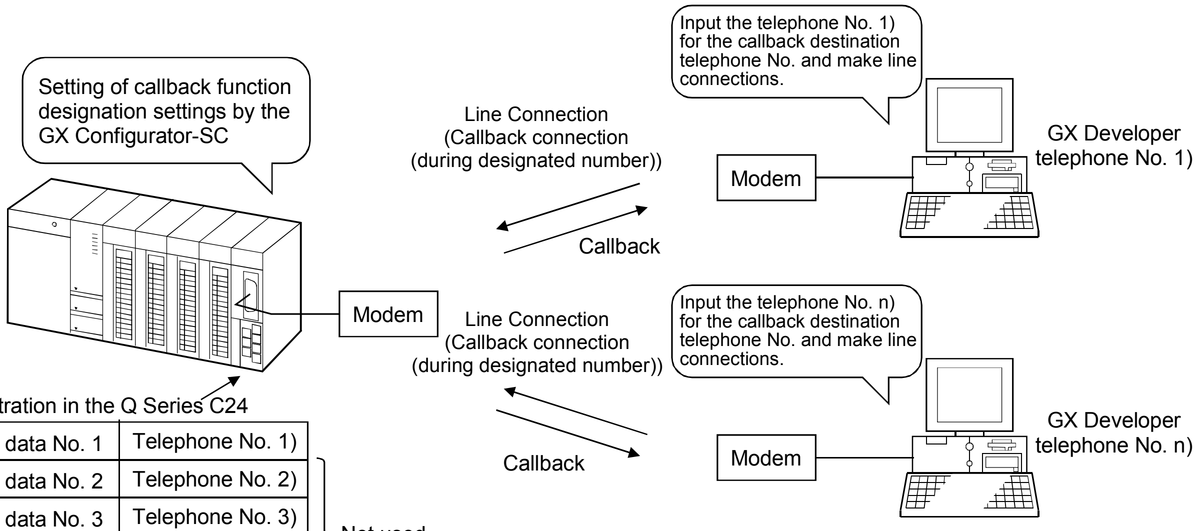
Callback data No. 1	Telephone No. 1)	
Callback data No. 2	Telephone No. 2)	Not used
Callback data No. 3	Telephone No. 3)	
to	to	
Callback data No. 10	Telephone No. 10)	

3) If it is being made possible to change the callback destination GX Developer

(Setting 2 (BH) or Setting 5 (3H))

- Select the callback destination telephone No. if it is being specified at the time when line connections are being made from the initial GX Developer side.
- The Q Series C24 calls back the GX Developer with the callback destination telephone No. received from the GX Developer side.
  At this time, the external line dialing, line types and the connection data set in the following callback data No. 1 are used.
- If the callback destination is not specified when line connections are made from the initial GX Developer side, the connection data set in the following callback data No. 1 are used to call back the GX Developer side.
  At this time, the external line dialing, line types and telephone number in the connection data become valid.
- Set callback data No. 1 in the "Modem function system setting" screen.

(Example) If line connections are being made with "Callback connection (during designated number)" as the connection system



Callback data No. 1	Telephone No. 1)
Callback data No. 2	Telephone No. 2)
Callback data No. 3	Telephone No. 3)
to	to
Callback data No. 10	Telephone No. 10)

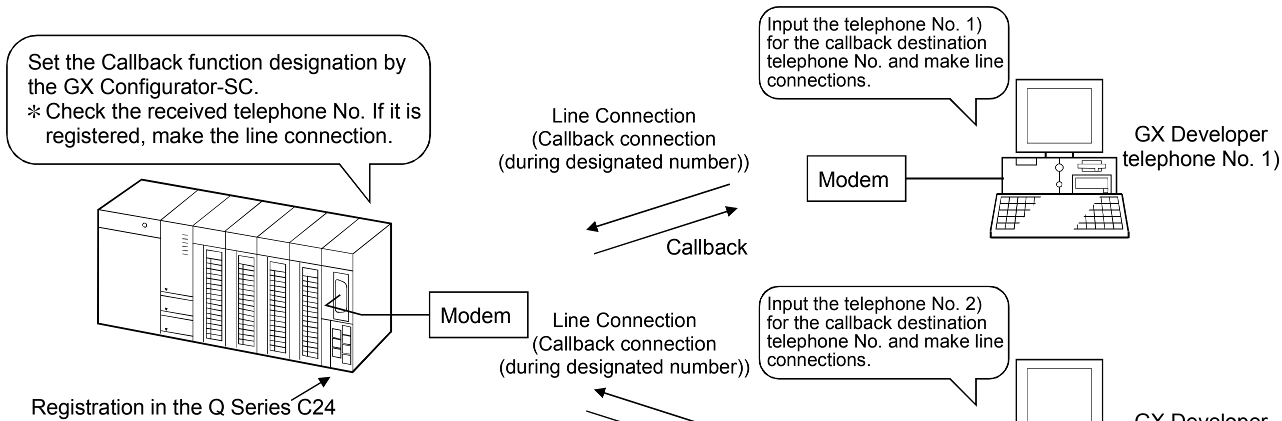
Not used

4) If the maximum number of callback destination GX Developer is limited to 10 modules.

(Setting 3 (F_H) or Setting 6 (7_H))

- Select the GX Developer to be called back if the Q Series C24 limits the callback destination to a maximum of 10 modules.
- Specify the callback destination telephone No. when making line connection from the initial GX Developer side.
- If the Q Series C24 checks the callback destination telephone No. received from the GX Developer side and it is a telephone No. that is registered in the Q Series C24, callback is executed.
  If a telephone No. that is not registered in the Q Series C24 is received from the GX Developer side, the Q Series C24 disconnects the line and does not execute callback.
- Data for checking the callback destination telephone No. by the Q Series C24 are registered in callback Data No. 1 to 10.
  Set the data registered in callback data No. 1 to 10 in the "Modem function system setting" screen.

(Example) If line connections are being made with "Callback connection (during designated number)" as the connection system



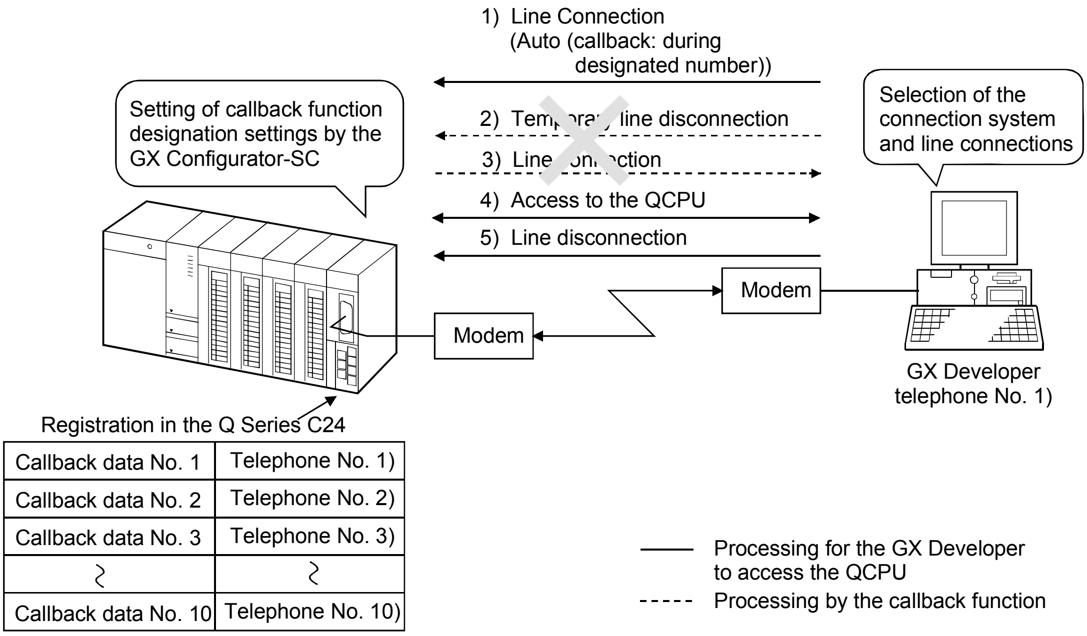
Callback data No. 1	Telephone No. 1)
Callback data No. 2	Telephone No. 2)
Callback data No. 3	Telephone No. 3)
to	to
Callback data No. 10	Telephone No. 10)

5) If line connections from the GX Developer are made with "Auto (Callback: during fixed/Callback: during designated number)" as the connection system

(Setting 1 (9H) to Setting 3 (FH))

- When accessing the QCPU from the GX Developer, select whether to use the callback function to make line connections or to make line connections without using the callback function.
- If the following is selected for the GX Developer connection system and line connections made, it is possible to access the QCPU from the GX Developer by that method only on that occasion.
  - ● Auto (Callback: during fixed)
  - ● Auto (Callback: during designated number)
  - ✻ The procedure is the same as when accessing the QCPU by selecting "Auto" for the connection system and making line connections.
- If line connections are made with the callback destination GX Developer limited to a maximum of 10 modules set, (setting 3 (FH)), select "Auto (Callback : during designated number)" as the connection system and specify the telephone No.
  The Q Series C24 checks the telephone No. received from the GX Developer side and if it is registered in the Q Series C24, the line connection status is held and it becomes possible to access the QCPU from the GX Developer.
  If a telephone No. is received from the GX Developer that is not registered in the Q Series C24, the Q Series C24 disconnects the line.
- Data for checking the callback destination telephone No. by the Q Series C24 are registered in callback Data No. 1 to 10.
  Set the data registered in callback data No. 1 to 10 in the "Modem function system setting" screen.

(Example) If line connections are being made with "Auto (Callback: during designated number)" as the connection system



Callback data No. 1	Telephone No. 1)
Callback data No. 2	Telephone No. 2)
Callback data No. 3	Telephone No. 3)
≀	≀
Callback data No. 10	Telephone No. 10)

REMARK

If the GX Configurator-SC's "Callback function designation" setting is performed in the Q Series C24, line connections to the GX Developer are possible by the connection system shown below.
The correspondence between the GX Configurator-SC "Callback function designation" setting items and the GX Developer connection system setting items is shown.

GX Developer connection system (＊1) / Q Series C24 Side Callback function specification	1)	2)	3)	4)	5)	6)	7)	8)	9)
Auto	○								○
Setting 1: Auto/Callback connection (during fixed)		○		○		○		○	
Setting 2: Auto/Callback connection (during designated number)		○	○	○	○	○	○	○	
Setting 3: Auto/Callback connection (during max. designated number is 10)			○		○		○	○	
Setting 4: Callback connection (during fixed)				○		○		○	
Setting 5: Callback connection (during designated number)				○	○	○	○	○	
Setting 6: Callback connection (during max. designated number is 10)					○		○	○	

○: Connection possible

＊1 This shows the GX Developer connection system. See the GX Developer Operating Manual for details about line connection from the GX Developer.

1) Auto
2) Auto (callback: during fixed)
3) Auto (callback: during designated number)
4) Callback connection (during fixed)
5) Callback connection (during designated number)
6) Callbak request (during fixed)
7) Callbak request (during designated number)
8) Callback reception waiting
9) Manual

3.3.5 I/O signals with the PLC CPU

The I/O signals with the PLC CPU for the modem function are described. See Section 3.8 of User's Manual (Basic) for the I/O signals not related to the modem function.

(1) I/O signal list

Device number	Signal description	Device number	Signal description
X0	CH1 Transmission normal completion ON: Normal completion	Y0	CH1 Transmission request ON: Requesting transmission
X1	CH1 Transmission abnormal completion ON: Abnormal completion	Y1	CH1 Reception data read completion ON: Data read completed
X2	CH1 Transmission processing ON: Transmission in progress	Y2	CH1 Mode switching request ON: Requesting switch
X3	CH1 Reception data read request ON: Requesting read	Y3	(Use prohibited)
X4	CH1 Reception abnormal detection ON: Abnormal detection	Y4	
X5	(For system)	Y5	
X6	CH1 Mode switching ON: Switching	Y6	
X7	CH2 Transmission normal completion ON: Normal completion	Y7	CH2 Transmission request ON: Requesting transmission
X8	CH2 Transmission abnormal completion ON: Abnormal completion	Y8	CH2 Reception data read completion ON: Data read completed
X9	CH2 Transmission processing ON: Transmission in progress	Y9	CH2 Mode switching request ON: Requesting switch
XA	CH2 Reception data read request ON: Requesting read	YA	(Use prohibited)
XB	CH2 Abnormal reception detection ON: Abnormal detection	YB	
XC	(For system)	YC	
XD	CH2 Mode switching ON: Switching	YD	
XE	CH1 ERR occurrence ON: Error occurring	YE	CH1 ERR. information clear request ON: Requesting error clear
XF	CH2 ERR occurrence ON: Error occurring	YF	CH2 ERR. information clear request ON: Requesting error clear
X10 *1	Modem initialization completion ON: Initialization completed	Y10 *1	Modem initialization request (standby request) ON: Requesting initialization
X11 *1	Dialing ON: Dial in progress	Y11 *1	Connection request ON: Requesting connection
X12 *1	Connection ON: Connection in progress	Y12 *1	Modem disconnection request ON: Requesting disconnection
X13 *1	Initialization/connection abnormal completion ON: Initialization/connection abnormal completed	Y13	(Use prohibited)
X14 *1	Modem disconnection completion ON: Disconnection completed	Y14 *1	Notification-issued request OFF: Requesting notification issuance
X15 *1	Notification normal completion ON: Normal completion	Y15	(Use prohibited)
X16 *1	Notification abnormal completion ON: Abnormal completion	Y16	
X17	Flash ROM read completion ON: Completed	Y17	Flash ROM read request ON: Requesting
X18	Flash ROM write completion ON: Completed	Y18	Flash ROM write request ON: Requesting
X19	Flash ROM system setting write completion ON: Completed	Y19	Flash ROM system setting write request ON: Requesting
X1A	CH1 Global signal ON: Output directed	Y1A	(Use prohibited)
X1B	CH2 Global signal ON: Output directed	Y1B	
X1C	System setting default completion ON: Completed	Y1C	System setting default request ON: Requesting
X1D	(For system)	Y1D	(Use prohibited)
X1E	Q series C24 ready ON: Accessible	Y1E	
X1F	Watchdog timer error (WDT error) ON: Module error occurred OFF: Module being normally operated	Y1F	

The signals shown with [shaded] are the I/O signals for the modem function.

*1 QJ71C24N-R4 cannot be used. (Related to modem function signal.)
- X10 to X16: For system
- Y10 to Y16: Not usable

IMPORTANT

(1) Of the input/output signals to the PLC CPU, the signals marked with "Use prohibited" must not be output (ON).
If any of the "Use prohibited" signals is output, the PLC system may malfunction.

(2) When the modem function is not used or the QJ71C24N-R4 is used, X10 to X16 are used for the system and Y10 to Y16 cannot be used.

(2) Function and description of each I/O signal

I/O signal	Signal name	Function/description	Description
X10	Modem initialization completion	Indicates normal completion of the Q series C24's initialization of the modem/TA connected to itself according to the initialization data designated.	Section 3.4.5
X11	Dial in progress	Indicates that the Q series C24 is dialing (connection processing) the partner side according to the data for connection designated.	
X12	Connection in progress	1) Indicates normal completion of the line-connection processing from or to the partner side. 2) When this signal is on, data communication with the destination is possible (notification is not possible).	Section 3.4.6
X13	Initialization/ connection abnormal completion	1) Indicates abnormal completion of the modem/TA initialization or line connection processing (dialing) to the destination. 2) Check the cause of the abnormal completion in the modem-error code storage area (address: 221_H) and remove the cause.	Section 3.4.5
X14	Modem disconnection completion	Indicates that the line for data communication with the destination has been disconnected.	Section 3.4.8
X15	Notification normal completion	Indicates the normal completion when performing the notification processing to the destination.	
X16	Notification abnormal completion	1) Indicates abnormal completion when the notification processing is performed with the destination. 2) Check the cause of the abnormal completion in the modem error code storage area (address: 221_H) and remove the cause.	Section 3.4.7
Y10	Modem initialization request (standby request)	1) Indicates the initialization request to the modem connected to the local station Q series C24. 2) Turn on the initialization-request signal after designating the initialization data to the buffer memory when it is not set with GX Configurator-SC.	Section 3.4.5
Y11	Connection request	1) Indicates the connection request (dialing) to enable data communication with the destination. 2) Turn on the connection request signal after designating the data for connection to the buffer memory when it is not set with GX Configurator-SC. 3) If the modem/TA connected to the local station is not initialized, the Q series C24-side modem is initialized as well prior to dialing, according to the initialization data designated.	Section 3.4.6
Y12	Modem disconnection request	Indicates a line-disconnection request from the partner side upon completion of data communication.	Section 3.4.8
Y14	Notification-issued request	1) Indicates the notification request to the partner side. 2) Turns on before completing the Q series C24-side modem/TA initialization is complete. 3) Turns off the notification-issued request signal after designating the data for connection in the buffer memory when it is not set with GX Configurator-SC.	Section 3.4.7

POINT

In the descriptions hereafter, I/O signal numbers between QCPU and Q series C24 are indicated assuming that the Q series C24 is installed to slot 0 of the basic base unit.

3.3.6 Buffer memory

The buffer memory (area shown with) that can be used with modem function is described.
See Section 3.9 for the buffer memory not related to the modem function.

POINT

The writing and reading of setting values to and from the buffer memory are performed using the special utility package ("GX Configurator-SC") of the Q series C24.
Perform settings and monitoring according to Chapter 8 of the User's Manual (Basic). This section provides supplementary explanations on setting values used to perform settings and monitoring with GX Configurator-SC.

(1) Buffer memory list

Address Dec. (Hex.)		Application	Name	Default value	Correspondence protocol		
CH1	CH2				MC	Non	Bi
0 (0_H)		For LED and communication error clear	Communication error clear request for CH1 and to turn LED off	0	RW		
1 (1_H)			Communication error clear request for CH2 and to turn LED off				
2 (2_H)		For Flash ROM access	Register/read/delete directions	0	RW		—
3 (3_H)			Frame No. direction				
4 (4_H)			Register/read/delete result storage				
5 (5_H)			Number of data bytes registration designation				
6 to 45 (6_H to $2D_H$)			User frame				
46 ($2E_H$)		For modem functions designation-1	Modem connection channel directions 0: None 1: CH1 2: CH2	0	RW		
47 ($2F_H$)			Notification execution designation 0: Does not execute 1: Execute				
48 (30_H)			Number of connection retries designation 1 to 5: Number of retries	3			
49 (31_H)			Connection retry interval designation 90 to 300: Connection retry interval (unit: s)	180			
50 (32_H)			Initialization/connection timeout designation 1 to 60: Time out (unit: s)	60			
51 (33_H)			Number of initialization retries designation 1 to 5: Number of retries	3			
52 (34_H)			Data number for initialization designation 0_H : Sends initialization data designated by the transmission user frame designation area $7D0_H$ to $801F_H$: Data No. for initialization	$7D0_H$ (2000)			
53 (35_H)			Data number for connection designation $BB8_H$ to $801F_H$: Data number for connection	0			
54 (36_H)			GX Developer connection designation 0: Does not connect 1: Connects				
55 (37_H)			No-communication interval time designation 0 : Waits infinitely 1 to 120: Non-communication interval time (Line disconnection wait time) (Unit: min)	30			
56 (38_H)			RS · CS control yes/no designation 0: Does not control 1: Controls	1			

Address Dec. (Hex.) CH1	Address Dec. (Hex.) CH2	Application	Name	Default value	Correspondence protocol MC	Correspondence protocol Non	Correspondence protocol Bi
57 to 143 (39$_H$ to 8F$_H$)		Use prohibited	System area				
144 (90$_H$)	304 (130$_H$)	For modem switching	Switching mode number designation	0	RW		
145 (91$_H$)	305 (131$_H$)		Transmission specification designation after switching				
146 (92$_H$)	306 (132$_H$)	Signal setting (＊1)	RS and DTR signal status designation	0005$_H$	RW		
⋮							
183 (B7$_H$)	343 (157$_H$)	Transmission user frame	CR/LF output designation	0	—	RW	—
184 (B8$_H$)	344 (158$_H$)		Output head pointer designation				
185 (B9$_H$)	345 (159$_H$)		Output count designation				
186 to 285 (BA$_H$ to 11D$_H$)	346 to 445 (15A$_H$ to 1BD$_H$)		Transmission frame No. designation (A maximum of 100 frames can be designated.)				
544 (220$_H$)		Flash ROM	Flash ROM system parameters write result	0	RW		
545 (221$_H$)		For modem function confirmation	Modem function error code 0 : Normal completion 1 or more: Abnormal completion (error code)	0	R		
546 (222$_H$)			Modem function sequence status 0: Idle status 1: Waiting for initialization 2: Initializing modem 3: Standby in progress 4: Checking password 5: Communication in progress 6: Notification in progress 7: Modem disconnection 8: Callback Request reception waiting 9: Callback Modem disconnect waiting 10: Callback Delay time waiting 11: Callback Reconnecting 12: Callback Rechecking password				
547 (223$_H$)			Number of data registrations for connection 0: No registration 1 or more: Number of registration				
548 to 549 (224$_H$ to 225$_H$)			Data registration status for connection (for conformation of registration No.) 0: No registration 1: Registered ＊ Bits for registration number are 0 (ON)/1 (OFF) Registration number BB8$_H$ (3000): Address 224$_H$ (b0) to Registration number BD5$_H$ (3029): Address 225$_H$ (b13)				
550 (226$_H$)			Number of data registrations for initialization 0: No registration 1 or more: Number of registration				
551 to 552 (227$_H$ to 228$_H$)			Data registration status for initialization 0: No registration 1: Registered ＊ Bits for registration number are 0 (ON)/1 (OFF) Registration number 9C4$_H$ (2500): Address 227$_H$ (b0) to Registration number 9E1$_H$ (2529): Address 228$_H$ (b13)				
553 (229$_H$)		Notification status confirmation	Number of notification executions 0: Not executed 1 or more: Number of executions	0	R		
554 (22A$_H$)			Data storage area 1: Notification execution data number 0 : No notification execution BB8$_H$ or more: Notification executed (Notification executions number)		R		
555 to 557 (22B$_H$ to 22D$_H$)			Data storage area 1: System area (Use prohibited)		—		
:			:	0			
570 (23A$_H$)			Data storage area 5: Notification execution data number 0 : No notification execution BB8$_H$ or more: Notification executed (Notification execution number)	0	R		
571 to 573 (23B$_H$ to 23D$_H$)			Data storage area 5: System area (Use prohibited)		—		
574 to 591 (23E$_H$ to 24F$_H$)		Use prohibited	System area				
⋮							
3072 to 6911 (C00$_H$ to 1AFF$_H$)		For user	User free area (3840 words) ＊ Application is determined by the user.	0	RW		

Address Dec. (Hex.) CH1	CH2	Application	Name	Default value	Correspondence protocol MC	Non	Bi
6912 to 6952 (1B00$_H$ to 1B28$_H$) (For registration No. 8001$_H$) : : 8142 to 8182 (1FCE$_H$ to 1FF6$_H$) (For registration No. 801F$_H$)		For user registration	User registration area (Registration No. 8001$_H$ to 801F$_H$) The user registration area has the following combined uses, with data written by the user according to the purpose of use by the TO instruction, etc. See each explanation item concerning the configuration of each area, the data written, etc. 1) If data communications is being carried out by user registration frame. • User registration frame (See Chapter 9) 2) If data communications is being carried out by the modem function. • Initialization Data (See Section 3.4.3) • Connection Data (See Section 3.4.4)	0	RW	RW	—
8183 to 8191 (1FF7$_H$ to 1FFF$_H$)		Use prohibited	System area				
8192 (2000$_H$)		System designation	Flash ROM writing allow/prohibit designation 0: Write prohibited 1: Write allowed	0	RW	RW	RW
8193 (2001$_H$)		For callback function	Callback function designation 0$_H$: Auto 1$_H$: Callback connection (during fixed)··········(Setting 4) 3$_H$: Callback connection (during designated number)··········(Setting 5) 7$_H$: Callback connection (during max. designated number is 10)····(Setting 6) 9$_H$: Auto/Callback connection (during fixed)··········(Setting 1) B$_H$: Auto/Callback connection (during designated number)··········(Setting 2) F$_H$: Auto/Callback connection (during max. designated number is 10)··········(Setting 3)	0	RW	RW	—
8194 (2002$_H$)		For callback function	Callback denial notification accumulated count designation 0$_H$: Not specified 1$_H$ to FFFF$_H$: Notification accumulated number count	1	RW	RW	—
8195 to 8198 (2003$_H$ to 2006$_H$)		Use prohibited	System area				
3199 (2007$_H$)		For modem function designation-2	Auto modem initialization specification 0: No auto initialization 1: Auto initialization	0	RW	RW	RW
8200 (2008$_H$)		For modem function designation-2	Modem initialization time DR (DSR) signal valid/invalid designation 0: DR signal is not ignored. 1: DR signal is ignored.	1	RW	RW	RW
8201 (2009$_H$)		For modem function designation-2	Complete signal handling designation for modem function 0: Does not turn ON/OFF from X13 to X16 1: Turns ON/OFF from X13 to X16	1	RW	RW	RW
8202 (200A$_H$)		For modem function designation-2	Wait time of notification designation 0$_H$: No waiting time 1$_H$ to FFFF$_H$: Wait time of notification (Notification interval time) (Unit: s)	10	RW	RW	RW
8203 (200B$_H$)		Use prohibited	System area				
8204 (200C$_H$)		For remote password function	Remote password mismatch notification count designation 0$_H$: No designation 1$_H$ to FFFF$_H$: Count for notification	0	RW	—	—
8205 (200D$_H$)		For remote password function	Remote password mismatch notification accumulated count designation 0$_H$: No designation 1$_H$ to FFFF$_H$: Accumulated count for notification	1	RW	—	—
8206 (200E$_H$)		For modem function designation - 3	Circuit disconnect wait time (PLC CPU watch use) 0000$_H$ to FFF$_H$: Wait time (Unit: s)	0	RW	RW	—

Address Dec. (Hex.) CH1	Address Dec. (Hex.) CH2	Application	Name	Default value	Correspondence protocol MC	Non	Bi
8207 (200FH)		Use prohibited	System area				
⋮							
8449 to 8458 (2101H to 210AH)		For callback Function	Data No. for callback designation 1 to 10 BB8H to 801FH: Data number for callback	0	RW	—	
⋮							
8944 (22F0H)		For callback function	Callback permit accumulated count 0 or more : Accumulated count	0	RW	—	
8945 (22F1H)		For callback function	Callback denial accumulated count 0 or more : Accumulated count	0	RW	—	
8946 (22F2H)		For callback function	Auto (callback) connection permit accumulated count 0 or more : Accumulated count	0	RW	—	
8947 (22F3H)		For callback function	Auto (callback) connection denial accumulated count 0 or more : Accumulated count	0	RW	—	
8978 (22F4H)		For callback function	Accumulated count of callback receive procedure cancel 0 or more : Accumulated count	0	RW	—	
8949 to 8954 (22F5H to 22FAH)		Use prohibited	System area				
8955 (22FBH)		For remote password function	Accumulated count of unlock process normal completion 0 or greater: Accumulated count of normal completion	0	RW	—	
8956 (22FCH)		For remote password function	Accumulated count of unlock process abnormal completion 0 or greater: Accumulated count of abnormal completion	0	RW	—	
8957 to 8958 (22FDH to 22FEH)		Use prohibited	System area				
8959 (22FFH)		For remote password function	Accumulated count of lock process based on circuit line disconnection 0 or greater: Accumulated count of lock process based on circuit line disconnection	0	RW	—	
9216 (2400H)		Use prohibited	System area				
⋮							
9728 to 16383 (2600H to 3FFFH)		For user (＊1)	User free area 2 (6656 words) (Communication data monitoring function default buffer) ＊ Usage is determined by the user.	0	RW		

＊1 Only QJ71C24N (-R2/R4) is usable. (System area when using QJ71C24 (-R2))

IMPORTANT

Do not write data in the system area of the buffer memory.
If data is written in the system area, the PLC system may operate abnormally.
There is also a partial system area in the user's area. Be careful when reading and writing from and to the buffer memory.

POINT

The writing and reading of setting values to and from the buffer memory are performed using the special utility package (GX Configurator-SC) of the Q series C24.
Perform settings and monitoring according to Chapter 8 of the User's Manual (Basic). This section provides supplementary explanations on setting values used to perform settings and monitoring with GX Configurator-SC.

(2) Details of the buffer memory (for modern function)

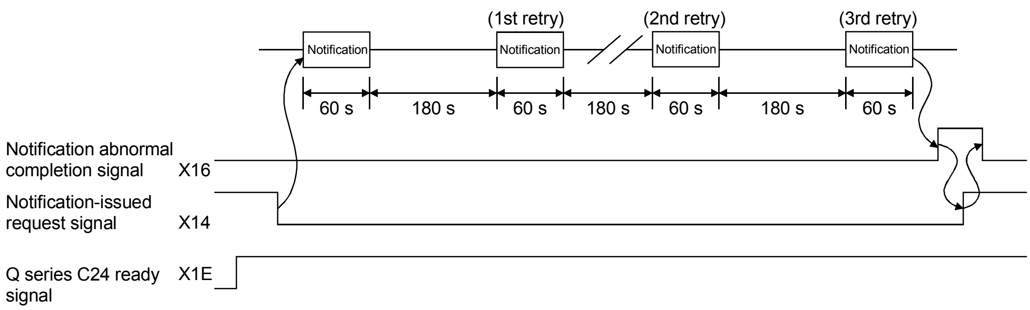
(a) Modem connection channel designation area (address 46 (2EH))
The interface on the Q series C24 side to which a modem/TA is connected is designated.

(b) Notification execution designation area (address 47 (2FH))
Whether or not to perform notification (message transmission) to the pager receiver during the fall of the notification-issued request signal Y14 is designated.

(c) Number of connection retries designation area (address 48 (30H))
1) Designates the number of retries for the notification/connection request when the connection could not be made to the partner device by the notification request/connection request.
2) The default value is recommended to use for the number of connection retries.

(d) Connection retry interval designation area (address 49 (31H))
1) Designates the interval time of the retry processing for the notification/connection request when the connection could not be made to the partner device by the notification request/connection request.
2) The default value is recommended to use for the connection retry interval.

(e) Initialization/connection timeout time designation area (address 50 (32H))
1) The following wait times are designated.
• Wait time until the modem/TA initialization is complete.
• Wait time per wait when the connection could not be made to the destination by the notification/connection request.
2) The default value is recommended to use for the initialization/connection retry timeout.
＊ Shown below is the relationship of the number of connection retries designation, connection retry interval designation and the time for initialization/connection timeout time designation used for the notification/connection request to the partner device.
• Number of connection retries : 3 times
• Connection retry interval : 180 s
• Initialization/connection retry timeout: 60 s



(f) Number of initialization retries designation area (address 51 (33H))
The number of retries when the initialization per the initialization request to the modem on to the Q series C24 side has failed.

(g) Data number for initialization designation area (address 52 (34H))

1) The registration number for the initialization data transmitted with the initialization request to the modem on the Q series C24 side is designated. The registration number for the Q series C24 is used.
2) For details on the designation using GX Configurator-SC, see Section 8.4.4 of the User's Manual (Basic). An example of designations using the program is shown in Section 3.4.5.

(h) Data number for connection designation area (address 53 (35H))

1) Designates the registration number of the data for connection used by the Q series C24 for the connection processing to the partner device in order to perform data communication/notification.
The registration number for the Q series C24 is used.
2) For details on the designation using GX Configurator-SC, see Section 8.4.4 of the User's Manual (Basic). An example of designations using the program is shown in Section 3.4.6.

(i) GX Developer connection designation area (address 54 (36H))

1) Whether to access the PLC from GX Developer by connecting the Q series C24 and GX Developer using the Q series C24 modem function is designated.
2) When connecting the Q series C24 and GX Developer using the Q series C24 modem function, select "personal computer-side interface = via telephone line connection (Q/A6TEL, C24) ". (When connecting direct shown in Section 3.2.3).
When this GX Developer designation is performed, designate "1" in this area on the Q series C24 side.

(j) No-communication interval time designation area (address 55 (37H))

1) Designates the wait time until the line is closed when the data communication has ceased with the destination device after the line connection.
2) The Q series C24 automatically performs the line disconnection processing when no data communication is performed with the destination device for a designated time.
(The connection in progress signals (X12) and initialization complete signals (X10) turn off.)

(k) RS · CS control yes/no designation area (address 56 (38H))

1) Designates whether to use the RS · CS signals for controls to notify local station-side data reception capability to the partner side during data transmission between the Q series C24 and modem/TA.
2) This setting is for the interface designated by the modem connection channel indicated in (a).
The control of the other interface that does not use the modem function is performed by the settings in the buffer memory DTR/DSR and DC control designation area (address: 93H/133H).

REMARK

The overview of the RS · CS controls are described.

(1) When transmission data
1) The Q series C24 detects the modem/TA data reception capability from on/off of the CS signal.
2) When the CS signal is on, data transmission from the Q series C24 starts or continues.
When the CS signal is off, data transmission from the Q series C24 is interrupted.

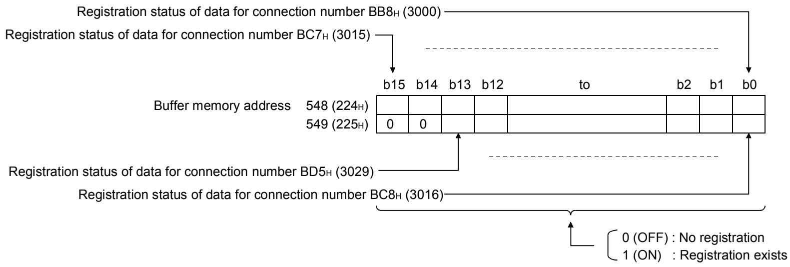
(2) When reception data
1) The Q series C24 side reception capability is notified to the modem/TA by the on/off of the RS signal.
2) When the RS signal is on, the Q series C24 can receive data.
Start/continue data transmission from the modem/TA to the Q series C24.
When the RS signal is off, the Q series C24 cannot receive data.
Cancel data transmission from the modem/TA to the Q series C24.
3) The on/off of the RS signal is controlled by the following conditions of the Q series C24:
• ON → OFF control of the RS signal
Performed when the OS area for reception data storage in the Q series C24 becomes 64 bytes (default) or less.
• OFF → ON control of the RS signal
Performed when the OS area for reception data storage in the Q series C24 becomes 263 bytes (default) or more.

(l) Modem function error code storage area (address 545 (221H))
1) Stores the error code when an error occurs during the modem function or abnormal signal (such as the initialization/connection abnormal completion signal X13) turns on.
2) See Section 10.2 of User's Manual (Basic) for the error codes.

(m) Modem function sequence status storage area (address 546 (222H))
1) The current status during use of the modem function is stored as a number.
2) See Section 3.4.1 for storage values for the modem function sequence status when using the modem.

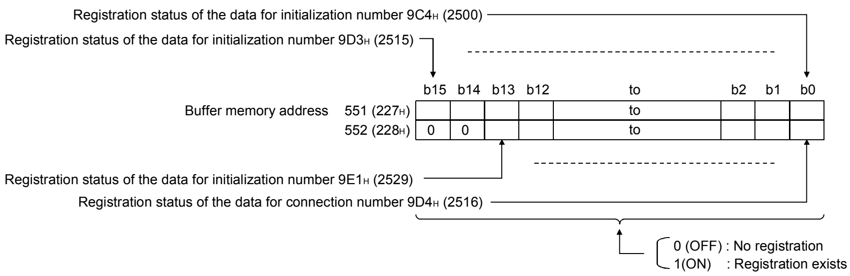
(n) Number of data registrations for connection storage area (address 547 (223H))
1) Stores in Flash ROM the number of registered data for connection used by the Q series C24 for the connection processing with the partner device in order to perform data communication/notification.
The number of registrations is the number of data for connection registered to the Flash ROM by the user.
2) The registration of data for connection is described in Section 3.4.4.

(o) Data registration status for connection storage area (address 548 to 549 (224H to 225H))
1) Stores in Flash ROM registration status of data for connection used by the Q series C24 in the connection processing with the partner device in order to perform data communication/notification.
2) The registration status of each data for connection with registration numbers of No.BB8H to BD5H (3000 to 3029) is indicated in the corresponding bit in the range shown in the figure below.



(p) Number of data registrations for initialization storage area (address 550 (226H))
1) Stores in Flash ROM the number of data registrations for initialization, sent to the modem on the Q series C24 side with the initialization request.
The number of registrations indicates the number of data for initialization registered to the Flash ROM by the user.

(q) Data registration status for initialization storage area (address 551 to 552 (227H to 228H))
1) Stores in Flash ROM registration status for initialization of data for initialization transmitted with the initialization request to the modem on the Q series C24 side.
2) The registration status of each data for initialization with registration numbers of No.9C4H to 9E1H (2500 to 2529) is indicated in the corresponding bit in the range shown in the figure below.
3) The registration of data for initialization is described in Section 3.4.3.



(r) Number of notification execution storage area (address 553 (229H))
1) Stores the number of execution of the Q series C24 notification (message transmission) processing for the pager receiver.
2) The storage value when the number of notification execution exceeds 32767 remains at 32767.
3) The value for this area can be changed by the user in the range of 0 to 32767.
When the storage value is changed by the user, the number of execution is stored according to the changed value.

(s) For notification execution data storage: Notification execution data number storage area (address 554, 558... (22AH, 22EH...))
1) Stores the registration number of the data for connection used in the Q series C24 notification (message transmission) processing to the pager receiver as log information.
2) The latest five data is stored in order at the corresponding areas (data 1, data 2, ...). (The latest information is stored in the data 1 notification execution data number storage area.)
The old notification execution data number other than the latest five are deleted in order.

	b15 to b0
Buffer memory address 554(22AH)	0H, BB8H to BD5H, 8001H to 801FH (Data 1)
⋮	⋮
570(23AH)	0H, BB8H to BD5H, 8001H to 801FH (Data 1)

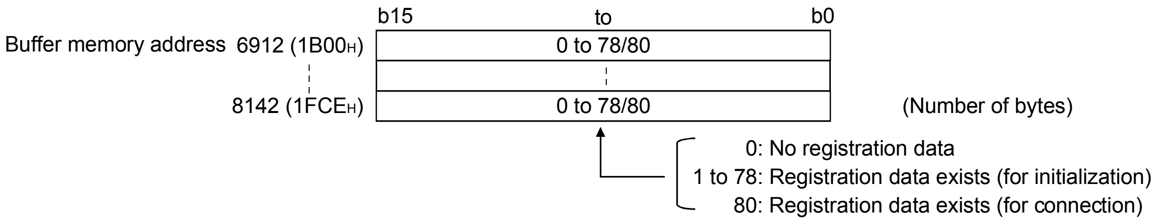
0: Notification not executed
BB8H or more: Notification executed (execution number)
＊ BB8H to BD5H (3000 to 3029)

(t) For user registration frame registration: Number of bytes in registration data designation area (address 6912, 6953... (1B00H, 1B29H...))
1) The initialization data or data for connection can be stored into the buffer memory as well as the Q series C24's Flash ROM.

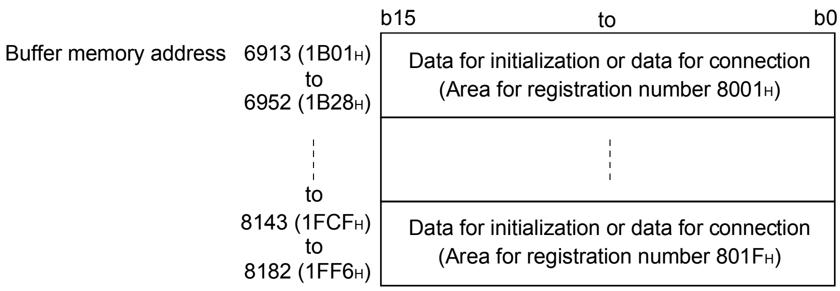
Data type	Registration destination		Registration number (Decimal (Hex.))
Initialization data	Flash ROM	Data registered by the OS	2000 to 2013 (7D0H to 7DDH)
		User-registered data	2500 to 2529 (9C4H to 9E1H)
	Buffer memory	(All registered by user)	–32767 to –32737 (8001H to 801FH)
Data for connection	Flash ROM	(All registered by user)	3000 to 3029 (BB8H to BD5H)
	Buffer memory	(All registered by user)	–32767 to –32737 (8001H to 801FH)

＊ A registration number for the initialization data or data for connection to the buffer memory is in the range of -32767 to 32737 (8001H to 801FH), and determined by the used area.

2) In this area, the number of bytes for the initialization data or data for connection (for 1 data) to be registered to the buffer memory is designated.
3) The registration of data for initialization is described in Section 3.4.3. The registration of data for connection is described in Section 3.4.4.



(u) For user frame registration: User frame designation area (address 6913 to 6952, 6954 to 6993... (1B01H to 1B28H, 1B2AH to 1B51H...))
1) When registering the initialization data or data for connection to the buffer memory, the number of registration data bytes (for 1 data) is designated.
2) The registration of data for initialization is described in Section 3.4.3. The registration of data for connection is described in Section 3.4.4.



(v) Auto modem initialization designation area (Address 8199 (2007H)
1) This designates whether the Q Series C24 side modem is initialized automatically or not.
2) Registration of this area is done through the GX Configurator-SC. The modem is initialized automatically when the Q Series C24 starts up after the QCPU restarts.

(w) DR (DSR) signal valid/invalid designation area during modem initialization (address 8200 (2008H))
Set this setting to "DR signal valid."
* This setting is used to designate how the DR signal is treated when only modem initialization is performed. Following the completion of modem initialization, data is sent according to the status of the DR signal.

(x) Modem function completed signal handling designation area (address 8201 (2009H))
Set this setting to "turn ON/OFF X13 to X16" (default value).

(y) Wait time of notification designation area (address 8202 (200AH))
1) Designates the waiting time from the moment the present notification is executed until the next notification is executed
(Unit: s), when performing more than one notification continuously.
2) Designates wait time of notification after checking the time required during debugging.

(z) Circuit disconnect wait time designation area (PLC CPU watch use) (address 8206 (200EH))
1) When sending data using the PLC CPU monitoring function, designates the time it takes to complete data transmission from the local station side modem to the external device after data transmission from the Q series C24 (wait time until the circuit is disconnected).
2) Specify the circuit disconnect wait time to match the specifications of the modem that is being used.

(3) Details of buffer memory (for the remote password function)

Each of the areas described below is valid when the Q series C24 performs the remote password check.

(a) Remote password mismatch notification count designation area (address 8204 (200CH))
1) Use 0 to FFFFH to designate the count that will be the notification timing to the QCPU when a remote password mismatch occurs during the user/external device unlock processing after the modem line has been connected.
2) It cannot confirm the accumulated number of times a remote password mismatch occurred up to the present after the line connection.

(b) Remote password mismatch notification accumulated count designation (address 8205 (200DH))
1) Use 0 to FFFFH to designate the accumulated count that will be the notification timing to the QCPU when a remote password mismatch occurs during the user/external device unlock processing after the Q series C24 has been started up.
2) The accumulated number of times up to the present a remote password mismatch occurred (accumulated count value in the Q series C24) after starting up can be checked in the area where the accumulated count of unlock process abnormal completion is stored (address 8956 (22FCH)).

(c) Storage area for accumulated count of unlock process normal completion (address 8955 (22FBH))
The accumulated number of times the remote password unlock process has been completed normally is stored.

(d) Storage area for accumulated count of unlock process abnormal completion (address 8956 (22FCH))
The accumulated number of times the remote password unlock process has been completed abnormally is stored.

(e) Storage area for accumulated count of lock process based on circuit line disconnection (address 8959 (22FFH))
The accumulated number of times the Q series C24 has automatically performed the lock process due to a modem line disconnection is stored.

POINT

Each of the accumulated count values stored in (c) to (e) above are further explained below:
1) The user can clear the values using either of the following:
- Set the accumulated count to "0" using the GX Configurator-SC modem function monitor/test screen.
- Write "0" to the applicable area of the buffer memory.

2) The accumulated count will be stored as 0H → 1H → 2H··· → FFFFH → 0H → 1H → ···.

(4) Details of buffer memory (for the callback function)

The areas shown below are valid if the Q Series C24 uses the callback function.

(a) Callback function designation area (Address 8193 (2001H))
1) If communications are done by connecting to the GX Developer via a modem, specify whether the callback function is to be used or not. Also specify the callback operation in the case that the callback function is used.
2) This specification becomes valid if "Connection" is entered in the GX Developer connection designation area (Address 54 (36H).
3) Show the setting value (the value stored in this area) in the GX Configurator-SC and show the corresponding Q Series C24's callback operation. This becomes invalid if any setting values other than those shown below are specified, and the callback function does not operate.
• When the callback function is not to be used : Auto (0H)
• When the callback function is to be used : Setting 1 (9H) to setting 6 (7H)
Setting 1 (9H): Auto/Callback connection (during fixed)
Setting 2 (BH): Auto/Callback connection (during designation number)
Setting 3 (FH): Auto/Callback connection (during max. designation number is 10))
Setting 4 (1H): Callback connection (during fixed)
Setting 5 (3H): Callback connection (during designation number)
Setting 6 (7H): Callback connection (during max. designation number is 10))

(b) Callback denial notification accumulated count designation area (Address 8194 (2002H))
1) Use 0 to FFFFH to designate the accumulated count that will be the notification timing to the QCPU when a denial of the callback occurs during access from the GX Developer after the Q series C24 has been started up.
2) The accumulated number of times up to the present a denial of the callback occurred (accumulated count value in the Q series C24) after starting up can be checked in the area where the accumulated count of denial of the callback is stored (address 8945 (22F1H)).

(c) Data No. for Callback designation area (Addresses 8449 to 8458 (2101H to 210AH))
1) This specifies the connection data registration No. where the callback destination GX Developer side's telephone No. is registered. Connection data are data that have been registered in the Q Series C24's flash ROM or buffer memory.
See Section 3.4.4 for connection data registration.
2) In the following case, the connection data telephone No. specified in callback data No. 1 becomes the callback destination.
• If the callback destination GX Developer is fixed (1 module).
* The external line dialing, line types and telephone number in the connection data become valid.
3) In the following cases, when the callback destination telephone No. from the GX Developer is specified and connection made, callback is performed using the external line dialing and line types in the connection data for the registration No. specified in callback data No. 1.
• If it is being made possible to change the callback destination GX Developer.
• If the maximum number of callback destination GX Developer is limited to 10 modules.

4) If the callback destination GX Developer is limited to a maximum of 10 modules, specify the connection data registration No. that specify the callback destination telephone No. for a maximum of 10 modules.
   - The external line dialing, line types and telephone number in callback data No. 1 become valid.
   - The telephone No. only becomes valid in callback data No. 2 to 10. The external line dialing and line types in the connection data for callback data No. 1 are used for these.

5) If "0_H" is specified in this specification, the callback data No. after that become "unspecified."

   (Example) If callback data No. 4 is specified as "0_H," the callback data No. 4 to 10 registrations become invalid.

(d) Callback permit accumulated count storage area (Address 8944 ($22F0_H$))
The accumulated count value when the Q Series C24 executed callback is stored here.

(e) Callback denial accumulated count storage area (Address 8945 ($22F1_H$))
The accumulated count value for callbacks which the Q Series C24 did not executed due to callback error detection is stored here.

(f) Auto (callback) connection permit accumulated count storage area (Address 8946 ($22F2_H$))
The accumulated count value for normal line connections from the GX Developer by the connection system shown below is stored here.
1) Auto (callback: during fixed)
2) Auto (callback: during designated number)

(g) Auto (callback) connection denial accumulated count storage area (Address 8947 ($22F3_H$))
The accumulated count value for line connections from the GX Developer by the connection system shown below that were not connected normally is stored here.
1) Auto (callback: during fixed)
2) Auto (callback: during designated number)

(h) Accumulated count of callback receive procedure cancel storage area (Address 8948 ($22F4_H$))
The accumulated count value for the number of callback procedures that were terminated from the initial GX Developer by the Q Series C24 when a line connection request by another GX Developer was executed during temporary line disconnect from the GX Developer side through callback specification is stored here.
＊ The Q Series C24 performs the callback operation with respect to the latest connection request.

POINT

Each of the accumulated count values stored in (d) to (h) above are further explained below:
1) The user can clear the values using either of the following:
   - Set the accumulated count to "0" using the GX Configurator-SC modem function monitor/test screen.
   - Write "0" to the applicable area of the buffer memory.
2) The accumulated count will be stored as $0_H \rightarrow 1_H \rightarrow 2_H \cdots \rightarrow FFFF_H \rightarrow 0_H \rightarrow 1_H \rightarrow \cdots$.

3.3.7 Precautions when using the modem function

Precautions when using the modem function to perform data communication with an external device via public line or call to the pager receiver are described.

(1) Line connection and disconnection
When performing data communication with an external device, it must be predetermined which station is to perform the line connection (dialing) and disconnection processing with the partner device as well as the timings.

(2) Reception data before connection completion
Before the connection processing to the modem is completed the reception data other than modem commands is ignored (read and disposed) at the interface that uses the modem function.
(Example) The Q series C24 will ignore the data even when an MC protocol command message is received.

(3) Transmission control
Delays may occur in transmission controls to notify the data reception capability at the local station to the partner device.
In order not to have a state in which the partner device cannot receive the transmission data, the amount of transmission/reception data and intervals should be determined beforehand.
When transmission/reception data in the non procedure protocol, the procedure must also be predetermined.

(4) Priority of data communication and notification
After line connection is established, the data transmission/reception processing with the partner device is performed in the order of the processing request occurrence.
At the same time, when the line disconnect processing or data transmission reception (including data transmission processing, reception processing and Flash ROM access processing) occurs, the line disconnect processing has the priority.

(5) Data communication time
The data transmission/reception time after line connection has been established with the partner device is the total time of the transmission time between the Q series C24 and modem/TA, between modem and TA, and between modem/TA and partner device.
When communicating via the MC protocol, the transmission time (such as T0 and T3) indicated in Chapter 2 of Reference Manual must include the transmission time between the Q series C24-side modem/TA and the destination device.

(6) Initial Settings

The connection data used for modem functions can be registered as follows using setting procedures.
Set the telephone number and message within the permissible number of registration characters for modem/TA.

1) If registered using GX Configurator-SC
   - Comments can be set to a maximum of 256 bytes. (These are not used for control.)
   - Telephone numbers can be set to a maximum of 64 bytes.
   - Messages can be set to a maximum of 256 bytes.
2) If registered from the PLC CPU (sequence program)
   - Comments cannot be set.
   - Telephone numbers can be set to a maximum of 18 bytes.
   - Messages can be set to a maximum of 30 bytes.

(7) PLC CPU monitoring function

See Section 2.4 for precautions when transmitting monitoring results using the modem function.

(8) Remote password check

(a) How to unlock the remote password

1) When the Q series C24 has been set as a module subject to the remote password check with the QCPU parameter, a remote password unlock processing must be performed from the external device after line connection before starting data communication.
2) The unlock processing for the QCPU remote password is performed as follows:
   - When communicating using MC protocol
     Perform the unlock processing from the external device using dedicated commands.
   - When accessing the PLC from the GX Developer
     Perform the unlock processing on the GX Developer screen when access begins.

(b) When the remote password unlock processing is completed abnormally

1) Repeat the unlock processing after checking the remote password set in the QCPU.
2) Start with the line connect processing again if the Q series C24 line connect signal (X12) turns OFF due to the unlock processing abnormal completion.
3) The user should clear the accumulated count stored in the following buffer memory before repeating the line connect processing if the Q series C24 CHn side ERR occurrence signal (XE/XF) turns ON and the ERR LED lights up due to the unlock processing abnormal completion.
   (Applicable buffer memory)
   Storage area for accumulated count of unlock process abnormal completion accumulated : Address 8756 (22FCH)
   (How to clear)
   Cleared by the user using one of the following:
   - Set the accumulated count to "0" on the GX Configurator-SC modem function monitor/test screen.
   - Write "0" to the applicable area of the buffer memory.

(c) When the number of times remote password mismatch occurs is large

1) When the number of times notification of a remote password mismatch is received exceeds the number of times specified in buffer memory address 8204 (200CH), the Q Series C24 disconnects the line automatically. (The connection signal (X12) turns OFF.)
After confirming the remote password registered in the QCPU and the remote password specified in the external device execute line connection again.

2) When the number of times notification of a remote password mismatch is received exceeds the accumulated count value (buffer memory address 8205 (200DH)), the Q Series C24 executes the following processing. (The line and modem are not disconnected.)
(when communicating using MC protocol)
• An error code (7FE8H) is stored in the buffer memory's MC protocol transmission error code storage area (address 602/618 (25AH/26AH).
• The CHn side error occurrence signal (XE/XF) turns ON and the ERR LED lights up.
(When communicating using the GX Developer)
• An error code (7FE8H) is stored in the buffer memory's modem function error code storage area (address 545 (221H).
• The CHn side error occurrence signal (XE/XF) turns ON and the ERR LED lights up.

3) The accumulated number of times up to the present a remote password mismatch occurred (accumulated count value in the Q series C24) can be checked in the area where the accumulated count of unlock process abnormal completion is stored (address 8956 (22FCH)).

4) The user should clear the accumulated number of times up to the present a remote password mismatch occurred using one of the following methods.
• Set the accumulated count of unlock processing abnormal completion to "0" on the GX Configurator-SC's modem function monitor/test screen.
• Write "0" in the buffer memory area where the accumulated count of unlock process abnormal completion is stored (address 8956 (22FCH)).

POINT

If the CHn side ERR occurrence signal (XE/XF) for the Q series C24 turns ON and the ERR LED lights up, this could indicate improper access from the external device.
See also an example of measures taken on the PLC CPU side described in (12).

REMARK

See Section 10.1.2 of User's Manual (Basic) on how to turn off the Q series C24 ERR LED after it has lit up.

(9) Number of modules for which the remote password check can be set

A maximum of eight modules can be registered with remote passwords in the QCPU.＊1

To set the remote password in a module, use the GX Developer remote password setting screen.

＊1 The remote password modules are as follows:
- Q series C24
- Q series Ethernet module

(10) Callback Function

(a) When the number of callback processing denials exceeds callback denial notification accumulated count (buffer memory address 8194 (2002H), the following processing is executed each time the Q Series C24 issues another refusal.
- An error code (7FE9H) is stored in the buffer memory's modem function error code storage area (address 545 (221H).
- The CHn side error occurrence signal (XE/XF) turns ON and the ERR LED lights up.

(b) When the number of callback processing refusals exceeds callback denial notification accumulated count, after performing the following checks and clearing processing, make the line connection again from the GX Developer.
- Check the setting contents of the callback function set in the Q Series C24.
- Check the setting contents of the callback function set in the GX Developer.
- The user should clear the accumulated counts stored in the following buffer memory areas.
  (Affected buffer memory)
  Callback denial accumulted count: Address 8945 (22F1H)
  (Clearing method) ···The user should clear this area by either of the following methods.
  - Set the accumulated count value in the GX Configurator-SC's modem function monitoring / test screen to "0."
  - Write "0" to the affected storage area in the buffer memory.

REMARK

See Section 10.1.2 of the User's Manual (Basic) for the method for turning off the Q Series C24's ERR LED when it lights up.

(11) Preventing a line disconnect when the GX Developer is connected

Perform the following settings and operations to prevent a line to the modem from disconnecting even if communication between the GX Developer and PLC is interrupted.

(a) Initial setting using the GX Configurator-SC (See Section 8.4.4 of User's Manual (Basic).)
1) Setting screen: Modem function system setting screen
2) Setting item: No-communication interval time designation
3) Setting value: 0 (infinite wait)

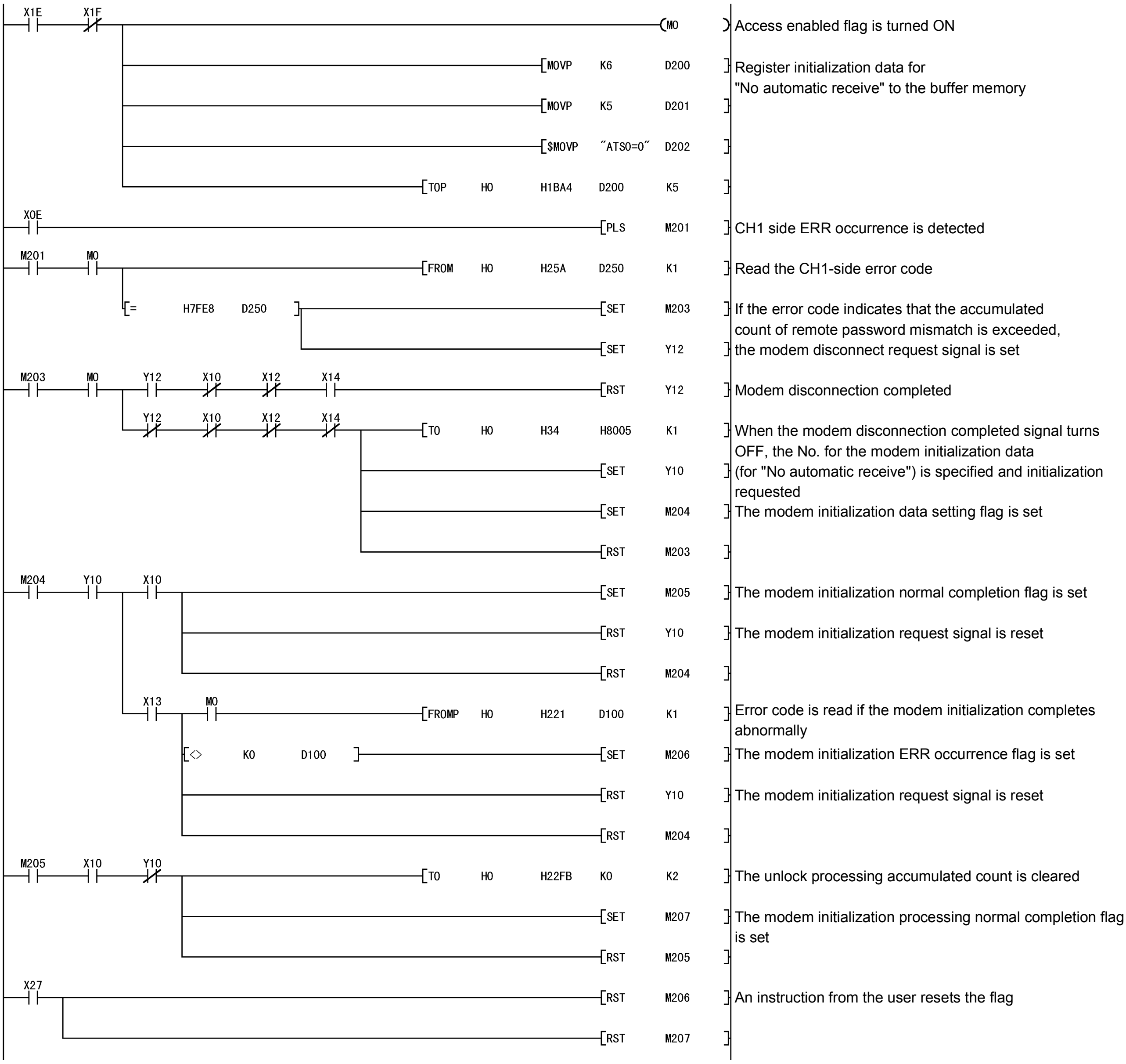
(b) Operation using the GX Developer
Always perform the line disconnect operation when the GX Developer on-line operation is completed after the line to the Q series C24 side is connected.

(12) An example of what to do on the PLC CPU side for improper access from the external device

The following is an example of performing, on the PLC CPU side, the line disconnect processing with respect to the opposite device and prohibiting receive via a modem when the number of "remote password mismatch" detected by the Q series C24 remote password check function exceeds the number set by the user.

1) The user should determine the count and accumulated count of notification given when a remote password mismatch occurs during the unlock processing from the external device with respect to the remote password set in the QCPU. (See Section 3.3.6 (3) (a) and (b).)
2) In the GX Configurator-SC system settings, in order for the Q series C24 to operate, set the count determined above in the following item on the "Modem function system setting" screen and register this to the Q series C24. (See Section 8.4.4 of User's Manual (Basic).)
   - Set in the item "Remote password mismatch notification count."
   - Set in the item "Remote password mismatch notification accumulated count."
3) In addition to initialization commands used in normal modem initialization, specify "No automatic receive" and additionally register the modem initialization command for this step to the Q series C24. (No automatic receive: This is the setting to prohibit line connection from the opposite device.) Use the "Modem function initialization data" screen to set. (See Section 8.4.2 of User's Manual (Basic).)
4) Constantly monitor the rise (OFF → ON) of the ERR occurrence signal (XE or XF) when connecting the line to the opposite device using the modem function after the system begins operating.
5) Monitor the following buffer memory when the ERR occurrence signal turns ON.
   Storage area for MC protocol transmission error codes (address: 602 (25AH))
6) Perform the line disconnect processing with respect to the opposite device when the error code stored in the above buffer memory is 7FE8H.
   (Use the modem disconnection request signal (Y12).)
7) After the above line disconnect processing is completed, specify the modem initialization command for which "No automatic receive" has been specified and perform modem initialization only. (See Section 3.4.7.)
8) Describe the above occurrence to the system manager and take necessary measures.

(Example) When the number of times a remote password mismatch occurred exceeds the notification accumulated count setting value during the remote password unlock processing in communication using MC protocol with the Q series C24 CH1 side interface used.



3.4 Start-up of the Modem Function

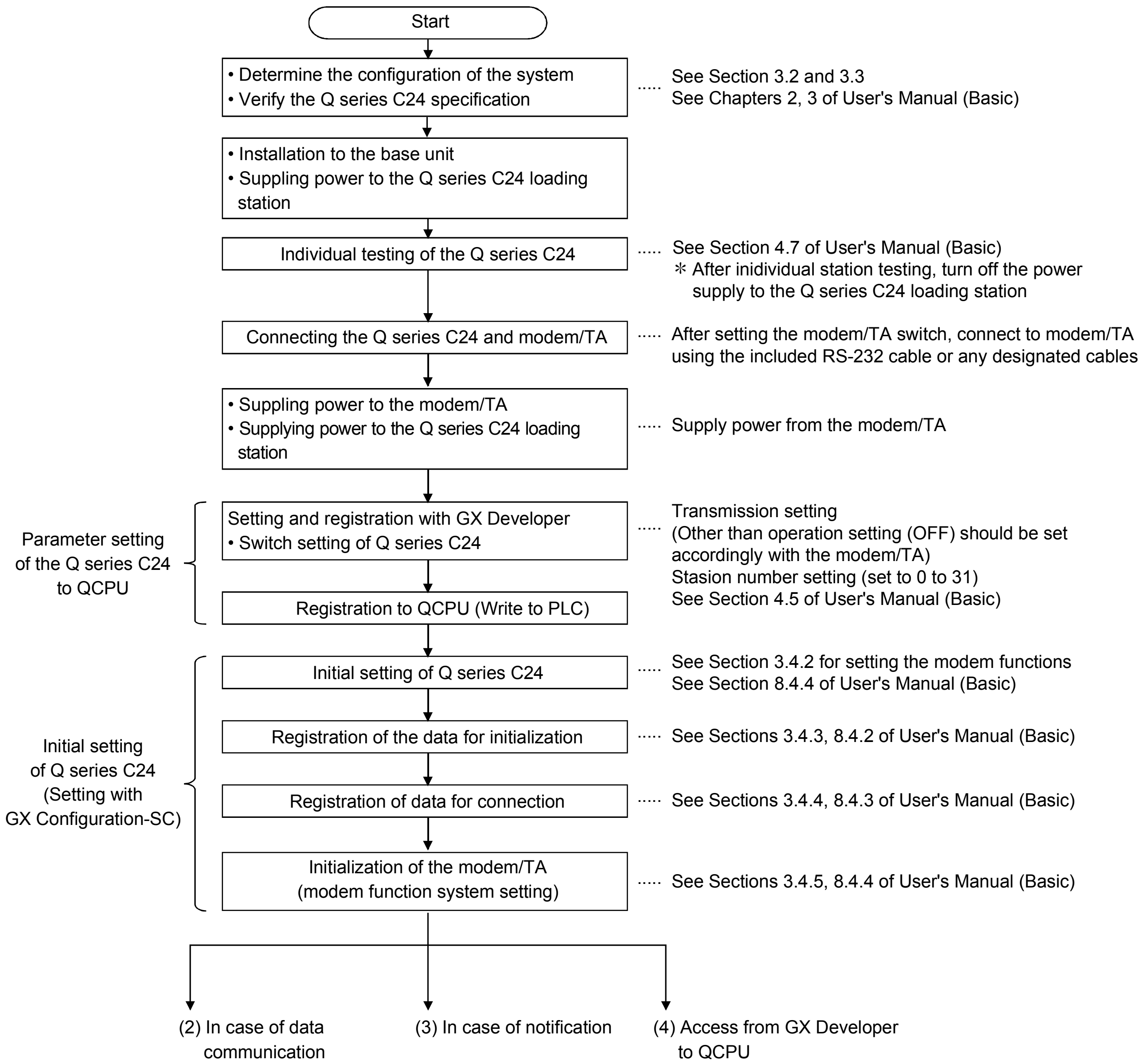
This section explains the start-up procedures, processing methods and programming when the modem function of the Q series C24 is to be used.

3.4.1 Start-up procedures when communicating data with external devices

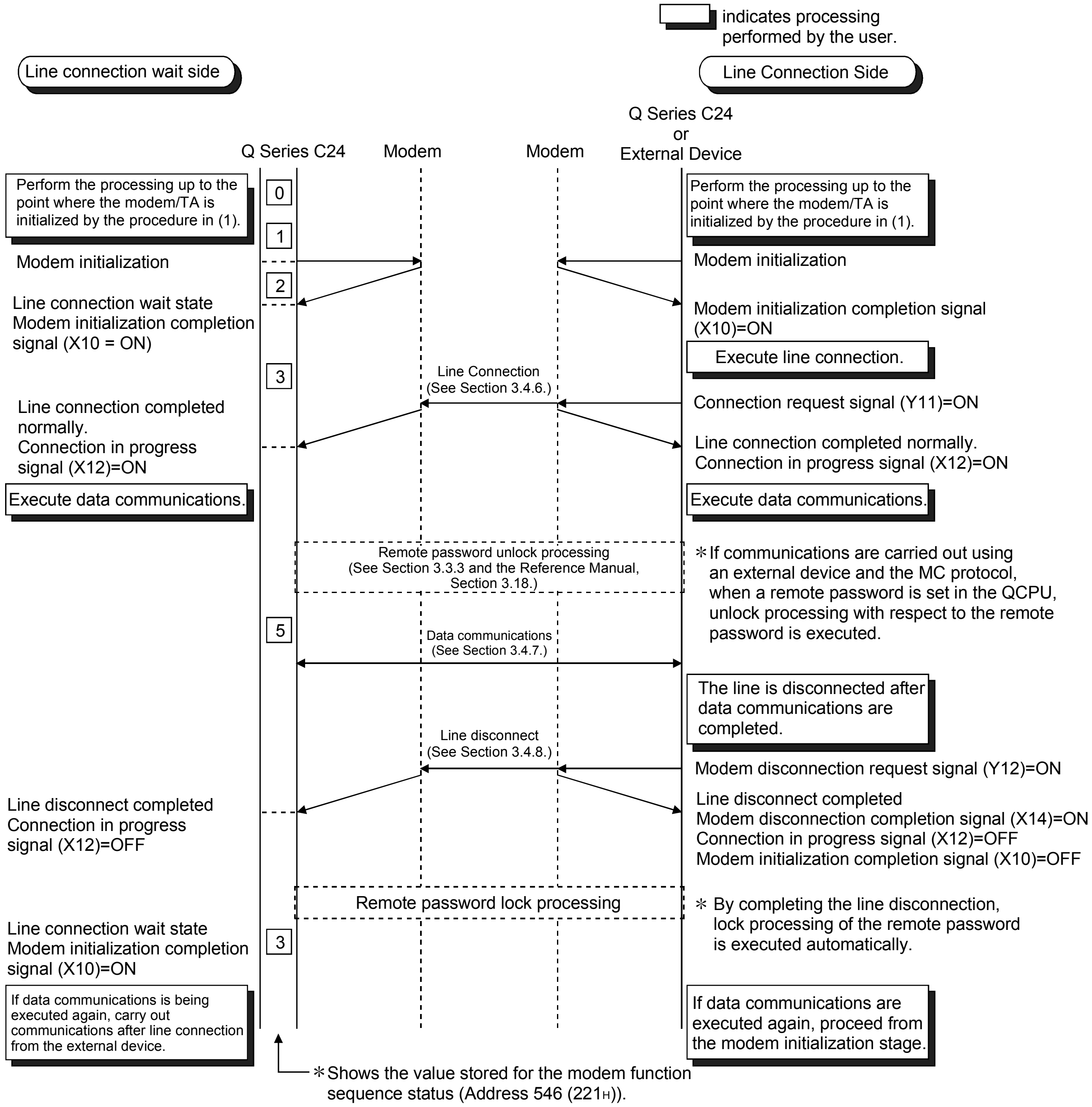
This section shows the procedure for starting the modem function and up to the point when data communications is started.

(1) Procedure up to initialization of the Q Series C24's modem / TA

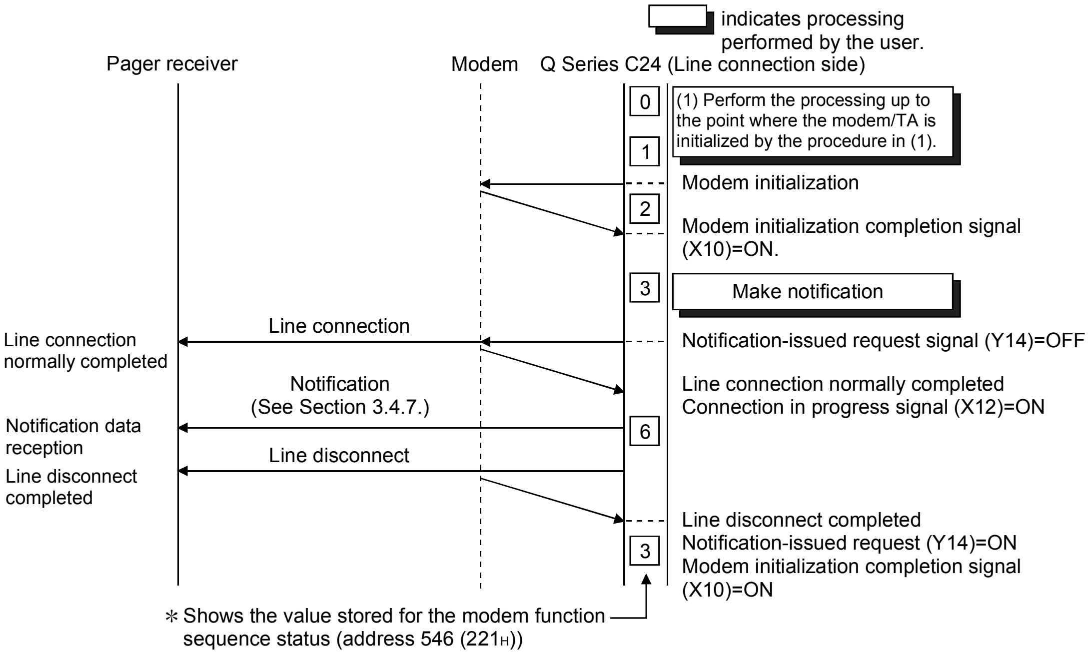
This initializes the modem / TA connected to the Q Series C24 in order to use the modem function. It becomes possible to carry out all kinds of communications when the modem / TA is initialized.



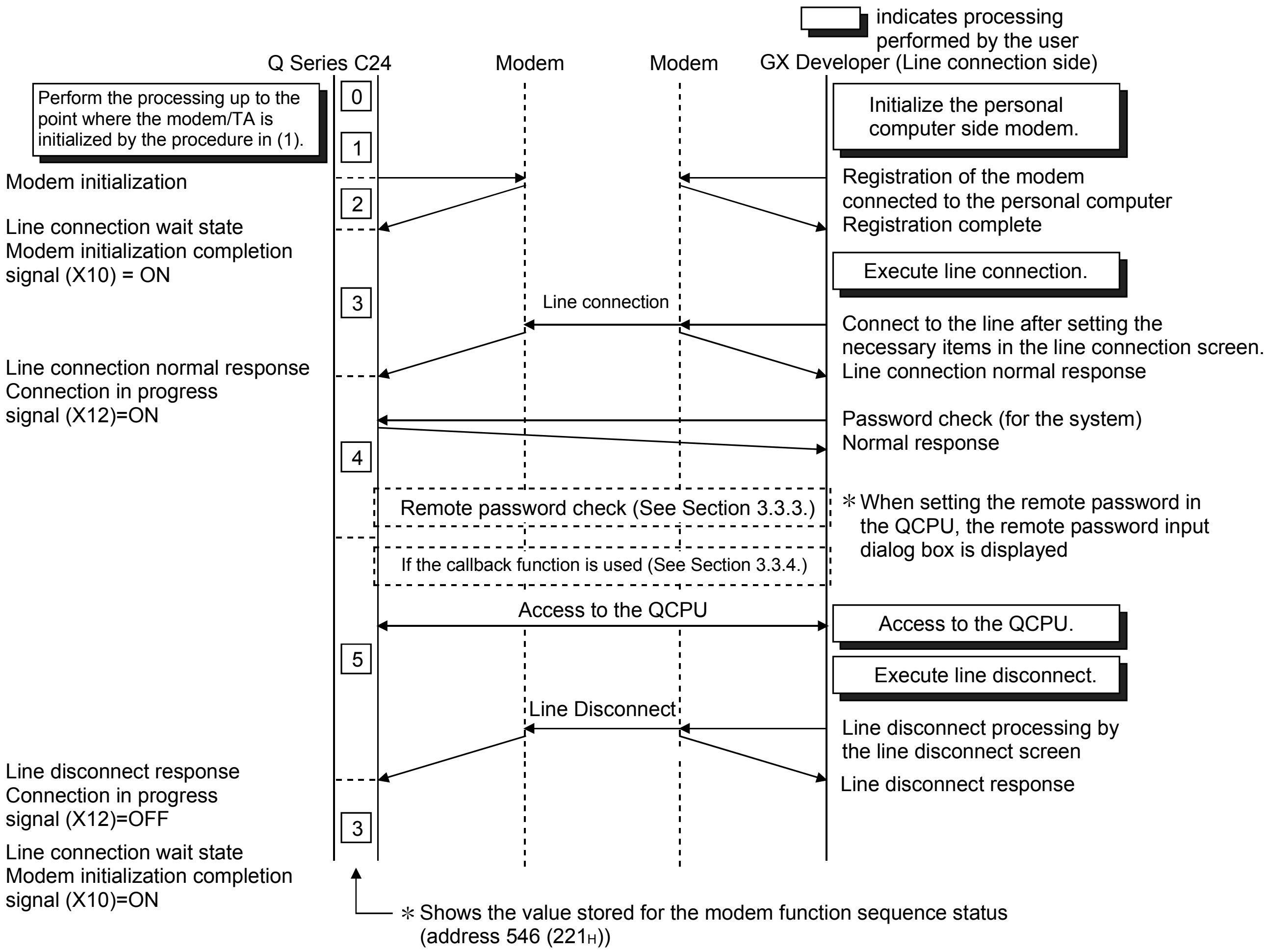
(2) Procedure when executing data communications



(3) If notification is made



(4) If accessing the QCPU from the GX Developer



3.4.2 Initial settings of the serial communication module

This section explains the initial settings of the Q series C24 when data communicating with external device, remotely notifying a pager receiver and accessing from GX Developer using the modem function.

(1) Switch settings by GX Developer

Switch setting by GX Developer		Data communication	Notification	GX Developer access	Remarks
Communication protocol setting		1 to 7	1 to 7	5	—
Transmission specification communication rate setting	Operation setting	OFF (Independent operation)			Set both CH1 and CH2 OFF
	Data bit setting	(Set according to modem/ TA on local station)		ON	OFF=7 bits, ON=8 bits
	Parity/non-parity setting			OFF	OFF = Non-parity, ON = Parity
	Even/odd parity setting			OFF	OFF = Odd, ON = Even
	Stop bit setting			OFF	OFF = 1 bit, ON = 2 bits
	Sum check enable/disable setting	(Set according to system specification)	OFF/ON	ON	OFF = Disabled, ON = Enabled
	Write during RUN enable/disable setting		OFF/ON	ON	OFF = Disabled, ON = Enabled
	Setting modification enable/disable setting		OFF/ON	OFF/ON	OFF = Disabled, ON = Enabled
	Transmission rate setting	(Set according to modem/TA on local station) (＊1)			(bps)
Station number setting		00 to 31			—

＊1 When the first five digits of the serial No. are 03042 or earlier, the transmission speed cannot be set to 115200 bps for connection between the Q series C24 and the GX Developer via a modem.

REMARK

This gives an example of the switch setting when the modem function is used to connect the GX Developer to the Q series C24 CH1 side and the PLC is accessed. Perform the switch setting similar to this example also when performing data communication or notification.
(See Section 4.5.2 of User's Manual (Basic) for more detail on switch setting.)

[Start procedure]
"GX Developer" → "PLC parameters" → "I/O assignment setting" → Switch setting

[Setting example]

	Slot	Type	Model name	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5
0	PLC	PLC						
1	0(*-0)	Intelli.	QJ71C24-R2	07E2	0005	0000	0000	0000

Switch number	Bit Position	Bit Specified value	Description			Setting value
Switch 1	b0	OFF	CH1 transmission setting	Operation setting	Independent	07E2
	b1	ON		Data bit	8 bits	
	b2	OFF		Parity bit	No	
	b3	OFF		Odd/even parity	Odd	
	b4	OFF		Stop bit	1 bit	
	b5	ON		Sum check code	Yes	
	b6	ON		Write during RUN	Allowed	
	b7	ON		Setting modification	Enable	
	b8 to b15	—	CH1 communication rate setting		19200 bps	
Switch 2	—		CH1 communication protocol setting		5	0005
Switch 5	—		Station number setting		0th station	0000

(2) Initial settings by GX Configurator-SC (set in the setting screen for modem function system)

(a) Perform initial settings on the interface side that use the modem function as described in Section 3.3.6:
The following table shows the default settings in the “Modem function system setting" screen and whether setting is possible or impossible in each type of communications.

"Modem function system setting" screen setting item	Data communications (MC non procedure, bidirectional)	Notification	GX Developer	Buffer memory address
Modem connection channel designation	●	●	●	46 (2EH)
Notification execution designation	×	●	×	47 (2FH)
Number of connection retries	○	○	○	48 (30H)
Connection retry interval designation (unit: s)	○	○	○	49 (31H)
Initialization/connection timeout time designation (Unit: s)	○	○	○	50 (32H)
Number of initialization retries designation	○	○	○	51 (33H)
Data No. for initialization designation (＊1)	●	●	●	52 (34H)
Data No. for connection designation (＊1)	●	●	×	53 (35H)
GX Developer connection designation	×	×	●	54 (36H)
No-communication interval time designation (＊2)	○	○	○	55 (37H)
RS · CS control yes/no designation	○	○	○	56 (38H)
Modem initialization time DR signal valid/invalid designation (＊3)	○	○	○	8200 (2008H)
Wait time of notification (Unit: s)	×	○	×	8202 (200AH)
Circuit disconnect wait time (PLC CPU watch use) ＊Unit: s	○	×	×	8206 (200EH)
Remote password mismatch notification count designation	○	×	○	8204 (200CH)
Remote password mismatch notification accumulated count designation	○	×	○	8205 (200DH)
Auto modem initialization designation	○	○	○	8199 (2007H)
Callback function designation	×	×	○	8193 (2001H)
Callback denial notification accumulated count designation	×	×	○	8194 (2002H)
Data No. for Callback designation 1 to 10	×	×	○	8449 to 8458 (2101H to 210AH)

●: Required item ○: Setting possible ×: Setting not required

＊1 For details on how to register the data No. for initialization, see Section 3.4.3. For details on how to register the data No. for connection, see Section 3.4.4.
＊2 Even if the PLC CPU on the Q series C24 loading station (local station) becomes STOP status under the following circumstances, the line (telephone) with the partner devices will be left connected. In order to prevent the line from being left connected when the line is not in use, be sure to make the appropriate settings.

1) When the PLC CPU is stopped when the connected signal (X12) is at the ON status.
   * This occurs because the program write after remote stop is enabled.
2) When the PLC CPU performs an error stop during self-diagnosis, etc.

POINT

When setting the No-communication interval time as infinite wait (set value = 0), be sure to perform line disconnection processing after the data has been communicated.
If the line is left connected for long periods of time without performing line disconnection after data has been communicated, not only will telephone bills be applied, but it may violate electronic communication business laws.

*3 The "Modem initialization time DR signal valid/invalid designation" designates whether the status of the DR signal output is valid or invalid at the startup of the Q series C24 .
When the DR signal = ON is output from the modem, register "valid" for this item.
When the DR signal = ON is not output from the modem, register "invalid" for this item.

(b) All transmissions using the modem function are transmitted in full-duplex.
Leave the following initial settings for the interface side that uses the modem function as default.

	(Default value)
1) CD terminal check	: Not checked
2) Communication system	: Full-duplex communication

(c) The processes that correspond to the following output signals may not be aborted.

Output signal	Requesting process name
Y10	Initialization request (standby request)
Y11	Connection request
Y12	Disconnection request
Y14	Notification-issued request

It is recommended to leave the following initial settings for the modem functions as default. (Upon error, it will end due to time out.)

	(Default value)
1) Number of connection retries	: 3 times
2) Connection retry intervals	: 180 s
3) Initialization/connection time out	: 60 s

POINT

Also perform the settings for a remote password check described in Section 3.3.5 (3) (a) and (b) when a remote password check is executed with respect to the remote password set in the QCPU.

3.4.3 Register/read/delete of the initialization data

The section explains the register/read/delete of the data for initialization such as initialization commands for the modem/TA connected to the Q series C24 side for data communication with the external device, pager receiver notification and accessing from GX Developer using the modem functions.

(1) Registration destination of the data for initialization

1) The data for initialization may be used by registering to the Q series C24 Flash ROM or buffer memory.
2) The buffer memory may register the data for connection shown in Section 3.4.4 and will register the data for initialization or data for connection in the designated area.
3) It is recommended that the data for initialization during the debug process is stored in the buffer memory. The registration data in the buffer memory will be erased after starting up the Q series C24 loading station again. It is necessary to register the data for initialization in the buffer memory after each start-up of the Q series C24.
4) It is recommended to store the data for initialization to the Flash ROM after completing the debug process.
   By registering it to the Flash ROM, the registration process of the data for initialization will be unnecessary thereafter.

(2) Types of data for initialization

1) There are data for initialization that are registered in the Flash ROM of the Q series C24 upon shipping and data for initialization that are set by the user.
2) The number of times registered/number of possible registrations are shown in the chart below.

(3) Data for initialization registration number

1) The registration numbers shown in the table below are used from the memory of the registration destination.
2) The registration number of the data for initialization is determined by the area of registration.

Registration data	Registration destination		Registration number (Decimal (hexadecimal))	Number of registrations
Data for initialization	Flash ROM	Data registered by the OS	2000 to 2013 (7D0H to 7DDH)	13
		Data registered by the user	2500 to 2529 (9C4H to 9E1H)	30
	Buffer memory	(All are set by the user)	–32767 to –32737 (8001H to 801FH)	31

(4) Precautions during the registration of data for initialization

1) The maximum size of the initialization commands that may be registered as one data for initialization is 78 bytes
2) Do not include CR/LF (data code : 0DH/0AH) in the data for initialization to be registered to the Q series C24. The CR/LF is output at the end of the AT command by the Q series C24 when processing initialization (automatically added).
3) The registration status of the data for initialization stored in the Flash ROM may be checked in "data registration for modem initialization" screen for GX Configurator-SC or the buffer memory (address : 226H to 228H (550 to 552). When newly registering, register by designating an unregistered number.

When designating a registration number that has already been registered, first delete the registration data in the preoccupied registration number prior to registration.

4) When connecting the Q series C24 to an external device using a cellular phone and a modem, set the transmission rate supported by the cellular communication module on the modem side.

(5) Registration contents at shipment

1) The data for initialization registered in the Flash ROM of the Q series C24 are shown below:

Registration number		Initialization command
Hexadecimal	Decimal	
$7D0_H$	2000	ATQ0V1E1X1\J0\Q2\V2\N3S0=1
$7D1_H$	2001	ATQ0V1E1X1\Q2\V2\N3S0=1
$7D2_H$	2002	ATQ0V1E1X1&K3\N3S0=1
$7D3_H$	2003	ATQ0V1E1X1&H1&R2&A3&D2S0=1
$7D4_H$	2004	ATQ0V1E1X1\J0\Q2\N3S0=1
$7D5_H$	2005	ATE1Q0V1&C1&D2&H1&I0&R2&S0S0=1
$7D6_H$	2006	ATE1Q0V1&C1&D2&K3&S0S0=1
$7D7_H$	2007	ATE1Q0V1&C1&D2&K3&S1S0=1
$7D8_H$	2008	ATE1Q0V1&C1&D2&K3&S0S0=1
$7D9_H$	2009	ATE1Q0V1&C1&D1&Q2&S0S0=1
$7DA_H$	2010	ATE1Q0V1&C1&D2&Q3&S0S0=1
$7DC_H$	2012	AT&S0S0=1
$7DD_H$	2013	ATX1&S0S0=1

2) If initialization commands other than listed above are needed, the data for initialization needs to be registered to the Flash ROM or the buffer memory of the Q series C24.

REMARK

- Perform the following setting in respect to the modem/TA connected to the Q series C24 side.
  For settings other than listed below, perform the setting as designated by the modem/TA.

Setting contents	Setting command example
—	AT
Display the result code (or, return the result code).	Qn
Set the result code as a word.	Vn
Perform character echo.	En
Dial tone and busy tone detection + X1	Xn
Set register 0 at 2	Sr=n
The modem and the serial speed are not equal.	\Jn
Control RTS/CTS.	\Qn
Control DSR.	&Sn
Control DTR.	&Dn
Enable extension result code (display MNP class).	\Vn
MNP mode/normal mode auto selection	\N3

- The following shows an specification example of the transmission rate supported by the cellular communication module using the modem initialization command, when connecting the Q series C24 to an external device using a cellular phone and a modem. (Transmission rate = 9600 bps is set)
  For the details, see the manual of the modem used.
  (Setting example for the initialization command of the registration No.$7D3_H$)
  ATQ0V1E1X1&H1&R2&A3&D0S0=1&N6
  (Setting example for the initialization command of the registration No.$7D4_H$)
  ATQ0V1E1X1\J0\Q2\N3&D0+MS=, 9600, 9600S0=1

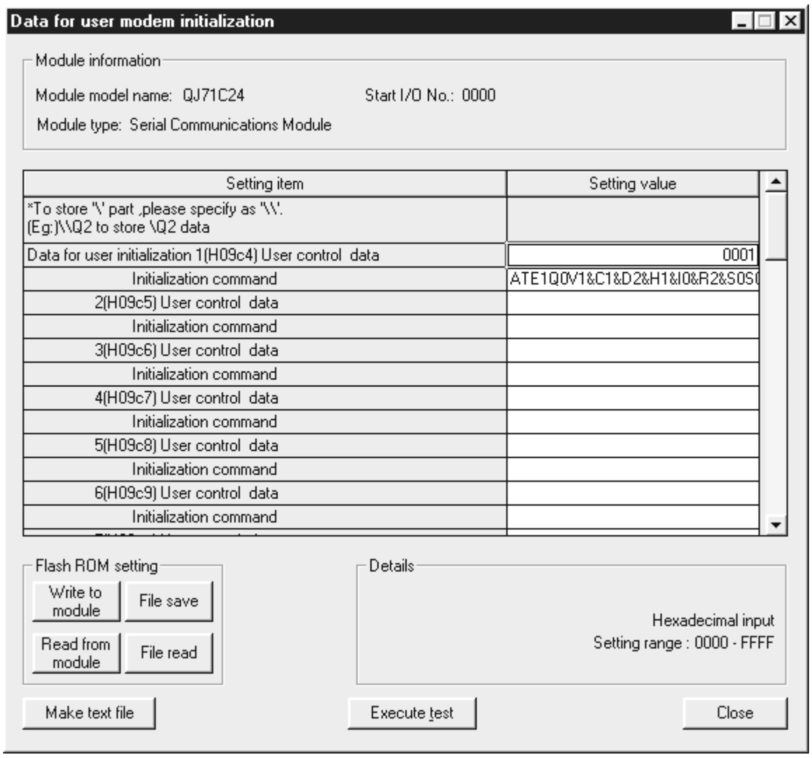
(6) Procedures for register/read/delete of the initialization data

(a) For the Flash ROM in the Q series C24

1) Register/read/delete operations are executed on the GX Configurator-SC's "Data registration for modem initialization" screen.
2) Display and operate the screen according to Section 8.4.2 of the User's Manual (Basic).

＊ The factory setting of initialization data stored in the Flash ROM of the Q series C24 cannot be deleted.

(Registration example)



REMARK

Use \\ code to specify a field to register "\" if GX Configurator-SC is used for data for modem initialization.
(Example) To register the \Q2 of data: \\Q2

(b) For the buffer memory of the Q series C24

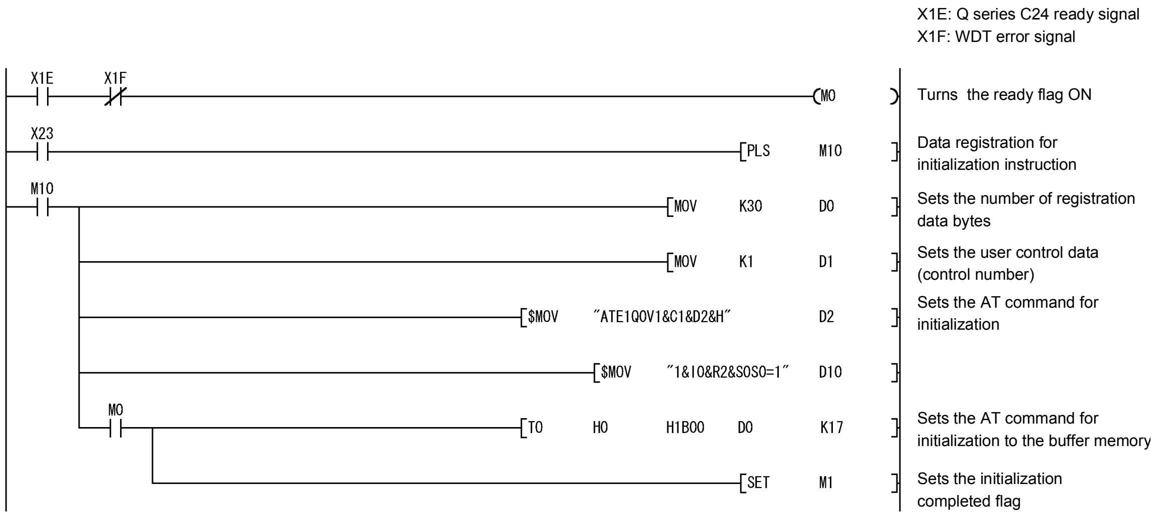
1) The initialization data write (registration) and read operations are performed by designating an applicable area that corresponds to registration numbers 8001H to 801FH for the user frame registration area (addresses: 1B00H to 1FF6H).
When deleting the initialization data, write "0" to the number of registration data bytes designation area.

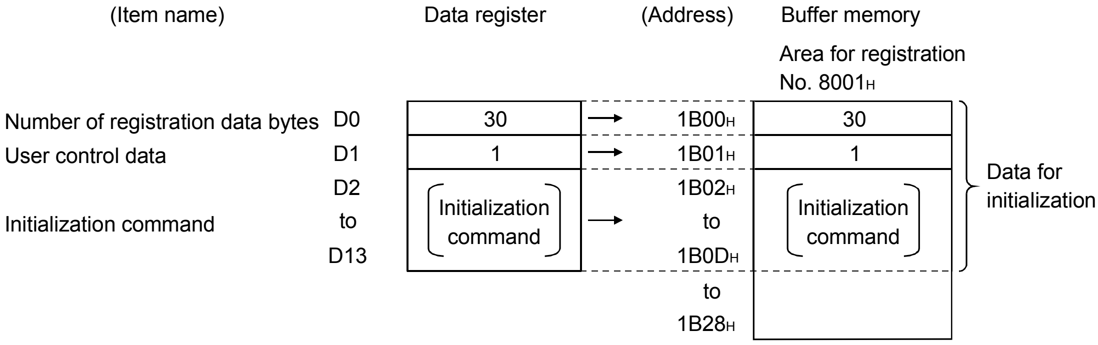
2) The table below shows an overview of the buffer memory used in the write, read, and delete operations of the initialization data as well as the designated values for each area.
For more details, see Chapter 9.
(Use the table by replacing the user frame with the initialization data.)

Address		Name		Designated/stored value	Specification required (○)/not required (×)		
Hexadecimal	Decimal				Write	Read	Delete
1B00H	6912	Registration No.8001H	Registration data byte number designation	0 : When deleting 1 to 78: Number of bytes in the registration data (Only for the initialization command section)	○	× (Read processing not required)	○
1B01H	6913		User controlled data	Any data used by the user to manage the registration data (manufacturer code, control number, etc.)			×
1B02H to 1B28H	6914 to 6952		Initialization command	Data code for the initialization command for registration			
1B29H	6953	Registration No. 8002H	Registration data byte number designation	0 : When deleting 1 to 78: Number of bytes in the registration data (Only for the initialization command section)	○	× (Read processing not required)	○
1B2AH	6954		User controlled data	Any data used by the user to manage the registration data (manufacturer code, control number, etc.)			×
1B2BH to 1B51H	6955 to 6993		Initialization command	Data code for the initialization command for registration			
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1FCEH	8142	Registration No. 801FH	Registration data byte number designation	0 : When deleting 1 to 78: Number of bytes in the registration data (Only for the initialization command section)	○	× (Read processing not required)	○
1FCFH	8143		User controlled data	Any data used by the user to manage the registration data (manufacturer code, control number, etc.)			×
1FD0H to 1FF6H	8144 to 8182		Initialization command	Data code for the initialization command for registration			

3) The contents of the data to be written into the designated area that corresponds to registration numbers 8001H to 801FH are the same as those for the Flash ROM.

4) The following shows an example of a sequence program used to write the initialization data (registration).
   - Example of writing the initialization data to the area having registration number 8001H





3.4.4 Register/read/delete of the data for connection

This section explains the registration/reading/deletion of data for connection such as the telephone number of the partner device and notification messages that are used for communicating data with external devices, notify pager receivers and accessing from GX Developer using the modem functions.

(1) Registration destination of data for connection

1) The data for connection can be used by registering to the Q series C24's Flash ROM or buffer memory.
2) The buffer memory can register the data for initialization shown in Section 3.4.3. The data for initialization or data for connection will be registered in the applicable area.
3) It is recommended to store the data for connection during the debug process in the buffer memory. The registration data in the buffer memory will be erased after the starting up the Q series C24 loading station again. It is necessary to register the data for connection in the buffer memory after each start-up of the Q series C24.
4) It is recommended to store the data for connection to the Flash ROM after completing the debug process.
By registering it to the Flash ROM, the registration process of the data for connection will be unnecessary thereafter.

(2) Types of data for connection

1) All data for connection are registered and used as defined by the user.
2) The number of possible registrations are shown in the table below.

(3) Data for connection registration number

1) The registration numbers shown in the table below are used by the memory of the registration destination.
2) The registration number of the data-for-connection is determined by the area of registration.

Registration data	Registration destination		Registration number (Decimal (hexadecimal))	Number of registrations
Data for connection	Flash ROM	(All are set by user)	3000 to 3029 (BB8H to BD5H)	30
	Buffer memory		–32767 to –32737 (8001H to 801FH)	31

(4) Precautions during the registration of data for connection

1) The maximum size of data that can be registered as one data for connection is 80 bytes. Do not deviate from the following data sizes for the following items:
Message area for notification = 36 bytes, data-for-connection area = 44 bytes
2) Designate the messages for notification accordingly with the display designation of the partner devices.
3) The registration status of the data for initialization stored in the Flash ROM can be checked in "data registration for modem connection" screen for GX Configurator-SC or the buffer memory (address : 223H to 225H (547 to 549)
When newly registering, register by designating an unregistered number.
When designating a number which is already registered, delete the registered data for that number first, then perform the registration.

(5) Procedures for register/read/delete of the data for connection

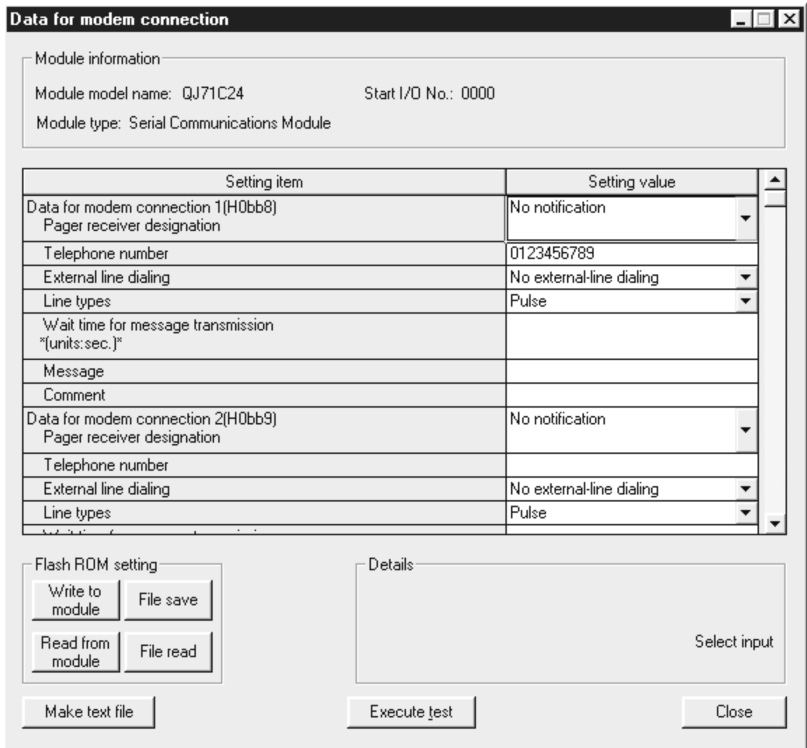
(a) For the flash ROM in the Q series C24

1) Register/read/delete operations are executed on the GX Configurator-SC's "Data for modem connection" screen.
2) Display and operate the screen according to Section 8.4.3 of the User's Manual (Basic).
3) Set the required items with the table below.

"Data for modem connection" screen setting item		Data communication (MC, non procedure, bidirections)	Notification	GX Developer
Data for modem connection 1 to 30	Pager receiver designation	×	●	×
	Telephone number	●	●	● (for callback)
	External line dialing	○	○	○ (for callback)
	Line types	○	○	○ (for callback)
	Wait time for message transmission unit: s	×	○	×
	Message	×	○	×
	Comment	○	○	○

●: Required item ○: Setting possible ×: Setting not required

(Registration example) Setting example to perform data communication



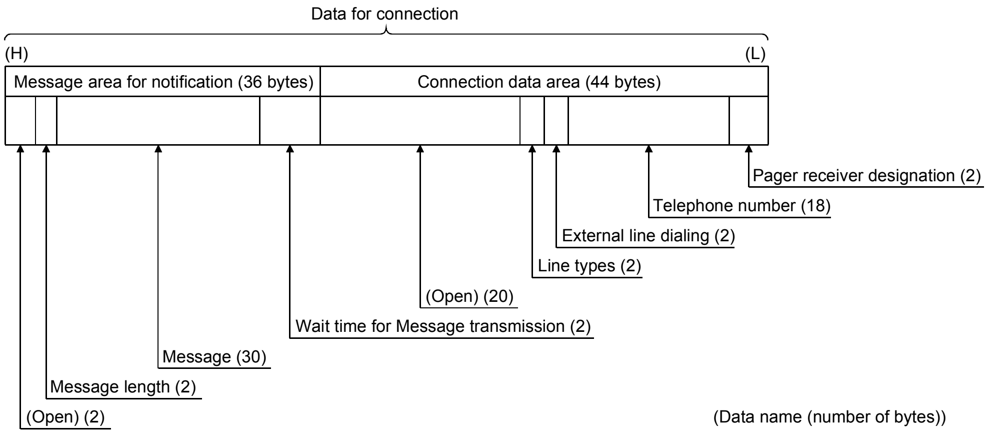
(b) For the buffer memory of the Q series C24

1) The connection data write (registration) and read operations are performed by designating an applicable area that corresponds to registration numbers 8001$_H$ to 801F$_H$ for the user frame registration area (addresses: 1B00$_H$ to 1FF6$_H$).
When deleting the connection data, write "0" to the number of registration data bytes designation area.

2) The table below shows an overview of the buffer memory used in the write, read, and delete operations of the connection data as well as the designated values for each area are.
For more details, see Chapter 9.
(Use the table by replacing the user frame with the connection data.)

Address		Name		Designated/stored value	Specification required (○)/not required (×)		
Hexadecimal	Decimal				Write	Read	Delete
1B00$_H$	6912	Registration No.8001$_H$	Registration data byte number designation	0 : When deleting 80: Number of registration data bytes	○	× (Read processing not required)	○
1B01$_H$ to 1B28$_H$	6913 to 6952		Connection data	Notification message for connection data to be registered, and connection data			×
1B29$_H$	6953	Registration No.8002$_H$	Registration data byte number designation	0 : When deleting 80: Number of registration data bytes	○	× (Read processing not required)	○
1B2A$_H$ to 1B51$_H$	6954 to 6993		Connection data	Notification message for connection data to be registered, and connection data			×
⋮							⋮
1FCE$_H$	8142	Registration No.801F$_H$	Registration data byte number designation	0 : When deleting 80: Number of registration data bytes	○	× (Read processing not required)	○
1FCF$_H$ to 1FF6$_H$	8143 to 8182		Connection data	Notification message for connection data to be registered, and connection data			×

3) The following shows the data arrangement of the connection area data (area corresponding to registration numbers 8001$_H$ to 801F$_H$) in the buffer memory that is used for the register, read and delete operations of the connection data, as well as the designated values and stored values.



(Data for connection area) ⋯ 44 bytes

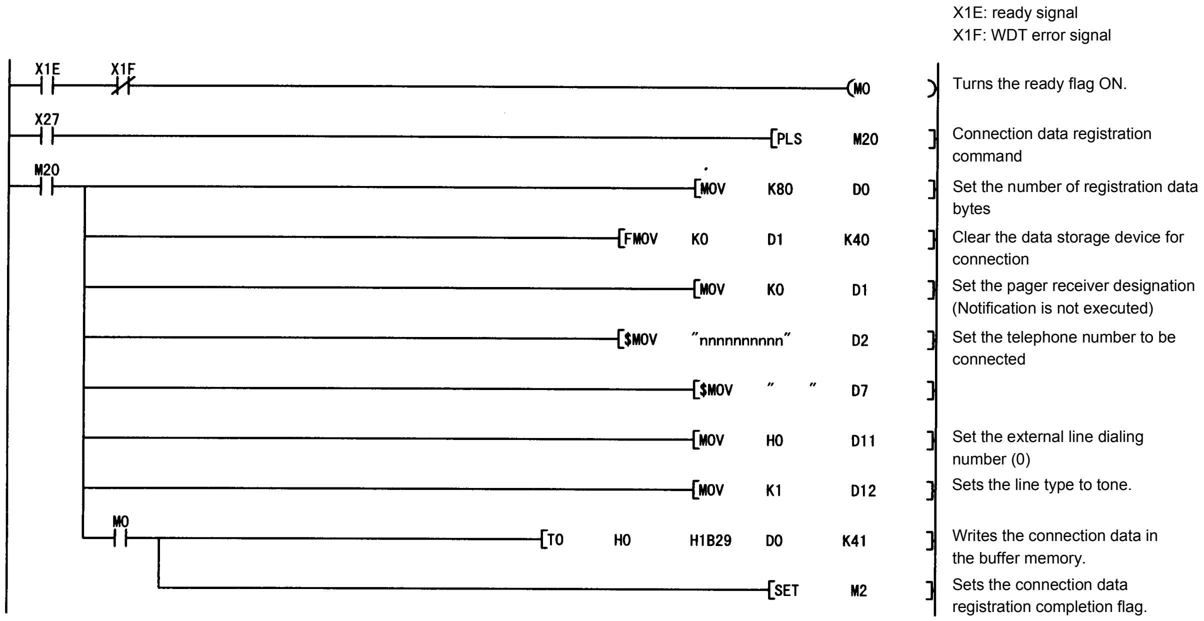
Data name	Designated/stored value and contents	Number of bytes	Data type
Pager receiver designation	Whether or not notification is performed, and the notification target module are designated. 0 : No notification 3 : Notification performed ∗ In the case of 3 above, the wait time for message transmission in the notification message must be designated.	2	Binary
Telephone number	• The other party's phone number used to establish line connection when communicating data or performing notification is designated. • When phone number is less than 18 characters, a space (code: 20_H) must be entered for the remainder.	18	ASCII
External line dialing number	The external-line access number on Q series C24 side when performing data communication/notification to the partner device is designated. 0 to 9, 10(∗), 11(#) : External-line access number on the Q series C24 side 255 : No external-line access number required on the Q series C24 side	2	Binary
Line type	The line type used to perform data communication/notification with the partner device is designated. 0 : Pulse 1 : Tone 2 : ISDN	2	Binary
(Open)	Designate "0" .	20	Binary

(Notifying message area) … 36 bytes (Designated when performing notification)

Data name	Designated/stored value and contents	Number of bytes	Data type
Wait time for message transmission	The wait time after line connection until message transmission is designated. (Unit: s) 0 to 255 : Wait time ∗ Valid when the pager receiver designation in data connection is "3".	2	Binary
Message	Designate the notification message according to the display specification on the other party's device.	30	Binary
Message length	The number of designated message bytes shown above is designated. 0 : No message designation 1 to 30 : Number of message bytes	2	Binary
(Open)	Designate "0".	2	Binary

(4) An example of a sequence program used for writing (registering) of data for connection is shown below.

• Example of writing data for connection to the registration number 8002H area



(Item name)		Data register		(Address)	Buffer memory Area for registration No. 8002H
Number of registration data bytes	D0	80	→	1B29H	80
Data for connection	D1 to D22	(Connection data)	→	1B2AH to 1B3FH	(Connection data)
	D23 to D40	(Data for notification)	→	1B40H to 1B51H	(Data for notification)

3.4.5 Initialization of modem/terminal adapter

This section explains the initialization of the modem/TA connected to the Q series C24, used for communicating data with the external device, performing notifications to pager receivers and accessing from GX Developer using the modem function.

(1) Requirements for initialization

Perform the following setting and registration:

1) The Q series C24 initial settings as shown in Section 3.4.2.
2) The data for initialization registration shown in Section 3.4.3, when initializing the modem/TA with the data for initialization set by the user.

REMARK

It is possible to initialize and connect at the same time by performing the connection process by designating the data for initialization and data for connection. (See Section 3.4.6.)

(2) Registering initialization data using GX Configurator-SC (Settings on the modem function system setting screen)

The number of the initialization data used to initialize the modem connected to the Q series C24 is registered on the GX Configurator-SC's "Modem function system setting" screen.
The following explains the number designated by the "Initialization data number" item on the GX Configurator-SC's "modem function system setting" screen and the related buffer memory when the initialization data number = 0 is designated.

	Used buffer memory				The number of data for initialization used and buffer memory designated value	
	Name		Address (CH1/CH2)			
			Hexadecimal	Decimal	When number used = 1	When number used = 2 or more
1	Data number for initialization designation		34H	52	7D0H to 801FH : Data for initialization registration number (＊1)	0H
2	User frame being transmitted number		B6HH/156H	182/338	(Unused)	(During initialization, the data registration number currently being sent is stored.)
3	CR/LF output designation		B7H/157H	183/339		0 (default value)
4	Output head pointer designation		B8H/158H	184/340		1 to 100 (See 1))
5	Output count designation		B9H/159H	185/341		1 to 100 (See 2))
6	Output frame number designation	First	BAH/15AH	186/342		7D0H to 801FH : Data for initialization registration number (＊1)
		Second	BBH/15BH	187/343		
		to	to	to		
		Hundredth	11DH/1BDH	285/445		

＊1 The data for initialization registration number to be used is designated.
7D0H to 7DDH (2000 to 2013) : Data registered by the OS
9C4H to 9E1H (2500 to 2529) : Data registered in the Flash ROM by the user
8001H to 801FH (–32767 to –32737): Data registered in the buffer memory by the user

1) Output head pointer designation area (address: 184/344 (B8H/158H))
Designate the location of the head position (n-th unit) in the output frame number designation area to which the registration number of the data for initialization to be sent is written.
1 : Transmitted form the first unit
to
100: Transmitted from the 100th unit

2) Output count designation area (address: 185/345 (B9H/159H))
The number of data for initialization units to be transmitted starting from the location set by the output head pointer designation area is designated here.
1 : 1 data will be transmitted
to
100: 100 data will be transmitted

(3) Precautions during modem/TA initialization

If the DSR signal from the modem/ TA goes OFF when modem/TA initialization is completed (X10 goes ON), the Q Series C24 executes initialization processing automatically in accordance with the following.

1) If the auto modem initialization is specified
Modem / TA initialization processing is executed in the initialization / connection timeout time interval while the DSR signal is OFF without relation to the ON/OFF status of the modem initialization request signal Y10.
2) If the auto modem initialization is not specified
The modem / TA initialization processing is executed when the DSR signal restarts without relation to the ON/OFF status of the modem initialization request signal Y10.

(4) If modem / TA initialization is executed automatically (Set by the GX Configurator-SC)

By having the GX Configurator-SC perform the settings for automatic modem initialization, modem initialization is executed automatically when the Q Series C24 starts up.
The modem initialization completion signal (X10) goes On.

(a) Settings for auto initialization of the modem / TA
Select "auto initialize" for the auto modem initialization designation in the GX Configurator-SC's "Modem function system setting" screen.
(b) Cautions when initializing the modem / TA automatically
1) If the modem's initialization processing is completed abnormally, the Q Series C24 executes the following processing.
• The initialization / connection abnormal completion signal (X13) does not go ON.
• An error code is stored in the buffer memory's modem function error code storage area (Address: 545 (221H)).
• Modem initialization is retried automatically using the initialization / connection timeout time stored in the buffer memory (address: 50 (32H), and is repeated until initialization is completed normally.
＊ When modem initialization is not completed normally, the user should perform the following, and restart the station where the Q Series C24 is installed.
• Check the set initialization data No.
• Check the registered contents of the initialization data corresponding to the set initialization data No. (If they are abnormal, correct them and register them again.)
• Check if the modem's power is turned on.

2) When the line is disconnected from the Q Series C24 side (using Y12), the initialization completion signal (X10) goes off together with the connection in progress signal (X12).
When connecting to the line again, do so after first initializing the modem.

> **POINT**
> When the line to the Q Series C24 is disconnected from the external device side, the Q Series C24's initialization completion signal (X10) does not go OFF.
> When desiring to disable reception by the Q Series C24 side's modem, execute line disconnect by the modem disconnection request signal (Y12).

(5) If the modem/TA is initialized by a sequence program

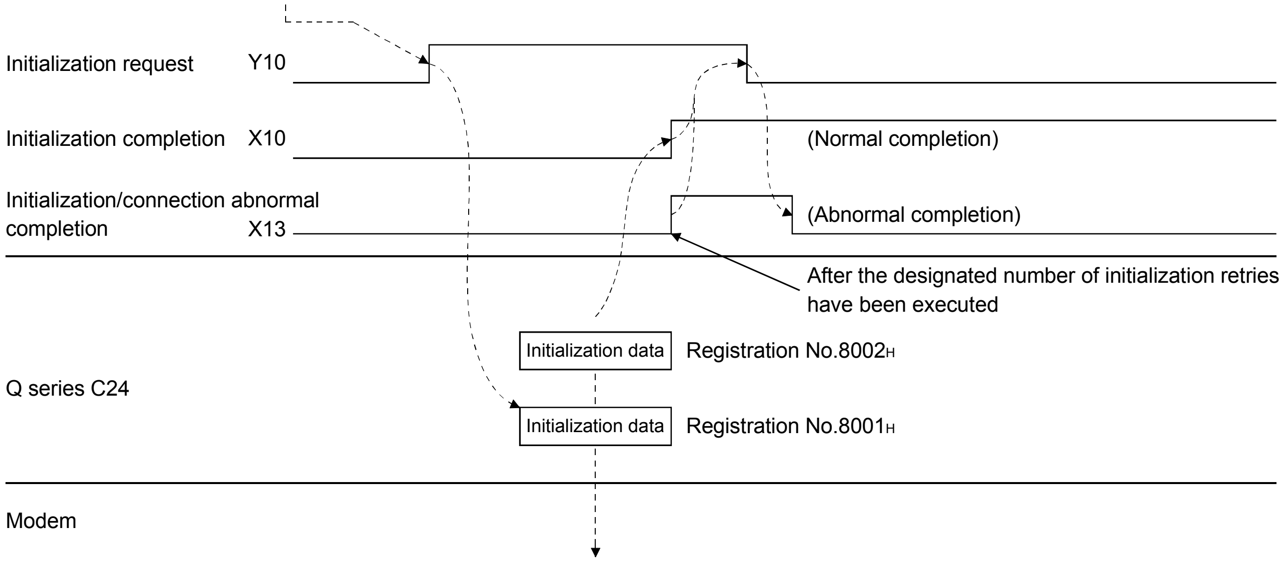
(a) I/O signals used in initialization
The initialization request signal (Y10), initialization complete signal (X10) and initialization/connection abnormal complete signal (X13) are used.

(Example) When initializing the modem connected to CH1 of the Q series C24 using two set of data for initialization (registration numbers 8001H and 8002H) that are registered in the buffer memory

Address	Buffer memory		(Designated value)	
B6H	Frame number being transmitted		0	
B7H	CR/LF output designation		0	
B8H	Output head pointer designation		3	······· Out of the output frame numbers, from which one the transmission will be initiated is designated.
B9H	Number of outputs		2	······· Out of the output frame numbers, the number of units to be transmitted is designated.
BAH	Output frame number	1st unit	9C4H	
BBH		2nd unit	9C5H	
BCH		3rd unit	8001H	······· Data for initialization registration number is designated.
BDH		4th unit	8002H	
BEH		5th unit	9D0H	
BFH		6th unit	9D1H	

Must be designated prior to the modem initialization request.

* The Q series C24 will transmit the data for initialization in the designated order.

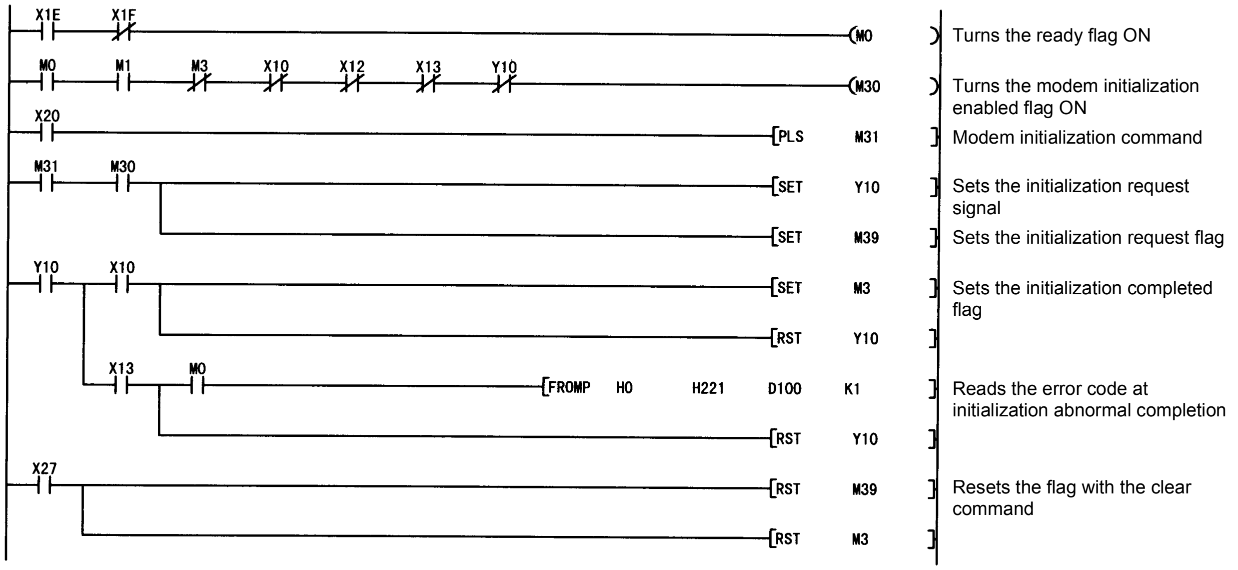


(b) Modem/TA initialization program example

An example of the modem/TA initialization program on the Q series C24 side by the PLC CPU is shown below.

∗ When the initialization data has been registered from GX Configurator-SC or from the PLC CPU.

X12: Connection in progress signal
X1E: Ready signal
X1F: WDT error signal
M0 : Accessible flag
M1 : Data registration complete flag for initialization
M30: Initialization enabled flag



3.4.6 Line connection

This section explains the connection (dialing) with the partner devices for the purpose of data communication with external devices using the modem functions.
In case of notification to a pager receiver, the line is connected while the notification is being processed. The connection processing such as a connection request (Y11) to I/O signal is, therefore, unnecessary.
✻ The data for connection indicated in this section should be set to perform the notification processing

(1) Requirements for connection

Complete the following settings and registrations in advance.

1) The initial settings for the Q series C24 as shown in Section 3.4.2
2) The registration of the data for initialization as shown in Section 3.4.3
3) The registration of the data for connection as shown in Section 3.4.4
4) The initialization of the modem/TA connected to the Q series C24 side as shown in Section 3.4.5
   In addition, both the initialization and line connection can be conducted simultaneously by designating the data for initialization and data for connection to perform connection processing.
   For the data setting for initialization to perform initialization and line connection simultaneously, see Section 3.4.2, 3.4.5. Explanation on the above-mentioned setting is omitted in this section.

(2) Registering the data for connection using GX Configurator-SC (Settings on the modem function system setting screen)

The number of the data for connection that is used for line connection in order to perform data communication with the external device is registered on the GX Configurator-SC's "Modem function system setting" screen.
The following explains the number designated by the "Connection data number" item on the GX Configurator-SC's "Modem function system setting" screen.
✻ The addresses shown in parentheses below indicate the addresses of the buffer memory where the setting values for this item on the "Modem function system setting" screen are stored.

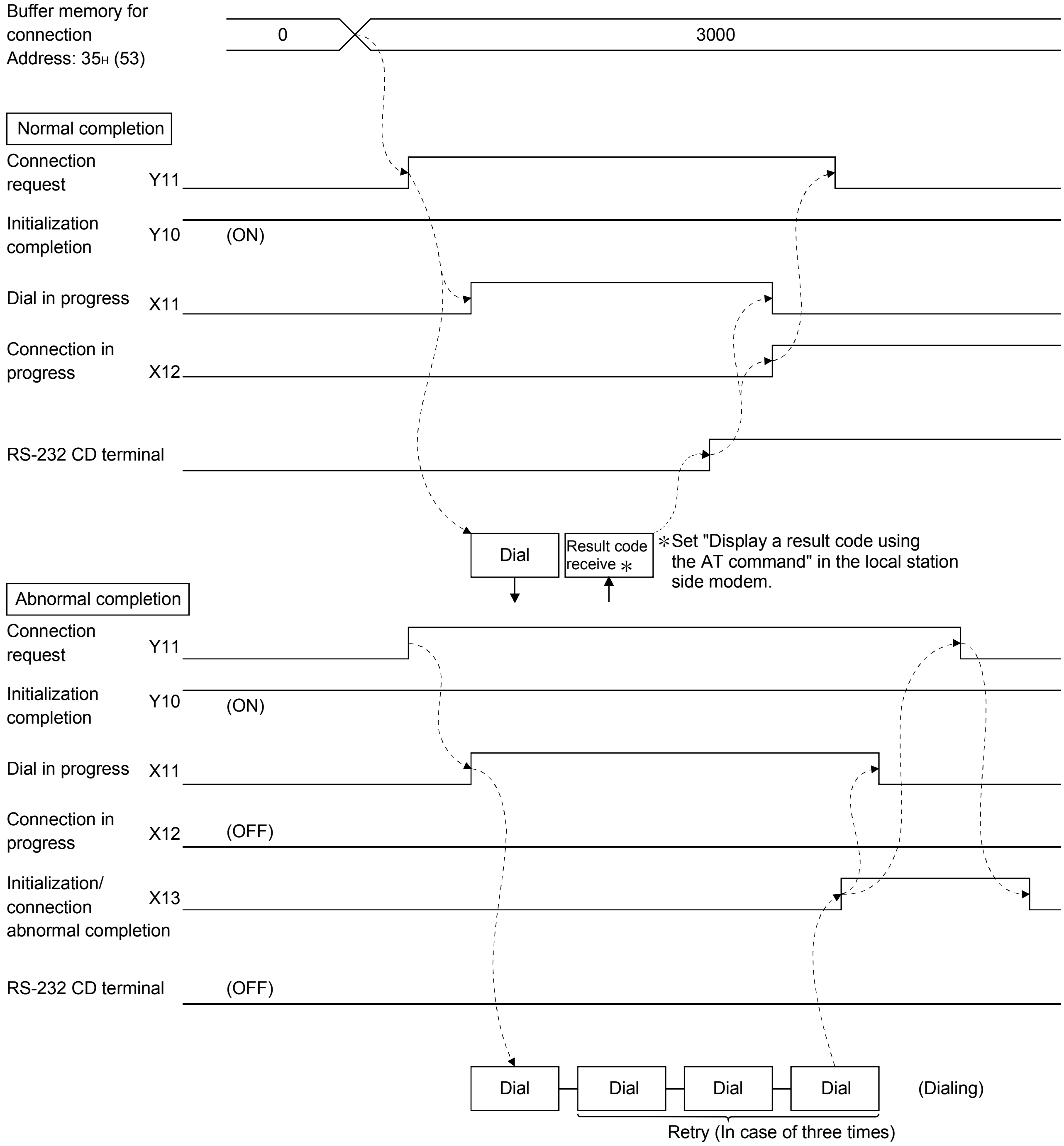
1) When line connecting from the Q series C24 side
   - Data number for connection designation area (address : 35_H (53))
     The data for connection registration number is designated.
     $BB8_H$ to $BD5_H$ (3000 to 3029) : Data registered to the Flash ROM by the user
     8001_H to $801F_H$ (–32767 to –32737): Data registered to the buffer memory by the user

2) When line connecting from the external device
   Since the line connection processing is not necessary on the Q series C24 side, connecting data registration for line connection and data number setting for connection are not needed.

(3) I/O signals used in line connection

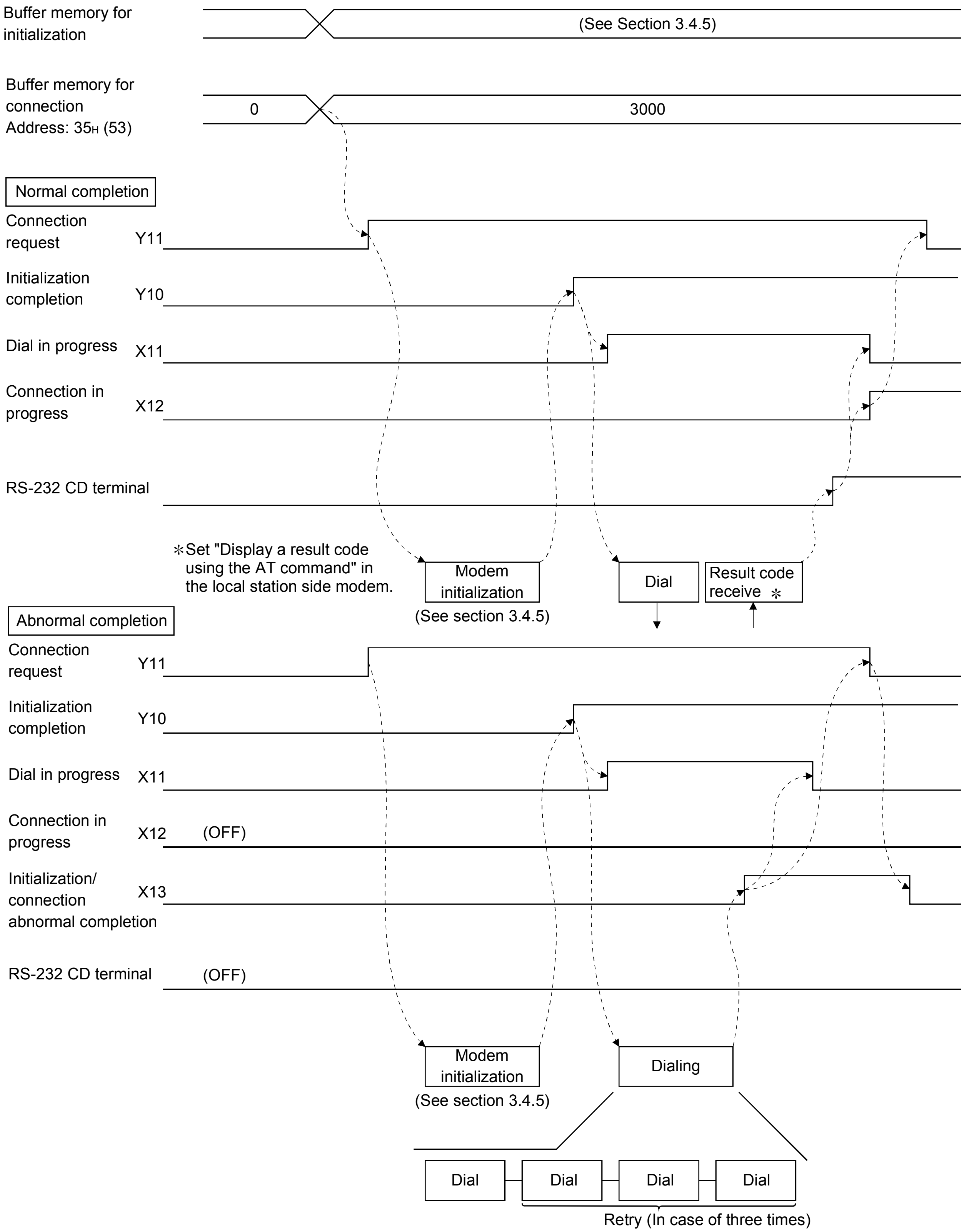
Connection request signal (Y11), dial in progress signal (X11), connection in progress signal (X12) and initialization/connection abnormal completion signal (X13) are used.

(Example1) When performing the line connection from the Q series C24 side only following the completion of initialization



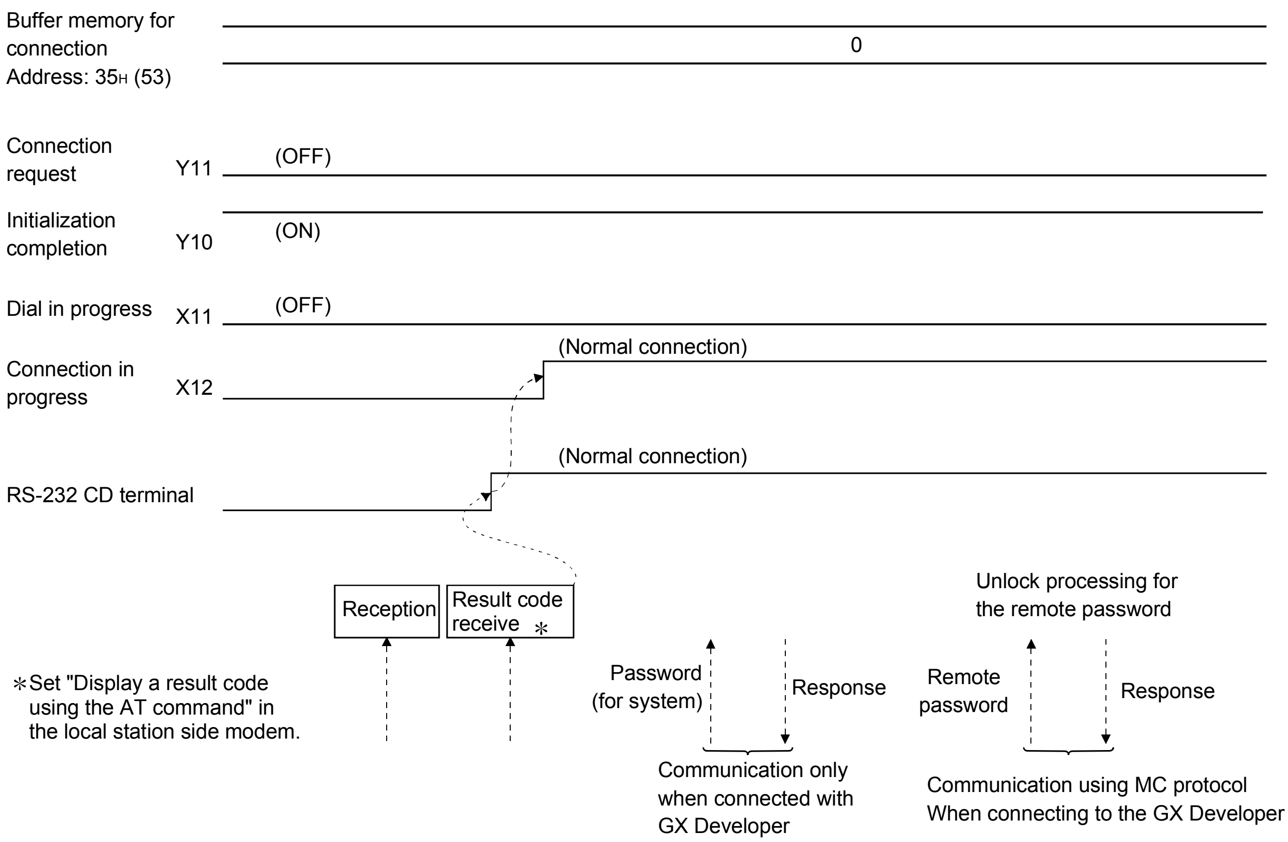
✻Connection channel and retry operation are performed using the buffer memory setting.

(Example2) When performing the initialization and the line connection from the Q series C24 side simultaneously



*Connection channel and retry operation are performed using the buffer memory setting.

(Example) When initiating the line connection from the partner device after the completion of initialization



POINT
(1) The connection channel on the Q series C24 side is set in the "modem function system setting" screen of GX Configurator-SC. (2) Abnormal processing when the partner device initiate the line connection is left entirely to the partner device. There is no method on the Q series C24 side to check a line connection error occurrence at the partner device. (3) When a remote password check is performed for the QCPU, normal completion of the unlock processing allows access to data communication/PLC thereafter.

(4) Precautions during the line connection

1) Prior to data communication with external devices, determine when and which station will perform the line connection (dialing) and line disconnection processing to the external device.

2) Use the following method to perform the unlock processing for the QCPU remote password from the opposite device.
   - During communication using MC protocol, transmit the dedicated command to the Q series C24 side.
   - When accessing the PLC using the GX Developer, perform the unlock processing on the GX Developer screen when access begins.
     See Section 3.3.7 (8) for what to do when the unlock processing is completed abnormally.

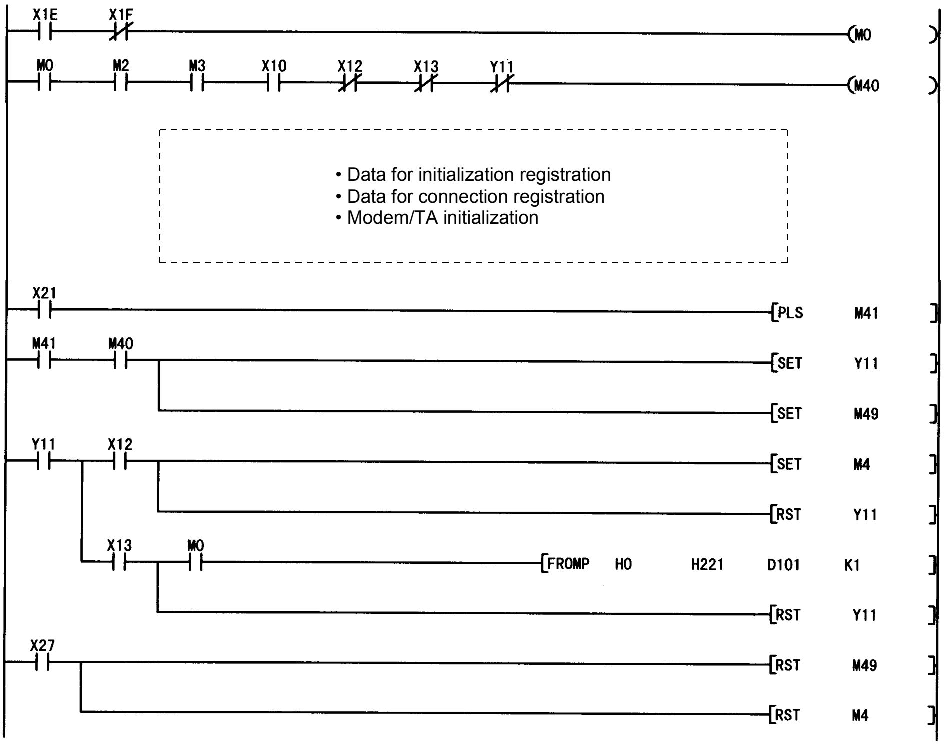
3) When reconnecting the line after disconnection, allow several seconds for the modem before turning on the Connection request (Y11). If it (Y11) is turned on immediately after line disconnection, the modem may not accept the first connection request, resulting in connection failure, and the user may be forced to wait for the retry time to elapse.

(5) Line connection program example

An example of a line connection program is shown below.

- Example of initiating line connection from the Q series C24 side following the initialization completion
  ✻ When the data for connection has been registered from GX Configurator-SC or from the PLC CPU.

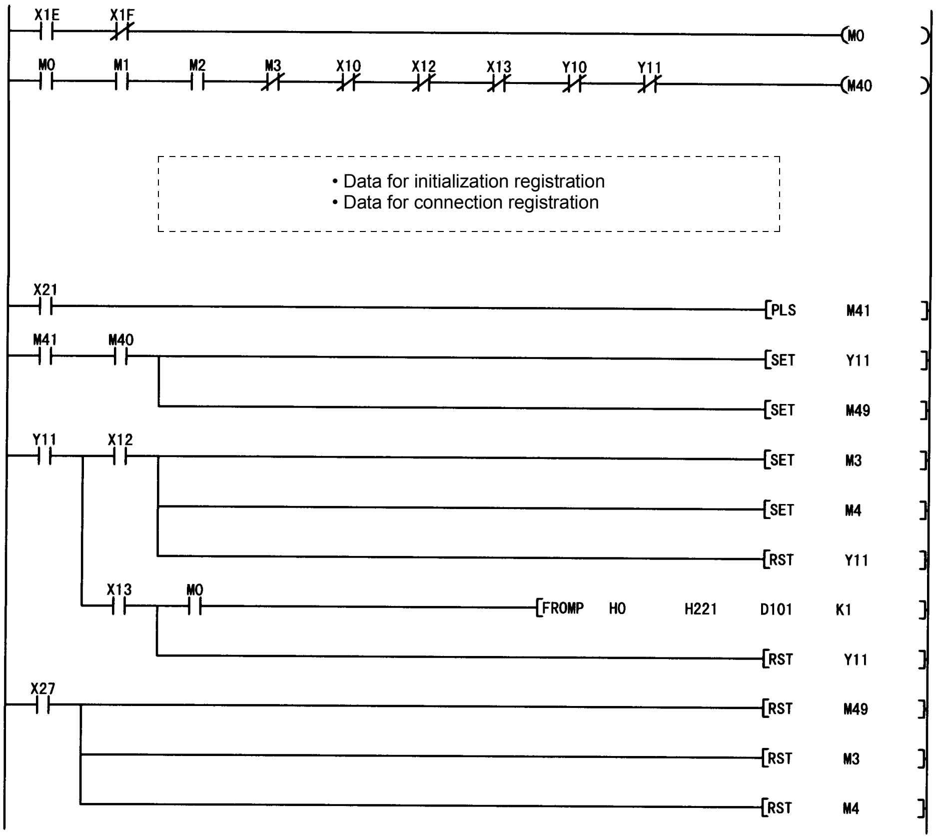
X10 : Initialization complete signal
X1E : Ready signal
X1F : WDT error signal
M0 : Accessible flag
M2 : Data registration complete flag for connection
See Section 3.4.4
M3 : Initialization complete flag
M40: Connectable flag



Turns the ready flag ON
Turns the line connectable flag ON.
See Section 3.4.3
See Section 3.4.4
See Section 3.4.5
Line connection command
Sets connection request signals
When the connection in progress signal ON (normal completion), sets the connection complete flag.
Reads the error code at connection abnormal completion.
Resets the flag with the clear command.

- Example of simultaneous execution of initialization and line connection from the Q series C24 side
  ✻ When the initialization and connection data have been registered from the GX Configurator-SC or from the PLC CPU.

X10 : Initialization complete signal
X1E : Ready signal
X1F : WDT error signal
M0 : Accessible flag
M1 : Data registration complete flag for initialization
M2 : Data registration complete flag for connection
See Section 3.4.4
M3 : Initialization complete flag
M40: Connectable flag



REMARK

When the line connection is initiated from the partner device, neither registration, setting nor connection processing is necessary.
As shown in example 3) of this section's (3), data communication is possible if the connection in progress signal (×12) turns ON after the completion of Q series C24 modem/TA initialization.
For an example of the modem/TA program for initialization, see Section 3.4.7.

3.4.7 Data communication and notification

This section explains the cautions for data communication with the partner device using modem function and procedures for notification to pager receivers.

(1) Requirements for data communication and notification

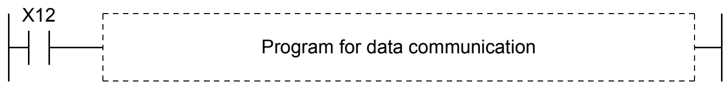
a) When communicating data with external devices
Perform the appropriate processing up to line connection or modem/TA initialization, depending on whether or not the line connection is initiated from the Q series C24 side.
After line connection, data communication can be performed using an MC protocol/non procedure protocol/bidirectional protocol in full-duplex communication.

1) When line connecting from the Q series C24 side
Processing up to line connection as shown in Section 3.4.6.
2) When line connecting from the external device
Processing up to the initialization of the modem/TA as shown in Section 3.4.5.

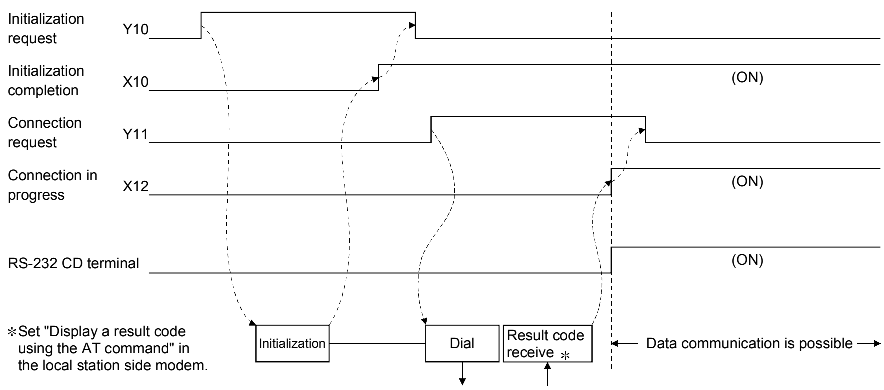
b) When notifying to pager receivers
Perform processing up to the initialization of the modem/TA as shown in Section 3.4.5.
∗ In notification to pager receiver, since the line connection is performed during notification processing, line connection processing is unnecessary. However, be sure to register data for connection.

(2) Buffer memory used and I/O signals

a) When communicating data with the external device
Only buffer memory and I/O signals the user uses for data communication (MC protocol/non procedure protocol/bidirectional protocol).
Communicate data using the connection in progress signal (X12) ON as the interlock signal.

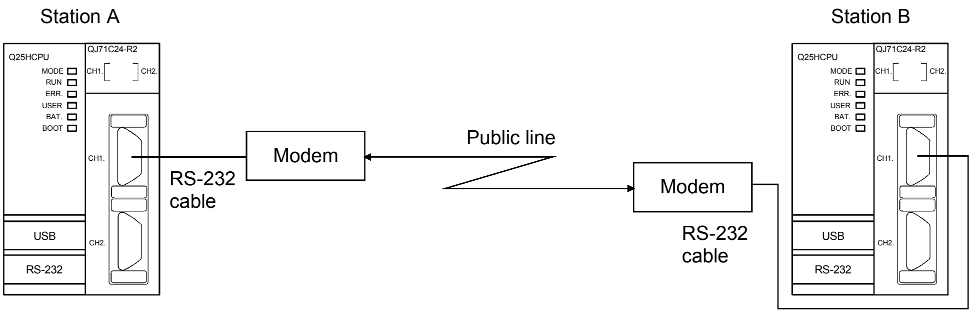


There is no I/O signal or buffer memory for modem functions used in data communication.



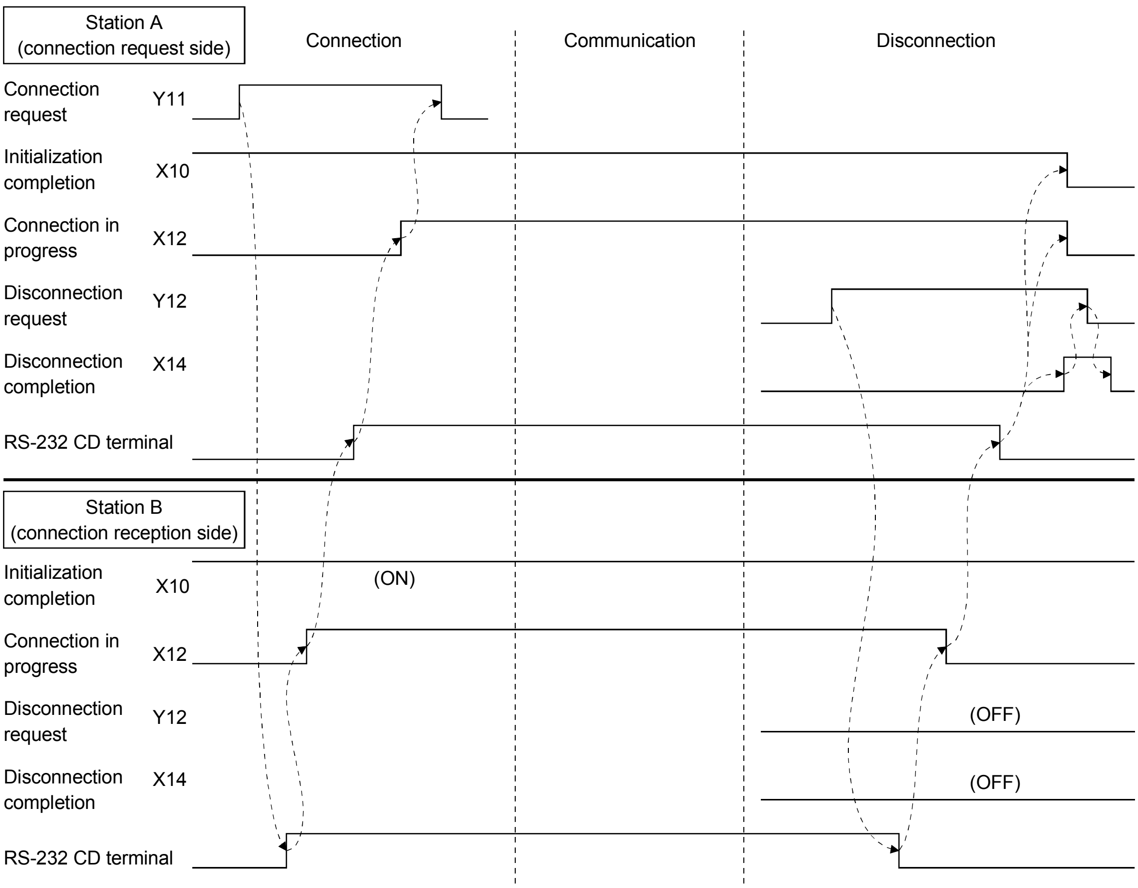
REMARK

This section explains the general procedure for non procedure protocol/bidirectional protocol (executed in full-duplex communication) data communication using the modem function between the PLC CPU with Q series C24 installed.



(General Procedure)

1) Perform initial setting for Q series C24 at both station A and station B.
2) Perform modem/TA initialization in station B.
3) Perform modem/TA initialization and line connection in station A.
4) Communicate data using the non procedure protocol/bidirectional protocol.
5) In order to end the communication, disconnect line from station A that initiated the line connection.



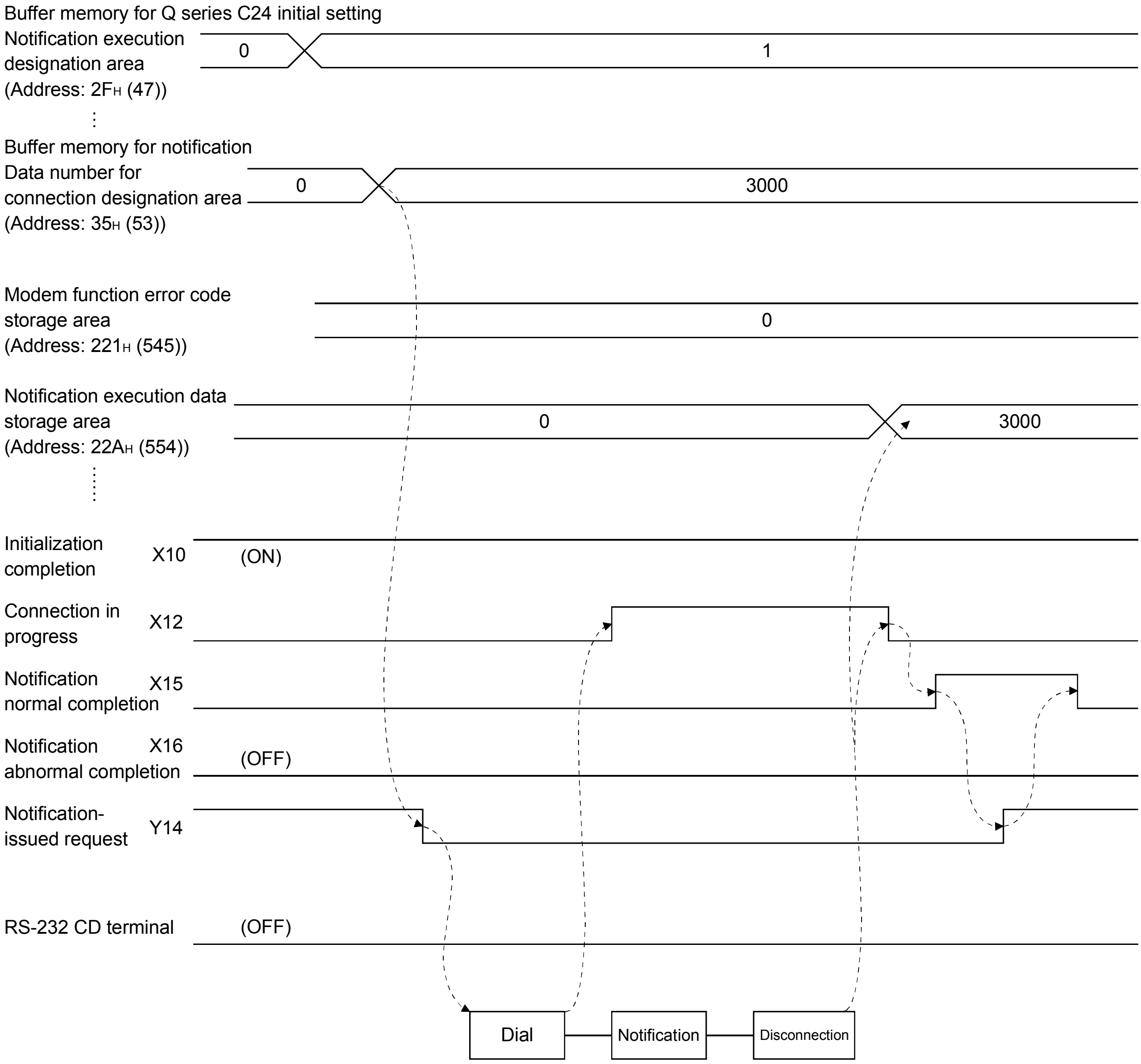
*It is possible to disconnect line from Station B, as well.

b) When notifying to pager receiver

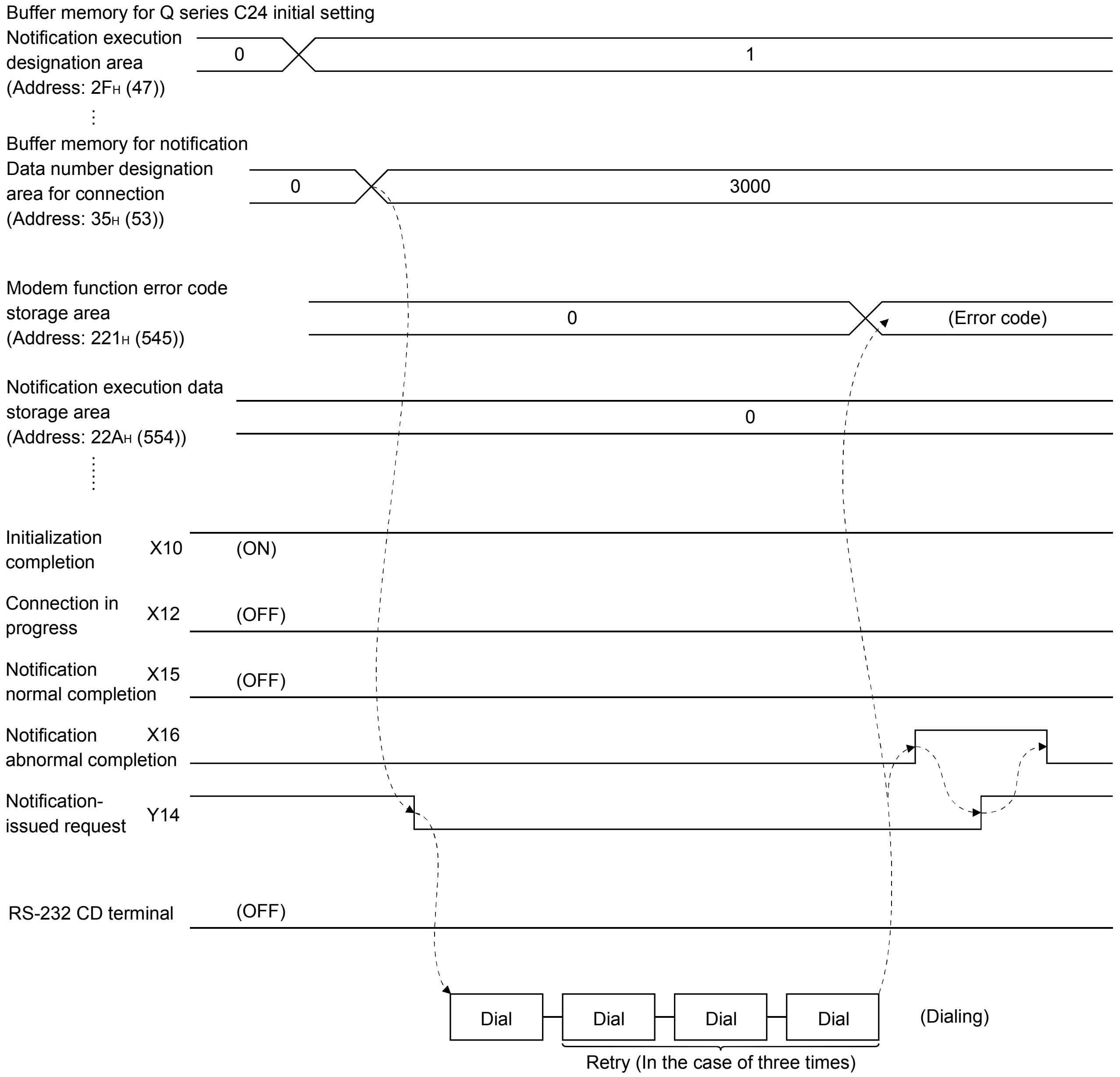
1) Initial setting by GX Configurator-SC
Register the data number registration area for connection below in the "Modem function system setting" screen.
BB8H to BD5H (3000 to 3029) : Data registered to the Flash ROM by the user
8001H to 801FH (–32767 to –32737): Data registered to the buffer memory by the user

2) I/O signal
Use notification-issued request signal (Y14), notification normal complete signal (X15), notification abnormal complete signal (X16).

(Example 1) When normal completion



(Example 2) When abnormal completion



＊Retry processing is conducted according to the values for the connection retry number to initialization/connection timeout registered in the initial setting for GX Configurator-SC.

(3) Precautions for performing data communication and notification

a) When communicating data with the external device

1) When setting the no-communication interval time to infinite wait (set value=0) in the initial setting of Q series C24, be sure to perform line disconnection after the completion of data communication.
2) Only the no procedure protocol/bidirectional protocol data communication can be performed in the PLC CPU with Q series C24 installed.
3) The Q series C24 automatically performs line disconnection processing if no data exchange is performed during the no-communication interval time.
(The connection in progress signals (X12) and initialization complete signals (X10) turn off.)

b) When notifying to pager receivers

1) Turn on the notification-issued request signal (Y14) before the Q series C24 modem/TA initialization is completed.
2) Notification processing is conducted when the notification-issued request signal (Y14) turns from ON to OFF after the completion of modem/TA initialization.
Therefore, notification processing is conducted when the PLC CPU of the station with Q series C24 installed is in stop status, or the PLC CPU stops due to error, since the notification-issued request signal (Y14) is turned off in either case.
Write the data number for connection in the initial setting for GX Configurator-SC.
3) When the notification-issued request signal (Y14) is turned OFF from ON before initialization of the Q series C24 modem/TA, the processing will end abnormally.
4) When the notification-issued request signal (Y14) is turned OFF from ON during initialization of the Q series C24 modem/TA, notification processing will be conducted after the completion of the modem/TA initialization.
5) Notification processing is completed in the order of line connection, message transmission, and line disconnection from Q series C24 for the transmission station of the radio wave to the notification destination.
Therefore, even if the power to the notification destination equipment is off, the notification processing will end normally as long as the above processing is completed.
6) When the notification-issued request signal (Y14=ON) is turned ON before notification processing is complete, some messages may not be sent.

POINT

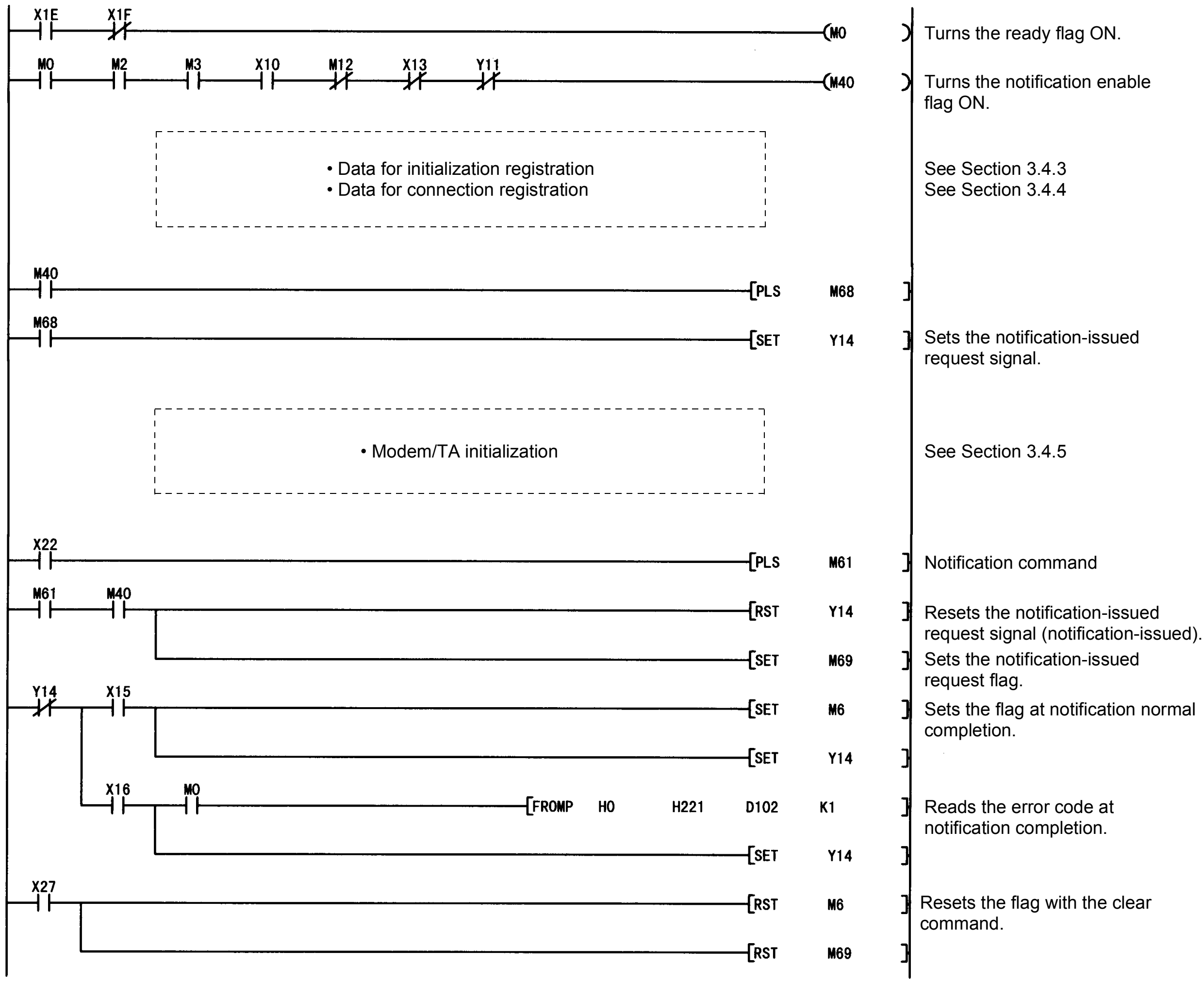
Turn on the notification-issued request signal (Y14) before the initialization processing of the Q series C24 modem/TA is completed, and turn it off after the initialization complete signal (X10) is turned ON (notification request).

(4) Program for notification example

An example of program for notification is shown below.

∗ When the initialization and connection data have been registered from the GX Configurator-SC or from the PLC CPU.

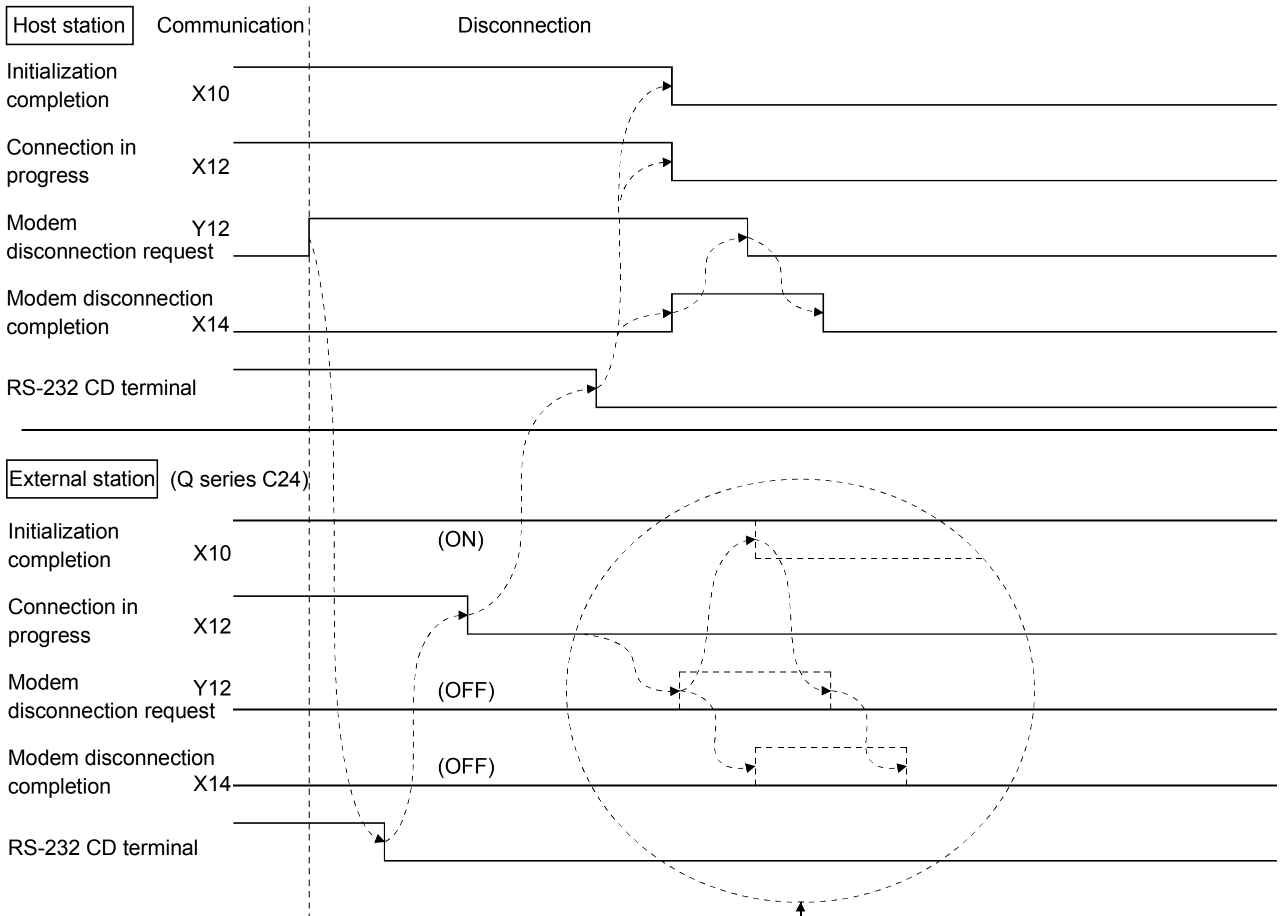
X10: Initialization complete signal
X1E: Ready signal
X1F: WDT error signal
M0 : Accessible flag
M2 : Data registration complete flag for connection See Section 3.4.4
M3 : Initialization complete flag
M40: Notification enable flag



3.4.8 Line disconnection

This section explains the line disconnection upon communication completion when communicating data with the external device using the modem functions.
In case of notification to pager receivers, since the line will be disconnected at the end of the notification processing, the disconnection processing such as I/O signal disconnection request (Y12) is unnecessary.

(1) I/O signal used
Uses modem disconnection request signal (Y12) and modem disconnection complete signal (Y14).



This is the procedure to take in order to turn off the initialization complete signal (X10).
＊In the case of Q series C24, when the line is disconnected from the external device, the initialization complete signal (X10) at the local station is not turned OFF.

POINT

(1) Line disconnection processing can be conducted from either device as long as the connection is in progress.
(2) The line disconnection processing disconnects the line connection with the external device as well as the connection with the Q series C24 modem.
(3) Even when an error occurs during the line disconnection, the disconnection processing will be forced.
(4) If data communication is to be resumed after line disconnection, either one of the following processing will be initiated depending on the initialization complete signal (X10).
    1) If the initialization complete signal is OFF
       Start from the initialization of the modem/TA.
    2) If the initialization complete signal is ON
       Start from the line connection with the external device.

REMARK

There is no buffer memory for line disconnection processing.

(2) Precautions during the line disconnection

1) Prior to data communication with external devices, determine when and which station will perform the line connection (dialing) and line disconnection processing to the external device.

2) If the line is disconnected during data transmission, transmission processing will be performed depending on the signal status of the Q series C24 RS-232C interface.

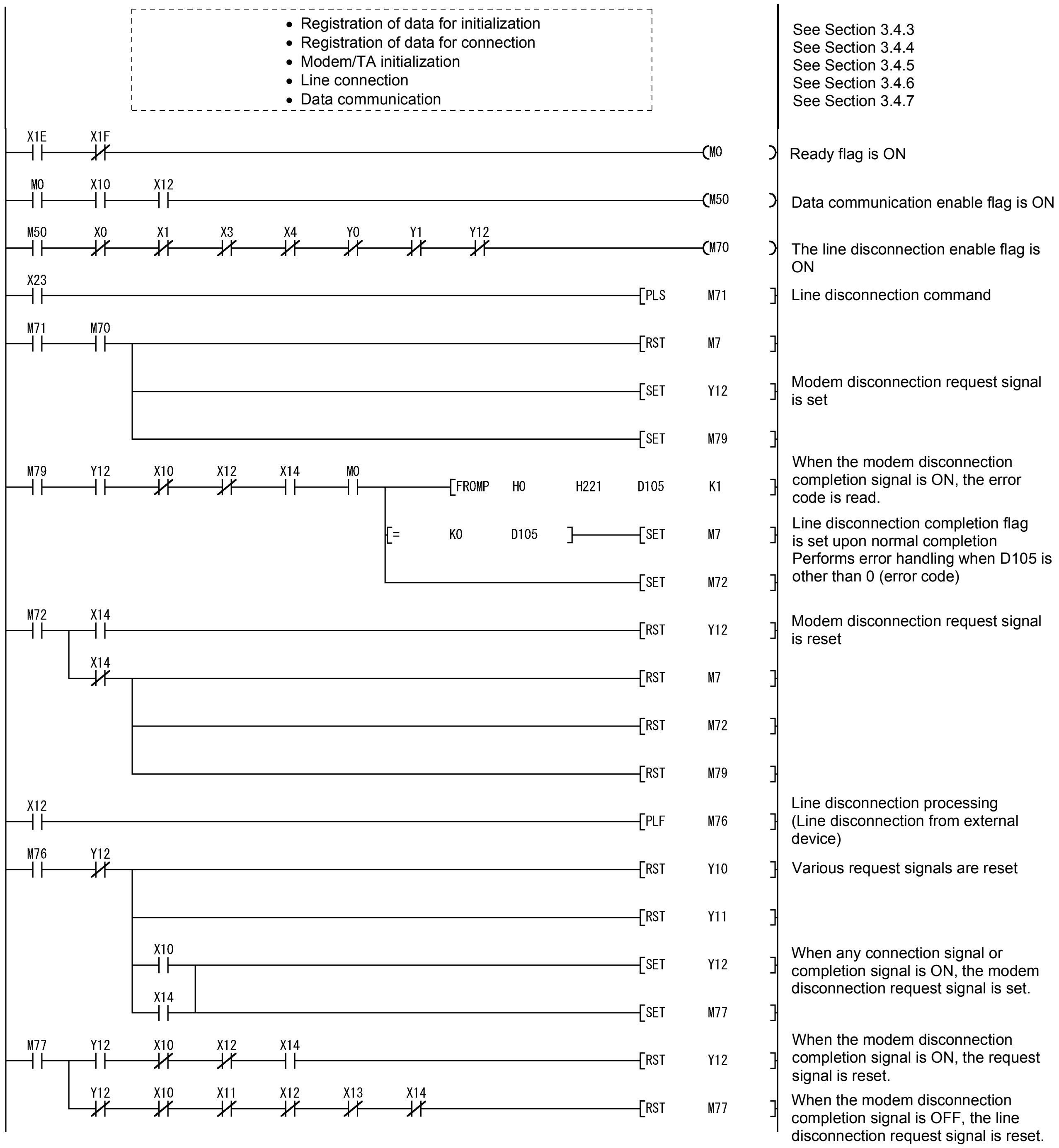
3) If the line is disconnected during data reception, data reception will be disabled. This may cause an error occurrence such as a reception time out.

(3) Program example for line disconnection

A program example for line disconnection is shown below.

X0: Normal transmission completion signal
X1: Abnormal transmission completion signal
X3: Reception data read request signal
X4: Abnormal reception detection signal
X10: Initialization complete signal
X12: Connection signal
X1E: Ready signal
X1F: WDT error signal

Y0: Transmission request signal
Y1: Reception data read complete signal
M0: Accessible flag
M50: Data communication enable flag
M70: Line disconnection enable flag



3.5 Sample Programs

This section shows sample programs to test the connection with the remote station's PLC CPU to which Q series C24 is installed.
Each program contains a minimum set of processing necessary for performing a exchange test.
Modify the data for initialization and data for connection to match each system environment.
When adding error-handling procedures, add them separately by seeing the explanation in this chapter.

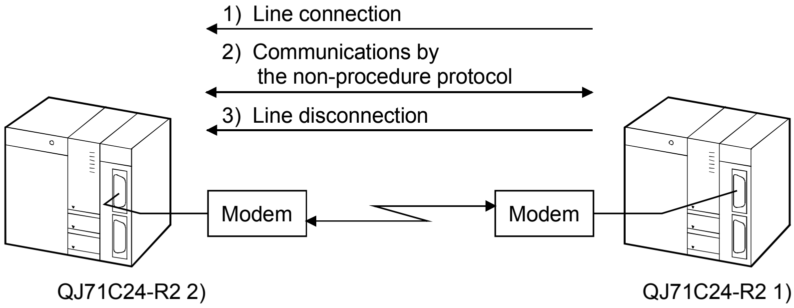
The uses of major devices that are used in these sample programs are listed below.

Application of device (comment list)					
Device	Application	Device	Application	Device	Application
X3	Reception data read request	Y64	Line connection completion	M100	Initialization request execution
X4	Reception abnormal detection	Y66	Notification completion	M101	Connection request execution Notification execution
X10	Initialization completion	Y67	Line disconnection completion	M102	Transmission execution in progress
X11	Dial in progress			M103	Reception data read execution in progress
X12	Connection in progress	M0	Q series C24 accessible		
X13	Initialization/connection abnormal completion	M1	Initialization data registration completion	SM400	Always ON
X14	Modem disconnection completion	M2	Data registration completion for connection		
X15	Notification normal completion	M3	Initialization completion	D0	Number of registration data bytes
X16	Notification abnormal completion	M4	Line connection completion	D1	Control number designation Receiver designation
X1E	Q series C24 ready	M6	Notification completion	D2	Initialization command/telephone number
X1F	WDT error	M7	Line disconnection completion	D11	External line dialing number, etc.
X20	Initialization command	M10	Convert the registration command into pulse	D12	Line type, etc.
X21	Line connection command	M20	Convert the registration command into pulse	D23	Wait time for message transmission
X22	Data communication command	M30	Initialization enabled	D24	Message
X23	Line disconnection command	M31	Convert the initialization command into pulse	D39	Message length
X24	Notification command	M40	Connectable	D50	Number of transmission data
		M41	Convert the connection command into pulse	D51	Transmission data
Y10	Initialization request	M50	Data communication enabled	D60	Number of reception data
Y11	Connection request	M51	Transmission enabled	D61	Reception data
Y12	Modem disconnection request	M52	Convert the transmission command into pulse	D100	Initialization error code
Y14	Notification-issued request	M60	Convert the notification command into pulse	D101	Line connection error code
Y60	Q series C24 accessible	M70	Line disconnection enabled	D102	Notification error code
Y61	Initialization data registration completion	M71	Convert the line disconnection command into pulse	D103	Data transmission error code
Y62	Data registration completion for connection	M80	Line disconnection (request) occurrence	D104	Data reception error code
Y63	Initialization completion	M91	Reception processing in progress flag	D105	Line disconnection error code
		M92	Transmission processing in progress flag		

3.5.1 Sample program for data communication-1

(1) Sample program system configuration

The configuration of a system using this sample program is shown below.



(2) Connection request station side (QJ71C24-R2 1)) sample program

The modem connected to the CH1 side interface is initialized, the line is connected, data are transmitted by the non-procedure protocol and the line is disconnected through commands from the user.

Perform the following settings before running this program.

(a) GX Developer switch settings (See Section 3.4.2.)

Switch No.	Setting value
Switch 1	07E2
Switch 2	0006
Switch 5	0000

(b) Settings by the GX Configurator-SC (See Section 3.4.2.)

Perform the following settings in each setting screen.
Use the default settings in screens and setting items other than those shown below.

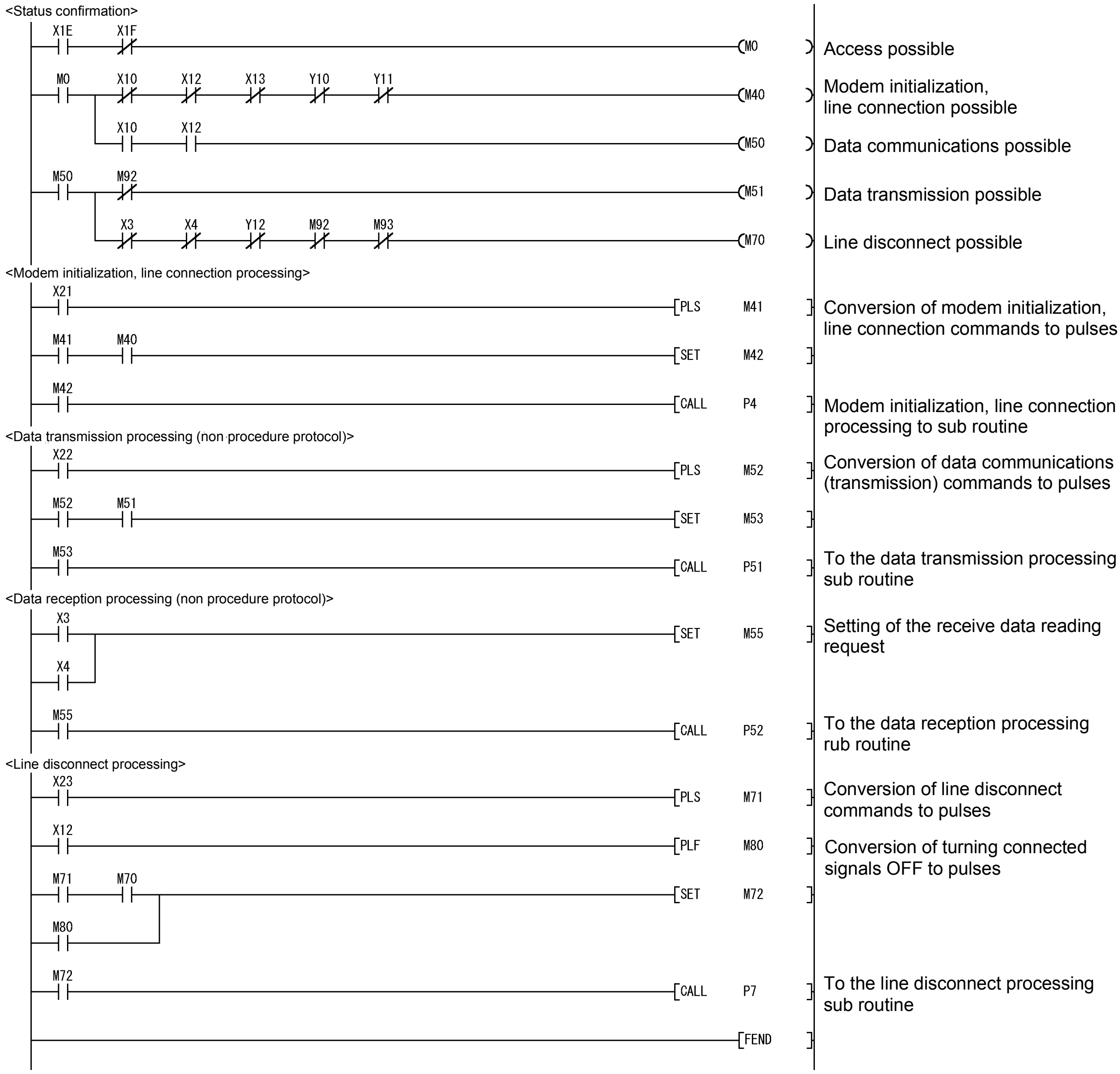
1) Modem function system settings

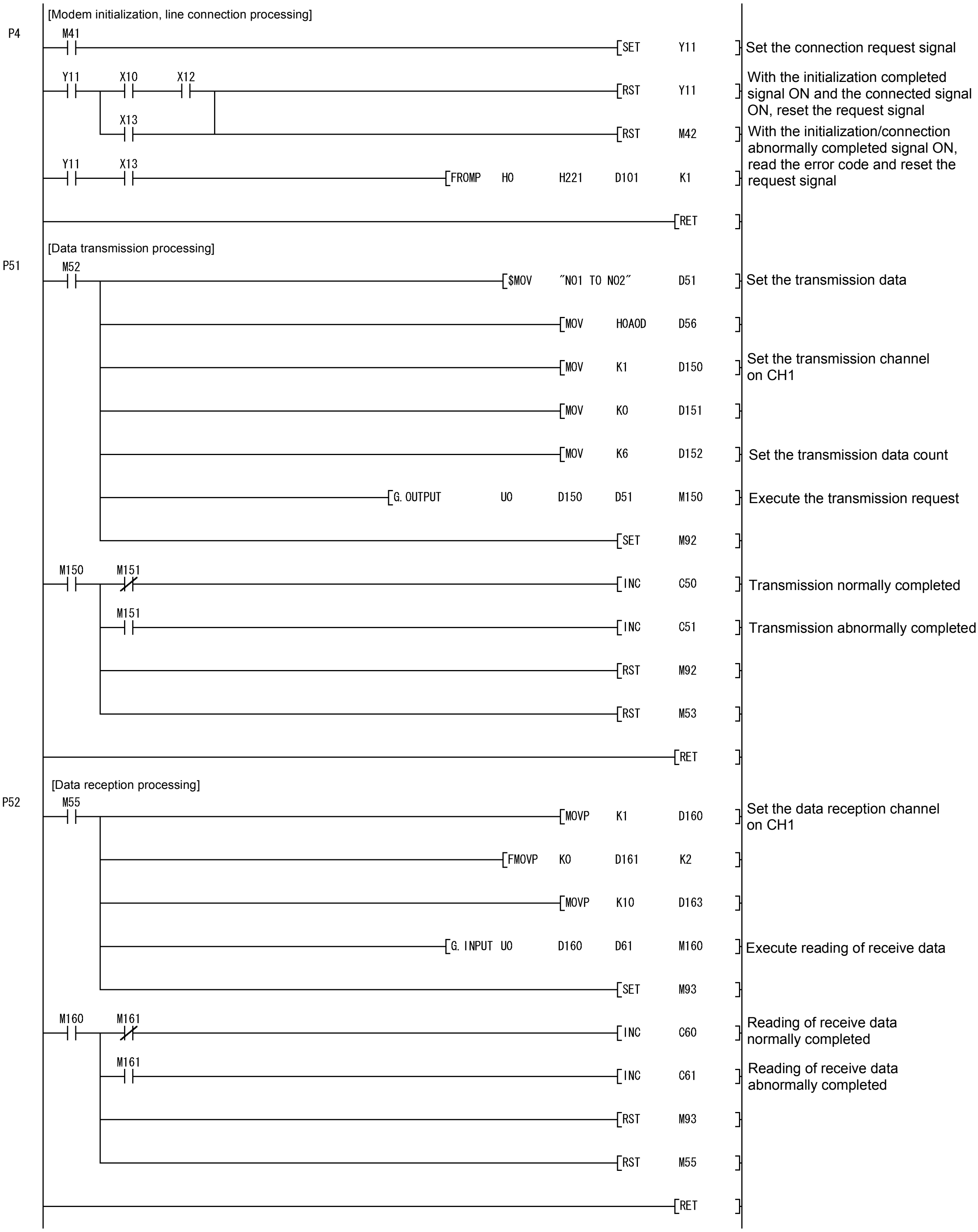
"Modem function system setting" screen setting items	Setting value
Modem connection channel designation	1CH
Data No. for initlaization designation	07D5
Data No. for connection designation	0BB8

2) Modem connection data registration

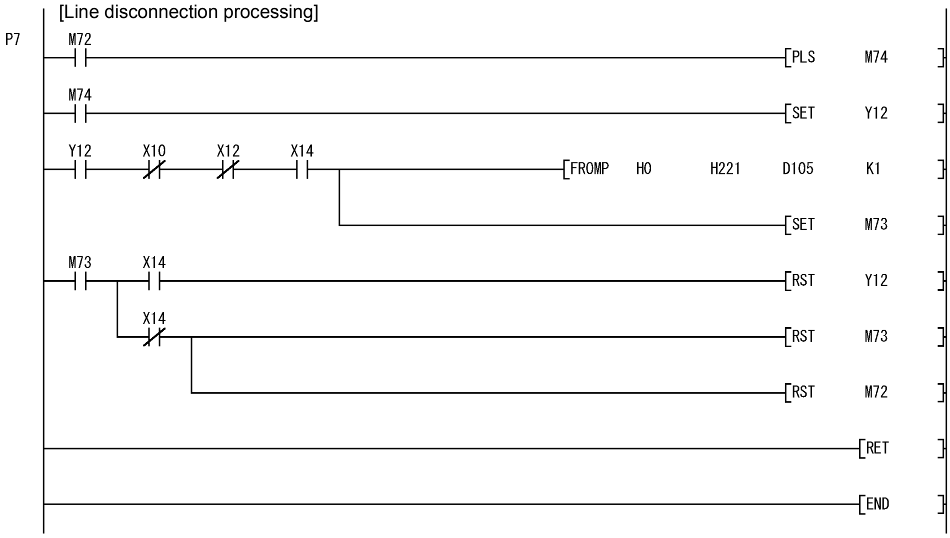
"Data for modem connection" screen setting items		Setting value
Data for modem connection 1 (H0BB8)	Telephone No. (＊1)	0123456789

＊1 Specify the external party's telephone No.


<Status confirmation>
X1E X1F M0
Access possible
M0 X10 X12 X13 Y10 Y11 M40
Modem initialization, line connection possible
X10 X12 M50
Data communications possible
M50 M92 M51
Data transmission possible
X3 X4 Y12 M92 M93 M70
Line disconnect possible
<Modem initialization, line connection processing>
X21 PLS M41
Conversion of modem initialization, line connection commands to pulses
M41 M40 SET M42
M42 CALL P4
Modem initialization, line connection processing to sub routine
<Data transmission processing (non procedure protocol)>
X22 PLS M52
Conversion of data communications (transmission) commands to pulses
M52 M51 SET M53
M53 CALL P51
To the data transmission processing sub routine
<Data reception processing (non procedure protocol)>
X3 SET M55
X4
Setting of the receive data reading request
M55 CALL P52
To the data reception processing rub routine
<Line disconnect processing>
X23 PLS M71
Conversion of line disconnect commands to pulses
X12 PLF M80
Conversion of turning connected signals OFF to pulses
M71 M70 SET M72
M80
M72 CALL P7
To the line disconnect processing sub routine
FEND


[Modem initialization, line connection processing]
P4
M41
SET Y11
Set the connection request signal
Y11 X10 X12
RST Y11
With the initialization completed signal ON and the connected signal ON, reset the request signal
X13
RST M42
With the initialization/connection abnormally completed signal ON, read the error code and reset the request signal
Y11 X13
FROMP H0 H221 D101 K1
RET
[Data transmission processing]
P51
M52
$MOV "NO1 TO NO2" D51
Set the transmission data
MOV H0A0D D56
MOV K1 D150
Set the transmission channel on CH1
MOV K0 D151
MOV K6 D152
Set the transmission data count
G.OUTPUT U0 D150 D51 M150
Execute the transmission request
SET M92
M150 M151
INC C50
Transmission normally completed
M151
INC C51
Transmission abnormally completed
RST M92
RST M53
RET
[Data reception processing]
P52
M55
MOVP K1 D160
Set the data reception channel on CH1
FMOVP K0 D161 K2
MOVP K10 D163
G.INPUT U0 D160 D61 M160
Execute reading of receive data
SET M93
M160 M161
INC C60
Reading of receive data normally completed
M161
INC C61
Reading of receive data abnormally completed
RST M93
RST M55
RET

[Line disconnection processing]



Modem disconnection request signal is set

When the modem disconnection completion signal is ON, the error code is read.

When the normal completion signal is ON, the line disconnection completion flag is set.

Modem disconnection request signal is reset

(3) Sample program for a connection receiving station side (QJ71C24-R2 2))

After the connection in progress signal (x12) = ON, data communications are carried out by the non procedure protocol through a command from the user.

Perform the following settings before running this program.

(a) GX Developer switch settings (See Section 3.4.2.)

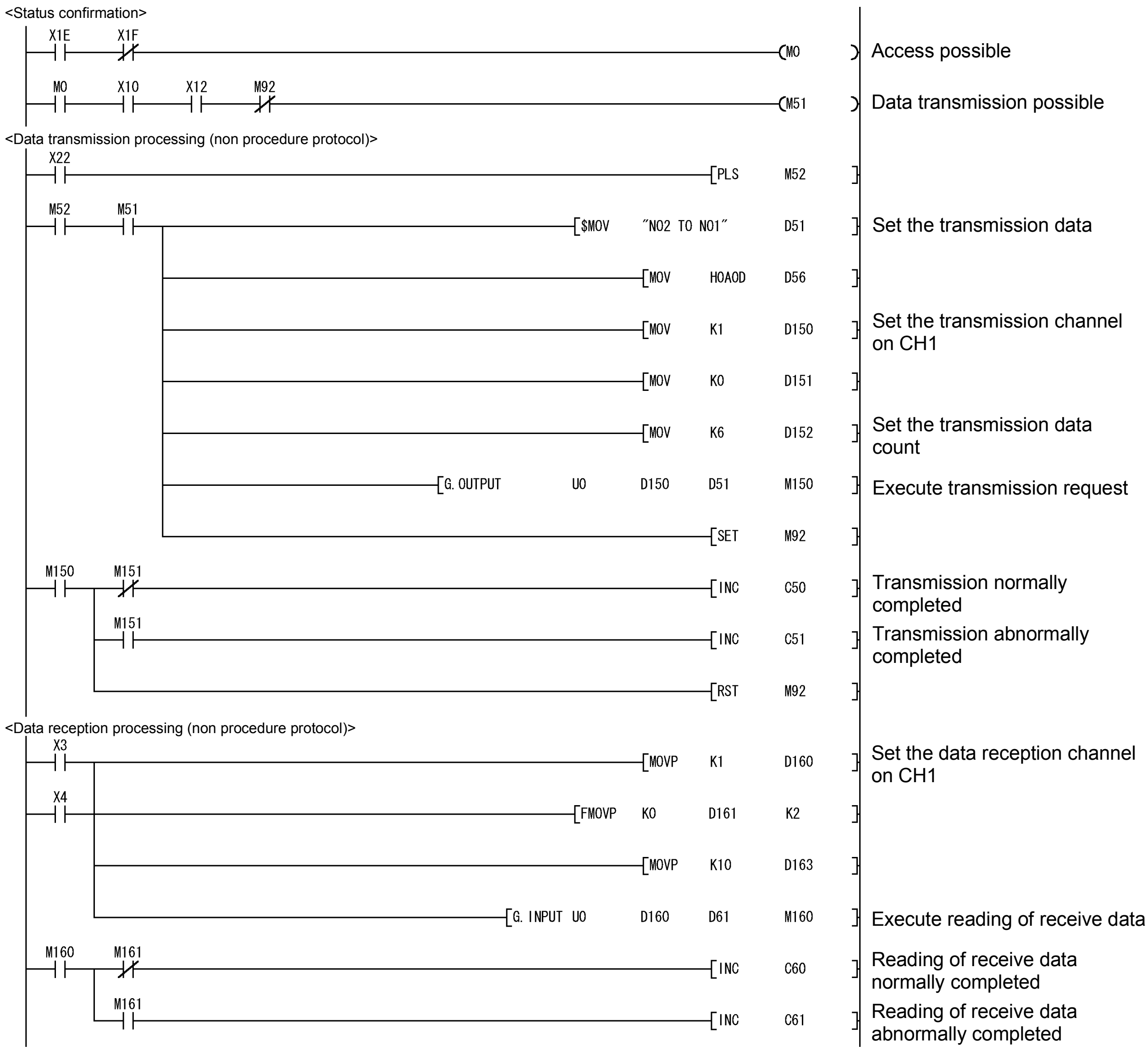
Switch No.	Setting value
Switch 1	07E2
Switch 2	0006
Switch 5	0000

(b) Settings by the GX Configurator-SC (See Section 3.4.2.)

Perform the following settings in each setting screen.
Use the default settings in screens and setting items other than those shown below

1) Modem function system settings

"Modem function system setting" screen setting items	Setting value
Modem connection channel designation	1CH
Data No. for initialization designation	07D5
Auto modem initialization designation	Auto initialize


<Status confirmation>
X1E X1F M0
Access possible
M0 X10 X12 M92 M51
Data transmission possible
<Data transmission processing (non procedure protocol)>
X22 PLS M52
M52 M51 $MOV "NO2 TO NO1" D51
Set the transmission data
MOV H0A0D D56
MOV K1 D150
Set the transmission channel on CH1
MOV K0 D151
MOV K6 D152
Set the transmission data count
G.OUTPUT U0 D150 D51 M150
Execute transmission request
SET M92
M150 M151 INC C50
Transmission normally completed
M151 INC C51
Transmission abnormally completed
RST M92
<Data reception processing (non procedure protocol)>
X3 MOVP K1 D160
Set the data reception channel on CH1
X4 FMOVP K0 D161 K2
MOVP K10 D163
G.INPUT U0 D160 D61 M160
Execute reading of receive data
M160 M161 INC C60
Reading of receive data normally completed
M161 INC C61
Reading of receive data abnormally completed

3.5.2 Sample program for data communication-2

(1) Sample program on the connection request station side

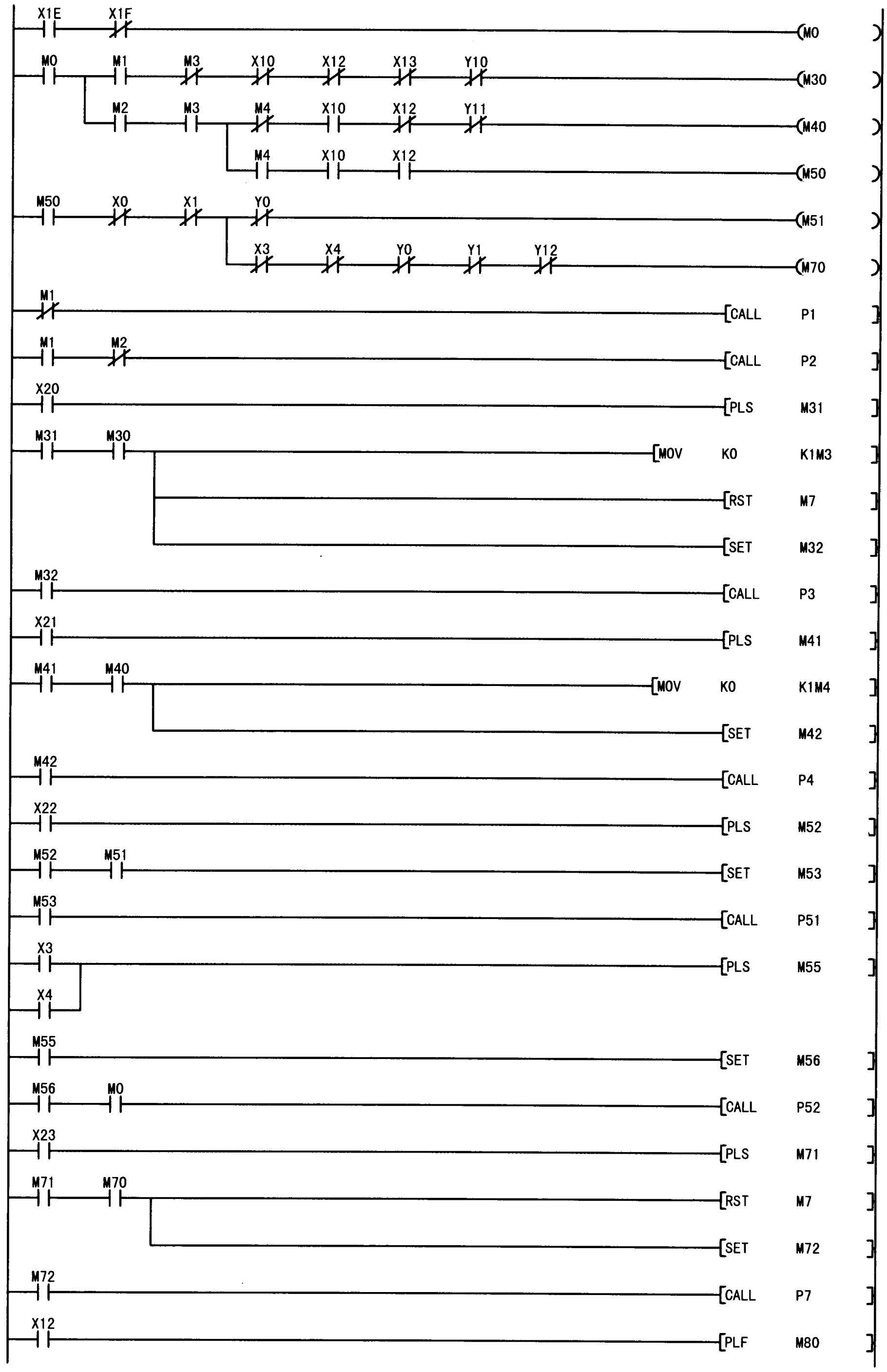
Initialization for the modem connected to CH1 interface, line connection, data communication by the non procedure protocol and line disconnection are executed by commands from the user.
Before executing this program, perform the following settings (changing the default values) on the GX Configurator-SC's "Modem function system setting/registration" screen and register them in the Q series C24. (Settings other than the items shown below are not required).

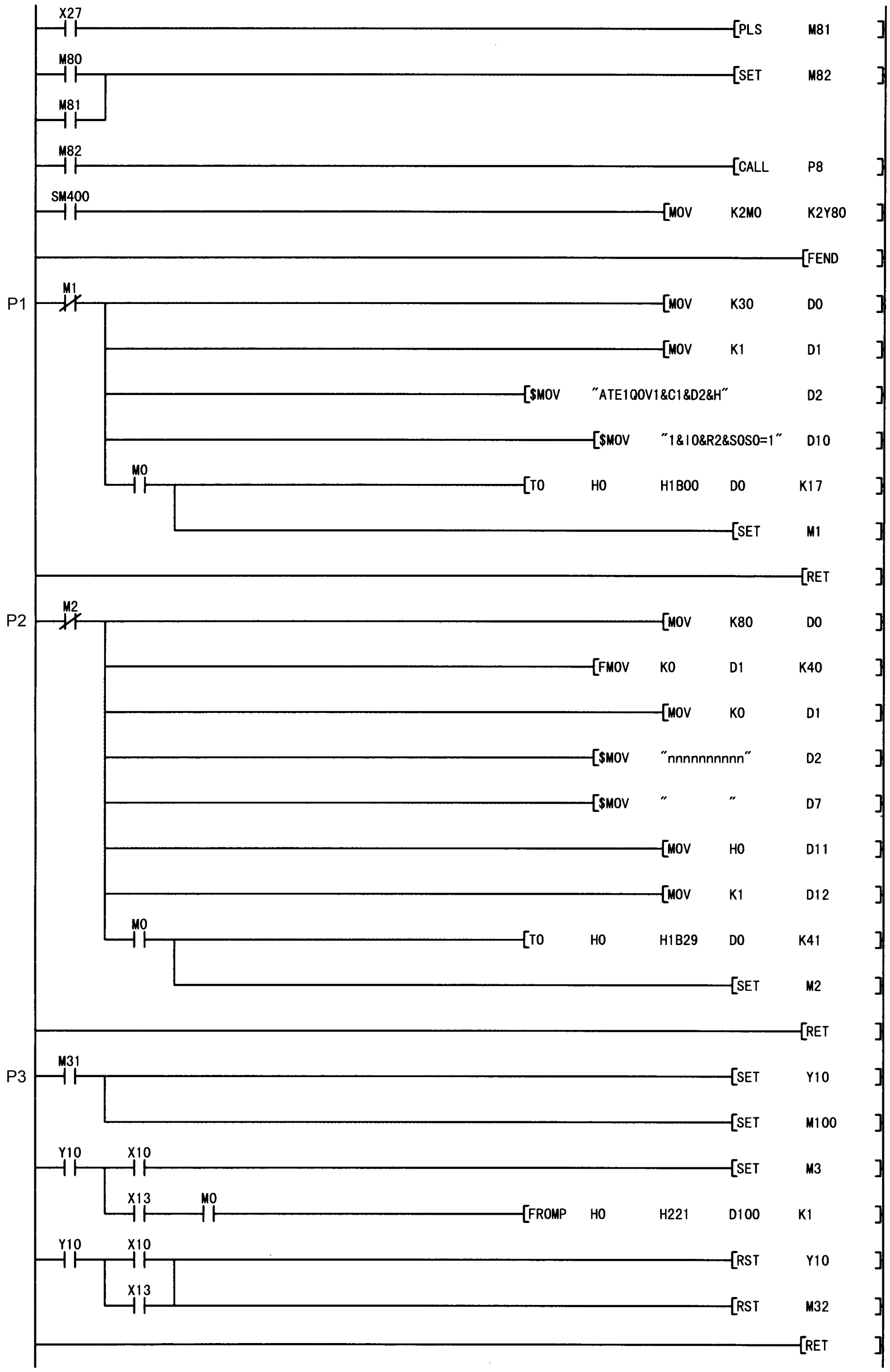
Settings on the GX Configurator-SC's "Modem function system setting" screen (For more details, see Section 8.4.4 of User's Manual (Basic).)

Setting item	Setting value
Modem connection channel designation	CH1
No-communication interval time designation	2 (min)
Data No. for initialization designation	8001H
Data No. for connection designation	8002H

REMARK

Registration of the modem's initialization data and line connection data, modem initialization, line connection, data communications by the non procedure protocol and line disconnection are all performed by the sequence program.


Accessible flag is turned ON
Modem initialization enabled flag is turned ON
Line connectable flag with the remote station is turned ON
Exchangeable flag with the partner station is turned ON
Data transmission enabled flag to the partner station turned ON
Line disconnection enabled flag with the partner station is turned ON
To the data registration processing for initialization subroutine
To the data registration processing for connection subroutine
Convert the initialization command into pulse
Various complete flags after the modem initialization processing is reset
To the modem initialization processing subroutine
Convert the line connection command into pulse
Various complete flags after the line connection processing is reset
To the line connection processing subroutine
Convert the data communication (transmission) command into pulse
To the data transmission processing subroutine
Convert the reception data read request into pulse
To the reception data read processing subroutine
Convert the line disconnection command into pulse
(Line disconnection from local station)
Line disconnection complete flag is reset
To the line disconnection processing subroutine
Convert the connection in progress signal OFF into pulse
(Line disconnection from partner side)



Convert the reset command of various requestb signal into pulse

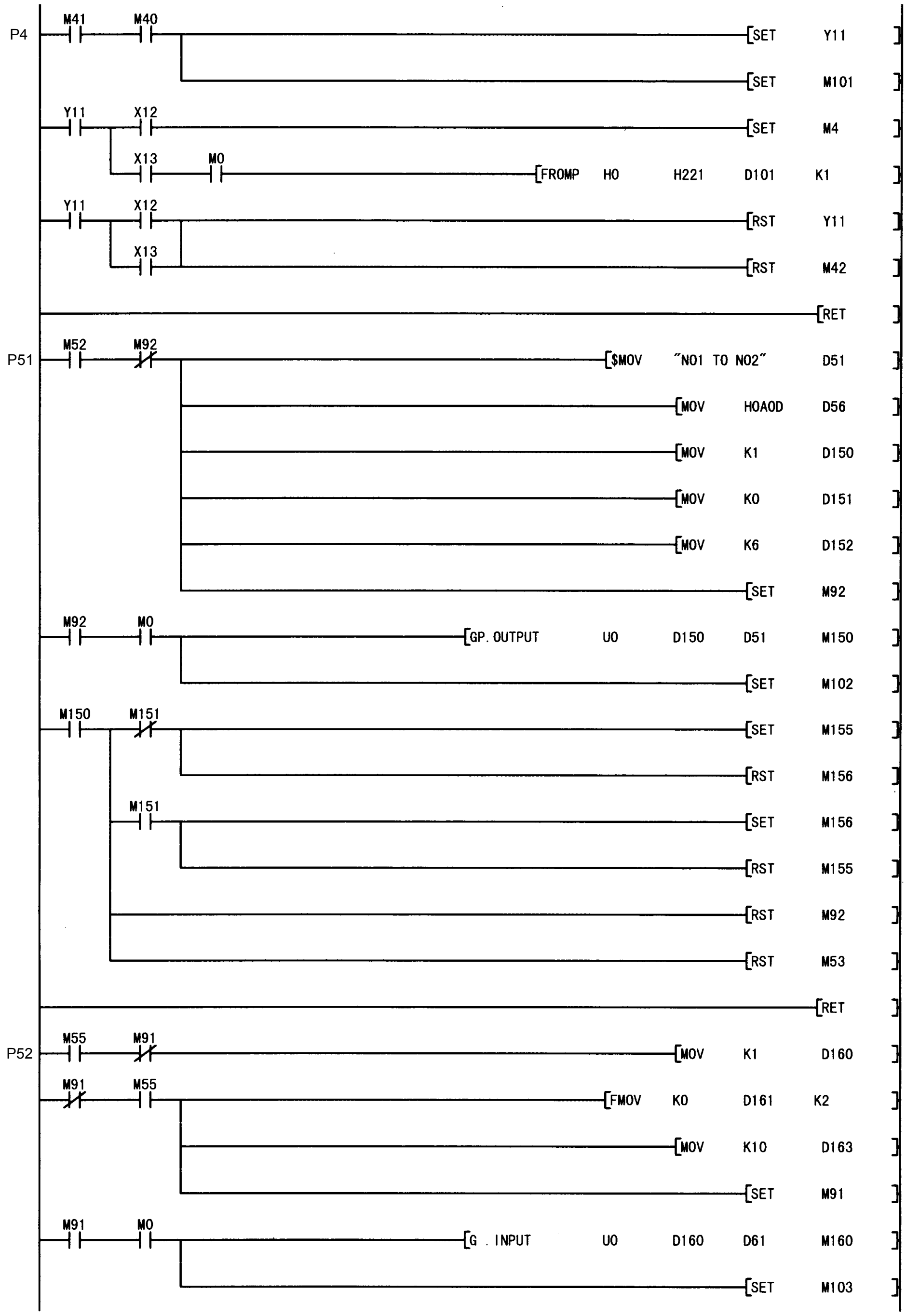
To the various request signal and the complete signal OFF subroutine

Output the various complete flag status (LED display)

Data registration processing for initialization subroutine
- Set the number of bytes of the registration data
- Set the user control data (control number)
- Set the initialization command
- Write the data for initialization (Data No. 8001H) (Registration to buffer memory)
- Data registration complete flag for initialization is set

Data registration processing for connection subroutine
- Set the number of bytes of the registration data
- Clear the data storage device for connection
- Set the pager receiver designation (Notification is not executed)
- Set the telephone number
- Set the space to the remainder of the telephone number designation area
- Set the rxternal line dialing number (0)
- Set the line type (tone)
- Write the data for connection (Data No.8002H) (Registration to buffer memory)
- Data registration complete flag for connection set

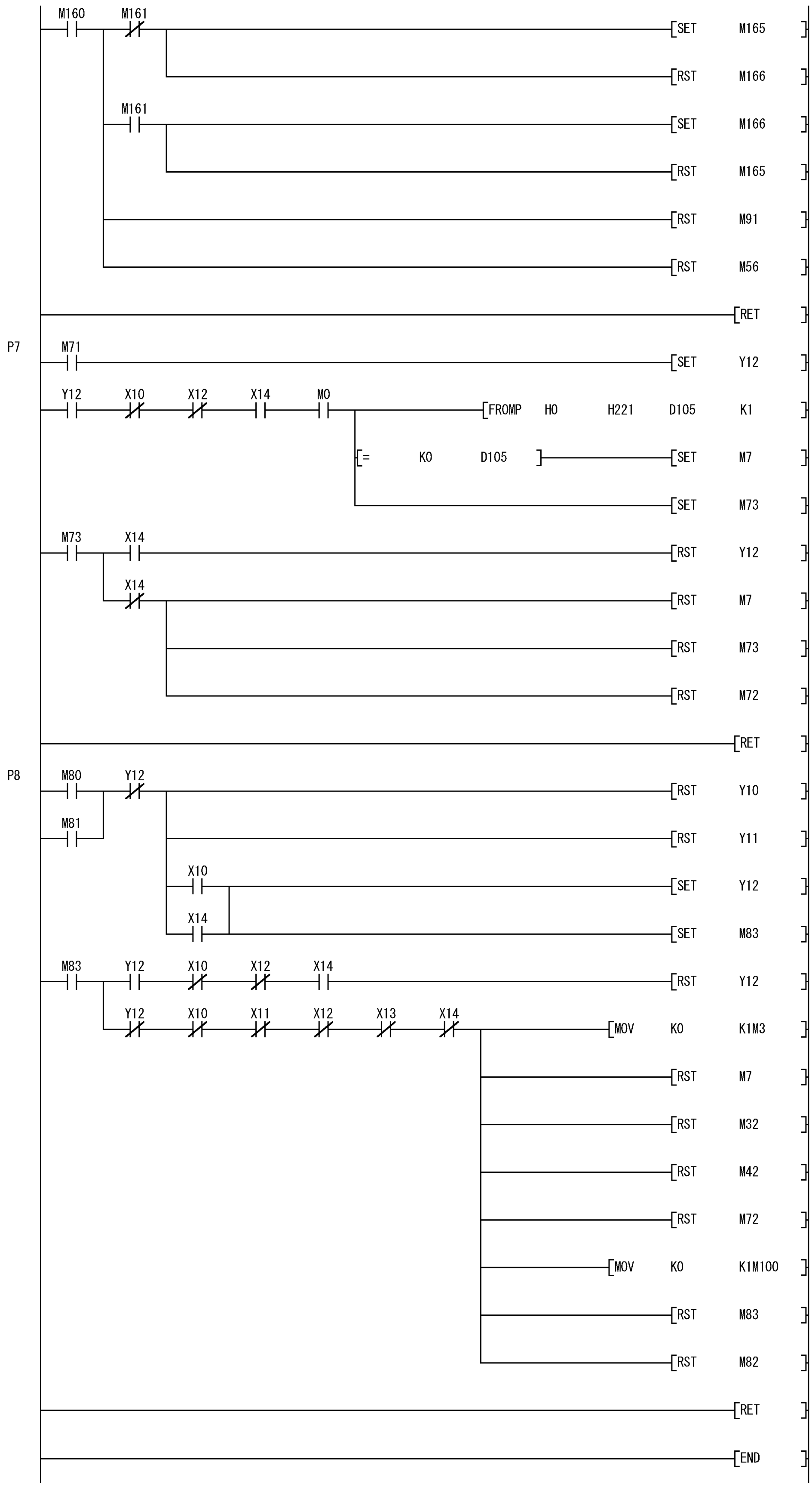
Modem initialization processing subroutine
- Set the initialization request signal
- Initialization request execution flag is set
- When the initialization complete signal ON, the initialization complete flag is set and the request signal is reset
- When the initialization/connection abnormal complete signal ON, the error code is read and the request signal is reset



Line connection processing subroutine
• Connection request signal is set
• Connection requestr execution flag is set
• When the connection in progress signal ON, the connection complete flag is set and the request signal is reset
• When the initialization/connection abnormal complete signal ON, the error code is read and request signalis is reset

Data communication processing subroutine (Non procedure protocol, transmission)
• Set the transmission data
• Sets the transmission channel to CH1
• Set the number of transmission data
• Sets the transmitting flag
• Executes the transmission request
• Transmission request execution flag is set
• Transmission normal completion
• Transmission abnormal completion

Data reception processing subroutine
• Sets the data reception channel to CH1
• Reception data read execution flag is set
• Executes the reception data reading



- Received data read normally completed
- Received data read abnormally completed

Line disconnection processing subroutine (Line disconnection from local station)

- Modem disconnection request signal is set
- When the modem disconnection completion signal is ON, the error code is read.
- When the normal completion signal is ON, the line disconnection completion flag is set.
- Modem disconnection request signal is reset

Subroutine resetting various request signals and completion signals

- Various request signals are reset
- When any completion signal is ON, the modem disconnection request signal is set.
- When the initialization complete signal is OFF and the modem disconnection completion signal is ON, the request signal is reset.
- When the related signals are OFF, the flag is reset.

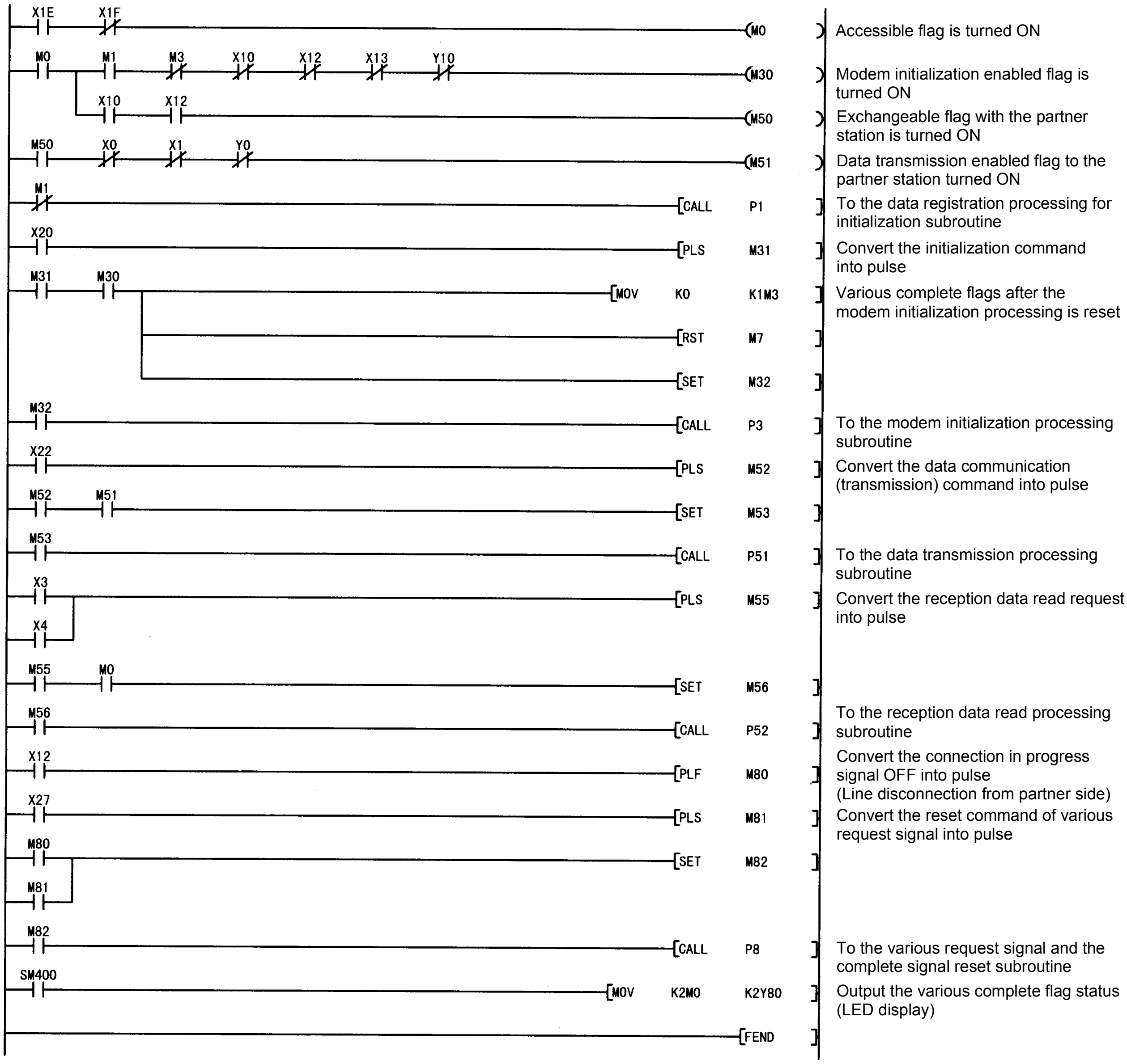
(2) Sample program on the connection reception station side

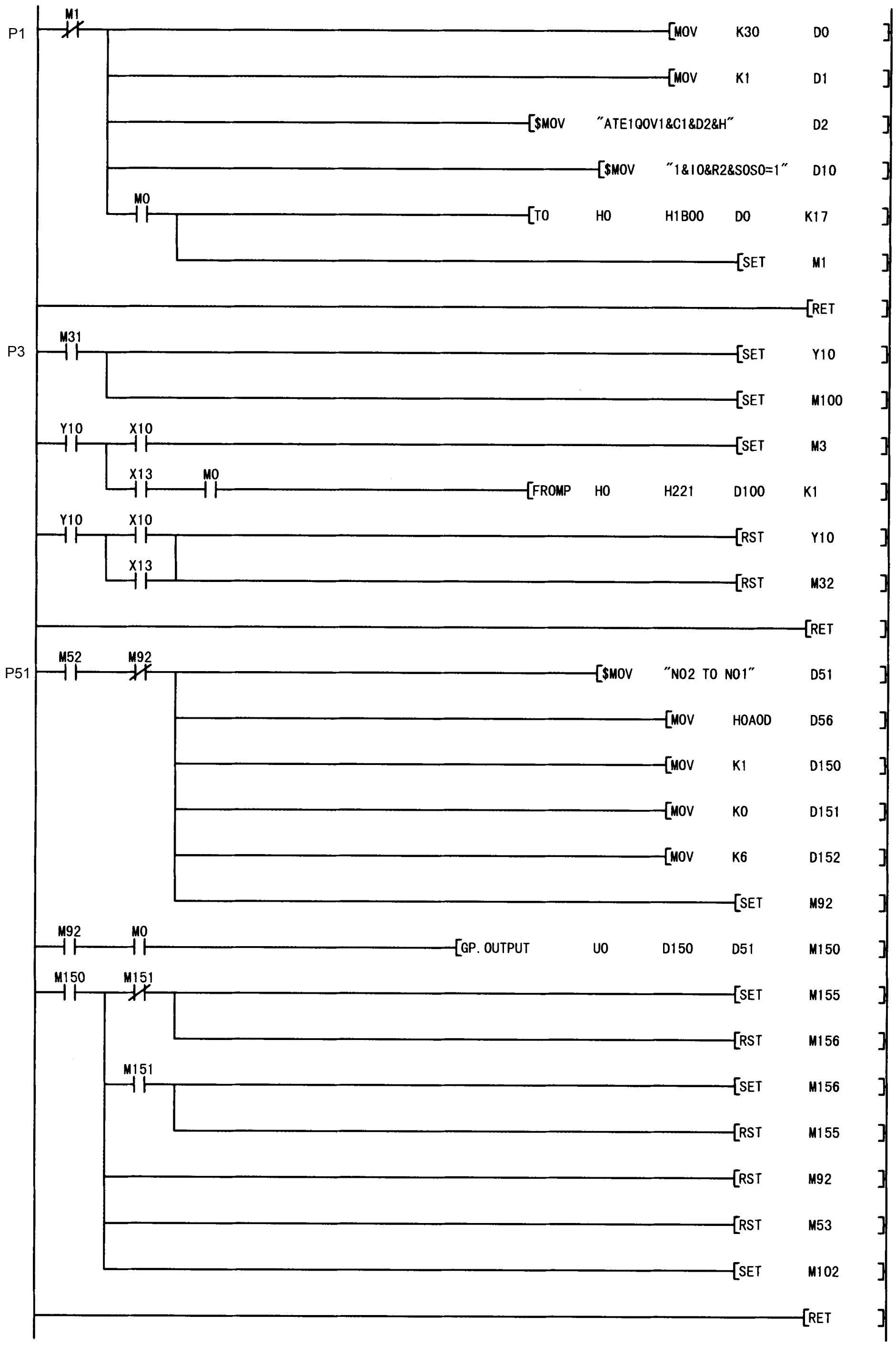
The modem initialization and data communication by the non procedure protocol are executed by commands from the user.

Before executing this program, perform the following settings (changing the default values) on the GX Configurator-SC's "Modem function system setting" screen and register them in the Q series C24. (Settings other than the items shown below are not required).

Settings on the GX Configurator-SC's "Modem function system setting/registration" screen
(For more details, see Section 8.4.4 of User's Manual (Basic).)

Setting item	Setting value
Modem connection channel designation	CH1
No-communication interval time designation	2 (min)
Data No. for initialization designation	8001_H

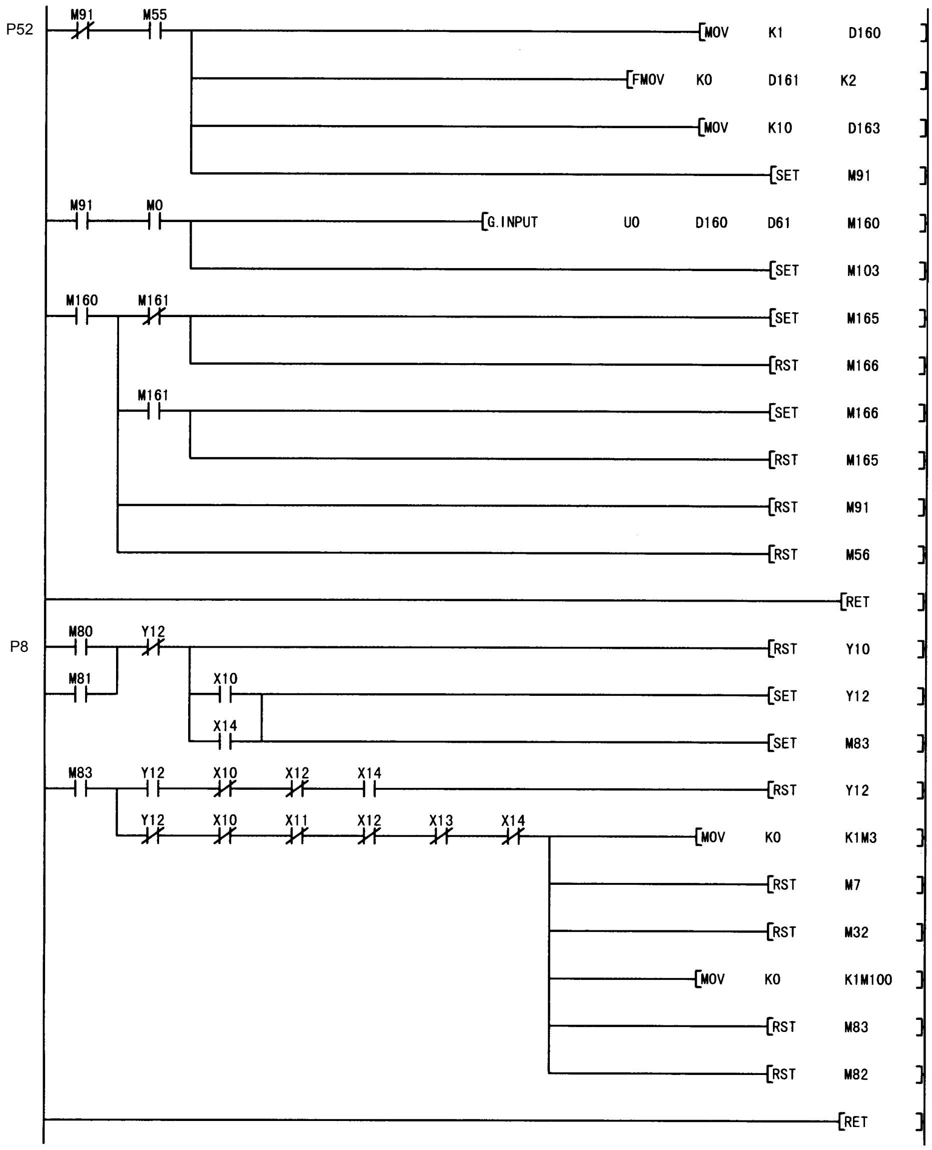

X1E X1F
M0
Accessible flag is turned ON
M0 M1 M3 X10 X12 X13 Y10
M30
Modem initialization enabled flag is turned ON
X10 X12
M50
Exchangeable flag with the partner station is turned ON
M50 X0 X1 Y0
M51
Data transmission enabled flag to the partner station turned ON
M1
CALL P1
To the data registration processing for initialization subroutine
X20
PLS M31
Convert the initialization command into pulse
M31 M30
MOV K0 K1M3
Various complete flags after the modem initialization processing is reset
RST M7
SET M32
M32
CALL P3
To the modem initialization processing subroutine
X22
PLS M52
Convert the data communication (transmission) command into pulse
M52 M51
SET M53
M53
CALL P51
To the data transmission processing subroutine
X3
X4
PLS M55
Convert the reception data read request into pulse
M55 M0
SET M56
M56
CALL P52
To the reception data read processing subroutine
X12
PLF M80
Convert the connection in progress signal OFF into pulse
(Line disconnection from partner side)
X27
PLS M81
Convert the reset command of various request signal into pulse
M80
M81
SET M82
M82
CALL P8
To the various request signal and the complete signal reset subroutine
SM400
MOV K2M0 K2Y80
Output the various complete flag status (LED display)
FEND



Data registration processing for initialization subroutine
- Sets the number of bytes of the registration data
- Sets the user control data (control number)
- Sets the initialization command
- Write the data for initialization (Data No. 8001H) (Registration to buffer memory)
- Data registration complete flag for initialization is set

Modem initialization processing subroutine
- Initialization request signal is set
- Initialization request execution flag is set
- When the initialization complete signal ON, the initialization complete flag is set and the request signal is reset
- When the initialization/connection abnormal complete signal ON, the error code is read and the request signal is reset

Data communication processing subroutine
(Non procedure protocol, transmission)
- Set the transmission data
- Sets the number of transmission data (words)
- Transmission request execution flag is set
- Transmission request execution
- Transmission request normal completion
- Transmission request abnormal completion



Data reception processing subroutine
- Sets the data reception channel to CH1
- Sets the data setting completion flag for reading the receive data.
- Executes the receive data reading.
- Receive data read execution flag is set
- Receive data normal completion
- Receive data abnormal completion

Resets subroutine of various request signal and complete signal
- Various request signal is reset
- When any complete signal ON, the modem disconnection request signal is set
- When the initialization complete signal OFF and the modem disconnection complete signal ON, the request signal is reset
- When the relation various signal OFF, the flag is reset

3.5.3 Sample program for notification

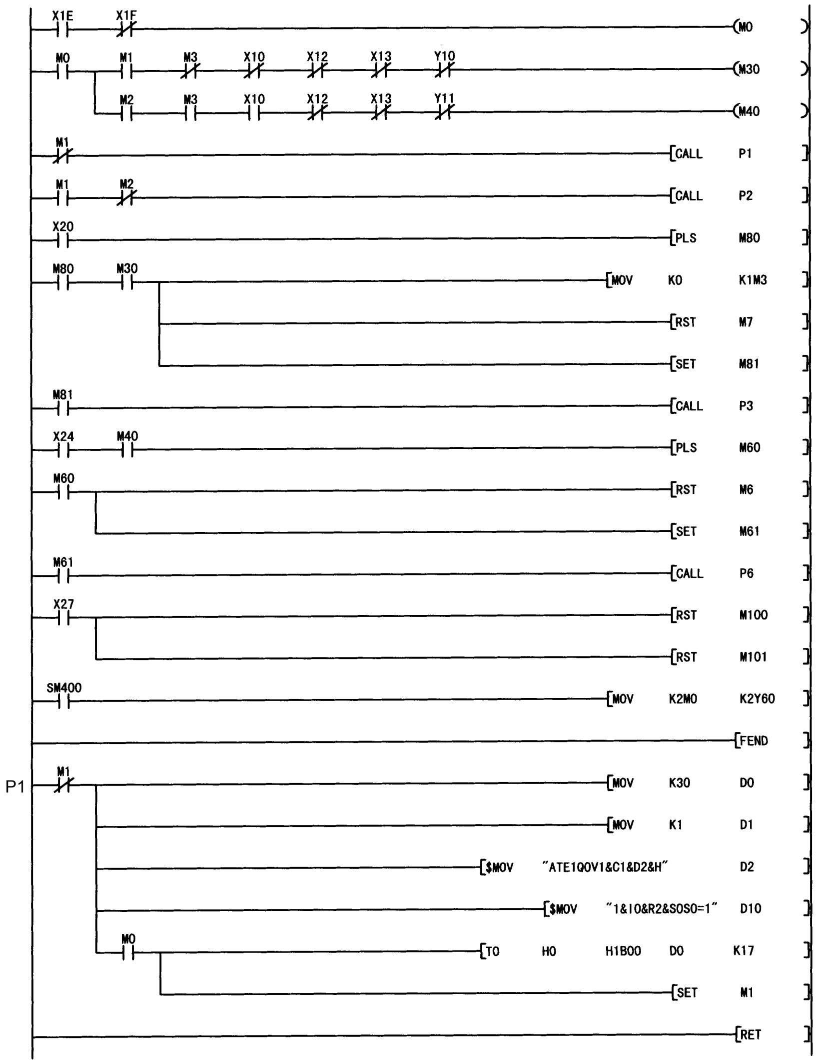
Modem initialization and notification are executed by commands from the user.
Before executing this program, perform the following settings (changing the default values) on the GX Configurator-SC's "Modem function system setting" screen and register them in the Q series C24. (Settings other than the items shown below are not required.)

Settings on the GX Configurator-SC's "Modem function system setting/registration" screen
(For more details, see Section 8.4.4 of User's Manual (Basic).)

Setting item	Setting value
Modem connection channel designation	CH1
Notification execution designation	Perform notification
No-communication interval time destination	2 (min)
Data No. for initialization designation	8001_H
Data No. for connection designation	8002_H

REMARK

Registration of the modem's initialization data and line connection data, modem initialization, line connection and notifications are all performed by the sequence program.



Accessible flag is turned ON

Modem initialization enabled flag is turned ON

Line connectable flag with the remote station is turned ON

To the data registration processing for initialization subroutine

To the data registration processing for connection subroutine

Converts the initialization command into pulse

Various complete flags after the modem initialization processing is reset

To the modem initialization processing subroutine

Converts the notification command into pulse

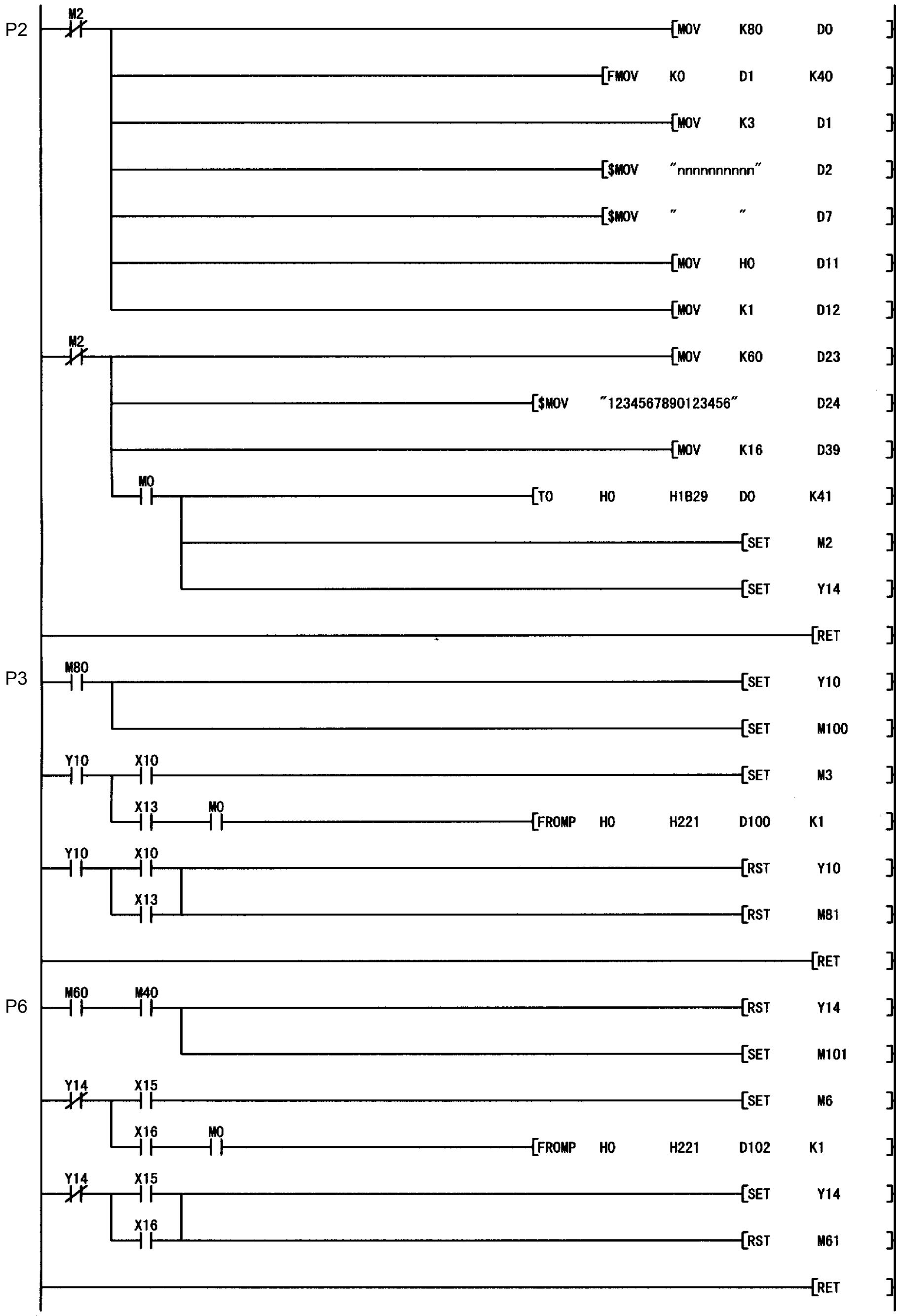
To the notification processing subroutine

When the reset command, the complete flag is reset

Output the various complete flag status (LED display)

Data registration processing for initialization subroutine
- Sets the number of bytes of the registration data
- Sets the user control data (control number)
- Sets the initialization command

- Write the data for initialization (Data No.8001$_H$) (Registration to buffer memory)
- Data registration complete flag for initialization is set



Data registration processing for connection subroutine
- Set the number of bytes of the registration data
- Clear the data storage device for connection
- Set the pager receiver designation (Notification is executed)
- Set the telephone number
- Set the space to the remainder of the telephone number designation area
- Set the external line dialing number (0)
- Set the line type (tone)
- Set the waiting time for the message transmission
- Set the message
- Set the message length
- Write the data for connection (Data No. 8002H) (Registration to buffer memory)
- Data registration complete flag for connection is set
- Notification-issued request signal is set (Initial status)

Modem initialization processing subroutine
- Initialization request signal is set
- Initialization request execution flag is set
- When the initialization complete signal ON, the initialization complete flag is set and the request signal is reset
- When the initialization/connection abnormal complete signal ON, the error code is read and the request signal is reset

Notification processing subroutine
- Notification-issued request signal is reset (Issue request)
- Notification execution flag is set
- When the notification normal complete signal ON, the notification complete flag is set and the request signal is set (Initial status)
- When the notification abnormal complete signal ON, the error code is read and the request signal is set (Initial status)

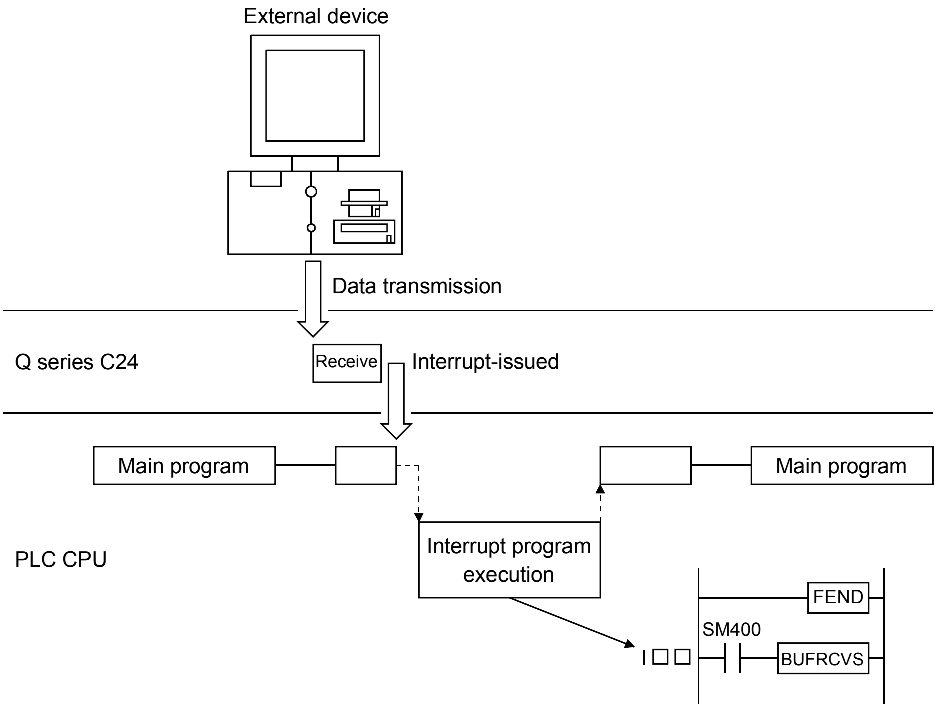
4

4 RECEIVING DATA WITH AN INTERRUPT PROGRAM

In data communication between the Q series C24 and the external device, an interrupt program can be used to receive data for the following data communication functions.

- Data reception during communication using the non procedure protocol
- Data reception during communication using the bidirectional protocol

This chapter explains a case in which data reception using the following data communication functions is performed with an interrupt program.



POINT

Receiving data with an interrupt program expedites data reception by the PLC CPU.

4.1 Settings for Receiving Data Using an Interrupt Program

The following explains the settings for performing data reception with an interrupt program during communication using the non procedure protocol or bidirectional protocol.

(1) Setting by GX Developer

1) The following settings are performed with the interrupt pointer No. of module screen.
   - The interrupt pointer number and quantity (quantity is fixed at 2) for the PLC CPU used for the Q series C24.
   - Assigning correspondence between the PLC CPU interrupt pointer number and the Q series C24 control number (fixed at 0).
2) Set the interrupt pointer No. of modules according to the explanation in Section 4.5.3 of the User's Manual (Basic).

(2) Setting by GX Configurator-SC

1) Perform the following settings in the transmission control and other system setting screens.
   - Specify "Interrupt-issued" in Receive interrupt-issued designation.
2) Display the screen in accordance with Section 8.4.5 of the User's Manual (Basic) and perform the system settings.

POINT

To start the interrupt program, the settings of the "Interrupt pointer No. of module" in GX Developer and the "System setting" in GX Configurator-SC are required.

4.2 Interrupt Program Startup Timing

The following explains the startup timing for interrupt program when performing data reception with an interrupt program during communication using the non procedure protocol or bidirectional protocol.

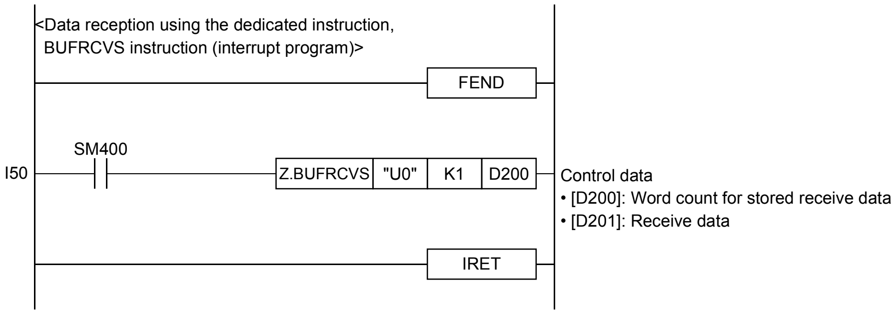
(1) The startup timing is the same for communication using either the non procedure protocol or bidirectional protocol.

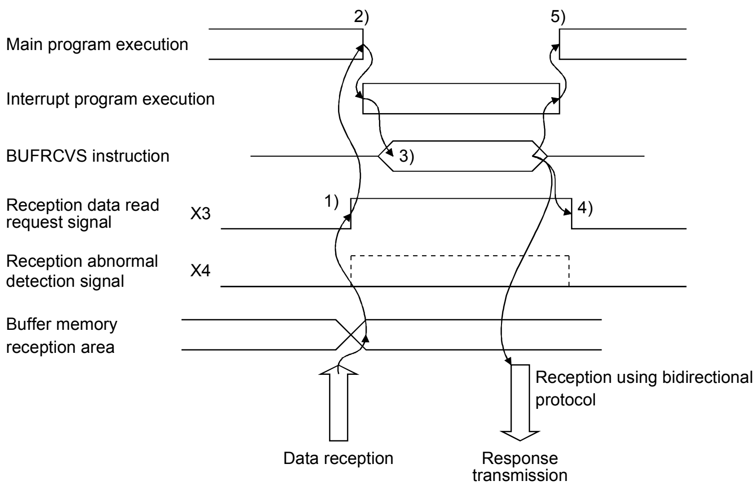
(2) Receive data from the external device is stored in the reception area of the buffer memory. When the next input signal rises, the interrupt program is started.

Input signal name	CH1 side	CH2 side
CHn reception data read request signal	X3	XA
CHn reception abnormal detection signal	X4	XB

4.3 Reception Control Method Using an Interrupt Program

The following explains the reception control method when receiving data with an interrupt program during communication using the non procedure protocol or bidirectional protocol.





1) When data is received from the external device, the receive data is stored in the buffer memory and the reception data read request signal turns ON.
2) The main program stops executing and the interrupt program starts.
3) The data reception dedicated instruction, BUFRCVS, for the interrupt program is executed and data is received. (*1)
4) When execution of the BUFRCVS instruction is complete, the reception data read request signal turns OFF.
5) When execution of the interrupt program is finished, execution of the main program restarts.

*1 When the reading of receive data using the BUFRCVS instruction is finished, the following processes are performed.

At normal completion: PLC CPU error flag (SM0) turns OFF.

At abnormal completion: PLC CPU error flag (SM0) turns ON.
The error code is stored in the PLC CPU error code (SD0).
For more details on the PLC CPU error flag (SM0) and error codes (SD0), see the PLC CPU Manual.

4.4 Programming

This section explains the programming when data reception is performed with an interrupt program during communication using the non procedure protocol or bidirectional protocol.

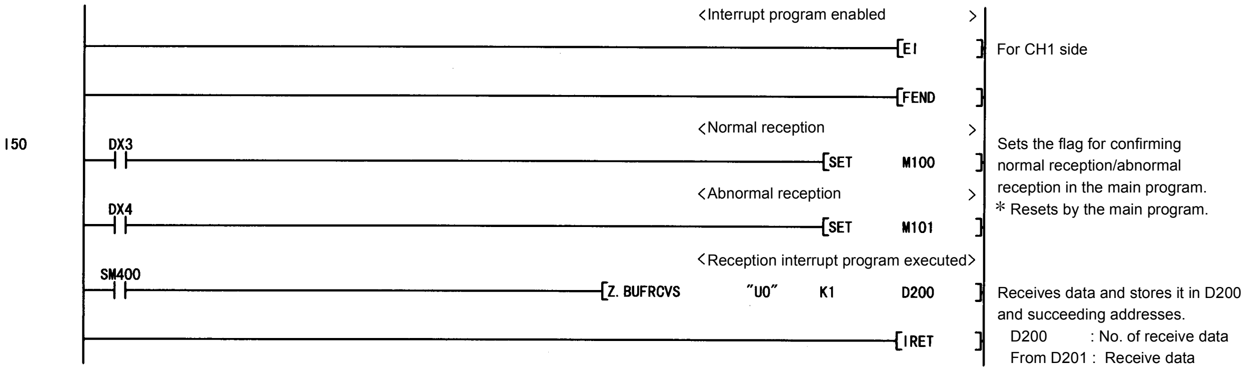
4.4.1 Program example

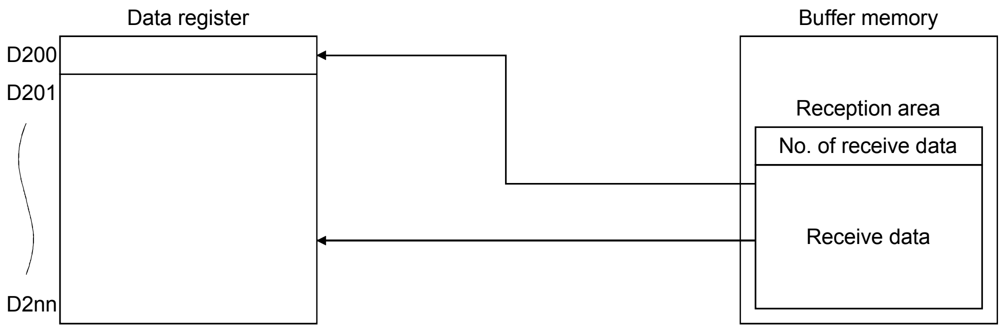
The following shows a program example for receiving data using an interrupt program.

(Program condition)

- Interrupt pointer No. of module set by GX Developer
  CPU side: Interrupt pointer. Start No. = 50,
  Interrupt pointer No. of units = 2 (fixed)
  ✻ CH1 side interrupt pointer = I50,
  CH2 side interrupt pointer = I51
  Intelli. module side: Start I/O No. = 0, Start SI No. = 0 (fixed)
- Setting for whether the interrupt program is started by GX Configurator-SC
  CH1 side: Issues interrupt (Communication is performed using the non procedure protocol.)
  CH2 side: Does not issue interrupt.

(Program example)
When the Q series C24 I/O signals are X/Y00 to X/Y1F





POINT

(1) When data reception is performed with an interrupt program, the dedicated BUFRCVS instruction is used regardless of whether the communication uses the non procedure protocol or bidirectional protocol. For more details on the BUFRCVS instruction, see Section 17.2.

(2) Create a program that enables/disables interrupts during execution of the main program in order to start the interrupt program.
Use the EI, DI and IMASK instructions.

4.4.2 Precautions when receiving data with an interrupt program

The following shows the precautionary notes when receiving data with an interrupt program.

(1) Create an interrupt program for data reception for each interface.

(2) Use GX Configurator-SC to set whether or not the interrupt program is started. Whether or not the interrupt program is started can also be set with direct writing to the buffer memory . However, if it is specified during data reception, the interrupt program will not start.

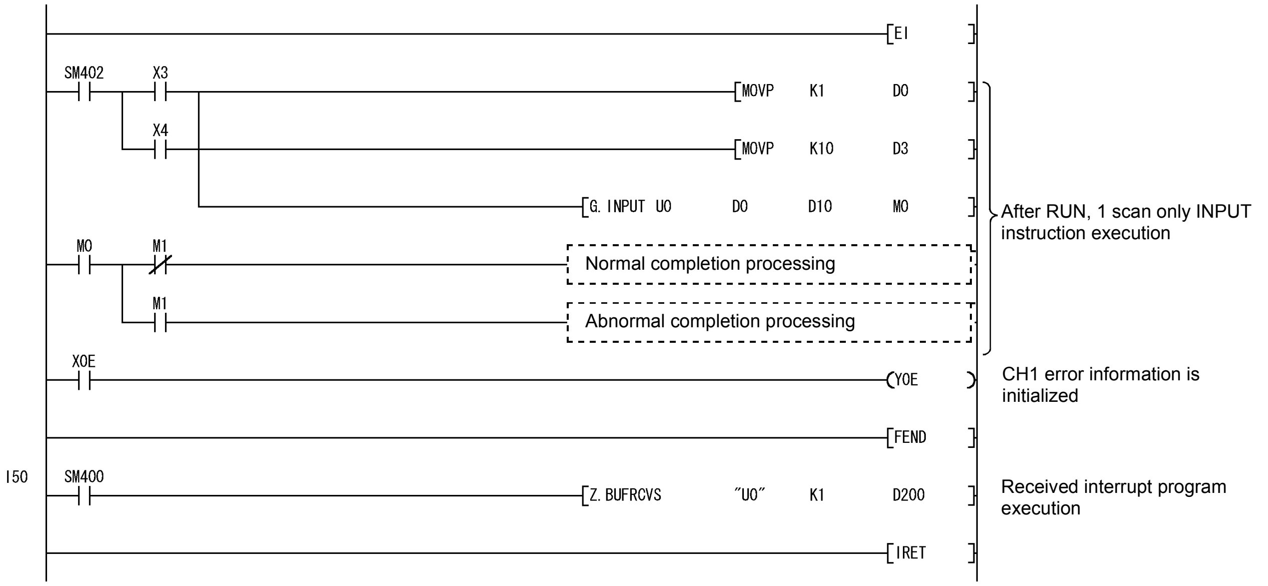
(3) Do not use the INPUT and BIDIN instructions during execution of the interrupt program. Always use the BUFRCVS instruction to receive data.

(4) Do not turn the reception data read completion signal (Y1/Y8) ON/OFF during execution of the interrupt program.

(5) Use always ON (SM400) or direct input signal (DX3, DX4) as the contact signal when executing the BUFRCVS instruction. (See Section 4.4)

(6) After the power supply turns from OFF to ON or the CPU module is reset, data cannot be received because the interrupt program is invalidated during the initial processing of the CPU module. For asynchronous data communication with the Q series C24 from the external device without communication procedure setting, read the data as shown in the following program.

Q series C24 I/O signals are from X/Y00 to X/Y1F



5

5 CHANGING SEND AND RECEIVE DATA LENGTH UNITS TO BYTE UNITS (WORD/BYTES UNITS SETTING)

The word units are used for the data length (count) of the amount of data sent/received using the following data communication functions in data communication between the Q series C24 and the external device.
This chapter explains how to change the units (word to byte, byte to word) of the data length (count) sent/received with the following data communication functions.

The data length units can be set for each Q series C24 interface. The Q series C24 controls the number of data to be transmitted to the external unit and the number of data when it requests the PLC CPU to read the data received from the external device according to the units set by the user.

(1) Data communication functions and buffer memory related to data length units

The following shows the data communications functions and buffer memory related to the data length units.
(The buffer memory addresses in the table are the default value.)

Data communications function		Name of buffer memory related to data length units (Address CH1, CH2)	Reference section
MC protocol	On-demand function	On-demand data length designation area ($A1_H$, 141_H)	Reference manual Section 3.11
Non procedure protocol	Data transmit function	Send data count storage area (400_H, 800_H)	User's manual (Basic) Chapter 6
	Data receive function	Received data count designation area ($A4_H$, 144_H) Receive data count storage area (600_H, $A00_H$)	
Bidirectional protocol	Data transmit function	Send data count storage area (400_H, 800_H)	User's manual (Basic) Chapter 7
	Data receive function	Receive data count storage area (600_H, $A00_H$)	

(2) How to change the units of the data length (count)

The units of the data length (count) can be changed using one of the following procedures.

1) Changing via GX Configurator-SC
The units can be changed on the GX Configurator-SC's system setting screen.
Change the units of the data length (count) according to the explanation in Section 8.4.5 of the User's Manual (Basic).

2) Changing via the PLC CPU
The units can be changed with the CSET instruction.
Change the units of the data length (count) according to the explanation in Section 17.4 of this manual.

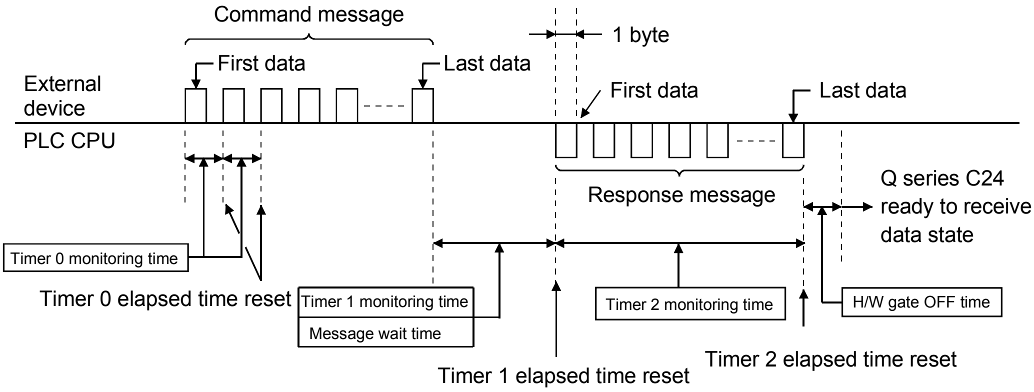
MEMO

6 CHANGING THE DATA COMMUNICATIONS MONITORING TIMES

The monitoring times are timers used by the Q series C24 to monitor the receiving interval time between each byte when receiving data from the external device, the PLC CPU processing time, and the time it takes to transmit to the external device.
The monitoring times can be set for each interface. The Q series C24 uses the monitoring time set by the user to control data transmission to and reception from the external device.
Set the monitoring times to match the specifications of the external device.
The Q series C24 monitoring times are shown below.

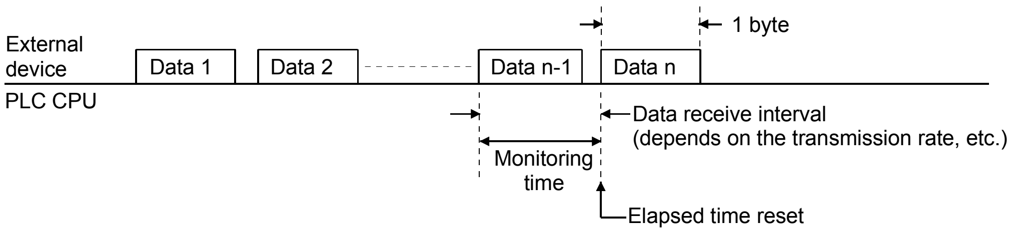
	Monitoring time		Q series C24 default value	Protocol that can monitor the time			Notes
				MC	Non procedure	Bi-directional	
1)	No-reception monitoring time (timer 0)	Format 0	0 bytes (Infinite wait)	○	○	○	Transmission time for the set number of bytes. (depends on the transmission rate)
		Format 1		×	○	×	
2)	Response monitoring time (timer 1)		5 s	○	—	○	For bidirectional protocol, this is valid for transmission only.
3)	Transmission monitoring time (timer 2)		3 min	○	○	○	—
4)	Message wait time		0 ms	○	—	—	No wait time

(Example) Data communications using an MC protocol



6.1 No-Reception Monitoring Time (timer 0) Setting

The no-reception monitoring time (timer 0) is the time for clearing the Q series C24 state when the Q series C24 was placed into the data receive wait state by trouble in the external device.
The Q series C24 monitors the reception interval in byte units at the start of data reception from the external device and ends monitoring when the preset last data is received and repeats this operation.
The following explains the no-reception monitoring time (timer 0) operation.



POINT

When changing the no-reception monitoring time (timer 0) default value by the sequence program and checking timer 0 with the new value at the Q series C24, after changing the default value, switch the mode as described in Chapter 15.

(1) Q series C24 operation by no reception monitoring time (timer 0)

Monitors the receive interval in byte units and returns the elapsed time to 0 each time one byte is received.
At time-out, the Q series C24 performs the following processing.

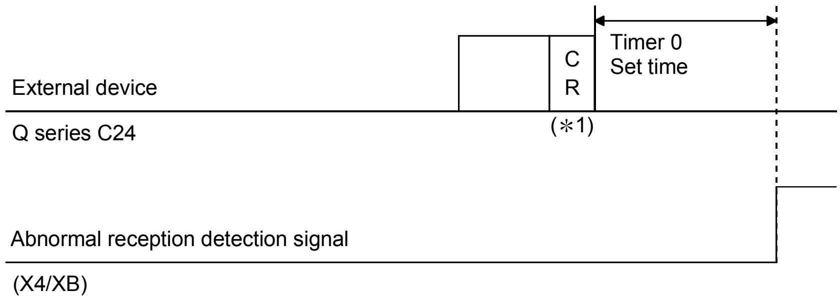
(a) Data communication using MC protocol
- Stores the error code to the MC protocol transmission error code storage area (buffer memory addresses 25AH, 26AH) for the target interface.
- Transmits a NAK message to the external device and enters the command message receive wait state.

(b) Data communications using non procedure protocol (Format 0)

1) Data communications not using user frames

- Passes the receive data up to time-out to the Q series C24.
- Stores the error code to the data receive result storage area (buffer memory addresses 258H, 268H) for the target interface and turns on the reception abnormal detection signal (X4, XB) and waits to receive the next data.

(Example) Receiving according to the received complete code (Received complete code: CR + LF (0D0AH))
When the LF is not received within the set time for timer 0 after reception of the CR, the abnormal reception detection signal to the PLC CPU turns ON and the received data at the CR is stored in the received data storage area of the buffer memory.



∗1 CR is treated as 1 byte of data included in the message.

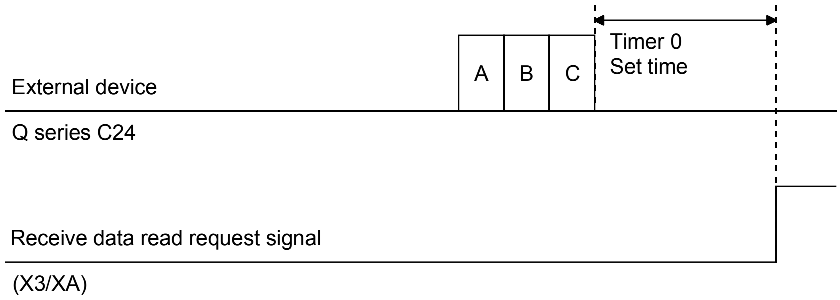
2) Data communications using user frames

- When designating the last frame, an arbitrary part of data in the area starting from the start of the reception of the current message until time-out is read into the Q series C24, and the data in the last frame area is ignored (deleted).
- Stores the error code to the data receive result storage area (buffer memory addresses 258H, 268H) for the target interface and turns on the reception abnormal detection signal (X4, XB) and waits to receive the next data.

(c) Data communication using non procedure protocol (Format 1)
The reception monitoring format 1 of the no-reception monitoring time (timer 0) is used for receiving a message for which the receive complete code and receive data count has not been preset. This occurs when the no-reception monitoring time (timer 0) runs out on the non procedure protocol.

- Data is received by the Q series C24 until the time is out, the receive data read request signal (X3, XA) turns ON, and the following data reception waiting condition occurs.

(Example) When receiving using the receive data count (Receive data count: 4 bytes)
After 3 bytes of data is received, the 3-byte data is stored in the received data storage area of the buffer memory by the time out (timer 0) and the receive data read request signal to the PLC CPU turns ON.



(d) Data communications using bidirectional protocol

- Ignores (deletes) the receive data from the start of reception of the current message to time-out.
- Stores the error code to the data receive result storage area (buffer memory addresses 258_H, 268_H) for the target interface.
- When the receive data complete, transmits a NAK message to the external device and waits to receive the next data.

(2) Changing the no-reception monitoring time (timer 0)

(a) Changing the no-reception monitoring time (timer 0)

The no-reception monitoring time (timer 0) is designated by the number of transmitted characters (byte count) corresponding to the data communication rate set in the interface, and then it is registered on the GX Configurator-SC's "Transmission control and others system setting" screen. Adjust or set the value based on the specifications of the external device. For details on the registration method of the no-reception monitoring time, see Section 8.4.5 of the User's Manual (Basic).

(b) No-reception monitoring time format specification in non procedure protocol (Format 0/Format 1)

The no-reception monitoring time format in non procedure protocol is specified to use the no-reception monitoring time (timer 0) by the non procedure protocol and is registered on the "Transmission control and others system setting" screen.
For details on the registration method, see the User’s Manual (Basic) Section 8.4.5.

REMARK

1) When changing the no-reception monitoring time (timer 0)
Find the result using the following expression and set the number of bytes or greater for the no-reception monitoring time (timer 0).

$$\text{No-reception monitoring time (timer 0)} = 1 + \frac{Td \times Vbps}{12000}$$

(Round up fractions below decimal point.)

Td : Maximum delay time for external device output processing (ms)
Vbps: Transmission rate (bps)

(Example) Calculation of no-reception monitoring time (timer 0)

- Transmission rate (Vbps) : 9600bps
- Maximum delay time for external device output processing (Td) : 50ms

$$\text{No-reception monitoring time (timer 0)} = 1 + \frac{50 \times 9600}{12000} = 41 \text{ bytes}$$

In this case, actual monitoring time is as follows:

41 bytes × 12 *1 / 9600 × 1000 = 51.25ms

*1 Number of transmit bits per byte (Fixed)

2) When exchanging data with the external device through the Q series C24 RS-422/485 interface and changing the no-reception monitoring time (timer 0)

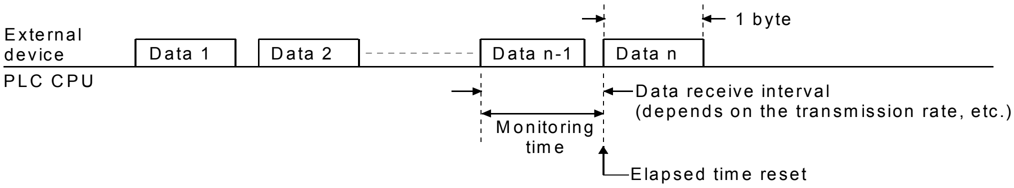
$$\text{No-reception monitoring time (timer 0)} = 1 + \frac{(Td + T1) \times Vbps}{12000}$$

(Round up fractions below decimal point.)

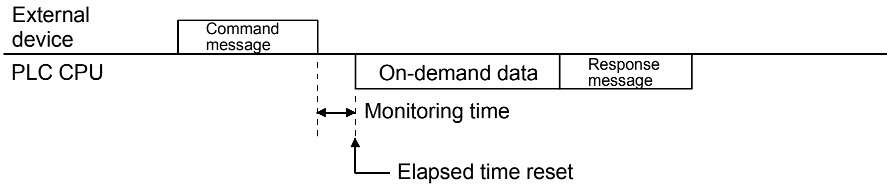
Td : Maximum delay time for external device output processing (ms)
T1 : External device side H/W gate OFF time (ms)
Vbps: Transmission rate (bps)

6.2 Response Monitoring Time (timer 1) Setting

The response monitoring time (timer 1) clears the receive wait state of the device that receives the response message when trouble in the device that received the message does not return a response message (result) to the external device.
When the Q series C24 receives a message from the external device, it monitors the PLC CPU processing time up to the start of transmission of the response message to the external device.
When a message was received, it monitors the external device processing time up to the start of reception of the response message from the external device.
The following describes the response monitoring time (timer 1) operation.



＊ If on-demand data is transmitted before a response message during data communications using a MC protocol, the time up to the start of transmission of the on-demand data is monitored.



(1) Q series C24 operation by response monitoring time (timer 1)

(a) When response monitoring time (timer 1) set to 0ms
After receiving a message, the Q series C24 does not monitor the time up to the start of transmission of a response message to the external device, but waits infinitely.
After transmitting a message, the Q series C24 does not monitor the time up to the start of reception of the response message from the external device, but waits infinitely.

(b) When response monitoring time (timer 1) is set to 100 ms or longer
After receiving a message, the Q series C24 monitors the time up to the start of transmission of a response message to the external device and returns the elapsed time to 0 at the start of transmission.
After transmitting a message, the Q series C24 monitors the time up to the start of reception of the response message from the external device and returns the elapsed time to 0 at the start of reception.
At time-out, the Q series C24 performs the following processing.

1) Data communications using a MC protocol

- Stores the error code to the MC protocol transmit error code storage area (buffer memory addresses 25AH, 26AH) for the target interface.
- Transmits a response message (NAK message) to the external device and waits to receive the next command message.

2) Data communications using bidirectional protocol
- Stores the error code to the data transmission result storage area (buffer memory addresses 257H, 267H) for the target interface and performs transmission processing abnormal completion.
- While waiting to transmit a response message, the Q series C24 does not check the response monitoring time.

(2) Changing the response monitoring time (timer 1)

The response monitoring time (timer 1) is registered on the GX Configurator-SC's "Transmission control and others system setting" screen. For data communication using the MC protocol, set the response monitoring time so that it is longer than the message wait time. (*1)
For details on the registration method of the response monitoring time, see Section 8.4.5 of the User's Manual (Basic).

*1 The message wait time is designated at the following locations.
- A compatible 1C frame: Designate in a command message
- QnA compatible 2C/3C/4C frame: GX Configurator-SC "MC protocol system setting" screen

POINT

When changing the response monitoring time (timer 1) default value (5 s), observe the following precautions.

(1) Data communications using an MC protocol
In any of the following cases make the default value the message wait time described in Section 6.4, or longer.

(a) When designating the monitor conditions with the following functions, set the maximum time matched to system operation.
- Word units random read (See Section 3.3.8 of Reference Manual.)
- Device memory monitor (See Section 3.3.9 of Reference Manual.)

(b) Access other than (a) above
1) When accessing a station connected (including multidrop link) to an external device, set the following value, or longer.

Response monitoring time >= Maximum number of scans required to process the command used × connected station scan time

2) When accessing another station over a network system, set the default value to infinity or the following time, or longer.

Response monitoring time >= Maximum number of scans required to process the command used × communications time

When setting the default value to infinity, check the external device response wait time and initialize the Q series C24 transmission sequence when time-out is generated. (See Reference Manual "Data designation item description" for each frame.)

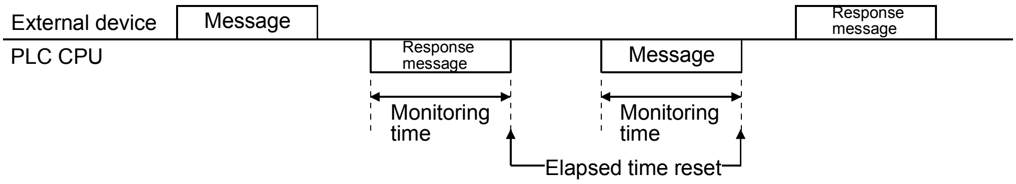
* See Appendix 3 of Reference Manual for the number of scans required by processing.
See Chapter 2 of Reference Manual for the communications time.

POINT

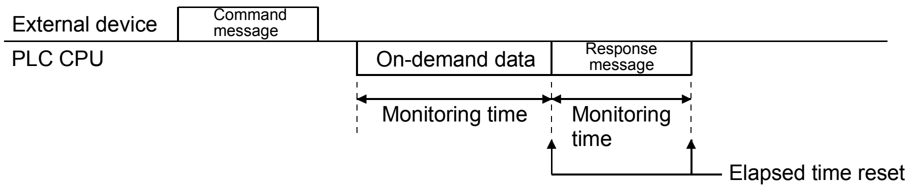
(2) Data communications using bidirectional protocol
Set the default value to the following time, or longer.
(Sequence scan time × 2) + 100 ms

6.3 Transmission Monitoring Time (timer 2) Setting

The transmission monitoring time (timer 2) clears the wait state when the Q series C24 that is to transmit a message or response message (result) has entered the transmission end wait state due to trouble in the external device.
When the Q series C24 transmits a message, it monitors the wait time up to the end of transmission of the message.
When the Q series C24 received a message from the external device, it monitors the wait time up to the end of transmission of the response message.
The following explains the transmission monitoring time (timer 2) operation.



＊ If on-demand data is transmitted before a response message during data communications using an MC protocol, each time is monitored.



(1) Q series C24 operation by transmission monitoring time (timer 2)

(a) When transmission monitoring time (timer 2) is set to 0ms
The time until transmission of the message or response message is not monitored.
If the Q series C24 cannot transmit, it waits infinitely.

(b) When transmission monitoring time (timer 2) is set to 100 ms or longer
Monitors the time from completion of message or response message transmission preparations to the end of transmission and returns the elapsed time to 0 at the end of transmission.
At time-out, the Q series C24 performs the following processing.

1) Data communications using MC protocol
- While waiting for the end of transmission of the response message, the Q series C24 stores the error code to the data transmission result storage area (buffer memory addresses 257H, 267H) for the target interface.
The Q series C24 enters the state in which it waits to receive the next command message without sending a response message (NAK message) to the external device.
- During on-demand data transmission, the Q series C24 stores the error code to the on-demand execution result storage area (buffer memory addresses 256H, 266H) for the target interface.
- If transmission was terminated midway in either of the cases above, the Q series C24 does not transmit the remaining data.

2) Data communications using non procedure protocol or bidirectional protocol
   - While waiting for the end of transmission of a message, the Q series C24 stores the error code to the data transmission result storage area (buffer memory addresses 257H, 267H) for the target interface and performs transmission processing abnormal completion.
     If message transmission was terminated midway, the Q series C24 does not transmit the remaining data.
   - If waiting for the end of transmission of a response message, the Q series C24 stores the error code to the data receive result storage area (buffer memory addresses 258H, 268H) for the target device and turns on the reception abnormal detection signal (X4, XB). (＊1)
     When the receive data read complete, the Q series C24 turns off the reception abnormal detection signal (X4, XB) and waits to receive the next command.
     If transmission of the response message was terminated midway, the Q series C24 does not transmit the remaining data.

＊1 When communicating using bidirectional protocol, it stores the error code in the data receive result storage area for the target interface. (The reception abnormal detection signal does not turn on.)

(2) Changing the transmission monitoring time (timer 2)

The transmission monitoring time (timer 2) is registered on the GX Configurator-SC's "Transmission control and others system setting" screen.
For details on the registration method of the transmission monitoring time, see Section 8.4.5 of the User's Manual (Basic).

POINT

The transmission monitoring time (timer 2) monitors the transmission termination time when the following states are generated.
- When DTR/DSR signal control is used and the DSR signal is turned off (See Section 7.1.)
- When DC1/DC3 receive control is used and DC3 is received (See Section 7.2.)
- When the RS-232 interface CS signal is turned off (See Section 3.2.1 of User's Manual (Basic).)

REMARK

Criteria when changing the transmission monitoring time (time 2) setting
Find the transmission monitoring time (timer 2) time from the maximum delay time of external device message receive processing or response message transmission processing and the transmission time/byte (t) and change the set value.

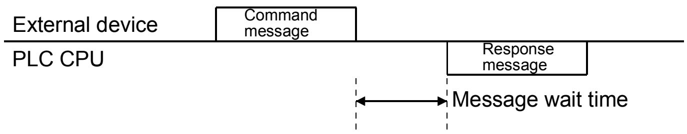
- Number of bytes transmitted/second (n) = Transmission rate/number of transmit bits/byte
- Transmission time/byte (t) = 1000 (ms)/number of bytes transmitted/s (n)
- Transmission monitoring time (timer 2) = (Maximum external device processing delay time) + (transmission time/byte (t) × transmit byte count)
  ......100 ms units truncated

Under the following conditions, the transmission monitoring time (timer 2) is set to 300 ms

- Transmission rate : 9600 bps
- Number of transmit bits/byte : 11 (start bit: 1, data bits: 8, stop bits: 2)
- Maximum processing delay time : 200 ms
- Transmit byte count : 3 bytes

6.4 Message Wait Time Setting

The message wait time is used during data communications using a MC protocol.
It is the time for an external device that cannot receive the data immediately after it has been transmitted.
When the Q series C24 transmits a response message in reply to a command message received from the external device, transmission of the response message is delayed by the message wait time, or longer.
The following explains the message wait time operation for data communications using QnA compatible 2C/3C/4C frame. (For A compatible 1C frames, the message wait time is designated in the command message.)



(1) Q series C24 operation by message wait time

1) When message wait time is 0 ms
If a response message can be transmitted, the Q series C24 immediately transmits the response message. A transmission wait time is not set.
2) When the message wait time is 10 ms or longer
If a response message can be transmitted, and the message wait time after reception of the command message has elapsed, the Q series C24 transmits the response message.

(2) Changing the transmission wait time

The transmission wait time is registered on the GX Configurator-SC's "MC protocol system setting" screen
For details on the registration method of the transmission wait time, see Section 8.4.6 of the User's Manual (Basic).

POINT

(1) If the external device that must wait a certain time before it can receive a response message after a command message was transmitted, set the message wait time as explained above.
Especially, for data communications with an external device connected to the Q series C24 RS-422/485 interface, set the message wait time to the external device hardware gate OFF time or longer.
(2) The message wait time described here is the time for data communications using QnA compatible 2C/3C/4C frame.

7 DATA COMMUNICATIONS USING DC CODE TRANSMISSION CONTROL

The transmission control function controls (termination, restart) the transmission and reception of data between the Q series C24 and external device by turning transmission control signals on and off, or by transmitting and receiving DC codes (DC1, DC2, DC3, DC4), or informs the range of validity for the data to the external device.
The transmission control function can be set for each Q series C24 interface. The Q series C24 uses the transmission control function set by the user to control data communications with external devices.
Set the transmission control function to match the specifications of the external device .

The table below shows the Q series C24 transmission control functions.

Transmission control function	Kind of control	Interface that can be controlled		Protocol that can be controlled			Note
		232	422/485	MC	Non procedure	Bidirectional	
DTR/DSR signal control ＊1	DTR control	○	— (Ignored)	—	○	—	Cannot be used simultaneously with DC control. One is selected.
	DSR control			○	○	○	
RS/CS signal control ＊2		○	—	○	○	○	Normal control.
CD signal control ＊2		○	—	○	○	○	The cable wiring depends on whether or not control is used. With half-duplex communications, control is necessary.
DC code control ＊1	DC1/DC3 transmission control	○	○	—	○	—	Cannot be used simultaneously with DTR/DSR signal control. One is selected.
	DC1/DC3 reception control			○	○	○	
	DC2/DC4 transmission control			○	○	○	
	DC2/DC4 reception control			○	○	○	

○ : Possible (transmission control used)
— : Invalid

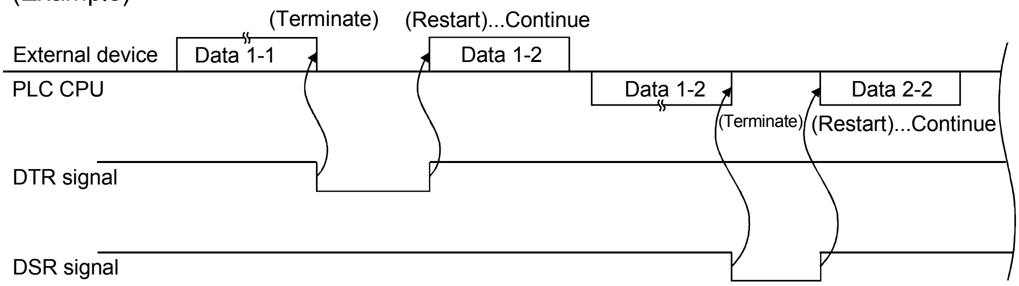
＊1 When using full-duplex communications with bidirectional protocol data communications, see Section 7.3 of User's Manual (Basic).
＊2 See Section 3.2.1 (1) of User's Manual (Basic) and check Q series C24 operation according to the RS and CS signal control contents and CD terminal check designation.

POINT
When the Q series C24 is started, DTR/DSR signal control and RS/CS signal control are enabled.

7

7.1 Control Contents of DTR/DSR (ER/DR) Signal Control

This control uses the RS-232 interface DTR/DSR signals to inform the external device whether or not the local station is ready to receive data.
The Q series C24 uses the DTR (ER) signal to inform the external device whether or not the local station is ready to receive data and uses the DSR (DR) signal to check if the external device is ready to receive data.
(Example)

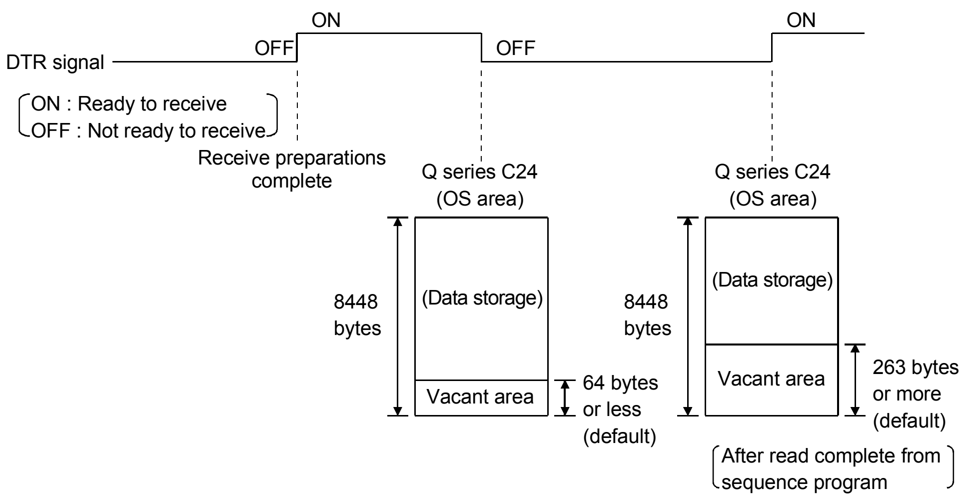


(1) Q series C24 DTR control

(a) Q series C24 DTR control

The Q series C24 uses the DTR signal to inform the external device whether or not it is ready to receive data.
The data transmitted from the external device by non procedure protocol is stored to the buffer memory receive data storage area through the OS area. (See User's Manual (basic) Section 6.1.2 ✻1.)
For the following conditions, the receive data is temporarily stored to the OS area and is transferred to the receive data storage area when the present receive data read processing is complete.

1) Receive data size exceeds the size of the buffer memory area when "receive data storage area < receive data length data" was received.
2) The data was received before the sequence program read the previously received data.
   The Q series C24 turns the DTR signal on/off as shown below, depending on the size of the vacant OS area.
   - Vacant area 64 bytes (default) or less .... OFF
   - Vacant area 263 bytes (default) or more ..... ON



(b) Specification of free OS area

The limit of free OS area for data reception under the DTR/DSR (ER/DR) signal control is specified in GX Configurator-SC's "Transmission control and others system setting" (See User's Manual (Basic), Section 8.4.5.).
When it reaches the limit, this status is notified to disable data reception.
The set values must satisfy the following condition.

"Transmission control start free area < Transmission control end free area"

1) Transmission control start free area specification (Address: 2012_H/2112_H)
   Specifies an available capacity in the OS area so that the full status is notified to disable the data reception (DTR signal is OFF).
   - Transmission control start free area: 64 to 4095 (Default: 64)
2) Transmission control end free area specification (Address: 2013_H/2113_H)
   Specifies an available capacity in the OS area so that data reception is enabled by notification (DTR signal is ON).
   - Transmission control end free area: 263 to 4096 (Default: 263)

REMARK

- Receive data clear described in Section 6.1.4 of User's Manual (Basic) clears the OS area simultaneously with clearing of the receive data storage area.
- If more data is received when the OS area mentioned above are 0 bytes, an SIO error is generated and the data received until the OS area becomes vacant is ignored. At this time, the SIO signal is turned on. (See User's Manual (Basic) Section 10.1.1.)

(2) Q series C24 DSR control

The Q series C24 uses the DSR signal to detect whether or not the external device is ready to receive data and to control data transmission to the external device as shown below, depending on whether the DSR is on/off.

1) If the DSR signal is ON and there is send data, the Q series C24 transmits it to the external device.
2) If the DSR signal is OFF, even if there is send data, the Q series C24 does not transmit it to the external device.
   When the DSR signal is turned on, the Q series C24 transmits the send data to the external device.

7.2 Control Contents of DC Code Control

This control uses the Q series C24 transmission control data to inform the external device whether or not local station is ready to receive data and the valid range of the send and receive data.
The four kinds of Q series C24 DC code control shown below are available. These control functions can be used simultaneously.

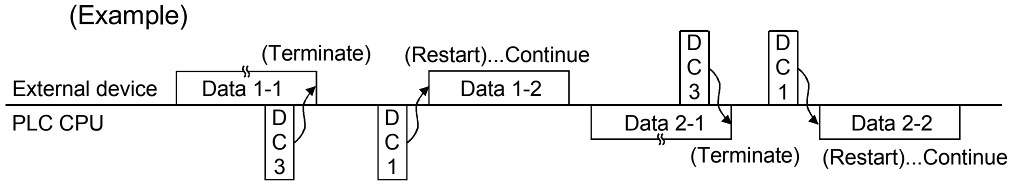
(1) DC1/DC3 transmission control, DC1/DC3 reception control

The Q series C24 informs the external device whether or not local station is ready to receive data by transmitting the DC1 and DC3 signals and checks whether or not the external device is ready to receive data by receiving the DC1 and DC3 signals.

DC1 Control data that informs the external device that the Q series C24 is ready to receive data

DC3 Control data that informs the external device that the Q series C24 is not ready to receive data

(Example)



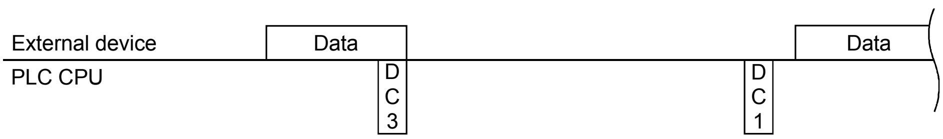
(a) Q Series C24 DC1/DC3 transmission control and free OS area specification
The control is performed in the same as those described in Section 7.1 (1) DTR control and the free OS area specification are the same as those described in Section 7.1 (1) (b).
The Q series C24 transmits DC1 or DC3 to the external device instead of turning the DTR signal on/off.

For the DC1 and DC3 transmit timing, replace DTR signal ON/OFF as shown below.

(DTR control) (DC1, DC3 transmission control)

DTR signal OFF= DC3 transmit ·······Transmitted when the vacant OS area drops to 64 bytes (default) or less

DTR signal ON = DC1 transmit·········Transmitted when the vacant OS area reaches 263 bytes (default) or more



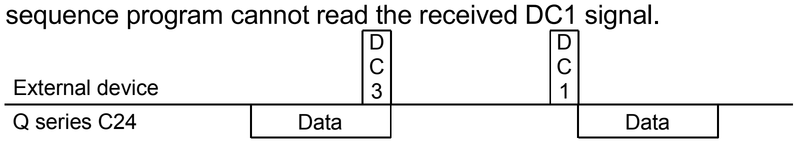
REMARK

- Receive data clear described in Section 6.1.4 of User's Manual (Basic) clears the OS area simultaneously with clearing of the receive data save area.
- If more data is received when the vacant OS area mentioned above is 0 bytes, an SIO error is generated and the data received until the OS area becomes vacant is ignored. At this time, the SIO LED is turned on. (See Section 10.1.1 of User's Manual (Basic).)

(b) Q series C24 DC1/DC3 reception control contents

1) When the Q series C24 receives DC3 from the external device, it terminates data transmission.
The sequence program cannot read the received DC3 signal.

2) When the Q series C24 receives DC1 from the external device, it restarts data transmission.
(The Q series C24 resumes transmission from the data terminated on DC3 reception.)
The sequence program cannot read the received DC1 signal.



3) Once DC1 is received, subsequent DC1 are ignored and are removed from the receive data.

POINT

(1) The following describes the state of the Q series C24 when the power is turned on, the CPU is reset, or the mode is switched during DC1, DC3 transmission control and DC1/DC3 reception control.

(2) DC1 is not transmitted to the external device.
- This is the same state as when DC1 was transmitted.
- The same state as when DC1 was received even if DC1 is not received from the external device.

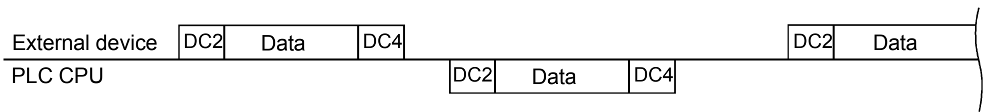
(2) DC2/DC4 transmission control, DC2/DC4 reception control

The Q series C24 encloses the send data from the local station in the DC2 and DC4 codes and transmits it to the external device and processes the data received from an external device enclosed in the DC2 and DC4 codes as valid data.

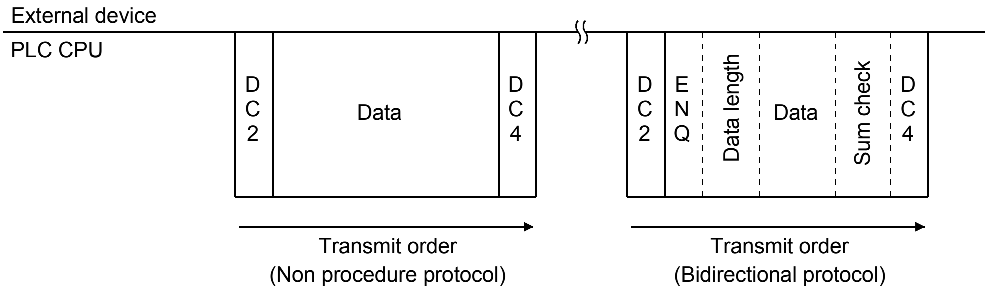
DC2...Control data that informs the external device that the data following it is the start of the valid data

DC4...Control data that informs the external device that the data immediately preceding it is the end of the valid data

(Example)

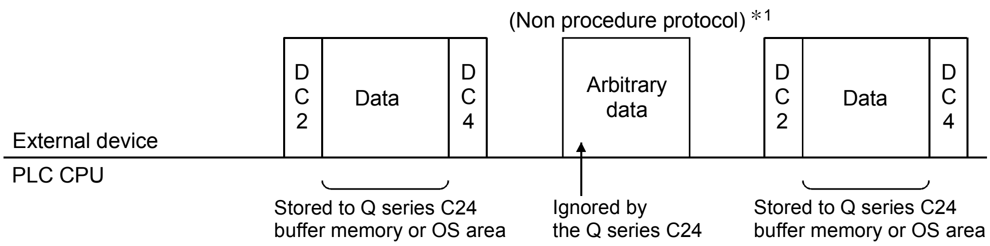


(a) Q series C24 DC2/DC4 transmission control contents
When transmitting data to an external device, the Q series C24 adds the DC2 code to the head of the send data and the DC4 code to the end of the send data.



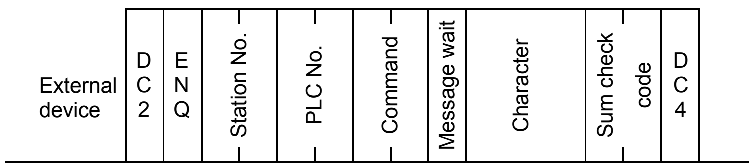
*The DC2 and DC4 code are also added when MC protocol is used.

(b) Q series C24 DC2/DC4 reception control contents
1) When the Q series C24 receives DC2 from the external device, it processes the receive data up to DC4 as valid data.
The sequence program cannot read the received DC2 code.
2) When the Q series C24 receives DC4, it ignores the receive data up to immediately before DC2 as invalid data.
The sequence program cannot read the received DC4 code.



3) Once DC2 is received, subsequent DC2 are ignored and are removed from the receive data.

*1 MC protocol A comoatible 1C frame format 1



(3) The transmission control method and changing the DC code
Switching between DC code control method and DTR/DSR control as well as changing of the DC code are registered on the GX Configurator-SC's "Transmission control and others system setting" screen.
For details on the registration method, see Section 8.4.5 of the User's Manual (Basic).

7.3 Precautions when Using the Transmission Control Functions

The following describes the precautions to be observed when using the Q series C24 transmission control functions.

(1) Agreement between external device and PLC CPU

The external device and PLC CPU must agree to the following.

1) Whether or not a transmission control function is to be used. If a control function is used, which control is to be used for data communications.
2) Control timing.
3) DC1 to DC4 codes when DC control is performed.
   (The DC1 to DC4 codes used can be arbitrarily changed.)

(2) Transmission control function usage conditions

1) DTR/DSR control and DC code control cannot be used at the same time.
   Select one of them using the GX Configurator-SC registration.
2) When using DTR/DSR control, connect the Q series C24 DTR and DSR signals to the external device.

(3) Transmission control function setting

Set a transmission control function that can control the target interface.
If a function that cannot control the target interface is set, the set contents are invalid.

(4) Setting of transmission control function during linked operation

When the two Q series C24 interfaces are linked (see Section 4.4.2 of User's Manual (Basic), set the transmission control function of only the interface that must be controlled.
Set the other interface to "Do not use transmission control function" (set value when directly set to the buffer memory: 0001_H).

(5) DC code control

1) DC1/DC3 transmission control and DC1/DC3 reception control are possible when full-duplex communications is used to communicate data between the Q series C24 and external devices.
   Do not use DC1/DC3 control with half-duplex communications.
2) The same data as the DC1 to DC4 codes cannot be included in the user data.
   To handle the same data as a DC code as user data, do the following.
   - Use DTR/DSR control.
   - Change the DC code.
   - Do not use the transmission control functions.

POINT

If the user data received from the external device includes the relevant DC code when DC1/DC3 reception control and DC2/DC4 reception control are used, the Q series C24 uses the corresponding DC code control.
If the user data transmitted from the PLC CPU includes a DC code, it is sent unchanged.

(6) Handling of DTR and DSR signals when DTR/DSR control is not used

When the DTR/DSR control function is not used, the Q series C24 handles the DTR and DSR signals as described below.

1) Leaves the DTR signal ON.
2) Ignores the DSR signal ON/OFF state.

8 DATA COMMUNICATIONS USING HALF-DUPLEX COMMUNICATIONS

For data communications between the Q series C24 and an external device using the RS-232 interface, it is set so that the Q series C24 and the external device do not transmit data at the same time.
The QJ71C24 (N)-R2 can be set for each interface.
When the Q series C24 is started, full-duplex communications is set. The user can change the communications method to match the specifications of the external device.

POINT

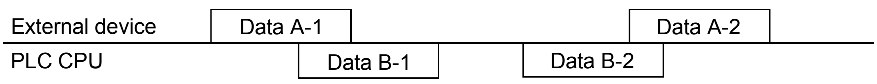
Since half-duplex communications does not have to be set in the following cases, you do not have to read this section.
(1) When data is only transmitted or receive during non procedure protocol data communications.
(2) When it is designated in the external device that no data transmission is performed from the external device to the Q series C24 unless so directed by the Q series C24.

8.1 Half-duplex Communications

The following describes the differences between full-duplex communications and half-duplex communications.
Since the Q series C24 uses the communications method designated by the user to control PLC CPU communications, control by sequence program is unnecessary.

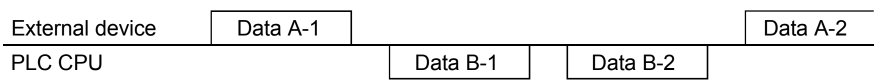
(1) Full-duplex communications

This communication method uses telephone conversation format image to communicate data with the external device.
The Q series C24 can receive data while transmitting data to the external device.
It can also transmit data while receiving data from the external device.



(2) Half-duplex communications

This communications method uses transceiver conversation format image to communicate data with the external device.
If the Q series C24 receives data from the external device while transmitting data to the external device, it controls data transmission and reception according to "Simultaneous transmission priority/non-priority designation".
The Q series C24 does not transmit data while it is receiving data from the external device.



8.2 Data Transmission and Reception Timing

Half-duplex communications uses the Q series C24 RS-232 interface CD and RS signals to control communications.
If the external device can transmit and receive data according to ON/OFF of the Q series C24 RS and CD signals as shown below, half-duplex communications is possible.

RS signal············ Turned ON/OFF by the Q series C24 as shown below.
When data is transmitted from the Q series C24, this signal is turned ON. When transmission is complete, turn this signal OFF.

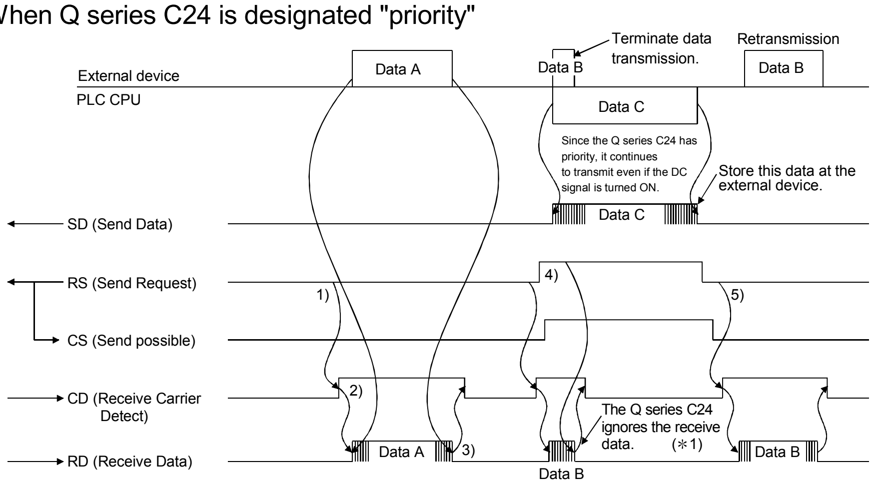
CD signal············ Turned ON/OFF by at the external device as shown below.
When data is transmitted from the external device, this signal is turned ON. When transmission is complete, turn this signal OFF.

The following describes the half-duplex communications data transmission and reception timings by Q series C24 CD signal and RS signal.

(1) Timing when transmitting data from external device

Transmit data by controlling the Q series C24 CD signal according to the "simultaneous transmission priority/non-priority designation" registered in "Transmission control and others system setting" screen of the GX Configurator-SC (See Section 8.4.5 of User's Manual (Basic))

(a) When Q series C24 is designated "priority"

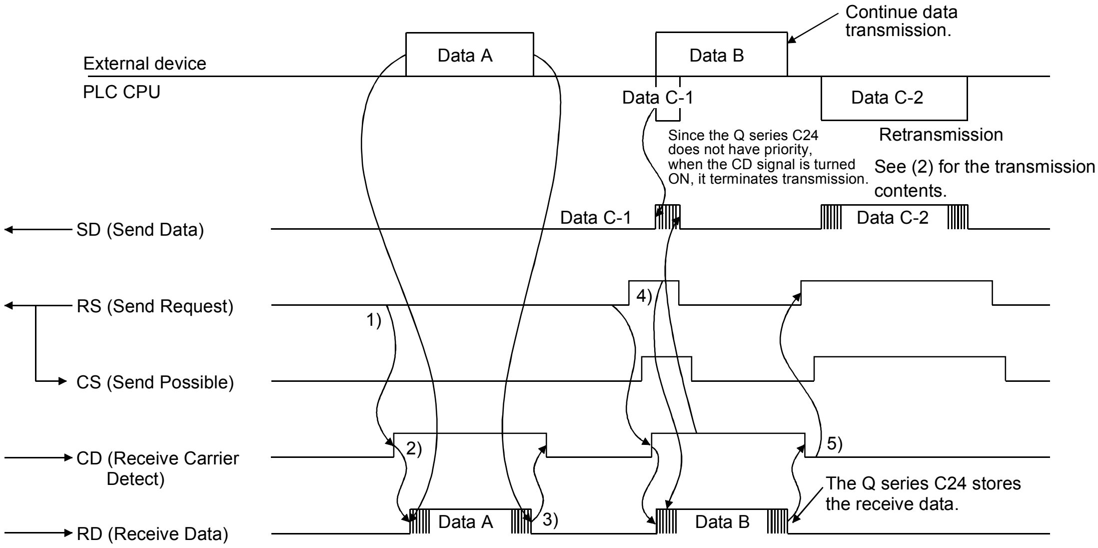


1) When transmit data, check the RS signal. If the RS signal is OFF, turn on the CD signal. If the RS signal is ON, wait until it is turned OFF, then turn ON the CD signal.
2) Transmit data after the CD signal is turned ON.
3) After data transmission is complete, turn off the CD signal.
4) If the RS signal was turned ON during data transmission, terminate data transmission and turn OFF the CD signal and perform data transmission processing. (Simultaneous transmission generated)
5) After transmission from the Q series C24 is complete, retransmit all the data terminated at step 4.

∗1 Take the following measures between the communicating devices as a countermeasure against ignoring of the receive data by the Q series C24.
- Transmit and receive a response message in reply to data transmission
- Retransmit the data due to response message time-out check or generation of a time-out error (external device side)

8

(b) When Q series C24 is designated "non-priority"



The contents of steps 4 and 5 below are different from those of item (a).

1) When transmitting data, check the RS signal. If the RS signal is OFF, turn ON the CD signal. If the RS signal is ON, wait until it is turned OFF, then turn ON the CD signal.
2) After the CD signal is turned ON, transmit the data.
3) After data transmission is complete, turn OFF the CD signal.
4) The external device will continue to transmit data to the Q series C24 even if the RS signal is turned ON during data transmission. (Simultaneous transmission generated)
5) After transmission from the external device is complete, data is transmitted from the Q series C24 to the external device. (See (2).)

REMARK

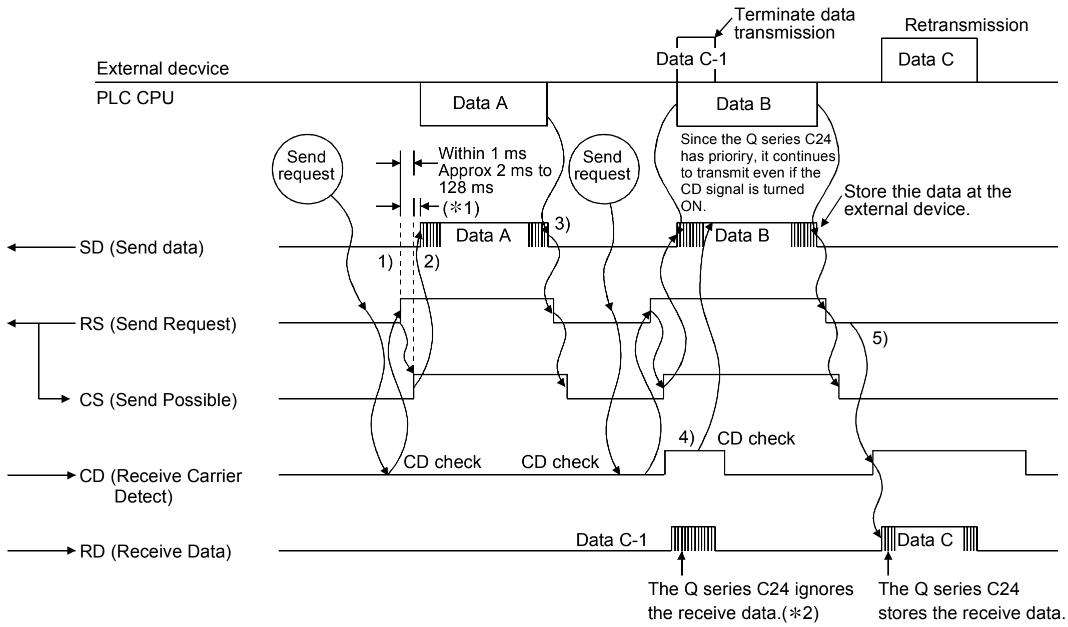
When using the DTR/DSR transmission control function described in Chapter 7, transmit data from the external device to the Q series C24 as shown below in both cases (a) and (b) above.

- When the Q series C24 DTR signal is turned OFF, terminate data transmission.
- When the Q series C24 DTR signal is turned ON after data transmission was terminated, restart data transmission (transmit from the terminated data).

(2) Timing when data is transmitted from the Q series C24

The Q series C24 RS signal is controlled and data is transmitted according to the "simultaneous transmission priority/non-priority" value registered in "Transmission control and others system setting" screen of the GX Configurator-SC. (See Section 8.4.5 of User's Manual (Basic)).

(a) When Q series C24 is designated "priority"

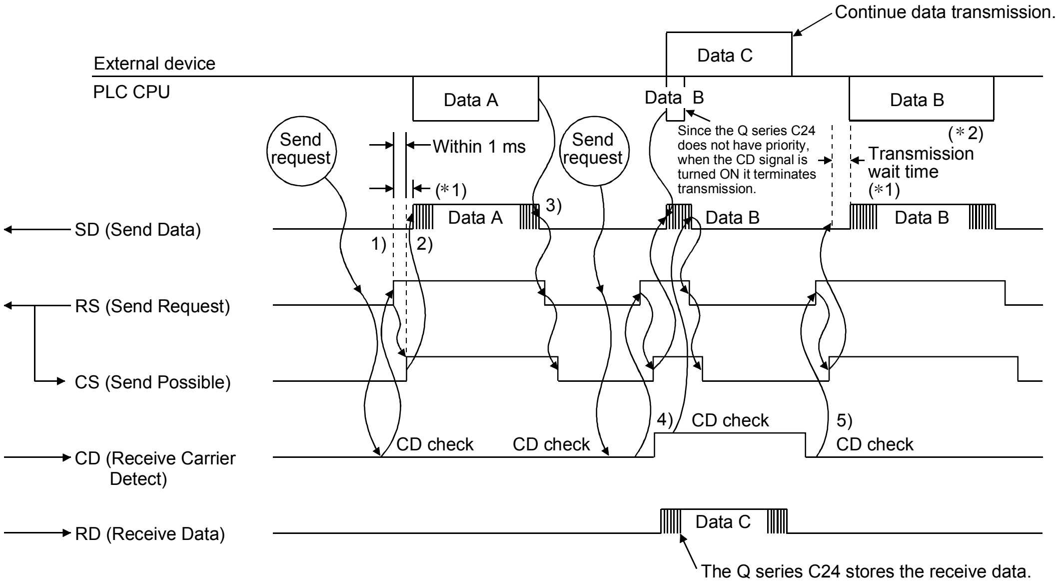


1) When transmitting data, check the Q series C24 CD signal. If the CD signal is OFF, turn on the Q series C24 RS signal.
   If the CD signal is ON, wait until it is turned OFF, then turn ON the RS signal.
2) After the RS signal is turned ON, transmit the data.
3) After data transmission is complete, turn off the RS signal.
4) If the CD signal is turned ON during data transmission, the Q series C24 continues to transmit data to the external device. (Simultaneous transmission generated)
5) After transmission from the Q series C24 is complete, transmit all the data terminated at step 4 from the external device to the Q series C24.

∗1 The time from RS signal ON to the start of transmission depends on the data transmission rate.
The higher the transmission rate, the shorter the time up to the start of transmission.

∗2 Do the following between the communicating devices as a countermeasure against ignoring of the receive data by the Q series C24.
- Transmit and receive a response message in reply to data transmission.
- Time-out check of the response message and data transmission due to time-out error (external device side).

(b) When Q series C24 designated "non-priority"



The contents of steps 4 and 5 below are different from those of item (a).

1) When transmitting data, check the Q series C24 CD signal. If the CD signal is off, turn on the Q series C24 RS signal.
   If the CD signal is on, wait until it is turned off, then turn on the RS signal.
2) After the RS signal is turned on, transmit the data.
3) After data transmission is complete, turn off the RS signal.
4) If the CD signal is turned on during data transmission, terminate data transmission and turn off the RS signal and perform the data receive processing. (Simultaneous transmission generated)
5) After transmission from the external device is complete, transmit the data terminated at step 4 from the beginning or from the last data transmitted. ∗2

∗1 The data size set to "Simultaneous transmission priority/non-priority" by GX Configurator-SC is not transmitted.

∗2 Transmit from the beginning or from the data transmitted immediately before transmission was terminated, according to the contents set to "Retransmission time transmission method by GX Configurator-SC".

REMARK

When using the DTR/DSR transmission control function described in Chapter 7, transmit data from the Q series C24 to the external device as shown below in both cases (a) and (b) above.

- When the Q series C24 DSR signal is turned OFF, terminate data transmission.
- When the Q series C24 DSR signal is turned on after data transmission was terminated, restart data transmission (transmit from the terminated data).

8.3 Changing the Communication System

To change the data communication mode from full-duplex communication to half-duplex communication, registration on the GX Configurator-SC's "Transmission control and others system setting" screen is required.
The following explains setting items for changing the communication system.
For more details on the registration method of the communication system, see Section 8.4.5 of User's Manual (Basic).

(1) RS-232 communication system designation

Designate either full-duplex or half-duplex communication.

(2) Simultaneous transmission priority/non-priority designation

When the Q series C24 and the external device start data transmission simultaneously in half-duplex mode, designate whether to continue (priority) or stop (non-priority) transmission from the Q series C24.
Designated values "1" to "255" for setting "non-priority" will be the transmission wait time that elapses from when the resumption of data transmission becomes available until data is actually sent.

(3) Retransmission time transmission method designation

When "half-duplex communication" and "non-priority" are set as indicated above, this setting becomes valid. When the Q series C24 and the external device begin transmission simultaneously, if the Q series C24 stops and then restarts transmitting, designate whether the stopped message will be transmitted from the beginning ("resend") or whether transmission will continue after the stopped message ("not resend").

(4) RS-232 CD terminal check designation

When using half-duplex communication, set the "CD terminal check designation" to on.

8.4 Connector Connections for Half-duplex Communications

The following explains the functions of the connector that connects the Q series C24 and external device when half-duplex communications is used.
Connect the Q series C24 and external device based on (1) and (2) below.

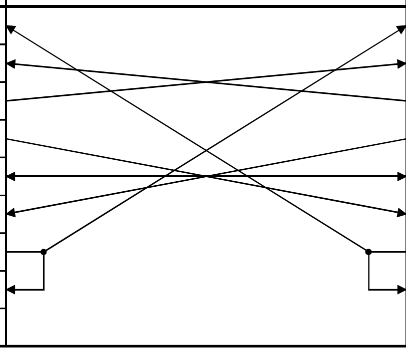
(1) Connect the Q series C24 RS signal to one of the external device half-duplex communications signals (CS, DSR, or CD signal).

(2) Connect the Q series C24 CD signal to one of the external device half-duplex communications signals (RS or DTR signal).

(3) The half-duplex communications described in this section cannot be performed when an RS-232 and RS-422 converter is used.

(Connection example)

Q series C24		Cable connection and signal direction	External device
Signal name	Pin No.		Signal name
CD	1		CD
RD(RXD)	2		RD(RXD)
SD(TXD)	3		SD(TXD)
DTR(ER)	4		DTR(ER)
SG	5		SG
DSR(DR)	6		DSR(DR)
RS(RTS)	7		RS(RTS)
CS(CTS)	8		CS(CTS)
RI(CI)	9		——

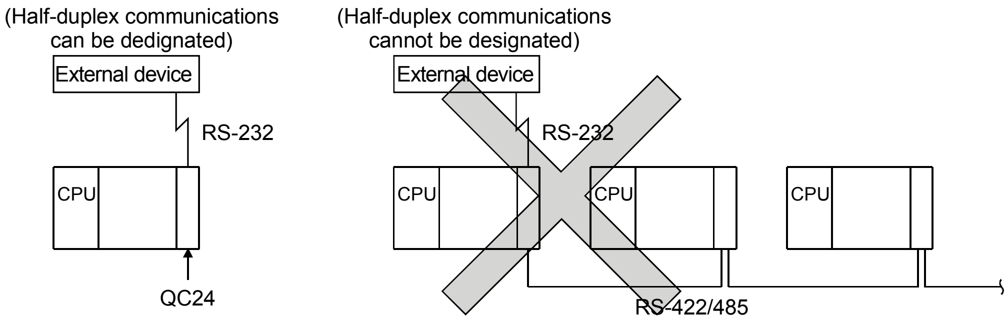


8.5 Half-duplex Communications Precautions

The following describes the precautions to be observed when using half-duplex communications.

(1) Half-duplex communications system configuration and functions

Half-duplex communications is possible only with a system that connects the PLC CPU and external device in a 1: 1 configuration.



(2) Agreement and confirmation between external device and PLC CPU

Agree and confirm the following items between the external device and the PLC CPU.

1) Whether or not half-duplex communications can be performed by Q series C24 RS signal and CD signal.
2) Q series C24 RS signal and CD signal ON/OFF timing.
3) Q series C24 and external device data transmission timing.
4) RS-232 cable connection method.

(3) Transmission control

When the transmission control functions described in Chapter 7 are used, DC code control DC1/DC3 transmission control and DC1/DC3 reception control cannot be used with half-duplex communications. Therefore, do not designate them.

9 CONTENTS AND REGISTRATION OF THE USER FRAMES FOR DATA COMMUNICATION

User frames are used to register some, or all, of the messages exchanged between an external device and the Q series C24 in advance and use them to check the send data or receive data.
The following functions can use Q series C24 user frames to transmit and receive data.
- MC protocol on-demand function. (See Chapter 10)
- Non procedure protocol data transmit and receive functions. (See Chapter 11)

Data can be transmitted and received by registering the corresponding user frames to the Q series C24 in advance to match the data contents that are transmitted and received between the external device and the Q series C24.
This chapter explains the data that can be registered, the data contents that are transmitted and received, and registering to the Q series C24 of user frames that can be used in data communications with the external device.
See Chapters 10 and 11 for a description of how each data communications function uses the user frames.

9.1 User Frame Types and Contents During Communication

This section explains the kinds of user frames handled by the Q series C24 and the data contents that are transmitted and received.
The following two kinds of user frames are available. Either kind can be used.

User frame (Generic term)
- User frame (Frame described in Section 9.1.1)
- Default registration frame (Frame described in Section 9.1.2)

9.1.1 User frames to be registered and used by the user

The following explains the registered data, data contents that are transmitted and received, and how the Q series C24 handles user frames registered the Q series C24 Flash ROM or buffer memory by the user.

(1) General description
User frames registered by the user are frames that contain arbitrary data that matches the specifications of the external device. The data contents are selected by the user.

(2) User frame registering
(a) Up to 231 user frames can be registered, read, and deleted at the Q series C24.
1) Q series C24 Flash ROM
(number that can be registered : Maximum 200, frame No.: $3E8_H$ to $4AF_H$)
2) Q series C24 buffer memory
(number that can be registered : Maximum 31, frame No.: 8001_H to $801F_H$)
(b) Up to 80 bytes (80 en characters) of data can be registered as 1 user frame.

(c) User frames can include data for handling the variable data (sum check code, Q series C24 station No., etc.) shown in (4) as a part of user frames.

(d) User frames can be overwritten to the Q series C24 buffer memory. (The old contents are destroyed.)

(e) The registration destination for the user frame can be divided into the following usage.
- After data communication has started, register the user frames without changes to buffer memory and use. (Frame No: 3E8$_H$ to 4AF$_H$)
- After data communication has started, register the user frames with changes to buffer memory and use. (Frame No: 8001$_H$ to 801F$_H$)

(3) Data that can be registered as user frame

Up to 80 bytes of data can be registered by combining 1 byte of register code 01$_H$ to FE$_H$ data and 2 bytes of register code FF$_H$ + 00$_H$ to FF$_H$ + FF$_H$ data.

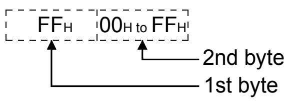
(a) One byte of register code (01$_H$ to FE$_H$) data
This is the register code for transmitting and receiving the register code (01$_H$ to FE$_H$) data.

(b) Two bytes of register code (FF$_H$ + 00$_H$) to (FF$_H$ + FF$_H$) data
This is the register code for transmitting and receiving the variable data (Sum check code, Q series C24 station No., etc.) shown in (4) as part of the user frame.
FF$_H$ is the register code of the first byte for handling variable data.

(4) Variable data

"Variable data" is the generic term for the following data.
These variable data can be handled as part of a user frame.
- Sum check code whose objective is an arbitrary range in the transmit and receive messages.
- Horizontal parity code whose objective is a determined range in the transmit and receive messages.
- Two's complement sum check code whose objective is a determined range in the transmit and receive messages.
- Q series C24 station No.
- One byte data in data transmission (NULL: Code 00$_H$)
  One byte of arbitrary data in data reception. (Used to handle an arbitrary byte of data as part of the user frame during receiving check by the Q series C24.)

(a) Variable data designation method
Variable data is designated by combining write code FF$_H$ and the data codes shown in the table below.
The sum check code, Q series C24 station No., and other variable data can be handled according to FF$_H$ of the first byte and 00$_H$ to FF$_H$ of the second byte.



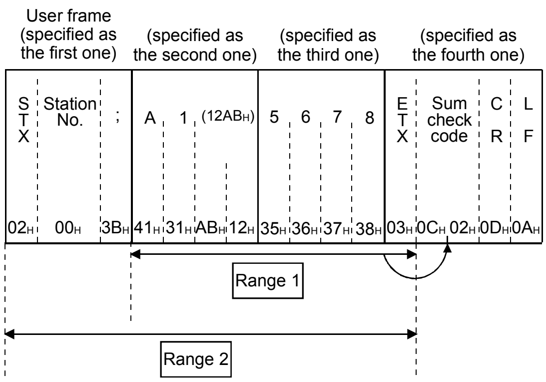
(b) Variable data designation contents, data contents transmitted and received, and handling by the Q series C24
The table below shows the register codes (FF$_H$+00$_H$) to (FF$_H$ + FF$_H$) combinations for handling variable data, the data contents that are transmitted and received, and how the Q series C24 handles the data.
Combinations other than those shown in the table cannot be registered.

Changeable data register code 1st byte	Changeable data register code 2nd byte	Data contents transmitted and received/Q series C24 handling	Calculation range (*3)	Detailed explana-tion
FFH	00H	Transmission: Transmits the data code 00H (NUL) data (1 byte). Reception: Skips the given part (1 byte) of the receive user frame. (Skips the check and performs receive processing.)	—	1)
	01H	Transmits and receives the station No. set in the GX Developer switch setting as 1-byte binary code data (00H to 1FH).		2)
	04H (*1)	Transmits and receives the horizontal parity code in the calculation range using 1 byte of binary code data	Range 1	3)
	05H (*1)	Transmits and receives the horizontal parity code in the calculation range using 2-byte ASCII code data		
	0AH (*1)	Transmits and receives the horizontal parity code in the calculation range using 1 byte of binary code data	Range 2	
	0BH (*1)	Transmits and receives the horizontal parity code in the calculation range using 2-byte ASCII code data		
	11H (*1)	Transmits and receives the two's complement sum check code in the calculation range.	Range 1	4)
	17H (*1)		Range 2	
	EEH	Transmits and receives the sum check code in the calculation range. (*2)	Range 1	5)
	F0H			
	F1H			
	F3H			
	F4H		Range 2	
	F6H			
	F7H			
	F9H			
	FFH	Transmits and receives the register code FFH data (1 byte).	—	

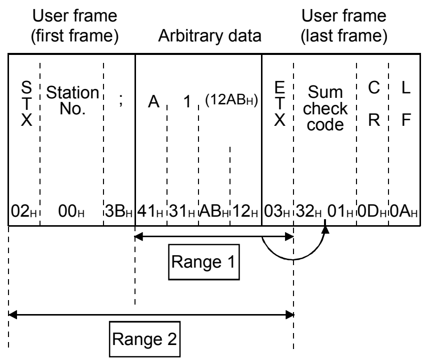
*1 For usage of the register code, there are restrictions on versions of the Q series C24.
Refer to the User's Manual (Basic) Section 2.7 for how to check the version.

*2 During data communication using a user frame that handles the last frame, the contents of the "sum check code" set in the transmission setting using the GX Developer switch setting will be ignored.

*3 Calculation ranges for the register codes



(Calculation range when transmitting data)



(Calculation range when receiving data)

Range 1

When transmitting: Calculation includes everything from the data following the first frame (first one frame only when multiple user frames have been specified) to immediately before the register code. (Except the transparent code designation additional code data shown in Chapter 12)

When receiving: Calculation includes everything from the data following the first frame to immediately before the register code. (Except the transparent code designation additional code data shown in Chapter 12)

Range 2

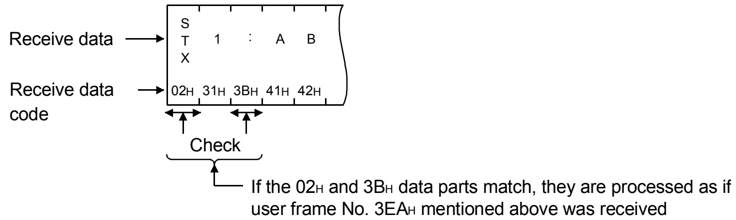
When transmitting and receiving: Calculation includes everything from the head of the message to immediately before the register code. (Except the transparent code designation additional code data shown in Chapter 12)

1) Q series C24 processing corresponding to register codes FF$_H$ and 00$_H$

The following uses an example to describe the processing performed by the Q series C24 when it receives a user frame part corresponding to register codes FF$_H$ and 00$_H$.

Assume that a user frame containing the data codes 02$_H$, FF$_H$, 00$_H$, and 3B$_H$ was set as receive user frame No. 3EA$_H$.

- When the Q series C24 receives the 3 bytes of data "STX, arbitrary data (1 byte), ; ", it processes them as if user frame No. 3EA$_H$ was received.
- The Q series C24 does not check the 2 bytes described above.



2) Transmission/reception data corresponding to register codes FF$_H$ and 01$_H$

The Q series C24 transmits and receives the user frame part corresponding to register codes FF$_H$ and 01$_H$ by representing the station No. set in the GX Developer switch setting as 1-byte binary data. See the first frame part shown in the illustration in item 3 for an example.

3) Transmission/reception data corresponding to register codes FF$_H$ + 04$_H$, FF$_H$ + 05$_H$, FF$_H$ + 0A$_H$, and FF$_H$ + 0B$_H$.

- For FF$_H$ + 04$_H$ and FF$_H$ + 0A$_H$

  The horizontal parity code that calculates the range for the transmission/reception data (message) is expressed as 1 byte of binary data and then transmitted and received.

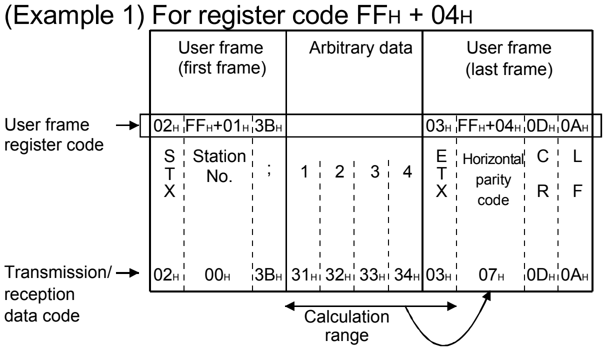
  The difference between FF$_H$ + 04$_H$ and FF$_H$ + 0A$_H$ is the difference in the calculation range.

- For FF$_H$ + 05$_H$ and FF$_H$ + 0B$_H$

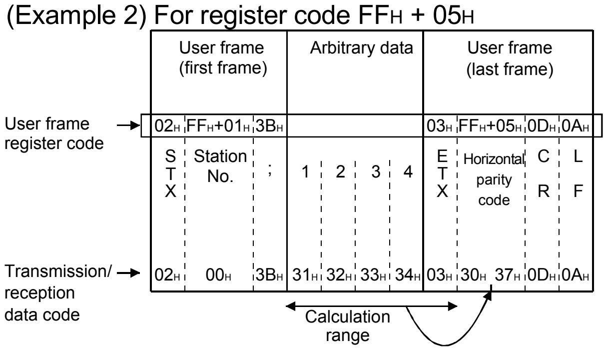
  The horizontal parity code that calculates the range for the transmission/reception data (message) is expressed as 2-byte ASCII code data and then transmitted and received from the upper digit. The difference between FF$_H$ + 05$_H$ and FF$_H$ + 0B$_H$ is the difference in the calculation range.

Examples of the transmission and reception data arrangement of the horizontal parity codes are shown below. (One first frame and one last frame each)

(Example 1) For register code FF$_H$ + 04$_H$



(Example 2) For register code FF$_H$ + 05$_H$

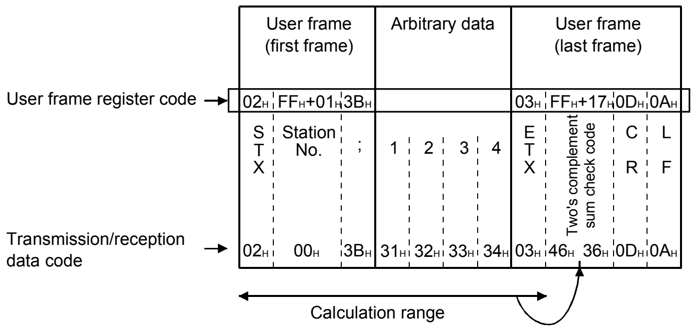


- How to calculate the horizontal parity code
  This is a numeric value obtained by calculating the XOR for the subject data and then converting it to ASCII code. (In the case of the example)

```
 "1" (31H)  0011 0001
                 XOR
 "2" (32H)  0011 0010 = 0000 0011
                            XOR
 "3" (33H)             0011 0011 = 0011 0000
                                        XOR
 "4" (34H)                         0011 0100 = 0000 0100
                                                    XOR
"ETX" (03H)                                    0000 0011 = 0000 0111
                                                            ↓    ↓
                                                ASCII code "0"  "7"
                                                          (30H) (37H)
```

4) Transmission/reception data corresponding to register codes FFH+11H and FFH+17H
   The two's complement sum check code that calculates the subject range for transmission/reception data (message) is expressed as two-character data in ASCII code, then transmitted and received from the upper digit.
   The difference between (FFH+11H) and (FFH+17H) is the difference between the calculation ranges.
   An example of the contents (arrangement) of the transmission and reception of the two's complement sum check code is shown below.

   (Example) Arrangement of data transmitted and received with the register code FFH+17H (one first frame and one last frame)



- How to calculate the two's complement sum check code
  The lower 1 byte of the value obtained by adding the subject data as binary data is converted to a two's complement, then converted to a hexadecimal ASCII code.
  (In the case of the example)

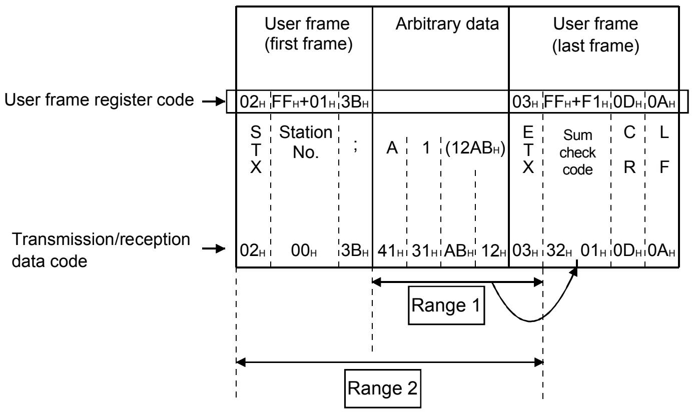
```
02H+00H+3BH+31H+32H+33H+34H+03H=10AH ----- Data in the subject rangeare added
                                           as binary data (hexadecimal)
              ↓
           00001010                  ----- The lower 1 byte of the above numeric value
              ↓                            is expressed as a binary number
           11110110                  ----- Reversed, then converted to a two's complement
              ↓
             F6H                     ----- Converted to a hexadecimal ASCII code
              ↓
           "F"   "6"
          (46H) (36H)
```

5) Transmission/reception data corresponding to register codes FFH+EEH to FFH+F9H
The sum check code that calculates the subject range for transmission/reception data (message) is expressed as the binary code/ ASCII code data shown below, then transmitted and received.

Register code	Data contents transmitted and received
FFH + EEH or FFH + F4H	The lower 2 bytes of the calculated sum check code are transmitted and received as 2-byte binary code data.
FFH + F0H or FFH + F6H	The lower byte of the calculated sum check code is transmitted and received as 1-byte binary code data.
FFH + F1H or FFH + F7H	The lower byte of the calculated sum check code is converted to 2-digit ASCII code, then transmitted and received.
FFH + F3H or FFH + F9H	The lower 4 bits of the calculated sum check code is converted to 1-digit ASCII code, then transmitted and received.

An example of the contents (arrangement) of the transmission and reception of the sum check code is given below.

(Example) Arrangement of data transmitted and received (one first frame and one last frame)



- How to calculate the sum check code and data contents transmitted and received
  This is a numeric value obtained by adding data in the above range as binary data.

  (In the case of the example $\boxed{\text{Range 1}}$) (H) (L)

  41H+ 31H + ABH + 12H + 03H = 0132H

Register code	Data contents transmitted and received (arrangement)
FFH + EEH	01H and 32H are transmitted and received, beginning from 32H.
FFH + F0H	32H is transmitted and received.
FFH + F1H	"3" and "2" are transmitted and received, beginning from "3."
FFH + F3H	"2" is transmitted and received.

(In the case of the example $\boxed{\text{Range 2}}$) (H) (L)

02H + 00H + 3BH + 41H + 31H + ABH + 12H + 03H = 016FH

Register code	Data contents transmitted and received (arrangement)
FFH, F4H	01H and 6FH are transmitted and received, beginning from 6FH.
FFH, F6H	6FH is transmitted and received.
FFH, F7H	"6" and "F" are transmitted and received, beginning from "6."
FFH, F9H	"F" is transmitted and received.

9.1.2 Default registration frame (read only)

This frame is registered to the Q series C24 in advance and can be used in the same way as the other user frames.

(1) Overview

The default registration frame is registered in the OS ROM of the Q series C24.
The following table lists one-byte data (codes: 01H to FEH) to a maximum of five-byte data, which is registered in the frames and can be used for read-only (frame numbers: 1H to 3E7H). Each of these frames is treated as an user frame.

(2) Default registration frame write data and data contents that are transmitted and received

The following shows the codes of the register data and the data contents that are transmitted and received.

Default registration frame No. (Hexadecimal (decimal))	Register data code (1st byte to nth byte)	Register byte count	Frame byte count	Data contents that are transmitted and received data contents
1H(1)	01H	1	1	(Data codes shown at the left)
2H(2)	02H			STX
to	to			to
FEH(254)	FEH			(Data codes shown at the left)
FFH(255)	—		—	(For variable data designation)
100H(256)	00H	1	1	NUL
101H(257)	FFH	1		(Data codes shown at the left)
102H(258)	0DH, 0AH	2	2	CR, LF
103H(259)	10H, 02H			DLE, STX
104H(260)	10H, 03H			DLE, ETX
105H(261)	00H, FEH	2	2	(Data codes shown at the left)
106H(262)	00H, 00H, FEH	3	3	(Data codes shown at the left)
107H(263)	03H, FFH, F1H	3	2	ETX, sum check code ＊1
108H(264)	03H, FFH, F1H, 0DH, 0AH	5	4	ETX, sum check code, CR, LF ＊1
109H(265)	(None)	—	—	—
to				
10DH(269)				
10EH(270)	FFH, EEH	2	1	Sum check code ＊1
to	to			
11FH(287)	FFH, FFH			
120H(288)	(None)	—	—	—
to				
3E7H(999)				

＊1 The combination of FFH, ☐H in the register code is used to handle variable data (sum check code, Q series C24 station No., etc.) as part of the user frame.
The data contents that are transmitted and received and the byte count depend on the code combined with register code FFH.
See Section 9.1.1 (4) for the register code combinations that can be handled as variable data and the data contents that are transmitted and received.

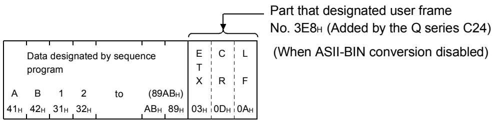
9.2 Transmission/Reception Processing Using User Frame Register Data

The following explains how the Q series C24 transmits and receives using user frame register data.
The Q series C24 checks the transmission/reception of following data, using registered data.

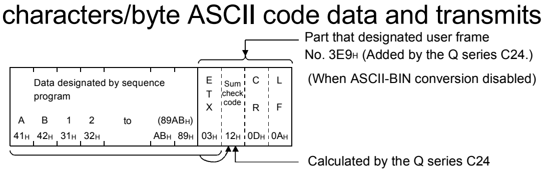
(1) Transmission

(a) If user frame transmission is designated, the user frame is converted, or not converted, from ASCII to BIN data and transmitted, depending on the data communications protocol, ASCII-BIN conversion designation, and user frame No. designation, based on the following data as the send data of the given part.

1) Register code 01_H to FE_H 1-byte data register part
Q series C24 transmission is based on the register code (01_H to FE_H) data.
(Example) Register the data codes 03_H, $0D_H$, and $0A_H$ as user frame No. $3E8_H$
When user frame No. $3E8_H$ is designated during data transmission, if ASCII-BIN conversion is disabled, the Q series C24 transmits the data codes 03_H, $0D_H$, $0A_H$ (ETX, CR, LF) as the send data of the given user frame part.
If ASCII-BIN conversion is enabled, the Q series C24 converts each of the data above to 2-character ASCII code data and transmits.

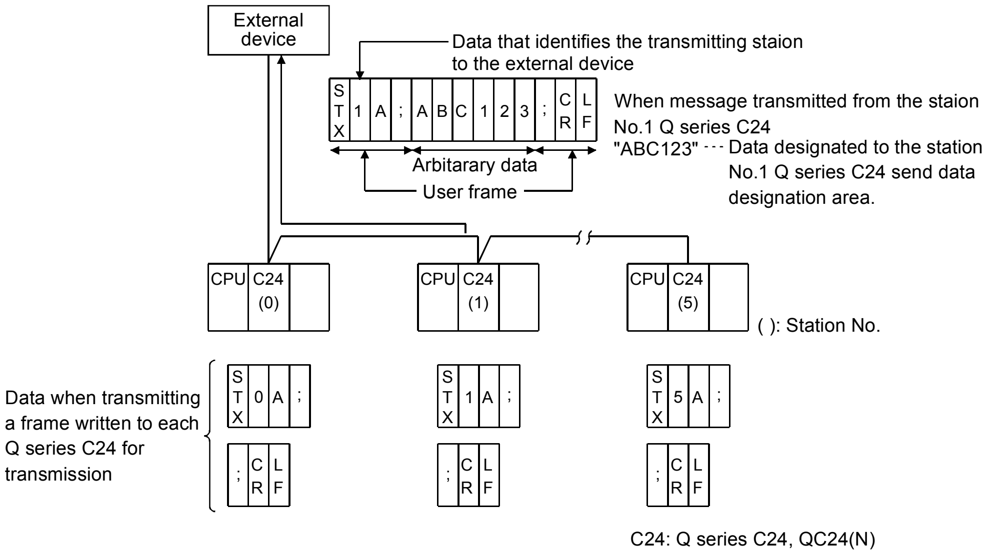


2) Register data codes FF_H+00_H to FF_H 2-byte data register part
The Q series C24 transmission is based on the variable data corresponding to the combination of the register codes FF_H and 00_H to FF_H.
For example, if sum check code is registered, the Q series C24 will calculate and transmit the sum check code.
If the Q series C24 station No. is registered, the station No. set in the Q series C24 is transmitted.
(Example) Register the data codes 03_H, FF_H, $F0_H$, $0D_H$, $0A_H$ as user frame No. $3E9_H$
When user frame No. $3E9_H$ is designated during data transmission, the Q series C24 calculates the sum check code as the send data of the given user registration frame part. If ASCII-BIN conversion is disabled, the Q series C24 transmits the calculated sum check code as the send data of that user frame part.
If ASCII-BIN conversion is enabled, the Q series C24 converts the calculated sum check code to 2 characters/byte ASCII code data and transmits.



REMARK

With a multidrop link, the user frame includes data that identifies which station transmitted the message to the external device to facilitate generation of arbitrary send data.

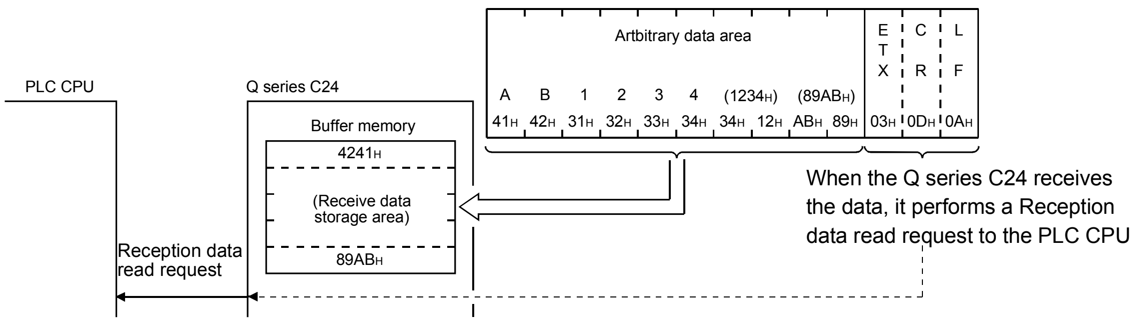


(2) Reception

(a) When setting for reception by user frame is performed, and the first frame is set, the Q series C24 receives the message when it receives data with the same contents as the designated first frame.
If the last frame is set, when the Q series C24 receives data with the same contents as the designated last frame, it sends a reception data read request to the PLC CPU.

(b) The following describes the Q series C24 receive processing using register data.

1) Register data code 01H to FEH 1-byte data register part
The Q series C24 receives and checks if the received data is data of the same code (01H to FEH) as the registered code.
(Example) Register the data codes 03H, 0DH, 0AH as user frame No. 3E8H
When user frame No. 3E8H is set as data receive, the Q series C24 receives and checks data codes 03H, 0DH, 0AH (ETX, CR, LF) as the receive data of that user frame part.

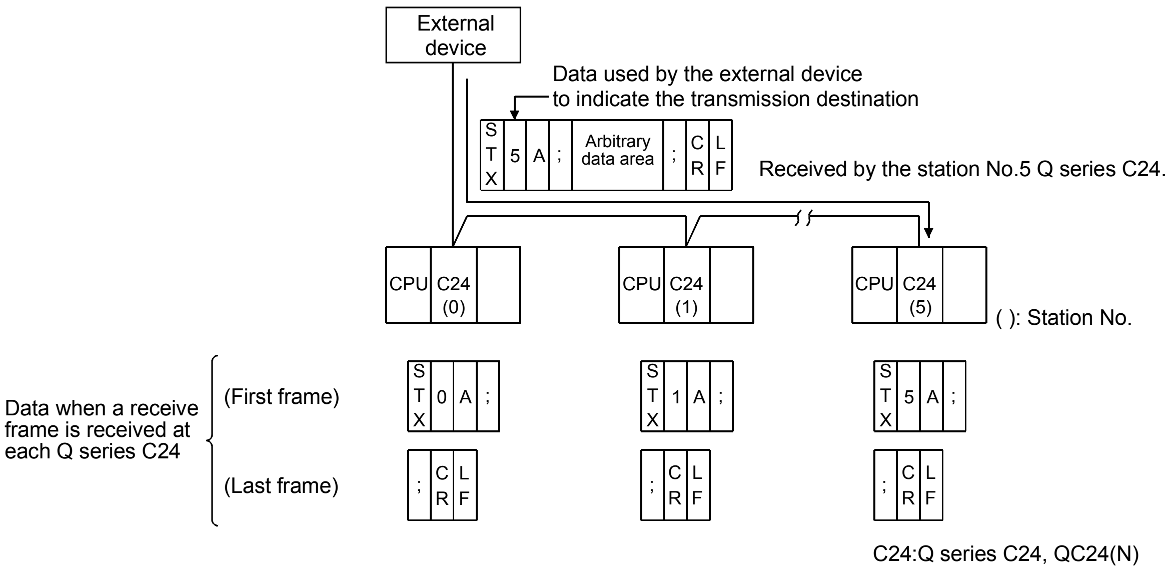


2) Register data code FF_H + 00_H to FF_H 2-byte data register part
The Q series C24 receives and checks if the received data is variable data corresponding to the combination of the register codes FF_H and 00_H to FF_H.
For example, if a sum check code is registered, the Q series C24 calculates the sum check code from the receive data and checks if it is the same as the received sum check code. If the two codes are not the same, the Q series C24 performs error processing.
If the Q series C24 station No. is registered, the Q series C24 checks if the received station No. is the same as the station No. set in the Q series C24. If the station Nos. are not the same, the Q series C24 processes the data as if normal data was received instead of an user frame.
(Example) Register the data codes 03_H, FF_H, $F0_H$, $0D_H$, $0A_H$ as user frame No. $3E9_H$
When user frame No. $3E9_H$ is set as a data receive frame, the Q series C24 calculates, receives, and checks the sum check code as the receive data of that user frame part.

(c) The Q series C24 removes the user frame data from the received message. (The PLC CPU cannot read this data.)

REMARK

With a multidrop link, if the receive user frame inherent to each Q series C24 is connected to the link in advance, the Q series C24 of a given station will store only the arbitrary data area of the message transmitted by the external device to the receive data storage area.



9.3 Precautions when Registering, Reading, Deleting and Using User Frames

The following shows the precautions which should be observed when registering user frames and using registered user frames to transmit data to and receive data correctly from the external device.

(1) Precautions when registering, reading or deleting user frames

(a) User frames can be registered using one of the following methods. However, an user frame to be registered to the flash ROM could be registered by the utility package (GX Configurator-SC) dedicated to the Q series C24 as much as possible.
   1) Registering via the utility package (GX Configurator-SC) for the Q series C24.
   2) Registering with the dedicated instruction "PUTE" from the PLC CPU.
   3) Registering from an external device with command "1610" through communication using the MC protocol.

(b) The following settings are required when registering or deleting user frames.
   1) Switch setting via GX Developer
      Set the setting modification to Enable in the transmission setting.
   2) Setting via GX Configurator-SC
      Set the flash ROM write allow/prohibit setting to Allow on the monitor/test screen.
      * To set from the PLC CPU, write "1" in the following buffer memory at the startup of the Q series C24 (when the ready signal rises).
      Flash ROM write allow/prohibit designation area (address: 2000H)

(c) To register, read or delete user frames from the PLC CPU, perform the operation while there is no data communication in progress with the external device.

(d) An user frame having only a sum check code as changeable data cannot be registered. To register a sum check code, add arbitrary data.

(e) Register a receive user frame in the Q series C24 flash ROM.

(f) The changeable data (05H to F9H) can be specified at only one place in the last frame.

(2) Precautions when using user frames

(a) To send/receive data using the user frames, it is necessary to set the user frame number to be used in the buffer memory prior to data transmission/reception (receive user frames must be set at the startup of the Q series C24).
The user frame number to be used can be set from the PLC CPU. However, please try to register frames using the utility package (GX Configurator-SC) of the Q series C24.

(b) Set the receive user frame number by the PLC CPU to show the procedure to receive data.
Receive user frame data by performing the following operations sequentially. (chapter 11 explains steps 2) and 3).)

1) If an user frame used in data reception was registered from PLC CPU, restart PLC CPU.
2) When starting the Q series C24, set the receive user frame No. to the buffer memory and write [1] to buffer memory user frame use enable/disable designation area (addresses: AD_H/$14D_H$).
3) After the value of the buffer memory user frame use enable/disable designation area changes to [2], start receiving data.
4) Check if the data from the external device was received normally.

(c) If the Q series C24 receives additional code data while receiving data with the non procedure protocol, it does not assume that the last byte of data is the following control data.
- Data received as user frame first frame, last frame (See Sections 9.1 and 9.2.)
- Receive complete code data

Therefore, do not set a user frame containing data receive additional code data as a non procedure protocol receive user frame.

(d) The arbitrary data area of a message received from an external device cannot include data with the same contents (same code) as the last frame.
(Example)

User frame (first frame)	Arbitrary dat area	User frame (last frame)

(e) In the following cases, set the data bit length of the transmission specification to 8 bits.
(It is set in the "transmission setting" of switch setting by GX Developer on the Q series C24 side.)

1) When transmitting and receiving the sum check code of the variable data as binary data
(Write code: FF_H, EE_H/FF_H, $F0_H$/FF_H, $F4_H$/FF_H, $F6_H$)
2) When transmitting and receiving a user frame containing data codes 80_H to FF_H

9.4 Register/Read/Delete User Frames

The following explains registering, reading, and deleting user frames in the Q series C24 flash ROM or buffer memory.

POINT

When registering, reading and deleting the user frames in the flash ROM, try to register them using the utility package (GX Configurator-SC) of the Q series C24.
Registering, reading and deleting operations from GX Configurator-SC are explained in Section 8.4.1 of the User's Manual (Basic).
This section explains how to register, read, or delete user frames from the PLC CPU.

(1) Type of user frames

Type		User frame No.	Registration destination	Remarks
Data communication function	Default registration frames	1$_H$ to 3E7$_H$ (1 to 999)	ROM for the Q series C24 OS	Read enabled
	User frame	3E8$_H$ to 4AF$_H$ (＊2) (100 to 1199) (＊3)	Q series C24 flash ROM	Register/read/delete enabled
		8001$_H$ to 801F$_H$ (-32767 to -32737) (＊1)	Q series C24 buffer memory (Addresses: 1B00$_H$ to 1FF6$_H$)	
User frame for the PLC CPU monitoring function		B001$_H$ to B00A$_H$, B061$_H$, B080$_H$ to B082$_H$	ROM for the Q series C24 OS	Register/read/delete disabled

＊1 Data contained in user frames used for registering and reading is arranged in the same way as data in user frames used for registering in or reading to the flash ROM. Use the arrangement described in this section as a reference, and register and read user frames.
User frames can also be registered in the buffer memory, but the user frame for the fixed format section should be registered in the flash ROM whenever possible.

＊2 A user frame cannot be overwritten for registration. To reregister a user frame having the same number, first delete the current user frame and then reregister.

＊3 Check the registration status of the user frame number from GX Configurator-SC.

(2) Devices that can register/read/delete user frames

Type	User frame No.	Device that can register/read/delete								
		PLC CPU			External device			GX Configurator-SC		
		Register	Read	Delete	Register	Read	Delete	Register	Read	Delete
Default registration frame	1$_H$ to 3E7$_H$	×			×	○	×	×		
User frame	3E8$_H$ to 4AF$_H$	○			○			○		
	8001$_H$ to 801F$_H$	○ (FROM/TO)						×		
User frame for PLC CPU monitoring function	B001 to B00A$_H$, B061$_H$, B080$_H$ to B082$_H$	×								

POINT

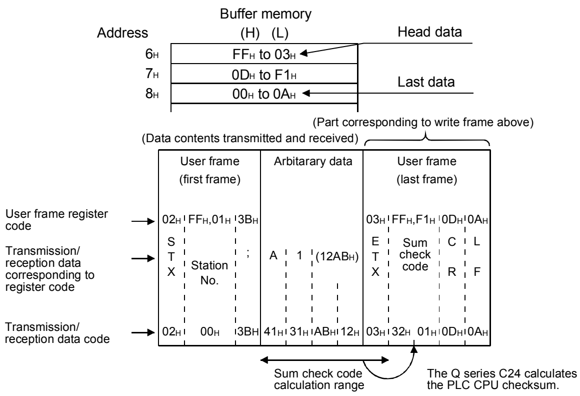
Conduct registering, reading, and deletion of the user frame from the sequence program when data communication is not being conducted with external device.

(3) Buffer memory to use

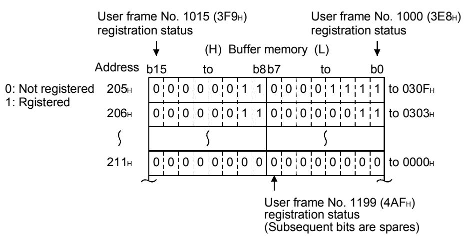
Address (Hexadecimal (decimal))	Name		Stored value	Processing		
				Register	Read	Delete
2_H (2)	Flash ROM access	Register/read/delete direction	0: No request 1: Register request 2: Read request 3: Delete request	○	○	○
3_H (3)		Frame No. direction	0: No frame No. 1000 to 1199 ($3E8_H$ to $4AF_H$) : Register/read/delete frame No.			
4_H (4)		Register /read/delete result storage	0: Normal completion One or higher: Abnormal completion (error code)			
5_H (5)		Write data byte count designation (See 1).)	0: Delete 1 to 80 (1_H to $C8_H$) : Register data byte count	○	○	×
6_H (6) to $2D_H$ (45)		User frame (See 2).)	Data code of frame to be registered/ deleted			
204_H (516)		Number of registered user frame storage	0: Not registered to Flash ROM 1 to 200 (1_H to $C8_H$) : Number registered to Flash ROM	△	△	△
205_H (517) to $21D_H$ (541)		User frame registration status storage (See 3).) (For registration No. check)	0: Given range not registered One or higher : Registration status			
$21E_H$ (542)	Number of registered default registration frames storage (OS ROM)		n: Registration count (See Section 9.1.2.)			
$1B00_H$ (6912)	Registration No. 8001_H	Register data byte count designation	(Register data byte count designation. See 1).) 1 to 80 (1_H to $C8_H$) : Register data byte count (User frame storage. See 2).) Register frame data code ✻ Register area for 31 frames	○	△	×
$1B01_H$ (6913) to $1B28_H$ (6952)		User frame storage ✻40 words				
$1B29_H$ (6953)	Registration No. 8002_H	Register data byte count designation				
$1B2A_H$ (6954) to $1B51_H$ (6993)		User frame storage ✻40 words				
$1B52_H$ (6994) to $1FCD_H$ (8141)	to					
$1FCE_H$ (8142)	Registration No. $80F1_H$	Register data byte count designation				
$1FCF_H$ (8143) to $1FF6_H$ (8182)		User frame storage ✻40 words				

Read/write from PLC CPU
○ : Always performed
△ : Performed as required
× : Unnecessary

1) Registration data byte count designation area (Addresses: 5H, 1B00H, 1B29H,..., 1FCEH)
   - Indicates the total number of bytes of register data of the user frame to be registered/read.
   - Flash ROM access
     During the register operation, the user registers the total number of bytes of register data.
     During the read operation, the total number of bytes of registered data is stored.
   - Buffer memory access
     During the register operation, the user registers the total number of bytes of register data.
2) User frame storage area
   (Addresses: 6H to 2DH, 1B01H to 1B28H, 1B2AH to 1B51H,...1FCFH to 1FF6H)
   - During the register operation, the user sequentially stores the register data of the user frame to be registered in (L) (H) order, beginning from the head area of the given area range.
   - During the read operation, the register data of the registered user frame is stored with the same contents as when registering.
     (Example) Contents stored to user frame storage area when a user frame to transmit and receive ETX, sum check code, CR, and LF (register codes: 03H, FFH, F1H, 0DH, 0AH) is registered to the Flash ROM.

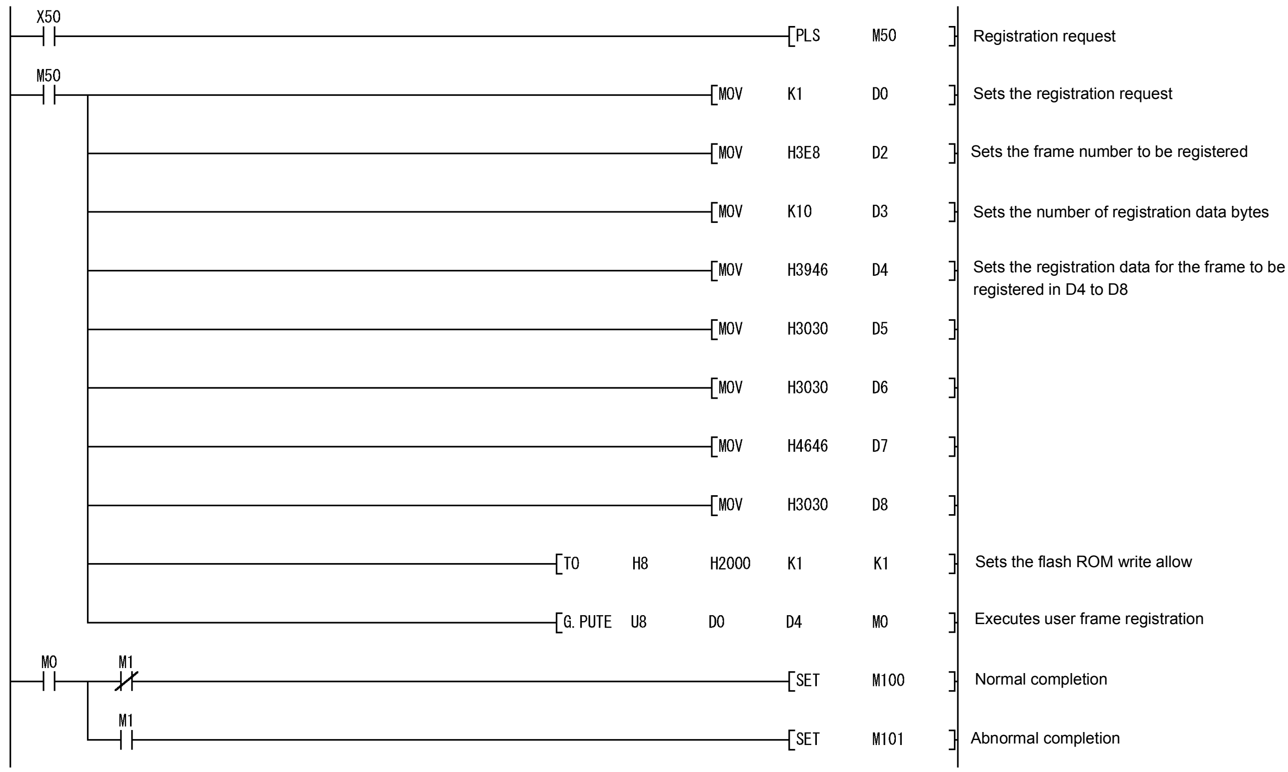


3) User frame registration status storage area (Addresses: 205H to 21DH)
   - The registration status of user frames to the Flash ROM is stored as the values shown below.
   - The contents of each area that indicates the registration status are shown below. The contents of the area are indicated in one user frame No./1 bit form.
     (Example)



9.4.1 Registering user frames

The following shows an example of a sequence program when registering user frames in the Q series C24 flash ROM.
For details on the PUTE instruction, see Section 17.7.
(When the Q series C24 I/O signals are X/Y80 to X/Y9F)

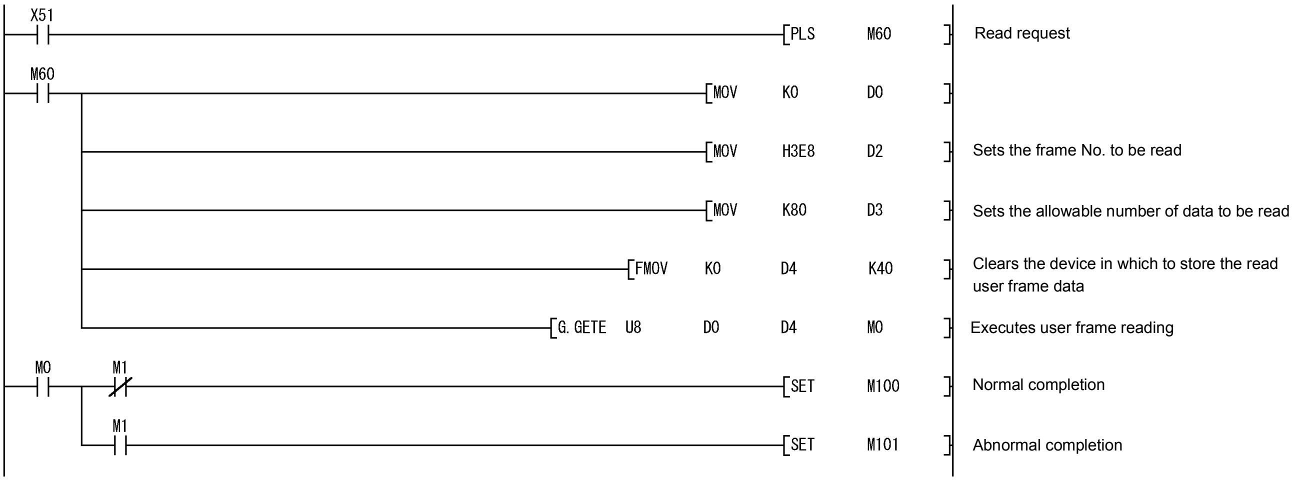


POINT

(1) When registering a user frame in the flash ROM, to designate an user frame number that has already been registered, delete the previously registered number and then reregister.
(2) The user should manage the number of total bytes for registered data.
(3) To check unregistered user frames, read the buffer memory (addresses: 205_H to $21D_H$) indicated in Section 9.4 (3).
(4) The SPBUSY instruction can be used to read the communication status by the dedicated instruction.

9.4.2 Reading user frames

The following shows an example of a sequence program when reading user frames registered in the Q series C24 flash ROM.
For details on the GETE instruction, see Section 17.5.
(When the Q series C24 I/O signals are X/Y80 to X/Y9F)

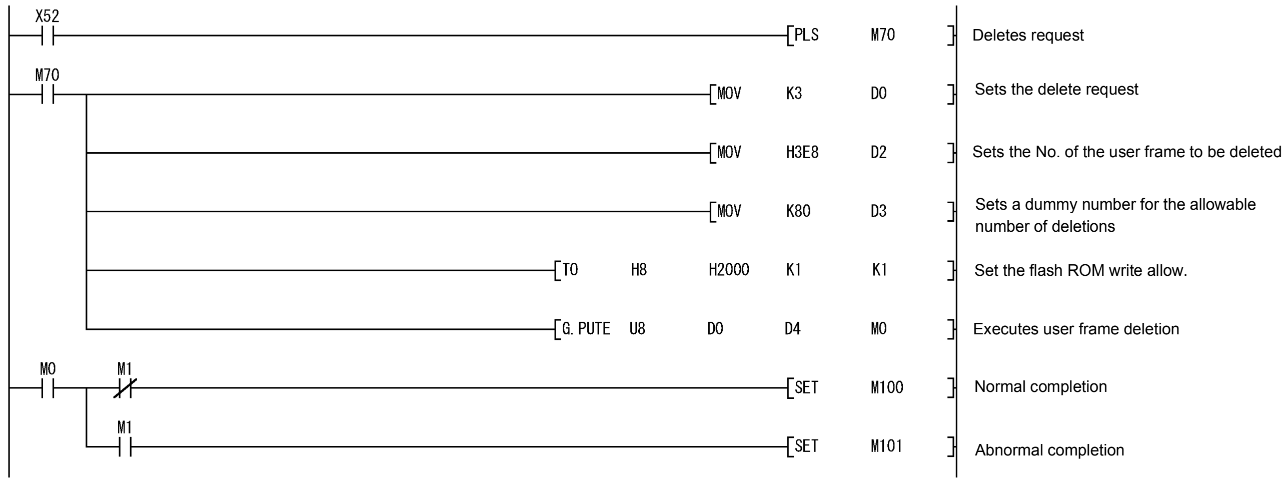


POINT

(1) When an unregistered user frame number is designated, the operation will complete abnormally.
(2) When the total bytes of data registered in the frame to be read is unknown, read 40 words (80 bytes) by the dedicated instruction.
(3) The SPBUSY instruction can be used to read the communication status by the dedicated instruction.

9.4.3 Deleting user frames

The following shows an example of a sequence program when deleting user frames registered in the Q series C24 flash ROM.
For details on the PUTE instruction, see Section 17.7.
(When the Q series C24 I/O signals are X/Y80 to X/Y9F)



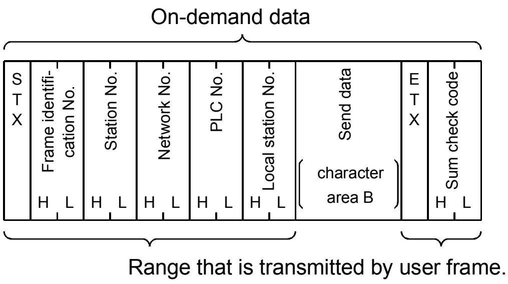
POINT
(1) When an unregistered user frame number is designated, the operation will complete abnormally. (2) The SPBUSY instruction can be used to read the communication status by the dedicated instruction.

10 ON-DEMAND DATA COMMUNICATIONS USING USER FRAMES

During communications between external device and PLC CPU using an MC protocol, on-demand data can be transmitted from the PLC CPU to the external device by on-demand function using user frames.
This chapter describes the transmission of designated send data by the PLC CPU using a message format other than the message formats (A compatible 1C frame formats 1 to 4, QnA compatible 4C frame format 5) described in Section 3.11.2.

10.1 User Frame Data Communications Function

The user frame data communications transmits and receives the message first and last parts in the format selected by the user during data communications between PLC CPU and external device via the Q series C24.
By using the function described in this chapter, on-demand data listed as shown below can be transmitted from the Q series C24 to an external device.
(Transmitting in QnA compatible 3C frame format 1)



Lists other than the "send data" part of the message format described in Section 3.11.2 are selected by the user as shown at the left. The "send data" part is the same as the list given in Section 3.11.2.

＊1 User frame data communications can be carried out by registering (registered by the data code) the message format to be transmitted by the external device and the message format to be received by the external device according to the specifications of the external device to the Q series C24 as user frames.
For the illustration above, the Q series C24 transmits the on-demand data as described below.

- User frame sum check code
  Calculates the sum check code according to the contents registered in advance by the user and transmits the result as ASCII code or binary code data.
- Other than user frame sum check code
  Transmits data of the code registered in advance by the user. (No conversion)
- Send data (character area B)
  This is the data that the sequence program requested for a transmission with on-demand instruction.
  The same contents and list as when transmitted without using a user frame described in Section 3.11.3 of Reference Manual by communication protocol by GX Developer switch setting and word/byte designation.

10.2 User Frame Types and Registration

Data communications using user frames can be performed by registering the user frames to the Q series C24 from an external device and the PLC CPU.
Chapter 9 explains the types of user frames and the data that can be used.
To register a user frame from the PLC CPU, see Chapter 9.
To register a user frame from an external device, first see Chapter 9 and check the precautions, etc., then register the user frame using the function described in Section 3.9 of Reference Manual.

10.3 User Frame On-Demand Data Transmission and Buffer Memory Used

This section describes user frame on-demand data transmission processing and the on-demand data list by user frame setting to Q series C24 buffer memory.

(1) Transmission of on-demand data using user frames

The following describes the transmission of on-demand data using user frame.

1) PLC CPU processing
   - Before issuing a transmission request to the Q series C24, set the No. of the user frame registered in the Q series C24 to the buffer memory shown below.
   - Except for the above, the PLC CPU execution procedure and control procedure are the same as when transmitting on-demand data without user frames described in Section 3.11 of Reference Manual.
2) External device processing
   - When the external device receives the user frame transmitted by the Q series C24 as the first frame, receive it as on-demand data.

(2) Buffer memory used and on-demand data list

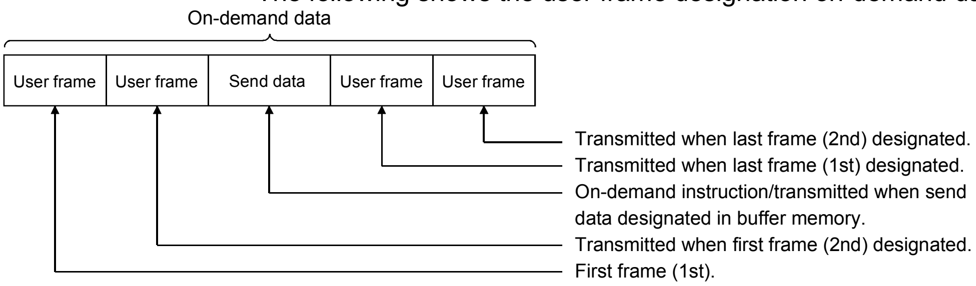
1) Buffer memory used
   During on-demand data transmission by user frame, the user frame to be transmitted is designated by the buffer memories shown below.

Address		Name			Description
CH1	CH2				
$A9_H$(169)	149_H(329)	On-demand user frame designation	First frame No. designation	(1st)	Designates the No. of the user frame that is transmitted as the first frame. 0_H : Do not transmit Others : Transmit (＊1) ＊ Other than 0 is always designated for the 1st frame. When designating the 1st frame, the 2nd frame can also be designated.
AA_H(170)	$14A_H$(330)			(2nd)	
AB_H(171)	$14B_H$(331)		Last frame No. designation	(1st)	Designates the No. of the user frame to be transmitted as the last frame. 0_H : Do not transmit Others : Transmit (＊1) ＊ When designating the 1st frame, the 2nd frame can also be designated.
AC_H(172)	$14C_H$(332)			(2nd)	

＊1 Designates the registration No. (shown below) of the user frame to be transmitted from among the user frames registered in the Q series C24.
1_H to $3E7_H$ (1 to 999) : Default registration frame
$3E8_H$ to $4AF_H$ (1000 to 1199) : User frame (registered in flash ROM)
8001_H to $801F_H$ (-32767 to -32737) : User frame (registered in buffer memory)

2) On-demand data list

The following shows the user frame designation on-demand data list.



POINT

(1) Only the on-demand data list combinations shown below can be used.

○ : Designation data

Combination \ Data name	First frame (1st)	First frame (2nd)	Send data	Last frame (1st)	Last frame (2nd)
1)	○	○	○	○	○
2)	○	○	○	○	
3)	○	○	○		
4)	○	○			
5)	○		○	○	○
6)	○		○	○	
7)	○		○		
8)	○				

(2) The send data for on-demand data transmission by user frame is outlined below.
(See Chapter 9 for a detailed description of user frame.)

Contents of send data		ASCII mode	Binary mode
User frame First frame (1st) Last frame (Last frame)	Codes registered from 00_H to FE_H	Transmit the data of the code registered in the Q series C24. (No conversion)	
	Combination of codes registered in FF_H and 00_H to FF_H	Transmit the data according to the user-designated contents, code, and byte count.	
User frame First frame (2nd) Last frame (Other than last frame)	Codes registered from 00_H to FE_H	Converts the data code registered in the Q series C24 to ASCII data and transmits.	Transmits data code registered in the Q series C24. For 10_H data, transmits 10_H + 10_H.
	Combination of codes registered in FF_H and 00_H to FF_H	Converts data of the contents, code, and byte count designated by the user to ASCII data and transmits.	Transmits the data of the contents, code, and byte count designated by the user. For 10_H data, transmits 10_H + 10_H.
Send data (See Section 3.11.3 of Reference Manual for details.)	—	Converts the designated send data to ASCII data and transmits.	Transmits the designated data unchanged. (No conversion) For 10_H data, transmits 10_H + 10_H.

10.4 On-Demand Function Control Procedure During User Frame Use

The following uses examples to explain the control procedure when using the on-demand function to frame to transmit on-demand data to an external device by user frame.

10.4.1 Data communication using the ASCII code

The following shows the control procedure when performing switch settings via GX Developer and registration via GX Configurator-SC.

(1) Switch settings via GX Developer

1) Set the "Communication protocol setting" to any one of the "MC protocol (formats 1 to 4) ".
2) Set the "Station number" to "0".

(2) Registration via GX Configurator-SC

Register as follows when transmitting a user frame, user selected transmission data (＊1) or a combination of user frames.

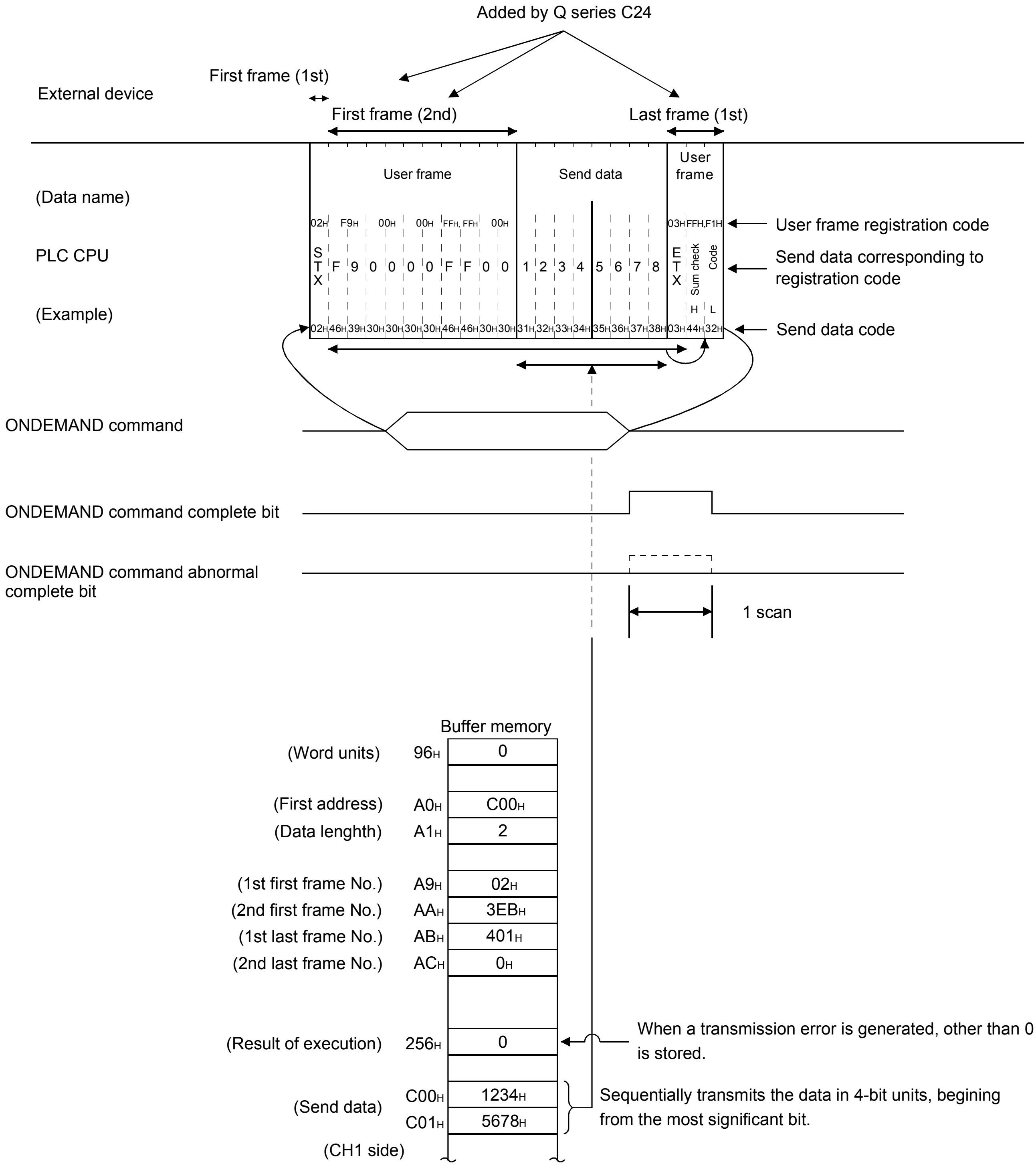
1) "User frame registration" screen

User frame No.	User frame (Registration code)	Contents of user frame registration
02_H (　2)	02_H	STX to host station No. data code matched to QnA compatible 3C frame format 1
$3EB_H$(1003)	$F9_H$, 00_H, 00_H, FF_H, FF_H, 00_H	
401_H(1025)	03_H, FF_H, $F1_H$	QnA compatible 3C frame format 1 corresponding ETX, sum check code data code

2) "Transmission control and others system setting" screen, "MC protocol system setting" screen
   - Set the "Word/byte units designation" to word units.
   - Set the "On-demand user frame designation" items to the following:
     First frame No. 1st: 02_H
     First frame No. 2nd: $3EB_H$
     Last frame No. 1st: 401_H
     Last frame No. 2nd: 0_H (No specification)

＊1 Use the ONDEMAND instruction to designate the transmission data to two words (1234_H, 5678_H).

[Control procedure]



10.4.2 Data communications using the binary code

The following shows the control procedure when performing switch settings via GX Developer and registration via GX Configurator-SC.

(1) Switch settings via GX Developer
1) Set the "Communication protocol setting" to "MC protocol (format 5)."
2) Set the "Station number" to "0."

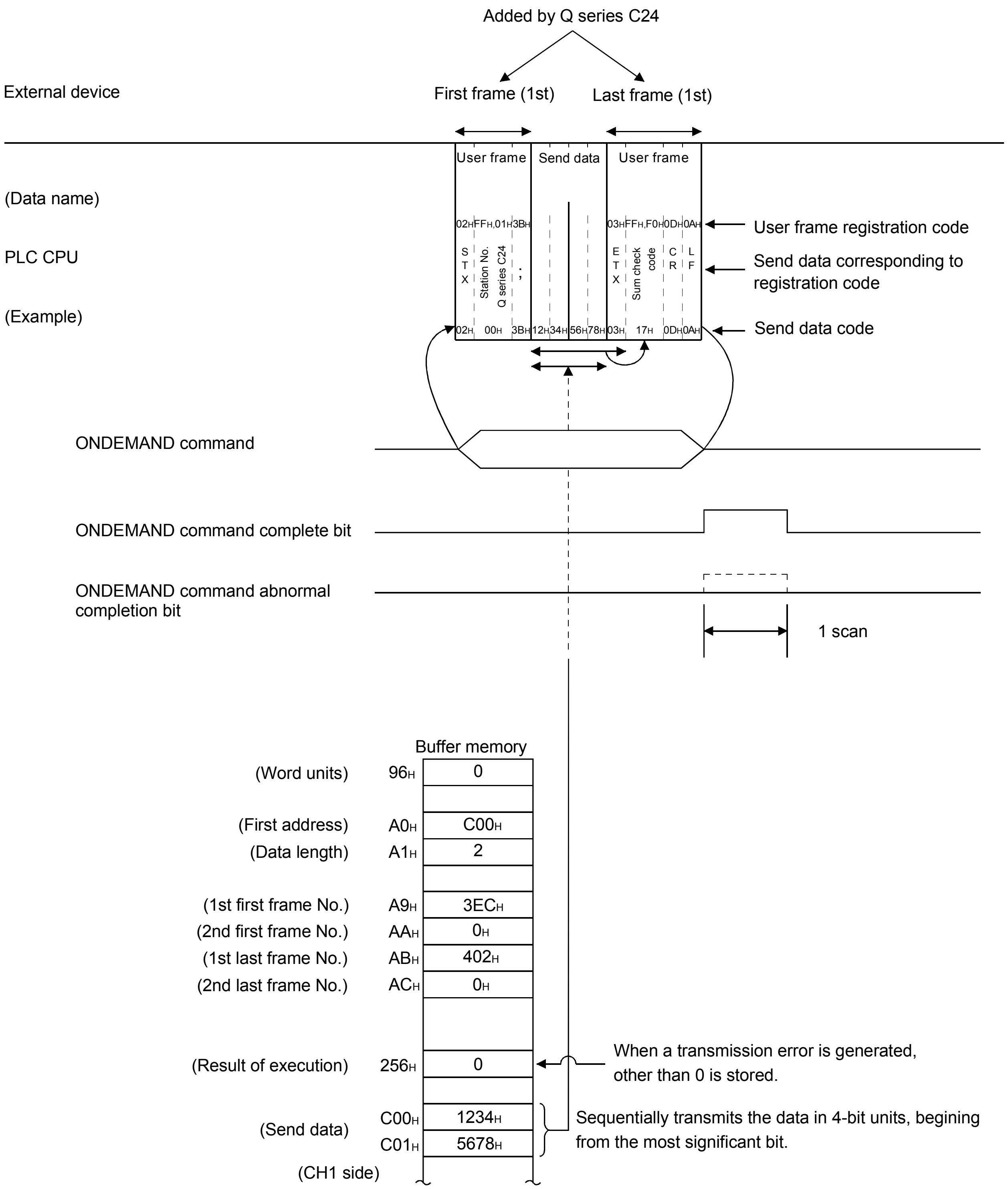
(2) Registration via GX Configurator-SC
Register as follows when transmitting a user frame, user selected transmission data (*1) or a combination of user frames.
1) "User frame registration" screen

User frame No.	User frame (Registration code)	User frame registration contents
3ECH(1004)	02H, FFH, 01H, 3BH	STX + Q series C24 station No. + ;
402H(1026)	03H, FFH, F0H, 0DH, 0AH	ETX + sum check code + CR + LF Sum check code is designated by a 1 byte binary code.

2) "Transmission control and others system setting" screen, "MC protocol system setting" screen
- Set the "Word/byte units designation" to word units.
- Set the "On-demand user frame designation" items to the following:
  First frame No. 1st: 3ECH
  First frame No. 2nd: 0H (No designation)
  Last frame No. 1st: 402H
  Last frame No. 2nd: 0H (No designation)

*1 Use the ONDEMAND instruction to designate the transmission data to two words (1234H, 5678H).

[Control procedure]



10.5 Example of an On-Demand Data Transmission Program Using User Frames

The following shows an example of a sequence program when sending on-demand data including user frames.
Perform the following settings via GX Developer and registration using GX Configurator-SC in advance.
The sequence program for sending on-demand data when performing the following settings using GX Developer and registration using GX Configurator-SC is the same as the sequence program indicated in Section 11.4 of Reference Manual.
(The Q series C24 I/O signals are X/Y00 to X/Y1F and are sent from the CH1 side interface)

(1) Switch settings via GX Developer

To set the following setting values on the "intelligent functional module switch setting" screen, see Section 4.5 of the User's Manual (Basic).

Setting item		Setting value	Remarks
Switch 1	CH1 Transmission setting	Set according to the external device.	—
	CH1 Communication rate setting		
Switch 2	CH1 Communication protocol setting	0001_H	MC protocol form 1
Switch 3	CH2 Transmission setting	0000_H	Not used
	CH2 Communication rate setting	0000_H	
Switch 4	CH2 Communication protocol setting	0001_H	
Switch 5	Station No. setting	0000_H	Q series C24 station No.

(2) Registration via GX Configurator-SC

1) Registering the user frame to be transmitted
To register the user frame data to be transmitted on the "User frame registration" screen, see Chapter 9 of this manual.
For more details on the "User frame registration" screen, see Section 8.4.1 of User's Manual (Basic).

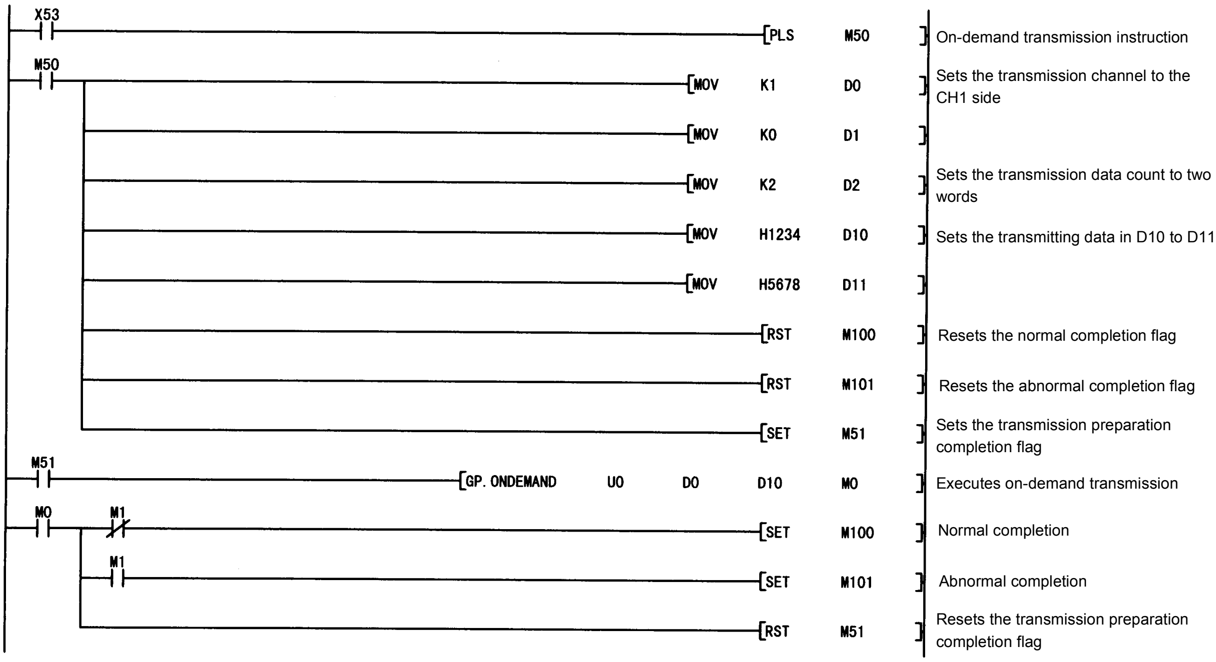
2) Registering the user frame No. to be transmitted and the unit of the data length.
Using the screens listed below, register the user frame No. and the unit of the length of data to be transmitted, which have been registered on the "User frame registration" screen.
For more details on the "Transmission control and others system setting" screen, see Section 8.4.5 of User's Manual (Basic).
For more details on the "MC protocol system setting" screen, see Section 8.4.6 of User's Manual (Basic).

Registration screen	Setting item		Setting value	Remarks
"Transmission control and others system setting" screen	Word/byte units designation		0000_H	Word unit
"MC protocol system setting" screen	On-demand buffer memory head address designation		0400_H	—
	On-demand data length designation		0000_H	—
	On-demand user frame designation	First frame No. designation 1st	0002_H	—
		First frame No. designation 2nd	$03EB_H$	
		Last frame No. designation 1st	0401_H	
		Last frame No. designation 2nd	0000_H	(No designation)
	Message wait time designation		0000_H	—

(3) Program example

The following program example shows the transmission of on-demand data using the on-demand function.

Designate two words of transmission data with the ONDEMAND instruction. The data for the user frame section of on-demand data to be sent is the registered data for the user frame No. that was registered with GX Configurator-SC.



POINT

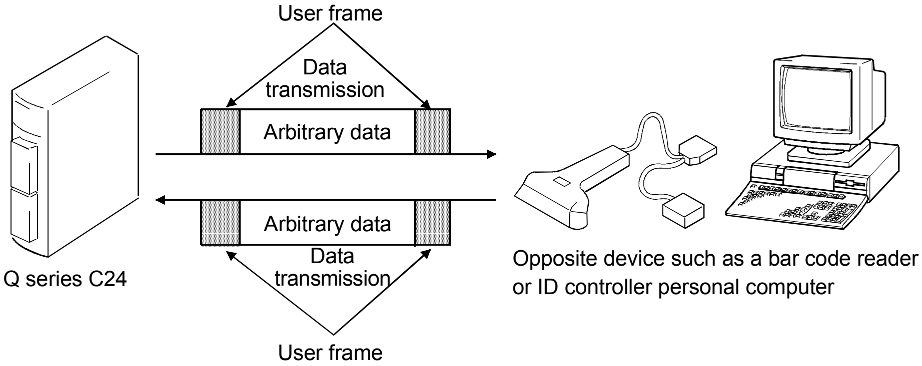
(1) The SPBUSY instruction can be used to read the communication status by the dedicated instruction.

(2) For details on the dedicated instructions, see Chapter 9 of User's Manual (Basic).

(3) Designate the storage capacity for transmission data (stored in D10 to D11 in the above program example) and data length (stored in D2 in the above program example) so that they do not exceed the range of buffer memory assigned by the user for the on-demand function.

11 DATA COMMUNICATIONS USING USER FRAMES

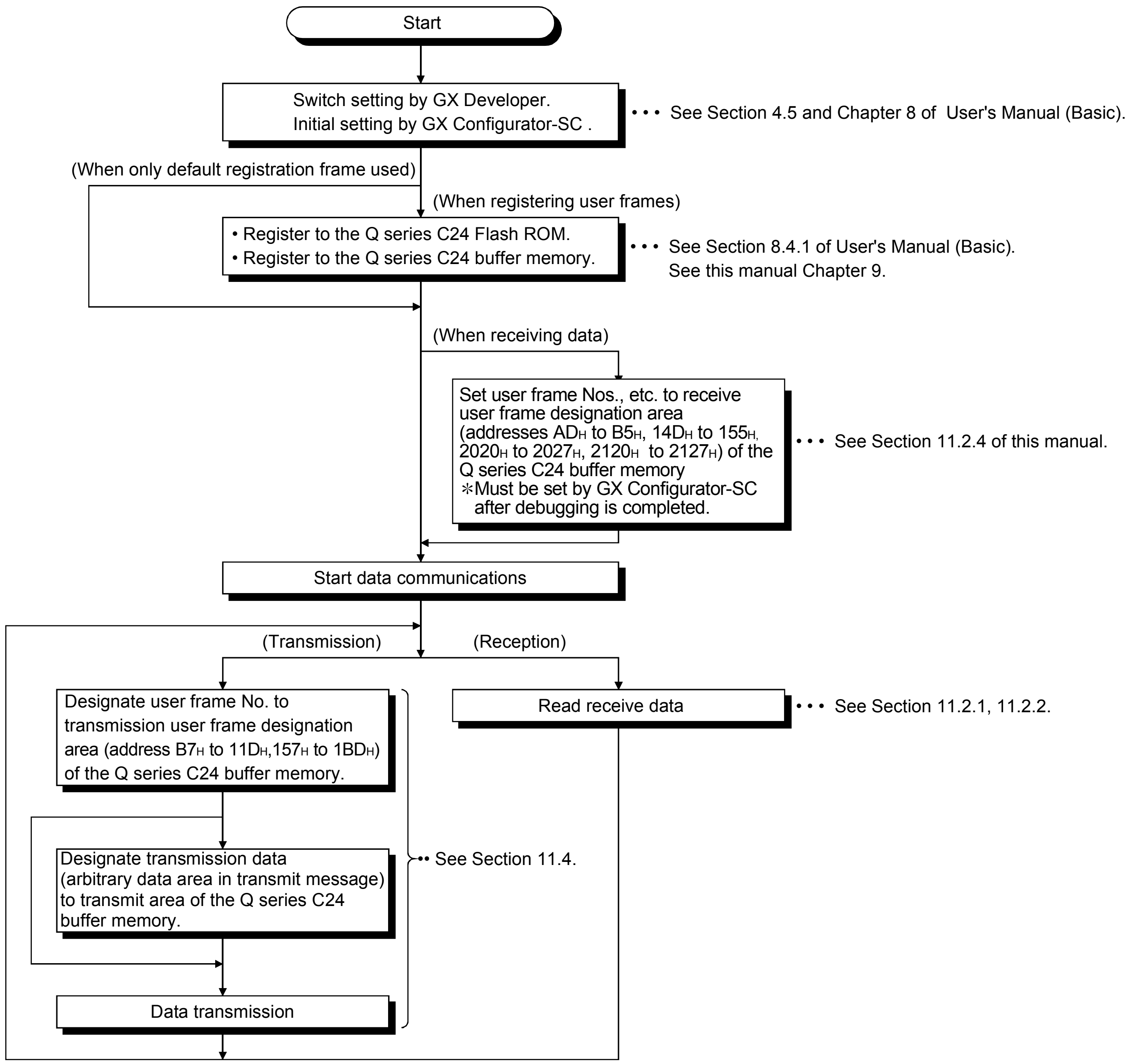
Registering the fixed format portion of the message transmitted/received by the opposite device and the Q series C24 as a user frame beforehand allows data transmission/reception using a user frame.
The use of the user frame to perform data transmission/reception facilitates the creation of transmission data on the PLC CPU side and a simplified sequence program for checking the reception data.
This Chapter explains the data transmission/reception method and procedure when performing data communication with the Q series C24 non procedure protocol using a user frame.



POINT
For more details on the "Transparent code" and "ASCII-BIN conversion" used in the explanations of this chapter, see the chapters listed below. When using transparent codes or performing data communication using ASCII-BIN conversion, please read the following chapters, as well. • When using transparent codes: See Chapter 12. • When performing data communication using ASCII-BIN conversion: See Chapter 13.

11.1 Overview of Data Communication Procedure

The following is an overview of the procedure when performing data communication between the opposite device and PLC CPU using a user frame.



11.2 Data Reception

In data reception using the user frame, the reception method on the Q series C24 side includes format 0 and format 1.
This section explains data reception for each format.

11.2.1 About reception data

In reception using the user frame, data arranged as indicated below can be received.

User frame (first frame)	Arbitrary data	User frame (last frame)

	Reception method	Combination	User frame (first frame)	Arbitrary data	User frame (last frame)	Explanation section	Remarks
With the first frame (*1)	Format-0	(1-A)	○	○	○	This section (1)	For data reception, mixed settings are possible.
		(1-B)	○	—	○		
		(1-C)	○	○	—		
	Format-1	(1-D)	○	○	—	This section (2)	
		(1-E)	○	—	—		
Without the first frame (*1)	Format-0	(2-A)	—	○	○	This section (3)	——
		(2-B)	—	—	○		

○: Specified data exists.

(When ASCII-BIN conversion is set to "Disable")

Codes that can be received	Codes stored to receive area *3
00_H to FF_H	(Not stored)
00_H to FF_H	00_H to FF_H

(When ASCII-BIN conversion is set to "Enable")

Codes that can be received	Codes stored to receive area *3
00_H to FF_H	(Not stored)
*2 30_H to 39_H, 41_H to 46_H	0_H to 9_H, A_H to F_H

*1 User frames for reception
1) The user frame for data reception can set up to a maximum of four combinations of the first frame and the last frame, regardless of whether there is a specification.
2) For a combination that specifies the first frame (with the first frame), it is necessary to specify the first frame even in other combinations.
3) For a combination that does not specify the first frame (without the first frame), the first frame cannot be specified even in other combinations.
4) A combination with the first frame and a combination without the first frame cannot be combined.

*2 If data of other than 30_H to 39_H and 41_H to 46_H are received as the data code of the arbitrary data area (including the transparent code data), the Q series C24 ASCII-BIN conversion will generate an error.

*3 Receive data arbitrary data area

1) When the arbitrary data area is stored to the receive area, and the storage byte count is an odd number of bytes, the receive data count shown below is stored to the receive data count storage area.
(When ASCII-BIN conversion is enabled, receive data count is the storage byte count when the arbitrary data area is converted to binary code and stored to the receive area.)

- Word units

Receive data count = Number of bytes stored to receive area ÷ 2....Fractions are truncated

- Byte units

Receive data count = Number of bytes stored to receive area

(00H is stored to the upper byte of the last data storage location of the receive area.)

2) When ASCII-BIN conversion enabled, make the arbitrary data area of the receive data an even number of bytes excluding the additional code.

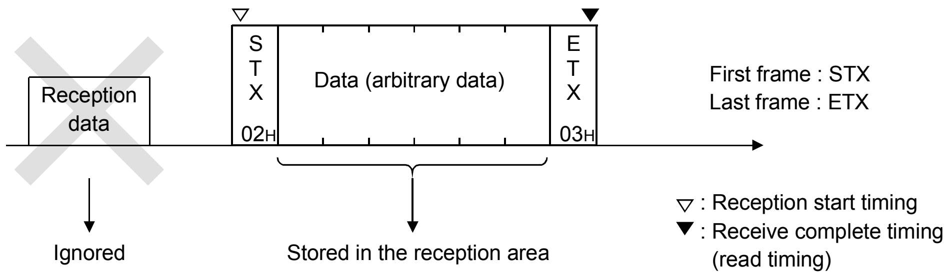
(1) Reception with the first frame (combination 1-A to C) (reception using Format-0)

(a) Reception of combination (1-A)

1) In this method, any data section of the reception message that can be handled by the PLC CPU side is enclosed by the first frame and the last frame and transmitted from the external device.
2) Any reception data prior to the first frame will be ignored.
3) The Q series C24 will begin reception processing when data of the same arrangement as the first frame is received.
When data of the same arrangement as the last frame is received, arbitrary data is stored in the reception area of the buffer memory and a read request is performed to the PLC CPU.
4) The received data count initially set in the Q series C24 should be a data count that exceeds the size of the arbitrary data to be received.
5) Reception processing via the receive complete code initially set in the Q series C24 will not be performed. The reception data for the receive complete code will be treated as arbitrary data.

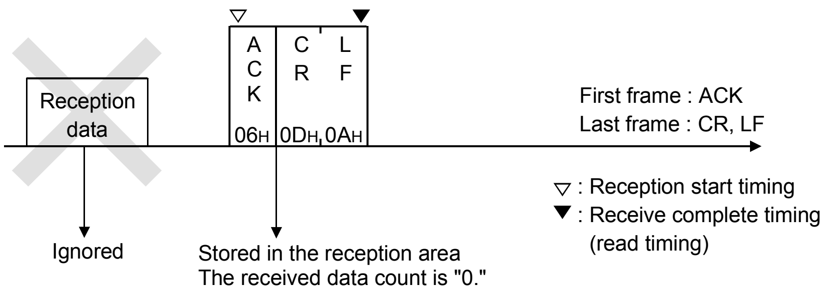
(Example) When data transmitted from a bar code reader is received STX will be registered in the first frame and ETX registered in the last frame according to the message format of the bar code reader.

(Data format transmitted from the bar code reader)

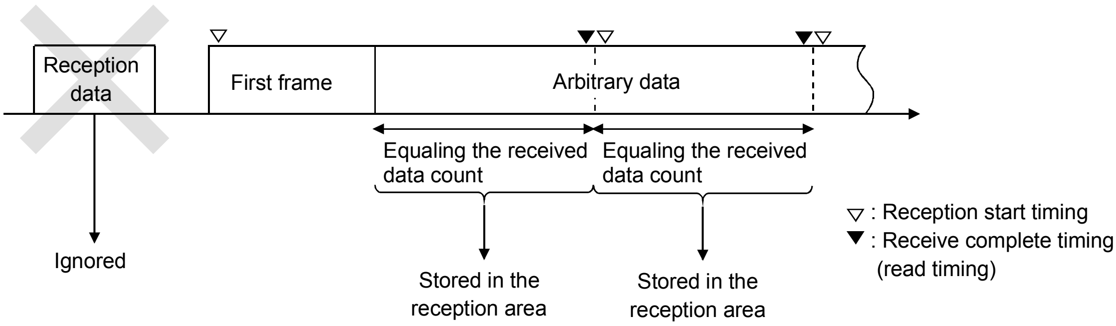


(b) Reception of combination (1-B)

1) In this method, messages to be received by the PLC CPU side are all transmitted from the external device as fixed format data.
2) Any reception data prior to the first frame will be ignored.
3) The Q series C24 will begin reception processing when data of the same arrangement as the first frame is received.
When data of the same arrangement as the last frame is received, a read request is performed to the PLC CPU.
4) Since there is no arbitrary data, the reception data count will be "0" when a read request is performed to the PLC CPU.
5) The received data count initially set in the Q series C24 uses the default value.



(c) Reception of combination (1-C)
1) In this method, start of data transmission from the external device to the PLC CPU side is notified by the first frame, after which arbitrary data of a fixed length is repeatedly transmitted from the external device.
2) Any reception data prior to the first frame will be ignored.
After the first frame is received, all later reception data is treated as arbitrary data.
3) The Q series C24 will begin reception processing when data of the same arrangement as the first frame is received.
A read request will be repeatedly performed to the PLC CPU when arbitrary data equaling the received data count initially set in the Q series C24 is received.
4) The received data count initially set in the Q series C24 should be a data count for arbitrary data (fixed length) transmitted from the external device.
5) Reception processing via the receive complete code initially set in the Q series C24 will not be performed. The reception data for the receive complete code will be treated as arbitrary data.

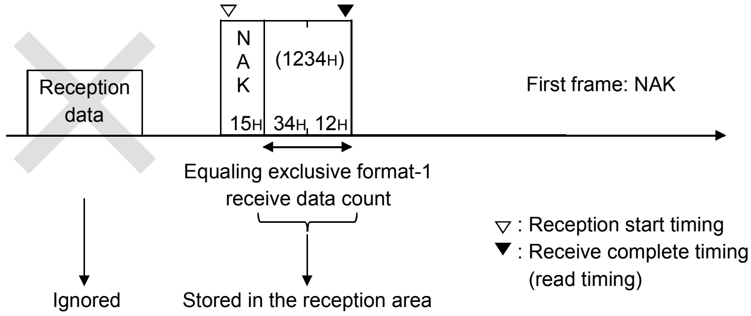


(2) Reception with the first frame (combination 1-D, 1-E) (reception using Format-1)

1) In this method, arbitrary data of exclusive format-1 received data count initially set in the Q series C24 is transmitted from the external device together with the first frame.
＊ The data length for the arbitrary data in the reception message that can be handled by the PLC CPU side (＊1) can be specified for each data reception frame combination (up to four combinations).
2) Any reception data prior to the first frame will be ignored.
3) The Q series C24 will begin reception processing when data of the same arrangement as the first frame is received.
When arbitrary data equaling the exclusive format-1 received data count is received, the arbitrary data is stored in the reception area of the buffer memory and a read request is performed to the PLC CPU.
4) Exclusive format-1 received data count initially set in the Q series C24 should be a data count for arbitrary data to be received.
The received data count initially set in the Q series C24 is not used.
5) Reception processing via the receive complete code initially set in the Q series C24 will not be performed. The reception data for the receive complete code will be treated as arbitrary data.

(Example 1) By specifying a user frame, in which only ACK (06_H) is registered, as the first frame and also exclusive format-1 received data count for arbitrary data as 0 bytes, a read request will be performed to the PLC CPU upon the reception of a 1-byte ACK.

(Example 2) By specifying a user frame, in which only NAK (15_H) is registered, as the first frame and also specifying exclusive format-1 received data count for arbitrary data as 2 bytes, a read request will be performed to the PLC CPU upon the reception of NAK + 2-byte data.



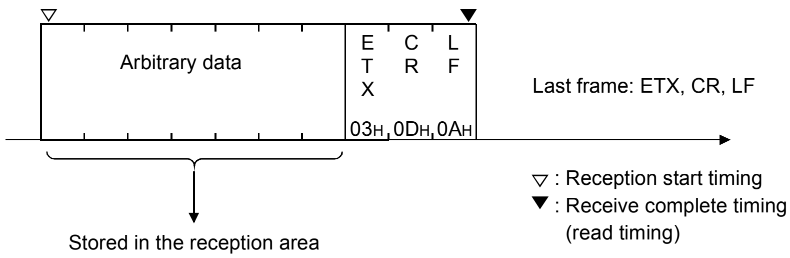
＊1 The data length for arbitrary data can be specified as a word/byte count of 0 or greater (the unit depends on word/byte units designation) for each combination of the first frame and the last frame specifying format-1.
The received data count for data reception using format-1 is referred to as exclusive format-1 received data count.

(3) Reception without the first frame (combination 2-A, 2-B) (reception using Format-0)

(a) Reception of combination (2-A)

1) In this method, a user frame is used as the last frame in place of the non procedure protocol data receive complete code and is transmitted from the external device together with arbitrary data.
2) Any reception data prior to the last frame are all treated as arbitrary data.
3) The Q series C24 will begin reception processing when arbitrary data is received.
When data of the same arrangement as the last frame is received, arbitrary data is stored in the reception area of the buffer memory and a read request is performed to the PLC CPU.
4) The received data count initially set in the Q series C24 is a data count that exceeds the size of the arbitrary data to be received.
5) The Q series C24 performs the following processing with respect to the reception data that is the same as the receive complete code initially set in the Q series C24.
When the reception data is included in the arbitrary data:
Reception is processed via the receive complete code.
When the reception data is included in the last frame:
Reception is not processed via the receive complete code.

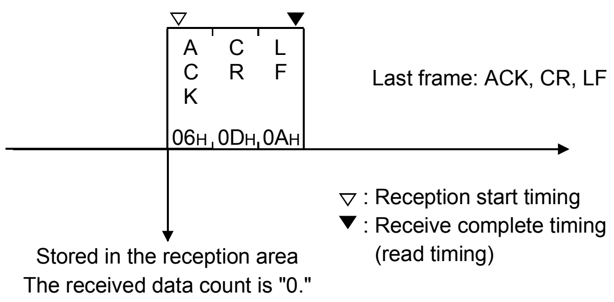
(Example) By registering ETX + CR + LF as the last frame, a read request is performed to the PLC CPU when the end of the reception data receives a message of ETX + CR+ LF.



(b) Reception of combination (2-B)

1) In this method, a user frame is used as the last frame in place of the non procedure protocol data receive complete code, and fixed format data is transmitted from the external device.
2) Any reception data prior to the last frame are all treated as arbitrary data.
3) When data of the same arrangement as the last frame is received, the Q series C24 performs a read request to the PLC CPU.
4) Upon the reception of data from this combination that contains no arbitrary data, the reception data count will be "0" when a read request is performed to the PLC CPU.
5) The received data count initially set in the Q series C24 uses the default value.
6) The Q series C24 performs the following processing with respect to the reception data that is the same as the receive complete code initially set in the Q series C24.
   When included in the last frame:
   Reception is not processed via the receive complete code.

(Example) By registering ACK + CR + LF as the last frame, a read request is performed to the PLC CPU when the end of the reception data receives a message of ACK + CR + LF.



POINT

Handling of the Q series C24 receive data

(1) When an user frame (first frame, last frame) of a code registered in the Q series C24 is received, receive processing by user frame is performed.
(2) Of the first frame No. and last frame No. (maximum 4 sets) initialized by the user at the buffer memory receive user frame designation area, the set No. (□th) of the user frame received from the external device is stored to the receive user frame storage area.
(3) If receive transparent code is designated, the data of the additional code included in the arbitrary data area is removed immediately after reception (before conversion when the receive data is converted from ASCII code to binary code).

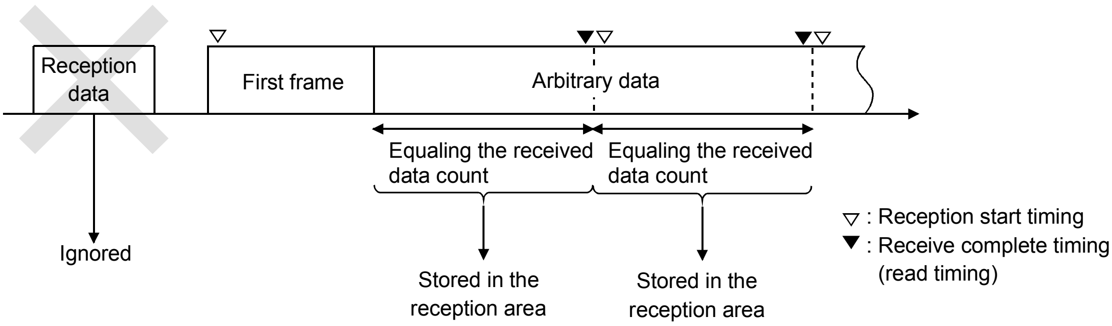
REMARK

The following shows the difference in how reception data for each reception method (Format-0 and Format-1) is treated when data is received using the combination of (first frame + arbitrary data).

(1) When data is received using Format-0 (combination (1-C))

1) The Q series C24 regards all arbitrary data after the first frame as valid data and stores it sequentially in the reception area.

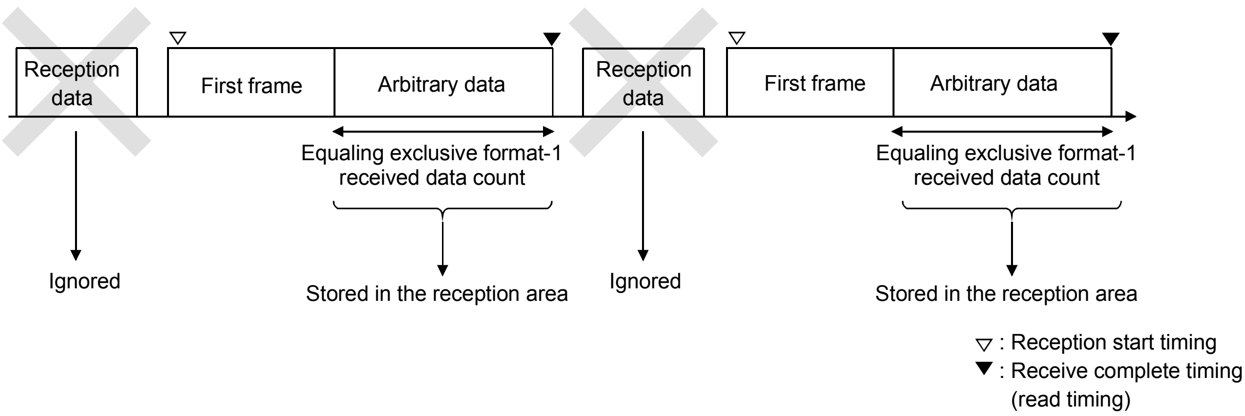
2) A read request is performed to the PLC CPU each time arbitrary data equaling the received data count is received, and this process is repeated.



(2) When data is received using Format-1 (combination (1-D, 1-E))

1) After the first frame is received, the Q series C24 regards all arbitrary data equaling exclusive format-1 received data count specified for the received first frame combination as valid data and stores it in the reception area. It then performs a read request to the PLC CPU.

2) After data equaling exclusive format-1 received data count is received, any data until the next first frame will be ignored. (Data will not be stored in the reception area.)



11.2.2 Timing for start/completion of data reception

This section explains the reading of reception data based on the user frame and other factors (such as the receive complete code and received data count) during data reception using a user frame.

(1) Timing for start/completion of data reception

The following describes the timing for start/completion of the data reception processing with the Q series C24.

- Data reception using a user frame
- Data reception using the receive complete code and received data count initially set in the Q series C24
- Data reception using exclusive format-1 received data count

<table>
<tr><th></th><th>Setting the user frame for reception</th><th>When using format-0
(See (2) for each timing)</th><th>When using Format-1
(See (2) for each timing)</th></tr>
<tr><td rowspan="2">Reception start</td><td>With the first frame</td><td colspan="2">When the first frame is received.</td></tr>
<tr><td>Without the first frame</td><td>When the first data of arbitrary data is received.</td><td>—</td></tr>
<tr><td rowspan="4">Receive complete</td><td rowspan="4">—</td><td colspan="2">When the factor of receive complete (timing of reception data reading to the PLC CPU) is one of the following:</td></tr>
<tr><td colspan="2">(Depends on prior settings. See (2).)</td></tr>
<tr><td>• When the last frame is received.
• When data of the receive complete code is received. (In the case of a combination without the first frame)
• When data equaling the received data count is received.
• When a receive error (time out for the no-reception monitoring time (timer 0)) occurs.</td><td>• When exclusive format-1 received data count is specified as 0 and the first frame is received.
• When exclusive format-1 received data count is specified as 1 or more and data equaling this count is received.
• When a receive error (time out for the no-reception monitoring time (timer 0)) occurs.</td></tr>
<tr><td colspan="2">∗ All arbitrary data received up to the point when one of the above occurs or a receive error is generated is stored in the reception area.</td></tr>
</table>

(2) Timing chart for reception processing using the Q series C24

The following is a timing chart for the reception processing when data reception is performed using the user frame, which includes the reception processing using the received data count.

The numbers in the table indicate the timing of a reception data read request to the PLC CPU (see next page).

[Combination with the first frame]

<table>
<tr><th colspan="2">—</th><th colspan="5">Timing pattern number (see next page)</th></tr>
<tr><th>Combin-ation</th><th>Reception data
Amount of reception data of arbitrary data</th><th>Reception data prior to the reception of the first frame</th><th>When receiving the first frame</th><th>When receiving arbitrary data in the reception message</th><th>When receiving the last frame</th><th>When receiving the complete code (*1)</th></tr>
<tr><td rowspan="2">1-A</td><td>Reception data count < Received data count</td><td rowspan="7">Deleted</td><td rowspan="6">Reception start</td><td>—</td><td>1-A 1)</td><td rowspan="2">Data of the complete code is treated as part of arbitrary data.</td></tr>
<tr><td>Reception data count ≧ Received data count</td><td colspan="2">1-A 2)</td></tr>
<tr><td>1-B</td><td>Reception data count = 0</td><td>—</td><td>1-B</td><td>—</td></tr>
<tr><td rowspan="2">1-C</td><td>Reception data count ≦ Received data count</td><td>1-C 1)</td><td rowspan="4"></td><td rowspan="3">Data of the complete code is treated as part of arbitrary data.</td></tr>
<tr><td>Reception data count > Received data count</td><td>1-C 2)</td></tr>
<tr><td>1-D</td><td>Reception data count (exclusive format-1 received data count > 0)</td><td>1-D</td></tr>
<tr><td>1-E</td><td>Reception data count (exclusive format-1 received data count = 0)</td><td>1-E</td><td>—</td><td>—</td></tr>
</table>

[Combination without the first frame]

<table>
<tr><td rowspan="2">2-A (*2)</td><td>Reception data count < Received data count</td><td rowspan="3">—</td><td rowspan="3">—</td><td rowspan="2">Reception start</td><td>2-A 1)</td><td>2-A 3)</td></tr>
<tr><td>Reception data count ≧ Received data count data</td><td>2-A 2)</td><td>2-A 4)</td></tr>
<tr><td>2-B (*2)</td><td>Reception data count = 0</td><td>—</td><td>Rece-ption start / 2-B</td><td>—</td></tr>
</table>

*1 The reception processing via the receive complete code is not performed when the same data as the receive complete code has been registered in the last frame.

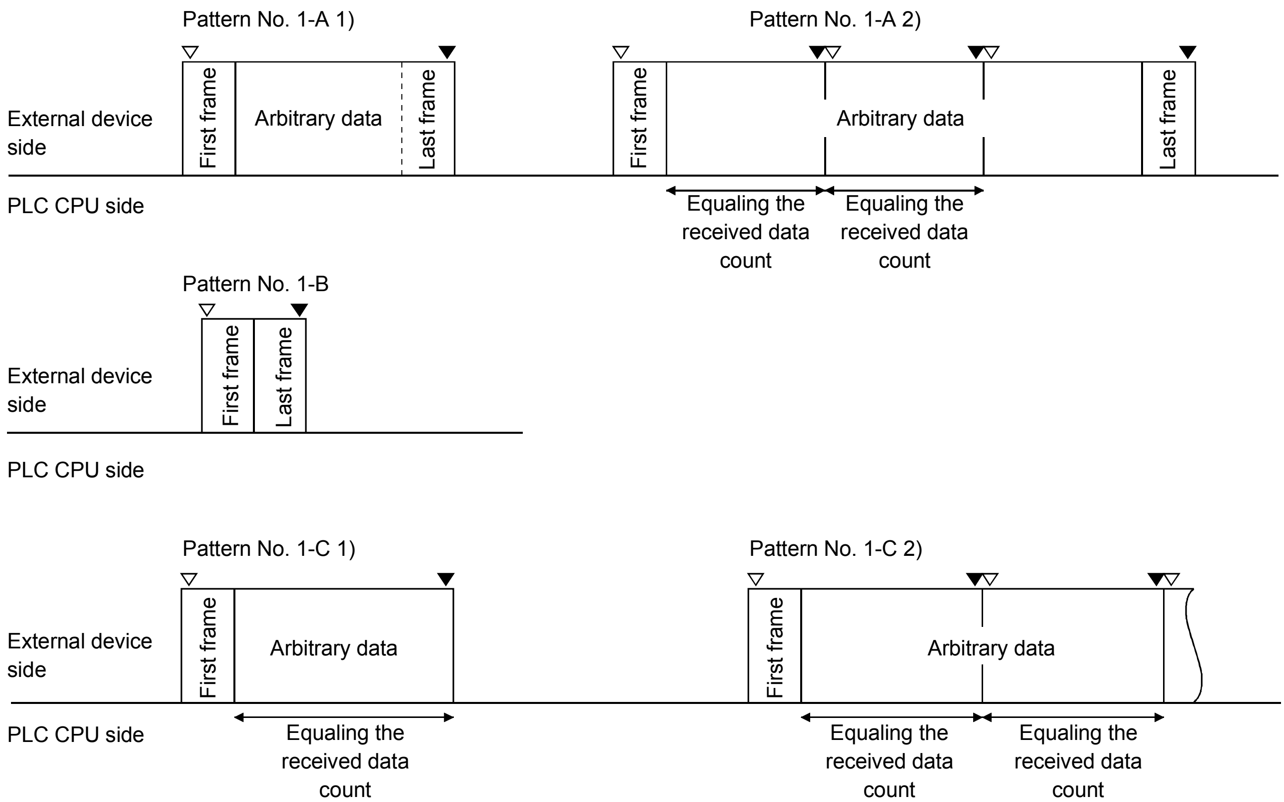
*2 The data reception interval is not monitored with the no-reception monitoring time (timer 0) when only the last frame is set.

POINT

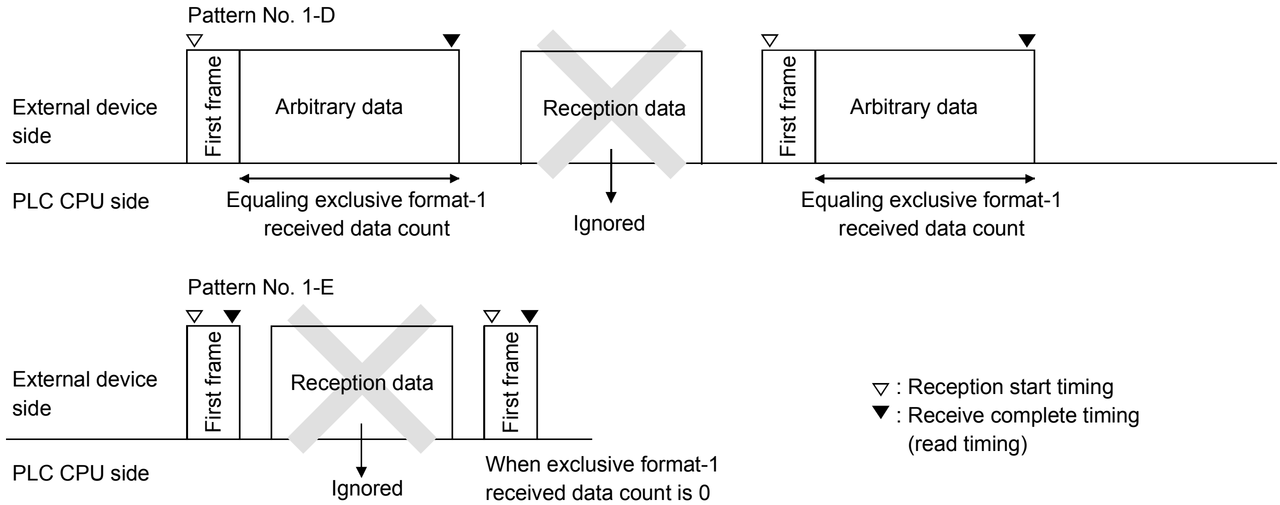
When a receive error is detected, the Q series C24 stores arbitrary data of the reception data received immediately before the error in the reception area of the buffer memory, then turns the reception error detection signal (X4) ON.

[Combination with the first frame] Timing patterns for reception start and receive complete (read)

(For data reception with format-0)



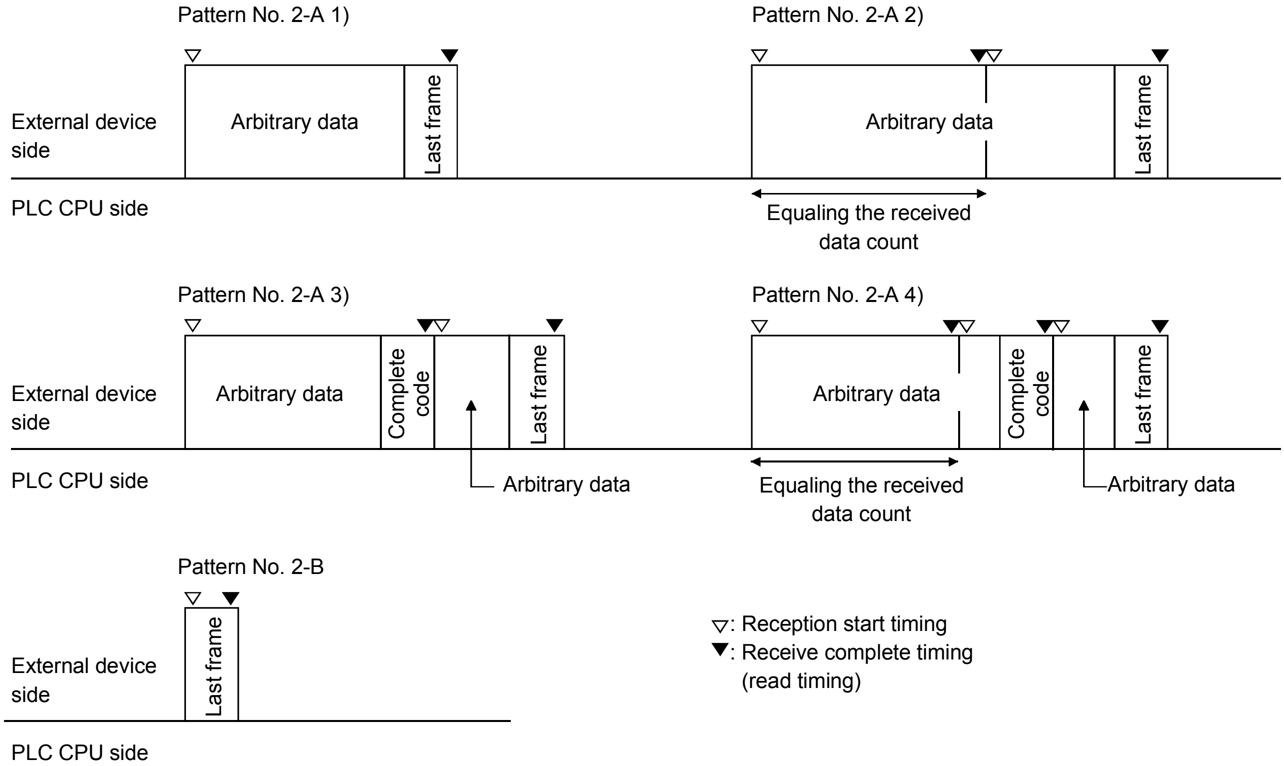
(For data reception with format-1)



POINT

When data is received using Format-1, the Q series C24 checks again whether the first frame has been received after receiving data equaling the exclusive format-1 received data count. Reception data during that time is ignored.

[Combination without the first frame] Timing patterns for reception start and receive complete (read)

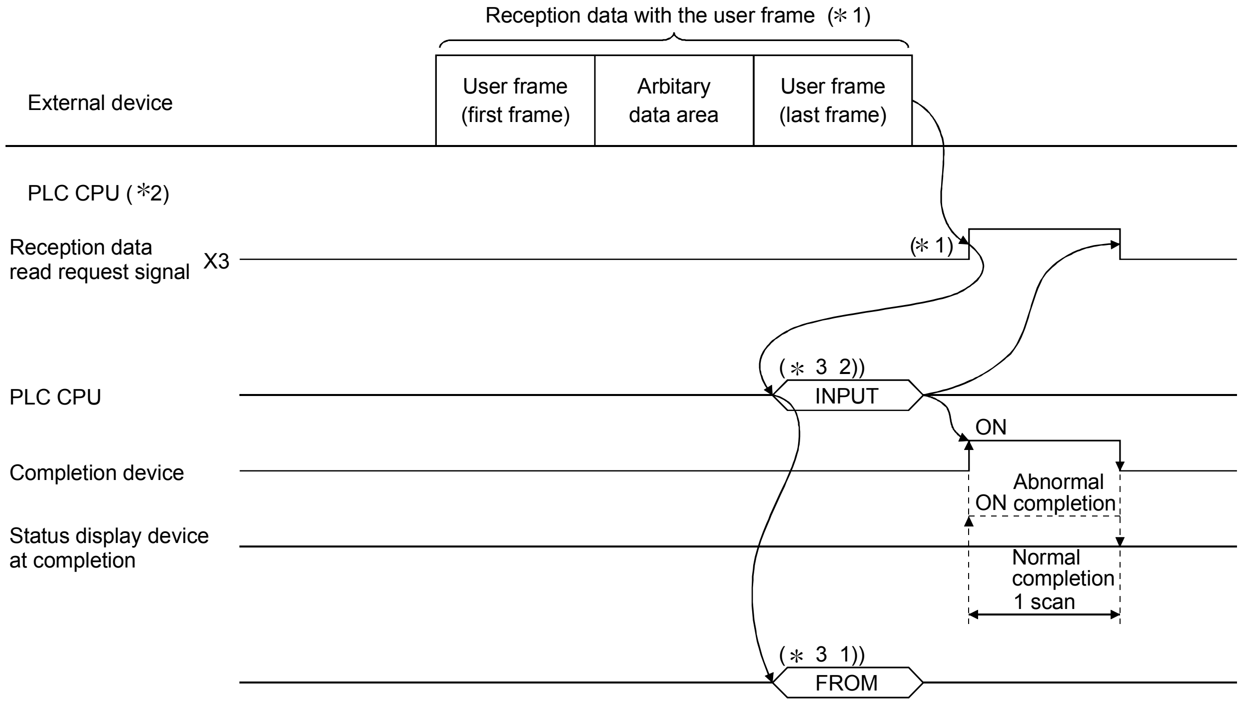


11.2.3 Receive procedure

The following shows the receive procedure when a message, including data with the same arrangement as the specified user frame, is received and the arbitrary data is read to the PLC CPU.

Procedure

(When the CH1 side interface of the Q series C24 receives data)



*1 See Sections 11.2.1 and 11.2.2 regarding the reading of reception data using a user frame and the timing of reception data reading to the PLC CPU.

*2 Sets the receive user frame registration No., etc. in the "non procedure system setting" screen for GX Configurator-SC.
During debugging, the initial setting value for data reception shall be set prior to data receiving, but after debugging is completed, it shall be set when the Q series C24 starts up. (See Section 11.2.4.)

*3 Reading ((1) below) for checking which user frame was received by the Q series C24 from the PLC CPU and reading of the receive data (2) below).
1) Reads which of the user frames set in the receiver user frame designation area was received from the receive user frame storage area (address: 25BH).
2) Reads the arbitrary data area of the receive message from the receive area (default addresses: 600H to 7FFH).

11.2.4 User frame setting for reception

(1) About user frame setting for reception

This setting is to receive data from the opposite device using non procedure protocol through the use of a user frame. Everything is set on the GX Configurator-SC "Non procedure system setting" screen. The setting items are listed below. (See Section 8.4.7 of User's Manual (Basic).)

[Setting screen] Non procedure system setting screen

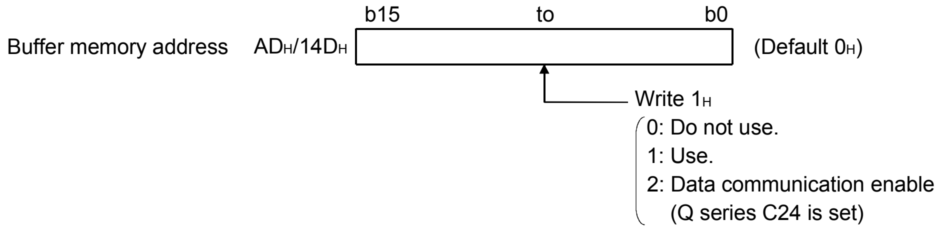
Received data count designation	01FF
Receive complete code designation *Hffff:Not designated receive complete code H0d0a:CR+LF H0000-H00ff:Receive complete code*	FFFF
Receive user frame designation User frame use enable/disable designation	Use
Input following eight items within the following range 0:Not designated H0001-H03e7:Default frame H03e8-H04af:Flash ROM user frame H8001-H801f:Buffer memory user frame	
Receive user frame designation First frame No. designation 1st	03E8
First frame No. designation 2nd	03E9
First frame No. designation 3rd	0006
First frame No. designation 4th	0015
Last frame No. designation 1st	041B
Last frame No. designation 2nd	0000
Last frame No. designation 3rd	0000
Last frame No. designation 4th	0000
Following user frame receive format designation is valid above function version B	
User frame receive format designation 1st	Format-0
User frame receive format designation 2nd	Format-0
User frame receive format designation 3rd	Format-1
User frame receive format designation 4th	Format-1
User frame receive format designation is valid only in case of [Format-1] Exclusive format-1 received data count 1st	0000
Exclusive format-1 received data count 2nd	0000
Exclusive format-1 received data count 3rd	0000
Exclusive format-1 received data count 4th	0002

GX Configurator-SC setting items (Non procedure system setting screen)	Description of setting values		Remarks
	Format-0	Format-1	
Received data count designation	Designates the data count that exceeds the size of the arbitrary data to be received or the data count of the received data size.	The specified value is invalid. (Exclusive format-1 received data count becomes valid.)	See Chapter 6 of User's Manual (Basic).
Receive complete code designation	(Reception of combination with the first frame) The specified value is invalid. (Reception of combination without the first frame) Designates the code for the last data in the reception message for performing a read request to the PLC CPU.		
User frame use enable/disable designation	Designates "Enable."		See (2) of this section for the contents of each setting.
First frame No. designation 1st to 4th	Designates the user frame No. (0 or 1 or higher).	Designates the user frame No. (1 or higher).	
Last frame No. designation 1st to 4th	Designates the user frame No. (0 or 1 or higher).	Designates 0_H for everything.	
User frame receive format designation 1st to 4th	Designates "Format-0."	Designates "Format-1."	
Exclusive format-1 received data count 1st to 4th	The specified value is invalid.	Designates the data count for the arbitrary data to be received.	

(2) Initial settings via GX Configurator-SC ("Non procedure system setting" screen)

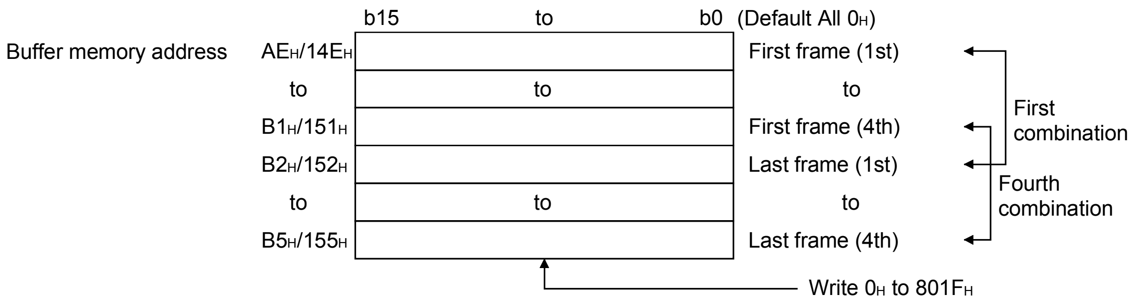
This section explains the buffer memory when setting various setting data for data reception using a user frame in a sequence program. (Numbers in the parentheses indicate the buffer memory address.)

(a) User frame use enable/disable designation (addresses: $AD_H/14D_H$)
Designate "Enable" when using user frames to receive data.



1) "1" is written in the user frame use enable/disable designation area.
2) After the preparation for the data reception using the user frames is completed, "2" is written in the user frame use enable/disable designation area. (Q series C24 is set)
3) After the value in the user frame use enable/disable designation area is changed from "1" to "2," start receiving data used by the user frame. Until "2" is written in the user frame use enable/disable designation area, data transmission is also not available.

(b) First frame No. designation area and last frame No. designation area (addresses: AE_H to $B5_H/14E_H$ to 155_H)
From among the user frames registered in the Q series C24, designate the frame numbers of the user frames you wish to use in the combination and order of priority as described in (1).



0_H (0): No designation
1_H to $3E7_H$ (1 to 999): Designate the default registration frame (for OS ROM registration).
$3E8_H$ to $4AF_H$ (1000 to 1199): Designate the user frame (for flash ROM registration).
8001_H to $801F_H$ (–32767 to –32737): Designate the user frame (for buffer memory registration).

[How to specify the first frame No. and the last frame No.]
Set the frame numbers using the following setting method.

(1) For the receive user frames, the first frame and last frame are set as a pair, regardless of whether the external device transmits these frames.
(If the external device does not transmit either one of the frames, the unsent frame No. is set to "0" (no setting)).

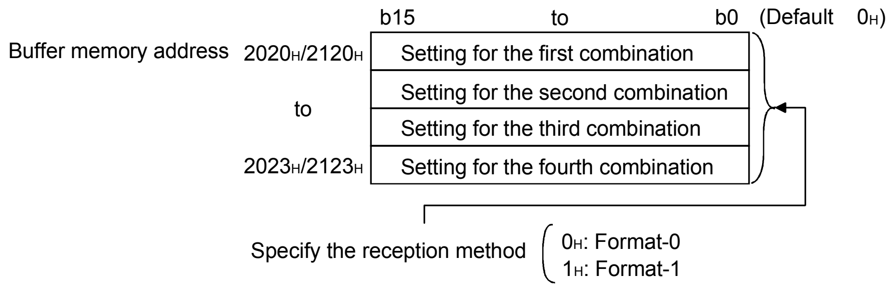
(2) A maximum of four combinations of first and last frames can be set for the non procedure protocol. (See Section 11.2.1.)
＊ Of the maximum four combinations to be set, if there is a combination that specifies the first frame, specify the first frame for all other combinations. In addition, set in the following order starting from the first buffer memory (AE_H to $B5_H$/$14E_H$ to 155_H).
(When specifying the first frame)
(i) Each frame No. for combinations that specify the first frame and the last frame
(ii) Each frame No. for combinations that specify the first frame but not the last frame
＊ Of the maximum four combinations to be set, if there is a combination that specifies the last frame only without specifying the first frame, the first frame cannot be specified in any of the combinations. Set the number of the last frame to be used in order starting from the first area of the buffer memory (AE_H to $B5_H$/$14E_H$ to 155_H).

(3) When setting more than one combination, the first frame having the registered data in the same arrangement or the same frame number cannot be designated. However, the last frame can be designated.

(4) Use the user frame numbers of the following user frames to set the receive user frames. (See Section 9.1.)
1) Default registration frame numbers: 1_H to $3E7_H$
2) User frame numbers registered in the Q series C24 flash ROM : $3E8_H$ to $4AF_H$
3) User frame numbers registered in the Q series C24 buffer memory: 8001_H to $801F_H$

(5) Do not specify (set) the frame No. of a user frame that includes the receive transparent code designation additional code data shown in Chapter 12 as a user frame for data reception using non procedure protocol.

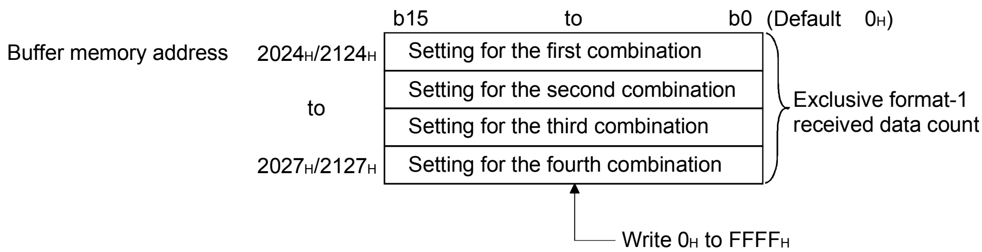
(c) User frame receive format designation (address: 2020_H to 2023_H/2120_H to 2123_H)
In data reception using a user frame, specify the reception method for each combination of receive user frames. This setting is valid in a setting shown in (2) (b) when it is set using a combination that specifies a user frame.



POINT

For combinations other than those with the first frame only, data reception is performed using Format-0 even if Format-1 is specified through the above reception method setting.

(d) Exclusive format-1 received data count designation (address: 2024_H to 2027_H/2124_H to 2127_H)
- For a combination specifying Format-1 in the user frame receive format designation, specify the arbitrary data word/byte count (size for performing a reception data read request to the PLC CPU) when the applicable first frame is received. Specify this for each combination specifying Format-1.
- Specify a size within the size of the storage area for the reception data in the buffer memory.
- The unit for the setting value depends on the setting value given in the word/byte units designation.



(3) Examples of registering a receive user frame

The following are examples of pre-registering a receive user frame on the CH1 side with the GX Configurator-SC.

(a) When the first frame is specified

In the example, the following three combinations are registered for the receive user frame.

[Setting conditions]

User frame		User frame receive format designation	Exclusive format-1 received data count	Remarks
1st combina-tion	(First frame + last frame)	Format-0	—	The received data count becomes valid.
2nd combina-tion	(First frame only)	Format-1	0$_H$	Exclusive format-1 received data count becomes valid.
3rd combina-tion	(First frame only)	Format-1	2$_H$	Exclusive format-1 received data count becomes valid.

See Section 8.4.7 of User's Manual (Basic) for registration using the GX Configurator-SC.

[Setting value]

Setting item		Setting value	Remarks
Received data count designation		1FF$_H$	For Format-0
Receive complete code designation		FFFF$_H$	Set to "No receive complete code."
User frame use enable/disable designation		Enable	Always specify "Enable."
Receive user frame designation First frame No. designation	1st	3E8$_H$	0$_H$: No designation 1$_H$ or higher: There is a designation. In this setting, only three combinations become valid.
	2nd	3E9$_H$	
	3rd	3EA$_H$	
	4th	0$_H$	
Receive user frame designation Last frame No. designation	1st	41D$_H$	
	2nd	0$_H$	
	3rd	0$_H$	
	4th	0$_H$	
User frame receive format designation	1st	Foramt-0	The received data count becomes valid.
	2nd	Foramt-1	Exclusive format-1 received data count becomes valid.
	3rd	Foramt-1	
	4th	Foramt-0	—
Exclusive format-1 received data count designation	1st	0$_H$	For Format-1
	2nd	0$_H$	
	3rd	2$_H$	
	4th	0$_H$	

(b) When the first frame is not specified
In the example, the following three combinations are registered for the receive user frame.

[Setting conditions]

User frame		User frame receive format designation	Exclusive format-1 received data count	Remarks
1st combina-tion	(Last frame only)	Format-0	—	The received data count becomes valid.
2nd combina-tion	(Last frame only)			
3rd combina-tion	(Last frame only)			

See Section 8.4.7 of User's Manual (Basic) for registration using the GX Configurator-SC.

[Setting value]

Setting item		Setting value	Remarks
Received data count designation		1FFH	For Format-0
Receive complete code designation		00□□H	Designate any received complete code.
User frame use enable/disable designation		Enable	Always specify "Enable."
Receive user frame designation First frame No. designation	1st	0H	0H: No designation
	2nd	0H	
	3rd	0H	
	4th	0H	
Receive user frame designation Last frame No. designation	1st	41DH	0H: No designation 1H or higher: There is a designation. In this setting, only three combinations become valid.
	2nd	41EH	
	3rd	41FH	
	4th	0H	
User frame receive format designation	1st	Format-0	Everything is set to Format-0 since the first frame is not designated.
	2nd	Format-0	
	3rd	Format-0	
	4th	Format-0	
Exclusive format-1 received data count designation	1st	0H	Setting value for Format-1. This setting is not required since everything is set to Format-0.
	2nd	0H	
	3rd	0H	
	4th	0H	

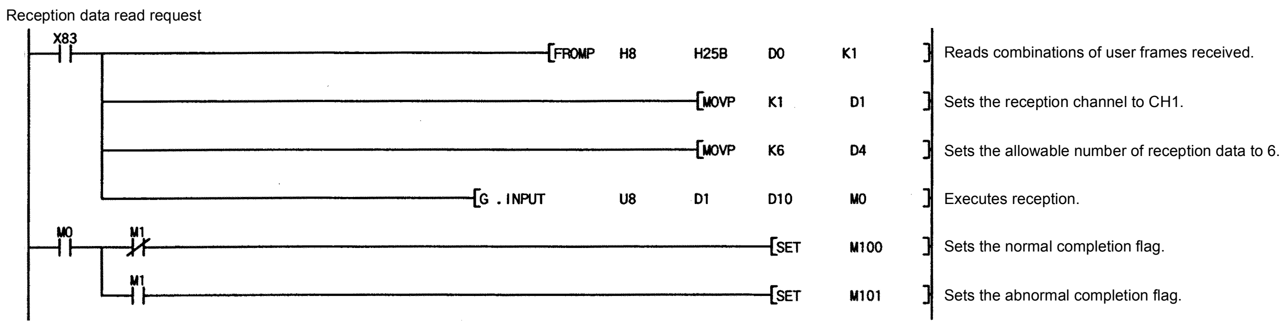
11.3 Receive Program

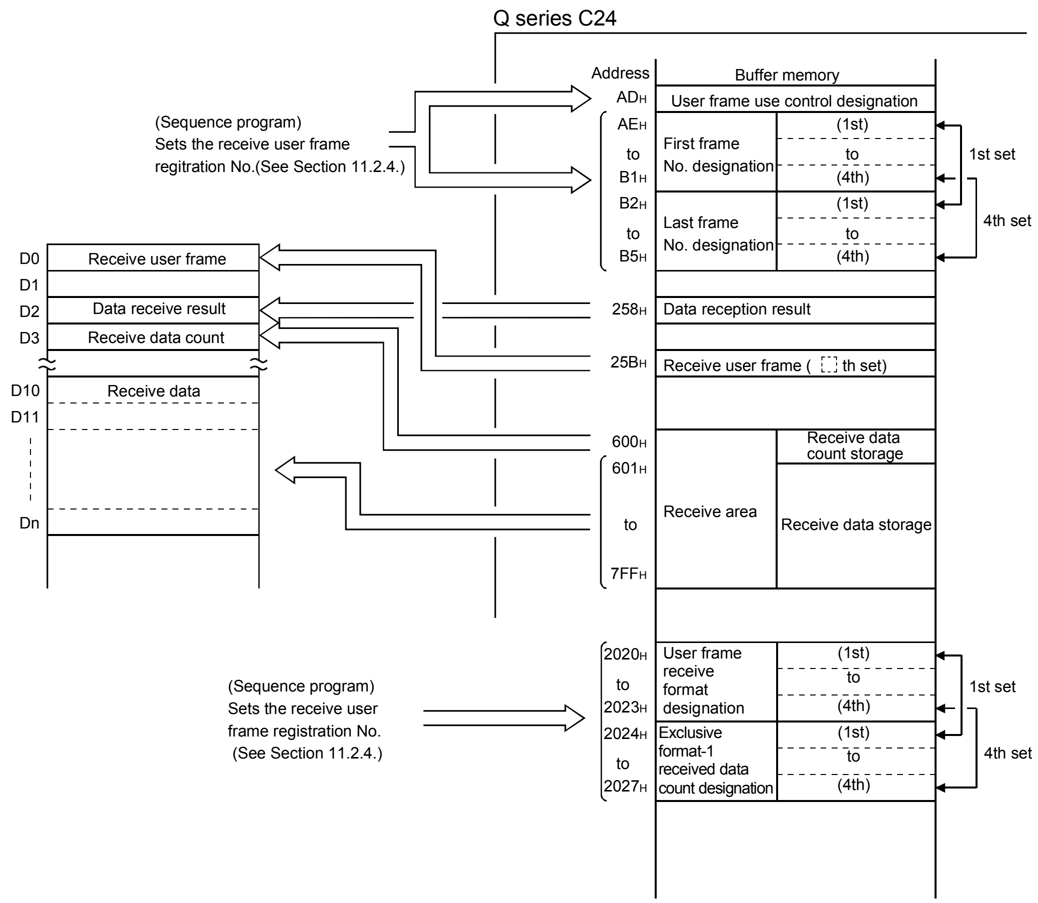
This section shows examples of the sequence program to read the reception data stored in the Q series C24 buffer memory to the PLC CPU, when data including the use frame is received.

11.3.1 Sequence program example

The following example shows a sequence program that stores the received user frame setting number (combination number) in D0 and the received data in addresses beginning with D10.

∗ For details on the INPUT instruction, see Section 9.4 of the User's Manual (Basic).





11.3.2 Application example for data reception using a combination that specifies the first frame

In the description of this program example, conditions for data reception using a user frame are as follows.

(1) The Q series C24 I/O signal
The Q series C24 is installed at QCPU I/O signal addresses X/Y80 to X/Y9F.

(2) Q series C24 interface used in data communications with the external device
The Q series C24 CH1 side RS-232 interface is used.

(3) Data to be registered on the GX Configurator-SC "Transmission control and other system settings" screen and "Non procedure system settings" screen used for data communication using a user frame.
Change default values for the items listed in the table below.
Use default values for other items.

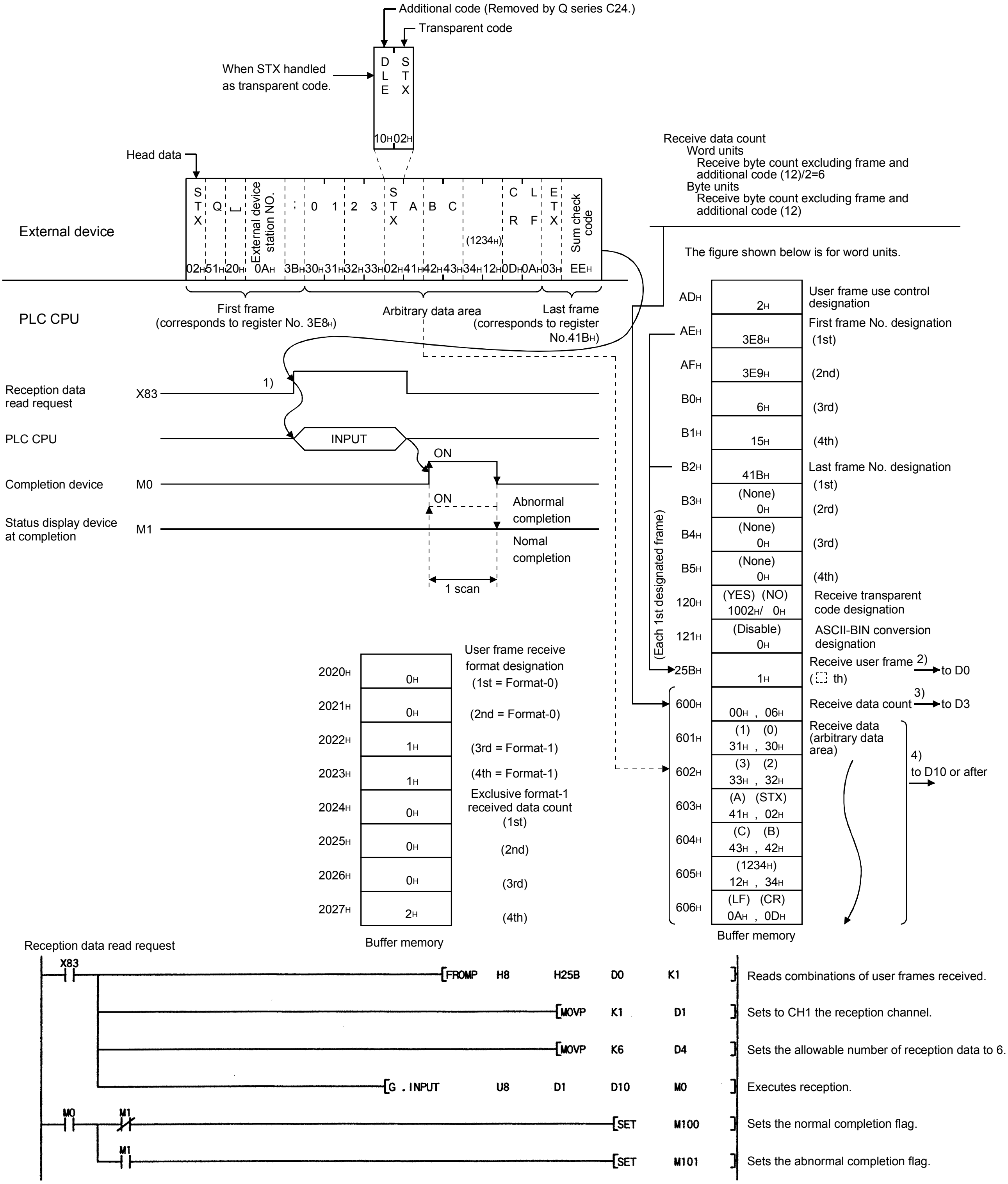
Item	Set contents	Buffer memory address to store registration value	Remarks	Explanation section
Word/byte units designation	Word/byte	96_H	Set to either one according to the example.	Section 8.4.5 of User's Manual (Basic)
Receive transparent code designation	Yes/No	120_H	When Yes, Additional code: 10_H (DLE) Transparent code: 02_H (STX)	
ASCII-BIN conversion designation	Do not convert	121_H	Select "Do not convert" in the example.	
Received data count	6 to 511	$A4_H$	Set according to the example.	Section 8.4.7 of User's Manual (Basic)
Receive complete code	None	$A5_H$	—	
User frame use control designation	Use	AD_H	See the diagram in the application example.	
First frame No. designation Last frame No. designation (＊1)	Yes	AE_H to $B5_H$		
User frame receive format designation	Format-0/ Format-1	2020_H to 2023_H		
Exclusive format-1 received data count designation	0_H to $FFFF_H$	2024_H to 2027_H		

＊1 This program example gives the registered contents of the user frame No. specified as the first frame No. and the last frame No.

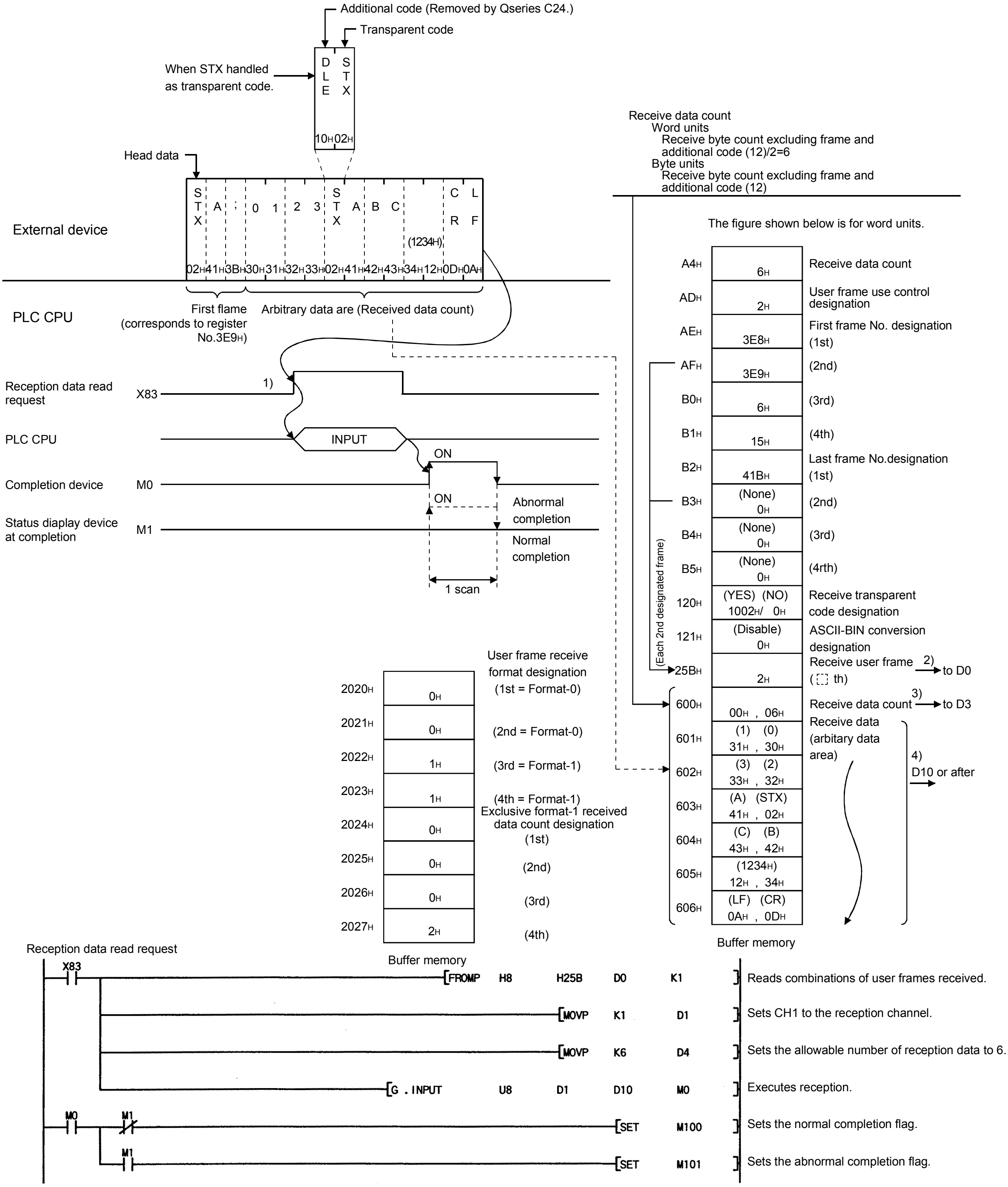
[When receiving with a combination that specifies the first frame]

		User frame No.	Registered code	Registered data contents
First frame No.	1st	$3E8_H$	02_H, 51_H, 20_H, $0A_H$, $3B_H$,	STX, Q, (SP), External device station No.,;
	2nd	$3E9_H$	02_H, 41_H, $3B_H$	STX, A, ;
	3rd	6_H	06_H,	ACK
	4th	15_H	15_H,	NAK
Last frame No.	1st	$41B_H$	03_H, FF_H, $F0_H$	ETX, Sum check code
	2nd	0_H (none)	—	
	3rd	0_H (none)	—	
	4th	0_H (none)	—	

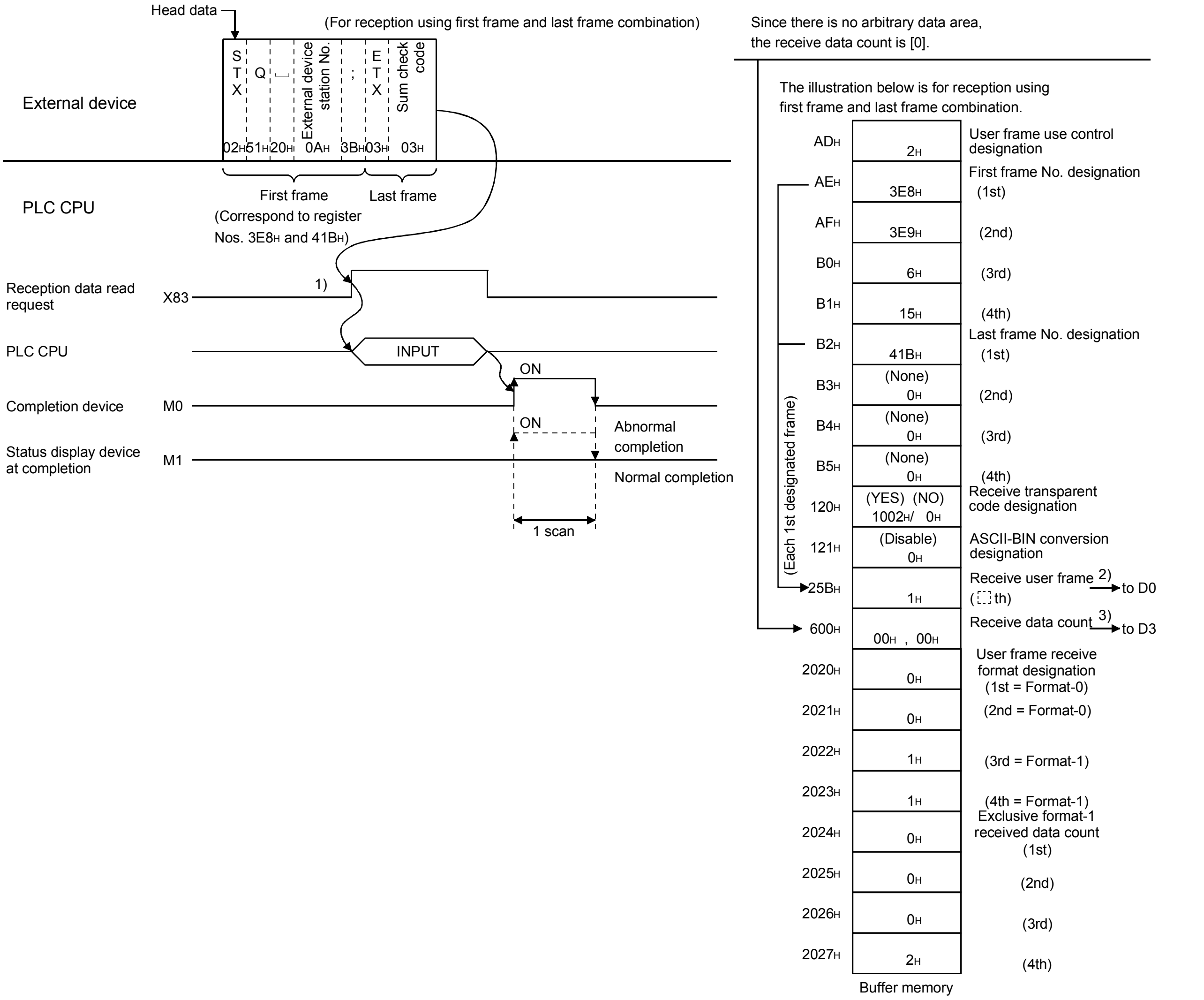
(a) When receiving with a combination of the first frame, arbitrary data and last frame (reception using Format-0)

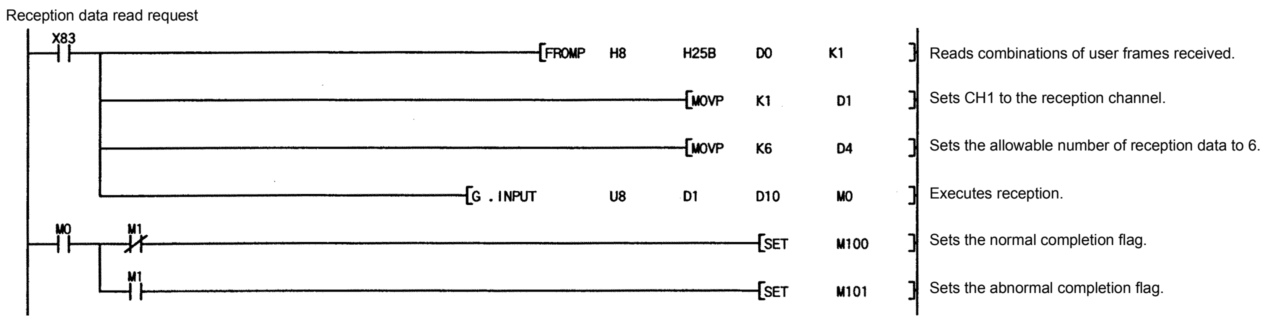


(b) When receiving with a combination of the first frame and arbitrary data (reception using Format-0)

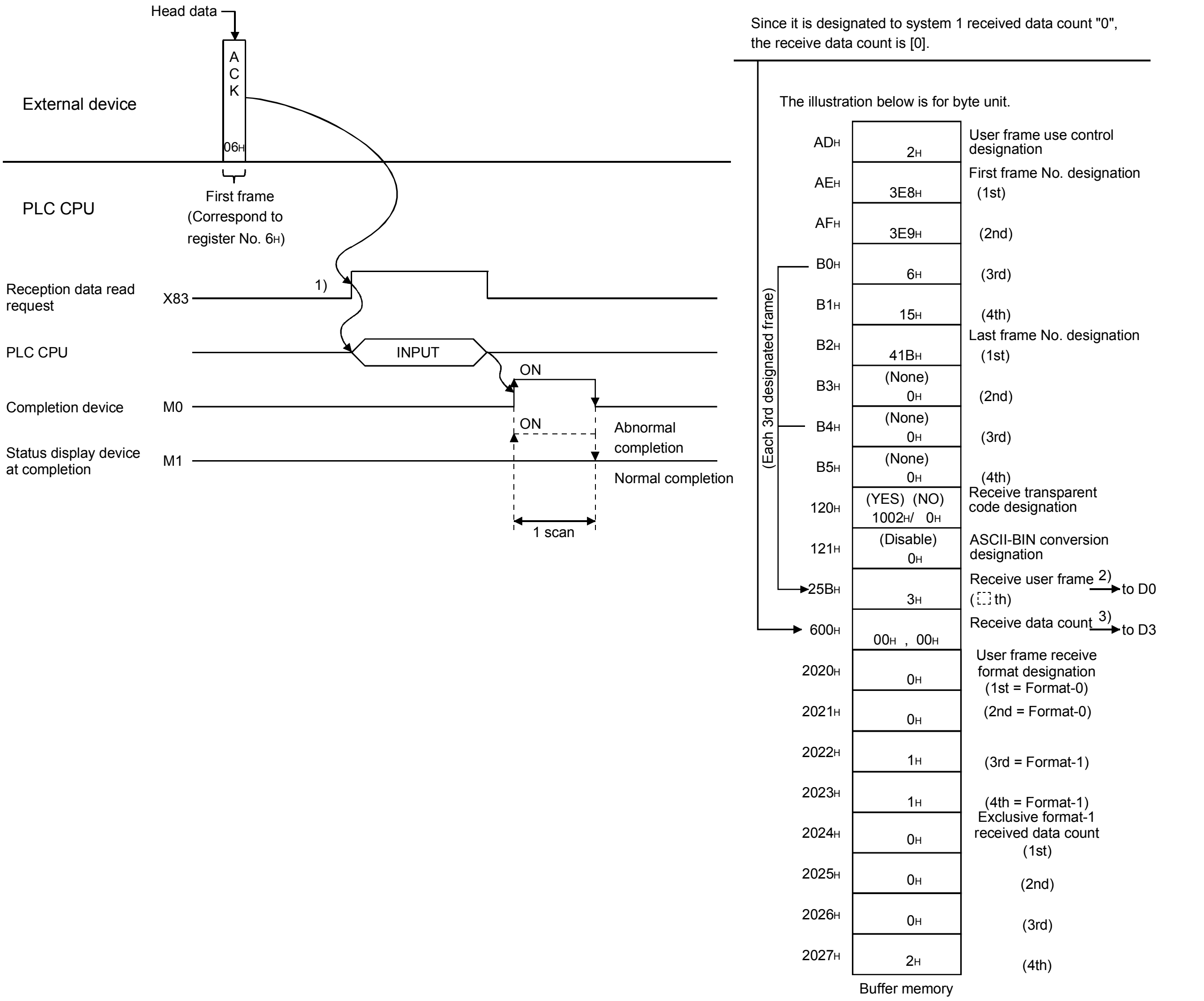


(c) When receiving with user frame only (reception using Format-0)

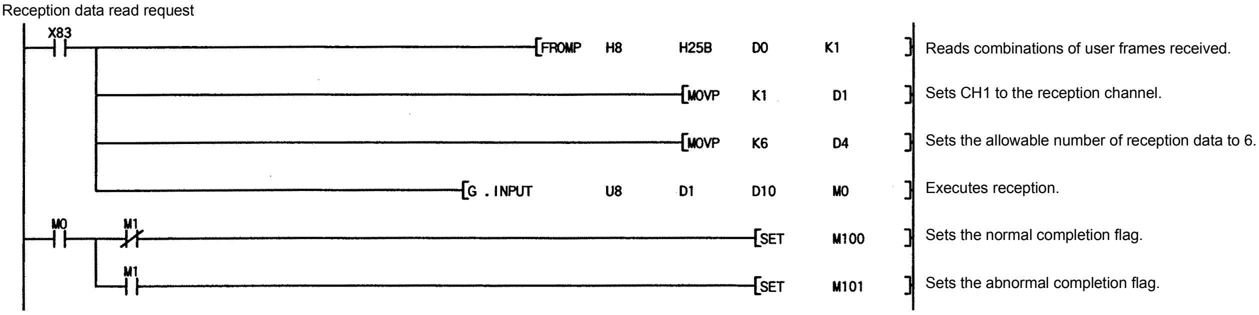




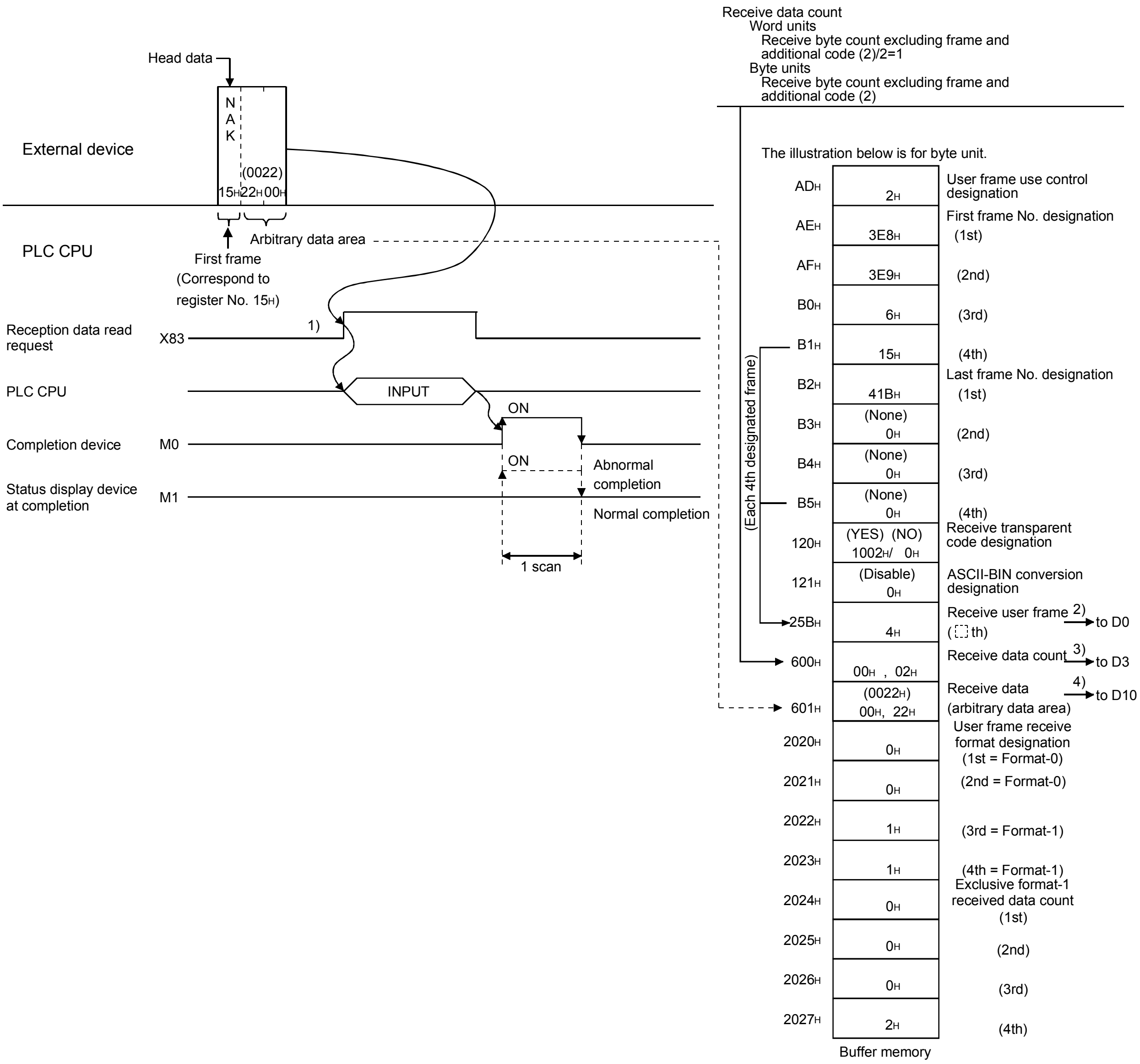
(d) When receiving with first frame only (reception using Format-1)

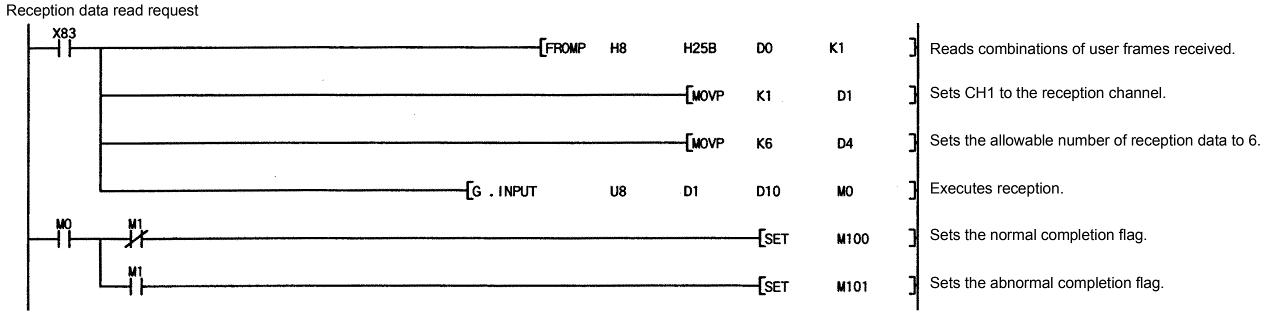


Reception data read request



(e) When receiving with a combination of the first frame and arbitrary data (Exclusive format-1 dedicated received data count) (reception using Format-1)





11.3.3 Application example for data reception using a combination that does not specify the first frame

In the description of this program example, conditions for data reception using a user frame are as follows.

(1) The Q series C24 I/O signal
The Q series C24 is installed at QCPU I/O signal addresses X/Y80 to X/Y9F.

(2) Q series C24 interface used in data communications with the external device
The Q series C24 CH1 side RS-232 interface is used.

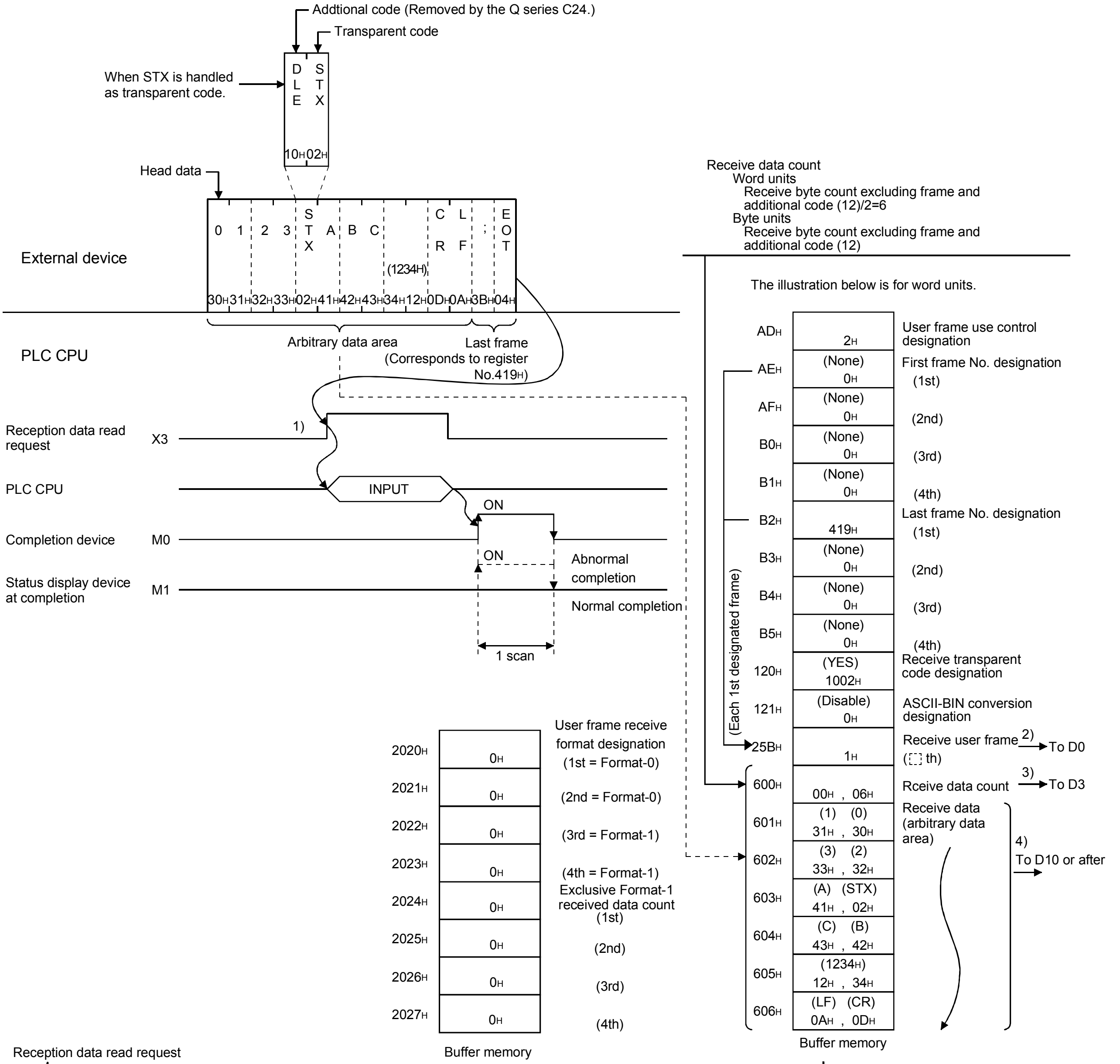
(3) Data to be registered on the GX Configurator-SC "Transmission control and other system settings" screen and "Non procedure system settings" screen used for data communication using a user frame.
Change default values for the items listed in the table below.
Use default values for other items.

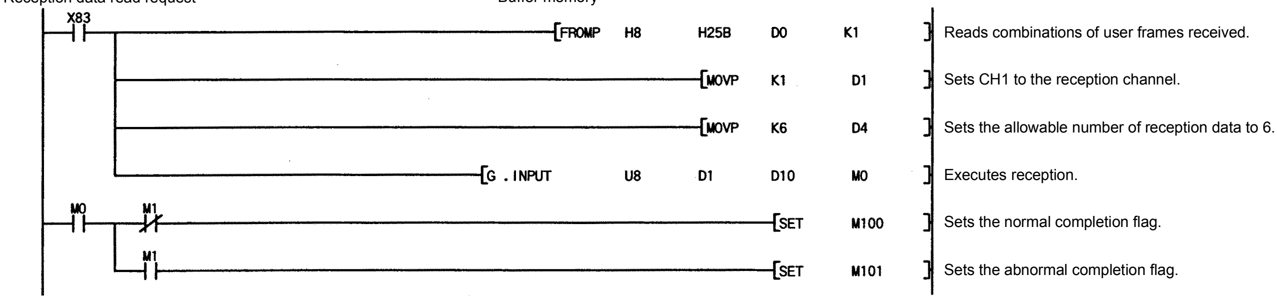
Item	Set contents	Buffer memory address to store registration value	Remarks	Explanation section
Word/byte units designation	Word/byte	96_H	The unit is set to "Word" in the example.	Section 8.4.5 of User's Manual (Basic)
Receive transparent code designation	Yes	120_H	Specify as follows: Additional code: 10_H (DLE) Transparent code: 02_H (STX)	
ASCII-BIN conversion designation	Do not convert	121_H	Select "Do not convert" in the example.	
Received data count	6 to 511	$A4_H$	Set according to the example.	Section 8.4.7 of User's Manual (Basic)
Receive complete code	None	$A5_H$	—	
User frame use control designation	Use	AD_H	See the diagram in the application example.	
First frame No. designation (*1)	None	AE_H to $B1_H$		
Last frame No. designation (*1)	Yes	$B2_H$ to $B5_H$		
User frame receive format designation	Format-0	2020_H to 2023_H	See the diagram in the application example. Specify Format-0 for a combination that does not specify the first frame.	
Exclusive format-1 received data count designation	0_H	2024_H to 2027_H		

*1 This program example gives the registered contents of the user frame No. specified as the first frame No. and the last frame No.

		User frame No.	Registered code	Registered data contents
First frame No.	1st	0_H (none)	—	
	2nd	0_H (none)	—	
	3rd	0_H (none)	—	
	4th	0_H (none)	—	
Last frame No.	1st	419_H	$3B_H$, 04_H	;, E0T
	2nd	0_H (none)	—	
	3rd	0_H (none)	—	
	4th	0_H (none)	—	

(d) When receiving using arbitrary data and last frame combination. (reception using Format-0)





11.4 Data Transmission

This section explains the arrangement of the transmission data and transmission procedure when transmitting data using a user frame.

11.4.1 Send data

The following describes the data list, codes, and handling of the Q series C24 send data during user frame data transmission.

(1) Send data list

Only the data list combinations shown below are allowed during user frame data transmission.

User frame (first n frames)	Arbitrary data area (Send data designation area data)	User frame (last m frames)

Combination \ Data name	User frame (first n frames)	Arbitrary data area	User frame (last m frames)	Note
1)	○	○	○	Total 99 frames
2)	○	○		
3)		○	○	
4)	○			Total 100 frames

○ : Designated data exists

＊2

(When ASCII-BIN conversion disabled)

Codes that can be designated	Codes when transmitting	Note
00_H to FF_H		Added by the Q series C24.
00_H to FF_H		Transmission area data.

(When ASCII-BIN conversion enabled)

Codes that can be designated	Codes when transmitting	Note
0_H to 9_H, A_H to F_H	30_H to 39_H, 41_H to 46_H	Added by the Q series C24. The codes shown at the left are 4-bit codes.
0_H to 9_H, A_H to F_H	30_H to 39_H, 41_H to 46_H	Transmission area data. The codes shown at the left at are 4-bit codes.

＊1

＊1 Four bits of 0_H to F_H data are converted to 30_H to 39_H and 41_H to 46_H ASCII data and transmitted as the data codes of the data to be transmitted (including the transparent code data).

＊2 Send data arbitrary data area

1) When the send data count designated by the PLC CPU during transmission in byte units is an odd number of bytes, the data of the lower byte of the last send data storage location of the send data storage area are transmitted.
2) When ASCII-BIN conversion is enabled, the data to be transmitted is transmitted as 2 characters/byte.

POINT

Handling of the Q series C24 send data

(1) The data of the user frame and the data of the transmission area designated from the PLC CPU are transmitted in the contents and order set in the buffer memory send user frame designation area.

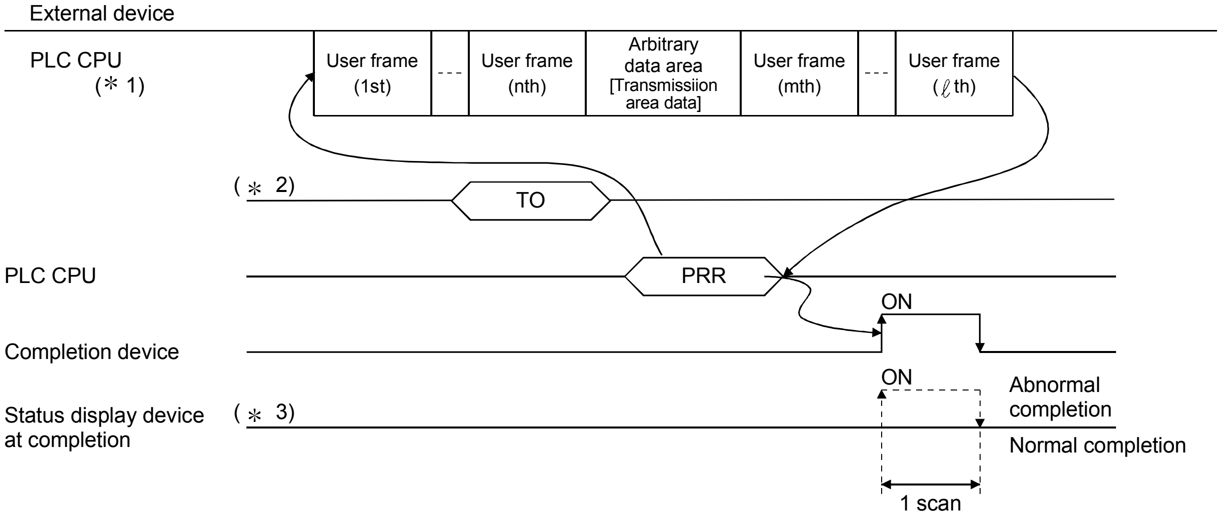
(2) For the user frame section and arbitrary data section, the data can be sent as ASCII code using the ASCII-BIN conversion.
For more details on the ASCII-BIN conversion, see Chapter 13.

(3) If send transparent code is designated, the additional code data is added in front of the transparent code/additional code in the data of the designated area during transmission and transmitted.

11.4.2 Transmission procedure

The following describes the transmission procedure when transmitting a message containing user frames to the external device.

Procedure



＊1 Designates the data of the user frame number to send.

＊2 PLC CPU processing

Before issuing a send request to the Q series C24, designate (write) the following data.

- Transmission user frame designation area
  User frame No., transmission method and transmission order registered in the Q series C24
- Transmission area (Buffer memory)
  User data corresponding to transmit message arbitrary data area

＊3 When a transmission data count error or data transmission error is generated, the Q series C24 stores the error code to the data transmission result storage area and turns on the transmission abnormal end signal (Xn1).

11.4.3 Settings for transmission user frames

These settings are required for sending data to an external device via user frames and the non procedure protocol.
These settings are made from the GX Configurator-SC or the PLC CPU.

(1) Settings via the GX Configurator-SC

Perform settings on the following screen to send data using user frames.

- "Non procedure system settings" screen
- "Transmission user frame No. designation system settings" screen
  For setting contents on each screen, see (2).

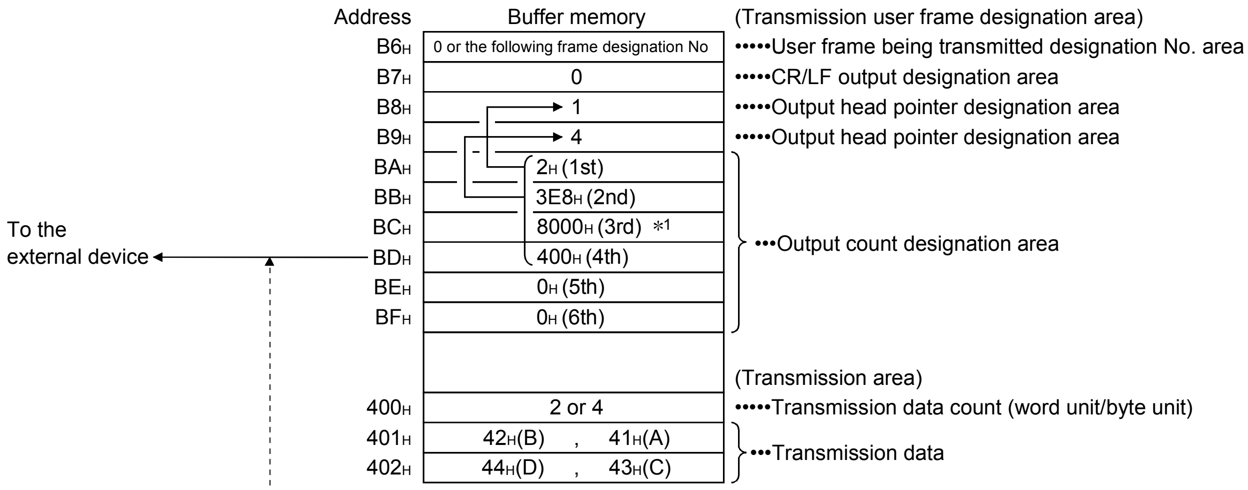
(2) Settings via the PLC CPU

(a) How to designate and write transmission data when transmitting via user frames

For arbitrary data section when sending a combination of user frames and arbitrary data section, the transmission data count and transmission data are written in the transmission area (the same as when sending them in an arbitrary format.)
User frames are registered using the GX Configurator-SC. Or, the user frame registration number to be sent is written from the PLC CPU to the transmission user frame designation area of the buffer memory as shown in the diagram below.
After executing registration/write, the Q series C24 transmits the designated data in the designated order upon execution of the PRR instruction.

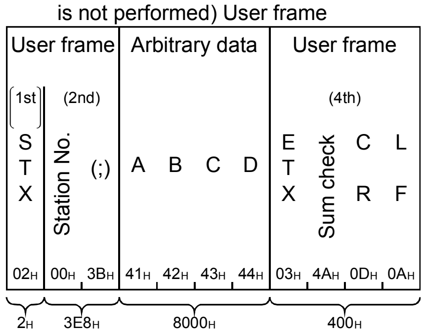
(Example) Sending data in the following sequence

Sending sequence	Transmission data type	User frame No.	Contents of sent/registered data
1	User frame	2_H (2)	02_H (STX)
2	User frame	$3E82_H$ (1000)	00_H, $3B_H$ (station No., ":")
3	Arbitrary data	8000_H (—32768)	41_H, 42_H, 43_H, 44_H ("ABCD")
4	User frame	400_H (1024)	03_H, FF_H, $F6_H$, $0D_H$, $0A_H$ (ETX, Sum check, CR, LF)



*1 When sending data that was written to the transmission area, 8000_H is used as a temporary user frame number. (Refer to (b) 5))

(When the ASCII-BIN conversion is not performed) User frame



Corresponding frame No.

* Figure at left is for byte units.
For word units, the optional data section is sent in the sequence "ABCD."

(b) Transmission user frame designation

The following explains application of the buffer memory to be used when sending data using user frames, along with the designated and stored values.

1) User frame being transmitted storage area (addresses: $B6_H$/156_H)

What number of the output frame number designation area is being sent is stored in the data transmission via user frames.

Buffer memory address	b15 to b0	
$B6_H$	0_H to 64_H	(CH1 side)
156_H	0_H to 64_H	(CH2 side)

0_H(0) : Not sent
1_H to 64_H(1 to 100) : User frame being transmitted designation No. (nth number)

2) CR/LF output designation area (addresses: $B7_H$/157_H)

When sending a user frame or arbitrary data that does not contain a CR/LF, designate whether a CR+LF will be sent each time a user frame or arbitrary data is sent.

Buffer memory address	b15 to b0	
$B7_H$	0 to 1	(CH1 side)
157_H	0 to 1	(CH2 side)

0 : Do not send
1 : Send

3) Output head pointer designation area (addresses: $B8_H$ /158_H)

Write the head position (nth number) in the output frame No. designation area for writing the registration number of the user frame to be sent.

Buffer memory address	b15 to b0	
$B8_H$	0 to 100	(CH1 side)
158_H	0 to 100	(CH2 side)

0 : No designation
1 : Send from the first
to to
100: Send from the 100th

REMARK

Transmission using a user frame cannot be performed when the value of the output head pointer designation area is "0."

4) Output count designation area (addresses: B9$_H$/159$_H$)
Write the output count of the user frames to be sent from the position desingnate in the output head pointer designation area.

Buffer memory address	b15 to b0	
B9$_H$	0 to 100	(CH1 side)
159$_H$	0 to 100	(CH2 side)

0 : No designation
1 : Transmit 1 frame
to to
100: Transmit 100 frames

REMARK

The operation is completed normally without data transmission if the value for the output count designation area is "0."

5) Output frame No. designation area (addresses: BA$_H$ to 11D$_H$/15A$_H$ to 1BD$_H$)
- Write the user frame No. to be sent in the order in which they are output from the position designated in the output head pointer designation area.
- When sending data that is written in the transmission area, use 8000$_H$ as a temporary user frame number.
- By designating user frame number 8000$_H$, the Q series C24 transmits the data of the transmission data designation area for the data count designated in the transmission data count designation area.

Buffer memory address		
BA$_H$	0$_H$ to 801F$_H$ (1st)	(CH1 side)
to	to	
11D$_H$	0$_H$ to 801F$_H$ (100th)	
15A$_H$	0$_H$ to 801F$_H$ (1st)	(CH2 side)
to	to	
1BD$_H$	0$_H$ to 801F$_H$ (100th)	

Specifies the following user frame No. for the data to be sent.
Note that the No. on the right side of the user frame No. below is the No. used for transmission without ASCII-BIN conversion for only the data of any frame section when transmission data is converted into ASCII-binary data and transmitted. See Chapters 12 and 13 for details.

0$_H$: No transmission designation. (No additional transmission is allowed.)
1$_H$ to 3E7$_H$/4001$_H$ to 43E7$_H$: Transmits the default frame having the designated number.
3E8$_H$ to 4AF$_H$/43E8$_H$ to 44AF$_H$: Transmits the user frame having the designated number. (For flash ROM registration)
8000$_H$/C000$_H$: Transmits data in the transmission area of the buffer memory.
8001$_H$ to 801F$_H$/C001$_H$ to C01F$_H$: Transmits the user frame having the designated number. (For buffer memory registration)

POINT

The following transmission can be performed by adding 4000$_H$ to the registered user frame No. and specifying this number.
- When ASCII-BIN conversion is designated, a specified frame can be sent without the conversion. (See Section 13.3.)
- A specified frame can be transmitted without adding the additional code for the send transparent code designation. (See Section 12.3.)

11.5 Transmission program

The following are examples of a sequence program when the user frame (four) and transmission area data are transmitted.
In the description of the sample programs, data transmission using user frames is described for the following conditions case:

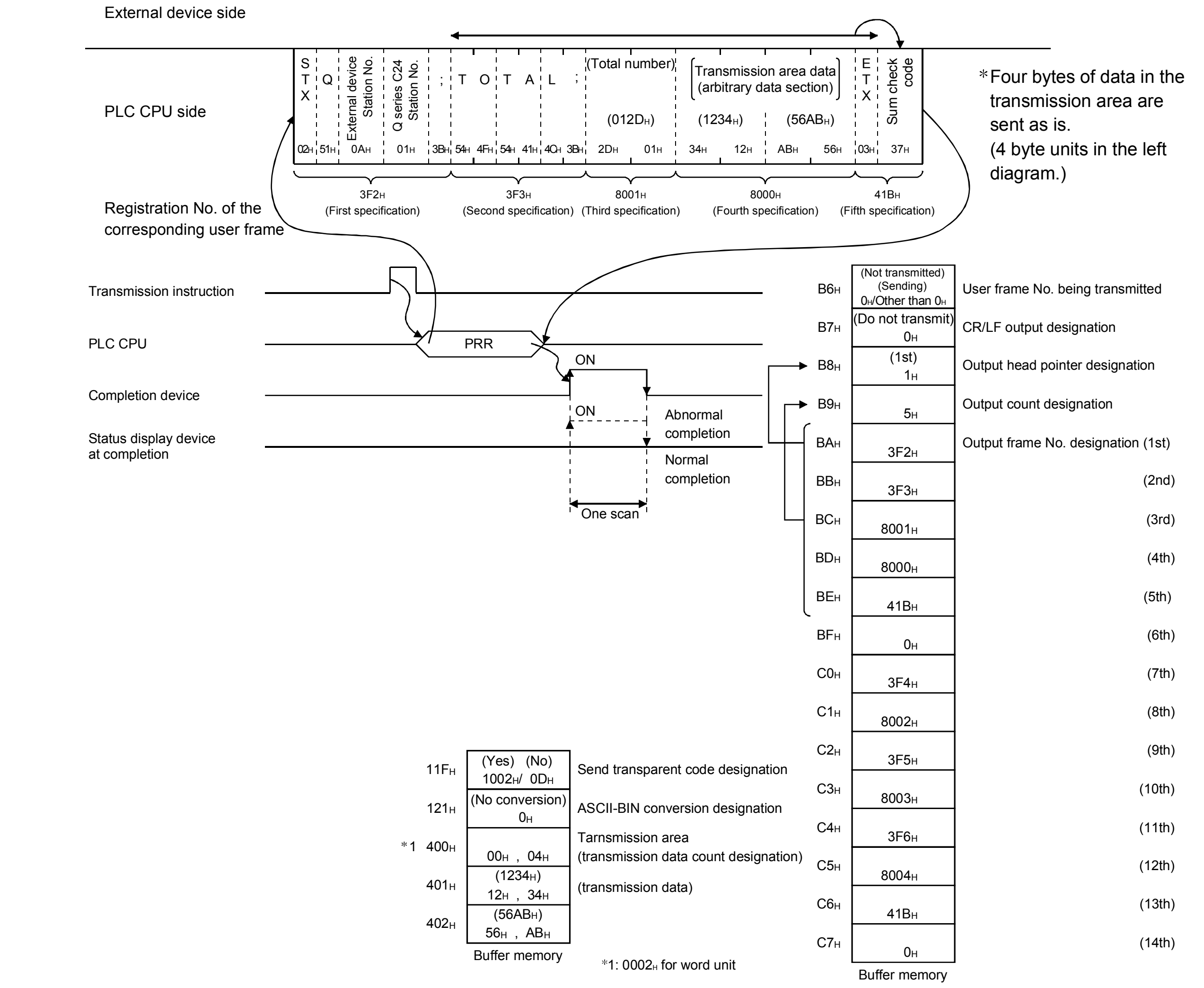
1) The Q series C24 I/O signals
   The Q series C24 installed at QCPU I/O signal addresses X/Y80 to X/Y9F.
2) The Q series C24 interface used in data communications with the external device
   The Q series C24 CH1 RS-232 interface
3) Switch setting using the GX Developer
   Set the following setting values on the "Intelligent function module switch setting" screen in accordance with Section 4.5 of User's Manual (Basic).

Setting item		Setting value	Remarks
Switch 1	CH1 Transmission setting	Set according to the external device	—
	CH1 Communication rate setting		
Switch 2	CH1 Communication protocol setting	0006_H	Non procedure protocol
Switch 3	CH2 Transmission setting	0000_H	Not used
	CH2 Communication rate setting		
Switch 4	CH2 Communication protocol setting	0000_H	
Switch 5	Station No. setting	0001_H	Q series C24 station number (used in the user frame)

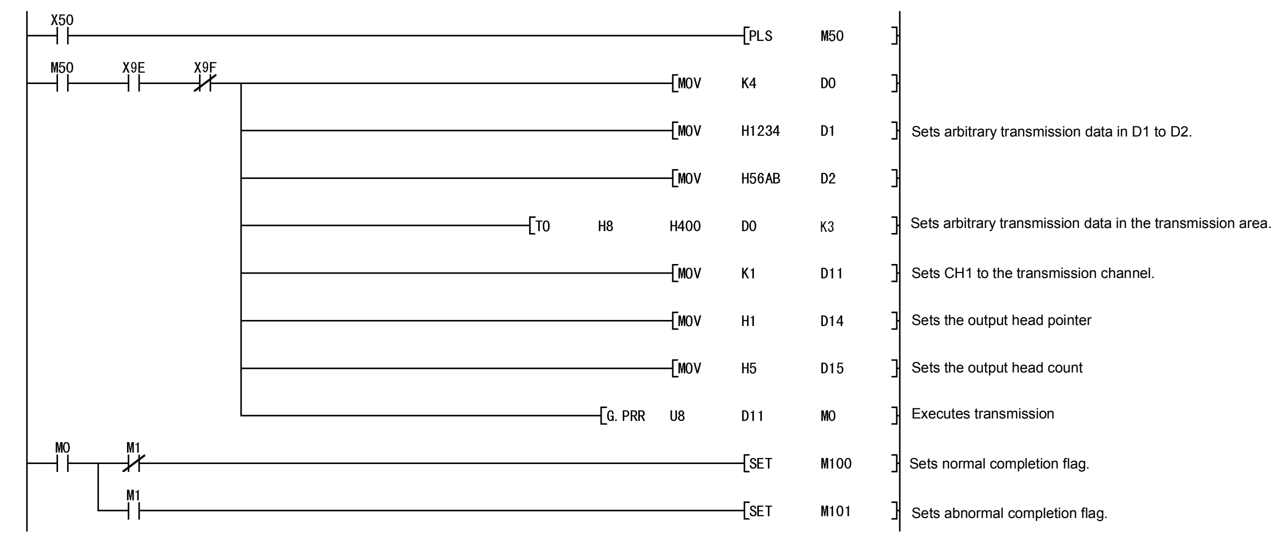
4) Data to be registered on the GX Configurator-SC's "Transmission control and others system setting" screen and the "Non procedure system settings" screen for data communication via user frames
   Change the default values for the items listed in the table below. Use default settings for other items.
   * In example (2), the output frame No. is not registered using the GX Configurator-SC. (It is registered using a sequence program.)

Item	Set contents	Buffer memory address to store registration value	Remarks	Explanation section
Word/byte units designation	Byte	96_H	—	Section 8.4.5 of User's Manual (Basic)
Send transparent code designation	No	$11F_H$	Additional code: 10_H (DLE) Transparent code: 02_H (STX)	
ASCII-BIN conversion designation	Disable	121_H	—	
Output frame No. designation 1st	$3F2_H$	BA_H	See the diagram in the application example.	Section 8.4.10 of User's Manual (Basic)
Output frame No. designation 2nd	$3F3_H$	BB_H		
Output frame No. designation 3rd	8001_H	BC_H		
Output frame No. designation 4th	8000_H	BD_H		
Output frame No. designation 5th	$41B_H$	BE_H		

(1) Example of a sequence program when setting is done using the GX Configurator-SC
＊ See Chapter 17 of this manual for details on the PRR command.



Transmission instruction

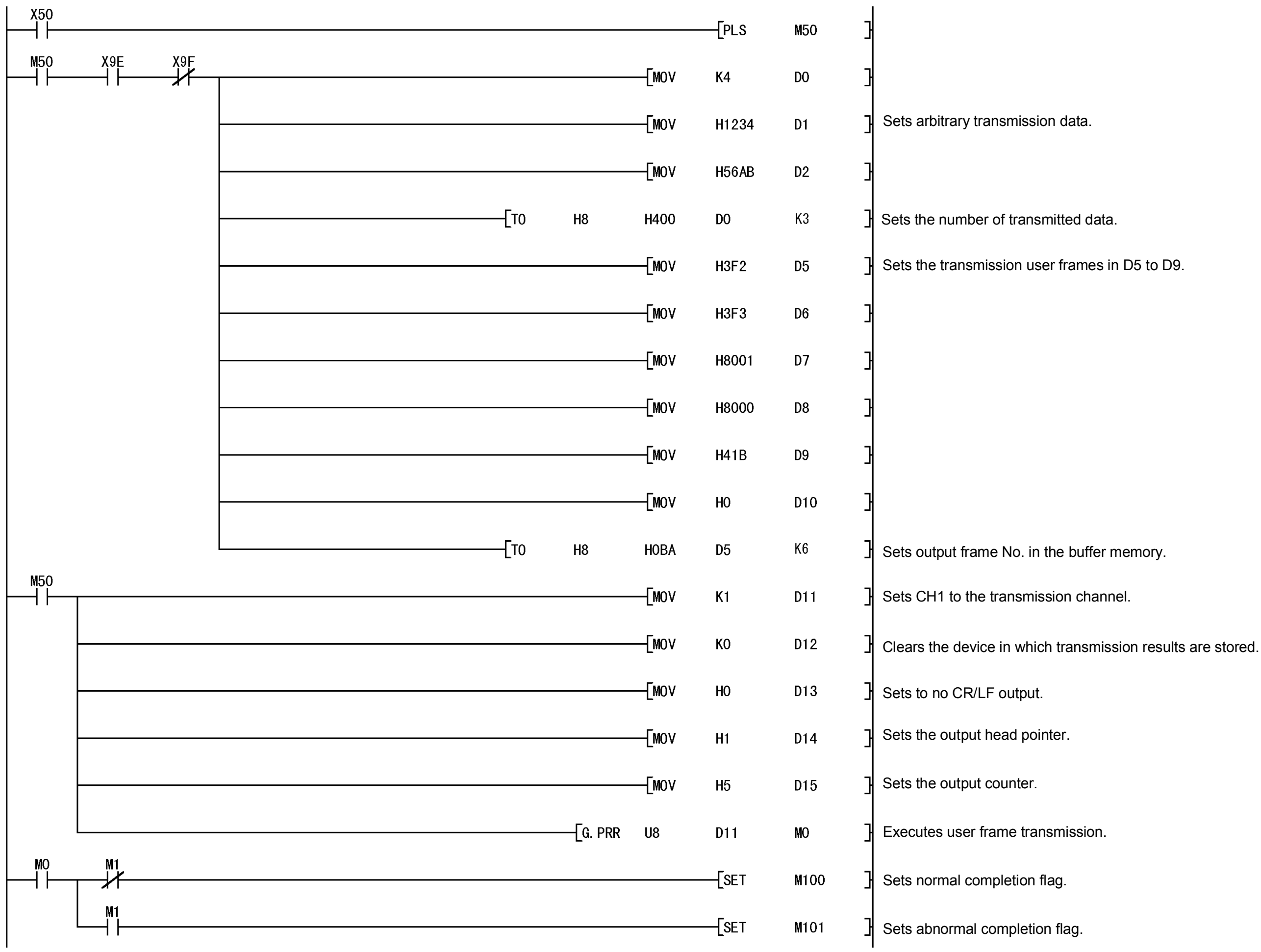


(2) Example of a sequence program when setting is not done using the GX Configurator-SC

The following is the method of data transmission without performing the output frame No. designation using the GX Configurator-SC.

＊ For further details on the PRR instruction, see Chapter 17 of this manual.

Transmission instruction



	Normal end		Abnormal end	
D0	Send data count	(0004H)	Send data count	(0004H)
D1	Send data	(3412H)	Send data	(3412H)
D2		(AB56H)		(AB56H)
D5	Output frame No.	(03F2H)	Output frame No.	(03F2H)
D6		(03F3H)		(03F3H)
D7		(8001H)		(8001H)
D8		(8000H)		(8000H)
D9		(041BH)		(041BH)
D10		(0000H)		(0000H)
D11	Interface No.	(0001H)	Interface No.	(0001H)
D12	Transmission result	(0000H)	Transmission result	(other than 0000H)
D13	CR/LF output	(0000H)	CR/LF output	(0000H)
D14	Output head pointer	(0001H)	Output head pointer	(0001H)
D15	Output counter	(0005H)	Output counter	(0005H)

12 TRANSPARENT CODES AND ADDITIONAL CODES

Transparent codes and additional codes are used during data communication with an external device to send/receive one-byte data for transmission control on the external device side as user data.
Transparent codes and additional codes are handled in data communication using the non procedure or bidirectional protocol.

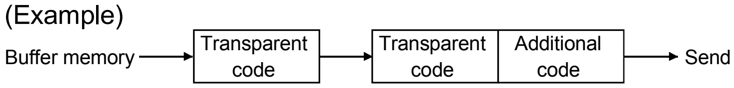
- Transparent code: One-byte data for transmission control.
- Additional code : During transmission, one-byte data added preceding the transparent code and additional code data.
  During reception, one-byte data deleted (the immediately succeeding one-byte data is processed for reception).

12.1 Handling the Transparent Code and Additional Code Data

The following explains how the Q series C24 handles transparent codes and additional codes during data communication using the non procedure or bidirectional protocol.
The range of additional code data that is added or deleted is explained in Sections 12.3 and 12.5.

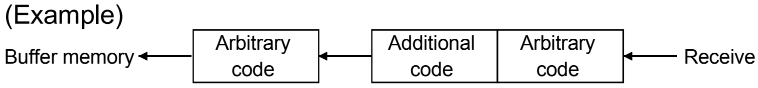
(1) During data transmission

Additional code data is added immediately before the transparent code and additional code data set for transmission.
(Example)



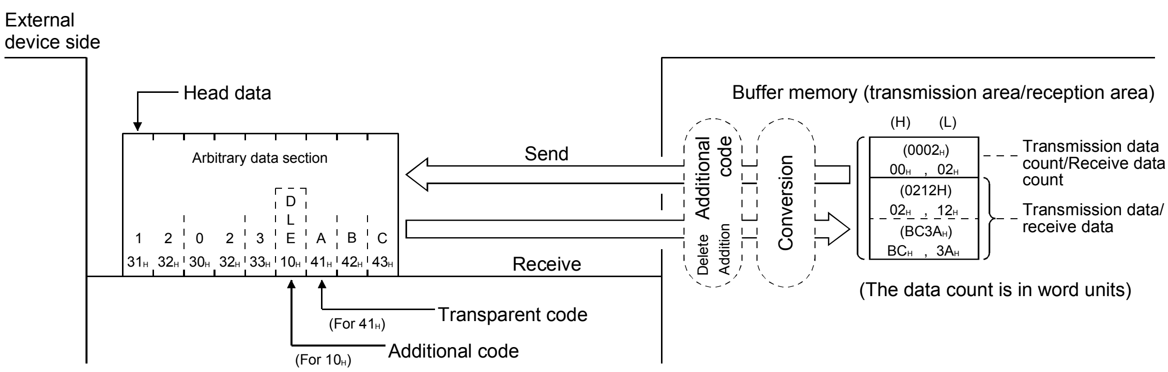
(2) During data reception

When additional code data set for reception is detected, the additional code data is removed and the immediately succeeding one-byte data is processed for reception.
(Example)



(3) During data communication using the ASCII-BIN conversion

The handling of transparent codes and additional codes is done for data after ASCII-BIN conversion during transmission and data immediately before the conversion during reception.
(Example) When communicating using an arbitrary format of the non procedure protocol



12.2 Registering Transparent Codes and Additional Codes

To control transparent codes and additional codes for data to be sent/received with the non procedure or bidirectional protocol, it is necessary to perform settings in the Q series C24 prior to data communication.
The following explains the registration of transparent and additional codes.

(1) For each interface, 10 combinations and one combination of transparent codes and additional codes can be set for transmission and reception, respectively.

(2) Transparent and additional codes are registered on the GX Configurator-SC's "Transmission control and others system setting" screen.
For details on the screen used for registration, see Section 8.4.5 of User's Manual (Basic).

POINT

If additional data code is received during data reception, the Q series C24 will not treat the immediately succeeding one-byte data as the following control data:
- Data received as the first frame and last frame of the user frames

Therefore, do not set the following:
(The code of the data described above cannot be designated as additional codes for data reception).

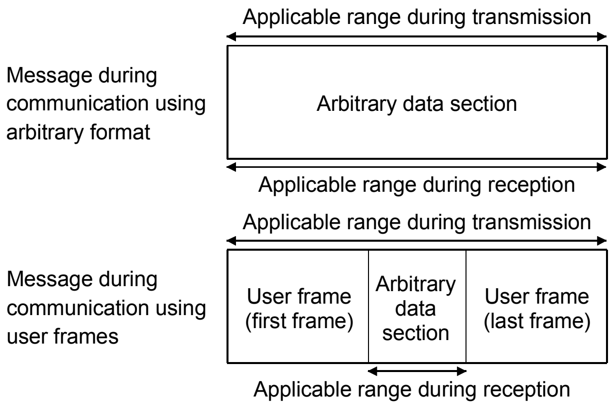
1) A receive user frame that contains additional code data for data reception
2) The same reception complete code as the additional code data for data reception

12.3 Handling Transparent Codes and Additional Codes During Non Procedure Protocol Data Communication

The following explains the handling of transparent codes and additional codes during non procedure protocol data communication.

(1) The data designated by the additional code will be added to or deleted from the data to be transmitted or received.

(2) The following shows the range of communication data for which processing of transparent codes and additional codes is performed.

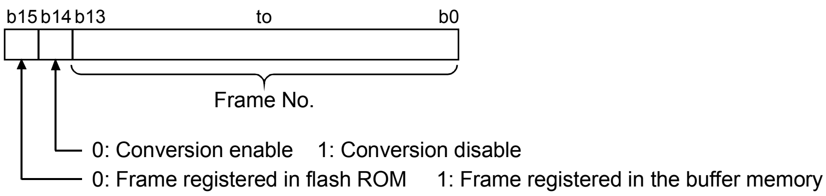


The Q series C24 performs the following processing during data transmission and reception:

(a) When an additional code set for reception is detected during data reception, the additional code data is removed and the immediately succeeding one-byte data is processed for reception as part of the receive data.

(b) When transparent code/additional code data set for transmission is detected during data transmission, the additional code designation data is added immediately before, and is then transmitted.

＊ During data transmission using user frames, even if a transparent code or additional code has been specified in the send transparent code designation area, it is possible to transmit data without adding the additional code data to the user frame portion or arbitrary data.
When sending data without adding the additional code data specified by the send transparent code designation, specify the user frame No. using the following method.
- Specify the number obtained by adding 4000_H to the registered user frame No.



When sending the data for the section designated by 4001_H to $44AF_H$ and $C000_H$ to $C01F_H$, data will be sent without conversion even if "Enable" has been specified in the ASCII-BIN conversion designation area. (See Section 13.3.)

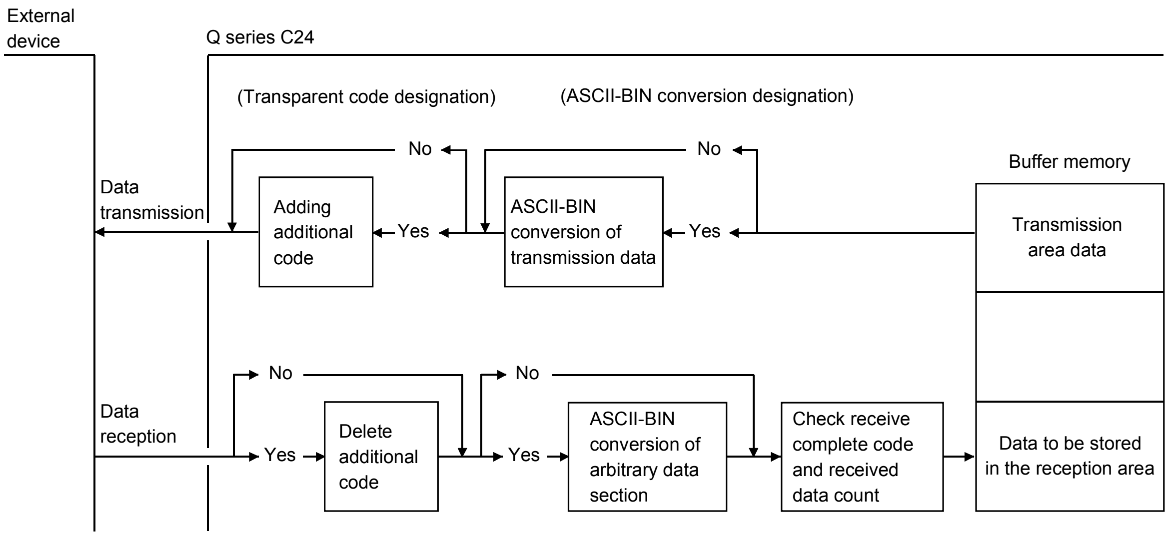
No. of the use frame to be sent	Designation No. when sending data without adding the additional code specified by the send transparent code designation.
1_H to $3E7_H$ (1 to 999)	4001_H to $43E7_H$ (16385 to 17383)
$3E8_H$ to $4AF_H$ (1000 to 1199)	$43E8_H$ to $44AF_H$ (17384 to 17583)
8000_H to $801F_H$ (-32768 to -32737)	$C000_H$ to $C01F_H$ (-16384 to -16353)

(3) The following describes the processing steps taken by the Q series C24 when performing communication with the transparent code designation and the ASCII-BIN conversion enabled.

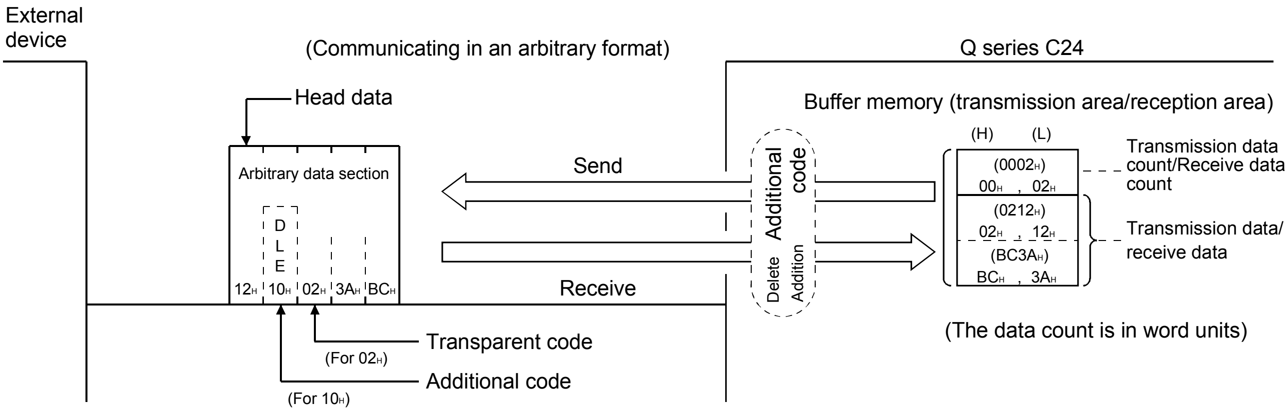
(a) Communication using arbitrary format

1) Receiving
- If a receive transparent code is designated, the additional code designation data is deleted (removed).
- The arbitrary data section is stored in the reception area of the buffer memory.
  If the ASCII-BIN conversion is designated, the data section is stored in the buffer memory after it has been converted to binary code data.
- During reception of an arbitrary data section, if the reception-complete code data or the entire count of receive data has been stored, a reception-data read is requested of the PLC CPU.

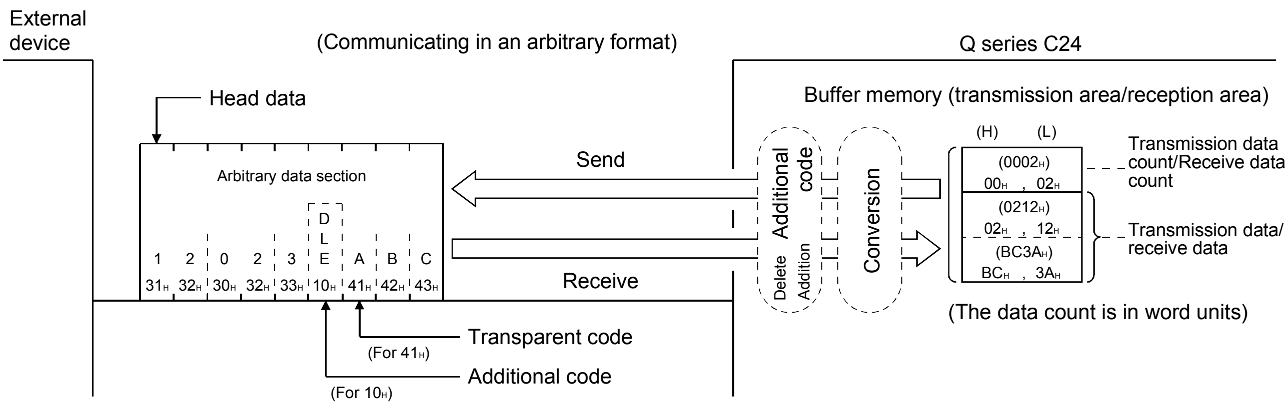
2) Sending
- The transmission data designated from the PLC CPU (arbitrary data section of the transmission message) is sent.
  If the ASCII-BIN conversion is designated, the transmission data section is sent after it has been converted to binary code data.
- If a send transparent code is designated, additional code data is added preceding the transparent code/additional code data, and is then transmitted.



(Example) When ASCII-BIN conversion is not performed



(Example) When ASCII-BIN conversion is performed



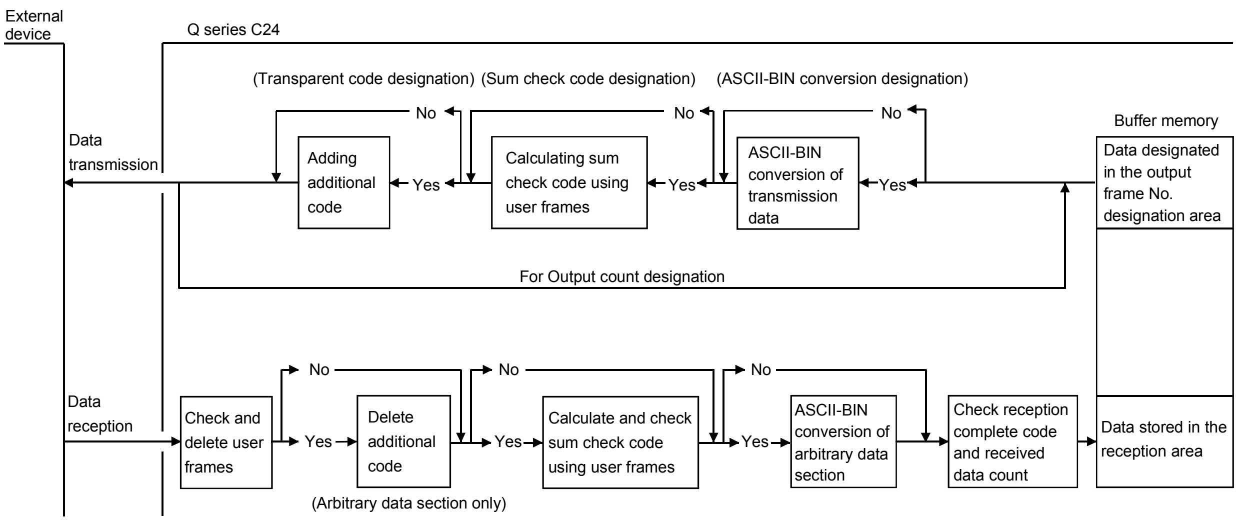
(b) Communication using user frames

1) Receiving

- Reception check of user frames (first frame, last frame) is performed.
- If a receive transparent code is designated, the additional code designation data is deleted (removed) from the arbitrary data section.
- If a sum check code is designated in a user frame (last frame), the sum check code is calculated.
- The arbitrary data section is stored in the reception area of the buffer memory.
  If the ASCII-BIN conversion is designated, the data section is stored in the buffer memory after it is converted to binary code data.
- During reception of an arbitrary data section, if the reception complete code or the entire count of received data has been stored, or when a user frame (last frame) has been received, a receive data read is requested of the PLC CPU.

2) Sending

- The transmission data designated by a user frame or the PLC CPU (arbitrary data section of the transmission message) is sent in the order designated by the user.
- If the ASCII-BIN conversion is designated, the applicable range of data is sent after data is converted to ASCII code data.
  Also, if a send transparent code is designated, the applicable range of data is sent after adding additional code data before the transparent code/additional code data.



POINT

Explained above is how the Q series C24 processes communication data when enabling and disabling the communication via the user-frame function, ASCII-BIN conversion function, and/or transparent code-designation communication function.
When communicating data to an external device, use this information as a reference in the selection of a communication method.

12.4 Example of Data Communication Using the Non Procedure Protocol

This section shows examples of data communication using the non procedure protocol when the following settings and registrations are made.

(1) Settings via GX Developer

Perform the following settings on the "Intelligent functional module switch setting" screen.
(See Section 4.5 of the User's Manual (Basic))

Setting item		Setting value	Remarks
Switch 1	CH1 Transmission setting	Set according to the external device	—
	CH1 Communication rate setting		
Switch 2	CH1 Communication protocol setting	0006_H	Non procedure protocol
Switch 3	CH2 Transmission setting	0000_H	Not used
	CH2 Communication rate setting		
Switch 4	CH2 Communication protocol setting	0000_H	
Switch 5	Station No. setting	0000_H	Q series C24 station number

(2) Settings via GX Configurator-SC

Register the following on the "Transmission control and others system setting" screen and the "Non procedure system settings" screen.
(See Sections 8.4.5 and 8.4.7 of User's Manual (Basic))
＊ For items other than those noted below, the default values are used.

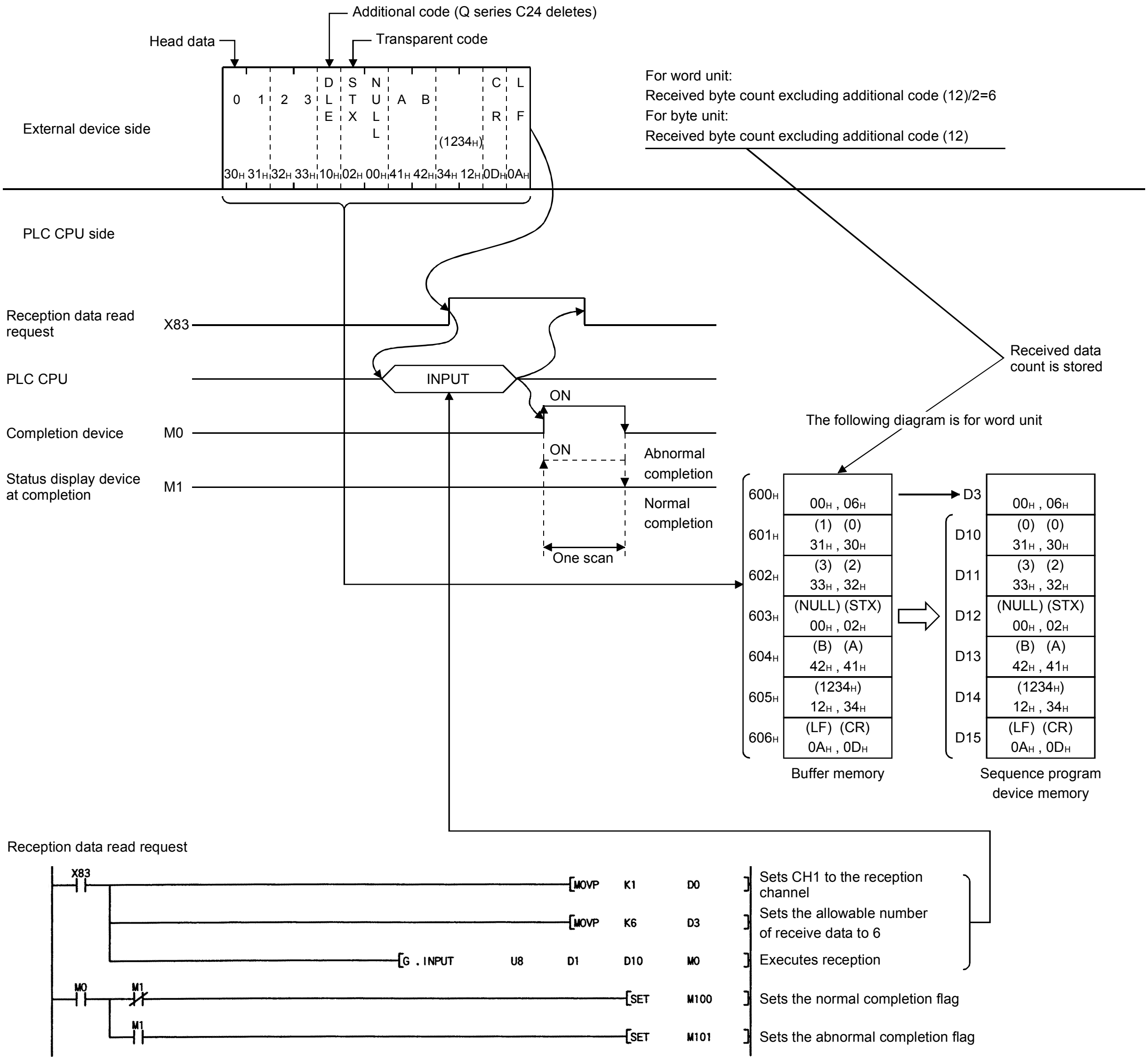
Registration screen	Setting item	Setting value	Remarks
Transmission control and other system settings	Send transparent code designation 1st combination	1002_H	Transparent code : 02_H (STX) Additional code : 10_H (DLE)
	Send transparent code designation 2nd combination	1003_H	Transparent code : 03_H (ETX) Additional code : 10_H (DLE)
	Receive transparent code designation 1st combination	1002_H	Transparent code : 02_H (STX) Additional code : 10_H (DLE)
Non procedure system settings	Received data count designation	0006_H	—

12.4.1 Example of data reception

The following shows an example of storing receive data in the data register.

(1) Receiving based on the receive complete code

Additional code: 10_H (DLE), transparent code: 02_H (STX), complete code: $0D0A_H$ (CR + LF)



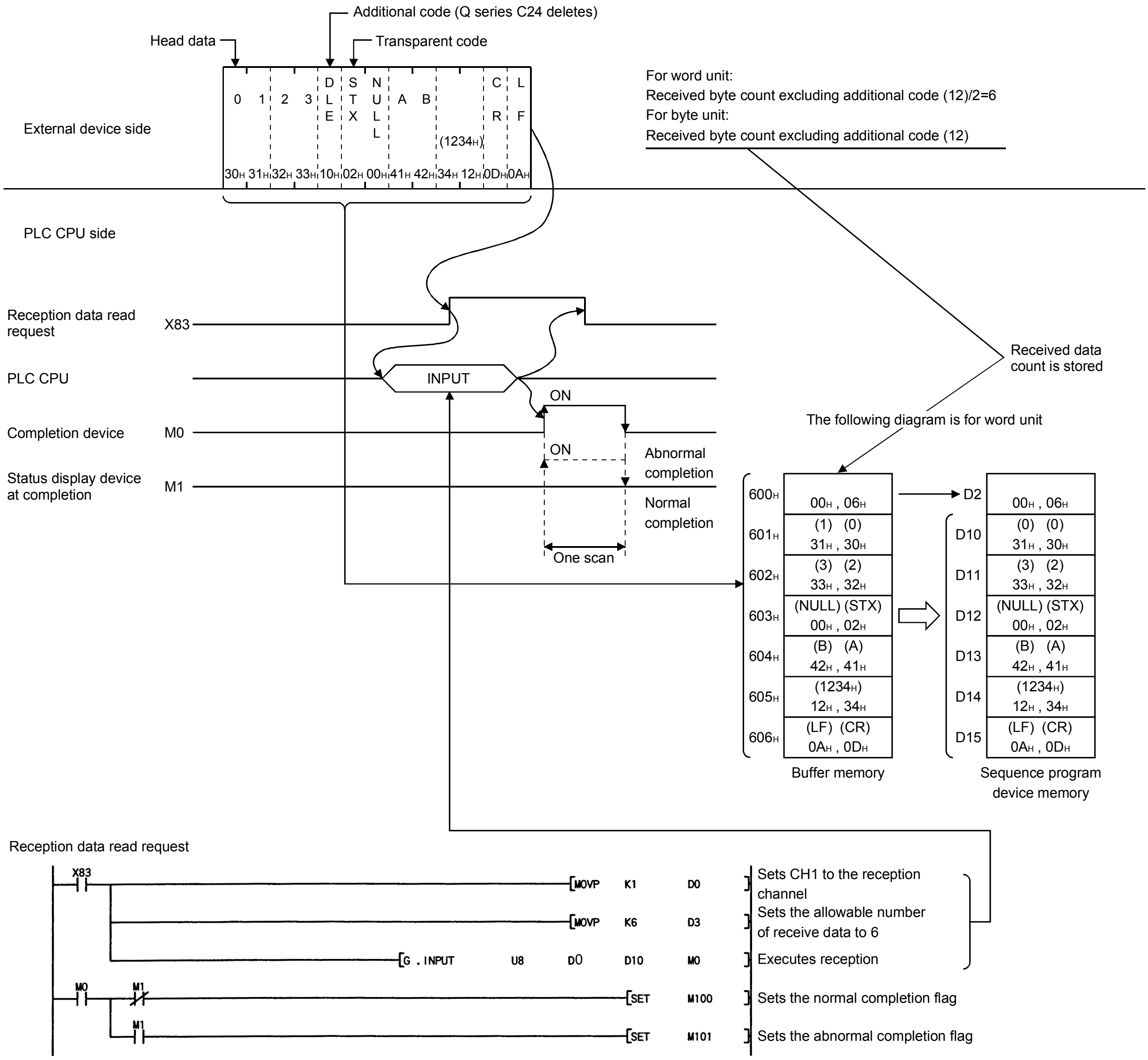
POINT

When the receive transparent code designation is set to Enable and the ASCII-BIN conversion is set to Disable, the codes for receivable data and those for receive data that is stored in the buffer memory's reception area as follows:

		Receivable codes	Codes stored in the reception area
Receive transparent code designation section	Additional code	01_H to FF_H	(Delete)
	Transparent code	00_H to FF_H	00_H to FF_H
Arbitrary data section (including complete code)		00_H to FF_H	00_H to FF_H

(2) Receiving based on the completed data count

Additional code: 10H (DLE), transparent code: 02H (STX),
Completed data count: Six words or 12 bytes



POINT

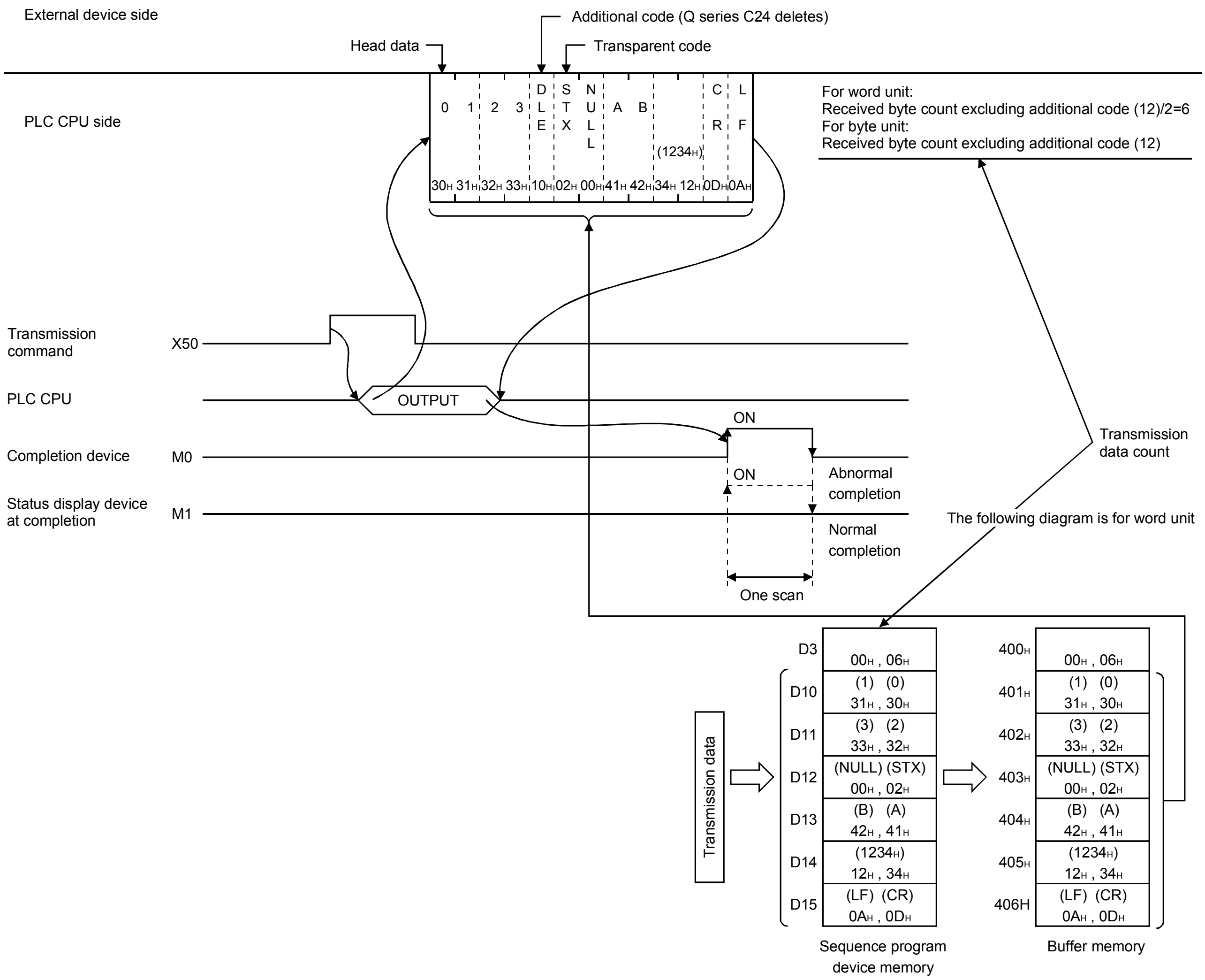
When the receive transparent code designation is set to Enable and the ASCII-BIN conversion is set to Disable, the codes for receivable data and those for receive data that is stored in the buffer memory's reception area as follows:

		Receivable codes	Codes stored in the reception area
Receive transparent code designation section	Additional code	01H to FFH	(Delete)
	Transparent code	00H to FFH	00H to FFH
Arbitrary data section (including complete code)		00H to FFH	00H to FFH

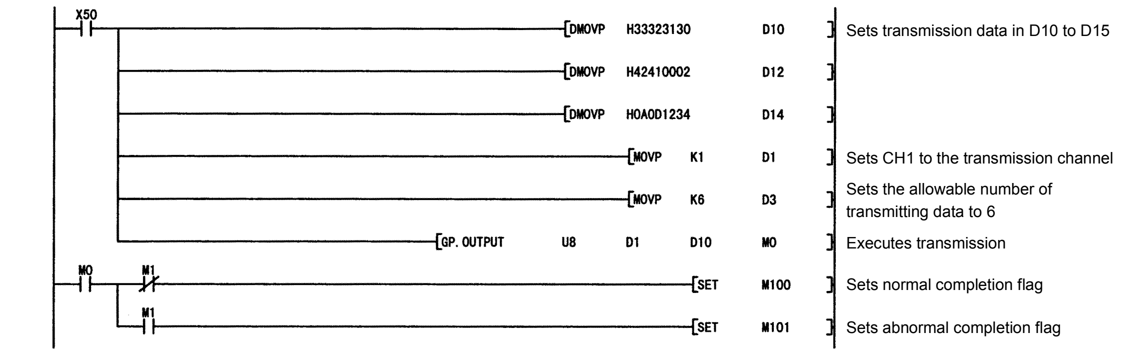
12.4.2 Example of data transmission

The following shows an example of data transmission.

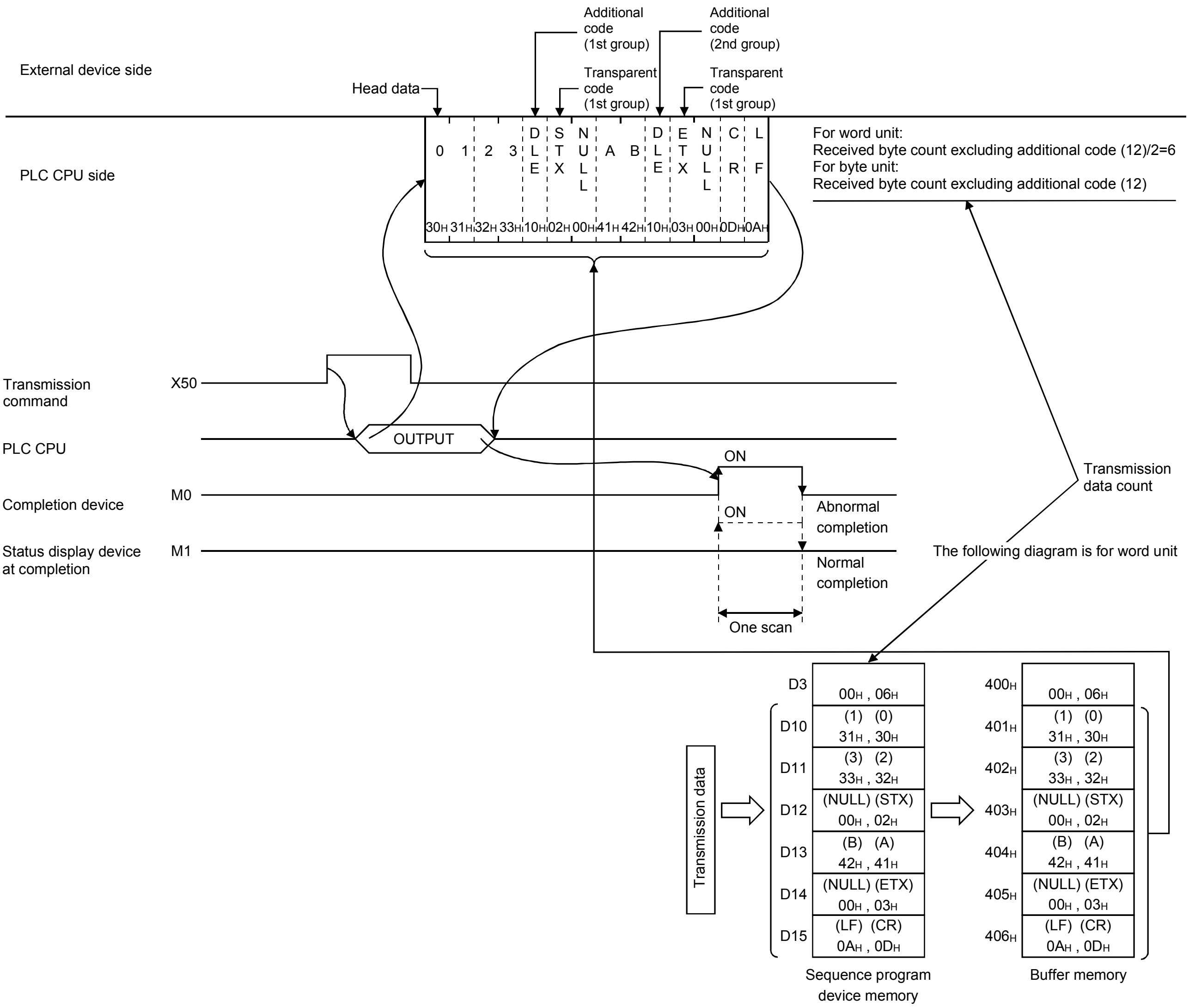
1) Additional code: 10H (DLE), transparent code: 02H (STX)



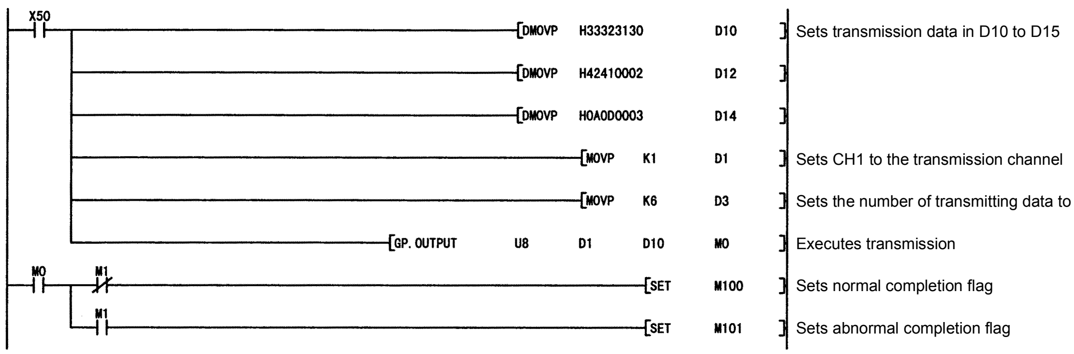
Transmission instruction



2) Additional code: 10H (DLE), transparent code: 02H (STX) (1st group)
Additional code: 10H (DLE), transparent code: 03H (ETX) (2nd group)



Transmission instruction

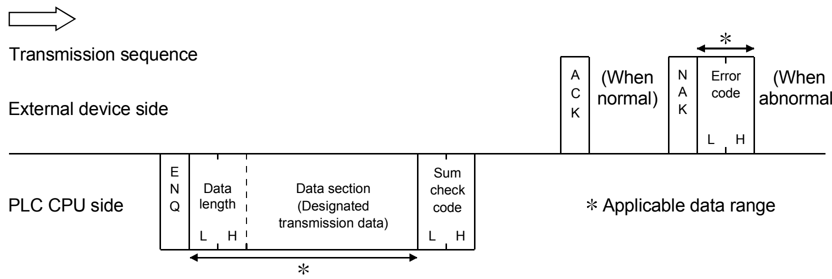


12.5 Handling Transparent Codes and Additional Codes During Bidirectional Protocol Data Communication

The following explains the handling of transparent codes and additional codes during data communication using the bidirectional protocol.

(1) The additional code designation data will be added to or deleted from the data that is sent or received.

(2) Communication data for which transmission/reception processing of transparent codes and additional codes is performed includes the message data length, data section and error code.
Such processing is not performed for the head code (ENQ, ACK, NAK) and sum check code of a message.
(Example)

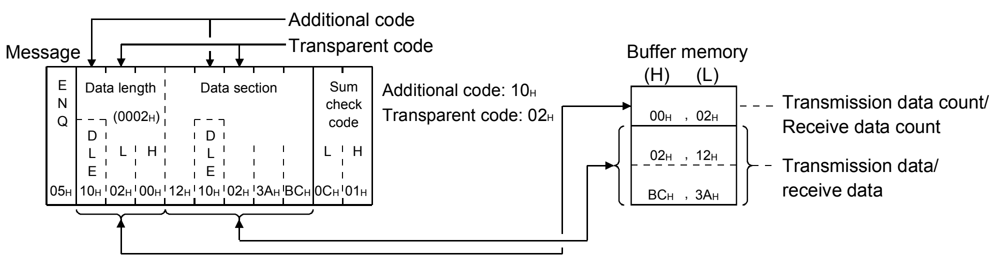


The Q series C24 performs the following processing during data transmission/reception.

(a) When an additional code set for reception is detected during data reception, the additional code data is removed and the immediately succeeding one-byte data is processed for reception as part of the receive data.
When transparent code/additional code data set for transmission is detected during transmission of a message in response to data reception, the additional code designation data is added immediately before, and is then transmitted.

(b) When transparent code/additional code data set for transmission is detected during data transmission, the additional code designation data is added immediately before, and is then transmitted.
When an additional code set for reception is detected while a message is being received in response to data transmission, the additional code data is removed and the immediately succeeding one-byte data is processed for reception as part of the receive data.

(c) Data having an additional code that is added or deleted cannot be included in the data length, nor will it be used for the sum check code.
(Example) When not using the ASCII-BIN conversion

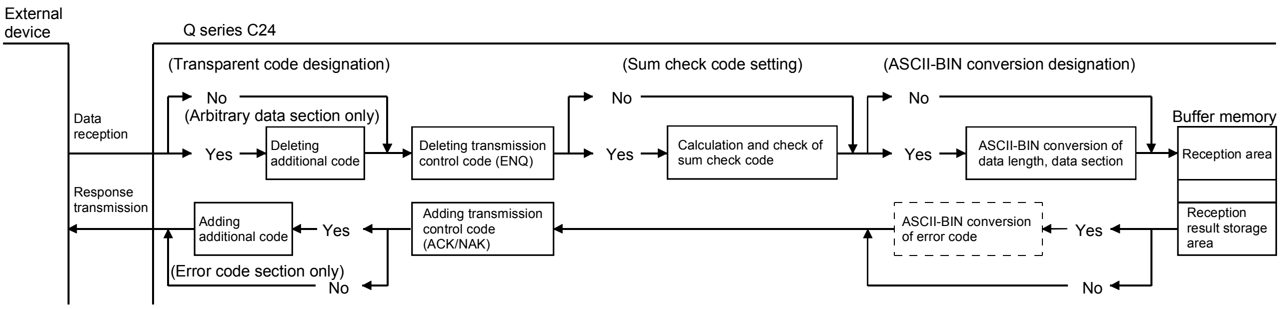


(3) The following shows the processing steps taken by the Q series C24 when performing communication with the transparent code designation and ASCII-BIN conversion enabled.

POINT
Explained above is how the Q series C24 processes communication data, when enabling and disabling the ASCII-BIN conversion function and/or transparent code designation communication function. When communicating data to an external device, use this information as a reference in the selection of a communication method.

(a) Receiving

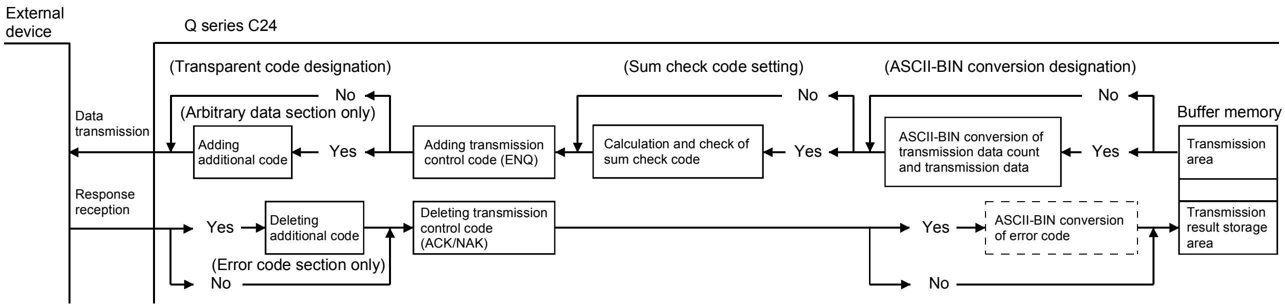
1) If a receive transparent code is designated, the additional code designation data is deleted (removed) from the arbitrary data section.
2) The arbitrary data section is stored in the reception area of the buffer memory.
   If the ASCII-BIN conversion is designated, the data section is stored in the buffer memory after it is converted to binary code data.
3) When the data section of the designated data length is received, a receive data read is requested of the PLC CPU.
   If the sum check code is set to Enable in the transmission setting via GX Developer switch settings, a reception data read is requested of the PLC CPU upon reception of the sum check code.



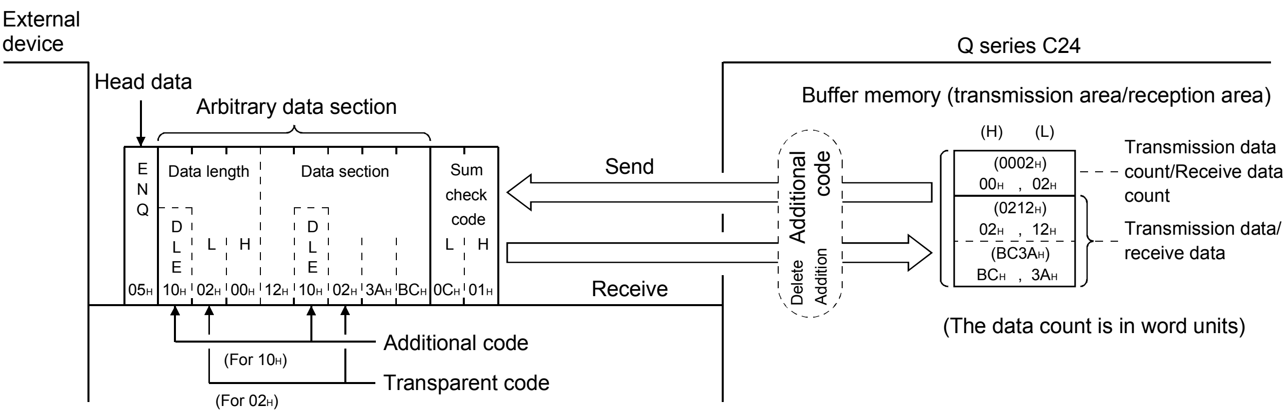
(b) Sending

1) The transmission control code data is added to the transmission data designated by the PLC CPU (arbitrary data section of the transmission message), and that transmission data is transmitted.
   If ASCII-BIN conversion is designated, the transmission data is sent after it is converted to ASCII code data.
2) If the sum check code is set to Enable in the transmission setting via GX Developer switch settings, the code will be calculated from the transmission message and added to the transmission message.

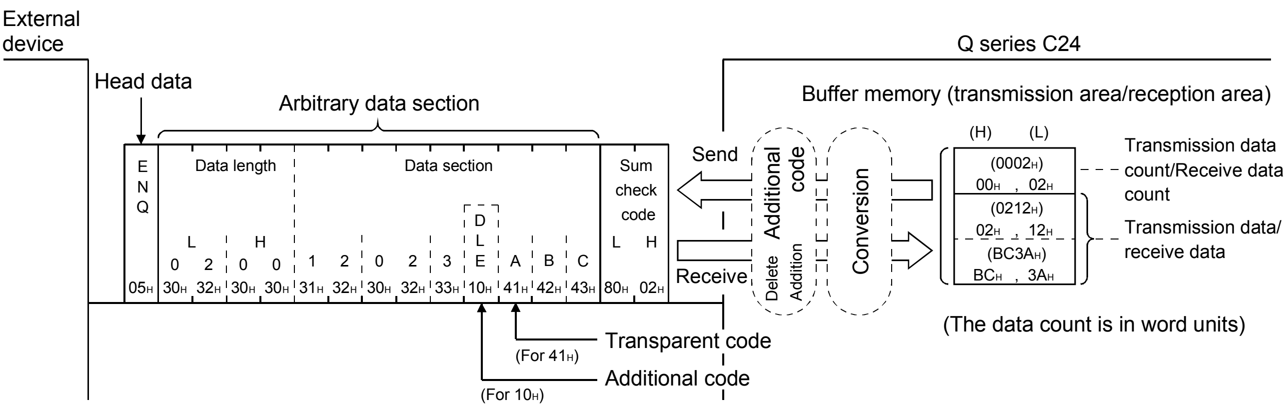
3) If a send transparent code is designated, additional code data is added preceding the transparent code/additional code data for the arbitrary data section, and is then sent.



(Example) The following example shows the data arrangement when data is sent and received. (The communication section of the response message is omitted).
(When the ASCII-BIN conversion is not performed)



(When the ASCII-BIN conversion is performed)



12.6 Example of Data Communication Using the Bidirectional Protocol

This section shows examples of the bidirectional protocol data communication when the following settings and registrations are made.

(1) Settings via GX Developer

Perform the following settings on the "Switch setting" screen.
(See Section 4.5 of the User's Manual (Basic)).

Setting item		Setting value	Remarks
Switch 1	CH1 Transmission setting	Set according to the external device	—
	CH1 Communication rate setting		
Switch 2	CH1 Communication protocol setting	0007H	Bidirectional protocol
Switch 3	CH2 Transmission setting	0000H	Not used
	CH2 Communication rate setting		
Switch 4	CH2 Communication protocol setting	0000H	
Switch 5	Station No. setting	0000H	Q series C24 station number

(2) Settings via GX Configurator-SC

Register the following settings on the "Transmission control and others system setting" screen.
(See Section 8.4.5 of User's Manual (Basic)).
* For items other than those listed below, the default values are used.

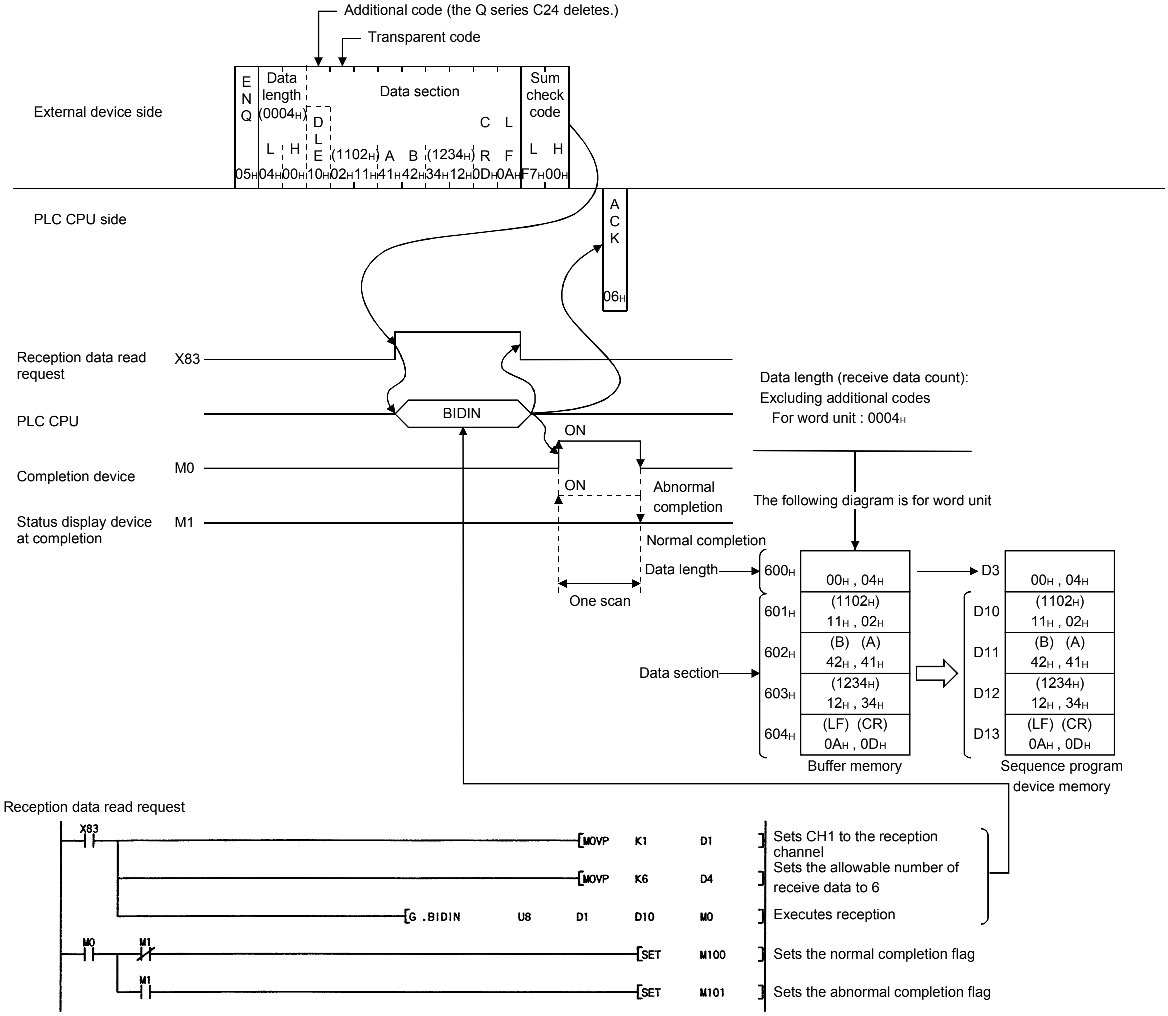
Registration screen	Setting item	Setting value	Remarks
Transmission control and other system settings	Send transparent code designation 1st combination	1002H	Transparent code : 02H (STX) Additional code : 10H (DLE)
	Send transparent code designation 2nd combination	1003H	Transparent code : 03H (ETX) Additional code : 10H (DLE)
	Receive transparent code designation 1st combination	1002H	Transparent code : 02H (STX) Additional code : 10H (DLE)

12.6.1 Example of data reception

The following shows an example of storing receive data in the data register.

(1) When the receive transparent code designation is set to Enable and the ASCII-BIN conversion is set to Disable

Additional code: 10H (DLE), transparent code: 02H (STX)



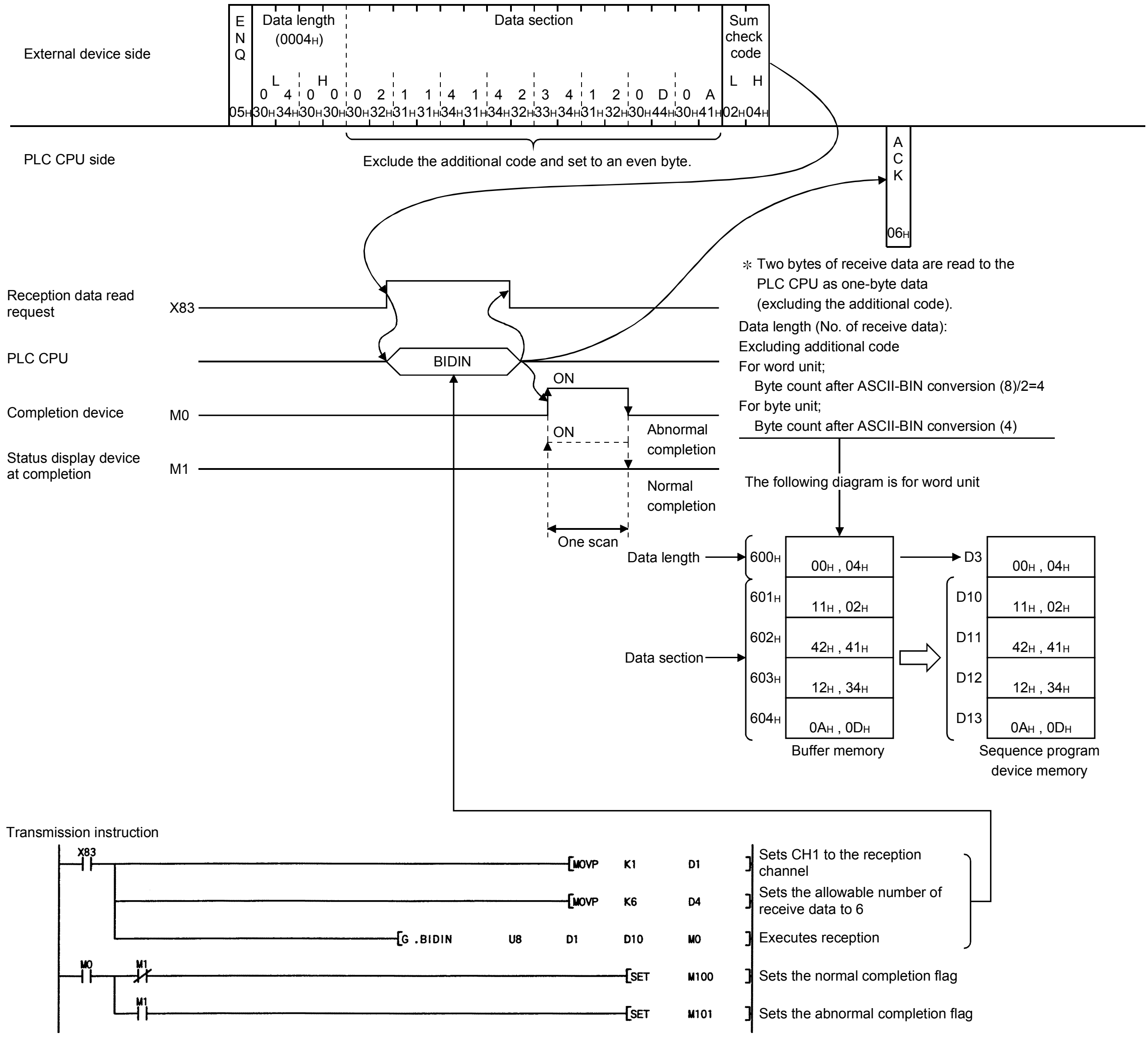
POINT

(1) When the receive transparent code designation is set to Enable and ASCII-BIN conversion is set to Disable, the codes for receivable arbitrary data sections and those for receive data that is stored in the buffer memory's reception area are as follows:

		Receivable codes	Codes stored in the reception area
Receive transparent code designation section	Additional code	01H to FFH	(Delete)
	Transparent code	00H to FFH	00H to FFH
Data length, data section			

(2) When the data length used is in byte units and the data length is an odd byte, 00H will be stored in the upper byte of the last data-storage position in the reception area.

(2) When the receive transparent code designation is set to Enable and the ASCII-BIN conversion is set to Enable
Additional code: 10H (DLE), transparent code: 02H (STX)



POINT

(1) When the receive transparent code designation is set to Enable and the ASCII-BIN conversion is set to Enable, the codes for receivable arbitrary data section and those for receive data that is stored in the buffer memory's reception area as follows:

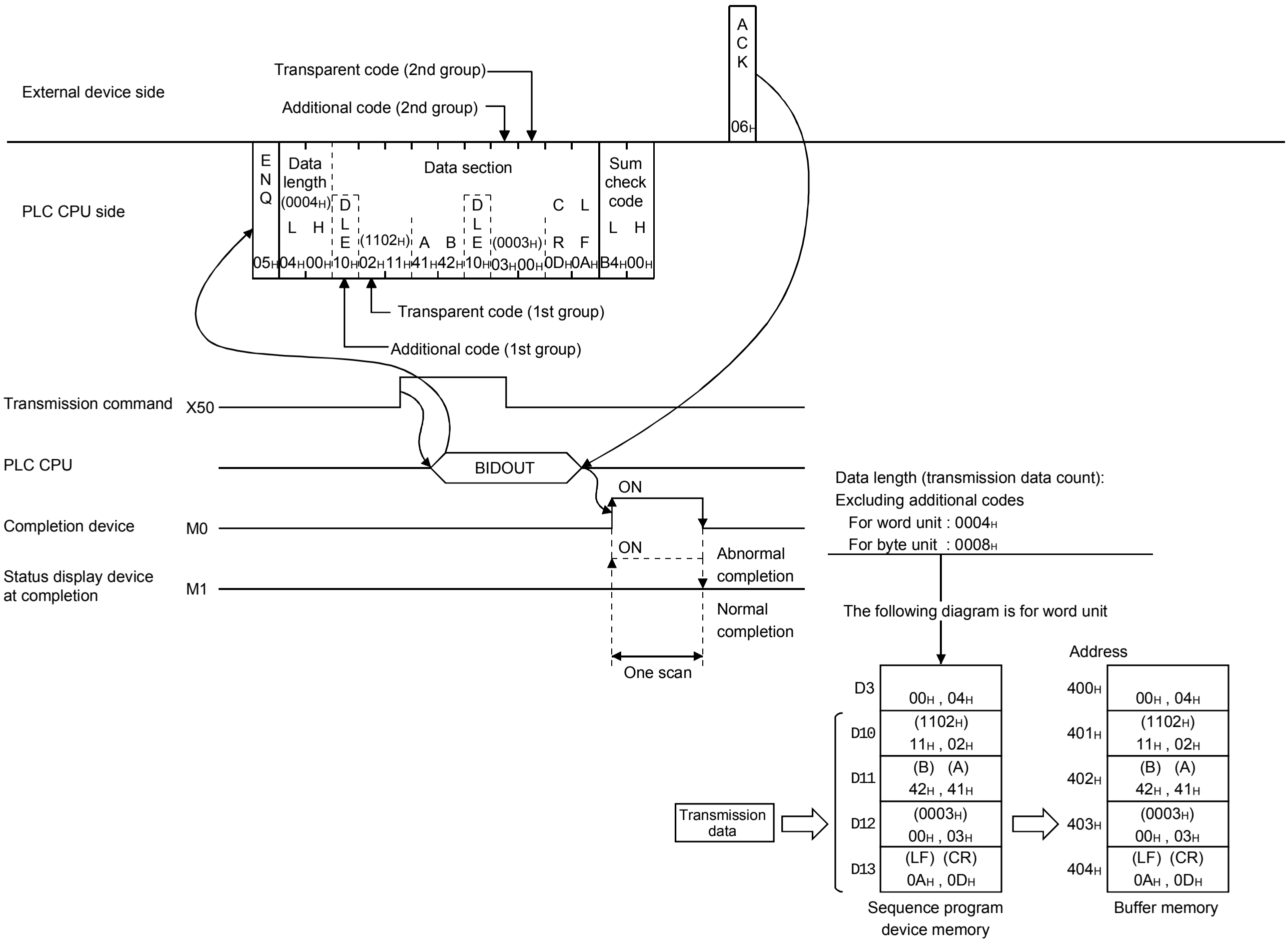
		Receivable codes	Codes stored in the reception area
Receive transparent code designation section	Additional code	01H to FFH	(Delete)
	Transparent code	30H to 39H 41H to 46H	0H to 9H AH to FH
Data length, data section			

12.6.2 Example of data transmission

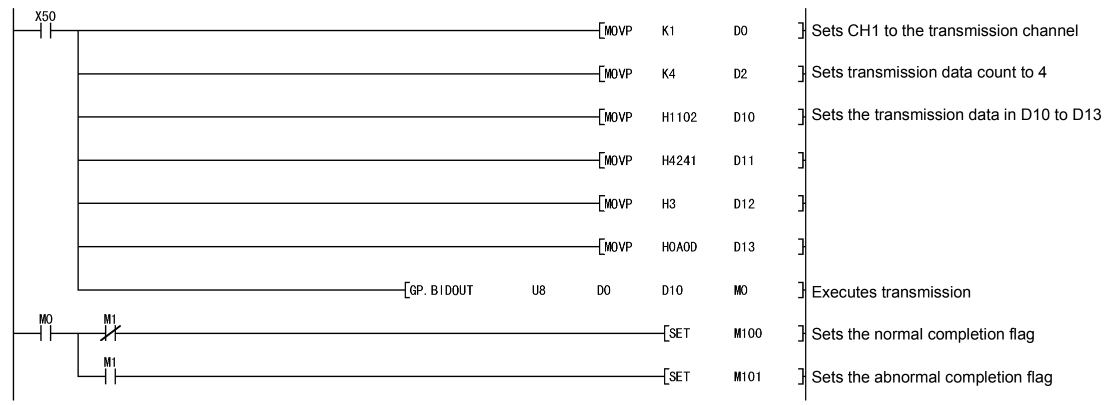
The following shows an example of data transmission.

(1) When the send transparent code designation is set to Enable and the ASCII-BIN conversion is set to Disable

Additional code: 10H (DLE), transparent code: 02H (STX) (1st group)
Additional code: 10H (DLE), transparent code: 03H (ETX) (2nd group)



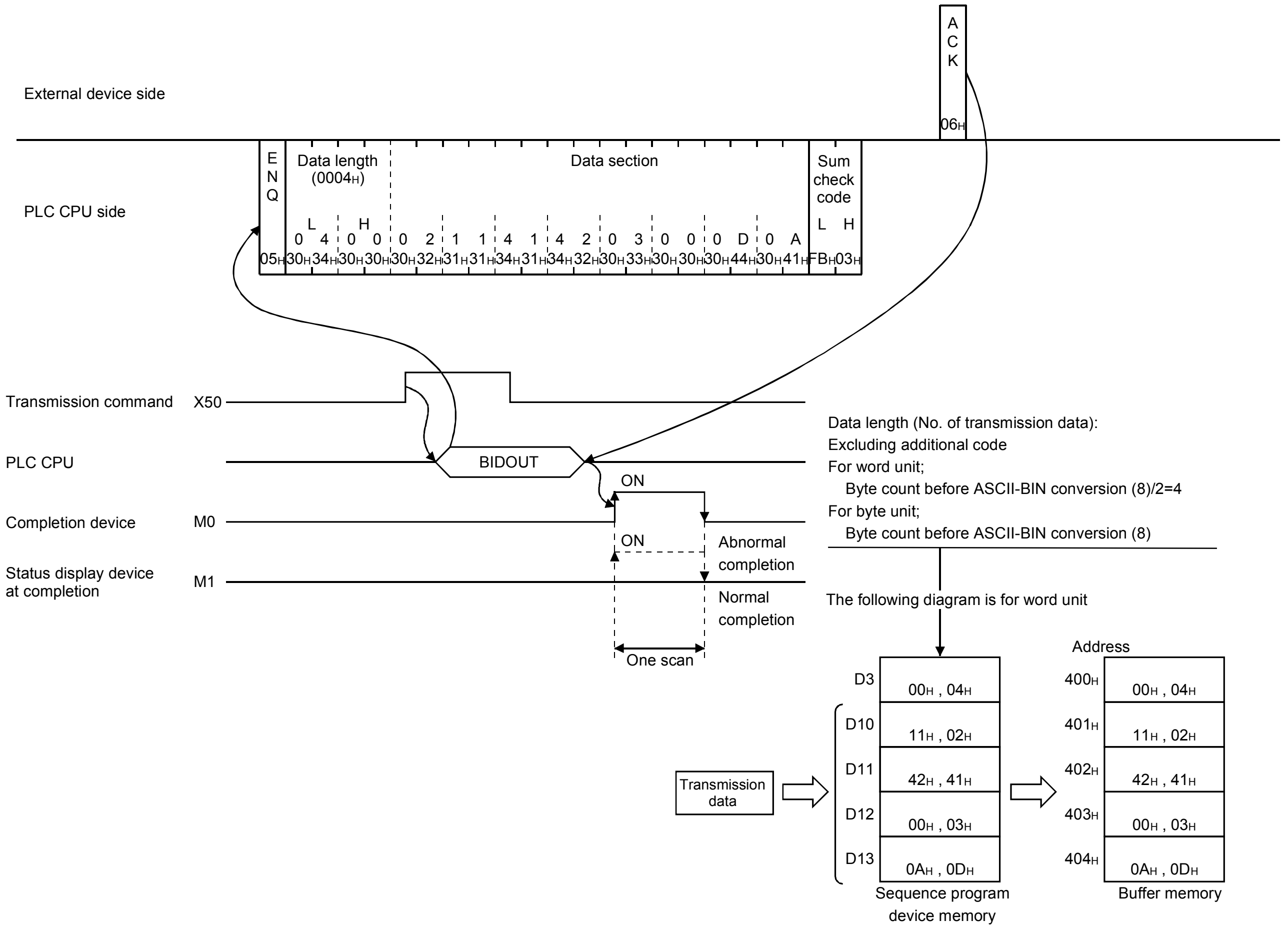
Transmission instruction



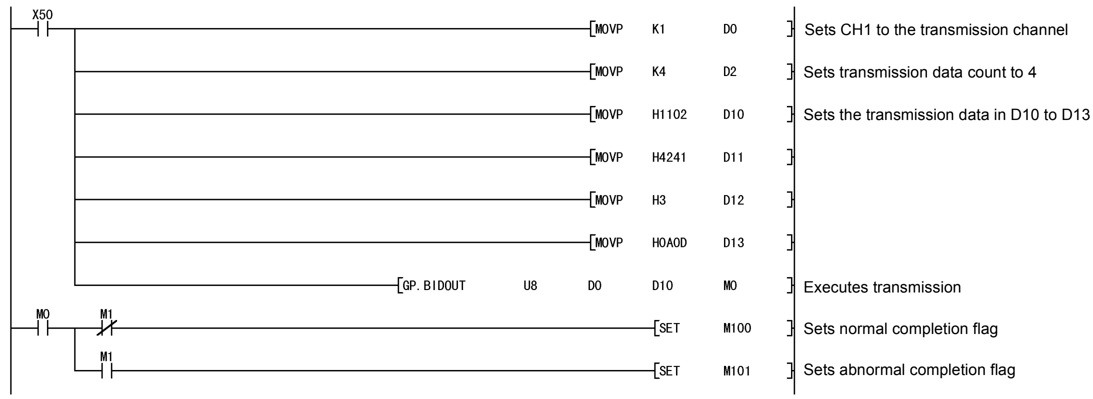
(2) When the send transparent code designation is set to Enabled and the ASCII-BIN conversion is set to Enabled

Additional code: 10H (DLE), transparent code: 02H (STX) (1st group)

Additional cede: 10H (DLE), transparent code: 03H (ETX) (2nd group)



Transmission instruction



POINT

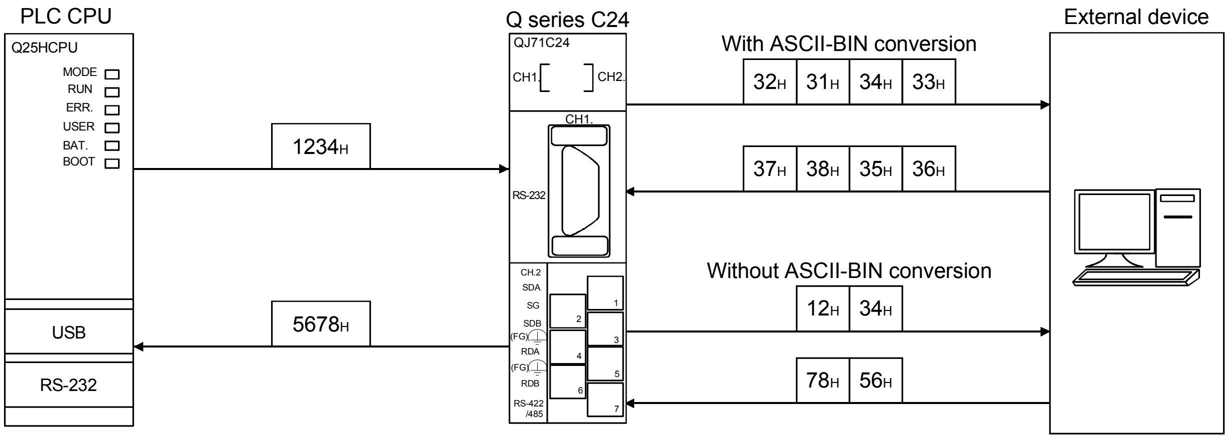
One word of data designated from the PLC CPU is converted to four-byte data ("0" to "9", "A" to "F"), and is then transmitted.

13 COMMUNICATING WITH ASCII CODE (ASCII-BIN CONVERSION)

This chapter explains the binary-to-ASCII conversion (called ASCII-BIN conversion) in order to send/receive data in ASCII format to/from an external device.

13.1 ASCII-BIN Conversion

ASCII-BIN conversion is a data conversion function that converts all data communicated between the Q series C24 and an external device to ASCII code data.
The ASCII-BIN conversion of communication data is performed by the Q series C24 according to the user settings.



13.2 Settings for ASCII-BIN Conversion

In order to convert data to be sent/received via the non procedure protocol and bidirectional protocol from binary code to ASCII code, it is necessary to make specific settings for the Q series C24 before performing data communication.
The following describes the settings for the ASCII-BIN conversion:

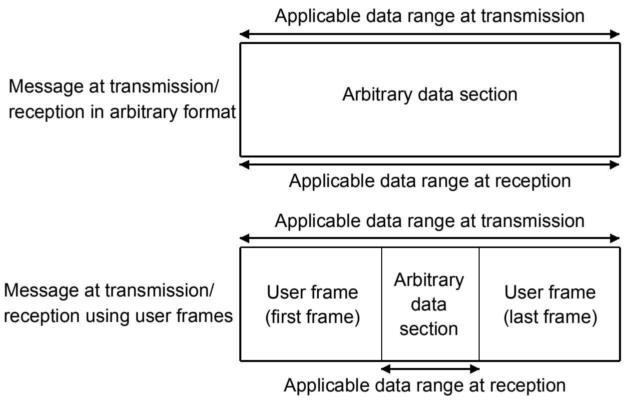
(1) The ASCII-BIN conversion settings can be designated for each interface.

(2) The ASCII-BIN conversion settings are registered in the "Transmission control and others system setting" screen of GX Configurator-SC.
For the registration screen, see Section 8.4.5 of the User's Manual (Basic).

13.3 Performing ASCII-BIN Conversion for Data Communicated via Non Procedure Protocol

This section explains the ASCII-BIN conversion of data to be communicated using the non procedure protocol.

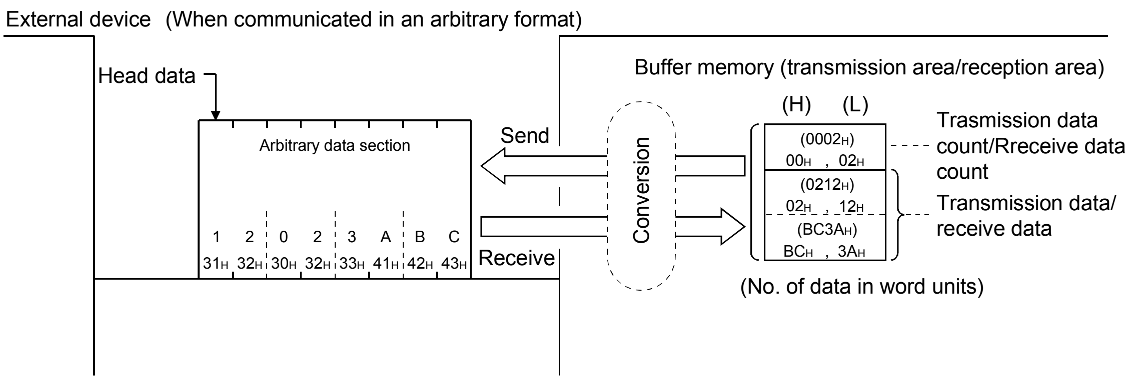
(1) The following shows the range of send/receive data for which ASCII-BIN conversion can be performed:



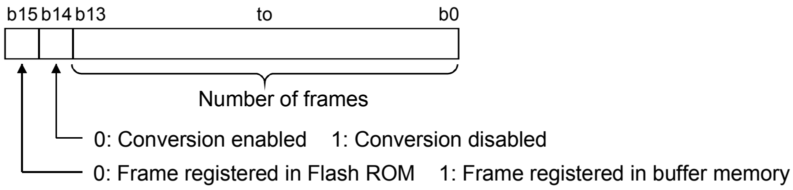
When sending or receiving data, the Q series C24 processes data as follows:

1) Out of the data in the applicable data range shown above, the Q series C24 sends and receives data whose data code is in the range of 30_H to 39_H ("0" to "9") and 41_H to 46_H ("A" to "F").

2) During data reception, the Q series C24 regards the arbitrary data section as ASCII code data, converting it to binary code data for storage in the buffer memory.
The user frame section is received in the data format corresponding to the registration contents in the Q series C 24. During data transmission, the Q series C 24 regards data designated by the PLC CPU (an arbitrary data section in the transmission message) and user-frame sections as binary code data, converting them into ASCII code data and transmitting them.



* Even if ASCII-BIN conversion is "enabled," it is possible to transmit data without converting the data in any user frame portion or buffer memory transmission area. When sending data without ASCII-BIN conversion, specify the user frame No. using the following method.
  - Specify the number obtained by adding 4000H to the registered user frame No.



When sending data in the sections designated in 4001_H to $44AF_H$, $C000_H$ to $C01F_H$, the additional codes by transmission transparent code designation will not be added. (See Section 12.3)

User frame No. to be sent	Designated No. when transmitting without ASCII-BIN conversion
1_H to $3E7_H$ (1 to 999)	4001_H to $43E7_H$ (16385 to 17383)
$3R8_H$ to $4AF_H$ (1000 to 1199)	$43E8_H$ to $44AF_H$ (17384 to 17583)
8000_H to $801F_H$ (-32768 to -32737)	$C000_H$ to $C01F_H$ (-16384 to -16353)

(2) The processing steps taken by the Q series C24 when communicating with ASCII-BIN conversion and transparent code designation enabled are explained in Section 12.3.
  - Transmission/reception in arbitrary formats
  - Transmission/reception using user frames

13.4 Example of Data Communication Using the Non Procedure Protocol

This section shows examples of data communication using the non procedure protocol when the following settings/registrations are made.

(1) Settings via GX Developer

Perform the following settings on the "Intelligent function module switch setting" screen.
(See Section 4.5 of the User's Manual (Basic).)

Setting item		Setting value	Remarks
Switch 1	CH1 Transmission setting	Set according to the external device	—
	CH1 Communication rate setting		
Switch 2	CH1 Communication protocol setting	0006_H	Non procedure protocol
Switch 3	CH2 Transmission setting	0000_H	Not used
	CH2 Communication rate setting		
Switch 4	CH2 Communication protocol setting	0000_H	
Switch 5	Station No. setting	0000_H	Station number of the Q series C24

(2) Settings via GX Configurator-SC

Register the following items on the "Transmission control and others system setting," "Non procedure system setting," and "Transmission user frame No. designation system setting" screens.
(See Sections 8.4.5, 8.4.7 and 8.4.10 of the User's Manual (Basic).)

＊ For items other than those noted below, the default values are used.

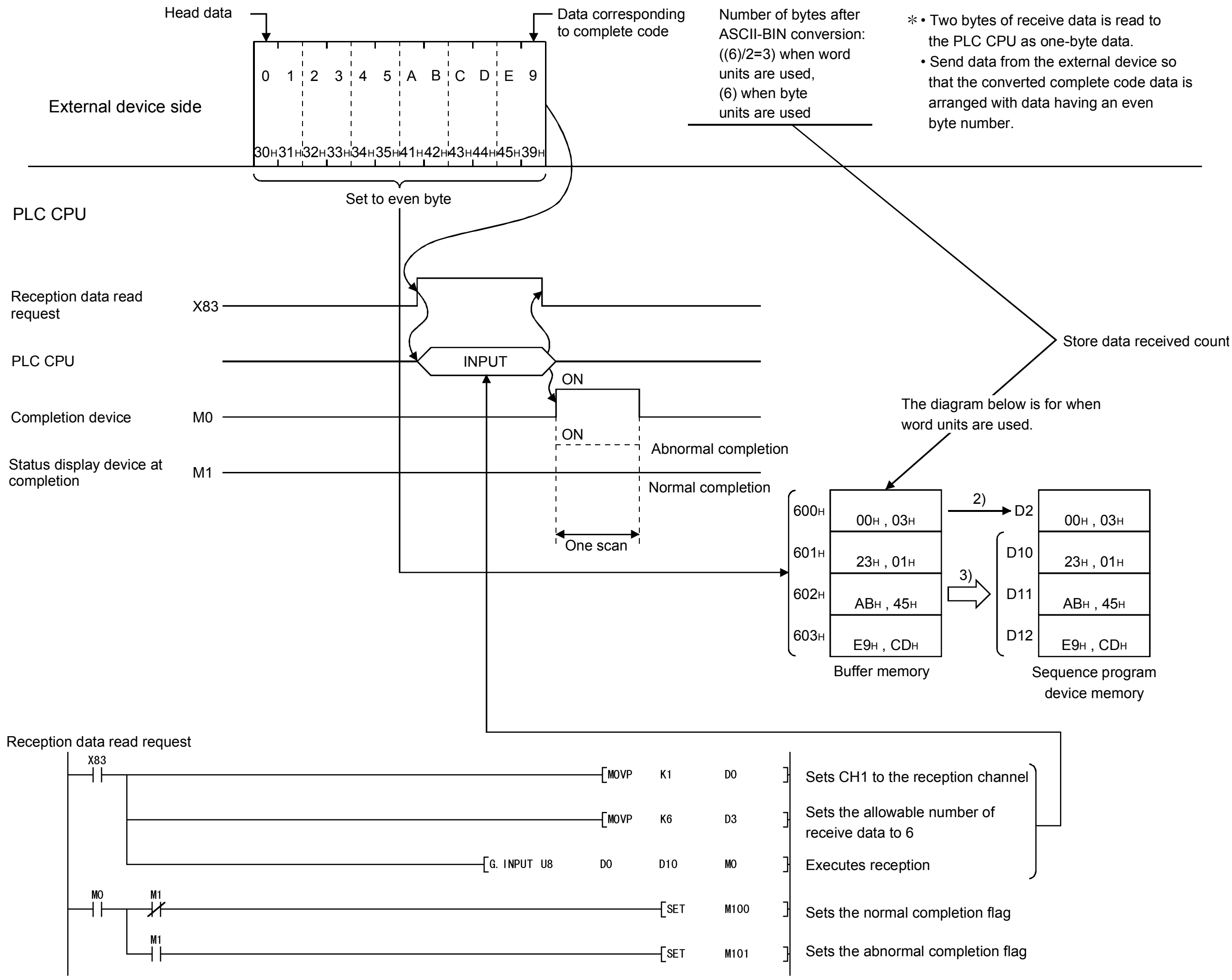
Registration screen	Setting item	Setting value
"Non procedure system setting" screen	Received data count designation	0003_H
	Receive complete code designation	0009_H
	Receive user frame designation User frame use enable/disable designation	Enable
	Receive user frame designation First frame No. designation 1st	$03E8_H$
	Receive user frame designation First frame No. designation 2nd	$03E9_H$
	Receive user frame designation Last frame No. designation 1st	$041B_H$
	Receive user frame designation Last frame No. designation 2nd	$041B_H$
	Transmission user frame designation Output head pointer designation	0001_H
	Transmission user frame designation Output count designation	0005_H
"Transmission user frame No. designation system setting" screen	Output frame No. designation 1st	$43F2_H$
	Output frame No. designation 2nd	$43F3_H$
	Output frame No. designation 3rd	$C001_H$
	Output frame No. designation 4th	8000_H
	Output frame No. designation 5th	$441B_H$
"Transmission control and others system setting" screen	ASCII-BIN conversion designation	Enable

13.4.1 Example of data reception

The following shows an example of data reception:

(1) Reception using the receive complete code

Complete code: 9H ······ (the code after ASCII-BIN conversion)



POINT

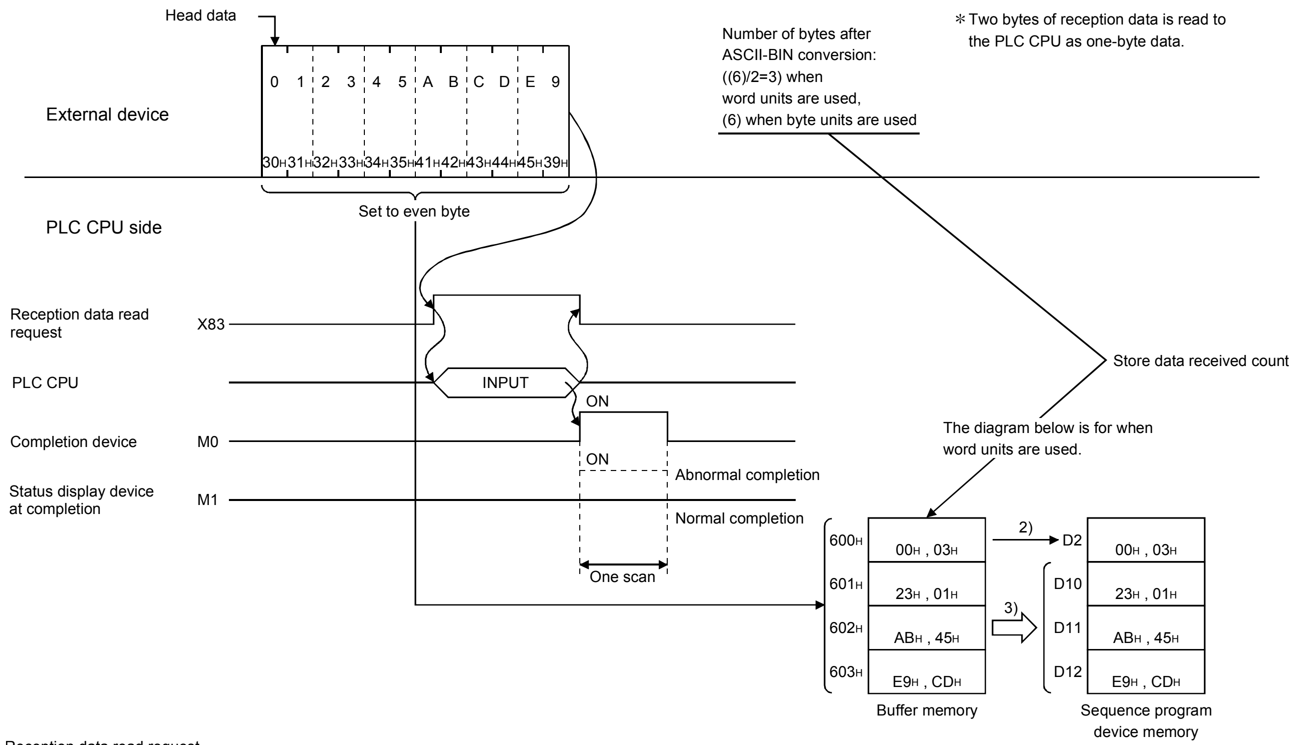
(1) When ASCII-BIN conversion is enabled, the codes of receivable data and the codes of receive data that is stored in the reception area of the buffer memory are as follows:

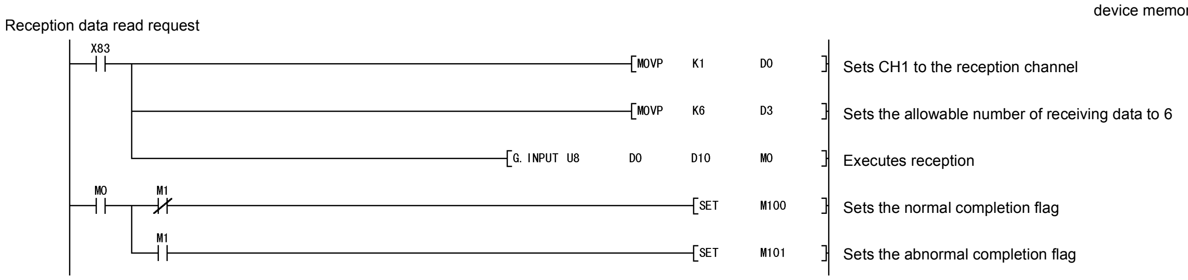
	Receivable codes	Codes stored in the reception area
Arbitrary data section (including complete code section)	30H to 39H, 41H to 46H	0H to 9H, AH to FH

* If data codes other than 30H to 39H and 41H to 46H are received for an arbitrary data section, an error occurs after ASCII-BIN conversion processing by the Q series C24.

(2) To perform ASCII-BIN conversion, the complete code after conversion should be used.

(2) Reception based on the received data count





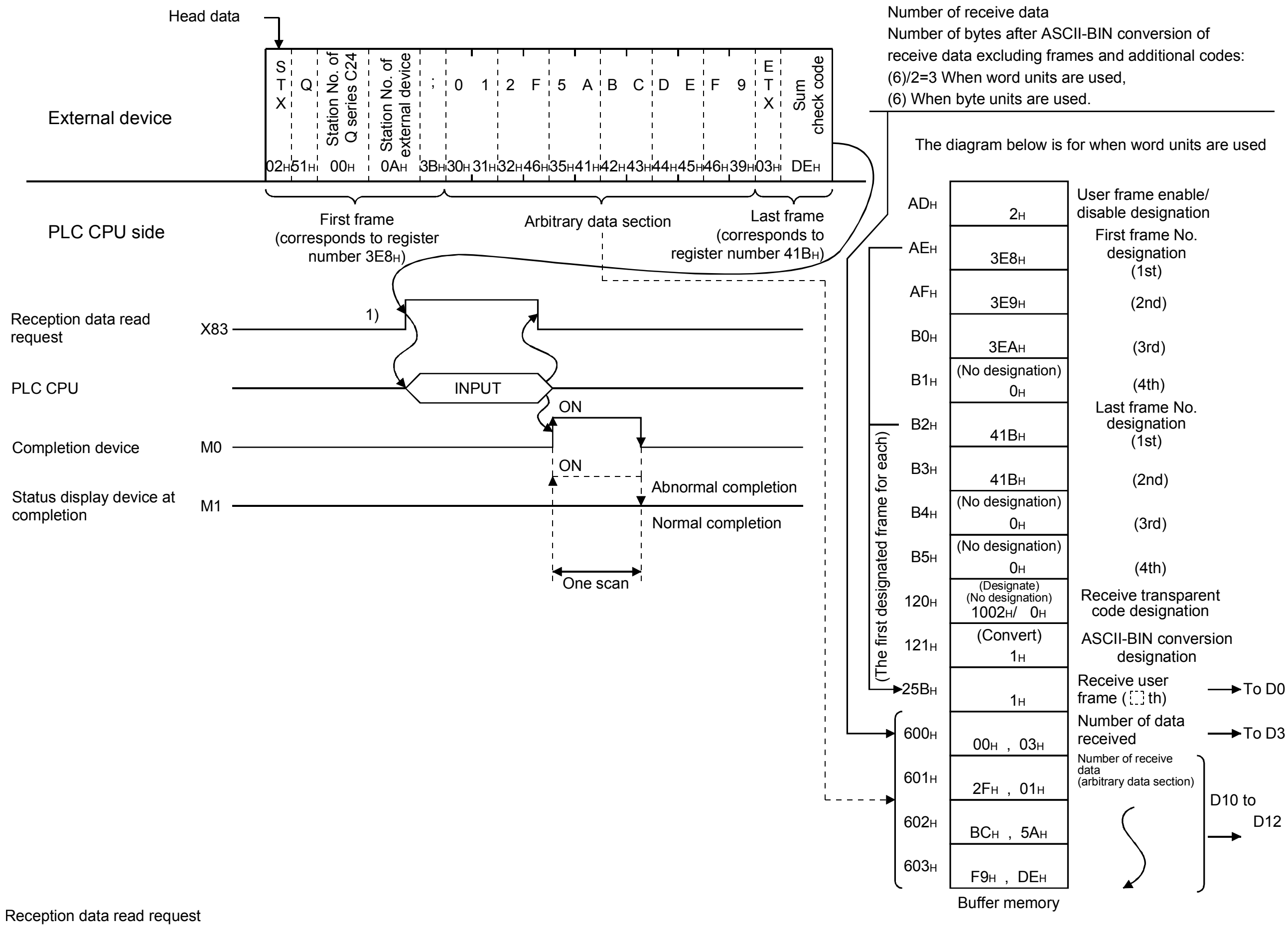
POINT

When the receive transparent code designation is set to Disable and ASCII-BIN conversion is enabled, the codes of receivable data and the codes of receive data that is stored in the reception area of the buffer memory are as follows:

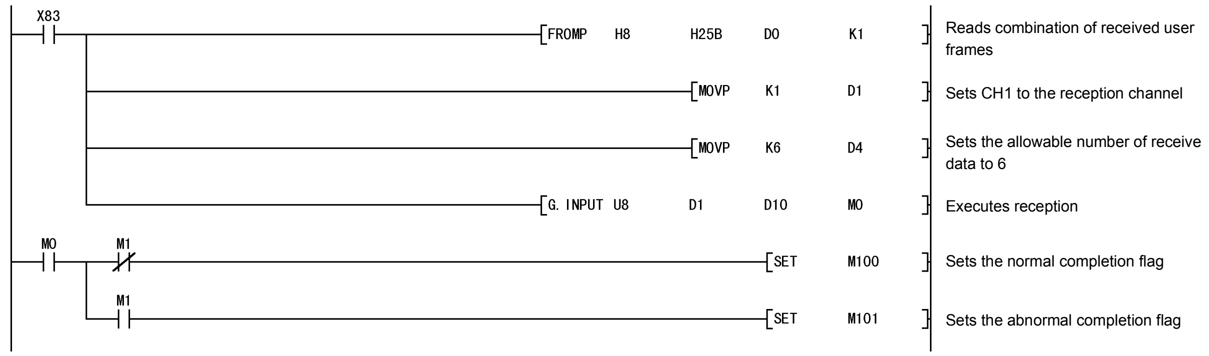
	Receivable codes	Codes stored in the reception area
Arbitrary data section	30_H to 39_H, 41_H to 46_H	0_H to 9_H, A_H to F_H

∗ If data codes other than 30_H to 39_H and 41_H to 46_H are received for an arbitrary data section, an error occurs after ASCII-BIN conversion by the Q series C24.

(3) Example of reception using user frames



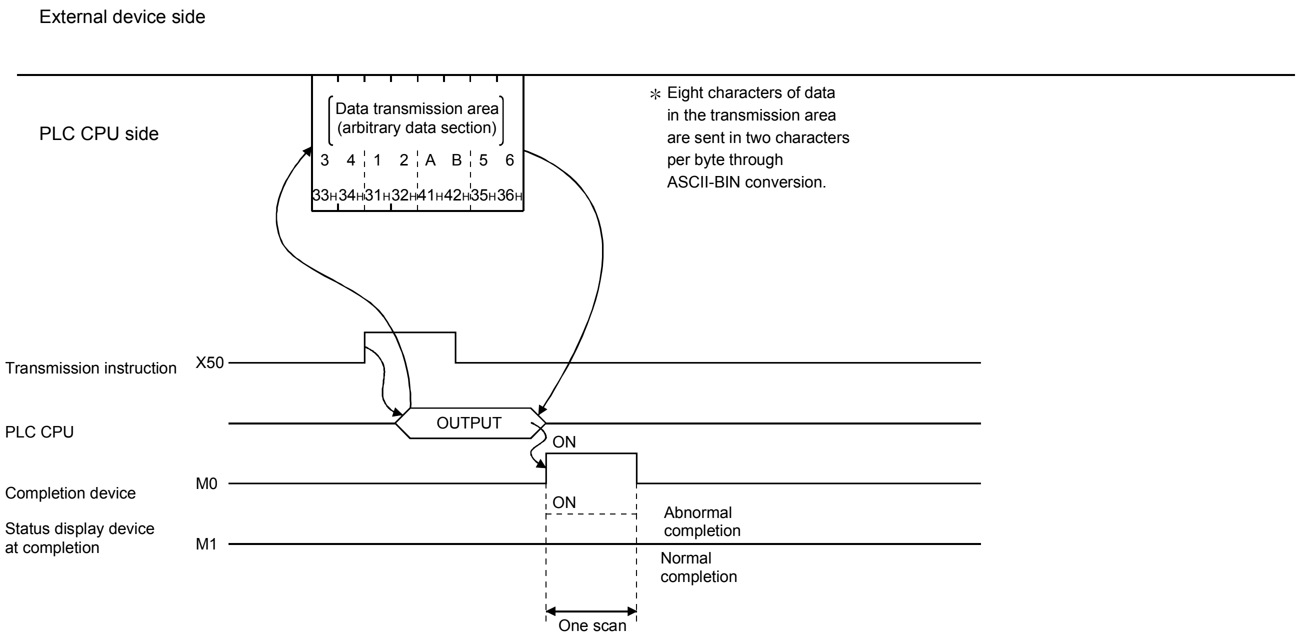
Reception data read request



13.4.2 Example of data transmission

The following shows an example of data transmission:

(1) Example of arbitrary data transmission

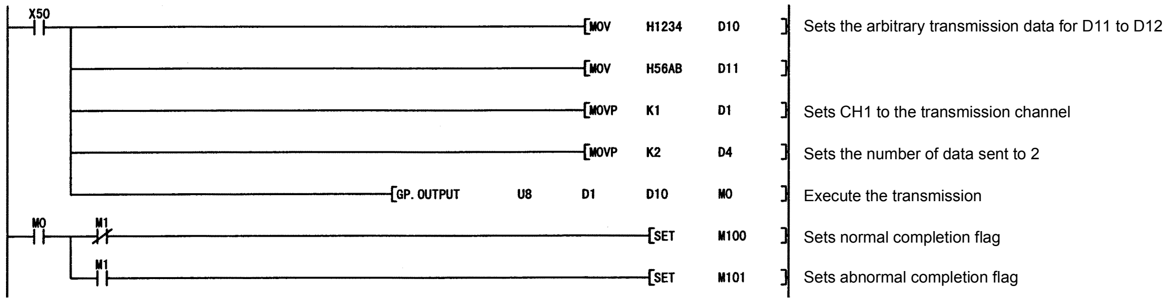


121H	(Convert) 1H	ASCII-BIN conversion designation
400H	00H , 02H	Transmission area (Designation of no. of data sent)
401H	(1234H) 12H , 34H	(Transmission data)
402H	(56ABH) 56H , ABH	

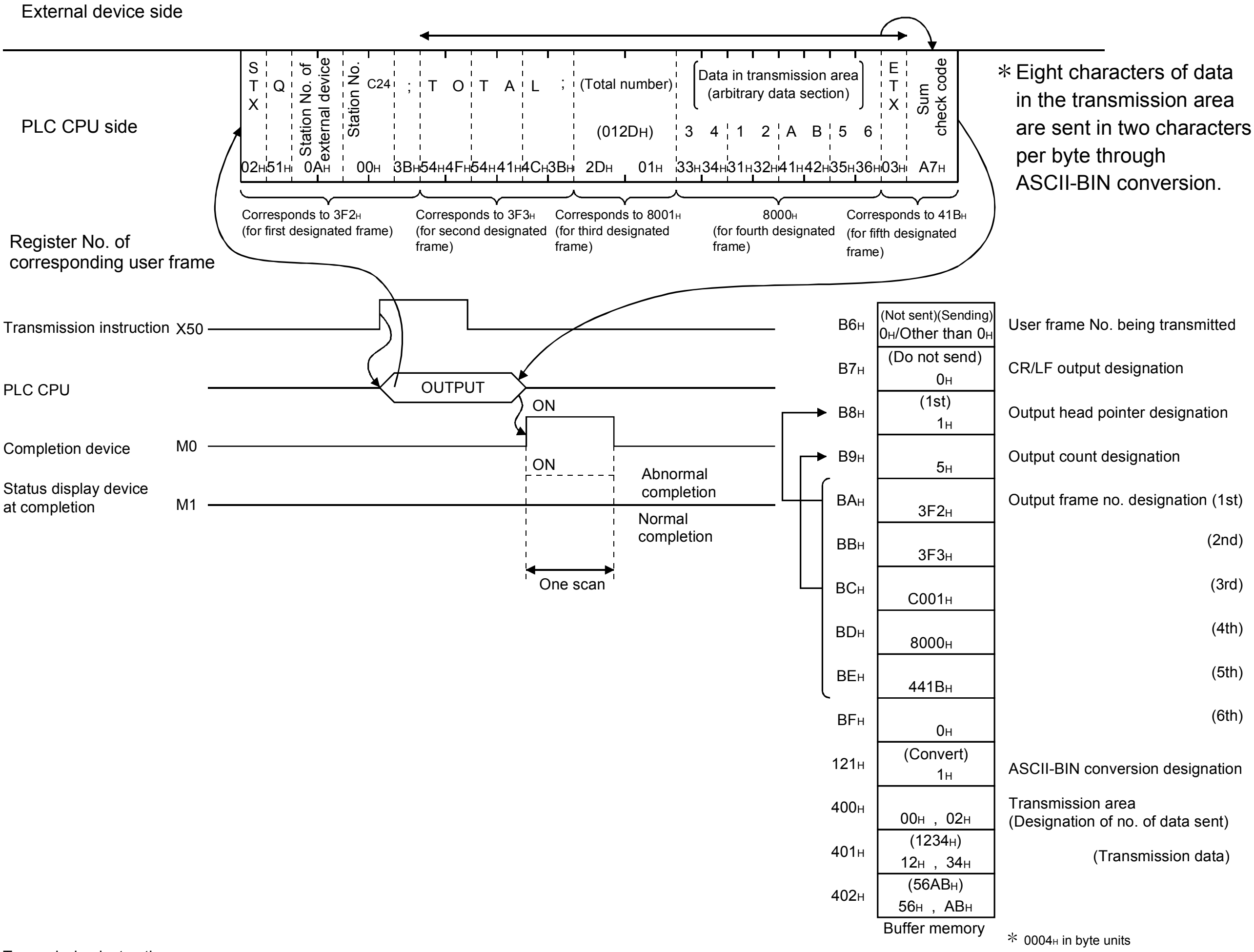
Buffer memory

*0004H in byte units

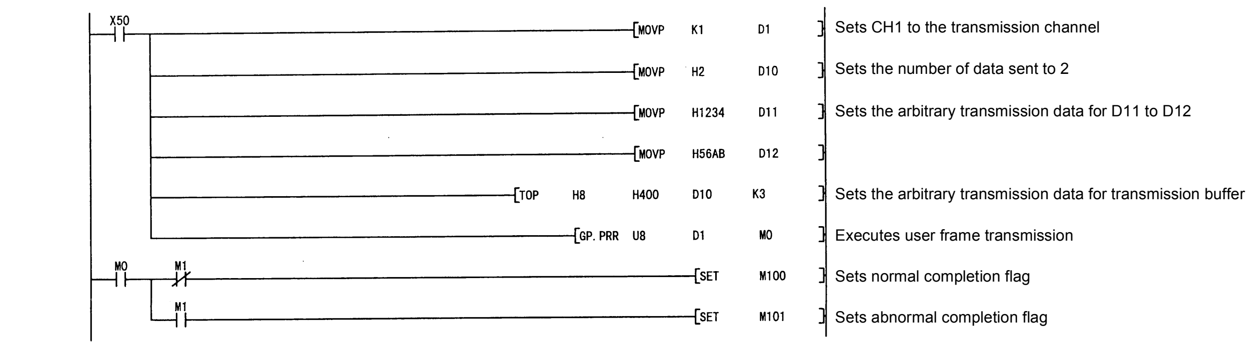
Transmission instruction



(2) Example of transmission by user frame



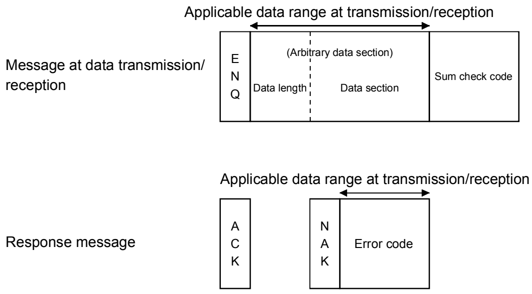
Transmission instruction



13.5 Performing ASCII-BIN Conversion for Data Communicated Via the Bidirectional Protocol

This section explains the ASCII-BIN conversion of data to be communicated using the bidirectional protocol.

(1) The following shows the range of transmission/reception data for which ASCII-BIN conversion can be performed.



When sending or receiving data, the Q series C24 processes data as follows:

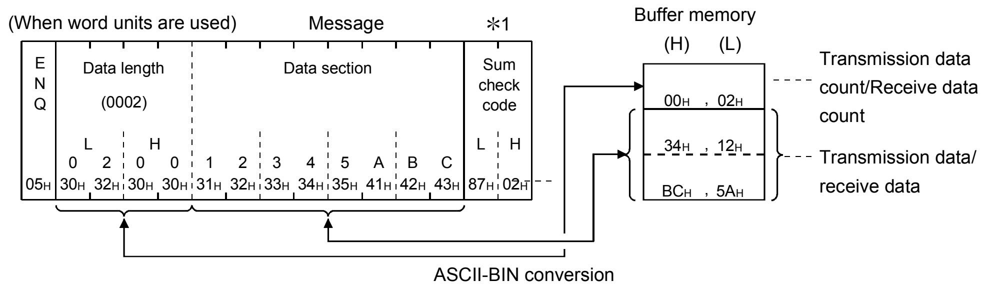
1) Range of ASCII-BIN conversion
The Q series C24 performs the ASCII-BIN conversion for any data section (data length and data section) and error code in a message.

2) Conversion of data length
- At transmission
The Q series C24 converts a transmission data count to 4-digit ASCII code data (hexadecimal), then sends it beginning with the lowest byte (L).
- At reception
The Q series C24 converts a received data length (4-digit ASCII code data (hexadecimal)) to 2-byte binary code data and stores it in the reception data count storage area.

3) Conversion of data section
- At transmission
The Q series C24 converts transmission data for one address to 4-digit ASCII code data (hexadecimal), then sends it beginning with the lowest byte (L).
- At reception
The Q series C24 converts each two characters of a received data section (2-digit ASCII code data (hexadecimal)) to 1-byte binary code data and stores it in the reception data storage area.

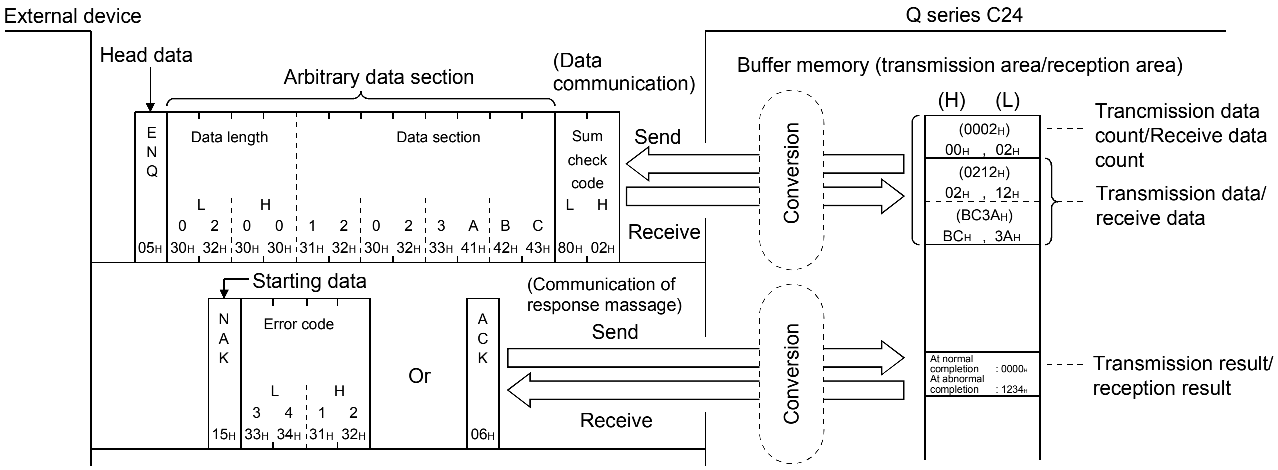
4) Conversion of error code
- At transmission
The Q series C24 converts an error code for a detected error to 4-digit ASCII code data (hexadecimal), then sends it beginning with the lowest byte (L).
(For 3412_H, it is converted to "3412" and sent beginning with "12".)
- At reception
The Q series C24 converts the first 2 digits of a received error code (4-digit ASCII code data (hexadecimal)) to 2-byte binary code data as the lower byte, and stores it in the transmission result storage area.
(For "1234" is received, it is converted to 3412_H and stored.)

5) Treatment of sum check code
The data length and the data section after ASCII-BIN conversion are added together and the lowest two bytes of the resulting binary code data are treated as a sum check code.
- At transmission
  The Q series C24 calculates a sum check code using the data length and data section after ASCII-BIN conversion, then adds it to the transmission message.
- At reception
  The Q series C24 calculates a sum check code using the received data length and data section prior to ASCII-BIN conversion, then checks the received head of the sum-check code using the code as a lower byte.



*1 Calculation of sum check code
$30_H + 32_H + 30_H + 30_H + 31_H + 32_H + 33_H + 34_H + 35_H + 41_H + 42_H + 43_H = \underset{(H)}{\underline{02}}\underset{(L)}{\underline{87}}{}_H$

(2) Section 12.5 explains how Q series C24 processes data communicated when ASCII-BIN conversion and transparent code designation are both enabled.
(Example)



13.6 Example of Data Communication Using the Bidirectional Protocol

This section shows examples of data communication using the bidirectional protocol when the following settings and registrations are made.

(1) Settings via GX Developer

Perform the following settings on the "Intelligent function module switch setting" screen.
(See Section 4.5 of the User's Manual (Basic).

<table>
<tr><th colspan="2">Setting item</th><th>Setting value</th><th>Remarks</th></tr>
<tr><td rowspan="2">Switch 1</td><td>CH1 Transmission setting</td><td rowspan="2">Set according to the external device</td><td rowspan="2">—</td></tr>
<tr><td>CH1 Communication rate setting</td></tr>
<tr><td>Switch 2</td><td>CH1 Communication protocol setting</td><td>0007H</td><td>Bidirectional protocol</td></tr>
<tr><td rowspan="2">Switch 3</td><td>CH2 Transmission setting</td><td rowspan="2">0000H</td><td rowspan="3">Not used</td></tr>
<tr><td>CH2 Communication rate setting</td></tr>
<tr><td>Switch 4</td><td>CH2 Communication protocol setting</td><td>0000H</td></tr>
<tr><td>Switch 5</td><td>Station No. setting</td><td>0000H</td><td>Station number of Q series C24</td></tr>
</table>

(2) Settings via GX Configurator-SC

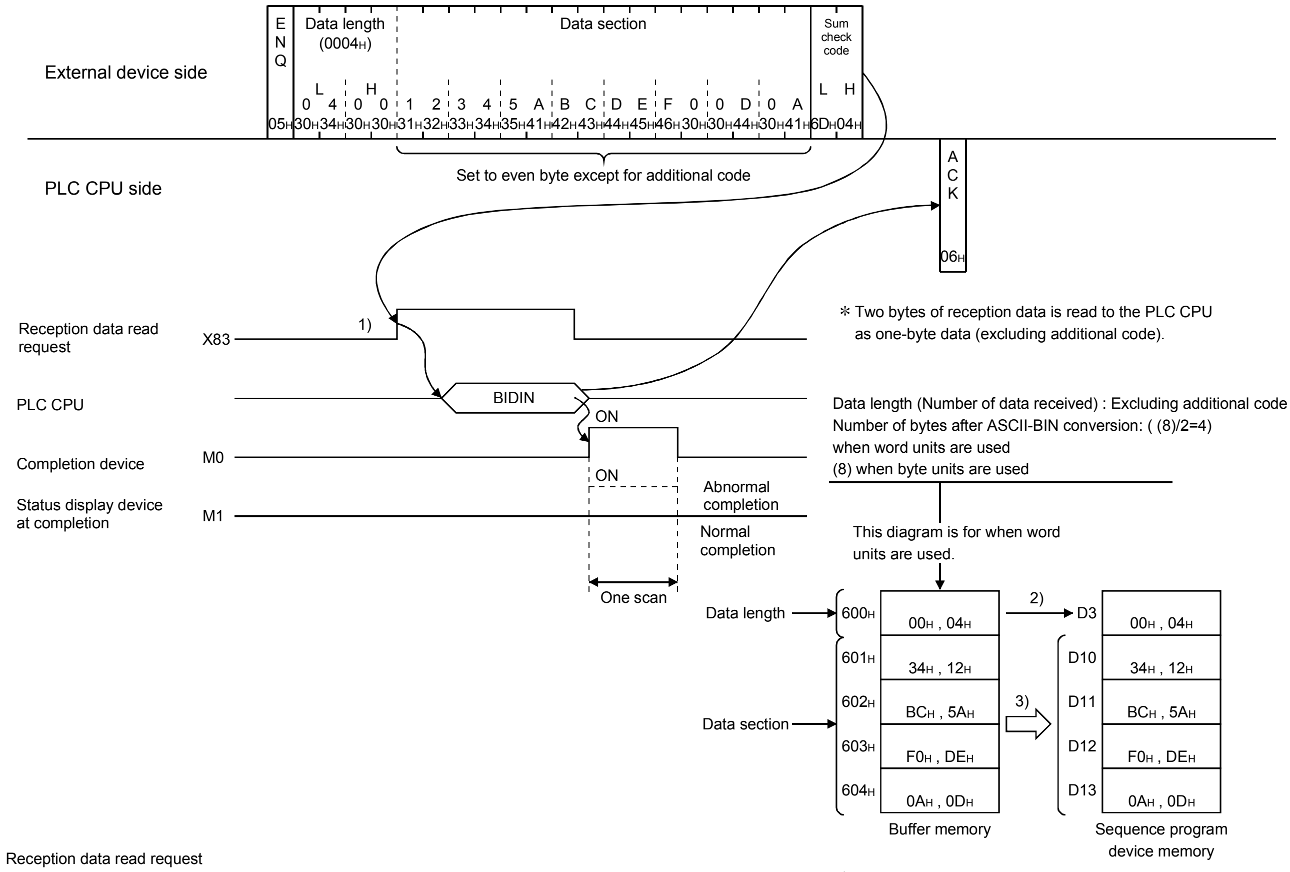
Register the following items on the "Transmission control and others system setting" screen.
(See Sections 8.4.5 of the User's Manual (Basic).)
✻ For items other than those noted below, the default values are used.

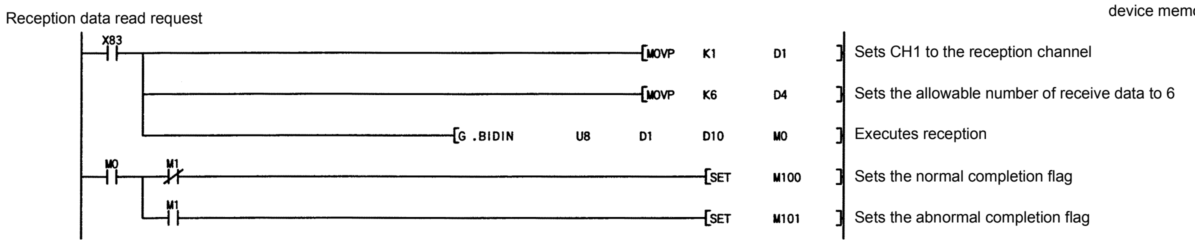
Setting item	Setting value
Send transparent code designation	1004H
Receive transparent code designation	1004H
ASCII-BIN conversion designation	Convert

13.6.1 Example of data reception

The following shows an example of data reception when ASCII-BIN conversion is enabled.

- When the receive transparent code designation is set to Enable and ASCII-BIN conversion is set to Enable
  Additional code: 10H (DLE), transparent code: 04H (E0T)





POINT

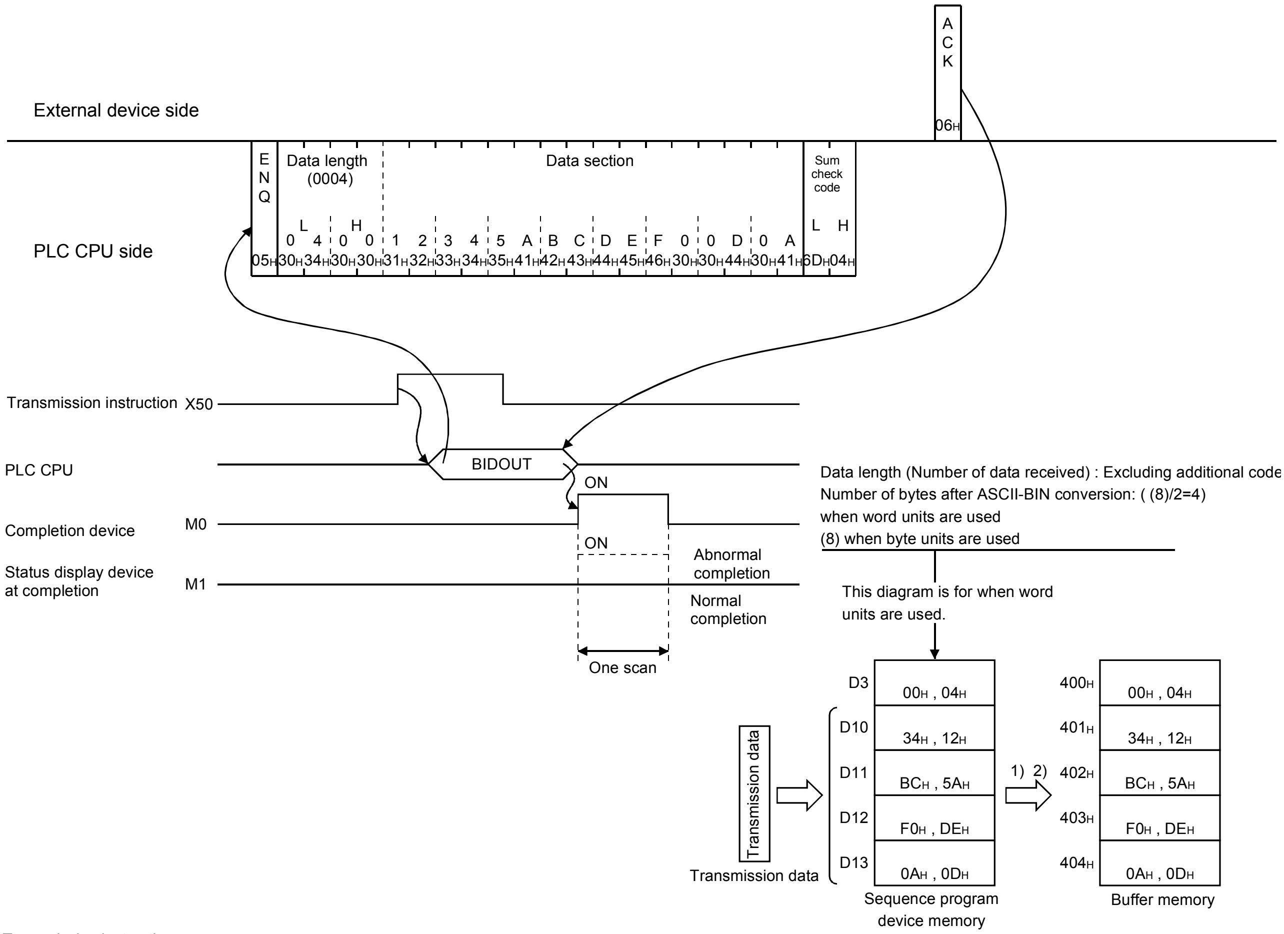
When the receive transparent code designation is set to Enable and ASCII-BIN conversion is set to Enable, the codes of receivable arbitrary data sections and the codes of receive data that is stored in the reception area of the buffer memory are as follows:

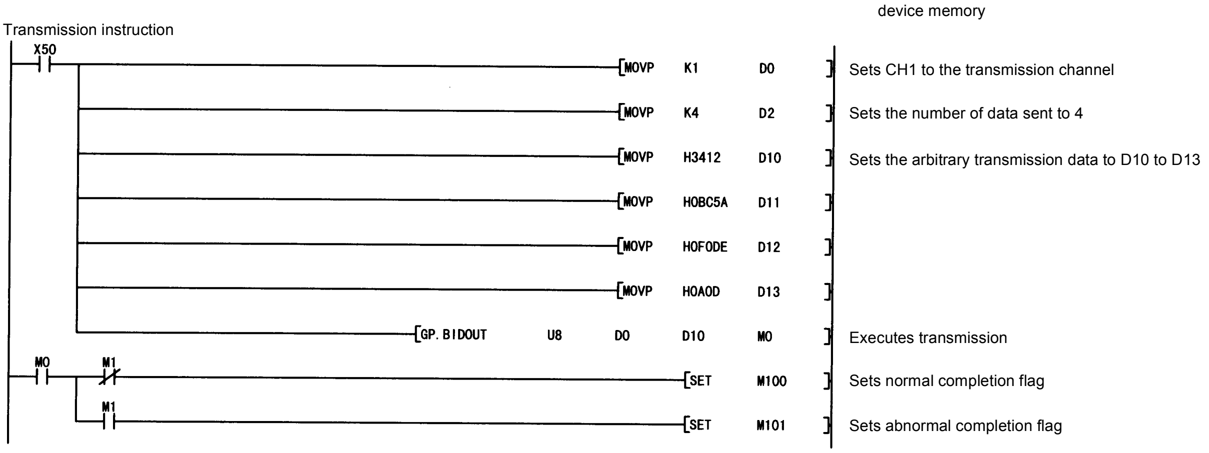
<table>
<tr><th colspan="2"></th><th>Receivable codes</th><th>Codes stored in the reception area</th></tr>
<tr><td rowspan="2">Sections for which the reception transparent code designation is enabled</td><td>Additional code</td><td>01H to FFH</td><td>(Delete)</td></tr>
<tr><td>Transparent code</td><td rowspan="2">30H to 39H
41H to 46H</td><td rowspan="2">0H to 9H
AH to FH</td></tr>
<tr><td colspan="2">Data length, data section</td></tr>
</table>

13.6.2 Example of data transmission

The following shows an example of data transmission when ASCII-BIN conversion is enabled.

- When the send transparent code designation is set to Enable and ASCII-BIN conversion is set to Enable
  Additional code: 10_H (DLE), transparent code: 04_H (E0T)





POINT

Data for one address (one word) in the buffer memory's transmission area is converted into four-byte ASCII code data ("0" to "9" and "A" to "F"), and is then transmitted.

14 DATA COMMUNICATIONS USING EXTERNAL DEVICE AND PLC CPU M : N CONFIGURATION

Always read this chapter when communicating data by using a multidrop link to connect the external devices and PLC CPU in an m: n system configuration.
You do not have to read this chapter when using a system configuration other than m: n to communicate data.

This section describes the case when data is communicated between external devices and the PLC CPU by connecting multiple external devices (m stations) and multiple Q series C24 (n stations) over a multidrop link. (The total number of m and n is up to 32 stations.)
With this m : n multidrop link, only MC protocol data communications by command transmission from the external devices can be performed.

14.1 Data Communications Precautions

(1) When communicating data by using an m: n system configuration, multiple external devices cannot communicate data with the PLC CPU at the same time. Interlock the external devices so that the external device can communicate with the PLC CPU in a 1:1 configuration.
See Sections 14.2 and 14.3 for the items to be agreed upon and the interlock method to interlock the external devices.

(2) Communicate data between external devices and the PLC CPU by the following methods only.
- Full-duplex data communications (m : n data communications is impossible with half-duplex data communications)
- Data communications by command transmission from external device using an MC protocol excluding the format 3 and format 5 control procedure (Data communications using the format 3 and format 5 control program and data transmission from sequence program using the on-demand function cannot be performed.)

(3) The data transmitted by one external device is received by all the other external devices, including the external device that transmitted the data. The send data from a PLC CPU is also received by all the external devices.
Therefore, it may be necessary for devices that received data not addressed to them (judged by station No. in the message) to ignore the receive data.
At the PLC CPU, Q series C24 also ignores the receive data other than that addressed to it.

(4) Connect to multiple external devices and connect the terminating resistor as described in Section 4.4.2 of User’s Manual (Basic).

(5) When communicating data by using an m: n system configuration, designate the following station number at the [Station No.] and [Local station No.] items in the command message to be transmitted from an external device.

1) When accessing the PLC CPU

	Communications using QnA compatible 2C/3C/4C	Communications using A compatible 1C frame
Station No.	Station No. of Q series C24 to be passed through (Station No. described in "Contents of the data designation items" of each frame in the reference manual.	
Local station No.	Station No. of access source external device ＊1	Designation unnecessary (No [Local station No.] item)

2) When accessing another external device (interlock communications)

	Communications using QnA compatible 2C/3C/4C	Communications using A compatible 1C frame
Station No.	Station No. of access destination external device ＊1	
Local station No.	Station No. of access source external device ＊1	Designation unnecessary (No [Local station No.] item)

＊1 A station No. with in the [0] to [31] (00_H to $1F_H$) range not set in Q series C24 at the PLC CPU is used as the external device No. in the [Station No.] and [Local station No.] items in the message.
Select and designate the No. of each external device.
The designation method is described in "Contents of the data designation items" of each frame in the reference manual.

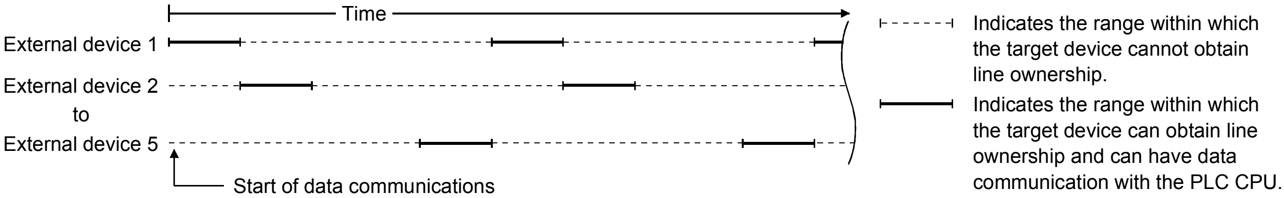
- Station No. ················ Designates the No. of the transmit destination external device.
- Local station No. ········ Designates the No. of the transmit source external device. (Does not have to be designated when A compatible 1C frame is used.)

14.2 External Devices Interlock Conditions

When using a multidrop line to communicate data between external devices and the PLC CPU in an m: n configuration, the external devices must be interlocked so that multiple external devices cannot communicate data with the PLC CPU at the same time.
This section describes the conditions for interlocking the external devices so that all of the external devices can communicate data with the PLC CPU.
(Conditions for priority use (obtaining line ownership) of the line from the start to the end of data communications with the PLC CPU.)

14.2.1 Maximum communications time per external device station

This condition determines the maximum time each external device can communicate with the PLC CPU after obtaining line ownership. (Time in the illustration below.)
This is selected to prevent loss of data communications between other external devices and the PLC CPU by shutdown of the external device that obtained line ownership.
(Example)



POINT

(1) Make the maximum data communications time per external device station the maximum time of the external device that requires the most time to communicate data with the PLC CPU.

(2) After system starting, complete data communications from the external device that obtained line ownership and the PLC CPU within the maximum communications time.
(If data communications cannot be completed within this time, initialize the Q series C24 transmission sequence by transmitting the EOT/CL code to the objective PLC CPU within the maximum communications time. (See "Contents of data designation item" of each frame in the reference manual.))

(3) While an external device and the PLC CPU are communicating data, have the other external devices check the time so that they do not transmit data during this time.

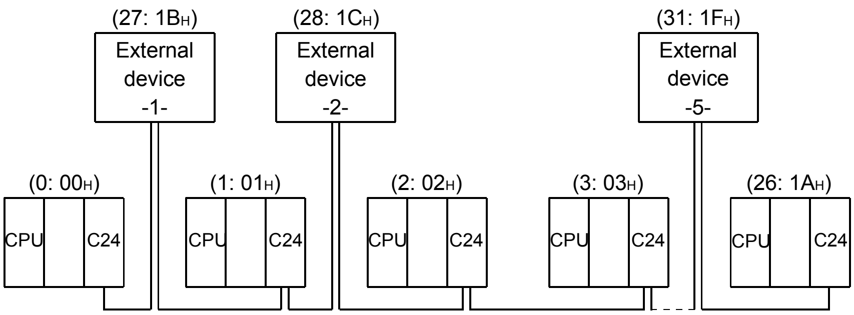
14.2.2 Message structure when communicating data between external devices

The message structure when communicating data between external devices is determined by any of the following.
This condition is determined to interlock the external devices so that they can exchange data with the PLC CPU in a 1:1 configuration.

(1) When making the message structure the same as that of each control procedure format frame

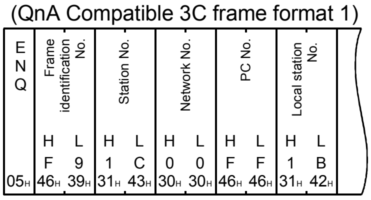
1) Use a number within the [0] to [31] (00_H to $1F_H$) range not set in Q series C24 of the PLC CPU as the external device No. in the [Station No.] and [Local station No.] items in the message.
2) Select and designate the external device numbers.
   The designation method is described in "Contents of data designation item" of each frame in the reference manual.
   - Station No. ······················ Designates the number of the transmission destination external device.
   - Local station No. ············· Designates the number of the transmission source external device. (Does not have to be designated when A compatible frame 1C is used.)

   (Example) When m : n configuration is 5:27
   The values in ( ) are the external device and Q series C24 station numbers. (decimal : hexadecimal).



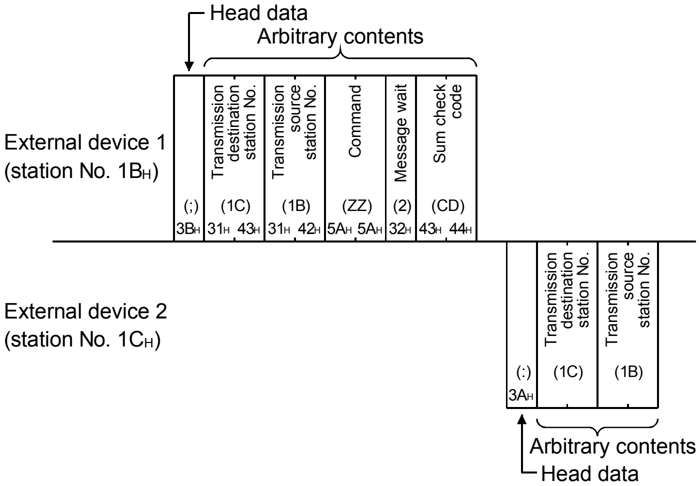
C24: Q series C24, QC24(N), UC24

(QnA Compatible 3C frame format 1)



(2) When message structure different from that of control procedure format frames can be used

1) Change the head data of each message to other arbitrary data.
   - When selecting ASCII code format 1, format 2, or format 4, change ENQ (05H).
2) Arbitrarily list the data following the head data of each message according to the user specifications.
   (Example)



POINT
Correspond the message structure for general reporting to all the other external devices except PLC CPU stations using unused station numbers or a message structure different from the Q series C24 control procedure format.

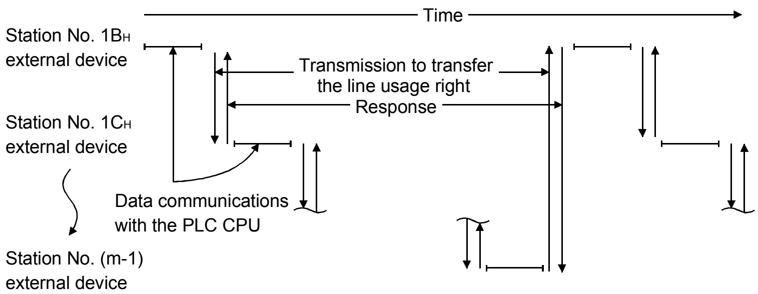
14.3 Examples of Procedure for Data Communications with the PLC CPU

The following uses examples to describe the procedure when communicating data with a PLC CPU by interlocking the external devices.

14.3.1 Sequential data communications between external devices and the PLC CPU

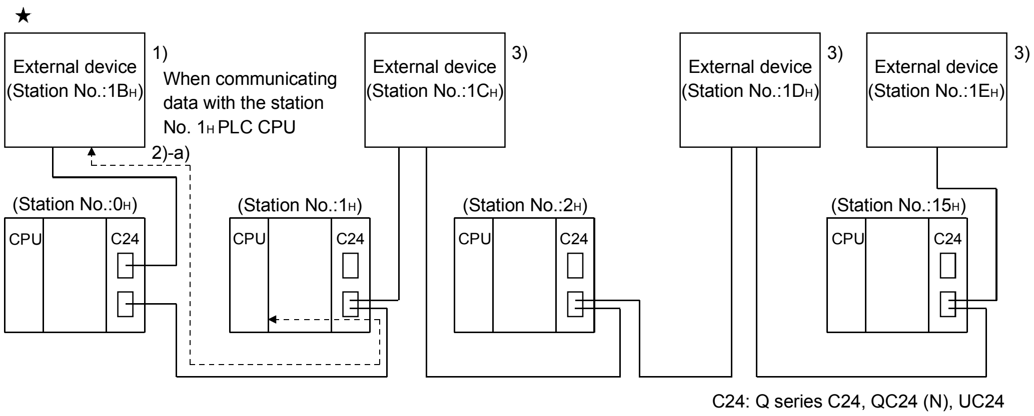
The external devices sequentially obtain the line usage right and communicate data with the PLC CPU based on their station No..

(Example)



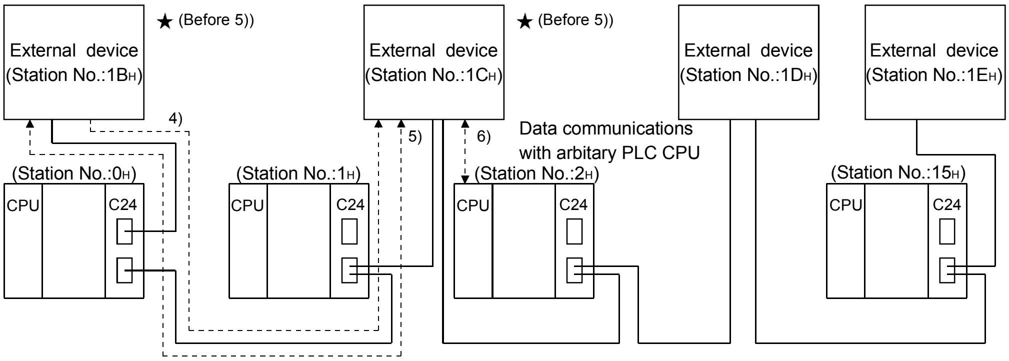
The following uses an example to describe the procedure when external devices communicate data with the PLC CPU.

★: External device that obtained the line usage right



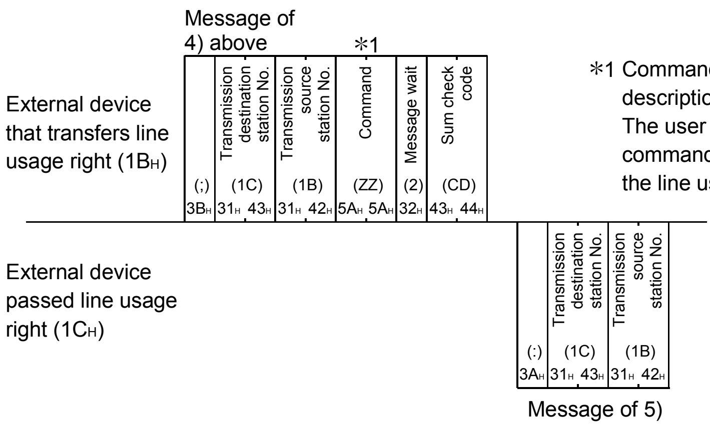
1) When the system starts, the external device with the lowest station No. (1BH) is given the line usage right.
2) The external device that obtained the line usage right,
   a) When communicating data with the PLC CPU, begins processing from 4) after communicating data with the PLC CPU within the maximum data communications time from among all the external devices.
   b) When not communicating data with the PLC CPU, immediately begins processing from 4).
3) The external devices that have not obtained the line usage right check the line usage time of the external device that obtained the line usage right and ignore the receive data not addressed to their own station.
   When the line usage time exceeds the maximum data communications time, each external device performs the processing of 7).

★: External device that obtained the line usage right



C24: Q series C24, QC24 (N), UC24

4) External devices that communicated data with the PLC CPU, or external devices that do not have to communicate data with the PLC CPU, transmit the data for transferring the line usage right to the external device of the next station No..
A message structure example is shown in 5.
When a response message (see 5)) is not received from the next external device to which the line usage right was passed, data transmission for transferring the line usage right to the external device of the next station No. is repeated until the line usage right is accepted.
5) The external device that accepts the line usage right transmits a response message to the external device that passed it the line usage right.
(Example)

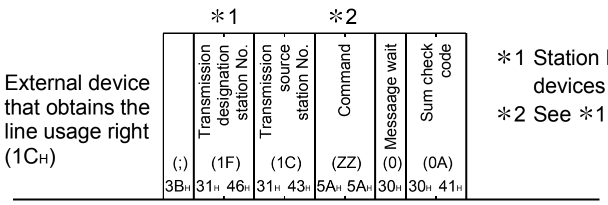


*1 Command "ZZ" is command for description purposes.
The user should select the command that transfers/accepts the line usage right.

6) The external device that accepted the line usage right by transmitting a response message performs processing beginning from 2).

7) When line usage time of the external device that currently has the line usage right exceeds the maximum data communications time.

a) The external device of the next station No. transmits all external devices general report data and obtains the line usage right and performs step 2).
(Example)



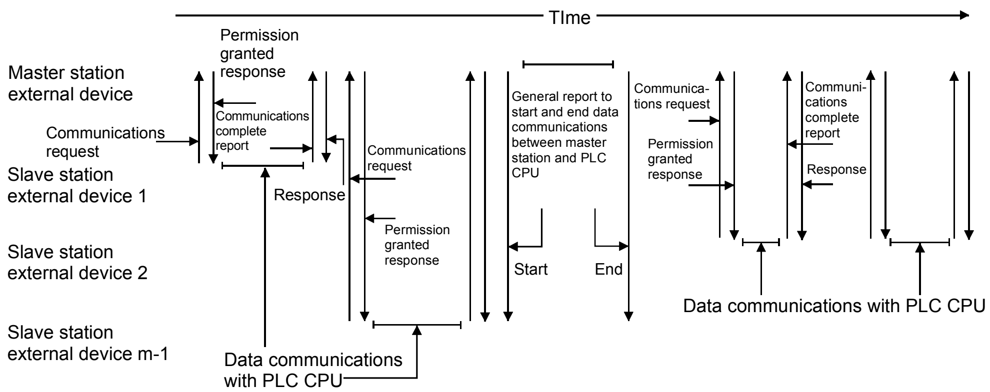
*1 Station No. for all external devices general report.
*2 See *1 of 5) above.

b) The other external devices check if all external devices general report data was received. If the data was received, the external device performs step 3).
If the data was not received, the next external device transmits all external devices general report data and obtains the line usage right and performs step 2). The other external devices perform b) of this item.

14.3.2 Data communications between PLC CPU and external devices by designating a master station and slave stations

One of the external devices is made the master station and the other external devices communicate data with the PLC CPU after obtaining permission from the master station.

(Example)

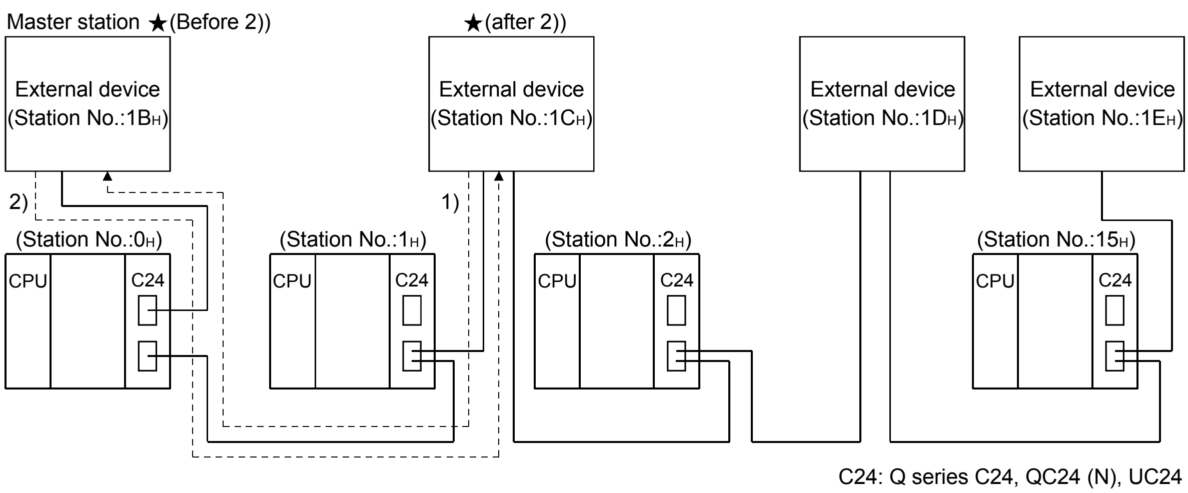


The following uses an example to describe the procedure when external devices communicate data with the PLC CPU.

In this example, after the start of data communications between external devices and the PLC CPU, the external devices perform a maximum data communications time time-out check. Slave station external devices that are not communicating data with the PLC CPU check if the external device that completed data communications with the PLC CPU transmitted a communications complete report.

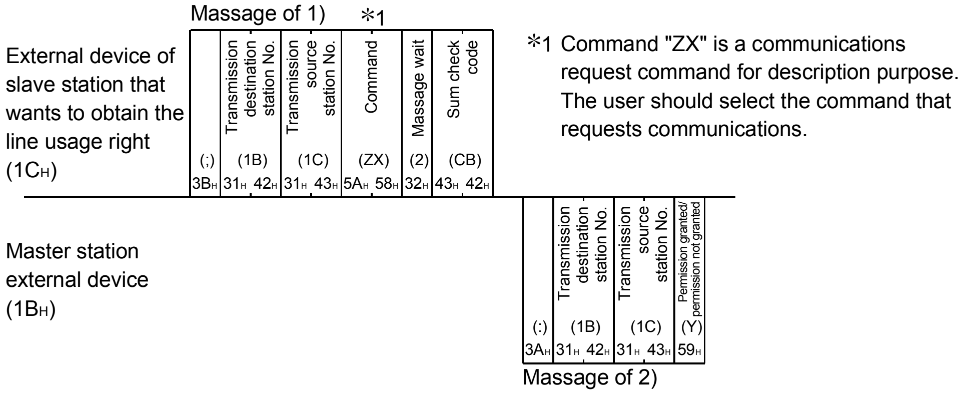
In the following descriptions, the external device with the lowest station No. (1BH) is assumed to be the master station and the other external devices are assumed to be slave stations.

★: External device that obtained the line usage right

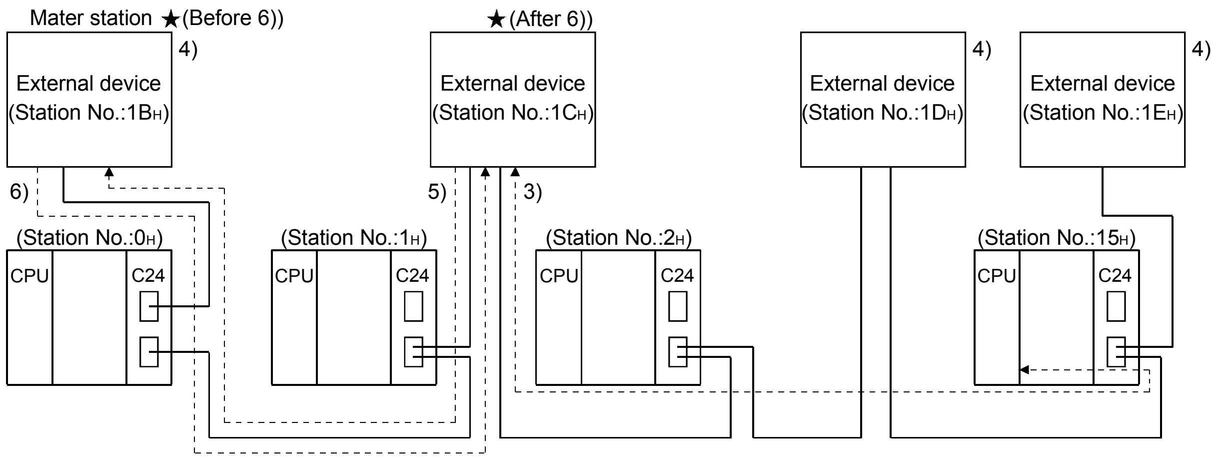


C24: Q series C24, QC24 (N), UC24

1) A slave station that wants to communicate data with the PLC CPU sends a communications request to the master station to obtain the line usage right.
A message structure example is shown in 2).
2) The master station transmits a permission granted response to the slave station that issued the communications request.



★: External device that obtained the line usage right



C24: Q series C24, QC24 (N), UC24

3) After communicating data with the PLC CPU within the maximum data communications time from among the external devices, the slave station that received the "permission granted" response goes to step 5).
4) The master station that transmitted the "permission granted" response and the slave stations that did not obtain line usage right check the line usage time of the slave station that obtained the line usage right and ignore receive data other than that addressed to their local station.
If the line usage time exceeds the maximum communications time, the external devices perform the processing of step 7).
5) After data communications are complete, the slave station that exchanged data with the PLC CPU transmits a communications complete report to the master station. A message structure example is shown in 6).
Slave stations that do not communicate data with the PLC CPU check if a communications complete report was transmitted and do not communicate data with the master station during that time.

6) The master station that received the communications complete report transmits a response to the slave station that transmitted the communications complete report.
(Example)

Massage of 5) *1

External device of slave station to perform the communications complete report ($1C_H$)

	Transmission destination station No.	Transmission source station No.	Command	Massage wait	Sum check code
(;)	(1B)	(1C)	(ZY)	(2)	(CC)
$3B_H$	31_H 42_H	31_H 43_H	$5A_H$ 59_H	32_H	43_H 43_H

*1 Command "ZY" is a communications complete report command for description purpose. The user should select the communications complete report command.

Master station external device ($1B_H$)

	Transmission destination station No.	Transmission source station No.
(:)	(1B)	(1C)
$3A_H$	31_H 42_H	31_H 43_H

Massage of 6)

7) After completion of 6) above, or when the line usage time of the slave station that obtained the line usage right exceeds the maximum data communications time:

a) The master station waits for a communications request from a slave station. When the master station receives a communication request, it performs processing from step 2).
b) The slave stations do not communicate data with the master station until data communications with the PLC CPU is necessary.
When data communications with the PLC CPU becomes necessary, that slave station performs processing from step 1).

8) When the master station itself wants to exchange data with the PLC CPU and a slave stations does not have the line usage right, it transmits all external devices except PLC CPU a general report data and obtains the line usage right before communicating data with the PLC CPU.
After data communications with the PLC CPU is complete, the master station transmits all external devices general report data to inform the slave stations that data communications with the PLC CPU is complete.
During this time, the slave stations do not communicate data with the master station until master station data communications is complete.
(Example)

External device of master station that obtained the line usage right ($1B_H$)

	Transmission destination station No. *1	Transmission source station No.	Command *2	Message wait	Sum check code
(;)	(1F)	(1B)	(ZX)	(0)	(07)
$3B_H$	31_H 46_H	31_H 42_H	$5A_H$ 58_H	30_H	30_H 37_H

*1 Station No. for all external devices general report.
*2 Commands "ZX" and "ZY" are commands for description purposes.
The user should select the command when the master station communicates data with slave stations.

External device of master station that transmits communications complete report ($1B_H$)

	Transmission destination station No. *1	Transmission source station No.	Command *2	Message wait	Sum check code
(;)	(1F)	(1B)	(ZY)	(0)	(08)
$3B_H$	31_H 46_H	31_H 42_H	$5A_H$ 59_H	30_H	30_H 38_H

15 SWITCHING THE MODE AFTER STARTING

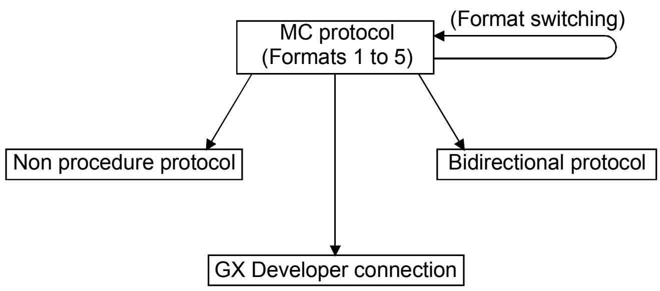
This function forcefully switches the current communication protocol and transmission specifications of the designated interface from an external device and the PLC CPU after the Q series C24 starts.
When the Q series C24 starts, it begins operation with the setting values of the GX Developer switch setting.

POINT
The mode switching function is used to change the communication protocol of the specified interface and transmission specifications and continue data communications without restarting the QCPU.

(1) Mode switching from external device

(a) If the communication protocol of the interface connecting the external device is MC protocol, mode switching can be performed.

(b) The communication protocol can be changed from the MC protocol as shown below.

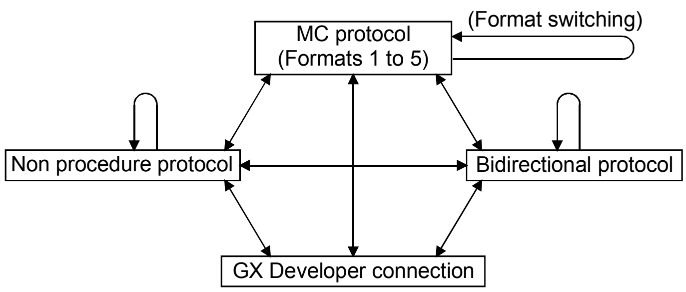


(c) The transmission specifications set by the GX Developer switch setting can be changed.

(2) Mode switching from PLC CPU

(a) Regardless of the current communication protocol of the connected interface, the external device can perform mode switching from the PLC program.

(b) The communication protocol can be changed from the PLC program as shown below.



(c) The transmission specifications set by the GX Developer switch setting can be changed.

POINT
When using the mode switching function, set the setting change of the communication setting to "enable" in the GX Developer switch setting. (See the User's Manual (Basic) Section 4.5.2.)

15.1 Mode Switching Operation and Contents that can be Changed

This section describes the set contents that can be changed with mode switching and the operation of Q series C24 after mode switching.

15.1.1 Settings that can be changed with mode switching

The following describes the settings that can be changed with mode switching.

(1) Switching the communication protocol

(a) The communication protocol setting of each interface can be switched.

(b) The communication protocol after the mode switching is specified by the switching mode No. designation area of the buffer memory (address: 90_H, 130_H).

(2) Changing the transmission specifications

(a) The transmission setting of each interface can be switched.

(b) The transmission setting after the mode switching is specified by the transmission specification after switching designation area of the buffer memory (address: 91_H, 131_H).

POINT

Mode switching allows the user to change the settings corresponding to communication protocol and transmission switch settings of the GX developer.

15.1.2 Operation for mode switching

The following describes the Q series C24 operation for mode switching.

(1) Processing currently executing

(a) If there is a mode switching request, mode switching immediately starts.

(b) If one of the following processings was being performed when a mode switching request was issued, that processing is terminated.

1) Data communications using an MC protocol
- Command message receive processing and response message or on-demand data transmission processing are all terminated.
- The transmission complete end signal for an on-demand data transmission request is not turned on.

2) Data communications using non procedure protocol and bidirectional protocol
   - Data and response message transmit and receive processing are all terminated.
   - All the input signals from the PLC CPU related to transmit and receive processing are turned off.
   - If the receive data from the external device was being stored to the Q series C24, the receive data up to that point is ignored and the data is processed with the current receive data count as [0].

(2) Modification of buffer memory stored value

(a) Special applications area (addresses: 252_H to 253_H, 262_H to 263_H)
The communication protocol status and transmission specifications after mode switching is complete are stored.
The values stored to areas other than the above are not changed. The contents before switching are preserved.

(b) User free area (addresses: 400_H to $1AFF_H$, 2600_H to $3FFF_H$)
The stored values are not changed. The contents before mode switching are preserved.

15.2 Mode Switching Precautions

(1) Set-up between the external device and the PLC CPU

Make the following setting for the external device and the PLC CPU so that mode switching is not performed during data communications.

(a) Which side is to switch the mode, the PLC CPU or external device

(b) Timing for each mode switching pattern
(For mode switching patterns, see Chapter 15, Section (1)(2).)

(c) Interlocking of all connected devices in the case of mode switching

1) Method and message structure when all the connected stations are informed of the mode switching execution
2) Method and message structure when all the connected stations are informed of the mode switching completion
3) Device No. and meaning of the value when a PLC CPU word device is used

(2) Mode switching from external device

(a) Once the mode has been changed to a mode other than MC protocol (Formats 1 to 5), it cannot be changed from the external device.
In this case, change the mode on the PLC CPU.

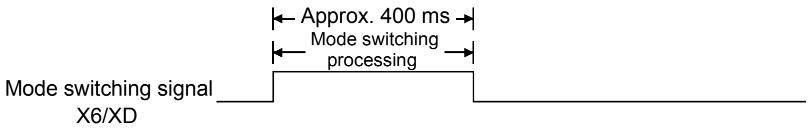
(b) Only the Q series C24 (including multidrop link stations) connected to an external device is available for mode switching from the external device (See the Reference Manual, Section 3.13.)
It is not available for other Q series C24 stations connected over a network system.

POINT

It is recommended to switch the mode on the PLC CPU side.

(3) Data communications after mode switching

The Q series C24 requires approximately 400 ms as processing time of mode switching only.
While the mode switching is being executed, the setting values cannot be stored into the buffer memory special applications area and data cannot be transmitted between the Q series C24 and the external device.



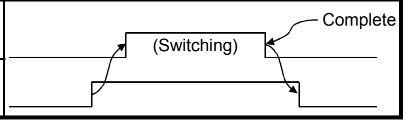
(4) Linked operation mode switching

Do not switch the mode when two interfaces of the Q series C24 are in linked operation.
Also, do not switch the mode for linked operation.

15.3 I/O Signals for Handshake with PLC CPU and Buffer Memory

This section describes the I/O signals for handshake and the buffer memories used when mode switching is performed.

(1) I/O signals for handshake with PLC CPU

	I/O signal		Signal name	Device turned ON/OFF		Timing
	CH1	CH2		CPU	C24	
Mode switching	X6	XD	Mode switching in progress		○	
	Y2	Y9	Mode switching request	○		

REMARK

The following signals can also be used as I/O signals, in addition to the above.
See Section 3.8 of User's Manual (Basic) for the PLC CPU I/O signals.

- Q series C24 ready signal (X1E) ······ Turned ON when the Q series C24 can be accessed from the PLC CPU
- Watchdog timer error signal (X1F) ··· Turned ON when the Q series C24 does not operate normally
- CH1 ERR. signal (XE) ······················ Turned ON when the CH1 ERR. occurred
- CH2 ERR. signal (XF) ······················ Turned ON when the CH2 ERR. occurred

(2) Buffer memory

Address (Decimal (hexadecimal))		Name		Setting value/Stored value
CH1	CH2			
144 (90_H)	304 (130_H)	For specifying mode switching	Switching mode No. designation (See (a).)	0001_H: MC protocol (Format 1) to 0007_H: Bidirectional protocol $00FF_H$: GX Developer connection
145 (91_H)	305 (131_H)		Transmission specification setting after switching (See (b).)	0000_H : Matched to the settings at the GX Developer 8000_H to $8FFF_H$: Matched to the settings of this area
515 (203_H)		For confirming mode switching and switch setting	Switch setting error, mode switching error condition	0 : Normal Other than 0: Switch setting error, mode switching error (See the User's Manual (Basic) Section 10.1.5)

(a) Switching mode No. designation area (addresses: 90_H, 130_H)
Write the desired mode No. (0001_H to 0007_H , $00FF_H$).

b15 to b0

Buffer memory address 90_H/130_H (Default 0000_H)

0001_H : MC protocol (Format 1)
0002_H : MC protocol (Format 2)
0003_H : MC protocol (Format 3)
0004_H : MC protocol (Format 4)
0005_H : MC protocol (Format 5)
0006_H : Non procedure protocol
0007_H : Bidirectional protocol
$00FF_H$: GX Developer connection ＊1

＊1 The communication protocol is specified as "00_H" when the GX Developer connection mode is set using the GX Developer switch setting. (See the User's Manual (Basic) Section 4.5.2.)

(b) Switching transmission specifications designation area (address: 91_H, 131_H)

1) Designates the transmission specifications after mode switching.
2) When the transmission specifications are returned to the contents set in GX Developer, [0000_H] is written to this area.
3) When setting arbitrary transmission specifications (other that the contents set in GX Developer), the value corresponding to ON/OFF of the relevant bit in the illustration shown below is written.
Relevant bit 1 (ON)/0 (OFF) is designated the same as transmission setting of GX Developer (See Section 4.5.2 of User's Manual (Basic)).

b15	b14 to b8	b7	b6	b5	b4	b3	b2	b1	b0	
1	00_H to F_H	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	CH1
1	00_H to F_H	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	CH2

Bit position	Description	Setting	
		OFF(0)	ON(1)
b0	Operation setting	Independent	Linked
b1	Data bit	7	8
b2	Parity bit	No	Yes
b3	Even/odd parity	Odd	Even
b4	Stop bit	1	2
b5	Sum check code	No	Yes
b6	Write during RUN	Prohibited	Allowed
b7	Setting modification	Prohibited	Allowed
b8 to b14	Communication rate	(＊1)	
b15	(Fixed to ON (1))	—	—

Specify [8000_H] when the "GX Developer connection" is selected for the switching mode No..

＊1 The specified values for the communication speed

Communication rate (Unit: bps)	Bit position b14 to b8	Communication rate (Unit: bps)	Bit position b14 to b8
50	$0F_H$	14400	06_H
300	00_H	19200	07_H
600	01_H	28800	08_H
1200	02_H	38400	09_H
2400	03_H	57600	$0A_H$
4800	04_H	115200	$0B_H$
9600	05_H	230400	$0C_H$

- Transmission speed of 230400 bps is available for only CH1 of the QJ71C24N (-R2/R4).
- When connecting external devices to both of two interfaces, the total of the communication speed should be 115200 bps of less (230400 bps or less if using QJ71C24N (-R2/R4)). When connecting an external device to either of two interfaces, the maximum of 115200 bps is available for the interface (a maximum of 230400 bps if using QJ71C24N (-R2/R4)). In this case, set 300 bps for the other interface to which no external device is connected.
- Set "00_H" to the interface for which "GX Developer connection" is set in the communication protocol setting. Serial communication module will operate at the communication speed set on the GX Developer.

REMARK

The PLC CPU must also be aware of the following I/O signals for handshake and buffer memories when the mode is switched from an external device.

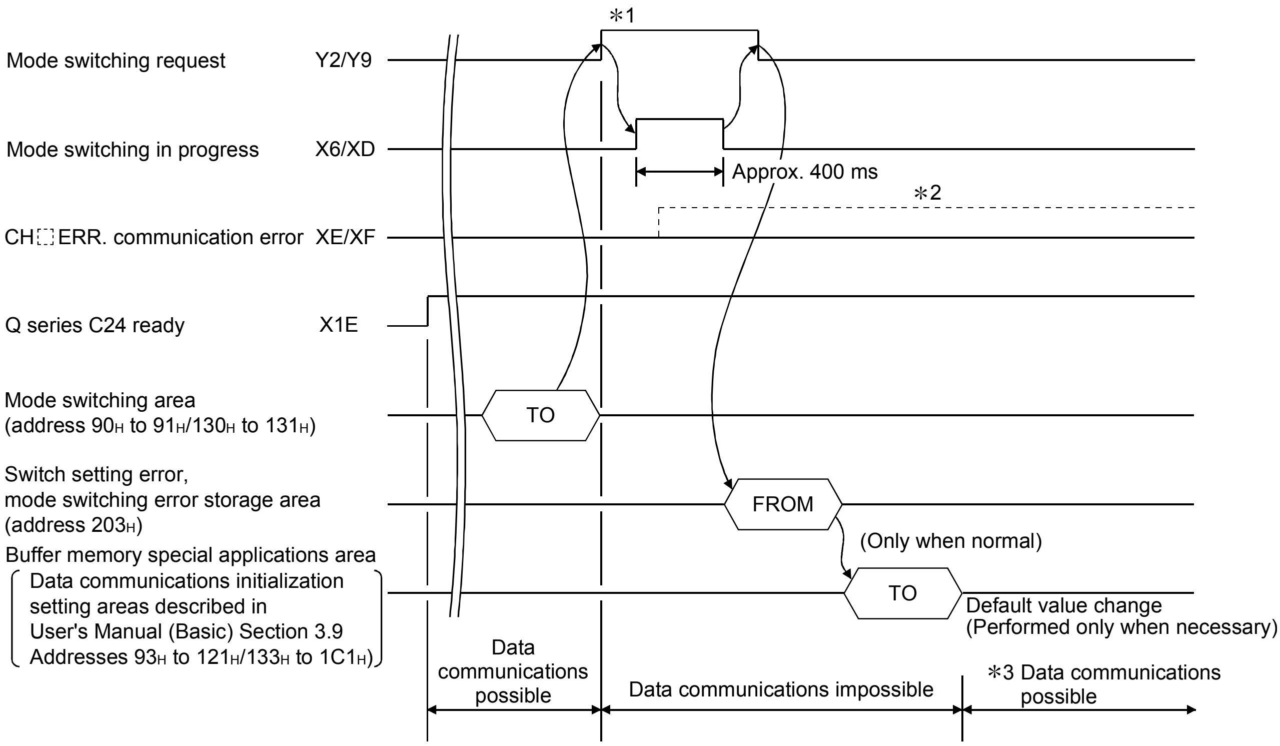
- Mode switching in progress signal (X6/XD)
- Switch setting error, mode switching error storage area (address: 203_H)

15.4 Switching the Mode from the PLC CPU

This section shows how the Q series C24 mode is switched from the PLC CPU.

15.4.1 Mode switching procedure

The following explains the procedure for switching the Q series C24 mode from the PLC CPU.



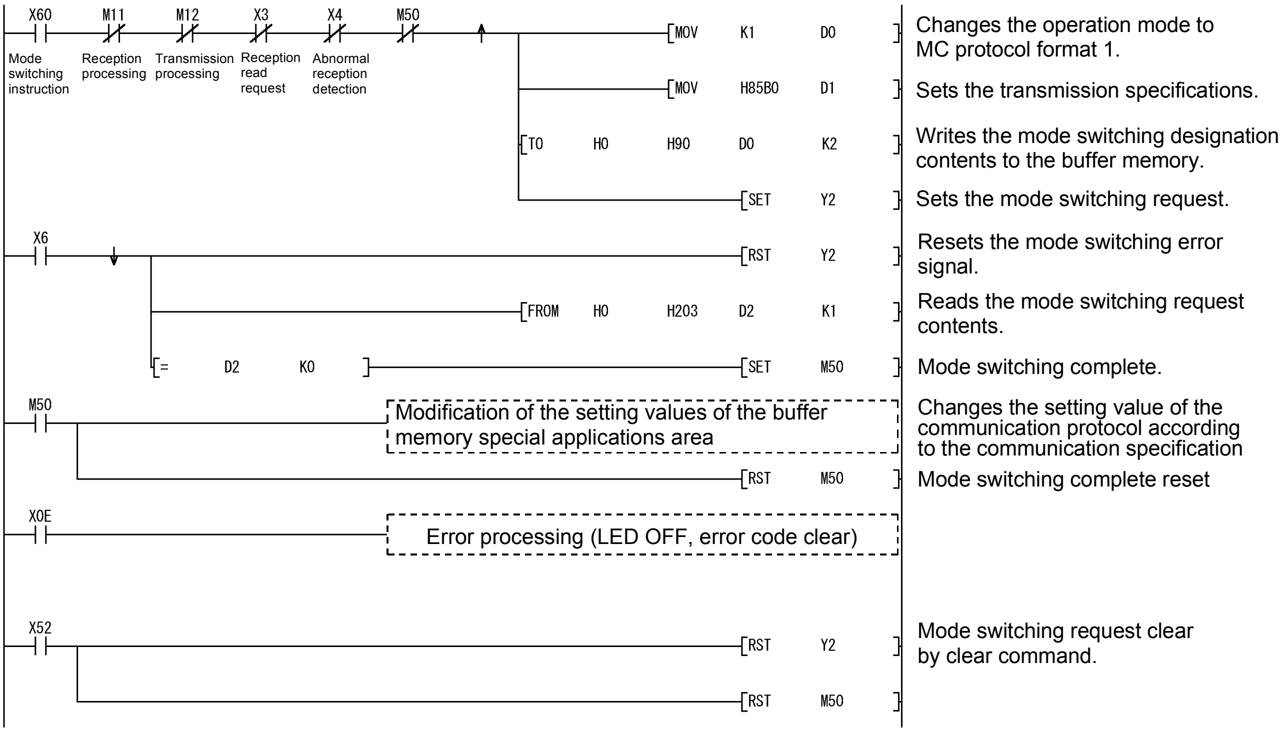
*1 Inform in advance all the connected device that data communications by mode switching cannot be performed.

*2 When XE and XF were turned on, check the error contents as described in Sections 10.1.2 of User's Manual (Basic) and take the corresponding action.
- Checking of mode switching designation contents for buffer memory mode switching area and writing of mode switching designation contents within the range that can be designated.
- Re-execution of mode switching.

*3 After checking that mode switching was completed normally, inform all the connected devices that data communications are possible and restart data communications.
To check the Q series C24 mode (communication protocol, transmission specifications) after switching, read the buffer memories (addresses: 252_H to 253_H, 262_H to 263_H) described in Section 10.1.5 of User's Manual (Basic).

15.4.2 Mode switching sample program

The following shows a sample sequence program that switches the CH1 interface mode.
(The Q series C24 I/O signals X/Y00 to X/Y1F)

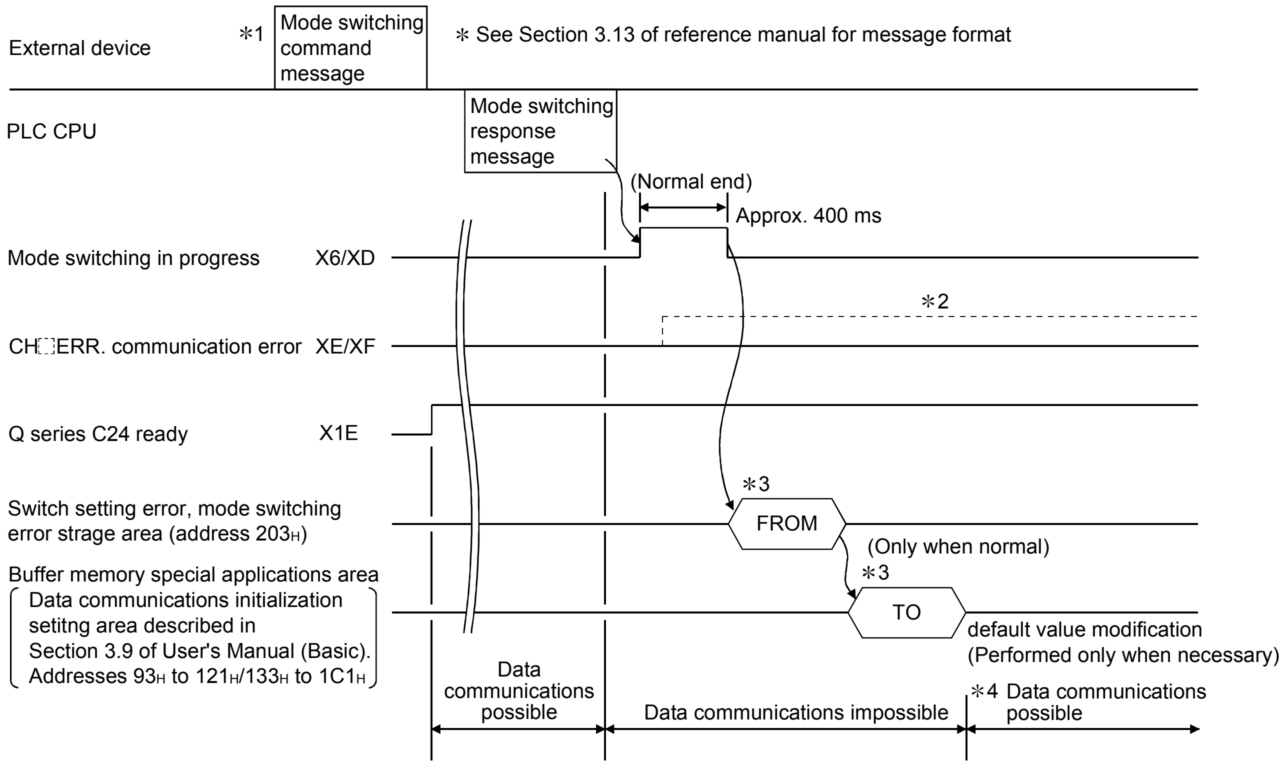


15.5 Switching the Mode from an External Device

This section shows how the Q series C24 mode is switched from an external device.

15.5.1 Mode switching procedure

The following explains the procedure for switching the Q series C24 mode from an external device.



*1 Inform in advance all the connected devices that data communications by mode switching cannot be performed.

*2 When XE, XF was turned on, check the error contents described in Sections 10.1.2 and 10.1.5 of User's Manual (Basic) and take the corresponding action.
- Checking of mode switching designation contents for buffer memory mode switching area and writing of mode switching designation contents within the range that can be designated.
- Re-execution of mode switching

*3 When the mode was switched from an external device, after mode switching is complete, read and write the buffer memory special applications area shown below from the PLC CPU.
- Switch setting error, mode switching error storage area (address: 203H)
- Data communications initialization setting areas (addresses: 93H to 121H/133H to 1C1H) described in Section 3.9 of User's Manual (Basic).

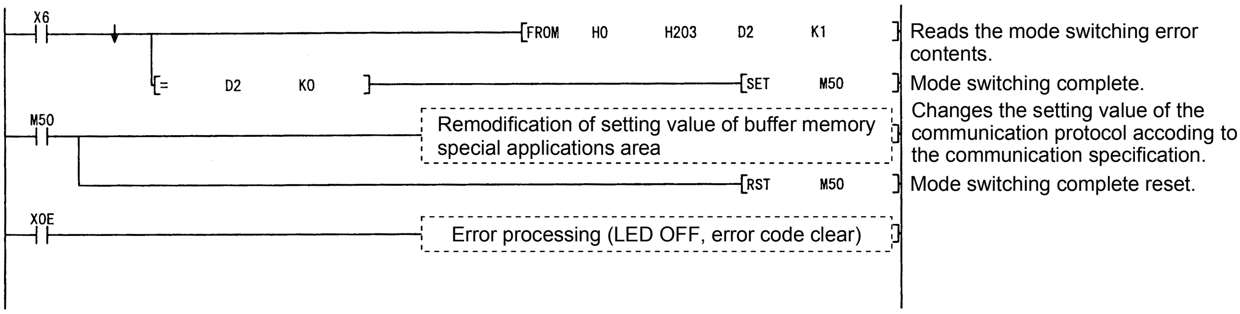
*4 After checking that mode switching was completed normally, inform all the connected devices that data communications are possible and restart data communications.

REMARK

To check the Q series C24 mode (communication protocol, transmission specifications) after switching, read the buffer memory (addresses: 252_H to 253_H, 262_H to 263_H) described in Section 10.1.5 of User's Manual (Basic).
(To check the external device, read the buffer memory with the MC protocol buffer memory read function.)

15.5.2 Mode switching sample program

The following shows a PLC CPU sample sequence program that switches the CH1 interface mode from an external device.
(The Q series C24 I/O signals X/Y00 to X/Y1F)



16 USING COMMUNICATION DATA MONITORING FUNCTION

The following describes the QJ71C24N (-R2/R4) communication data monitoring function.

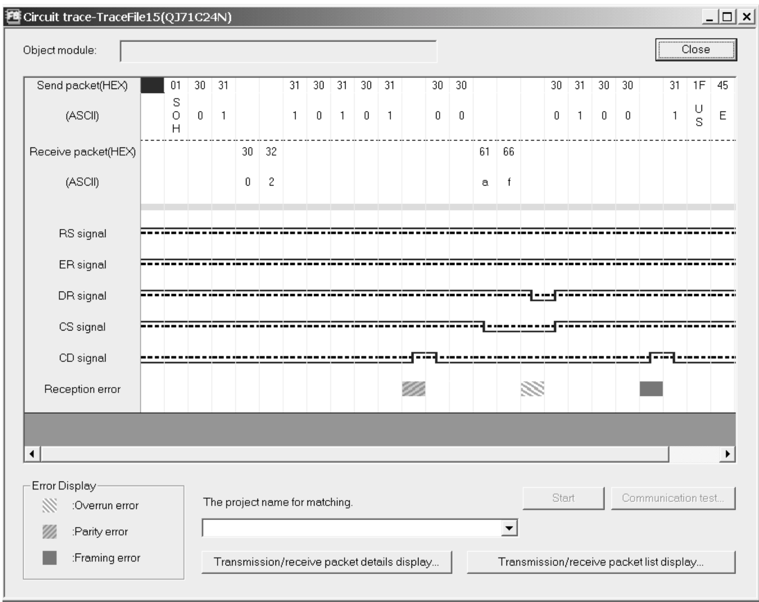
16.1 Communication Data Monitoring Function

16.1.1 Overview

Communication data monitoring function is a function to monitor communication data between the QJ71C24N (-R2/R4) and an external device on communication lines.
The system startup time can be reduced by analyzing the communication data on the communication lines when debugging the system.
The following two methods are for the communication data monitoring.

(1) Communication data monitoring by the PLC program (Explained in this section)
Monitoring is performed by the monitor start instruction written in the communication data monitoring specification area of the buffer memory.

(2) Communication data monitoring by GX Configurator-SC
The debugging support function of the GX Configurator-SC protocol FB support in used for monitoring (circuit trace).
See the Operating Manual (Protocol FB support function) for the debugging support function of the GX Configurator-SC protocol FB support.



This section describes the communication data monitoring by the PLC program.

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16.1.2 Communication data monitoring operation

The following describes the communication data monitoring operation.

POINT

(1) When using the communication data monitoring function, the total transmission speed of the two interfaces should not exceed 115200 bps.
(2) The communication data monitoring function is effective when the communication protocol is assigned to 0_H to 8_H.

(1) Monitor start

(a) Monitor start instruction "0001_H" is written in the communication data monitoring specification area (Address: 2018_H/2118_H). (Set by user)
(b) By the monitor start instruction, the monitor data pointer/monitor data size area are cleared to 0 and "0002_H" is written in the communication data monitoring specification area which starts monitoring. ∗1
(Q series C24 is set.)
(c) When a monitor setting error occurs, "$100F_H$" is written in the communication data monitoring specification area. (Q series C24 is set.)
Check the monitor buffer head address and the monitor buffer size setting range and perform monitoring again.

∗1 Monitor data area (Default address: 2602_H to $32FF_H$/3302_H to $3FFF_H$) is not cleared to 0.

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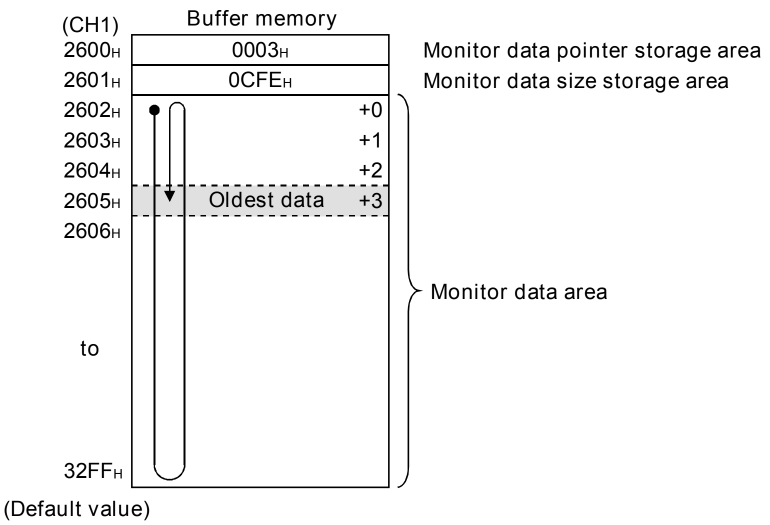
(2) During monitoring

(a) After monitoring starts, data of reception, transmission, receiving error, and signal change are stored from the head address of the monitor data area in the order of occurrence.
(b) When the monitoring data exceeds the capacity of the monitor data area, monitoring is continued by writing new data over the oldest data.
However, monitoring may automatically stop according to the settings of the monitor option area (Address: 2019_H/2119_H). (See Section 16.2 (2) (b).)



(c) Each data is stored in the monitor data area using the following timing.

Data classification		Data storage timing
Received data		When receiving data
Transmitted data		When transmitting data
Receiving error data		When detecting receiving errors
RS-232 line	RS, DSR signals	When changing the RS, ER signals
	CS, DSR, CD signals	When signal changes are detected during the periodic processing (Operation interval: 1 to 19 ms) as well as for the above timing (Monitoring is not performed during the periodic processing)

(3) Monitor stop

Monitoring stops if any of the following conditions are satisfied.

(a) Monitor stop by user instructions
Monitoring stops if "0000H" is written in the communication data monitoring specification area of the buffer memory. (Set by user)

(b) Monitor stop by the system when the monitor data area is full
1) The full stop specification (bit 0) of the monitor option specification area of the buffer memory is set to "ON. "
2) When the monitor data area is full (monitor buffer size), monitoring is automatically stopped and "1002H" is written in the communication data monitoring specification area. (Q series C24 is set.)

(c) Monitor stop by the system when the timer 0 error occurs
1) The timer 0 error stop specification (bit 2) of the monitor option specification area of the buffer memory is set to "ON. "
2) When the timer 0 error (error code 7F40H) occurs, monitoring is automatically stopped and "1002H" is written in the communication data monitoring specification area. (Q series C24 is set.) *1

*1 Part of the data immediately after the occurrence of a timer 0 error may be entered in the monitor data area.

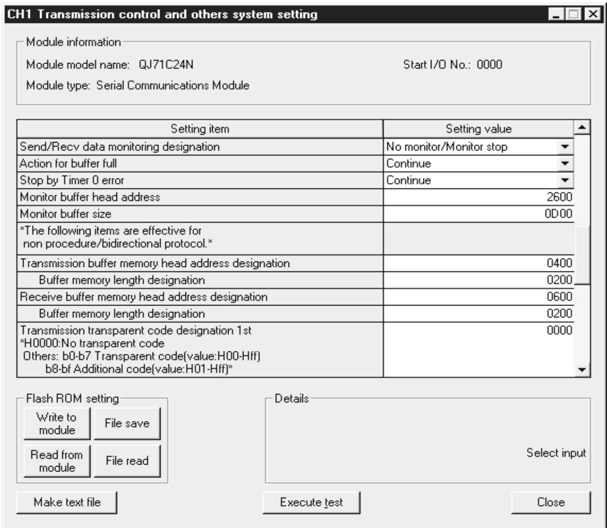
16.2 Communication Data Monitoring Function Settings

Settings for the communication data monitoring function can be made on the "Transmission control and other system setting" screen of the GX Configurator-SC, or by the PLC program.

(1) GX Configurator-SC setting for the communication data monitoring function

The setting items for the communication data monitoring function are shown below.
See (2) for setting details.

[Transmission control and other system setting screen]

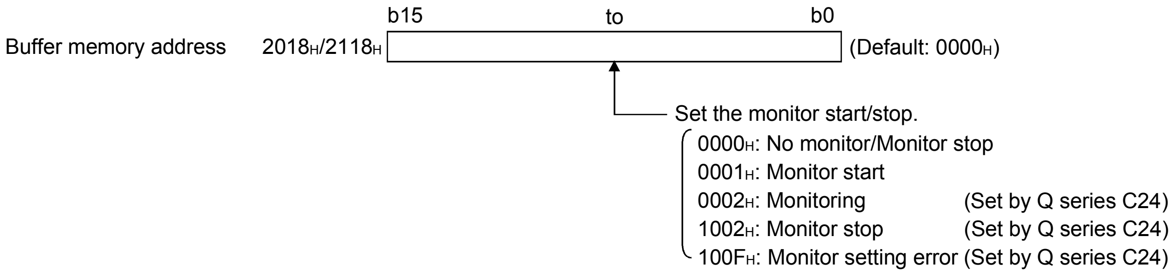


[Setting items]

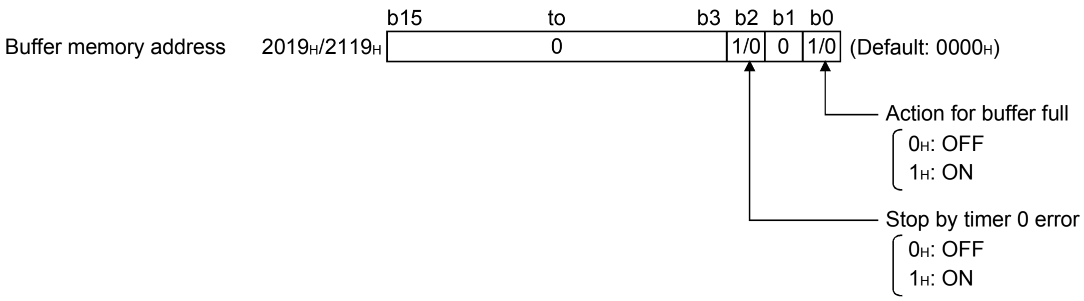
Setting items	Setting values	Item details
Send/Receive data monitoring designation	No monitoring/Monitor stop Monitor start	Select "monitor start" for constant monitoring.
Action for buffer full	Continue/Stop	Select "stop" to stop monitoring when the monitor data area is full.
Stop by Timer 0 error	Continue/Stop	Select "stop" to stop monitoring when a timer 0 error occurs.
Monitor buffer head address	0400_H to $1AFD_H$, 2600_H to $3FFD_H$	Enter a value to change the monitor buffer address. (Default address: 2600_H/3300_H)
Monitor buffer size	0003_H to $1A00_H$	Enter a value the monitor buffer size. (Default: $0D00_H$)

(2) Buffer memory for communication data monitoring function

(a) Communication data monitoring specification area (Address: 2018_H/2118_H)
Set start/stop of the communication data monitoring.
See Section 16.1.2 for communication data monitoring setting operation.



(b) Monitor option specification area (Address: 2019_H/2119_H)
Specify the options of the communication data monitoring function.



1) Action for buffer full (bit 0)
   - When action for buffer full is OFF
     When the monitoring data exceeds the capacity of the monitor data area, monitoring continues by writing the new data over the oldest data.
   - When action for buffer full is ON
     When the monitor data area is full (monitor buffer size), monitoring is automatically stopped and "1002_H" is written in the communication data monitoring specification area. (set by Q series C24)

2) Stop by timer 0 error (bit 2)
   - When the stop by timer 0 error is OFF
     Monitoring continues even if the timer 0 error (error code $7F40_H$) occurs.
   - When the stop by timer 0 error is ON
     When the timer 0 error (error code $7F40_H$) occurs, monitoring is automatically stopped and "1002_H" is written in the communication data monitoring specification area. (set by Q series C24)

(c) Monitor buffer head address specification area (Address: $201A_H$/$211A_H$)
Specify the head address of the storage area (monitor data area) for the monitor data within the range of the user's free area of the buffer memory.
Setting range: 0400_H to $1AFD_H$, 2600_H to $3FFD_H$ (Default: 2600_H/3300_H)

(d) Monitor buffer size specification area (Address: 201BH/211BH)
Set the size of the monitor data area.
Setting range: 0003H to 1A00H (Default: 0D00H)

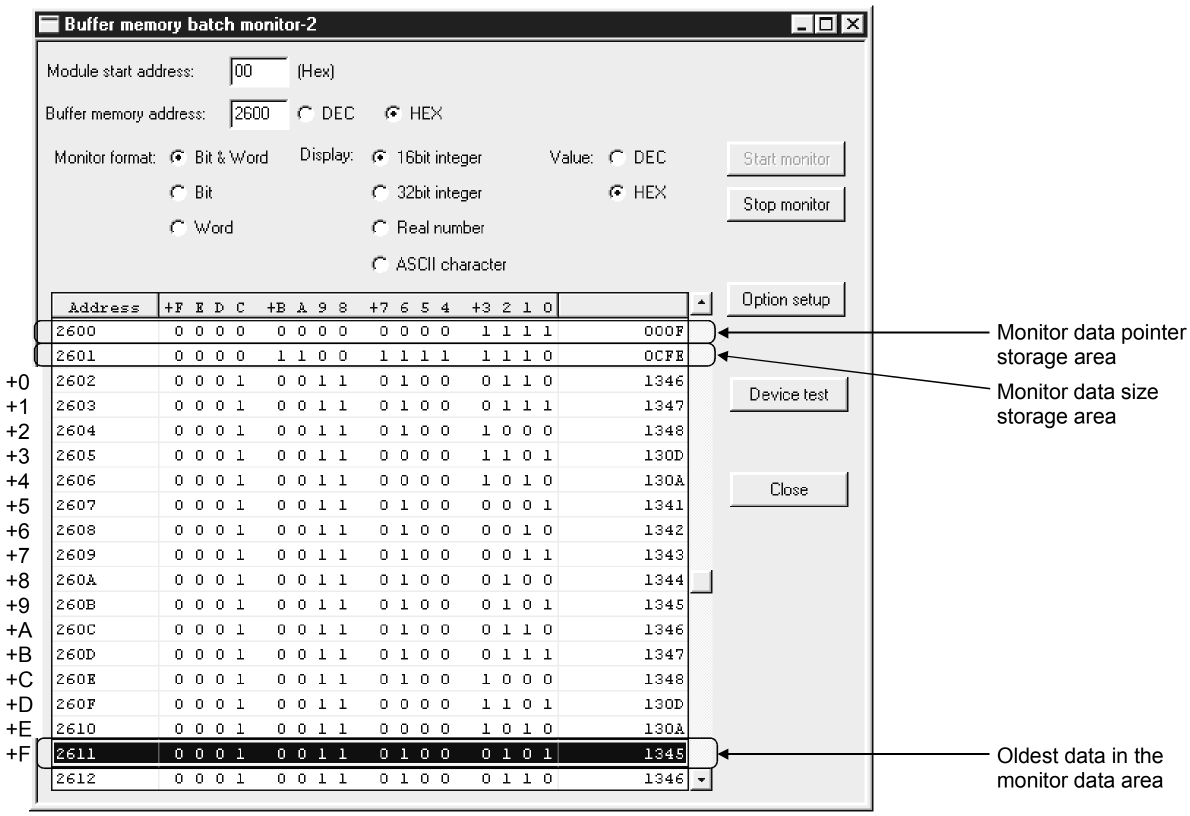
(e) Monitor data pointer storage area (Address: according to monitor buffer head address setting (Default: 2600H/3300H))

1) The oldest data position of the monitor data area is stored using the offset value from the head address of the monitor data area.

   0 to (monitor buffer size specification (Default: 0D00H) –3): oldest data position

2) When the monitoring data exceeds the monitor buffer size, the new data is written over the oldest data. (Ring buffer type)
   The oldest data position of the monitor data area can be confirmed from this area.

   (Example) "2611H" becomes the oldest data when "000FH" is the monitor data pointer using "2602H" as the head address of the monitor data area.



(f) Monitor data size area (Address: according to the monitor buffer head address setting (Default: 2601H/3301H))
The number of monitor data stored in the monitor data area is stored.

0 to (monitor buffer size specification (Default: 0D00H) –2): Number of monitor data

(g) The monitor data area (Default addresses: 2602H to 32FFH /3302H to 3FFFH)
The monitor data are stored in one-word units as shown in the configuration below.
See Section 16.3 for an example of the communication data monitoring.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	*	CD	CS	DSR	Received data								When receiving data
0	0	0	1	*	CD	CS	DSR	Transmitted data								When transmitting data
0	0	1	0	*	CD	CS	DSR	0						RS	DTR	When the RS/DTR signal is changed
0	0	1	1	*	CD	CS	DSR	0					FE (*1)	OVR (*1)	PE (*1)	When a reception error occurs
0	1	0	0	*	CD	CS	DSR	0								When detecting a CD to DSR signal change

Data classification (b12 to b15)
0: When receiving data
1: When transmitting data
2: When the RS/DTR signal is changed
3: When a reception error occurs
4: When detecting a CD to DSR signal change

Signal condition (b8 to b11)
*System area

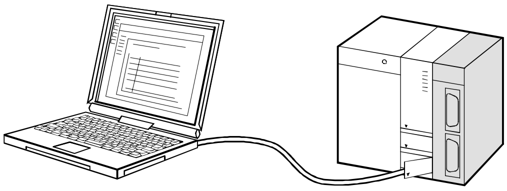
*1 FE: Framing error
OVR: Overrun error
PE: Parity error

16.3 Communication Data Monitoring Example

The following is an example of the data monitoring of nonprocedural protocol communication.

(1) System configuration

The system configuration for the sample program is as shown below.
The CH used for operation of this sample program is CH1 only.



(2) Program condition

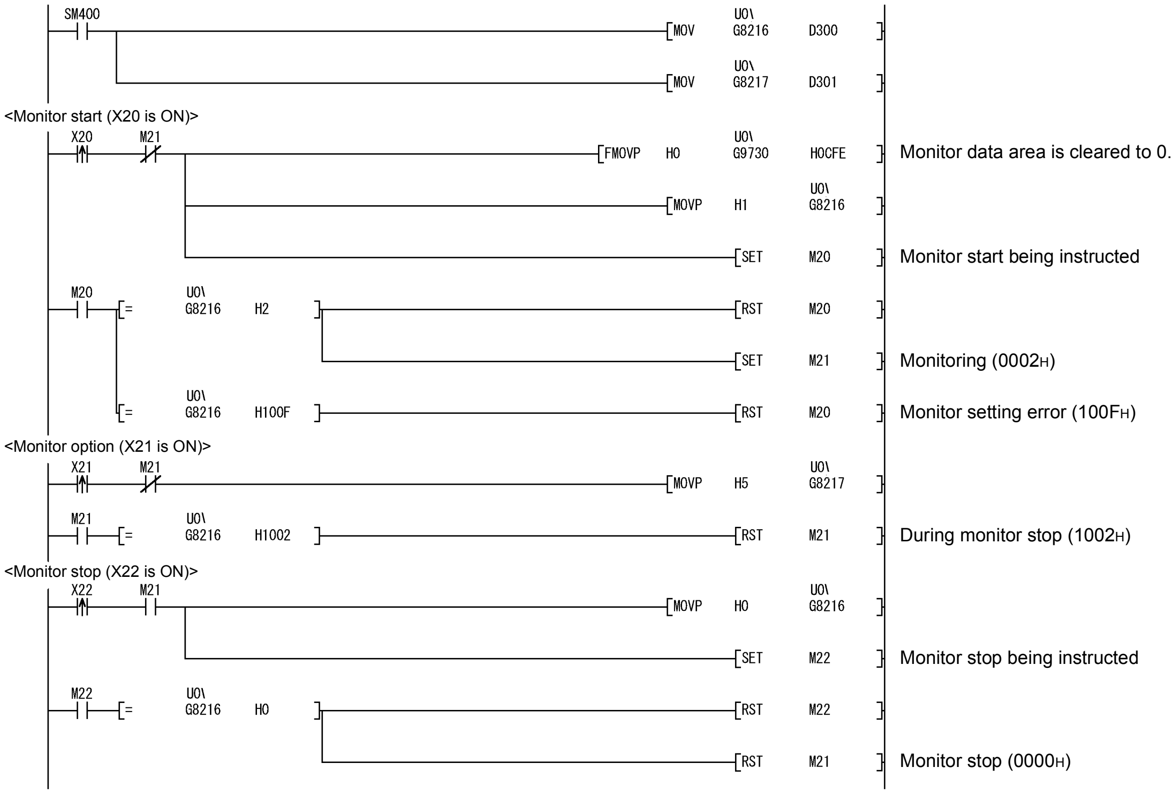
This is a program to monitor transmitted data from CH1 of the QJ71C24N-R2 with user instructions.

(a) GX Developer switch setting (See User's Manual (Basic) Section 4.5.2.)

Switch number	Setting value
Switch 1	07C2
Switch 2	0006
Switch 3	07C2
Switch 4	0006
Switch 5	0000

(b) Devices used by the user
- Monitor start instruction signal ·················· X20
- Monitor option specification signal ············ X21
- Monitor stop instruction signal ·················· X22
- During monitor start instructions ··············· M20
- During monitoring ····································· M21
- During monitor stop instructions ··············· M22
- Communication data monitoring specification area storage condition ········· D300
- Monitor option specification area storage condition······································ D301

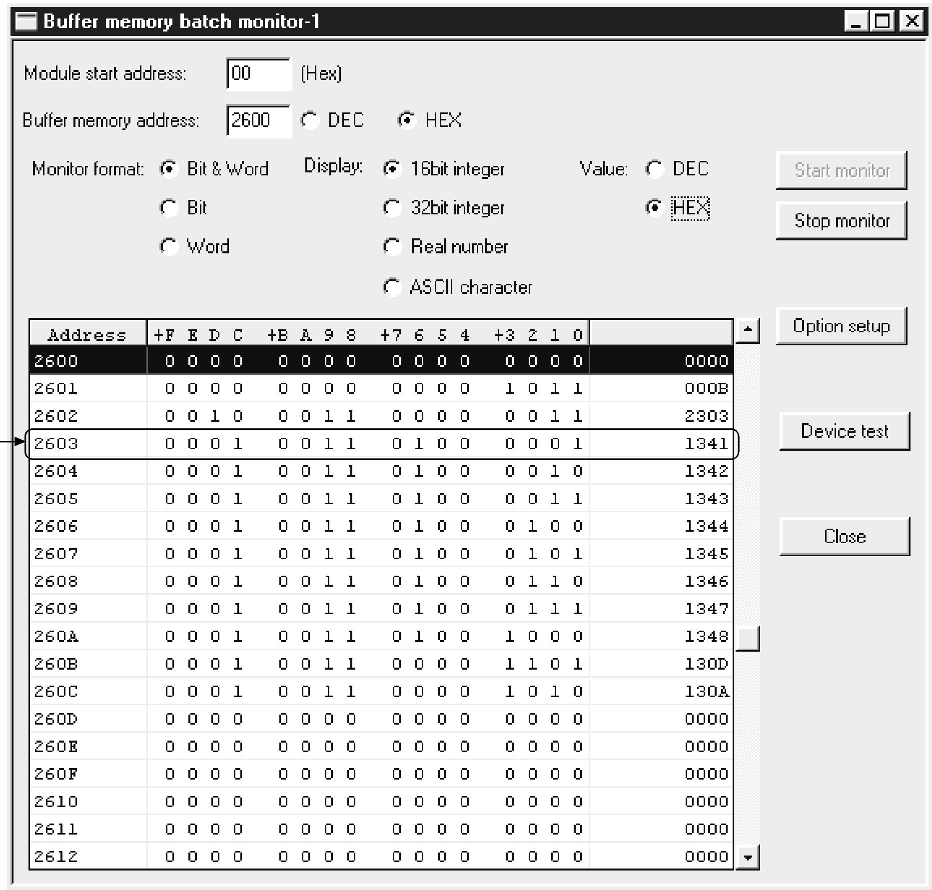
(C) Sample program



(3) Confirming monitor data by GX Developer

The monitor data area for CH1 (Address: 2602_H to $32FF_H$) is monitored on the buffer memory batch monitoring screen of the GX Developer.
See Section 16.2 (2) (g) for the data configuration of the monitor data area.

(Example) The following data are sent from CH1 using non procedure protocol.
Transmitted data; "ABCDEFGH" + $0D0A_H$ (five-word)



b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	When transmitting data
∗ System area				∗	CD	CS	DSR	Data transmission								

17 DEDICATED INSTRUCTIONS

Dedicated instructions are used to simplify programming when using the intelligent functional module functions. Among the dedicated instructions for the Q series C24 explained in this manual, this chapter focuses on the instructions that can be used for QCPU.

17.1 Dedicated Instruction List

The following table lists the dedicated instructions explained in this chapter.

Application	Dedicated instruction	Functional description	Reference section
For data transmission/reception	BUFRCVS	Receives data by an interrupt program during data communication via the non procedure protocol or bidirectional protocol.	Section 17.2
	PRR	Employs user frames to perform data communication via the non procedure protocol according to the contents defined in the transmission user frame designation area.	Section 17.6
For setting the units of communication data count	CSET	Sets the units (word/byte) of transmission/reception data count.	Section 17.4
For the PLC CPU monitoring function		Registers/cancels PLC CPU monitoring in order to use the PLC CPU monitoring functions.	Section 17.3
For registration/reading of user frames to Flash ROM	PUTE	Registers a user frame.	Section 17.7
	GETE	Reads a user frame.	Section 17.5

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POINT

(1) The user should not change data (control data, request data, etc.) designated by a dedicated instruction until the execution of that instruction is completed.

(2) Dedicated instructions for the Q series C24 are executed based on the current setting values stored in the buffer memory when the module is started.
When it is necessary to change any of the setting values, change the desired setting value using GX Configurator-SC before starting up the respective module. Alternatively, setting values can be changed using a sequence program before starting up the PLC CPU.

1) Area of the buffer memory assigned for applicable functions of dedicated instructions.
2) Setting values for data communication
   - Word/byte unit setting
   - Receive complete code
   - Received data count

   etc.

17.2 BUFRCVS Instruction

Setting data	Applicable device								
	Internal device		File register	MELSECNET/H, MELSECNET/10 Direct J□\□		Special module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word				
(S)	—	○	○	—					
(D)	○	○	○	—					

[Instruction code]	[Executing condition]	[Instruction format]
BUFRCVS	(rising pulse)	Z.BUFRCVS "Un" (S) (D)

Setting data

Setting data	Description	Setting range	Set by	Data type
"Un"	Start I/O signal of the module (00 to FE: The 2 upper digits of an input/output signal expressed in 3-digit.)	0 to FE$_H$	User	Binary 16 bits
(S)	Reception channel number 1: Channel 1 (CH1 side) 2: Channel 2 (CH2 side)	1, 2	User	Device name
(D)	Head number of the devices that store receive data ＊ Receive data is read from the reception area of the buffer memory.	—	System	Device name

The file registers of each of the local device and the program cannot be used as the setting data.

Receive data

Device	Item	Setting data	Setting range	Set by
(D)+0	Receive data length	Stores the number of data read from the receive data count storage area. (＊1)	0 or more	System
(D)+1 to (D)+n	Receive data	Stores data read from the receive data count storage area in sequence, starting from the youngest address.	—	System

＊1 According to the "Word/byte units designation" by GX Configurator-SC, the number of bytes is stored when byte is designated and the number of words is stored when word is designated.

REMARK

(1) For information about errors caused by incorrect data designated by the user, see the description in "Errors" on the next page.
When a reception error occurs, the error code can be read from the data reception result storage area (address: 258$_H$/268$_H$) in the buffer memory.

(2) The "Set by" column indicates the following:
- User : Data set by the user before executing the dedicated instruction.
- System: The PLC CPU stores execution results of the dedicated instruction.

Functions

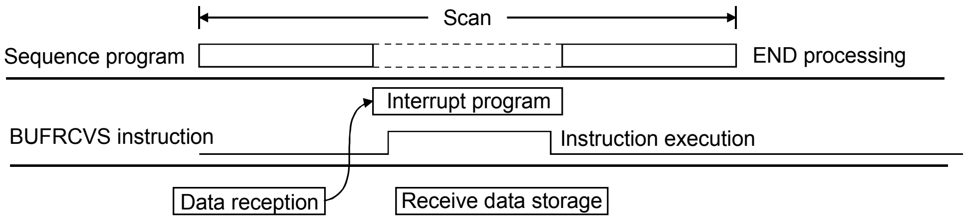
(1) This instruction stores data received from an external device to a designated device.

(2) This instruction can identify the address of the reception area in the buffer memory and read relevant receive data.

(3) When this instruction is executed, reception is completed and the reception data read request signal (X3/XA) or the reception abnormal detection signal (X4/XB) is turned off automatically.
It is not necessary to turn on the reception data read completion signal (Y1/Y8) when receive data is read by this instruction.

(4) The BUFRCVS instruction is used by an interrupt program and its processing is completed in one scan.

[Operation when the BUFRCVS instruction is being executed]



Errors

(1) When the dedicated instruction is completed abnormally, the error flag (SM0) turns on and the error code is stored in SD0.
See the following manuals regarding the error code, and check the errors and take corrective actions.
<Error codes>
4FFFH or less : QCPU (Q Mode) User's Manual (Hardware Design, Maintenance and Inspection)
7000H or higher: Section 10.2 of the User's Manual (Basic)

Precaution when using the BUFRCVS instruction

(1) Use the BUFRCVS instruction when receiving data via an interrupt program.

(2) If reading of data received is to be done for the same interface, data cannot be received by the main program when the receiving of data is done by an interrupt program.
Thus, the BUFRCVS instruction cannot be used together with the following instructions.
- INPUT instruction (instruction for receiving data using the non procedure protocol via the main program)
- BIDIN instruction (instruction for receiving data using the bidirectional protocol via the main program)

＊ Data cannot be received using the FROM instruction and input/output signals.

(3) The CSET and BUFRCVS instructions cannot be executed at the same time.

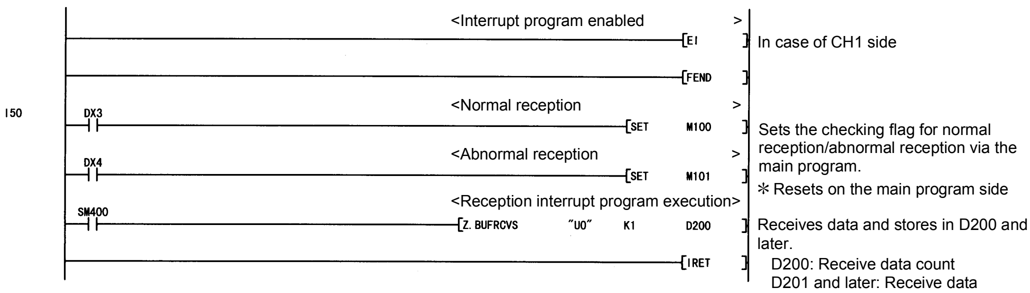
(4) The device storing data received via the BUFRCVS instruction must have an area that is large enough to store the maximum size of data received from the external device.
If an area large enough to store the maximum size of data received from the external device is not secured, the data following the storage device will be overwritten.

Program example

An interrupt program that reads receive data.

(Setting)
- Interrupt pointer setting with GX Developer
  CPU side: Interrupt pointer. Start No. = 50,
  Interrupt pointer No. of units = 2 (fixed)
  ＊ CH1 side interrupt pointer = I50,
  CH2 side interrupt pointer = I51
  Intelligent. module side: Start I/O No. = 0, Start SI No. = 0 (fixed)
- Interrupt program start enable/disable setting with GX Configurator-SC
  CH1 side: Issues interrupt (performs communication via the non procedure protocol.)
  CH2 side: Does not issue interrupt

When the input/output signals of the Q series C24 are X/Y00 to X/Y1F



17.3 CSET Instruction (PLC CPU Monitoring Register/Cancel)

Setting data	Applicable device								
	Internal device		File register	MELSECNET/H, MELSECNET/10 Direct J□\□		Special module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word				
(S1)	—	○		—				K, H	—
(S2)	—	○		—					
(D1)	—	○		—					
(D2)	○	○		—					

[Instruction code]	[Executing condition]	[Instruction format]
CSET	↑	ZP.CSET "Un" (S1) (S2) (D1) (D2)

Setting data

Setting data	Description	Set by	Data type
"Un"	Start I/O signal of the module (00 to FE: The 2 upper digits of an input/output signal expressed in 3-digit.)	User	Binary 16 bits
(S1)	Channel No. for sending the monitoring result 1: Channel 1 (CH1 side) 2: Channel 2 (CH2 side)	User	Binary 16 bits
(S2)	Head number of the devices that store control data	User, System	Device name
(D1)	Dummy	—	Device name
(D2)	Head bit device number of the local station that turns ON for one scan upon instruction completion. (D2)+1 also turns ON if the instruction execution completes abnormally.	System	Bit

The file registers of each of the local device and the program cannot be used as the setting data.

Control data

(1) Registering the PLC CPU monitoring

Device	Item	Setting data	Setting range	Set by
(S2)+0	Execution type	Designate 0.	0	User
(S2)+1	Completion status	Stores the result of execution upon completion of an instruction. 0 : Normal Other than 0: Abnormal (error code)	—	System
(S2)+2	Request type	Designate the request content. 2: Registers PLC CPU monitoring.	2	User
(S2)+3	Cycle time units	Designate the unit of cycle time. 0: 100 ms 1: s 2: min	0 to 2	User
(S2)+4	Cycle time	Designate the cycle time. 1_H to $FFFF_H$: Cycle time	1_H to $FFFF_H$	User
(S2)+5	PLC CPU monitoring function	Designate the monitoring function. 1: Constant cycle transmission 2: Condition agreement transmission	1, 2	User

Device	Item			Setting data	Setting range	Set by
(S2)+6	PLC CPU monitoring transmission measure			Designate the transmission measure. 0: Data transmission (device data, CPU abnormal information) 1: Notification	0, 1	User
(S2)+7	Constant cycle transmission	User frame output head pointer		Designate the head pointer of the table setting the user frame numbers for constant cycle transmission. 0 : No designation (at condition agreement transmission and notification) 1 to 100: Head pointer	0, 1 to 100	
(S2)+8		User frame transmission count		Designate the user frame transmission (output) counts for constant cycle transmission. 0 : No designation (at condition agreement transmission and notification) 1 to 100: Transmission count	0, 1 to 100	
(S2)+9		Modem connection data No.		Designate the data No. for connecting the modem function when sending notifications in constant cycle transmission. 0 : No designation (at data transmission and condition agreement transmission) BB8$_H$ to BD5$_H$: Data No. for connection (flash ROM) 8001$_H$ to 801F$_H$: Data No. for connection (buffer memory)	0, BB8$_H$ to BD5$_H$ 8001$_H$ to 801F$_H$	
(S2)+10	Registered word blocks count			Designate the number of blocks of a word device to be monitored.	0 to 10	
(S2)+11	Registered bit blocks count			Designate the number of blocks of a bit device to be monitored.	0 to 10	
(S2)+12	PLC CPU abnormal monitoring (PLC CPU status monitoring)			Designate whether or not to execute abnormal monitoring for the PLC CPU. 0: Do not monitor. 1: Monitor.	0, 1	
(S2)+13	PLC CPU monitoring setting 1 st. * first block	Device code		Designate the code of a device to be monitored. 0: Do not monitor device. Other than 0: Device code.	See Section 2.2.2 (4).	
(S2)+14 (S2)+15		Monitoring head device		Designate the head number of the monitoring device in this block.	0 or more	
(S2)+16		Registration points		Designate the registration points (read points) for this block. 0: Do not monitor device. 1or more: Registration points * For a bit device, designate the points in word units.	0.1or more	
(S2)+17		Condition agreement trans-mission	Monitoring condition	Designate the monitoring condition for this block. 0: No designation (at constant cycle transmission) 1or more: Monitoring condition	See Section 2.2.2 (2).	
(S2)+18			Monitoring condition value	Designate the monitoring condition value for this block. 0 or more: Monitoring condition * Designate 0 for constant cycle transmission.		
(S2)+19			User frame output head pointer	Designate the head pointer of the table designating the user frame number for condition agreement transmission for this block. 0 : No designation (at constant cycle transmission and notification) 1 to 100: Head pointer	0, 1 to 100	
(S2)+20			User frame trans-mission count	Designate the user frame transmission (output) count in condition agreement transmission for this block. 0 : No designation (at constant cycle transmission and notification) 1 to 100: Transmission count	0, 1 to 100	
(S2)+21			Modem connec-tion data No.	Designate the data No. for connecting the modem function when sending notification in condition agreement transmission for this block. 0 : No designation (at data transmission and constant cycle transmission) BB8$_H$ to BD5$_H$: Data No. for connection (flash ROM) 8001$_H$ to 801F$_H$: Data No. for connection (buffer memory)	0, BB8$_H$ to BD5$_H$ 8001$_H$ to 801F$_H$	

Device	Item			Setting data	Setting range	Set by
(S2)+22 to (S2)+102	PLC CPU monitoring setting 2nd to 10 th * 2nd to 10th block			The same arrangement as the first PLC CPU monitoring setting item.	—	User
(S2)+103	CPU status monitoring setting ✻ Abnormal monitoring 11 th ✻ 11th block	Condition agreement transmissio n	Fixed value	Designate the fixed value when the CPU status monitoring is performed.	1	
(S2)+104					0	
(S2)+105					0	
(S2)+106					1	
(S2)+107					5	
(S2)+108					1	
(S2)+109			User frame output head pointer	Designate the head pointer of the table designating the user frame number for condition agreement transmission for this block 0 : No designation (at constant cycle transmission and notification) 1 to 100: Head pointer	0, 1 to 100	
(S2)+110			User frame transmissi on count	Designate the transmission (output) count of the user frames in condition agreement transmission for this block. 0 : No designation (at constant cycle transmission and notification) 1 to 100: Transmission count	0, 1 to 100	
(S2)+111			Modem connec-tion data No.	Designate the data No. for connecting the modem function when sending notifications in condition agreement transmission for this block. 0 : No designation (at data transmission and constant cycle transmission) BB8H to BD5H : Data No. for connection (flash ROM) 8001H to 801FH : Data No. for connection (buffer memory)	0, BB8H to BD5H, 8001H to 801FH	

(2) Canceling the PLC CPU monitoring

Device	Item	Setting data	Setting range	Set by (✻1)
(S2)+0	Execution type	Designate 0H.	0	User
(S2)+1	Completion status	Stores the result of execution upon completion of an instruction. 0 : Normal Other than 0: Abnormal (error code)	—	System
(S2)+2	Request type	Designate the request content. 3: Cancels the PLC CPU monitoring.	3	User
(S2)+3 to (S2)+111	For system	—	—	System

REMARK

(1) For information about errors caused by incorrect data designated by the user, see the description in "Errors" on the next page.

(2) The "Set by" column indicates the following:
- User : Data set by the user before executing the dedicated instruction.
- System: The PLC CPU stores execution results of the dedicated instruction.

Functions

(1) To register the PLC CPU monitoring, this instruction registers data necessary for the Q series C24 to execute the PLC CPU monitoring function.
When the data registration to execute the PLC CPU monitoring function is completed normally, the Q series C24 begins monitoring the PLC CPU and transmitting monitoring results to an external device.

(2) To cancel the PLC CPU monitoring, this instruction ends the Q series C24's monitoring operation of the PLC CPU.
When canceling of the PLC CPU monitoring is completed normally, the Q series C24 terminates the operation of the PLC CPU monitoring function.

(3) A maximum of 10 blocks can be designated for a word device or bit device to monitor the device memory.
To register the device memory to monitor, designate the word device blocks for the registered word blocks, then designate the bit device blocks for the registered bit blocks.

(4) Before sending the PLC CPU monitoring results to the external device, the user frame and user frame number should be registered with GX Configurator-SC in advance.

(5) To register the PLC CPU monitoring once again, cancel the PLC CPU monitoring before registration.

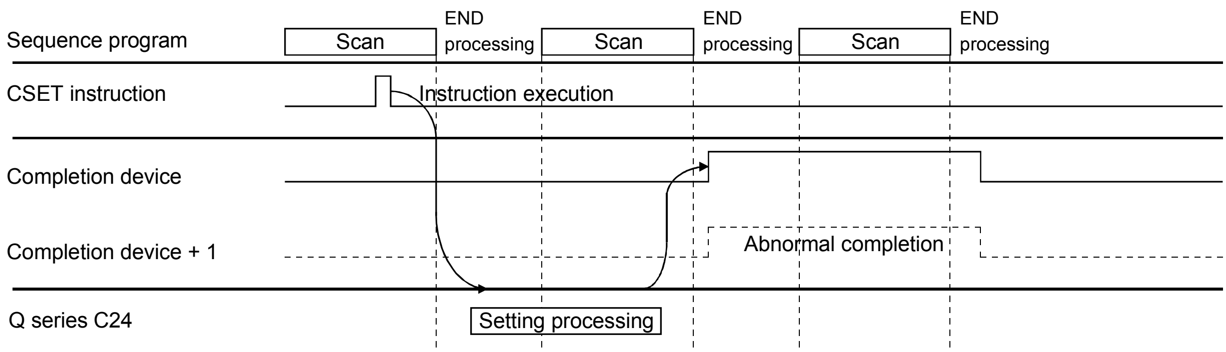
(6) Whether the CSET instruction is being executed or has been completed normally/abnormally can be checked by the completion device (D2) designated as a setting data.

(a) Completion device ((D2) + 0)
Turns on at the END processing of the scan where the CSET instruction is completed, and turns off at the next END processing.

(b) Completion device ((D2) + 1)
Turns on and off depending on the completion status of the CSET instruction.
• Normal completion : Stays off and does not change.
• Abnormal completion: Turns on at the END processing of the scan where the CSET instruction is completed, and turns off at the next END processing.

(7) When the PLC CPU monitoring registration is performed, the corresponding interface data communication protocol setting is only designated when non procedure protocol is used for the following data for designation in the control data.
• User frame output head pointer for constant cycle sending/ batch conditions sending.
• User frame transmission count for constant cycle sending/ batch conditions sending.
When the communication protocol setting for the corresponding interface is MC protocol, there is no need to designate the user frame output head pointer and the user frame transmission count. (It is ignored when being designated.)

[Operation when a CSET instruction is being executed]



Errors

(1) When the dedicated instruction is completed abnormally, the error flag (SM0) turns on and the error code is stored in SD0.
See the following manuals regarding the error code, and check the errors and take corrective actions.
<Error codes>
4FFFH or less : QCPU (Q Mode) User's Manual (Hardware Design, Maintenance and Inspection)
7000H or higher: Section 10.2 of the User's Manual (Basic)

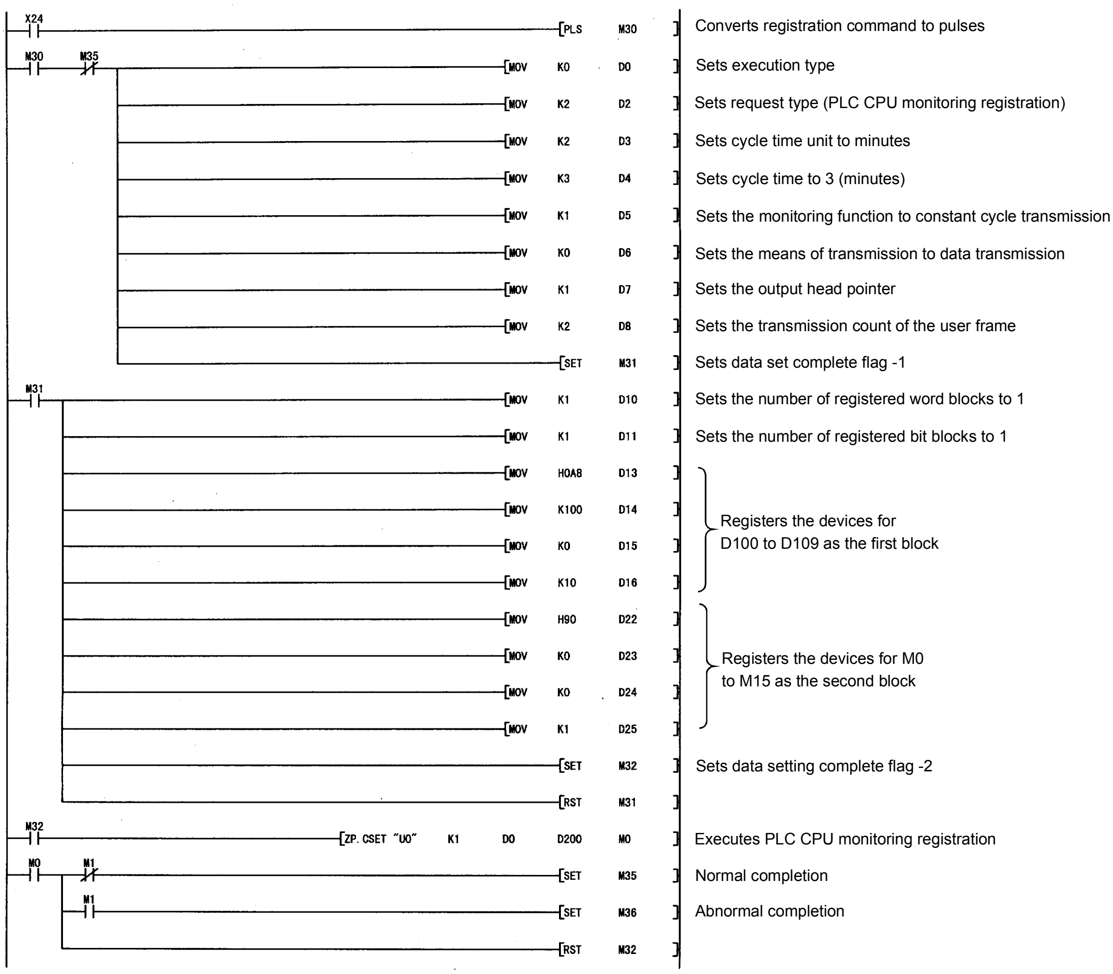
Program example

(1) A program that registers the PLC CPU monitoring

The following example shows how to register the PLC CPU monitoring and send the monitoring results from the interface on the CH1 side.

* The following registration is done to send the contents of M0 to M15 and D100 to D109 to the external device on a constant cycle (cycle time is 3 min).

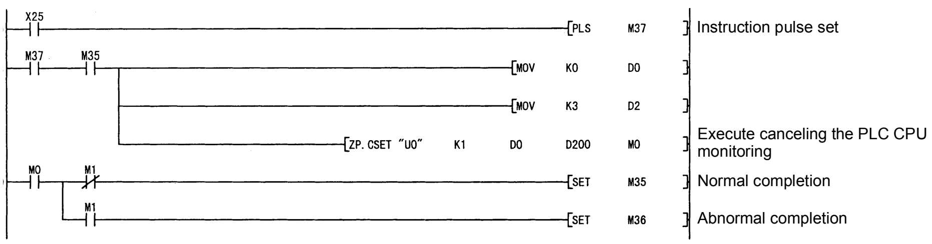
When the input/output signals of the Q series C24 are X/Y00 to X/Y1F



(2) A program that cancels the PLC CPU monitoring

This following example shows how to cancel the PLC CPU monitoring for the interface on CH1 side.

When the input/output signals of the Q series C24 are X/Y00 to X/Y1F.



17.4 CSET Instruction (Initial Settings)

Setting data	Applicable device								
	Internal device		File register	MELSECNET/H, MELSECNET/10 Direct J□\□		Special module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word				
(S1)	—	○		—				K, H	—
(S2)	—	○		—					
(D1)	—	○		—					
(D2)	○	○		—					

[Instruction code]	[Executing condition]	[Instruction format]
CSET		ZP.CSET "Un" (S1) (S2) (D1) (D2)

Setting data

Setting data	Description	Set by	Data type
"Un"	Start I/O signal of the module (00 to FE: The 2 upper digits of an input/output signal expressed in 3-digit.)	User	Binary 16 bits
(S1)	Channel No. for sending the monitoring result 1: Channel 1 (CH1 side) 2: Channel 2 (CH2 side)		
(S2)	Head number of the devices that store control data	User, System	Device name
(D1)	Dummy	—	Device name
(D2)	Head bit device number of the local station that turns ON for one scan upon instruction completion. (D2)+1 also turns ON if the instruction execution completes abnormally.	System	Bit

The file registers of each of the local device and the program cannot be used as the setting data.

Control data

Device	Item	Setting data	Setting range	Set by
(S2)+0	Execution type	Designate 0.	0	User
(S2)+1	Completion status	Stores the result of execution upon completion of an instruction. 0 : Normal Other than 0: Abnormal (error code)	—	System
(S2)+2	Request type	Designate the request content. 1: Setting of word/byte units and buffer memory assignment change	1	User
(S2)+3	Word/byte units designation	Designate the units of transmission/reception data count. 0: Current setting value 1: Word units 2: Bit units	0, 1, 2	

Device	Item	Setting data	Setting range	Set by
(S2)+4	On-demand function buffer memory head address	Designate the head address of the buffer memory used with the on-demand function. 0_H: Use the current setting value 400_H to $1AFF_H$, 2600_H to $3FFF_H$: Head address	0_H, 400_H to $1AFF_H$, 2600_H to $3FFF_H$	User
(S2)+5	On-demand function buffer memory size	Designate the size (word number) of the buffer memory used with the on-demand function. 0_H: Use the current setting value 1_H to $1A00_H$: Size	0_H, 1_H to $1A00_H$	
(S2)+6	Transmission area head address	Designate the head address of the transmission area used with the non procedure /bidirectional protocol. 0_H: Use the current setting value 400_H to $1AFF_H$, 2600_H to $3FFF_H$: Head address	0_H, 400_H to $1AFF_H$, 2600_H to $3FFF_H$	
(S2)+7	Transmission area size	Designate the size (word number) of the transmission area used with the non procedure /bidirectional protocol. 0_H: Use the current setting value 1_H to $1A00_H$: Size * The head transmission area (1 word) is used as a transmission data count designation area.	0_H, 1_H to $1A00_H$	
(S2)+8	Reception area head address	Designate the head address of the reception area used with the non procedure /bidirectional protocol. 0_H: Use the current setting value 400_H to $1AFF_H$, 2600_H to $3FFF_H$: Head address	0_H, 400_H to $1AFF_H$, 2600_H to $3FFF_H$	
(S2)+9	Reception area size	Designate the size (word number) of the reception area used with the non procedure /bidirectional protocol. 0_H: Use the current setting value 1_H to $1A00_H$: Size * The head reception area (1 word) is used as a reception data count storage area.	0_H, 1_H to $1A00_H$	
(S2)+10 to (S2)+111	For system	—	—	System

REMARK

(1) For information about errors caused by incorrect designated by the user, see the description in "Errors" on the next page.

(2) The "Set by" column indicates the following:
- User : Data set by the user before executing the dedicated instruction.
- System: The PLC CPU stores execution results of the dedicated instruction.

Functions

(1) This instruction changes the current values of the settings below to transmit/receive data using the following communication protocols:
- Data count unit (word/byte) of the data to be transmitted/received
- Transmission area in the buffer memory used by the on-demand function of the MC protocol
- Transmission and reception areas in the buffer memory used with the non-procedure protocol
- Transmission and reception areas in the buffer memory used with the bidirectional protocol

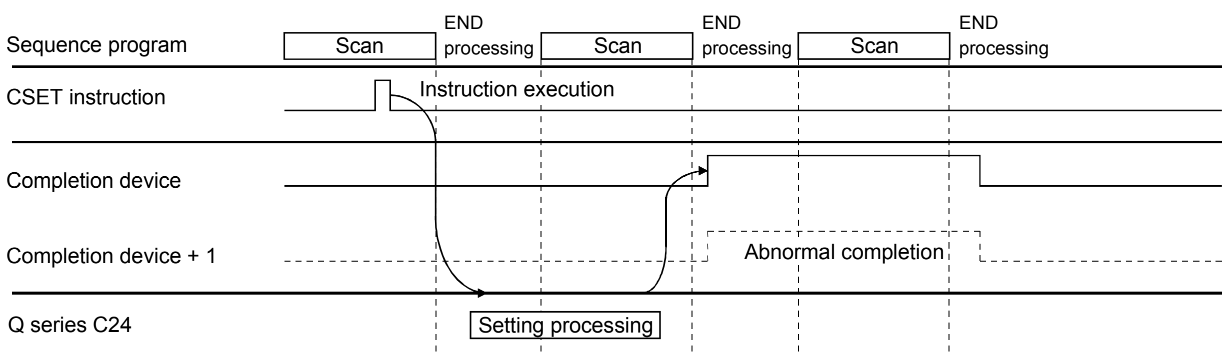
(2) To change the above setting values from the PLC CPU, execute the CSET instruction.
The CSET instruction must be executed before starting any data communication (execute it before the first scan). Once data communication begins, the CSET instructions cannot be executed (the setting values cannot be changed).
More than one CSET instruction cannot be executed simultaneously to perform the initial settings.

(3) Whether the CSET instruction is being executed or has been completed normally/ abnormally can be checked with the completion device (D2) designated by the setting data.

(a) Completion device ((D2) + 0)
Turns on at the END processing of the scan where the CSET instruction is completed, and turns off at the next END processing.

(b) Completion device ((D2) + 1)
Turns on and off depending on the completion status of the CSET instruction.
- Normal completion : Stays off and does not change.
- Abnormal completion: Turns on at the END processing of the scan where the CSET instruction is completed, and turns off at the next END processing.

[Operation when the CSET instruction is being executed]



Errors

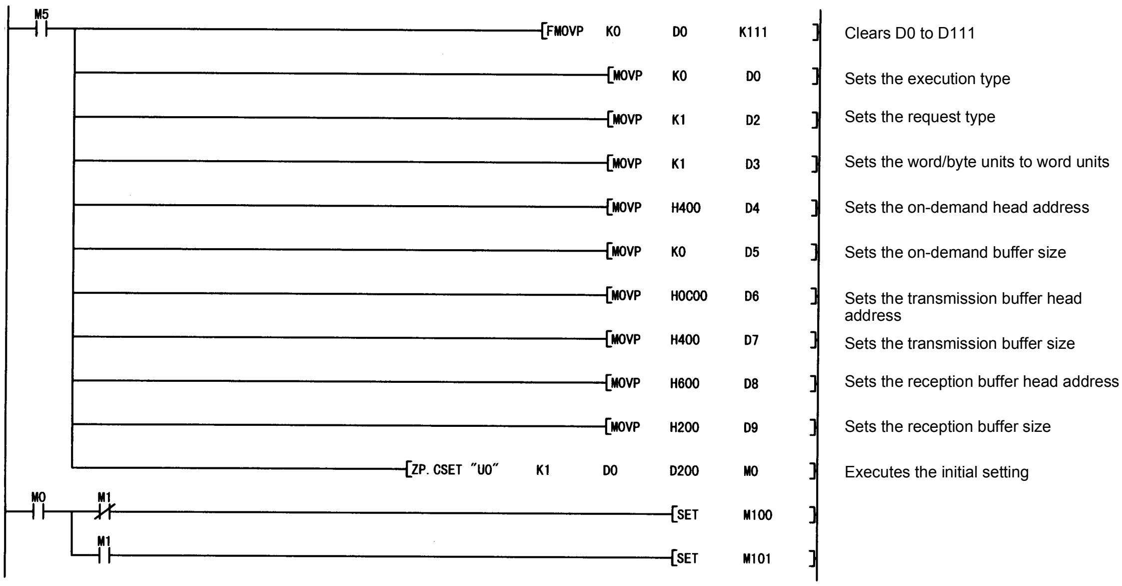
(1) When the dedicated instruction is completed abnormally, the error flag (SM0) turns on and the error code is stored in SD0.
See the following manuals regarding the error code, and check the errors and take corrective actions.
<Error codes>
4FFFH or less : QCPU (Q Mode) User's Manual (Hardware Design, Maintenance and Inspection)
7000H or higher: Section 10.2 of the User's Manual (Basic)

Program example

A program that changes the transmission buffer area for interface on CH1 side

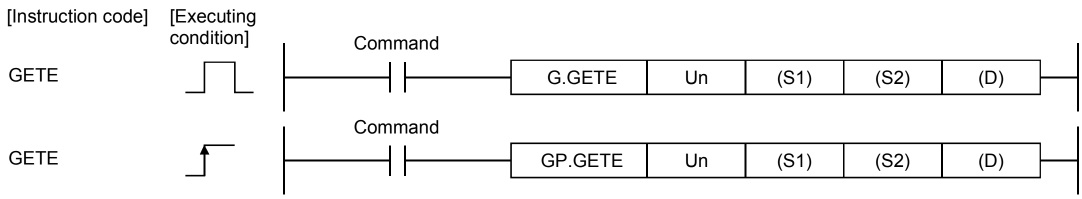
- Set the transmission buffer to C00H to FFFH.
- Set the reception buffer to 600H to 7FFH.

When the input/output signals of the Q series C24 are X/Y00 to X/Y1F



17.5 GETE Instruction

<table>
<tr><th rowspan="3">Setting data</th><th colspan="9">Applicable device</th></tr>
<tr><th colspan="2">Internal device</th><th rowspan="2">File register</th><th colspan="2">MELSECNET/H, MELSECNET/10 Direct J□\□</th><th rowspan="2">Special module U□\G□</th><th rowspan="2">Index register Zn</th><th rowspan="2">Constant</th><th rowspan="2">Others</th></tr>
<tr><th>Bit</th><th>Word</th><th>Bit</th><th>Word</th></tr>
<tr><td>(S1)</td><td>—</td><td colspan="2">○</td><td colspan="6">—</td></tr>
<tr><td>(S2)</td><td>—</td><td colspan="2">○</td><td colspan="6">—</td></tr>
<tr><td>(D)</td><td>○</td><td colspan="2">○</td><td colspan="6">—</td></tr>
</table>



Setting data

<table>
<tr><th>Setting data</th><th>Description</th><th>Set by</th><th>Data type</th></tr>
<tr><td>Un</td><td>Start I/O signal of the module
(00 to FE: The 2 upper digits of an input/output signal expressed in 3-digit.)</td><td rowspan="2">User</td><td rowspan="2">Binary 16 bits</td></tr>
<tr><td>(S1)</td><td>Head number of the devices that store control data</td></tr>
<tr><td>(S2)</td><td>Head number of the devices storing the registered data that has been read</td><td>User, System</td><td>Device name</td></tr>
<tr><td>(D)</td><td>Head bit device number of the local station that turns ON for one scan upon instruction completion.
(D)+1 also turns on if the execution completes abnormally.</td><td>System</td><td>Bit</td></tr>
</table>

The file registers of each of the local device and the program cannot be used as setting data.

Control data

<table>
<tr><th>Device</th><th>Item</th><th>Setting data</th><th>Setting range</th><th>Set by</th></tr>
<tr><td>(S1)+0</td><td>Dummy</td><td>—</td><td>0</td><td>—</td></tr>
<tr><td>(S1)+1</td><td>Read result</td><td>The result of reading via the GETE instruction is stored.
0 : Normal
Other than 0: Abnormal (error code)</td><td>—</td><td>System</td></tr>
<tr><td>(S1)+2</td><td>Directed frame No.</td><td>Designate the user frame No.</td><td>1000 to 1199</td><td>User</td></tr>
<tr><td rowspan="2">(S1)+3</td><td>Allowable number of read bytes</td><td>Designate the maximum bytes of the user frame's registered data that can be stored in (S2).</td><td>1 to 80</td><td>User</td></tr>
<tr><td>Registered bytes count</td><td>The number of bytes of the user frame's registered data that has been read is stored.</td><td>1 to 80</td><td>System</td></tr>
</table>

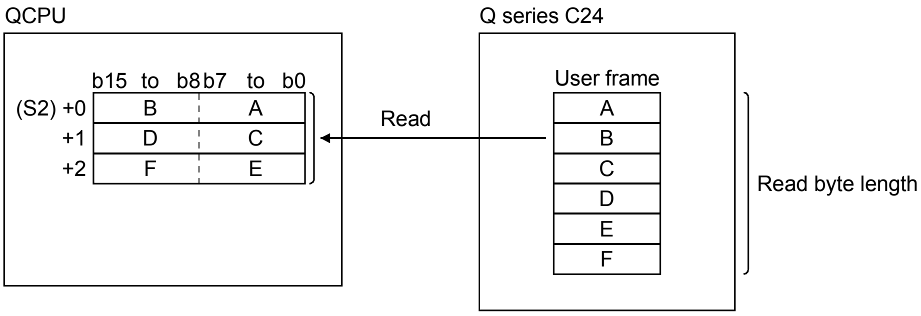
REMARK

(1) For information about errors caused by incorrect data designated by the user, see the description in "Errors" on the next page.

(2) The "Set by" column indicates the following:
- User : Data set by the user before executing the dedicated instruction.
- System: The PLC CPU stores execution results of the dedicated instruction.

Functions

(1) This instruction reads data from the user frame in the Q series C24 as designated by Un.



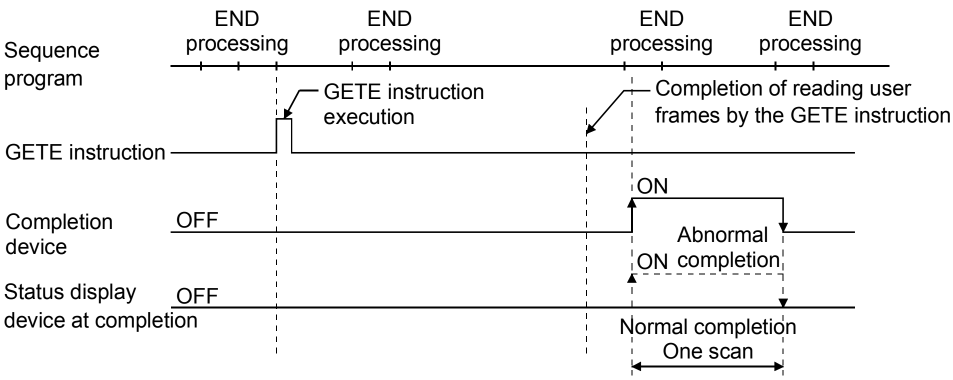
(2) While the GETE instruction is being executed, no other GETE or PUTE instructions can be executed.
While a GETE instruction is already being executed, if another GETE instruction or a PUTE instruction is executed, the second instruction must wait until the execution of the current GETE instruction is completed.

(3) Whether the GETE instruction was completed normally/abnormally can be checked by the completion device (D) or status display device at completion ((D)+1).

(a) Completion device
Turns on at the END processing of the scan where the GETE instruction is completed, and turns off at the next END processing.

(b) Status display device at completion
Turns on and off depending on the completion status of the GETE instruction.
- Normal completion : Stays off and does not change.
- Abnormal completion: Turns on at the END processing of the scan where the GETE instruction is completed, and turns off at the next END processing.

[Operation when the GETE instruction is being executed]



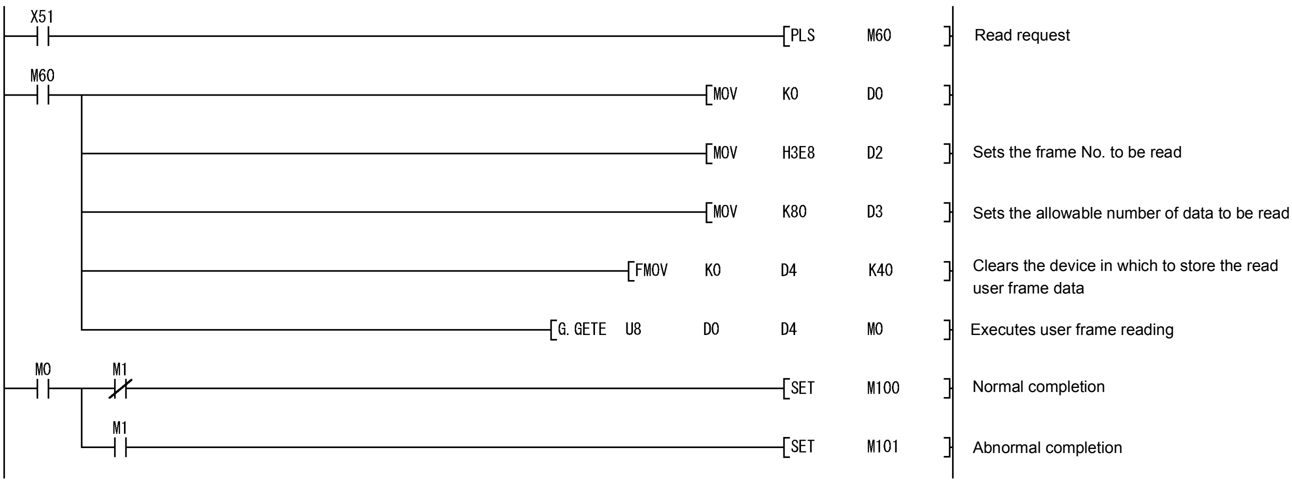
Errors

(1) When the dedicated instruction is completed with an error, the complete status display device at completion ((D)+1), turns on and the error code is stored in the control data read result ((S1)+1).
See the following manuals regarding the error code, and check the errors and take corrective actions.
<Error codes>
4FFFH or less : QCPU (Q Mode) User's Manual (Hardware Design, Maintenance and Inspection)
7000H or higher: Section 10.2 of the User's Manual (Basic)

Program example

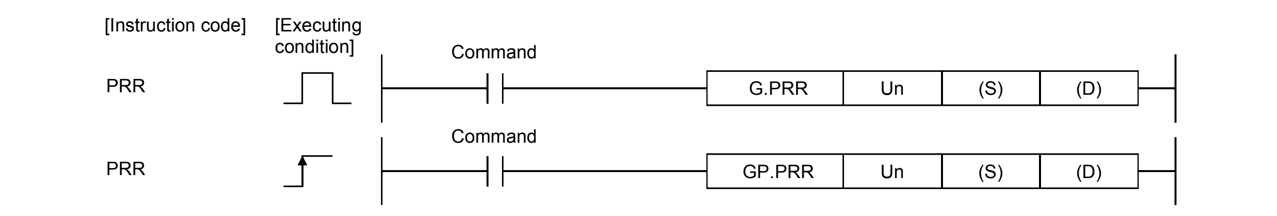
A program that reads registered data of the user frame having registration number 3E8H to devices D4 and later.

When the input/output signals of the Q series C24 are X/Y80 to X/Y9F



17.6 PRR Instruction

Setting data	Applicable device								
	Internal device		File register	MELSECNET/H, MELSECNET/10 Direct J□\□		Special module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word				
(S)	—	○	○	—					
(D)	○	○	○	—					



Setting data

Setting data	Description	Set by	Data type
Un	Start I/O signal of the module (00 to FE: The 2 upper digits of an input/output signal expressed in 3-digit.)	User	Binary 16 bits
(S)	Head number of the devices that store control data	User, System	Device name
(D)	Head bit device number of the local station that turns ON for one scan upon instruction completion. (D)+1 also turns on if the execution completes abnormally.	System	Bit

The file registers of each of the local device and the program cannot be used as setting data.

Control data

Device	Item	Setting data	Setting range	Set by
(S)+0	Transmission channel	Designate the transmission channel. 1: Channel 1 (CH1 side) 2: Channel 2 (CH2 side)	1, 2	User
(S)+1	Transmission result	The transmission completion result by the PRR instruction is stored. 0 : Normal Other than 0: Abnormal (error code)	—	System
(S)+2	CR/LF addition designation	Designate whether or not to add CR/LF to the transmission data. 0: Do not add CR/LF. 1: Add CR/LF.	0, 1	User
(S)+3	Transmission pointer	Transmission user frame designation area designates from which the frame number data may be transmitted.	1 to 100	User
(S)+4	Output count	Designate the number of user frames to be transmitted.	1 to 100	User

REMARK

(1) For information about errors caused by incorrect data designated by the user, see the description in "Errors" on the next page.

(2) The "Set by" column indicates the following:
- User : Data set by the user before executing the dedicated instruction.
- System: The PLC CPU stores execution results of the dedicated instruction.

Functions

(1) This instruction transmits the user frame data using the non procedure protocol of the Q series C24 as designated by Un, according to the control data stored in the device designated by (S) and succeeding devices, as well as the transmission user frame designation area of the Q series C24.

(2) The following instructions cannot be executed on a channel on which a PRR instruction is being executed.
- OUTPUT instruction
- ONDEMAND instruction
- Other PRR instruction
- BIDOUT instruction

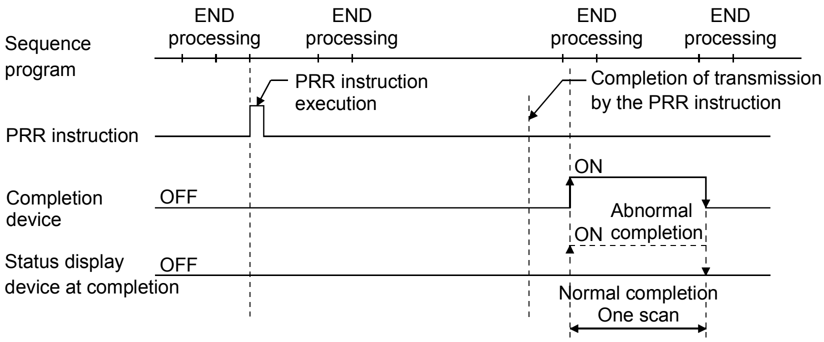
While a PRR instruction is already being executed, if one of the instructions above is executed, the second instruction must wait until the execution of the current PRR instruction is completed.

(3) Whether the PRR instruction was completed normally or abnormally can be checked with the completion device (D) or status display device at completion ((D)+1).

(a) Completion device
Turns on at the END processing of the scan where the PRR instruction is completed, and turns off at the next END processing.

(b) Status display device at completion
Turns on and off depending on the completion status of the PRR instruction.
- Normal completion : Stays off and does not change.
- Abnormal completion: Turns on at the END processing of the scan where the PRR instruction is completed, and turns off at the next END processing.

[Operation when the PRR instruction is being executed]



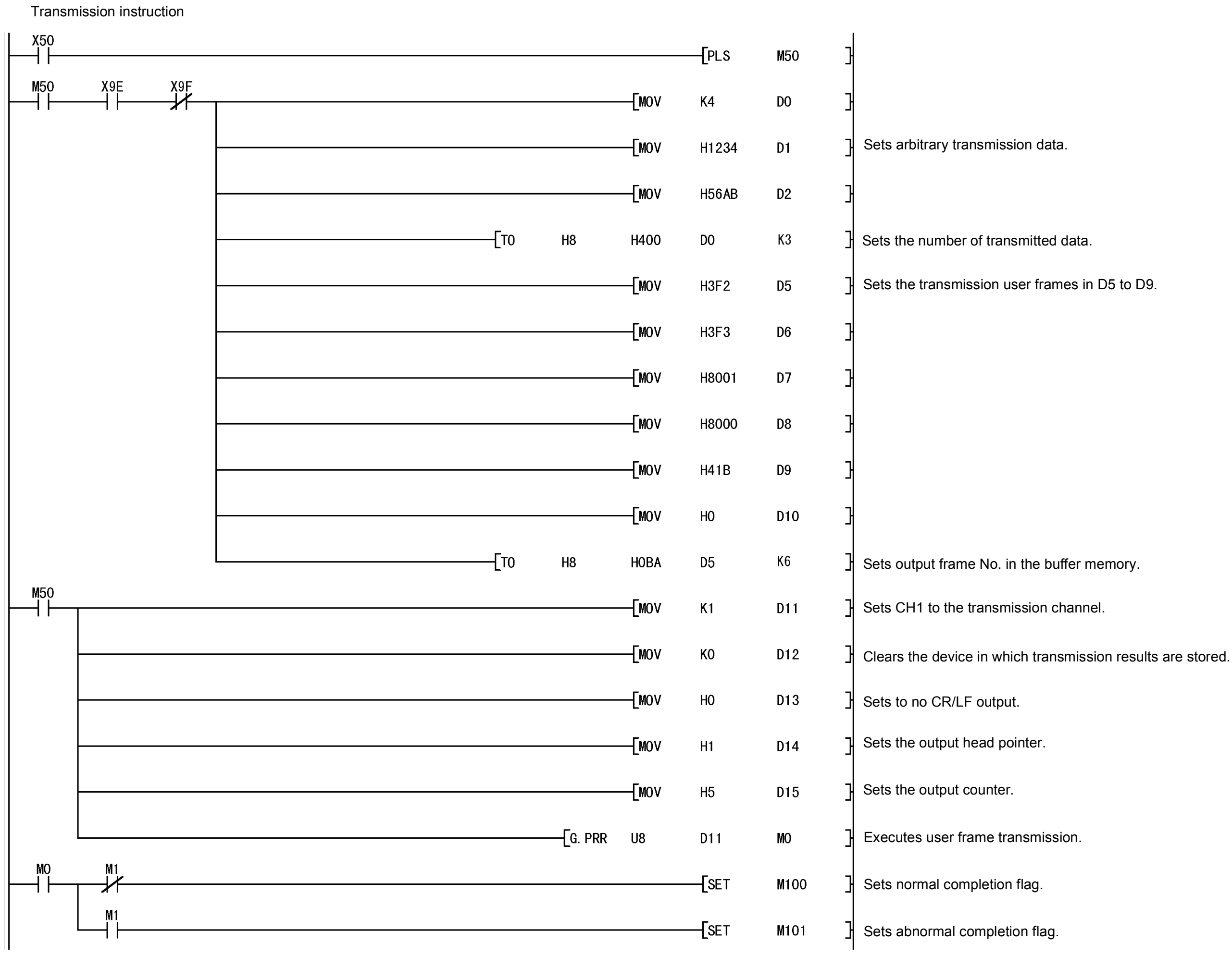
Errors

(1) When the dedicated instruction is completed with an error, the status display device at completion ((D)+1), turns on and the error code is stored in the control data transmission result ((S1)+1).
See the following manuals regarding the error code, and check the errors and take corrective actions.
<Error codes>
4FFFH or less : QCPU (Q Mode) User's Manual (Hardware Design, Maintenance and Inspection)
7000H or higher: Section 10.2 of the User's Manual (Basic)

Program example

A program that sends arbitrary data and the first to fifth user frames registered in the output frame setting.

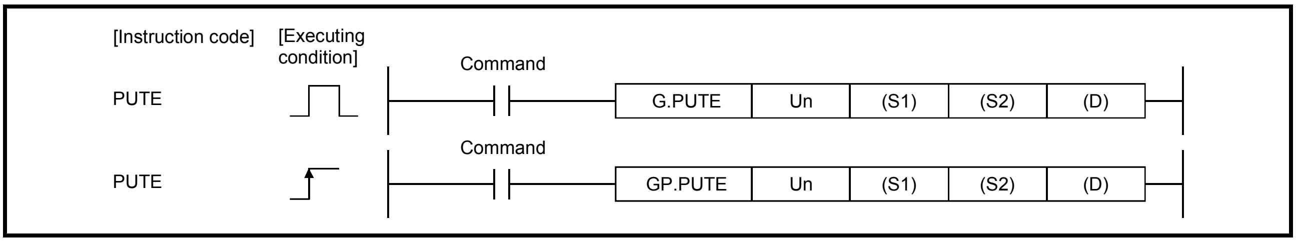
When the input/output signals of the Q series C24 are X/Y80 to X/Y9F



	Normal end		Abnormal end	
D0	Send data count	(0004H)	Send data count	(0004H)
D1	Send data	(3412H)	Send data	(3412H)
D2		(AB56H)		(AB56H)
D5	Output frame No.	(03F2H)	Output frame No.	(03F2H)
D6		(03F3H)		(03F3H)
D7		(8001H)		(8001H)
D8		(8000H)		(8000H)
D9		(041BH)		(041BH)
D10		(0000H)		(0000H)
D11	Interface No.	(0001H)	Interface No.	(0001H)
D12	Transmission result	(0000H)	Transmission result	(other than 0000H)
D13	CR/LF output	(0000H)	CR/LF output	(0000H)
D14	Output head pointer	(0001H)	Output head pointer	(0001H)
D15	Output counter	(0005H)	Output counter	(0005H)

17.7 PUTE Instruction

Setting data	Applicable device								
	Internal device		File register	MELSECNET/H, MELSECNET/10 Direct J□\□		Special module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word				
(S1)	—	○		—					
(S2)	—	○		—					
(D)	○	○		—					



Setting data

Setting data	Description	Set by	Data type
Un	Start I/O signal of the module (00 to FE: The 2 upper digits of an input/output signal expressed in 3-digit.)	User	Binary 16 bits
(S1)	Head number of the devices that store control data	User, System	Device name
(S2)	Head number of the devices storing the registered data that has been read	System	
(D)	Head bit device number of the local station that turns ON for one scan upon instruction completion. (D)+1 also turns on if the execution completes abnormally.		Bit

The file registers of each of the local device and the program cannot be used as setting data.

Control data

Device	Item	Setting data	Setting range	Set by
(S1)+0	Register/delete designation	Designate whether to register or delete the user frame having the number designated by (S1) +2. Register: 1 Delete: 3	1, 3	User
(S1)+1	Register/delete result	The registration/deletion result by the PUTE instruction is stored. 0 : Normal Other than 0: Abnormal (error code)	—	System
(S1)+2	Frame No.	Designate the user frame No.	1000 to 1199	User
(S1)+3	Registered bytes count	1 to 80: Number of bytes of the user frame to be registered. * Designate 1 to 80 as dummy when deleting.	1 to 80	User

REMARK

(1) For information about errors caused by incorrect data designated by the user, see the description in "Errors".

(2) The "Set by" column indicates the following:
- User : Data set by the user before executing the dedicated instruction.
- System: The PLC CPU stores execution results of the dedicated instruction.

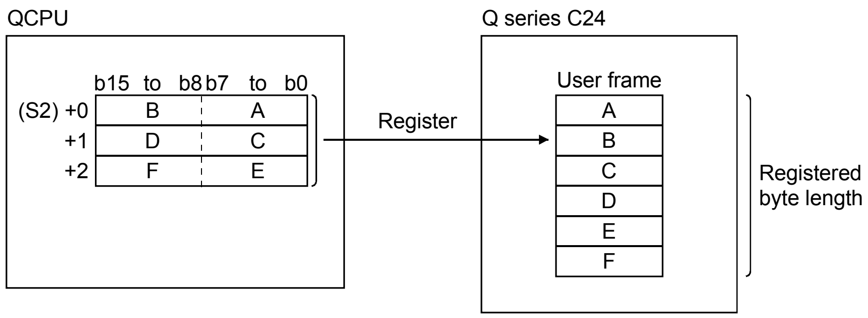
Functions

(1) This instruction registers or deletes the user frame for the Q series C24 as designated by Un.

(2) When registering a user frame

(a) When registering a user frame, set 1 to the device for (S1)+0.
Data in the device designated by (S2) and after will be registered according to the control data.

(b) The registered data should be stored in the device designated by (S2) and after as described below.
Thus, at least (registered data number)/2 devices will be necessary to store the registered data and they should be assigned beginning with the device designated by (S2).
For example, when registering 6 bytes of data, 3 devices beginning with the device designated by (S2) will be used.



(3) When deleting a user frame

(a) When deleting a user frame, set 3 to the device for (S1)+0.
The user frames of the frame numbers designated by (S1)+2 will be deleted.

(b) The registered byte number designated by (S1)+3 and registered data storage device designated by (S2) are not used by the PUTE instruction, but they are necessary for formatting it.
Designate 1 to 80 for (S1)+3 and a dummy device for (S2).

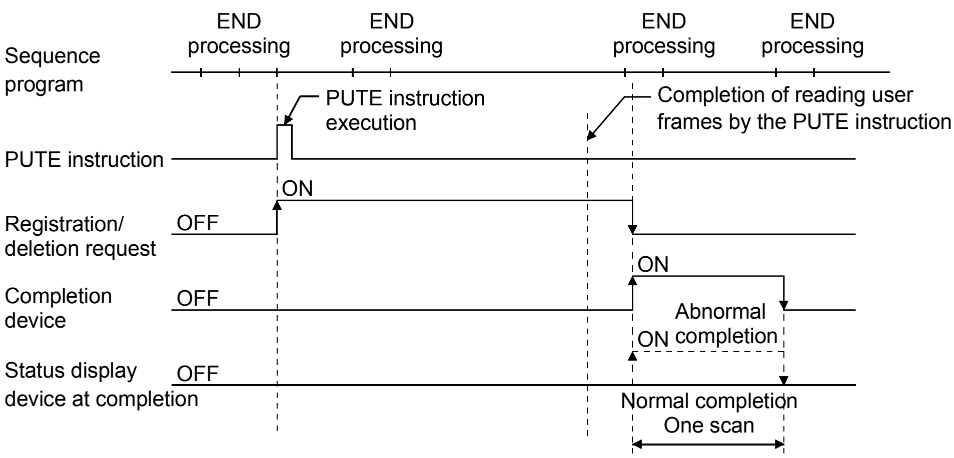
(4) While a PUTE instruction is being executed, another PUTE instruction or a GETE instruction cannot be executed.
While a PUTE instruction is already being executed, if another PUTE instruction or a GETE instruction is executed, the second instruction must wait until the execution of the current PUTE instruction is completed.

(5) Whether the PUTE instruction was completed normally or abnormally can be checked with the completion device (D) or status display device at completion (D+1).

(a) Completion device
Turns on at the END processing of the scan where the PUTE instruction is completed, and turns off at the next END processing.

(b) Status display device at completion
Turns on and off depending on the completion status of the PUTE instruction.
- Normal completion : Stays off and does not change.
- Abnormal completion: Turns on at the END processing of the scan where the PUTE instruction is completed, and turns off at the next END processing.

[Operation when the PUTE instruction is being executed]



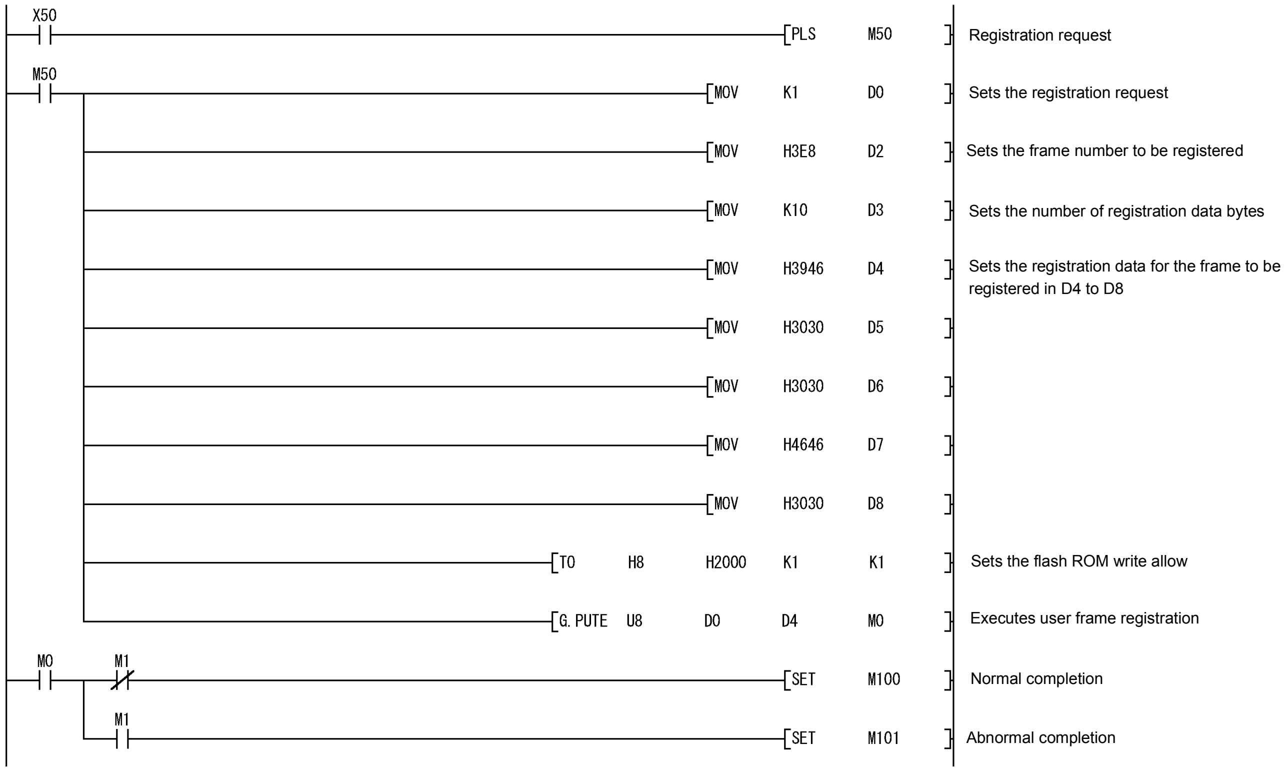
Errors

(1) When the dedicated instruction is completed with an error, the status display device at completion ((D)+1), turns on and the error code is stored in the control data registration/deletion result ((S1)+1).
See the following manuals regarding the error code, and check the errors and take corrective actions.
<Error codes>
$4FFF_H$ or less : QCPU (Q Mode) User's Manual (Hardware Design, Maintenance and Inspection)
7000_H or higher: Section 10.2 of the User's Manual (Basic)

Program example

A program that registers the user frame having registration number 3E8H.

When the input/output signals of the Q series C24 are X/Y80 to X/Y9F



MEMO

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WARRANTY

Please confirm the following product warranty details before starting use.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the dealer or Mitsubishi Service Company.
Note that if repairs are required at a site overseas, on a detached island or remote place, expenses to dispatch an engineer shall be charged for.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year 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 six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term 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 the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not possible 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 chance loss and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, chance losses, lost profits incurred to the user by Failures of Mitsubishi products, damages and secondary damages caused from special reasons regardless of Mitsubishi's expectations, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other duties.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or National Defense purposes shall be excluded from the programmable logic controller applications.
Note that even with these applications, if the user approves that the application is to be limited and a special quality is not required, application shall be possible.
When considering use in aircraft, medical applications, railways, incineration and fuel devices, manned transport devices, equipment for recreation and amusement, and safety devices, in which human life or assets could be greatly affected and for which a particularly high reliability is required in terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

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