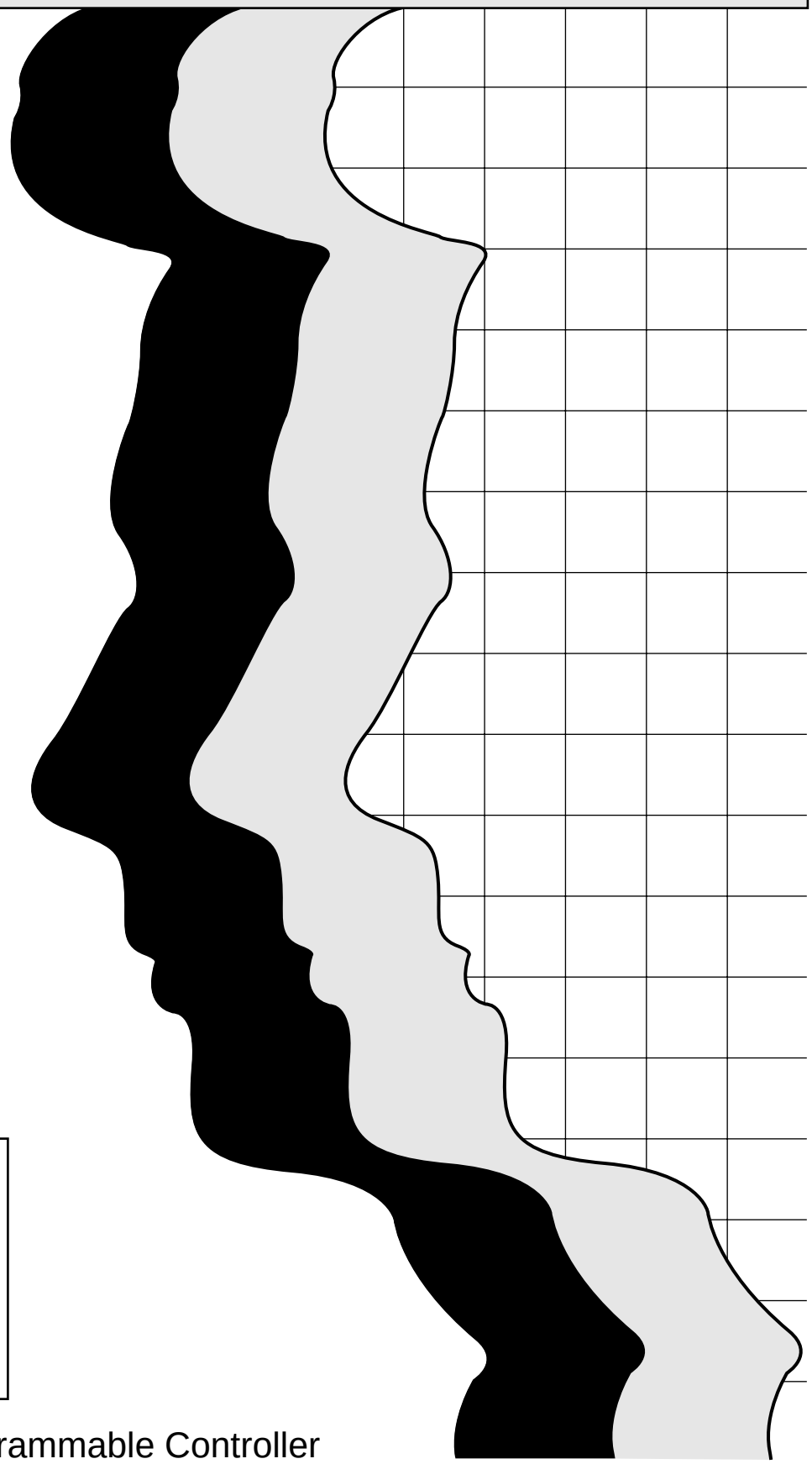
MITSUBISHI

Computer Link Module

Guidebook



A

MELSEC

Mitsubishi Programmable Controller

REVISIONS

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

Print Date	*Manual Number	Revision
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INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end user.

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1. GENERAL DESCRIPTION

This guidebook has been compiled for the beginners of the computer link module for use with the MELSEC-A series PCs to help them understand the following fundamentals:

- what the computer link functions can do;
- the usage of the computer link functions; and
- the outline of the communications procedure and the flow of data.

For the details of the descriptions contained herein and of the multidrop link function, refer to the manuals listed below. Please read them and further understand the functions of the computer link module.

(Reference manuals)

- Computer Link/Multidrop Link Module User's Manual

  (Computer Link Function/Printer Function) SH-3511

For the computer link functions, refer to the following sections in this guidebook:

(1) When checking computer link functions available for dedicated protocols
  1) Determining the system configuration..... Section 3.1.1
  2) External wiring..... Section 3.3
  3) Setting hardware..... Section 4.1
  4) Data communications
    (a) Reading out data from device memory in PC CPU..... Section 4.5
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  5) On-demand function..... Section 4.7

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  2) External wiring..... Section 3.3
  3) Setting hardware..... Section 5.1
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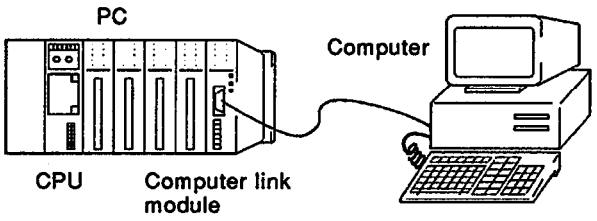
1.1 What are Computer Link Functions?

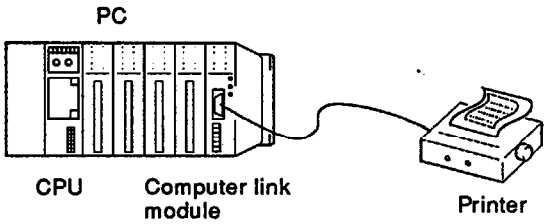
Computer link functions

Computer link functions are intended to permit data communications between an external device (computer, printer, etc.) and the PC CPU through the RS-232C or RS-422 (or 485) interface of the computer link module.

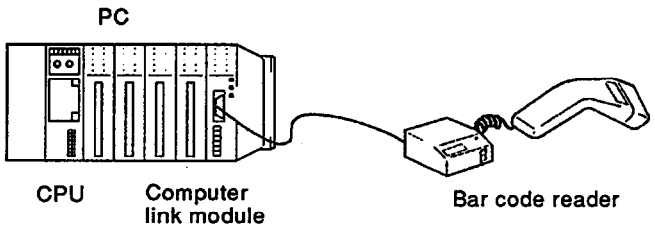
The computer link functions enable the external device to do the following:



- Monitoring and displaying the operation status of the PC CPU
- Collecting and analyzing data within the PC
- Uploading and downloading sequence programs
- Writing production instruction data to the PC CPU



- Printing out data from the PC CPU



- Reading out data from a bar code reader into the PC CPU

Data communications is established with a dedicated protocol or in the no-protocol or bidirectional mode.

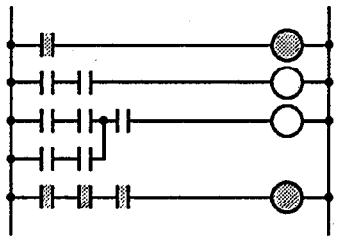
1.2 Data Communications Using Dedicated Protocols

1.2.1 What is dedicated protocol?

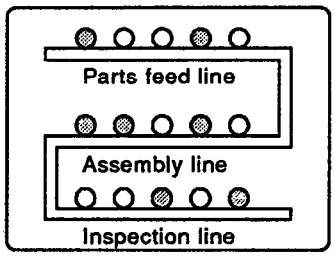
Dedicated protocol is a function to read out or write data (device data etc.) kept in the PC CPU in response to a dedicated command in a predetermined text format sent from the computer.
No special sequence program is necessary for data communications.

1.2.2 Applications of dedicated protocols

(1) Monitoring the operation status of the PC
The operation status of a production line or machine can graphically be monitored and checked on the computer display.

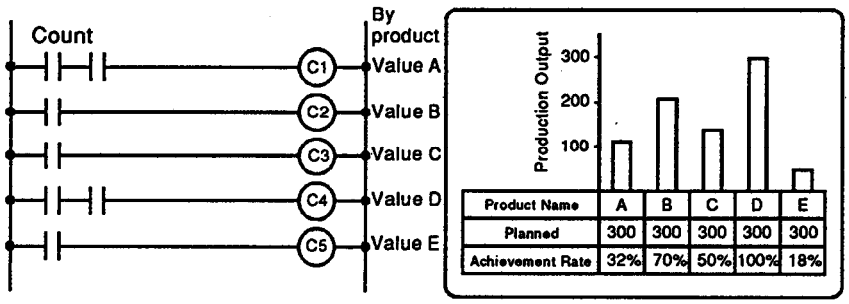


The coils are kept on during operation by the PC program.



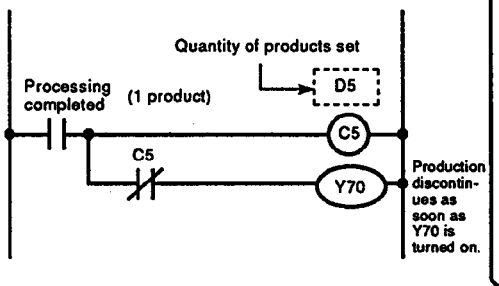
The line in operation can be monitored on the computer display.

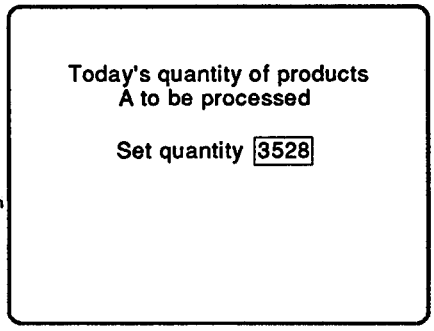
(2) Collecting and analyzing data
The production output, the number of operation times, and other data on a production line or machine can be shown and checked in the form of graphs or tables on the computer display.



Product Name	A	B	C	D	E
Planned	300	300	300	300	300
Achievement Rate	32%	70%	50%	100%	18%

The quantity of products to be processed can be set to a production line or machine through the computer.

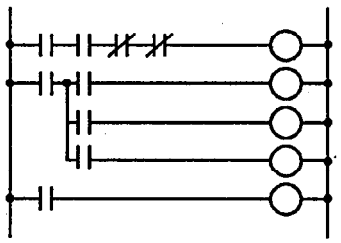




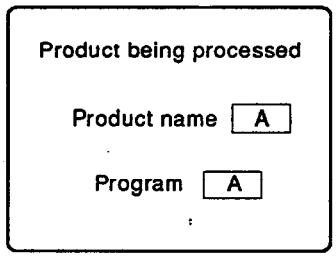
The PC program sets the counter to count the quantity of products processed, and production will discontinue on counting up to the set number.

Write 3528 to the set quantity D5 on the counter C5 from the computer.

(3) Uploading/Downloading sequence programs
PC programs and parameters can be read out into the computer. Or, by installing two or more programs in the computer, a program that meets the control purpose can be written to the PC.



(Program for processing product A)
By running the PC with this program, product A can be processed.



By writing the program corresponding to the product name from the computer to the PC, control can be directed.

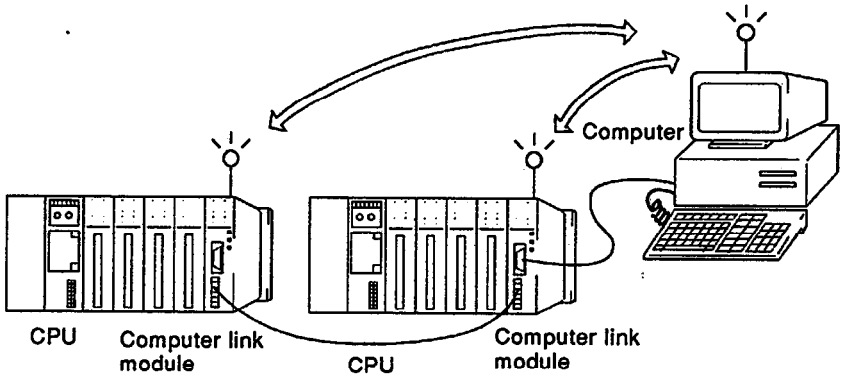
1.3 Data Communications in the No-Protocol Mode

1.3.1 What is no-protocol mode?

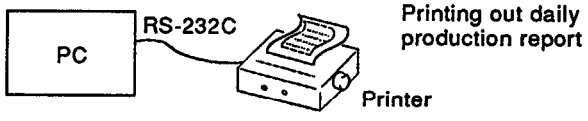
No-protocol mode is a function to permit data communications between the computer link module and the external device in any data format (no specific format, such as dedicated protocols, is determined on the computer link module).
In the no-protocol mode, a sequence program for transmitting or receiving data to/from the computer link module is required.
Data written from the sequence program into the buffer memory area of the computer link module will be transmitted as it is to the external device on a request to send.
Data received from the external device, on the other hand, will be stored into the buffer memory area of the computer link module, and the sequence program can read it out in the original code.

1.3.2 Applications of the no-protocol mode

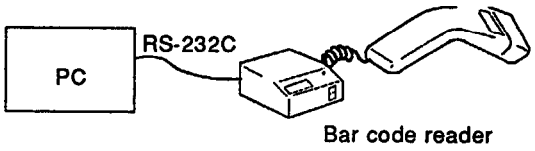
(1) Interaction between the PC CPU and the computer
Any data can be transmitted and received between the sequence program and the computer.



(2) Data logging
Data stored in the PC can be printed out on a printer through the RS-232C interface.



(3) Reading out data from a terminal
Data can be read out from a bar code reader and used in the PC.



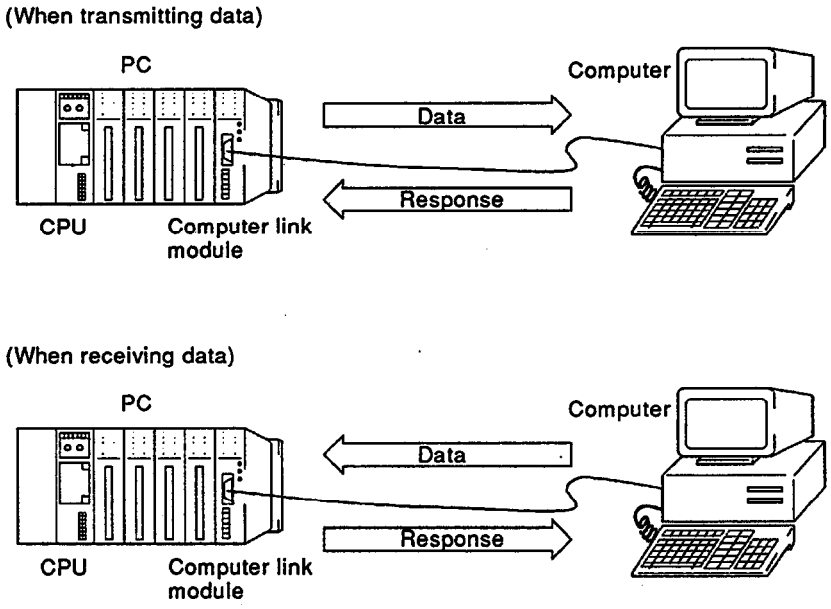
1.4 Data Communications in the Bidirectional Mode

1.4.1 What is bidirectional mode?

Bidirectional mode is a function for specified data communications between the sequence program and the external device.
Unlike the no-protocol mode, the bidirectional mode permits data communications between the PC CPU and the external device while sending a reception completed signal to the communicating device.

1.4.2 Applications of the bidirectional mode

(1) Interaction between the PC CPU and the computer
Any data can be transmitted and received between the sequence program and the computer.
Whether the communicating device has received the data correctly can be checked with response text.



The computer link module processes all its response text.

2. SYSTEM CONFIGURATIONS

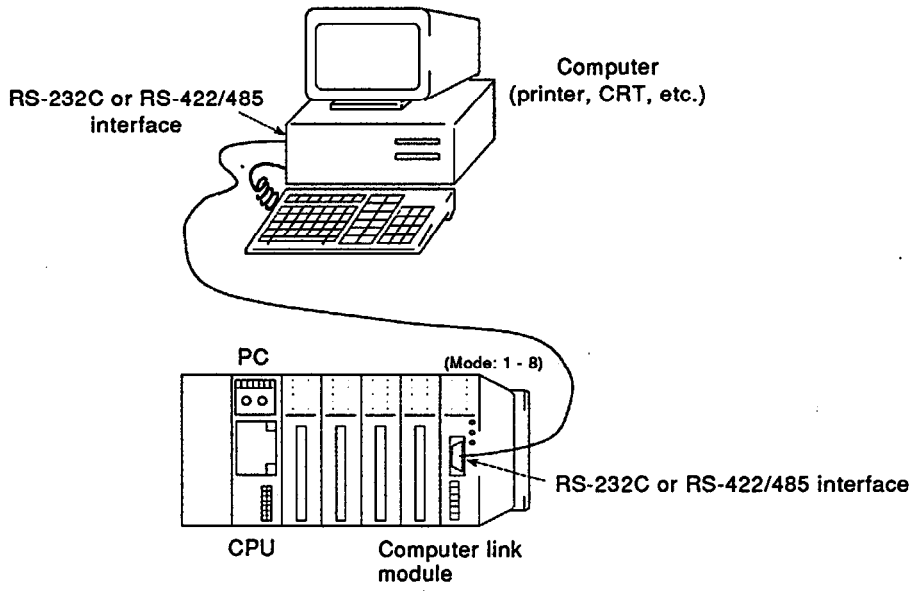
This section describes the system configurations for computer link operations.

2.1 System Configurations that Allow Computer Link Operations and Number of Link Stations

Systems using a computer link module consist of an external device (computer etc.) and 1 to 32 PC CPUs, two external devices and 1 to 32 PC CPUs, etc. For connections between an external device and a PC CPU, the RS-232C or RS-422/485 interface can be used.

2.1.1 When the external device (computer etc.) and the PC CPU are in the ratio of 1:1

When the ratio is 1:1



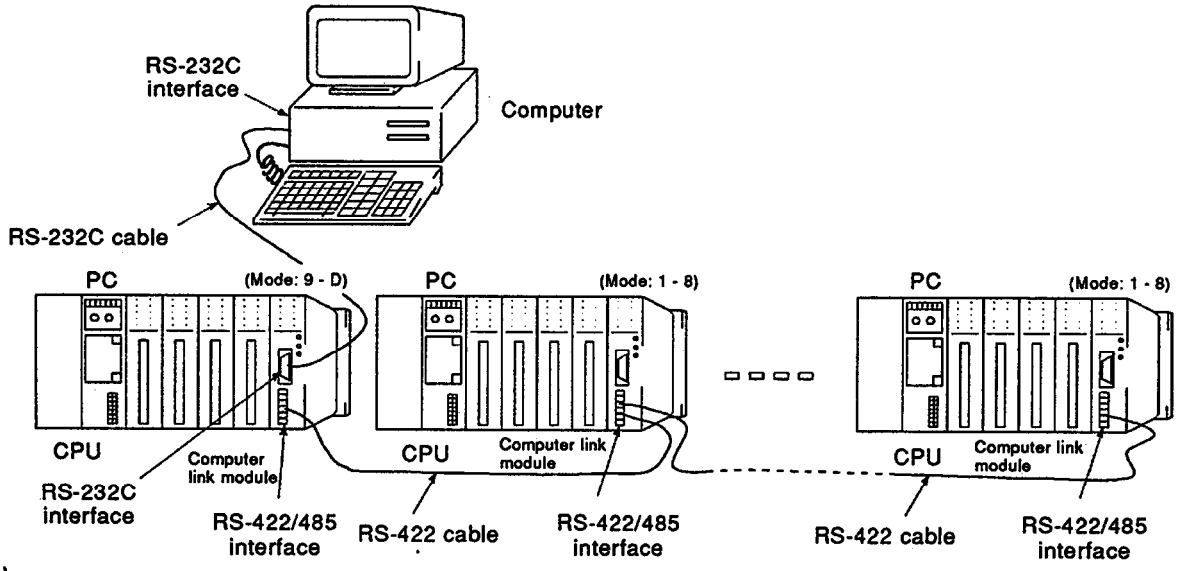
Available Computer Link Module Functions		
Dedicated Protocol	No-protocol Mode	Bidirectional Mode
O	O	O

Fig. 2.1 System Configuration (I)

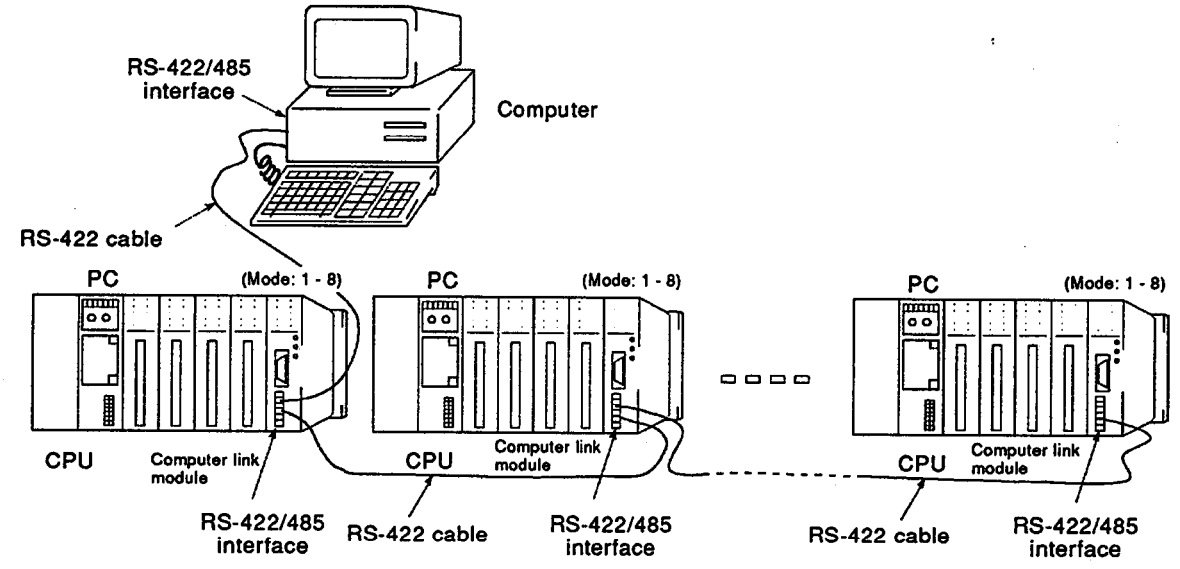
2.1.2 When the external device (computer etc.) and the PC CPU are in the ratio of 1:n

When the ratio is 1:n (n = Max. 32)

System configuration 1 The external device is connected to one of the computer link modules with an RS-232C cable.



System configuration 2 The external device is connected to one of the computer link modules with an RS-422 cable.



Available Computer Link Module Functions		
Dedicated Protocol	No-protocol Mode	Bidirectional Mode
O *1	O	×

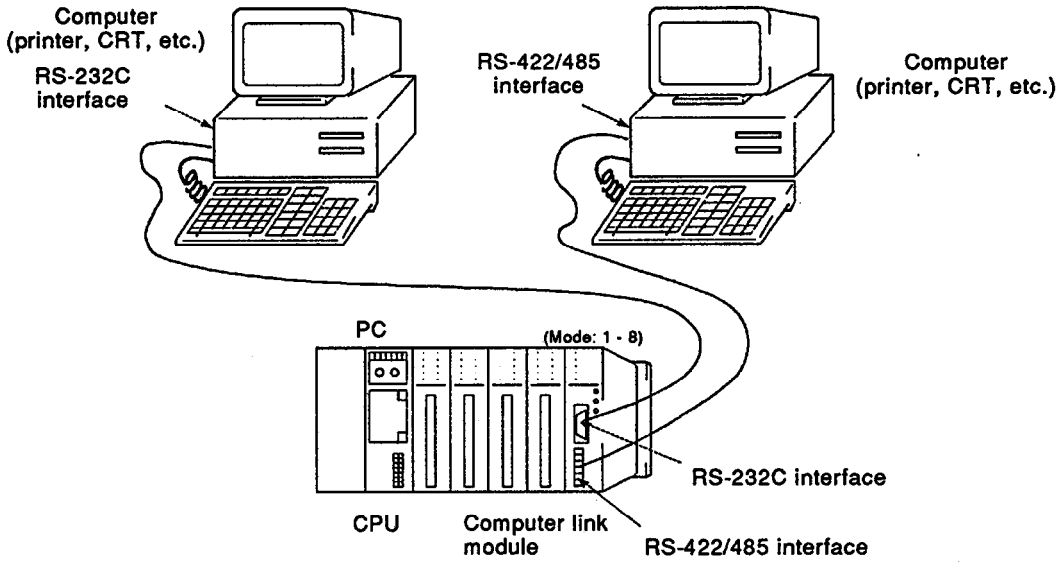
*1: Data communications by the on-demand function is impossible.

Fig. 2.2 System Configuration (II)

2.1.3 When the external device (computers etc.) and the PC CPU are in the ratio of 2:1

When the ratio is 2:1

(This system consists of two external devices respectively connected to a PC CPU.)



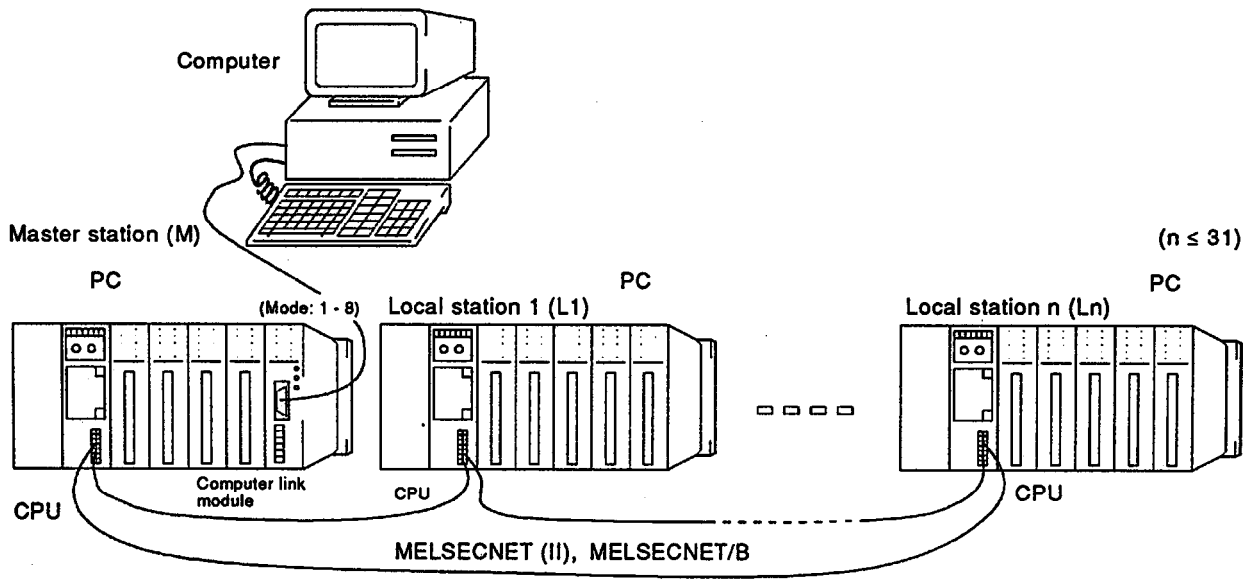
This system configuration uses one interface in one of dedicated protocol formats 1 to 4, and the other in the no-protocol or bidirectional mode.

Available Computer Link Module Functions		
Dedicated Protocol	No-protocol Mode	Bidirectional Mode
O	O	O

Fig. 2.3 System Configuration (III)

2.2 System Configuration for Access to PC CPUs of Other Stations Through the MELSECNET

Using a dedicated protocol enables the computer to communicate with PC CPUs connected via the MELSECNET.
Through a PC CPU loaded with a computer link module and connected to the computer, data can be communicated with PC CPUs unloaded with a computer link module.



All data in the device memory can be transmitted and received.

Range of PC CPUs that are communicable from computer

(In the case of the above system configuration)

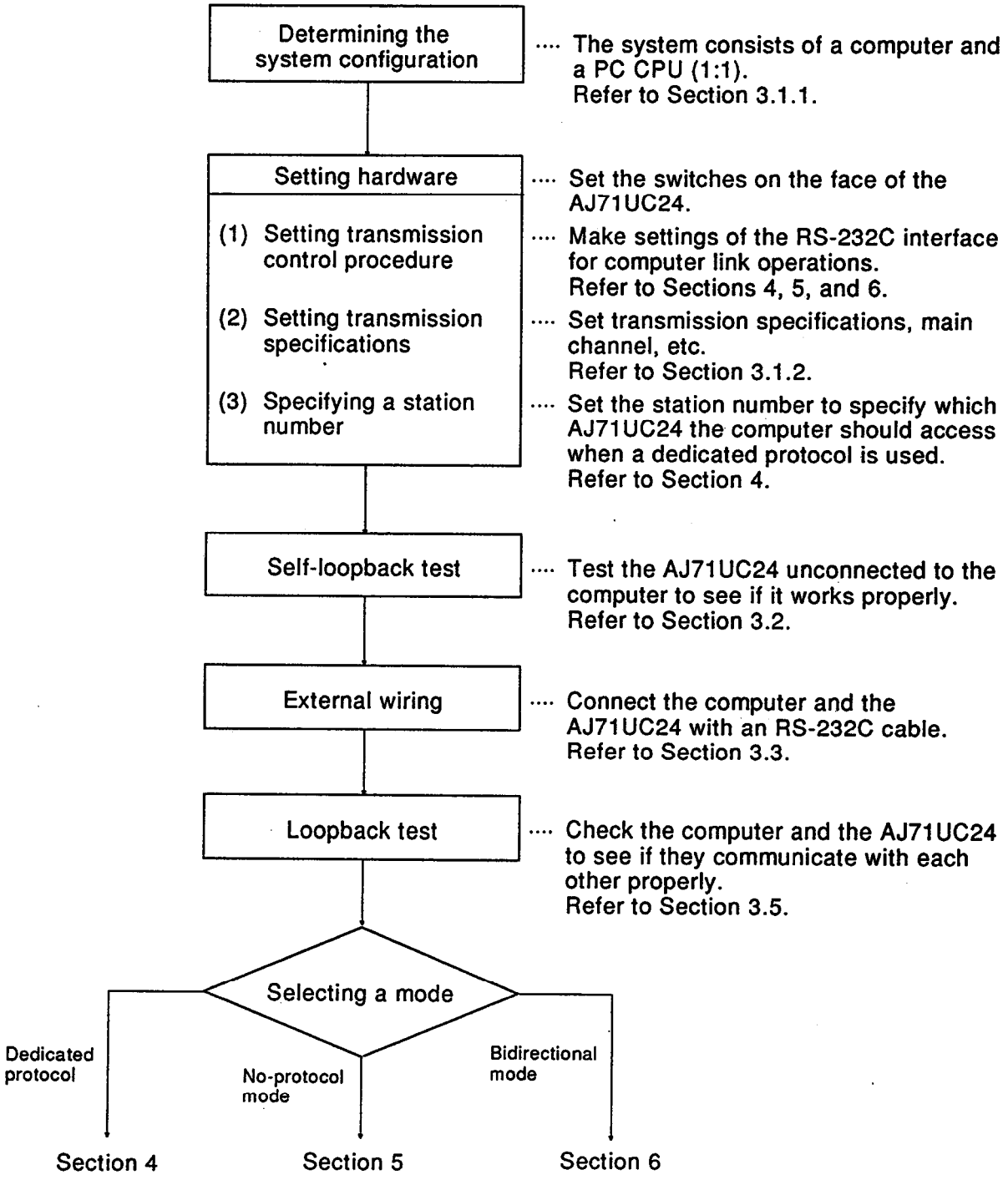
Computer-Connected Station	PC CPUs that are Communicable from Computer			
	M	L1	L2	L3
M	O	O	O	O
L1	O	O	×	×
L2	O	×	O	×
L3	O	×	×	O

Fig. 2.4 System Configuration (IV)

3. PROCEDURES PRIOR TO COMPUTER LINK FUNCTION OPERATIONS DESCRIBED IN THIS GUIDEBOOK

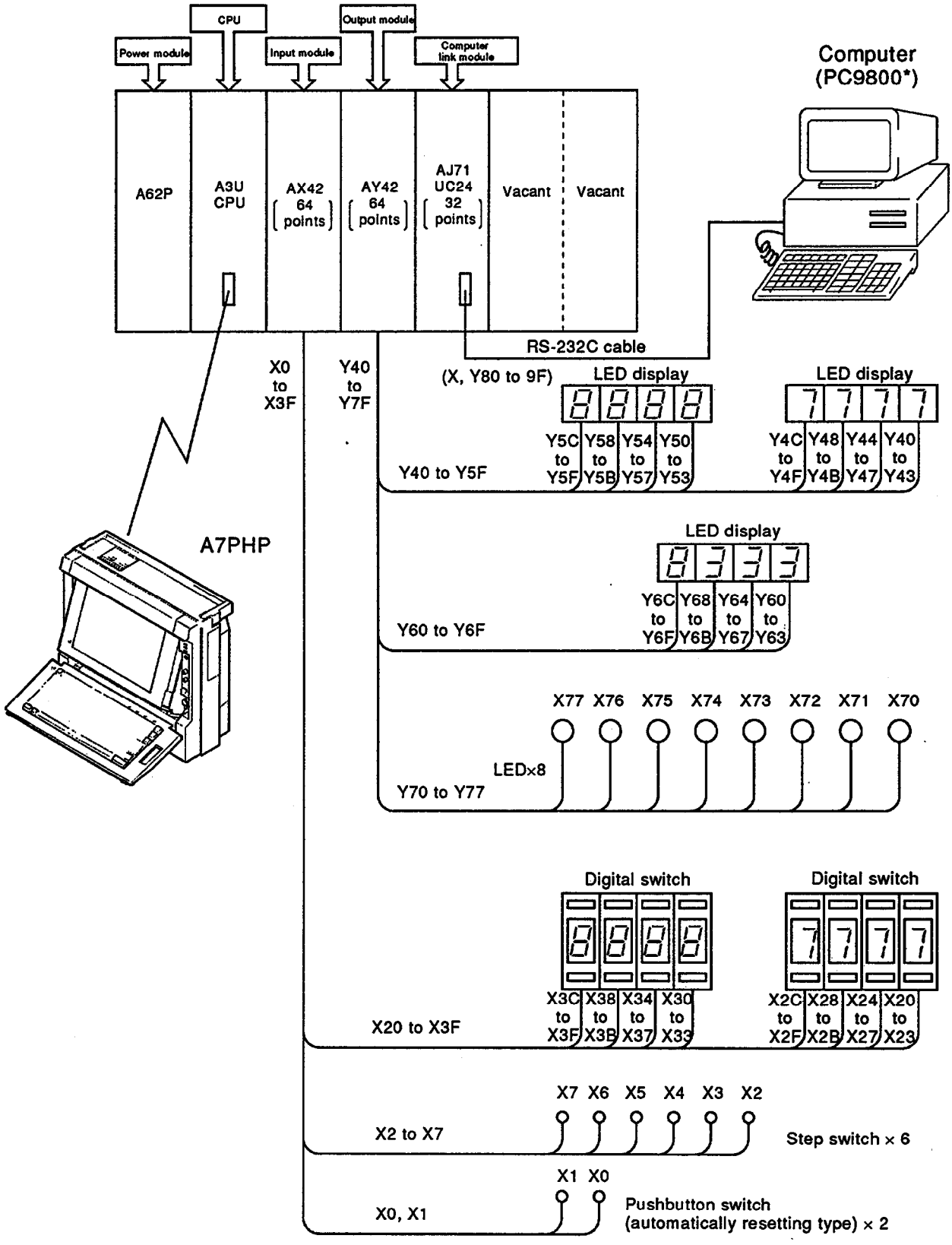
3.1 Settings and Procedures before Operations

This section describes the settings of the computer link functions covered in this guidebook and operation procedures.
The AJ71UC24 is used for computer link module, and the A3UCPU for PC CPU.



3.1.1 System configuration

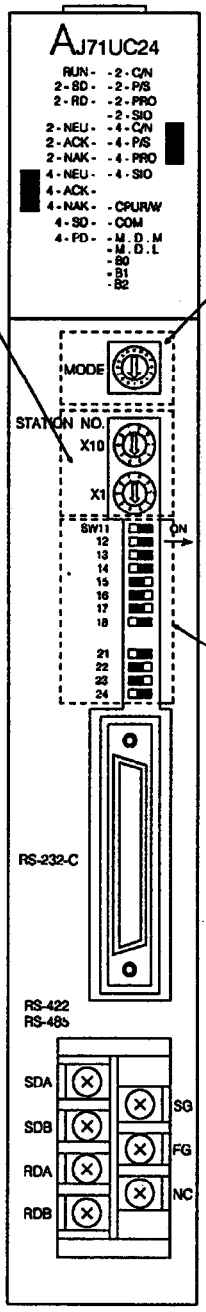
The following is the system configuration for computer link operations described in this guidebook.



* PC9800 is a registered trademark of NEC Corp.

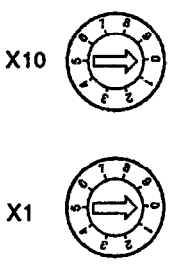
3.1.2 Function of setting switches

Described below are the setting switches on the face of the AJ71UC24 and their functions.



Station number setting switches

These switches are to set the station number for communications using a dedicated protocol.
The station number can be set between 0 and 31.
Set the switches to 0 in 1:1 communications.



Set the switches to station number 0 for communications.

Mode setting switch

This switch is to set the mode of each interface.

1: Communications with a dedicated protocol in control procedure format 1
5: Communications in the no-protocol or bidirectional mode
F: Self-loopback test

Transmission specifications setting switches

These switches are to set the data bit length, the presence/absence of a parity bit, the stop bit length, sum check enabled/disabled, etc.

Setting Switch	Description	Setting Position	
SW11	Main channel setting	OFF (RS-232C)	
SW12	Data bit setting	OFF (7 bits)	
SW13	Transmission speed setting	OFF	(4800BPS)
SW14		OFF	
SW15		ON	
SW16	Parity check enabled/disabled	ON (Enabled)	
SW17	Even/Odd parity setting	ON (Even)	
SW18	Stop bit setting	OFF (1 bit)	
SW21	Sum check enabled/disabled	OFF (Disabled)	
SW22	Write during RUN enabled/disabled	ON (Enabled)	
SW23	Computer link/Multidrop link selection	ON (Computer link)	
SW24	Unused	——	

3.2 Self-Loopback Test

Self-loopback test is to check the AJ71UC24 to see if it works properly when unconnected to the computer.
The functions for communications with the PC CPU and those of the RS-232C or RS-422/485 interface for transmitting and receiving data are to be checked.

(Step 1) Setting the mode setting switch
Set the mode setting switch to "F" to select self-loopback test.

(Step 2) Setting the transmission specifications setting switches
Set the transmission specifications setting switches as shown in Section 3.1.2.

(Step 3) Connecting cables
Connect the RS-232C connector cables or RS-422/485 terminal block cables as shown below:

RS-232C Cable Connections

AJ71UC24		Cable Connection
Signal Name	Pin No.	
FG	1	
SD	2	
RD	3	
RS	4	
CS	5	
DSR	6	
SG	7	
CD	8	
DTR	20	

RS-422/485 Cable Connections

AJ71UC24	
Signal Name	Cable Connection
SDA	
SDB	
RDA	
RDB	
SG	
FG	

(1) Engage a connector with the above cable connections for testing to the RS-232C connector.

(2) Short the terminals of the RS-422/485 connector as shown in the above figure.

(Step 4) Carrying out a self-loopback test

1) Set the RUN/STOP key switch on the PC CPU to STOP.

2) As soon as the power to the PC CPU is turned on or the CPU is reset, an AJ71UC24 READY signal (ready signal) will be turned on and checking will automatically start. (The READY signal will be turned on several seconds after the power is turned on or the CPU is reset.)

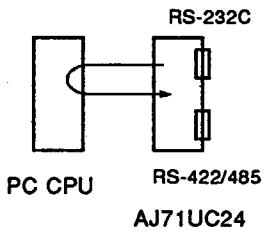
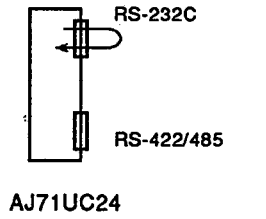
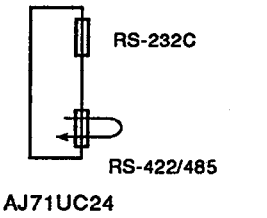
3) Checking sequence
Checking proceeds and repeats in the sequence of (1) PC CPU communications check → (2) RS-232C check → (3) RS-422/485 check.
(The AJ71UC24 automatically executes it.)

4) Check the indicator LEDs to see if they function as described in the table below:

When normal ..... Go to step (5) to terminate the test.

In case of error .... Turn off the power, and check the mode setting switch and the transmission specifications setting switches for settings and the cables for connections. Make the correct settings and connections, and perform another test.

Check Points of Self-Loopback Test

Check Point	Description	Indication When Normal		Indication in Case of Error		Remarks
PC CPU communications check	The functions for communications with the PC CPU are checked.	2-C/N	OFF	2-C/N	ON	
		CPU R/W	Comes on			
RS-232C communications check	The data transmission and reception functions of the RS-232C interface are checked.	2-SIO	OFF	2-SIO	ON	
		2-SD	Flickers			
		2-RD				
RS-422/485 communications check	The data transmission and reception functions of the RS-422/485 interface are checked.	4-SIO	OFF	4-SIO	ON	
		4-SD	Flickers			
		4-RD				

*The test will go on even if an error occurs in the middle of a check.

5) Operation to terminate the test

(1) Turn off the power.

(2) Disconnect the cables, and connect another one for computer link operations.

(3) Turn the mode setting switch from "F" to "1" or "5".

3.3 External Wiring

The following table shows the connection diagram of the RS-232C cable.

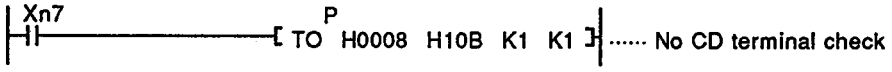
AJ71UC24		Cable Connection and Signal Direction	Computer	Signal Name	Description (Status on Computer Side)
Signal Symbol	Pin No.		Signal Symbol		
FG	1		FG	Frame ground	Cable shield terminal
SD	2		SD	Send data	Signal terminal which sends data
RD	3		RD	Received data	Signal terminal which receives data
RS	4		RS	Request to send	Signal terminals which, as soon as the self-station is ready to send, are turned on and send data to the CS of the station (simplification) while informing the communicating device that data is to be sent.
CS	5		CS	Clear to send	
DSR	6		DSR	Data set ready	Terminal for receiving an operation ready signal from the communicating device
SG	7		SG	Signal grounding	Signal grounding terminal
CD	8		CD	Data channel receiving carrier detect	Terminal which receives an ON signal when data is to be transmitted from the communicating device
DTR	20		DTR	Data terminal ready	Terminal which informs the communicating device that the self-station is ready to operate

Connect the cable according to the specifications of the computer.

Since the following type of RS-232C connector is used, connect a suitable mating connector for this one to the cable.
D-sub 25-pin (female) screwed type
17LE-13250-22-D2AC manufactured by DDK

POINT

The above diagram shows the wiring with a module that cannot turn on the CD signal in the computer link module. Data communications can be executed by inserting the following in the sequence program.



3.4 Setting the Computer

Set the computer according to the following:

RS-232C-0 ..... 4800 baud rates, 7 bits*, even parity, 1 stop bit, no X parameter
Printer ..... 24 dots, ANK
Memory size (KB) 640
Screen display attribute .... White
Numeric data processor .... None
Boot device ..... Standard
Numeric data processor 2 ... None

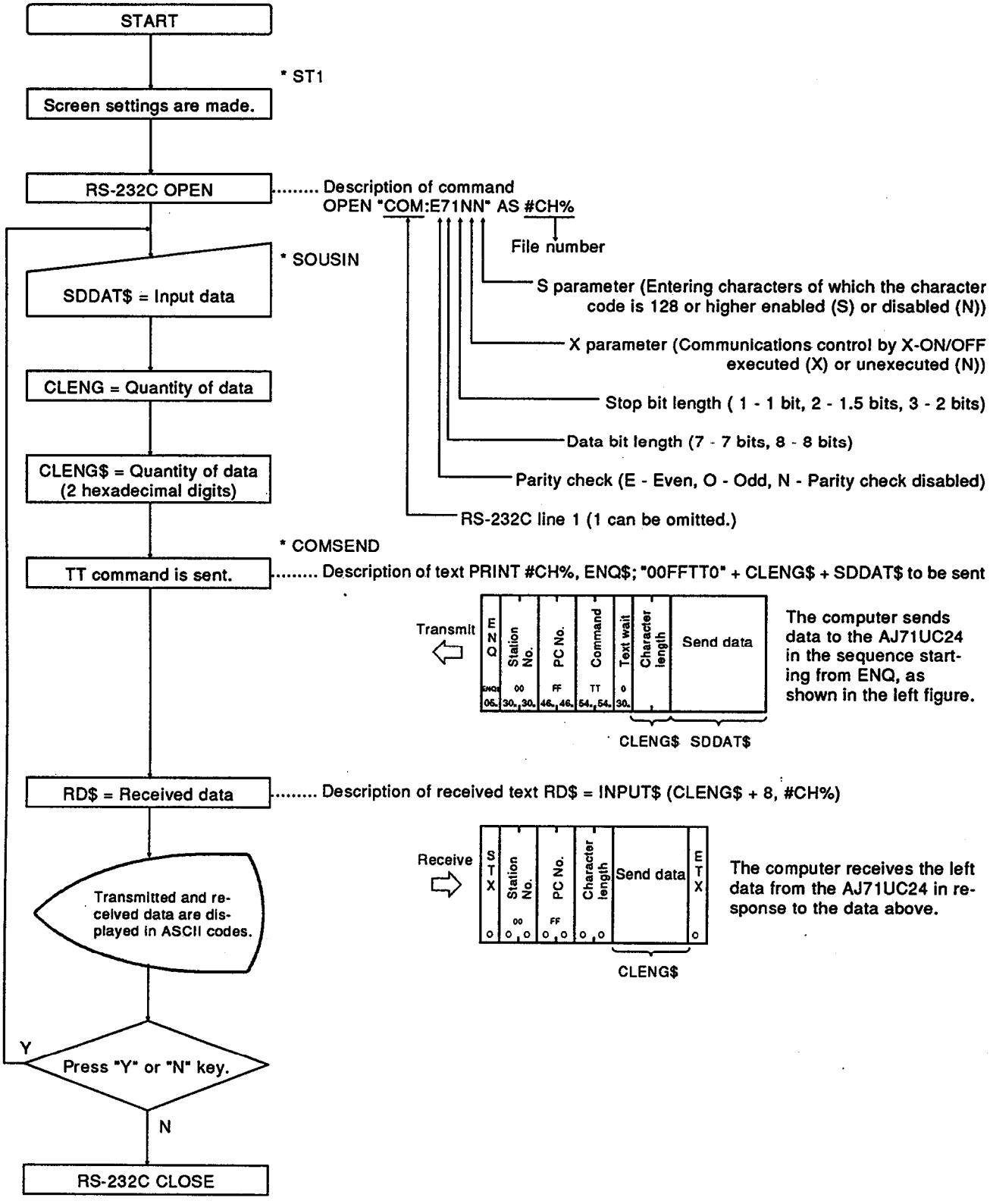
*Select 8 bits for the bidirectional mode.

3.5 Loopback Test

Loopback test is to check the status of data communications between the computer and the AJ71UC24 by the use of a dedicated command (TT) in one of dedicated protocol formats 1 to 4.
Data is transmitted from the computer to the AJ71UC24. The AJ71UC24 then sends back the received data as it is to the computer.
This function checks whether the data transmitted from the computer and that sent back from the AJ71UC24 match each other.

3.5.1 Program for loopback test (N88BASIC)

```
1000 '!-------------------------------------------------------------------------------------------------------------------!
1010 '!                          Example of AJ71UC24 loopback test program                                              !
1020 '!                                    (TT command)                                                                 !
1030 '!-------------------------------------------------------------------------------------------------------------------!
1040 *ST1
1050      CLS                                    :'Screen initialization
1060      CH%=1                                  :'Channel number
1070      ENQ$=CHR$(&H5)                         :'ENQ code
1080 '!-----------------------------------Open and initial settings of RS-232C are made.-----------------------------------!
1090      OPEN "COM:E71NN" AS #CH%               :'Communications mode and other specifications are set.
1100      '
1110 '!-------------------------------------------------Send data is entered.-------------------------------------------------!
1120 *SOUSIN
1130      CLS
1140      LOCATE 1, 1 : INPUT "SEND DATA";SDDAT$
1150      CLENG=LEN(SDDAT$)                      :'Character length
1160      CLENG$=RIGHT$("0"+HEX$(CLENG),2)  :'Character length is converted into hexadecimal.
1170      '
1180 '!-------------------------------------------------TT command is transmitted.--------------------------------------------!
1190 *COMSEND
1200      PRINT #CH%,ENQ$; "00FFTT0"+CLENG$+SDDAT$
1210      RD$=INPUT$(CLENG+ 8,#CH%) :MAXR%=LEN(RD$)   :'Returned data is received.
1220 '!-----------------------------------Send data and ASCII codes are displayed.-------------------------------------------!
1230      LOCATE 48, 0 : PRINT "SEND DATA"
1240      LOCATE 48, 1 : PRINT "ASCII CODES"
1250      SD$=ENQ$+"00FFTT0"+CLENG$+SDDAT$              :MAXS%=LEN(SD$)
1260      FOR I%=1 TO MAXS%
1270           IF I%>20 THEN Y%=I%-18 : X%=5 ELSE Y%=I%+2 : X%=0
1280           LOCATE 48+X%, Y%
1290           PRINT RIGHT$("0"+HEX$(ASC(MID$(SD$,I%,1))),2)
1300      NEXT I%
1310 '!-----------------------------------Received data and ASCII codes are displayed.----------------------------------!
1320      LOCATE 65, 0 : PRINT "RECEIVED DATA"
1330      LOCATE 65, 1 : PRINT "ASCII CODES"
1340      FOR I%=1 TO MAXR%
1350           IF I%>20 THEN Y%=I%-18 : X%=5 ELSE Y%=I%+2 : X%=0
1360           LOCATE 65+X%, Y%
1370           PRINT RIGHT$("0"+HEX$(ASC(MID$(RD$, I%, 1))), 2)
1380      NEXT I%
1390 '
1400      LOCATE 1,20 :INPUT "RETRANSMIT (Y/N)?"; Y$
1410      IF Y$="Y" THEN *SOUSIN
1420 CLOSE
1430 END
```



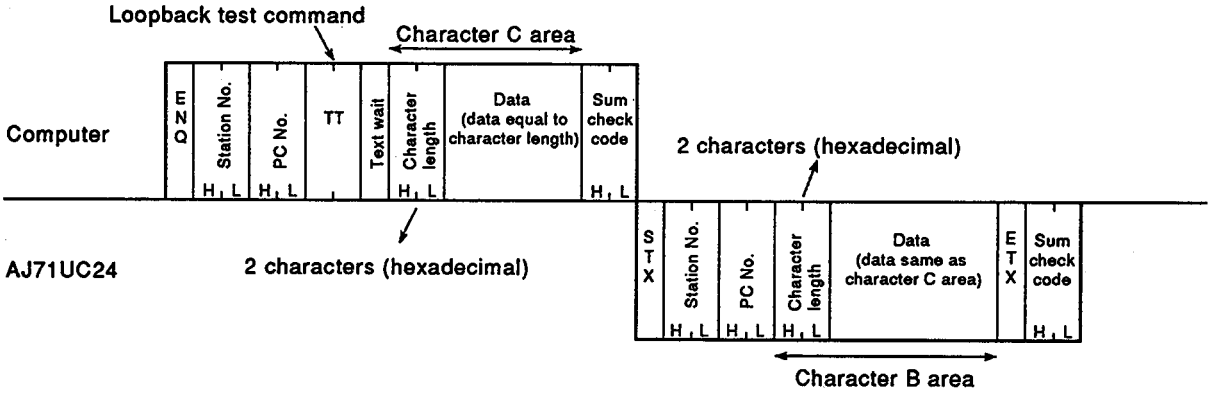
The name with an asterisk (*[ ]) is a label name used in the computer program.

Text structure in loopback test

The control procedure (format 1) and text for loopback test are as follows:

Control procedure

The following is the text structure in control procedure format 1:



POINT

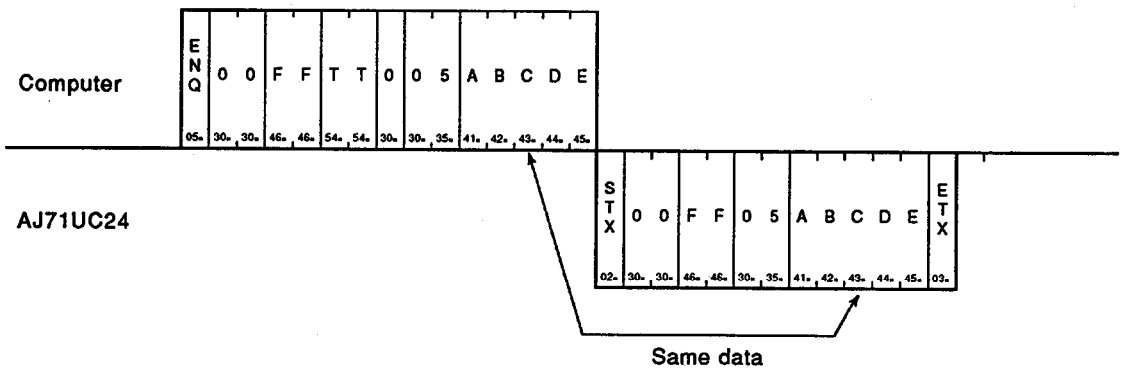
Set the character length within the following range:
- 1 ≤ Character length ≤ 254

Remarks

The sum check code can be omitted by turning off the transmission specifications setting switch SW21 on the AJ71UC24.

Designation example

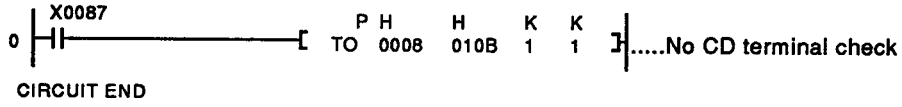
Loopback text when "ABCDE" is set in the data area of the send data (text wait time: 0 msec; sum check code: omitted)



For details of the control procedure and the text structure, see Section 4.3 in 4. DATA COMMUNICATIONS USING DEDICATED PROTOCOLS.

3.5.2 Loopback test procedure

1) Connect the cable between the computer and the AJ71UC24 according to Section 3.3 for the regular system configuration.
2) Set the setting switches on the face of the AJ71UC24 as described in Section 3.1.2.
   Turn the mode setting switch to 1.
3) Turn on the PC CPU.
   Write the following sequence program to the PC CPU:



   After the sequence program is written, reset the PC CPU to run it. The 2-NEU indicator LED on the AJ71UC24 will come on, and a loopback test can be carried out.
   (The 2-NEU indicator LED will come on several seconds after the power is turned on or the PC CPU is reset.)
4) Write the program shown in Section 3.5.1 to the computer. Then, run the computer.
   If no error is found, the following message will appear on the computer display:

```
SEND DATA?■
```

5) Enter data from the computer keyboard ([A][B][C][D][E][↵], for example).
6) The computer checks whether the data transmitted from the computer and that returned from the AJ71UC24 match each other.
   If they are identical, it means that communications between the computer and the AJ71UC24 is normal.

```
SEND DATA? ABCDE
```

Send data ASCII code		Received data ASCII code	
05	ENQ	02	STX
30 30	Station No. (00)	30 30	Station No. (00)
46 46	PCNo. (FF)	46 46	PCNo. (FF)
54 54	Command (TT)	30 35	Character length (5)
30	Text wait	41	Send data (ABCDE)
30 35	Character length (5)	42 43 44 45	
41 42 43 44 45	Send data (ABCDE)	03	ETX

```
RETRANSMIT (Y/N)?
```

Check these points!

• When communications is impossible	Is the sequence program (Section 3.5.2 3)) written to the PC CPU? Are the hardware settings (Section 3.1.2) and the cable connections (Section 3.3) correct? Check the indicator LEDs on the AJ71UC24 (Section 4.2), then reexamine the settings and the connections.
• When there is a mismatch between the data transmitted from the computer and that returned from the AJ71UC24	Are the transmission specifications setting switch settings (Section 3.1.2), the cable connections (Section 3.3), and the computer settings (Section 3.4) correct? Check the indicator LEDs on the AJ71UC24 (Section 4.2), then reexamine the settings.

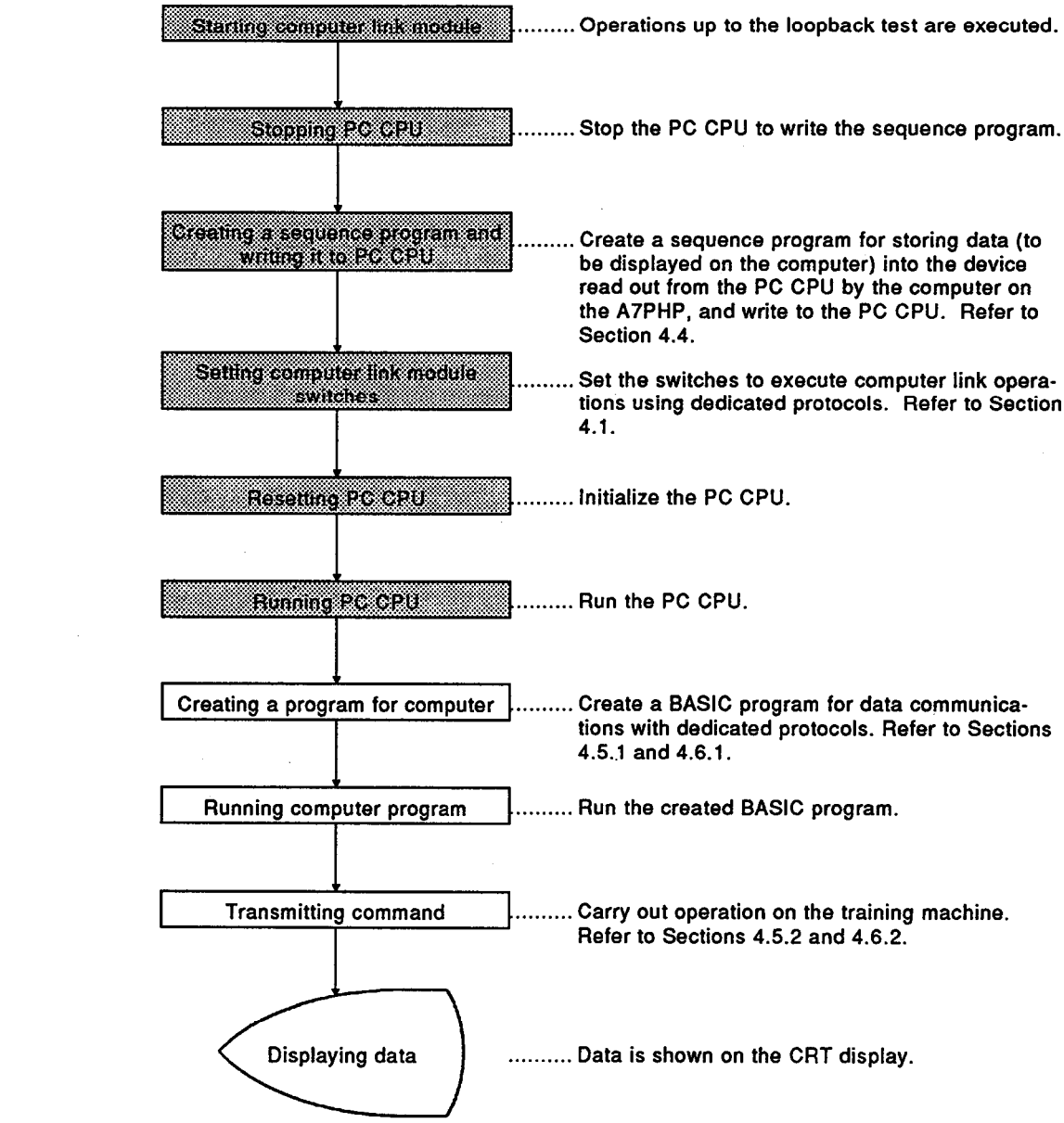
After making the correct settings, reset the PC CPU to restart the loopback test.

NEXT STEP

As soon as the loopback test is completed, the computer can be linked using dedicated protocols.
Now, let's go to Section 4.
As for computer link operations in the no-protocol or bidirectional mode, proceed to Section 5 or Section 6.

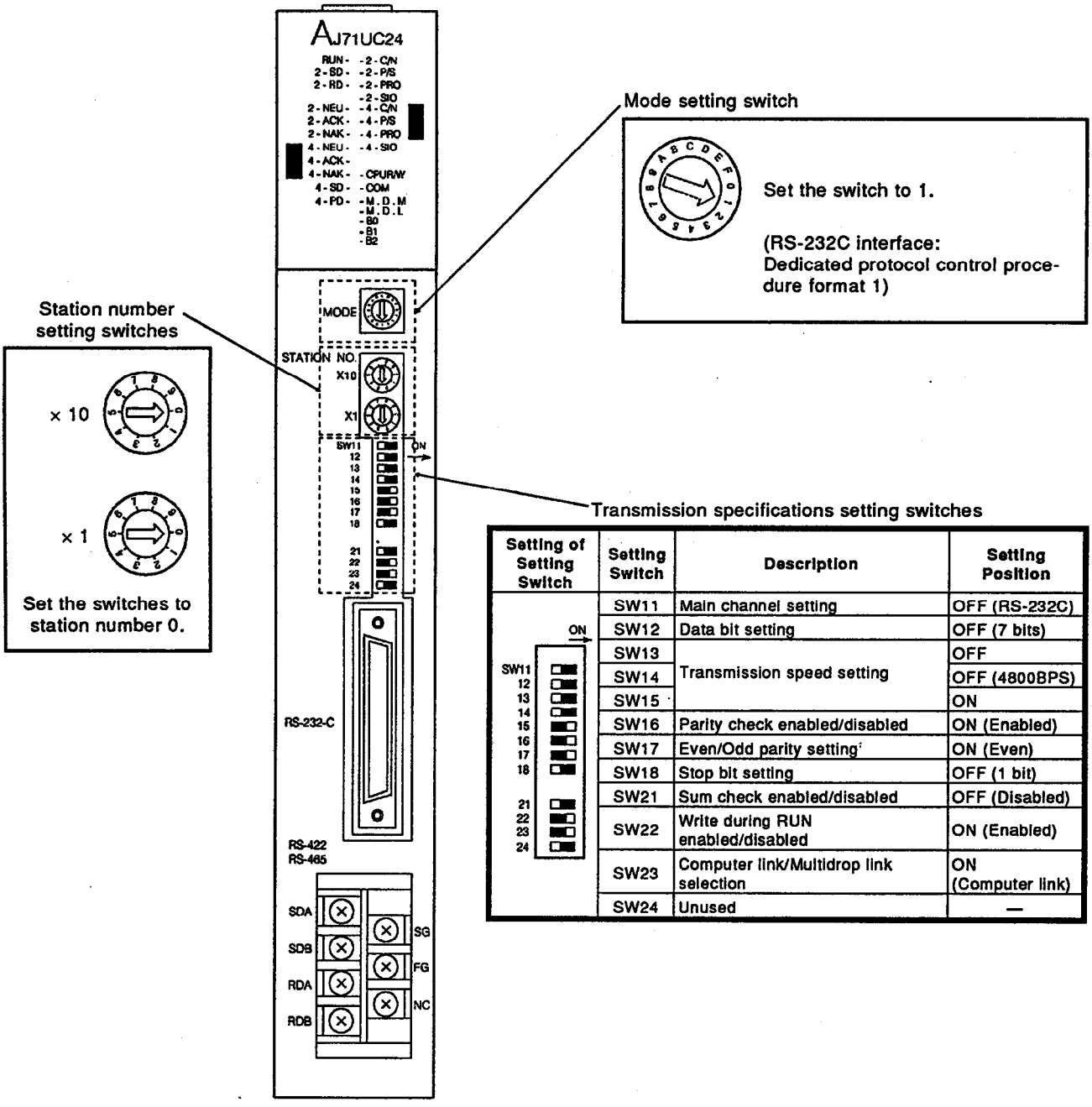
4. DATA COMMUNICATIONS USING DEDICATED PROTOCOLS

This section gives the communications procedure using dedicated protocols followed herein.



4.1 Settings Switches on the Computer Link Module AJ71UC24

Set the setting switches on the AJ71UC24 as shown below:



Setting of Setting Switch	Setting Switch	Description	Setting Position
	SW11	Main channel setting	OFF (RS-232C)
	SW12	Data bit setting	OFF (7 bits)
	SW13	Transmission speed setting	OFF
	SW14		OFF (4800BPS)
	SW15		ON
	SW16	Parity check enabled/disabled	ON (Enabled)
	SW17	Even/Odd parity setting	ON (Even)
	SW18	Stop bit setting	OFF (1 bit)
	SW21	Sum check enabled/disabled	OFF (Disabled)
	SW22	Write during RUN enabled/disabled	ON (Enabled)
	SW23	Computer link/Multidrop link selection	ON (Computer link)
	SW24	Unused	—

POINT

When a module other than the AJ71UC24 is used as computer link module, data communications described hereinafter can be executed by setting the corresponding switches as shown above.

4.2 Description of Indicator LEDs Related to Dedicated Protocols

The table below shows the states of the indicator LEDs on the AJ71UC24 during data communications using dedicated protocols in the system configuration described in Section 3.1.1. 1.

LED Name	Function of LED	LED ON	LED OFF	Corrective Action
RUN	Indicates the operation status of the AJ71UC24.	Normal	Module trouble	• Check the switches SW13 to SW15 and SW23 for settings. • Check the mode setting switch to see if it is set at the right number.
2-SD	Indicates the status of data transmission from the AJ71UC24 to the computer.	Flickers during data transmission.	Data not transmitted	• If the LEDs do not flicker even after the computer sends a command, check the cable connections.
2-RD	Indicates the status of data reception by the AJ71UC24 from the computer.	Flickers during data reception.	Data unreceived	
2-NEU	Indicates the status of processing by the AJ71UC24 on a request from the computer.	The AJ71UC24 is waiting for a request from the computer.	Processing requested by the computer is being executed.	If the status remains unchanged even after the computer sends a command, check the following: • cable connections • set number of the mode setting switch
2-ACK		The last received request is completely executed.	The last received request is incompletely executed.	
2-NAK		The last received request is incompletely executed.	The last received request is completely executed.	
2-C/N	Indicates the status of communications between the AJ71UC24 and the PC CPU.	Communications error	Normal	Check the switch SW22 (write during RUN enabled/disabled).
2-P/S	Indicates a parity or sum check error.	An error occurs.	Normal	The received data does not match the transmission specifications settings. • Match the transmission specifications of the AJ71UC24 with those of the computer. • Check the transmission specifications setting switches for settings.
2-PRO	Indicates the protocol status.	An error occurs.	Normal	The received data format does not match the mode setting. • Check the mode setting switch to see if it is set at the right number. • Check the text transmitted by the computer.
2-SIO	Indicates the data reception status.	An error occurs.	Normal	The received data does not match the transmission specifications settings. • Match the transmission specifications of the AJ71UC24 with those of the computer. • Check the transmission specifications setting switches for settings. • Lower the transmission speed.
CPU R/W	Indicates the status of communications between the AJ71UC24 and the PC CPU.	Flickers during communications (or comes on during suspension).	Communications error	Check the PC CPU and the computer for operation status. Check the mode setting switch to see if it is set at the right number.
COM	Indicates the function selected.	Computer link	Multidrop link	Set the switch SW23 (computer link/multidrop link selection) to ON.
B0	Indicates the transmission speed setting (settings of the switches SW13 to SW15) at 4800 BPS.	Error	Normal	Check the switches SW13 to SW15 for transmission speed setting.
B1		Error	Normal	
B2		Normal	rror	

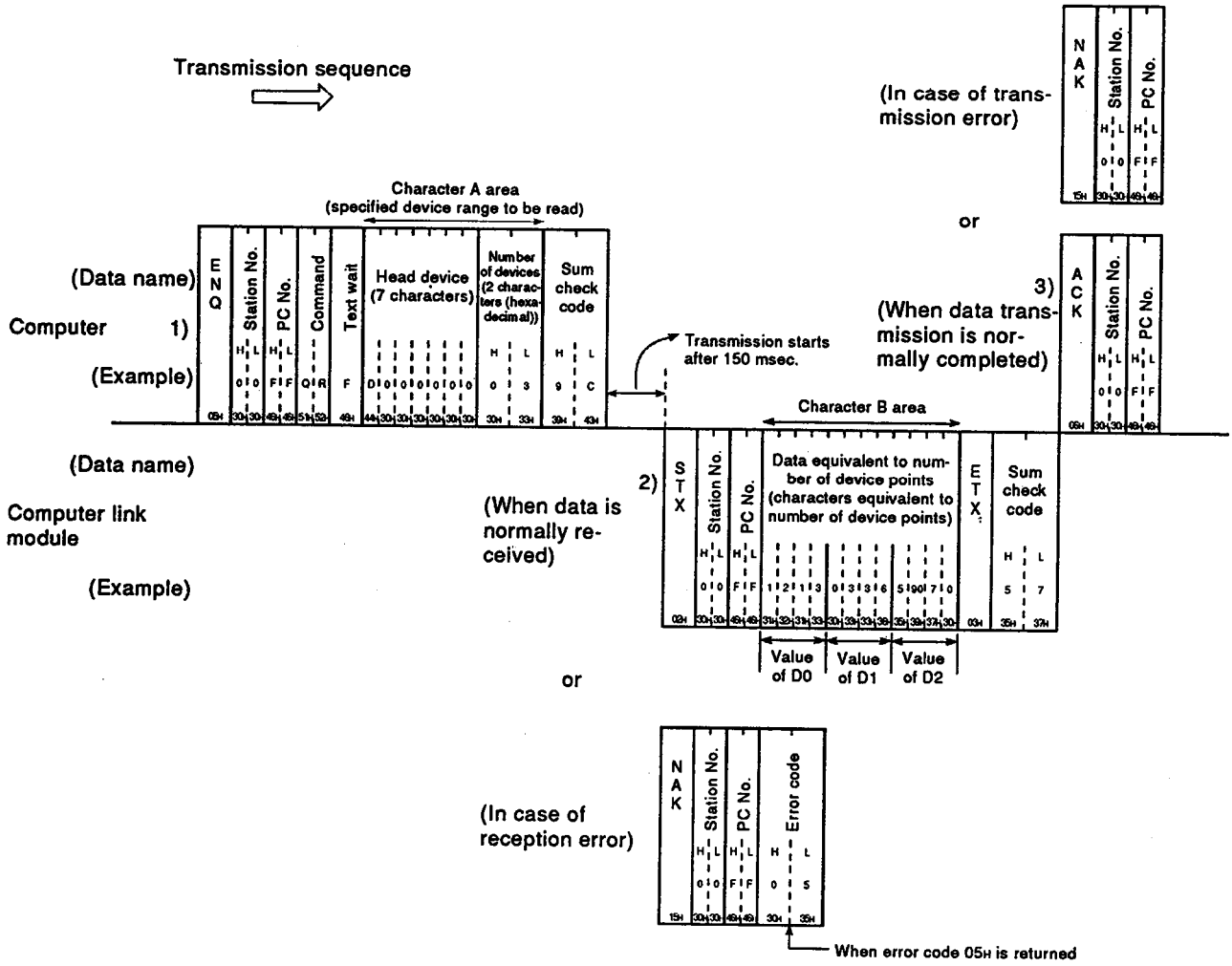
4.3 Dedicated Protocol Formats and Data Settings

Four text formats are available for data communications with dedicated protocols, however, this guidebook describes data communications in text format 1.

4.3.1 Control procedure and text structure in text format 1

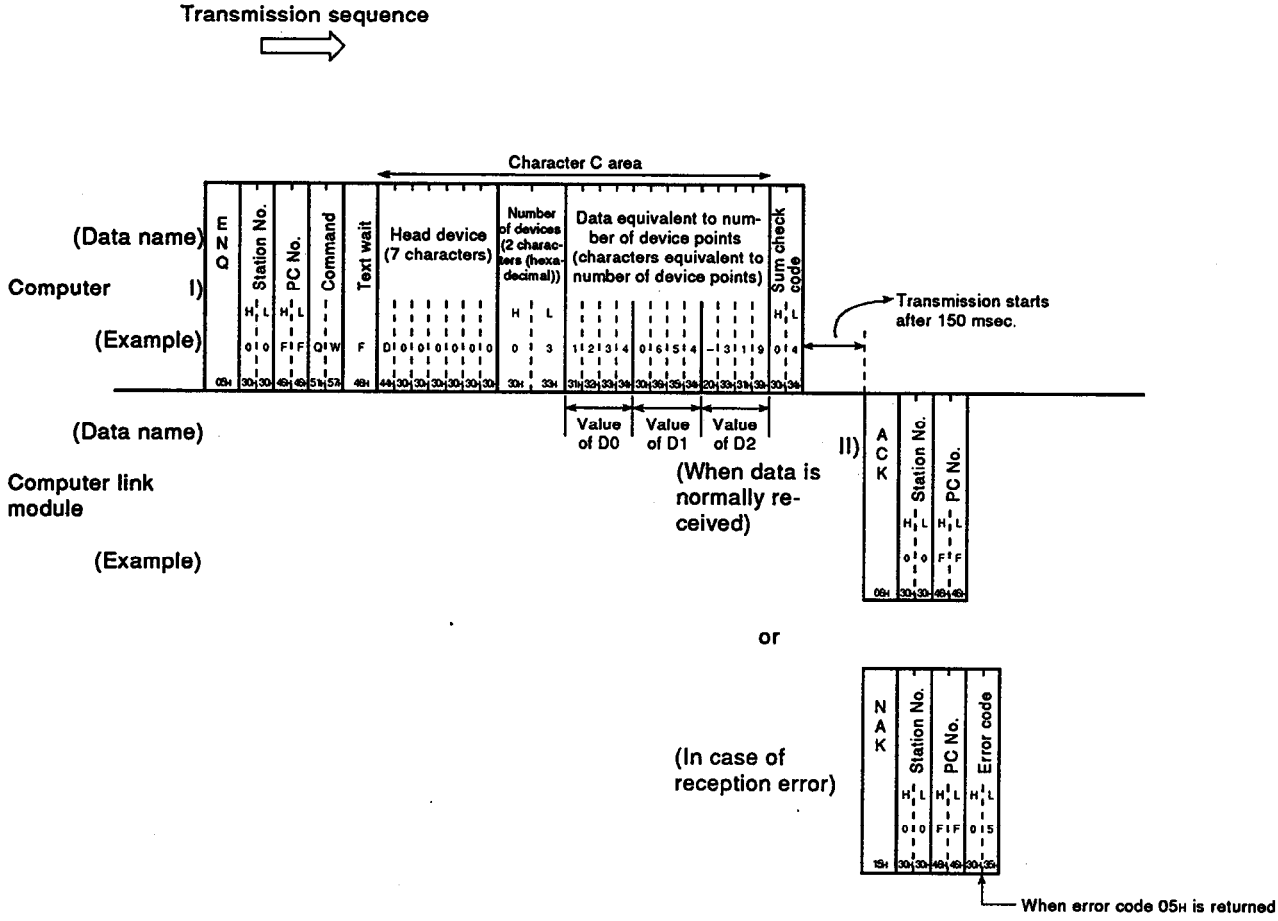
(1) Control procedure when the computer reads out data from the PC

(Example) When reading out data from three devices D0 to D2 of the PC CPU on a QR command (batch-reading data from device memory or in word units)



(2) Control procedure when writing data from the computer to the PC

(Example) When writing data to devices D0 to D2 of the PC CPU on a QW command (batch-writing data to device memory or in word units)



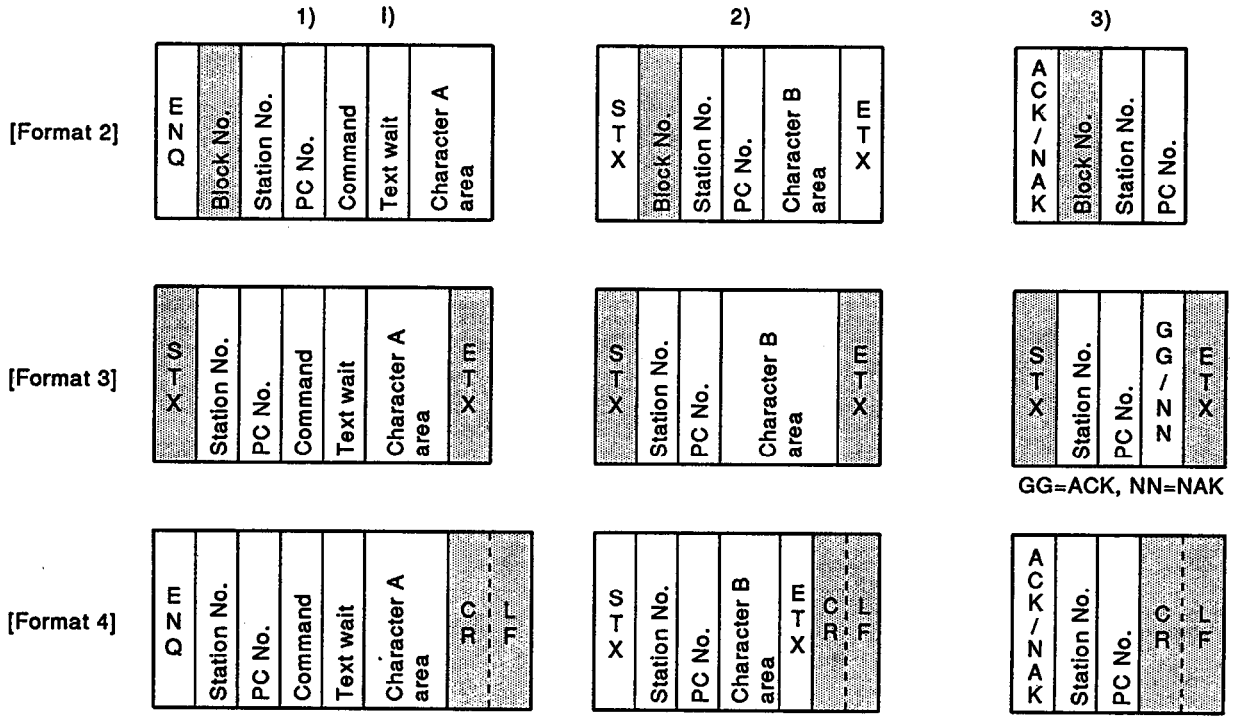
REMARKS

(1) The data in the "character A area", "character B area", and "character C area" in the above figures is different depending on the command. For details, see the section of commands in the User's Manual.
The data in each of the character A, B, and C areas is all the same in the four text formats.

(2) Because the response 3) from the computer can be omitted, its transmission is omitted herein.

(3) The transmission and reception of the sum check codes in 1), 2), and I) can be omitted by changing the setting of the transmission specifications setting switch SW21 on the AJ71UC24.
In this guidebook, the communications of each sum check code is omitted by setting the transmission specifications setting switch SW21 to OFF.

(4) The differences in text structure between text format 1 and text formats 2 to 4 are as shown below. The shading blocks are the different elements from format 1.



4.3.2 Description of data settings in format 1

Described below are the data elements to be specified for control procedure format 1:

(1) Control codes

Control Code	Code (Hexadecimal)	Description	Function
STX	02H	Start of Text	Indicates the head of send data.
ETX	03H	End of Text	Indicates the end of send data.
ENQ	05H	Enquiry	Indicates the head of send data.
ACK	06H	Acknowledge	Responds to the communicating device when data communications is normally completed.
NAK	15H	Negative Acknowledge	Responds to the communicating device in case of data communications error.
EOT	04H	End of Transmission	Initialize the transmission sequence for data communications and sets the computer link module waiting for a command from the computer.
CL	0CH	Clear	

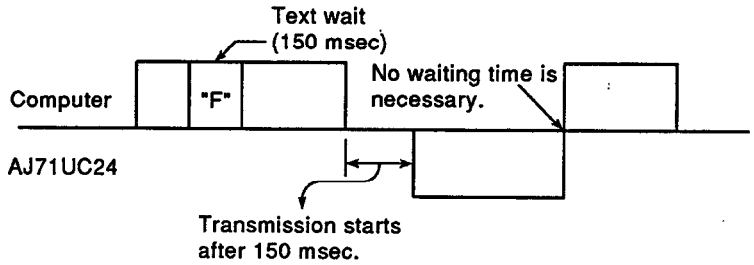
(2) Station number ("00")
The station number is used to identify which AJ71UC24 the computer should access. In this guidebook, the number 00H set by the station number setting switch on the face of the AJ71UC24 is converted into two ASCII-code digits (hexadecimal) and specified.

(3) PC number ("FF")
The PC number is used to identify which PC CPU on the MELSECNET should be accessed through the PC CPU connected to the computer.
In this guidebook, data communications is executed with the PC CPU connected to the computer, and FFH is converted into two ASCII-code digits (hexadecimal) and set.

(4) Command ("OR/OW")
The command is to specify what kind of access the computer should make to read out or write data from or to the PC CPU.
In this guidebook, data is batch-read or batch-written in word units, and thus the QR or QW command is specified.

(5) Text wait ("F")
The text wait is used to secure a waiting time when the AJ71UC24 gives a response (processing result) to the computer after the computer sent a command.
In this guide book, a waiting time of 150 msec is allowed, and thus "F" is specified. (The time is converted into an ASCII-code digit on the basis of 10 msec to 1H.)

(Example) When the text wait is 150 msec



(6) Error code
The error code shows what kind of error has occurred and caused NAK. The error code is between 00H and FFH, and is transmitted in two ASCII-code digits (hexadecimal).
When two or more errors occur at the same time, the error code corresponding to the one first detected is sent.

REMARKS

Sum check code

In data communications in each format using dedicated protocols, the following sum check code can also be transmitted or received by setting the transmission specifications setting switch SW21 (sum check enabled/disabled) to ON to improve the reliability of the data to be transmitted or received.

When the SW21 is set to ON, the AJ71UC24 can:

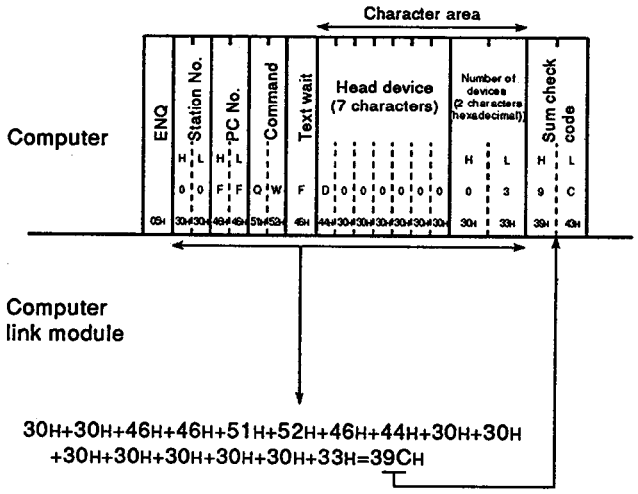
(1) add a sum check code to the data to be transmitted; or

(2) check the sum check code of the received data.

Since this guidebook refers to data communications with the SW21 set to OFF, it does not cover such a sum check code.

For reference, an example of the sum check code is given below:

(Example) When data is to be read out from the three devices D0 to D2 under the settings of format 1, station number: 0, PC number: FF, command QR (batch-reading data from device memory), and text wait: 150 ms, the sum check code value is as follows:



4.3.3 Buffer memory allocation

The following list shows the buffer memory areas to be used for dedicated protocols.
In data communications in dedicated protocol control procedure format 1 herein, data is read out from or written to the areas with the mark ★ only by the sequence program.
Regarding the buffer memory addresses 100H to 11FH except the above, do not change their settings from the default values.

Address	Buffer Memory Address Name		Default Value	Dedicated Protocol
0H	User free area (256 words)	Default allocation: No-protocol mode send data size storage area	0 (Area for transmission in no-protocol mode)	O
1H to 7FH		Default allocation: Buffer memory area for transmission in no-protocol mode (Send data storage area)		
80H		Default allocation: No-protocol mode received data size storage area	0 (Area for reception in no-protocol mode)	
81H to FFH		Default allocation: Buffer memory area for reception in no-protocol mode (Received data storage area)		
100H	Area for specifying reception completed code in no-protocol mode		0D0AH (CR, LF)	—
101H	Error LED indication states storage area		0	Δ
102H	Error LED turn off request area		0	●
103H	Area for specifying word/byte units in no-protocol mode		0 (Words)	●
104H	Area for specifying head address of buffer memory for transmission in no-protocol mode		0	—
105H	Area for specifying buffer memory size for transmission in no-protocol mode		80H	—
106H	Area for specifying head address of buffer memory for reception in no-protocol mode		80H	—
107H	Area for specifying buffer memory size for reception in no-protocol mode		80H	—
108H	Area for specifying data size received in no-protocol mode		127 (Words)	—
109H ★	Area for specifying head address of on-demand buffer memory		0	●
10AH ★	Area for specifying on-demand data length		0	●
10BH ★	RS-232C CD terminal check setting area		0 (Enabled)	●
10CH ★	On-demand errors storage area		0	Δ
10DH	Area for requesting to clear received data in no-protocol mode		0	—
10EH	System area (unusable)		—	—
10FH	RS-232C communications mode setting area		0 (Full-duplex transmission)	●
110H	Area for specifying priority/non-priority in simultaneous transmission		0 (Priority)	●
111H	Area for specifying transmission method for resuming transmission		0 (No retransmission)	●
112H	Bidirectional mode setting area		0	—
113H	Time-out check time setting area		0	—
114H	Area for specifying data valid/invalid in simultaneous transmission		0	—
115H	Area for specifying check sum enabled/disabled		0	—
116H	Data transmission errors storage area		0	—
117H	Data reception errors storage area		0	—
118H	Operation mode storage area		0 (Mode 0)	Δ
119H	Mode switching setting area		0 (No switching)	O
11AH	Area for specifying transmission control (DTR/DSR control or DC code control)		0 (DTR/DSR control)	●
11BH	Area for specifying DC1/DC3 control code		1311H	●
11CH	Area for specifying DC2/DC4 control code		1412H	●
11DH	RS-232C signal states storage area		—	Δ
11EH	Mode setting switch/Station number setting switch positions storage area		—	Δ
11FH	Transmission specifications setting switch positions storage area		—	Δ
120H to DFFH	★ User free area (3296 words)		0	O

The symbols ●, O, Δ, and — in the Dedicated Protocol column of the above list represent the following:

- ● : Area from/to which the PC CPU can read out/write data and from which the computer can read out data.
- O : Area from/to which the PC CPU and the computer can read out /write data.
- Δ : Area from which the PC CPU and the computer can only read out data.
- —: Area which is unused for dedicated protocols.

4.3.4 I/O signals to the PC CPU

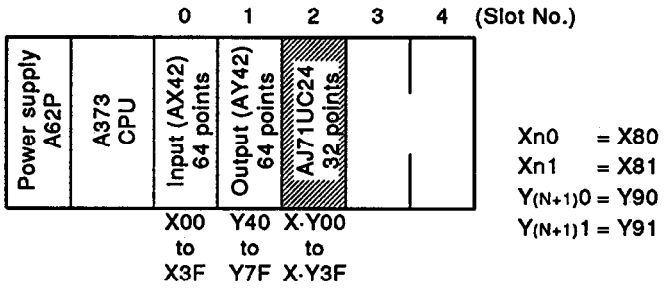
The following table shows the I/O signals available for dedicated protocols.

(1) Input signals (AJ71UC24 → PC CPU)

<table>
<tr><th>Input Signal</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>Xn2</td><td>Global signal</td><td>Turned on or off when the PC CPU receives a global command from the computer.</td></tr>
<tr><td>Xn3</td><td>On-demand being executed</td><td>Turned on only when data is transmitted by the on-demand function.</td></tr>
<tr><td>Xn4
to
Xn6</td><td>AJ71UC24 transmission sequence status</td><td>Indicates the computer link status when dedicated protocols are used.
<table>
<tr><th>Value</th><th>Xn6</th><th>Xn5</th><th>Xn4</th><th>Transmission Sequence Status</th></tr>
<tr><td>0</td><td>OFF</td><td>OFF</td><td>OFF</td><td>When the AJ71UC24 is executing initial processing after the power is turned on or formats 1 to 4 are not used.</td></tr>
<tr><td>1</td><td>OFF</td><td>OFF</td><td>ON</td><td>Waiting for ENQ</td></tr>
<tr><td>2</td><td>OFF</td><td>ON</td><td>OFF</td><td>After receiving ENQ</td></tr>
<tr><td>3</td><td>OFF</td><td>ON</td><td>ON</td><td>After receiving station number (self)</td></tr>
<tr><td>4</td><td>ON</td><td>OFF</td><td>OFF</td><td>Waiting for response from PC after receiving all data</td></tr>
<tr><td>5</td><td>ON</td><td>OFF</td><td>ON</td><td>Waiting for text</td></tr>
<tr><td>6</td><td>ON</td><td>ON</td><td>OFF</td><td>Unused</td></tr>
<tr><td>7</td><td>ON</td><td>ON</td><td>ON</td><td>Unused</td></tr>
</table></td></tr>
<tr><td>Xn7</td><td>AJ71UC24 READY signal</td><td>Remains on when the AJ71UC24 is ready to operate.</td></tr>
<tr><td>XnD</td><td>Watch dog timer error</td><td>Turned on when the AJ71UC24 is unable operate.</td></tr>
</table>

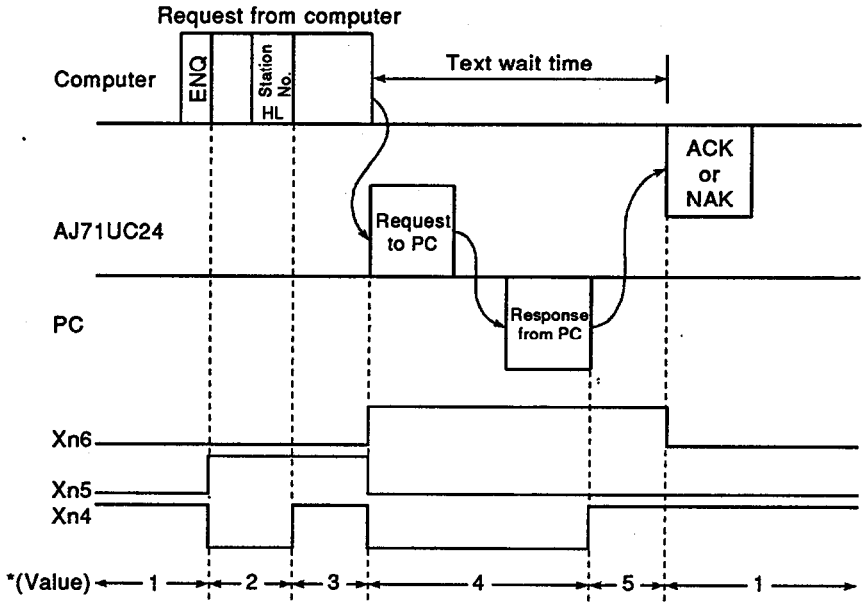
The shading blocks are signals used in this guidebook.

(Note) The I/O numbers Xn0 and Y(n+1)0 depend on the slot in which the AJ71UC24 is loaded.
In the system configuration described herein, the AJ71UC24 is used for X·Y80 to 9F, as shown in the following figure.



REMARKS

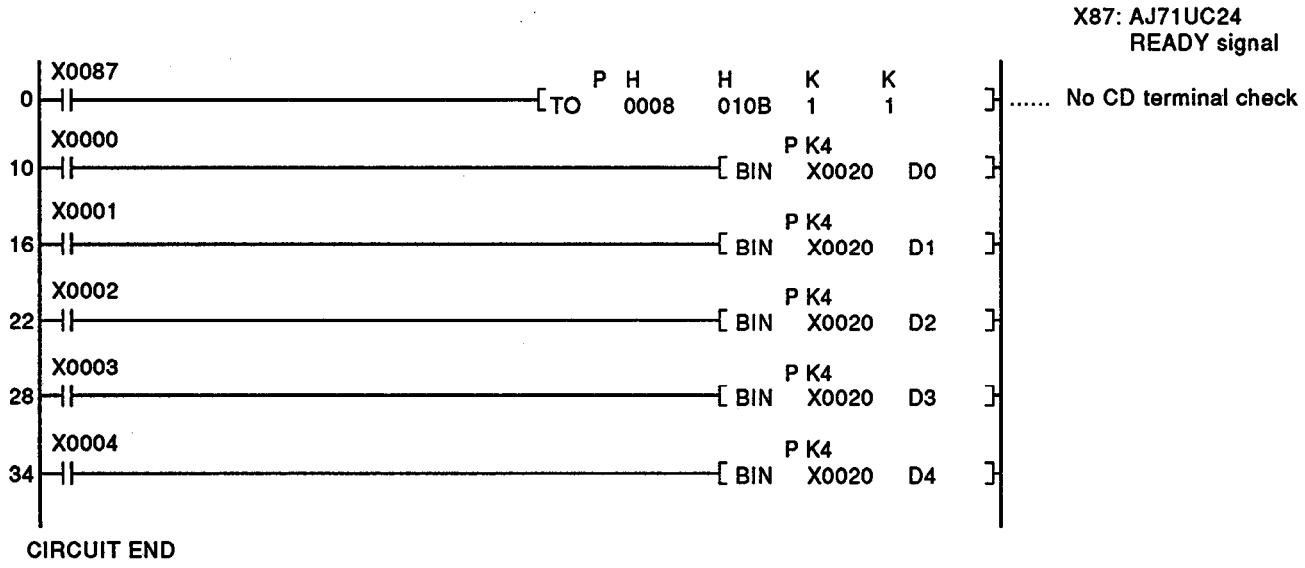
(Example) The figure below shows the change in the state of each of the input signals Xn4 to Xn6 during link operation.



*: The values are 3-bit BIN values of the Xn4 to the Xn6 which show the transmission sequence status.

4.4 Sequence Program

Create a program, which allows the computer to store data (for computer monitoring) into the device read out from the PC CPU, on the A7PHP, and write it to the PC CPU.



The above program is a control program for the system configuration shown in Section 3.1.1, not for communications with the computer.

4.5 Reading Out Data from the Device Memory in the PC CPU

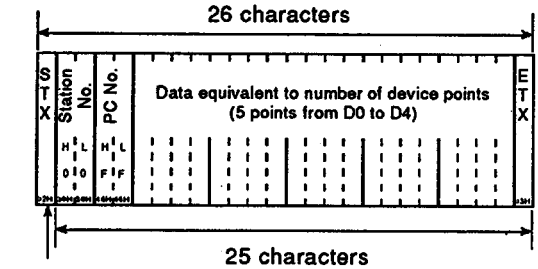
The contents of the data registers D0 to D4 (5 words) in the PC CPU are read out into the computer in word units and shown on the CRT display.

4.5.1 Computer program (N88BASIC)

```
1000 ' !---------------------------------------------------------------------------------------------------------------------------------!
1010 ' !                                  Example of program for AJ71UC24 QR command                                                     !
1020 ' !                          (Batch-reading data from data registers D0 to D4 (present value))                                      !
1030 ' !---------------------------------------------------------------------------------------------------------------------------------!
1040 *ST1
1050     CLS                                          : ' Screen initialization
1060     WTCNT%=10                                    : ' Retry counter waiting for data reception
1070     DLCNT% =1000                                 : ' Counter for adjusting data reception waiting time
1080     STCNT% =26                                   : ' Received data length when STX is received
1090     NACNT% = 7                                   : ' Received data length when NAK is received
1100     ERFLG% =0                                    : ' For storing error flags at the end of reception
1110     RVCNT% =0                                    : ' For storing all data requested to receive
1120     CH%    =1                                    : ' Channel number
1130     STX$   =CHR$(&H2)                            : ' STX code
1140     ETX$   =CHR$(&H3)                            : ' ETX code
1150     ENQ$   =CHR$(&H5)                            : ' ENQ code
1160     NAK$   =CHR$(&H15)                           : ' NAK code
1170     '
1180 ' !---------------------------------- Open and initial settings of RS-232C are made. ----------------------------------------- !
1190     OPEN "COM:E71NN" AS #CH%                     : ' Communications mode and other specifications are set. !
1200     '                                                                                                                             !
1210 ' !------------------------------------------------ QR command is transmitted. ------------------------------------------------- !
1220 *COMSEND
1230     PRINT #CH%, ENQ$; "00FFQRFD00000005"
1240     '
1250 ' !------------------------------------------- Present values of D0 to D4 are received. ---------------------------------------- !
1260 *RECEIVE
1270     RVCNT% =1 : GOSUB *JYUSIN                    : ' Request to receive 1 character
1280     IF ERFLG% =99 THEN *ERFIN                    : ' Unreceived
1290     BUF$ =RCV$
1300     IF (BUF$=STX$ OR BUF$=NAK$) THEN *REC1 ELSE *RECEIVE
1310 *REC1
1320     IF BUF$=STX$ THEN RVCNT%=STCNT%-1            : ' "25" is set for the number of characters requested to receive.
1330     IF BUF$=NAK$ THEN RVCNT%=NACNT%-1            : ' "6" is set for the number of characters requested to receive.
1340     GOSUB *JYUSIN                                : ' Request to receive
1350     IF ERFLG%=99 THEN *ERFIN                     : ' Unreceived
1360     BUF$=BUF$+RCV$                               : ' All received data is stored into BUF$.
1370     '
1380     IF LEFT$(BUF$, 5)=STX$+"00FF" AND RIGHT$ (BUF$, 1)=ETX$ THEN *DISP
1390     IF LEFT$(BUF$, 5)=NAK$+"00FF" THEN *ERCODE ELSE *ERDISP
1400     '
1410 ' !------------------------------------------------ Received data is displayed. ------------------------------------------------ !
1420 *DISP
1430     LOCATE 27, 4 : PRINT "BATCH-READING IN WORD UNITS IS NORMALLY COMPLETED."
1440     D$=MID$ (BUF$, 6, 20)
1450     LOCATE 27, 8 : PRINT "D$=" ; D$
1460     LOCATE  7,12 : PRINT "LIST OF PRESENT VALUES OF D0 TO D4"
1470     FOR I%=1 TO 5
1480     DAT%=VAL ("&H"+MID$(D$, (I%-1)*4+1, 4))     : ' Data (four hexadecimal digits) is converted into decimal.
1490     DNO%=I%-1                                    : ' Data register number.
1500     LOCATE 15, 14+I%
1510     PRINT USING "D#=####" ; DNO%, DAT%
1520     NEXT I%
1530     GOTO *FIN
1540 ' !---------------------------------------- Data in case of reception error is displayed. ------------------------------------- !
```

```
1450      LOCATE 27, 8 : PRINT "D$=" ; D$
1460      LOCATE  7,12 : PRINT "LIST OF PRESENT VALUES OF D0 TO D4"
1470      FOR I%=1 TO 5
1480      DAT%=VAL ("&H"+MID$(D$, (I%-1)*4+1, 4))     : ' Data (four hexadecimal digits) is converted into decimal.
1490      DNO%=I%-1                                   : ' Data register number.
1500      LOCATE 15, 14+I%
1510      PRINT USING "D#=####" ; DNO%, DAT%
1520      NEXT I%
1530      GOTO *FIN
1540  ' !---------- Data in case of reception error is displayed. ---------- !
```

"One-point advice"



Received data BUF$

The details of the line numbers 1320 and 1380 in the program are as follows:

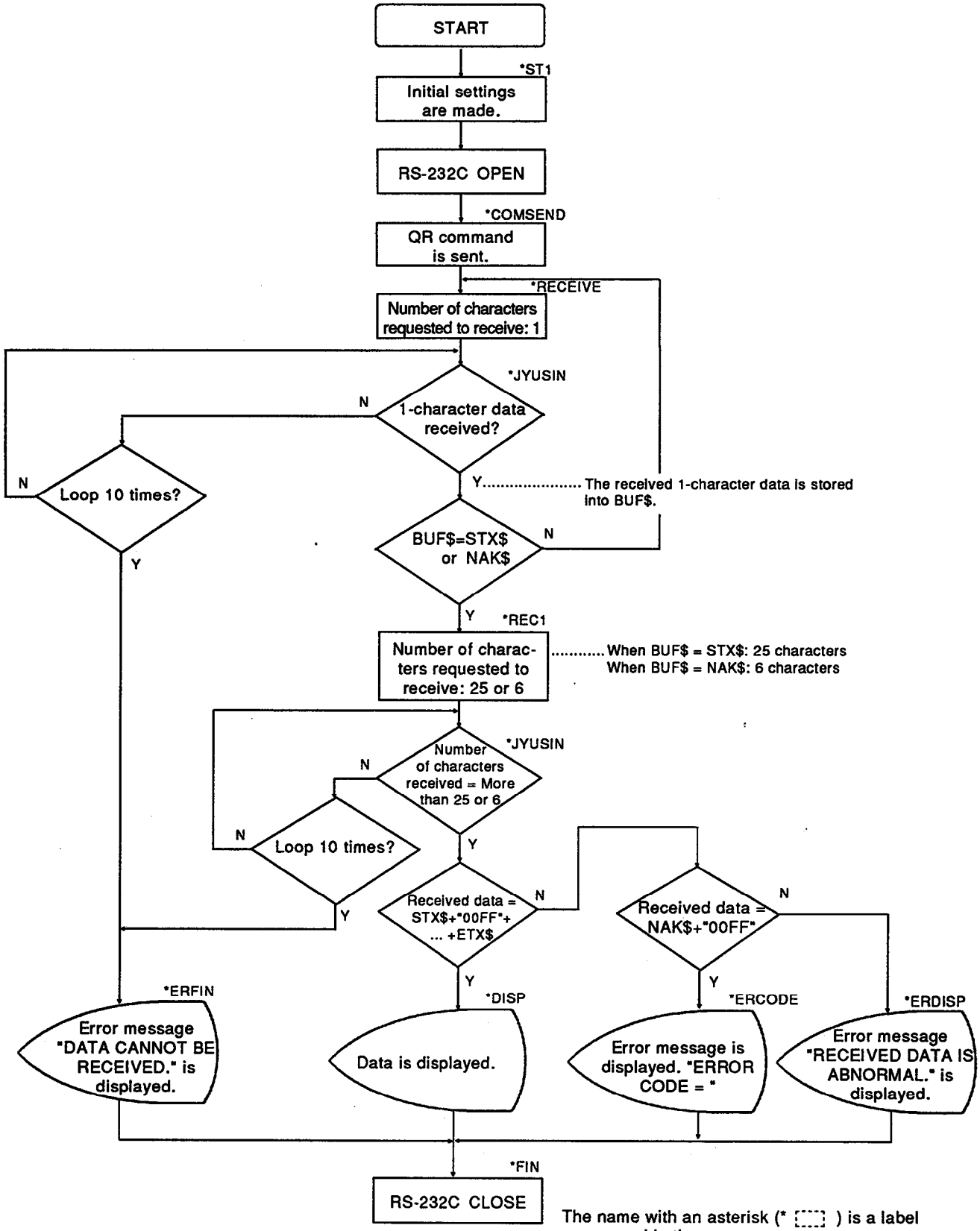
```
1320 IF BUF$=STX$ THEN RVCNT%=STCNT%-1
```

As soon as the computer receives the STX code from the AJ71UC24, it sets 25 representing the number of characters (data remaining to be received.

```
1380 IF LEFT$(BUF&, 5)=STX$+"00FF" AND RIGHT$(BUF$, 1)
                    =ETX$ THEN *DISP
```

The first five characters of the data received from the AJ71UC24 are arranged as shown in the left figure. If the last character is the ETX code, the program jumps to the line labelled *DISP.

Batch-reading data from data registers D0 to D4.

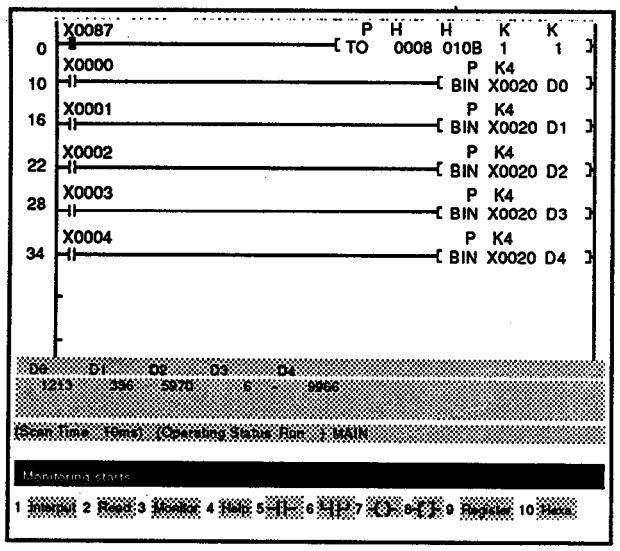


The name with an asterisk (* ⬚) is a label name used in the program.

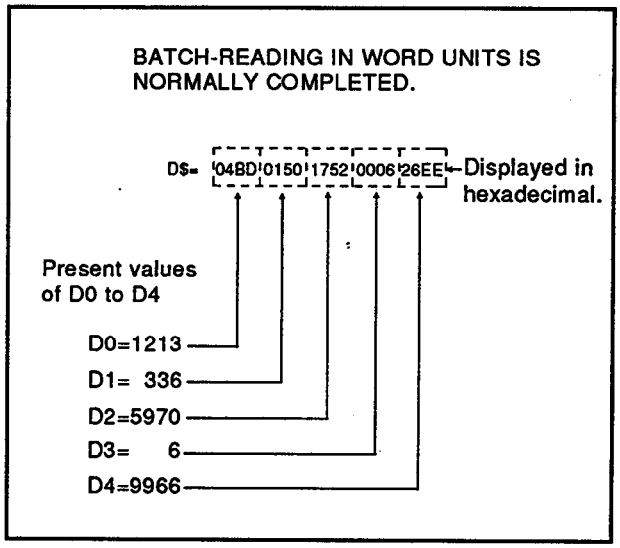
4.5.2 Operation on training machine

Write the sequence program described in Section 4.4 to the PC CPU, and the BASIC program shown in Section 4.5.1 to the computer.
After writing the programs, run the PC CPU.
If there is no error, start a computer link operation following the procedure below:

1) Set desired values to the digital switches X20 to X2F on the training machine.
2) Turn on the X0. The values will be stored into the data register D0.
   In the same manner, when the X1, X2, X3 or X4 is turned on, they will be stored into the D1, D2, D3 or D4 correspondingly.
   (They are controlled by the sequence program shown in Section 4.5.)
3) Monitor and check the contents of the data registers D0 to D4 on the A7PHP.
4) Run the BASIC program, and the contents of the data registers D0 to D4 will be constantly read out and shown on the CRT display.
   Let's check the contents.



PHP Display



Computer Display

Check these points!

- Although the computer sends a request to batch-read data,

"DATA CANNOT BE RECEIVED.
RECEPTION WILL BE DISCONTINUED."

is displayed.

- Is the sequence program (Section 4.4) written to the PC CPU?
- Are the cable connections (Section 3.3) correct?
- Are the computer settings (Section 3.4) and the AJ71UC24 switch settings (Section 4.1) correct? Check the indicator LEDs on the AJ71UC24 (Section 4.2), then reexamine the settings and the connections.

- Although batch-reading has been executed,

BATCH-READING IS ABNORMALLY COMPLETED. ERROR CODE = [ ]

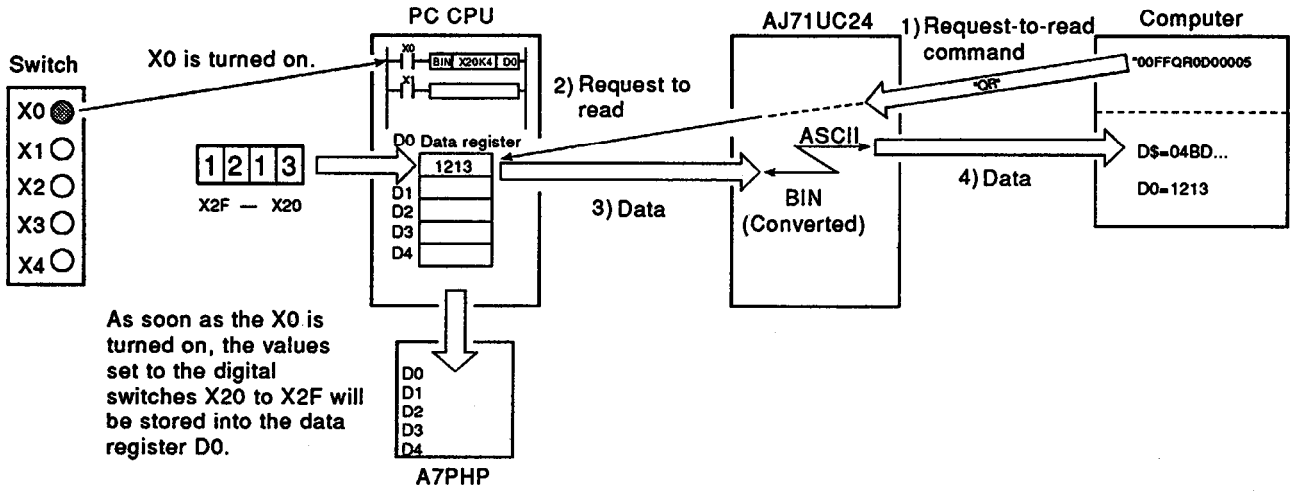
is displayed.

- Has the AJ71UC24 sent the NAK signal?
  Are the computer program settings (RS-232C settings, request-to-read command) (Section 4.5.1) and the AJ71UC24 switch settings (Section 4.1) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 4.2), then reexamine the settings.
- For details of the error code displayed, refer to the Computer Link Module User's Manual, and take proper action.

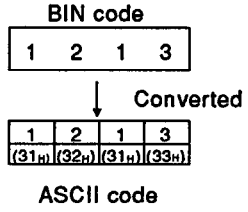
After making the correct settings, reset the PC CPU to restart communications.

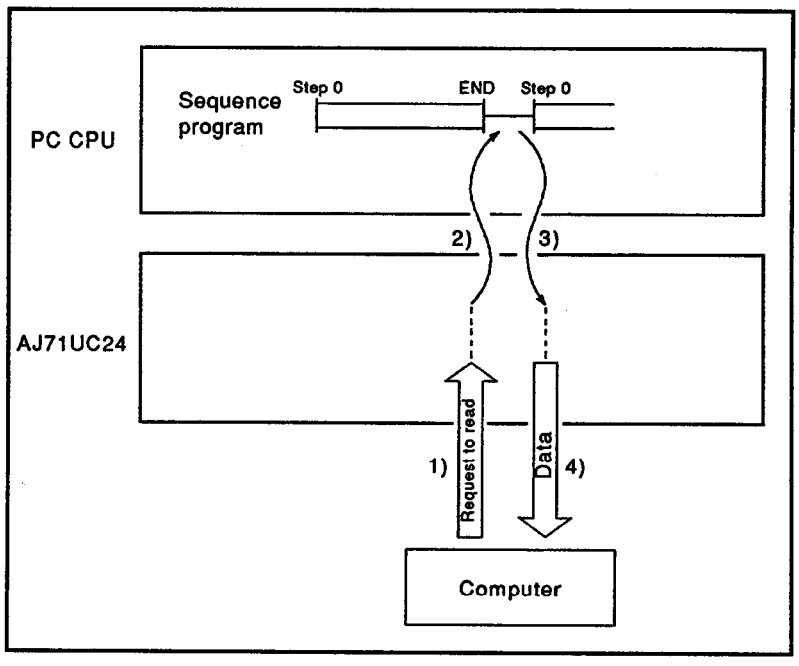
4.5.3 Outline of reading out data from device memory

The following figure outlines the flow of data readout from device memory to other modules described in Section 4.5.2.



1) The computer sends the request to read (command: QR) to the AJ71UC24.
2) On receipt of the request, the AJ71UC24 requests the PC CPU to read out data when the PC CPU executes END processing.
3) The PC CPU passes the data to the AJ71UC24.
4) The AJ71UC24 converts the read data into ASCII codes and transmits it to the computer.





4.6 Writing Data into the Device Memory in the PC CPU

Enter numeric data from the keyboard connected to the computer into the data registers D0 to D4 in the PC CPU.

4.6.1 Computer program (N88BASIC)

```
1000 ' !---------- !
1010 ' !                    Example of program for AJ71UC24 QW command                    !
1020 ' !                    (batch-writing data into data registers D0 to D4)              !
1030 ' !---------- !
1040 *ST1
1050     CLS                                    : ' Screen initialization
1060     WTCNT%=10                              : ' Retry counter waiting for data reception
1070     DLCNT% =1000                           : ' Counter for adjusting data reception waiting time
1080     ACCNT% =5                              : ' Received data length when ACK is received
1090     NACNT% =7                              : ' Received data length when NAK is received
1100     ERFLG% =0                              : ' For storing error flags at the end of reception
1110     RVCNT% =0                              : ' For storing all data requested to receive
1120     CH%    =1                              : ' Channel number
1130     ENQ$   =CHR$(&H5)                      : ' ENQ code
1140     ACK$   =CHR$(&H6)                      : ' ACK code
1150     NAK$   =CHR$(&H15)                     : ' NAK code
1160     '
1170 ' !---------- Data to be written into data registers is entered. ---------- !
1180     CLS
1190     LOCATE  10, 10 : PRINT "ENTER DATA IN DECIMAL."
1200     LOCATE  10, 12 : INPUT "D0=  " ; D(0)
1210     LOCATE  10, 13 : INPUT "D1=  " ; D(1)
1220     LOCATE  10, 14 : INPUT "D2=  " ; D(2)
1230     LOCATE  10, 15 : INPUT "D3=  " ; D(3)
1240     LOCATE  10, 16 : INPUT "D4=  " ; D(4)
1250     '
1260 ' !---------- Written data is converted into hexadecimal. ---------- !
1270     D$=" "
1280     FOR I%=0 TO 4
1290        D$=D$+RIGHT$("000"+HEX$(D(I%)),4)
1300     NEXT I%
1310     '
1320 ' !---------- Open and initial settings of RS-232C are made.---------- !
1330     OPEN "COM:E71NN" AS #CH%               : ' Communications mode and other specifications are set.
1340     '
1350 ' !---------- QW command is sent. ---------- !
1360 *COMSEND
1370     PRINT #CH%, ENQ$; " 00FFQWFD00000005 " +D$
1380     '
1390 ' !---------- Response text is received. ---------- !
1400 *RECEIVE
1410     RVCNT%=1 : GOSUB *JYUSIN               : ' Request to receive 1 character
1420     IF ERFLG%=99 THEN *ERFIN               : ' Unreceived
1430     BUF$=RCV$
1440     IF (BUF$=ACK$ OR BUF$=NAK$) THEN *REC1 ELSE *RECEIVE
1450     '
1460 *REC1
1470     IF BUF$=ACK$ THEN RVCNT%=ACCNT%-1      : ' "4" is set for the number of characters requested to receive.
1480     IF BUF$=NAK$ THEN RVCNT%=NACNT%-1      : ' "6" is set for the number of characters requested to receive.
1490     GOSUB *JYUSIN                          : ' Request to receive
1500     IF ERFLG%=99 THEN *ERFIN               : ' Unreceived
1510     BUF$=BUF$+RCV$                         : ' All received data is stored into BUF$.
1520     '
1530     CHK$=ACK$+ "00FF"                      : ' Response text structure when reception is normally completed
1540     IF BUF$=CHK$ THEN *SCDISP ELSE *ERDISP : ' Judgment of response text
1550     '
1560 ' !----------Message "RECEPTION IS NORMALLY COMPLETED." is displayed. ---------- !
1570 *SCDISP
```

```
1580      LOCATE 20, 20  :  PRINT "BATCH-WRITING IS NORMALLY COMPLETED."      : GOTO  *FIN
1590      '
1600  ' !-------------------Message "BATCH-WRITING IS ABNORMALLY COMPLETED." is displayed.-------------------- !
1610  *ERDISP                                                                                                  !
1620      LOCATE 20, 20  :  PRINT "BATCH-WRITING IS ABNORMALLY COMPLETED."
1630      ERCD$=MID$ (BUF$, 6, 2)
1640      LOCATE 27, 22  :  PRINT  "ERROR CODE =" ;ERCD$
1650      GOTO  *FIN
1660      '
1670  *ERFIN
1680      LOCATE 20, 20 : PRINT "RESPONSE TEXT CANNOT BE RECEIVED. RECEPTION WILL BE DISCONTINUED."
1690      '
1700  ' !-----------------------------------------------------RS-232C is closed.-----------------------------------------------------
1710  *FIN
1720      CLOSE  #CH%
1730      '
1740      END
1750  '
1760  ' !-----------------------------------------------Data reception subroutine-----------------------------------------------
1770  *JYUSIN
1780      FOR  I%= 1  TO  WTCNT%
1790         FOR  J%= 1  TO  DLCNT%                  : ' Data reception wait
1800         NEXT  J%
1810         IF LOC (CH%) => RVCNT% THEN *BUFIN : ' Jump when more characters than the specified
                                                     number are received
1820      NEXT  I%
1830      ERFLG%=99  :  RETURN                       : ' Data unreceived error
1840  *BUFIN
1850      RCV$=INPUT$ (RVCNT%, CH%)                  : ' Received data readout
1860      RETURN
1870      '
```

"One-point advice"

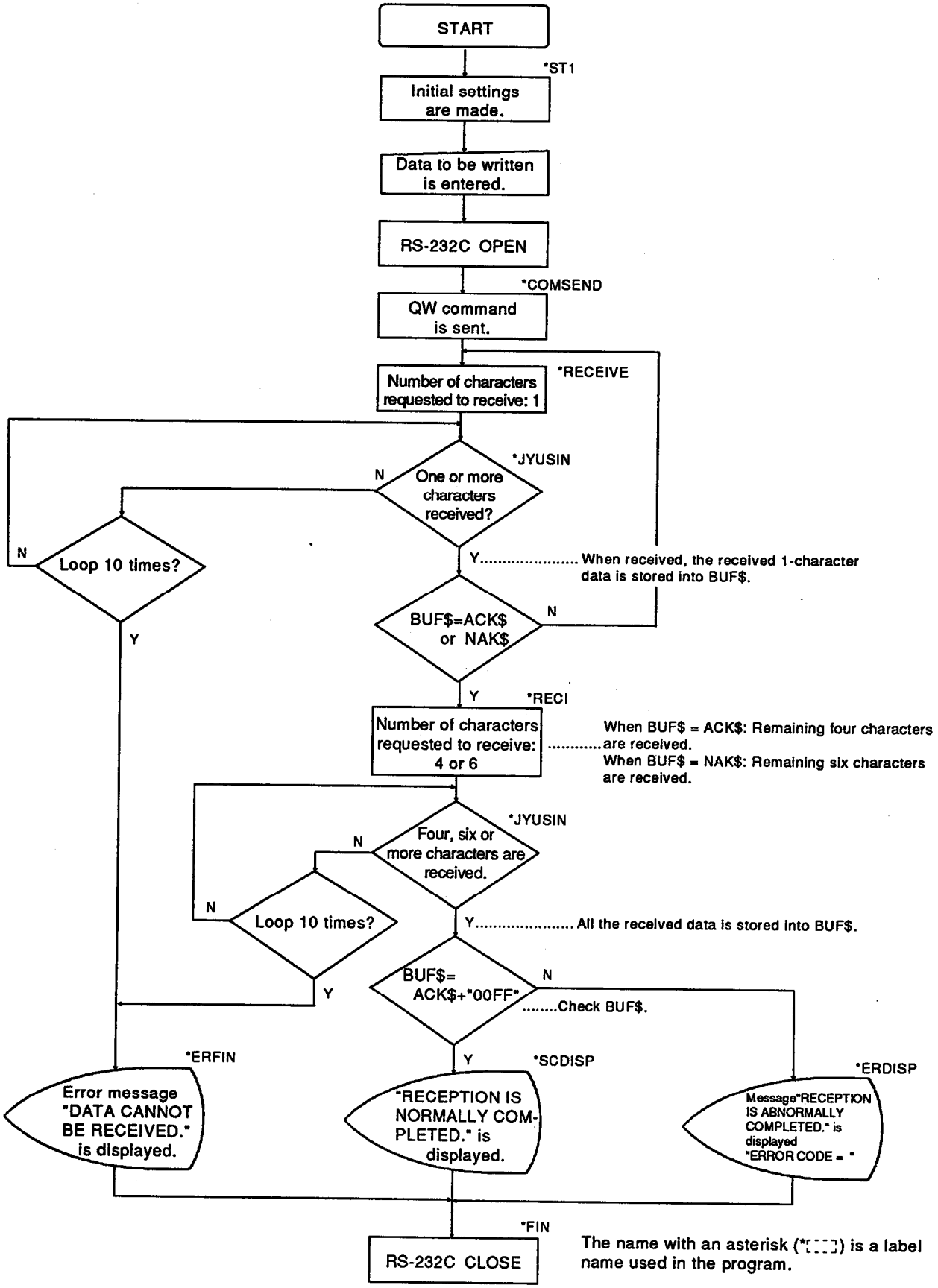
The details of the line number 1290 in the program are as follows:

1290. D$=D$+RIGHT$ ("000"+HEX$(D(I%)), 4)

The data stored in each of the data registers D0 to D4 is converted into four hexadecimal digits, and they are joined together.

	Converted into hexadecimal (H)	Stored (H)
D0=1234	D0=04D2	D$=04D2
D1=-32765	D1=8003	D$=04D28003
D2=8	D2=0008	D$=04D280030008
D3=21987	D3=55E3	D$=04D28003000855E3
D4=-21	D4=FFEB	D$=04D28003000855E3FFEB

Batch-writing data to the data registers D0 to D4



4.6.2 Operation on training machine

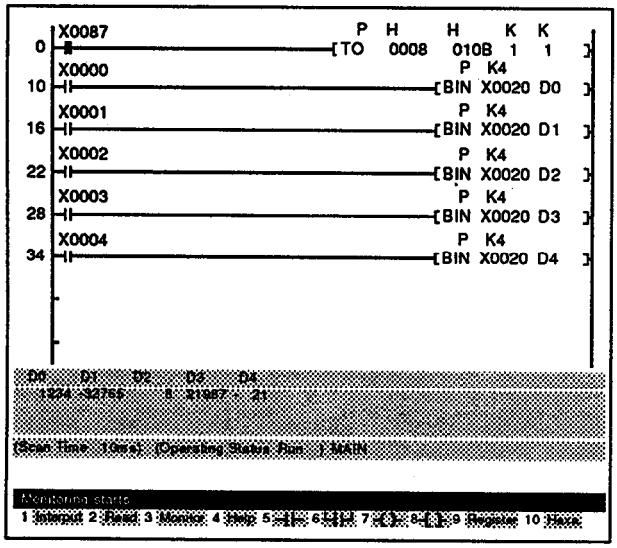
Write the sequence program described in Section 4.4 to the PC CPU, and the BASIC program shown in Section 4.6.1 to the computer.
After writing the programs, run each of them.
If there is no error, start a computer link operation following the procedure below:

1) Enter numeric data (-32768 to 32767) to be written to the data registers D0 to D4 by device from the keyboard connected to the computer.

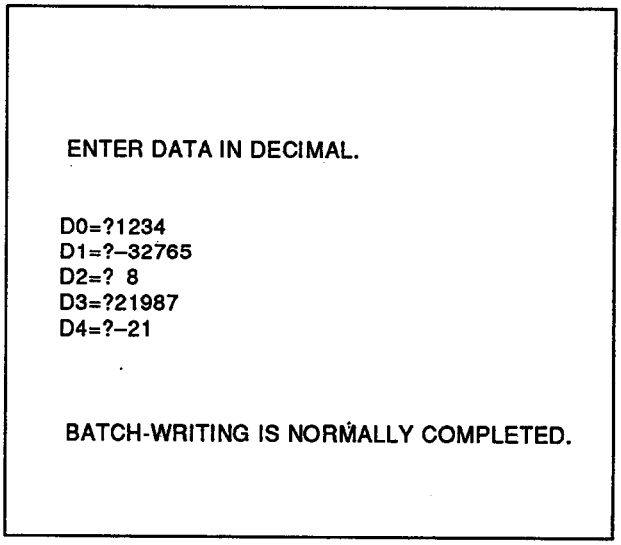
   For example, [1][2][3][4][↵]

2) As soon as all the numeric data is written to the registers D0 to D4, it is batch-written to the PC.

3) Monitor the data registers D0 to D4 on the A7PHP to check the written numeric data.



PHP Display



Computer Display

Check these points!

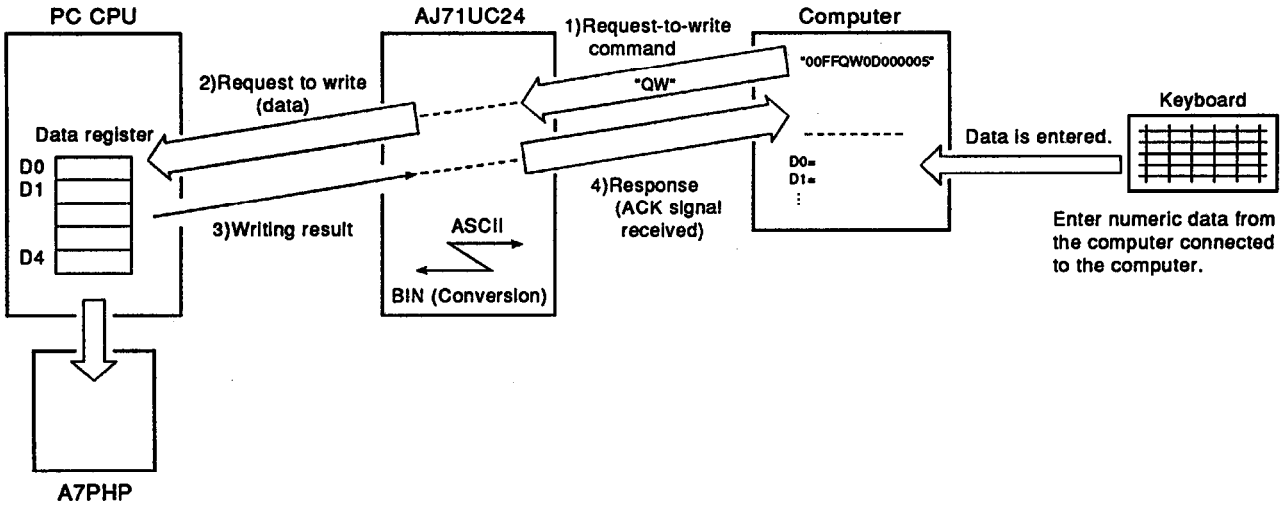
- When data to be written to the PC CPU is transmitted from the computer,

"RESPONSE TEXT CANNOT BE RECEIVED. RECEPTION WILL BE DISCONTINUED."	is displayed.	• Is the sequence program (Section 4.4) written to the PC CPU? • Are the cable connections (Section 3.3) correct? • Are the computer settings (Section 3.4) and the AJ71UC24 switch settings (Section 4.1) correct? Check the indicator LEDs on the AJ71UC24 (Section 4.2), then reexamine the settings and the connections.
BATCH-WRITING IS ABNORMALLY COMPLETED. ERROR CODE =	is displayed.	• Has the AJ71UC24 sent the NAK signal? Are the computer program settings (RS-232C settings, request-to-write command) (Section 4.6.1) and the AJ71UC24 switch settings (Section 4.1) correct? Check the indicator LEDs on the AJ71UC24 (Section 4.2), then reexamine the settings. • For details of the error code displayed, refer to the Computer Link Module User's Manual, and take proper action.

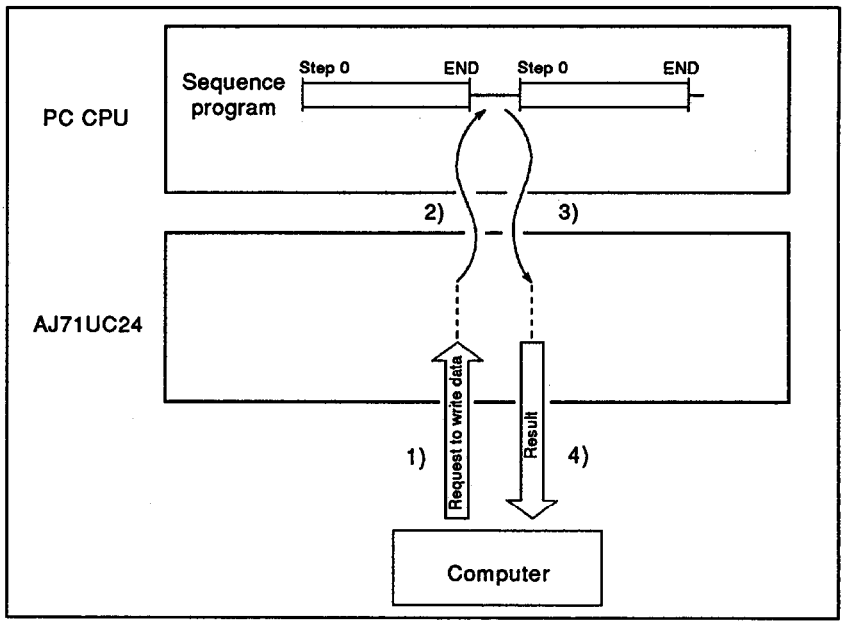
After making the correct settings, reset the PC CPU to restart communications.

4.6.3 Outline of writing data into the device memory

The following figure outlines the flow of writing of data into the device memory described in Section 4.6.2.



1) The computer sends a request to write (command: QW) to the AJ71UC24.
2) On receipt of the request, the AJ71UC24 requests the PC CPU to write data when the PC CPU executes END processing.
3) The PC CPU writes data and sends the result to the AJ71UC24.
4) The AJ71UC24 sends the writing result received from the AJ71UC24 to the computer.

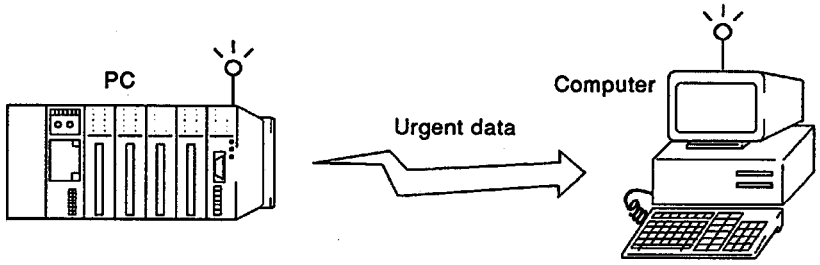


4.7 On-Demand Function

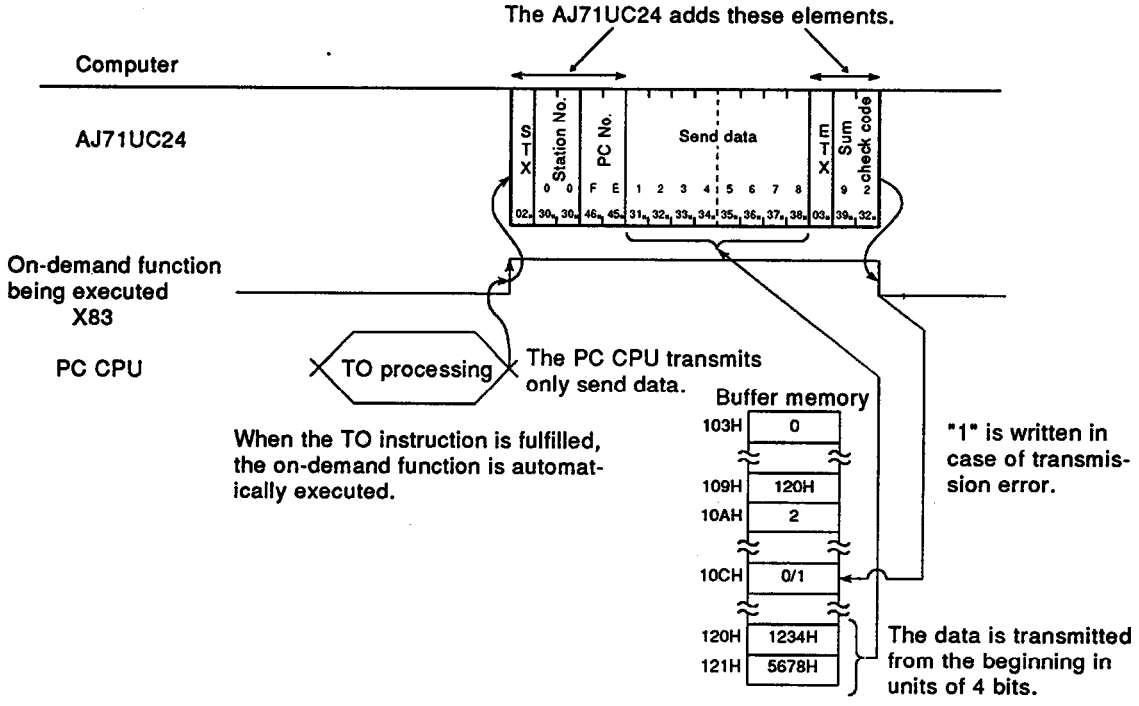
4.7.1 What is on-demand function?

When it is necessary to transmit data urgently from the PC CPU to the computer, the on-demand function allows the PC CPU to start transmission.

This function is available when the computer and the PC CPU is in the ratio of 1:1.



4.7.2 Control procedure and text structure in transmission control procedure format 1



REMARKS

In transmission control procedure format 2, the block number is 00H.

4.7.3 Settings for the on-demand function

(1) Buffer memory areas used for the on-demand function

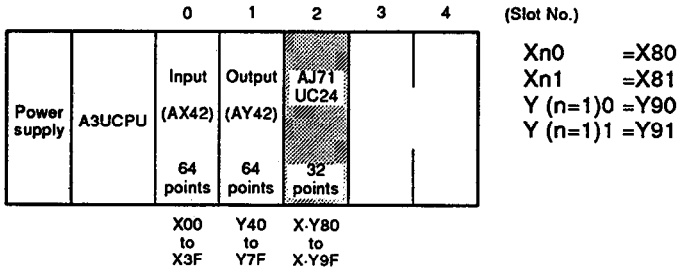
Address	Name	Description
109H	Area for specifying head address of buffer memory for on-demand function	The head address of the buffer memory at which the data to be transmitted by the on-demand function is stored is specified by the TO instruction from the sequence program.
10AH	Area for specifying on-demand data length	The length of the data to be transmitted by the on-demand function is specified by the TO instruction from the sequence program.
10CH	On-demand errors storage area	When an error occurs during data transmission by the on-demand function, the AJ71UC24 writes "1". 0: No error exists. 1: An error exists.

The buffer memory addresses 100H to 11FH are the reserved areas for special uses.
Do not use them as storage areas for data transmitted by the on-demand function.

(2) On-demand handshake signal
An on-demand handshake signal is turned on when a request to transmit data from the PC CPU to the computer is sent, or it is turned off as soon as the AJ71UC24 transmits all data specified. This signal is used as an interlock to prevent more than one on-demand request from occurring at the same time.

Signal	Description of Signal	Timing
Xn3	Turned on while on-demand function is being executed.	The AJ71UC24 turns it on. / The AJ71UC24 turns it off.

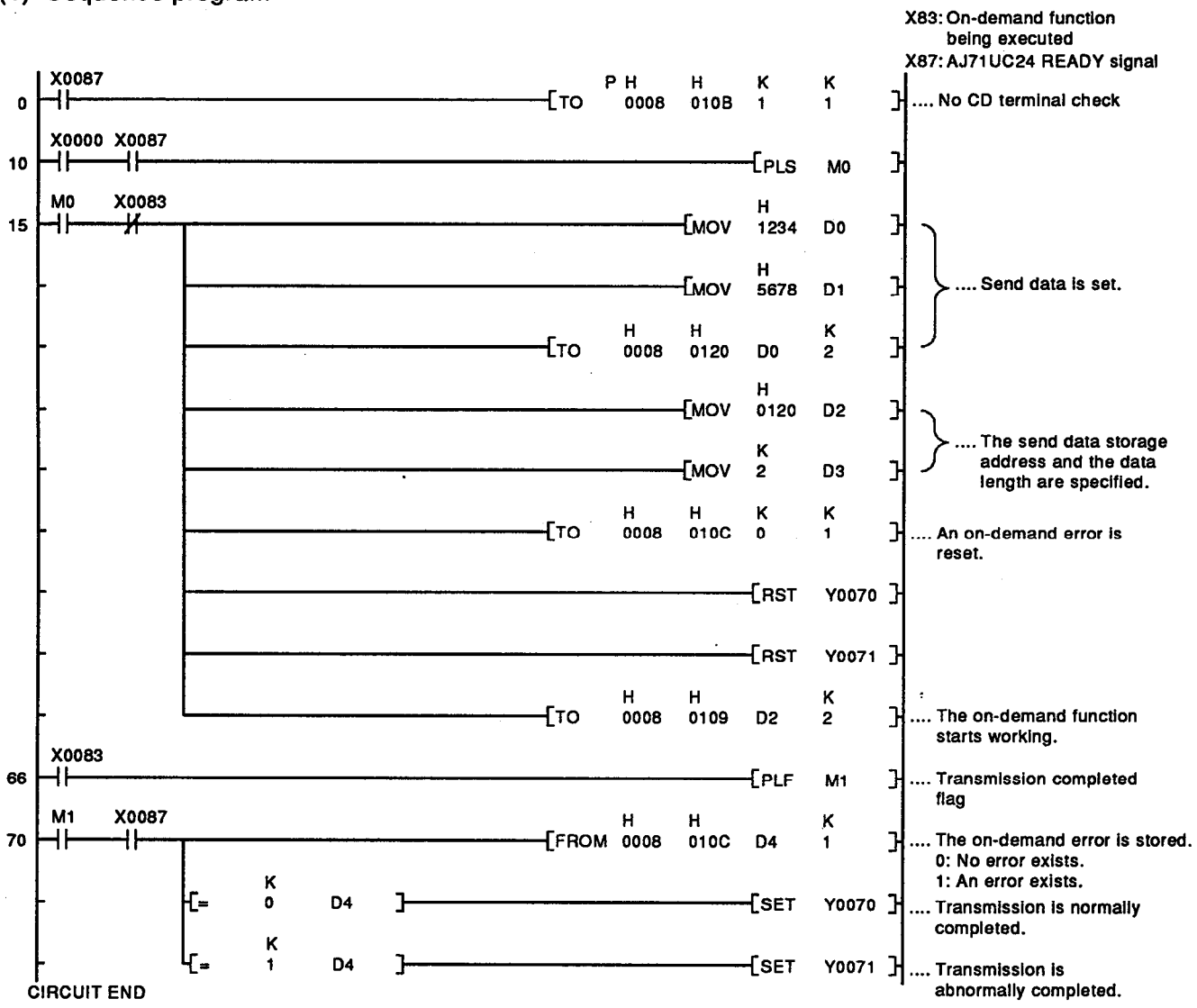
Note: The I/O numbers Xn0 and Y(n+1) depend on the slot in which the AJ71UC24 is loaded. In the system configuration described herein, the AJ71UC24 is used for X·Y80 to 9F, as shown in the following figure:



4.7.4 Transmitting data from the PC CPU by the on-demand function

(Practice) When the X0 is turned on in the middle of communications using dedicated protocols, the on-demand function is executed to allow the PC CPU to transmit data to the computer.

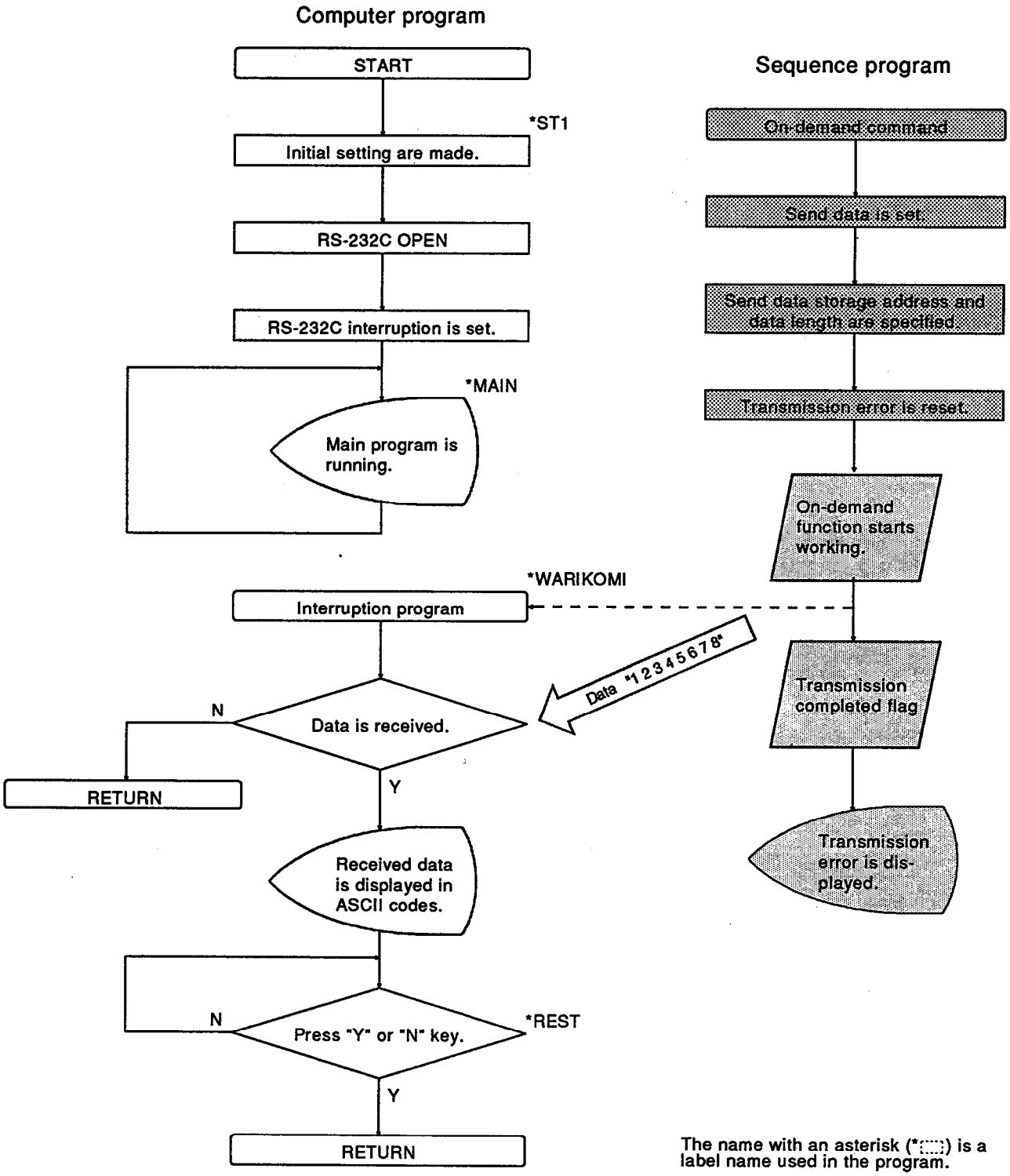
(1) Sequence program



(2) Computer program (N88BASIC)

```
1000 ' !-------------------------------------------------------------------------------------------------------------------------!
1010 ' !                          Example of AJ71UC24 on-demand function program                                               !
1020 ' !                                                                                                                         !
1030 ' !-------------------------------------------------------------------------------------------------------------------------!
1040 *ST1
1050      CLS 3                                    :'Screen initialization
1060      CH% =1                                   :'Channel number
1070      '
1080 ' !----------------------------------Open and initial settings of RS-232C are made.-------------------------------------- !
1090      OPEN "COM:E71NN" AS #CH%                 :'Communications mode and other specifications are set.
1100      ON COM GOSUB *WARIKOMI :COM ON           :'RS-232C interruption is set.
1110      '
1120 ' !-----------------------------------------------------Main program------------------------------------------------------ !
1130 *MAIN
1140      CLS
1150      LOCATE 10,  1 : PRINT "MAIN PROGRAM IS RUNNING."
1160      LOCATE 10,  3 : PRINT "WHEN ON-DEMAND FUNCTION IS EXECUTED"
1170      LOCATE 10,  4 : PRINT "INTERRUPTION PROGRAM WILL RUN."
1180      LOCATE  1, 10
1190      FOR I%= 1 TO 100 : PRINT USING"### "; I% ;
1200           FOR J%= 1 TO 100
1210           NEXT J%
1220      NEXT I%
1230      LOCATE  1, 10
1240      FOR I%= 1 TO 100 : PRINT      "      ";
1250           FOR J%= 1 TO 100
1260           NEXT J%
1270      NEXT I%
1280      GOTO *MAIN
1290      '
1300 ' !-----------------------------------------------------Interruption program---------------------------------------------------!
1310 *WARIKOMI
1320      CLS
1330      IF LOC(CH%)=0 THEN RETURN
1340      LOCATE 25,  1 : PRINT "DATA IS RECEIVED FROM AJ71UC24."
1350      LOCATE 25,  2 : PRINT "RECEIVED DATA ASCII CODE (HEXADECIMAL)"
1360      FOR WT%= 1 TO 1000 : NEXT WT%
1370      RD$=INPUT$(LOC(CH%),#CH%)          :MAX%=LEN(RD$)
1380      FOR L%=1 TO MAX%
1390           A$=MID$(RD$,L%,1)
1400           PRINT SPC(35)RIGHT$("0"+HEX$(ASC(A$)),2)
1410      NEXT L%
1420      LOCATE 25, 23 : PRINT "PRESS A KEY TO RETURN TO MAIN PROGRAM."
1430 *REST
1440      IK$=INKEY$ : IF IK$=" " THEN *REST
1450      RETURN
```

On-demand function



The name with an asterisk (*□□) is a label name used in the program.

(3) Operation on training machine

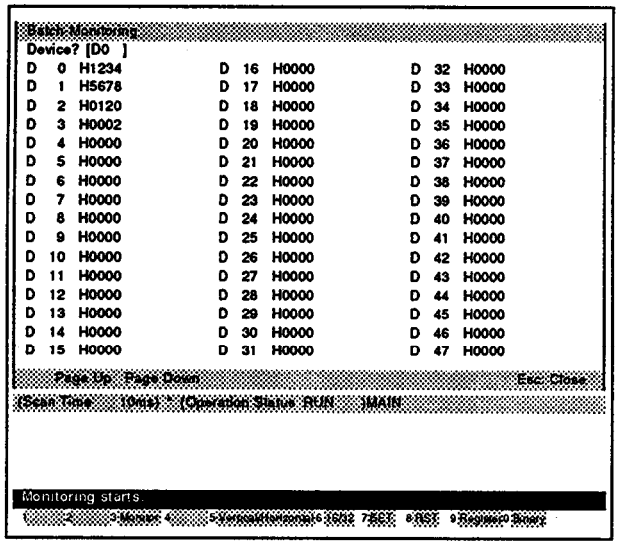
Write the sequence program described in 1) to the PC CPU, and the BASIC program shown in 2) to the computer.
After writing the programs, run each of them.
If there is no error, start a computer link operation following the procedure below:

1) The CRT display of the computer shows the numbers from 1 to 100 in sequence.
(Interruption input waiting state by the on-demand function)

```
MAIN PROGRAM IS RUNNING.
WHEN ON-DEMAND FUNCTION IS EXECUTED
INTERRUPTION PROGRAM WILL RUN.

1 2 3 4 5 .....
.....
.....
.....(Serial numbers).....99 100
```

Computer Display 1)

2) When the X0 is turned on, the sequence program commands the AJ71UC24 to execute the on-demand function, thereby transmitting data "12345678H" to the computer.
On the computer, the interruption processing routine is executed, and the received data is displayed.



PHP Display (batch-monitoring)

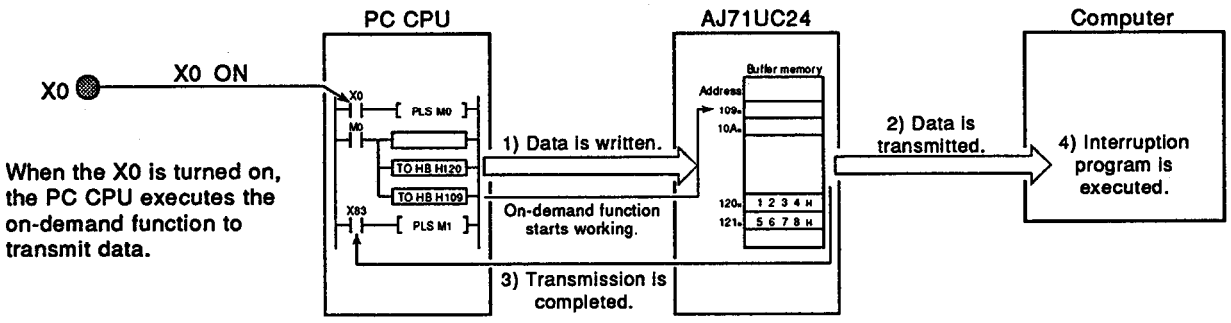
```
DATA IS RECEIVED FROM AJ71UC24.
RECEIVED DATA ASCII CODES (HEXADECIMAL)
02   ←STX
30 } 00
30
46 } FE
45
31
32
33
34
35 } "12345678"
36
37
38
03   ← ETX
PRESS A KEY TO RETURN TO MAIN PROGRAM.
```

Computer Display 2)

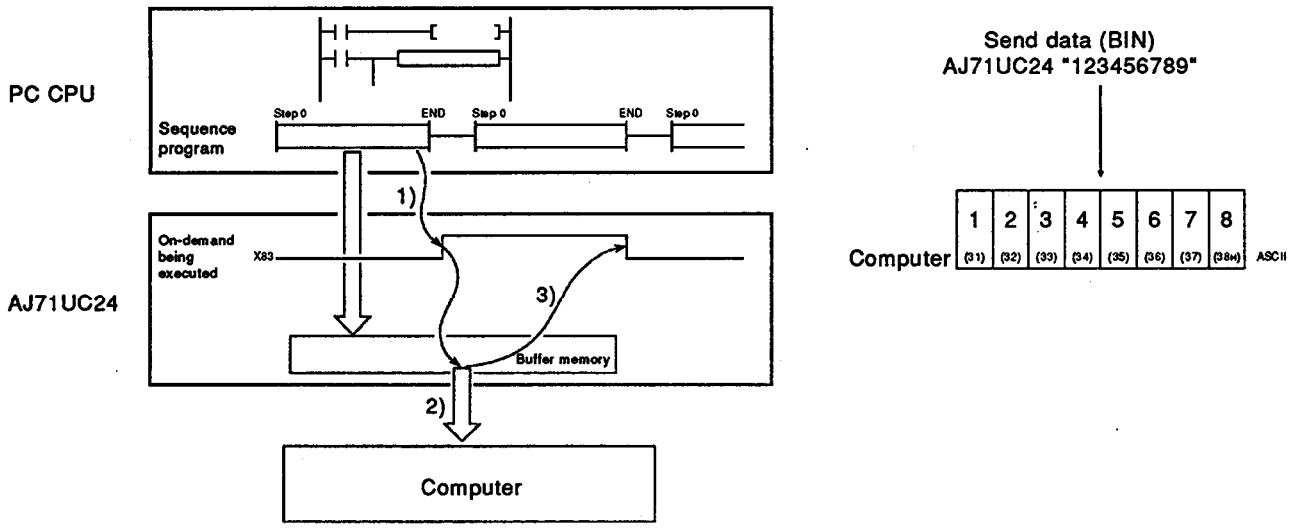
Check these points!

When the computer screen does not change from 1) to 2) even after the X0 is turned on.	• Is the sequence program (1) written to the PC CPU? • Are the cable connections (Section 3.3) correct?
When the data set on the PC CPU and that received by the computer do not match each other.	• Are the computer settings (Section 3.4) and the AJ71UC24 switch settings (Section 4.1) correct?

(4) Outline of data communications by the on-demand function

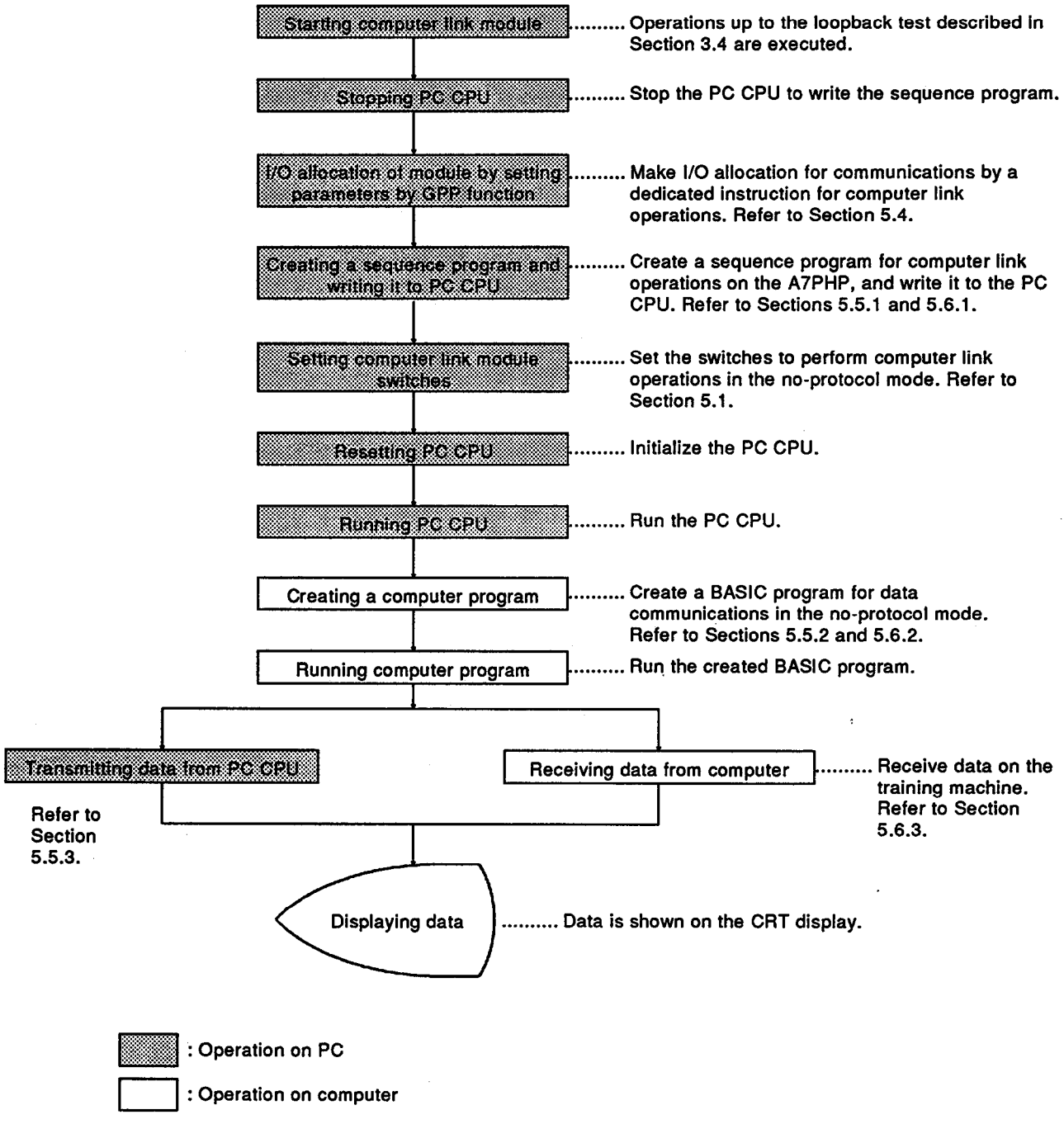


1) As soon as the PC CPU writes data to the buffer memory in the AJ71UC24 on the TO instruction, the on-demand function starts working, and the on-demand being executed signal (X83) is turned on.
2) The AJ71UC24 converts the written data into ASCII codes, and transmits it to the computer.
3) On completion of data transmission, the AJ71UC24 turns off the on-demand being executed signal (X83).
4) When it receives the data, the computer executes the interruption processing routine, and displays the received data.



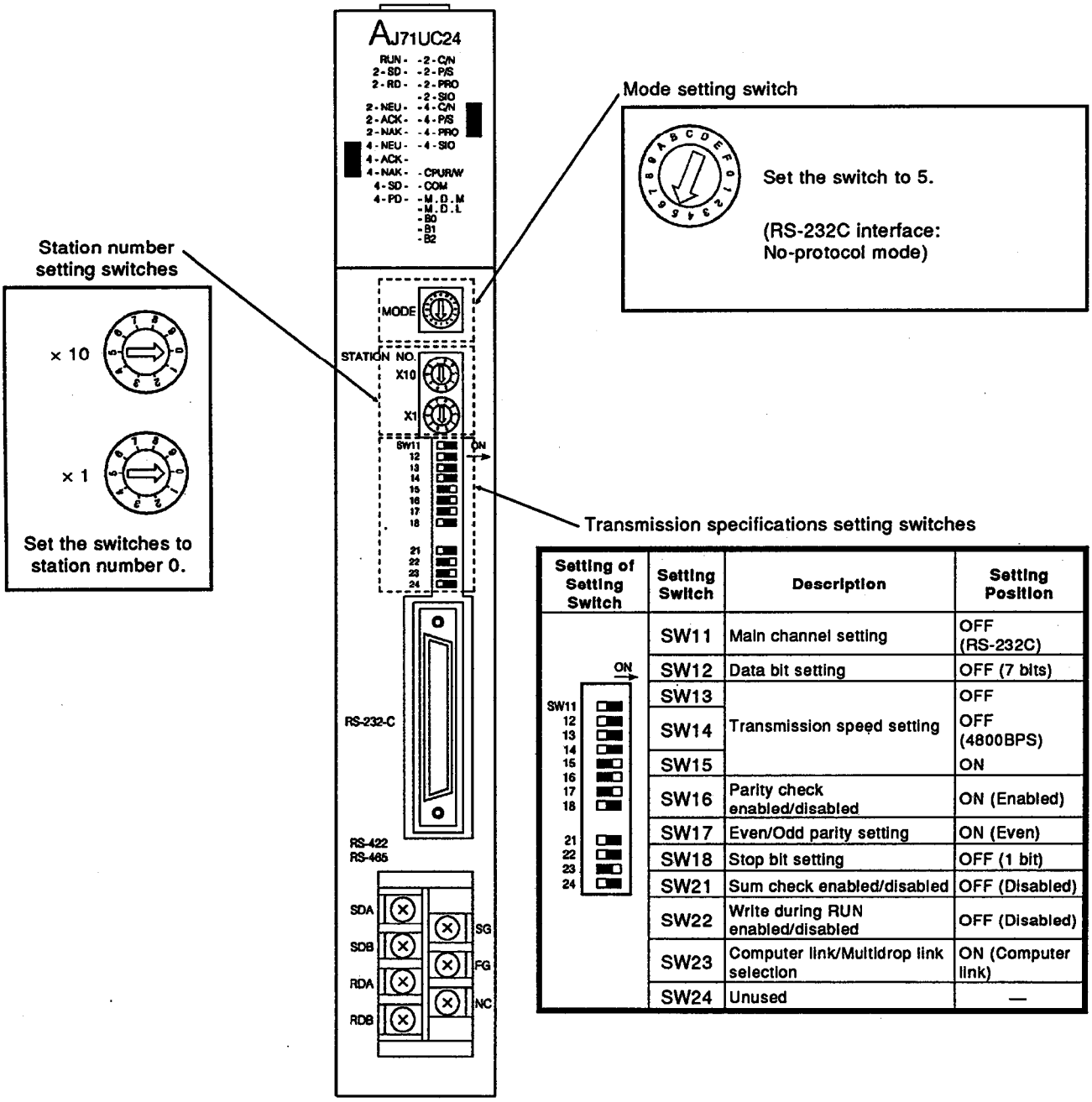
5. COMMUNICATIONS IN THE NO-PROTOCOL MODE

This section describes the communications procedure in the no-protocol mode to be followed in this guidebook.



5.1 Setting Switches on the Computer Link Module AJ71UC24

Set the setting switches on the AJ71UC24 as illustrated below:



Setting of Setting Switch	Setting Switch	Description	Setting Position
	SW11	Main channel setting	OFF (RS-232C)
	SW12	Data bit setting	OFF (7 bits)
	SW13	Transmission speed setting	OFF
	SW14		OFF (4800BPS)
	SW15		ON
	SW16	Parity check enabled/disabled	ON (Enabled)
	SW17	Even/Odd parity setting	ON (Even)
	SW18	Stop bit setting	OFF (1 bit)
	SW21	Sum check enabled/disabled	OFF (Disabled)
	SW22	Write during RUN enabled/disabled	OFF (Disabled)
	SW23	Computer link/Multidrop link selection	ON (Computer link)
	SW24	Unused	—

POINT

When a module other than the AJ71UC24 is used as computer link module, data communications described hereinafter can be executed by setting the corresponding switches as shown above.

5.2 Description of Indicator LEDs Related to the No-Protocol Mode

The table below shows the states of the indicator LEDs on the AJ71UC24 during data communications in the no-protocol mode in the system configuration described in Section 3.1.1.

LED Name	Function of LED	LED ON	LED OFF	Corrective Action
RUN	Indicates the operation status of the AJ71UC24.	Normal	Module trouble	• Check the switches SW13 to SW15 and SW23 for settings. • Check the mode setting switch to see if it is set at the right number.
2-SD	Indicates the status of data transmission from the AJ71UC24 to the computer.	Flickers during data transmission.	Data not transmitted	• If the LEDs do not flicker even after the computer sends a command, check the cable connections.
2-RD	Indicates the status of data reception by the AJ71UC24 from the computer.	Flickers during data reception.	Data unreceived	
2-NEU	—	Error	Normal	• Check the mode setting switch to see if it is set at the right number.
2-C/N	Indicates the communications status between the AJ71UC24 and the PC CPU.	Communications error	Communications normal	• Check the switch SW22 (write during RUN enabled/disabled) for setting.
2-P/S	Indicates a parity error.	Parity error	Normal	The received data does not match the transmission specifications settings. • Match the transmission specifications of the AJ71UC24 with those of the computer. • Check the transmission specifications setting switches for settings.
2-SIO	Indicates the data reception status.	Reception error	Normal	The received data does not match the transmission specifications settings. • Match the transmission specifications of the AJ71UC24 with those of the computer. • Check the transmission specifications setting switches for settings. • Lower the transmission speed. • Reduce the size of the data transmitted from the computer.
CPU R/W	Indicates the communications status between the AJ71UC24 and the PC CPU.	Flickers during communications (or comes on during suspension).	Communications error	• Check the PC CPU and the computer for operation status. • Check the mode setting switch to see if it is set at right number.
COM	Indicates the function selected.	Computer link	Multidrop link	• Set the switch SW23 (computer link/multidrop link selection) to ON.
B0	Indicates the transmission speed setting (settings of the switches SW13 to SW15) at 4800 BPS.	Error	Normal	• Check the switches SW13 to SW15 (transmission speed) for settings.
B1		Error	Normal	
B2		Normal	Error	

5.3 Settings for the No-Protocol Mode

5.3.1 Buffer memory allocation

The following list shows the buffer memory areas to be used for the no-protocol mode.

In data communications in the no-protocol mode described herein, data is read out from or written to the areas with the mark ★ by the sequence program.
Regarding the buffer memory addresses 100H to 11FH except the above, do not change their settings from the default values.

Address	Buffer Memory Address Name		Default Value		No-Protocol
0H ★	User free area (256 words)	Default allocation: No-protocol mode send data size storage area	Area for transmission in no-protocol mode	0	O
1H to 7FH		Default allocation: Buffer memory area for transmission in no-protocol mode (Send data storage area)			O
80H		Default allocation: No-protocol mode received data size storage area	Area for reception in no-protocol mode		O
81H to FFH		Default allocation: Buffer memory area for reception in no-protocol mode (Received data storage area)			O
100H	Area for specifying reception completed code in no-protocol mode		0D0AH (CR, LF)		●
101H	Error LED indication states storage area		0		△
102H	Error LED turn off request area		0		●
103H	Area for specifying word/byte units in no-protocol mode		0 (Words)		●
104H	Area for specifying head address of buffer memory for transmission in no-protocol mode		0		●
105H	Area for specifying buffer memory size for transmission in no-protocol mode		80H		●
106H	Area for specifying head address of buffer memory for reception in no-protocol mode		80H		●
107H	Area for specifying buffer memory size for reception in no-protocol mode		80H		●
108H	Area for specifying data size received in no-protocol mode		127 (Words)		●
109H	Area for specifying head address of on-demand buffer memory		0		–
10AH	Area for specifying on-demand data length		0		–
10BH ★	RS-232C CD terminal check setting area		0 (Enabled)		●
10CH	On-demand errors storage area		0		–
10DH	Area for requesting to clear received data in no-protocol mode		0		●
10EH	System area (unusable)		—		–
10FH	RS-232C communications mode setting area		0 (Full-duplex transmission)		●
110H	Area for specifying priority/non-priority in simultaneous transmission		0 (Priority)		●
111H	Area for specifying transmission method for resuming transmission		0 (No retransmission)		●
112H	Bidirectional mode setting area		0 (No-protocol mode)		–
113H	Time-out check time setting area		0 (Infinite)		–
114H	Area for specifying data valid/invalid in simultaneous transmission		0 (Data valid)		–
115H	Area for specifying check sum enabled/disabled		0 (Check sum enabled)		–
116H	Data transmission errors storage area		0		–
117H	Data reception errors storage area		0		–
118H	Operation mode storage area		0 (Mode 0)		△
119H	Mode switching setting area		0 (No switching)		O
11AH	Area for specifying transmission control (DTR/DSR control or DC code control)		0 (DTR/DSR control)		●
11BH	Area for specifying DC1/DC3 control code		1311H		●
11CH	Area for specifying DC2/DC4 control code		1412H		●
11DH	RS-232C signal states storage area		—		△
11EH	Mode setting switch/Station number setting switch positions storage area		—		△
11FH	Transmission specifications setting switch positions storage area		—		△
120H to DFFH	User free area (3296 words)		0		O

The symbols ●, O, △, and – in the No-Protocol column of the above list represent the following:

● : Area from/to which the PC CPU can read out/write data and from which the computer can read out data.
O : Area from/to which the PC CPU and the computer can read out/write data.
△ : Area from which the PC CPU and the computer can only read out data.
– : Area which is unused for the no-protocol mode.

5.3.2 I/O signals for PC CPU

The following tables show the I/O signals available for the no-protocol mode.

(1) Input signals (AJ71UC24 → PC CPU)

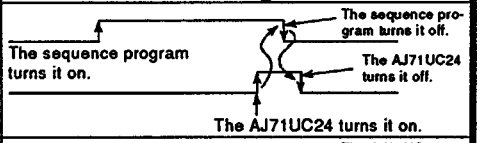
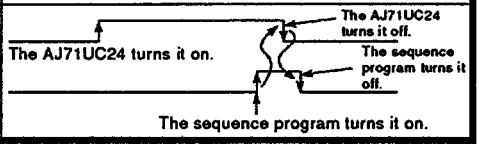
Input Signal	Signal Name	Description
Xn0	Transmission completed	Turned on when the PC CPU has transmitted data.
Xn1	Request to read out received data	Turned on when the AJ71UC24 recives data from the external device after the power to the module was turned on.
Xn7	AJ71UC24 READY signal	Turned on when the AJ71UC24 is ready to operate.
XnD	Watch dog timer error	Turned on when the AJ71UC24 is unable to operate.

(2) Output signals (PC CPU → AJ71UC24)

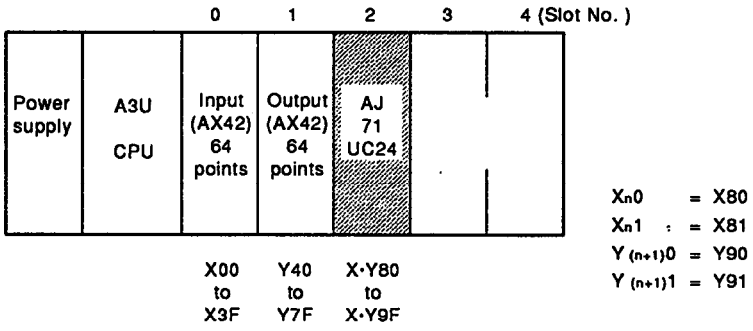
Input Signal	Signal Name	Description
Y(n+1) 0	Request to send	Turned on when the data in the buffer memory in the AJ71UC24 is transmitted from the PC CPU to the computer after the AF71UC24 was turned on.
Y(n+1) 1	Received data readout completed	Turned on when the PC CPU has read the data received by the AJ71UC24 from the external device.

The shading blocks are signals used in this guidebook.

(3) Handshake I/O signals in the no-protocol mode
Such signals as used to transmit data from the sequence program to the external device or allow the sequence program to detect and read out data from the external device are called handshake I/O signals. They are necessary for data communications in the no-protocol mode.
The table below shows the handshake I/O signals.

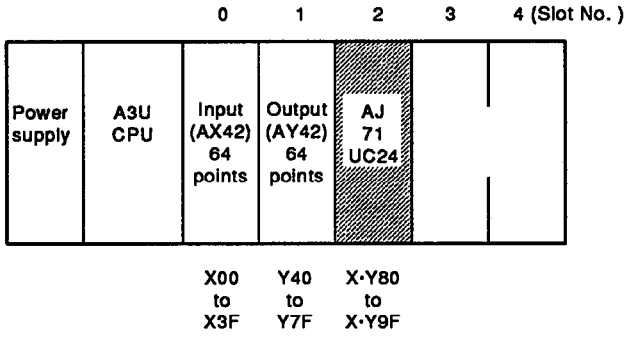
	Signal	Timing
PC CPU ↓ External device	$Y_{(n+1)}$ 0 (Request to send) X_{n0} (Transmission completed)	
External device ↓ PC CPU	X_{n1} (Request to read out received data) $Y_{(n+1)}$ 1 (Received data read out completed)	

(Note) The I/O signal numbers X_{n0} and $Y_{(n+1)}$ depend on the slot in which the AJ71UC24 is loaded.
The following figure is a loading example.
In the system configuration descrbed herein, the AJ71UC24 is used for X·Y80 to 9F, as shown in the figure below.



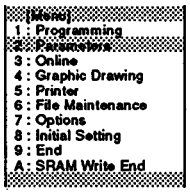
5.4 I/O Allocation of the Computer Link Module

The sequence program for data communications in the no-protocol mode uses dedicated instructions for the computer link module.
I/O allocation of the module is made by setting parameters of the GPP function.
The module is loaded in the PC CPU, as illustrated below:

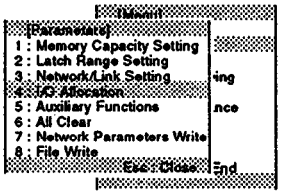


The following is an example of I/O allocation by the GPP function (SW1SRXV-GPPA) of the A7PHP.

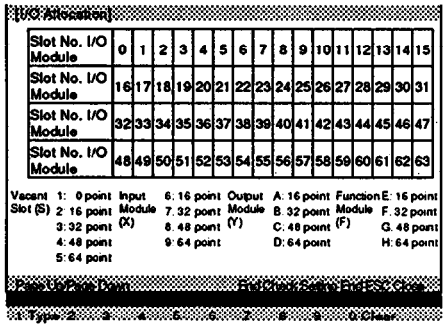
[Start I/O allocation]



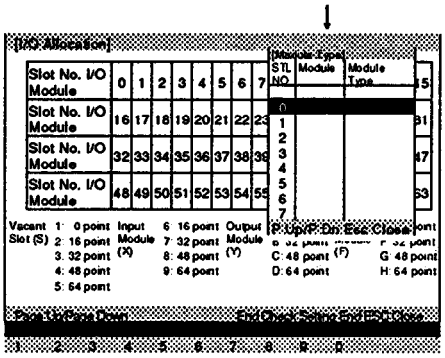
(1) Select "2: Parameters" on the Menu window. ([↑], [↓] → [RETURN] or [2])



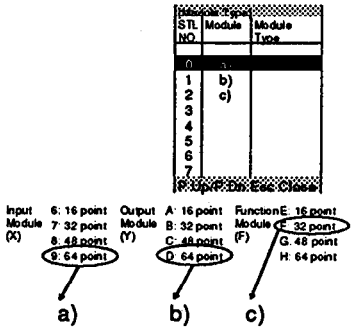
(2) Select "4: I/O Allocation" on the Parameters menu window. ([↑] or [↓] → [RETURN] or [4])



(3) The I/O Allocation window opens.



(4) Press the [F1] (Type) key.
The Module Type window opens on the I/O Allocation window.



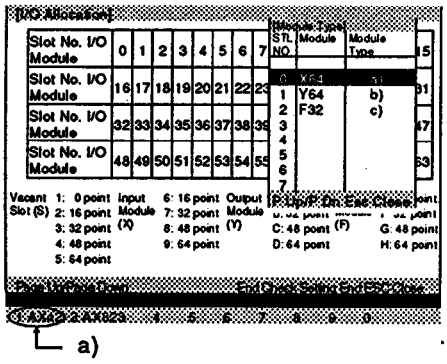
(5) Specify modules in the Module column of the Module Type window.

Select the modules by pressing the corresponding keys among [1] to [9] and [A] to [H].
Move the cursor to the slot numbers using the [↑], [↓] or [RETURN] key.

a) Input module (X) 64 points,
[9] → [RETURN]

b) Output module (Y) 64 points,
[D] → [RETURN]

c) Function module (F) 32 points.
[F] → [RETURN]



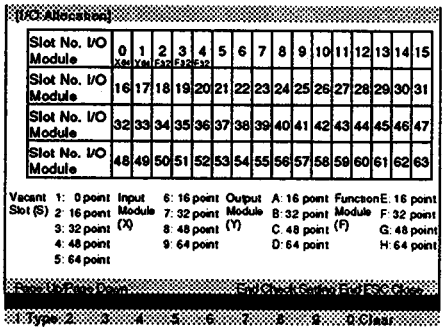
(6) Next, enter the module types.
Move the cursor to the Module Type column using the [→] key. At the bottom of the screen, a list of module types with the identical device points are displayed.
Select the right module type by pressing the corresponding key among [F1] to [F10] and [Shift+F1] to [Shift+F10].
If the corresponding module type cannot be found, enter the module type directly from the keyboard.

a) AX42
[F1] → [RETURN]
(or [A] → [X] → [4] → [2] → [RETURN])

b) AY42
[F1] → [RETURN]
(or [A] → [Y] → [4] → [2] → [RETURN])

c) AJ71UC24
[A] → [J] → [7] → [1] → [U] → [C] → [2] → [4] → [RETURN]

After all necessary settings are made, press the [End] key. The I/O Allocation window will reappear.



(7) Give the [End] key a press to terminate the setting operation.

(Note) Be sure to press the [End] key after the setting operation. If the I/O Allocation window is closed without pressing the [End] key, the set data will be lost.

POINT

When module types are set on the I/O Allocation window:
- Dedicated instructions (PR/PRN/INPUT) for the computer link module are available.

When a dedicated instruction for the computer link module is used:
- Data can be transmitted and received, regardless of I/O signals or buffer memory addresses.
- The data transmission/reception program can be simplified.

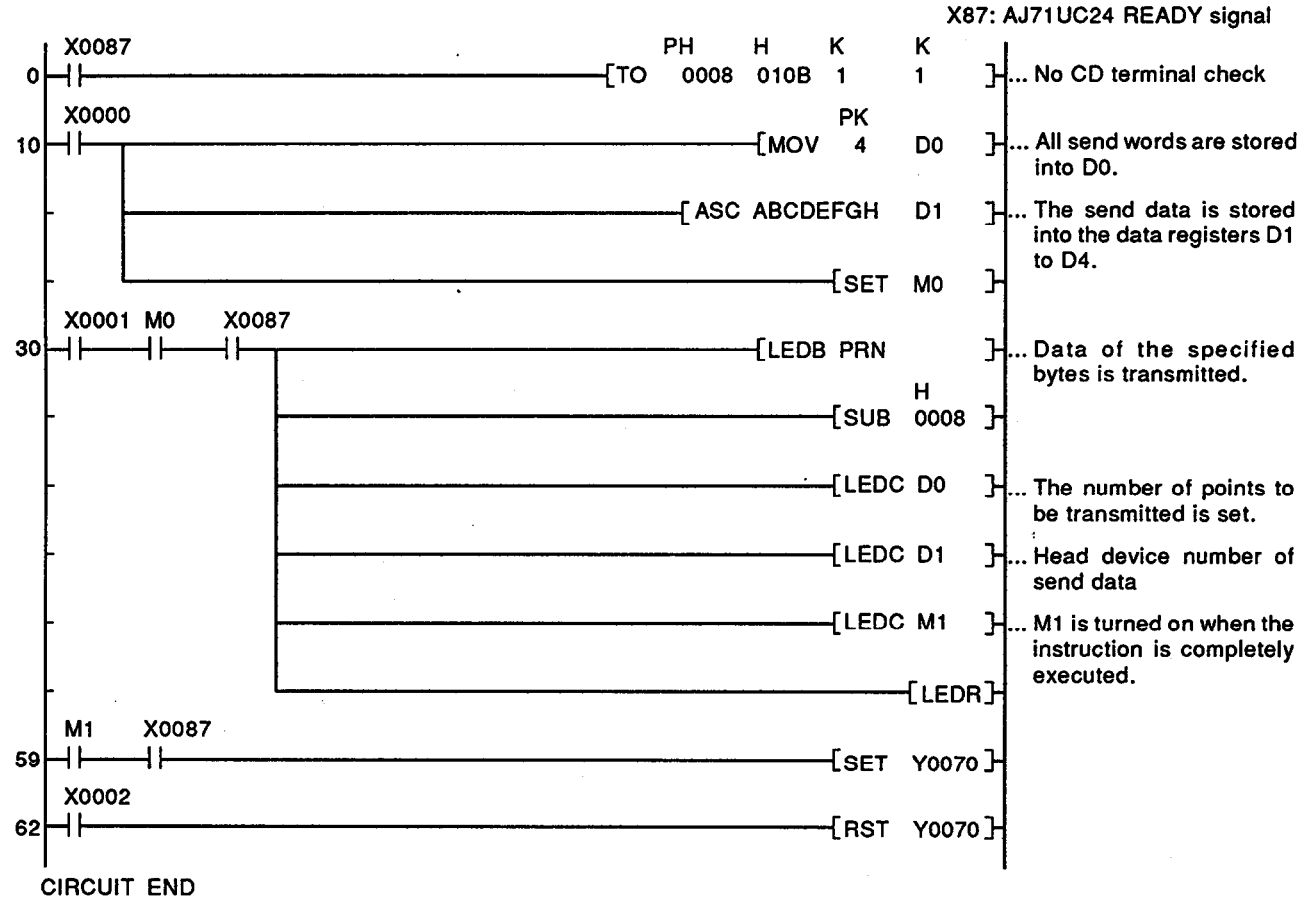
5.5 Transmitting Data from the PC CPU

Transmit data from the PC CPU to the computer.
The data is to be transmitted in word units.

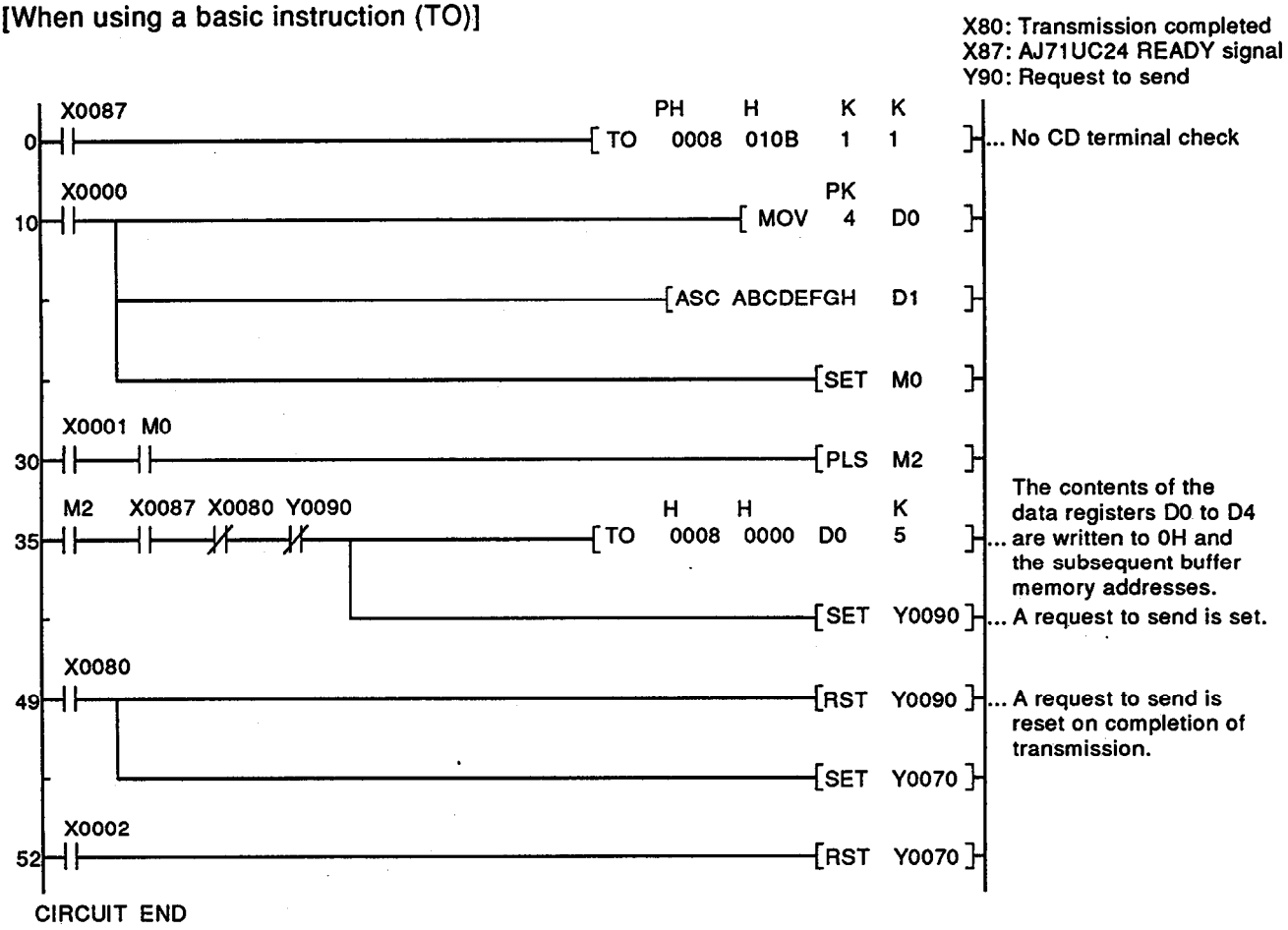
(Practice) When the X0 is turned on, the character data "ABCDEFGH" (in ASCII codes) is written into the buffer memory of the AJ71UC24 on the PRN instruction from the sequence program.
When the X1 is turned on, the written data goes to the computer in the no-protocol mode.
The computer shows the received data on the CRT display.

5.5.1 Sequence program

[When using a dedicated instruction (PRN)]



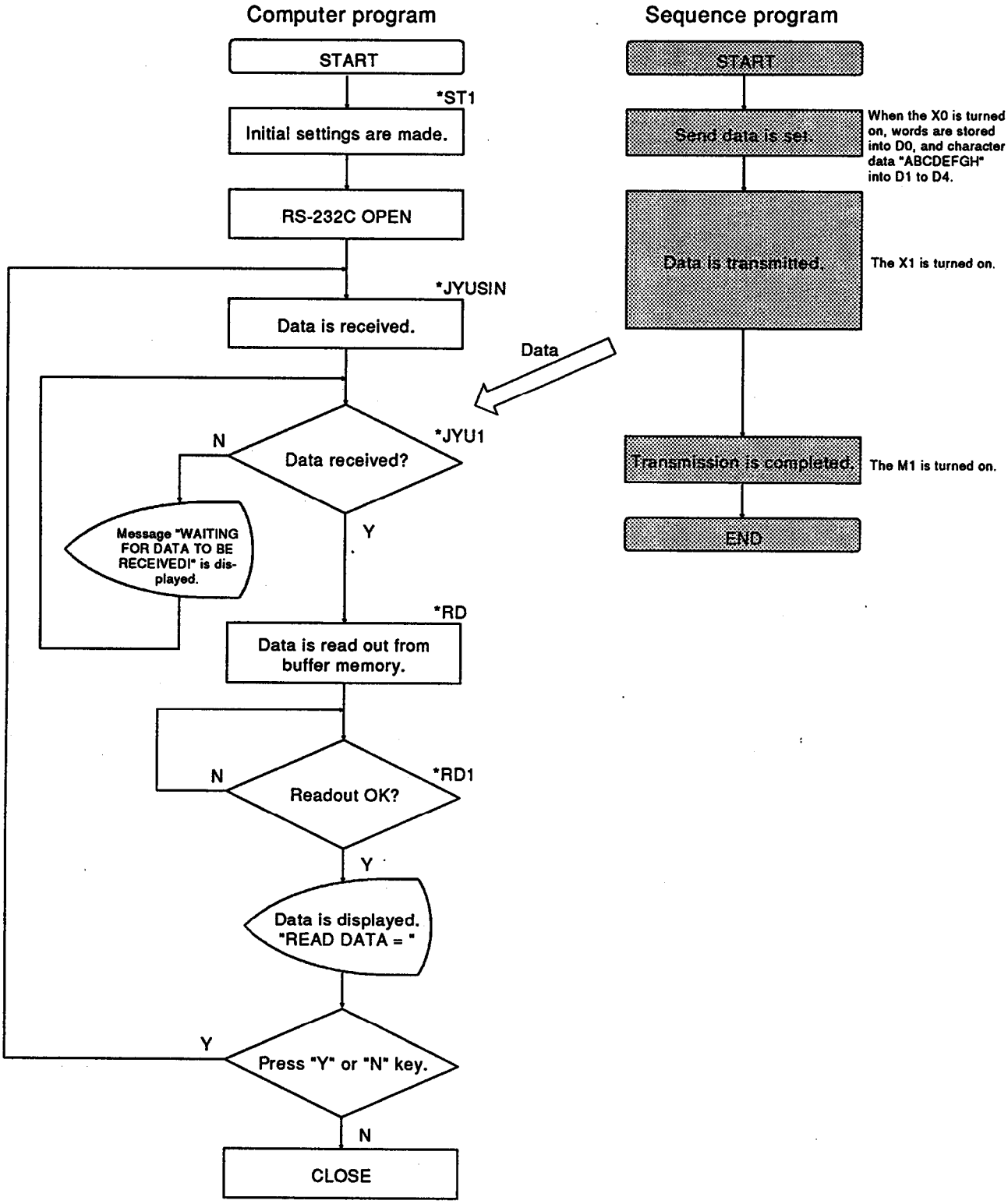
[When using a basic instruction (TO)]



5.5.2 Computer program (N88BASIC)

```
1000  '    ! ------------------------------------------------------------ !
1010  '    !                Example of AJ71UC24 no-protocol mode program                !
1020  '    !                  (transmitting data from PC CPU)                           !
1030  '    ! ------------------------------------------------------------ !
1040  *ST1
1050        CLS                                          : ' Screen initialization
1060        CH% =1                                       : ' Channel number
1070        '
1080  '    ! ---------- Open and initial settings of RS-232C are made. ---------- !
1090        OPEN "COM : E71NN" AS #CH%                   : ' Communications mode and other specifications are set.
1100  '    ! ---------- Data is received. ---------- !
1110  *JYUSIN
1120        CLS
1130        LOCATE 6 , 1 : PRINT ""DATA IS RECEIVED FROM PC IN NO-PROTOCOL MODE."
1140  *JYU1
1150        IF LOC (CH%) <> 0 THEN *RD
1160        LOCATE 10 , 5 : PRINT "WAITING FOR DATA TO BE RECEIVED!"
1170        LOCATE 10 , 8 : PRINT "TRANSMIT DATA FROM PC." : GOTO *JYU1
1180        "
1190  '    ! ---------- Data is read out from buffer memory. ---------- !
1200  *RD
1210        B$ = " "
1220  *RD1
1230        FOR I% = 0 TO 1000 : NEXT I%
1240        IF LOC (CH%) <> 0 THEN B$ = B$ + INPUT$ (LOC (CH%) , #CH%) : GOTO *RD1
1250        "
1260  '    ! ---------- Received data is displayed. ---------- !
1270        LOCATE 10 , 5 : PRINT "READ DATA = " ; B$
1280        LOCATE 10 , 8 : INPUT "RECEIVE AGAIN (Y/N)?" ; Y$
1290        IF Y$ = "Y" THEN *JYUSIN
1300        '
1310  CLOSE
1320  END
```

Transmitting data from the PC CPU

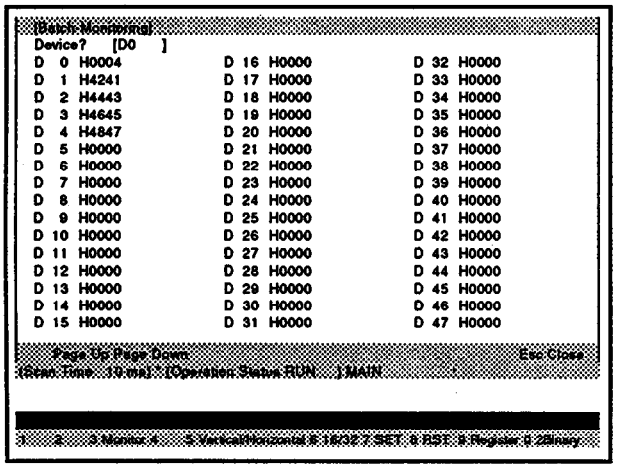


The name with an asterisk (*[ ]) is a label name used in the computer program.

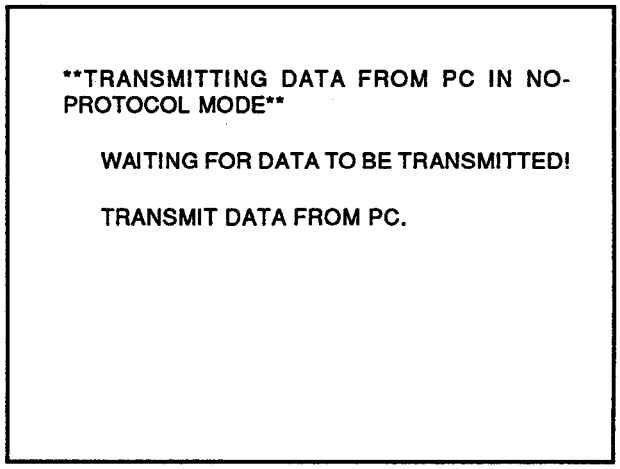
5.5.3 Operation on training machine

Write the parameters described in Section 5.4 and the sequence program shown in Section 5.5.1 to the PC CPU, and the BASIC program explained in Section 5.5.2 to the computer.
After writing the parameters and the programs, run each of the programs.
If there is no error, start a computer link operation following the procedure below:

1) Turn on the X0. The words of the send data to the computer will be stored into the data register D0, and the send data into the data registers D1 to D4. Check by the batch-monitoring function to see if the data is completely stored.

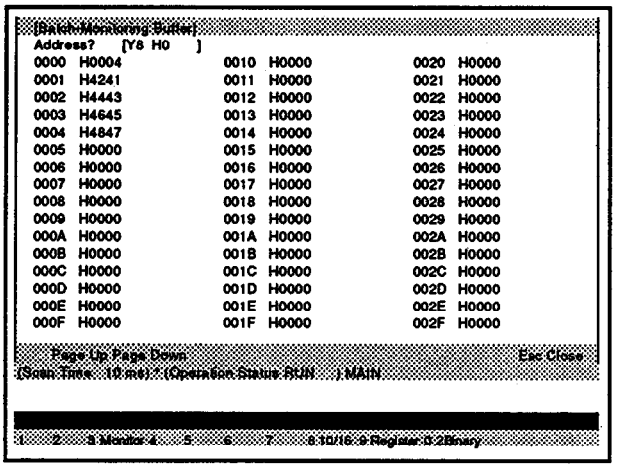


PHP Display (batch-monitoring)

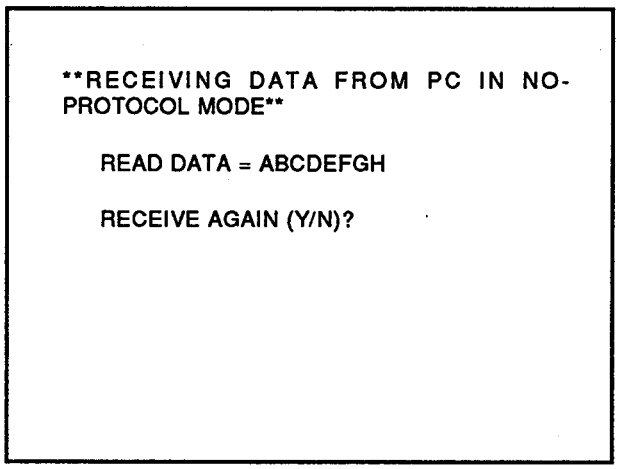


Computer Display

2) Turn on the X1. The send data stored in the data registers D0 to D4 will be written to the buffer memory addresses H0 to H4 of the computer link module and transmitted to the computer.



PHP Display (batch-monitoring buffer)



Computer Display

Check these points!

- After setting data on the PC CPU, the request-to-send signal was turned on, and the data was transmitted to the computer.
  Although the AJ71UC24 turned on the transmission completed signal

```
**RECEIVING DATA FROM PC
IN NO-PROTOCOL MODE**

   WAITING FOR DATA TO BE
   RECEIVED!
   TRANSMIT DATA FROM PC.
```

is displayed.

- Is the sequence program (Section 5.5.1) written to the PC CPU?
- Are the AJ71UC24 mode setting switch setting (Section 5.1), the cable connections (Section 3.3), and the I/O allocation (Section 5.4) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 5.2), then reexamine the setting and the connections.

- When the data transmitted by the PC CPU and that received by the computer do not match each other.

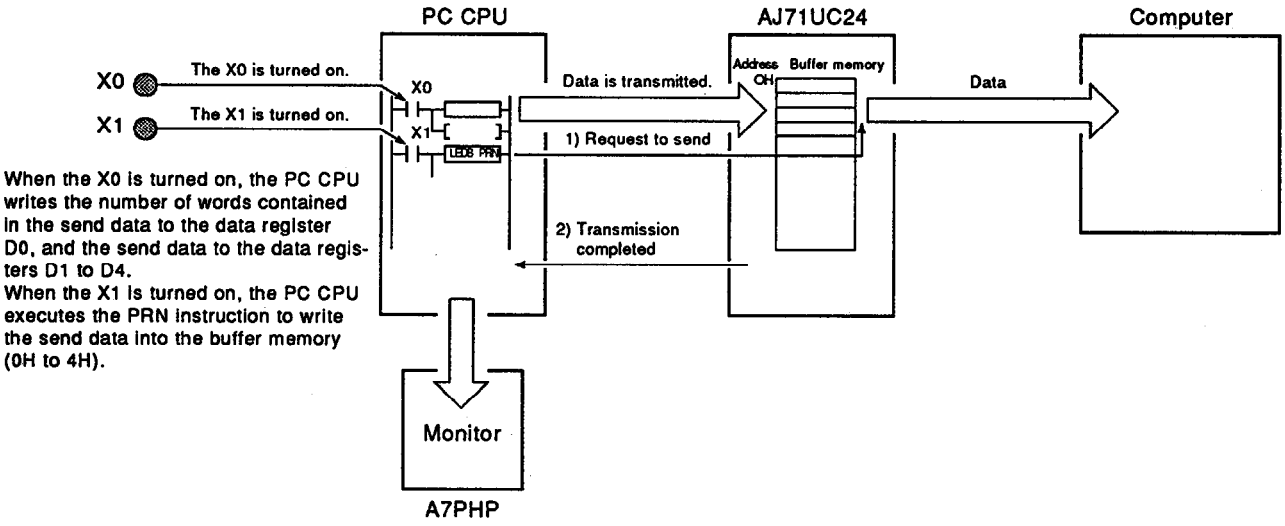
```
**RECEIVING DATA FROM PC
IN NO-PROTOCOL MODE**

   READ DATA = [--------]
    RECEIVE AGAIN (Y/N)?
```

- Are the computer settings (Section 3.4), the AJ71UC24 switch settings (Section 5.1), and the computer program (RS-232C settings) settings (Section 5.5.2) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 5.2), then reexamine the settings.

After making the correct settings, reset the PC CPU to restart communications.

5.5.4 Outline of transmitting data from the PC CPU in the no-protocol mode

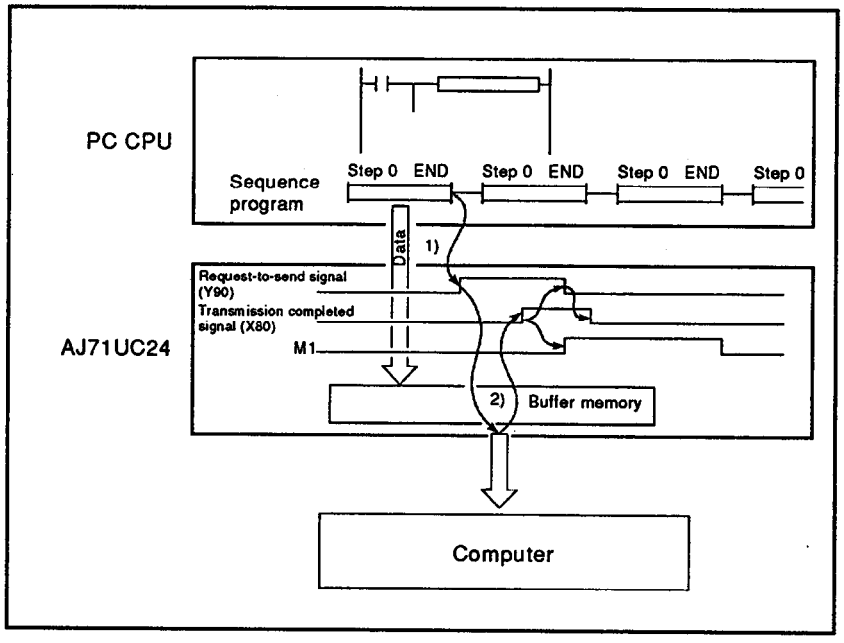
The figure below outlines the flow of data transmission from the PC CPU in the no-protocol mode carried out in Section 5.5.3.



1) *As soon as the request to send is turned on, the AJ71UC24 transmits data to the computer.

2) When all the data is transmitted, the AJ71UC24 sends the transmission completed signal (X80) to the PC CPU to complete a cycle of data transmission.

* : The PRN instruction is automatically executed when the request to send to and the transmission completed signal from the AJ71UC24 are turned on or off internally. It is not necessary to turn them on or off with the sequence program.



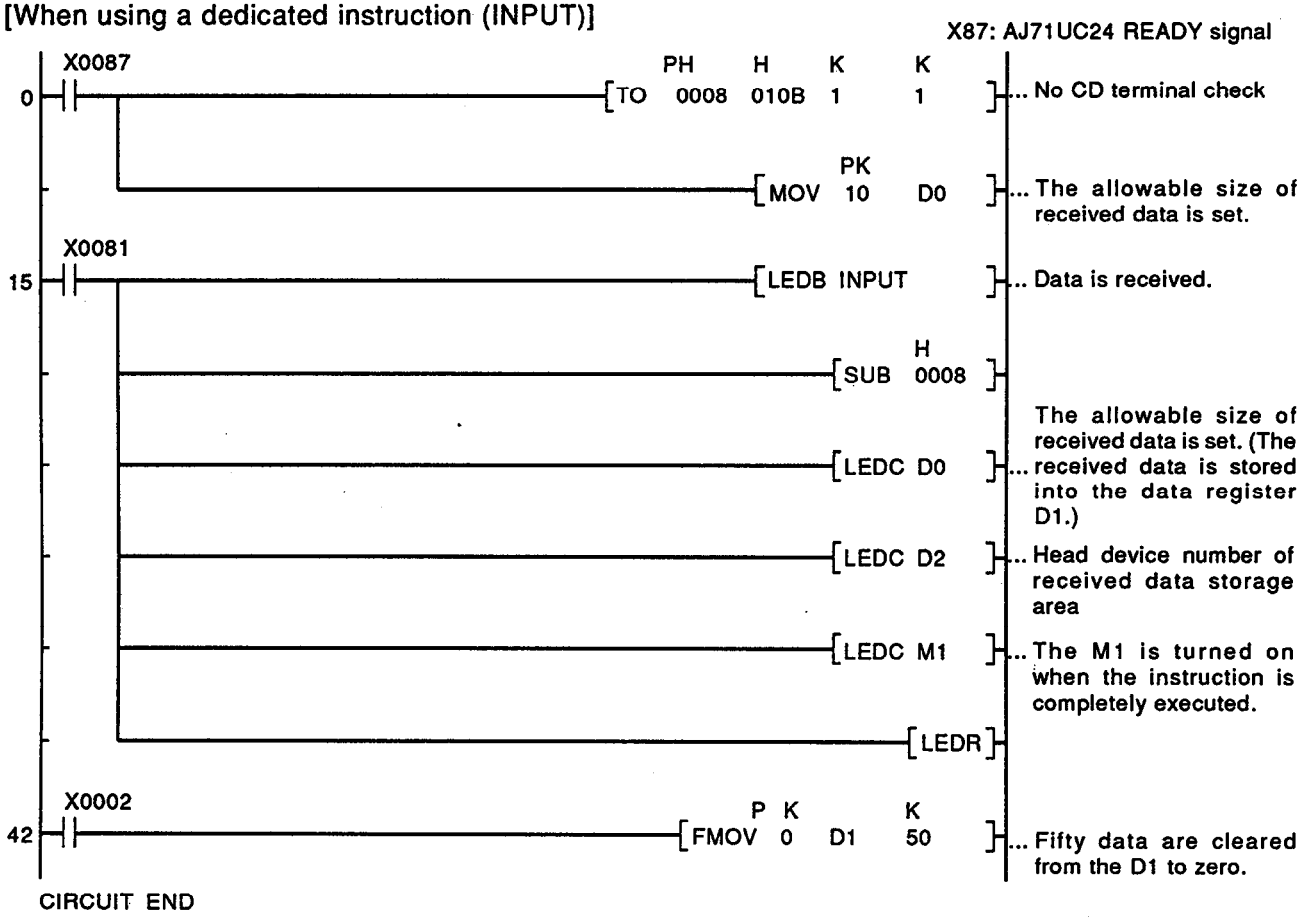
5.6 Receiving Data from the Computer

The PC CPU receives data from the computer.
The data is to be received in word units.

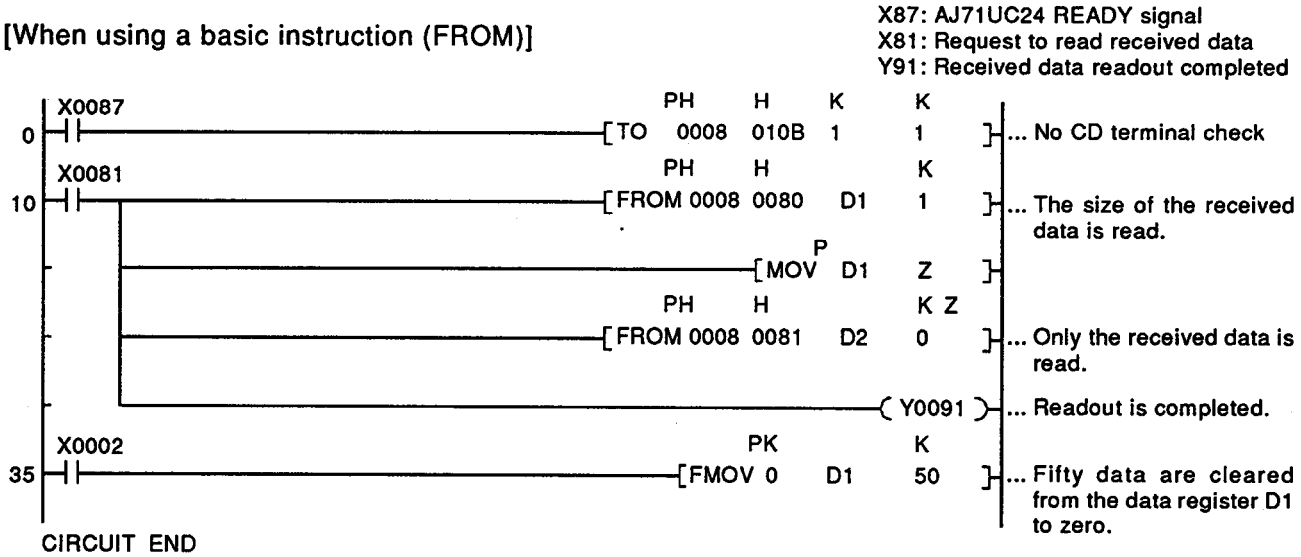
(Practice) The computer transmits data entered through the keyboard to the PC CPU. The PC CPU reads out the received data from the buffer memory in response to the INPUT or FROM instruction from the sequence program.

5.6.1 Sequence program

[When using a dedicated instruction (INPUT)]



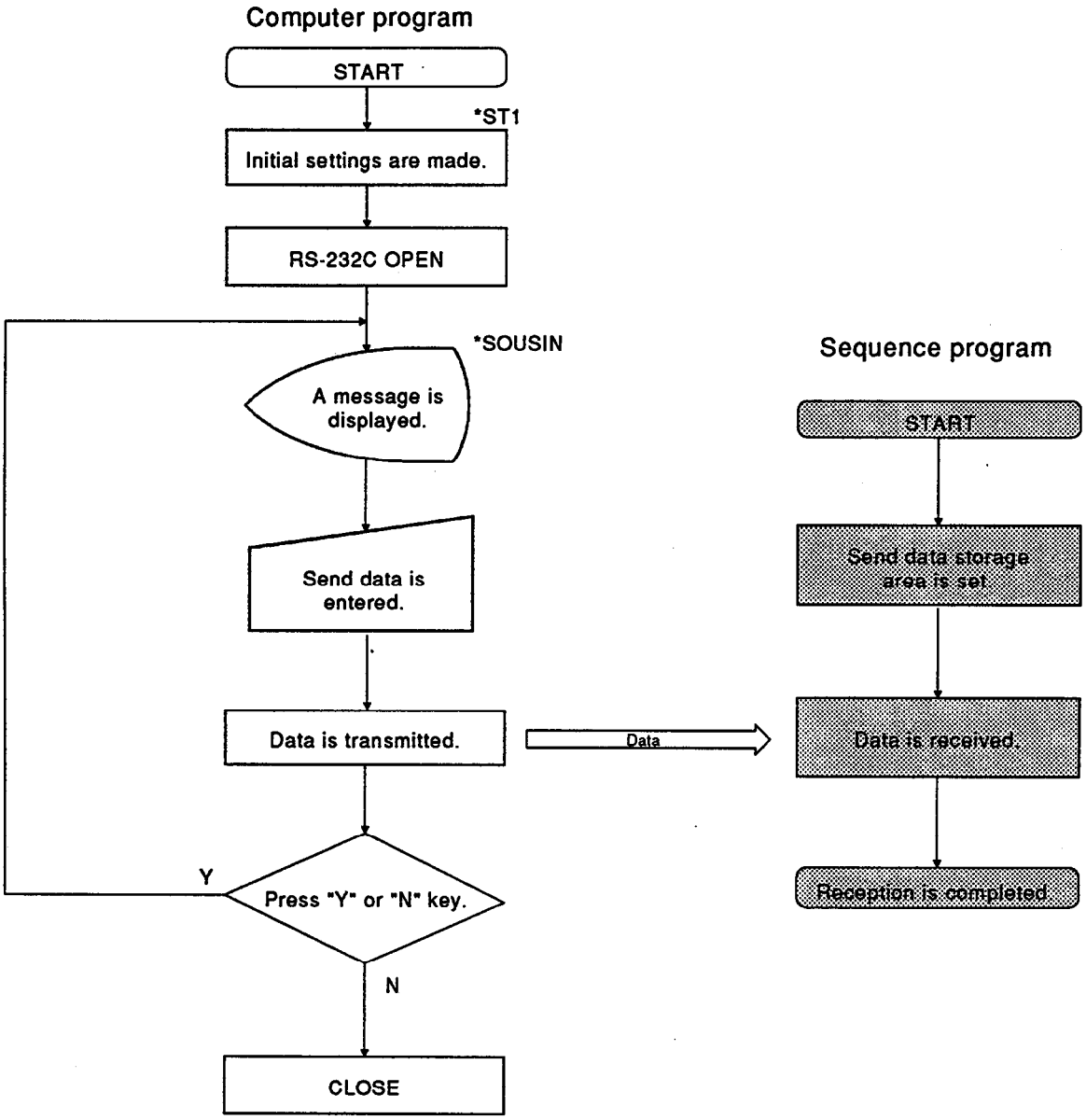
[When using a basic instruction (FROM)]



5.6.2 Computer program

```
1000 '    !-------------------------------------------------------------!
1010 '    !                Example of AJ71UC24 no-protocol mode program
1020 '    !                      (receiving data from computer)
1030 '    !-------------------------------------------------------------!
1040 *ST1
1050        CLS                                          : ' Screen initialization
1060        CH% =1                                       : ' Channel number
1070        CR$  =CHR$ (&HD)                             : ' CR code
1080        LF$  =CHR$ (&HA)                             : ' LF code
1090        '
1100 '    !---------- Open and initial settings of RX-232C are made. ----------!
1110        OPEN  "COM : E71NN" AS #CH%                  : ' Communications mode and other specifica-
1120        '                                              tions are set.
1130 '    !---------- Data is transmitted. ----------!
1140 *SOUSIN
1150        CLS
1160        LOCATE  6 , 1 : PRINT "**TRANSMITTING DATA TO PC IN NO-PROTOCOL MODE**"
1170        LOCATE 10 , 5 : INPUT "SEND DATA" ; SD$
1180        PRINT #CH% , SD$ ; CR$ ; LF$ ;
1190        LOCATE 10 , 8 : INPUT "DATA TRANSMISSION IS COMPLETED. RESET AND RETRANSMIT (Y/N)?" ; Y$
1200        IF  Y$ = "Y"   THEN  *SOUSIN
1210        '
1220 CLOSE
1230 END
```

Receiving data from the computer



The name with an asterisk (*:....) is a label name used in the computer program.

5.6.3 Operation on training machine

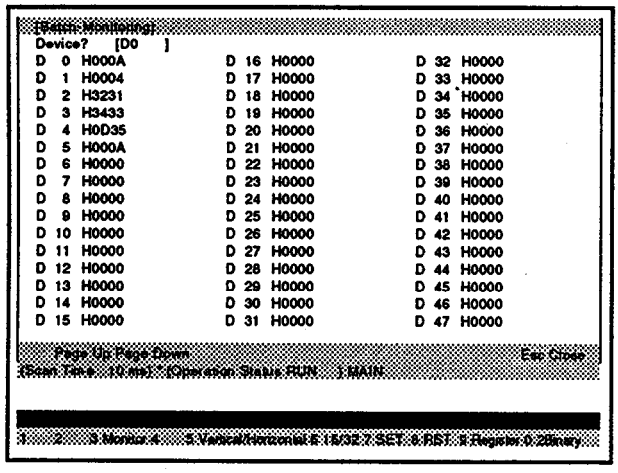
Write the parameters set in Section 5.4 and the sequence program described in Section 5.6.1 to the PC CPU, and the BASIC program shown in Section 5.6.2 to the computer.
After writing them, run each of the program.
If there is no error, start a computer link operation following the procedure below:

1) Enter send data from the keyboard connected to the computer, and transmit it to the PC CPU. (For example, [1] [2] [3] [4] [5] [RETURN])

```
**TRANSMITTING DATA TO PC IN NO-
PROTOCOL MODE**

   SEND DATA?
```

Computer Display

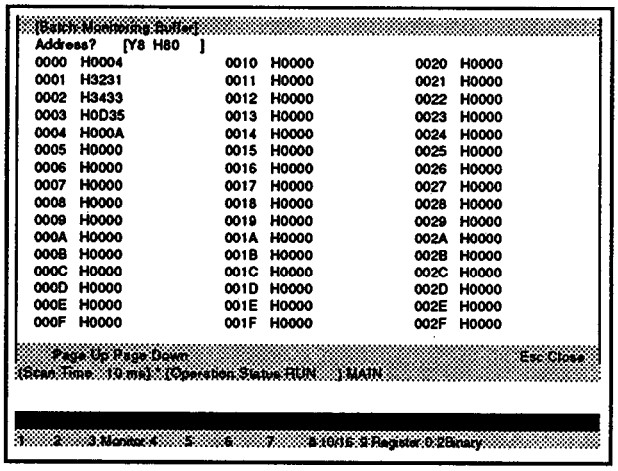
2) The data transmitted from the computer is written into the buffer memory (H81 ~) in the computer link module.



PHP Display (batch-monitoring)

```
**TRANSMITTING DATA TO PC IN NO-
PROTOCOL MODE**

   SEND DATA? 12345

   DATA TRANSMISSION IS COMPLETED.
   RESET AND RETRANSMIT (Y/N)?
```

Computer Display



PHP Display (batch-monitoring buffer)

Check these points!

- Although the computer has sent data and the message telling that transmission is completed is displayed on the screen, the PC CPU does not receive the data.

```
**TRANSMITTING DATA TO PC
IN NO-PROTOCOL MODE**

    SEND DATA? = [--------]

    DATA TRANSMISSION IS
    COMPLETED. RESET AND
    RETRANSMIT (Y/N)?
```

- Is the sequence program (Section 5.6.1) written to the PC CPU?
- Are the AJ71UC24 switch settings (Section 5.1) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 5.2), then reexamine the settings.

- When data cannot be transmitted from the computer

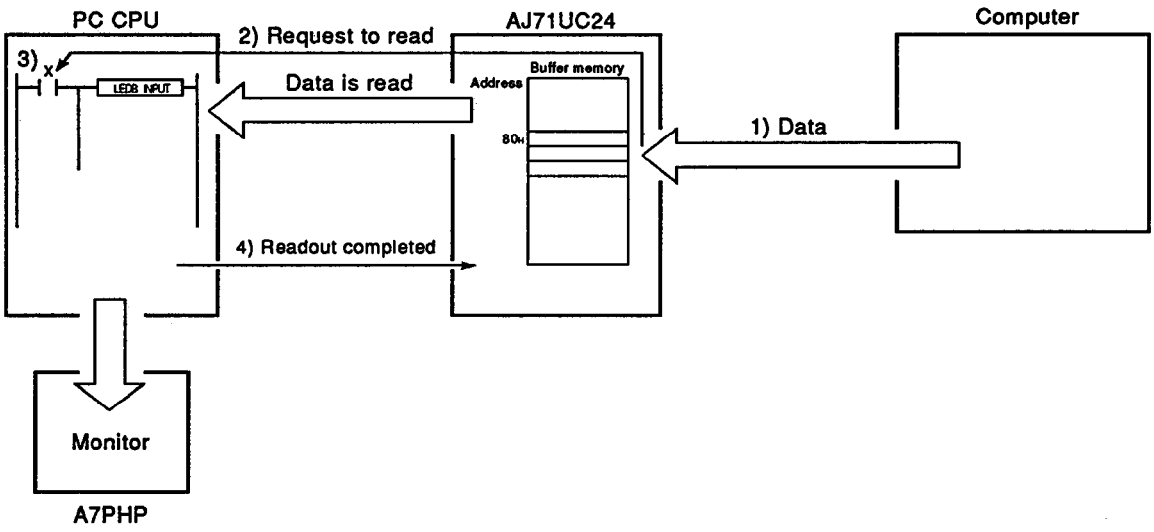
```
**TRANSMITTING DATA TO PC
IN NO-PROTOCOL MODE**

    SEND DATA? = [--------]
```

- Are the computer settings (Section 3.4) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 5.2), then reexamine the settings.

After making the correct settings, reset the PC CPU to restart communications.

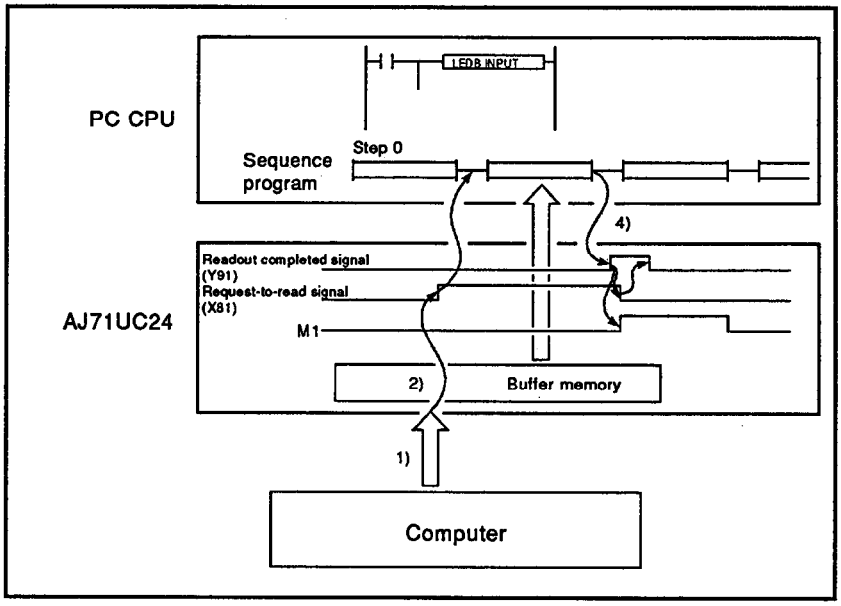
5.6.4 Outline of receiving data from the computer in the no-protocol mode

The figure below outlines the flow of data reception from the computer in the no-protocol mode executed in Section 5.6.3.



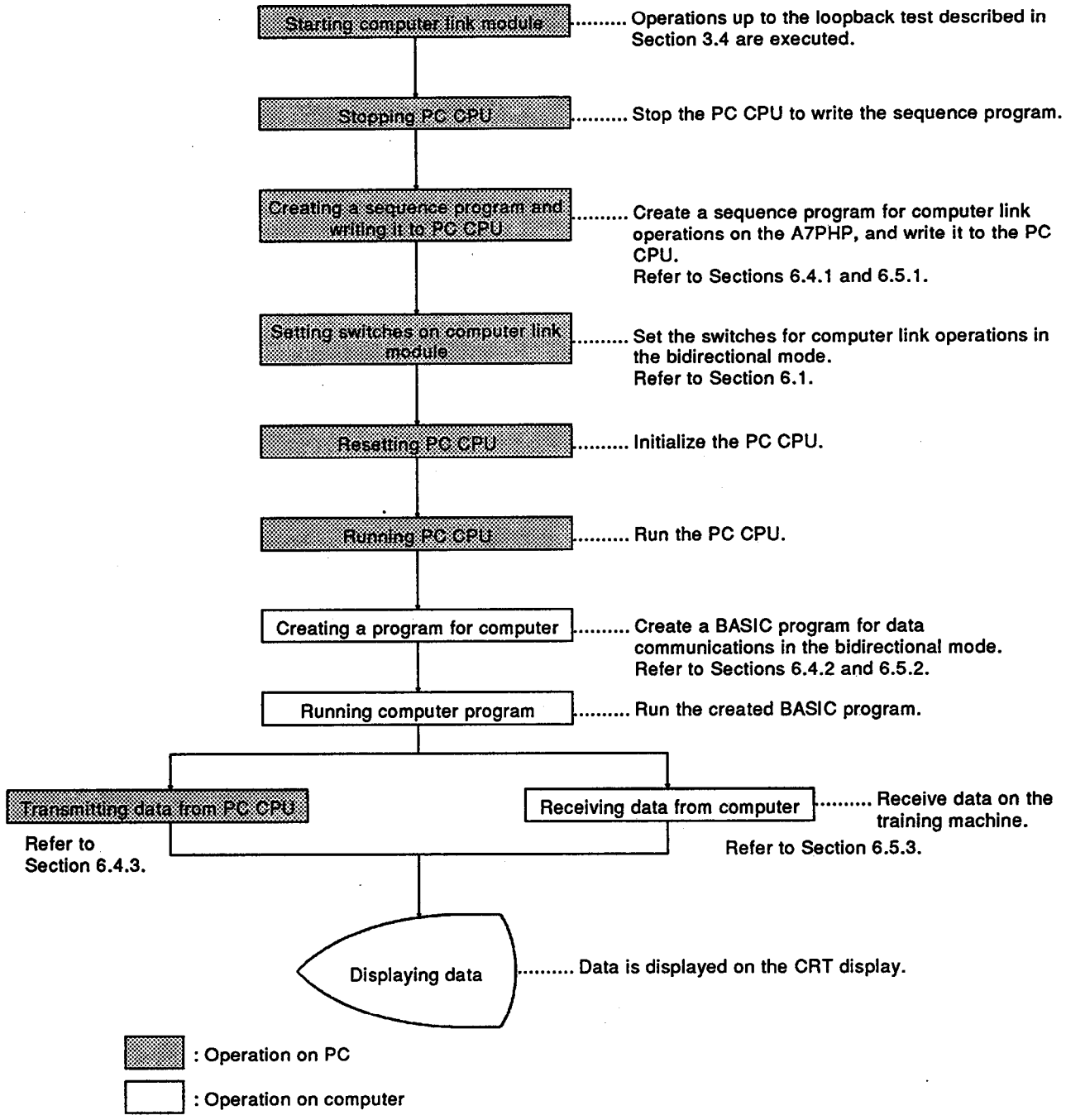
1) As soon as it receives data from the computer, the AJ71UC24 writes it into the buffer memory (received data storage area).
2) On receipt of the set end codes CR and LF ($0D0A_H$), the AJ71UC24 sends the *request-to-read signal to the PC CPU.
3) The PC CPU reads out the received data from the AJ71UC24 using the sequence program.
4) After it has read out all the data, the PC CPU turns on the readout completed signal (Y91).
   When the readout completed signal (Y91) is turned on, the AJ71UC24 turns off the request-to-read signal (X81), completing a cycle of data communications.

* : The INPUT instruction is automatically executed when the request to read from or the readout completed signal to the AJ71UC24 is turned on or off internally.
It is not necessary to turn them on or off with the sequence program.



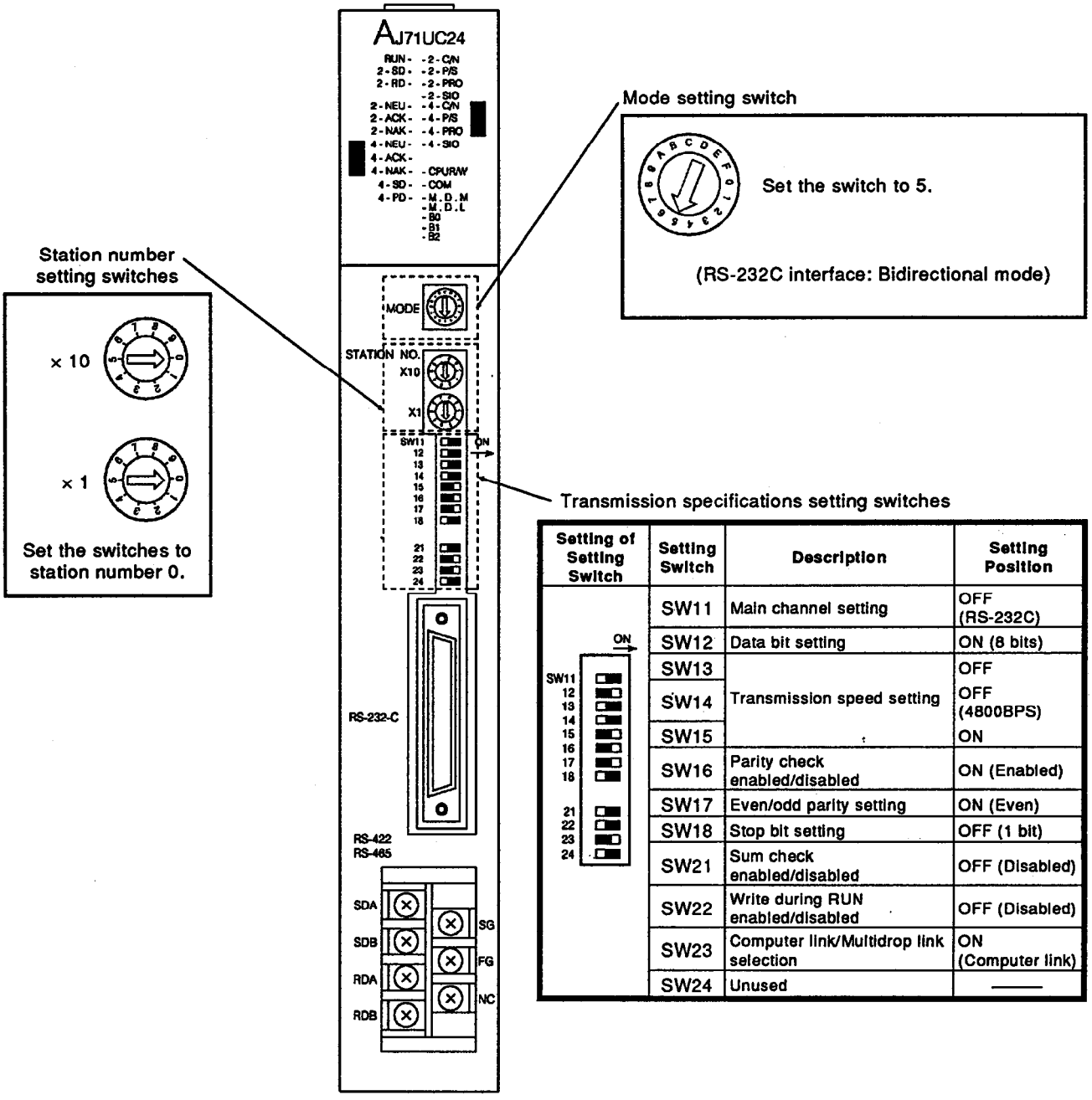
6. COMMUNICATIONS IN THE BIDIRECTIONAL MODE

This section describes the communications procedure in the bidirectional mode to be followed in this guidebook.



6.1 Setting Switches on the Computer Link Module AJ71UC24

Set the setting switches on the AJ71UC24 as shown below:



Setting of Setting Switch	Setting Switch	Description	Setting Position
	SW11	Main channel setting	OFF (RS-232C)
	SW12	Data bit setting	ON (8 bits)
	SW13	Transmission speed setting	OFF
	SW14		OFF (4800BPS)
	SW15		ON
	SW16	Parity check enabled/disabled	ON (Enabled)
	SW17	Even/odd parity setting	ON (Even)
	SW18	Stop bit setting	OFF (1 bit)
	SW21	Sum check enabled/disabled	OFF (Disabled)
	SW22	Write during RUN enabled/disabled	OFF (Disabled)
	SW23	Computer link/Multidrop link selection	ON (Computer link)
	SW24	Unused	——

POINT

When a module other than the AJ71UC24 is used as computer link module, data communications described hereinafter can be executed by setting the corresponding switches as shown above.

6.2 Description of Indicator LEDs Related to the Bidirectional Mode

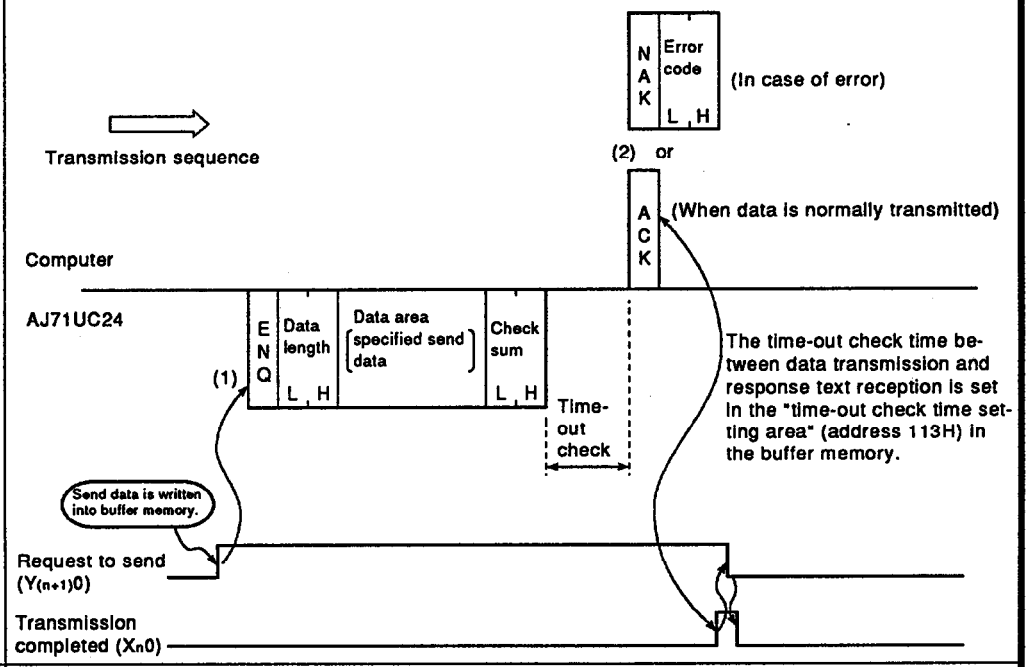
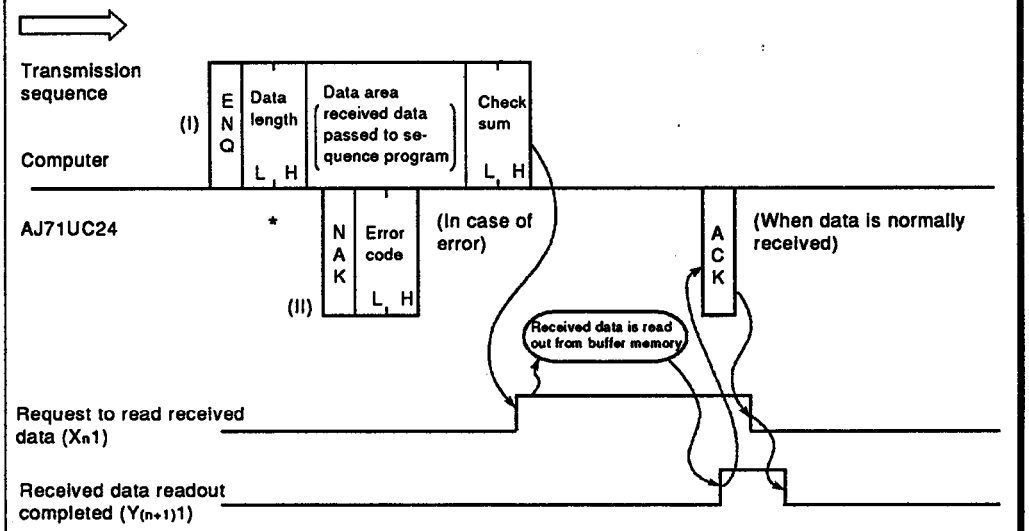
The following table shows the states of the indicator LEDs on the AJ71UC24 related to data communications in the bidirectional mode in the system configuration described in Section 3.1.1

LED Name	Function of LED	LED ON	LED OFF	Corrective Action
RUN	Indicates the operation status of the AJ71UC24.	Normal	Module trouble	*Check the switches SW13 to SW15 and SW23 for settings. *Check the mode setting switch to see if it is set at the right number.
2-SD	Indicates the status of data transmission from the AJ71UC24 to the computer.	Flickers during data transmission.	Data not transmitted	*If the LEDs do not flicker even after the computer sends a command, check the cable connections.
2-RD	Indicates the status of data reception by the AJ71UC24 from the computer.	Flickers during data reception.	Data unreceived	
2-NEU	——	Error	Normal	*Check the mode setting switch to see if it is set at the right number.
2-C/N	Indicates the status of communications between the AJ71UC24 and the PC CPU.	Communications error	Normal	*Check the switch SW22 (write during RUN enabled/disabled) for setting.
2-P/S	Indicates a parity error.	Parity error	Normal	The received data does not match the transmission specifications settings. *Match the transmission specifications of the AJ71UC24 with those of the computer. *Check the transmission specifications setting switches for settings.
2-SIO	Indicates the status of data reception.	Reception error	Normal	The received data does not match the transmission specifications settings. *Match the transmission specifications of the AJ71UC24 with those of the computer. *Check the transmission specifications setting switches for settings. *Lower the transmission speed. *Reduce the size of the data transmitted from the computer.
CPU R/W	Indicates the status of communications between the AJ71UC24 and the PC CPU.	Flickers during communications (or comes on during suspension).	Communications error	*Check the PC CPU and the computer for operation status. *Check the mode setting switch to see if it is set at the right number.
COM	Indicates the function selected.	Computer link	Multidrop link	*Set the switch SW23 (computer link/multidrop link selection) to ON.
B0	Indicates the transmission speed setting (settings of the switches SW13 to SW15) at 4800 BPS.	Error	Normal	*Check the switches SW13 to SW15 (transmission speed) for settings.
B1		Error	Normal	
B2		Normal	Error	

6.3 Control Procedure and Data Settings in the Bidirectional Mode

This section describes the basic control procedure for data communications in the bidirectional mode and the settings in the control procedure.

6.3.1 Control procedure and text structure

<table>
<tr><th>Communications</th><th>Control Procedure (Protocol)</th></tr>
<tr><td>When the PC CPU transmits data to the computer</td><td> 
</td></tr>
<tr><td>When the PC CPU receives data from the computer</td><td> 
</td></tr>
<tr><td>Remarks</td><td>As soon as it detects an error in the middle of data reception in full- duplex transmission, the AJ71UC24 sends the NAK signal (section indicated by an asterisk (*)). In such a case in half-duplex transmission, it responds with an NAK signal after the data is all received.
Since the AJ71UC24 ignores the data it has received if an error occurs during reception, it does not request the PC CPU to read out the received data.
The sum check in (1) and (I) can be omitted. Thus, this guidebook does not refer to check sum communications.</td></tr>
</table>

6.3.2 Data settings

This section describes the elements of data specified in the control procedure for the bidirectional mode.

(1) Control codes

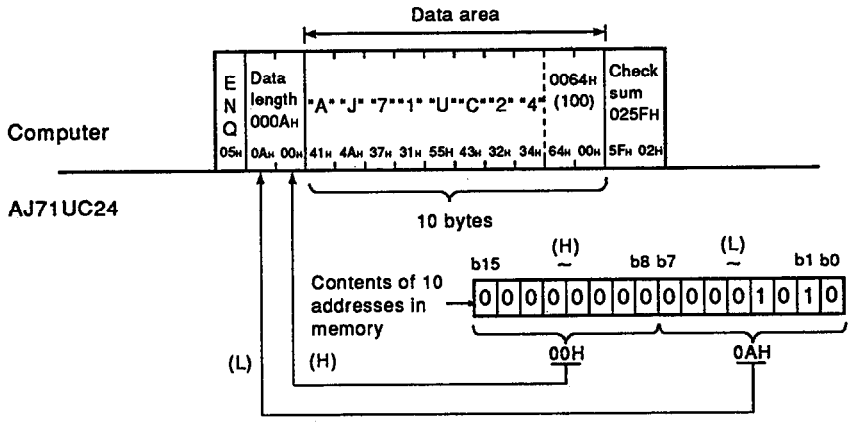
The following table shows control codes:

Control Code	Code (Hexadecimal)	Description	Function
ENQ	05H	Enquiry	Code indicating the start of send data.
ACK	06H	Acknowledge	Code to be sent to the communicating device on normal termination of data communications.
NAK	15H	Negative Acknowledge	Code to be sent to the communicating device on abnormal termination of data communications.

(2) Data length

The number of bytes or words of the data area in the text is expressed in 2- byte binary data.
The data length unit (words/bytes) depends on the contents of the buffer memory address 103H (bidirectional word/byte setting area) in the AJ71UC24.
This guidebook describes data transmission and reception in word units.

[Example] The data length when "AJ71UC24" and the numeric value 100 are transmitted as data is as follows (unit: byte):



(3) Data area

The data area is a series of 1 byte data. Data of codes 00H to FFH can be processed.

REMARKS

Check sum

Check sum is the figures of the last two bytes (16 bits) of the sum of the data length and the data area in the text, expressed in binary data.

When 1 is set for the area for specifying check sum enabled/disabled (address 115H) of the buffer memory in the AJ71UC24, the check sum is not calculated.

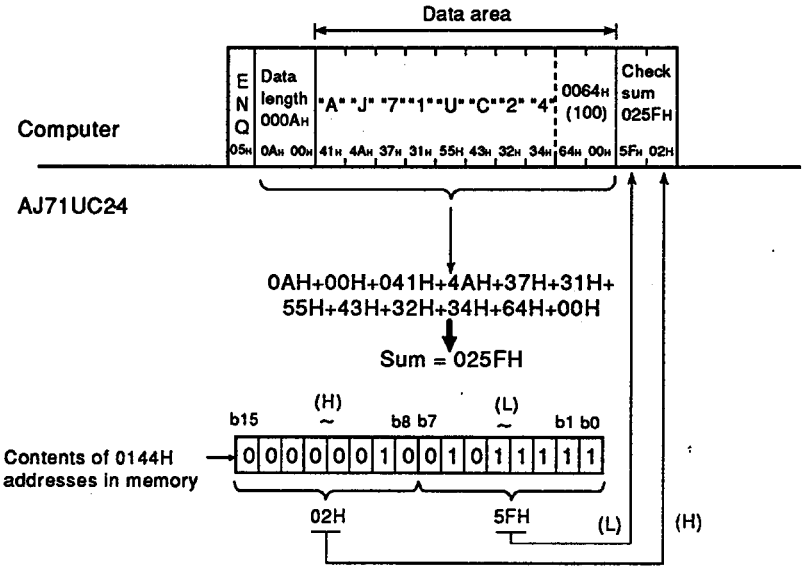
Consequently, the text does not need to contain a check sum.

When not any check sum is enabled, the received data to the next control code (see (1)) will be ignored after the data area equivalent to the data length in the text is received.

This guidebook refers to data communications with the area for specifying check sum enabled/disabled set to 1, and a check sum is not calculated.

For reference, an example of the contents of the check sum in text is given below:

[Example] The check sum when "AJ71UC24" and the numeric value 100 are transmitted as data is as follows (unit: byte):



6.3.3 Buffer memory allocation

The list below shows the buffer memory areas to be used for communications in the bidirectional mode.
In data communications in the bidirectional mode herein, data can be read out from and written to the areas with the symbol ★ using the sequence program.
Regarding the buffer memory addresses 100H to 11FH except the above, do not change their settings from the default values.

Address	Buffer Memory Address Name	Default Value	Bidirectional
0H ★	User free area (256 words) — Default allocation — Bidirectional mode send data size storage area	0 (Area for transmission in bidirectional mode)	O
1H to 7FH	User free area (256 words) — Default allocation — Buffer memory area for transmission in bidirectional mode (Send data storage area)	0 (Area for transmission in bidirectional mode)	O
80H	User free area (256 words) — Default allocation — Bidirectional mode received data size storage area	0 (Area for reception in bidirectional mode)	O
81H to FFH	User free area (256 words) — Default allocation — Buffer memory area for reception in bidirectional mode (Received data storage area)	0 (Area for reception in bidirectional mode)	O
100H	Area for specifying reception completed code in no-protocol mode	0D0AH (CR, LF)	—
101H	Error LED indication states storage area	0	Δ
102H ★	Error LED turn off request area	0	●
103H	Area for specifying word/byte units in bidirectional mode	0 (Words)	●
104H	Area for specifying head address of buffer memory for transmission in bidirectional mode	0	●
105H	Area for specifying buffer memory size for transmission in bidirectional mode	80H	●
106H	Area for specifying head address of buffer memory for reception in bidirectional mode	80H	●
107H	Area for specifying buffer memory size for reception in bidirectional mode	80H	●
108H	Area for specifying data size received in no-protocol mode	127 (Words)	—
109H	Area for specifying head address of on-demand buffer memory	0	—
10AH	Area for specifying on-demand data length	0	—
10BH ★	RS-232C CD terminal check setting area	0 (Enabled)	●
10CH	On-demand errors storage area	0	—
10DH	Area for requesting to clear received data in no-protocol mode	0	—
10EH	System area (unusable)	—	—
10FH	RS-232C communications mode setting area	0 (Full-duplex transmission)	●
110H	Area for specifying priority/non-priority in simultaneous transmission	0 (Priority)	●
111H	Area for specifying transmission method for resuming transmission	0 (No retransmission)	●
112H ★	Bidirectional mode setting area	0 (No-protocol mode)	●
113H ★	Time-out check time setting area	0 (Infinite)	●
114H	Area for specifying data valid/invalid in simultaneous transmission	0 (Data valid)	●
115H ★	Area for specifying check sum enabled/disabled	0 ((Check sum enabled)	●
116H ★	Data transmission errors storage area	0	Δ
117H ★	Data reception errors storage area	0	Δ
118H	Operation mode storage area	0 (Mode 0)	Δ
119H	Mode switching setting area	0 (No switching)	O
11AH	Area for specifying transmission control (DTR/DSR control or DC code control)	0 (DTR/DSR control)	●
11BH	Area for specifying DC1/DC3 control code	1311H	●
11CH	Area for specifying DC2/DC4 control code	1412H	●
11DH	RS-232C signal states storage area	—	Δ
11EH	Mode setting switch/Station number setting switch positions storage area	—	Δ
11FH	Transmission specifications setting switch positions storage area	—	Δ
120H to DFFH	User free area (3296 words)	0	O

The symbols ●, O, Δ, and — in the Bidirectional column of the above list represent the following:

- ● : Area from/to which the PC CPU can read out/write data and from which the computer can read out data.
- O : Area from/to which the PC CPU and the computer can read out /write data.
- Δ : Area from which the PC CPU and the computer can only read out data.
- —: Area which is unused for the bidirectional mode.

6.3.4 I/O signals to the PC CPU

The following tables show the I/O signals available for the bidirectional mode.

(1) Input signals (AJ71UC24 → PC CPU)

Input Signal	Signal Name	Description
Xn0	Transmission completed	Turned on when data transmission is completed in response to the request from the PC CPU to send data.
Xn1	Request to read out received data	Turned on when data is received from the external device after the AJ71UC24 was turned on.
Xn7	AJ71UC24 READY signal	Turned on when the AJ71UC24 is ready to operate.
XnD	Watch dog timer error	Turned on when the AJ71UC24 is unable to operate.

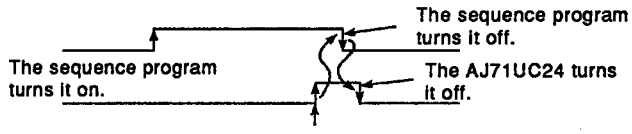
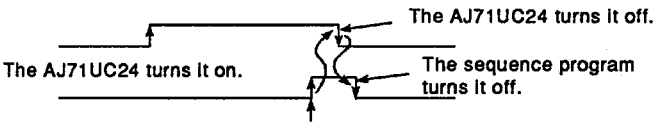
(2) Output signals (PC CPU → AJ71UC24)

Output Signal	Signal Name	Description
Y(n+1) 0	Request to send	Turned on when the PC CPU transmits data stored in the buffer memory in the AJ71UC24 to the computer after the AJ71UC24 was turned on.
Y(n+1) 1	Received data readout completed	Turned on when the PC CPU has read out all data the AJ71UC24 received from the external device.

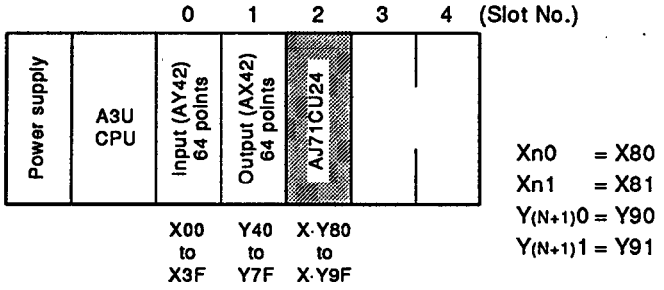
The shading blocks are signals used in this guidebook.

(3) Handshake signals in the bidirectional mode

Such signals as used in data communications in the bidirectional mode to transmit data from the sequence program to the computer or allow the sequence program to detect and read out data from the computer are called handshake signals. They are necessary for data communications in the bidirectional mode.
The following table shows the handshake I/O signals.

	Signal	Timing
PC CPU ↓ Computer	$Y_{(n+1)}0$ (Request to send) X_n0 (Transmission completed)	
Computer ↓ PC CPU	X_n1 (Request to read out received data) $Y_{(n+1)}1$ (Received data readout completed)	

(Note) The I/O numbers X_n0 and $Y_{(n+1)}0$ depend on the slot in which the AJ71UC24 is loaded.
The following figure is a loading example.
In the system configuration in this guidebook, the AJ71UC24 is used for X·Y80 to 9F, as shown below.



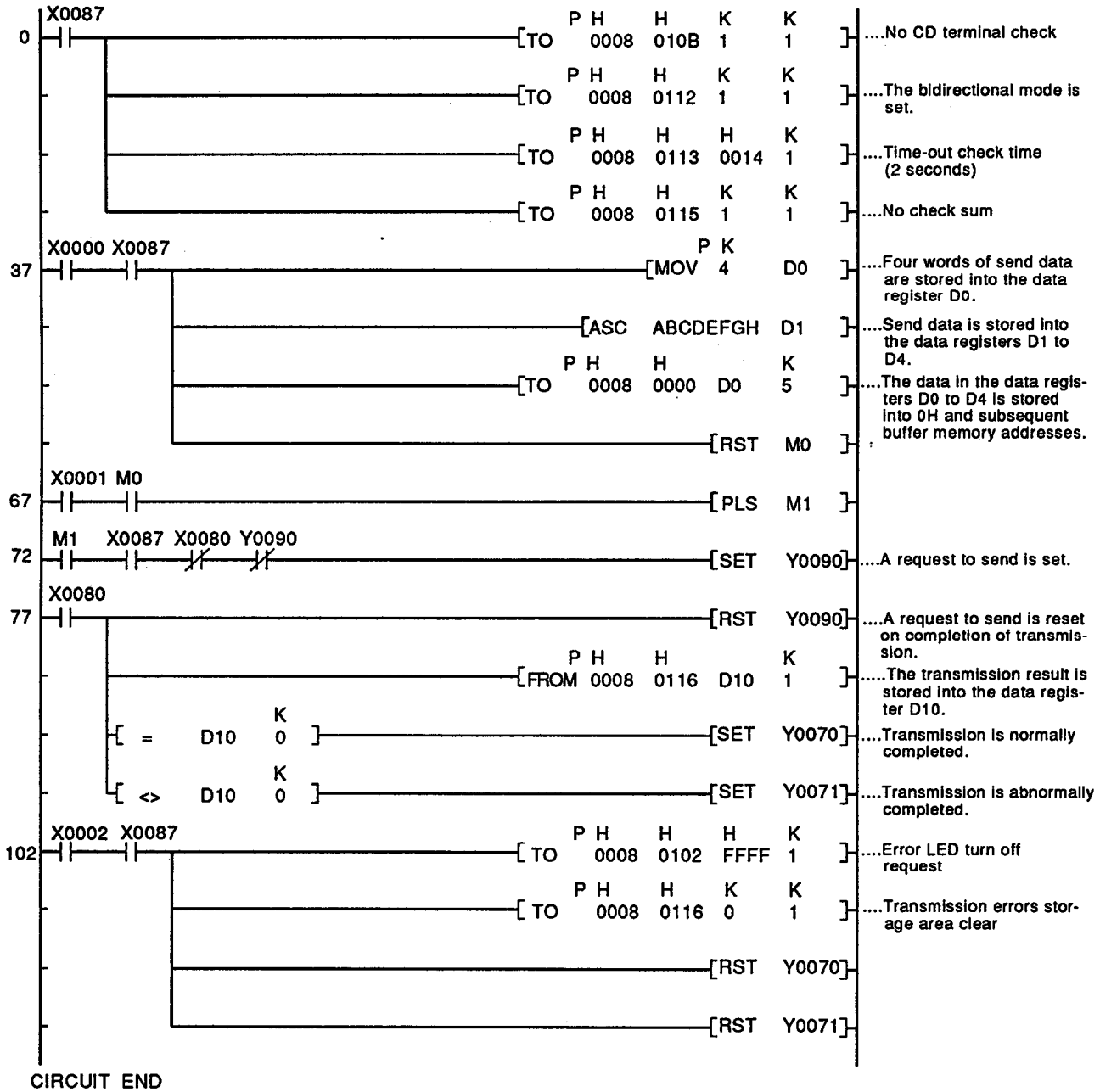
6.4 Transmitting Data from the PC CPU

Transmit data from the PC CPU to the computer.
The data is to be transmitted in word units.

(Practice) When the X0 is turned on, the character data "ABCDEFGH" (ASCII codes) is written into the buffer memory (addresses 0H to 4H) in the AJ71UC24.
When the X1 is turned on, the character data "ABCDEFGH" is transmitted to the computer in the bidirectional mode.
On receipt of a response from the computer, the PC CPU completes transmission.

6.4.1 Sequence program

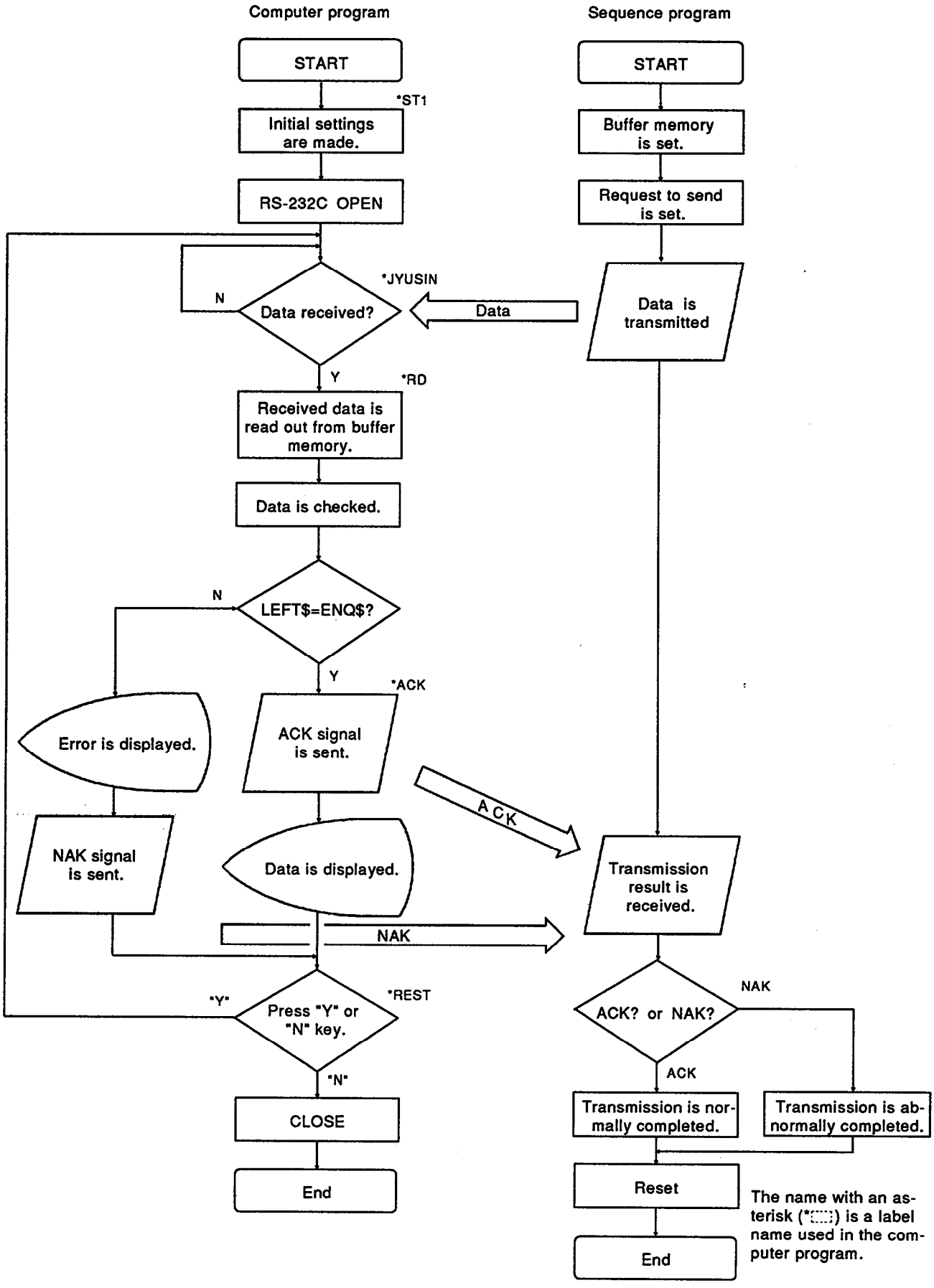
X80: Transmission completed
X87: AJ71UC24 READY signal
Y90: Request to send



6.4.2 Computer program (N88BASIC)

```
1000 ' !---------------------------------------------------------------------------------------------------------------------------------------- !
1010 ' !                                    Example of AJ71UC24 bidirectional mode program                                                    !
1020 ' !                                          (transmitting data from PC CPU)                                                             !
1030 ' !---------------------------------------------------------------------------------------------------------------------------------------- !
1040 *ST1
1050     CLS                                                    : ' Screen initialization
1060     CH%  =1                                                : ' Channel number
1070     ENQ$ =CHR$(&H5)                                        : ' ENQ code
1080     ACK$ =CHR$(&H6)                                        : ' ACK code
1090     NAK$ =CHR$(&H15)                                       : ' NAK code
1100     '
1110 ' !------------------------------ Open and initial settings of RS-232C are made. ------------------------------------------------------ !
1120     OPEN "COM:E81NN" AS #CH%                               : ' Communications mode and other specifications are set.
1130 ' !------------------------------------------------------- Data is received. ------------------------------------------------------------ !
1140 *JYUSIN
1150     CLS
1160     LOCATE  6, 1 : PRINT  """RECEIVING DATA FROM PC IN BIDIRECTIONAL MODE"""
1170 *JYU1
1180     FOR  I%=0  TO  1000  :NEXT I%
1190     IF LOC(CH%)<>0  THEN *RD
1200     LOCATE  10, 5 : PRINT "WAITING FOR DATA TO BE RECEIVED!"
1210     LOCATE  10, 8 : PRINT "TRANSMIT DATA FROM PC." : GOTO  *JYU1
1220     '
1230 ' !-----------------------------------------Data is read out from buffer memory. ------------------------------------------------------- !
1240 *RD
1250     B$=" "
1260 *RD1
1270     FOR  I%=0    TO  1000  :NEXT  I%
1280     IF LOC(CH%)<>0  THEN  B$=B$+INPUT$(LOC(CH%),#CH%)  ELSE  *RD1
1290     '
1300 ' !-----------------------------------------------------Received data is checked. ------------------------------------------------------ !
1310     IF LEFT$(B$,1)=ENQ$  THEN  *ACK
1320     E1$=CHR$(&H22)+CHR$(&H0) : E2$="0022"  : ' &H0022=User definition error
1330     COLOR  2:  LOCATE  10, 5
1340     PRINT  "COMMUNICATIONS ERROR!!  ERROR CODE = "E2$ : COLOR  0
1350     PRINT  #CH%,NAK$;E1$:GOTO  *REST       : ' NAK signal is transmitted.
1360     '
1370 ' !-----------------------------------------------------ACK signal is transmitted. ------------------------------------------------------ !
1380 *ACK
1390     PRINT  #CH%,ACK$
1400     '
1410 ' !-----------------------------------------------------Received data is displayed. ----------------------------------------------------- !
1420     DAT$=MID$(B$,4,LEN(B$)-3)
1430     LOCATE  10, 5 : PRINT "RECEIVED DATA =  ";DAT$
1440     '
1450 *REST
1460     LOCATE  10, 8 : INPUT "RECEIVE AGAIN (Y/N)?" ; Y$
1470     IF Y$="Y"  THEN  *JYUSIN
1480     '
1490 CLOSE
1500 END
```

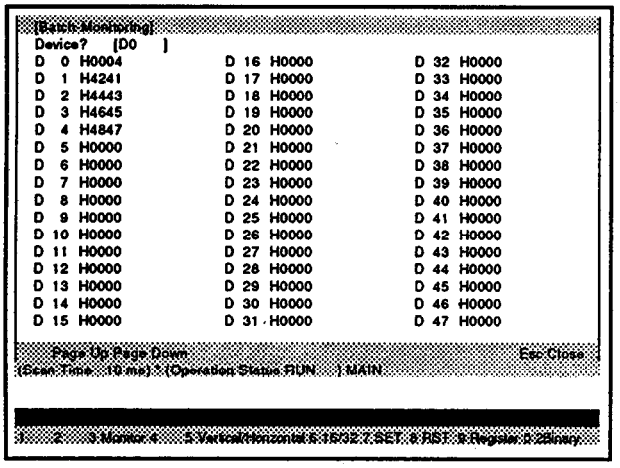
Transmitting data from the PC CPU



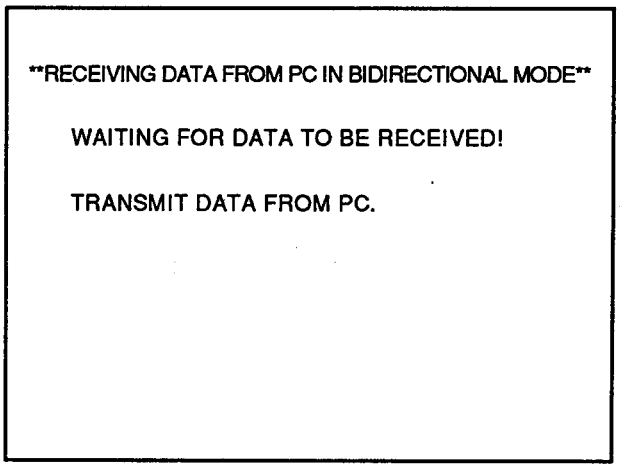
6.4.3 Operation on training machine

Write the sequence program described in Section 6.4.1 to the PC CPU, and the BASIC program shown in Section 6.4.2 to the computer.
After writing the programs, run each of them.
If there is no error, start a computer link operation following the procedure below:

1) When the X0 is turned on, 4 representing the number of words is stored into the data register D0, and the data "ABCDEFGH" into the data registers D1 to D4, then written to the buffer memory addresses 0H to 4H in the computer link module.
   Monitor and check the values in the data registers D0 to D4 on the A7PHP display.

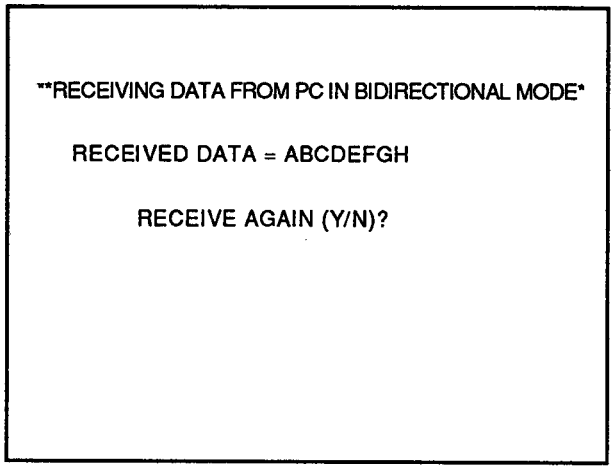


PHP Display (batch-monitoring)



Computer Display

2) Turn on the X1. Data will be transmitted to the computer.



Computer Display

Check these points!

- Although the send data is set in the PC CPU and the request-to-send signal is turned on,

```
**RECEIVING DATA FROM PC
IN BIDIRECTIONAL MODE**

   WAITING FOR DATA TO BE
   RECEIVED!
   TRANSMIT DATA FROM PC.
```

is displayed.

- Is the sequence program (Section 6.4.1) written to the PC CPU?
- Are the AJ71UC24 mode setting switch setting (Section 6.1) and the cable connections (Section 3.3) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 6.2), then reexamine the setting and the connections.

- When data is transmitted from the PC CPU,

```
**RECEIVING DATA FROM PC
IN BIDIRECTIONAL MODE**

COMMUNICATIONS ERROR!!
  ERROR CODE = 0022
    RETRANSMIT (Y/N)?
```

is displayed.

- Has the computer sent the NAK signal?
  Are the computer settings (Section 3.4) and the AJ71UC24 switch settings (Section 6.1) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 6.2), then reexamine the settings.

- When the send data and the data the computer received differ from each other.

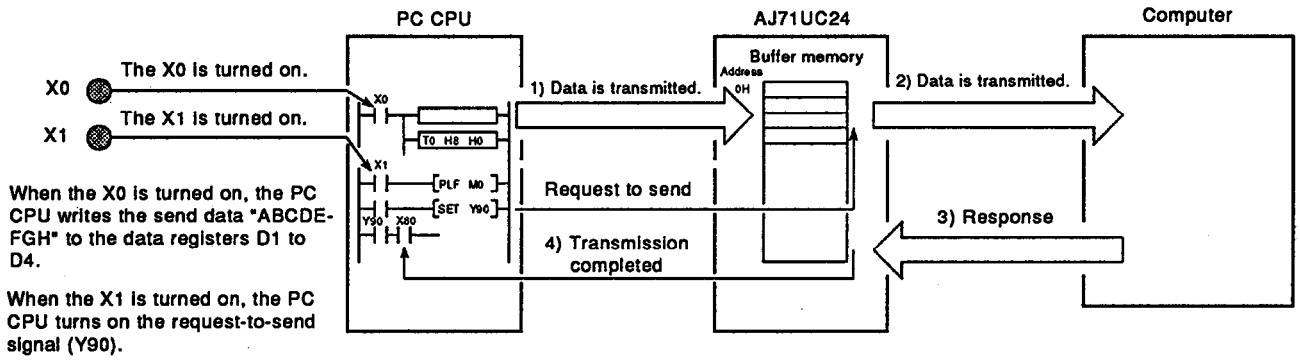
```
**RECEIVING DATA FROM PC
IN BIDIRECTIONAL MODE**

  RECEIVED DATA =[.....]

    RECEIVE AGAIN (Y/N)?
```

- Are the AJ71UC24 switch settings (Section 6.1) and the computer program (RS- 232C settings) settings (Section 6.4.2) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 6.2), then reexamine the settings.

After making the correct settings, reset the PC CPU to restart communications.

6.4.4 Outline of receiving data from the PC CPU in the bidirectional mode

The figure below outlines the flow of data transmission from the PC CPU in the bidirectional mode described in Section 6.4.3.

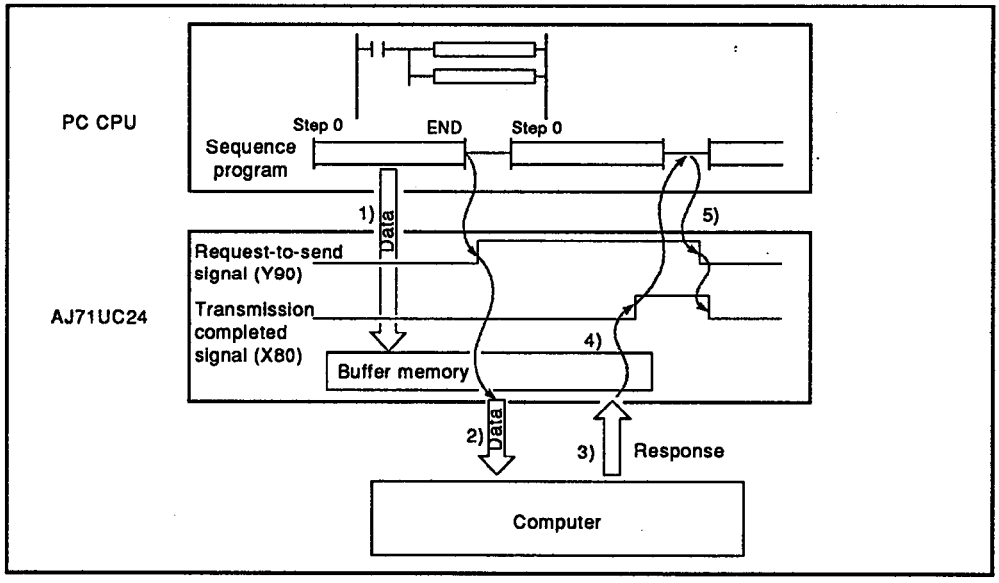


1) The PC CPU writes data to the buffer memory in the AJ71UC24 in response to the TO instruction from the sequence program.

2) As soon as the request-to-send signal (Y90) is turned on, the AJ71UC24 transmits the data as it is to the computer.

3) The computer checks the received data, and sends back a response (receiving result) to the AJ71UC24.

4) On receipt of the response, the AJ71UC24 turns on the transmission completed signal (X80) to complete a cycle of data transmission.



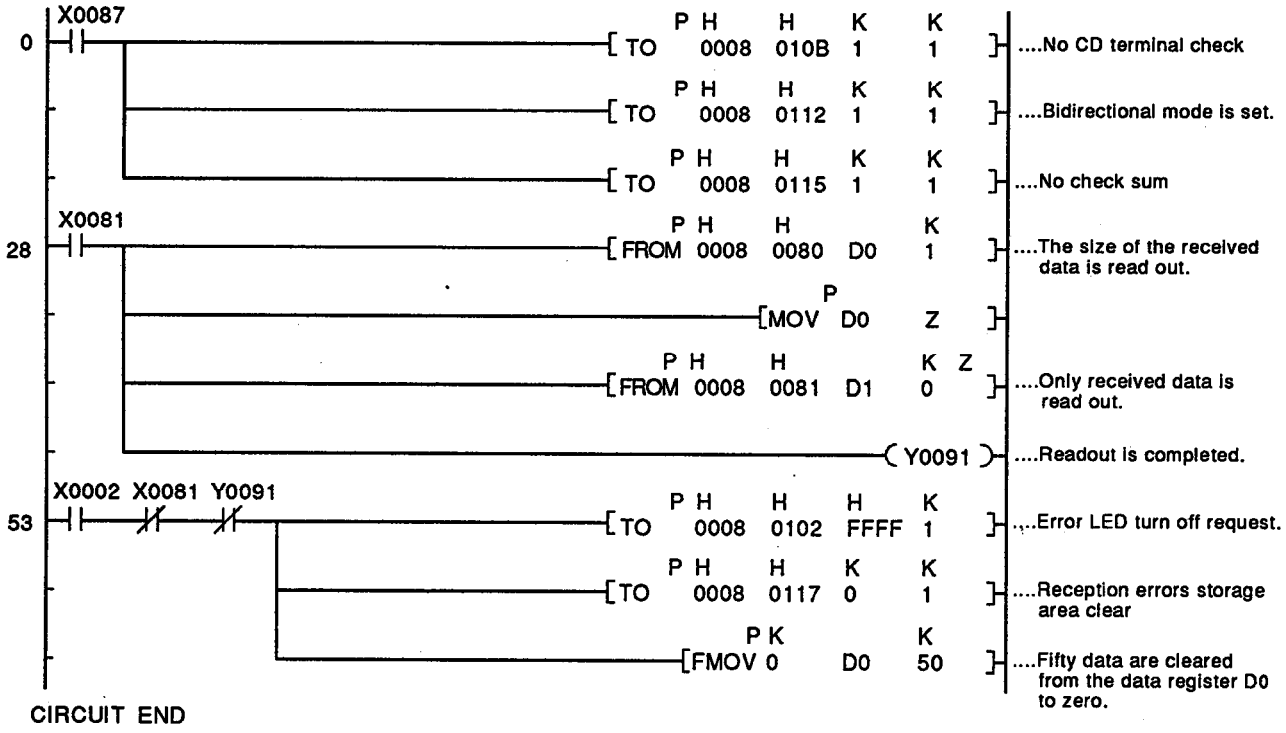
6.5 Receiving Data from the Computer

The PC CPU receives data from the computer.
The data is to be received in word units.

(Practice) The computer transmits data entered from the keyboard to the PC CPU. The PC CPU reads out the received data from the buffer memory on the FROM instruction from the sequence program.
The computer completes communications on receipt of the transmission result.

6.5.1 Sequence program

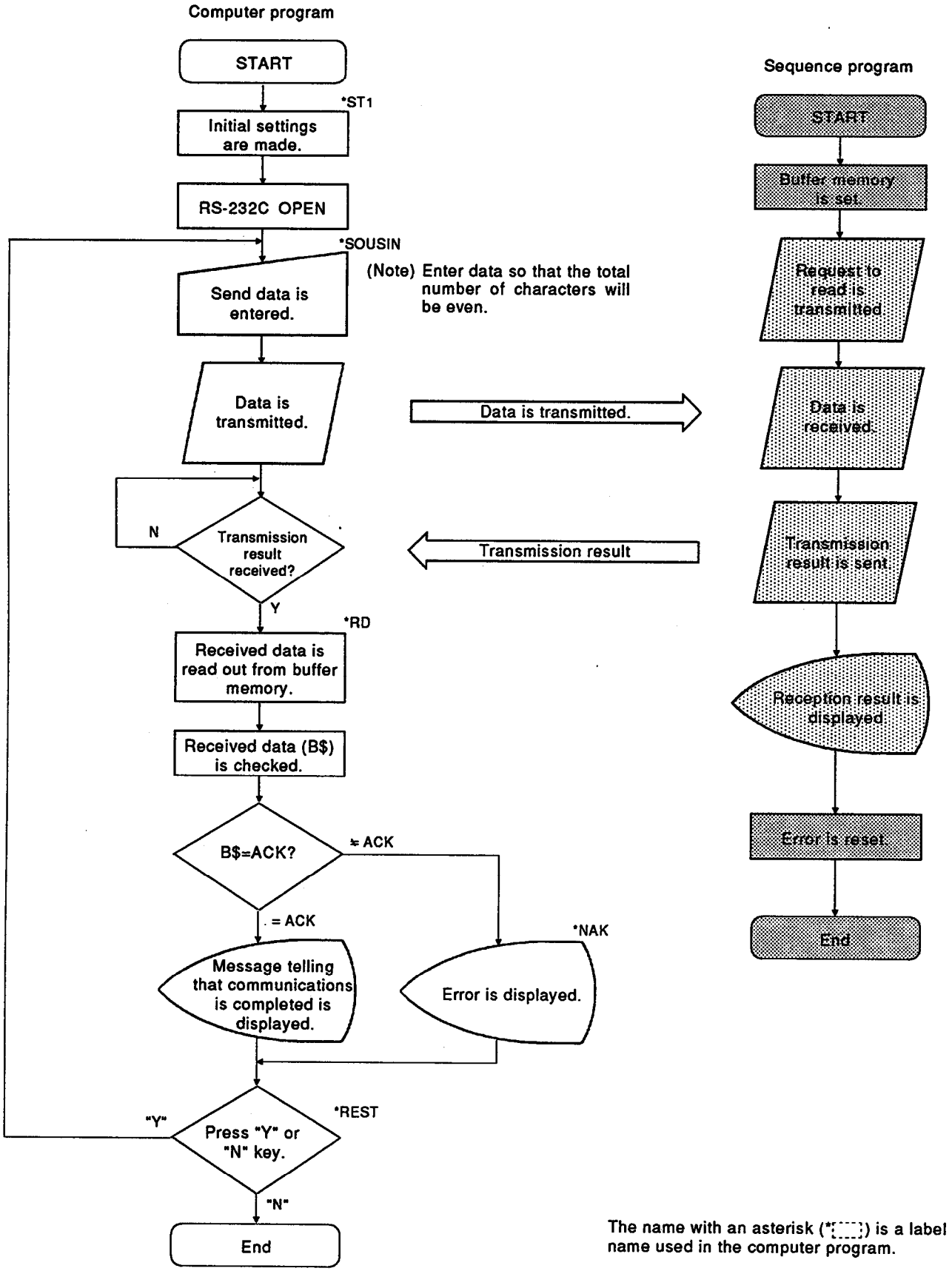
X81: Request to read out received data
X87: AJ71UC24 READY signal
Y91: Received data readout completed



6.5.2 Program for the computer (N88BASIC)

```
1000 ' !---------- !
1010 ' !                    Example of AJ71UC24 bidirectional mode program                    !
1020 ' !                        (receiving data from computer)                                !
1030 ' !---------- !
1040 *ST1
1050     CLS                                          : ' Screen initialization
1060     CH% =1                                       : ' Channel number
1070     ENQ$ =CHR$(&H5)                              : ' ENQ code
1080     ACK$ =CHR$(&H6)                              : ' ACK code
1090     NAK$ =CHR$(&H15)                             : ' NAK code
1100     '
1110 ' !---------- Open and initial settings of RS-232C are made. ---------- !
1120     OPEN "COM:E81NN" AS #CH%                     : ' Communications mode and other specifications are set.
1130 ' !----------Data is transmitted. ---------- !
1140 *SOUSIN
1150     CLS
1160     LOCATE 6, 1 : PRINT "**TRANSMITTING DATA TO PC IN BIDIRECTIONAL MODE**"
1170     LOCATE 10, 5 : INPUT "SEND DATA" ; SD$
1180     SN$=RIGHT$("000"+HEX$(LEN(SD$)/2), 4)        : ' Data size is calculated.
1190     N1$=CHR$(VAL("&H"+RIGHT$(SN$, 2)))
1200     N2$=CHR$(VAL("&H"+LEFT$(SN$, 2)))
1210     NS$=N1$+N2$
1220     DAT$=NS$+SD$
1230     PRINT #CH% , ENQ$ ; DAT$ ;
1240     '
1250 ' !----------ACK/NAK data is transmitted. ---------- !
1260 *RECEIVE
1270     IF LOC(CH%)<>0 THEN *RD ELSE *RESEIVE
1280 ' !----------Data is read out from buffer memory. ---------- !
1290 *RD
1300     B$=" "
1310 *RD1
1320     FOR I%=0 TO 1000 :NEXT I%
1330     IF LOC(CH%)<>0 THEN B$=B$+INPUT$(LOC(CH%), #CH%) ELSE *RD1
1340     '
1350 ' !----------Received data is checked. ---------- !
1360     IF B$<>ACK$ THEN *NAK
1370     LOCATE 10, 8 : PRINT "COMMUNICATIONS COMPLETED." : GOTO *REST
1380     '
1390 *NAK
1400     E1$=RIGHT$("0"+HEX$(ASC(RIGHT$(B$, 1))), 2)
1410     E2$=RIGHT$("0"+HEX$(ASC(MID$(B$, 2, 1))), 2)
1420     IF LEFT$(B$, 1)=NAK$ THEN E$=E1$+E2$ ELSE E$="####"
1430     COLOR 2: LOCATE 10, 8
1440     PRINT "COMMUNICATIONS ERROR!! ERROR CODE = ";E$ : COLOR 0
1450 *REST
1460     LOCATE 10, 11 : INPUT "RESET AND RETRANSMIT (Y/N)?" ; Y$
1470     IF Y$="Y" THEN *SOUSIN
1480     '
1490 CLOSE
1500 END
```

Receiving data from the computer



The name with an asterisk (*[ ]) is a label name used in the computer program.

6.5.3 Operation on training machine

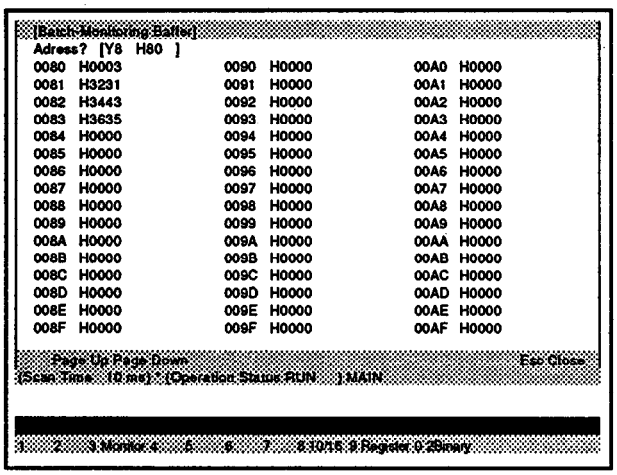
Write the sequence program described in Section 6.5.1 to the PC CPU, and the BASIC program shown in Section 6.5.2 to the computer.
After writing the programs, run each of them.
If there is no error, start a computer link operation following the procedure below:

1) Enter send data consisting of an even number of characters from the keyboard, and transmit it to the PC CPU.
(For example, [1][2][3][4][5][6][↵])

```
**TRANSMITTING DATA TO PC IN BIDIRECTIONAL MODE**

        SEND  DATA?
```

(Note) Enter data so that the total number of characters will be even.

2) The data transmitted from the computer is written into the buffer memory (H80 ~) in the computer link module.



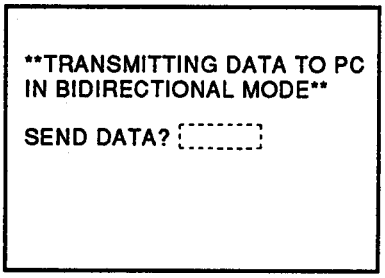
PHP Display (batch-monitoring buffer)

```
**TRANSMITTING DATA TO PC IN BIDIRECTIONAL MODE**

        SEND DATA? 123456

        COMMUNICATIONS COMPLETED.

        RESET AND RETRANSMIT (Y/N)?
```

Computer Display

Check these points!

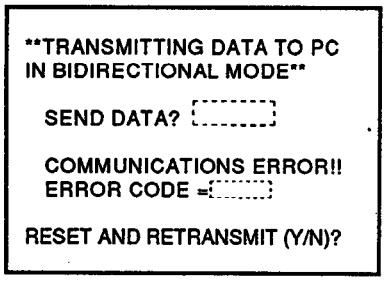
- When data cannot be transmitted from the computer.



is displayed.

- Is the sequence program (Section 6.5.1) written to the PC CPU?
- Are the AJ71UC24 mode setting switch setting (Section 6.1) and the cable connections (Section 3.3) correct?
  Check the indicator LEDs on the AJ71UC24 (6.2), then reexamine the setting and the connections.

- When the PC CPU sends an error code.



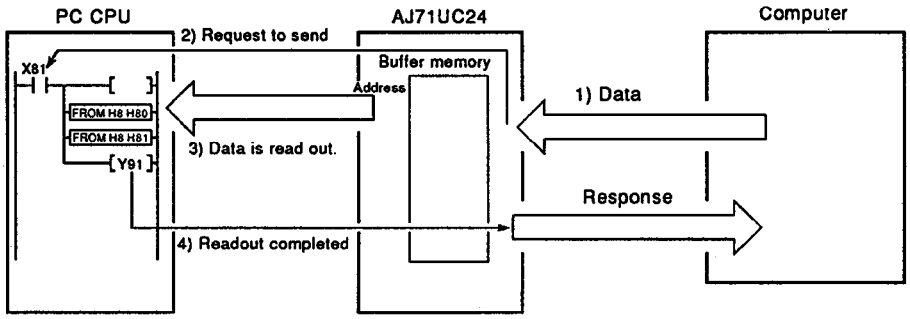
is displayed.

- Has the AJ71UC24 sent the NAK signal?
  Are the AJ71UC24 switch settings (Section 6.1), the computer settings (Section 3.4), and the computer program (RS-232C) settings (Section 6.5.2) correct?
  Check the indicator LEDs on the AJ71UC24 (Section 6.2), then reexamine the settings.
- Is the total number of characters of the send data entered from the keyboard odd?
  (Because the data is to be transmitted in word units, it must be composed of an even number of characters.)
- For details of the error code displayed, refer to the Computer Link Module User's Manual, and take proper action.

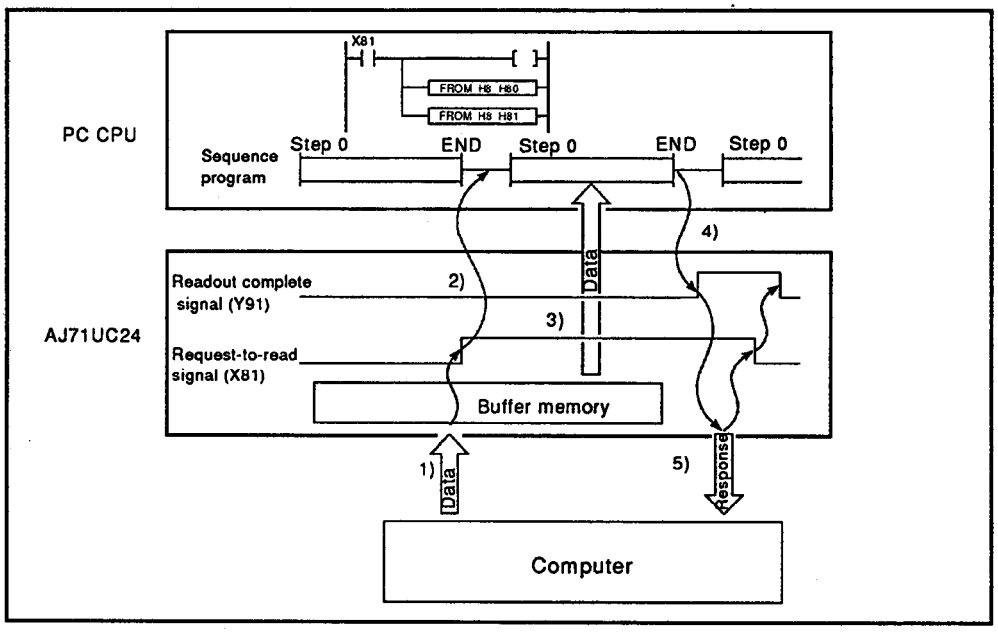
After making the correct settings, reset the PC CPU to restart communications.

6.5.4 Outline of receiving data from the computer in the bidirectional mode

The figure below outlines the flow of data reception from the computer in the bidirectional mode described in Section 6.5.3.



1) When the computer transmits data, the AJ71UC24 receives and stores it into its buffer memory.
2) The AJ71UC24 sends the request-to-read signal (X81) to the PC CPU.
3) The PC CPU reads out the received data from the AJ71UC24 on the FROM instruction from the sequence program.
4) On completion of data readout, the sequence program turns on the readout completed signal (Y91).
5) As soon as the readout completed signal (Y91) is turned on, the AJ71UC24 sends back a response to the computer, and turns off the request-to-read signal (X81) to complete a cycle of data reception.



Computer Link Module

Guidebook

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