MITSUBISHI

QnA SERIES

Serial Communications Module

User's Manual

Corresponding Additional Explanation
for AJ71QC24N [-R2/R4]
[Modem Function Additional Version]

Mitsubishi Programmable Controller

● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

When using Mitsubishi equipment, thoroughly read this manual and the associated manuals introduced in this manual. Also pay careful attention to safety and handle the module properly.

These precautions apply only to Mitsubishi equipment. See the CPU module user's manual for a description of the PC system safety precautions.

These ● SAFETY PRECAUTIONS ● classify the safety precautions into two categories: "DANGER" and "CAUTION".

⚠ DANGER	Procedures which may lead to a dangerous condition and cause death or serious injury if not carried out properly.
⚠ CAUTION	Procedures which may lead to a dangerous condition and cause superficial to medium injury, or physical damage only, if not carried out properly.

Depending on circumstances, procedures indicated by ⚠ **CAUTION** may also be linked to serious results. In any case, it is important to follow the directions for usage.

Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

[DESIGN PRECAUTIONS]

⚠ DANGER

- When using the notification function, the pager receiver/cellular phone/PHS 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 PC system, install a call circuit with a lamp display or buzzer sound.
- When performing the control of the PC in operation (especially changing data, program, and operation status (status control)) by connecting a personal computer, etc. to the special function module, configure an interlock circuit in a sequence program so the safety of the overall system is always maintained.

  Especially, when this control is performed to a remote PC from an external device, troubles that have occurred on the PC 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 PC CPU for data communication error occurrences, as well as construct an interlock circuit in the sequence program.

⚠ 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 (3.9 inch) or more from each other.

  Not doing so could result in noise that would cause malfunction.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- Use the PC in an environment that meets the general specifications contained in this manual. Using this PC in an environment outside the range of the general specifications could result in electric shock, fire, malfunction, and damage to or deterioration of the product.
- Make sure to switch all phases of the external power supply off when installing or placing wiring. If you do not switch off the external power supply, it will cause electric shock or damage to the product.
- Insert the tabs at the bottom of the module into the mounting holes in the base module. If the module is not properly installed, it may result in malfunctions, failure, or fallout.
- Tighten the screws within the range of specified torque. If the screws are loose, it may result in fallout, short circuits, or malfunctions. Tightening the screws too far may cause damage to the screw and/or the module, resulting in fallout, short circuits, or malfunctions.
- Do not directly touch the module's conductive parts or electronic components. Doing so could cause malfunction or failure in the module.
- Perform correct pressure-displacement, crimp-contact or soldering for wire connections using the tools specified by the manufactures. Attach connectors to the module securely.

[WIRING PRECAUTIONS]

⚠ CAUTION

- Be sure to fix communication 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 result in a module malfunction and cable damage.
- Before connecting the cables, check the type of interface to be connected. Connection, or erroneous wiring, to the wrong interface may failure the module and external devices.
- When connecting an external device to the AJ71QC24N-R4 RS-422 interface, do not connect a device that must receive power from the AJ71QC24N-R4. If you connect the device, it will cause failure to the module or external device.
- Tighten the terminal screws within the range of specified torque.

  If the terminal screws are loose, it may result in short circuits or malfunctions.

  Tightening the screws too far may cause damage to the screw and/or the module, resulting in fallout, short circuits, or malfunctions.
- When detaching the communication cable from the module, do not pull the cable portion. For cables with connectors, hold the connector at the junction to the module, then detach it. For cables without connectors, first loosen the screw at the junction, then detach the cable. Pulling the cable portion while it is connected to the module may cause a malfunction or damage to the module and cable.
- Be sure there are no foreign substances such as sawdust or wiring debris inside the module. Such debris could cause fires, failure, or malfunction.

[STARTING AND MAINTENANCE PRECAUTIONS]

DANGER

- Do not touch the connector while the power is on. Doing so could cause malfunction.
- Make sure to switch all phases of the external power supply off before cleaning or retightening screws. If you do not switch off the external power supply, it will cause failure or malfunctions of the module. If the screws are loose, it may result in fallout, short circuits, or malfunctions. Tightening the screws too far may cause damages to the screws and/or the module, resulting in fallout, short circuits, or malfunctions.

CAUTION

- Do not disassemble or modify the modules. Doing so could cause failure, malfunction, injury, or fire.
- Make sure to switch all phases of the external power supply off before mounting or removing the module. If you do not switch off the external power supply, it will cause failure or malfunction of the module.

[OPERATING PRECAUTIONS]

DANGER

- Do not write data into the "system area" of the buffer memory of special function modules. Also, do not output the "prohibited to use" signal as the output signal to a special function module from the PC CPU.

  Writing data into the "system area" or outputting a signal for "prohibited to use" may cause system malfunctions in the PC.

CAUTION

- Before performing the control of the PC in operation (especially changing data, program, and operation status (status control)) by connecting a personal computer, etc. to the special function module, read this manual or User's Manual carefully and confirm if the overall safety is maintained.

  Failure to perform correct operations to change data, program, or the status may result in system malfunctioning, machine damage, or an accident.
- When using the module while values, such as buffer memory set values, are registered in the EEPROM, do not turn off the power supply for the module loading station nor reset the PC CPU.

  If the power supply for the module loading station is turned off or the PC CPU is reset while any values are registered, the data contents in the EEPROM become inconsistent and as a result the values must be set again in the buffer memory, etc. and reregistered to the EEPROM. Also, this may cause failure and malfunctions of the module.

[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
Apr. 1997	SH(NA)-3630-A	First printing
Apr. 1998	SH(NA)-3630-B	Addition SAFETY PRECAUTION, Chapter 1 to 7 (About the explanation of modem function), Chapter 8 (Overall), Appendix (About the explanation of modem function) Correction INTRODUCTION (Section 6.4), Section 5.2 (5) (7), Section 6.1 to 6.3 (Name of Section) Reflection of the correction/error chart (BCN-85905-A)

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INTRODUCTION

Thank you for purchasing the Mitsubishi programmable controller MELSEC-QnA Series.

Before using your MELSEC-QnA Series, please read this manual thoroughly to gain an understanding of the functions and performances of the QnA Series PC so that the equipment is used to its optimum.

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About This Manual

The following product manuals are available. Please use this table as a reference to request the appropriate manual as necessary.

Rated Manuals

Manual Name	Manual No. (Model Code)
Serial Communication Module Guidebook Centered about the basic functions of the serial communication module, this manual describes the basic method of transferring data with external devices using each protocol. This manual applies to all the serial communication modules.	IB-66622 (13JF11)
Serial Communication Module User's Manual This manual describes the specifications of the data exchange function using the dedicated protocol, without procedure protocol, and bidirectional protocol and how to use them. It also describes the specifications of the special functions and how to use them. It is common to all the serial communication modules. When using AJ71QC24N(-R2/R4), read the User's Manual and this Additional Explanation.	IB-66612 (13J825)
Computer Link Guidebook This manual describes the basic method of transferring data with external devices (computer, etc.) in each computer link mode. See it when transferring data using dedicated protocols A compatible frames. This manual applies to all the serial communication modules.	SH-3510 (13JE76)
Computer Link/Multidrop Link Module User's Manual (Computer Link Function, Printer Function) This manual describes how to use the control procedure and commands when transferring data using dedicated protocol A compatible frames. It is common to all the serial communication modules. When using commands, read Section 5.4 (description of A compatible frame commands) of User's Manual.	SH-3511 (13JE77)
AJ71QC24N (-R2/R4) Serial Communication Module User's Manual (Hardware) This manual describes the system configuration when using the module, module specifications, settings up to operation, starting procedure, and module outline dimensions.	IB-66765 (13JL12)

How to use the manuals

This is an Additional Explanation to the following User's Manual for the new release of AJ71QC24N (-R2/R4) Serial Communication Module. In order to use various functions of the AJ71QC24N (-R2/R4), read both the Additional Explanation and the User's Manual according to the description below:

● **Manual applicable to this Additional Explanation**

Serial Communication Module User's Manual .....IB-66612 (earlier than -B version)

● **The following modules require both this Additional Explanation and the User's Manual mentioned above**

- AJ71QC24N
- AJ71QC24N-R2
- AJ71QC24N-R4

● **How to use this Additional Explanation and the User's Manual mentioned above**

To review the functions, specifications, and the procedure before the operation:

- Read from Chapter 1 to Chapter 4 of the User's Manual to check the functions, specifications, and the procedure before the operation which are common to the Serial Communication Modules.
- Read PART 1 of this Additional Explanation to check the added functions of AJ71QC24N (-R2/R4).

To review the functions and methods of data exchange and how to use the special functions:

- Read from Chapter 5 to Chapter 20 of the User's Manual to check how to use the functions common to the Serial Communication Modules.
- Read PARTS 2 to 3 of this Additional Explanation to check how to use the added functions of AJ71QC24N(-R2/R4).

To review the error codes and troubleshooting:

- Read this manual/description item, and confirm the contents of the error and corrective action. See Chapter 21 in the User's Manual for the error codes and troubleshooting when using a function other than modem function.
  For error codes when using the mode function, see Section 8.5 of this Additional Explanation.

Notes when reading the Serial Communication Module User's Manual

To use the AJ71QC24N(-R2/R4), please read the Serial Communication Module User's Manual , which is sold separately, in addition to reading this Additional Explanation.

If AJ71QC-24N(-R2/R4) is not described in the Serial Communication Module User's Manual, read the manual with AJ71QC-24(-R2/R4) replaced by AJ71QC24N(-R2/R4).

The contents of this Additional Explanation except for the specifications and functions of AJ71QC24N(-R2/R4) are the same as those of the conventional module, AJ71QC24(-R2/R4).

● **Structure and general description of each chapter in this Additional Explanation**

This Additional Explanation is composed of PARTS 1 to 3, and the description contents of each part is shown below:

PART 1 **Chapter 1 to Chapter 3**

This part describes the overview of the AJ71QC24N(-R2/R4) and the comparisons of functions with those of the conventional module (AJ71QC24 (-R2/R4)).

Chapter 1. OVERVIEW

Overview, features, function overview of the AJ71QC24N(-R2/R4) are described.

Chapter 2. FUNCTIONAL COMPARISON WITH THE CONVENTIONAL MODULE

Functional comparisons with the conventional serial communication module, as well as the precautions when the programs for the conventional modules are used for AJ71QC24N(-R2/R4), are described.

Chapter 3. TRANSMISSION SPECIFICATIONS

The performance specifications of AJ71QC24N(-R2/R4) are described.

PART 2 **Chapter 4 to Chapter 7**

This part describes how to setup and communicate data to use the AJ71QC24N (-R2/R4)'s added functions.

Chapter 4. START-UP THE MODULE

The switch settings for the startup of AJ71QC24N(-R2/R4) whose transmission specification switches are different from the conventional modules are described.

Chapter 5. COMMUNICATIONS USING QnA (EXTENSION) FRAME

The multiple block batch read and batch write functions, which were newly added to AJ 71QC24N(-R2/R4) for the communications by QnA frame or QnA extension frame using the dedicated protocol, are described.

Chapter 6. COMMUNICATIONS USING QnA SIMPLIFIED FRAME

The communication function by the QnA simplified frame, which was newly added to AJ71QC24N(-R2/R4) for a high-speed data communication using the dedicated protocol, is described.

Chapter 7. PC CPU COMMUNICATION TIME

The processing time required by the target PC CPU to process a request from an external device for the communication using the dedicated protocol of the AJ71QC24N(-R2/R4) is described.

PART 3 **Chapter 8**

This part describes the overview and usage of the modem function that can be used with AJ71QC24N(-R2) after the software version indicated in Section 2.1 in this Additional Explanation.

Chapter 8. COMMUNICATIONS BY THE MODEM FUNCTION

PART 1

This part describes the overview and the performance specifications of the AJ71QC24N(-R2/R4), comparison of functions with those of the conventional product (AJ71QC24(-R2/R4)), and the precautions when using the conventional module's programs for the AJ71QC24N(-R2/R4).

When the AJ71QC24N(-R2/R4) is used, please read from Chapter 1 to Chapter 3 of the Serial Communication Module User's Manual, which is sold separately, in addition to reading from Chapter 1 to Chapter 3 of this Additional Explanation.

If AJ71QC24N(-R2/R4) is not described in the Serial Communication Module User's Manual, read the manual with AJ71QC24(-R2/R4) replaced by AJ71QC24N(-R2/R4).

The contents of this Additional Explanation except for the specifications and functions of AJ71QC24N(-R2/R4) are the same as those of the conventional module, AJ71QC24(-R2/R4).

1. OVERVIEW

The overview of this Additional Explanation, features of the target serial communication module, and the included parts are described.

1.1 Overview

This Additional Explanation describes the serial communication modules of the following QnA series which are used for the serial communication between the QnA series PCs and the external devices.

This Additional Explanation describes only the functions, specifications, and usage which were modified from or added to the conventional serial communication module.

See the Serial Communication Module User's Manual for the functions, specifications, and usage which are not described in this Additional Explanation, because they are the same as those of the conventional product.

① AJ71QC24N serial communication module
This is a module equipped with one channel each of RS-232C and RS-422/485 compliant interface.
CH1: RS-232C interface (D-sub 25-pin female)
CH2: RS-422/485 interface (Two-piece terminal block)

② AJ71QC24N-R2 serial communication module
This is a module equipped with two channels of RS-232C compliant interface.
CH1: RS-232C interface (D-sub 25-pin female)
CH2: RS-232C interface (D-sub 25-pin female)

③ AJ71QC24N-R4 serial communication module
This is a module equipped with one channel each of RS-422 and RS-422/485 compliant interface.
CH1: RS-422 interface (D-sub 25-pin female)
CH2: RS-422/485 interface (Two-piece terminal block)

Points

The explanations after that in this Additional Explanation use the following generic names, abbreviations, and terms.

(1) The target serial communication modules are described as follows:
  ① The module's model name is used when the target modules need to be distinguished.
  ② The serial communication modules described above and the conventional serial communication modules are distinguished as follows:
    · QC24N : The serial communication modules described above
    · QC24 : The conventional serial communication modules
  ③ If the distinction of the target module is not necessary, it is described as follows:
    · QC24(N) : Generic name for QC24N and QC24

(2) For those not mentioned above, the generic names, abbreviations, and terms listed in Section 1.5 of the Serial Communication Module User's Manual are used.

Hayes is a registered trademark of the US Hayes Micro Computer Products, Inc. MNP (Microcom Networking Protocol) is a trademark of US Microcom Corporation. Other company names and product names are registered trademarks or trademarks of the corresponding industries.

1.2 Features

Features of QC24N which are newly added to those of QC24 are described.

1 High-speed communication (detailed explanation in Chapter 4)

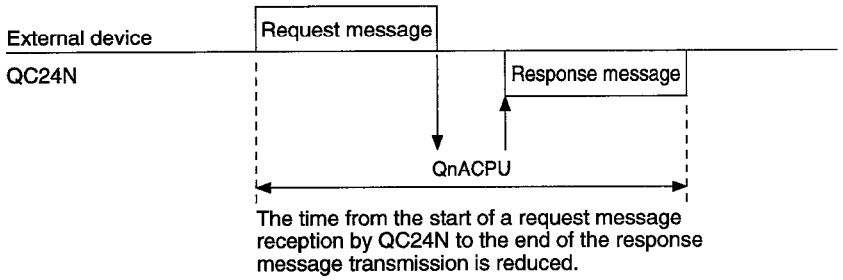
The data communication between QC24N and the external device can be executed in a high-speed.

	Transmission Speed (BPS) Setting Range	Remarks
QC 24	300 to 19200	—
QC24N	300 to 115200	The sum of CH1 and CH2 can be selected within 115200BPS.

2 Faster communication by the dedicated protocol (detailed explanation in Appendix)

The communication speed using the dedicated protocol has been improved by the faster internal processing of the QC24N.

The processing time of data read and data write from the external device is reduced by this accelerated processing.



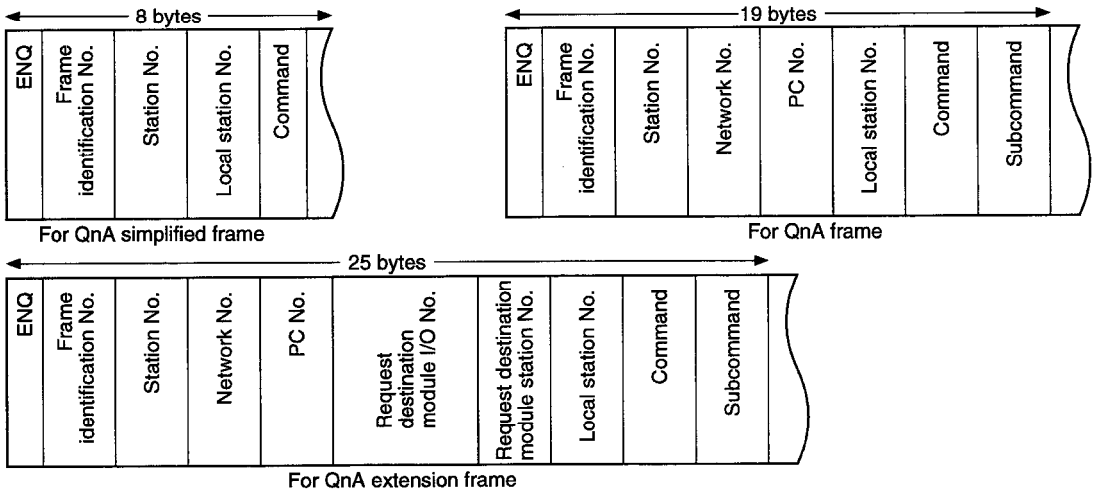
3 Communication by a QnA simplified frame (detailed explanation in Chapter 6)

The QnA simplified frame is used for the data communication in the ASCII mode (from format 1 to format 4) of the dedicated protocol, and uses a simplified message format.

The communication by this frame can execute a batch read and write of a device, device monitoring, etc.

Because of less transmission data, processing of the message by the external device is made easier and the transmission time of the message can be reduced.

(Example) The first part of the transmission data for requesting a data read (when the format is 1)

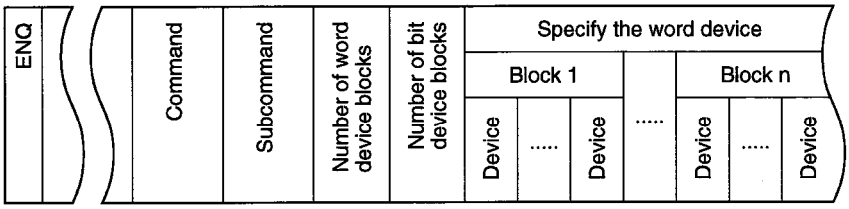


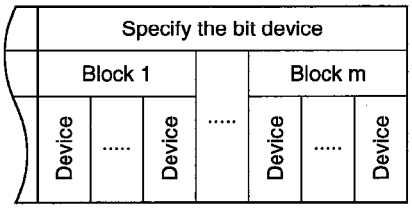
4 Data read and data write by multiple block batch read and batch write (detailed explanation in Chapter 5)

The communication of dedicated protocol's QnA frames or QnA extension frames can be used to read and write the main data.

By defining n points of QnACPU's word device and bit device (one point occupies 16 bits) as one block, the external device can randomly specify multiple blocks to execute a batch read and a batch write of the data.

(Example) Message format of a multiple block batch read



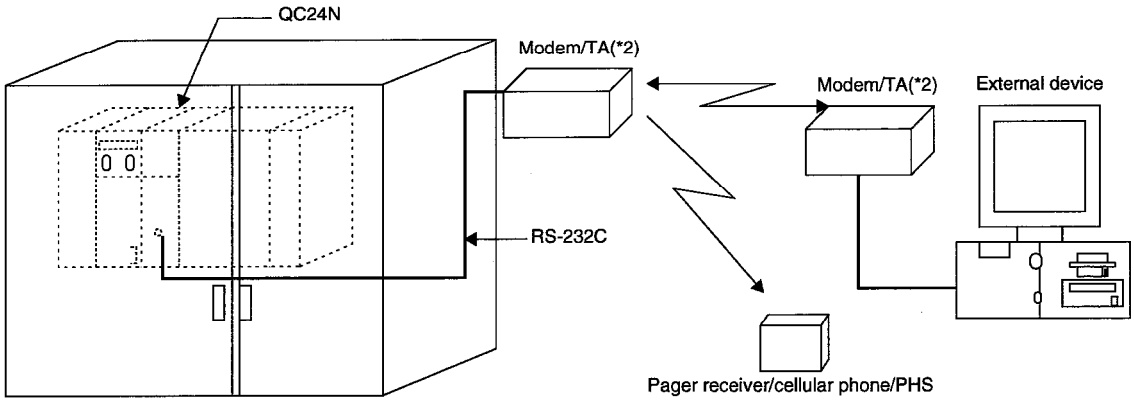


5 Data communication using a public line with the modem function (detailed explanation in Chapter 8)(*1)

Using the public line/internal line/digital line (ISDN), data communication between the PC CPU and external device from remote area via QC24N RS-232C interface by full-duplex communication.

(Exchange from dedicated protocol, non-procedure protocol, and bidirectional protocol)

Messages can be sent to notify the PC system maintenance information by pager receiver (pager)/cellular phone/PHS.



*1 See Section 2.1*2 for the QC24N types that support the modem function.
*2 TA: terminal adapter

1.3 Included Parts

The parts included in QC24N are as follows:

When unpacking the module, check that the products listed in the table below are present.

Model	Product Name	Qty.
AJ71QC24N	AJ71QC24N serial communication module	1
	RS-422 communication terminal resistor (330Ω), 1/4W (orange/orange/brown/□)	2
	RS-485 communication terminal resistor (110Ω), 1/2W (brown/brown/brown/□)	2
AJ71QC24N-R2	AJ71QC24N-R2 serial communication module	1
AJ71QC24N-R4	AJ71QC24N-R4 serial communication module	1
	RS-422 communication terminal resistor (330Ω), 1/4W (orange/orange/brown/□)	2
	RS-485 communication terminal resistor (110Ω), 1/2W (brown/brown/brown/□)	2

2. FUNCTIONAL COMPARISON WITH THE CONVENTIONAL MODULE

Comparison of the functions between QC24N and the conventional product QC24, how to make use of the QC24 programs for the QC24N, and the installation of QC24N to an existing system are described.

2.1 Functional Comparison with the Conventional Module

Comparisons of the functions between QC24N and the conventional product QC24 are as follows:

Functions					QC24N	QC24	Remark
1	Dedicated protocol	Communication frame	ASCII mode	QnA frame	Enable		See User's Manual
				QnA extension frame			
				A compatible frame			
2				QnA simplified frame	Enable	Disable	See Chapter 6
3			Binary mode	QnA extension frame	Enable		See User's Manual
4		Communication by read and write with the device memory		Other than those listed below	Enable		
5				Multiple block batch read, batch write	Enable (*1)	Disable	See Chapter 5
6		Transmission by user entry frame			Enable		See User's Manual
7		Communication other than read and write with the device memory and transmission by user entry frame * Buffer memory, read and write of a file, loopback test, etc.					
8		Communication between an external device and the PC CPU through m:n connection.					
9	Non procedure protocol	Transmission and reception by an arbitrary format					
		Transmission and reception by the user entry frame					
		Transmission and reception by ASCII-BIN conversion					
		Transmission and reception by the transparent code specification					
10	Bidirectional protocol	Transmission and reception by an arbitrary format					
		Transmission and reception by ASCII-BIN conversion					
		Transmission and reception by the transparent code specification					
11	Transmission control	DC code control					
		DTR/DSR signal control					
12	Half-duplex communication						
13	Mode switching						
14	Read and write of the module status and signal status						
15	Access to other PC by link dedicated commands						
16	Data transmission speed (BPS)				115200 maximum	19200 maximum	See Chapter 4
17	Communication by public line using the modem function				Possible (*2)	Not possible	See Chapter 8

* How to use the function where both of the QC24N and QC24 are indicated as "Enable" is same for QC24N and QC24. However, because internal processing speed has been improved in QC24N, the time required for an access processing to the PC CPU and message transmission processing by QC24N is shorter than the time required by QC24.

*1 The PC CPU that can be accessed are the host with QC24N installed and remote stations via MELSECNET/10 as shown below.

Function	PC CPU		
	QnA	Q2AS (H)	Q4AR
Multiple block batch read/batch write	(Products 9707B or later) *		(All possible)

Manufactured date Function version (Mentioned only B or later)

* The products with 9707 B or later printed on the package display and the date column on rated plate of the module are the products with this function added.

*2 Using the QC24N RS-232C interface (1 channel only), the communication via public line, etc. is possible using the modem function.

	AJ71QC24N	AJ71QC24N-R2	AJ71QC24N-R4
Modem function	(Products 9804□ or later) *		(Unusable)

Manufactured date Function version (Mentioned only B or later)

* Modules equipped with the modem function have the indication of 9804 □ or later in the DATE column of the rated plate on the main module and on the shipment box.

2.2 Using Programs Designed for the Conventional Module

Data communication between the QnACPU and the external device, or between the QnACPUs which was executed by the QC24 can also be executed by the QC24N.

In the following section, the use of programs were designed for QC24 for the data communication with the QC24N is described.

1 **Communication programs for QC24 on the external device end and on the QnACPU (local station) end of the QC24 installed station can be utilized for QC24N.**

2 **Because internal processing speed of QC24N has been improved, the time required by QC24N for an access processing to the PC CPU and message transmission processing to external device will be shorter than the time required by QC24. (How to use the function is the same, but the performance and response speed are different between QC24N and QC24.) When utilizing the existing QC24 communication program on the external device or on the QnACPU (local station) end, it may be required to adjust the exchange timing by conducting an operation check.**

(Example of communication timing adjustment)

(a) When communicating by dedicated protocol
Adjust with the "Message wait" time as shown below. Particularly, adjustment is necessary when " Scanning time of the QC24N installed station > Message wait time."

① When communication is performed with the QnA frame or QnA extension frame, designate in the QC24N buffer memory (at address 11EH/1BEH).

② When communication is performed with the A compatible frame, designate in the request message transmitted from the external device.

(b) When communicating by the non procedure protocol or bidirectional protocol
Delay the data transmission timing.

- Data transmission from external device to QC24N

  Delay the data transmission timing from the external device. (Adjust on the external device end.)

- Data transmission from QC24N to external device

  When communication is performed by the non procedure protocol, delay the data transmission, controlled by the sequence program, from QC24N to external device by one scan. (When communication is performed by the bidirectional protocol, delay the timing to turn on the reception data read complete signal by one scan.)

3 **The same precautions as ones for data communication via RS-422 and RS- 422/485 interface, shown in Section 3.3.3 in the User's Manual, are also applied to QC24N.**

- Countermeasures for receiving wrong data on the external device end
- Operation of the RS-422/485 interface on the QC24(N) end

4 **To execute the data communication using the functions described in this Additional Explanation, create a new program.**

2.3 Installation on an Existing System

Installation of a QC24N on an existing system is described.

1 **Installing on a multi-drop connection system**

The QC24N can be installed on an existing system to which external devices and the PC CPU are connected as 1:n or m:n multi-drop connection (*1).

*1 This is when the QC24 or a computer link module (such as AJ71UC24) is used as the PC CPU module of the multi-drop connection.

2 **Replacing the QC24 module with a QC24N**

The QC24 can be replaced with the QC24N module, and the wiring used by the QC24 can be used as is.

Point

The communication might not work correctly when the module is simply replaced, because the performance and the response speed of the QC24N and the QC24 are different.
Be sure to check to see the normal operation when the module is replaced.

3. TRANSMISSION SPECIFICATIONS

3.1 Transmission Specifications

The communications specifications of the QC24N is shown below.

See QnACPU User's Manual for QC24N general specifications. See QC24N User's Manual (Hardware) for QC24N hardware specifications.

Item			Specifications (*1)		
Interface			AJ71QC24N	AJ71QC24N-R2	AJ71QC24N-R4
		CH1	RS-232C	RS-232C	RS-422
		CH2	RS-422/485	RS-232C	RS-422/485
Communications format			Full-duplex / Half-duplex (Only RS-232C interface is selectable.)		
Synchronous format			Asynchronous system		
Transmission speed			Within 300 to 115200 BPS for both CH1 and CH2 (The total of CH1 and CH2 must be within 115200 BPS.)		
Data format		Start bit	1		
		Data bit	7 / 8		
		Parity bit	1 (yes) / 0 (no)		
		Stop bit	1 / 2		
Error detection		Parity check	Yes (odd/even) / No		
		Sum check code	Yes / No		
Transmission control		DTR/DSR	Yes (Only RS-232C interface is selectable.) / No		
		DC cord	Yes (DC1/DC3, DC2/DC4) / No		
Writing to EEPROM			100,000 times for the same area (Max.)		
Line connection	Independent mode	Dedicated protocol	RS-232C ..... 1:1* Only 1:1 can be used for the bidirectional protocol. Only m:n can be used for the dedicated protocol. RS-422 ..... 1:1 RS-422/485 ..... 1:1, 1:n, m:n		
		Non procedure protocol			
		Bidirectional protocol			
	Interlock mode	Dedicated protocol	1:n, m:n	AJ71QC24N-R2 is disabled to exchange	
		Non procedure protocol	1:n		
		Bidirectional protocol	Data exchange disables		
Transmission distance			RS-232C ..... 15 m (49.2 ft.) or less RS-422 ..... 1200 m (3937.0 ft) or less (Within 30 m (98.4 ft) when GPP is connected.) RS-422/485 ..... 1200 m (3937.0 ft) or less		
Power consumption (5 VDC)			0.4A	0.3A	0.6A
Number of I/O points			32 points (*2)		
Weight: kg (lb)			0.385 (0.85)	0.37(0.81)	0.385(0.85)

*1 The transmission specification when communicating with the modem function is described in Section 8.3.1. The transmission specification between the QC24N and modem/TA, which is not described in Section 8.3.1 has the specification shown in this chart.

*2 Set special 32 points when allocating I/O by GPP function.

Set "AJ71QC24" as a model name registration when using dedicated command.

MEMO

PART 2

The settings and the data communication method in order to use the added functions (except modem function) of the AJ71QC24N(-R2/R4) are described.
In order to use the added functions of the AJ71QC24N(-R2/R4), read the following chapters in this Additional Explanation and the Serial Communication Module User's Manual, which is sold separately.

(1) To start-up the QC24N

① Transmission specifications switch setting : Chapter 4 in the Additional Explanation
② Other items : Chapter 4 in the Serial Communication Module User's Manual

(2) To execute a multiple block batch read or a multiple block batch write

① The order and contents of data, method : Chapter 5 in the Additional Explanation
② Contents of the designated items : Sections 6.1, 6.2 and Chapter 5 in the Serial Communication Module User's Manual

(3) To communicate data by a QnA simplified frame

① The order and contents of data, method : Chapter 6 in the Additional Explanation
② Contents of the designated items : Sections 6.1, 6.2 and Chapter 5 in the Serial Communication Module User's Manual

If AJ71QC-24N(-R2/R4) is not described in the Serial Communication Module User's Manual, read the manual with AJ71QC24(-R2/R4) replaced by AJ71QC24N(-R2/R4).

The contents of this Additional Explanation except for the specifications of AJ71QC24N (-R2/R4) is the same as these of the conventional module, AJ71QC24(-R2/R4).

4. START-UP THE MODULE

The transmission specifications switch settings and other items for starting up the QC24N are described.

4.1 Starting Up the Module

The following contents for starting up the QC24N are the same as those of the conventional module, QC24.

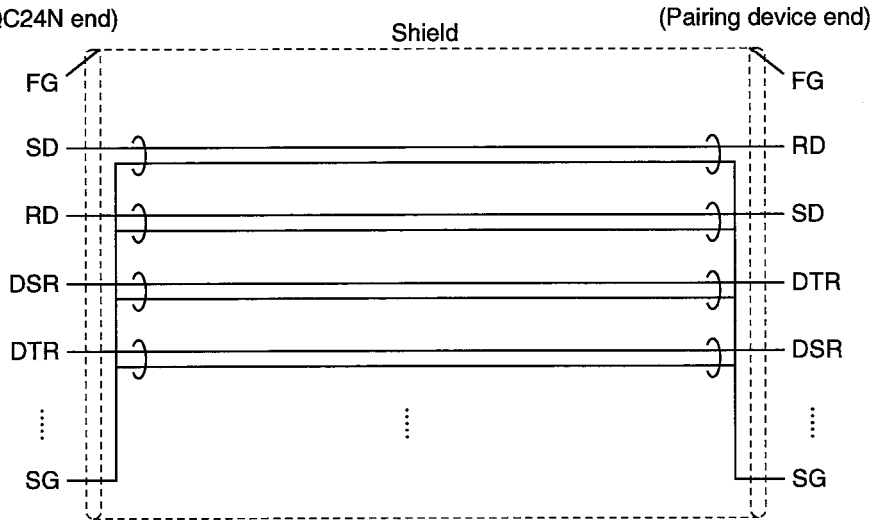
See Chapter 4 in the Serial Communication Module User's Manual, or the User's Manual (Hardware) of the QC24N.

(1) Switch settings except for the data transmission speed setting
(2) Contents of the LED display of the QC24N
(3) Self-test of the QC24N
(4) How to connect the external device, and the precautions (*1)

*1 The communication between the QC24N and the external device can be performed using the wiring described in the User's Manual. In addition, more wiring examples are shown in order to prevent external noise when the normal data communication cannot be executed.
In either case, shielded twisted pair cables, as recommended in the User's Manual, should be used.

① For the RS-232C interface

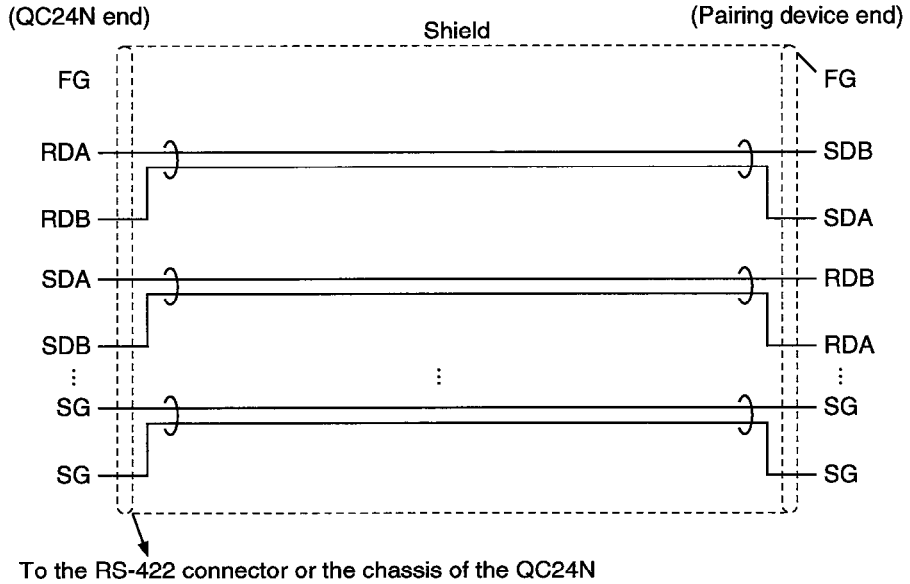
- Connect between the FG of both stations with the shield of the connection cable.
  On the external device end, however, follow the instruction manual of the external device.
- Connect each signal other than SG and FG of the connection cable by paring up with SG.



* FG of the QC24N is connected to the screw stopping area of the connector, thus it is the FG of the module itself.

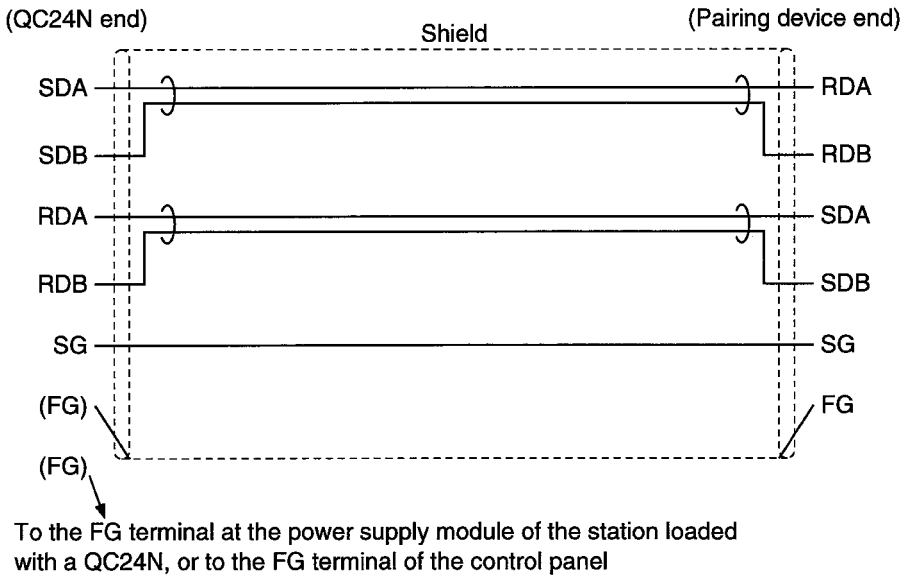
② For the RS-422 interface

- Connect the shield of the connection cable to both stations.
  QC24N end : Connect the shield to the connector or to the chassis.
  (Example) Connect to the (FG) terminal of the RS-422/485 interface.
  External device end : Connect according to the instruction manual of the external device.
  (Example) Connection to the FG terminal, etc.
- Connect nnA and nnB of each signal in the connection cable as a pair.



③ For the RS-422/485 interface

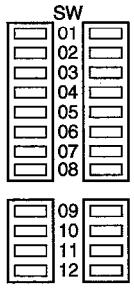
- Connect between the FG of both stations with the shield of the connection cable.
  On the external device end, however, follow the instruction manual of the external device.
- Connect the (FG) of the QC24N end to the FG terminal at the power supply module of the station which has a QC24N PC is installed, or to the FG terminal of the control panel on which the QC24N PC is installed.
- Connect nnA and nnB of each signal in the connection cable as a pair.



4.2 Transmission Specifications Switch Setting

The transmission specification switches, which define the transmission specifications of the data communication between the external device and the QC24N, are described.

Be sure to match the transmission specification to the pairing device.

Switch Details	Switch CH1	Switch CH2	Setting Item	Switch State OFF	Switch State ON	Remarks
	SW01		Operation setting	Independent operation	Linked operation	Always set CH1 to OFF. Set only CH2 ON/OFF.
	SW02		Data bits setting	7 bits	8 bits	Parity bit not included.
	SW03		Parity bit enable /disable setting	Disable	Enable	When set to Enable, the setting of SW04 is effective.
	SW04		Even parity /odd parity setting	Odd	Even	Effective only when Parity Bit Enable is selected.
	SW05		Stop bit setting	1 bit	2 bits	—
	SW06		Sum check enable /disable setting	Disable	Enable	Dedicated protocol, bidirectional protocol
	SW07		Write during RUN enable/disable setting	Disable	Enable	Dedicated protocol
	SW08		Setting change enable/disable	Disable (prohibit)	Enable (allow)	Sets mode switching and EEPROM write allow/prohibit.
	SW09 to SW12		Transmission speed setting	(*1)		Can be set as long as the total of CH1 and CH2 is within 115200 BPS.

(Factory settings are all OFF.)

*1 The data transmission speeds allowed to set are as follows:

		Transmission speed (unit: BPS)											
		300	600	1200	2400	4800	9600	19200	38400	14400	28800	57600	115200
Switch	SW09	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
	SW10	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
	SW11	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF
	SW12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON

* Settings other than above are not accepted.

Point

(1) The names of the CH1 and CH2 transmission specifications switches (SW n1 n2) are the same. Check the target interface before setting the switches.

(2) The QC24N buffer memory (address 251H, 261H) can be used to check the setting status of transmitting specifications switches SW01 to SW12.

5. COMMUNICATIONS USING QnA (EXTENSION) FRAME

The multiple block batch read and batch write functions, which were added for the QC24N, are described.

5.1 The QnA (Extension) Frame Communications Function

The communication by the QnA (extension) frame is a function used by the external device to access QnACPU and others using the dedicated protocol of the QC24(N).

The communication functions and the communication methods by the dedicated protocol, except for the multiple block batch read and batch write described in this Additional Explanation, are the same as those of QC24.

Use the communication function by referring to the Serial Communication Module User's Manual .

5.2 Multiple Block Batch Read and Batch Write

The control procedure and other items related to executing data read and data write from the external device to the device memory of the QnACPU using the multiple block batch read and batch write are described.

1 Overview of the function

Using the multiple block batch read and batch write, by defining n points of QnACPU's word device and bit device (one point occupies 16 bits) as one block, the external device can randomly designate multiple blocks to execute a batch read and a batch write of the data.

Functions		Command	Processing	Number of points processed Per communication	PC CPU state (*1)		
					During STOP	During RUN	
						Write enable set	Write disable set
Multiple block batch read	Word units	0406	Marking n points of word device and bit device (one point occupies 16 bits) as one block, read/ write multiple blocks designated randomly.	480 points	○	○	○
Multiple block batch write	Word units	1406		480 points	○	○	×

*1 Use the transmission specifications switch setting SW07 (Write-enabled during RUN when it is ON.) to set whether it is possible to write to the PC CPU during RUN.

2 Frames and formats that the multiple block batch read and batch write are allowed

Data communication is allowed with format 1 to format 4 (ASCII mode) and format 5 (binary mode) of the QnA frames or QnA extension frames.

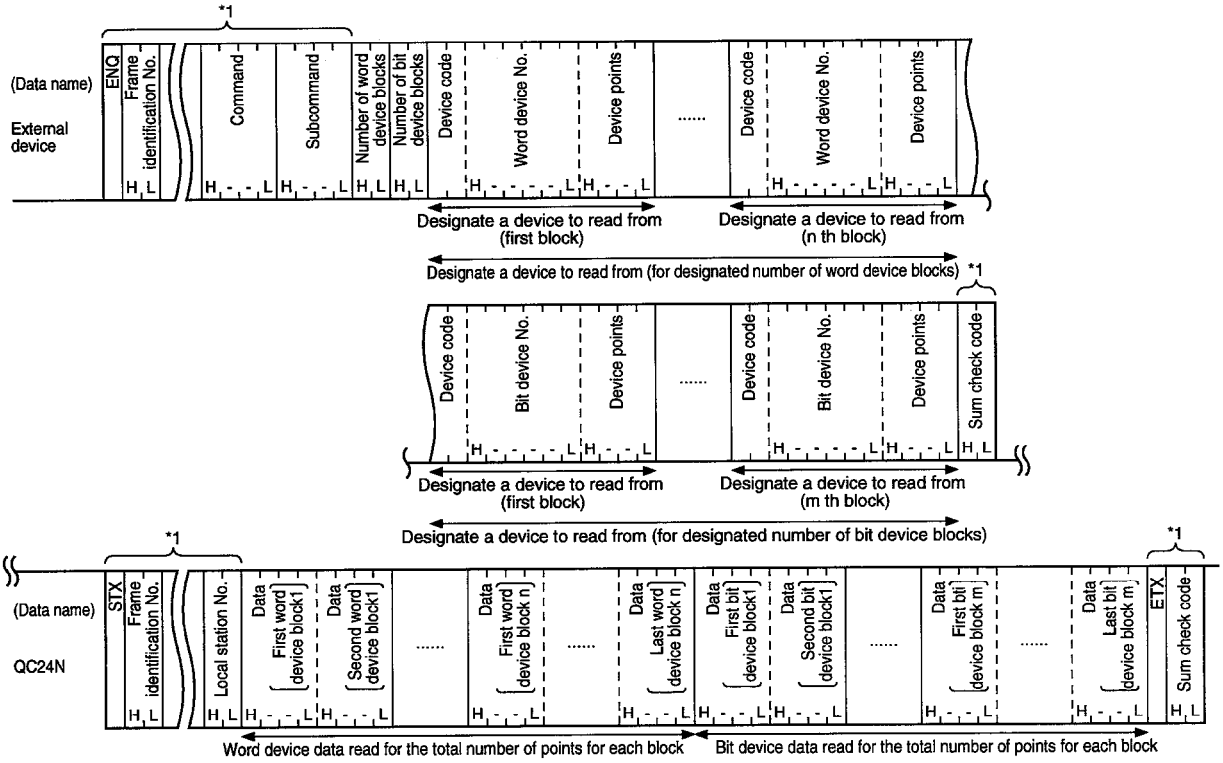
3 PCs for which the multiple block batch read and batch write are allowed

The data communication is allowed with the local station with the QC24N, QnACPU (QnACPU shown in Section 2.1 *1) of remote station via MELSECNET/10 installed.

4 Data order in the character area during the multiple block batch read

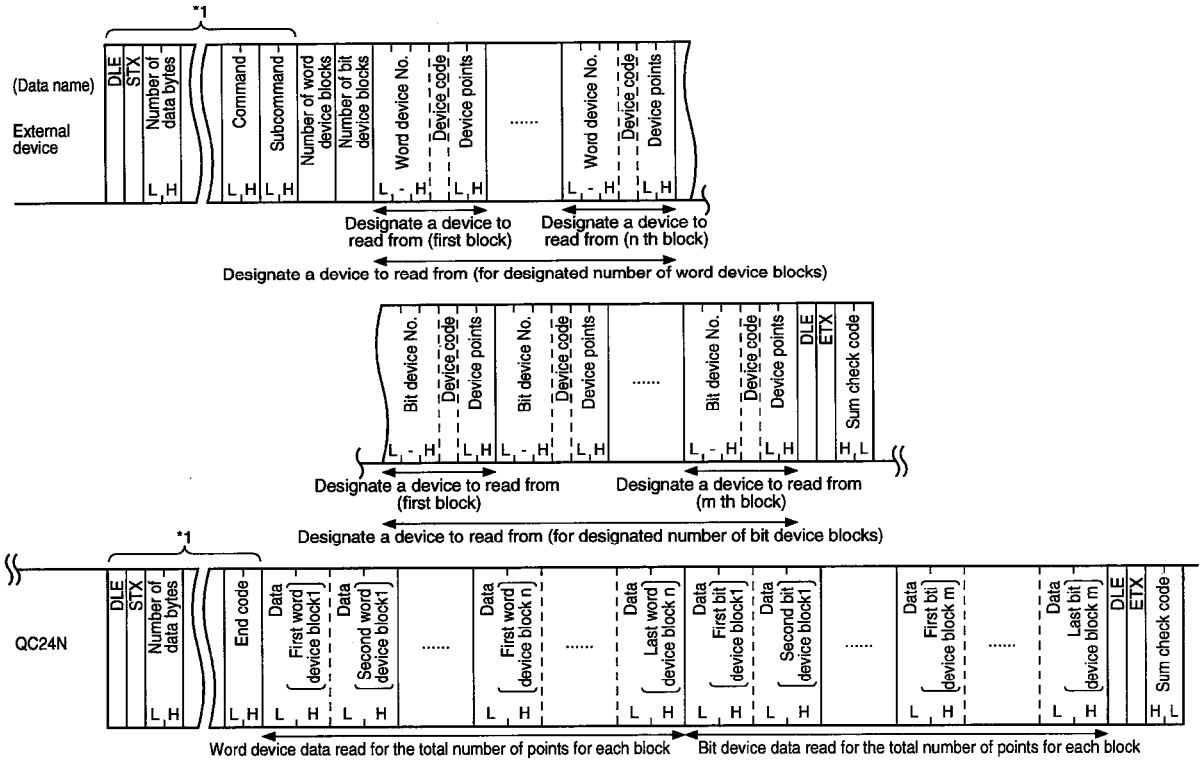
① For ASCII mode (format 1 to 4)

(Example) When the format is 1:



*1 See the User's Manual for the data order in the head and end areas of each transmission/reception frame and format.

② For binary mode (format 5)

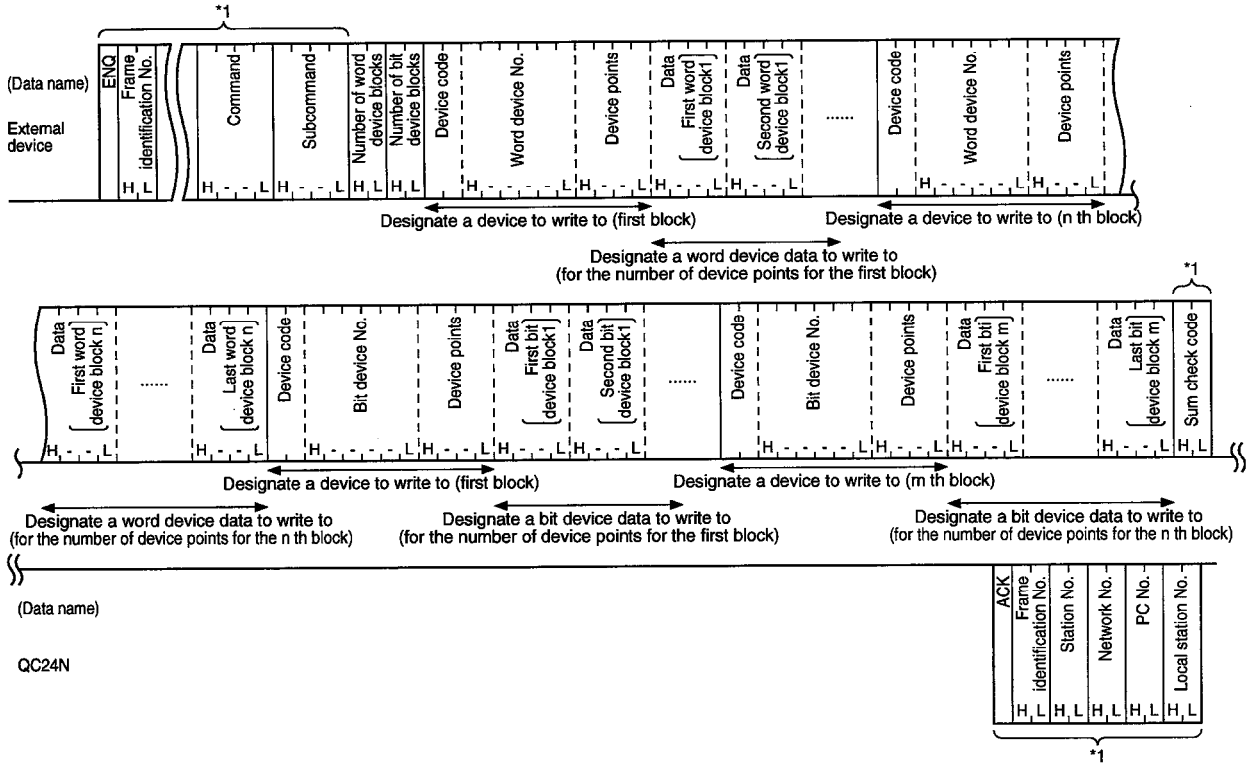


*1 See the User's Manual for the data order in the head areas of each transmission/reception frame and format.

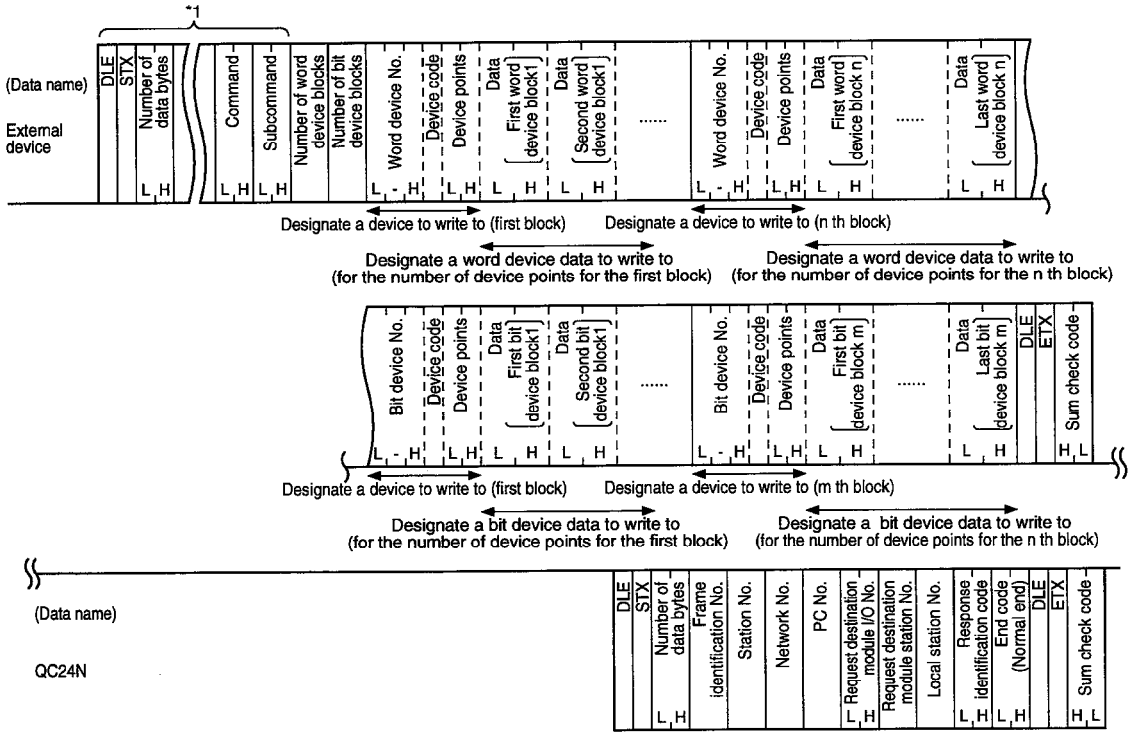
5 Data order in the character area during the multiple block batch write

① For ASCII mode (format 1 to 4)

(Example) When the format is 1:



② For binary mode (format 5)



*1 See the User's Manual for the data order in the head and end areas of each transmission/reception frame and format.

6 Details of the multiple block batch read and batch write

Details of the multiple block batch read and batch write are described.

Besides the data shown below, the details are the same as when using the other commands.

(a) Number of word device blocks and number of bit device blocks

Designates each of the number of word device blocks or bit device blocks to be sent directly after this data in the batch read or batch write to the word device and bit device.

① Data communication in ASCII mode

Each number of blocks are converted to 2-digit ASCII code (hexadecimal) and transmitted.

(Example) For 5 blocks ..... Becomes "05", and transmitted starting from "0".

For 20 blocks ..... Becomes "14", and transmitted starting from "1".

② Data communication in binary mode

Transmits 1-byte numeric value indicating each number of blocks.

(Example) For 5 blocks ..... 05H is transmitted.

For 20 blocks ..... 14H is transmitted.

③ Designate each number of blocks so the following is satisfied:

120 ≥ number of word device blocks + number of bit device blocks

④ When setting one of the number of blocks to 0, the corresponding device number, device code, device points, and data designations are not necessary.

(b) Word device number and bit device number

Designates the head word device or bit device for each block to which batch read or batch write is performed, when continuous word/bit devices are used as one block.

① Data communication in ASCII mode

The head device number of each block is converted to 6-digit ASCII code and transmitted.

(Example) For internal relay M1234 and link register W1234:

The internal relay M1234 is converted to "001234" or "␣␣1234" and the link register W1234 "001234" or "␣␣1234". The transmission starts from "0" or "␣".

② Data communication in binary mode

The head device number of each block is indicated in a 3-byte numeric value and transmitted.

(Example) For internal relay M1234 and link register W1234:

The internal relay M1234 is converted to 0004D2H and transmitted in the order, D2H, 04H, and 00H.

The link register W1234 is converted to 001234H and transmitted in the order 34H, 12H, and 00H.

(C) Device code

Identifies the head device memory for each block for batch read and batch write.

The device code for each device is shown in Serial Communication Module User's Manual's Section 6.2.1 [3] .

① Data communication in ASCII mode

Each device code is converted to 2-digit ASCII code (hexadecimal) and transmitted.

(Example) For internal relay (M) and link register (W):

The internal relay (M) is converted to "M*" and link register (W) to "W*", and transmitted in the order "M" to "W".

② Data communication in binary mode

1-byte numeric value indicating each device code is transmitted.

(Example) For internal relay (M) and link register (W):

The internal relay (M) is transmitted as 90H, and link register (W) is transmitted as B4H.

(d) Device points

This is used when the continuous word devices or bit devices are used as one block.

It designates the number of points in the continuous device range of each block for batch read or batch write (1 point=16 bits for bit device memory and 1 point=1 word for word device memory).

① Data communication in ASCII mode

The number of points for each block is converted to a 4-digit ASCII code (hexadecimal) and transmitted.

(Example) For 5 points ..... Converted to "0005" and transmitted starting from "0".

For 20 points ..... Converted to "0014" and transmitted starting from "0".

② Data communication in binary mode

2-byte numeric value indicating the number of points for each block is transmitted.

(Example) For 5 points ..... Converted to 0005H and transmitted starting from 05H.

For 20 points ..... Converted to 0014H and transmitted starting from 14H.

③ Each device points must be designated in the following range:

- For multiple block batch read

  480 ≥ total number of points for all word device blocks + total number of points for all bit device blocks

- For multiple block batch write

  480 ≥ 4 × (number of word device blocks + number of bit device blocks) + total number of points for all word device blocks + total number of points for all bit device blocks

Point

The extension designation is allowed to the device memory to which a read or write is performed by the multiple block batch read and batch write function.
See the explanation in Section 6.2.10 of the Serial Communication Module User's Manual to make an extension designation to the device memory.

7 Multiple block batch read (Command: 0406)

This section uses an example to explain the control procedure for reading by designating multiple blocks randomly, when n-points of continuous bit device memory (1 point = 16 bits) and word device memory is considered as one block.

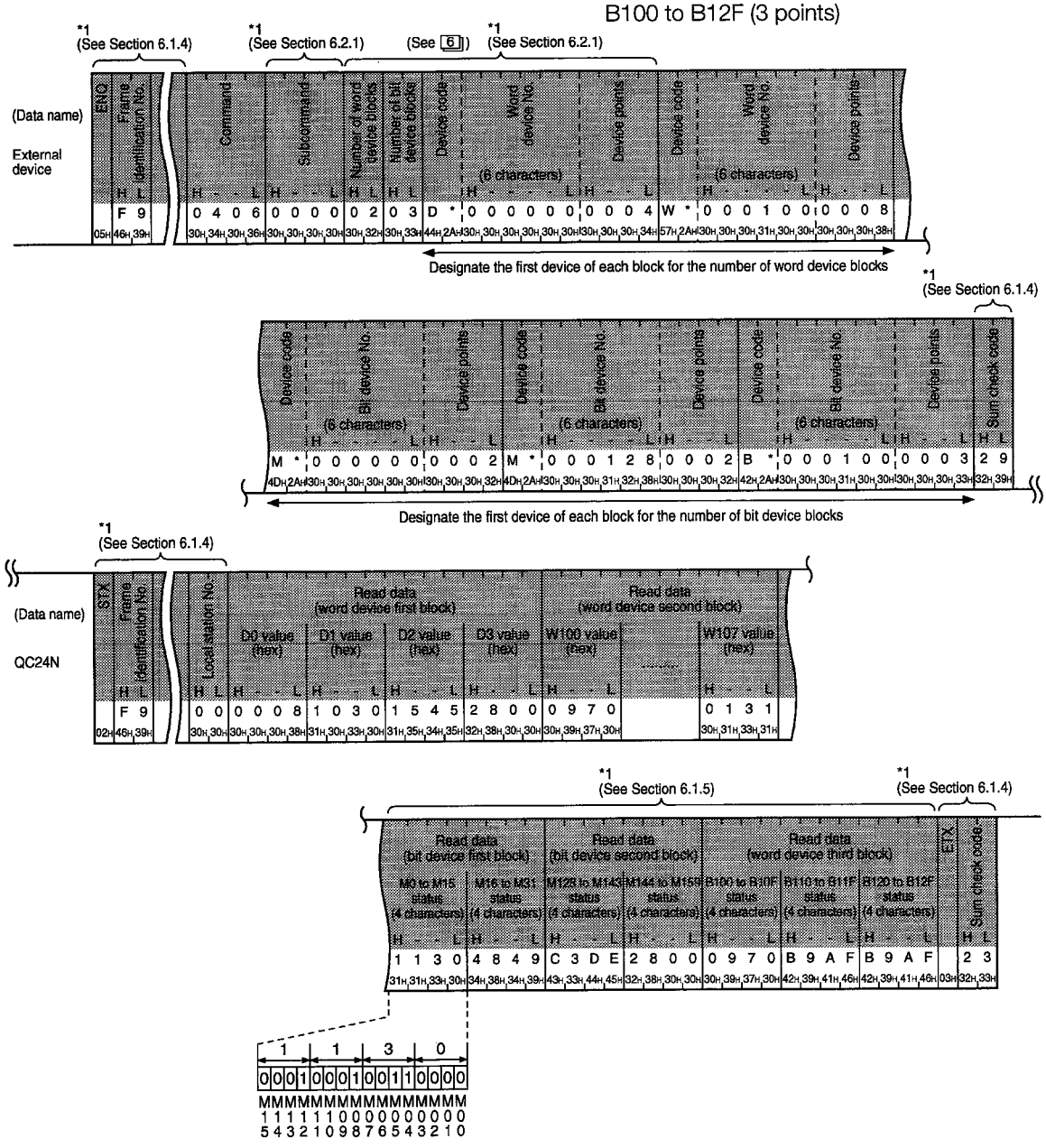
[Control procedure]

Format 1 and format 5 of the QnA (extension) frame are shown, focusing mainly on the designations to the character area.

To access by format 2 to format 4 of the QnA (extension) frame, follow the procedure described in Sections 6.1.1 and 6.1.2 of the User's Manual after seeing this description.

(a) When the following device memory is read in ASCII mode format 1:

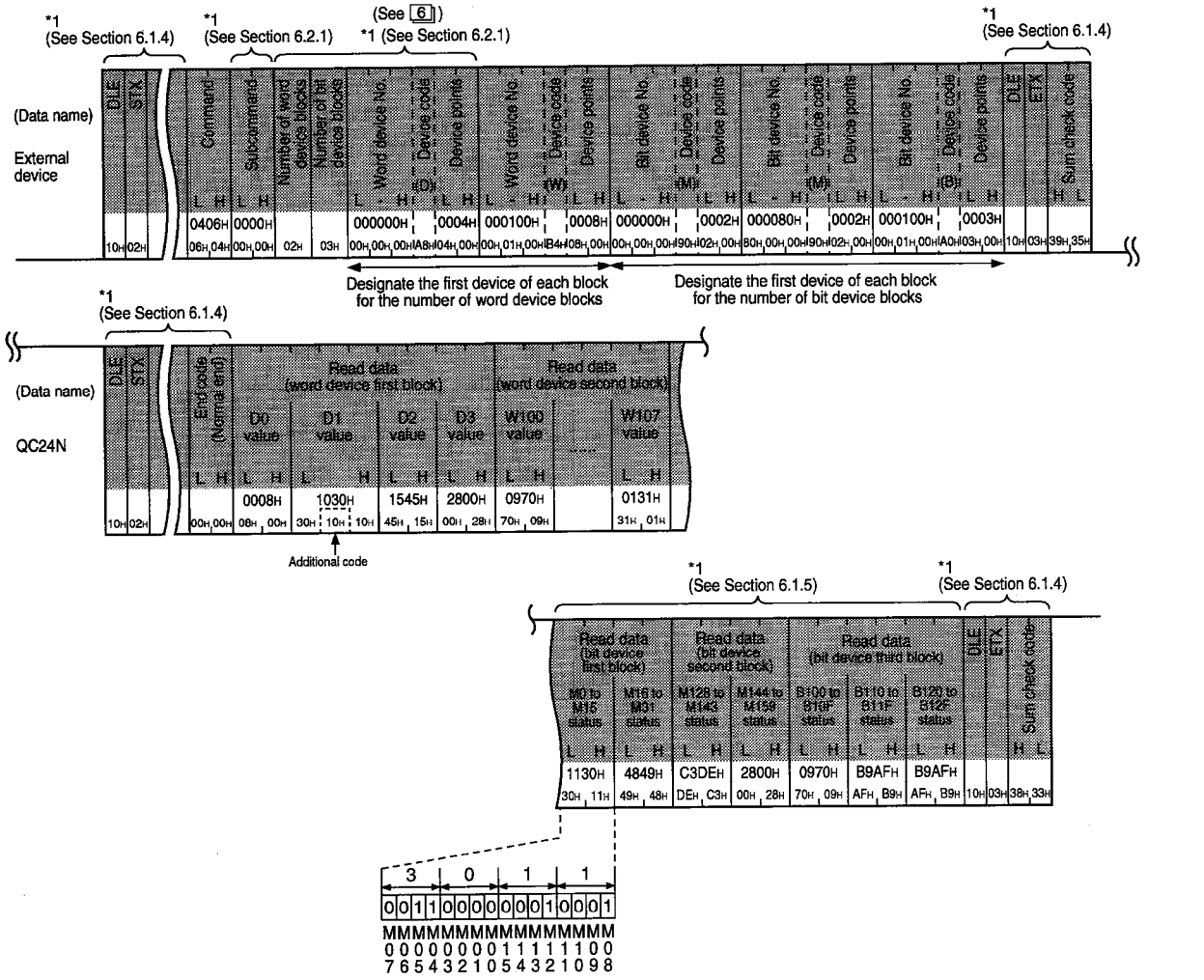
- Word device memory : 2 blocks ; D0 to D3 (4 points), W100 to W107 (8 points)
- Bit device memory : 3 blocks ; M0 to M31 (2 points), M128 to M159 (2 points), B100 to B12F (3 points)



*1 Indicates the Section No. of the Serial Communication Module User's Manual.

(b) When the following device memory is read in binary mode format 5:

- Word device memory : 2 blocks ; D0 to D3 (4 points), W100 to W107 (8 points)
- Bit device memory : 3 blocks ; M0 to M31 (2 points), M128 to M159 (2 points), B100 to B12F (3 points)



*1 Indicates the Section No. of the Serial Communication Module User's Manual.

Point

(1) Designate the number of blocks so that the following is satisfied:
120 ≥ number of word device blocks + number of bit device blocks

(2) Designate each device points so that the following is satisfied:
480 ≥ total number of points for all word device blocks + total number of points for all bit device blocks

(3) This command can only be executed to the PC CPU listed in Section 2.1. *1.

8 Multiple block batch write (Command:1406)

This section uses an example to explain the control procedure for writing by designating multiple blocks randomly, when n-points of continuous bit device memory (1 point = 16 bits) and word device memory is considered as one block.

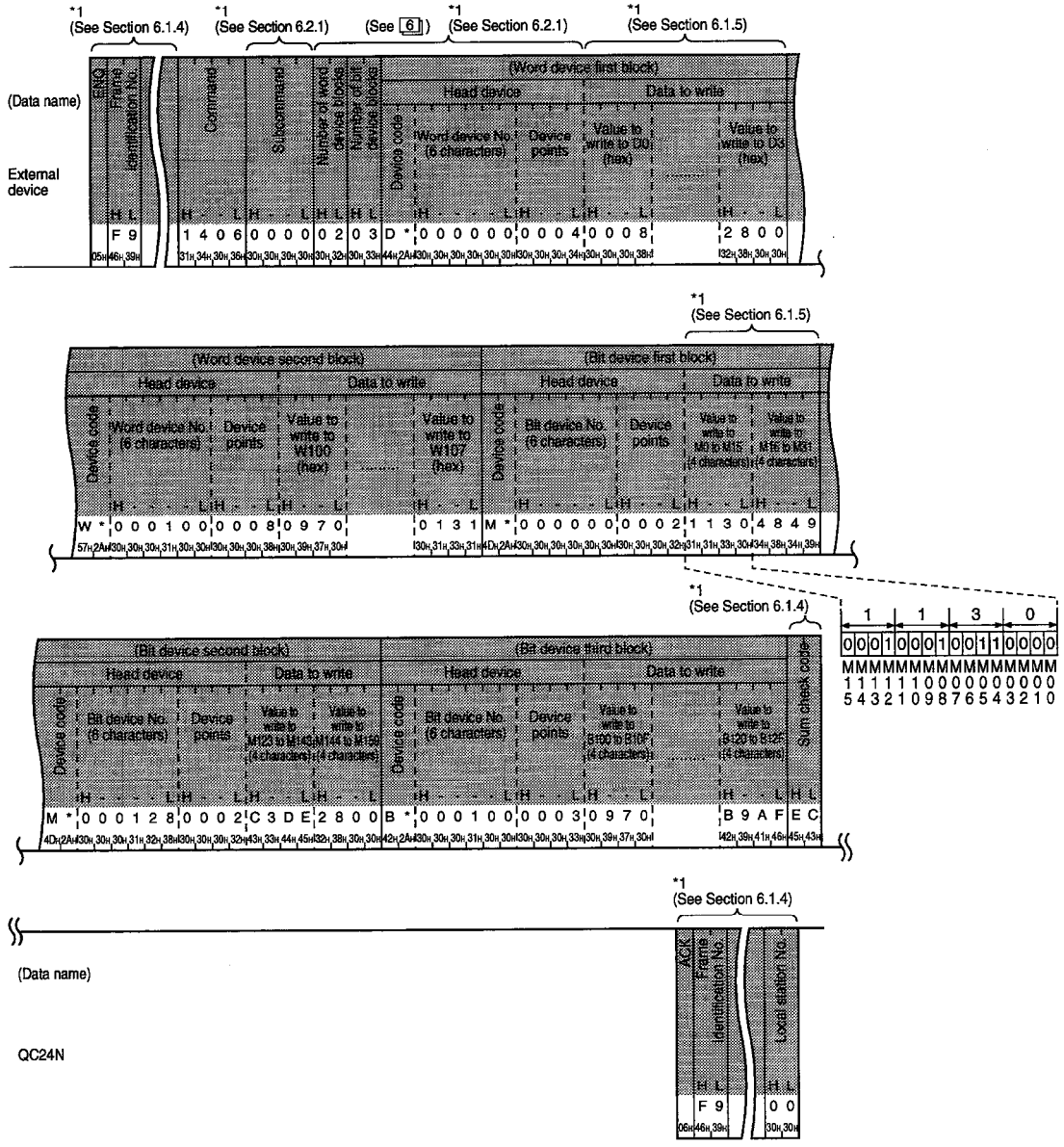
[Control procedure]

Format 1 and format 5 of the QnA (extension) frame are shown, focusing mainly on the designations to the character area.

To access by format 2 to format 4 of the QnA (extension) frame, follow the procedure described in Sections 6.1.1 and 6.1.2 of the User's Manual after seeing this description.

(a) When the following device memory is written in ASCII mode format 1:

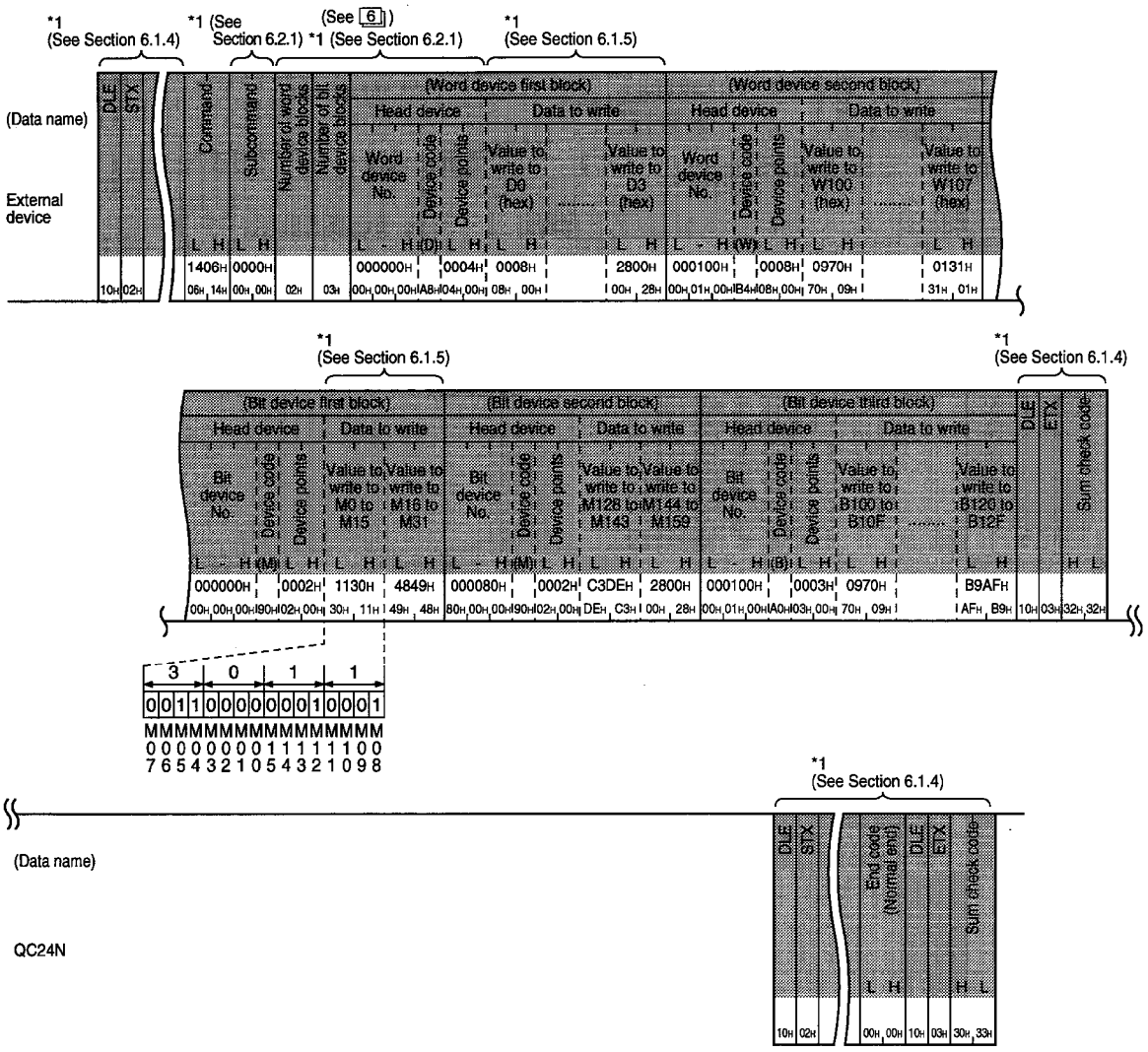
- Word device memory : 2 blocks ; D0 to D3 (4 points), W100 to W107 (8 points)
- Bit device memory : 3 blocks ; M0 to M31 (2 points), M128 to M159 (2 points), B100 to B12F (3 points)



*1 Indicates the Section No. of the Serial Communication Module User's Manual.

(b) When the following device memory is written in binary mode format 5:

- Word device memory : 2 blocks ; D0 to D3 (4 points), W100 to W107 (8 points)
- Bit device memory : 3 blocks ; M0 to M31 (2 points), M128 to M159 (2 points), B100 to B12F (3 points)



*1 Indicates the Section No. of the Serial Communication Module User's Manual .

Point

(1) Designate the number of blocks so that the following is satisfied:
120 ≥ number of word device blocks + number of bit device blocks

(2) Designate each device points so that the following is satisfied:
480 ≥ 4 × (number of word device blocks + number of bit device blocks) + total number of points for all word device blocks + total number of points for all bit device blocks

(3) This command can only be executed to the PC CPU listed in Section 2.1. *1.

6. DATA COMMUNICATIONS USING QnA SIMPLIFIED FRAME

This section describes the communication function by the QnA simplified frame which has been added in the QC24N.

6.1 QnA Simplified Frame Data Communications Function

The communications function by the QnA simplified frame is described.

(1) The QnA simplified frame is a frame for the dedicated protocol with simplified message format in order to reduce the communication time from the external device to the device memory of the QnACPU (local station) with a QC24N installed.

(2) Because of less amount of the transmission data, processing of the message by the external device is made easier and the transmission time of the message can be reduced.

6.2 Format of the QnA Simplified Frame, Accessible PCs, and the Accessible Range

The format of the QnA simplified frame, accessible PCs, and the accessible range are described.

1 Format of the QnA simplified frame

The communication is allowed by format 1 to format 4 for the ASCII mode, and is executed by the format of the number set by the mode setting switch of the QC24N.

There is no QnA simplified frame by format 5 for the binary mode.

	Mode	Frame type (dedicated protocol)	Mode switch NO.				
			Format 1	Format 2	Format 3	Format 4	Format 5
Dedicated protocol	ASCII mode	QnA frame	1	2	3	4	
		QnA extension frame					
		A compatible frame					
		QnA simplified frame					
	Binary mode	QnA extension frame					5

2 Accessible PCs and the range by the QnA simplified frame

The communication is allowed only to the following local station QnACPUs.

① Local station QnACPU, Q4ARCPU and Q2AS(H)CPU installed QC24N.

② Other station's QnACPU, Q4ARCPU and Q2AS(H)CPU installed QC24N with the multi-drop connection.

Point

The access to other station's PC is not allowed via the MELSECNET/10 remote station installed QC24N (local station), MELSECNET(II)/B, or MELSECNET/10.

6.3 Command for QnA Simplified Frame and Function List

The commands and functions used for the communication by the QnA simplified frame are as follows.

All the commands are for reading data from and writing data to the device memory of the PC CPU installed a QC24N by the dedicated protocol.

Functions		Command	Processing	Number of points processed per communication	PC CPU state (*1)		
					During STOP	During RUN	
						Write enable set	Write disable set
Batch read	Bit units	1	Bit devices are read in 1 point units. (1 point = 1 bit)	3952 points	○	○	○
	Word units	2	Bit devices are read in 1 point units. (1 point = 16 bits)	480 points			
			Word devices are read in 1 point units.				
Batch write (*2)	Bit units	3	Bit devices are written in 1 point units. (1 point = 1 bit)	3952 points	○	○	×
	Word units	4	Bit devices are written in 1 point units. (1 point = 16 bits)	480 points			
			Word devices are written in 1 point units.				
Random read	Word units	5	Bit devices are read in 1 point units and the devices and device No. are randomly set. (1 point = 16 bits)	96 points	○	○	○
			Word devices are read in 1 point units and the devices and devices No. are randomly set.				
Test (Random write) (*2)	Bit units	6	Bit devices are written in 1 point units and the devices and device No. are randomly set. (1 point = 1 bit)	94 points	○	○	×
	Word units	7	Bit devices are written in 1 point units, and the devices and device No. are randomly set. (1 point = 16 bits)	960 points			
			Word devices are written in 1 point units, and the devices and device No. are randomly set.				
Monitor data registration (*3)	Word units	8	Bit devices that monitor are registered in 1 point units. (1 point = 16 bits)	96 points	○	○	○
			Word devices that monitor are registered in 1 point units.				
Monitor (*3)	Word units	9	Device monitors for which monitor data registration was conducted.	Number of registrations portion			

*1 Use the QC24N transmission specification switch SW07 to set whether it is possible to write to the PC CPU during RUN.
SW07 = ON ..... Write possible during RUN (Enable)
SW07 = OFF ..... Write not possible during RUN (Disable)

*2 When the system protect is active (system protect switch SW05=ON) for the QnACPU which executes the command, an error occurs and a NAK message is returned.

*3 The procedure for monitoring is the same as that for monitoring the communication by the QnA (extension) frame.

6.4 Basic Format of the Data communication by the QnA Simplified Frame

The basic format of the data communication by the QnA simplified frame and the contents of the designated data name are described.

6.4.1 Basic format of the data communication

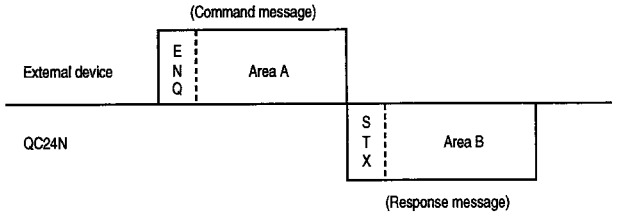
The basic format of the data communication by the QnA simplified frame is as follows:
The differences between the four ASCII mode formats when format 1 is made the standard are shown below.

Format 2 ..... Format with block number added to each message
Format 3 ..... Format with each message enclosed between STX and ETX
Format 4 ..... Format with CR, LF added to each message

● Basics of dedicated protocol control procedure

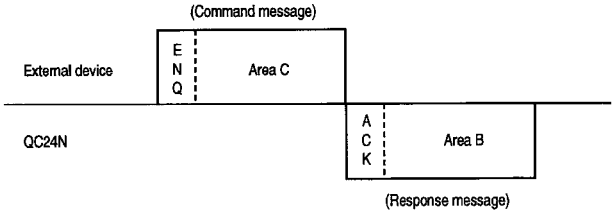
This section describes the basics of the transmission data given in the description of each control procedure.

(a) When the external device reads data from PC



① Area A indicates transmission from external device to QC24N.
② Area B indicates transmission from QC24N to external device.
③ The external device program is generated so that the data are sequentially sent from left to right.
(Example: For Area A, the data is sequentially sent to the right from ENQ.)

(b) When the external device writes data to PC



① Area C indicates transmission from external device to QC24N.
② Area B indicates transmission from QC24N to external device.
③ The external device program is generated so that the data are sequentially sent from left to right.
(Example: For Area C, the data is sequentially sent to the right from ENQ.)

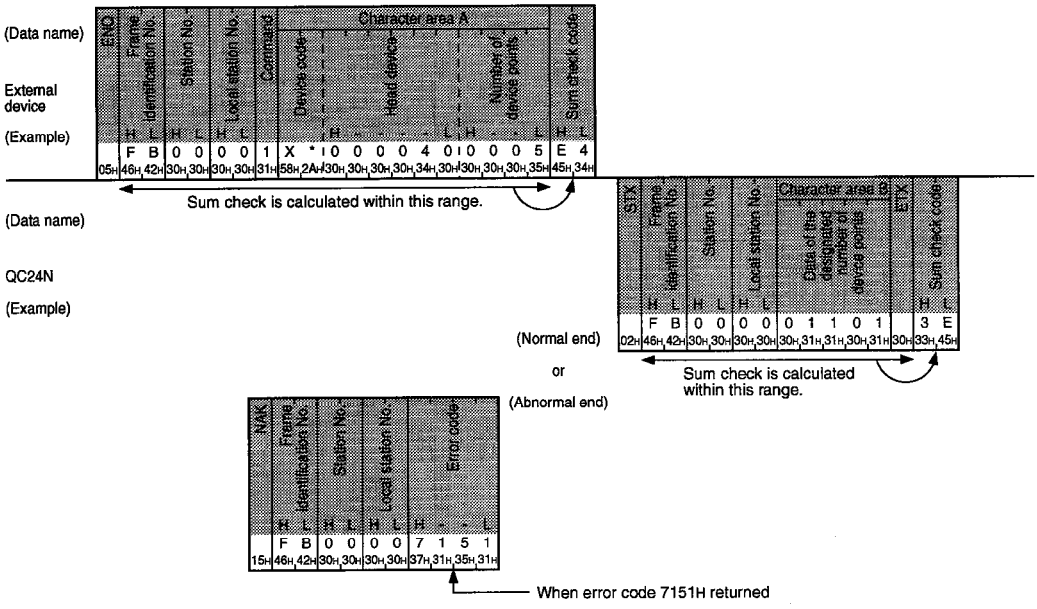
Point

When the QC24 receives a command message from an external device, after it completes processing of Area A in the message, the QC24N transmits a response message and enters the neutral state.
When the QC24N is in the neutral state, it waits to receive the next command message and a on-demand data transmission request from the PC CPU.

1 Communication using control procedure format 1

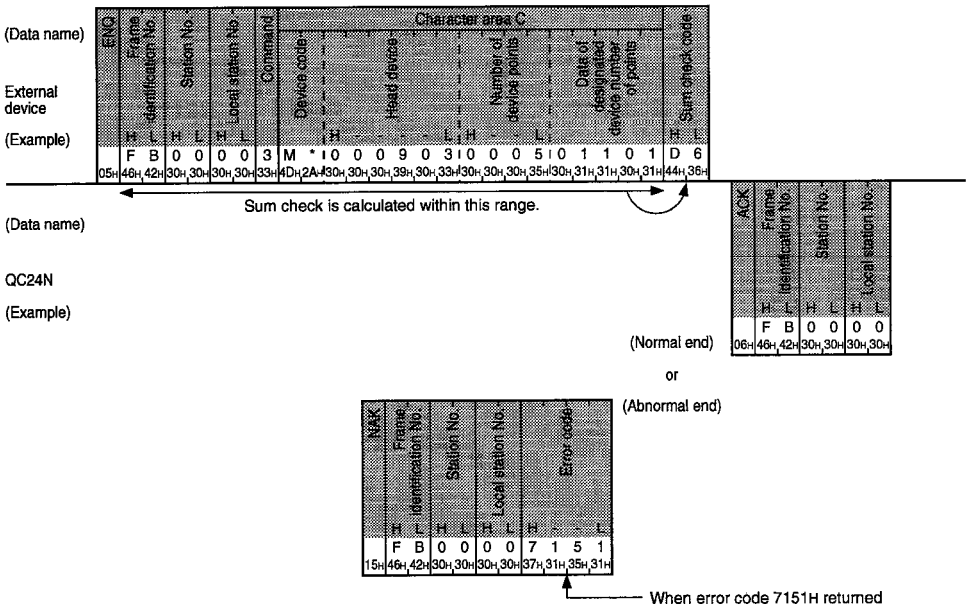
① When the external device reads data from QnACPU

(Example) Using a command 1, the external device reads five points data form X 40 to X 44 of the QnACPU:



② When the external device writes data to QnACPU

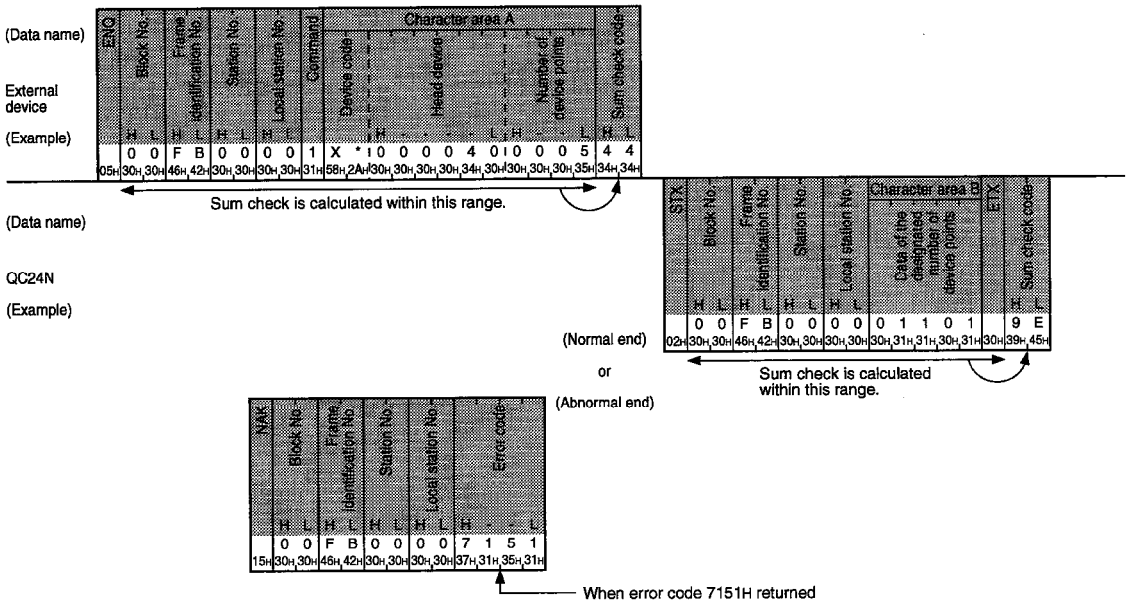
(Example) Using a command 3, the external device writes five points data to M903 to M907 of the QnACPU:



2 Communication using control procedure format 2

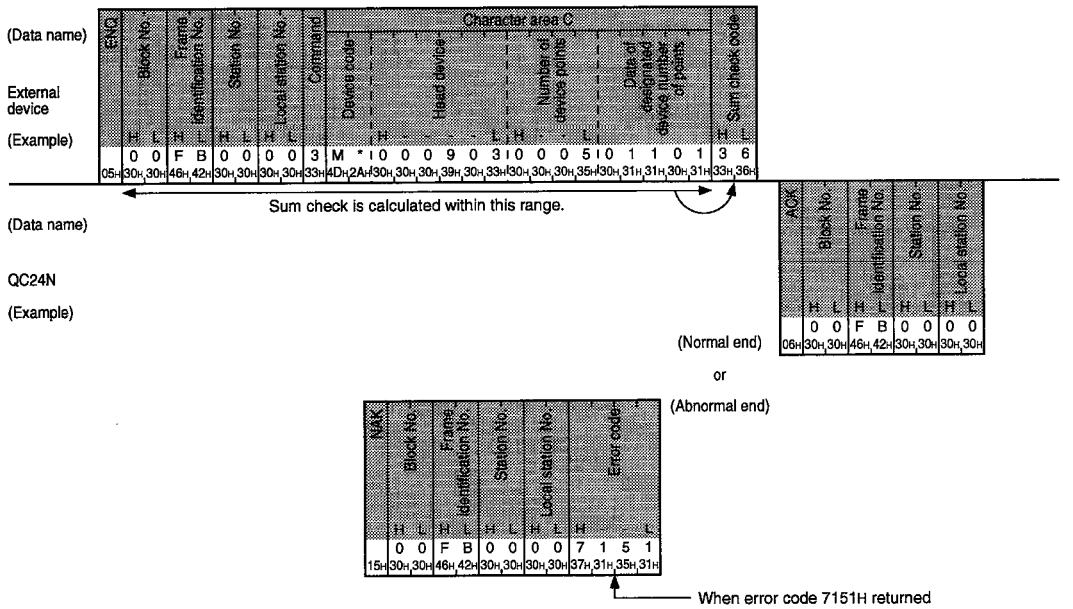
① When the external device reads data from QnACPU

(Example) Using a command 1, the external device reads five points data form X 40 to X 44 of the QnACPU:



② When the external device writes data to QnACPU

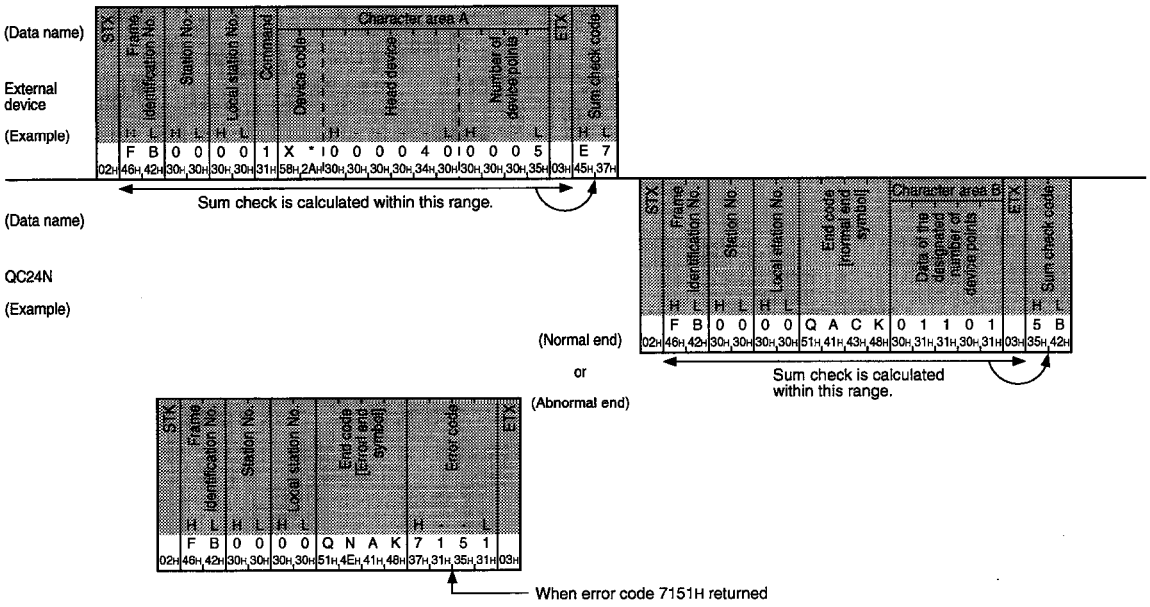
(Example) Using a command 3, the external device writes five points data to M903 to M907 of the QnACPU:



3 Communication using control procedure format 3

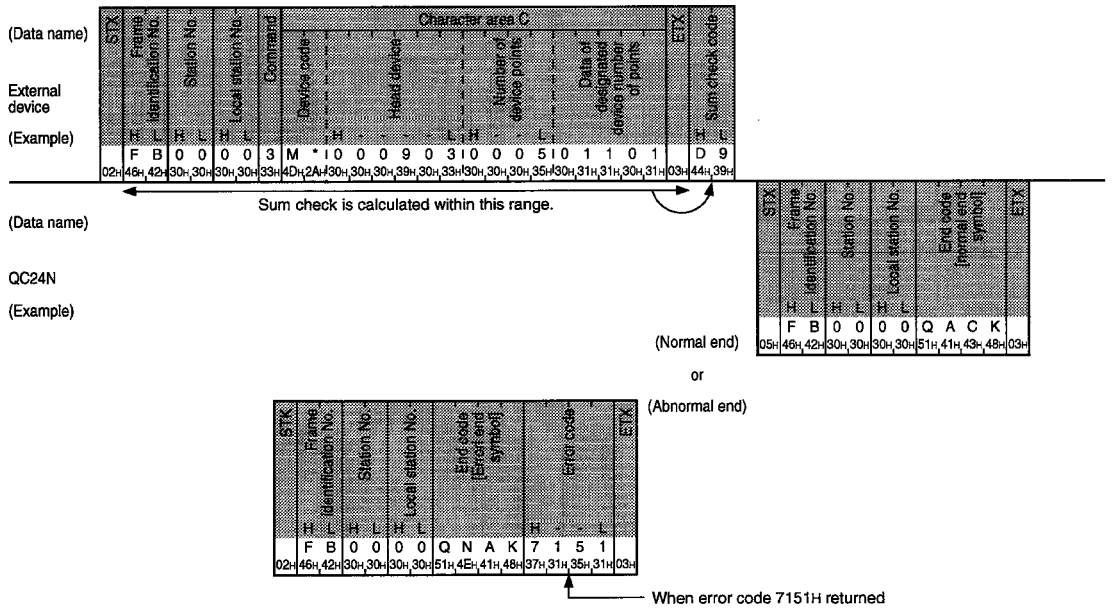
① When the external device reads data from QnACPU

(Example) Using a command 1, the external device reads five points data from X 40 to X 44 of the QnACPU:



② When the external device writes data to QnACPU

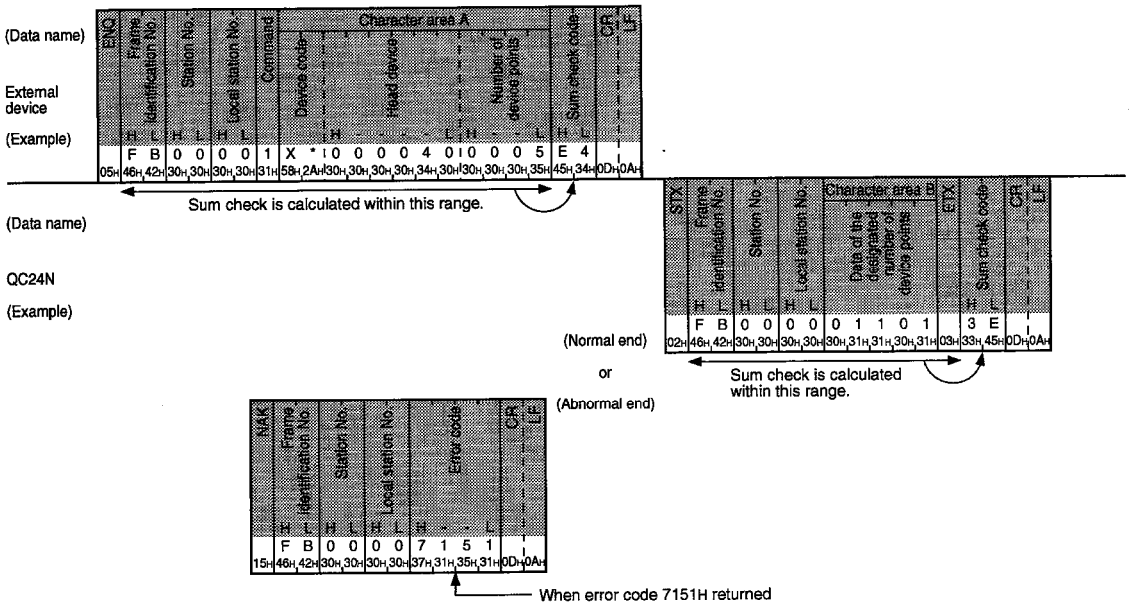
(Example) Using a command 3, the external device writes five points data to M903 to M907 of the QnACPU:



4 Communication using control procedure format 4

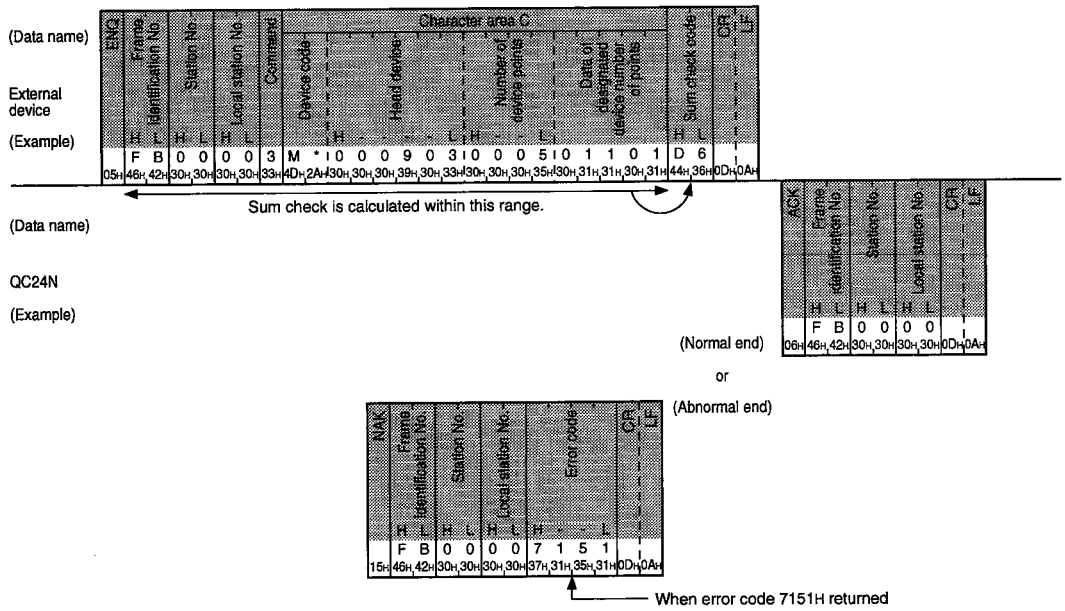
① When the external device reads data from QnACPU

(Example) Using a command 1, the external device reads five points data form X 40 to X 44 of the QnACPU:



② When the external device writes data to QnACPU

(Example) Using a command 3, the external device writes five points data to M903 to M907 of the QnACPU:



6.4.2 Contents of the data designation items

Among the designations of the data name designated by the control procedure in each format of the QnA simplified frame, the contents of the data name dedicated to the QnA simplified frame that are different from those of the QnA frame and QnA extension frame are described.

Point

The data names other than those shown in this section use the same designation method which is used for the communication by the QnA frame and the QnA extension frame.
See Section 6.1.4 of the Serial Communication Module User's Manual.

1 Frame identification number

When the communication is executed by the QnA simplified frame, "FB" is used as the frame identification number.

Mode	Frame	Frame identification No.
ASCII mode	QnA frame	"F 9"
	QnA extension frame	"F 8"
	QnA simplified frame	"F B"
Binary mode	QnA extension frame	F 8 H

2 Command

One of the commands from "1" to "9" for the QnA simplified frame (See Section 6.3) that corresponds to the function to be used is transmitted as one digit of ASCII code.

3 Character area (area A, area B, area C)

The character area use the same designation method and contents as those for the communication by the QnA frame and QnA extension frame.

It depends on the command transmitted from the external device.

The following table shows the QnA simplified frame commands and the corresponding QnA (extension) frame commands whose designation method of the character area is the same as the QnA simplified frame.

Command		QnA simplified frame command	QnA (extension) command which corresponds to the command to the left	
			Command	Subcommand
Batch read	Bit units	1	0401	0001
	Word units	2	0401	0000
Batch write	Bit units	3	1401	0001
	Word units	4	1401	0000
Random read	Word units	5	0403	0000
Test (Random write)	Bit units	6	1402	0001
	Word units	7	1402	0000
Monitor data registration	Word units	8	0801	0000
Monitor	Word units	9	0802	0000

Designate the character area of the command to be used according to Section 6.2 in the Serial Communication Module User's Manual.

6.4.3 Precautions for the data communication

The precautions for the data communication by the QnA simplified frame are as follows:

(1) Precautions for each format are the same as those for the communication by the QnA frame or QnA extension frame.

See Sections 6.1.1 and 6.1.2 in the Serial Communication Module User's Manual.

(2) The monitoring conditions for reading data which can be designated by the communication of the QnA frame or the QnA extension frame cannot be designated by the communication by the QnA simplified frame.

In addition, the extension setting of the device memory to read and write is not allowed, either.

(3) When the data is communicated by the QnA simplified frame, the number of points and range of read and write for each command are the same as those when the corresponding QnA (extension) frame command is used.

(The designation method of the character area and the contents are the same.)

The QnA (extension) frame commands which correspond to the QnA simplified frame commands are listed in Section 6.4.2 of this chapter.

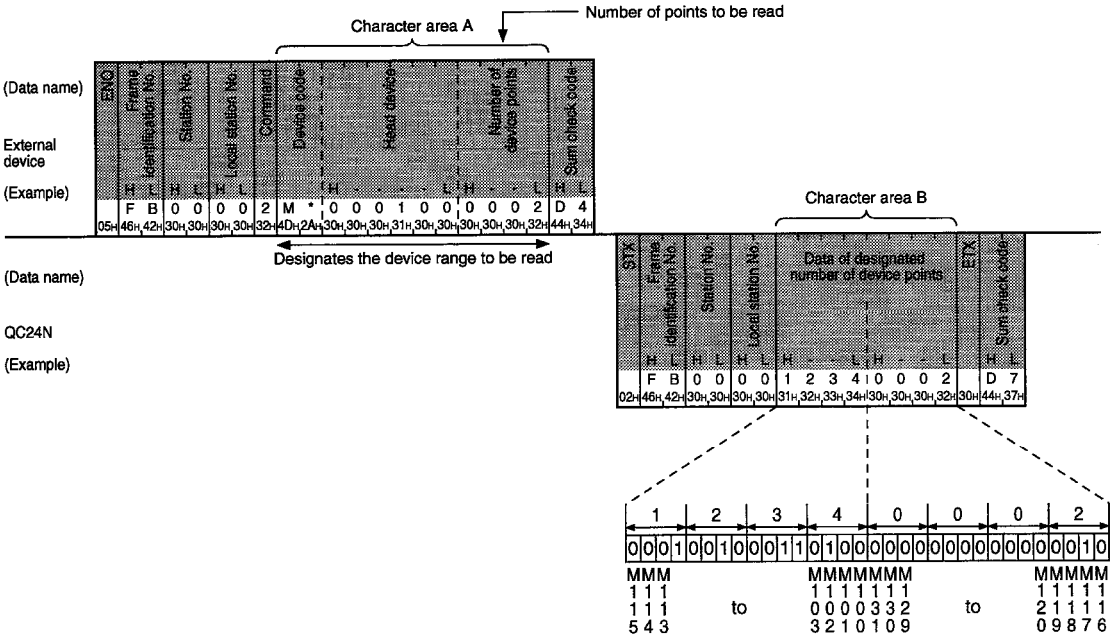
6.5 Example of Data Communication by the QnA Simplified Frame

The control procedure of the data communication by the QnA simplified frame is shown in format 1.

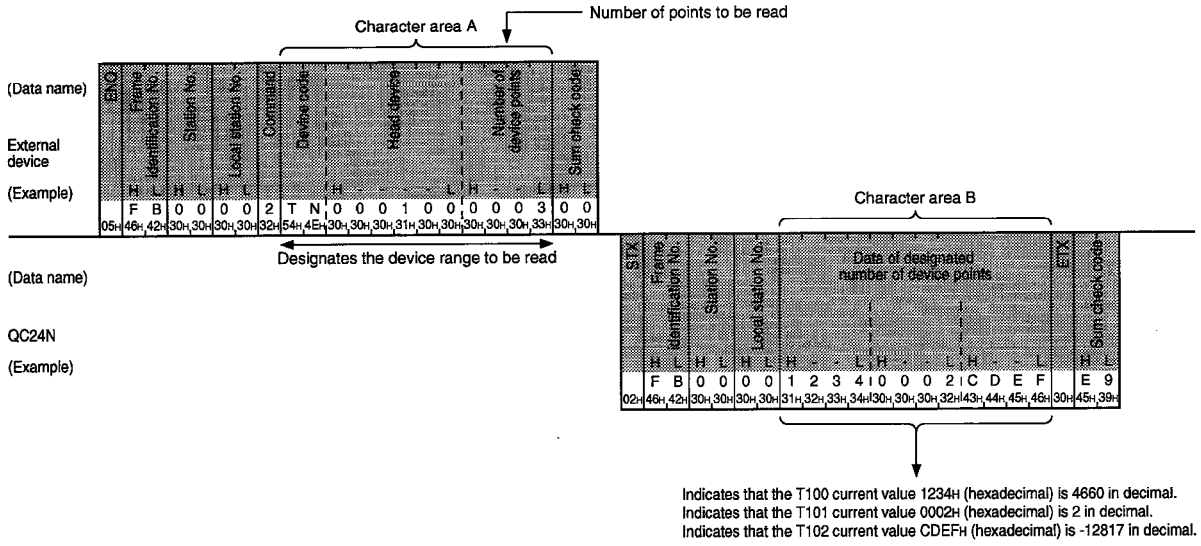
See Section 6.4.1 for examples of the control procedures using command 1 and 3.

1 **Batch read in word units (Command: 2)**

(a) When reading two points (32 bits) from internal relays M100 to M131



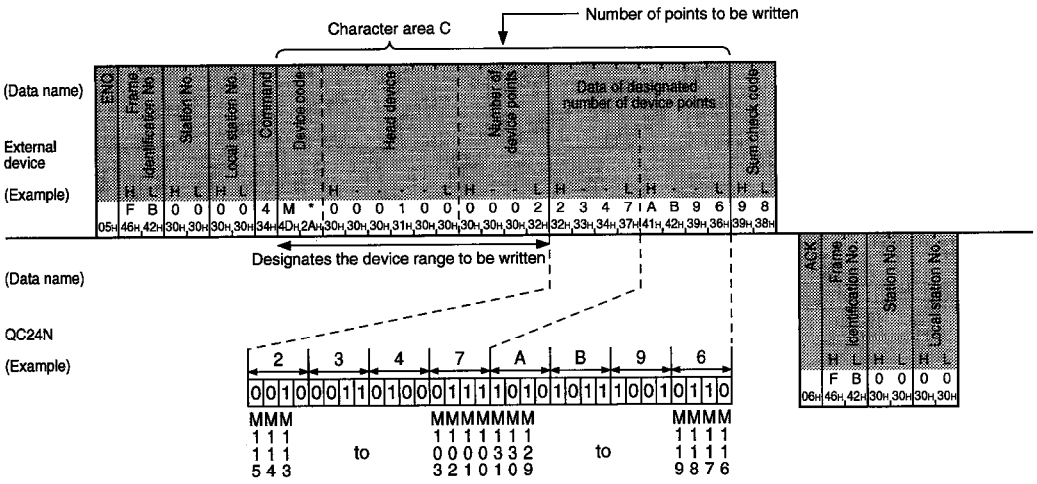
(b) When reading the current value of three points from timer T100 to T102



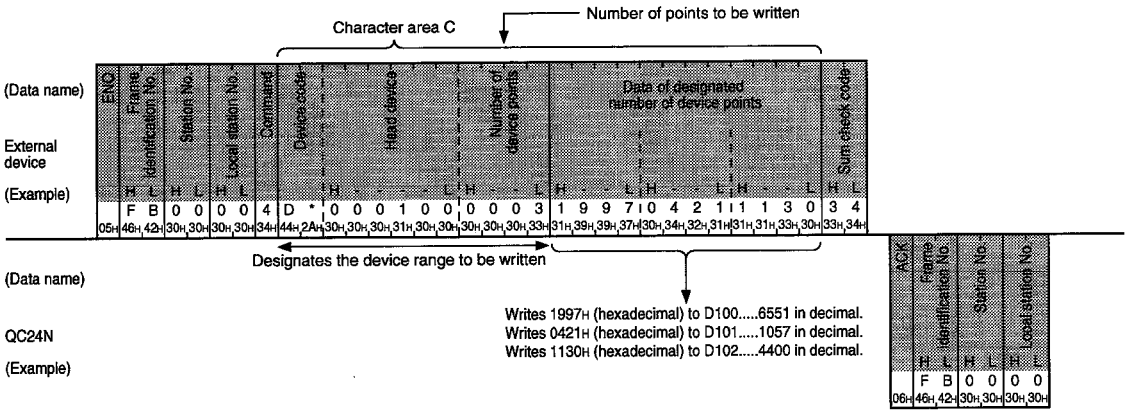
* The designation method and contents for the character area of command 2 are the same as that of the QnA (extension) frame command 0401 (subcommand 0000).

2 Batch write in word units (Command: 4)

(a) When writing two points (32 bits) to internal relays M100 to M131



(b) When writing three points to D100 to D102

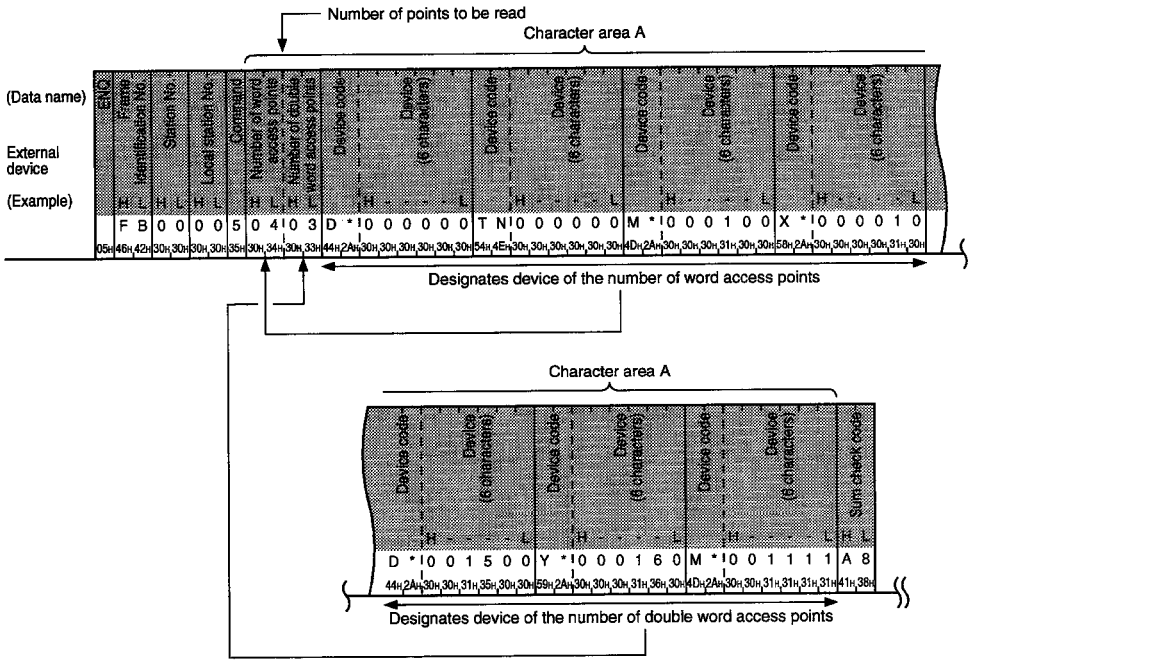


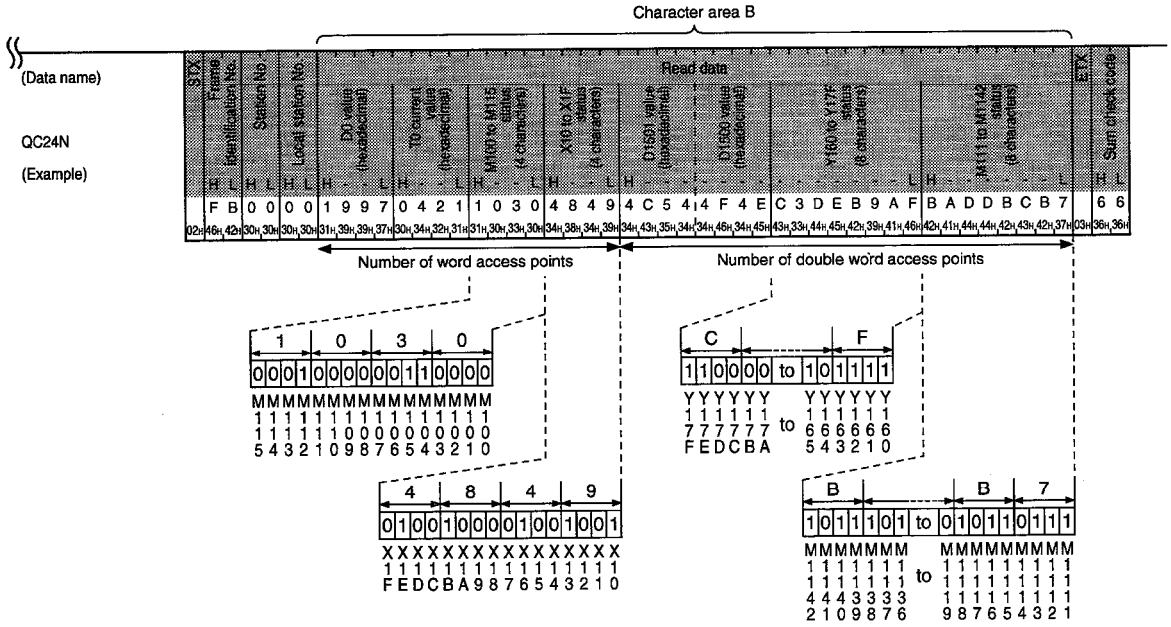
* The designation method and contents for the character area of command 4 are the same as that of the QnA (extension) frame command 1401 (subcommand 0000).

3 Random read in word units (Command: 5)

When reading the following device memories

- Word access : D0, T0, M100 to M115, X10 to X1F
- Double word access : D1500 to D1501, Y160 to Y17F, M1111 to M1142

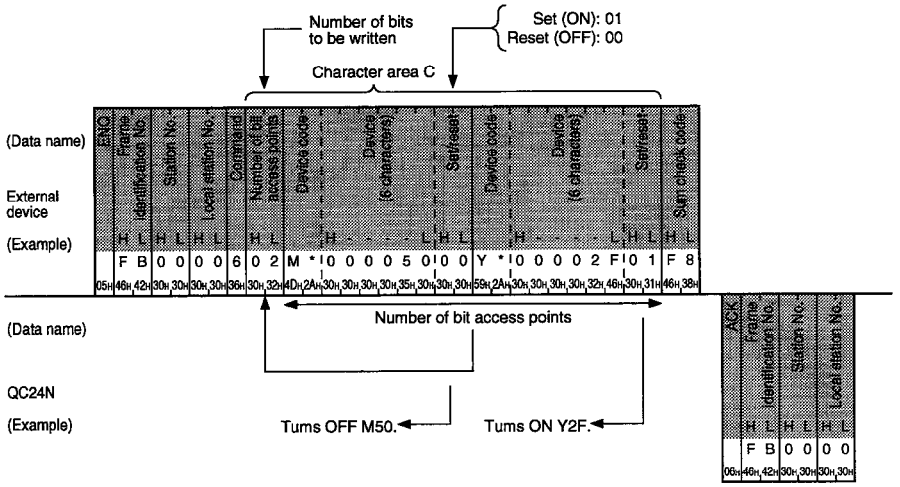




* The designation method and contents for the character area of command 5 are the same as that of the QnA (extension) frame command 0403 (subcommand 0000).

4 Test in bit units (Command: 6)

When turning off internal relay M50 and turning on output relay Y2F

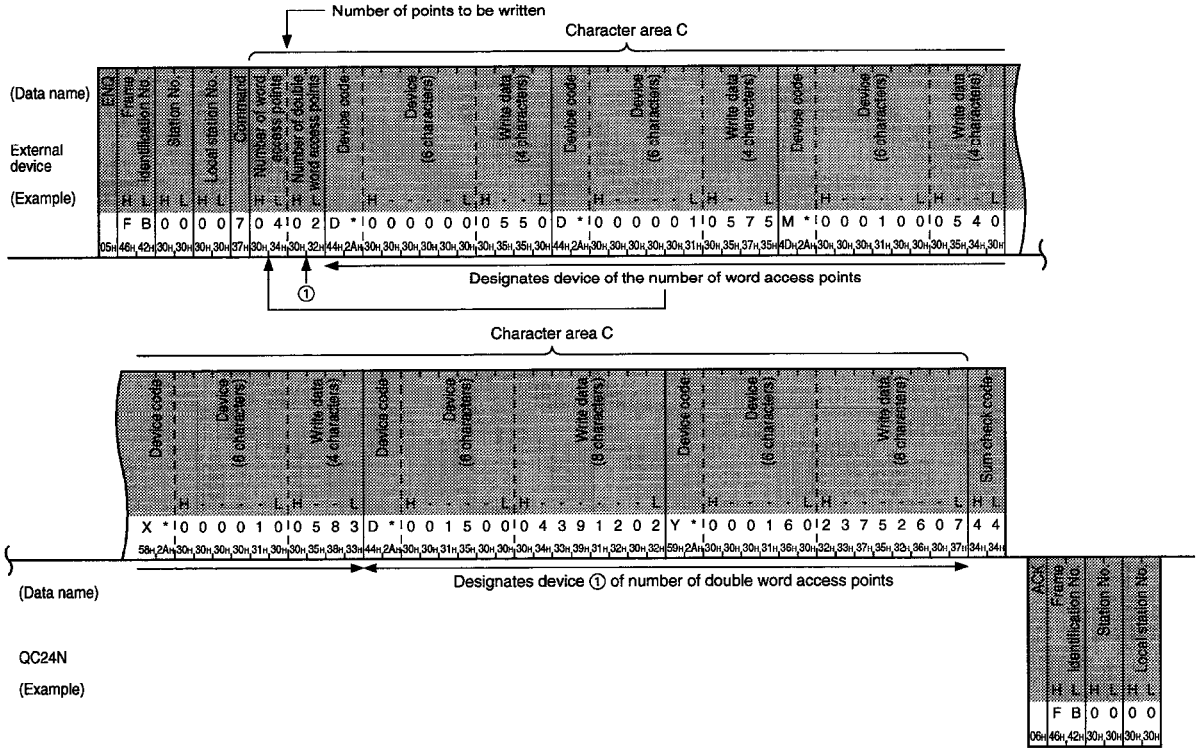


* The designation method and contents for the character area of command 6 are the same as that of the QnA (extension) frame command 1402 (subcommand 0001).

5 Test in word units (Command: 7)

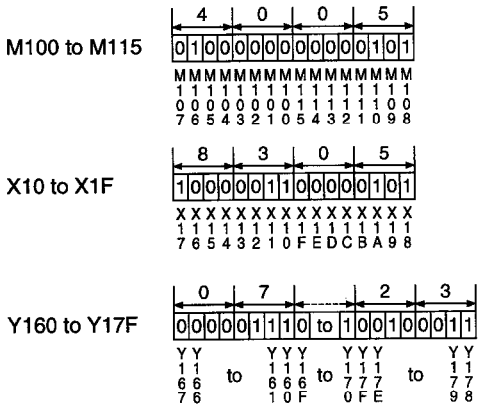
When writing the following device memories

- Word access : D0, D1, M100 to M115, X10 to X1F
- Double word access : D1500 to D1501, Y160 to Y17F



* The designation method and contents for the character area of command 7 are the same as that of the QnA (extension) frame command 1402 (subcommand 0000).

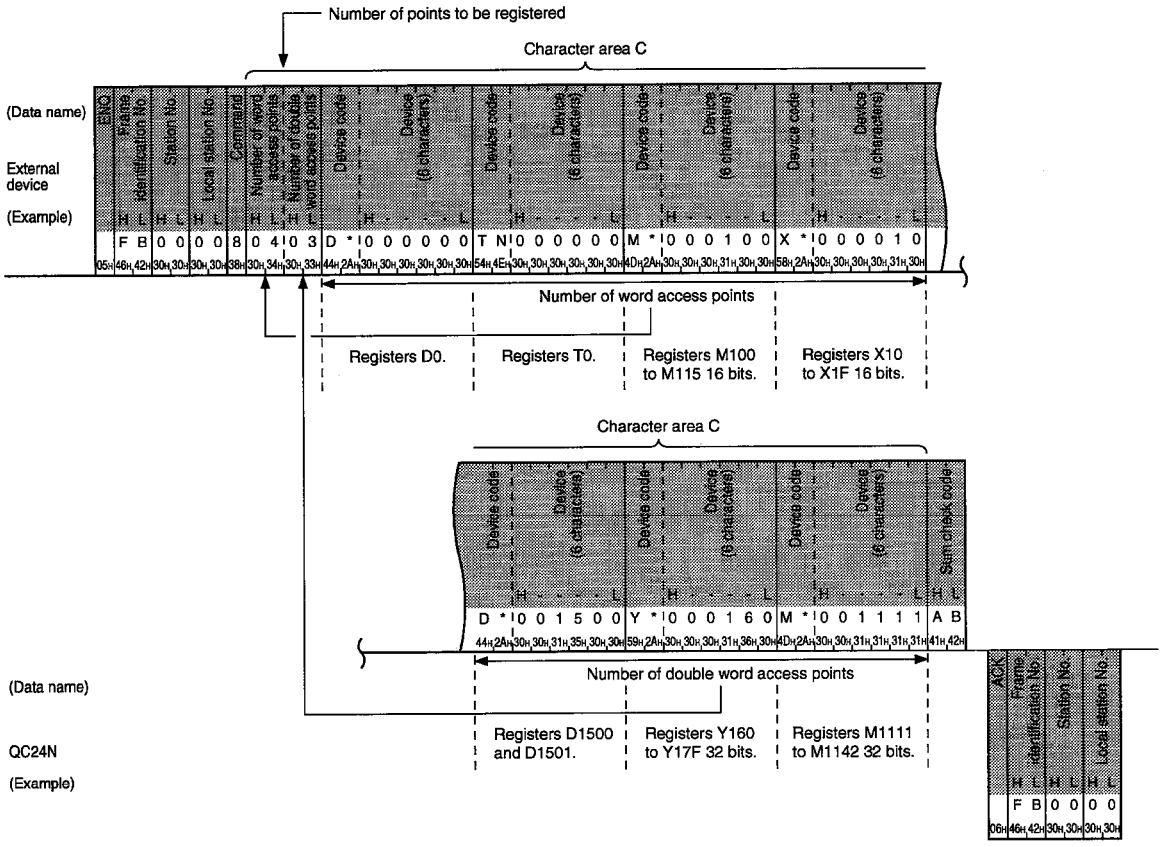
The correspondence between the data to be tested by each word units and the bit device is as follows:



6 **Monitor data registration in word units (Command: 8)**

When registering the monitor data for the following device memories

- Word access : D0, T0, M100 to M115, X10 to X1F
- Double word access : D1500 to D1501, Y160 to Y17F, M1111 to M1142



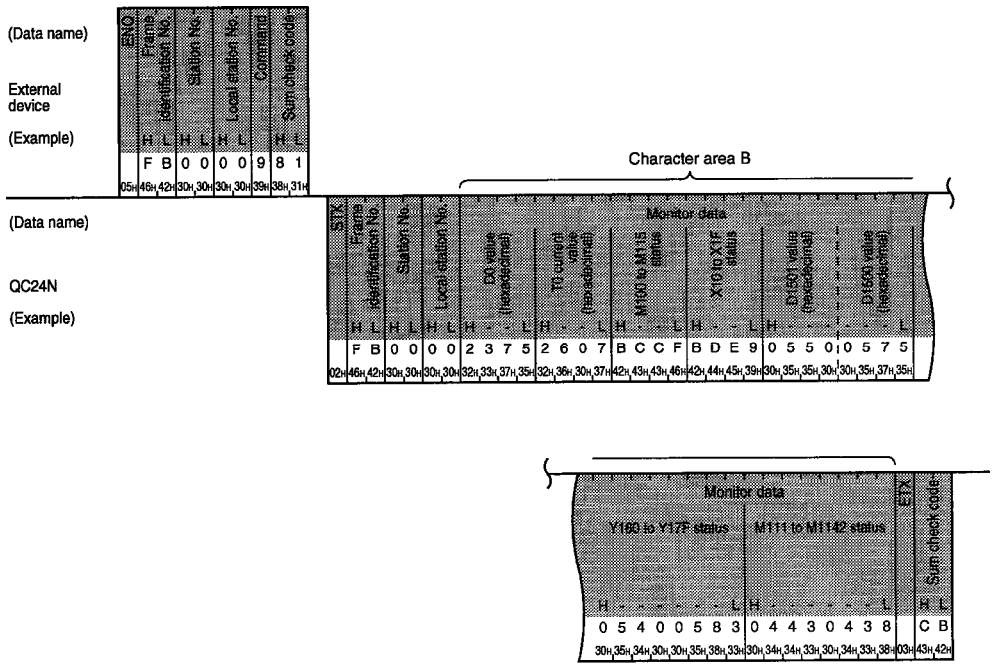
* The designation method and contents for the character area of command 8 are the same as that of the QnA (extension) frame command 0801 (subcommand 0000).

7 Monitor in word units (Command: 9)

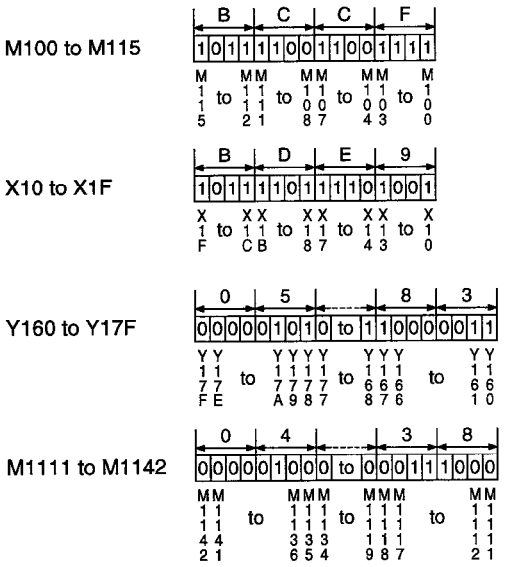
When monitoring the following device memories with monitoring data registered

(Device memories with monitor data registered)

- Word access : D0, T0, M100 to M115, X10 to X1F
- Double word access : D1500 to D1501, Y160 to Y17F, M1111 to M1142



The correspondence between the bit device which is registered as monitor data and the data actually read is as follows:



* The contents for the character area of command 9 is the same as that of the QnA (extension) frame command 0802 (subcommand 0000).

7. PC CPU COMMUNICATION TIME

7.1 PC CPU Communication Time (Scan Time Increase)

When the PC CPU is in the RUN state, it processes the number of processing points per communication each time it executes an END instruction for requests sent from the QC24N by dedicated protocol. The intervening time to the scan time and the number of scans required by processing at this time are shown below.

1 QnA (extension) frame command

Item			Command	Sub-command	Intervening time [ms] (Scan time increase) Q3ACPU (When A38B used) Number of access points: ①	Intervening time [ms] (Scan time increase) Q3ACPU (When A38B used) Number of access points: ②	Number of access points ①/②	Number of scans required for processing When [Enable during RUN] set	Number of scans required for processing When [Disable during RUN] set
Device memory	Batch read	Bit units	0401	0001	1.068	2.428	1/3952	1	
		Word units		0000	0.996	3.168	1/480	1	
	Batch write	Bit units	1401	0001	1.008	2.428	1/3952	1	2
		Word units		0000	0.996	3.196	1/480	1	2
	Random read	Word units	0403	0040	1.304	6.976	1/96	3	4
				0000	1.272	7.256		2	3
	Test [Random write]	Bit units	1402	0001	1.240	9.160	1/94	1	2
		Word units		0000	1.156	6.764	1/80	1	2
	Monitor data registration	Word units	0801	0040	0.980	0.990	1/96	1	
				0000	0.948	0.950			
	Monitor With condition	Word units	0802	0000	1.320	6.932	1/96	Monitor condition YES: 2	Monitor condition NO: 1 / YES: 2 / NO: 1
	Monitor Without condition				1.212	7.256			
	Multiple block batch read	Word units	0406	0000	1. 250	16.400	1/480 (*1)	1	
	Multiple block batch write	Word units	1406	0000	1. 280	13.460	1/480 (*1)	1	2
Buffer memory	Batch read		0613	0000	——		—	——	
	Batch write		1613	0000					
PC CPU	Remote RUN		1001	0000	—		—	1	
	Remote STOP		1002	0000	—			1	
	Remote PAUSE		1003	0000	—			1	
	Remote latch clear		1005	0000	—			1	
	Remote RESET		1006	0000	—			1	
Drive memory	Memory usage state read		0205	0000	1.072	2.480	1/256	1	
	Memory optimization		1207	0000	—		—	1	2

*1 Number of blocks ① = 1, Number of blocks ② = 120

*2 Number of blocks ① = 1, Number of blocks ② = 96

Item			Command	Sub-command	Intervening time [ms] (Scan time increase)			Number of scans required for processing			
					Q3ACPU (When A38B used)		Number of access points ①/②	When [Enable during RUN] set		When [Disable during RUN] set	
					Number of access points: ①	Number of access points: ②		File No. designation		File No. designation	
								FFFFH	YES	FFFFH	YES
File	File information table read	Without header statement	0201	0000	1.104	3. 324	1/36	1			
		With header statement	0202	0000	1.192	4.132	1/16	1			
		File No. Usage State	0204	0000	1. 376		1	1			
	File information modification	Date of last updating	1204	0000	1.136		1	2	1	3	2
		File name size modification		0001	1.252		1	2	1	3	2
		Batch modification		0002	1.196		1	2	1	3	2
	File search		0203	0000	1.020		1	1			
	File contents read		0206	0000	1.164	3.228	1/960	2	1	2	1
	File creation (File name register)		1202	0000	1.376		1	1		2	
	File contents write	Arbitrary data	1203	0000	1.168	3.296	1/960	2	1	3	2
		Same data (FILL)		0001	1.200	1.336	1/960	2	1	3	2
	File lock register/clear		0808	0001	0. 996		1	2	1	3	2
				0000	1.000						
	File copy		1206	0000	1.388	1.540	1/480	1 only: 2 / Both: 3	1	1 only: 3 / Both: 4	2
	File delete		1205	0000	1.152		1	2	1	3	2
User entry frame	Entry data read		0610	0000	——		—	——			
	Data entry		1610	0000							
	Entry data delete			0001							
Global			1618	000□	——		—	——			
On-demand			2101	—	——		—	——			
Transmission sequence initialize (Usable in binary mode only)			1615	0000	——		—	——			
Mode switching			1612	0000							
LED OFF, error code initialize			1617	000□							
Loopback test			0619	0000							

2 A compatible frame command

Item			Command	Intervening time [ms] (Scan time increase)		Number of scans required for processing	
				Q3ACPU (When A38B used)			
				Number of access points: ①	Number of access points: ②	When [Enable during RUN] set	When [Disable during RUN] set
Device memory	Batch read	Bit units	BR	1.028	1.116	1/256	1
			JR	1.032	1.132		
		Word units	WR	1.012	1.192	1/32	1
			QR	1.040	1.128		
	Batch write	Bit units	BW	1.032	1.096	1/160	1 / 2
			JW	1.072	1.144		
		Word units	WW	1.024	1.104	1/10	1 / 2
			QW	1.028	1.044		
	Test (Random write)	Bit units	BT	1.260	2.876	1/20	1 / 2
			JT	1.220	2.876		
		Word units	WT	1.232	1.876	1/10	1 / 2
			QT	1.224	1.844		
	Monitor data registration	Bit units	BM JM	——		—	0
		Word units	WM QM				
	Monitor	Bit units	MB	1.260	2.388	1/20	1
			MJ	1.312	2.488		
		Word units	MN	1.260	2.452	1/20	1
			MQ	1.240	2.448		
Extended file register	Batch read		ER	1.044	1.276	1/64	1
	Batch write		EW	1.048	1.368	1/64	1 / 2
	Test (Random write)		ET	1.172	1.896	1/10	2
	Monitor data registration		EM	——		—	——
	Monitor		ME	1.280	2.504	1/20	1
	Direct read	Word units	NR	0.980	1.328	1/64	1
	Direct write	Word units	NW	1.056	1.344	1/64	1 / 2

3 QnA simplified frame command

Item			Command	Intervening time [ms] (Scan time increase)			Number of scans required for processing	
				Q3ACPU (When A38B used)		Number of access points ①/②	When [Enable during RUN] set	When [Disable during RUN] set
				Number of access points: ①	Number of access points: ②			
Device memory	Batch read	Bit units	1	1.068	2.428	1/3952	1	
		word units	2	0.996	3.168	1/480	1	
	Batch write	Bit units	3	1.008	2.428	1/3952	1	2
		word units	4	0.996	3.196	1/480	1	2
	Random read	word units	5	1.272	7.256	1/96	2	3
	Test	Bit units	6	1.240	9.160	1/94	1	2
		word units	7	1.156	6.764	1/80	1	2
	Monitor data registra-tion	word units	8	0.948	0.950	1/96	1	
	Monitor	word units	9	1.212	7.256	1/96	1	1

POINT

The PC CPU can process only one of these operations with END processing. If GPP or a module accesses a given PC CPU at the same time, one processing must wait until the other processing is completed. Therefore, the number of scans required for processing increases.

PART 3

The overview and usage of the modem function, in order to use the modem function added from the product AJ71QC24N(-R2) indicated in Section 2.1, are described.

In order to use the modem functions of the AJ71QC24N(-R2), read the following chapters in this Additional Explanation and the Serial Communication Module User's Manual, which is sold separately.

(1) To start-up the QC24N

① Transmission specifications switch setting	: Chapter 4, Section 8.4.4 in the Additional Explanation
② Other items	: Chapter 4 in the Serial Communication Module User's Manual

(2) To execute a multiple block batch read or a multiple block batch write

① The order and contents of data, method	: Chapter 5 in the Additional Explanation
② Contents of the designated items	: Sections 6.1, 6.2 and Chapter 5 in the Serial Communication Module User's Manual

(3) To communicate data by a QnA simplified frame

① The order and contents of data, method	: Chapter 6 in the Additional Explanation
② Contents of the designated items	: Sections 6.1, 6.2 and Chapter 5 in the Serial Communication Module User's Manual

(4) To use the functions which are not described above

: Chapter 5 to Chapter 20 in the Serial Communication Module User's Manual

<u>If AJ71QC-24N(-R2) is not described in the Serial Communication Module User's Manual, read the manual with AJ71QC24(-R2) replaced by AJ71QC24N(-R2).</u>

The contents of this Additional Explanation except for the specifications of AJ71QC24N (-R2) is the same as these of the conventional module, AJ71QC24(-R2).

8. COMMUNICATIONS BY THE MODEM FUNCTION

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

8.1 Communication by the Modem Function

The overview, features, and functions of the modem function of the AJ71QC24N(-R2) are herein described.

8.1.1 Overview

The overview of the modem function is described below:

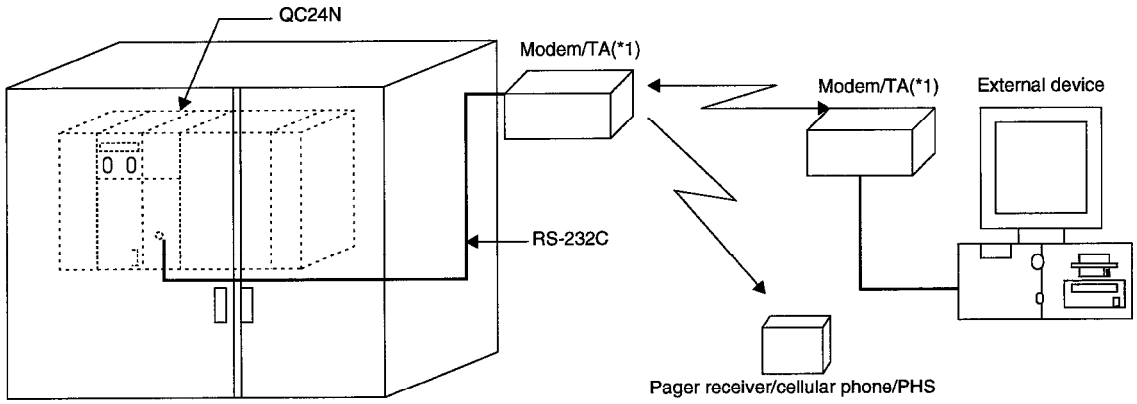
(1) The modem function easily performs data transmission/reception to remote devices via public lines/office telephone systems/digital lines (ISDN) by connecting a modem or TA (terminal adapter) to the QC24N's RS-232C interface.

① Communicating arbitrary data with an external device

② Call pager receiver/cellular phone/PHS to notify the PC's system maintenance information.

(2) Initialization of the modem or TA, line connection (dialing), and line disconnection are performed using the PC 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/cellular phone/PHS can be made.



*1 TA: terminal adapter

8.1.2 Features

The features of the modem function are described below:

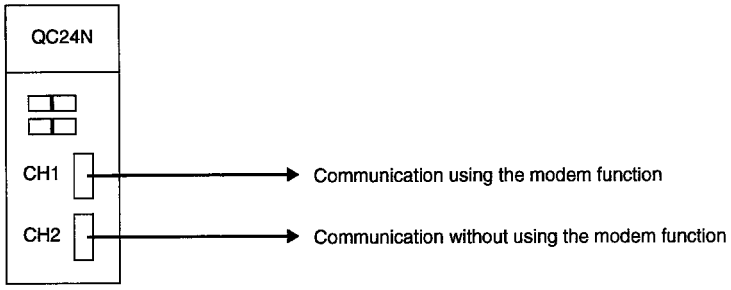
1 Types of QC24N that can use the modem function

① The modem function can be used with the AJ71QC24N and AJ71QC24N-R2 using an RS-232C interface.

* The AJ71QC24N-R4 cannot use the modem function because it does not have an RS-232C interface.

② For the AJ71QC24N-R2, the modem function can only be used by one of the two existing RS-232C interfaces.

With the interface of the AJ71QC24N and AJ71QC24N-R2, which does not use the modem function, direct data communication with an external device can be performed using a dedicated 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 stored to the QC24N EEPROM in multiple sets.

- Modem/TA initialization data (AT command)

  User setup: 30 sets (78 bytes/set); default value: 5 sets

- Connection data
  User setup: 30 sets (80 bytes/set)
  (Telephone number of the connection destination or display message to the pager receiver, etc.)

② By registering the above data to the QC24N ahead of time, the modem/TA (terminal adapter) initialization, line connection (dialing), and line cutoff can be performed with ease.

③ When the no-communication interval time (1 min. to 120 min.) is set, the QC24N 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 PC CPU

① Data communication can be performed via full-duplex communication.

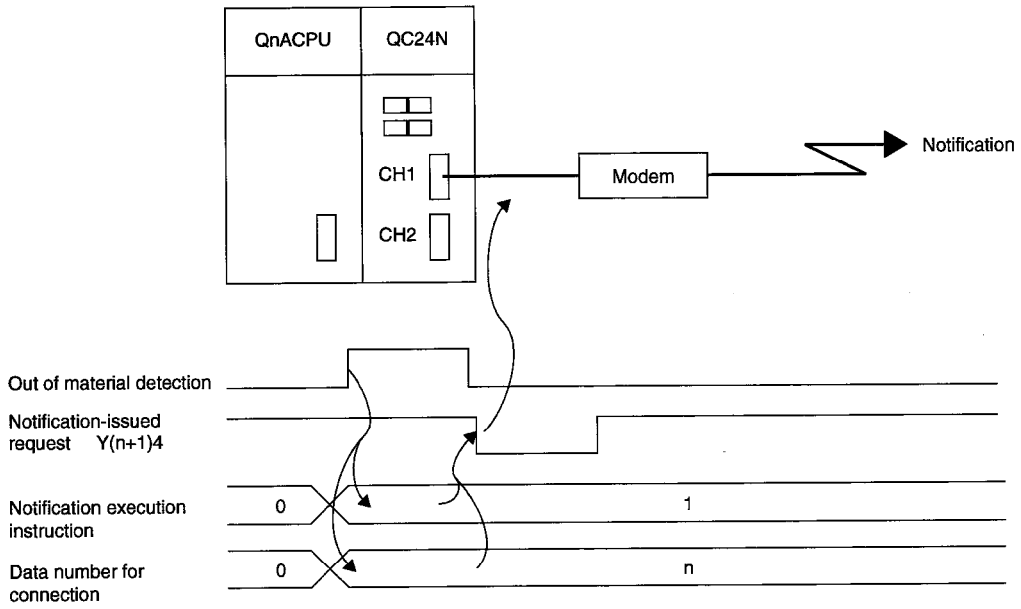
② From the external device to the PC CPU, communication using the dedicated protocol, non procedure protocol and bidirectional protocol can be performed.

③ From the PC CPU to the external device (transmission by the on-demand dedicated-protocol function only), communication by the non procedure protocol and bidirectional protocol can be performed.

4 Notification to the pager receiver/cellular phone/PHS

① In order to notify to the pager receiver/cellular phone/PHS of the PC system maintenance information, the QC24N performs calling and message transmission according to the user-designated connection data when the output signal from PC CPU is turned from ON to OFF.

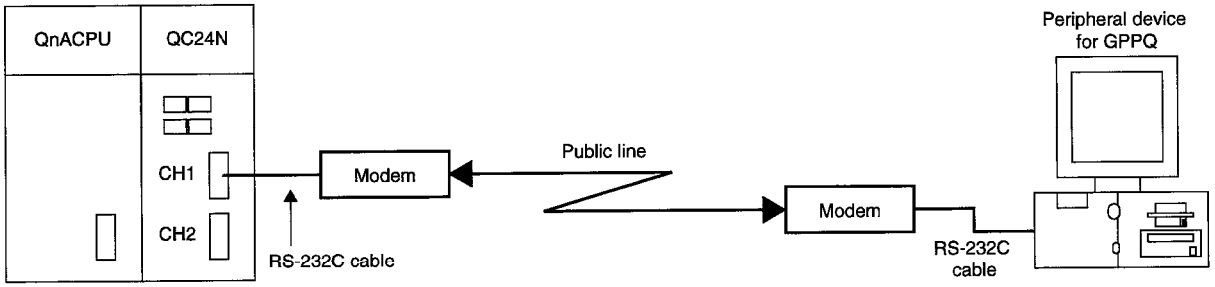
② Because notification processing is performed while the output signals from PC CPU are turned OFF from ON, dedicated notification can be performed when the PC CPU enters



the STOP state due to an error, etc.

5 Communication from the peripheral device for GPPQ

The peripheral devices for GPPQ can read and write the device data and sequence program from/to the remote PC CPU. (It is possible to communicate with only CH1 side of QC24N)



* The peripheral device for GPPQ regards the QnACPU station with QC24N installed as a QnACPU station with a Q6TEL installed (or connected).

8.1.3 Function list

The overview of the modem function is shown below:

<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).</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="4">Data communication</td><td>Performs communication with an external device using the dedicated 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 QC24N-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 peripheral devices for GPPQ and PC via QC24N.</td></tr>
<tr><td>Notification</td><td>Calls and transmits messages to the pager receiver/cellular phone/PHS.</td></tr>
<tr><td>Line disconnection</td><td colspan="2">Forcefully disconnects the line from the connected destination device.</td></tr>
<tr><td>EEPROM 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 EEPROM in the QC24N according to the request from PC CPU.</td></tr>
</table>

8.1.4 Function comparisons with related devices

Shown below is a comparison with the related products which support data communication with the PC using the modem and public line, etc., similarly to the communication performed via the QC24N modem function.

Communication function name		QC24N (modem function)	Q6TEL	A6TEL
Modem/TA initialization		○	○	
Line connection (dialing)		○	(Performed on the partner side)	
Communication between same products (such as QC24N-QC24N)	Dedicated protocol	×	×	
	Non procedure protocol	○	×	
	Bidirectional protocol	○	×	
Communication between QC24N and other products		—	—	—
Remote communication from peripheral device for GPPQ		○	○	×
Remote communication from peripheral device for GPPA		×	○	○
Notification	Pager receiver	○	○	○
	Cellular phone	○	○	○
	PHS	○	○	○
Password check from the GPPQ function		○ (*1)	○	○
Line disconnection		○	(Performed on the partner side)	
Data for initialization registration		○ (EEPROM)	○	○
Data for connection registration		○ (EEPROM)	○	○
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 The QC24N transmits a response without checking the password received from the peripheral device for GPPQ.

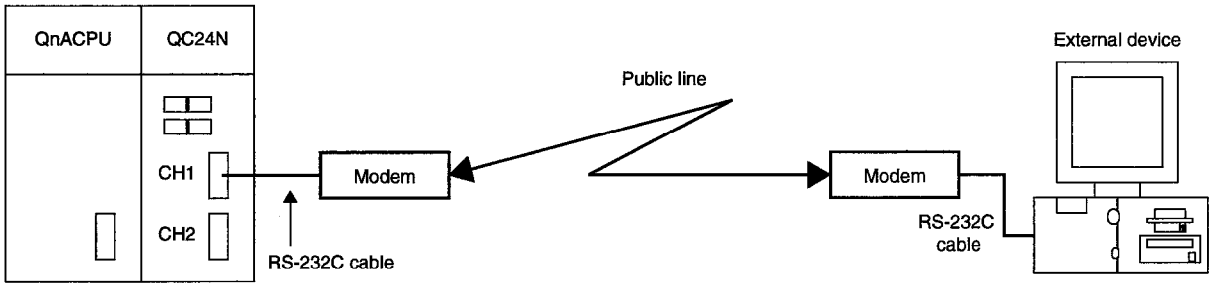
8.2 System Configuration

This section covers system configurations when the QC24N modem function is used to call a pager receiver/cellular phone/PHS or to perform data communication with an external device via public lines.

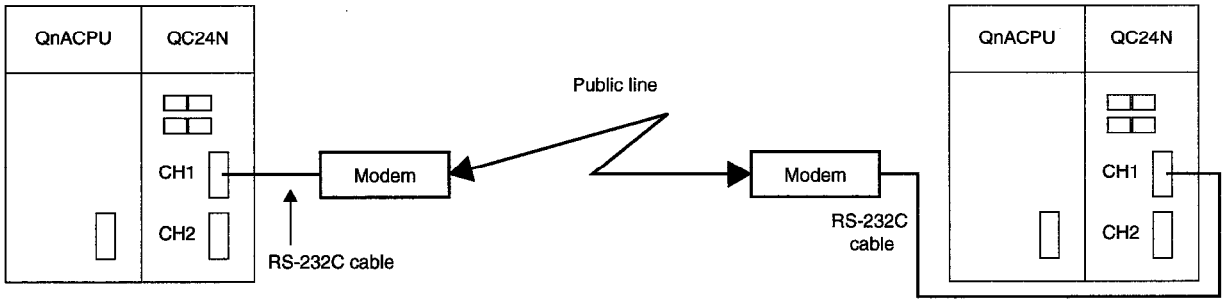
8.2.1 System configuration when performing data communication with an external device

The system configuration examples shown below are used when performing data communication between the external device and PC using the QC24N's dedicated protocol/non procedure protocol/ bidirectional protocol.

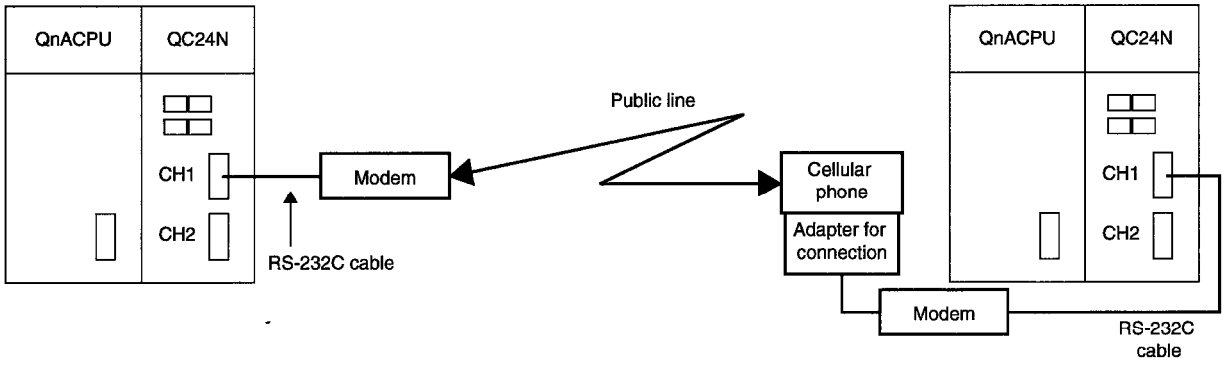
1 Connection example with an external device



2 Connection example with a QC24N



3 Connection example with a QC24N via cellular phone/PHS

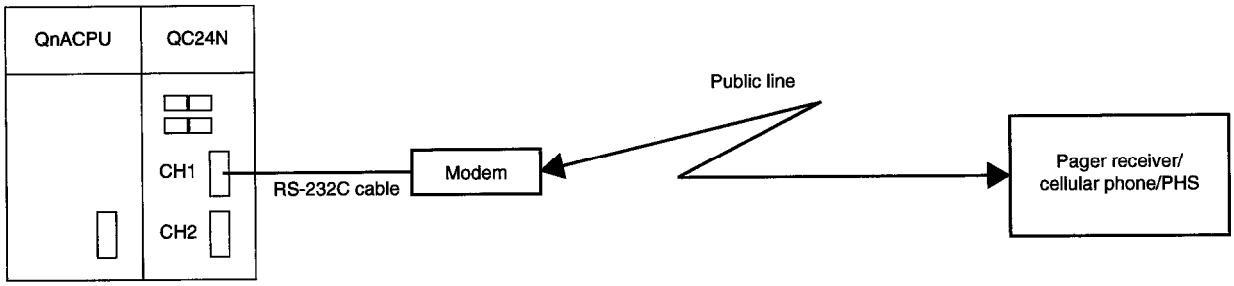


* The public lines indicated in 1 to 3 above are compatible with the office telephone system as well.

* 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.

8.2.2 System configuration when using the notification function

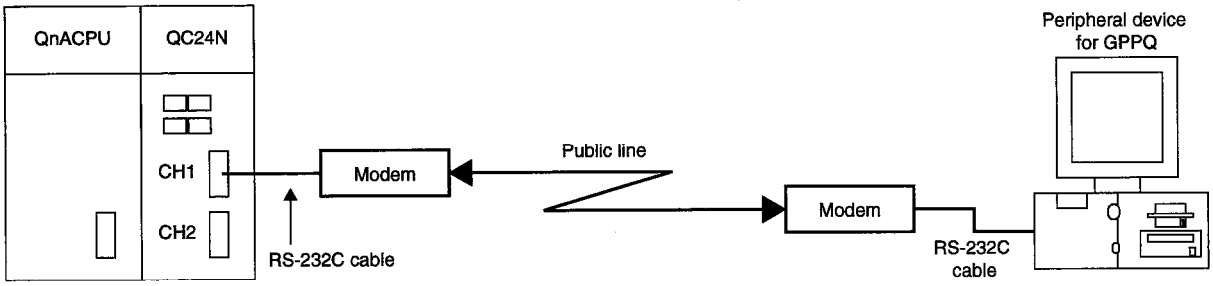
The system configuration example when calling the pager receiver/cellular phone/PHS by the QC24N notification function is shown below.



* The public line indicated above is compatible with the office telephone system as well.
* In the system configuration as shown above, the digital line (ISDN) can be used instead of public line to perform notification to the cellular phone or PHS.
  When connecting via a digital line, a TA (terminal adapter) and a DSU (digital service module) are used instead of a modem.

8.2.3 System configuration when connecting the peripheral device for GPPQ

The system configuration examples shown below when the peripheral device for GPPQ performs data communication with a remote station PC via QC24N.



* Select "Via modem interface module for QnA" in the GPPQ PC-side interface setup.

* The public lines indicated above is compatible with the office telephone system as well.
* In the system configuration shown 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.
* It is possible to communicate with only CH1 side of QC24N when communicating with the peripheral device for GPPQ.

8.2.4 Precautions for system configurations

The precautionary items when configuring the system to perform data communication with an external device or call a pager receiver/cellular phone/PHS via public line, an office telephone system or digital line (ISDN) using the QC24N modem function are explained.

1 QC24N insertable station

① The QC24N that uses the modem function can only be installed to the QnACPU stations.

② The QC24N cannot be installed to MELSECNET (II) remote station.

Also, the QC24N which uses the modem function cannot be installed to MELSECNET/10 remote station.

2 Usable QC24N interface

① The modem function can be used with the AJ71QC24N or AJ71QC24N-R2, which has an RS-232C interface as indicated in Section 2.1.

The modem function cannot be used with the AJ71QC24N-R4, since it does not have the RS-232C interface.

② For AJ71QC24N-R2, the modem function can only be used with one of the two existing RS-232C interfaces.

With the interface of the AJ71QC24N and AJ71QC24N-R2, which does not use the modem function, direct data communication with an external device can be performed using a dedicated protocol, non procedure protocol or bidirectional protocol (independent operation).

③ The peripheral device for GPPQ can only be connected to the CH1-side interface of the AJ71QC24N or AJ71QC24N-R2.

④ It is not possible to communicate using the two QC24N interfaces in linked operation (data communication via two interfaces).

3 Connectable modem/TA

Only the modems indicated in Section 8.3.2 can be used for the QC24N RS-232C interface using the modem function.

4 Number of connectable modems/TA's

Only one modem/TA can be connected to the QC24N RS-232C interface that uses the modem function.

5 Modem/TA connection cables

① The RS-232C cable supplied with the modem/TA or the designated modem/TA cable can be used for connection between the QC24N and modem/TA.

② The QC24N RS-232C interface connector has a 25-pin (female) D-sub. Depending on the RS-232C cable connector, the 9-25 pin converter (user supplied) may be necessary.

6 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 PC with the modem/TA connection cable.

7 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/four-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.

8 Communication system

Communication via the modem function is performed using full-duplex communication.

Connections cannot be made devices designed for half-duplex communication.

9 Data communication and notification to external devices

① Data communication with external devices and notification to a pager receiver/cellular phone/PHS 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/cellular phone/PHS cannot be detected.

Setup a separate call circuit with a lamp display or buzzer to ensure the safety of the PC system.

8.3 Designation

The transmission specification on the QC24N side, connectable modems/TA's (terminal adapter), I/O signals related to the modem function, and buffer memory for the usage of the QC24N modem function are described.

8.3.1 Transmission specification

The transmission specification on the QC24N side when communicate by the modem function is as shown below.

The transmission specification between QC24N and a modem/TA not described in this chart is follows the specification indicated in Chapter 3.

Item		AJ71QC24N	AJ71QC24N-R2	AJ71QC24N-R4
Modem function usage availability		Yes		Unusable
Interface for the modem function		RS-232C	RS-232C (*1)	—
Linked operation between CH1 and CH2 of the QC24N		No		
Communication system		Full duplex communication		
Synchronization method		Start-stop synchronous system		
Transmission speed (Unit: bps)		38400, 19200, 9600, 4800, 2400, 1200, 115200, 57600, 28800, 4400 (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 yes / no (selectable)		
Data communication availability	No procedure protocol	Communication enabled		
	Bidirectional protocol	Communication enabled		
	Dedicated protocol	Communication enabled		
	Link-dedicated instruction communication	Communication disabled		
Line connection (QC24N: modem)		1 : 1		

*1 Communicates by the modem function is possible only using one of the two RS-232C interfaces.

Communicates with a peripheral device for GPPQ can only be performed on the CH1 side.

8.3.2 Designation of connectable modems/terminal adapters

The specification of modems/TA's that can be connected to the QC24N side when using the QC24N's modem function is shown below.

1 Specification and precautions for the connectable modems

(a) Modem specification

Item			Designation		Remarks
			When using the subscriber's telephone line/ office telephone system	When using a manual line connection/cellular phone/PHS	
Modem-to-modem communication designation	Connection line		Analog 2-line/4-line		—
	Initialization		Hayes AT command compatible		
	Telephone line		A line compatible with NTT communication protocol		See Section 8.2.4 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	
QC24N-to modem communication designation	QC24N-side connector (RS-232C)		25-pin (female) D sub		See the User's Manual
	DR signal control		Only the DR (DSR) signal must be able to turn on		(*2)
	Other		Compatible with the QC24N designation		See Chapter 3, Section 8.3.1

*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/PHS

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 QC24N side as shown below:

Setting item		Setting range
Communication speed		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 QC24N
	Stop bit	
	Parity bit	

*1 When using different modems, the slower communication speed will be in effect.

- 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 AT command that turns on the DR terminal into the EEPROM etc., of the QC24N-side modem from a personal computer.

* In order to write the AT command that turns on the DR terminal from a personal computer, a terminal software (supplied with the modem) must be installed to the personal computer.

  An overview of the procedure from installation to writing AT commands and connecting to the QC24N is described below.

(Procedure 1) Install a terminal software to the personal computer.

(Procedure 2) Connect the modem to be connected to the QC24N side and personal computer using the RS-232C cable.

(Procedure 3) Startup the personal computer, and start the terminal software.

(Procedure 4) Write the AT command that turns on the DR terminal.

(Example 1) AT&SO&W [Enter]

(Example 2) ATZ [Enter]

AT&F&W [Enter]

The AT command that turns on the DR terminal may differ depending on the modem. See the manual of the terminal software manual for details.

(Procedure 5) After turning on the DR terminal, connect the modem and QC24N.

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

(a) TA specification

Item		Designation	Remarks
TA-to-TA communication designation	Connection line	ISDN (INS net 64) equivalent High-speed digital dedicated line	DSU and TA are required
	Initialization	Hayes AT command compatible	—
	Communication standard	B-channel line exchange (V.110) D-channel packet exchange	
QC24N-to-TA communication designation	Electrical condition	V.28 compliant	
	Circuit definition	V.24 compliant	
	QC24N-side connector (RS-232C)	25-pin (female) D sub	See the User's Manual
	DR signal control	Only the DR (DSR) signal must be able to turn on	(*1)
	Other	Compatible with the QC24N designation	See Chapter 3, Section 8.3.1

*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.

Flow 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 QC24N side as shown below:

Setting item		Setting range
Communication speed		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 QC24N
	Stop bit	
	Parity bit	

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 AT command that turns on the DR terminal into the EEPROM etc., of the QC24-side TA from a computer.

* In order to write the AT command that turns on the DR terminal from a personal computer, a terminal software (supplied with the TA) must be installed to the personal computer.

An overview of the procedure from installation to writing AT commands and connecting to the QC24N is described below.

(Procedure 1) Install a terminal software to the personal computer.

(Procedure 2) Connect the TA to be connected to the QC24N and personal computer using the RS-232C cable.

(Procedure 3) Startup the personal computer, and start the terminal software.

(Procedure 4) Write the AT command that turns on the DR terminal.

(Example) AT&SO&W Enter

The AT command that turns on the DR terminal may differ depending on the TA. See the manual of the terminal software manual for details.

(Procedure 5) After turning on the DR terminal, connect the TA and QC24N.

MEMO

8.3.3 I/O signals with the PC CPU

The I/O signals with the PC CPU added for the QC24N's modem function are described. See Section 3.4 of the User's Manual for the I/O signals not related to the modem function.

1 I/O signal list

Signal direction: QC24N → PC CPU			Signal direction: PC CPU → QC24N		
Device number	Signal name		Device number	Signal name	
Xn0	CH1 side	Transmission normal completion	Yn0	CH1 side	Transmission request
Xn1		Transmission abnormal completion	Yn1		Reception data read completion
Xn2		Transmission processing in progress	Yn2		Mode switching request
Xn3		Reception data read request	Yn3	(Prohibited to use)	
Xn4		Reception abnormal detection	Yn4		
Xn5	————		Yn5		
Xn6	CH1 side	Mode switching in progress	Yn6		
Xn7	CH2 side	Transmission normal completion	Yn7	CH2 side	Transmission request
Xn8		Transmission abnormal completion	Yn8		Reception data read completion
Xn9		Transmission processing in progress	Yn9		Mode switching request
XnA		Reception data read request	YnA	(Prohibited to use)	
XnB		Abnormal reception detection	YnB		
XnC	————		YnC		
XnD	CH2 side	Mode switching in progress	YnD		
XnE	CH1 ERR LED on		YnE	CH1 ERR LED off request	
XnF	CH2 ERR LED on		YnF	CH2 ERR LED off request	
X (n+1) 0	Initialization completion		Y (n+1) 0	Initialization request (standby request)	
X (n+1) 1	Dial in progress		Y (n+1) 1	Connection request	
X (n+1) 2	Connection in progress		Y (n+1) 2	Modem disconnection request	
X (n+1) 3	Initialization/connection abnormal completion		Y (n+1) 3	(Prohibited to use)	
X (n+1) 4	Modem disconnection completion		Y (n+1) 4	Notification-issued request	
X (n+1) 5	Notification normal completion		Y (n+1) 5	(Prohibited to use)	
X (n+1) 6	Notification abnormal completion		Y (n+1) 6		
X (n+1) 7	EEPROM read completion		Y (n+1) 7	EEPROM read request	
X (n+1) 8	EEPROM write completion		Y (n+1) 8	EEPROM write request	
X (n+1) 9	EEPROM system setting write completion		Y (n+1) 9	EEPROGM system setting write request	
X (n+1) A	CH1 side	Global signal	Y (n+1) A	(Prohibited to use)	
X (n+1) B	CH2 side	Global signal	Y (n+1) B		
X (n+1) C	System setting default completion		Y (n+1) C	System setting default request	
X (n+1) D	————		Y (n+1) D	(Prohibited to use)	
X (n+1) E	QC24N ready (accessible)		Y (n+1) E		
X (n+1) F	Watchdog timer error		Y (n+1) F		

The signals in the ▒▒ are the new I/O signals added to the modem function.

Important

Do not output (turn ON) the "prohibited to use" signal as the output signal to a special function module from the PC CPU.
Outputting a signal for "prohibited to use" may cause system malfunctions in the PC.

2 Function and description of each I/O signal

I/O signal	Signal name	Function/description	Description section
X (n+1) 0	Initialization completion	Indicates normal completion of the QC24N's initialization of the modem/TA connected to itself according to the initialization data designated in the buffer memory.	Section 8.4.7
X (n+1) 1	Dial in progress	Indicates that the QC24N is dialing (connection processing) the partner side according to the data for connection designated in the buffer memory.	Section 8.4.8
X (n+1) 2	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).	
X (n+1) 3	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: 221H) and remove the cause.	Section 8.5
X (n+1) 4	Modem disconnection completion	Indicates that the line for data communication with the destination has been disconnected.	Section 8.4.10
X (n+1) 5	Notification normal completion	Indicates the normal completion when performing the notification processing to the destination.	Section 8.4.9
X (n+1) 6	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: 221H) and remove the cause.	Section 8.5
Y (n+1) 0	Initialization request (standby request)	1) Indicates the initialization request to the modem connected to the local station QC24N. 2) Turn on the initialization-request signal after designating the initialization data to the buffer memory.	Section 8.4.7
Y (n+1) 1	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. 3) If the modem/TA connected to the local station is not initialized, the QC24N-side modem is initialized as well prior to dialing, according to the initialization data designated in the buffer memory.	Section 8.4.8
Y (n+1) 2	Modem disconnection request	Indicates a line-disconnection request from the partner side upon completion of data communication .	Section 8.4.10
Y (n+1) 4	Notification-issued request	1) Indicates the notification request to the partner side. 2) Turns on before completing the QC24N-side modem/TA initialization is complete. 3) Turns off the notification-issued request signal after designating the data for connection in the buffer memory.	Section 8.4.9

Point

In the descriptions hereafter, I/O signal numbers between QnACPU and QC24N are indicated assuming that the QC24N is installed to slot 0 of the QnACPU basic base unit.

8.3.4 Buffer memory

The buffer memory added for the QC24N modem function is described.

See Section 3.5 of the User's Manual for the buffer memory not related to the modem function.

1 Buffer memory list

Address and target I/F		Application	Name		QC24N default value
CH1	CH2				
0H (0)		System setting	LED off request (for LED No. 5 to 13)		0
1H (1)			LED off request (for LED No. 16 to 29)		
2H (2)			For EEPROM access	Register/read/delete instruction	
3H (3)				Frame number instruction	
4H (4)				Register/read/delete result storage	
5H (5)				Number of registration data bytes designation/storage	
6H (6) to 2DH (45)				User registration frame designation/ storage *For 40 words	
2EH (46)			For modem functions	Modem connection channel designation	0
2FH (47)				Notification execution designation	0 (Not executed)
30H (48)				Number of connection retries designation	3
31H (49)				Connection retry interval designation	180 (sec.)
32H (50)				Initialization/connection timeout designation	60 (sec.)
33H (51)				Number of initialization retries designation	3
34H (52)				Data number for initialization designation	2000
35H (53)				Data number for connection designation	0
36H (54)				Q6TEL connection designation	0
37H (55)				No-communication interval time designation	30 (min.)
38H (56)				RS-CS control yes / no designation	1 (control)
39H (57) to 8FH (143)			System area (Prohibited to use)		0
90H (144)	130H (304)		For modem switching	Switching mode number designation	0
91H (145)	131H (305)			Switching transmission designation	0
92H (146)	132H (306)		System area (Prohibited to use)		0
~					~
B2H (178)	152H (338)	System setting	User registration frame for reception designation	Final frame number (1st)	0DH
B3H (179)	153H (339)			(2nd)	0AH
B4H (180)	154H (340)			(3rd)	0
B5H (181)	155H (341)			(4th)	

Address and target I/F		Application	Name				QC24N default value
CH1	CH2						
B6H (182)	156H (342)	System setting	User registration frame for transmission designation	Transmission-in-progress user registration frame number			0
B7H (183)	157H (343)			Schedule designation		CR/LF output	0
B8H (184)	158H (344)					Output head pointer	0
B9H (185)	159H (345)					Number of outputs	0
BAH (186)	15AH (346)				Output frame number designation	(1st)	0
BBH (187) to 11DH (285)	15BH (347) to 1BDH (445)					(2nd) to (100th)	0
11EH (286)	1BEH (446)		Message wait time designation				0
~							~
21EH (542)		System information	Number of default registration frame registrations storage				No. of actual registrations
21FD (543)			System area (Prohibited to use)				0
220H (544)			EEPROM system setting write result storage				0
221H (545)			For modem function	Modem function error code storage			0
222H (546)				Modem function sequence status storage			0
223H (547)				For EEPROM access	Number of data registrations for connection storage		0 (No registration)
224H (548)					Data registration status for connection storage		0
225H (549)					Number of data registrations for initialization storage		0 (No registration)
226H (550)					Data registration status for initialization storage		0
227H (551)				Number of notification execution storage			0
228H (552)				For notification execution data storage	Data 1	Notification execution data number	0
229H (553)						System area (Prohibited to use)	0
22AH (554)					Data 2	Notification execution data number	0
22BH (555)						System area (Prohibited to use)	0
22CH (556)					to	to	
22DH (557)					Data 3	Notification execution data number	0
22EH (558)						System area (Prohibited to use)	0
22FH (559)							
230H (560)							
231H (561)							
to							
23AH (570)							
23BH (571)							
23CH (572)							
23DH (573)							
23EH (574) to 24FH (591)			System area (Prohibited to use)				0

Address and target I/F		Application	Name		QC24N default value
CH1	CH2				
250H (592)	260H (608)	System information	Mode setting switch setting status storage		Depends on the switch setting
~					~
C00H (3072) to 1AFFH (6911)		For users	User free area *for 3840 words		0
1B00H (6912)		For user registration frame registration	Registration number: 8001H	Number of registration data bytes designation	0
1B01H (6913) to 1B28H (6952)				User registration frame designation *for 40 words	0
1B29H (6953)			Registration number: 8002H	Number of registration data bytes designation	0
1B2AH (6954) to 1B51H (6993)				User registration frame designation *for 40 words	0
1B52H (6994) to 1FCDH (8141)			to	to	
1FCEH (8142)			Registration number: 801FH	Number of registration data bytes designation	0
1FCFH (8143) to 1FF6H (8182)				User registration frame designation *for 40 words	0
1FF7H (8183) to 1FFFH (8191)		——	System area (Prohibited to use)		0

The area in the ▒▒ are the new area added to the modem function.

Important

(1) Perform read/write of the buffer memory (such as changing the default value) according to the description section of the corresponding areas.

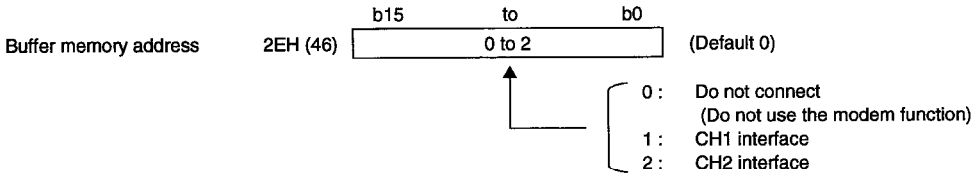
(2) Do not write data into the "system area" of the buffer memory.
Writing data into the "system area" may cause system malfunctions in the PC.

(3) The buffer memory is not backed up by battery.
The QC24N default values or default values in the QC24N EEPROM registered by the user is written to the special application area during QC24N startup. (See Chapter 15 in the User's Manual.)

2 Details of the buffer memory

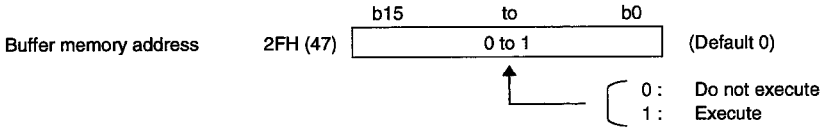
(a) Modem connection channel designation area (address 2EH(46))

The interface on the QC24N side to which a modem/TA is connected is designated.



(b) Notification execution designation area (address 2FH(47))

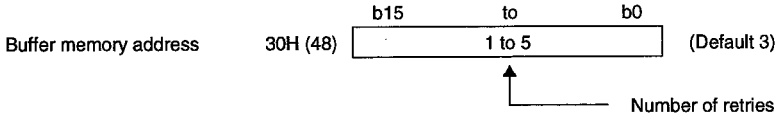
Whether or not to perform notification (message transmission) to the pager receiver/cellular phone/PHS during the fall of the notification-issued request signal Y14 is designated.



(c) Number of connection retries designation area (address 30H(48))

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.

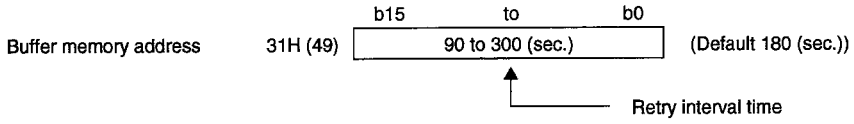
② The default value is recommended for the number of connection retries.



(d) Connection retry interval designation area (address 31H(49))

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 for the connection retry interval.

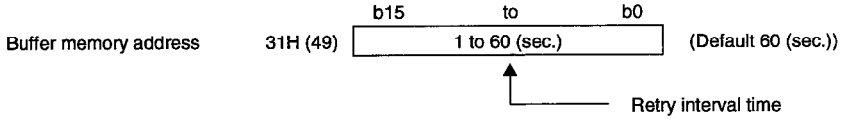


(e) Initialization/connection timeout designation area (address 32H(50))

① The following wait times are designated.

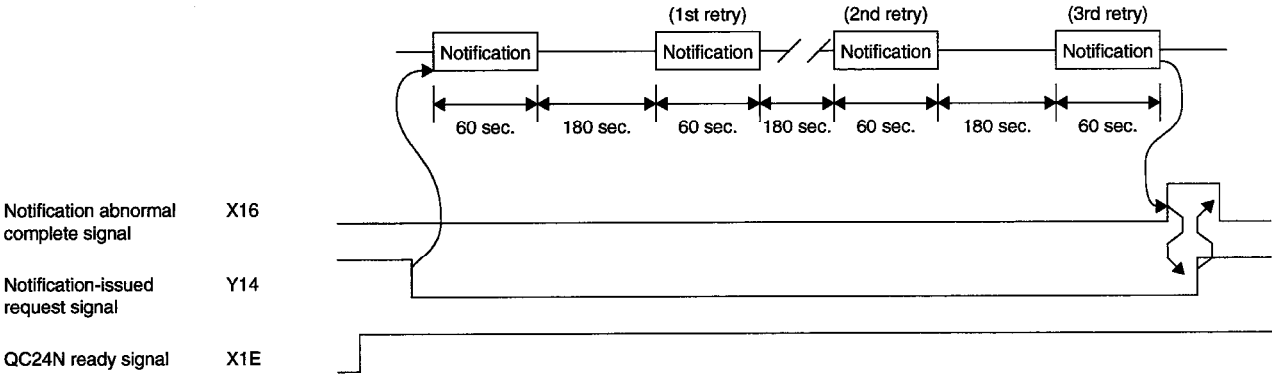
- Wait time until the modem/TA initialization is complete.
- Wait time per wait when the connection could not be made to the destination by the notification/connection request.

② The default value is recommended for the initialization/connection retry timeout.



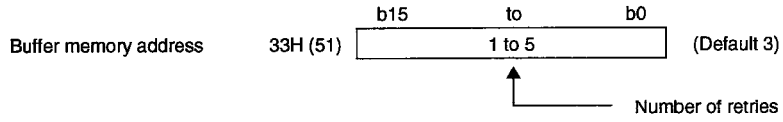
* Shown below is the relationship of the number of connection retries designation, connection retry interval designation and the time for initialization/connection timeout designation used for the notification/connection request to the partner device.

(When the number of retries is 3, retry interval is 180 sec., and timeout is 60 seconds.)



(f) Number of initialization retries designation area (address 33H(51))

The number of retries when the initialization per the initialization request to the modem on to the QC24N side has failed.

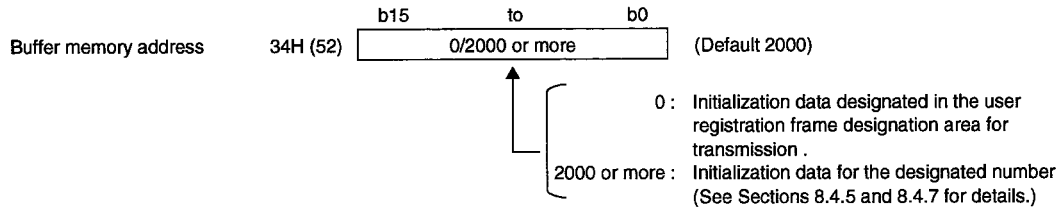


(g) Data number for initialization designation area (address 34H(52))

① The registration number for the initialization data transmitted with the initialization request to the modem on the QC24N side is designated.

The registration number for the QC24N is used.

② The designation method is described in Section 8.4.7.

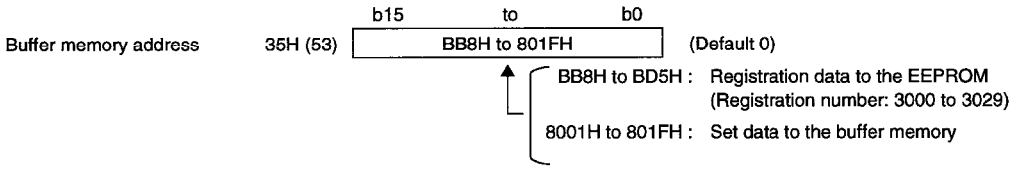


(h) Data number for connection designation area (address 35H(53))

① Designates the registration number of the data for connection used by the QC24N for the connection processing to the partner device in order to perform data communication/notification.

The registration number for the QC24N is used.

② The designation method is described in Section 8.4.8.

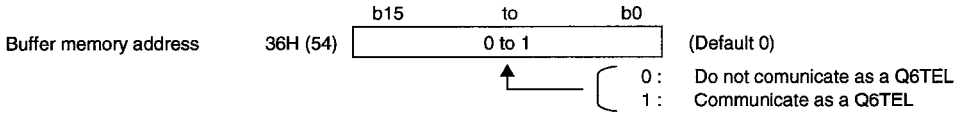


(i) Q6TEL connection designation area (address 36H(54))

① Whether to access the PC from the peripheral device for GPPQ by connecting the QC24N and peripheral device for GPPQ using the QC24N modem function is designated.

② When connecting the QC24N and peripheral device for GPPQ using the QC24N modem function, select "personal computer-side interface = via QnA modem interface module" in the GPPQ connection designation. (When connecting direct shown in Section 8.2.3)

When this GPPQ designation is performed, designate "1" in this area on the QC24N side.

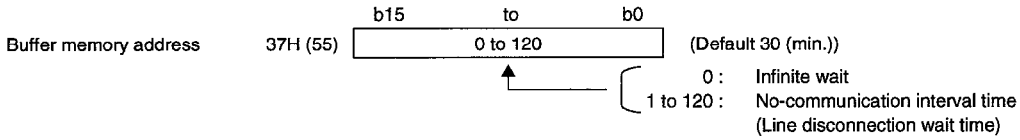


(j) No-communication interval time designation area (address 37H(55))

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 QC24N 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.)



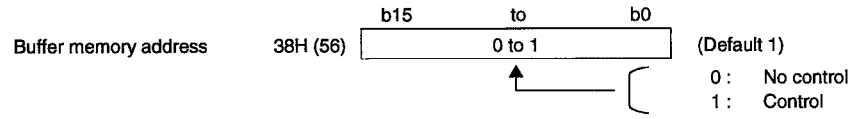
(k) RS·CS control / not-control designation area (address 38H(56))

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 QC24N 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).

* Among the settings of the DTR/DSR and DC control designation area in the buffer memory (address: 93H/133H), the setting for the interface that uses the modem function is ignored.



Remark

The overview of the RS·CS controls are described.

(1) When transmission data

① The QC24N 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 QC24N starts or continues.

When the CS signal is off, data transmission from the QC24N is interrupted.

(2) When reception data

① The QC24N 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 QC24N can receive data. Start/continue data transmission from the modem/TA to the QC24N.

When the RS signal is off, the QC24N cannot receive data. Cancel data transmission from the modem/TA to QC24N.

③ The on/off of the RS signal is controlled by the following conditions of the QC24N:

• ON → OFF control of the RS signal

Performed when the OS area for reception data storage in the QC24N becomes 64 bytes or less.

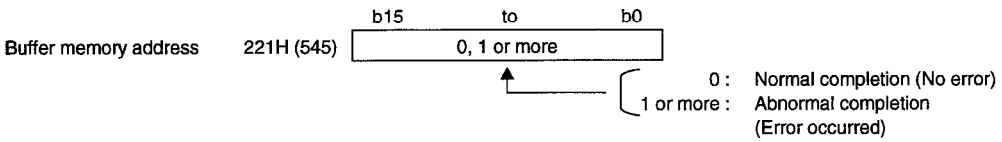
• OFF → ON control of the RS signal

Performed when the OS area for reception data storage in the QC24N becomes 263 bytes or more.

(l) Modem function error code storage area (address 221H(545))

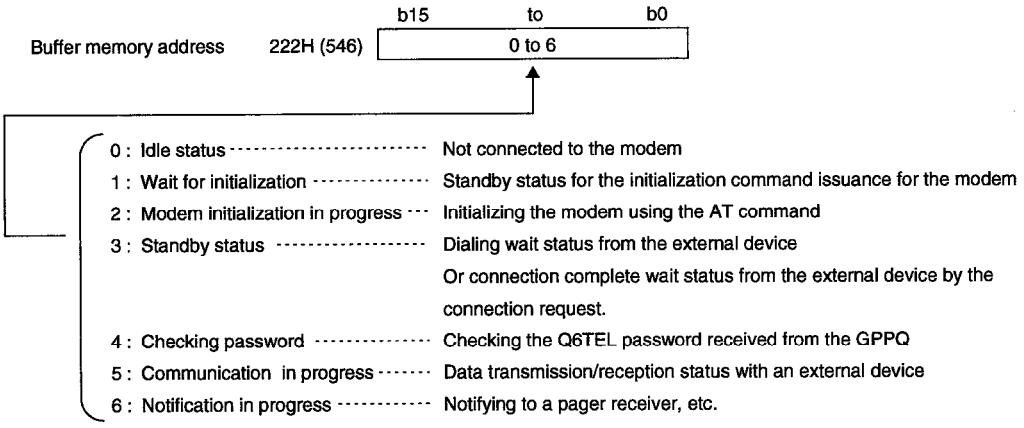
① Stores the error code when an error occurs during the modem function or abnormal signal (such as the initialization/connection abnormal completion X13) turns on.

② See Section 8.5 for the error codes.

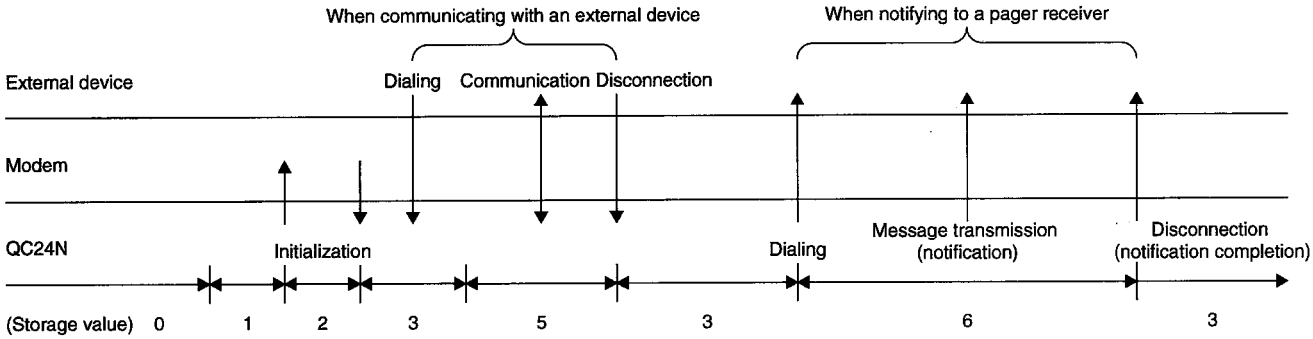


(m) Modem function sequence status storage area (address 222H(546))

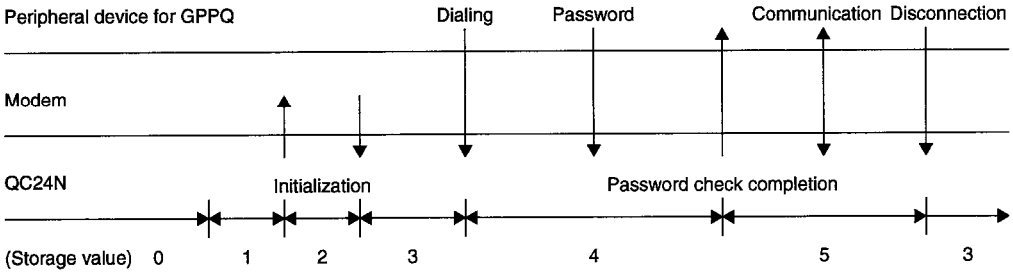
The current status of the modem function is stored as a number.



(Example 1) When communicating with an external device or notifying to a pager receiver



(Example 2) When communicating with a peripheral device for GPPQ

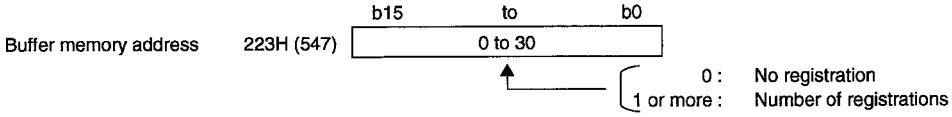


(n) For EEPROM access: Number of data registrations for connection storage area (address 223H(547))

① Stores in EEPROM the number of registered data for connection used by the QC24N 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 EEPROM by the user.

② The registration of data for connection is described in Section 8.4.6.

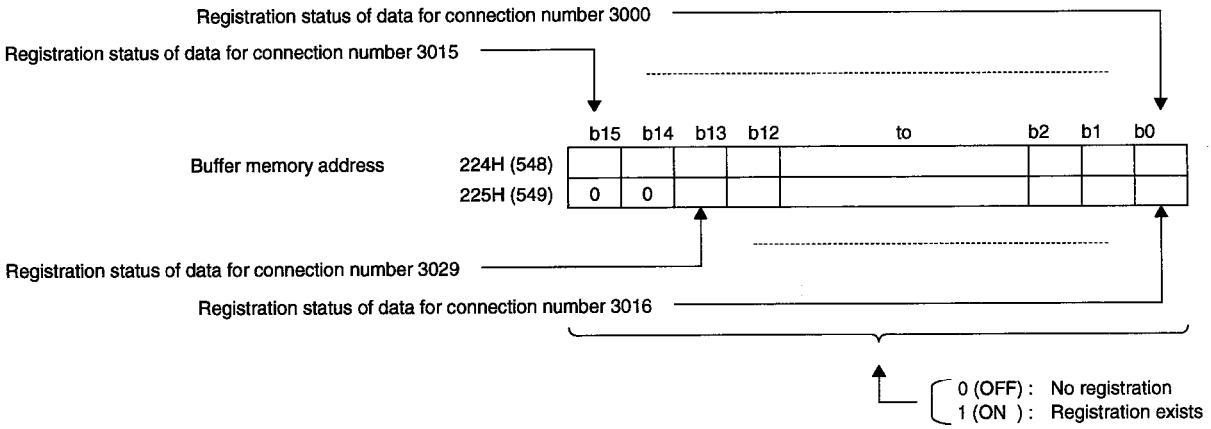


(o) For EEPROM access: Data registration status for connection storage area (address 224H to 225H(548 to 549))

① Stores in EEPROM registration status of data for connection used by the QC24N 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 3000 to 3029 is indicated in the corresponding bit in the range shown in the figure below.

③ The registration of data for connection is described in Section 8.4.6.

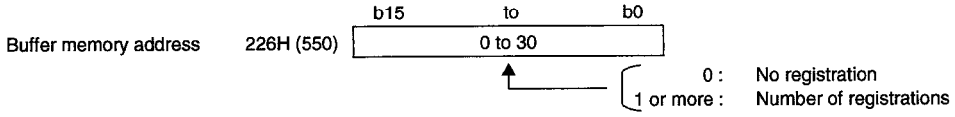


(p) For EEPROM access: Number of data registrations for initialization storage area (address 226H(550))

① Stores in EEPROM the number of data registrations for initialization, sent to the modem on the QC24N side with the initialization request.

The number of registrations indicates the number of data for initialization registered to the EEPROM by the user.

② The registration of data for initialization is described in Section 8.4.5.

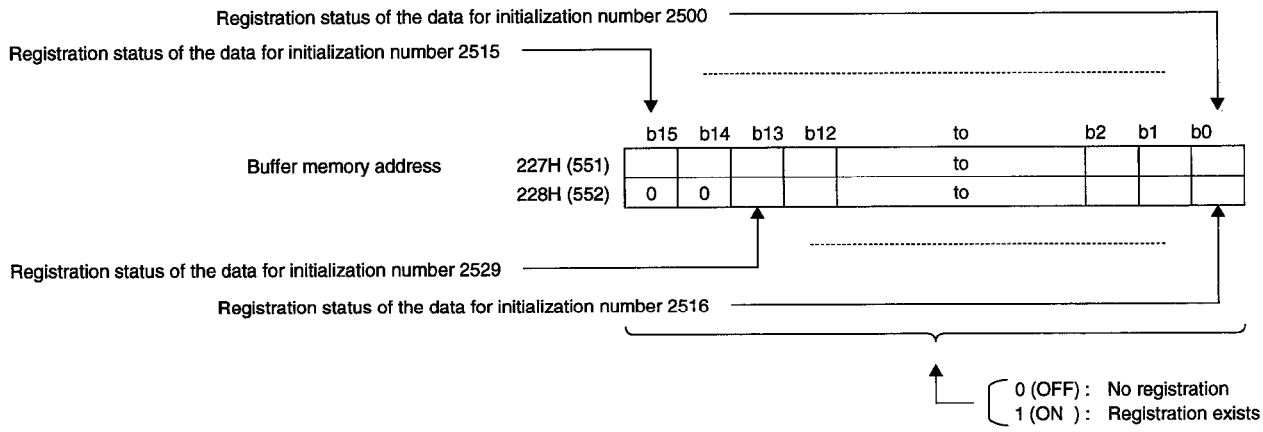


(q) For EEPROM access: Data registration status for initialization storage area (address 227H to 228H(551 to 552))

① Stores in EEPROM registration status for initialization of data for initialization transmitted with the initialization request to the modem on the QC24N side.

② The registration status of each data for initialization with registration numbers of 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 8.4.5



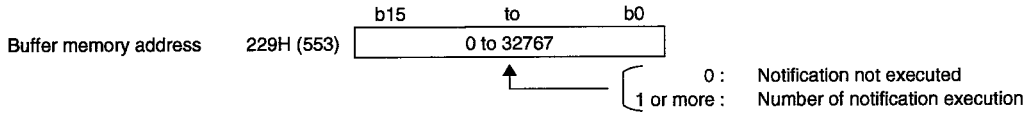
(r) Number of notification execution storage area (address 229H(553))

① Stores the number of execution of the QC24N notification (message transmission) processing for the pager receiver/cellular phone/PHS.

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.

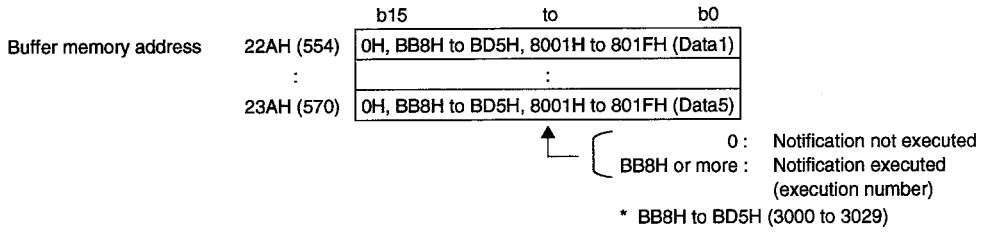


(s) For notification execution data storage: Notification execution data number storage area (address 22AH, 22EH... (554, 558...))

① Stores the registration number of the data for connection used in the QC24N notification (message transmission) processing to the pager receiver/cellular phone/PHS 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.



(t) For user registration frame registration: Number of bytes in registration data designation area (address 1B00H, 1B29H... (6912, 6953...))

① The initialization data or data for connection can be stored into the buffer memory as well as the QC24N's EEPROM.

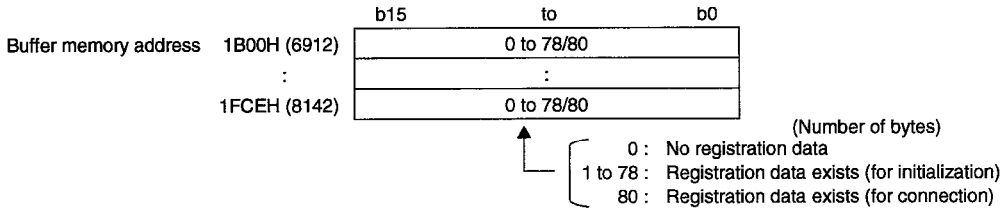
Data type	Registration destination		Registration number (Decimal (Hex.))
Initialization data	EEPROM	Data registered by the OS	2000 to 2004 (7D0H to 7D4H)
		User-registered data	2500 to 2529 (9C4H to 9E1H)
	Buffer memory	(All registered by user)	-32767 to -32737 (8001H to 801FH)
Data for connection	EEPROM	(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 8.4.5.

The registration of data for connection is described in Section 8.4.6.

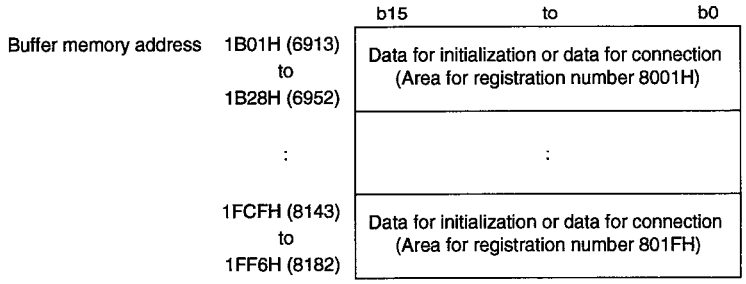


(u) For user registration frame registration: User registration frame designation area (address 1B01H to 1B28H, 1B2AH to 1B51H...(6913 to 6952, 6954 to 6993...))

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 8.4.5.

The registration of data for connection is described in Section 8.4.6.



8.3.5 Precautions when using the modem function

Precautions when using the QC24N modem function to perform data communication with an external device via public line or call to the pager receiver/cellular phone/PHS 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 (*1) that uses the modem function.

(Example) The QC24N will ignore the data even when a dedicated protocol command message is received.

*1 This is set in the modem connection channel designation area in the buffer memory (address: 2EH).

3 **Transmission control**

Delays may occur in transmission controls to notify the partner device of the data reception capability at the local station.

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 no procedure protocol, the procedure must also be predetermined.

4 **Communication with the peripheral devices for GPPQ**

The QnACPU with QC24N installed can be considered as a PC CPU station with a Q6TEL installed (or connected), and the PC can be accessed form the peripheral devices for GPPQ via QC24N.

When the password for Q6TEL is set at the GPPQ in the PC access from the peripheral device for GPPQ, the password for Q6TEL (*1) is first transmitted from the peripheral device for GPPQ to the QC24N after the connection is complete.

However, since the QC24N does not maintain the password for Q6TEL, it cannot determine whether the password is correct or not.

The QC24N returns the corresponding response, and enables data read/write and status control for the PC CPU.

*1 The password consists of a string for enabling/disabling access to the PC via Q6TEL, and is entered using keys on the peripheral device for GPPQ prior to accessing

5 **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 EEPROM access processing) occurs, the line disconnect processing has the priority.

6 **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 QC24N and modem/TA, between modem and TA, and between modem/TA and partner device.

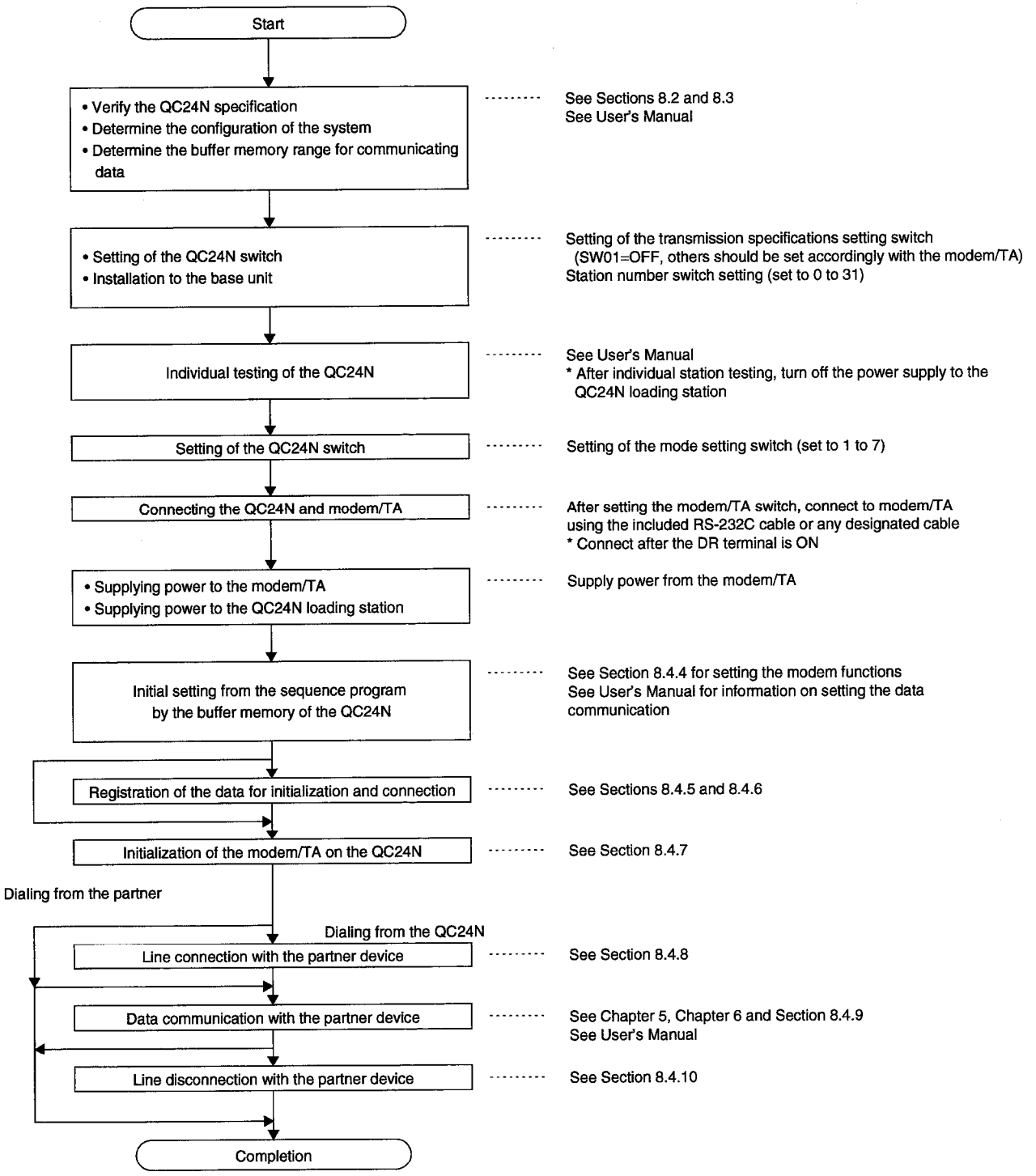
When communicating via the dedicated protocol, the transmission time (such as T0 and T3) indicated in Section 5.7 of the User's Manual must include the transmission time between the QC24N-side modem/TA and the destination device.

8.4 Start-up of the Modem Function

This section explains the start-up procedures, processing methods and programming when the modem function of the QC24N is to be used.

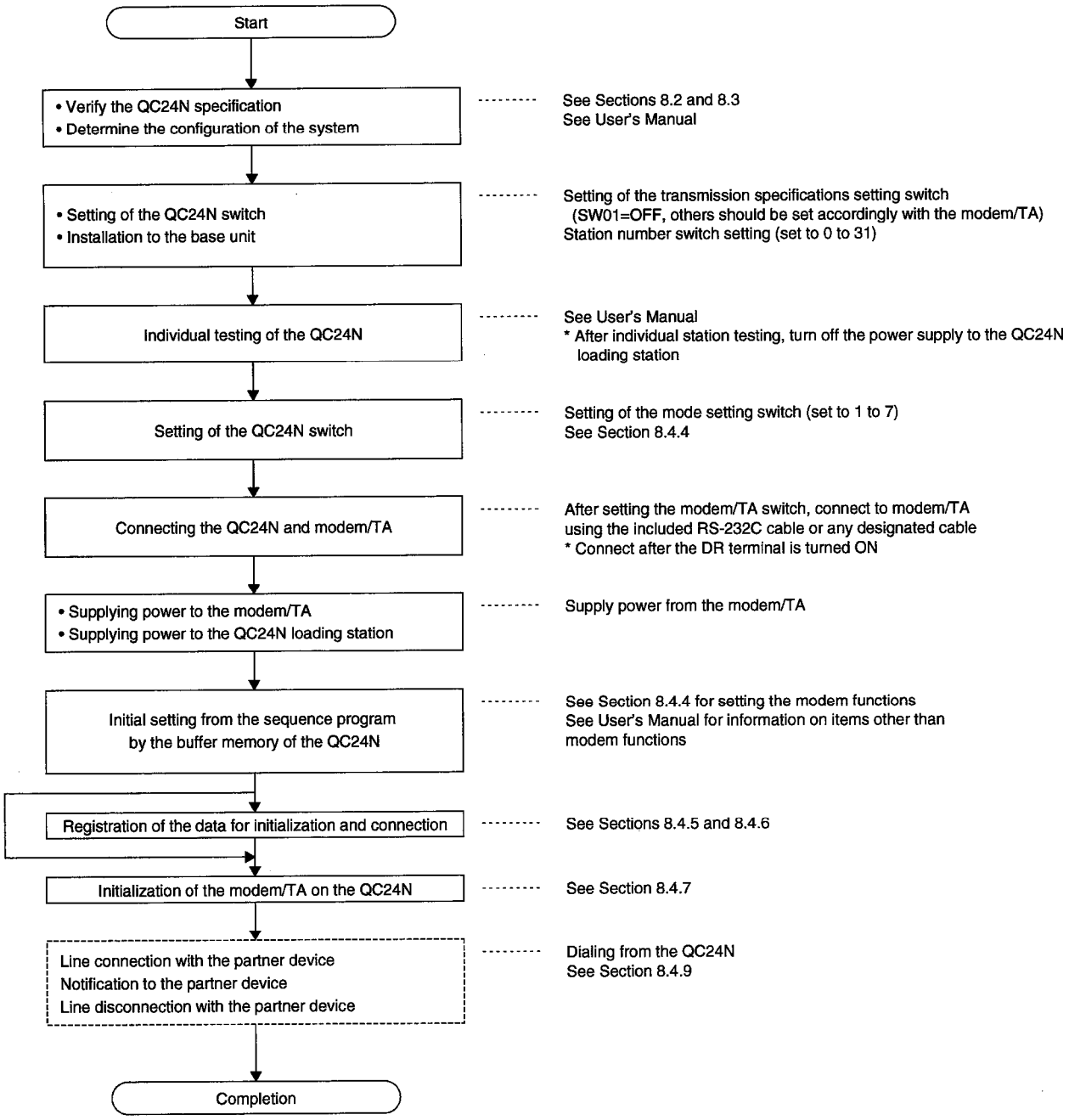
8.4.1 Start-up procedures when communicating data with external devices

The following is a summary of the start-up procedures when communicating data with external devices in a remote location via the dedicated protocol/non procedure protocol/bidirectional protocol using the modem functions.



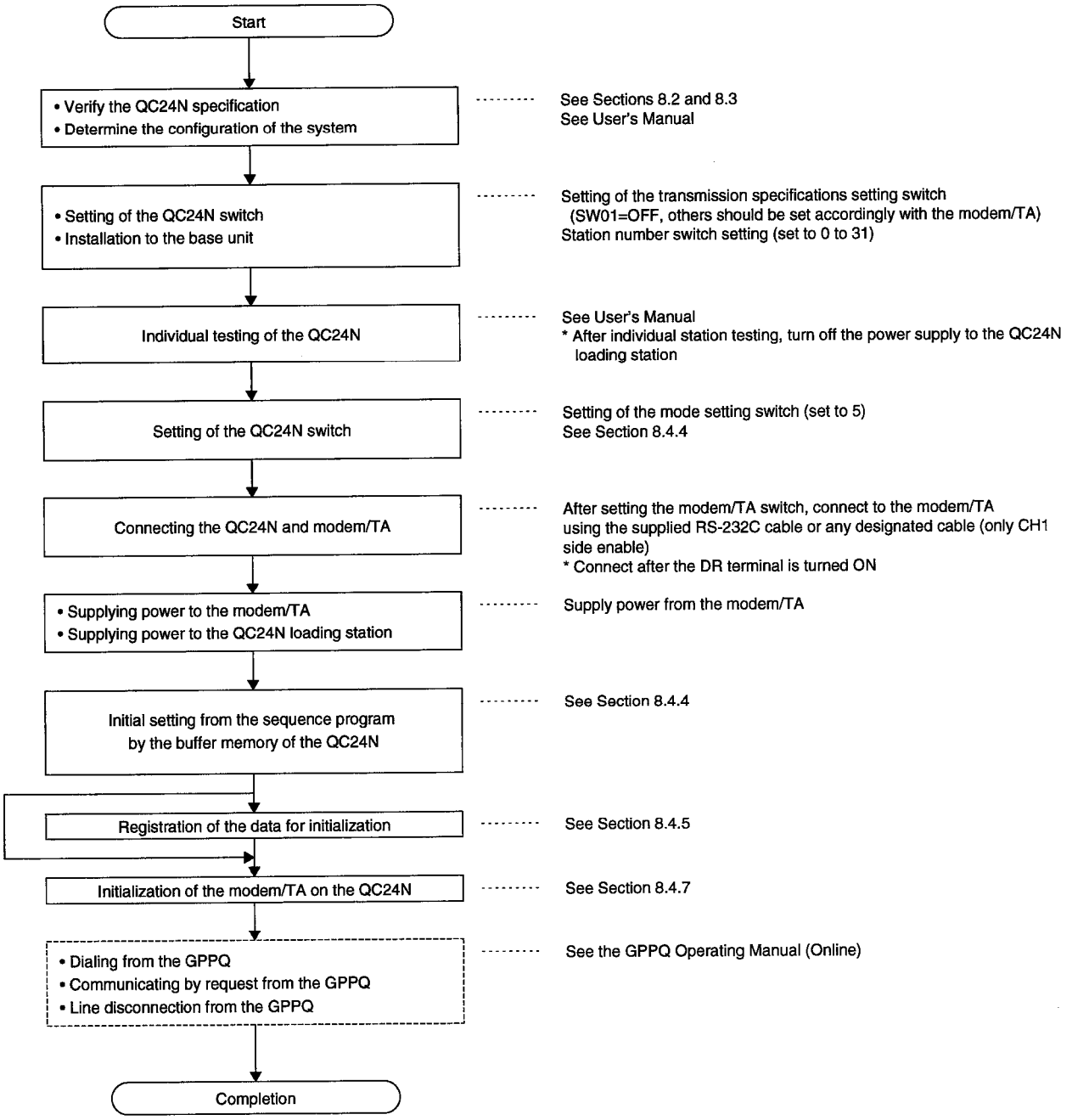
8.4.2 Start-up procedures when using the notification functions

The following is a summary of the start-up procedures when remotely notifying a pager receiver/cellular phone/PHS (call-up, message display) using the modem function.



8.4.3 Start-up procedures when using the peripheral devices for GPPQ

The following is a summary of the start-up procedures when accessing a PC in a remote location from the peripheral devices for GPPQ via the QC24N using the modem function.



Point

The above procedures are used when accessing a remote PC from a peripheral device for GPPQ using a public line via the QC24N.
When accessing the PC with the peripheral device for GPPQ directly connected to the QC24N channel 1 (CH1) interface without using the modem function of the QC24N, perform the setting described in Section 4.9 of the User's Manual.

8.4.4 Initial settings of the QC24N

The following explains the initial settings of the QC24N when data communicating with external device or remotely notifying a pager receiver/cellular phone/PHS (call-up, message display) using the modem function.

1 Switch settings

Switch			Data communication	Notification	GPPQ access	Remarks
Mode setting switch		MODE	1 to 7	1 to 7	5	—
Transmission specification setting switch	Operation setting	SW01	OFF (Independent operation)			Set both CH1 and CH2 OFF
	Data bit setting	SW02	(Set according to modem/ TA on local station)		(Set according to local station modem/AT) (*1)	OFF=7 bits, ON=8 bits
	Setting of parity/non-parity	SW03				OFF = Non-parity, ON = Parity
	Even/odd parity setting	SW04				OFF = Odd, ON = Even
	Stop bit setting	SW05				OFF = 1 bit, ON = 2 bits
	Sum check enable/disable setting	SW06	(Set according to system specification)	OFF/ON	ON	OFF = Disabled, ON = Enabled
	Write during RUN enable/ disable setting	SW07		OFF/ON	ON	OFF = Disabled, ON = Enabled
	Setting modifications enable/disable setting	SW08		OFF/ON	OFF/ON	OFF = Disabled, ON = Enabled
	Transmission speed setting	SW09 to SW12	(Set according to modem/TA on local station)			(bps)
Station number setting switch		STATION NO.	00 to 31			—

*1 The peripheral device for GPPQ side communicates with a modem with the following settings:

- Data bit length : 8 bits
- Parity bit : Non-parity
- Stop bit length : 1 bit
- Transmission speed : 19200 BPS (When communication is not possible, auto-switched to 9600 BPS)

2 Initial settings of the buffer memory

(a) Perform initial settings on the interface side that use the modem function as outlined below:

① Modem connection channel (Set using address 2EH)
Be sure to set the interface side that uses the modem function. However, at the interface side that uses the modem function, all reception data other than modem commands prior to the completion of the connection process with the modem will be ignored (read and discarded).

② Notify enabled/disabled (Set using address 2FH)
When notifying to a pager receiver/cellular phone/PHS, always set to "Notify."

③ Q6TEL connection (Set using address 36H)
When accessing the PC from the peripheral device for GPPQ through the QC24N considering the QC24N as a Q6TEL, set as "Communication as Q6TEL."
(When connecting direct shown in Section 8.2.3)

④ No-communication interval time (Set using address 37H)

Even if the PC CPU on the QC24N loading station (local station) becomes STOP state 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.

- When the PC CPU is stopped when the connected signal (X(n+1)2) is at the ON state.

* This occurs because the program write after remote stop is enabled.

- When the PC 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.

(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 (Set using address 97H/137H) : Not checked

② Communication system (Set using address 98H/138H) : 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 (Set using address 30H) : 3 times

② Connection retry intervals (Set using address 31H) : 180 seconds

③ Initialization/connection time out (Set using address 32H) : 60 seconds

8.4.5 Registration/reading/deletion of initialization command

The registration/reading/deletion of the data for initialization such as initialization commands for the modem/TA connected to the QC24N side for data communication with the external device and pager receiver/cellular phone/PHS notification using the QC24N modem functions are explained below.

1 Registration destination of the data for initialization

① The data for initialization may be used by registering to the QC24N EEPROM or buffer memory.

② The buffer memory may register the data for connection shown in Section 8.4.6 and will register the data for initialization or data for connection in the designated area.

③ It is recommended to store the data for initialization to the EEPROM after completing the debug process.

By registering it to the EEPROM, the registration process of the data for initialization will be unnecessary thereafter.

④ 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 QC24N loading station again. It is necessary to register the data for initialization in the buffer memory after each start-up of the QC24N.

2 Types of data for initialization

① There are data for initialization that are registered in the EEPROM of the QC24N 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 data for initialization registration number registered in the buffer memory is determined by the area of registration.

Registration data	Registration destination		Registration number (Decimal (hexadecimal))	Number of registrations
Data for initialization	EEPROM	Data registered by the OS	2000 to 2004 (7D0H to 7D4H)	5
		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 (78 bytes in single-byte characters)

② Do not include CR/LF (data code : 0DH/0AH) in the data for initialization to be registered to the QC24N. The CR/LF is automatically added at the end of the AT command by the QC24N.

③ The registration status of the data for initialization stored in the EEPROM may be checked in 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 QC24N to an external device using a cellular phone and a modem, set the transmission speed supported by the cellular communication module on the modem side.

5 Registration contents at shipment

① The data for initialization registered in the EEPROM of the QC24N are shown below:

Registration number		Initialization command
Hexadecimal	Decimal	
7D0H	2000	ATQ0V1E1X1\J0\Q2\V2\N3S0=1
7D1H	2001	ATQ0V1E1X1\Q2\V2\N3S0=1
7D2H	2002	ATQ0V1E1X1&K3\N3S0=1
7D3H	2003	ATQ0V1E1X1&H1&R2&A3&D2S0=1
7D4H	2004	ATQ0V1E1X1\J0\Q2\N3S0=1

② If initialization commands other than listed above are needed, the data for initialization needs to be registered to the EEPROM or the buffer memory of the QC24N.

Remark

- Perform the following setting in respect to the modem/TA connected to the QC24N side.

  For settings other than listed below, perform the setting as specified 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/normal mode auto selection	\N3

- The following shows an specification example of the transmission speed supported by the cellular communication module using the modem initialization command, when connecting the QC24N to an external device using a cellular phone and a modem.

  For the details, see the manual of the modem used.

  (When changing the data for initialization of registration number 2003.)

  ATQ0V1E1X1&H1&R2&A3&D0S0=1&N6

  (When changing the data for initialization of registration number 2004.)

  ATQ0V1E1X1\J0\Q2\N3&D0+MS=,,9600, 9600S0=1

6 Data for initialization registration/reading/deletion method

(a) In respect to the EEPROM in the QC24N

① Data for initialization registration/reading/deletion is performed using the EEPROM access area in the buffer memory used in the registration/reading/deletion process of the user registration frame (address : 2H to 2DH) and the EEPROM read/write signal of the I/O signal (X/Y17 toX/Y18).

② The buffer memory and the designated/stored value of each area that is used for the registration, reading, and deletion process of the data for initialization are shown below.

For details, see Chapter 16 in the User's Manual.

(Read the table by replacing the user registration frame with the data for initialization.)

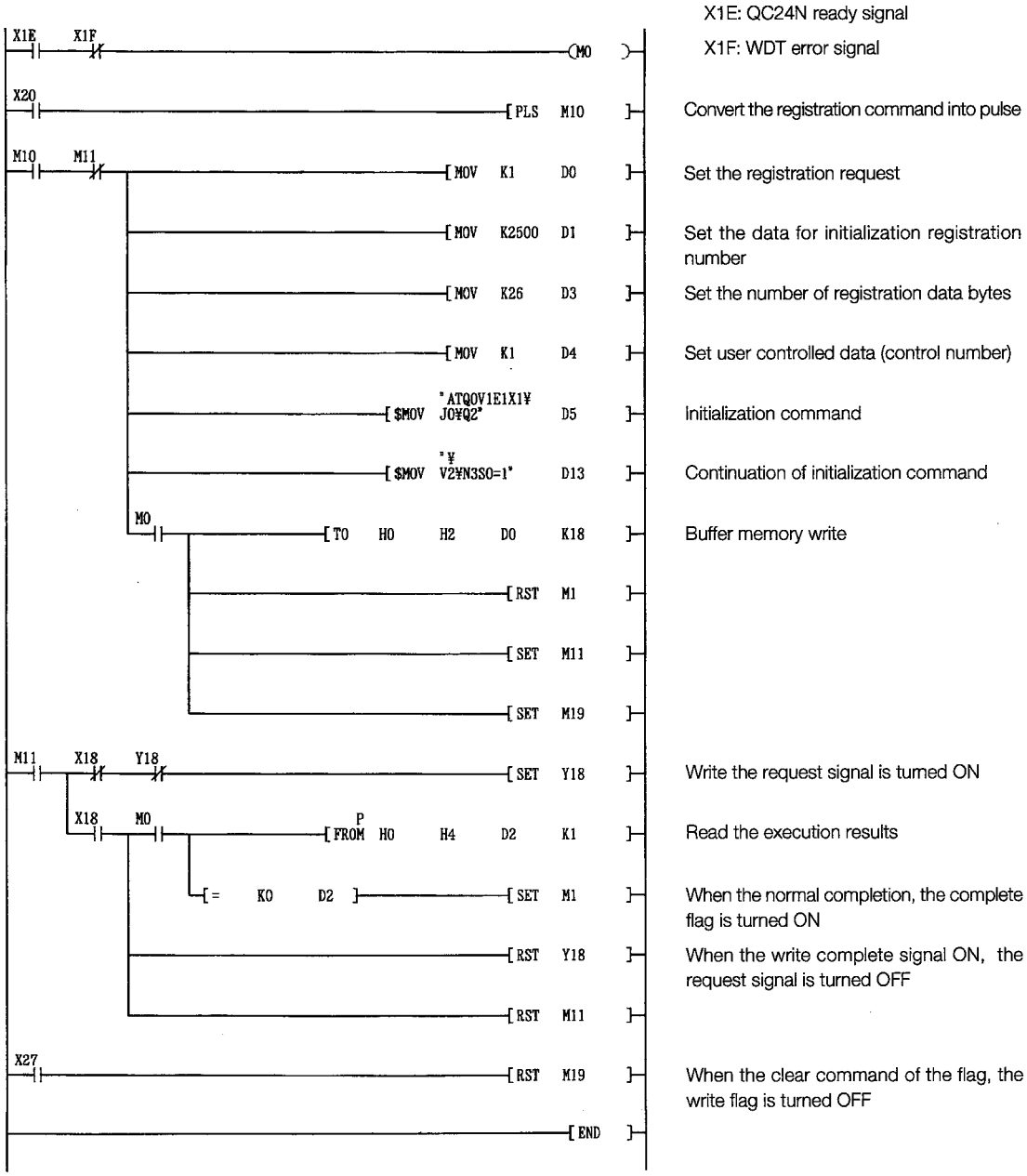
Address		Name		Designated/stored value	Designation necessary (○)/unnecessary (×)		
Hexadecimal	Decimal				Registration	Reading	Deletion
2H	2	Registration/reading/ deletion instruction		0 : No request 2: Read request 1 : Registration request 3: Delete request	○		
3H	3	Frame number specification (*1)		0 : No frame number designated 2500 to 2529 : Registration number of the data for target initialization	○		
4H	4	Registration/reading/ deletion result storage (*2)		0 : Normal completion Other than 0 : Abnormal completion	×(Stored)		
5H	5	Number of registration data bytes designation		1 to 78 : Number of registration data bytes (Applicable only to the initialization command section.)	○	× (Stored)	×
6H	6	Registration/ read data	User control data	Arbitrary data that the user uses to control registration data (manufacturer code, control number, etc.)			
7H to 2DH	7 to 45		Initialization command	Data code for the initialization command for registration/read			

*1 The data for initialization stored in the EEPROM of the QC24N upon shipping cannot be deleted.

*2 When an abnormal completion occurs, the error code is stored. Perform corrective actions and verification of the error content according to the User's Manual.

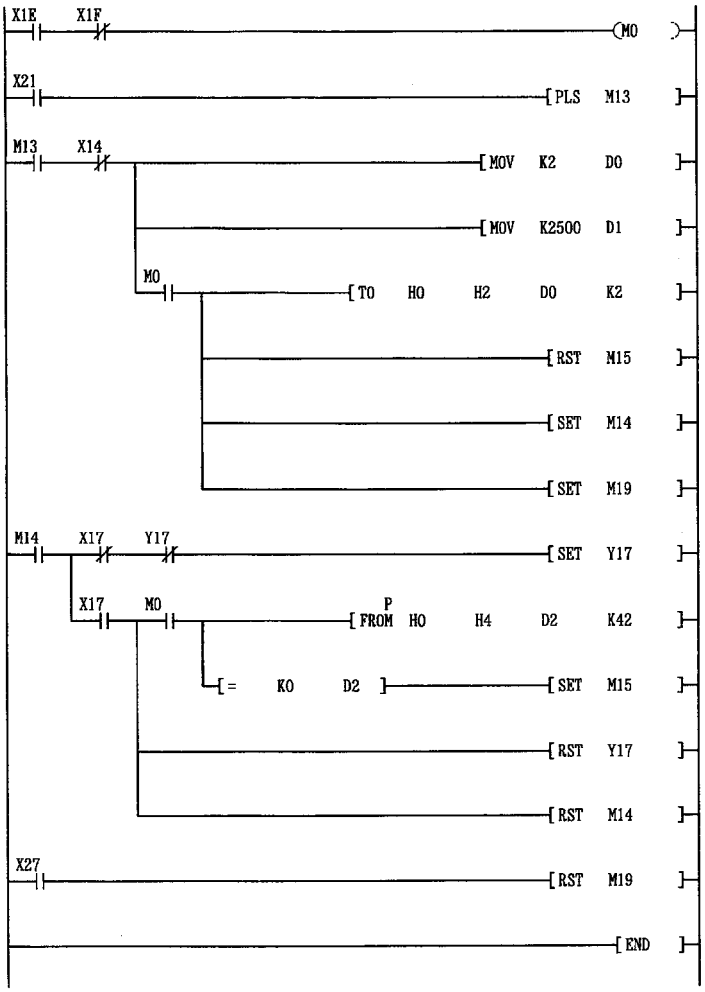
③ An example of a sequence program used for registration/reading/deletion of data for initialization is shown below.

• Example of registration data for initialization



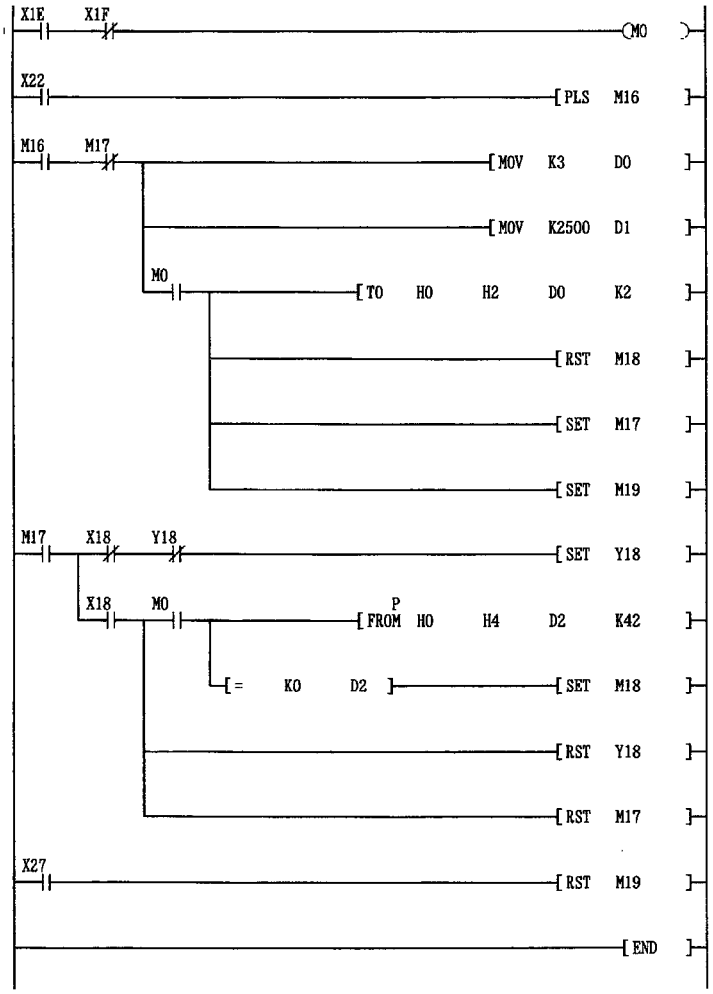
(Item name)	(Address)	Buffer memory		EEPROM	
Registration/reading/deletion instructions	2H	1		Area for registration No. 2500	
Frame number instructions	3H	2500			
Registration/reading/deletion results	4H	0	←		
Number of registration data bytes	5H	23	→	23	Data for initialization
User control data	6H	1	→	1	
Initialization command	7H to 2DH	Initialization command	→	Initialization command	

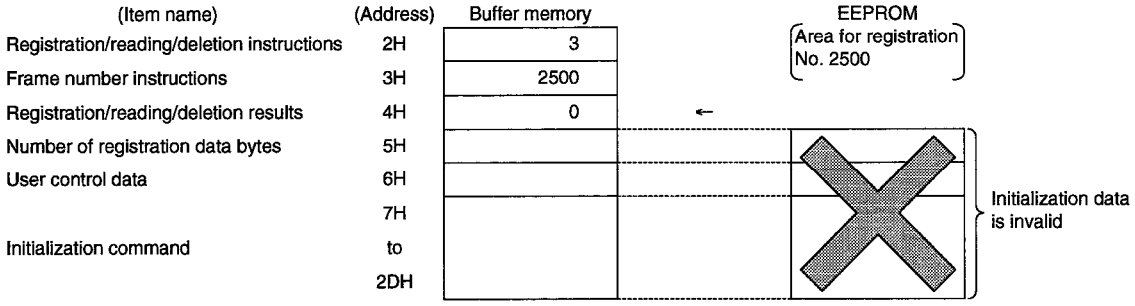
• Example of reading data for initialization



(Item name)	(Address)	Buffer memory		EEPROM	
Registration/reading/deletion instructions	2H	2		Area for registration No.2500	
Frame number instructions	3H	2500			
Registration/reading/deletion results	4H	0	←		
Number of registration data bytes	5H	23	←	23	Data for initialization
User control data	6H	1	←	1	
Initialization command	7H to 2DH	Initialization command	←	Initialization command	

• Example of deletion data initialization





(b) In the case of the buffer memory of the QC24N

① The data for initialization write (registration)/read is performed by designating a corresponding area that is compatible with registration number 8001H to 801FH in respect to the area for user registration frame registration (address : 1B00 to 1FF6H).
When deleting the data for initialization, write "0" to the number of registration data bytes designation area.

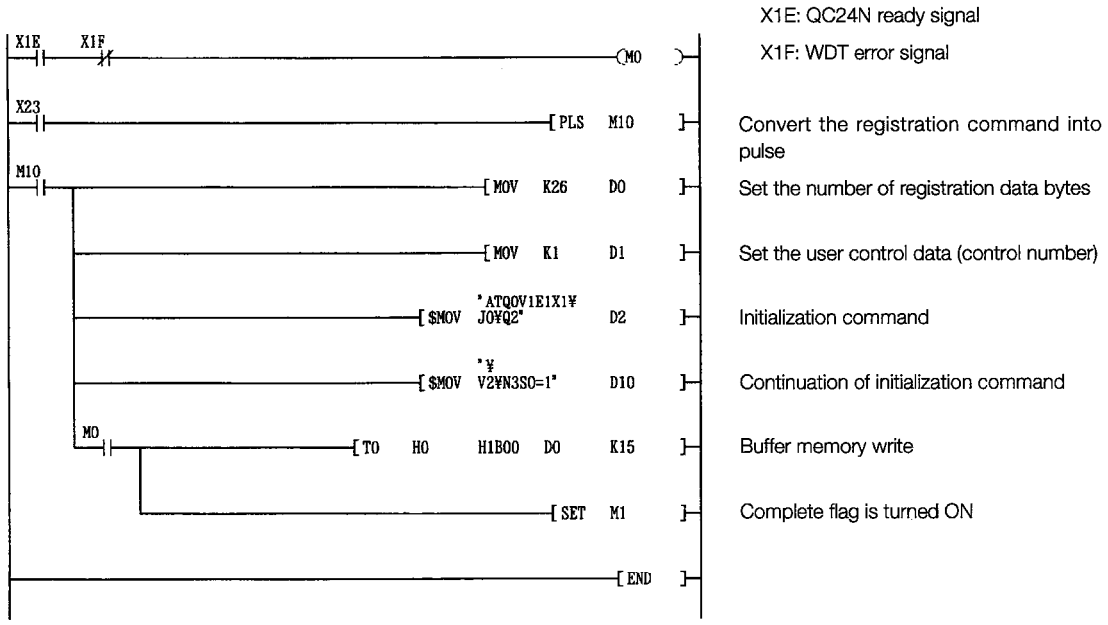
② An overview of the buffer memory used in the writing, reading, and deleting process of the data for initialization as well as the designated value for each area are shown in the table below.
For details, see Chapter 16 in the User's Manual.
(Read the table by replacing the user registration frame with the data for initialization.)

Address		Name		Designated/stored value	Designation necessary (O)/unnecessary (×)		
Hexadecimal	Decimal				Write	Read	Deletion
1B00H	6912	Registration number 8001H	Number of registration data bytes designation	0 : When deleting 1 to 78 : Number of registration data bytes (Applicable only to the initialization command section.)	O	Read processing unnecessary	O
1B01H	6913		User control data	Arbitrary data that the user uses to control registration data (manufacturer code, control number, etc.)			×
1B02H to 1B28H	6914 to 6952		Initialization command	Data code for the initialization command for register			
1B29H	6953	Registration number 8002H	Number of registration data bytes designation	0 : When deleting 1 to 78 : Number of registration data bytes (Applicable only to the initialization command section.)	O	Read processing unnecessary	O
1B2AH	6954		User control data	Arbitrary data that the user uses to control registration data (manufacturer code, control number, etc.)			×
1B2BH to 1B51H	6955 to 6993		Initialization command	Data code for the initialization command for register			
~	~	~	~	~	~	~	~
1FCEH	8142	Registration number 801FH	Number of registration data bytes designation	0 : When deleting 1 to 78 : Number of registration data bytes (Applicable only to the initialization command section.)	O	Read processing unnecessary	O
1FCFH	8143		User control data	Arbitrary data that the user uses to control registration data (manufacturer code, control number, etc.)			×
1FD0H to 1FF6H	8144 to 8182		Initialization command	Data code for the initialization command for register			

③ The contents of the data to be written into the designated area that is compatible with registration number 8001H to 801FH is the same as the situation in respect to the EEPROM.

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

• Example of writing data for initialization to the registration number 8001H area



(Item name)		Data register		(Address)	Buffer memory Area for registration No. 8001H	
Number of registration data bytes	D0	23	→	1B00H	23	Data for initialization
User control data	D1	1	→	1B01H	1	
Initialization command	D2 to D13	(Initialization command)	→	1B02H to 1B0DH	(Initialization command)	
				to 1B28H		

8.4.6 Registration/reading/deletion of 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 and notify pager receivers/cellular phones/PHS using the QC24N modem functions.

1 Registration destination of data for connection

① The data for connection can be used by registering to the QC24N's EEPROM or buffer memory.

② The buffer memory can register the data for initialization shown in Section 8.4.5. 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 to the EEPROM after completing the debug process.

By registering it to the EEPROM, the registration process of the data for connection will be unnecessary thereafter.

④ 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 QC24N loading station again. It is necessary to register the data for connection in the buffer memory after each start-up of the QC24N.

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 data-for-connection registration number registered in the buffer memory is determined by the area of registration.

Registration data	Registration destination		Registration number (Decimal (Hexadecimal))	Number of registrations
Data for connection	EEPROM	(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 EEPROM can be checked in 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 Data for connection registration/reading/deletion method

(a) In respect to the EEPROM in the QC24N

① Registration/reading/deletion of data for connection is performed using the EEPROM access area in the buffer memory used in the registration/reading/deletion process of the user registration frame (address : 2H to 2DH) and the EEPROM read and write I/O signals (X/Y17 to X/Y18).

② The buffer memory and the designated/stored value of each area used for the registration, reading and deletion process of data for connection is shown below.

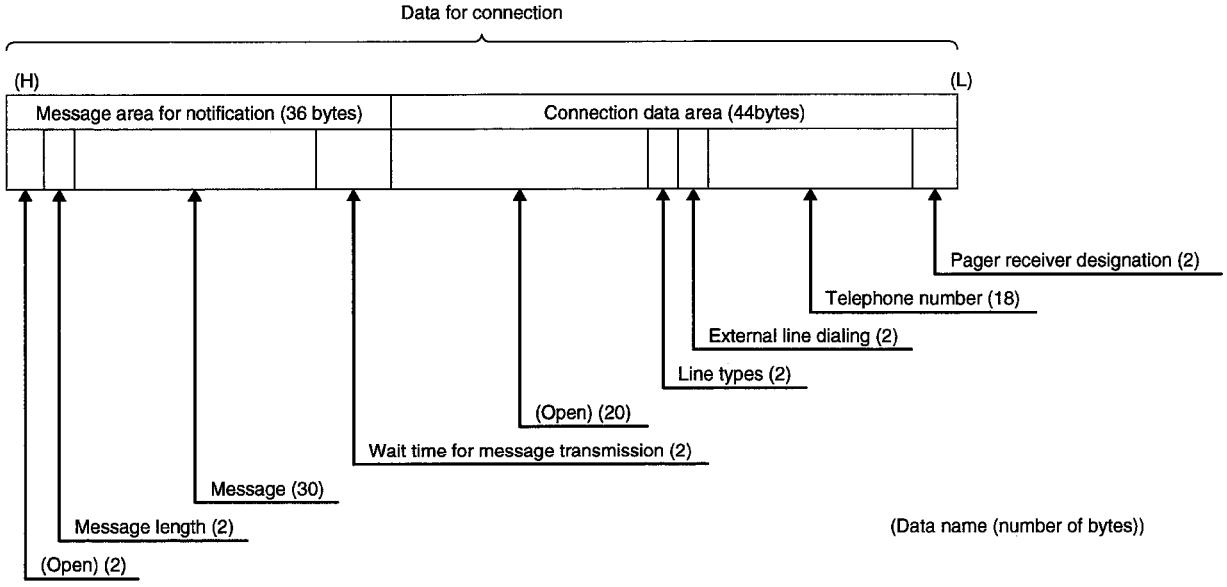
Address		Name	Designated/stored value	Designation necessary (O)/unnecessary (x)		
Hexadecimal	Decimal			Registration	Reading	Deletion
2H	2	Registration/reading/ deletion designation	0 : No request 2 : Read request 1 : Registration request 3 : Delete request	O		
3H	3	Frame number designation	0 : No frame number designated 3000 to 3029 : Registration number of the target data for connection	O		
4H	4	Registration/reading/ deletion result storage (*1)	0 : Normal completion Other than 0 : Abnormal completion	x (Stored)		
5H	5	Number of registration data bytes designation	80 : Number of registration data bytes	O	x (Stored)	x
6H to 2DH	6 to 45	Data for connection	Messages for notification to be registered/ read, data for connection			

*1 When an abnormal completion occurs, the error code is stored. Perform corrective actions and verification of the error content according to the User's Manual.

③ The data structure in the data for connection area in the buffer memory that is used for the registration, reading and deletion process of the data for connection is shown below, as well as designated values and stored values.

For other than data for connection area, see Chapter 16 in the User's Manual.

(Read the table by replacing the user registration frame with data for connection.)



(Data for connection area) ··· 44 bytes

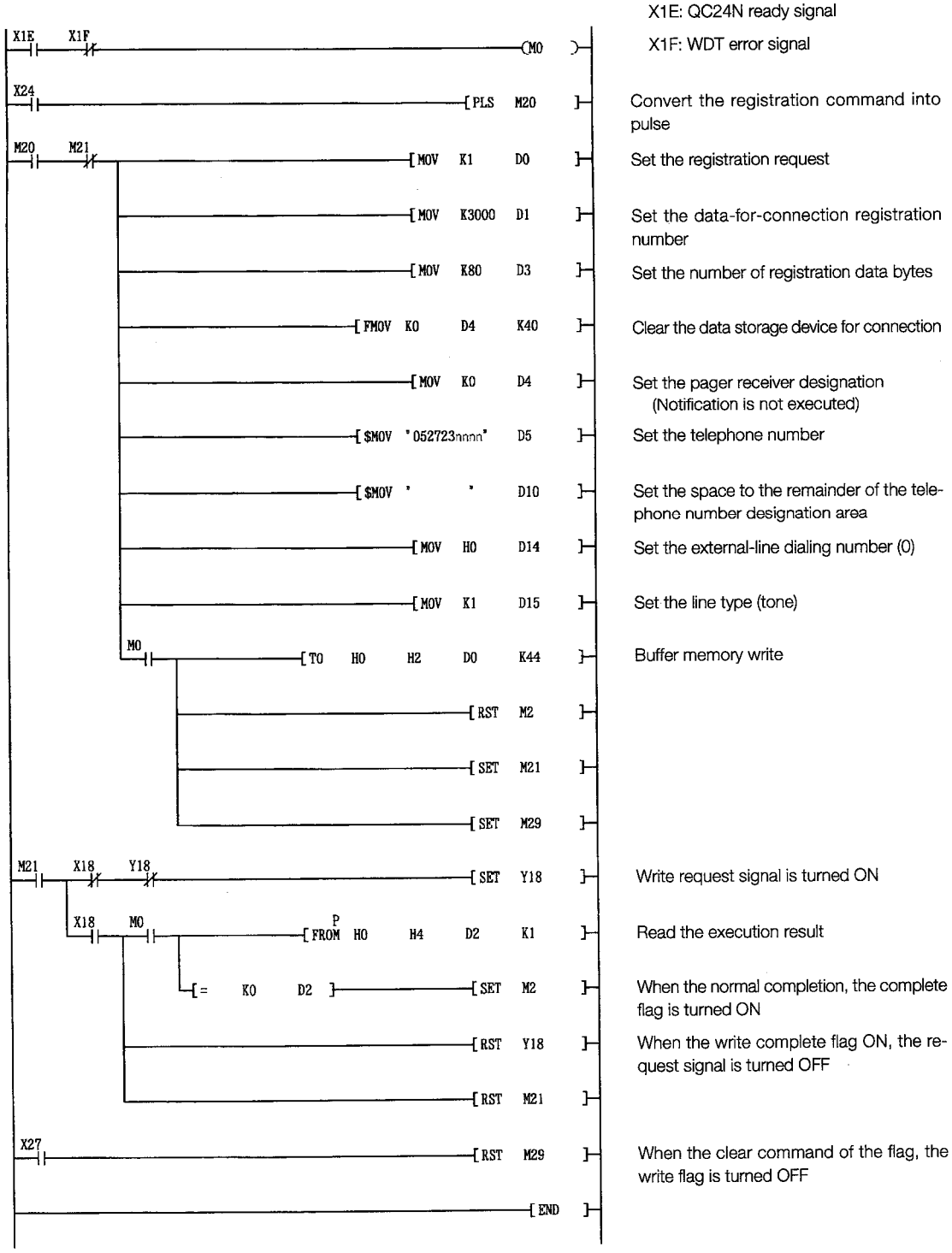
Data name	Designated/stored value and contents	Number of bytes	Data type
Pager receiver designation	Whether or not notification is performed, and the notification target module are designated. 0 : No notification 1 : Notification performed, target device = NTT DoCoMo 2 : Notification performed, target device = Tele-Message 3 : Notification performed, target device = Other than above * 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. (Any phone number, even non-NTT numbers can be used) • When phone number is less than 18 characters, a space (code: 20H) must be entered for the remainder.	18	ASCII
External line dialling number	The external-line access number required when performing data communication/notification to the partner device is designated here. 0 to 9 10(*) } : External-line access number on the QC24N side 11(#) 255 : No external-line access number required on the QC24N 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: seconds) 0 to 255 : Wait time * Valid when the pager receiver type designation 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 specified message bytes shown above is designated. 0 : No message designation 1 to 30 : Number of message bytes	2	Binary
(Open)	Designate "0."	2	Binary

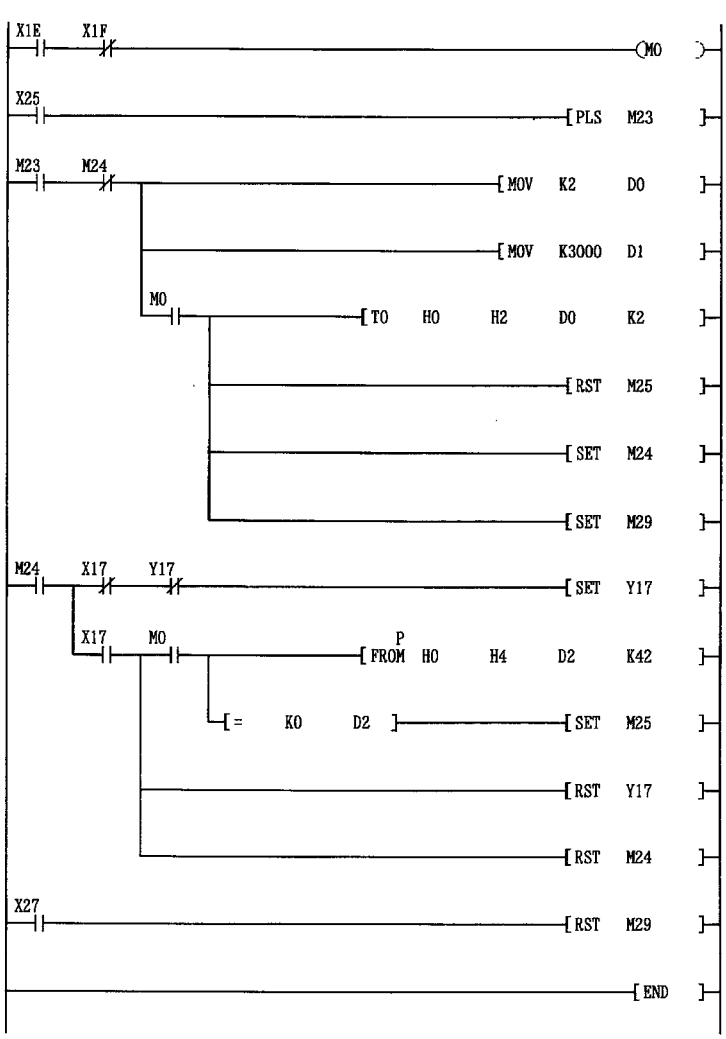
④ An example of a sequence program used for data for connection registration/reading/deletion is shown below.

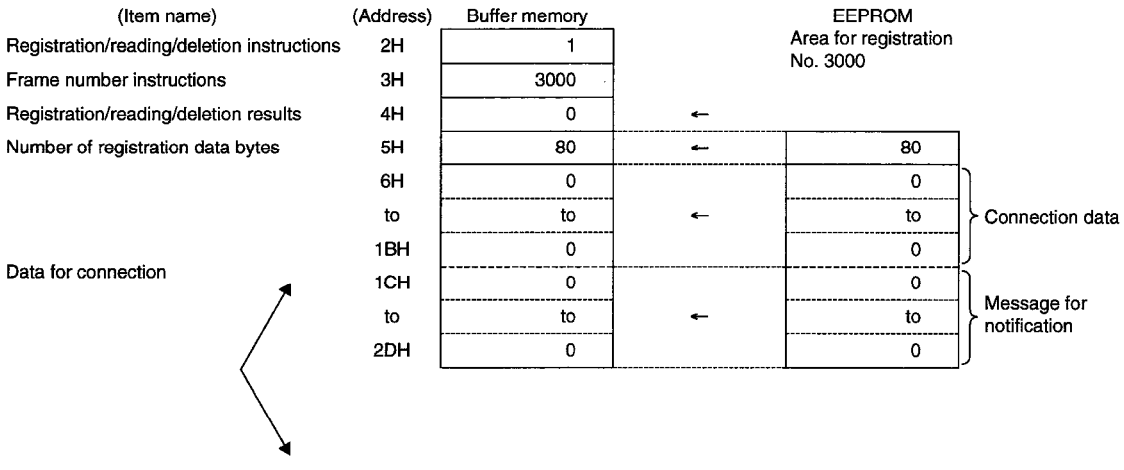
• Example of registration of data for connection

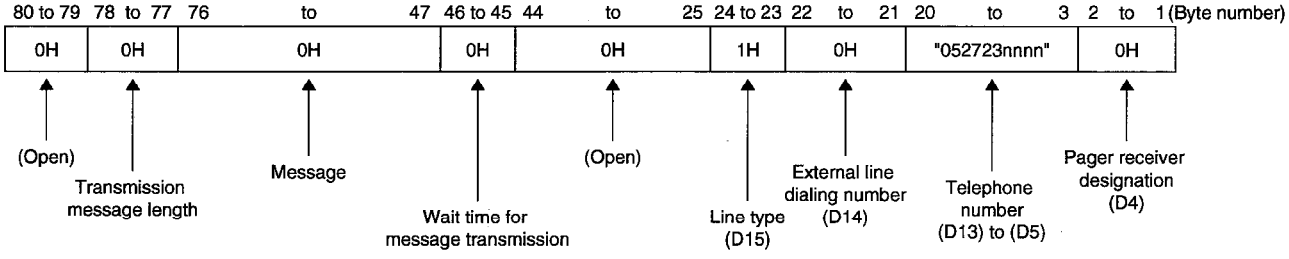


* For a image diagram of registration, see the read example diagram.

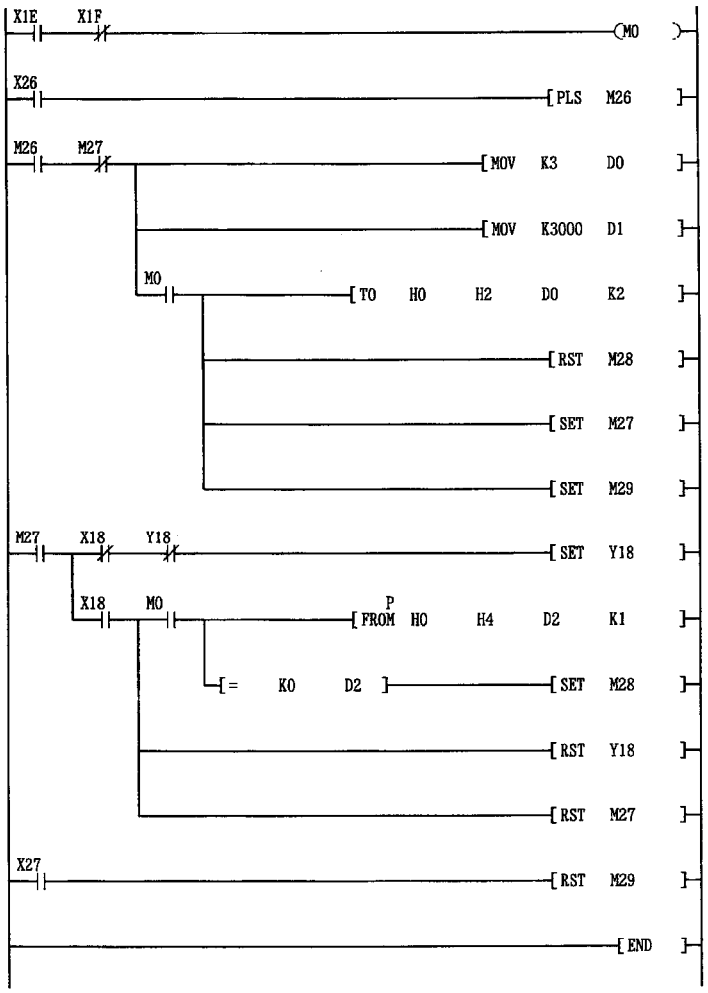
• Example of reading data for connection

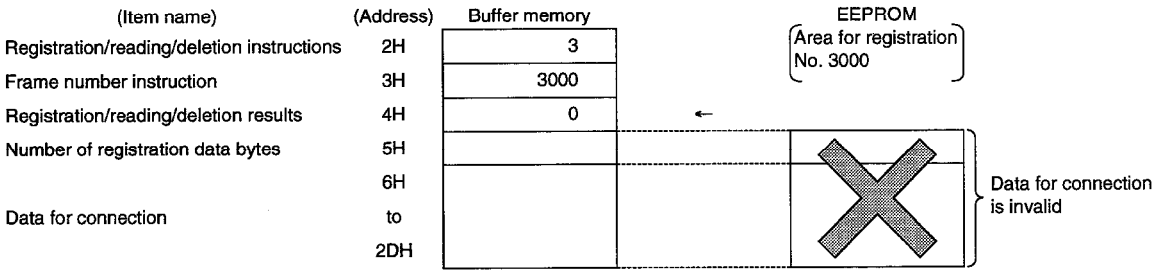






• Example of deletion data for connection





(b) In the case of the buffer memory of the QC24N

① The data for connection write (registration)/read is performed by designating a corresponding area that is compatible with registration number 8001H to 801FH in respect to the area for user registration frame registration (address : 1B00 to 1FF6H).

When deleting the data for connection, write "0" to the number of registration data bytes designation area.

② An overview of the buffer memory used in the writing, reading and deleting process of the data for connection as well as the designated value for each area are shown in the table below.

For details, see Chapter 16 in the User's Manual.

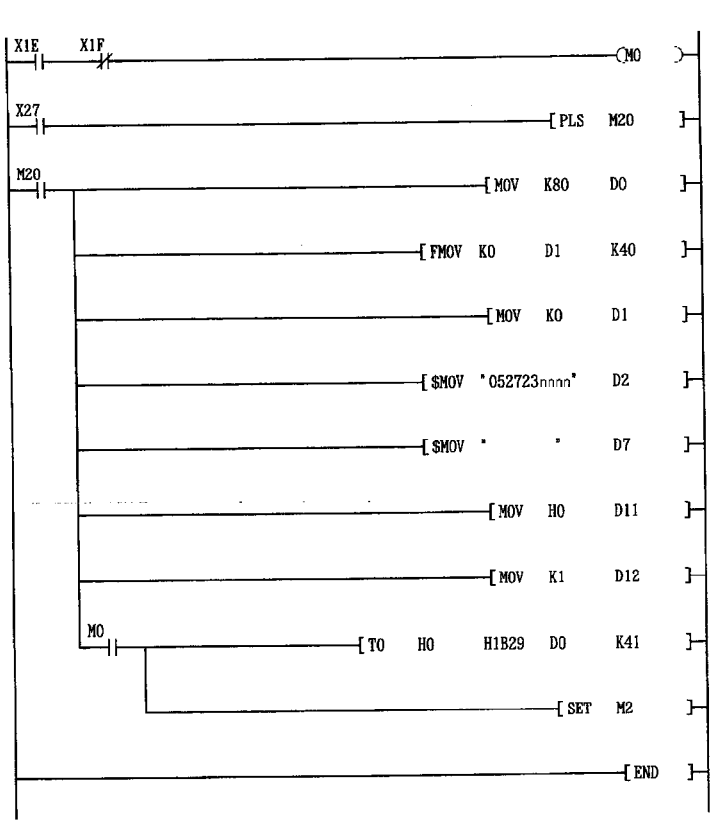
(Read the table by replacing the user registration frame with data for connection.)

Address		Name		Designated/stored value	Designation necessary (O)/unnecessary (×)		
Hexadecimal	Decimal				Write	Read	Deletion
1B00H	6912	Registration number 8001H	Number of registration data bytes designation	0 : When deleting 80 : Number of registration data bytes	○	Read processing unnecessary	○
1B01H to 1B28H	6913 to 6952		Data for connection	Notification message for the data for connection to be registered, connection data	○		×
1B29H	6953	Registration number 8002H	Number of registration data bytes designation	0 : When deleting 80 : Number of registration data bytes	○	Read processing unnecessary	○
1B2AH to 1B51H	6954 to 6993		Data for connection	Notification message for the data for connection to be registered, connection data	○		×
~							~
1FCEH	8142	Registration number 801FH	Number of registration data bytes designation	0 : When deleting 80 : Number of registration data bytes	○	Read processing unnecessary	○
1FCFH to 1FF6H	8143 to 8182		Data for connection	Notification message for the data for connection to be registered, connection data	○		×

③ The contents of the data to be written into the designated area that is compatible with registration number 8001H to 801FH is the same as the situation in respect to the EEPROM.

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)

8.4.7 Initialization of modem/terminal adapter

The initialization of the modem/TA connected to the QC24N, used for communicating data and performing notifications to pager receivers/cellular phones/PHS using the QC24N modem function, will be discussed.

1 Requirements for initialization

Perform the following setting and registration:

① The QC24N initial settings as shown in Section 8.4.4

② The data for initialization registration shown in Section 8.4.5, when initializing the modem/TA with the data for initialization set by the user.

Remark

It is possible to initialize and connect by performing the connection process by designating the data for initialization and data for connection . (See Section 8.4.8.)

2 Buffer memory used in initialization

This is determined by the number of data for initialization to be used among the data for initialization registered in the EEPROM or the buffer memory of QC24N.

The designated values for the buffer memory are shown below:

	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	Transmission-in-progress user registration frame number		B6H/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	Number of outputs 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 7D4H (2000 to 2004) : Data registered by the OS

9C4H to 9E1H (2500 to 2529) : Data registered in the EEPROM 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: 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 Number of outputs designation area (address: 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 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 QC24N 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	Transmission-in-progress frame number		0
B7H	CR/LF output designation		0
B8H	Output header pointer designation		3
B9H	Number of outputs		2
BAH	Output frame number	1st unit	9C4H
BBH		2nd unit	9C5H
BCH		3rd unit	8001H
BDH		4th unit	8002H
BEH		5th unit	9D0H
BFH		6th unit	9D1H

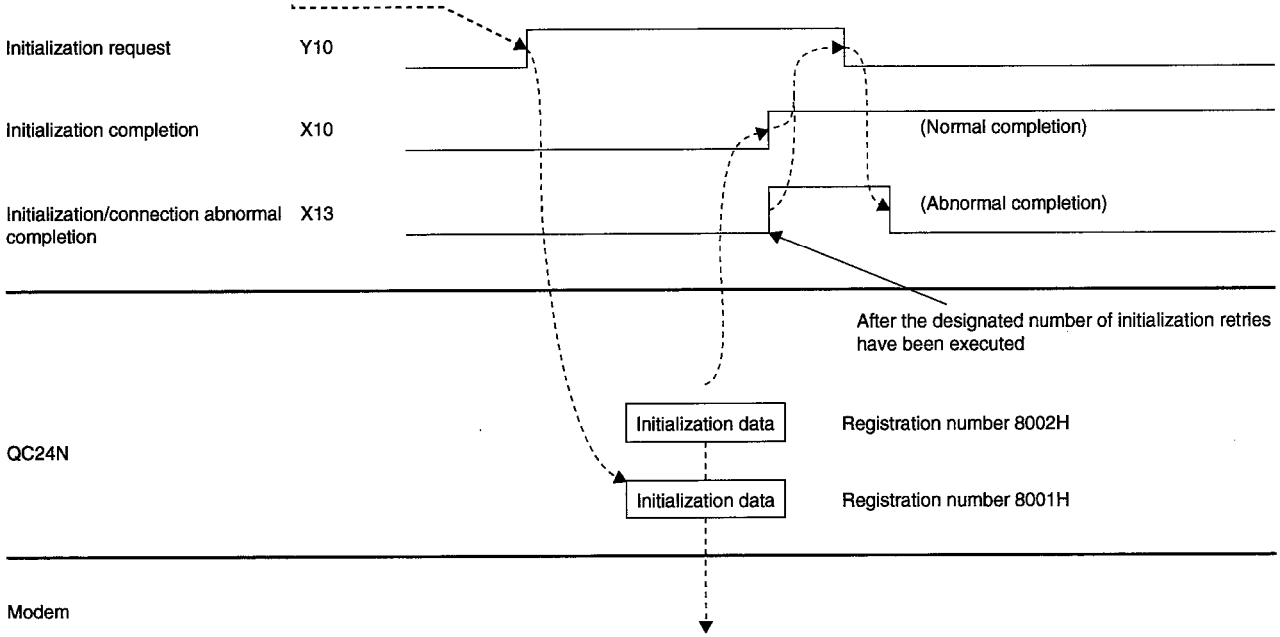
Out of the output frame numbers, from which one the transmission will be initiated is designated.

Out of the output frame numbers, the number of units to be transmitted is designated.

Data for initialization registration number is designated.

* The QC24N will transmit the data for initialization in the designated order.

Must be designated prior to the modem initialization request.



4 Precautions during modem/TA initialization

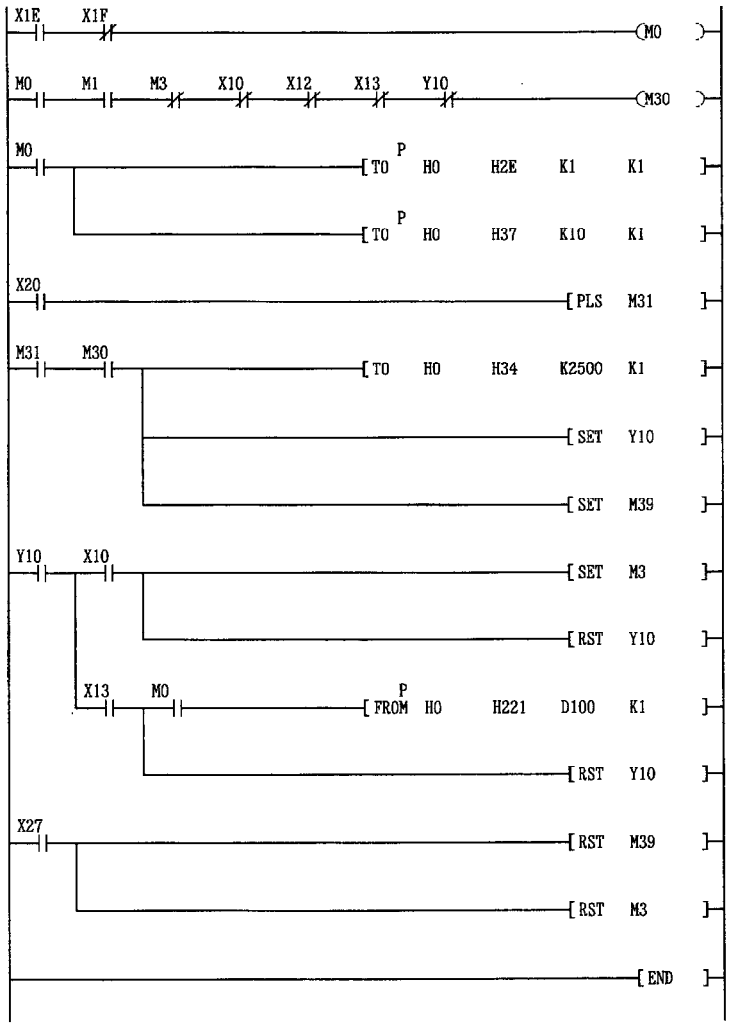
After the initialization for the QC24N-side modem/TA has been completed by the PC CPU, the QC24N monitors the status of the modem/TA as long as the initialization complete signal (X10) is ON.

If the line to the modem/TA is disconnected during the initialization complete signal (X10) is ON, the QC24N will automatically start the initialization process of the modem/TA when the line is restored regardless of the ON/OFF setting of the initialization request signal Y(n+1)0.

5 Modem/TA initialization program example

An example of the modem/TA initialization program by the PC CPU is shown below.

- Example of using one data for initialization



X12: Connection in progress signal

X1E: QC24N ready signal

X1F: WDT error signal

M0: QC24N inaccessible flag

M1: Data registration complete flag for initialization

See Section 8.4.5

M30: Initialization enabled flag

Initial settings of the QC24N

See Section 8.4.4

- Set the modem connection channel on the QC24N
- Set the no-communication interval time (10 minutes)

Convert the modem initialization command into pulse

Modem/TA initialization

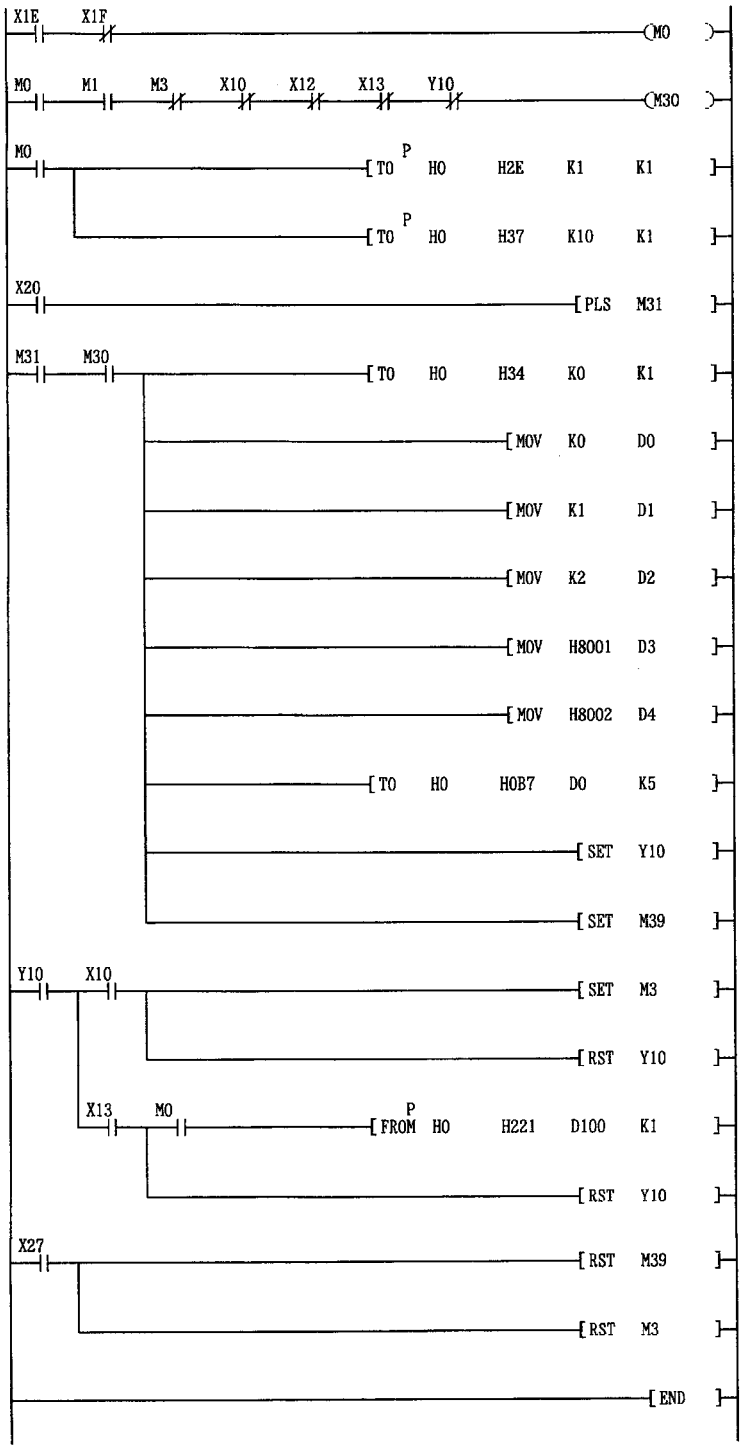
- Designate the data number for initialization
- Initialization request signal is turned ON

- When the initialization complete signal ON, the initialization complete flag is turned ON and request signal is turned OFF

- When the abnormal complete signal ON, the error code is read and request signal is turned OFF

When the clear command of the flag, the initialization request and the complete flag are turned OFF

• Example of using two data for initialization



X12: Connection in progress signal

X1E: QC24N ready signal

X1F: WDT error signal

M0: QC24N inaccessible flag

M1: Data registration complete flag for initialization

See Section 8.4.5

M30: Initialization enabled flag

Initial settings of the QC24N

See Section 8.4.4

- Set the modem connection channel on the QC24N
- Set the no-communication interval time (10 minutes)

Convert the initialization command into pulse

Modem/TA initialization

- Specify the data number for initialization
- Set the CR/LF output designation
- Set the output header pointer
- Set the number of outputs
- Set the data number for initialization (first unit) (second unit)
- Write to the user-registration frame for transmission designation area
- Initialization request signal is turned ON
- When the initialization complete signal ON, the initialization complete flag is turned ON and the request signal is turned OFF
- When the abnormal complete signal ON, the error code is read and the request signal is turned OFF

When the clear command of the flag, the initialization request and the complete flag are turned OFF

8.4.8 Line connection

This section explains the connection (dialing) with the partner devices for the purpose of data communication with external devices using the QC24N modem functions.

In case of notification to a pager receiver/cellular phone/PHS, 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 QC24N as shown in Section 8.4.4

② The registration of the data for initialization as shown in Section 8.4.5

③ The registration of the data for connection as shown in Section 8.4.6

④ The initialization of the modem/TA connected to the QC24N side as shown in Section 8.4.7

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 8.4.7. Explanation on the above-mentioned setting is omitted in this section.

2 Buffer memory used in line connection

The buffer memory is determined by whether the line is connected from the QC24N side or the partner device.

The buffer memory used and designated value are explained below.

① When initiating line connection from the QC24N

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

  The data for connection registration number is designated.

  BB8H to BD5H (3000 to 3029) : Data registered to the EEPROM by the user

  8001H to 801FH (-32767 to -32737) : Data registered to the buffer memory by the user

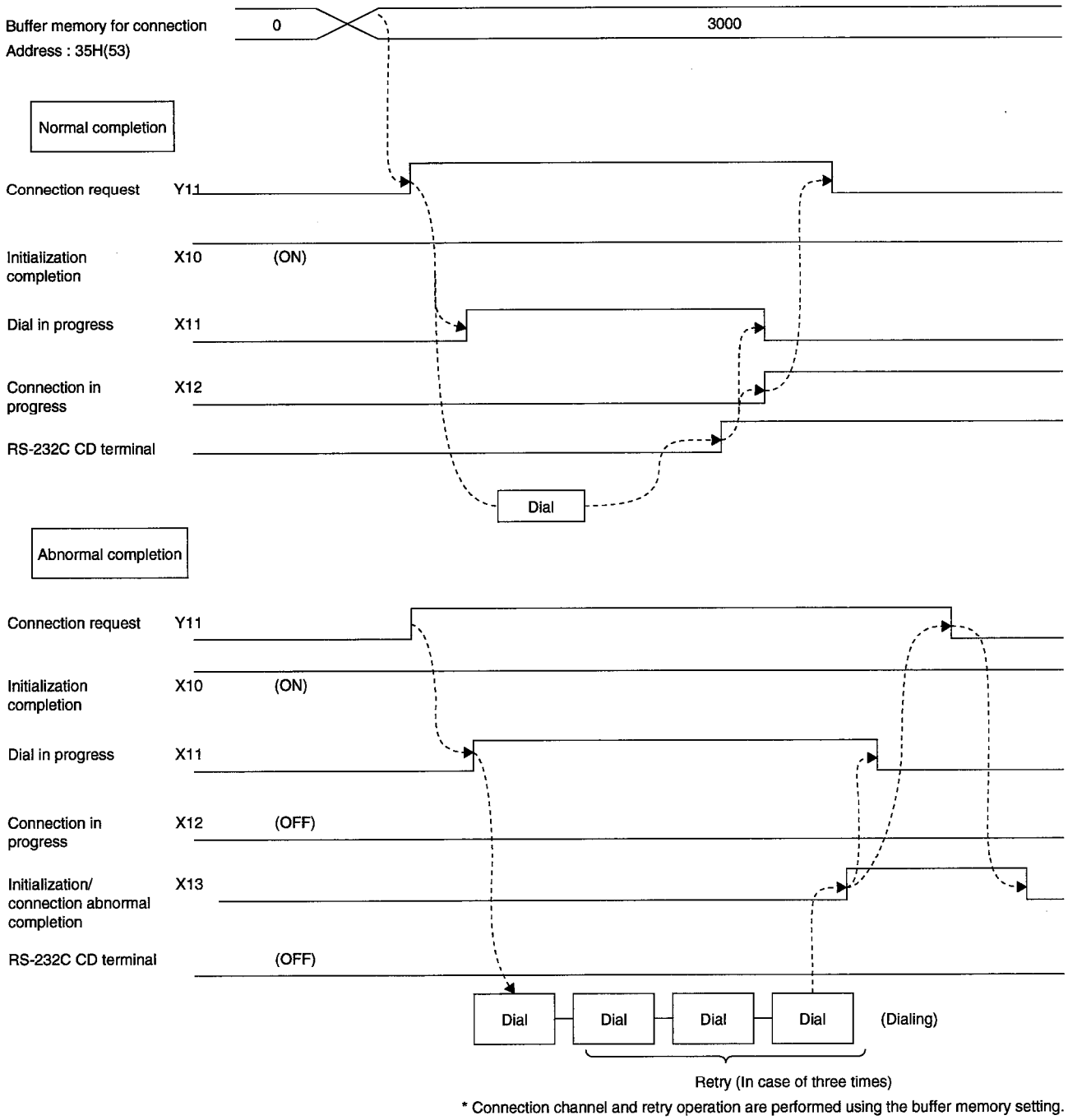
② When initiating line connection from the partner device

Since the line connection processing is not necessary on the QC24N side, the line connection buffer memory is not used.

3 I/O signals used in line connection

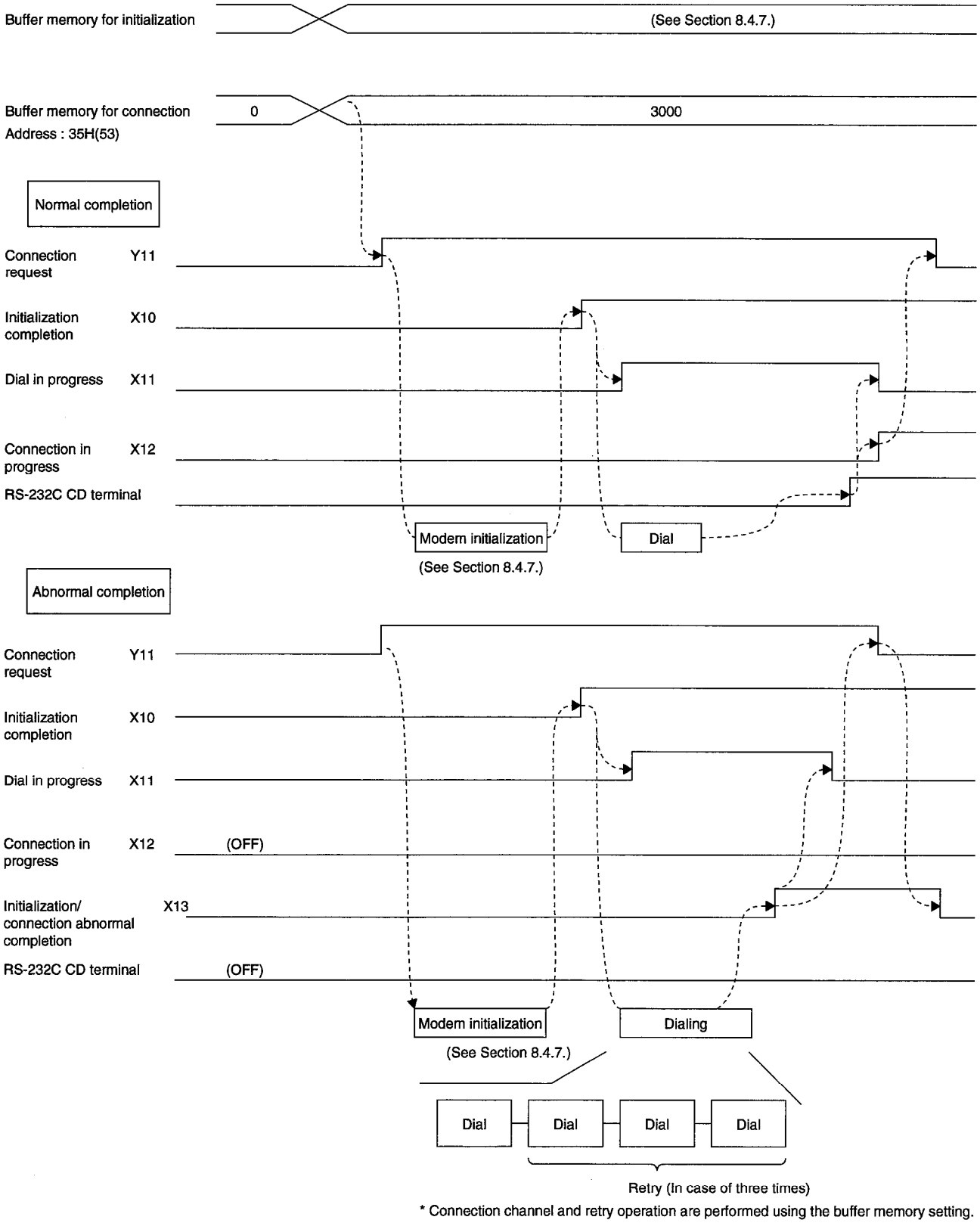
Connection request signal (Y11), dial in progress signal (X11), connection in progress signal (X12) and initialization/connection abnormal complete signal (X13) are used.

(Example 1) When performing the line connection from the QC24N side only following the completion of initialization



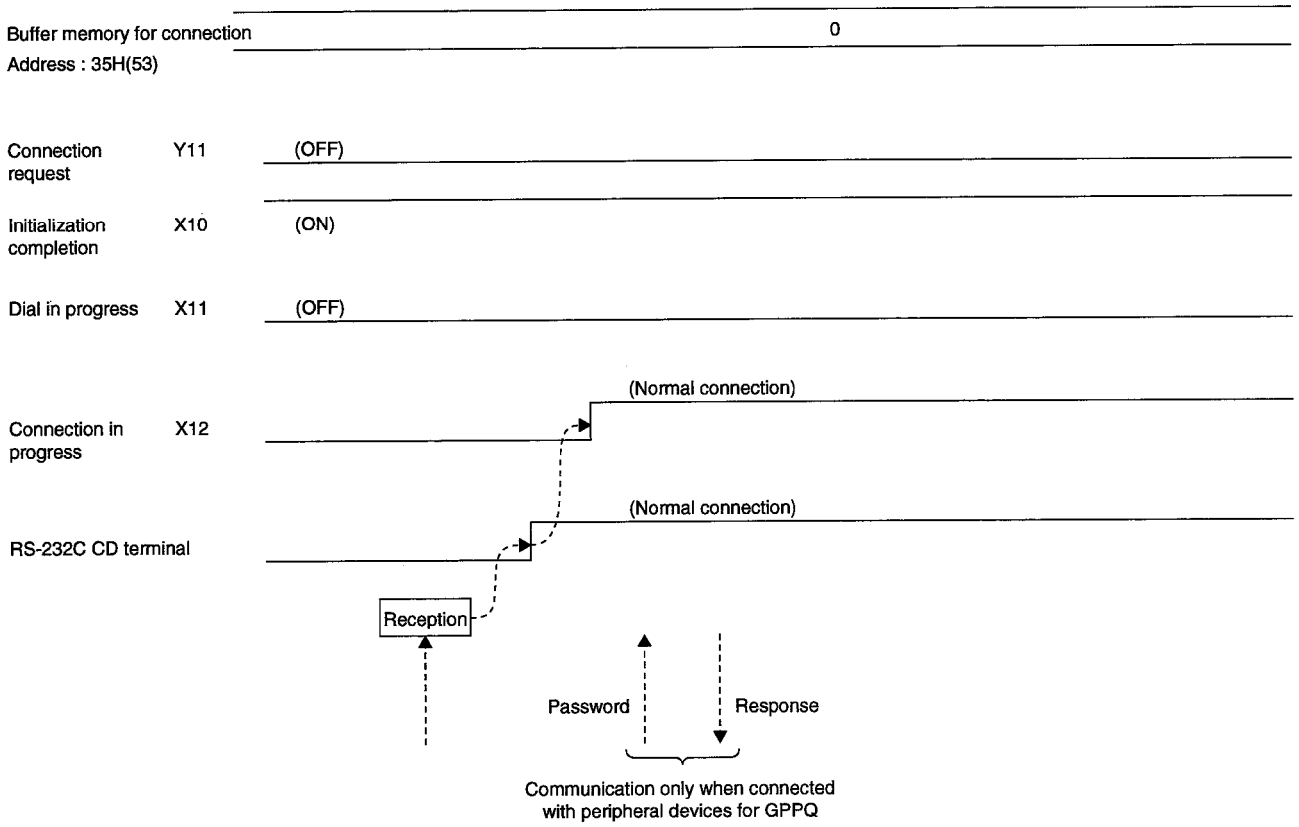
* Connection channel and retry operation are performed using the buffer memory setting.

(Example 2) When performing the initialization and the line connection from the QC24N side simultaneously



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

(Example 3) When initiating the line connection from the partner device after the completion of initialization



Point

(1) The connection channel on the QC24N side is set in the modem connection channel designation area (address : 2EH(46)) of the buffer memory.

(2) Abnormal processing when the partner device initiate the line connection is left entirely to the partner device.
There is no method on the QC24N side to check a line connection error occurrence at the partner device.

4 Precautions during the line connection

① During connection to the peripheral devices for GPPQ, the GPPQ side will consider the QnACPU station with QC24N installed as the PC CPU station (or connected) with Q6TEL installed.

When the password for Q6TEL is set on the GPPQ side, the Q6TEL password (*1) is first transmitted from the peripheral device for GPPQ upon completion of connection. However, because QC24N does not control the Q6TEL password, it can not determine whether or not it received the correct password.

The QC24N then returns a corresponding response, enabling data read/write and status control for the PC CPU thereafter.

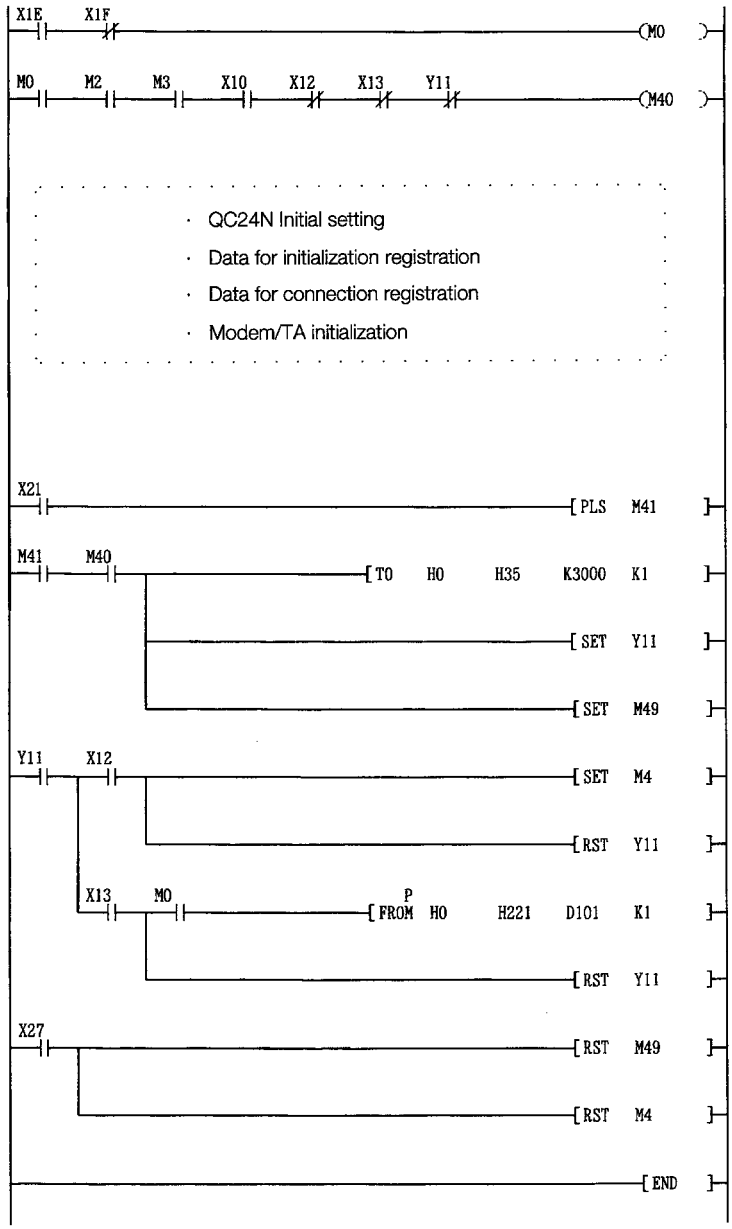
*1 The password is entered on the peripheral device for GPPQ side using the keyboard, prior to access, with character strings for PC access enabled/disabled through Q6TEL.

② Prior to data communication with external devices, determine when and which station will perform the line connection (dialing) and line disconnection processing to the partner device.

5 Line connection program example

An example of a line connection program is shown below.

• Example of initiating line connection from the QC24N side following the initialization completion



X10: Initialization complete signal

X1E: QC24N ready signal

X1F: WDT error signal

M0: QC24N accessible flag

M2: Data registration complete flag for connection

See Section 8.4.6

M3: Initialization complete flag

M40: Connectable flag

See Section 8.4.4.

See Section 8.4.5.

See Section 8.4.6.

See Section 8.4.7.

Convert the line connection command into pulse

Line connection

· Set the data number for connection

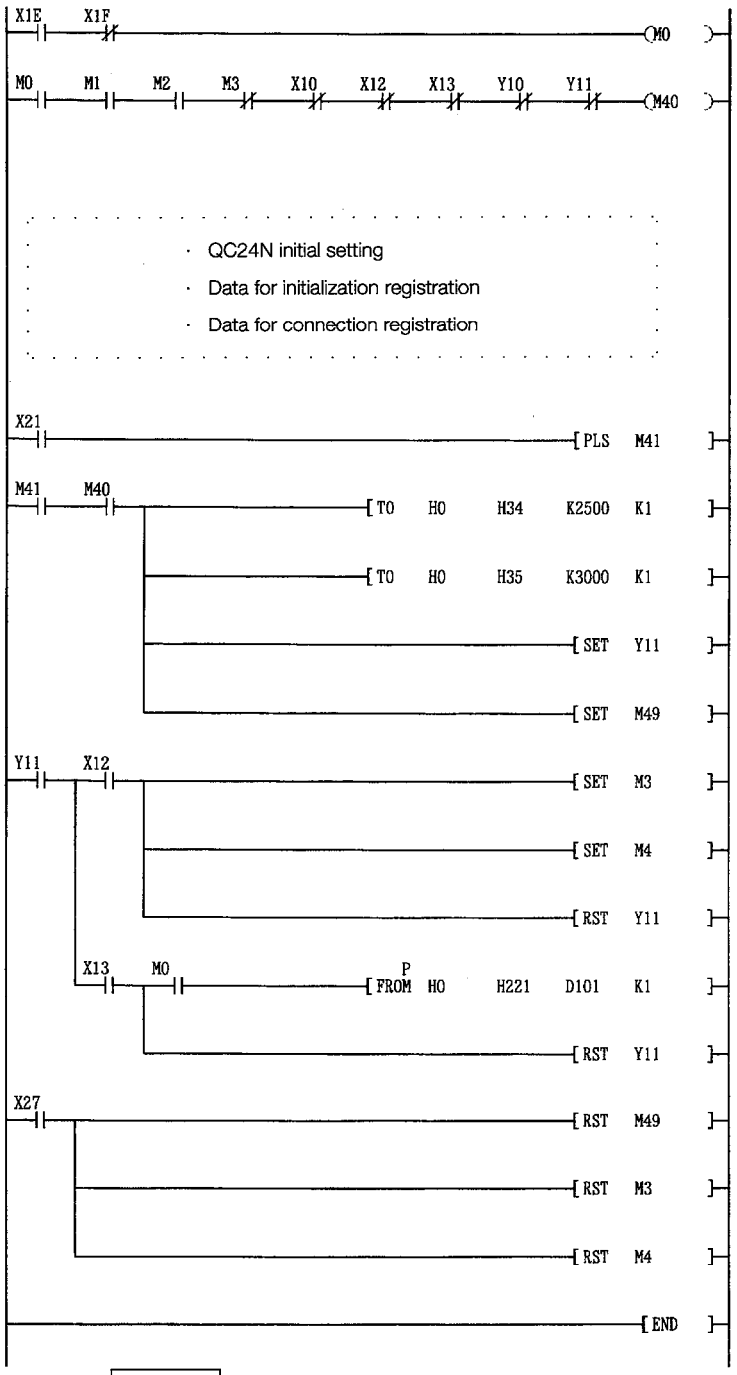
· Connection request signal is turned ON

· When the connection in progress signal ON (normal completion), the connection complete flag is turned ON and the request signal is turned OFF

· When the abnormal completion signal ON, the error code is read and the request signal is turned OFF

When the clear command of the flag, the connection request and the complete flag are turned OFF

• Example of simultaneous execution of initialization and line connection from the QC24N side



X10: Initialization complete signal
X12: Connection in progress signal
X1E: QC24N ready signal
X1F: WDT error signal
M0: QC24N accessible flag
M1: Data registration complete flag for initialization
M2: Data registration complete flag for connection
See Section 8.4.6
M3: Initialization complete flag
M40: Connectable flag
See Section 8.4.4.
See Section 8.4.5.
See Section 8.4.6.

Convert the line connection command into pulse

Initialization and line connection for modem/TA
· Set the data number for initialization
· Set the data number for connection
· Connection request signal is turned ON

· When the connection in progress signal ON (normal completion), the initialization complete flag and connection complete flag are turned ON and the request signal is turned OFF.

· When the abnormal complete signal ON, the error code is read and the request signal is turned OFF.

When the clear command of the flag, the connection request and the complete flag are turned OFF

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 (X12) turns ON after the completion of QC24N modem/TA initialization.

For an example of the modem/TA program for initialization, see Section 8.4.7.

8.4.9 Data communication and notification

This section explains the cautions for data communication with the partner device using QC24N modem function and procedures for notification to pager receivers/cellular phones/PHS.

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 QC24N side.

After line connection, data communication can be performed using a dedicated protocol/non-procedure protocol/bidirectional protocol in full-duplex communication.

① When initiating the line connection from the QC24N side

Processing up to line connection as shown in Section 8.4.8

② When the line connection is initiated from the partner device

Processing up to the initialization of the modem/TA as shown in Section 8.4.7.

(b) When notifying to pager receivers/cellular phones/PHS

Perform processing up to the initialization of the modem/TA as shown in Section 8.4.7.

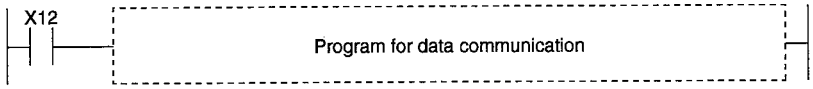
* In notification to pager receiver/cellular phones/PHS, since the line connection is performed during notification processing, line connection processing is unnecessary. However, be sure to register data for connection.

2 Buffer memory used and I/O signals

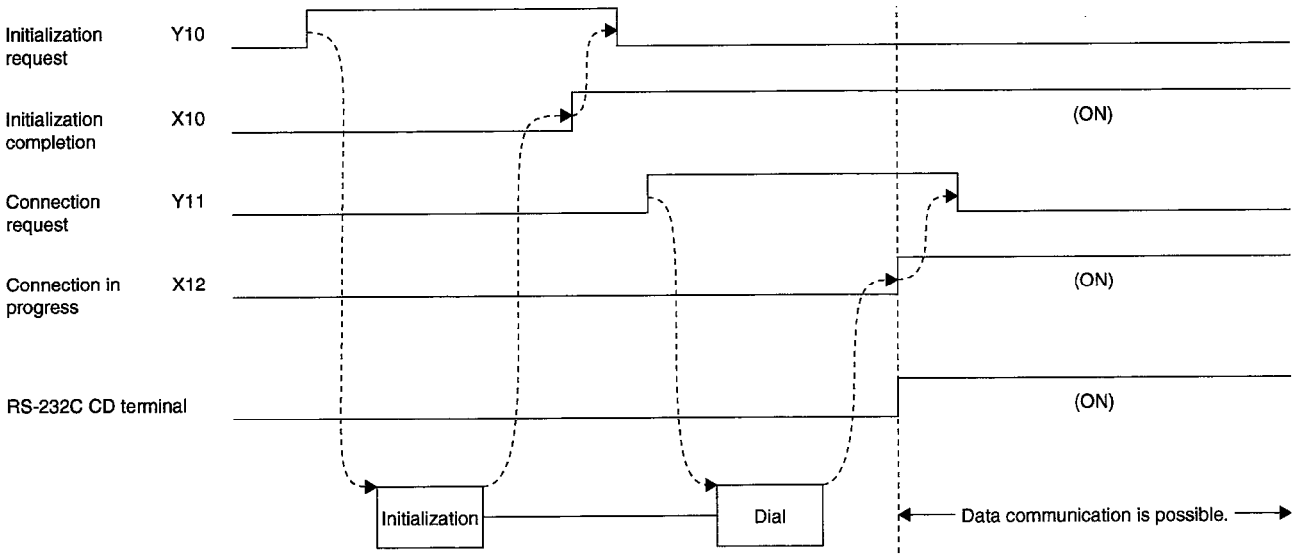
(a) When communicating data with the partner device

Only buffer memory and I/O signals the user uses for data communication (dedicated protocol/non-procedure protocol/bidirectional protocol).

Communicate data using the connection in progress signal (X12) ON as the interlock signal.

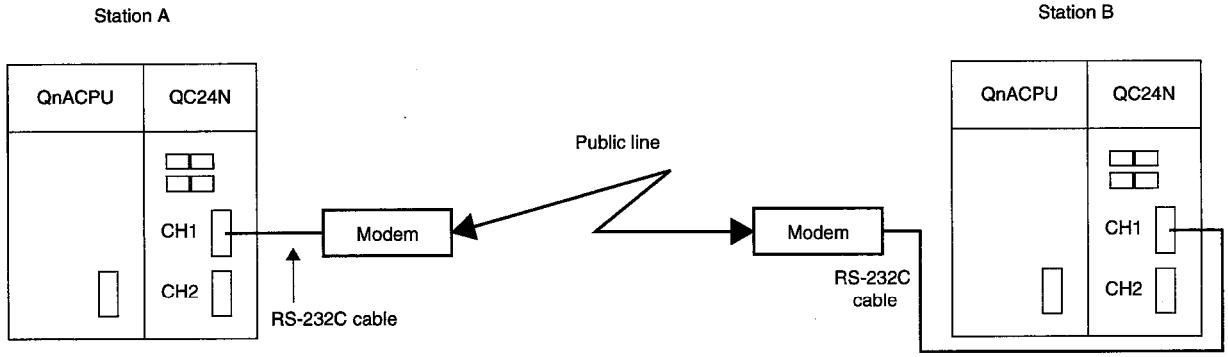


There is no I/O signal or buffer memory for modem functions used in data communication.



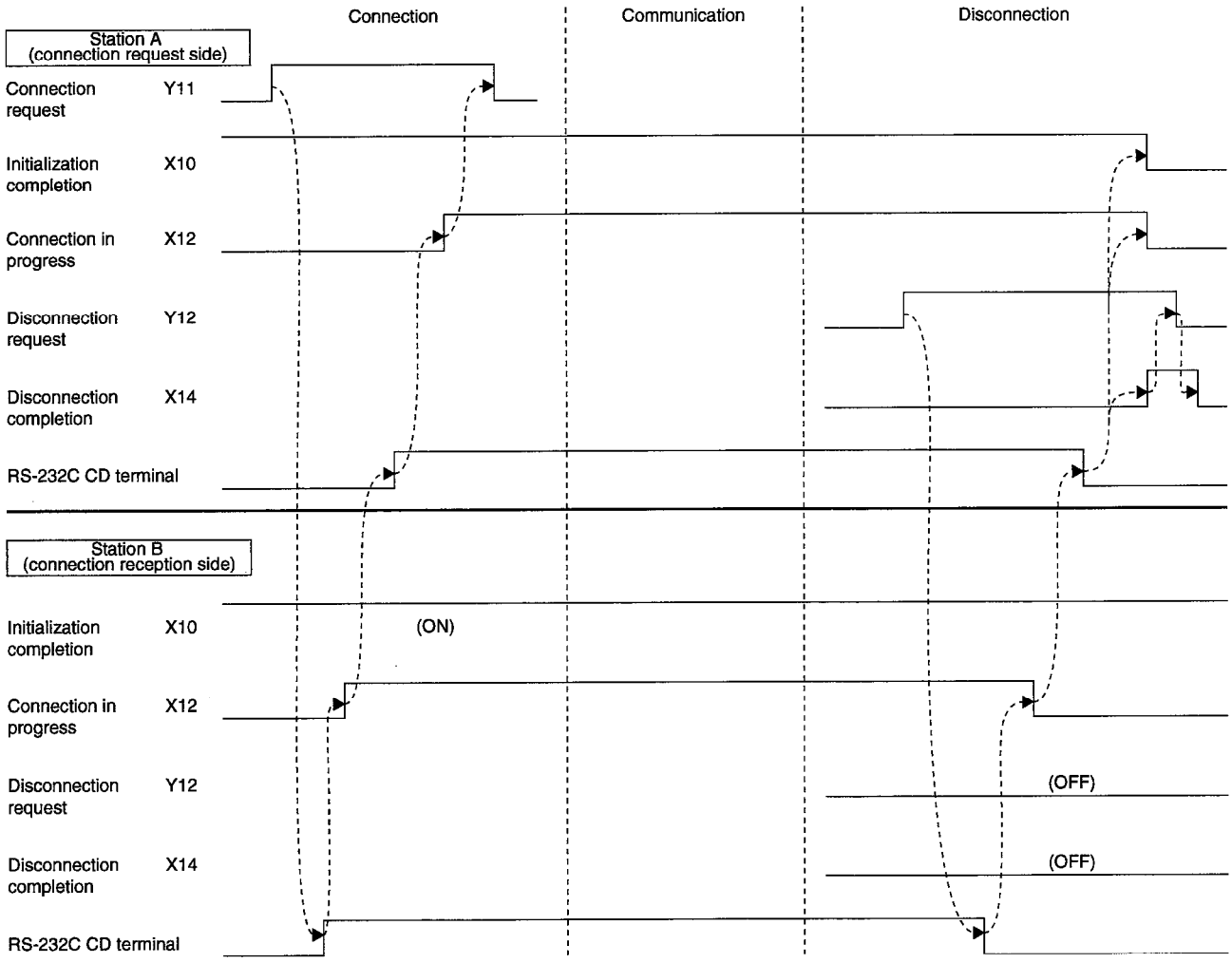
Remark

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 PC CPU with QC24N installed.



(General Procedure)

① Perform initial setting for QC24N 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 B.
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/cellular phone/PHS

Use the data number designation area for connection.

① Buffer memory

Designate the data number designation area for connection (address : 35H(53)) to designate the following data for connection registration number.

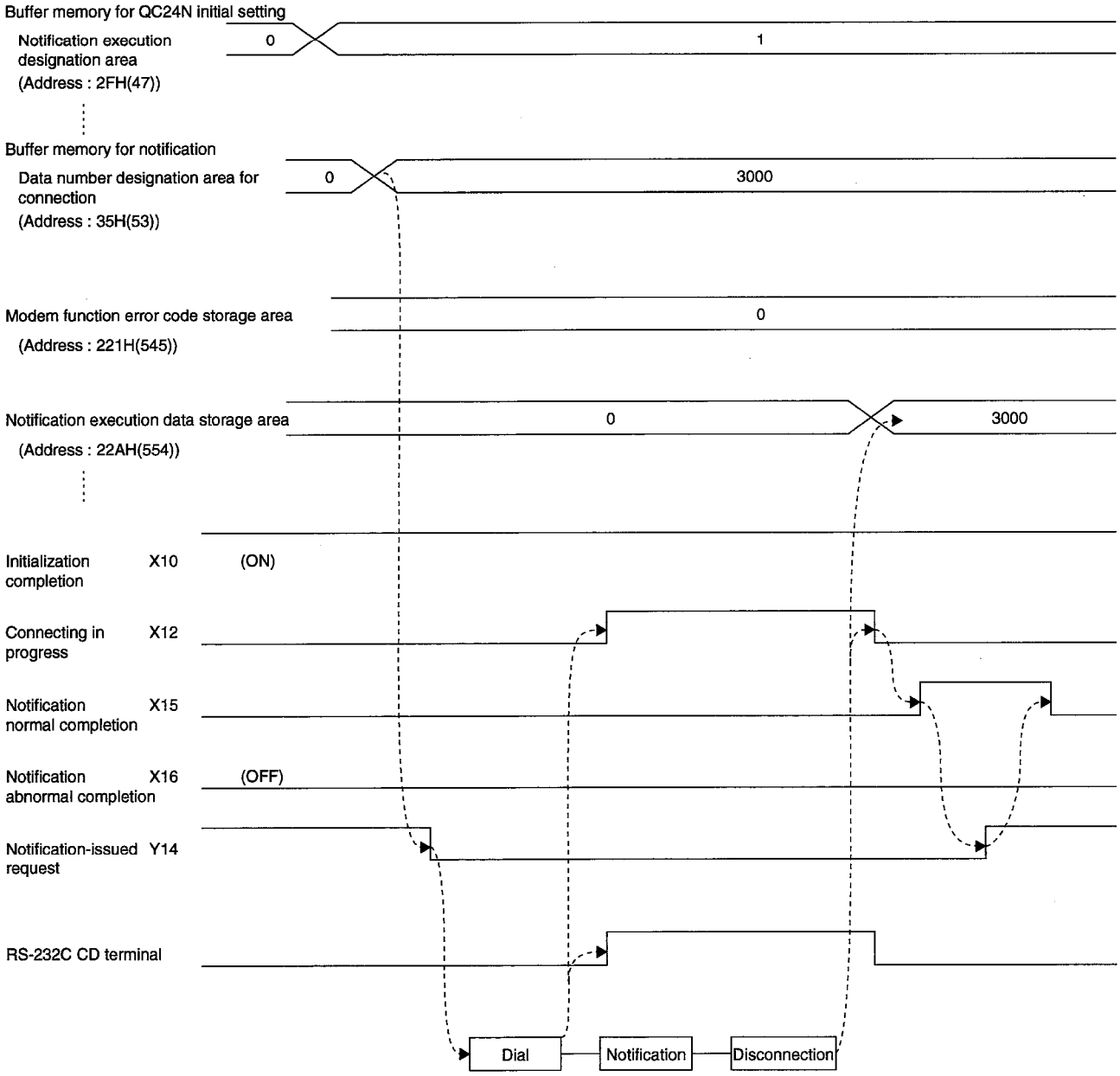
BB8H to BD5H (3000 to 3029) : Data registered to the EEPROM by the user

8001H to 801FH (-32767 to -32737) : Data registered to the buffer memory by the user

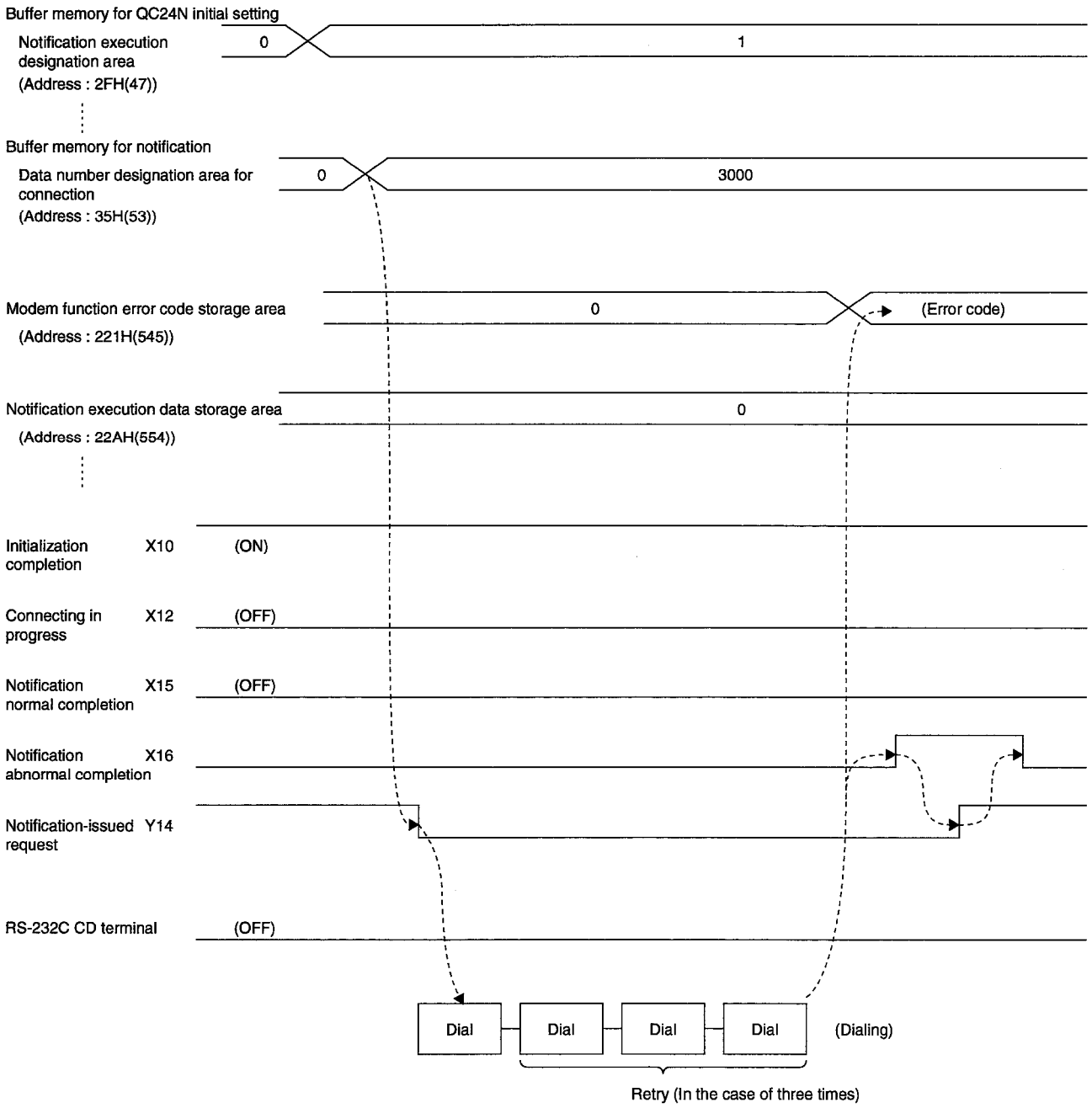
② I/O signal

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 time out (address : 30H to 32H) set in the buffer memory.

3 Precautions for performing data communication and notification

(a) When communicating data with the partner device

① When setting the no-communication interval time (set for address 37H) to infinite wait (set value=0) in the initial setting of QC24N, 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 PC CPU with QC24N installed.

③ The QC24N automatically performs line disconnection processing if no data exchange is performed during the no-communication interval time (specified in address 37H).

(The "connection in progress signals" (X12) and initialization complete signals (X10) turn off.)

(b) When notifying to pager receivers/cellular phone/PHS

① Turn on the notification-issued request signal (Y14) before the QC24N 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 PC CPU of the station with QC24N installed is in stop status, or the PC 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 buffer memory (address : 35H) before the PC CPU turns to a stop status.

③ When the notification-issued request signal (Y14) is turned OFF from ON before initialization of the QC24N modem/TA, the processing will end abnormally.

④ When the notification-issued request signal (Y14) is turned OFF from ON during initialization of the QC24N 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 QC24N 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.

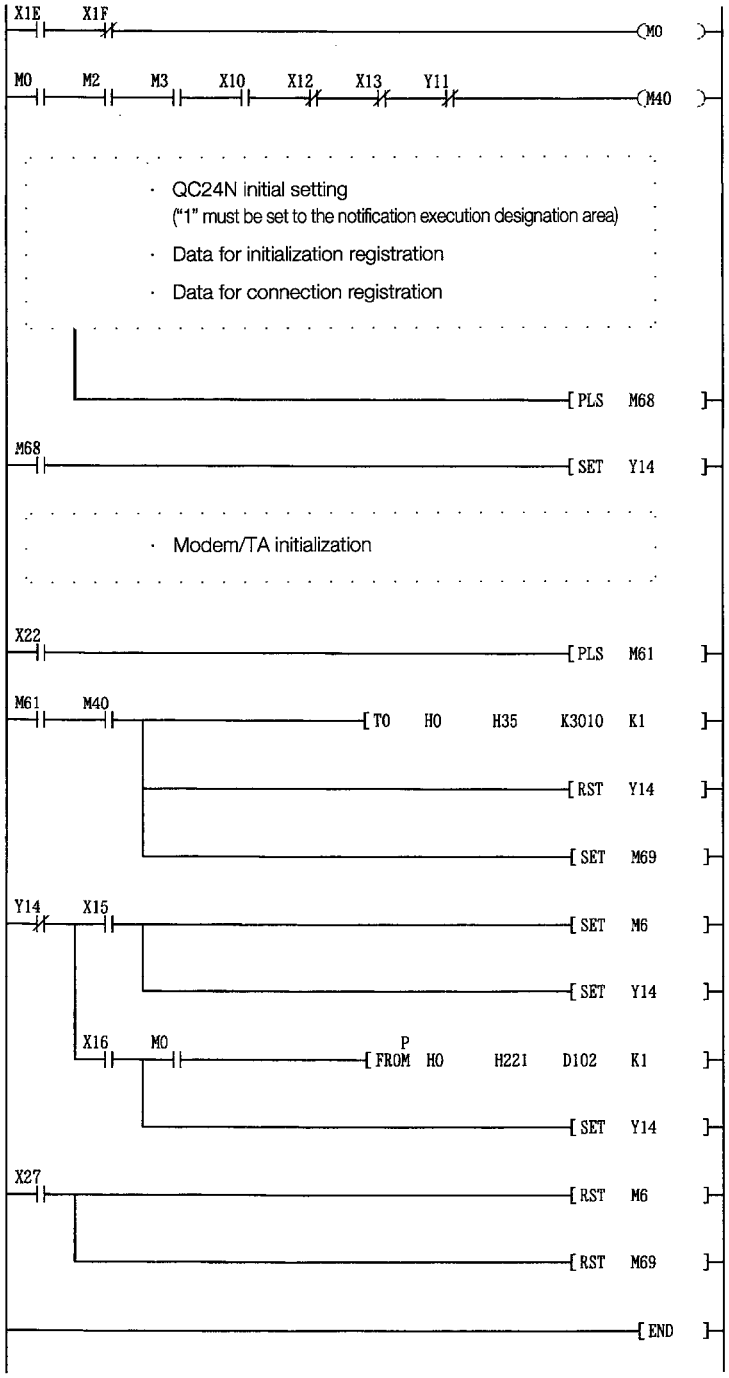
⑥ When the notification-issued request signal (Y14=ON) is turned ON before notification processing is complete, some messages may not be sent.

Point

Turn on the notification-issued request signal (Y14) before the initialization processing of the QC24N modem/TA is completed, and turn it off after the initialization complete signal (X10) is turned ON.

4 Program for notification example

An example of program for notification is shown below.



X10: Initialization complete signal

X12: Connection in progress signal

X1E: QC24N ready signal

X1F: WDT error signal

M0: QC24N accessible flag

M2: Data registration complete flag for connection

See Section 8.4.6

M3: Initialization complete flag

M40: Connectable flag

See Section 8.4.4.

See Section 8.4.5.

See Section 8.4.6.

Notification-issued request signal is turned ON (only 1 time)

See Section 8.4.7.

Convert the notification command into pulse

Notification processing

- Set the data number for connection (for notification)
- Notification-issued request signal is turned OFF

- When the notification normal complete signal ON, the notification complete flag is turned ON and the notification-issued request signal is turned ON
- When the notification abnormal complete signal ON, the error code is read and the notification-issued request signal is turned ON

When the clear command of the flag, the notification request and the complete flag are turned OFF

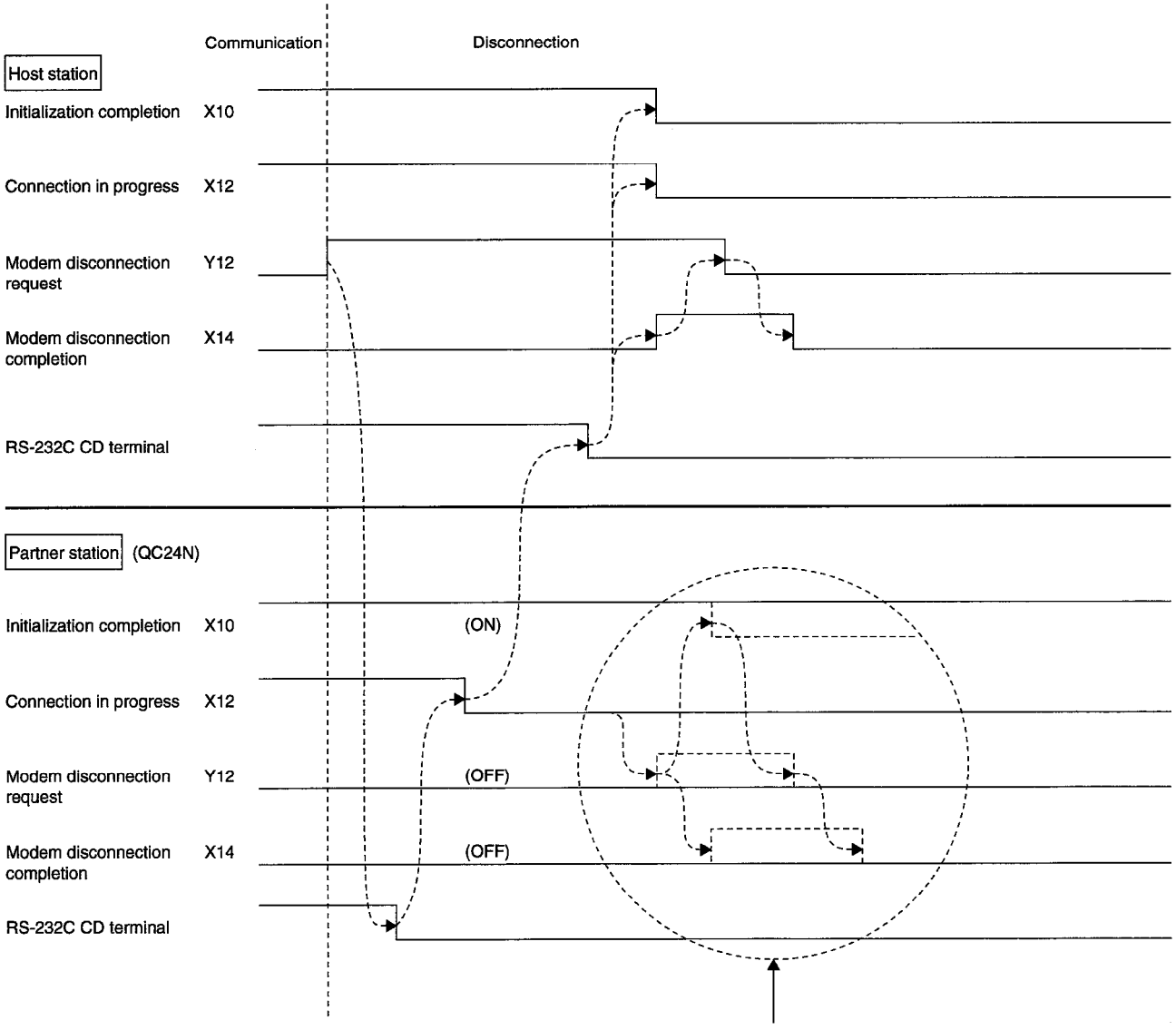
8.4.10 Line disconnection

This section explains the line disconnection upon communication completion when communicating data with the partner device using the QC24N modem functions.

In case of notification to pager receivers/cellular phones/PHS, 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 QC24N, when the line is disconnected from the partner 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 partner device as well as the connection with the local station's QC24N 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 partner device

Remark

There is no buffer memory for line disconnection processing.

2 Precautions during the line disconnection

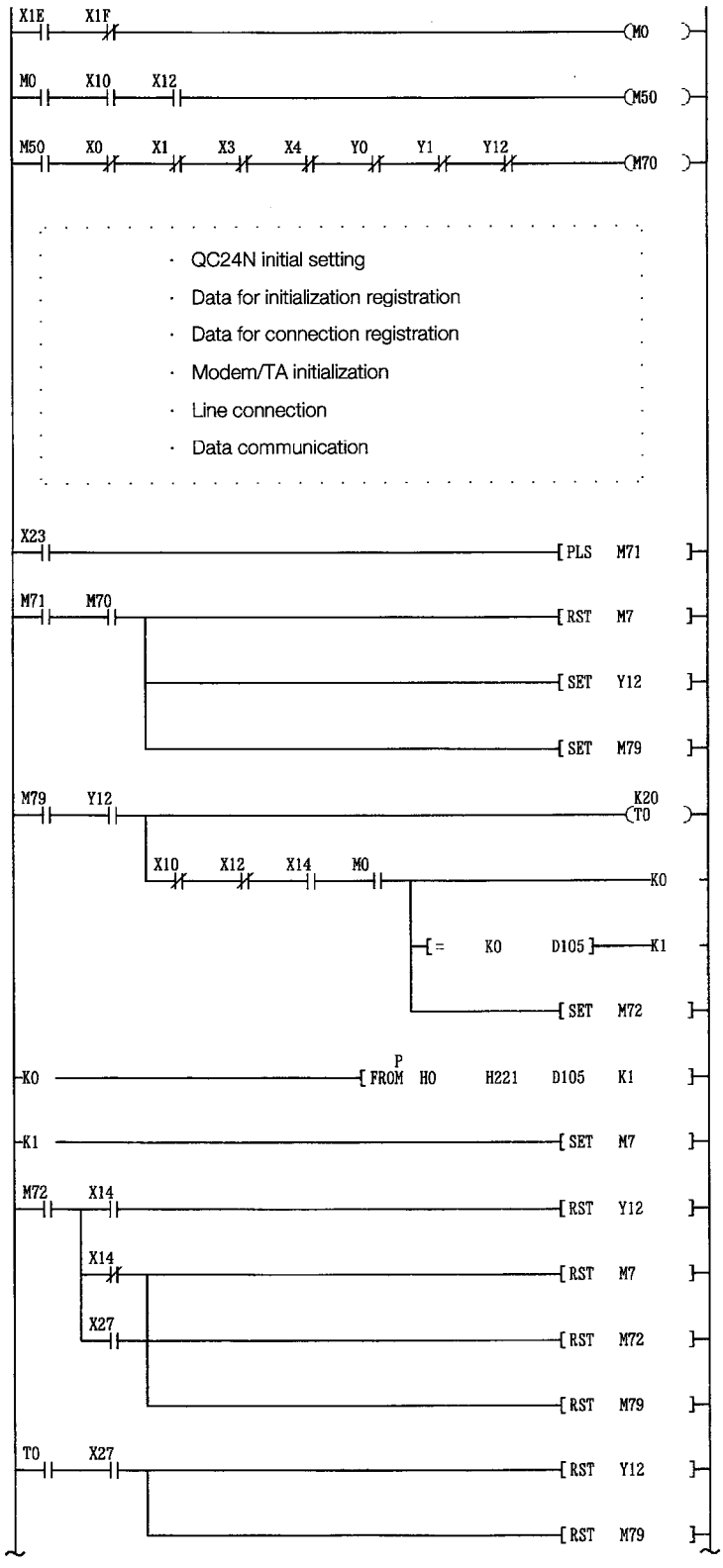
① Prior to data communication with external devices, determine when and which station will perform the line connection (dialing) and line disconnection processing to the partner device.

② If the line is disconnected during data transmission, transmission processing will be performed depending on the signal status of the local station's QC24N 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 for line disconnection example

An example of a program for line disconnection is shown below.



X0: Transmission normal complete signal
X1: Transmission abnormal complete signal
X3: Reception data read request signal
X4: Reception abnormal detection signal
X10: Initialization complete signal
X12: Connection in progress signal
X1E: QC24N ready signal
X1F: WDT error signal
Y0: Transmission request signal
Y1: Reception data read complete signal
M0: QC24N accessible flag
M50: Data exchangeable flag
M70: Line disconnection enabled flag

See Section 8.4.4.

See Section 8.4.5.

See Section 8.4.6.

See Section 8.4.7.

See Section 8.4.8.

See Section 8.4.9.

Convert the line disconnection command into pulse

Line disconnection processing
(Line disconnection from host station)

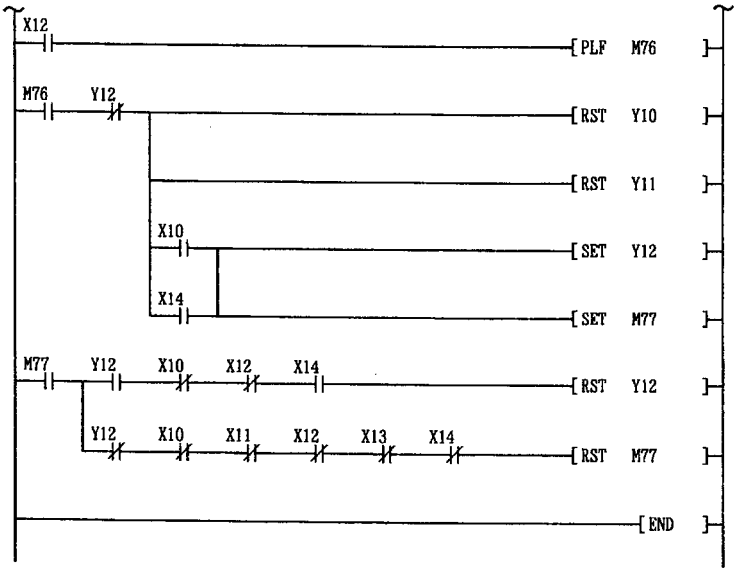
- Modem disconnection request signal is turned ON

- When the modem disconnection complete signal ON, the error code is read
- When the normal completion, the line disconnection complete flag is turned ON

- Modem disconnection request signal is turned OFF

- When the clear command of the flag, the line disconnection request and the complete flag are turned OFF

- When the line disconnection processing time out occurrence, the request signal is forcefully turned OFF



Line disconnection processing
(Line disconnection from partner side)

- Various request signal are turned OFF
- When any complete signal/connection in progress signal ON, the modem disconnection request signal is turned ON
- When the modem disconnection complete signal ON, the request signal is turned OFF
- When the modem disconnection complete signal OFF, the processing is end

8.5 Error Code List

The following table shows the error codes, description and corrective actions for errors (including errors at the abnormal completion) that may occur while the QC24N modem function is used.

The error codes for the modem function are stored in the modem function error code storage area (address : 221H(545)) of the buffer memory.

Error code (hex)	Error item	Error description	Corresponding LED	Corrective action	Reference section
3E8H to 3FFFH	—	(Error detected by the CPU)	—	See the troubleshooting section of the User's Manual of the CPU and take a corrective action.	—
7153H	Frame length error	The received message length has exceeded the allowable range.	CHn. ERR	• Review the transmission message. • Correct the message format so the number of access points is within the allowable range.	—
7F25H	Data length error	The received "data length" has exceeded the receive area size.		• Correct the "data length" to be transmitted from the external device side. • Change the "word/byte unit" setting set by the QC24(N) to byte unit. • Increase the QC24(N)'s reception area.	—
7F6BH	CD signal control error	When it is set to "perform CD terminal check," data was received while the CD signal is OFF.		• Review the CD signal control on the external device side. (Send while the CD signal is ON.) • Perform a communication after setting "do not perform CD terminal check."	—
7F6CH	Transmission error	Cannot transmit because the line is disconnected.		• First perform line connection processing of the interface that uses the modem function, then start transmission.	—
7FD0H	Modem function error	There is an error in the designation of the notification execution.		Set 0 to 1 to the notification execution designation.	Section 8.3.4
7FD1H		There is an error in the designation of the number of connection retries.		Set the number of connection retries in the range of 1 to 5.	
7FD2H		There is an error in the designation of the connection retry interval.		Set the connection retry interval in the range of 90 to 300 seconds.	
7FD3H		There is an error in the initialization/ connection time out designation.		Set the initialization/connection time out in the range of 1 to 60 seconds.	
7FD4H		There is an error in the designation of the number of initialization retries.		Set the number of initialization retries in the range of 1 to 5.	
7FD5H		There is an error in the designation of the data number for initialization.		Designate the registered data number for initialization, or set 0.	Section 8.3.4 Section 8.4.7
7FD6H		There is an error in the data for connection designated by the data number for connection.		Recheck the pager receiver designation.	Section 8.4.6
7FD7H				Recheck the dialing number of the external line.	
7FD8H				Recheck the telephone number designation.	
7FD9H		The line to the destination is being connected.		Connect the line or notify when the line to the destination is not connected.	Section 8.4.8 Section 8.4.9
7FDAH		There is an error in the designation of the data number for connection.		Designate a registered number for the data for connection.	Section 8.3.4 Section 8.4.8
7FDBH		There is an error in the designation of the Q6TEL connection.		Set 0 to 1 to the Q6TEL connection designation.	Section 8.3.4
7FDCH		There is an error in the data for connection designated by the data number for connection.		Recheck the waiting time for the notification-message part of the message transmission.	Section 8.4.6

Error code (hex)	Error item	Error description	Corresponding LED	Corrective action	Reference section
7FDDH	Modem function error	A connection time out error occurred.	CHn. ERR	• Recheck the telephone number in the data for connection. • Check if the destination is ready for a connection. • Recheck the set value of the connection time out. • Recheck the initialization command.	Section 8.3.4 Section 8.4.5 Section 8.4.6
7FDEH		Connection to the modem/TA was unsuccessful, or the modem is not connected.		• Check if there is any problem with the modem/TA by seeing the operation manual of the modem/TA. • Connect the modem/TA to the QC24N. • Check the connection cable by seeing the operation manual of the modem/TA.	Section 8.2
7FDFH		Modem connection channel number is not designated.	—	Set 1 to 2 to the modem connection channel designation.	Section 8.3.4
7FE0H		Designated modem connection channel number is incorrect.			
7FE1H		There is an error in the designation of the user registration frame number.	CHn. ERR	• Recheck the user registration frame number. • Designate the registered user registration frame number. • Register the designated data for initialization.	Section 8.4.5 Section 8.4.6 Section 8.4.7
		There is an error in the designation of the output head pointer.		• Designate the output head pointer in the range of 1 to 100. • Designate the position (n-th position) where the data for initialization number is designated. • Designate the data for initialization number at the designated position (n-th position).	Section 8.4.7
7FE2H		There is an error in the designation of the output frame number.		Designate a registered data for initialization number within the range of the designated number of outputs from the location of the output head pointer.	Section 8.4.7
7FE3H		There is an error in the designation of the number of registered data bytes.		• Designate the data for initialization in the range of 1 to 78. • Designate 80 for the data for connection.	Section 8.4.5 Section 8.4.6
7FE4H		There is an error in the data for connection.		Recheck the message length of the message for notification.	Section 8.4.6
7FE5H		There is an error in the designation of the no-communication interval time.		Designate the no-communication interval time in the range of 0 to 120.	Section 8.3.4

* If an error occurs while performing data exchange using the modem function described in Chapter 8, first check the following items and confirm whether or not the error is caused by the modem/TA connection.

If an error relating to the modem function is occurring, perform necessary corrective actions for each cause according to the reference sections given below:

- Check the ON/OFF status of current I/O signals of QC24N. (See Section 8.3.3.)
- Check the storage status for error codes related to the modem function. (See Sections 8.3.4 and 8.5.)
- Check the ON/OFF status of the DR terminal of the modem/TA. (See Section 8.3.2 and the manual for the modem/TA.)

8.6 Sample Programs

This section shows sample programs to test the connection with the remote station's PC CPU to which QC24N is installed.

Each program contains a minimum set of processing necessary for performing a communication 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 Chapter 8 in this manual,.

In these sample programs, the data for initialization and data for connection are registered to the buffer memory (not in the EEPROM).

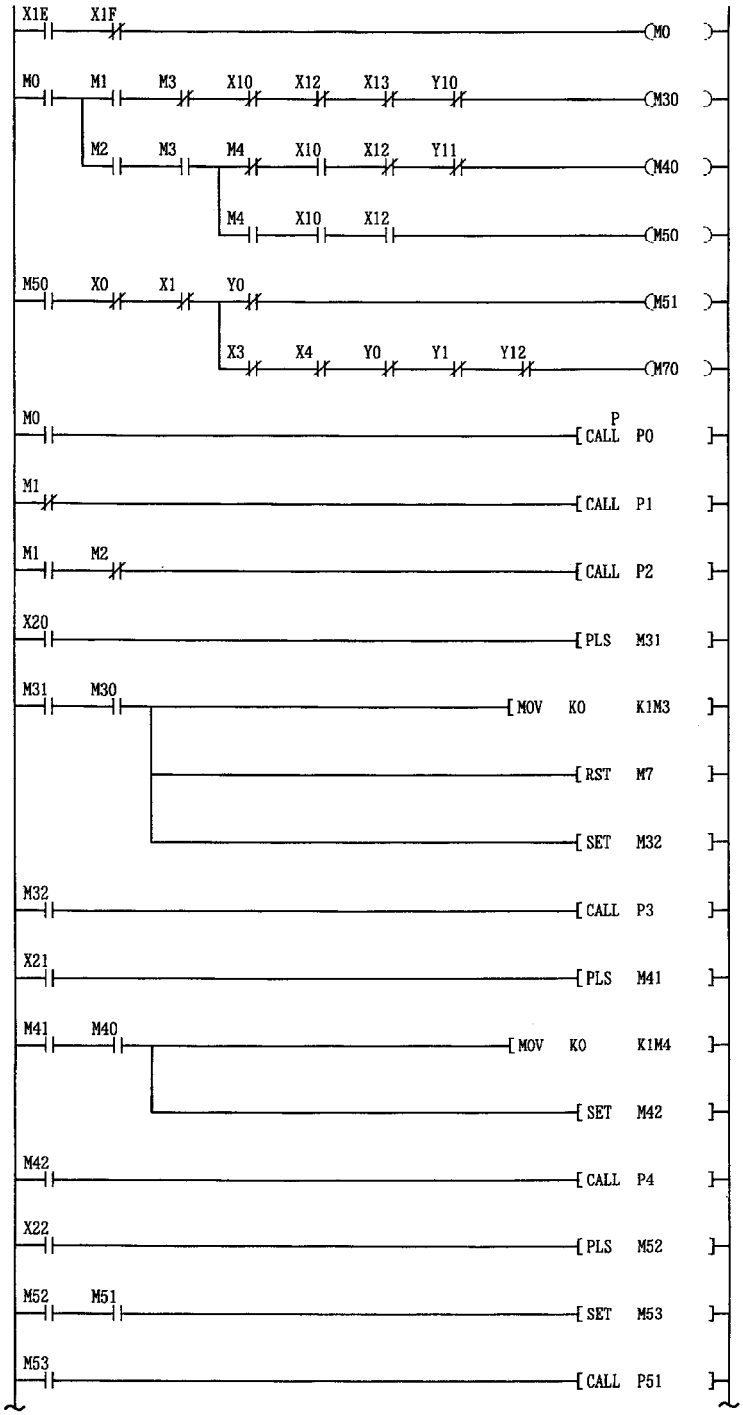
The uses of major devices that are used in these sample programs are listed below.

Application of device (comment list)					
Device	**Application**	**Device**	**Application**	**Device**	**Application**
X0	Transmission normal completion	Y61	Initialization data registration completion	M100	Initialization request execution
X1	Transmission abnormal completion	Y62	Data registration completion for connection	M101	Connection request execution Notification execution
X2	Transmission processing in progress	Y63	Initialization completion	M102	Transmission request execution
X3	Reception data read request	Y64	Line connection completion	M103	Reception data read execution
X4	Reception abnormal detection	Y66	Notification completion		
X10	Initialization completion	Y67	Line disconnection completion	SM400	Always ON
X11	Dialing				
X12	Connection in progress	M0	QC24N accessible	D0	Number of registration data bytes
X13	Initialization/connection abnormal completion	M1	Initialization data registration completion	D1	Control number designation Receiver designation
X14	Modem disconnection completion	M2	Data registration completion for connection	D2	Initialization command/telephone number
X15	Notification normal completion	M3	Initialization completion	D11	External line dialing number, etc.
X16	Notification abnormal completion	M4	Line connection completion	D12	Line type, etc.
X1E	QC24N ready	M6	Notification completion	D23	Message transmission waiting time
X1F	WDT error	M7	Line disconnection completion	D24	Message
X20	Initialization command	M10	Convert the registration command into pulse	D39	Message length
X21	Line connection command	M20	Convert the registration command into pulse	D50	Number of transmission data
X22	Data communication command	M30	Initialization enabled	D51	Transmission data
X23	Line disconnection command	M31	Convert the initialization command into pulse	D60	Number of reception data
X24	Notification command	M40	Connectable	D61	Reception data
		M41	Convert the connection command into pulse	D100	Initialization error code
Y0	Transmission request	M50	Data communication is possible	D101	Line connection error code
Y1	Reception data read completion	M51	Transmission enabled	D102	Notification error code
Y10	Initialization request	M52	Convert the transmission command into pulse	D103	Data transmission error code
Y11	Connection request	M60	Convert the notification command into pulse	D104	Data reception error code
Y12	Modem disconnection request	M70	Line disconnection enabled	D105	Line disconnection error code
Y14	Notification-issued request	M71	Convert the line disconnection command into pulse		
Y60	QC24N accessible	M80	Line disconnection (request) occurrence		

8.6.1 Sample program for data communication

1 Sample program on the connection request station side

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



Accessible flag to QC24N 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 is turned ON

Line disconnection enabled flag with the partner station is turned ON

To the QC24N initial setting processing subroutine

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 turned OFF

To the modem initialization processing subroutine

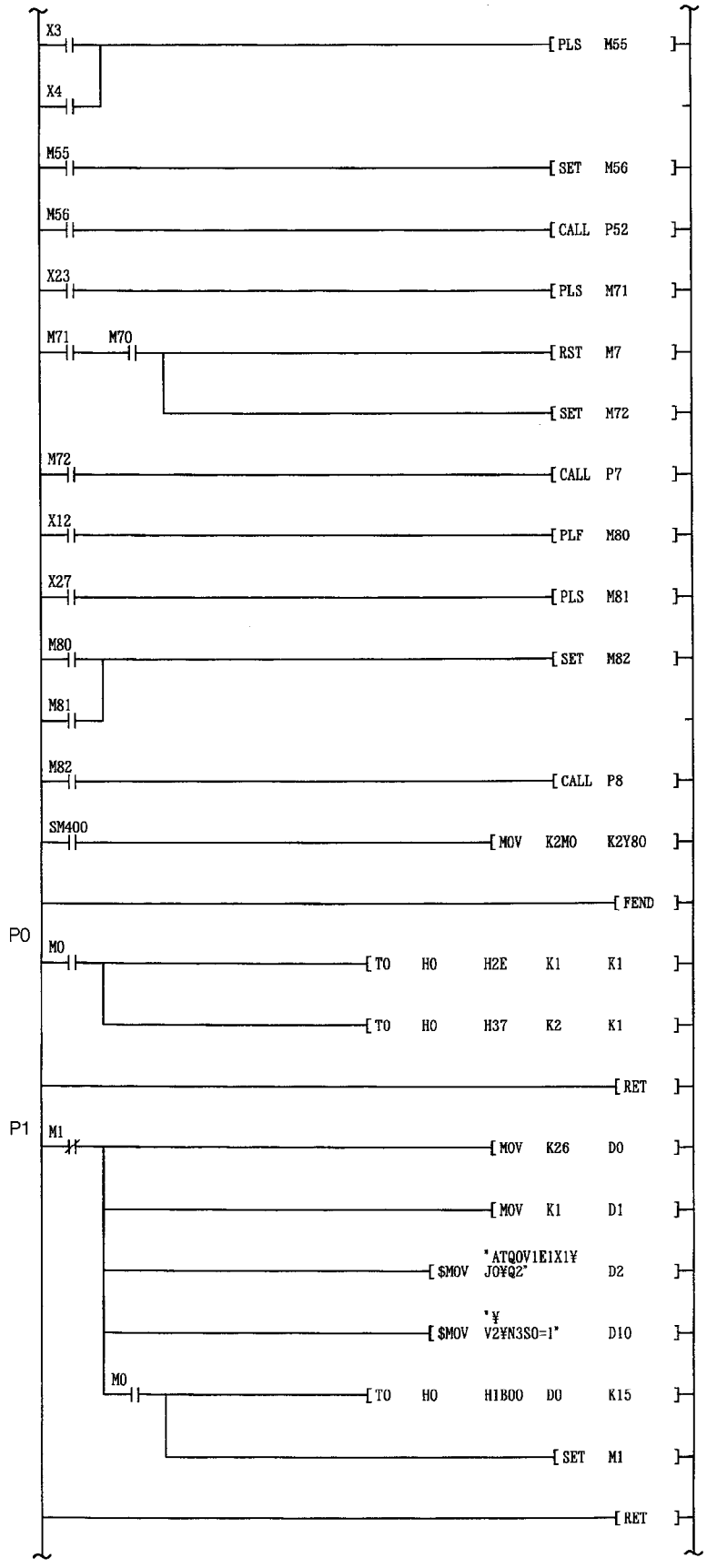
Convert the line connection command into pulse

Various complete flags after the line connection processing into pulse

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 host station)
Line disconnection complete flag is turned OFF

To the line disconnection processing subroutine

Convert the connection in progress signal OFF into pulse
(Line disconnection from partner side)

Convert the OFF command of various request signal into pulse

To the various request signal and the complete signal OFF subroutine

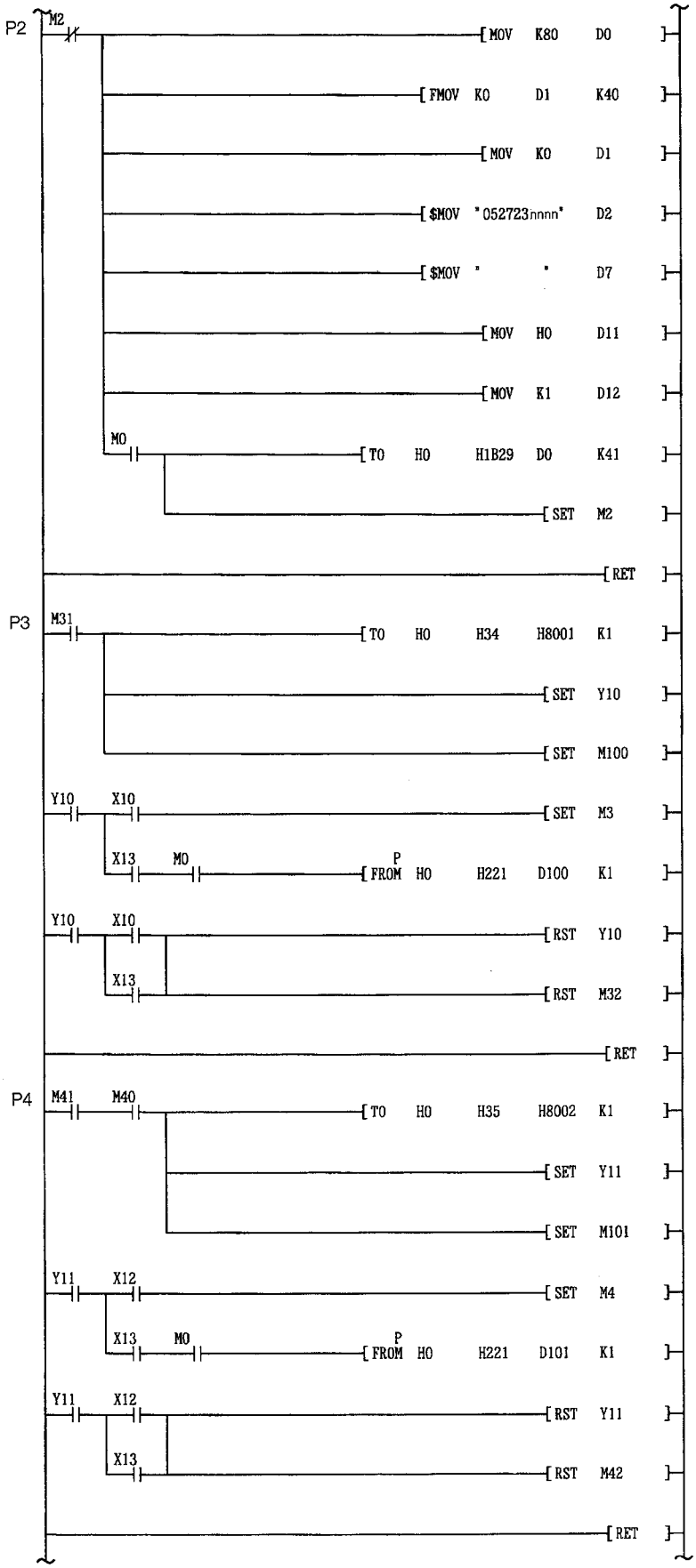
Output the various complete flag status (LED display)

Initial setting processing subroutine

- Set the modem connection channel number
- Set the no-communication interval time (2 minutes)

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
  (Registration to buffer memory)
- Data registration complete flag for initialization is turned ON



Data registration processing for connection subroutine

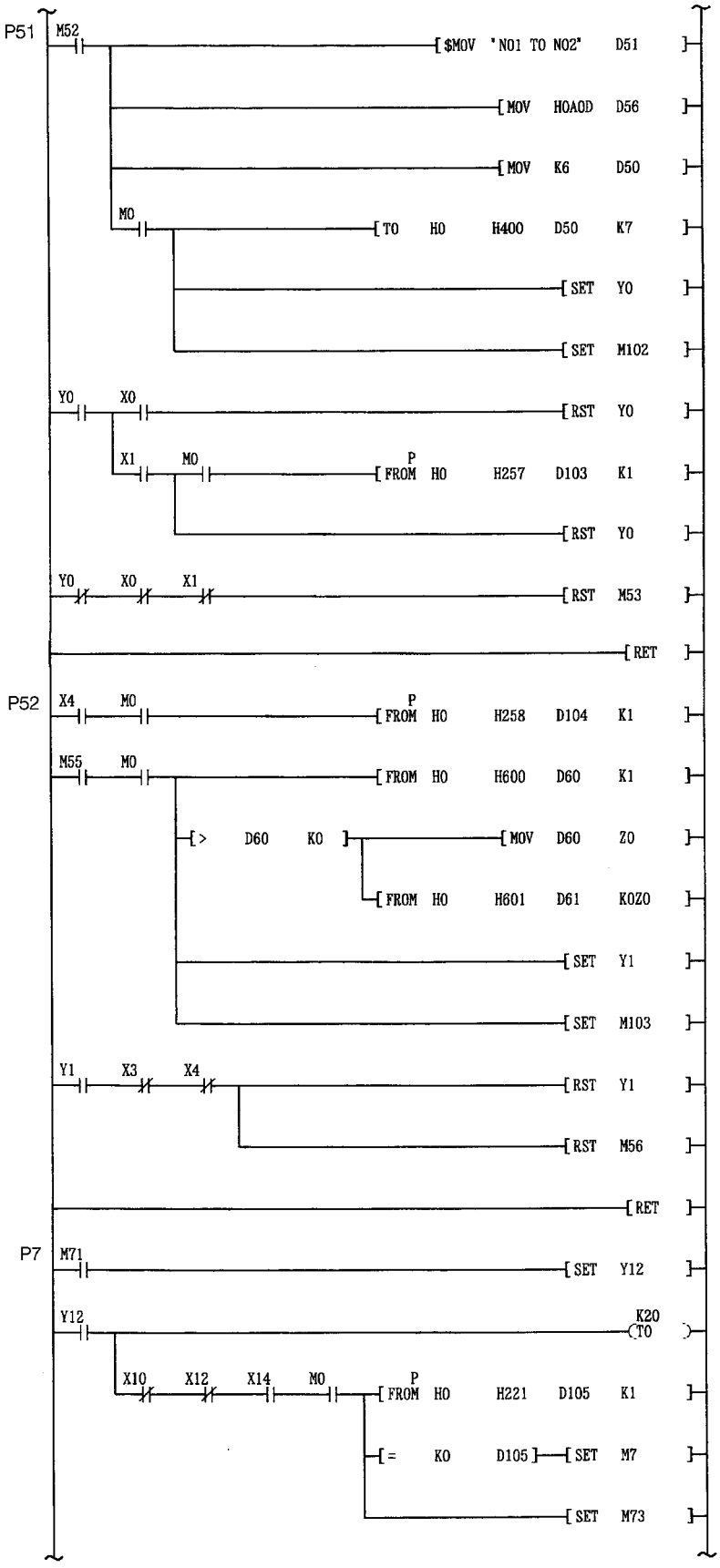
- Set the number of bytes of the registration data
- Clear the data storage device for connection
- Set the pager receiver designation (Notification is not executed)
- Set the telephone number
- Set the space to the remainder of the telephone number designation area
- Set the external line dialing number (0)
- Set the line type (tone)
- Write the data for connection (Registration to buffer memory)
- Data registration complete flag for connection is turned ON

Modem initialization processing subroutine

- Write the data number for initialization
- Initialization request signal is turned ON
- Initialization request execution flag is turned ON
- When the initialization complete signal ON, the initialization complete flag is turned ON and the request signal is turned OFF
- When the initialization/connection abnormal complete signal ON, the error code is read and the request signal is turned OFF

Line connection processing subroutine

- Write the data number for connection
- Connection request signal is turned ON
- Connection request execution flag is turned ON
- When the connection in progress signal ON, the connection complete flag is turned ON and the request signal is turned OFF
- When the initialization/connection abnormal complete signal ON, the error code is read and the request signal is turned OFF



Data communication processing subroutine
(Non-procedure protocol, transmission)

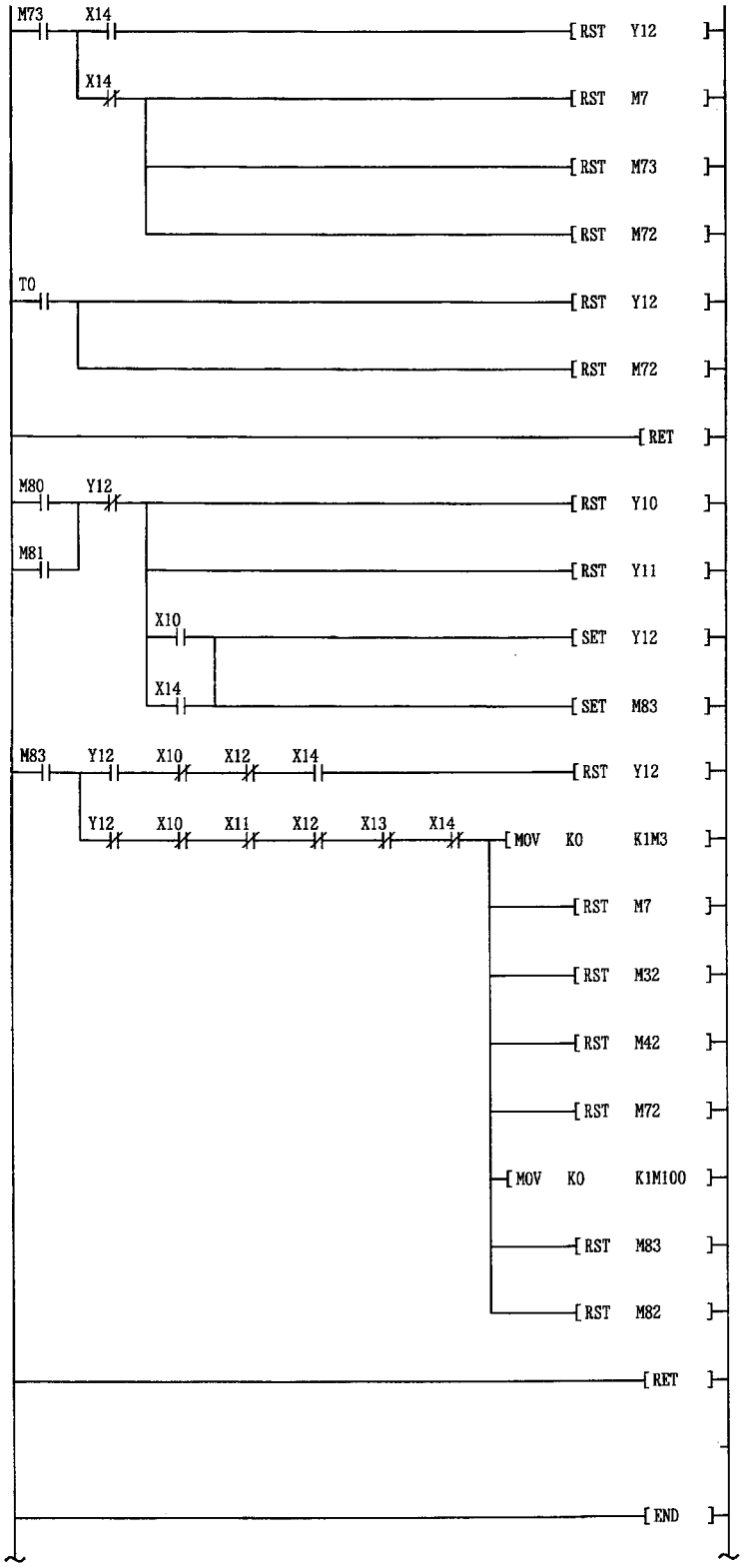
- Set the transmission data
- Set the number of transmission data (words)
- Write the transmission data, etc.
- Transmission request signal is turned ON
- Transmission request execution flag is turned ON
- When the transmission normal complete signal ON, the transmission request signal is turned OFF
- When the transmission abnormal complete signal ON, the error code is read and the request signal is turned OFF

Data reception processing subroutine
(Non-procedure protocol, reception)

- When the reception abnormal detection signal ON, the error code is read
- Read the reception data, the reception data read complete signal is turned ON
- Reception data read execution flag is turned ON
- When the reception data read request signal OFF, the reception data read complete signal is turned OFF

Line disconnection processing subroutine
(Line disconnection from host station)

- Modem disconnection request signal is turned ON
- When the modem disconnection complete signal ON, the error code is read
- When the normal complete signal ON, the line disconnection complete flag is turned ON



· Modem disconnection request signal is turned OFF

· When the line disconnection processing time out occurrence, the request signal is forcefully turned OFF

OFF subroutine of various request signal and complete signal

· Various request signal is turned OFF

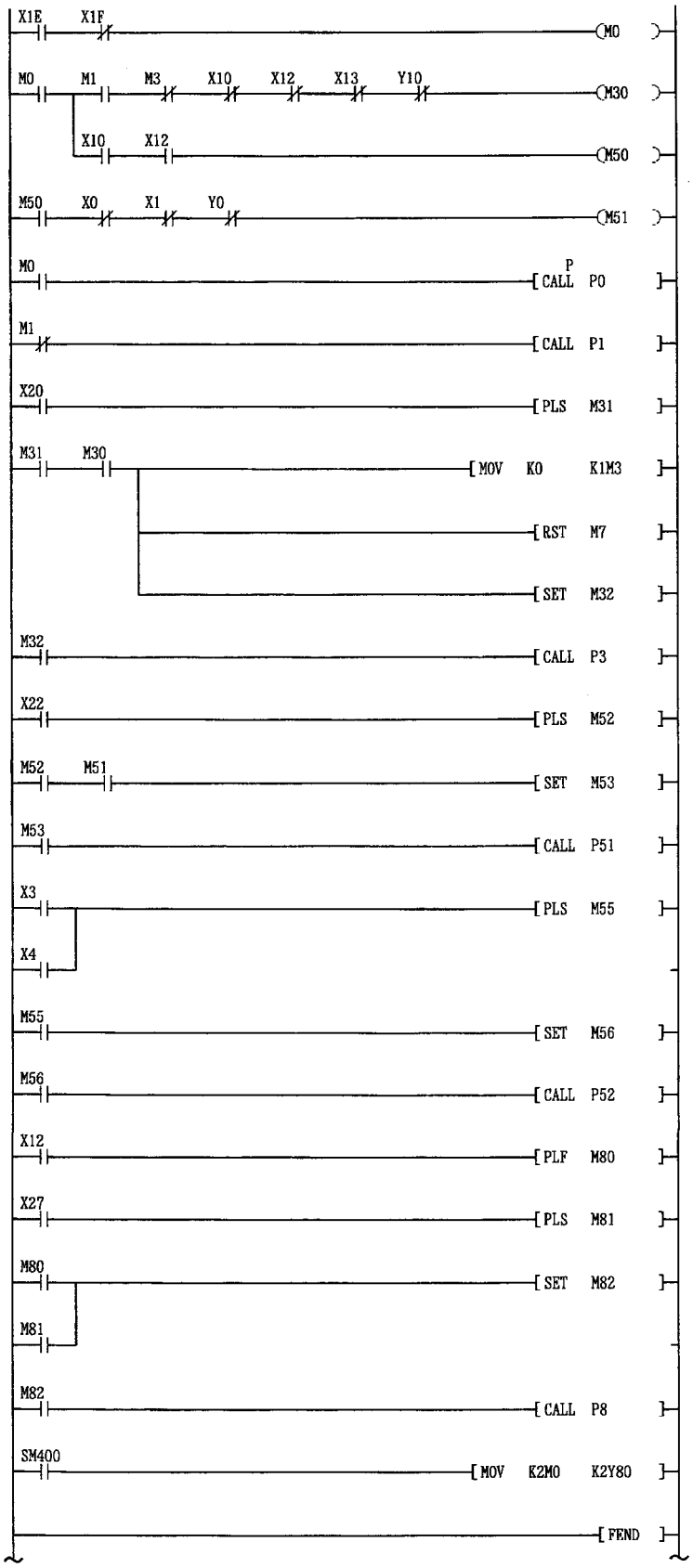
· When any complete signal ON, the modem disconnection request signal is turned ON

· When the initialization complete signal OFF and the modem disconnection complete signal ON, the request signal is turned OFF

· When the relation various signal OFF, the flag is turned OFF

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.



QC24N accessible flag is turned ON

Modem initialization enabled flag is turned ON

Exchangeable flag with the partner station is turned ON

Data transmission enabled flag to the partner station is turned ON

To the QC24N initial setting processing subroutine

To the data registration processing for initialization sub-routine

Convert the initialization command into pulse

Various complete flags after the modem initialization processing is turned OFF

To the modem initialization processing subroutine

Convert the data communication (transmission) command into pulse

To the data communication processing subroutine

Convert the reception data read request into pulse

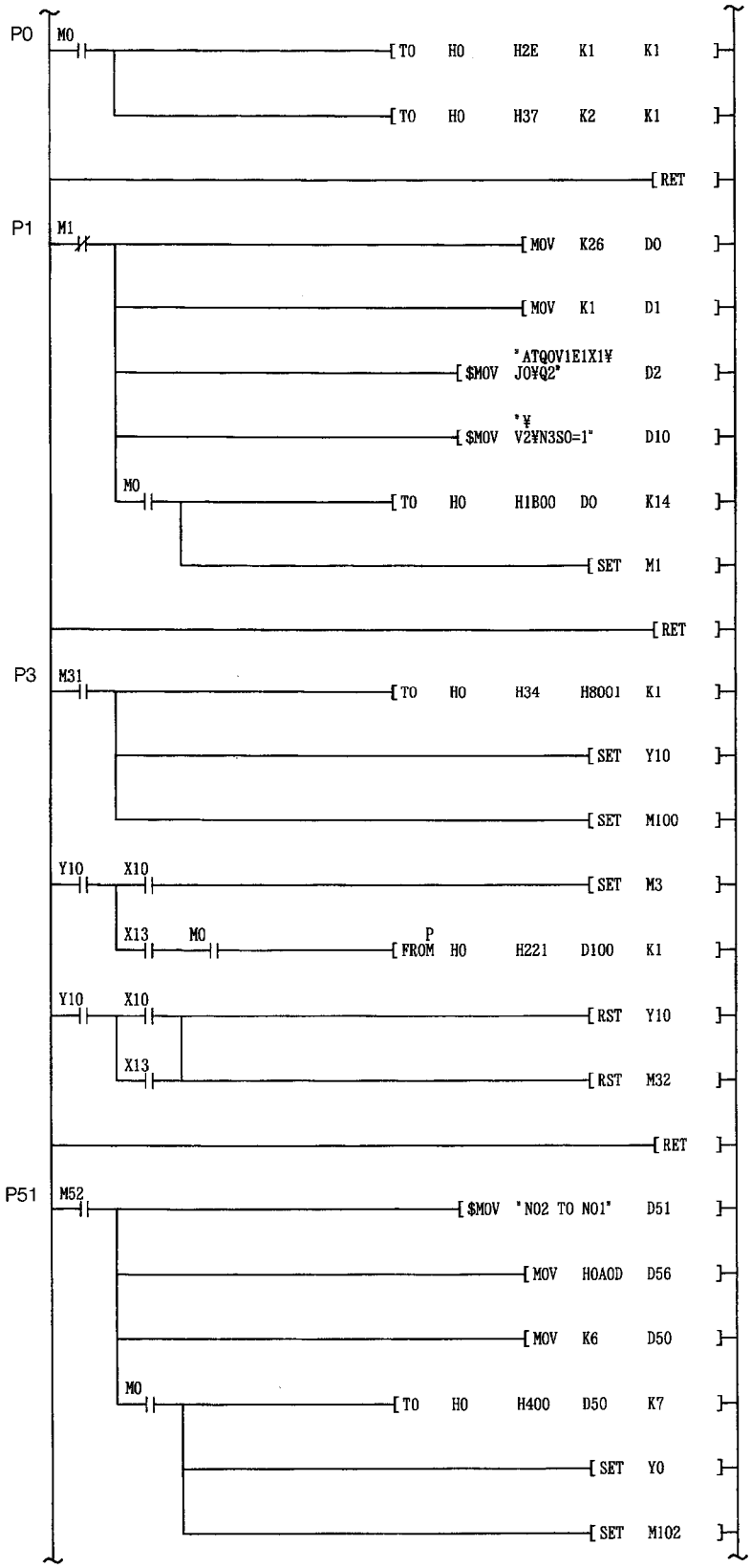
To the reception data read processing subroutine

Convert the connection in progress signal OFF into pulse (Line disconnection from partner side)

Convert the OFF command of various request signal into pulse

To the various request signal and the complete signal OFF subroutine

Output the various complete flag status (LED display)



Initial setting processing subroutine

- Set the modem connection channel number
- Set the no-communication interval time (2 minutes)

Data registration processing for initialization subroutine

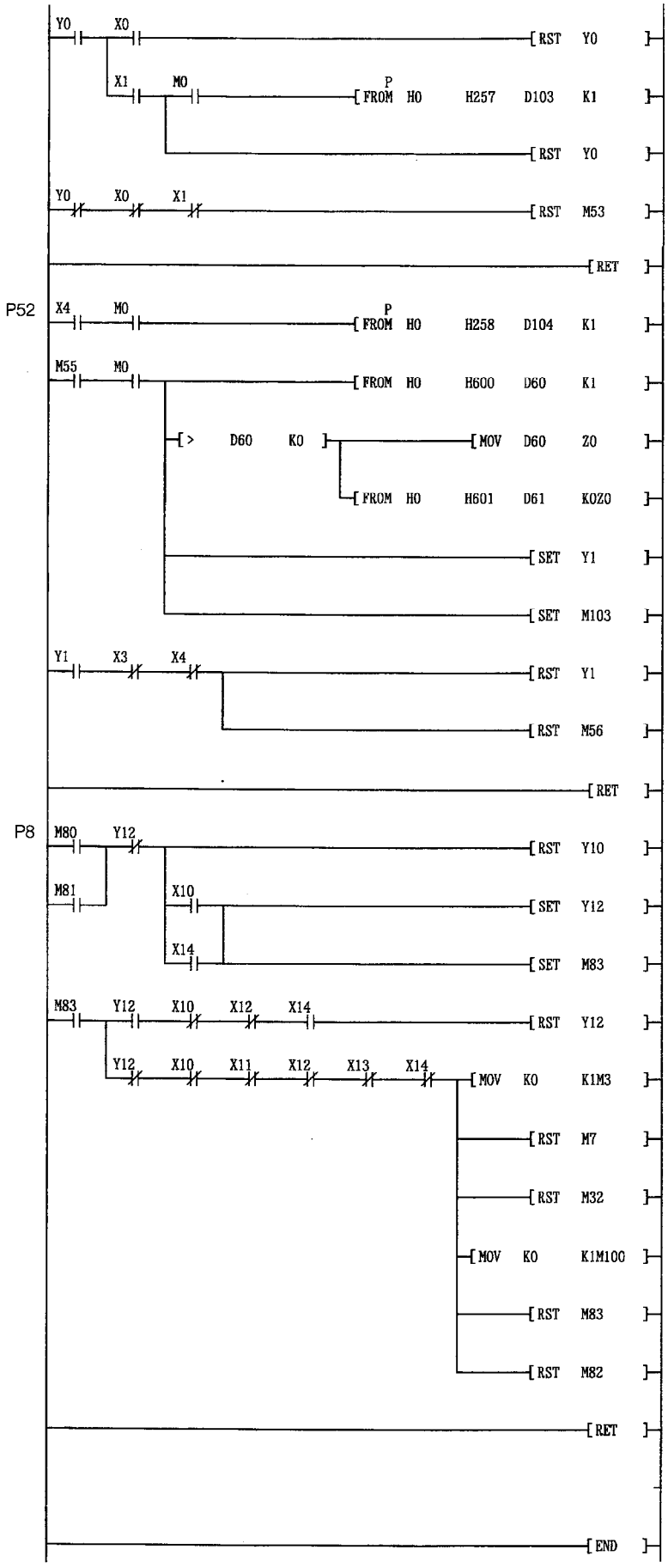
- Set the number of bytes of the registration data
- Set the user control data (control number)
- Set the initialization command
- Write the data for initialization (Registration to buffer memory)
- Data registration complete flag for initialization is turned ON

Modem initialization processing subroutine

- Write the data number for initialization
- Initialization request signal is turned ON
- Initialization request complete flag is turned ON
- When the initialization complete signal ON, the initialization complete flag is turned ON and the request signal is turned OFF
- When the initialization/connection abnormal complete signal ON, the error code is read and the request signal is turned OFF

Data communication processing subroutine
(Non-procedure protocol, transmission)

- Set the transmission data
- Set the number of transmission data (words)
- Write the transmission data, etc.
- Transmission request signal is turned ON
- Transmission request execution flag is turned ON



- When the transmission normal complete signal ON, the transmission request signal is turned OFF
- When the transmission abnormal complete signal ON, the error code is read and the request signal is turned OFF

Data reception processing subroutine
(Non-procedure protocol, reception)

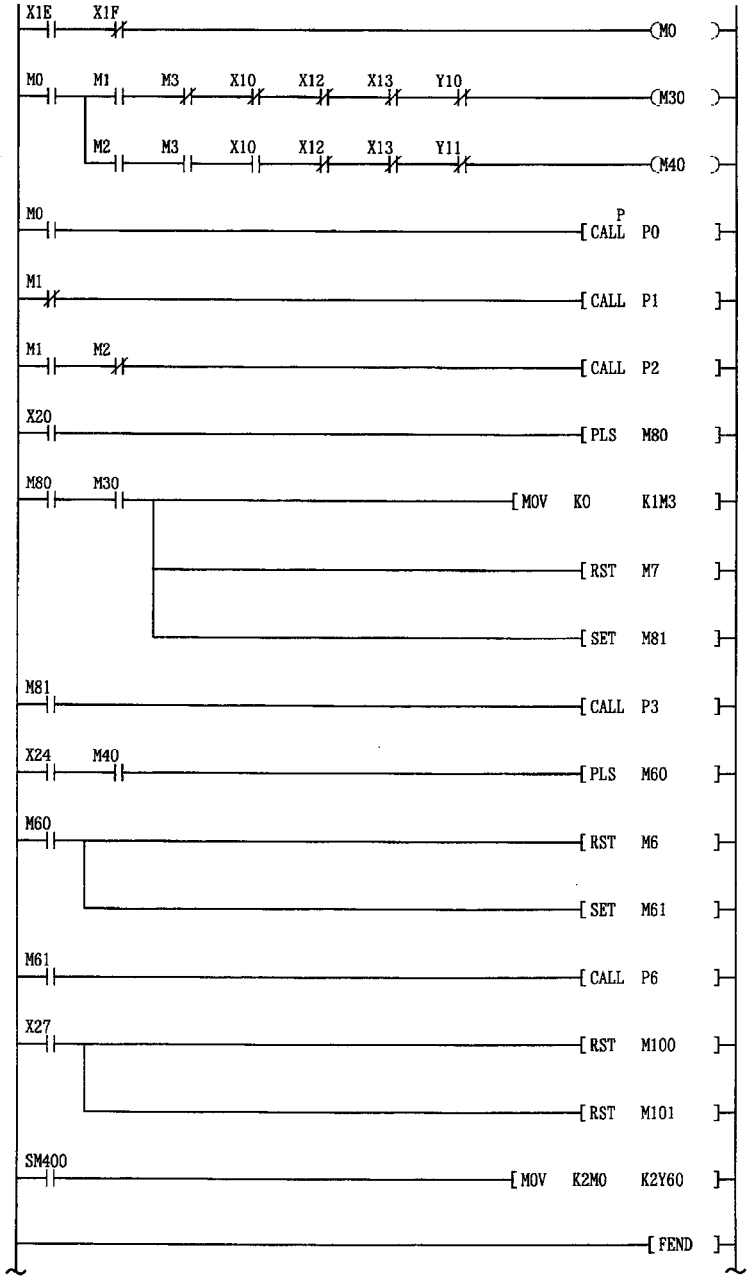
- When the reception abnormal detection signal ON, the error code is read
- Read the reception data, the reception data read complete signal is turned ON
- Reception data read execution flag is turned ON
- When the reception data read request signal OFF, the reception data read complete signal is turned OFF

OFF subroutine of various request signal and complete signal

- Various request signal is turned OFF
- When any complete signal ON, the modem disconnection request signal is turned ON
- When the initialization complete signal OFF and the modem disconnection complete signal ON, the request signal is turned OFF
- When the relation various signal OFF, the flag is turned OFF

8.6.2 Sample program for notification

Modem initialization and notification are executed by commands from the user.



QC24N accessible flag is turned ON

Modem initialization enabled flag is turned ON

Line connectable flag with the remote station is turned ON

To the QC24N initial setting processing subroutine

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 turned OFF

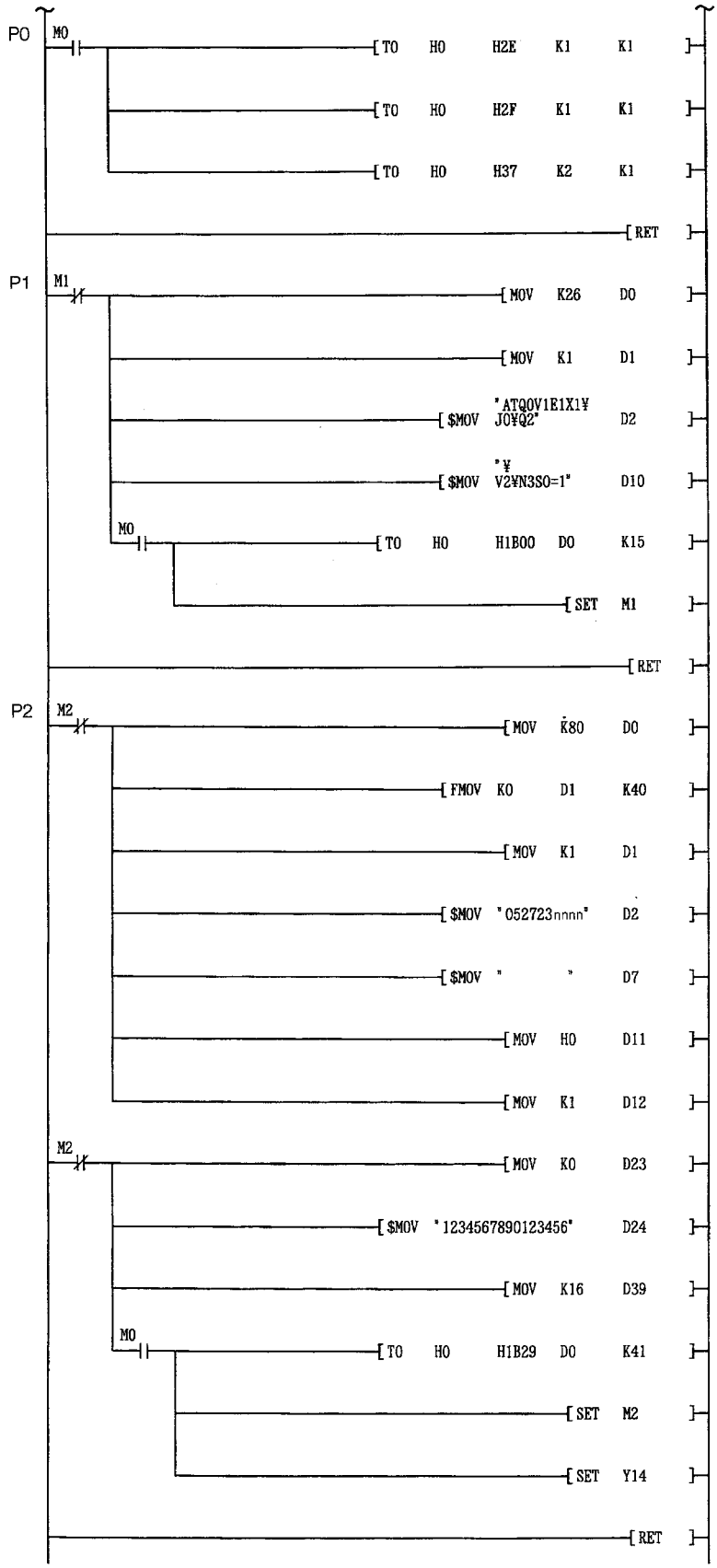
To the modem initialization processing subroutine

Convert the notification command into pulse

To the notification processing subroutine

When the flag OFF command, the complete flag is turned OFF

Output the various complete flag status (LED display)



Initial setting processing subroutine

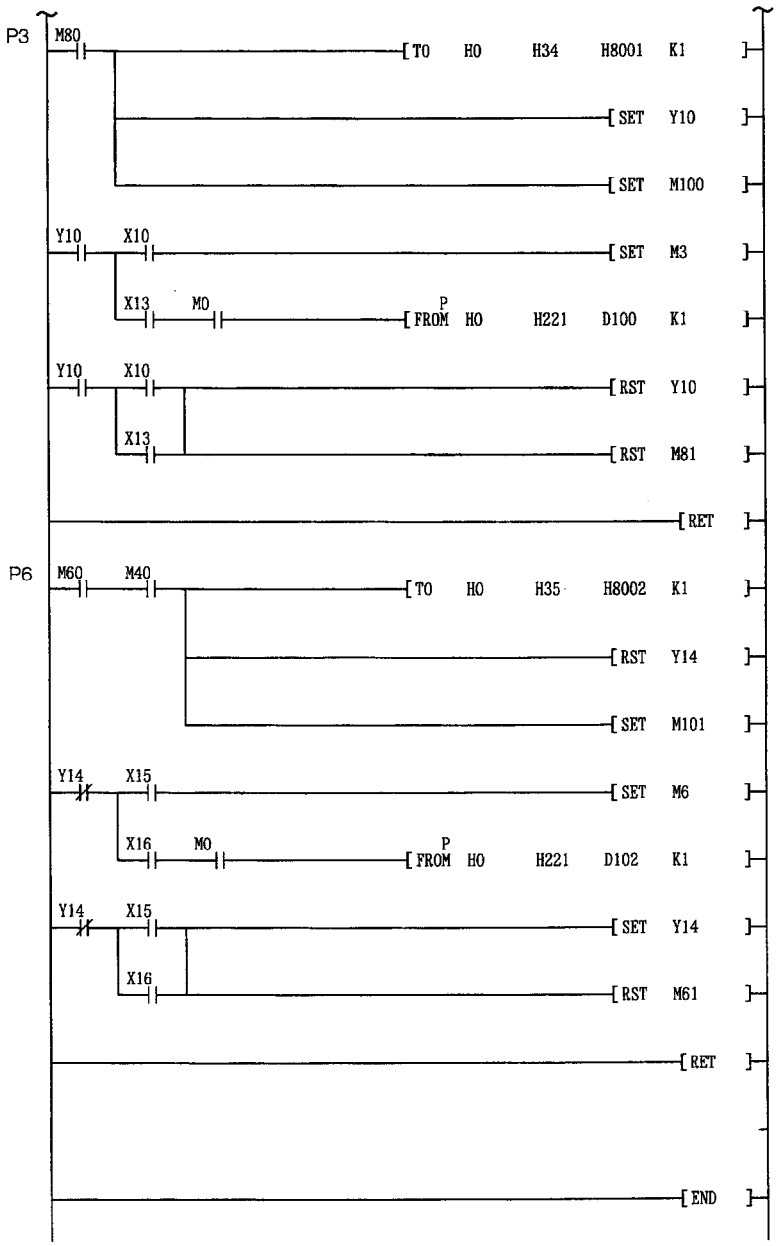
- Set the modem connection channel number
- Set the notification execution
- Set the no-communication interval time (2 minutes)

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 (Registration to buffer memory)
- Data registration complete flag for initialization is turned ON

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 specification (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 (This is dummy because the pager receiver designated data is 1)
- Set the message
- Set the message length
- Write the data for connection (Registration to buffer memory)
- Data registration complete flag for connection is turned ON
- Notification-issued request signal is turned ON (Initial status)



Modem initialization processing subroutine

- Write the data number for initialization
- Initialization request signal is turned ON
- Initialization request execution flag is turned ON
- When the initialization complete signal ON, the initialization complete flag is turned ON and the request signal is turned OFF
- When the initialization/connection abnormal complete signal is turned ON, the error code is read and the request signal is turned OFF

Notification processing subroutine

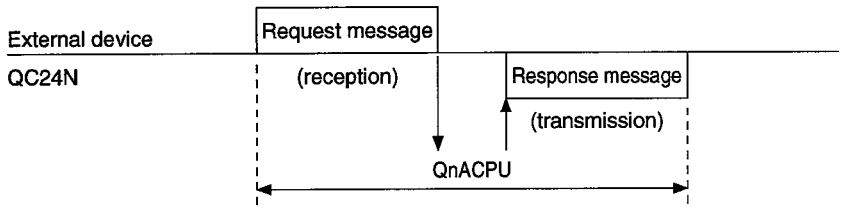
- Write the data number for connection (for notification)
- Notification-issued request signal is turned OFF (Issue request)
- Notification execution flag is turned ON
- When the notification normal complete signal ON, the notification complete flag is turned ON and the request signal is turned ON (Initial status)
- When the notification abnormal complete signal ON, the error code is read and the request signal is turned ON (Initial status)

APPENDIX
PROCESSING TIME OF THE PC

When the external device accesses the local station QnACPU with QC24(N) installed by the dedicated protocol, the processing time of the PC is as follows when the QC24 (conventional module) and the QC24N are used.

The values listed in the following table are the processing time of the PC when the access was performed by word under the following conditions:

- The local station QnACPU with a QC24(N) installed is in the STOP status.
- The time from the start of the request message reception by QC24 (N) to the end of the response message transmission is reduced.
- The device to be accessed is the data register (D).
- The data communication is executed by format 1, data bit: 7, stop bit: 1, and no parity.



- The data transmission speed between the external device and the QC24(N) is as follows:
  Top : 19200BPS
  Bottom : 57600BPS

Access contents	Number of access points	Processing time of the PC (unit: ms)		
		QC 24	QC 24N	
		QnA frame	QnA frame	QnA simplified frame
Batch read	1	69.2 —	29.6 14.5	22.1 12.7
	64	204.0 —	148.8 55.6	142.2 53.2
	65	204.4 —	150.6 56.2	142.8 53.9
	480	1105.1 —	936.1 324.4	926.4 322.9
Batch write	1	66.0 —	28.5 14.3	21.3 12.4
	64	318.1 —	147.1 54.4	140.2 52.9
	65	319.3 —	148.5 55.6	142.5 53.7
	480	1985.2 —	925.0 316.4	918.1 312.6

(To the next page)

(From the previous page)

Access contents	Number of access points	Processing time of the PC (unit: ms)		
		QC 24	QC 24N	
		QnA frame	QnA frame	QnA simplified frame
Test (Random write)	1	71.1 —	29.1 14.0	21.8 13.2
	10	160.2 —	80.8 33.4	73.5 30.2
	80	1156.4 —	478.8 169.2	471.8 167.8
Random read	1	83.0 —	33.5 19.3	27.1 17.7
	96	1267.3 —	577.2 208.4	570.4 205.9
Monitor data registration	1	77.2 —	28.5 17.4	22.8 13.8
	20	230.0 —	100.2 40.8	93.9 39.0
	60	554.4 —	252.0 90.7	244.5 90.1
	96	850.0 —	387.4 138.3	380.0 135.8
Monitor	1	62.1 —	24.0 13.3	17.0 11.1
	20	99.3 —	61.4 25.9	54.5 24.9
	60	190.2 —	138.3 54.9	131.3 52.6
	96	268.0 —	208.4 80.9	201.6 78.0
Multiple block batch read	1	(No function)	32.0 15.8	(No function)
	150 (*1)		393.9 139.8	
	200 (*2)		515.6 182.5	
Multiple block batch write	1		30.9 16.3	
	150 (*1)		389.6 136.9	
	200 (*2)		511.7 178.5	

*1 When the total number of blocks for the bit device and the word device is 15.

*2 When the total number of blocks for the bit device and the word device is 20.

Serial Communications Module
User's Manual

MODEL	QC24N-U-S-TUIKA-E
MODEL CODE	13JL13
SH(NA)3630-B(9804)MEE	

MITSUBISHI ELECTRIC CORPORATION

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Specifications subject to change without notice.