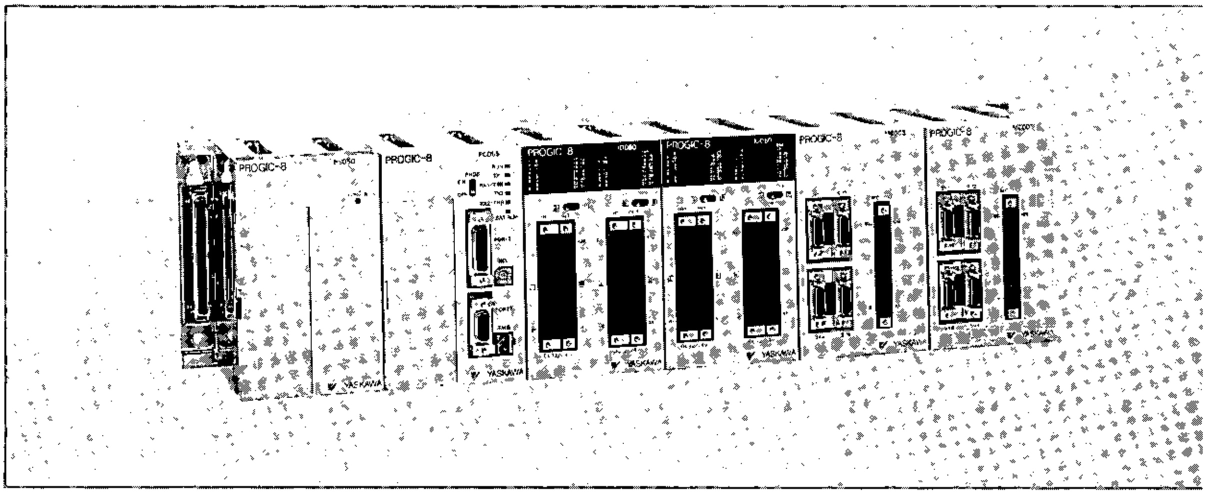
PROGIC-8

MULTIAXES MOTION CONTROLLER

DESCRIPTION OF MEMOBUS (INDUSTRIAL COMMUNICATION SYSTEM) MAINLY UTILIZING PROGIC-8 AS A SLAVE



YASKAWA

INTRODUCTION

The MEMOBUS is an industrial data communication system applicable to the multiaxes motion controller PROGIC-8 and MEMOCON-SC series.

The MEMOBUS system is comprised of one master unit (computer, ACGC, MEMOCON-SC series) and up to 32 slave units (PROGIC-8 and/or MEMOCON-SC series ; up to 15 PROGIC-8 slave units can be used.)

Transmission (serial communication) between the master and slave units is controlled by programs held in the master unit. The master unit initiates transmission and the slave units respond to it.

The master unit communicates with one slave unit at a time. Each slave unit is given an address code and the master unit refers to an access address for a specific slave unit. The slave unit which has received a command from the master unit executes the designated function and responds to the master unit.

In this way, the master unit can read or rewrite the status of coils and the contents of registers of the slave units. They, in turn, may be disbursed in various locations so that centralized monitoring and control becomes possible over a wide production area.

The transmission protocol of the system is called MEMOBUS. It is very simple and easy to understand, and is designed with a common format.

Any computer may become the master unit only if it is provided with an RS-232C port.

If only one slave is used, connect directly to the master by RS-232C cable. However, prepare modems when more than one slave (up to 32 units) is used.

Described in this manual are the specifications of the MEMOBUS, system configuration, connections, setting up transmission parameters, and communication protocol.

CONTENTS

SECTION 1

SPECIFICATIONS

This section discribes the MEMOBUS system specifications.

1.1 TRANSMISSION SPECIFICATIONS

(1) Transmisson Mode : Half duplex, asynchronous
- Between master/slave unit and modem : RS-232C
- Between modems : Frequency shift keying (FSK)

(2) MEMOBUS Master Unit : Any one of computer, ACGC, P150, MEMOCON-SC
(3) MEMOBUS Slave Units : Up to 32 PROGIC-8 and/or MEMOCON-SC
(Up to 15 PROGIC-8 slave units can be used.)
(4) Communication Protocol : MEMOBUS message
(5) Transmission Rate 300 to 19200 baud (user selectable)
(6) Transmission Mode : RTU mode (Refer to Sec. 5.3, "COMMUNICATION MODE".)
(7) Data Format : RS-232C
- Data : 8 bits (RTU mode)
- Parity check : Even parity
- Stop bit : 1 bit

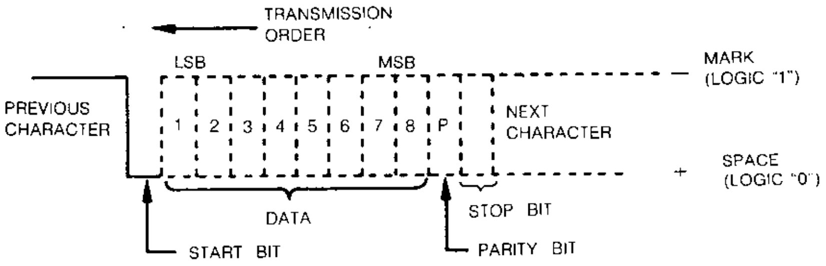


Fig. 1.1 Data Format

(8) Error Check : CRC-16 (RTU mode)
(9) Distance of Communication : 4.5km max
(10) Transmission Cable : Two-core twisted-pair cable (RG-108/U or equivalent)
Impedance—100Ω at 100kHz

1.2 MODEM SPECIFICATIONS

(1) Types : DISCT-J2078, DISCT-J1078 (can be used simultaneously)
(2) Modulation : FSK (50kHz, 80kHz)
(3) Transmission Output Voltage : $6V_{P-P}$ at 100kHz, 100Ω load
(4) Receiving Input Voltage : $100mV_{P-P}$ minimum at 100kHz
(5) Power Source : 85 to 121VAC, 47.5 to 63Hz, 10VA (J1078 modem is used)
+15VDC(+12VDC)±5%, 200mA, −15VDC(−12VDC)±5%,
100mA (J2078 modem is used)

1.3 GENERAL SPECIFICATIONS

(1) Ambient Temperature : 0 to +55°C
(2) Storage Temperature : −20 to +85°C
(3) Humidity : 5 to 95% R.H. (non-condensing)
(4) Vibration Resistance : In compliance with JIS* C 0911 II B class 3
(5) Grounding Resistance : 100Ω or less

* Japanese Industrial Standard.

SECTION 2

SYSTEM CONFIGURATION

This section describes the precautions for building MEMOBUS system. Read throughly and retain for reference for proper system configuration.

2.1 WHEN COMPUTER IS USED AS A MASTER

The programs controlling communication according to MEMOBUS messages must be stored in advance in the computer. The modems are to be connected with two-core twisted-pair cables, each core providing one-way transmission. No extra devices are needed for branching a cable since it is connected via a terminal block.

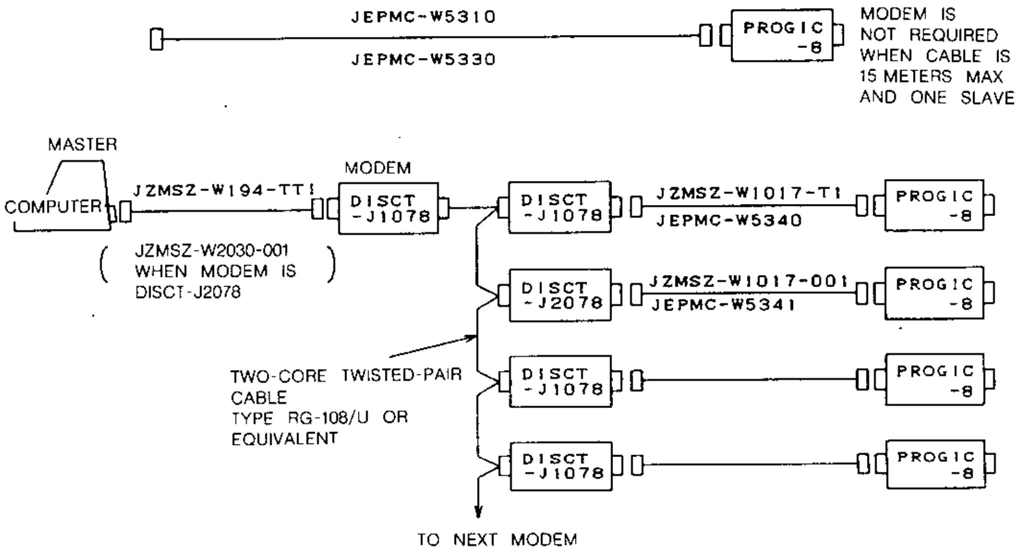
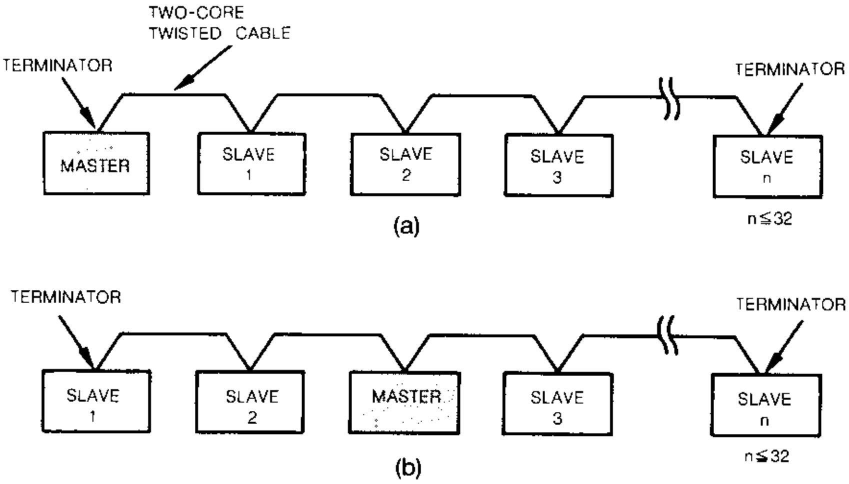


Fig. 2.1 Configuration with Computer Master

2.2 PRECAUTIONS WHEN BUILDING A SYSTEM

(1) Be sure to connect all the units in series, Fig. 2.2 (a). The master unit may be located anywhere in the communication line of the units, Fig. 2.2 (b). Be sure to terminate both ends of the line of units with terminators.



Note : Modem is omitted in these illustrations.

Fig. 2.2

(2) No modem is necessary when only one slave unit is connected and is not more than 15 meters from the master unit. Modems become necessary when more than one slave unit is connected or when one is more than 15 meters from the master unit, Fig. 2.3.

Either modem J2078 or J1078 can be used, or both can be used in the same system.

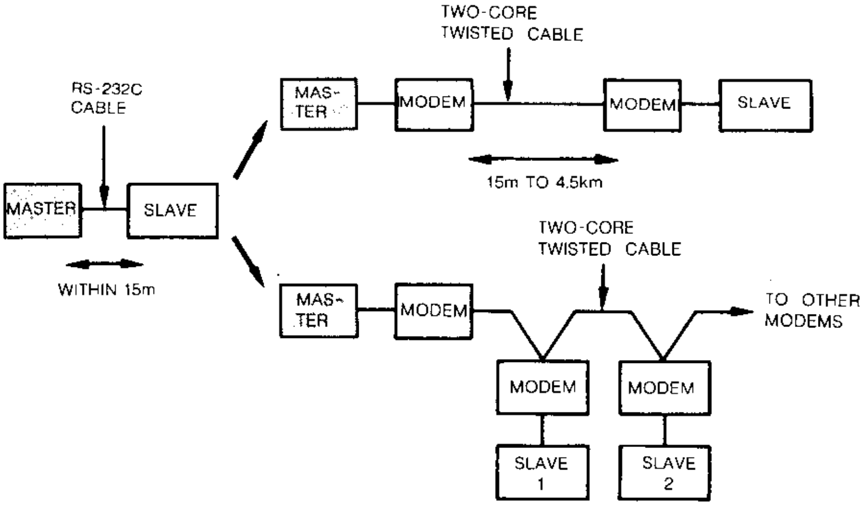


Fig. 2.3

(3) When starting or stopping power to modem, a erroneous signal will be transmitted into the two-core twisted-pair cable momentarily (not longer than 1 ms) and, therefore, if communication is performed between other modems at that moment, an error will result.

A communication error may also possibly result from other external noises. The master unit should, therefore, be controlled by software to reattempt communication when it has detected an error.

If a message of master unit is externally disturbed during transmission, no slave unit will return messages. To cope with this problem, the master unit should have a timer which permits reattempting communication when a time-out error has been detected.

(4) If a slave unit is turned ON or OFF while modem power is ON, the modem will produce a erroneous signal which will be transmitted into the two-core twisted -pair cable (for tens of milliseconds). To prevent this interference, use the following sequences :

- Power ON —Turn ON the slave unit, then turn ON the modem.
- Power OFF—Turn OFF the modem, then turn OFF the slave unit, or turn OFF the modem and the slave unit simultaneously.

Refer to Fig. 2.4.

You can remove the RS-232C cable connecting the modem and slave unit before turning the slave ON or OFF : no problem arises even if the modem is ON.

(5) Slave units connected to the same master unit must be set up for the same communication parameters, except for addresses. The same address cannot be given to more than one slave unit.

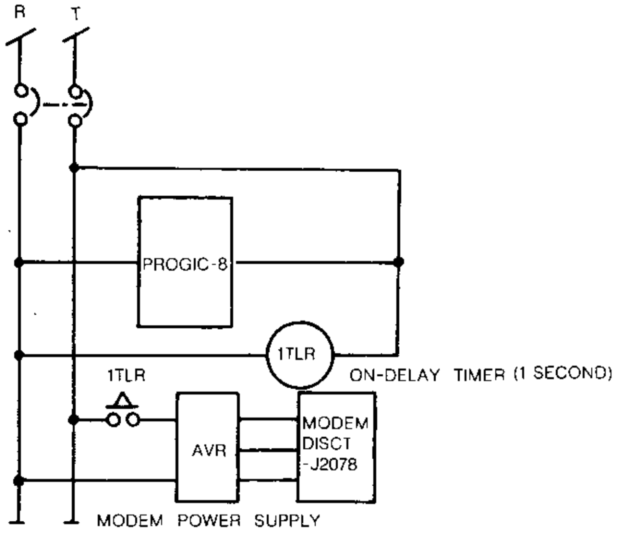


Fig. 2.4 Power Sequence Example (J2078 Modem)

SECTION 3

CONNECTIONS BETWEEN MODEMS

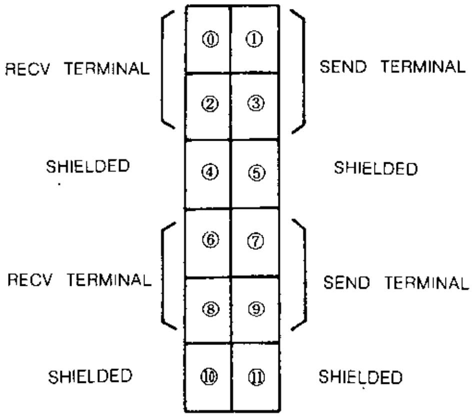
This section describes the method and precautions for connecting the modems.

3.1 CONNECTION BETWEEN MODEMS

Be sure to use two-core twisted-pair cables (RG-108/U or equivalent) for transmisson between modems. Connect the cables to the terminal block provided on the front panel of modem.

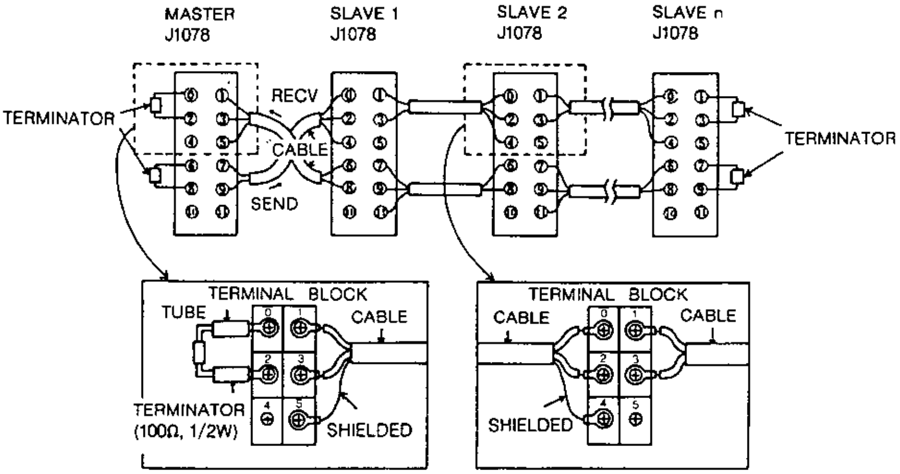
(1) J1078 MODEM

As shown in **Fig. 3.2**, for connection of two-core twisted shielded cable, connect all send terminals (SEND) at the master side with receive terminals at the slave side. Then gather all send terminals at the slave side to connect with receive terminals (RECV) at the master side.



Note : Terminal blocks 0 and 1, 2 and 3, 6 and 7, 8 and 9, 4 and 5, 10 and 11 are connected in J1078.

Fig. 3.1 Terminal Block (J1078 Modem)



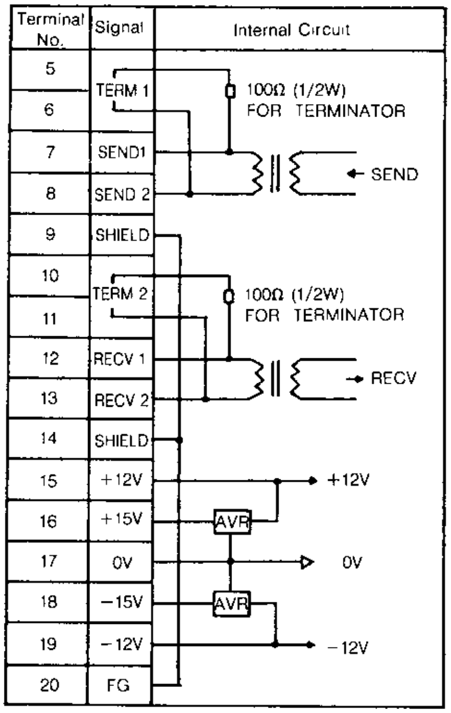
Notes :

1. Two signal lines of two-core twisted cable do not have polarity.
2. Terminate both ends of two-core twisted-pair cable with terminators (100Ω, 1/2W or more).
3. J1078 at the master side can be located in any place on the same line ; not specially required to be in the end
4. J2078 and J1078 can be used in the same system.

Fig. 3.2 Connection of Two-core Twisted Shielded Cables (J1078 Modem)

(2) J2078 MODEM

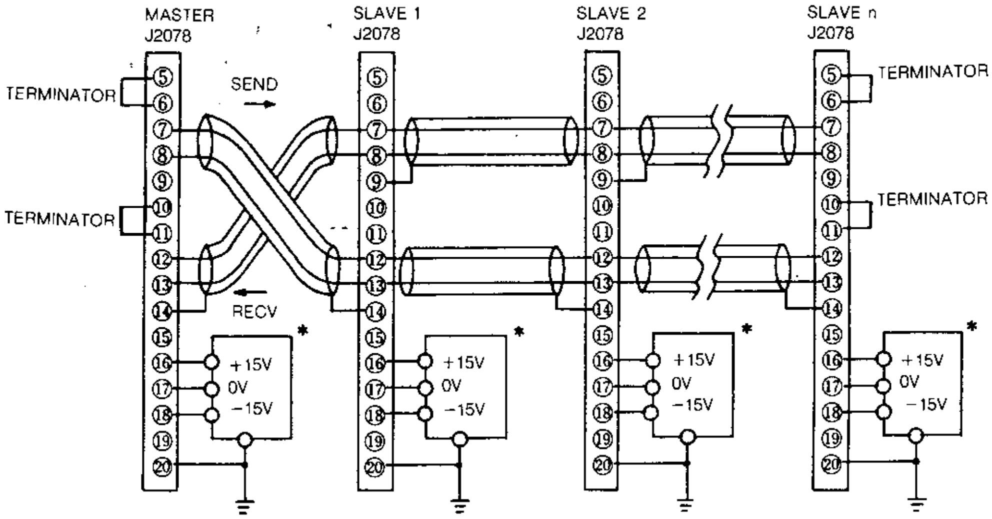
As shown in **Fig. 3.4**, for connection of two-core twisted shielded cable, connect all send terminals (SEND) at the master side with receive terminals at the slave side. Then gather all send terminals at the slave side to connect with receive terminals (RECV) at the master side.



Terminal No.	Signal
5	TERM 1
6	
7	SEND1
8	SEND 2
9	SHIELD
10	TERM 2
11	
12	RECV 1
13	RECV 2
14	SHIELD
15	+12V
16	+15V
17	0V
18	−15V
19	−12V
20	FG

Note : Do not use terminals ① to ④.

Fig. 3.3 Terminal Block (J2078 Modem)



* External power supply : +15V ±5% (200mA).
−15V±5% (100mA) or +12V±5% (200mA).
−12V±5% (100mA) power supply for logic circuit.

Notes :

1 Two signal lines of two-core twisted cable do not have polarity.
2. Terminate both ends of two-core twisted-pair cable with terminators (100Ω, 1/2W or more).
3 J2078 at the master side can be located in any place on the same line ; not specially required to be in the end.

Fig. 3.4 Connection of Two-core Twisted Shielded Cables (J2078 Modem)

SECTION 4

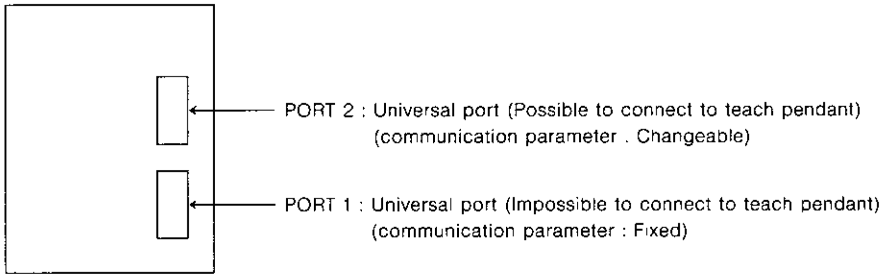
COMMUNICATION PARAMETERS

This section describes the procedure for displaying or setting of communication parameters to modify the speed.

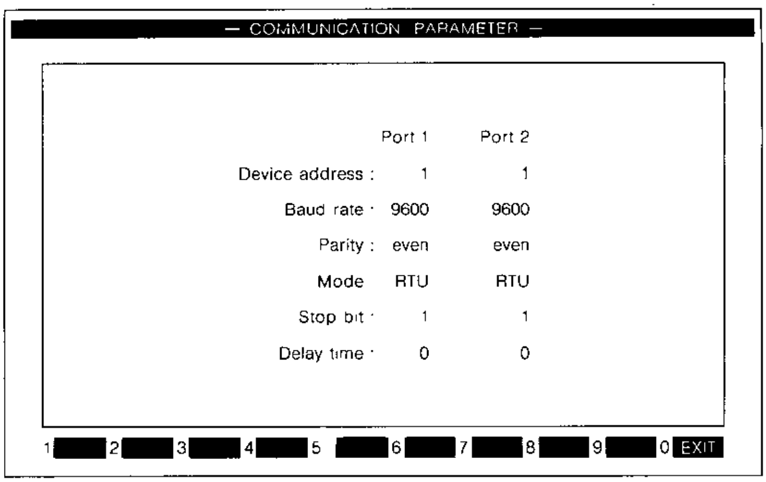
4.1 DISPLAY AND SETTING OF COMMUNICATION PARAMETERS

Communication port 2 has been added to PLC units (PC055, PC056), at which communication parameters can be changed. To display and set communication parameters, do as follows.

PLC UNIT (PC055, PC056)


PORT 2 : Universal port (Possible to connect to teach pendant)
(communication parameter . Changeable)
PORT 1 : Universal port (Impossible to connect to teach pendant)
(communication parameter : Fixed)

(1) Select from the PLC programming menu from "O : ONLINE OPERATION" to "J : CONDITION DISPLAY" to "T : COMMUNICATION PARAMETER."
→ Parameters of communication ports 1 and 2 are displayed.



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                    — COMMUNICATION PARAMETER —

                         Port 1    Port 2
       Device address :     1         1
            Baud rate ·  9600      9600
               Parity :  even      even
                 Mode    RTU       RTU
             Stop bit ·     1         1
           Delay time ·     0         0

 1    2    3    4    5    6    7    8    9    0 EXIT
```

(2) With Port 1, the communication parameters are only displayed but cannot be changed.

(3) With Port 2, not only the communication parameters are displayed but "Baud rate" can be set or changed.

(4) To set or change the baud rate at Port 2, do as follows.

① Depress [↵] on the communication parameter display.
→ The baud rate at Port 2 is ready for setting or change.

② The cursor position is displayed in highlight.
The baud rate can be switched by [←] or [→] cyclically as shown below.

Baud rate (bps)

← → 300 ← → 600 ← → 1200 ← → 2400 ← → 4800 ← → 9600 ← → 19200 ← →

③ Place the cursor at the baud rate to be set, then depress [↵].
→ The baud rate at the cursor position is selected and the highlight disappears.

④ To cancel the change, press ESC after step ①, when it is ready for modification, the status before modification is restored.

⑤ Turn OFF the power once after change of the baud rate. Then turn ON the power. The changed baud rate will take effect.

SECTION 5

COMMUNICATION PROTOCOL

This section describes the details of communication between the master and slave units.

5.1 COMMUNICATION PROTOCOL

(1) Communication between the master and slave units is controlled by programs held in the master unit. In all cases, the master unit initiates data transmission and a slave unit will respond to it. When master unit begins data transmission, it sends a set of data (query message) to a slave unit in a fixed sequence. Upon receiving the query message, the slave unit decodes it, takes the necessary action and then returns data (response message) to the master unit.

5.2 MESSAGE FORMAT

The message consists of four parts : slave address, function code, data, and error check code, which are always transmitted in this sequence. Fig. 5.1 shows the format of the message.

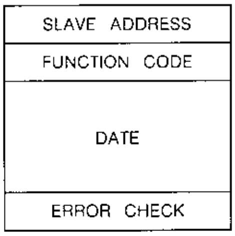


Fig. 5.1 Message Format

(1) Slave Address
This is a number in a range of 1 to 15 which is preset for every slave unit. The master unit communicates with only one slave unit at a time. Although all connected slave units receive the query message sent from the master unit, only the slave unit having the slave address coinciding with the query message accepts the message.

NOTE

The slave address "0" can be used with some function codes (see Table 5.1) so that all slave units accept the query message regardless of their preset addresses. In this case, no slave units return a response message to the master unit after execution.

Table 5.1 Function Codes

Function Code (Hexadecimal)	Function	Maximum Number of Data in a Message
1H	Reading out coil status	2000
2H	Reading out input relay status	512
3H	Reading out data register contents	125
4H	Reading out input register contents	125
5H	Changing status of single coil	1
6H	Writing in single-data register	1
7H	Reading out particular coil status	8
8H	Loopback test	—
FH	Changing multi-coil status	800
10H	Writing in multi-data registers	100
12H	Reading out link relay status	1024
15H	Reading out link register contents	125
19H	Changing status of single-link relay	1
1BH	Writing in single-link register	1
1DH	Changing multi-link relays status	800
1FH	Writing in multi-link registers	100
22H	Reading out special multi-registers	125
24H	Reading out special multi-relay/coil status	512
25H	Changing special single coil status	512
26H	Changing special multi-coil status	512

(2) Function Code

The master unit specifies function to be executed to a slave unit using function code. Table 5.1 summarizes the function codes.

(3) Data

After setting the function, the master unit sends the data needed to execute the function to the slave unit. Data depends on the function. For details, refer to the description of the message format given for each function.

Note that the coil, input relay, input register, and data register are identified by relative numbers relating to their reference numbers. The value of the reference number (minus 1) is used for PROGIC-8.

Table 5.2 Reference Number and Relative Number

Elements	Reference Number		Relative Number	
	PROGIC-8	MEMOCON-SC Series	PROGIC-8	MEMOCON-SC Series
Output Coil	OXXX	0XXXX	OXXX−O001	0XXXX−00001
Internal Coil	NXXX	0XXXX	NXXX−N001+512	0XXXX−00001
Input Relay	IXXX	1XXXX	IXXX−I001	1XXXX−10001
Input Register	ZXXX	3XXXX	ZXXX−Z001	3XXXX−30001
Data Register	WXXX	4XXXX	WXXX−W0001	4XXXX−40001
Link Relay	DXXX	DXXXX	DXXX−D0001	DXXXX−D0001
Link Register	RXXX	RXXXX	RXXX−R0001	RXXXX−R0001

- Calculation Example

  As for O003 : Relative number O003−O001=002

  As for N100 : Relative number N100−N001+512=99+512
  =611

Note : The master, which can be connected to MEMOCON-SC Series, can also be connected to PROGIC-8, even if in RTU mode. **Table 5.2** shows the correspondence of MEMOCON-SC Series reference number to that of PROGIC-8.

(4) Error Check Code

The message ends with data for detecting errors (wrong bits) in the contents of the message which may possibly occur during transmission.

5.3 COMMUNICATION MODES

Use RTU (Remote Terminal Unit) for communication between the master and slave units.

Table 5.3 RTU Mode

Item	
Number of Data Bits	8 (binary)
Parity	Even
Stop Bit	1 bit
Baud Rate	9600 bps (Changeable at Port 2 of PLC unit, PROGIC-8)
Data Time Interval	24 bits' time or less
Error Detection	CRC-16 (Cyclic Redundancy Check)

NOTE

In the query message of the master unit, the time interval between datas should not exceed the data time interval specified above. If the interval is too long, the slave unit regards that transmission as having ended and disregards the message because the format is wrong.

5.4 SLAVE UNIT RESPONSE

Receiving a query message from the master unit, the slave unit examines it and, when valid, moves the query message from the receive buffer to the execution buffer. If invalid, the slave unit disregards the message and takes no action. Processing is done in interrupt mode up to that time.

At the end of that scan, the query message is decoded and executed. Then the slave unit prepares a response message and moves it to the transmit buffer. If the query message is defective (for example, an illegal function code is referred to), the slave unit does not execute it, but rather creates a message identifying the defect and enters it in the transmit buffer.

When the response message is prepared in the transmit buffer, the slave unit calls for interrupt and sends the message to the master unit.

(1) Normal Response

With the functions of changing the status of a coil and writing in a holding register and loopback, the slave unit responds with the same message as the query message.

With the functions of changing multi-coil status and writing in multi-holding registers, the slave unit returns part of the multi-query message (slave address, function code, starting number, and the number of coils or holding registers) as the response message.

In the response message of the reading-out functions, the slave address and function code are the same as in the query message and the data read out is appended.

(2) Response to Abnormal Message

If the query message is abnormal (except in the case of transmission error), the slave unit takes no action and returns the response message shown in Fig. 5.2.

The master unit can determine whether or not the query message it has sent has been executed, by examining the function code involved in the response message. If it detects an error, it should further examine the error code that follows the function code (see Table 5.4).

SLAVE ADDRESS		
1	FUNCTION CODE	FUNCTION CODE+80H
ERROR CODE		ANY ONE OF 1, 2, 3H
ERROR CHECK		

Fig. 5.2 Response to a Wrong Query Message

Table 5.4 Error Codes (Commands only for MC Unit)

Error Code	Meaning
1H	Command error
2H	Not used.
3H	Not used.
4H	CRC error
5H	Memory protect ON
6H	Not used.
7H	Program cannot be found.
8H	Wrong flag operation
9H	Not enough memory
AH	Function cannot be found.
BH	Wrong mode
CH	Busy (during execution) error
DH	Parameter cannot be found.
EH	Axis cannot be found.
FH	Program has already been input. (same program was found.)
10H	Input value is out of range.
11H	Program No. (# 0) not opened.
12H	Program No. (# 0) closed error.
13H	Program area is not initialized.

(3) No Response

In the cases noted below, the slave unit disregards the query message and does not respond. When the slave address is "0" with a writing function, all slave units execute the query message but do not respond.

- A transmission error (overrun, framing, parity or CRC-16) is found in the query message.
- The slave address given in the query message differs from the address assigned to the slave unit.
- The time interval between adjacent data in the query message is too long : 24 bits' time in RTU mode.

NOTE

Set time limit to monitor responses in the master unit and retransmit the same query message if no response is received within a certain time. The time limit should normally be 3 to 5 seconds.

6.1 MESSAGE FORMAT (RTU MODE)

(1) In RTU mode, the message format should be as shown in Fig. 6.1. The data length and contents vary with the function. The formats of the query and response messages are described below according to the functions. Table 6.1 summarizes the message lengths of the functions.

Note : If data follows the low byte of CRC-16, a communication error will occur. Make sure that no data will follow the CRC-16. When BASIC is used to create message format, add ";" at the end of PRINT command and sentence.

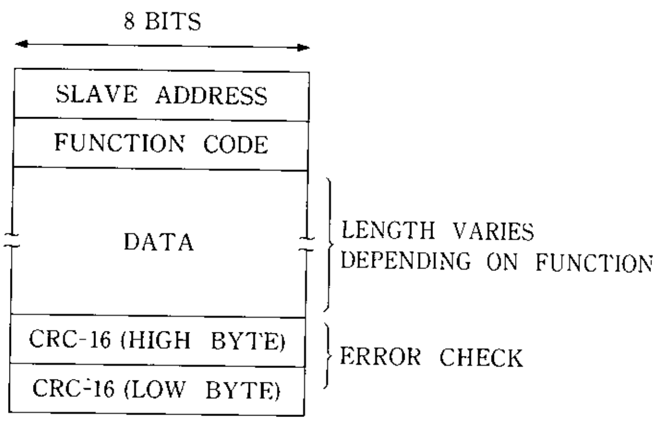


Fig. 6.1 Message Format in RTU Mode

Table 6.1 Message Byte Lengths

Function Code (Hexadecimal)	Function	Query Message		Response Message		Corresponding ROM Version
		Minimum	Maximum	Minimum	Maximum	
1H	Reading out coil status	8	8	6	255	Corresponds to every version.
2H	Reading out input relay status	8	8	6	255	
3H	Reading out data register contents	8	8	7	255	
4H	Reading out input register contents	8	8	7	255	
5H	Changing status of single-coil	8	8	8	8	
6H	Writing in single-data register	8	8	8	8	
7H	Reading out particular coil status	4	4	5	5	
8H	Loopback test	8	8	8	8	
FH	Changing multi-coil status	10	109	8	8	
10H	Writing in multi-data registers	11	209	8	8	
12H	Reading out link relay status	8	8	6	255	
15H	Reading out link register contents	8	8	6	255	
19H	Changing status of single-link relay	8	8	8	8	
1BH	Writing in single-link register	8	8	8	8	
1DH	Changing multi-link relay status	10	109	8	8	
1FH	Writing in multi-link registers	11	209	8	8	
22H	Reading out special multi-registers	9	9	7	255	PC050 Ver3303
24H	Reading out special multi-relay/coil status	9	9	7	70	
25H	Changing special single coil status	9	9	9	9	PC055 Ver3405
26H	Changing special multi-coil status	11	74	9	9	

Table 6.2 Message Byte Lengths (only for MC unit)

Function Code (Hexadecimal)	Function	Query Message		Response Message	
		Minimum	Maximum	Minimum	Maximum
11H	Reading out motion program	18	18	19	218
51H	Writing in motion program	19	218	9	9
21H	Reading out motion parameter	13	13	17	216
61H	Writing in motion parameter	17	216	9	9
18H	Reading out point table contents	12	12	16	216
19H	Changing point table contents	16	216	9	9
57H	Clearing program specified by program No. (#0)	18	18	9	9
4FH	Initializing motion program area	9	9	9	9
4EH	Initializing motion parameter	9	9	9	9
76H	Initializing point table	8	8	9	9

For the details of above functions, refer to Sec. 6.22 or beyond. When these query messages are used, switch the MC unit to "EDIT MODE"

6.2 READING OUT COIL STATUS [01H]

(1) Function

The status of coils whose numbers are continuous will be read out when the number of coils and the starting number are designated.

The data includes the status of eight coils, arranged in the order of the coil numbers, in the response message. LSB of the data indicates the status of the coil having the smallest number.

When the number of coils is a multiple of eight, MSB of the last data represents the status of the last coil. Otherwise, the redundant bits (MSBs) of the last data are all 0's.

(2) The following shows examples where the status of a total of 37 (25H) coils among coils 0020 (14H) to 0056 from slave 2.

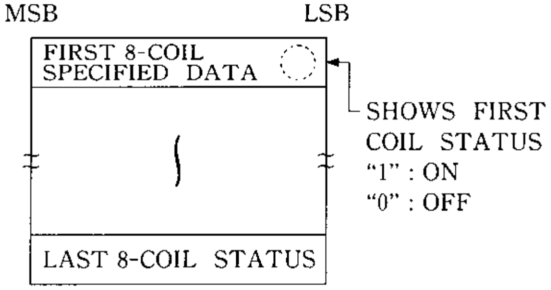
Ex.

• Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		01H	
STARTING NO.	HIGH BYTE	00H	FIRST COIL NO. -1
	LOW BYTE	13H	
QUANTITY	HIGH BYTE	00H	
	LOW BYTE	25H	
CRC-16	HIGH BYTE	0CH	
	LOW BYTE	27H	

Note :

The following shows arrangement and indications of the data bytes.



• Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		01H	
NO. OF DATA ITEMS		05H	$\left[\frac{N+7}{8}\right]$*
FIRST 8-COIL STATUS		CDH	
NEXT 8-COIL STATUS		6BH	
NEXT 8-COIL STATUS		B2H	
NEXT 8-COIL STATUS		0EH	
NEXT 8-COIL STATUS		1BH	
CRC-16	HIGH BYTE	04H	
	LOW BYTE	FFH	

• Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE +80		81H
ERROR CODE		02H
CRC-16	HIGH BYTE	31H
	LOW BYTE	91H

∗N shows the number of coils. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

6.3 READING OUT INPUT RELAY STATUS [02H]

(1) Function

The status of input relays whose numbers are continuous will be read out when the number of input relays and the starting number are designated.

The data includes the status of eight input relays, arranged in the order of the input relay numbers, in the response message. LSB of the data indicates the status of the input relay having the smallest number.

When the number of input relays is a multiple of eight, MSB of the last data represents the status of the last input relay. Otherwise, the redundant bits (MSBs) of the last data are all 0's.

(2) The following shows examples where the status of a total of 22 input relays among I197 to I218 are read out from slave 2. (197=C5H, 22=16H)

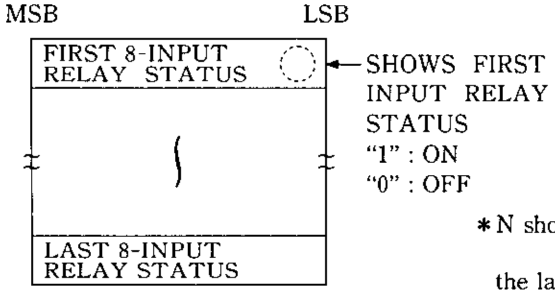
• Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		02H	
STARTING NO.	HIGH BYTE	00H	FIRST RELAY NO.-I001
	LOW BYTE	C4H	
QUANTITY	HIGH BYTE	00H	
	LOW BYTE	16H	
CRC-16	HIGH BYTE	B8H	
	LOW BYTE	0AH	

• Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		02H	
NO. OF DATA ITEMS		03H	$\left[\frac{N+7}{8}\right]$*
FIRST 8-INPUT RELAY STATUS		ACH	
NEXT 8-INPUT RELAY STATUS		DBH	
NEXT 8-INPUT RELAY STATUS		35H	
CRC-16	HIGH BYTE	22H	
	LOW BYTE	BBH	

Note :
The following shows arrangement and indications of the data bytes.


MSB
LSB
FIRST 8-INPUT RELAY STATUS
SHOWS FIRST INPUT RELAY STATUS
"1" : ON
"0" : OFF
LAST 8-INPUT RELAY STATUS

• Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		82H
ERROR CODE		03H
CRC-16	HIGH BYTE	F0H
	LOW BYTE	A1H

* N shows the number of input relays. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

6.4 READING OUT DATA REGISTER CONTENTS [03H]

(1) Function

The contents of data registers whose numbers are continuous will be read out when the number of data registers and the starting number are designated.

The contents of the data registers are entered in the response message as data, divided into two parts : the high byte and the low byte, arranged in the order of the register numbers.

(2) The following shows examples where the content of total 3 data registers among W0108 to W0110 are read out. (108=6CH)

- Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		03H	
STARTING NO.	HIGH BYTE	00H	FIRST DATA REGISTER NUMBER-W0001
	LOW BYTE	6BH	
QUANTITY	HIGH BYTE	00H	1 to 125
	LOW BYTE	03H	
CRC-16	HIGH BYTE	74H	
	LOW BYTE	24H	

Note :

The following shows arrangement and indications of the data bytes.

MSB	LSB
FIRST DATA REGISTER HIGH BYTE	
FIRST DATA REGISTER LOW BYTE	
LAST DATA REGISTER HIGH BYTE	
LAST DATA REGISTER LOW BYTE	

- Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		03H	
NO. OF DATA ITEMS		06H	NO. OF DATA REGISTERS×2
FIRST DATA REGISTER CONTENTS	HIGH BYTE	02H	
	LOW BYTE	2BH	
NEXT DATA REGISTER CONTENTS	HIGH BYTE	00H	
	LOW BYTE	00H	
NEXT DATA REGISTER CONTENTS	HIGH BYTE	00H	
	LOW BYTE	63H	
CRC-16	HIGH BYTE	50H	
	LOW BYTE	48H	

- Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		83H
ERROR CODE		03H
CRC-16	HIGH BYTE	F1H
	LOW BYTE	31H

6.5 READING OUT INPUT REGISTER CONTENTS [04H]

(1) Function

The contents of input registers whose numbers are continuous will be read out when the number of input registers and the starting number are designated.

The contents of the input registers are entered in the response message as data, divided into two parts : the high byte and the low byte, arranged in the order of the register numbers.

(2) The following shows examples where the content of input register Z0009 is read out from slave 21 (15H).

- Query Message

SLAVE ADDRESS		15H	
FUNCTION CODE		04H	
STARTING NO.	HIGH BYTE	00H	FIRST INPUT REGISTER NO. -Z0001
	LOW BYTE	08H	
QUANTITY	HIGH BYTE	00H	1 to 125
	LOW BYTE	01H	
CRC-16	HIGH BYTE	B3H	
	LOW BYTE	1CH	

- Response Message (Normal)

SLAVE ADDRESS		15H	
FUNCTION CODE		04H	
NO. OF DATA ITEMS		02H	NO. OF INPUT REGISTERS×2
INPUT REGISTER CONTENTS	HIGH BYTE	05H	
	LOW BYTE	39H	
CRC-16	HIGH BYTE	4AH	
	LOW BYTE	71H	

- Response Message (Abnormal)

SLAVE ADDRESS		15H
FUNCTION CODE+80		84H
ERROR CODE		03H
CRC-16	HIGH BYTE	43H
	LOW BYTE	05H

Note :

The following shows arrangement and indications of the data bytes.

MSB LSB
FIRST INPUT REGISTER HIGH BYTE
FIRST INPUT REGISTER LOW BYTE
⁞
LAST INPUT REGISTER HIGH BYTE
LAST INPUT REGISTER LOW BYTE

6.6 CHANGING STATUS OF SINGLE COIL [05H]

(1) Function

A designated coil will be put into a designated status (ON or OFF).

(2) The following shows examples where the status of coil O0173 (0173) is changed from slave 3 (173=ADH).

Ex.

- Query Message

SLAVE ADDRESS		03H	
FUNCTION CODE		05H	
COIL NO.	HIGH BYTE	00H	COIL NO.−1
	LOW BYTE	ACH	
SPECIFIED STATUS	HIGH BYTE	FFH	"FF00" : ON "0000" : OFF
	LOW BYTE	00H	
CRC-16	HIGH BYTE	4DH	
	LOW BYTE	F9H	

- Response Message (Normal)

SLAVE ADDRESS		03H	
FUNCTION CODE		05H	
COIL NO.	HIGH BYTE	00H	COIL NO.−1
	LOW BYTE	ACH	
SPECIFIED STATUS	HIGH BYTE	FFH	"FF00" : ON "0000" : OFF
	LOW BYTE	00H	
CRC-16	HIGH BYTE	4DH	
	LOW BYTE	F9H	

- Response Message (Abnormal)

SLAVE ADDRESS		03H
FUNCTION CODE+80		85H
ERROR CODE		03H
CRC-16	HIGH BYTE	A3H
	LOW BYTE	51H

NOTE

1. When slave address is set to "0", all slaves execute this command. However, any slave will not send response message back after execution. Therefore, master should read out register contents again to check the execution.
2. Normally, disable coil before changing status. The command can be executed even in ENABLE condition. However, coil status will be renewed with internal logic solving results.

6.7 WRITING IN SINGLE-DATA REGISTER [06H]

(1) Function

Designated data will be written into a designated data register.

(2) The following shows examples of write-in to data register W0136 of slave 5. (136=88H)

Ex.

- Query Message

SLAVE ADDRESS		05H	
FUNCTION CODE		06H	
DATA REGISTER NO.	HIGH BYTE	00H	DATA REGISTER NO.-W0001
	LOW BYTE	87H	
WRITE-IN DATA	HIGH BYTE	03H	SETTING DATA
	LOW BYTE	9EH	
CRC-16	HIGH BYTE	B9H	
	LOW BYTE	3FH	

- Response Message (Normal)

SLAVE ADDRESS		05H	
FUNCTION CODE		06H	
DATA REGISTER NO.	HIGH BYTE	00H	DATA REGISTER NO.-W0001
	LOW BYTE	87H	
WRITE-IN DATA	HIGH BYTE	03H	SETTING DATA
	LOW BYTE	9EH	
CRC-16	HIGH BYTE	89H	
	LOW BYTE	3FH	

Note :

The following shows arrangement and indications of the data bytes.

MSB LSB

WRITE-IN DATA HIGH BYTE
WRITE-IN DATA LOW BYTE

- Response Message (Abnormal)

SLAVE ADDRESS		05H
FUNCTION CODE+80		86H
ERROR CODE		03H
CRC-16	HIGH BYTE	43H
	LOW BYTE	A0H

NOTE

When slave address is set to “0”, all slaves execute this command. However, any slave will not send response message back after execution. Therefore, master should read out register contents again to check the execution.

6.8 READING OUT PARTICULAR COILS STATUS [07H]

(1) Function

The status of eight fixed coils will be read. The coils are O001 to O008.

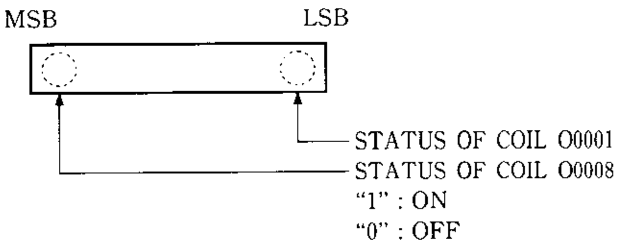
LSB of the data of the response message indicates the status of coil O001 and MSB the status of coil O008.

(2) The following shows examples of read-out of specified coils of slave 1.

• Query Message

SLAVE ADDRESS		01H
FUNCTION CODE		07H
CRC-16	HIGH BYTE	41H
	LOW BYTE	E2H

Note :
The following shows arrangement and indications of the data bytes.



• Response Message (Normal)

SLAVE ADDRESS		01H
FUNCTION CODE		07H
SPECIFIED COIL STATUS		03H
CRC-16	HIGH BYTE	03H
	LOW BYTE	F1H

• Response Message (Abnormal)

SLAVE ADDRESS		01H
FUNCTION CODE+80		87H
ERROR CODE		03H
CRC-16	HIGH BYTE	03H
	LOW BYTE	F1H

6.9 LOOPBACK TEST [08H]

(1) Function
The query message will be returned directly as the response message. This function is used checking communication between the master and slave units.

(2) The following shows examples of loopback test with slave 1.

Ex.

- Query Message

SLAVE ADDRESS		01H	
FUNCTION CODE		08H	
TEST CODE*	HIGH BYTE	00H	SET TEST CODE TO "00"
	LOW BYTE	00H	
DATA	HIGH BYTE	A5H	SETTING DATA
	LOW BYTE	37H	
CRC-16	HIGH BYTE	DAH	
	LOW BYTE	8DH	

* : Make sure to set test code to "00".

- Response Message (Normal)

SLAVE ADDRESS		01H	
FUNCTION CODE		08H	
TEST CODE*	HIGH BYTE	00H	SET TEST CODE TO "00"
	LOW BYTE	00H	
DATA	HIGH BYTE	A5H	SETTING DATA
	LOW BYTE	37H	
CRC-16	HIGH BYTE	DAH	
	LOW BYTE	8DH	

- Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		88H
ERROR CODE		01H
CRC-16	HIGH BYTE	87H
	LOW BYTE	COH

6.10 CHANGING MULTI-COIL STATUS [0FH]

(1) Function

When the number of coils and the starting number are designated, the status of the coils will be changed to (ON or OFF), even when they are disabled.

The data includes the new status, ON and/or OFF, of eight coils arranged in the order of their numbers. LSB of the data indicates the status of the coil having the smallest number.

When the number of coils is a multiple of eight, MSB of the last data represents the status of the last coil. Otherwise, the slave unit disregards the redandunt bits (MSBs) of the last data.

(2) The following shows examples where the status of total 10 coils among coil 0020 to 0029 of slave 1 are changed. (20=14H, 10=AH)

- Query Message

SLAVE ADDRESS		01H	
FUNCTION CODE		0FH	
STARTING NO.	HIGH BYTE	00H	FIRST RELAY NO. − 1
	LOW BYTE	13H	
NO. OF COILS	HIGH BYTE	00H	1 to 800
	LOW BYTE	0AH	
NO. OF DATA BYTES		02H	$\left[\frac{N+7}{8}\right]$*
FIRST 8-COIL STATUS		00H	
NEXT 8-COIL STATUS		00H	
CRC-16	HIGH BYTE	E7H	
	LOW BYTE	9BH	

- Response Message (Normal)

SLAVE ADDRESS		01H
FUNCTION CODE		0FH
STARTING NO.	HIGH BYTE	00H
	LOW BYTE	13H
NO. OF COILS	HIGH BYTE	00H
	LOW BYTE	0AH
CRC-16	HIGH BYTE	24H
	LOW BYTE	09H

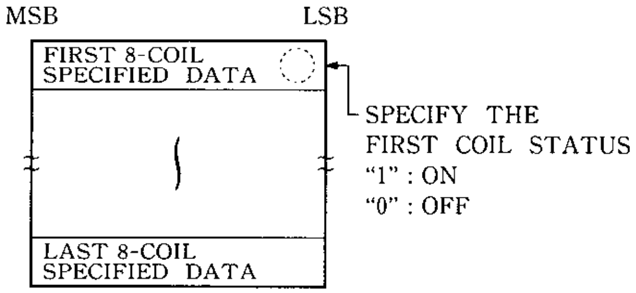
* N shows the number of coils. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

- Response Message (Abnormal)

SLAVE ADDRESS		01H
FUNCTION CODE+80		8FH
ERROR CODE		02H
CRC-16	HIGH BYTE	C5H
	LOW BYTE	F1H

Note :

The following shows arrangement and indications of the data bytes.


MSB
LSB
FIRST 8-COIL SPECIFIED DATA
LAST 8-COIL SPECIFIED DATA
SPECIFY THE FIRST COIL STATUS
"1" : ON
"0" : OFF

1. When slave address is set to "0", all slaves execute this command. However, any slave will not send response message back after execution. Therefore, master should read out register contents again to check the execution.
2. Normally, disable coil before changing status. The command can be executed even in ENABLE condition. However, coil status will be renewed with internal logic solving results.

6.11 WRITING IN MULTI-DATA REGISTERS [10H]

(1) Function

When the number of data registers and the starting number are designated, given data will be written into them.

Write data should be entered in the query in the order of data register numbers, with the high byte followed by the low byte.

(2) The following shows examples of write-in to a total of 2 registers of data registers W0136 and W0137 of slave 1. (136=88H)

Ex.

- Query Message

SLAVE ADDRESS		01H	
FUNCTION CODE		10H	
STARTING NO.	HIGH BYTE	00H	FIRST DATA REGISTER NO. −W0001
	LOW BYTE	87H	
QUANTITY	HIGH BYTE	00H	1 to 100
	LOW BYTE	02H	
NO. OF DATA BYTES		04H	DATA REGISTER NO.×2
DATA TO FIRST REGISTER	HIGH BYTE	00H	
	LOW BYTE	0AH	
DATA TO NEXT REGISTER	HIGH BYTE	01H	
	LOW BYTE	02H	
CRC-16	HIGH BYTE	1AH	
	LOW BYTE	7AH	

- Response Message (Normal)

SLAVE ADDRESS		01H
FUNCTION CODE		10H
STARTING NO.	HIGH BYTE	00H
	LOW BYTE	87H
QUANTITY	HIGH BYTE	00H
	LOW BYTE	02H
CRC-16	HIGH BYTE	F1H
	LOW BYTE	E1H

- Response Message (Abnormal)

SLAVE ADDRESS		01H
FUNCTION CODE+80		90H
ERROR CODE		02H
CRC-16	HIGH BYTE	CDH
	LOW BYTE	C1H

Note :

The following shows arrangement and indications of the writing in data bytes.

MSB LSB

HIGH BYTE TO FIRST REGISTER
LOW BYTE TO FIRST REGISTER
≀
HIGH BYTE TO LAST REGISTER
LOW BYTE TO LAST REGISTER

NOTE

When slave address is set to "0", all slaves execute this command. However, no slave will send a response message back after execution. Therefore, master should read out register contents again to check the execution.

6.12 READING OUT LINK RELAY STATUS [12H]

(1) Function

The status of link relays whose numbers are continuous will be read out when the number of link relays and the starting number are designated.

The data includes the status of eight link relays, arranged in the order of the link relay numbers, in the response message. LSB of the data indicates the status of the link relay having the smallest number.

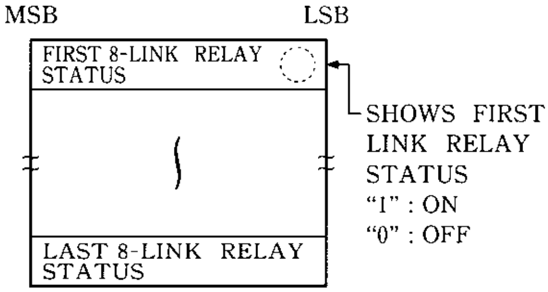
When the number of link relays is a multiple of eight, MSB of the last data represents the status of the last link relay. Otherwise, the redundant bits (MSBs) of the last data are all 0's.

(2) The following shows examples where the status of a total of 37 (25H) link relays among link relays D0020 (14H) to D0056 from slave 2.

- Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		12H	
STARTING NO.	HIGH BYTE	00H	FIRST LINK RELAY NO.－D0001
	LOW BYTE	13H	
QUANTITY	HIGH BYTE	00H	
	LOW BYTE	25H	
CRC-16	HIGH BYTE	89H	
	LOW BYTE	E4H	

Note :
The following shows arrangement and indications of the data bytes.



- Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		12H	
NO. OF DATA BYTES		05H	$\left[\frac{N+7}{8}\right]$*
FIRST 8-COIL STATUS		CDH	
NEXT 8-COIL STATUS		6BH	
NEXT 8-COIL STATUS		B2H	
NEXT 8-COIL STATUS		DEH	
NEXT 8-COIL STATUS		1BH	
CRC-16	HIGH BYTE	7BH	
	LOW BYTE	FEH	

- Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		92H
ERROR CODE		02H
CRC-16	HIGH BYTE	3CH
	LOW BYTE	A1H

* N shows the number of coils. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

6.13 READING OUT LINK REGISTER CONTENTS [15H]

(1) Function

The contents of link registers whose numbers are continuous will be read out when the number of link registers and the starting number are designated.

The contents of the link registers are entered in the response message as data, divided into two parts : the high byte and the low byte, arranged in the order of the register numbers.

(2) The following shows examples where the content of a total of 3 link registers among link registers R0001 to R0003 from slave 2.

• Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		15H	
STARTING NO.	HIGH BYTE	00H	FIRST LINK REGISTER NO.−R0001
	LOW BYTE	00H	
QUANTITY	HIGH BYTE	00H	1 to 125
	LOW BYTE	03H	
CRC-16	HIGH BYTE	4CH	
	LOW BYTE	3BH	

Note :

The following shows arrangement and indications of the read out data bytes.

MSB LSB

FIRST LINK REGISTER HIGH BYTE
FIRST LINK REGISTER LOW BYTE
⁝
LAST LINK REGISTER HIGH BYTE
LAST LINK REGISTER LOW BYTE

• Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		15H	
NO. OF DATA BYTES		06H	NO. OF LINK REGISTERS×2
FIRST LINK REGISTER CONTENTS	HIGH BYTE	12H	
	LOW BYTE	34H	
NEXT LINK REGISTER CONTENTS	HIGH BYTE	56H	
	LOW BYTE	78H	
NEXT LINK REGISTER CONTENTS	HIGH BYTE	9AH	
	LOW BYTE	BCH	
CRC-16	HIGH BYTE	FCH	
	LOW BYTE	95H	

• Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		95H
ERROR CODE		03H
CRC-16	HIGH BYTE	FFH
	LOW BYTE	51H

6.14 CHANGING STATUS OF SINGLE-LINK RELAY [19H]

(1) Function
A designated link relay will be put into a designated status (ON or OFF).

(2) The following shows examples where the status of link relay D0173 is changed from slave 3 (173 = ADH).

• Query Message

SLAVE ADDRESS		03H	
FUNCTION CODE		19H	
COIL NO.	HIGH BYTE	00H	LINK RELAY NO. - D0001
	LOW BYTE	ACH	
SPECIFIED STATUS	HIGH BYTE	FFH	"FF00" : ON "0000" : OFF
	LOW BYTE	00H	
CRC-16	HIGH BYTE	9CH	
	LOW BYTE	3BH	

• Response Message (Normal)

SLAVE ADDRESS		03H	
FUNCTION CODE		19H	
COIL NO.	HIGH BYTE	00H	LINK RELAY NO. - D0001
	LOW BYTE	ACH	
SPECIFIED STATUS	HIGH BYTE	FFH	"FF00" : ON "0000" : OFF
	LOW BYTE	00H	
CRC-16	HIGH BYTE	9CH	
	LOW BYTE	3BH	

• Response Message (Abnormal)

SLAVE ADDRESS		03H
FUNCTION CODE + 80		99H
ERROR CODE		03H
CRC-16	HIGH BYTE	ABH
	LOW BYTE	91H

NOTE

1. When slave address is set to "0", all slaves execute this command. However, any slave will not send response message back after execution. Therefore, master should read out register contents again to check the execution.
2. Normally, disable coil before changing status. The command can be executed even in ENABLE condition. However, coil status will be renewed with internal logic solving results.

6.15 WRITING IN SINGLE-LINK REGISTER [1BH]

(1) Function

Designated data will be written into a designated link register.

(2) The following shows examples of write into link register R0136 of slave 5. (136=88H)

Ex.

· Query Message

SLAVE ADDRESS		05H	
FUNCTION CODE		1BH	
DATA REGISTER NO.	HIGH BYTE	00H	LINK REGISTER NO.−R0001
	LOW BYTE	87H	
WRITE-IN DATA	HIGH BYTE	03H	SETTING DATA
	LOW BYTE	9EH	
CRC-16	HIGH BYTE	55H	
	LOW BYTE	3DH	

· Response Message (Normal)

SLAVE ADDRESS		05H	
FUNCTION CODE		1BH	
DATA REGISTER NO.	HIGH BYTE	00H	LINK REGISTER NO.−R0001
	LOW BYTE	87H	
WRITE-IN DATA	HIGH BYTE	03H	SETTING DATA
	LOW BYTE	9EH	
CRC-16	HIGH BYTE	55H	
	LOW BYTE	3DH	

Note :

The following shows arrangement and indications of the data bytes.

MSB	LSB
WRITE-IN DATA HIGH BYTE	
WRITE-IN DATA LOW BYTE	

· Response Message (Abnormal)

SLAVE ADDRESS		05H
FUNCTION CODE+80		9BH
ERROR CODE		03H
CRC-16	HIGH BYTE	4AH
	LOW BYTE	FDH

NOTE

When slave address is set to "0", all slaves execute this command. However, any slave will not send response message back after execution. Therefore, master should read out register contents again to check the execution.

6.16 CHANGING MULTI-LINK RELAYS STATUS [1DH]

(1) Function

When the number of link relays and the starting number are designated, the status of the coils will be changed to (ON or OFF).

The data includes the new status, ON and/or OFF, of eight coils arranged in the order of their numbers. LSB of the data indicates the status of the coil having the smallest number.

When the number of coils is a multiple of eight, MSB of the last data represents the status of the last coil. Otherwise, the slave unit disregards the redundant bits (MSBs) of the last data.

(2) The following shows examples where the status of total 10 link relays among link relays D0020 to D0029 of slave 1 are changed. (20=14H, 10=AH)

• Query Message

SLAVE ADDRESS		01H	
FUNCTION CODE		1DH	
STARTING NO.	HIGH BYTE	00H	FIRST COIL NO.−1
	LOW BYTE	13H	
NO. OF COILS	HIGH BYTE	00H	1 to 800
	LOW BYTE	0AH	
NO. OF DATA BYTES		02H	$\left[\frac{N+7}{8}\right]$ *
FIRST 8-COIL STATUS		00H	
NEXT 8-COIL STATUS		00H	
CRC-16	HIGH BYTE	67H	
	LOW BYTE	4EH	

• Response Message (Normal)

SLAVE ADDRESS		01H
FUNCTION CODE		1DH
STARTING NO.	HIGH BYTE	00H
	LOW BYTE	13H
NO. OF COILS	HIGH BYTE	00H
	LOW BYTE	0AH
CRC-16	HIGH BYTE	9CH
	LOW BYTE	0AH

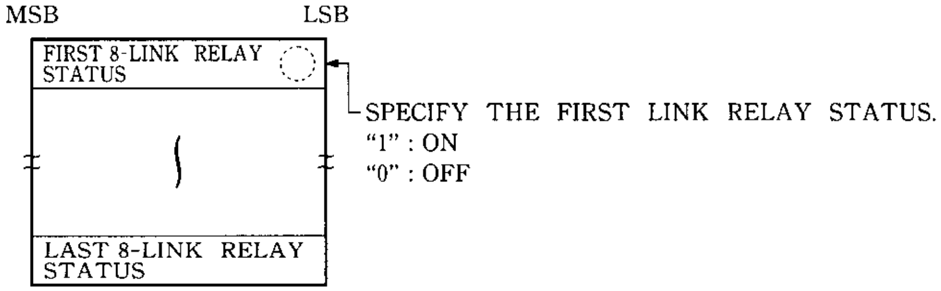
* N shows the number of coils. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

• Response Message (Abnormal)

SLAVE ADDRESS		01H
FUNCTION CODE+80		9DH
ERROR CODE		02H
CRC-16	HIGH BYTE	C9H
	LOW BYTE	51H

Note :

The following shows arrangement and indications of the data bytes.


MSB
LSB
FIRST 8-LINK RELAY STATUS
LAST 8-LINK RELAY STATUS
SPECIFY THE FIRST LINK RELAY STATUS.
"1" : ON
"0" : OFF

1. When slave address is set to "0", all slaves execute this command. However, any slave will not send response message back after execution. Therefore, master should read out register contents again to check the execution.
2. Normally, disable coil before changing status. The command can be executed even in ENABLE condition. However, coil status will be renewed with internal logic solving results.

6.17 WRITING IN MULTI-LINK REGISTERS [1FH]

(1) Function

When the number of link registers and the starting number are designated, given data will be written into them.

Write data should be entered in the query in the order of link register numbers, with the high byte followed by the low byte.

(2) The following shows examples of write-in to a total of 2 registers of link registers R0136 and R0137 of slave 1. (136=88H)

- Query Message

SLAVE ADDRESS		01H	
FUNCTION CODE		1FH	
STARTING NO.	HIGH BYTE	00H	FIRST LINK REGISTER NO. −R0001
	LOW BYTE	87H	
QUANTITY	HIGH BYTE	00H	1 to 100
	LOW BYTE	02H	
NO. OF DATA BYTES		04H	DATA REGISTER NO.×2
DATA TO FIRST REGISTER	HIGH BYTE	00H	
	LOW BYTE	0AH	
DATA TO NEXT REGISTER	HIGH BYTE	01H	
	LOW BYTE	02H	
CRC-16	HIGH BYTE	2AH	
	LOW BYTE	4AH	

- Response Message (Normal)

SLAVE ADDRESS		01H
FUNCTION CODE		1FH
STARTING NO.	HIGH BYTE	00H
	LOW BYTE	87H
QUANTITY	HIGH BYTE	00H
	LOW BYTE	02H
CRC-16	HIGH BYTE	A5H
	LOW BYTE	E0H

- Response Message (Abnormal)

SLAVE ADDRESS		01H
FUNCTION CODE+80		9FH
ERROR CODE		02H
CRC-16	HIGH BYTE	C8H
	LOW BYTE	31H

Note :

The following shows arrangement and indications of the writing in data bytes.

MSB LSB

HIGH BYTE TO FIRST LINK REGISTER
LOW BYTE TO FIRST LINK REGISTER
≀
HIGH BYTE TO LAST LINK REGISTER
LOW BYTE TO LAST LINK REGISTER

NOTE

When slave address is set to “0”, all slaves execute this command. However, no slave will send a response message back after execution. Therefore, master should read out register contents again to check the execution.

6.18 READING OUT SPECIAL MULTI-REGISTERS [22H]

(1) Function

The contents of timer registers (TR001 to TR256) and counter registers (CR001 to CR256) whose numbers are continuous will be read out when the number of timer/counter registers and the starting number are designated.

The contents of the registers are entered in the response message as data, divided into two parts : the high byte and the low byte, arranged in the order of the register numbers.

(2) Type and Reference No.

Type	Register	Reference No.
01H	Timer register	TR001 to TR256
02H	Counter register	CR001 to CR256

(3) The following shows examples where the content of total 3 timer registers among TR108 to TR110 are read out. (108=6CH)

- Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		22H	
Type		01H	
STARTING NO.	HIGH BYTE	00H	FIRST REGISTER NO. (LOWER 3-DIGIT) −1
	LOW BYTE	6BH	
QUANTITY	HIGH BYTE	00H	
	LOW BYTE	03H	
CRC-16	HIGH BYTE	32H	
	LOW BYTE	5FH	

- Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		22H	
Type		01H	
NO. OF DATA BYTES		06H	NO. OF REGISTERS ×2
FIRST REGISTER CONTENTS	HIGH BYTE	02H	
	LOW BYTE	2BH	
NEXT REGISTER CONTENTS	HIGH BYTE	00H	
	LOW BYTE	00H	
NEXT REGISTER CONTENTS	HIGH BYTE	00H	
	LOW BYTE	63H	
CRC-16	HIGH BYTE	E5H	
	LOW BYTE	5CH	

- Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		A2H
ERROR CODE		03H
CRC-16	HIGH BYTE	E9H
	LOW BYTE	01H

6.19 READING OUT SPECIAL MULTI-RELAY/COIL STATUS [24H]

(1) Function

The status of relays and coils whose numbers are continuous will be read out when the number of M code relays (M101 to M289), timer coils (T001 to T256), counter coils (C001 to C256), MC control coils (Y001 to Y512), MC control relays (X001 to X512), MC unit coils (Q001 to Q256), or MC unit relays (P001 to P256) and the starting number are designated.

The data includes the status of eight coils, arranged in the order of the coil numbers, in the response message. LSB of the data indicates the status of the relay/coil having the smallest number.

When the number of relays/coils is a multiple of eight, MSB of the last data represents the status of the last relay/coil. Otherwise, the redundant bits (MSBs) of the last data are all 0's.

(2) Type and Reference No.

Type	Register	Reference No.
01H	M code relay	M101 to M289
02H	Timer coil	T001 to T256
03H	Counter coil	C001 to C256
04H	MC unit coil	Y001 to Y512
05H	MC control coil	Q001 to Q256
06H	MC unit relay	X001 to X512
07H	MC control relay	P001 to P256

(3) The following shows examples where the status of a total of 37 (25H) coils among coils MC unit relays X020 (14H) to X056 from slave 2.

• Query Message

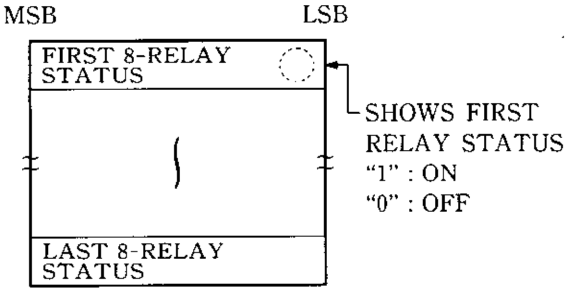
SLAVE ADDRESS		02H	
FUNCTION CODE		24H	
Type		06H	
STARTING NO.	HIGH BYTE	00H	FIRST COIL NO. (LOWER 3-DIGIT) −1
	LOW BYTE	13H	
QUANTITY	HIGH BYTE	00H	
	LOW BYTE	25H	
CRC-16	HIGH BYTE	86H	
	LOW BYTE	3AH	

• Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		24H	
Type		06H	
NO. OF DATA BYTES		05H	$\left[\frac{N+7}{8}\right]$ *
FIRST 8-RELAY STATUS		CDH	
NEXT 8-RELAY STATUS		6BH	
NEXT 8-RELAY STATUS		B2H	
NEXT 8-RELAY STATUS		0EH	
NEXT 8-RELAY STATUS		1BH	
CRC-16	HIGH BYTE	A3H	
	LOW BYTE	96H	

Note :

The following shows arrangement and indications of the data bytes.



• Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE		81H
ERROR CODE		02H
CRC-16	HIGH BYTE	31H
	LOW BYTE	91H

* N shows the number of relays. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

6.20 CHANGING SPECIAL SINGLE COIL STATUS [25H]

(1) Function

A designated MC control coil (Y001 to Y512) or MC unit coil (Q001 to Q256) will be put into a designated status (ON or OFF).

(2) Type and Reference No.

Type	Register	Reference No.
04H	MC unit coil	Y001 to Y512
05H	MC control coil	Q001 to Q256

(3) The following shows examples where the status of MC unit coil Y0173 is changed from slave 2 (173=ADH).

- Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		25H	
Type		04H	
COIL NO.	HIGH BYTE	00H	COIL NO. (LOWER 3 -DIGIT)−1
	LOW BYTE	ACH	
SPECIFIED STATUS	HIGH BYTE	FFH	"FF00" : ON "0000" : OFF
	LOW BYTE	00H	
CRC-16	HIGH BYTE	4FH	
	LOW BYTE	E4H	

- Response Message (Normal)

SLAVE ADDRESS		02H	
FUNCTION CODE		25H	
Type		04H	
COIL NO.	HIGH BYTE	00H	COIL NO.−1
	LOW BYTE	ACH	
SPECIFIED STATUS	HIGH BYTE	FFH	"FF00" : ON "0000" : OFF
	LOW BYTE	00H	
CRC-16	HIGH BYTE	4FH	
	LOW BYTE	E4H	

- Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE+80		A5H
ERROR CODE		03H
CRC-16	HIGH BYTE	EBH
	LOW BYTE	51H

6.21 CHANGING MULTI-SPECIAL COIL STATUS [26H]

(1) Function

When the number of MC control coils (Y001 to Y512) or MC unit coil (Q001 to Q256) and the starting number are designated, the status of the coils will be changed to (ON or OFF).

The data includes the new status, ON and/or OFF, of eight coils arranged in the order of their numbers. LSB of the data indicates the status of the coil having the smallest number.

When the number of coils is a multiple of eight, MSB of the last data represents the status of the last coil. Otherwise, the slave unit disregards the redundant bits (MSBs) of the last data.

(2) Type and Reference No.

Type	Register	Reference No.
04H	MC unit coil	Y001 to Y512
05H	MC control coil	Q001 to Q256

(3) The following shows examples where the status of total 10 (0Ah) coils among MC unit coil Y020 (14h) to Y029 of slave 2 are changed.

- Query Message

SLAVE ADDRESS		02H	
FUNCTION CODE		26H	
Type		04H	
STARTING NO.	HIGH BYTE	00H	FIRST COIL NO. (LOWER 3-DIGIT) − 1
	LOW BYTE	13H	
NO. OF COILS	HIGH BYTE	00H	
	LOW BYTE	0AH	
NO. OF DATA BYTES		02H	$\left[\frac{N+7}{8}\right]$ *
FIRST 8-COIL DATA		00H	
NEXT 8-COIL DATA		00H	
CRC-16	HIGH BYTE	C2H	
	LOW BYTE	E4H	

- Response Message (Normal)

SLAVE ADDRESS		02H
FUNCTION CODE		26H
Type		04H
STARTING NO.	HIGH BYTE	00H
	LOW BYTE	13H
NO. OF COILS	HIGH BYTE	00H
	LOW BYTE	0AH
CRC-16	HIGH BYTE	BFH
	LOW BYTE	C4H

* N shows the number of coils. $\left[\frac{N+7}{8}\right]$ is the largest integer that does not exceed $\frac{N+7}{8}$.

- Response Message (Abnormal)

SLAVE ADDRESS		02H
FUNCTION CODE + 80		A6H
ERROR CODE		03H
CRC-16	HIGH BYTE	EBH
	LOW BYTE	A1H

6.22 READING OUT MOTION PROGRAM [6EH, 11H]

(1) Function
A designated program No. (#O) will be read out.

(2) The following shows examples where the program #O of slave 1 is read out.

Ex.

- Query Message

SLAVE ADDRESS		02H	
COMMAND CODE (ONLY FOR MC UNIT)		6EH	
MESSAGE LENGTH	HIGH BYTE	00H	
	LOW BYTE	13H	
FUNCTION CODE		11H	
UNIT NO.		01H	
PROGRAM NO. (#O)	LOW BYTE	01H	
	HIGH BYTE	00H	
RESERVE		00H	
RESERVE		00H	
RESERVE		00H	
RESERVE		00H	
FLAG		00H	"0": START "1": CONTINUE
RESERVE		00H	
RESERVE		00H	
RESERVE		00H	
CRC	HIGH BYTE	E0H	
	LOW BYTE	87H	

- Response Message (Normal)

SLAVE ADDRESS		01H	
COMMAND CODE (ONLY FOR MC UNIT)		6EH	
MESSAGE LENGTH	HIGH BYTE		
	LOW BYTE		
FUNCTION CODE		11H	
UNIT NO.		01H	
PROGRAM NO. (#O)	LOW BYTE	01H	
	HIGH BYTE	00H	
BLOCK NO. (#B)	LOW BYTE	01H	
	HIGH BYTE	00H	
SIZE	LOW BYTE		NO. OF BYTES OF READ OUT PROGRAM
	HIGH BYTE		
FLAG			"0": END "1": CONTINUE
RESERVE		00H	
RESERVE		00H	
RESERVE		00H	
READ OUT PROGRAM (ASCII CHARACTER)			
CRC	HIGH BYTE		
	LOW BYTE		

- Response Message (Abnormal)

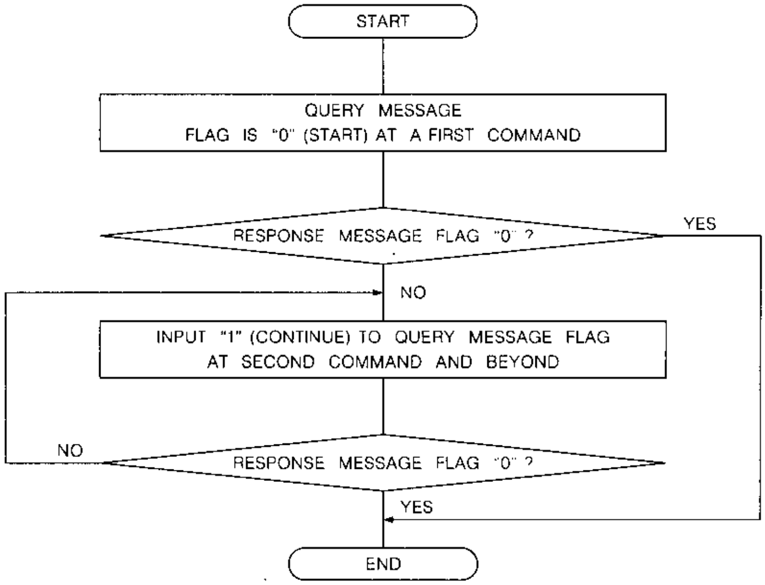
SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		91H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	93H
	LOW BYTE	74H

- Meaning of Query Message Flag

Since maximum message length is 200 bytes, message more than 200 bytes must be divided to several messages.

Flag is used for slave unit to notify master unit whether message is completed or not.

Flowchart for this procedure is shown below.


START
QUERY MESSAGE
FLAG IS "0" (START) AT A FIRST COMMAND
RESPONSE MESSAGE FLAG "0" ?
YES
NO
INPUT "1" (CONTINUE) TO QUERY MESSAGE FLAG
AT SECOND COMMAND AND BEYOND
NO
RESPONSE MESSAGE FLAG "0" ?
YES
END

- Meaning of Response Message Flag

When the last program is read out : Flag is "0"
When program is continued : Flag is "1"

6.23 WRITING IN MOTION PROGRAM [6EH, 51H]

(1) Function
Designated data (program) will be written into a designated program No. (#O).

(2) The following shows examples of write into #O01 (MC unit 1) of slave 1.

- Query Message

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	
	LOW BYTE	
FUNCTION CODE		51H
UNIT NO.		01H
PROGRAM NO. (#O)	LOW BYTE	01H
	HIGH BYTE	00H
BLOCK NO. (#B)	LOW BYTE	01H
	HIGH BYTE	00H
SIZE	LOW BYTE	
	HIGH BYTE	
FLAG		00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
WRITE-IN PROGRAM (ASCII CHARACTER)		
CRC	HIGH BYTE	
	LOW BYTE	

SIZE: NO. OF BYTES OF PROGRAM TO BE WRITTEN-IN

FLAG: "0" : END
"1" : CONTINUE
"2" : START

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		51H
UNIT NO.		01H
ERROR CODE		00H
CRC	HIGH BYTE	53H
	LOW BYTE	4BH

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		D1H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	52H
	LOW BYTE	A3H

- Meaning of Query Message Flag

  Since maximum message length is 200 bytes, message more than 200 bytes must be divided to several messages.

  Flag is used for slave unit to notify master unit whether message is completed or not..

① When program is less than 200 bytes : Query message flag is "0" (END).

② When program is commanded 2 times :
Query message flag is "2" (START) the first time and "0" (END) the second time.

③ When program is commanded several times :
Query message flag is "2" (START) the first time ; "1" (CONTINUE) the second time or later and "0" (END) the last time.

6.24 READING OUT MOTION PARAMETER [6EH, 21H]

(1) Function

The contents of parameters whose numbers are continuous will be read out when the number of parameters and the starting parameter number are designated.

The contents of the parameters are entered in the response message as data, divided into four bytes arranged in the order of the parameter numbers from lower byte.

(2) The following shows examples where the content of a total of 2 parameter numbers P101 and P102 (MC unit 1) of slave 1 are read out (101=65H).

Ex.

- Query Message

SLAVE ADDRESS		01H	
COMMAND CODE (ONLY FOR MC UNIT)		6EH	
MESSAGE LENGTH	HIGH BYTE	00H	
	LOW BYTE	07H	
FUNCTION CODE		21H	
UNIT NO.		01H	
PARAMETER NO.	LOW BYTE	65H	FIRST PARAMETER NO.
	HIGH BYTE	00H	
RESERVE		00H	
NO. OF PARAMETERS	LOW BYTE	02H	1 to 50
	HIGH BYTE	00H	
CRC	HIGH BYTE	5CH	
	LOW BYTE	0EH	

Message Length : Number of bytes from function code to number of parameters.

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		A1H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	93H
	LOW BYTE	7BH

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	0FH
FUNCTION CODE		21H
UNIT NO.		01H
PARAMETER NO.	LOW BYTE	65H
	HIGH BYTE	00H
RESERVE		00H
NO. OF PARAMETERS	LOW BYTE	02H
	HIGH BYTE	00H
PARAMETER CONTENTS	LOWEST BYTE	01H
	LOWER BYTE	00H
	HIGHER BYTE	00H
	HIGHEST BYTE	00H
PARAMETER CONTENTS	LOWEST BYTE	02H
	LOWER BYTE	00H
	HIGHER BYTE	00H
	HIGHEST BYTE	00H
CRC	HIGH BYTE	2DH
	LOW BYTE	1BH

- Parameter Value

MSB	4 BYTES		LSB
Highest Byte	Higher Byte	Lower Byte	Lowest Byte

6.25 WRITING IN MOTION PARAMETER [6EH, 61H]

(1) Function

Designated data will be written into a designated number of parameters whose starting parameter number is designated. Written-in data are entered in the response message, divided into four bytes, arranged in the order of the parameter numbers from lower byte.

(2) The following shows examples where the content of a total of 2 parameter numbers P101 and P102 (MC unit 1) of slave 1 are written-in.

Ex.

- Query Message

SLAVE ADDRESS		01H	
COMMAND CODE (ONLY FOR MC UNIT)		6EH	
MESSAGE LENGTH	HIGH BYTE	00H	
	LOW BYTE	0FH	
FUNCTION CODE		61H	
UNIT NO.		01H	
PARAMETER NO.	LOW BYTE	01H	
	HIGH BYTE	00H	
RESERVE		00H	
NO. OF PARAMETERS	LOW BYTE	02H	1 to 50
	HIGH BYTE	00H	
PARAMETER 1 CONTENTS	LOWEST BYTE	01H	
	LOWER BYTE	00H	
	HIGHER BYTE	00H	
	HIGHEST BYTE	00H	
PARAMETER 2 CONTENTS	LOWEST BYTE	02H	
	LOWER BYTE	00H	
	HIGHER BYTE	00H	
	HIGHEST BYTE	00H	
CRC	HIGH BYTE	E2H	
	LOW BYTE	0FH	

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		61H
UNIT NO.		01H
ERROR CODE		00H
CRC	LOW BYTE	53H
	HIGH BYTE	44H

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		E1H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	92H
	LOW BYTE	AFH

- Example of Parameters

Parameter No.		Contents	Set Value		
Decimal	Hexadecimal		P.P. Display	Internal Data	
0	0H	ID Code		00000000H	Common Parameters
1	1H	Designate Axis No. 1	X	00000001H	
2	2H	Designate Axis No. 2	Y	00000002H	
3	3H	Designate Axis No. 3	Z	00000004H	
4	4H	Designate Axis No. 4	S	00000008H	
⋮	⋮				
10	AH	Interpolation Feed Max. Speed	24000	00005DC0H	
101	65H	Position Loop Gain	30	0000001EH	1st-axis Parameters
⋮					
119	77H	Function Select 3	5	00000005H	
201	C9H	Position Loop Gain	50	00000032H	2nd-axis Parameters
⋮					
301	12DH	Position Loop Gain	100	00000064H	3rd-axis Parameters
⋮					
401	191H	Position Loop Gain	30	0000001EH	4th-axis Parameters
⋮					

One parameter is processed internally as 4-byte (32-bit) data. Parameter read-out/write-in is performed in units of 4 bytes.

6.26 READING OUT POINT TABLE CONTENTS [6EH, 18H]

(1) Function

The contents of point tables whose numbers are continuous will be read out when the number of table registers and the starting number are designated.

The contents of the point tables are entered in the response message as data, divided into 4 bytes for one axis, arranged in the order of the point table numbers from lower byte. Data for 4 axes are read out as one point table data.

(2) The following shows examples where the content of point table No. 1 is read out from slave 1 (MC unit 1)

Ex.

· Query Message

SLAVE ADDRESS		01H	
COMMAND CODE (ONLY FOR MC UNIT)		6EH	
MESSAGE LENGTH	HIGH BYTE	00H	
	LOW BYTE	06H	
FUNCTION CODE		18H	
UNIT NO.		01H	
POINT TABLE NO.	LOW BYTE	01H	
	HIGH BYTE	00H	
SIZE	LOW BYTE	01H	POINT TABLE NO. 1 to 10
	HIGH BYTE	00H	
CRC	HIGH BYTE	9DH	
	LOW BYTE	D4H	

· Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		98H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	43H
	LOW BYTE	76H

· Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	16H
FUNCTION CODE		18H
UNIT NO.		01H
POINT TABLE NO.	LOW BYTE	01H
	HIGH BYTE	00H
SIZE	LOW BYTE	01H
	HIGH BYTE	00H
DATA (AXIS NO. 1)	LOWEST BYTE	
	LOWER BYTE	
	HIGHER BYTE	
	HIGHEST BYTE	
DATA (AXIS NO. 4)	LOWEST BYTE	
	LOWER BYTE	
	HIGHER BYTE	
	HIGHEST BYTE	
CRC	HIGH BYTE	
	LOW BYTE	

6.27 CHANGING POINT TABLE CONTENTS (6EH, 19H)

(1) Function

Designated data will be written into a designated number of point tables whose starting point table number is designated. Written-in data are entered in the response message as data, divided into 4 bytes for one axis, arranged in the order of the point table numbers from lower byte. Data for 4 axes are written in as one point table data.

(2) The following shows examples where the point Table No. 1 is written in from slave 1 (MC unit 1).

- Query Message

SLAVE ADDRESS		01H	
COMMAND CODE (ONLY FOR MC UNIT)		6EH	
MESSAGE LENGTH	HIGH BYTE	00H	
	LOW BYTE	16H	
FUNCTION CODE		19H	
UNIT NO.		01H	
POINT TABLE NO.	LOW BYTE	01H	
	HIGH BYTE	00H	
SIZE	LOW BYTE	01H	POINT TABLE NO. 1 to 10
	HIGH BYTE	00H	
DATA (AXIS NO. 1)	LOWEST BYTE		
	LOWER BYTE		
	HIGHER BYTE		
	HIGHEST BYTE		
DATA (AXIS NO. 4)	LOWEST BYTE		
	LOWER BYTE		
	HIGHER BYTE		
	HIGHEST BYTE		
CRC	HIGH BYTE		
	LOW BYTE		

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		19H
UNIT NO.		01H
ERROR CODE		00H
CRC	HIGH BYTE	D3H
	LOW BYTE	5DH

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		99H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	12H
	LOW BYTE	B6H

6.28 CLEARING PROGRAM SPECIFIED BY PROGRAM NO. (#O) [6EH, 57H]

(1) Function

Designated program (#O) will be cleared. Make sure to use this function when the program number (#O) which will be written in has already existed.

(2) The following shows examples where the program number (#O) No. 1 is cleared from slave 1 (MC unit 1).

Ex.

- Query Message

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	0CH
FUNCTION CODE		57H
UNIT NO.		01H
PROGRAM NO. (#O)	LOW BYTE	01H
	HIGH BYTE	00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
RESERVE		00H
CRC	HIGH BYTE	E0H
	LOW BYTE	B2H

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		57H
UNIT NO.		01H
ERROR CODE		00H
CRC	HIGH BYTE	B3H
	LOW BYTE	4AH

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		D7H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	72H
	LOW BYTE	A1H

6.29 INITIALIZING MOTION PROGRAM AREA [6EH, 4FH]

(1) Function

Designated unit program area will be initialized (all programs are cleared).

(2) The following shows examples where the program area will be initialized from slave 1 (MC unit 1).

- Query Message

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	02H
FUNCTION CODE		4FH
UNIT NO.		01H
CRC	HIGH BYTE	BCH
	LOW BYTE	33H

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		4FH
UNIT NO.		01H
ERROR CODE		00H
CRC	HIGH BYTE	33H
	LOW BYTE	4DH

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		CFH
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	F2H
	LOW BYTE	A6H

6.30 INITIALIZING MOTION PARAMETER [6EH, 4EH]

(1) Function

Designated unit parameters will be initialized (all parameters are set to default values).

(2) The following shows examples where the parameter will be initialized from slave 1 (MC unit 1).

- Query Message

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	02H
FUNCTION CODE		4EH
UNIT NO.		01H
CRC	HIGH BYTE	BDH
	LOW BYTE	A3H

- Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		4EH
UNIT NO.		01H
ERROR CODE		00H
CRC	HIGH BYTE	62H
	LOW BYTE	8DH

- Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		CEH
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	A3H
	LOW BYTE	66H

6.31 INITIALIZING POINT TABLE [6EH, 76H]

(1) Function

Designated unit point table contents will be initialized (set to all "0").

(2) The following shows examples where the point table will be initialized from slave 1 (MC unit 1).

Ex.

• Query Message

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	02H
FUNCTION CODE		76H
UNIT NO.		01H
CRC	HIGH BYTE	AEH
	LOW BYTE	63H

• Response Message (Normal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE		76H
UNIT NO.		01H
ERROR CODE		00H
CRC	HIGH BYTE	E3H
	LOW BYTE	40H

• Response Message (Abnormal)

SLAVE ADDRESS		01H
COMMAND CODE (ONLY FOR MC UNIT)		6EH
MESSAGE LENGTH	HIGH BYTE	00H
	LOW BYTE	03H
FUNCTION CODE+80		F6H
UNIT NO.		01H
ERROR CODE		05H
CRC	HIGH BYTE	22H
	LOW BYTE	ABH

6.32 CALCULATING CRC-16 CODE

The CRC-16 code is calculated as the remainder (16 bits) when all 8-bit data, from the slave address to the last data of the message, are joined in series as shown in Fig. 6.2 and the resulting number is divided by the 17-bit number, 1 1000 0000 0000 0101.

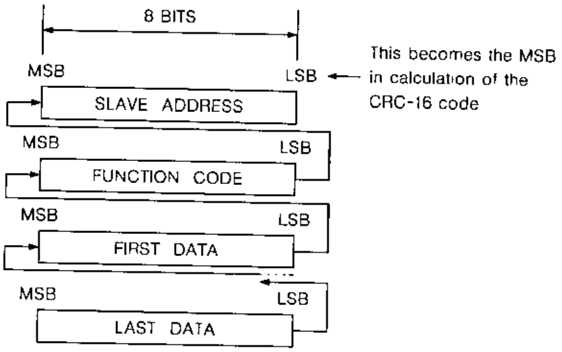


Fig. 6.2 Calculating the CRC-16 Code

NOTE

1 Initialize the remainder to-1 (all 16 bits to l's) in the MEMOBUS system, unlike ordinary initialization to 0.

2 The LSB of the slave address becomes the MSB and the MSB of the last data becomes LSB.

3 Even for the response message from a slave unit, calculate the CRC-16 code and compare it with that of the response message.

(1) How to calculate CRC-16 Code

Perform the following procedures :

(a) Initialize all the 16 bits of the remainder to 1's.

(b) Exclusive OR (EX. OR) the slave address and the remainder.

(c) Shift the result one bit to the right until "1" is moved out.

(d) Exclusive OR the result with the least significant 16 bits (1000 0000 0000 0101) of the constant divider.

(e) Shift the result eight bits to the right and, if "1" is moved out during shift, perform EX. OR operation for the result with the constant used in Step(d). Then perform EX. OR operation for result with the next 8 bits (function code).

(f) Repeat the above steps until the last data is reached.

(g) Place the high byte (actually low byte) of the 16-bit result then the low byte (actually high byte) in the last part of the query message.

(2) Sample Program of CRC-16 Code Calculation

Ex.

```
10   XMT(1)=& H2 : XMT(2)=& H7 : N=2   · Message data
20   GOSUB * CRC16                     · To CRC-16 calculation routine
30
40
50
100  * CRC16                           · CRC-16 calculation started
110  CRCTMP=&HFFFF                     · Initial set
120  FOR I=1 TO N                      · N : No. of data bytes excluding CRC-16
130  CRCTMP=CRCTMP XOR XMT(1)
140  FOR J=1 TO 8                      · No. of shifts
150  CT=CRCTMP AND &H1                 · Check for bits moved out after shift
160  IF CRCTMP<0 THEN CH=1 ELSE        · CH=1 : All bits are 1.
     CH=0 : GOTO 180
170  CRCTMP=CRCTMP AND & H7FFF
180  CRCTMP=CRCTMP ¥2                  · Right 1-bit shift
190  IF CH=1 THEN CRCTMP=CRCTMP
     OR &H4000
200  IF CT=1 THEN CRCTMP=CRCTMP        · When moved-out bit is 1
     XOR &HA001
210  NEXT J, I
220  IF CRCTMP<0 THEN CL=1 : CRCTMP
     =CRCTMP AND &H7FFF ELSE CL=0
230  C1=CRCTMP AND &HFF : C2=
     (CRCTMP AND &H7F00) ¥256
240  IF CL=1 THEN C2=C2 OR &H80
250  XMT(N+1)=C1 : XMT(N+2)=C2         · Decimal (CRC-16) C1 in high order,
                                         C2 in low byte
260  XMT$(N+1)=HEX$(XMT(N+1))          · When converted to hexadecimal
                                         (high byte)
270  XMT$(N+2)=HEX$(XMT(N+2))          · When converted to hexadecimal
                                         (low byte)
280  RETURN
```

For Fig. 6.3, CRC-16 calculation process is shown in Fig. 6.5 and the calculated result in Fig. 6.4.

0000 0010	SLAVE ADDRESS (2)
0000 0111	FUNCTION CODE (7)

(READING OUT PARTICULAR COIL STATUS)

Fig. 6.3 Message Example

0000 0010	SLAVE ADDRESS
0000 0111	FUNCTION CODE
0100 0101	CRC-16 (HIGH ORDER)
0001 0010	CRC-16 (LOW ORDER)

Note : Proper care should be taken for making high order and low order of CRC-16

Fig. 6.4 Calculated Result of CRC-16 Code

```
          CRCTMP               FLAG
1111 1111 1111 1111                 INITIAL SET
               |0000 0010|          DEVICE ADDRESS
-------------------------
1111 1111 1111 1101                 RESULT OF EX. OR
0111 1111 1111 1110              1  SHIFT 1
1010 0000 0000 0001
-------------------------
1101 1111 1111 1111                 RESULT OF EX. OR
0110 1111 1111 1111              1  SHIFT 2
1010 0000 0000 0001
-------------------------
1100 1111 1111 1110                 RESULT OF EX. OR
0110 0111 1111 1111              0  SHIFT 3
0011 0011 1111 1111              1  SHIFT 4
1010 0000 0000 0001
-------------------------
1001 0011 1111 1110                 RESULT OF EX. OR
0100 1001 1111 1111              0  SHIFT 5
0010 0100 1111 1111              1  SHIFT 6
1010 0000 0000 0001
-------------------------
1000 0100 1111 1110                 RESULT OF EX. OR
0100 0010 0111 1111              0  SHIFT 7
0010 0001 0011 1111              1  SHIFT 8
1010 0000 0000 0001
-------------------------
1000 0001 0011 1110                 RESULT OF EX OR
               |0000 0111|          FUNCTION CODE
-------------------------
1000 0001 0011 1001                 RESULT OF EX. OR
0100 0000 1001 1100              1  SHIFT 1
1010 0000 0000 0001
-------------------------
1110 0000 1001 1101                 RESULT OF EX. OR
0111 0000 0100 1110              1  SHIFT 2
1010 0000 0000 0001
-------------------------
1101 0000 0100 1111                 RESULT OF EX. OR
0110 1000 0010 0111              1  SHIFT 3
1010 0000 0000 0001
-------------------------
1100 1000 0010 0110                 RESULT OF EX. OR
0110 0100 0001 0011              0  SHIFT 4
0011 0010 0000 1001              1  SHIFT 5
1010 0000 0000 0001
-------------------------
1001 0010 0000 1000                 RESULT OF EX. OR
0100 1001 0000 0100              0  SHIFT 6
0010 0100 1000 0010              0  SHIFT 7
0001 0010 0100 0001              0  SHIFT 8
-------------------------
    12            41
  CRC-16        CRC-16
(LOW BYTE)   (HIGH BYTE)
```

Fig. 6.5 CRC-16 Code Calculating Process

SECTION 7

MODEM INSTALLATION

This section describes the mounting and connection for modems.

7.1 MODEM CONFIGURATION (TYPES : DISCT-J1078, J2078)

A modem consists of a modulator which converts digital signals (RS-232C) to 50 kHz and 80 kHz analog signals and a demodulator which converts these analog signals to digital signals (RS-232C). (Fig. 7.1).

Logic "1" (−12V) of digital signal is called "Mark" and logic "0" (+12V) is called "Space". They correspond to 50 kHz and 80 kHz analog signals, respectively.

Digital Signal		Analog Signal
Logic "1" (−12V) : Mark	←→	50 kHz
Logic "0" (+12V) : Space	←→	80 kHz

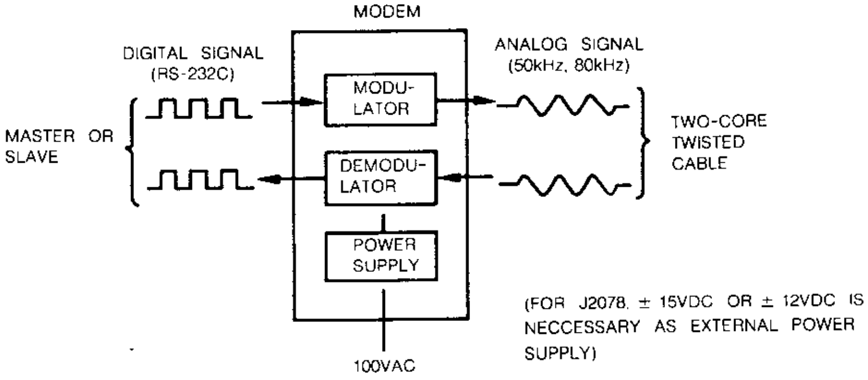


Fig. 7.1 Modem Block Diagram

7.2 INSTALLATION

(a) J1078 Modem

Fig. 7.2 shows the J1078 modem. J1078 can be installed in any slot (one span) on a mount base for 1000 Series I/Os.

A panel mounted type is also available by using a metal fitting. Be sure to install J1078 vertically as shown in Fig. 7.3.

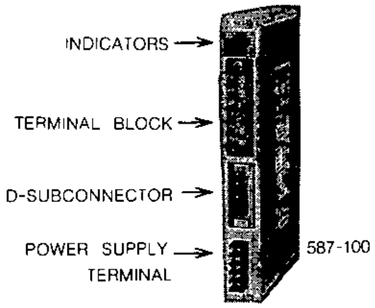


Fig. 7.2 J1078 Modem

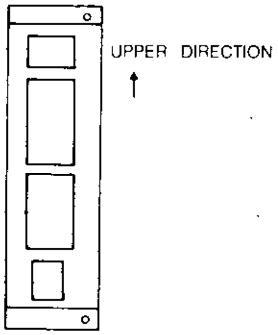


Fig. 7.3 J1078 Mounting Direction

(b) J2078 Modem

Fig. 7.4 shows the J2078 modem. J2078 can be installed in any slot (one span) on a mount base for 2000 Series I/Os.

A panel mounted type is also availabe by using a metal fitting. Be sure to install J2078 vertically as shown in Fig. 7.5.

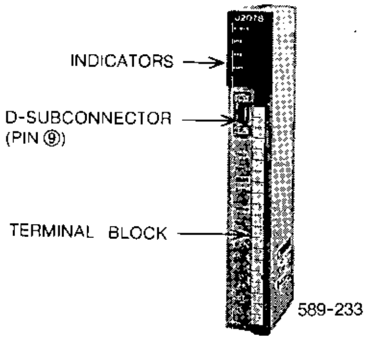


Fig. 7.4 J2078 Modem

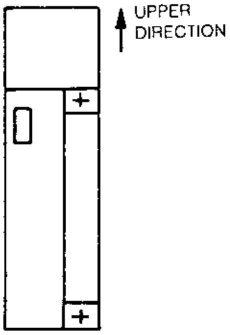


Fig. 7.5 J2078 Mounting Direction

7.3 CONNECTION

(1) Power supply terminal

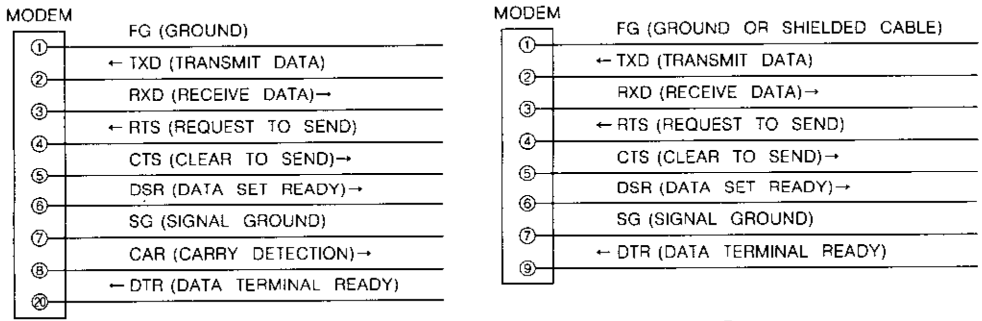
100 VAC is applied to the "AC INPUT" pin at the power supply terminal. "GND" terminal should be grounded with 100 Ω or less of grounding resistance. External power supply ±15 VDC or ±12 VDC is required for J2078.

(2) Terminal block

Two-core twisted cable (RG108/U or equivalent) should be used for the terminal block. Refer to "3.1 CONNECTIONS BETWEEN MODEMS" for details.

(3) D-sub connector

Standard D-sub connector (DB-25P connector) is used for the connection between a modem and a master (or slave). Signal level is EIA standard RS-232C. For J2078, pin ⑨ is used.



Note : Pin ⑧ is not used.

Note . Pins of ⑨ to ⑲ and ㉑ to ㉕ are not used.

(b) J2078

(a) J1078

Fig. 7.6 RS-232C Cable Connection

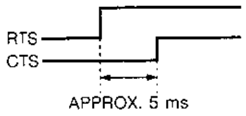


Fig. 7.7 CTS Signal Response Time

(4) Indicator

For indicators, refer to **Table 7.1**.

Table 10.1 Indicators

(a) J1078

Indicator	Description
POWER	Logic circuit power supply is normal.
REQUEST TO SEND (RTS)	RTS signals from a master or a slave are logic "1" (+12V).
CARRIER DETECT (CAR)	Carry signals or data have arrived at a receive terminal. At this time, CAR (Carry detection) signals are logic "1" (+12V).
RECEIVED DATA (RXD)	Data is being received from the receive terminal. The indicator lights at logic "0".
TRANSMITTED DATA (TXD)	Data is being transmitted from the transmit terminal. The indicator lights at logic "1".

(b) J2078

Indicator	Description
POWER	External power supply (±15V or ±12V) is normal.
REQUEST TO SEND (RTS)	RTS signals from a master or a slave are logic "1".
TRANSMITTED DATA (TXD)	Data is being transmitted from the transmit terminal. The indicator lights at logic "1".
RECEIVED DATA (RXD)	Data is being received from the receive terminal. The indicator lights at logic "1".

SECTION 8

WIRING

This section describes the precautions for connecting RS-232C cables between master and slaves.
Also describes handling of two-core twisted cables.

8.1 RS-232C CABLE

(1) The length of RS-232C cable which connects modem to other devices should be as short as possible (up to 15 meters). RS-232C cable should not be stored in the same duct with other power lines or control lines.

They should be stored in separate ducts or should be wired independently. RS-232C cable can be stored with analog signal lines or transmission cables in the same duct.

8.2 TWO-CORE TWISTED CABLE

(1) For panel wiring, two-core twisted cables should not be run in the same duct with power supply lines or control lines. They should be run in separate ducts or should be wired independently. However, two-core twisted cables can be run with analog signal lines or transmission lines in the same duct.

(2) For the panel wiring, the cables should be run in a pit. If they are run in a pit, other power supply lines or control lines should be run in a separate pit. If these cables and lines are run in the same pit, then the cable should first be run in a conduit.

Both ends of the conduit should be grounded. If the cables have to be.run in the same pit with power lines, the power lines and the conduit should be separated as far as possible by separating trays. The cables can be run with analog lines or transmission lines in the same pit.

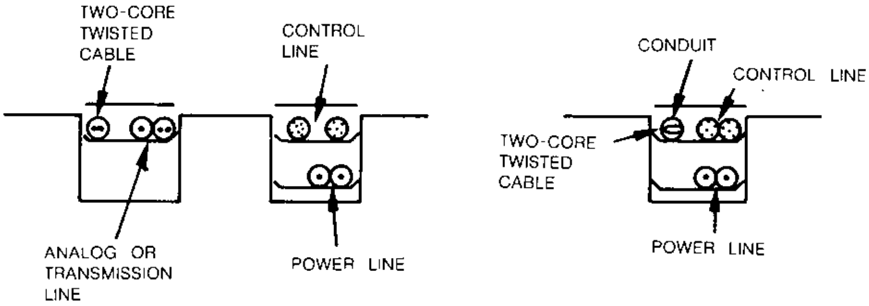


Fig. 8.1 Running Two-core Twisted Cable

Whether the shielding of two-core twisted cable should be single-side grounded or double-side grounded depends on the nature of external noise. Normally, single-side grounding should be employed. Double-side grounding should be used if it produces better results. In case of single-side grounding, either side can be grounded. In general, reception side grounding is recommended.

APPENDIX A SAMPLE MEMOBUS MESSAGES

1. Reading-out Status of Coils 0020-0056

(1) Query Message

ADDRESS	FUNCTION	START NO		NO. OF COILS		CRC	
02	01	00	13	00	25	0C	27

(2) Response Message

ADDRESS	FUNCTION	NO OF DATA	COIL STATUS					CRC	
02	01	05	CD	6B	0E	1B	1B	04	FF

2. Reading-out Status of Input Relays I197-I218

(1) Query Message

ADDRESS	FUNCTION	START NO.		NO. OF COILS		CRC	
02	02	00	C4	00	16	B8	0A

(2) Response Message

ADDRESS	FUNCTION	NO. OF DATA	INPUT RELAY STATUS			CRC	
02	02	03	AC	DB	35	22	BB

3. Reading-out Contents of Data Registers W0108-W0110

(1) Query Message

ADDRESS	FUNCTION	START NO		NO OF COILS		CRC	
02	03	00	6B	00	03	74	24

(2) Response Message

ADDRESS	FUNCTION	NO. OF DATA	CONTENTS OF DATA REGISTER						CRC	
02	03	06	02	2B	00	00	00	63	50	48

4. Reading-out Contents of Input Register Z009

(1) Query Message

ADDRESS	FUNCTION	START NO		NO OF REGISTERS		CRC	
15	04	00	08	00	01	B3	1C

(2) Response Message

ADDRESS	FUNCTION	NO. OF DATA	CONTENTS OF INPUT REGISTER		CRC	
15	04	02	C5	39	4A	71

5. Changing Status of Coil 0173

(1) Query Message

ADDRESS	FUNCTION	COIL NO.		STATUS		CRC	
03	05	00	AC	FF	00	4D	F9

(2) Response Message
Same as that of query message.

6. Writing-in Data Register W0136

(1) Query Message

ADDRESS	FUNCTION	DATA REGISTER NO		WRITING DATA		CRC	
05	06	00	87	03	9E	B9	3F

(2) Response Message
Same as that of query message.

7. Reading-out Status of Particular Coil

(1) Query Message

ADDRESS	FUNCTION	CRC	
01	07	41	E2

(2) Response Message

ADDRESS	FUNCTION	COIL STATUS	CRC	
01	07	6D	E3	DD

8. Loopback Test

(1) Query Message

ADDRESS	FUNCTION	TEST CODE		DATA		CRC	
02	08	00	00	A5	37	DA	BE

(2) Response Message
Same as that of query message.

9. Changing Status of Coils 00020-00029

(1) Query Message

ADDRESS	FUNCTION	START NO.		NO. OF COILS		NO OF DATA	STATUS		CRC	
01	0F	00	13	00	0A	02	00	00	E7	9B

(2) Response Message

ADDRESS	FUNCTION	START NO.		NO. OF COILS		CRC	
01	0F	00	13	00	0A	24	09

10. Writing-in Data Registers W0136-W0137

(1) Query Message

ADDRESS	FUNCTION	START NO.		NO. OF REGIS-TERS		NO. OF DATA	WRITING DATA				CRC	
01	10	00	87	00	02	04	00	0A	01	02	1A	7A

(2) Response Message

ADDRESS	FUNCTION	START NO		NO. OF COILS		CRC	
01	10	00	87	00	02	F1	E1

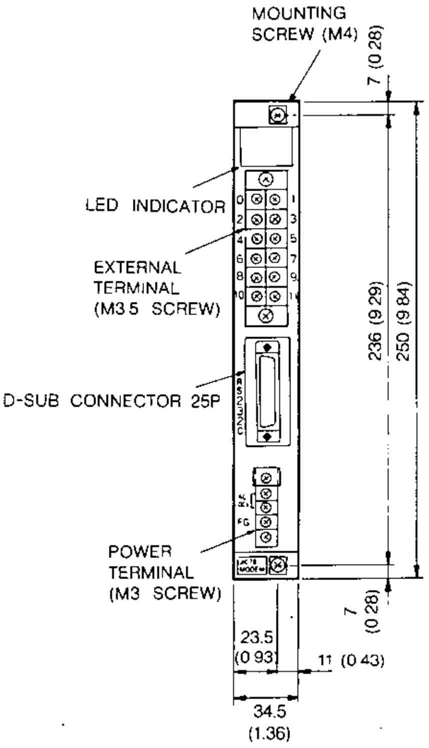
APPENDIX B MEMOBUS CABLE SPECIFICATIONS

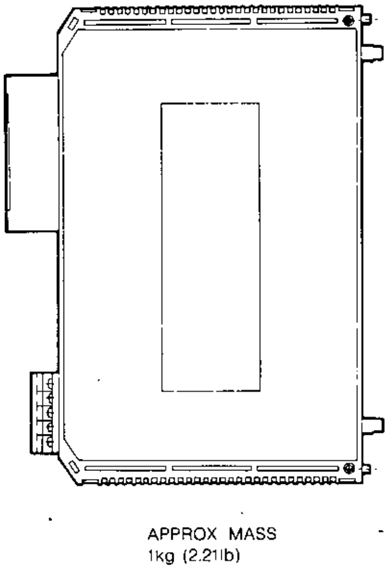
Type	Length in m (inches)	Applications
JEPMC-W5310	2.5 (98.4) 15 (590.6)	Between computer, ACGC (25-pin) and PROGIC-8 (PLC unit Port 1, 9-pin)
JEPMC-W5330	2.5 (98.4) 15 (590.6)	Between computer, ACGC (25-pin) and PROGIC-8 (PLC unit Port 1, 15-pin)
JEPMC-W5311	2.5 (98.4) 15 (590.6)	Between IBM PC (9-pin) and PROGIC-8 (PLC unit Port 1, 9-pin)
JEPMC-W5331	2.5 (98.4) 15 (590.6)	Between IBM PC (9-pin) and PROGIC-8 (PLC unit Port 2, 15-pin)
JEPMC-W5340*		Between modem J1078 (25-pin) and PROGIC-8 (PLC unit Port 2, 15-pin)
JEPMC-W5341*		Between modem J2078 (9-pin) and PROGIC-8 (PLC unit Port 2, 15-pin)
JZMSZ-W1017-T1, -T2	5 (196.9) 15 (590.6)	Between modem J1078 (25-pin) and PROGIC-8 (PLC unit Port 1, 9-pin)
JZMSZ-W2030-001	2.5 (98.4)	Between modem J2078 (9-pin) and PROGIC-8 (PLC unit Port 1, 9-pin)
JZMSZ-W194-TT1	2.5 (98.4)	Between computer, ACGC (25-pin) and modem J1078
JZMSZ-W2030-001	2.5 (98.4)	Between computer, ACGC (25-pin) and modem J2078

* : Future use

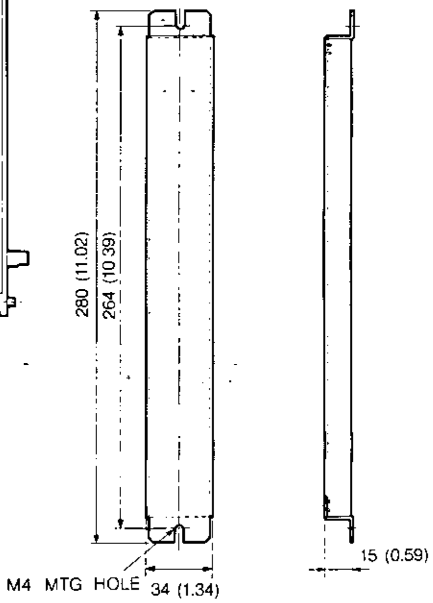
APPENDIX C DIMENSIONS in mm (inches)

(1) Modem (Type DISCT-J1078)

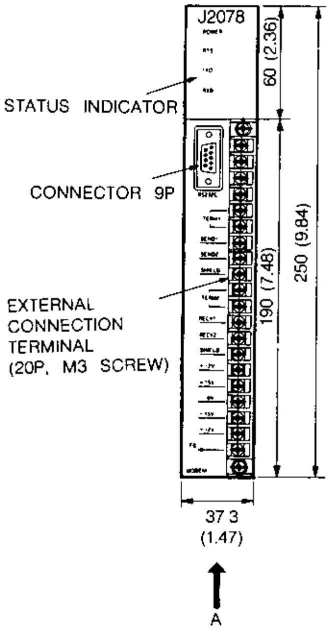


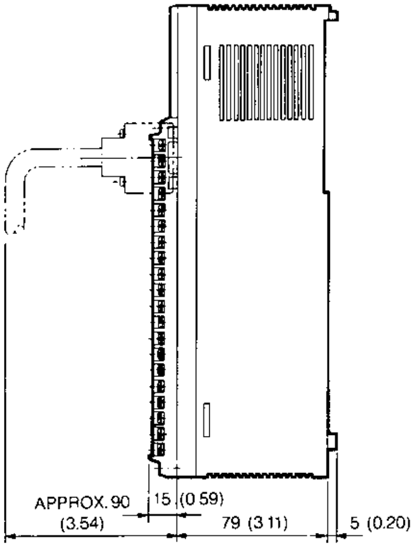


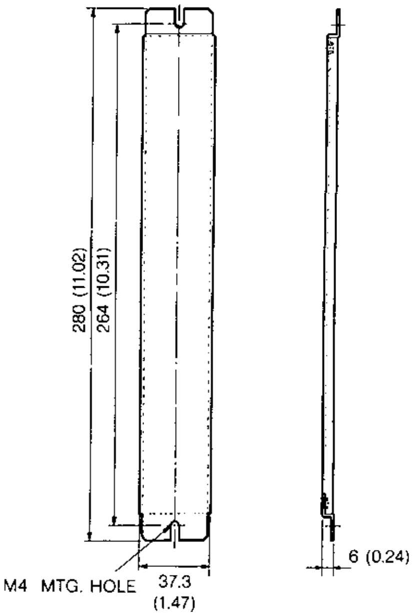
Note When I/O support (DF8303994) is required for stand-alone installation, contact your YASKAWA representative.

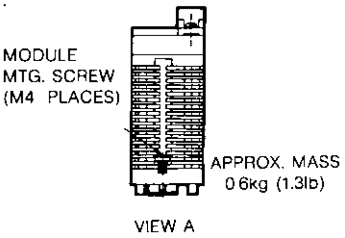


(2) Modem (Type DISCT-J2078)









Note : When I/O support (DF-8305869) is required for stand-alone installation, contact your YASKAWA representative.

NOTE

NOTE

PROGIC-8

MULTIAXES MOTION CONTROLLER

DESCRIPTION OF MEMOBUS (INDUSTRIAL COMMUNICATION SYSTEM) MAINLY UTILIZING PROGIC-8 AS A SLAVE

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