User's Manual

LG Programmable Logic Controller

Computer Link Module

MASTER-K

K7F-CUEA
K4F-CUEA
K3F-CU2A
K3F-CU4A

L G Industrial Systems

Chapter 1 Introduction

1 Introduction

This manual describes the computer link (Cnet) system of MASTER-K series. The Cnet network system means PLCs of network communicate through the computer link module.

The MASTER-K Cnet module has following features;

- A frame editor software that are based on MS-Windows 95/98 is provided. User can write an user-defined protocol for communication with other manufacturer's PLCs.
- Supports RS-232C and RS-485 channels and they can operate stand-alone mode or interlocking mode.
- A 128kbyte flash memory is equipped for user protocol data storage.
- Supports a LGIS's dedicated protocol for easy and simple setup of the network between LGIS products such as PMU.
- Supports a multi-drop function that maximum 32 station can be joined into a network.
- With a built-in modem communication function, it can control a remote PLC by dedicated protocol, KGL-WIN connection, or user-defined protocol.
- Supports various communication speed (baud rate) from 300bps to 153,600bps (RS-422)
- RS-422 channel provides 1:1, 1:N, or N:M communication modes.
- Full duplex (RS-422) and half-duplex (RS-485) are available.
- In a main base board, multiple Cnet modules can be mounted. (K200S : 2 modules, K300S : 4 modules, K1000S : 8 modules)
- Provides powerful self-diagnosis functions and loop-back test function.

The following table shows communication modules of MASTER-K series. Please refer the table when configure a MK network system.

Network type	Master / Slave	Cable type	Catalog number	Applicable PLC system
MK Fnet	Master (FMM)	Twisted pair	K3F-FUEA	K200S
			K4F-FUEA	K300S
			K7F-FUEA	K1000S
			G0L-FUEA	IBM compatible PC
		Optical fiber	K7F-FUOA	K1000S
	Slave (FSM)	Twisted pair	K3F-RBEA	K200S
			K4F-RBEA	K300S
			K7F-RBEA	K1000S
			G0L-SMxA	Stand-alone
		Optical fiber	K7F-RBEA	K1000S
	Option (FOU)	Twisted pair	G0L-FREA	Stand-alone
		Optical / twisted pair	G0L-FEOA	Stand-alone
MK Cnet	Master / slave (selectable)	Twisted pair or RS-232C cable	K3F-CU2A	K200S
			K3F-CU4A	K200S
			K4F-CUEA	K300S
			K7F-CUEA	K1000S

Remark

1. There is a limitation on the maximum module numbers that are mountable on a base board. Refer the following table for details

Module type	Fnet	Cnet
K200S	Max. 2 modules	Max. 2 modules
K300S	Max. 4 modules	Max. 4 modules
K1000S	Max. 4 modules	Max. 8 modules

2. Communication modules can be mounted on main base board only.
3. Master/slave can be selected with parameter setting.

Chapter 2 Terminology

2 Terminology

This chapter will describe the meaning of terms used in this manual.

2.1.1 Communication methods

1) Simplex

This is a communication type that the data is transmitted with a fixed direction. It is not allowed to move data in reverse direction.

2) Half-duplex

It is available to move data in both directions. However, data transference in a direction should be done after another direction transference is completed because two-way transmissions share a common communication cable.

3) Full-duplex

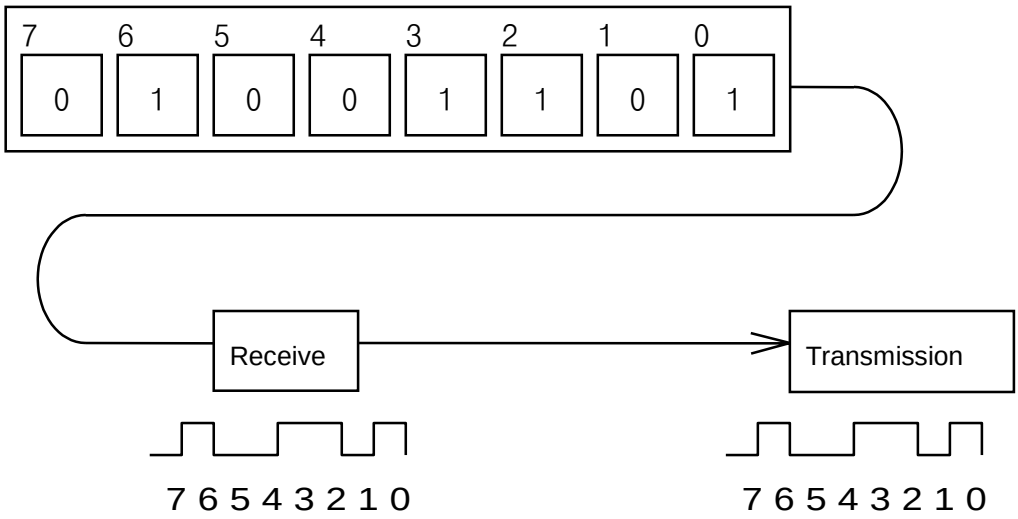
Data is transmitted in two-way directions with two communication cables.

2.1.2 Transmission type

The transmission type can be divided into two types in consideration of binary (bit composed 0 and 1) transmission speed, reliability, and economy.

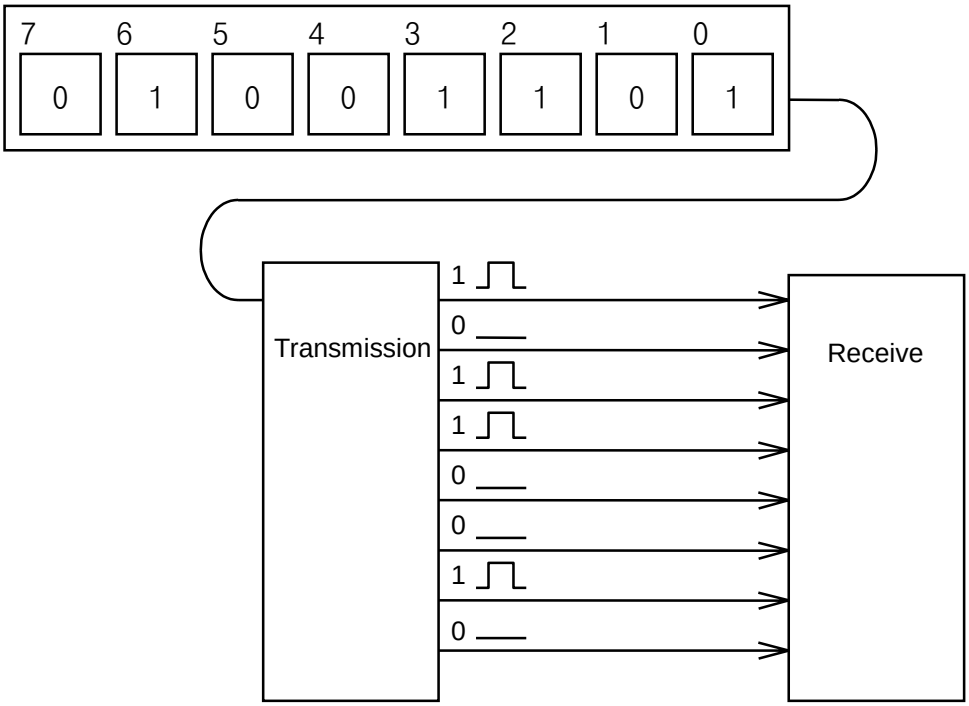
1) Serial transmission

In serial transmission type, each bits of data is transmitted in order through single cable. Its transmission speed is slow, but it provides lower installation cost and simpler software. RS-232C, RS-422, and RS-485 are typical serial transmission types.



2) Parallel transmission

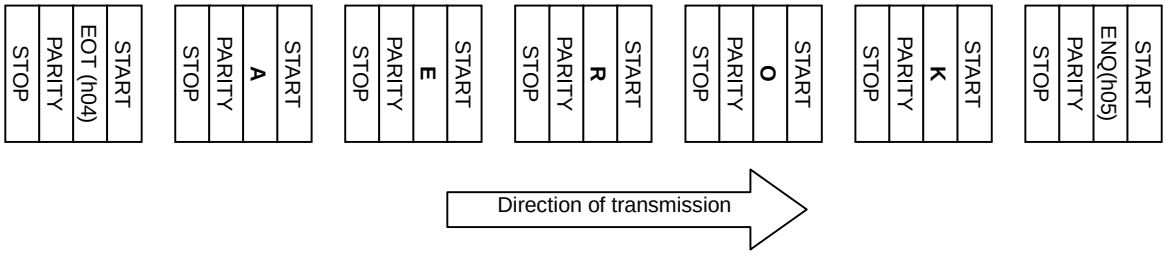
In parallel transmission, 8bits (1byte) are transmitted at once through 8 communication lines. It provides faster transmission speed, and higher communication reliability, but installation cost are increased in geometrical series by transmission distance.



2.1.3 Asynchronous transmission

With the asynchronous transmission, there is no clock signal for timing synchronization. Data is divided in a character (7 or 8 bits) and start/stop bits are added at the top/bottom of character. Then each characters with start/stop bits are transmitted in order.

Example) The transmission of 'KOREA'



2.1.4 Protocol

This is a rule that specifies how two or more devices communicate more efficiently and reliably. Generally, it defines following features;

- Establishment of communication
- Connection between devices
- The structure of data exchange format
- Re-transmission when an error occurred
- Switching transmit/receive
- Character synchronization between devices

2.1.5 BPS / CPS

The BPS and CPS stand for 'Bit Per Second' and 'Character Per Second'. The BPS/CPS show how many bits / characters can be transferred in a second. Because a character is consist of 8 bits, in general, the CPS shows how many bytes can be transferred in a second.

2.1.6 Node

It indicates a point that a data line is branched into two or more lines in the network tree structure. Generally, a network consists of multiple nodes. Also, the term 'station' has same meaning.

2.1.7 Packet

It is a compound word of 'package' and 'bucket' and a data transmission unit of a 'packet exchange system'. In this system, the data is divided into a specific length unit, and a header is added. A 'header + divided data' is called as a packet.

2.1.8 Port

A port means a data input/output gate of data transmission devices. In Cnet serial communication, a port means RS-232C or RS-422/485 port.

2.1.9 RS-232C

RS-232C is one of serial communication standards that are established by EIA. It defines the communication interface between modem and a computer (or other devices), and it can be used for direct connection without modem (null-modem). The demerit of RS-232C is that a transmission distance is short and only 1:1 connection is possible.

2.1.10 RS-422/485

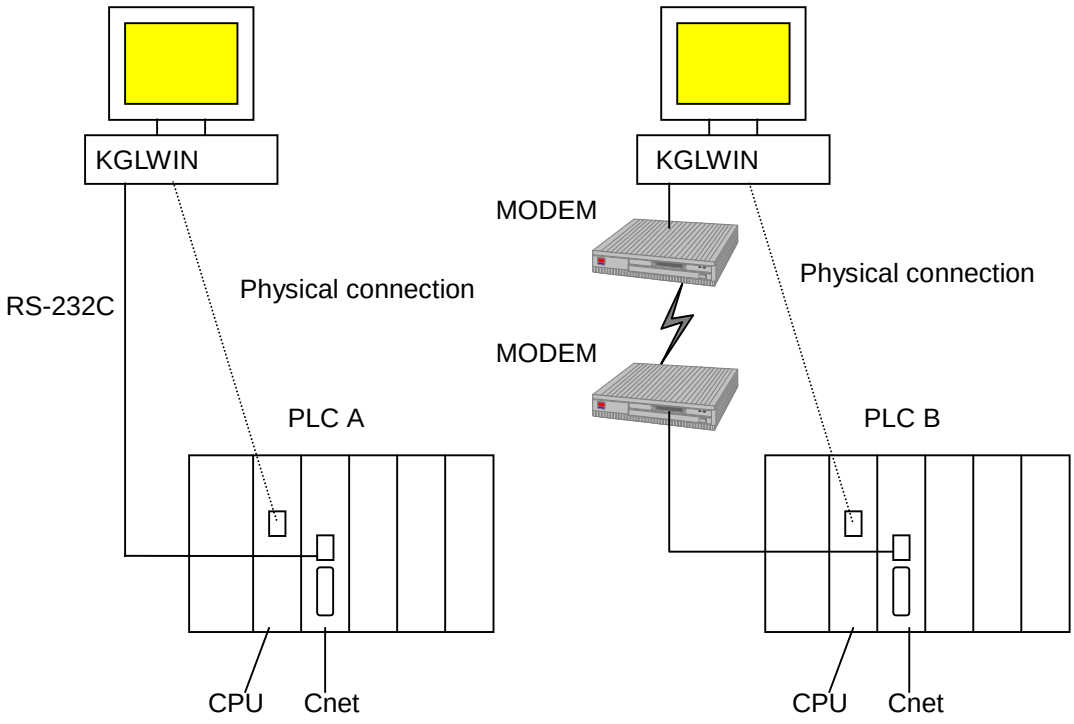
It is a standard of serial communication that is made up for demerits of RS-232C standard. It supports long transmission distance and 1:N connection. The difference of RS-422 and RS-485 is the number of signal lines. The RS-422 has 4 signal lines such as TX(+), TX(-), RX(+), and RX(-), and RS-485 has 2 signal lines (+ and –). Because of transmit and receive line is separated, RS-422 can perform full-duplex communication, but the RS-485 performs half-duplex communication because transmit and receive share one signal line.

2.1.11 BCC

The BCC stands for 'Block Check Character'. To check a transmitting data contains error or not, a transmitting station calculates BCC from data and adds the BCC at the bottom of data. Then, the receiving station can determine whether an error occurred by comparing the BCC with transmitted data.

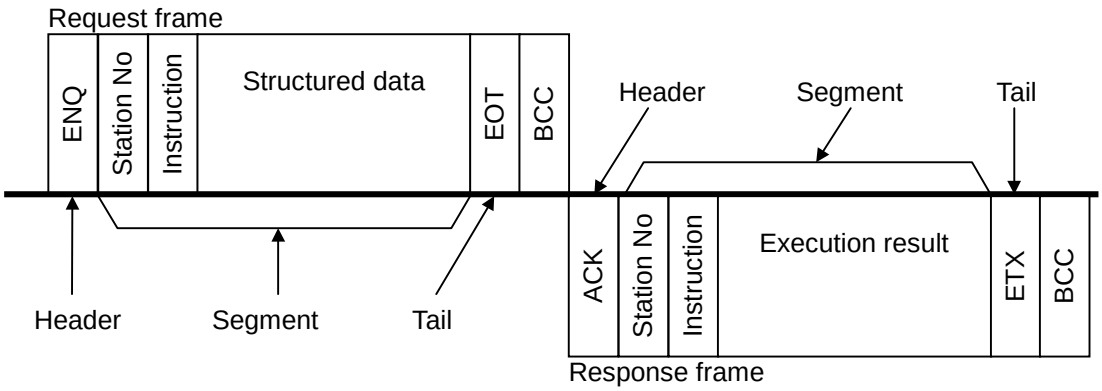
2.1.12 KGL-WIN function

In the MASTER-K Cnet network, user can control (program read, write, monitor and debugging) a remote PLC through a Cnet network as if the remote PLC is connected to KGL-WIN directly. Especially, a PLC at the far-away place can be controlled with a modem connection. However, only 1stage remote connection is available.



2.1.13 Frame

The frame is a structure definition of data transmission. It consists of a segment (station number, instruction, structured data, and/or execution result), control code for synchronization, parity bit, and BCC for error detection. The frame of MASTER-K Cnet is as following picture.



① Header : An ASCII code that indicates the start of frame

② Tail : An ASCII code that indicates the end of frame

③ Parity : It is a bit used for an error detection of a byte

④ BCC : It is a byte used for an error detection of a frame

Chapter 3 Specifications

3 Specifications

3.1 General specifications

The following table shows the general specifications of MASTER-K series.

No	Item	Specifications					Remark
1	Operating ambient temperature	0 ~ 55℃ (32 ~ 131 °F)					
2	Storage ambient temperature	-25 ~ 70℃ (-13 ~ 158 °F)					
3	Operating ambient humidity	5 ~ 95%RH, non-condensing					
4	Storage ambient humidity	5 ~ 95%RH, non-condensing					
5	Vibration resistance	Occasional vibration					IEC 1131-2
		Frequency	Acceleration	Amplitude	Sweep count		
		10≤ f<57 Hz	-	0.075 mm	10 times in each direction for X, Y, Z		
		57 ≤ f≤ 150 Hz	9.8 ㎨ (1G)	-			
		Continuos vibration					
		Frequency	Acceleration	Amplitude			
		10≤ f<57 Hz	-	0.035 mm	10 times in each direction for X, Y, Z		
		57≤ f≤ 150 Hz	4.9 ㎨ (0.5G)	-			
6	Shock resistance	Maximum shock acceleration: 147 ㎨ (15G) Duration time :11 ms (3 times in each of X, Y and Z directions) Pulse wave: half sine wave pulse					IEC 1131-2
7	Noise immunity	Square wave impulse noise	± 1,500 V				LGIS ' s specification
		Electrostatic discharge	Voltage :4 kV(contact discharge)				IEC 1131-2 IEC 801-2
		Radiated electro-magnetic field	27 ~ 500 MHz, 10 V/m				IEC 1131-2 IEC 801-2
		Fast transient burst noise	Severity Level	All power modules	Digital I/O (Ue ≥ 24 V)	Digital I/O (Ue<24 V) Analog I/O Communication I/O	IEC 1131-2 IEC 801-4
			Voltage	2 kV	1 kV	0.25 kV	
8	Atmosphere	Free of corrosive gases					
9	Altitude for use	Up to 2,000m (6,560ft)					
10	Pollution degree	2					
11	Cooling method	Self-cooling					

Remark

1. IEC (International Electrotechnical Commission) : The international civilian organization which produces standards for electrical and electronics industry.
2. Pollution degree : It indicates a standard of operation ambient pollution level. The pollution degree 2 means the condition in which normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected

3.2 Performance specifications

The following table shows the performance specifications of MASTER-K Cnet modules.

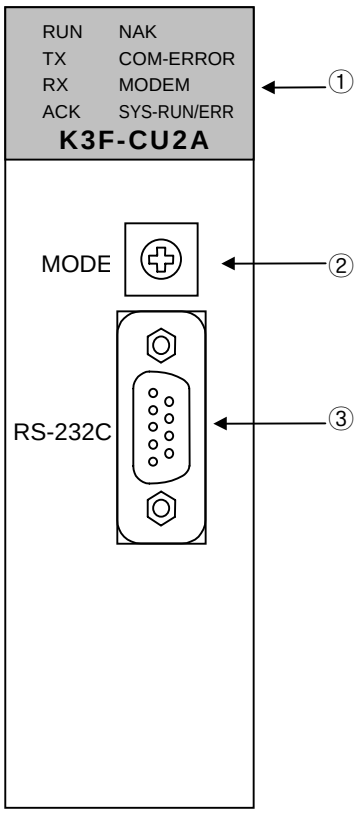
Items	Specifications		
Serial communication channel	RS-232C	Comply with RS-232C standards, 1 channel	
	RS-422/485 [1]	Comply with RS-422/485 standards, 1 channel	
Modem function	Long-distance remote communication with external device is possible via a public telephone line by connecting a modem to Cnet module.[2]		
Operation modes	Dedicated protocol	Supports multi-drop and 1:1 connection. (Dedicated protocol for LGIS's products)	
	KGL-WIN protocol	Supports a connection with KGL-WIN and remote PLC control (program read, write, monitor, and debug)	
	User-define protocol	Supports a user-defined protocol written by a frame editor.	
Data structure	Data bit	7 or 8	Set with the basic parameter of frame editor [3]
	Stop bit	1 or 2	
	Parity	Even / Odd / None	
Channel selection	Stand-alone / Interlocking (set with operation mode switch) [4]		
Synchronization	Asynchronous		
Baud rate	300 ~ 153,600 bps (set with the basic parameter of frame editor) [5]		
Station number	Max. 32 stations (0 ~ 31), Set with the basic parameter of frame editor		
Transmit distance	RS-232C	Max. 15m	
	RS-422/485	Max. 500m	
Diagnosis functions	Loop-back self-diagnosis function		
	Indicates operation status by 16 LEDs (K200S : 8 LEDs)		
Current consumption	Max. 100mA		

Remark

1) RS-422 and RS-485 can be selected with the basic parameter of frame editor.
2) To use modem function, set the 'type' of basic parameter as 'dial-up modem' or 'dedicated modem' in frame editor.
3) In stand-alone mode, RS-232C and RS-422/485 channels can have different data structures.
4) It is not allowed to change operation mode while the Cnet module is operating.
5) Only RS-422/485 channel of K300S/1000S Cnet version 1.3 (or later) can be use 76,800 and 153,600 bps. The maximum baud rate of K200S is 38,400.

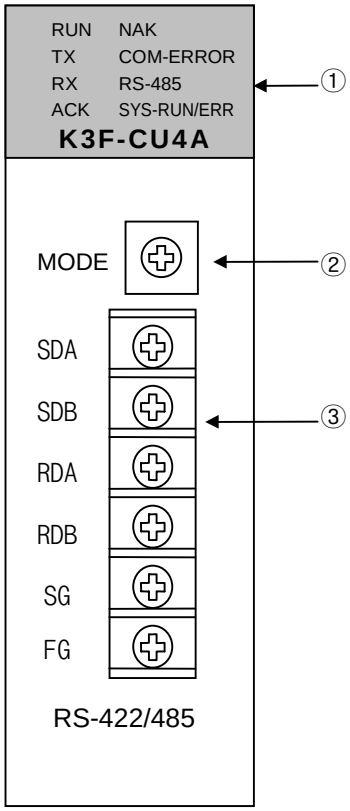
3.3 Parts names and descriptions

3.3.1 K3F-CU2A



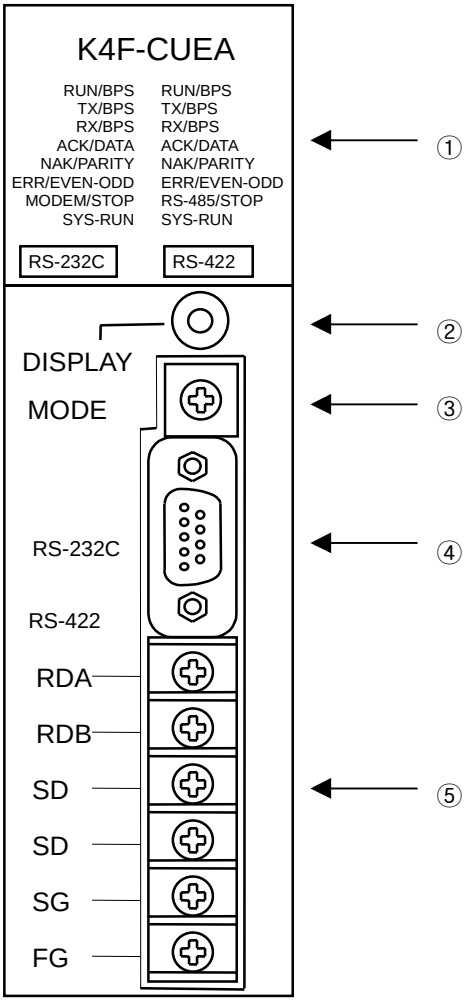
No	Name	Contents
①	LED displaying section	Indication of operating status of K3L-CU2A(see Appendix A1)
②	Mode switch	Setting of operation mode(see 4.1)
③	Connector RS-232C	Connector RS-232C for connection with external devices

3.3.2 K3F-CU4A



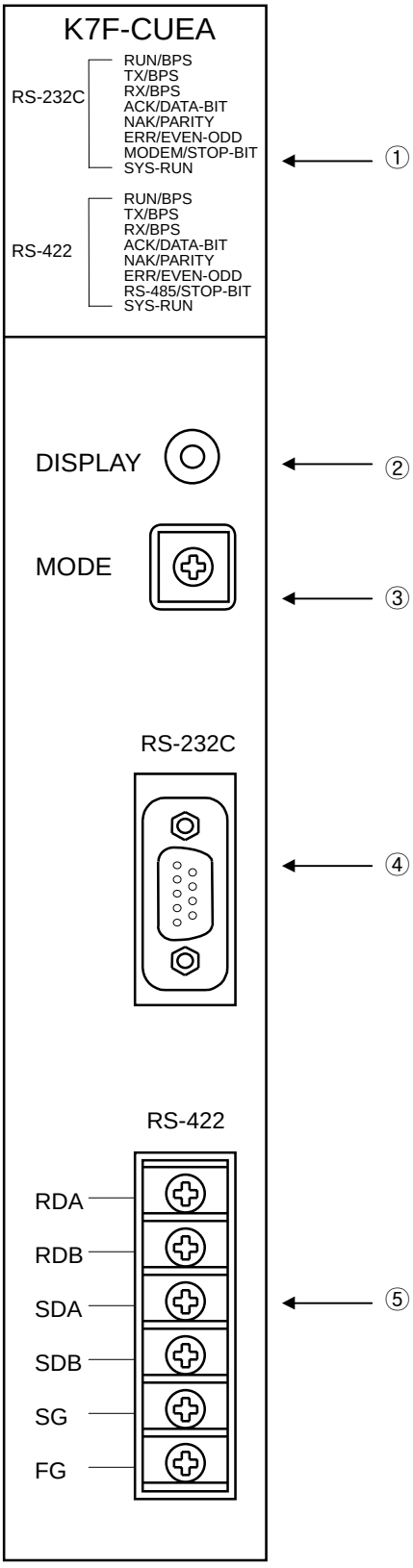
No	Name	Contents
①	LED displaying section	Indication of operating status of K3F-CU4A(see Appendix A)
②	Mode switch	Setting of operation mode(see 4.1)
③	Connector RS-422/485	Connector RS-232C for connection with external devices

3.3.3 K4F-CUEA



No.	Name	Contents
①	LED displaying section	Indication of operating status of K4F-CUEA(see Appendix A1)
②	Display switch	Switch for indication of parameter and station number (see Appendix A1)
③	Mode switch	Setting of operation mode(see 4.1)
④	Connector RS-232C	Connector RS-232C for connection with external devices
⑤	Connector RS-422/485	Connector RS-422/485 for connection with external devices

3.3.4 K7F-CUEA



No.	Name	Contents
①	LED displaying section	Indication of operating status of K7F-CUEA(see Appendix A1)
②	Display switch	Switch for indication of parameter and station number (see Appendix A1)
③	Mode switch	Setting of operation mode(see 4.1)
④	Connector RS-232C	Connector RS-232C for connection with external devices
⑤	Connector RS-422/485	Connector RS-422/485 for connection with external devices

3.4 Cable specifications

When communicate with RS-422 or RS-485 channel, twisted pair cable should be used in consideration of transmit distance and speed. The following table shows the recommended cable specification of communication cable. Please make sure use the recommended cable or equivalent cable complying with the following specifications.

- Type : Low capacitance LAN interface cable
- Catalog number : LIREV-AMESB
- Specification : 2P × 22AWG (D / 0.254 TA)
- Manufacturer : LG Cable Co. Ltd.

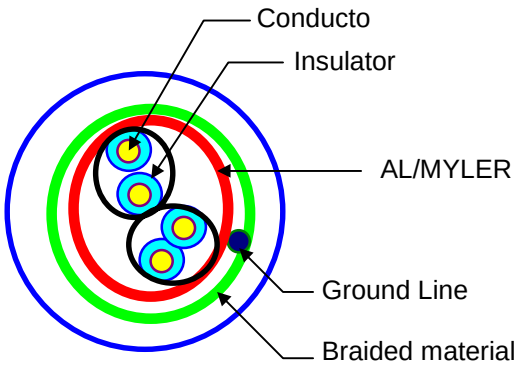
1) Electrical characteristics

Item	Unit	Characteristic	Test condition
Conductor resistance	Ω / km	59 or less	Normal condition
Dielectric strength	V / 1 min	Stands 1 minute at 500VDC	Normal condition
Insulation resistance	MΩ - km	1,000 or more	Normal condition
Electrostatic capacity	pF / m	45 or less	Frequency : 1kHz
Characteristic impedance	Ω	120 ± 12	Frequency : 10MHz

2) Appearance characteristics

Item			Solid cable	Standard cable
Conductor	No. of cores	pair	2	2
	Specification	AWG	22	22
	Composition	No. / mm	1 / 0.64	7 / 0.254
	Outer diameter	mm	0.64	0.76
Insulator	Thickness	mm	0.55	0.55
	Outer diameter	mm	1.64	1.76

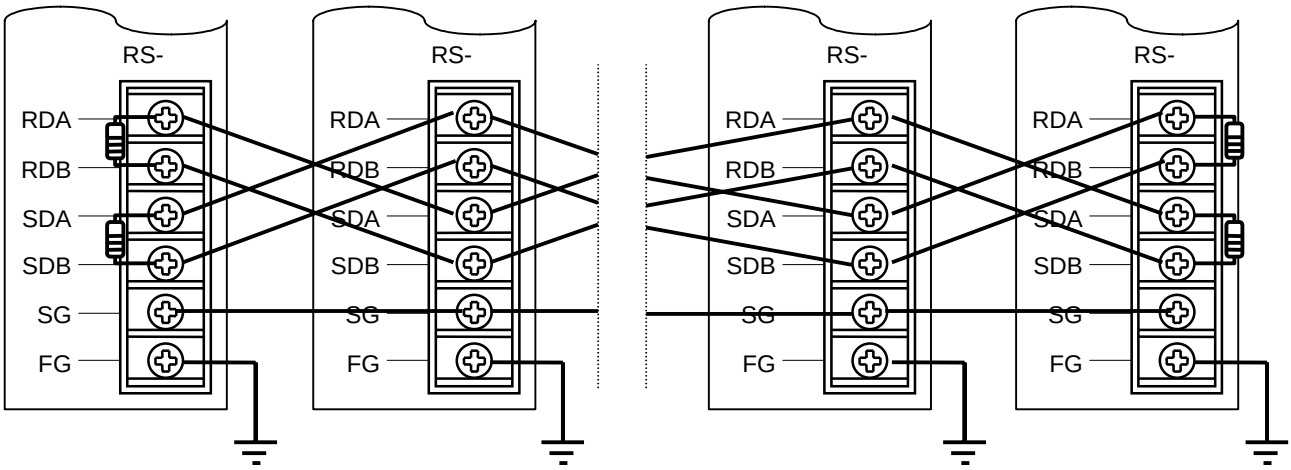
3) Structure of cable



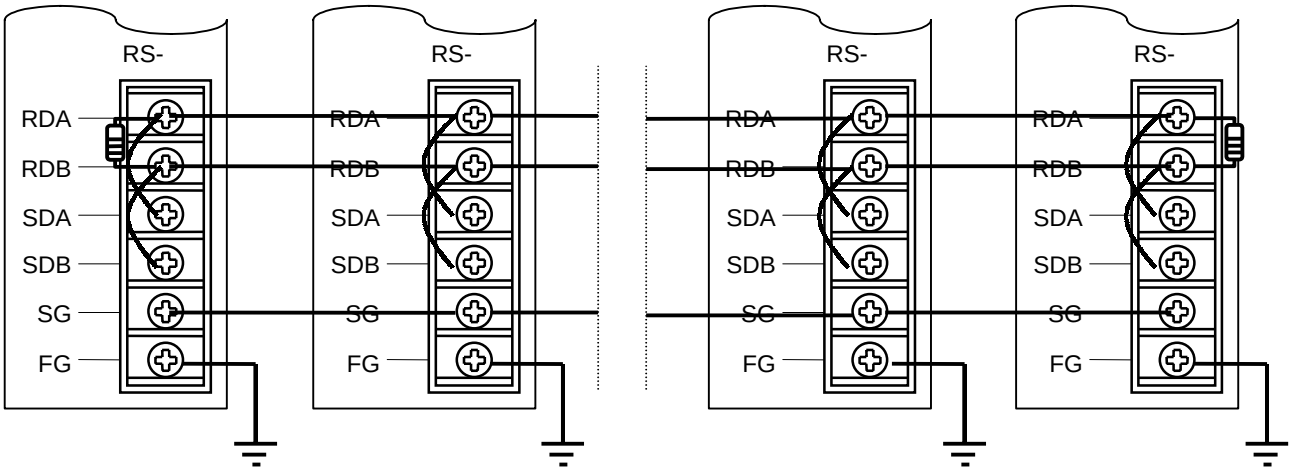
3.5 Terminal resistor

When communicate via RS-422 or RS-485 channel, terminal resistors should be added at the ends of network wiring. The terminal resistor prevents a distortion of signal caused from reflected wave of cable. The terminal resistor should have the same resistance with the characteristic impedance of cable. If you use the recommended cable or equivalent, please connect two 120Ω, 1/2W resistors at the ends of network.

3.5.1 RS-422 network



3.5.2 RS-485 network



Chapter 4 Operation of Cnet module

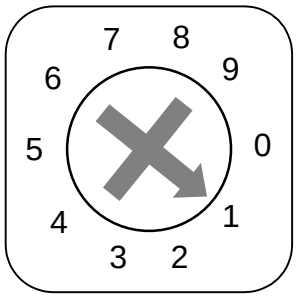
4 Operation of Cnet module

4.1 Operation mode setting

The operation mode of Cnet module is set by a rotary switch at the front panel of the module. The Cnet module will read the switch status and set the operation mode when the power is supplied. To change the operation mode of Cnet module, therefore, make sure to cycle the power of Cnet module after mode switch setting. (However, the on-line mode is added to the Cnet v2.0, and the operation mode can be changed while the power is supplied. Please refer chapter 4.3.3 for details)

The following tables show the operation mode according to the mode switch setting.

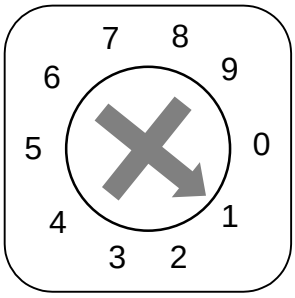
1) K7F-CUEA / K4F-CUEA

Mode switch	Switch position	Operation mode		Remarks
		RS-232C	RS-422	
	0	User-defined	User-defined	Interlocking mode [1]
	1	Dedicated	Dedicated	
	2	User-defined	User-defined	Stand-alone mode
	3	Dedicated	Dedicated	
	4	User-defined	Dedicated	Stand-alone mode [2]
	5	Dedicated	User-defined	
	6	KGL-WIN	User-defined	
	7	KGL-WIN	Dedicated	
	8	Loop-back	Loop-back	Self-diagnosis
		Flash memory write [3], [4]		Press the 'display' button at the power-on
	9	On-line [4]		On-line mode change

Remark

1) In the interlocking mode, the RS-232C channel operates as main channel and the RS-422 channel operates as the data path. The data structure of RS-422 channel is set as that of RS-232C channel.
2) In stand-alone mode, RS-232C and RS-422 channel can operates in different operation modes.
3) To enter into the flash memory write mode, press the 'display' button and turn on the power of Cnet module. (It doesn't need to hold the display button) Otherwise, the Cnet will operate as the loop-back mode.
4) Available if the O/S version of Cnet is v2.0 or later

2) K3F-CU2A / K3F-CU4A

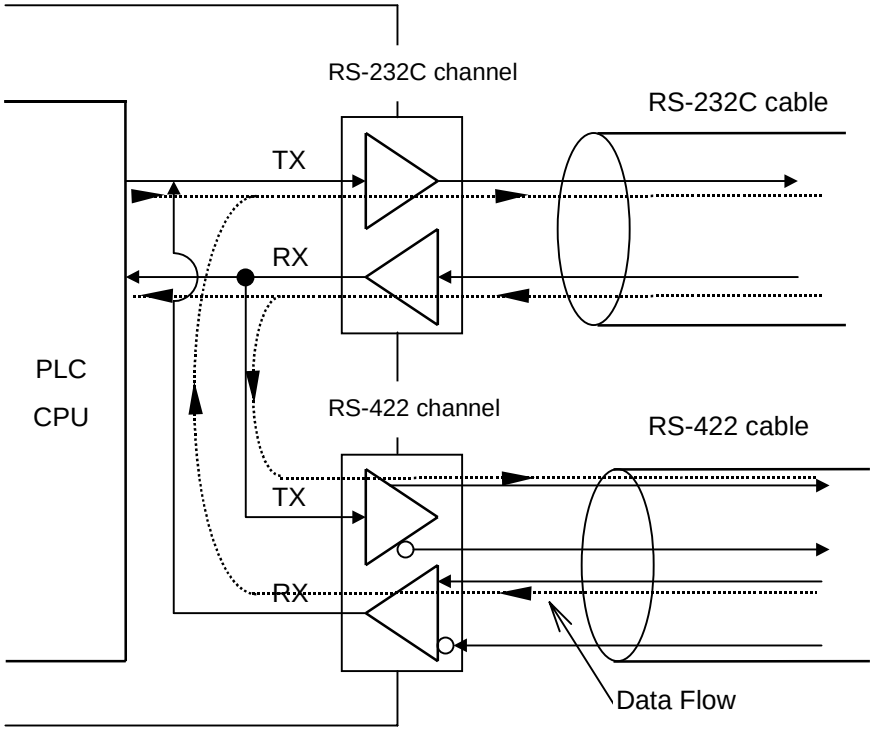
Mode switch	Switch position	Operation mode	Remarks
	0	User-defined	
	1	Dedicated	
	2	KGL-WIN	
	3	Loop-back	
	4	Reserved	Not used
	5		
	6		
	7		
	8	Flash memory write	Cnet v2.0 or later
	9	On-line	

4.1.1 Interlocking mode

In the interlocking mode, RS-232C and RS-422 channel operate being interlocked each other. The master channel is set as RS-232C channel automatically. The received data of RS-232C channel is sent via RS-422 channel, and the received data of RS-422 is sent via RS-232C channel.

The data exchange between CPU and Cnet module is done via RS-232C channel only, and the received data of RS-422 channel is directly re-sent via RS-232C channel, not stored in the Cnet module.

The following picture shows the data flow of interlocking mode.

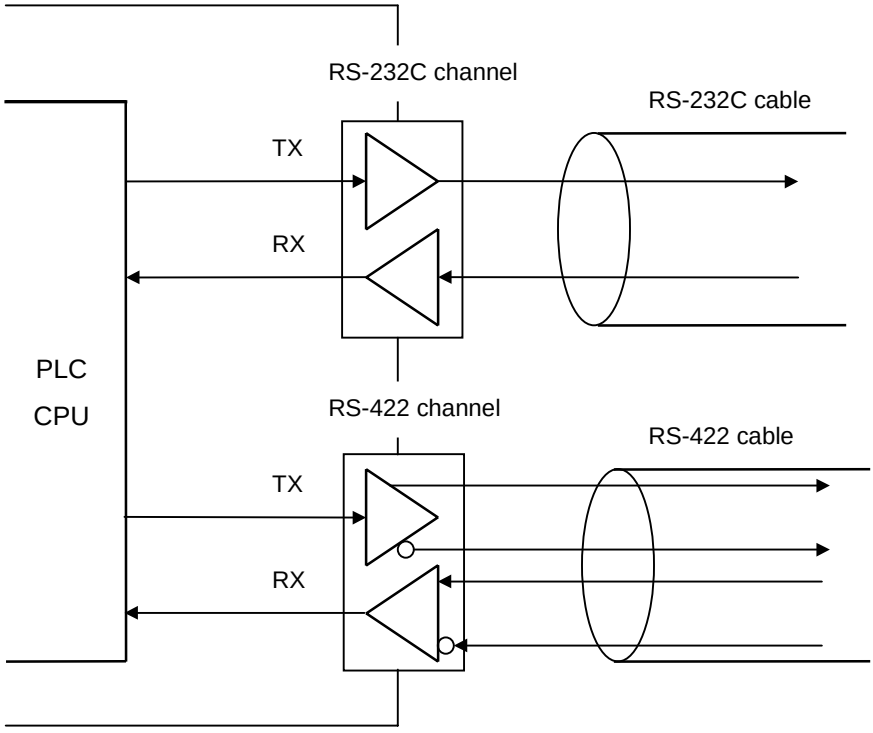


Remark

1. In the interlocking mode, the data structure is set as that of RS-232C channel. The setting of RS-422 channel is ignored.
2. In the interlocking mode, the modem can not be connected to the RS-232C channel. It is only available in the stand-alone mode. If the RS-232C channel is set as modem connection in the interlocking mode, the RS-232C channel operates as null modem mode.
3. K200S (K3F-CU2A / K3F-CU4A) does not support interlocking mode.

4.1.2 Stand-alone mode

In the stand-alone mode, RS-232C and RS-422 channels operate independently. Each channel can have different data structure, and it is possible to start/stop the operation of each channel separately. The data flow in the stand-alone mode is shown in the following figure.



Remark

1. The change of mode switch position is not effected until the power of Cnet is cycled. Please turn off the Cnet module whenever change the mode switch setting.
2. In stand-alone mode, the data structure of RS-232C and RS-422 channels should be written and downloaded separately with frame editor before starts the operation.

4.1.3 Loop-back mode

It is a special mode for self-diagnosis of Cnet module. In the loop-back mode, the Cnet module check if channels operate normally. Please refer the chapter 7.2 for details.

4.2 Pin connection

4.2.1 RS-232C channel

The RS-232C channel uses a 9-pin female connector for the interface between external device. The following table shows the pin-out of 9-pin connector of the Cnet module.

Pin No.	Name	Function	Signal direction	Description
			Cnet External device	
1	CD	Carrier detect	←	DTC reports the carrier detection to the DTE
2	RxD	Received data	←	Received data signal
3	TxD	Transmitted data	→	Transmitted data signal
4	DTR	Data terminal ready	→	DTE reports communication ready to the DTC
5	SG	Signal ground	↔	Ground pin for signal
6	DSR	Data set ready	←	DCE reports communication ready to the DTE
7	RTS	Request to send	→	DTE request data transmission to the DCE
8	CTS	Clear to send	←	DCE reports data transmission ready to the DTE
9	RI	Ring	←	DCE reports the ringing tone reception to the DTE

DTE : Data Terminal Equipment

DCE : Data Communication Equipment

The RS-232C channel can communicate through direct or modem connection. When communicate through modem, the ‘type’ of basic parameter should be set as ‘dial-up modem’ or ‘dedicated modem’ in the frame editor. When the Cnet module is directly connected to external device, the ‘type’ should be set as ‘null-modem’.

However, if the operation mode is interlocking mode, only null-modem type is available.

1) Pin connection with modem

The following table shows how to connect a modem to the RS-232C connector of Cnet module.

Cnet (9-pin)		Pin connection and signal direction	Modem (25-pin)	
Pin No.	Name		Pin No.	Name
1	CD	←	8	CD
2	RxD	←	3	RxD
3	TxD	→	2	TxD
4	DTR	→	20	DTR
5	SG	↔	7	SG
6	DSR	←	6	DSR
7	RTS	→	4	RTS
8	CTS	←	5	CTS
9	RI	←	22	RI

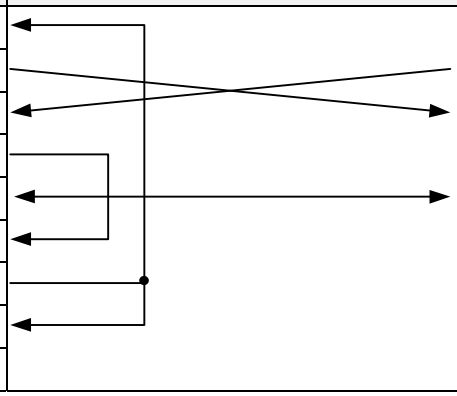
2) Pin connection of null-modem (direct connection)

In null-modem type, the connection can be divided into two types according to the handshake function.

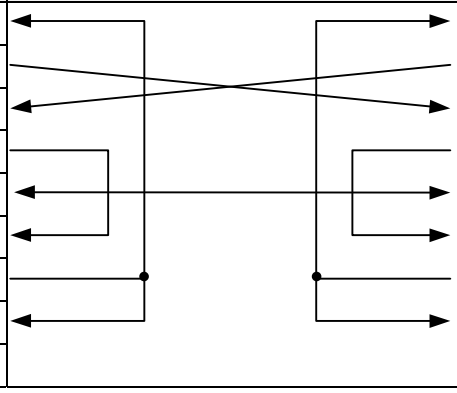
① If an external device uses CD signal (use handshake function), connect Cnet module and external device as following table.

Cnet (9-pin)		Pin connection and signal direction	External device (9-pin)	
Pin No.	Name		Pin No.	Name
1	CD	← →	1	CD
2	RxD	→	2	RxD
3	TxD	← →	3	TxD
4	DTR	→	4	DTR
5	SG	↔	5	SG
6	DSR	← →	6	DSR
7	RTS	→	7	RTS
8	CTS	← →	8	CTS
9	RI		9	RI

② If the external device does not use CD signal (no handshake function), connect the Cnet module and external device as following table. In general, personal computers are typical devices that don't care CD signal.

Cnet (9-pin)		Pin connection and signal direction	External device (9-pin)	
Pin No.	Name		Pin No.	Name
1	CD		1	CD
2	RxD		2	RxD
3	TxD		3	TxD
4	DTR		4	DTR
5	SG		5	SG
6	DSR		6	DSR
7	RTS		7	RTS
8	CTS		8	CTS
9	RI		9	RI

③ When connect two Cnet modules without handshake function, please connect as following table.

Cnet (9-pin)		Pin connection and signal direction	Cnet (9-pin)	
Pin No.	Name		Pin No.	Name
1	CD		1	CD
2	RxD		2	RxD
3	TxD		3	TxD
4	DTR		4	DTR
5	SG		5	SG
6	DSR		6	DSR
7	RTS		7	RTS
8	CTS		8	CTS
9	RI		9	RI

4.2.2 RS-422 / RS-485 channel

The RS-422/485 channel uses 6-pin terminal block to interface with external devices. The following table shows the pin-out of 6-pin terminal block.

Pin No.	Name	Signal direction	Function
		Cnet External devices	
1	RDA	←	Received data (+)
2	RDB	←	Received data (–)
3	SDA	→	Transmitted data (+)
4	SDB	→	Transmitted data (–)
5	SG	↔	Signal ground
6	FG		Frame ground

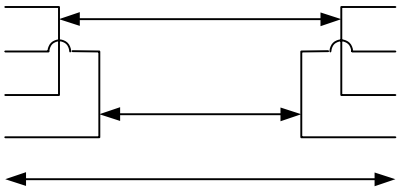
1) RS-422

To use RS-422 protocol, set the ‘type’ as ‘RS-422’ in basic parameter. The following table shows that how to connect Cnet module and external devices.

Cnet module		Connection and signal direction	External devices
Pin No.	Name		
1	RDA	↔	RDA
2	RDB	↔	RDB
3	SDA	↔	SDA
4	SDB	↔	SDB
5	SG	↔	SG
6	FG		FG

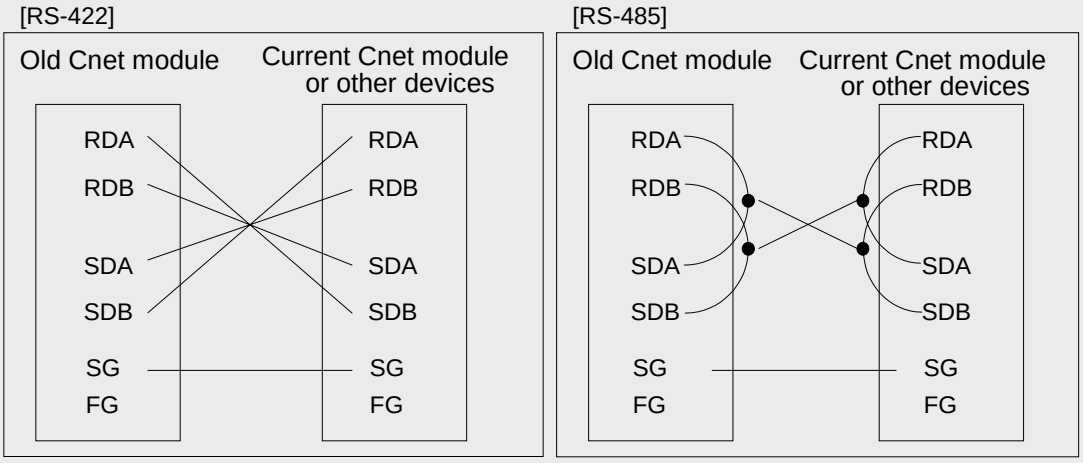
2) RS-485

To use RS-485 communication (multi-drop), select 'RS-485' in the 'type' of basic parameter setting. The following table shows the connection diagram of RS-485 network.

Cnet module		Connection and signal direction	External devices
Pin No.	Name		
1	RDA		RDA
2	RDB		RDB
3	SDA		SDA
4	SDB		SDB
5	SG		SG
6	FG		FG

Remark

Some old Cnet modules produced before March of 1997 may have different pin-out. The A (RDA, SDA) and B (RDB, SDB) are exchanged in those Cnet modules. Therefore, please connect as following figure when the old Cnet modules don't operate correctly.



4.3 Parameter setting

4.3.1 Setting items

The transmission specifications of Cnet module (data structure, baud rate, station number, etc.) are set with the 'basic parameter' of frame editor software. Therefore, all parameters should be set correctly and downloaded into the Cnet module before start communication. The content of parameters is stored in the built-in flash memory of Cnet module, and it is not cleared or changed until other parameters are downloaded by frame editor.

In the interlocking mode, the RS-422 channel does not need parameter setting because the setting of RS-232C channel is adopted to the RS-422 channel. In stand-alone mode, however, RS-232C and RS-422 channels should be set and downloaded separately.

The following table shows transmission specification of Cnet module.

Item		Setting value	Default value	Remark
Data structure	Data bit	7 or 8	8	In the interlocking mode, the RS-422 channel is set as that of RS-232C
	Stop bit	1 or 2	1	
	Parity	Even / Odd / None	None	
Baud rate		300 ~ 153,600[1)] bps	38,400 bps	
Mode	RS-232C channel	Dial-up modem, dedicated modem, null modem [2)]	Null modem	
	RS-422 channel	RS-422 / RS-485	RS-422	
Station number		0 ~ 31	0	

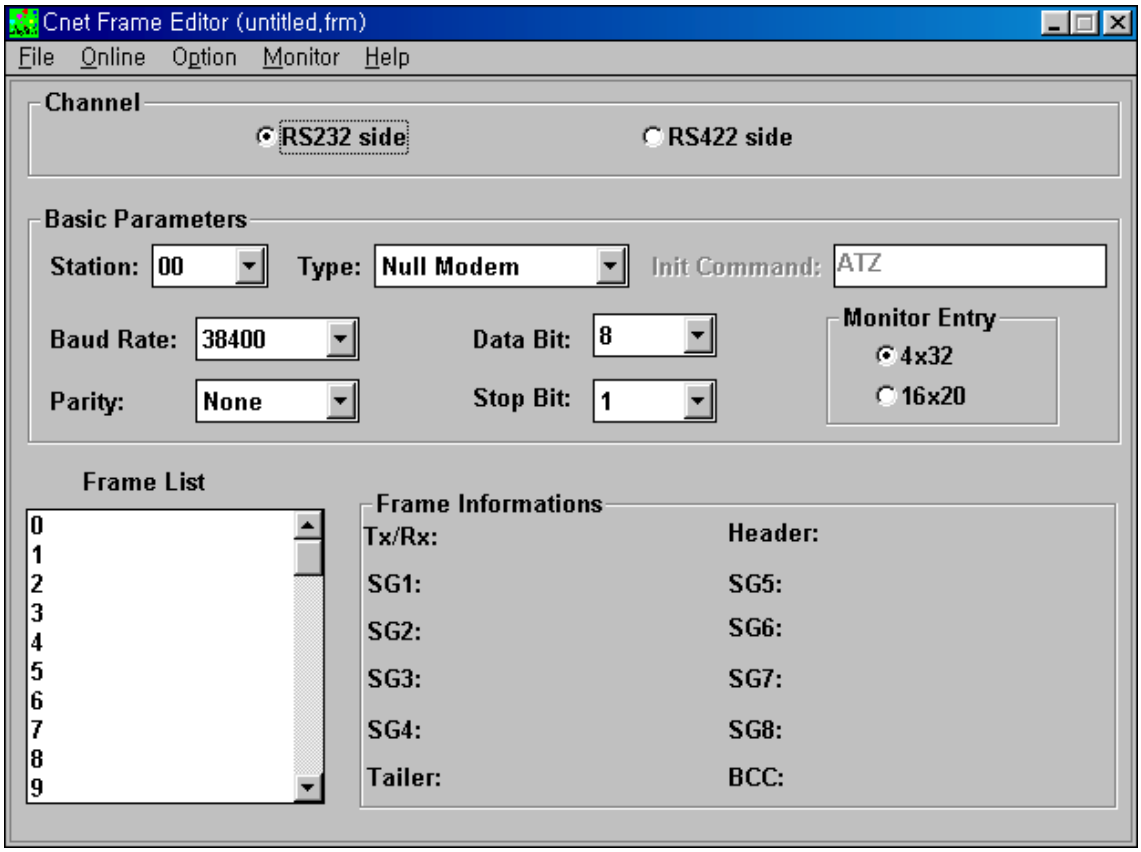
Remark

1) Only RS-422 channel of K300S and K1000S Cnet version 1.3 (or later) supports 76,800 and 153,600 bps. The Cnet module of K200S provides max. 38,400 bps.
2) In interlocking mode, the Cnet module will operate in null-modem mode even though the parameter is set as dial-up modem or dedicated modem

4.3.2 Procedure of setting

The frame editor is used for parameter setting of Cnet module.

1) Run the frame editor software.
2) The initial screen as following figure will appear.



3) Select a channel to be set. (RS-232 side or RS422 side)
4) Select the station number. (0 ~ 31)
5) Select the type of communication. Please refer the following table.

Channel	Type	Selection guide
RS-232C	Null-modem	To connect directly with a cable to an external device at near. (15m or less away from the Cnet module)
	Dial-up modem	To connect with modem to an external device at far-away place via a public telephone line.
	Dedicated modem	To connect with modem via a dedicated line.
RS-422	RS-422	To communicate in full-duplex mode (1:N network) with external devices which are within 500m
	RS-485	To communicate in half-duplex mode (multidrop network) with external devices which are within 500m

6) Input a modem initializing command if the ‘dial-up modem’ or ‘dedicated modem’ type is selected. The default command is ‘ATZ’, but other initializing command may be required according network condition. Please refer the following table.

Command	Operation	Description
ATZ	Modem initializing	Reset the modem as factory default status.
ATXn	Extended result code n = 0 : Start dialing after dial tone n = 3 : Start dialing after waiting as the specified time of S6 resistor.	If the modem is used with a private branch-exchanger system, ‘ATX3’ should be added to the initializing command. This command is not required if the modem doesn’t call outside.
ATMn	Modem speaker control n = 0 : Always turn off n = 1 : Turn off speaker after connection is completed n = 2 : Always turn on	
AT&Cn	Data carrier detect on/off n = 0 : Always turn on DCD function n = 1 : Turn on during on-line mode only	An asynchronous modem may output the ‘on-line’ massage while the modem is not connected. To fix this error, put ‘AT&C1’ into the initializing command.

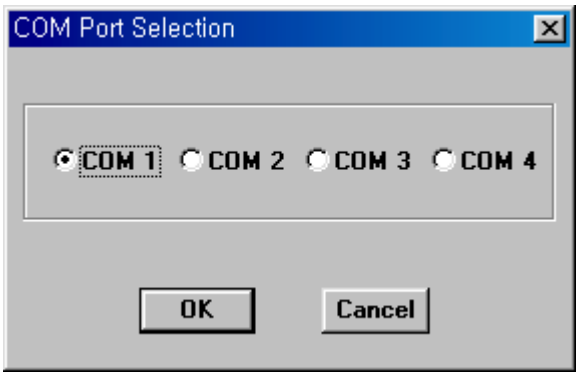
Remark

Each commands can be used in combination. For example, ‘ATX1’ and ‘ATM1’ commands can be used as ‘ATX1M1’.

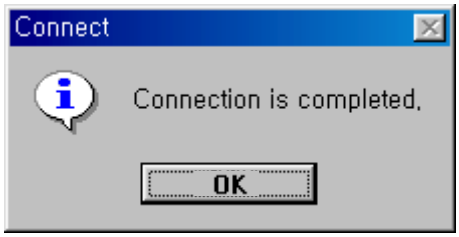
7) Set other parameters such as baud rate, data bit, stop bit, etc.

8) After parameter setting is finished, download parameters to the Cnet module by each channel. At first, connect the CPU module and PC with KGL-WIN cable. (Do not connect Cnet module with PC)

9) Choose ***Option – Port*** in menu, then the following screen will appear. Select the COM port that are connected to the KGL-Win cable, and press 'OK' button.

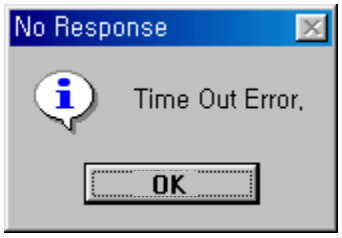


10) Choose ***Online – Connect*** in menu to connect frame editor to the CPU. If the connection is successful, the following massage will be displayed.



If the connection fails, there are two error messages according to the cause of failure.

① There is no response within a specified time. (Time-out error)

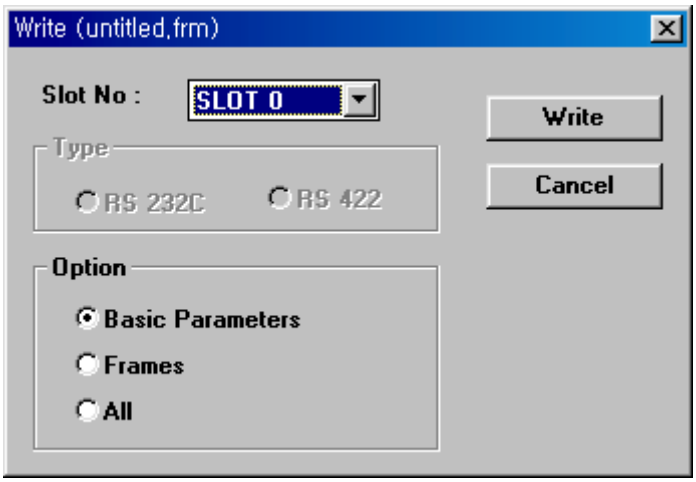


If the above message window is displayed, it means that PC and CPU module are not connected or the connection cable is bad. Please check the connection between PC and CPU module.

② The COM port doesn't work properly.

If the above message window is displayed, it means that there is a crash between the designated COM port and other device. It could be a peripheral such as mouse or a software that uses COM port such as KGL-WIN. Please check the COM port configuration, and remove the crashing device or software.

11) After the connection is completed, choose ***Online – Write*** in menu to write parameters to the Cnet module.

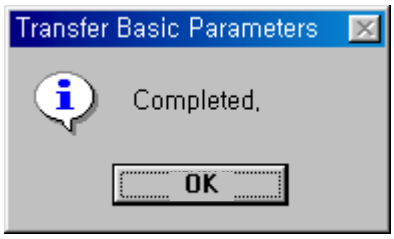


Choose the slot number at which the Cnet module is mounted, and select 'Basic Parameters' in the option. Press 'Write' button to start downloading.

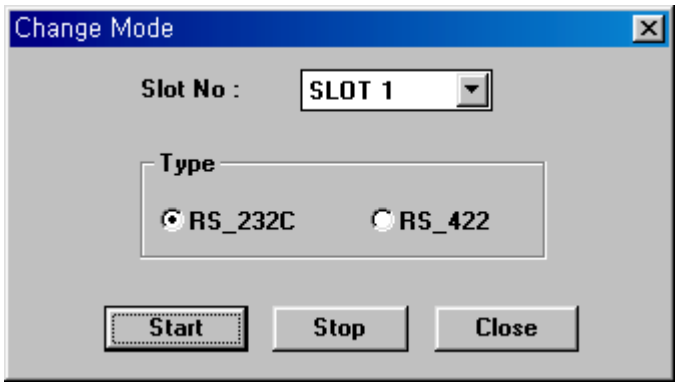
Remark

If there is a user-defined frame to be downloaded, select 'Frames' in option items. Then only the user-defined frame will be downloaded to Cnet module. If the 'All' item is selected, both of parameters and user-defined frame will be downloaded.

The following message will appears when the parameter is downloaded successfully.



12) The Cnet module will stop operation automatically after the parameters download is completed. Therefore, the Cnet module should be started by user. To start the Cnet module, choose Online – Change Comm. in menu, then select the slot number and channel type (RS-232C or RS-422). Press the 'start' button to start the Cnet operation.



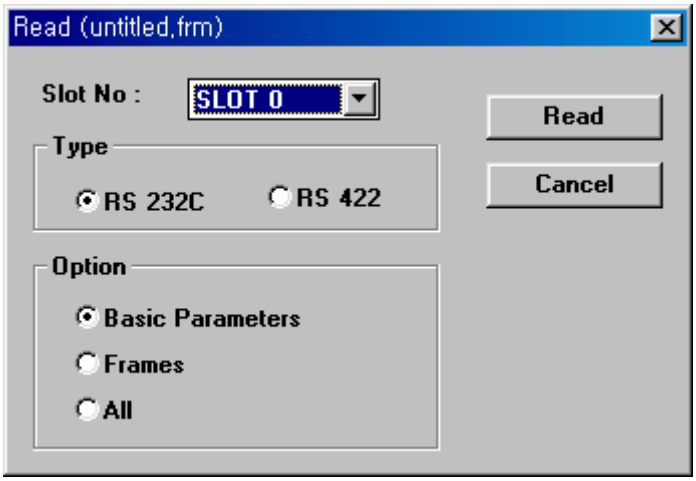
4.3.3 Read parameters from Cnet

There are two ways to read the parameter setting of Cnet module, by the parameter reading function of frame editor and by LED display of Cnet module.

In this chapter, it will described how to read parameters from Cnet module by frame editor. Please refer the chapter 3.1.2 'LED specification' about how to read parameter setting by LED display of Cnet module.

1) Choose Online – connect to connect the frame editor to the CPU module.

2) After the connection is completed, choose Online – Read in menu. The following message window will appear.



Select the slot number at which the Cnet module is mounted, channel to be read (RS-232C or RS-422), and what information to be read (parameter, frames, or both). Then press 'Read' button and the read data will be displayed.

4.4 On-line mode

The Cnet module of which O/S version is v2.0 or later supports the on-line mode. In the on-line mode, use can change the operation mode of Cnet module via frame editor software, and it doesn't need to cycle the power of Cnet module after changing the mode setting switch. Therefore, it is possible to change operation mode while the Cnet module is running.

The features of on-line mode are as following;

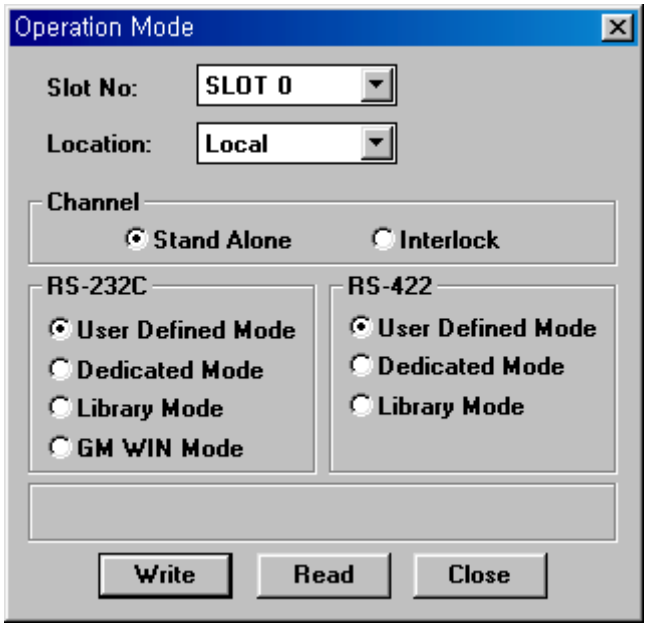
- Mode switch position of on-line mode : 9
- Set the operation mode separately for each channels (RS-232C, RS-422)
- User can change the operation mode of local / remote[1)] Cnet module
- The operation mode setting is stored in built-in flash memory, so the operation mode is kept while the power of Cnet module is off.
- Supports a new operation mode, 'Library mode', and this operation mode can be entered in the on-line mode only.

4.4.1 Operation mode change of local Cnet module

When the operation mode switch of a local Cnet module is set as '9', the operation mode of local Cnet module can be changed by the online menu of frame editor (version 2.0 or later). In case of local connection, user can change the operation mode of Cnet module to all operation modes which the Cnet module supports, and stand-alone/interlocking modes. The following example shows how to change operation mode of Cnet module mounted on slot 0.

1) Position the mode setting switch of Cnet module at '9', and turn the power on.

2) Connect the frame editor (version 2.0 or later) to the CPU by choosing ***Online – Connect.*** After the connection is completed, choose ***Online – Mode*** in menu. The following screen will be displayed.

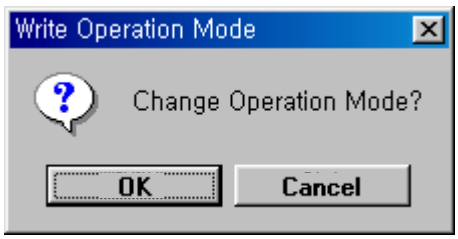


3) Set the slot number and location as ‘slot 0’ and ‘local’.

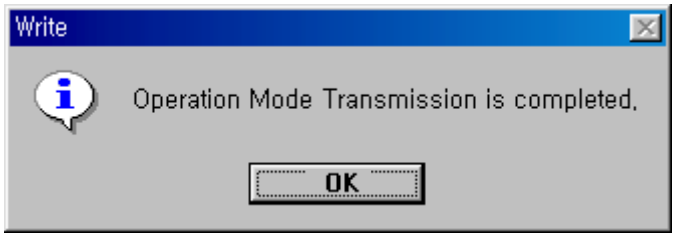
4) Select ‘stand-alone’ or ‘interlock’ mode. If you choose the interlock mode, RS-422 channel will be inactivated.

5) If the K200S Cnet module (K3F-CU2A or K3F-CU4A) is connected, only one channel (RS-232C or RS-422) is available according to the module type.

6) After the setting is finished, press the ‘Write’ button. Then the following confirmation message window will appear.



7) If the operation mode is changed successfully, the following message window is displayed.



8) The Cnet module v2.0 (or later) supports a 'Library Mode'. In library mode, the Cnet module operates according to a library that are downloaded to the Cnet module. Please refer the chapter 6.1.7 for details.

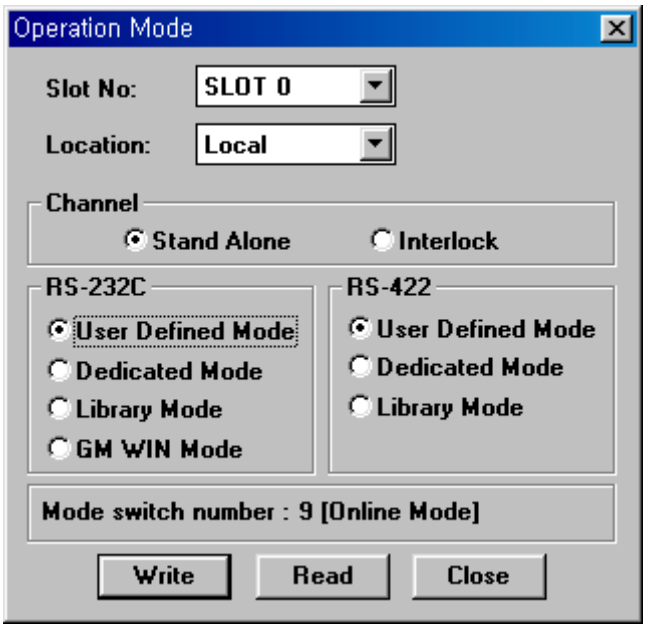
Caution

Make sure to download a library file to the Cnet module before change the operation mode to the library mode. If the operation mode is changed to library mode without downloaded library, the Cnet module will malfunction. It will not operate normally until a library is downloaded at the flash memory write mode.

9) The downloaded operation mode is stored in flash memory, and the Cnet module will start with the previously downloaded operation mode when it is turned on.

10) The downloaded operation mode is valid only when the mode setting switch is at '9' position. Otherwise, the Cnet module operates with the mode designated by switch setting.

11) To read the operation mode of Cnet module, choose the slot number and press the 'Read' button. The following screen will be displayed after reading is completed.



12) The operation mode reading is available in all operation modes of Cnet, except 'Loop-back' and 'Flash memory write' mode.

Remark

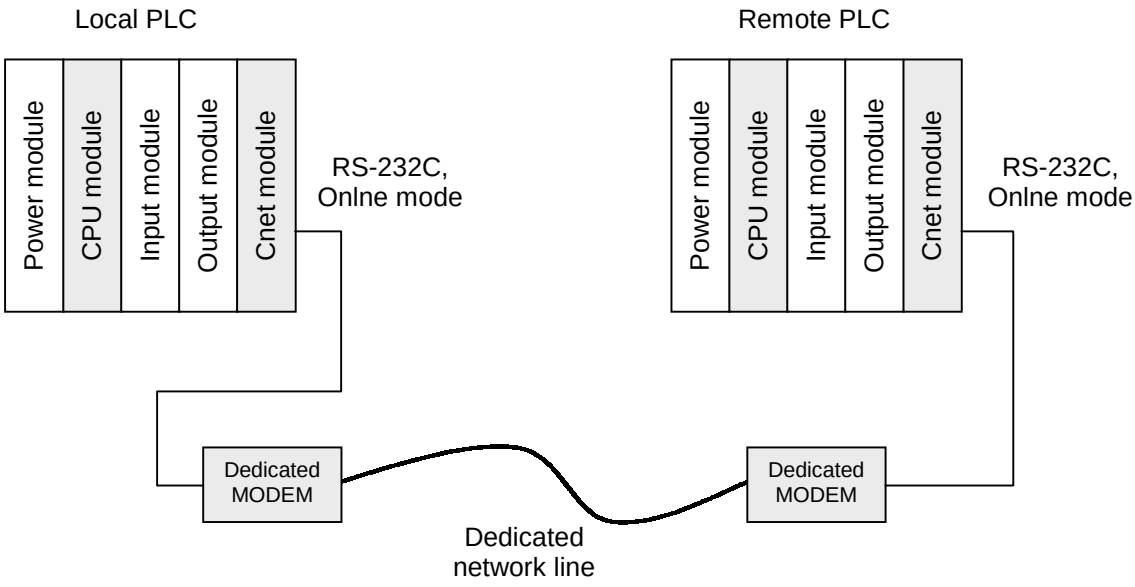
The Cnet module will stop operation about 1 second after the operation mode is changed.

4.4.2 Operation mode change of remote Cnet module

It is available to change the operation mode of a remote Cnet module connected to the local Cnet module via RS-232C channel. In general, this function is used to edit the sequence program and change operation mode of a CPU in the distance. (Change the operation mode of Cnet module to KGL-WIN mode → Connect KGL-WIN to the remote CPU by remote connection (depth 1) → Change the remote CPU to STOP mode → Edit program → Change the remote CPU to RUN mode → Change the operation mode of remote Cnet module to previous mode)

- Both of local and remote Cnet modules should be at the online mode.
- Only RS-232C connection is available. If two Cnet modules are connected via RS-422/485 channel, operation mode change is not available.
- It is available to read the operation mode of remote Cnet module.
- After the operation mode is changed, the Cnet module will stop about 1 second, then restart operation in the new operation mode.
- The RS-232C channel setting of two Cnet modules (local and remote) should be same.
- The version of Cnet O/S and frame editor must be v2.0 or later.

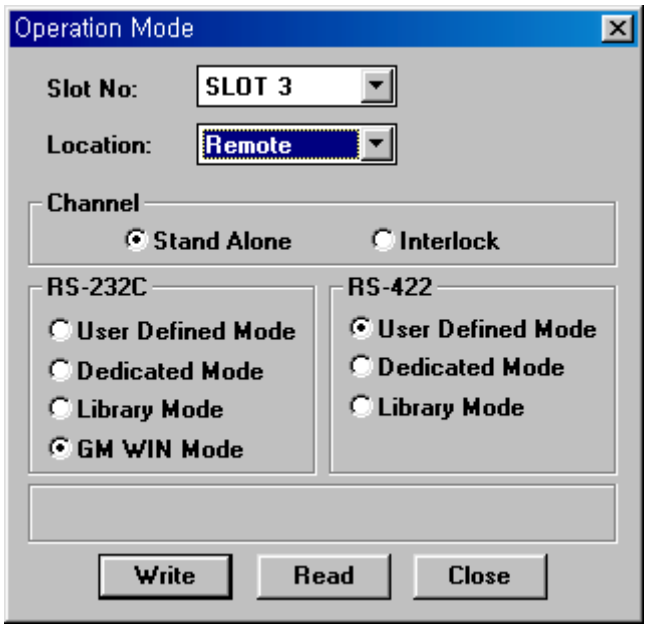
The following figure shows an example of system configuration.



The procedure to change the operation mode of remote Cnet module is as following;

1) Set the operation mode switch of local and remote Cnet module at the '9' position (online mode) and turn on the power of both systems.

2) Check the RS-232C communication between local and remote Cnet module. If they operates well, connect the frame editor to the CPU module of local system and then choose ***Online – Mode*** in menu of frame editor. (Refer the chapter 4.4.1 for details) The following screen will be displayed.



3) Select the slot number at which the local Cnet module is mounted. (Do not select the slot number of remote module). Set the location as 'Remote', and set the operation mode to be downloaded to the remote Cnet module.

4) After setup is finished, press 'Write' button to change the operation mode of remote Cnet module.

4.4.3 Instructions for dedicated mode (read/write)

The Cnet module of which O/S is 1.7 or earlier operates as only slave station in dedicated mode. When two MASTER-K Cnet modules communicate, therefore, one Cnet module set as master station and another module set as slave station. Then the master module should be set as user-defined mode, and download a LGIS's dedicated protocol written with frame editor.

With the Cnet v2.0 or later, Cnet module can operate as master station in the dedicated mode. Therefore, only basic parameter setting is required when two MK Cnet modules communicate each other. (No protocol downloading).

The 'Write' and 'Read' instructions are used for dedicated communication between MK Cnet modules, and have following features.

- Supports independent programming for RS-232C and RS-422 channel
- Read / write multiple blocks (max. 110 bytes) is available by using continuous read / write instruction of dedicated protocol.
- The communication status is stored at the designated memory area.

Remark

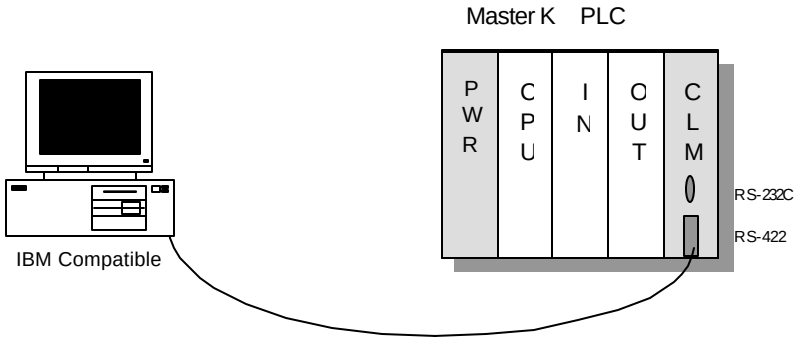
1. When a master station communicates with multiple slave stations via RS-422 channel, write sequence program as each instruction does not execute at the same time. Otherwise, the transmitted / received data may be conflicted.
2. To use 'Read' and 'Write' instruction, the O/S of master station should be v2.0 or later. However, the O/S of slave station can be 1.7 or earlier.
3. Both of RS-232C channel of master and slave station should be set as the dedicated mode.

Chapter 5 System configuration

5 System configuration

5.1 1:1 connection (Dedicated protocol)

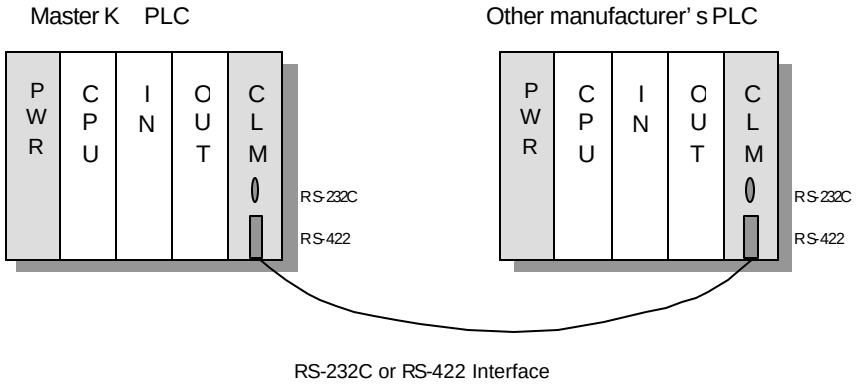
The following figure shows the example of system configuration when the Cnet module is connected to external device (computer, etc.) via RS-232C or RS-422 interface.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC	K7F-CUEA	3	0 ~ 31

5.2 1:1 connection (User-defined protocol)

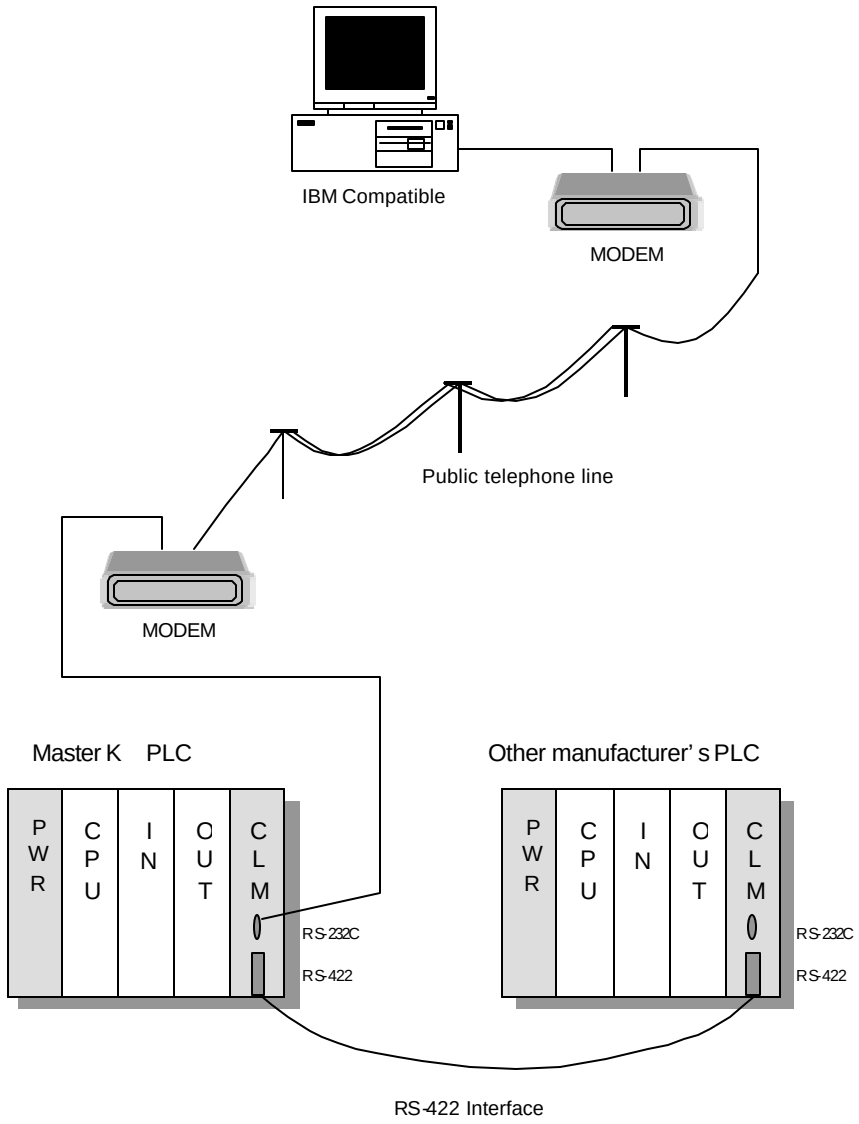
The following figure shows the example of system configuration when the Cnet module connected to the other manufacturer's PLC system. The Cnet should be set as the user-defined mode, and the protocol of other manufacturer' s PLC should be downloaded to the Cnet module.



Network devices			
Type	Device name	Mode setting	Station number
MASTER-K PLC	K7F-CUEA	2	0 ~ 31
Other manufacturer' s PLC	–	–	–

5.3 1:2 connection (User-defined protocol, Modem)

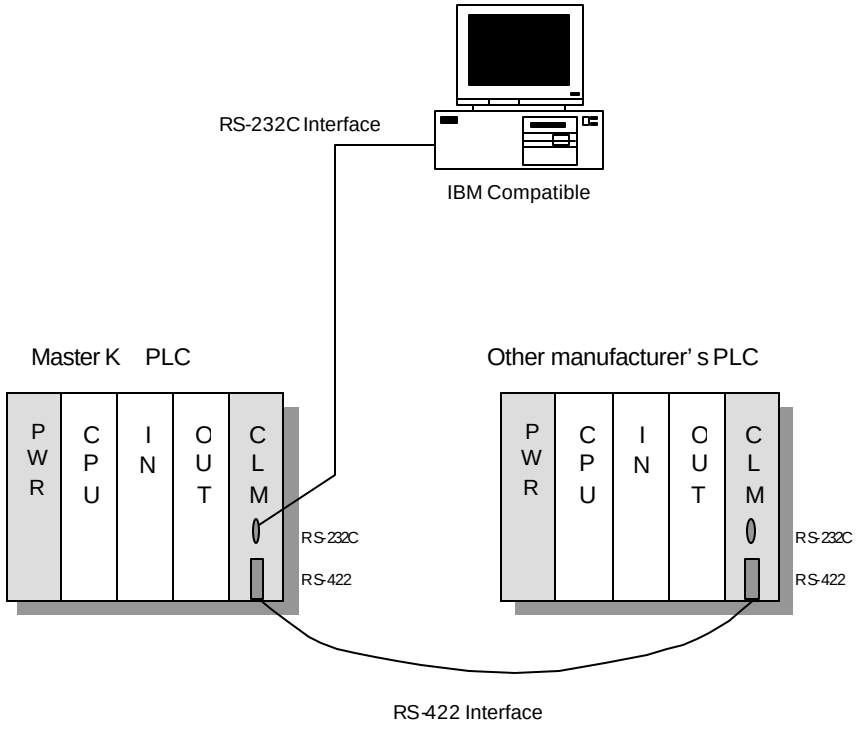
The following figure shows the example of system configuration when the Cnet module connected to the external device via RS-232C channel, and to the other manufacturer's PLC system via RS-422 channel. The Modem is used for long-distance RS-232C network.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC	K7F-CUEA	2	0 ~ 31
Other manufacturer's PLC	–	–	–

5.4 1:2 connection (User-defined, RS-232C)

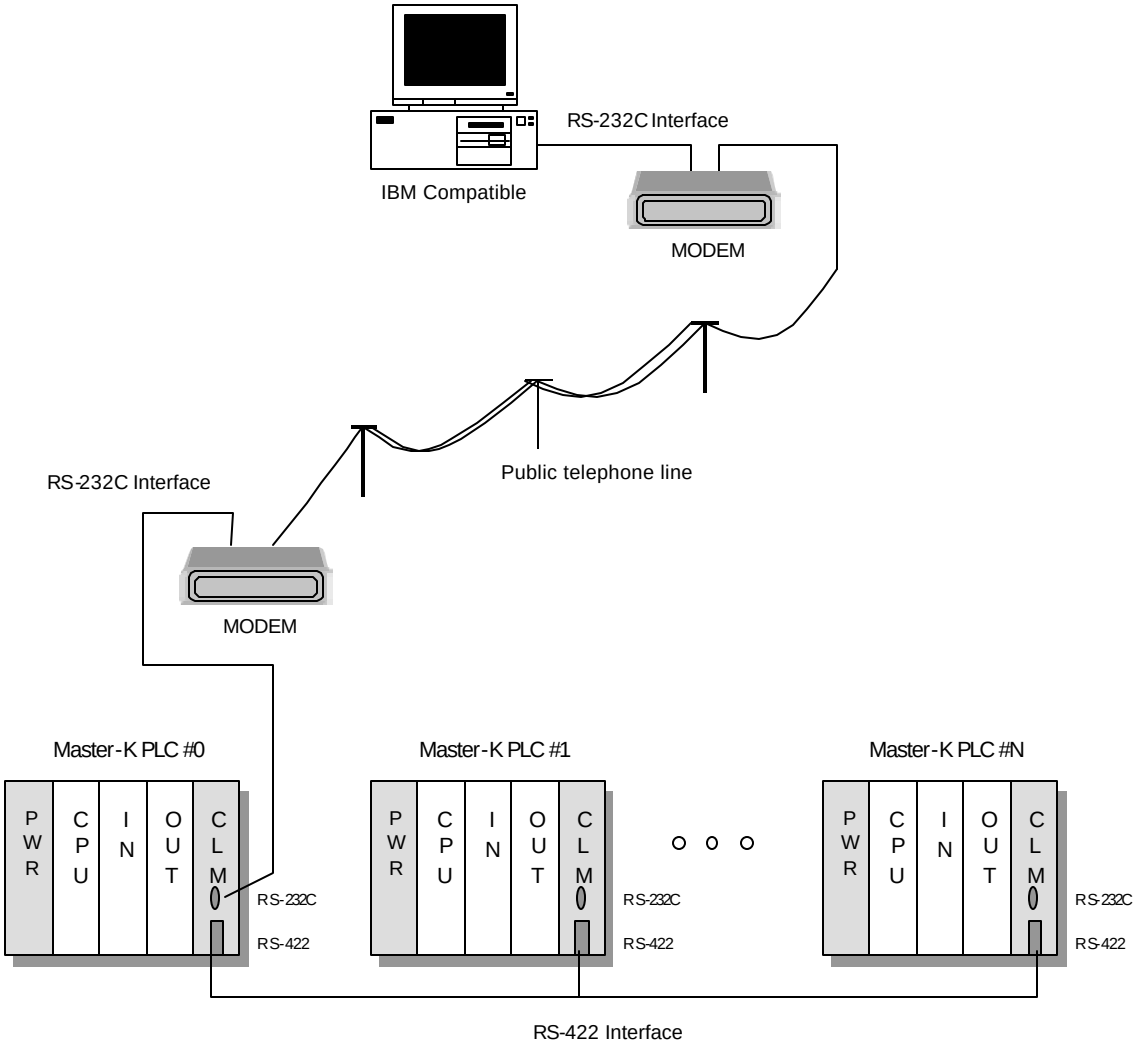
The following figure shows an example of system configuration when the Cnet module is connected to the external device via RS-232C channel and to the other manufacturer's PLC via RS-422 channel.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC	K7F-CUEA	5	0 ~ 31
Other manufacturer's PLC	–	–	–

5.5 1:N connection (Dedicated, Modem)

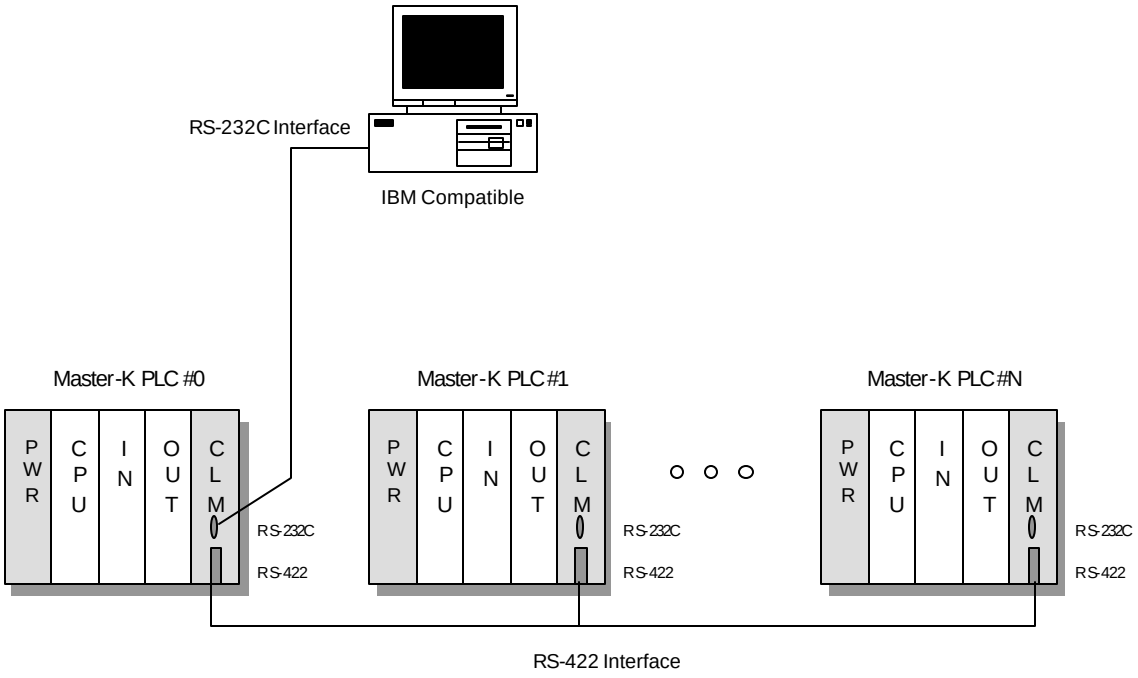
The following figure shows an example of system configuration when the Cnet module is connected to the external device via RS-232C channel, and to other MK Cnet modules via RS-422 channel. Two modems are used for long-distance RS-232C communication.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC # 0	K7F-CUEA	3	0
MASTER-K PLC # 1	K7F-CUEA	3	1
⋮	⋮	⋮	⋮
MASTER-K PLC # N	K7F-CUEA	3	31(h1F)

5.6 1:N connection (Dedicated, RS-232C)

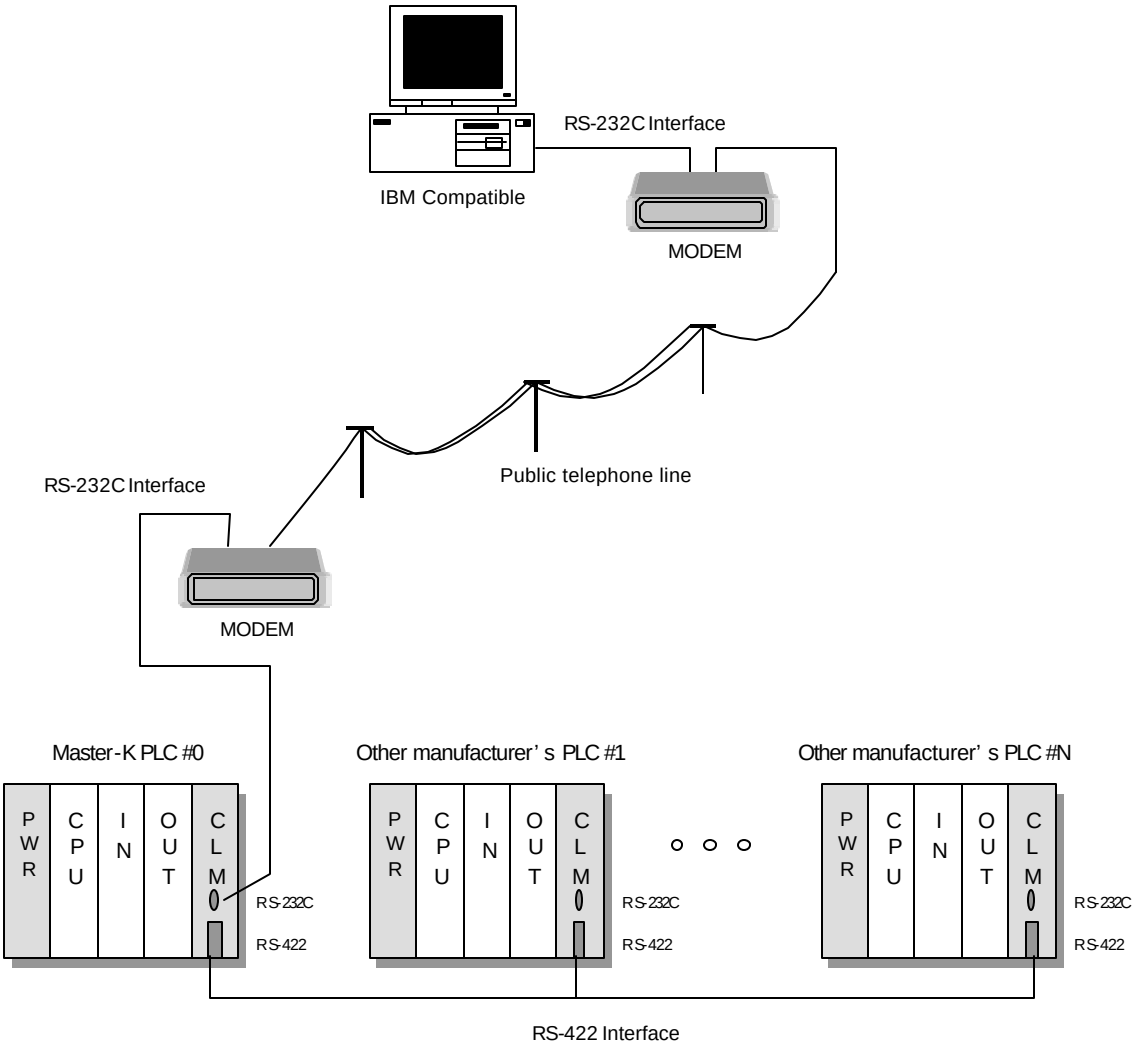
The following figure shows an example of system configuration when the Cnet module is connected to the external device via RS-232C channel, and to other MK Cnet modules via RS-422 channel.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC # 0	K7F-CUEA	3	0
MASTER-K PLC # 1	K7F-CUEA	3	1
⋮	⋮	⋮	⋮
MASTER-K PLC # N	K7F-CUEA	3	31(h1F)

5.7 1:N connection (User-defined, MODEM)

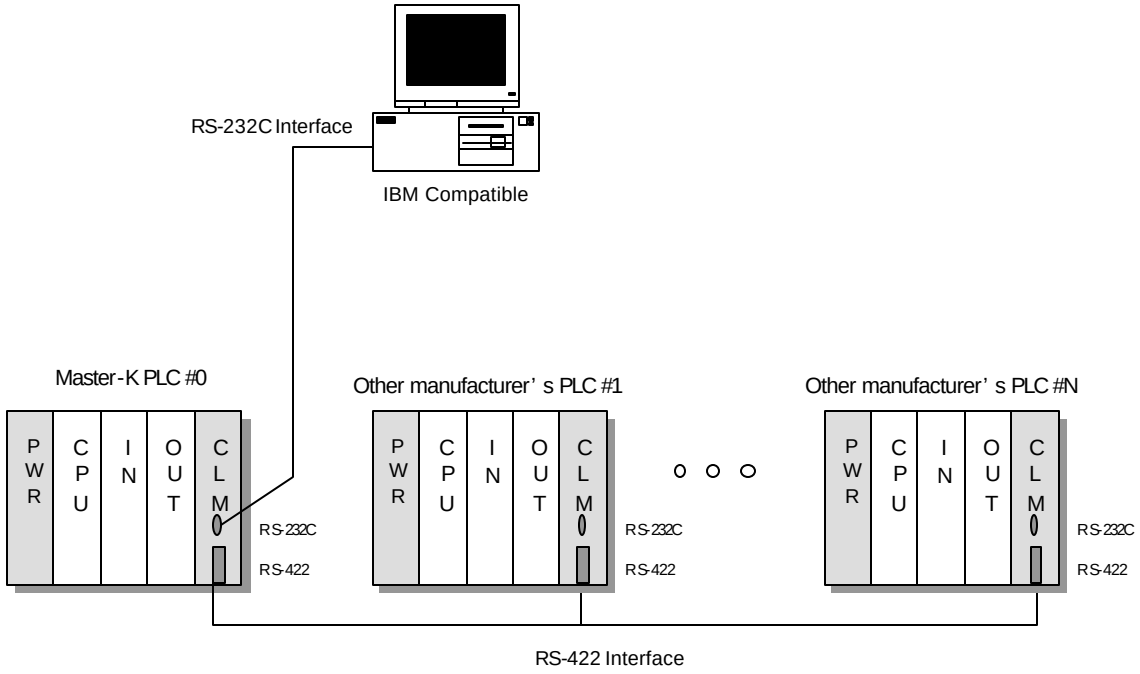
The following figure shows an example of system configuration when the Cnet module is connected to the external device via RS-232C channel, and to other manufacturer's PLCs via RS-422 channel. Two modems are used for long-distance RS-232C communication.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC # 0	K7F-CUEA	5	0 ~ 31
Other manufacturer's PLC # 1	–	–	–
⋮	⋮	⋮	⋮
Other manufacturer's PLC # N	–	–	–

5.8 1:N connection (User-defined, RS-232C)

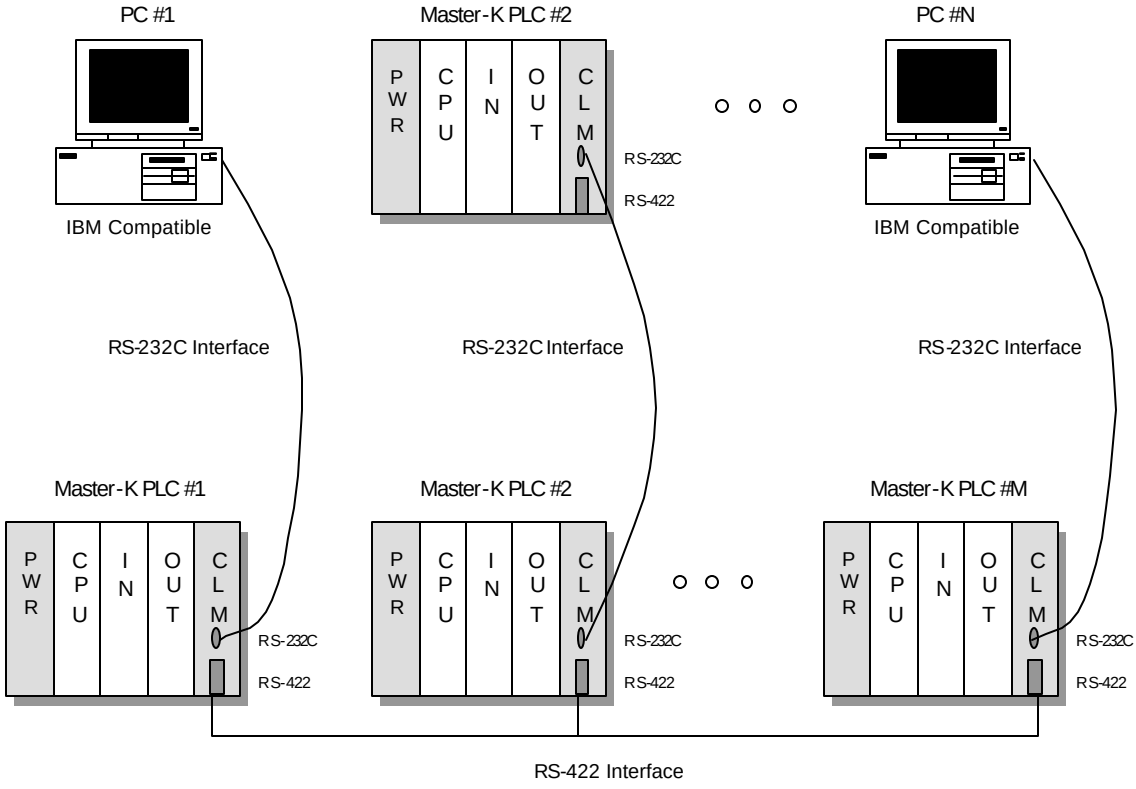
The following figure shows an example of system configuration when the Cnet module is connected to the external device via RS-232C channel, and to other manufacturer's PLCs via RS-422 channel.



Network devices			
Type	Device name	Mode setting	Station number
PC	Built-in RS-232C	–	–
MASTER-K PLC # 0	K7F-CUEA	5	0 ~ 31
Other manufacturer's PLC # 1	–	–	–
⋮	⋮	⋮	⋮
Other manufacturer's PLC # N	–	–	–

5.9 N:M connection (Dedicated)

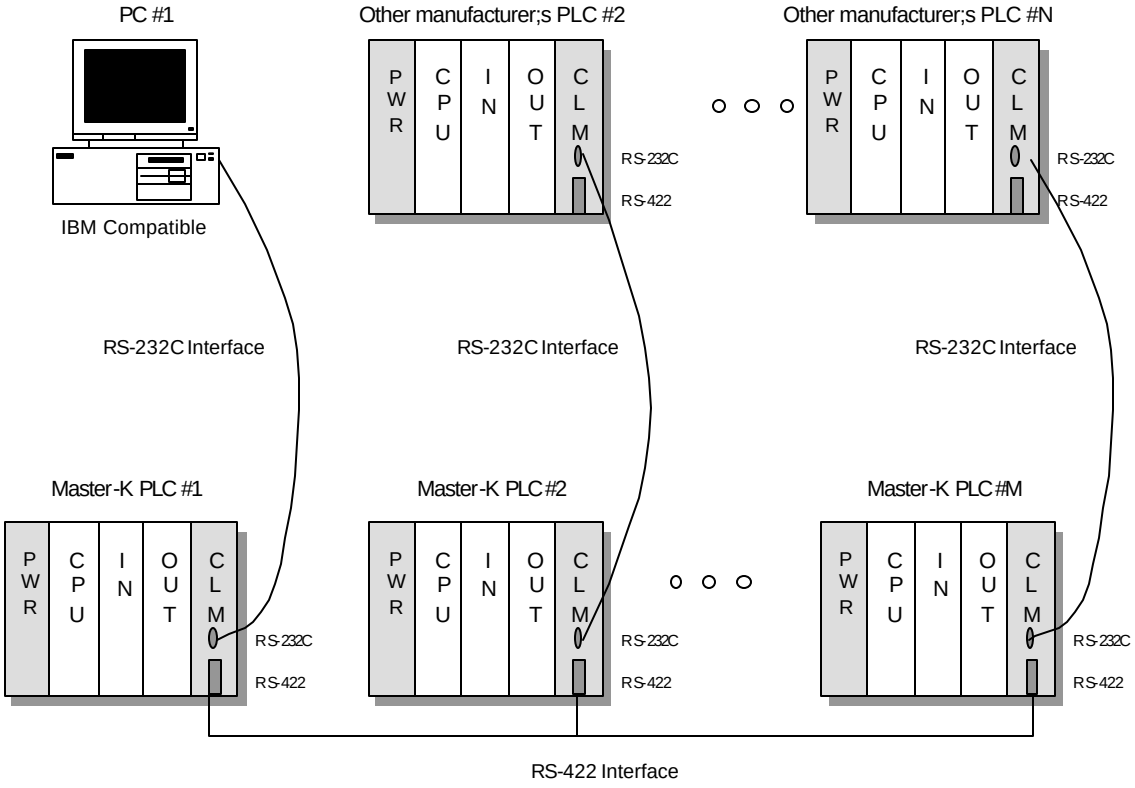
The following figure shows an example of system configuration when multiple MK Cnet modules are connected via RS-422 channel, and each of them are connected to external device via RS-232C channel.



Network devices			
Type	Device name	Mode setting	Station number
PC # 1	Built-in RS-232C	–	–
MASTER-K PLC # 2	K7F-CUEA	3	1
⋮	⋮	⋮	⋮
PC # N	Built-in RS-232C	–	–
MASTER-K PLC # 1	K7F-CUEA	5	0
MASTER-K PLC # 2	K7F-CUEA	3	1
⋮	⋮	⋮	⋮
MASTER-K PLC # M	K7F-CUEA	5	31(h1F)

5.10 N:M connection (User-define)

The following figure shows an example of system configuration when multiple MASTER-K Cnet modules are connected via RS-422 channel, and each modules are connected to the external device or other manufacturer's PLC via RS-232C channel.



Network devices			
Type	Device name	Mode setting	Station number
PC # 1	Built-in RS-232C	–	–
Other manufacturer' s PLC # 2	–	–	–
⋮	⋮	⋮	⋮
Other manufacturer' s PLC # 3	–	–	–
MASTER-K PLC # 1	K7F-CUEA	2	1
MASTER-K PLC # 2	K7F-CUEA	2	2
⋮	⋮	⋮	⋮
MASTER-K PLC # M	K7F-CUEA	2	31(h1F)

Chapter 6 User-defined communication

6 User-defined communication

6.1 Introduction

Because of the difference between the protocols of each manufacturer's communication module, it is impossible to build a network system that the MASTER-K Cnet module and other manufacturer's communication module communicate with their own protocol.

In order to communicate the other communication device, the MASTER-K Cnet module should have the protocol of the device to communicate with.

The frame editor is software used for writing a user-defined protocol and downloading it to the MK Cnet module. Each user-defined protocols (hereafter, call it as Frame) have a names, and they are used in a sequence program with SND and RCV instructions.

In this chapter, it is described how to use the frame editor software package and SND / RCV instructions.

6.2 Functions and usage of frame editor

The frame editor is a software package that is used for writing and downloading a user-defined protocol. It has the following major functions;

- Basic parameter setting : Define the communication specification of Cnet module
- Frame editing : Define a user-defined protocol
- Monitoring : Supervise the status of communication network

The basic parameter and frame can be read (upload) and write (download) independently for each channels (RS-232C, RS-422/485).

A procedure to communicate with an user-defined protocol is as following;

① Basic parameter setting
② Write an user-defined protocol (send / receive frame)
③ Download send/receive frame to the Cnet module
④ Change the operation mode of Cnet module to RUN mode
⑤ Write a sequence program for communication (SEND/RECV instructions) with KGL-WIN software.
⑥ Download the sequence program to the CPU
⑦ Change the CPU to RUN mode

6.2.1 Menu and screen configuration

1) Screen configuration

The figure 6.1 shows an initial screen of frame editor, which firstly appears when the frame editor is executed

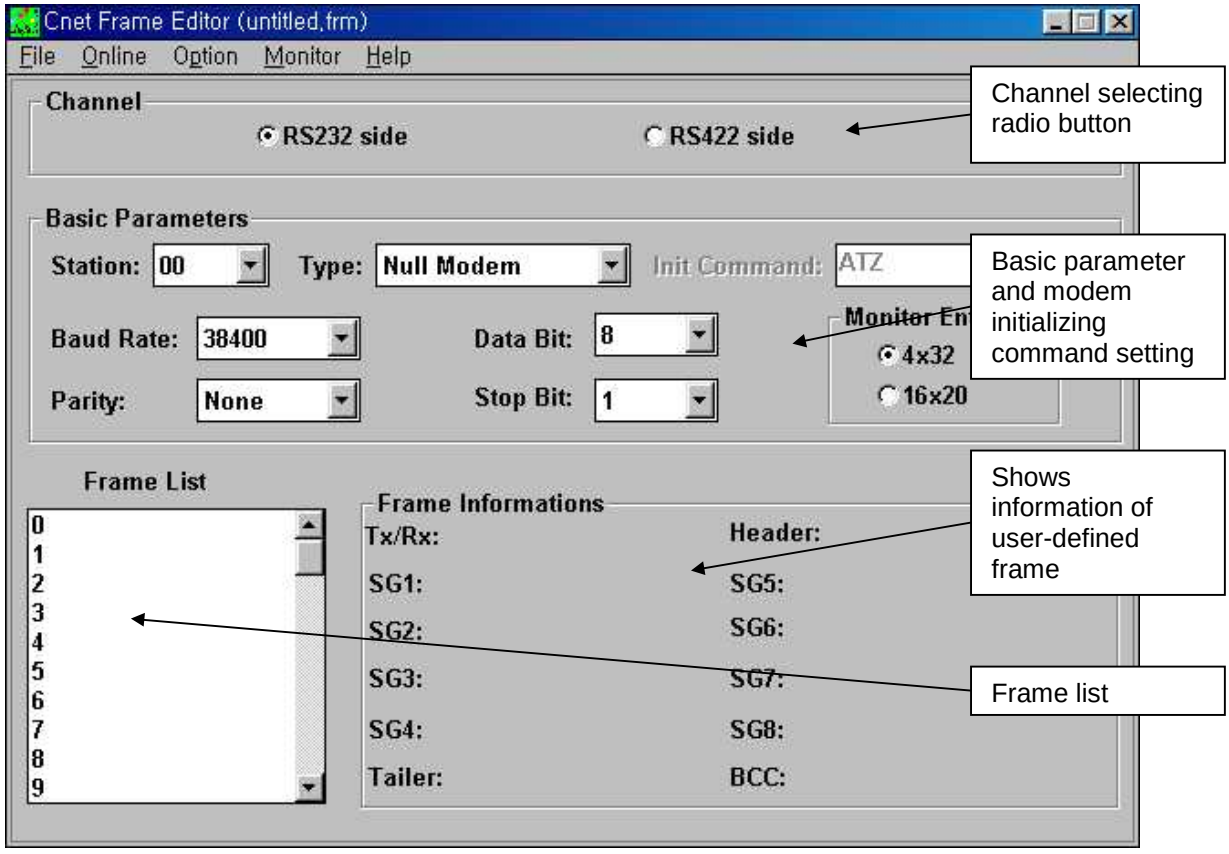


Fig. 6.1 An initial screen of frame editor

2) Menu configuration

Main menu	Sub menu	Functions	Remark
File	New	Create a new frame file (*.frm)	
	Open	Load a frame file	
	Save	Save current frame setting as a file (overwrite)	
	Save as	Save current frame setting as a new file	
	Open Lib	Load a library for communication with other manufacturer's device.	Available with the frame editor v2.0 or later
	Exit	Quit frame editor software	
Online	Connect	Connect frame editor to the PLC CPU module	
	Disconnect	Disconnect frame editor from the CPU module	
	Read	Read (upload) the parameter and frame data from the Cnet module	
	Write	Write (download) the parameter and frame data to the Cnet module	
	Change Comm.	Run or stop the operation of each channels (RS-232C / RS-422)	
	Mode	Change the operation mode of Cnet module via RS-232C channel. (Remote mode change)	Available with the frame editor v2.0 or later
Option	Port	Select a COM port that communicate with	
Monitor	Receive Frame	Monitor the data that the Cnet module receive	
	Send Frame	Monitor the data that the Cnet module send	Only the RS-232C channel is available

6.2.2 Basic parameter setting

Basic parameters define the communication specification of Cnet module such as station number, baud rate, parity bit, data bit, stop bit, and modem configuration. When use a modem for long distance RS-232C communication, a modem initializing command should be defined. (It can vary according the manufacturer of modem, but 'ATZ' is a general command in most cases)

The basic parameter setting shown in the figure 6.2 means as following configuration;

- station number: 0
- baud rate : 38,400 bps
- parity check : None
- data bit : 8 bits
- stop bit : 1

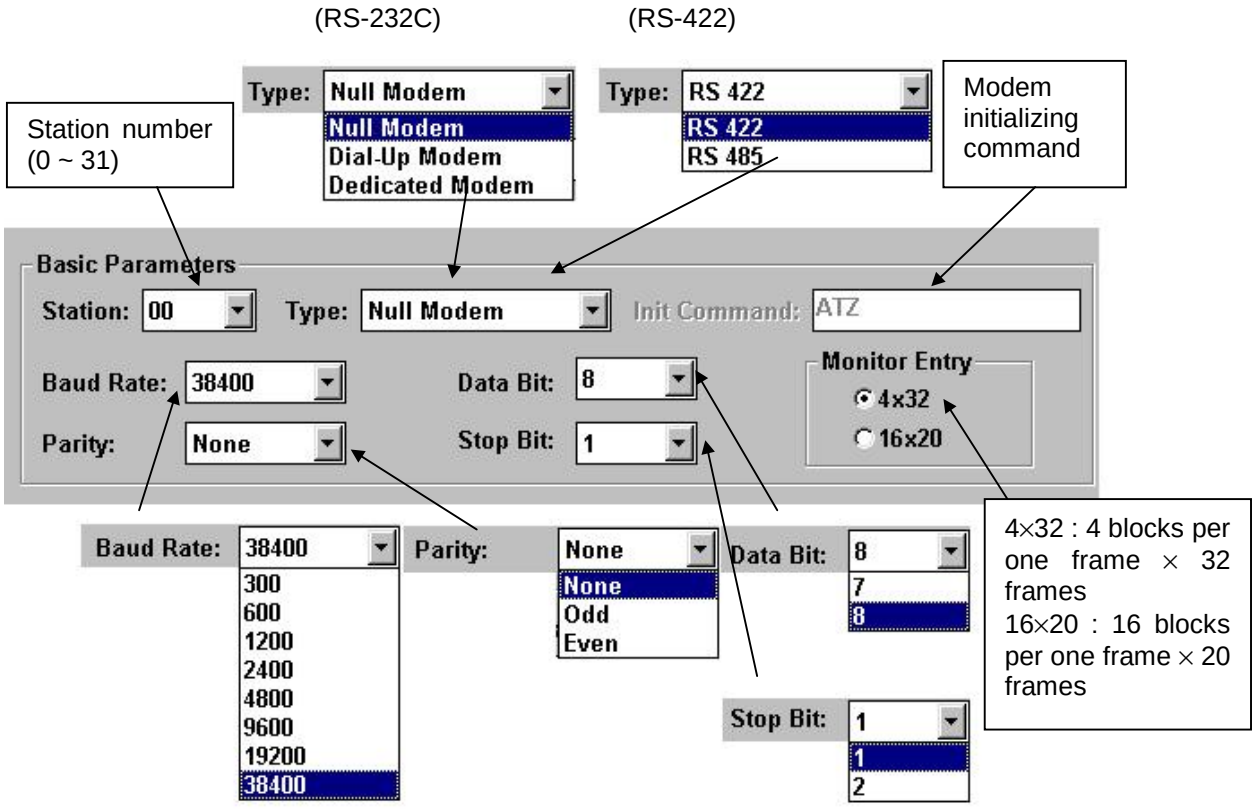


Fig. 6.2 Basic parameter

The description of each parameters is as following table;

Item		Description	Remark
Station number	Station number	Set the station number of Cnet module	0 ~ 31
RS-232C communication type	Null modem	Direct connection with RS-232C cable	
	Dial-up modem	Use a modem via public telephone line	
	Dedicated modem	Use a modem via a dedicated line	
Initializing command	Initializing command	Set an initializing command of modem	Only available when dial-up or dedicated modem is selected
RS-422 communication type	RS-422	Use RS-422 protocol	1:1 network
	RS-485	Use RS-485 protocol (multidrop)	1:n or n:m network
Basic parameters	Baud rate	Set a communication speed	Set independently for each channels (RS-232C / RS-422)
	Data bit	7 bits or 8 bits	
	Parity	none / even / odd	
	Stop bit	1 bit or 2 bit	
	Monitor entry	Set a maximum monitoring blocks	Cnet module v1.3 or later

6.2.3 Defining a frame

The figure 6.3 is a lower part of initial screen of frame editor, and it shows a frame list and brief information.

Each frame has a name and it is used for an identifier of the frame. When write a sequence program, these frame names are used with SND / RCV instructions. Each channel can have max. 64 frames, and the max. length of a frame name is 256 byte in ASCII format.

The right side of screen shows a brief information of the highlighted frame.

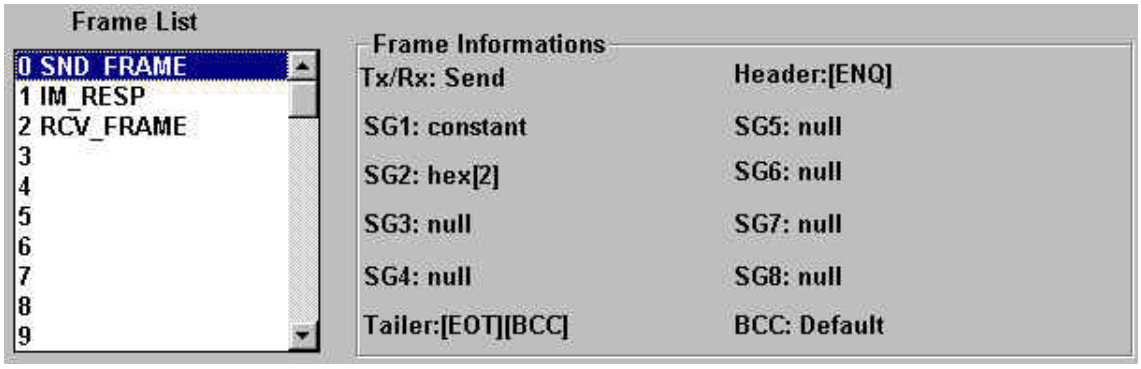


Fig. 6.3 The frame list and information

1) Write a sending frame

The sending frame defines the data structure that is transmitted to the external device from the Cnet module. Writing procedure is as following;

① Select a frame number in the frame list of figure 6.3, and double-click. The screen as the figure 6.4 will appear.

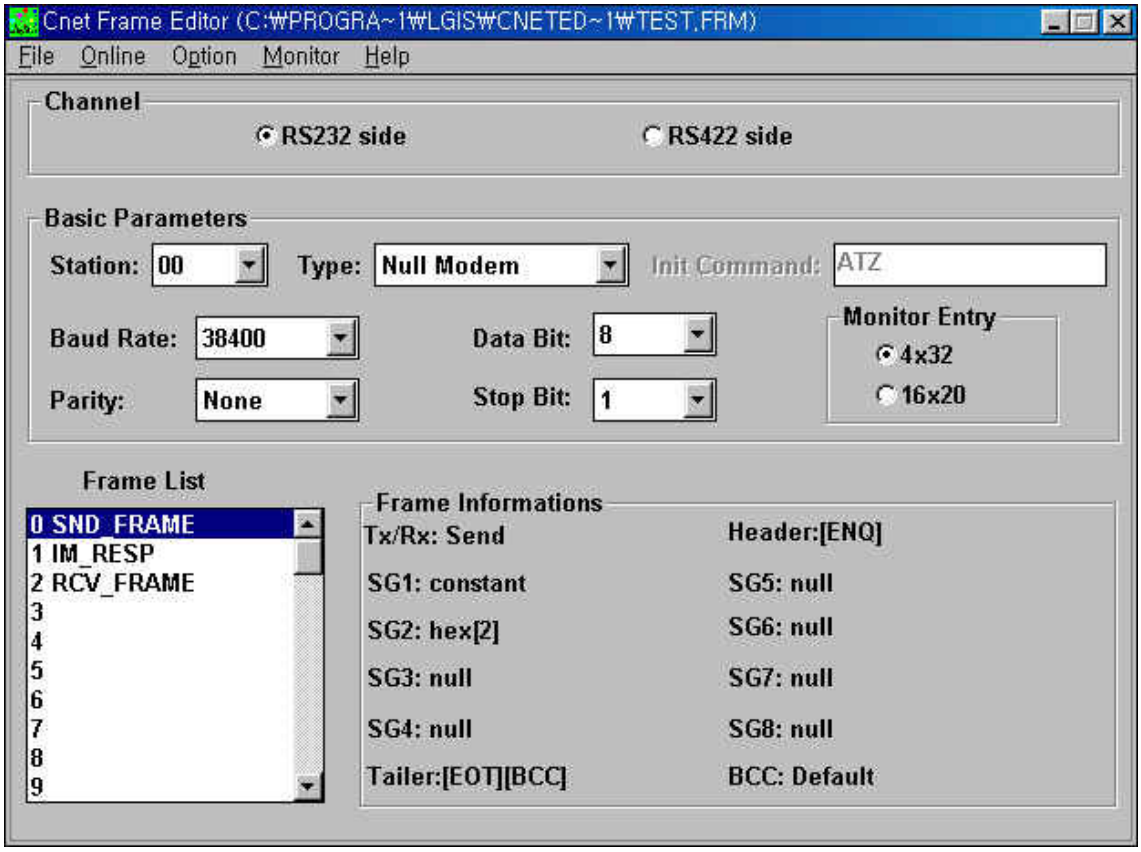


Fig. 6.4 Frame setting window

② Input a frame name. The name can be consist of all characters such as alphabet or numbers. It is used for an identifier in the sequence program.

③ Select the direction of data. When write sending frame, choose 'Send' as following figure 6.5

Fig. 6.5 Selecting send/receive

④ Set a header of frame. In general, a control character such as ENQ (Enquire, ASCII code h05), STX (Start text, ASCII code h02), or ACK (Acknowledge, ASCII code h06) is used for a header. However, it could be a number, other character, or a combination of them. The start and end of header should be '[' and ']' as following figure 6.6

Fig. 6.6 Examples of header setting

⑤ Set a data to be sent according to segment. The data frame is divided by segment to distinguish fixed data area (Constant) and variable data area (Array). The required data of the segment set as array is inputted in the sequence program. The maximum size of constant segment is 30 bytes, and the array segment is 240 bytes in ASCII format. The following figure 6.7 shows an example of segment setting.

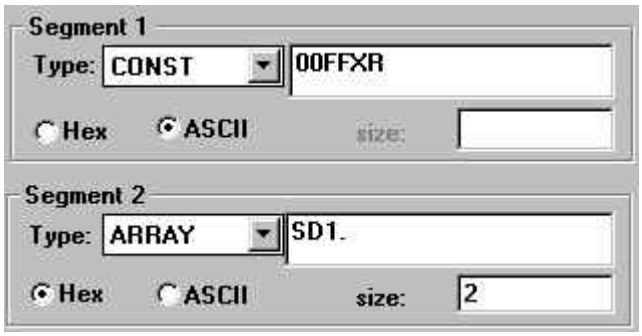


Fig. 6.7 An example of segment setting

When the constant segment is set as HEX type, the data should be set as 2 or even bytes (example : 11, 1234, FFAC03, 68AB32CD, etc)

The name of array segment should be given as only 'SD1.'.

The size of array segment is determined as byte unit. When the data format of array segment is set as ASCII, input the number of characters at the size. (For example, If the SD1. is 'ABCD', the size should be 5.) When the data format of array segment is set as HEX, the size is the half of number of hexadecimal data. (h1234 = 2 bytes)

Remark

When a segment is assigned as hexadecimal constant, you can not input 'h0x00' format. (example : h0100, h0A00, or h0000) Please use array type if it is need to input 'h0x00'.

⑥ Set a tail of frame. The tail is consist of control characters, numbers, or alphabets like header. Moreover, the tail can include a BCC check code for error detection. The following figure 6.8 shows an example of tail setting.

Fig. 6.8 Example of tail setting

⑦ To use the BCC check function, write '[BCC]' at the tail and setting BCC by pressing the BCC setting button. (see the figure 6.9)

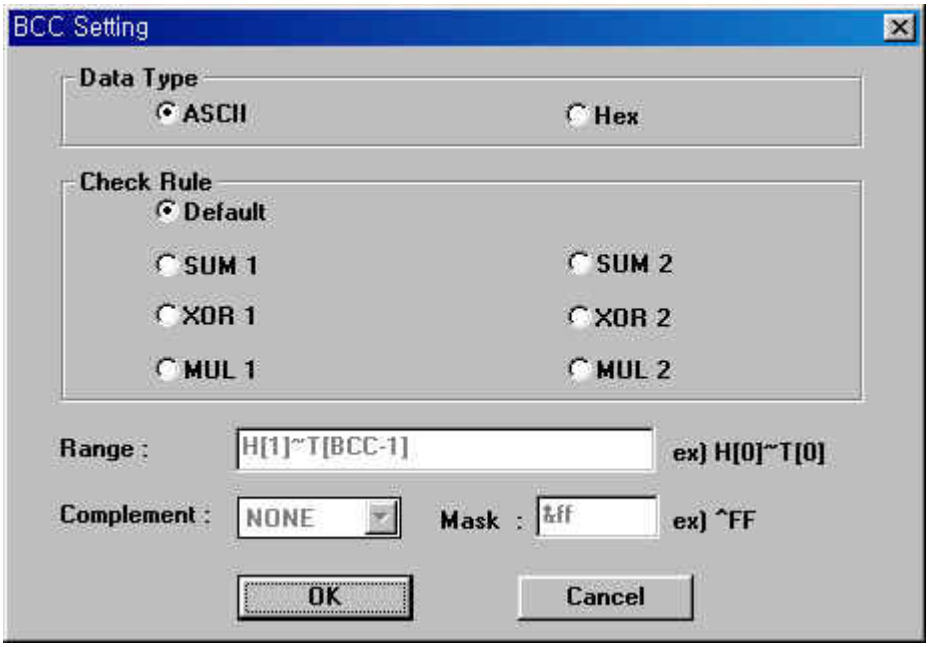


Fig. 6.9 BCC setting window

There are 7 methods to calculate BCC as followings;

- Default : Add all values from the second data of header to the previous of [BCC].
- SUM1 : Add all values of data within the user-defined range.
- SUM2 : Mask a user-defined value to the result of SUM1
- XOR1 : Calculate BCC by exclusive OR operation.
- XOR2 : Mask a user-defined value to the result of XOR1
- MUL1 : Get BCC by multiplying all values of data within the user-defined range
- MUL2 : Mask a user-defined value to the result of MUL1

Remark

There are 3 method to mask the BCC such as &(AND), ^(XOR), and |(OR). For example, &FF means to perform AND operation with BCC and hFF.

⑧ Example of frame setting

The following example shows how to set frame when send the data format as below table.

	Low										High
Frame	ENQ	0	0	F	F	X	R	0	0	2	0
ASCII	h05	h30	h30	h46	h46	h58	h52	h30	h30	h32	h30
Frame	0	3	0	0	3	EOT	BCC1	BCC2			
ASCII	h30	h33	h30	h30	h33	h04	h34	h45			

Remark

The ‘h’ of ASCII data means the data is hexadecimal format. When write frame, do not use ‘h’.

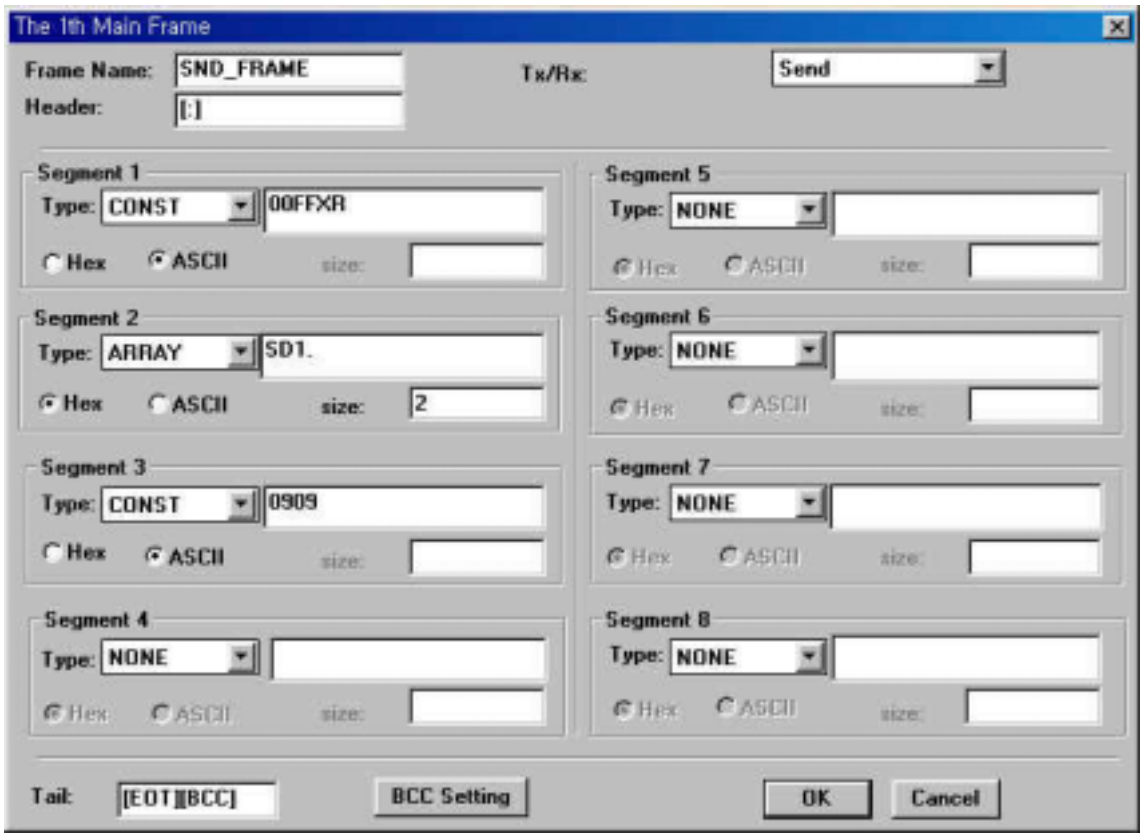


Fig. 6.10 An example of frame setting

2) Writing a receiving frame

In general, writing a receiving frame is similar with writing a sending frame. In this chapter, how to write a receiving frame is explained with an example that receive following data from external device.

	Low										High
Frame	STX	0	0	F	F	2	4	5	0	1	0
ASCII	h05	h30	h30	h46	h46	h32	h34	h35	h30	h31	h30
Frame	2	0	6	3	5	0	ETX	BCC1	BCC2		
ASCII	h32	h30	h36	h33	h35	h30	h04	h34	h41		

6 bytes follows '00FF' are received data from external device. (h245010206350). To receive the data, write a receiving frame as following;

① Select a frame number at the frame list.

② Input a frame name after the screen as the figure 6.4 appeared.

③ Set the direction of data. To receive data from external device, select 'Receive'.

④ Set a header of frame. It is similar with that of sending frame. In this example, input [STX] to the header.

⑤ Set each segments of frame. When a segment is set as array, use only the 'RD1.' for variable name.

⑥ Set the tail of frame.

⑦ If it is need to return a response to the external device immediately, write a name of immediate response frame. The immediate response frame is sent to the external device by Cnet module, and it is registered at the frame list as sending frame. See the figure 6.12 for an example of immediate response frame.

Remark

The immediate response frame can have constant segment only. If it contains an array segment, a communication error will occur.

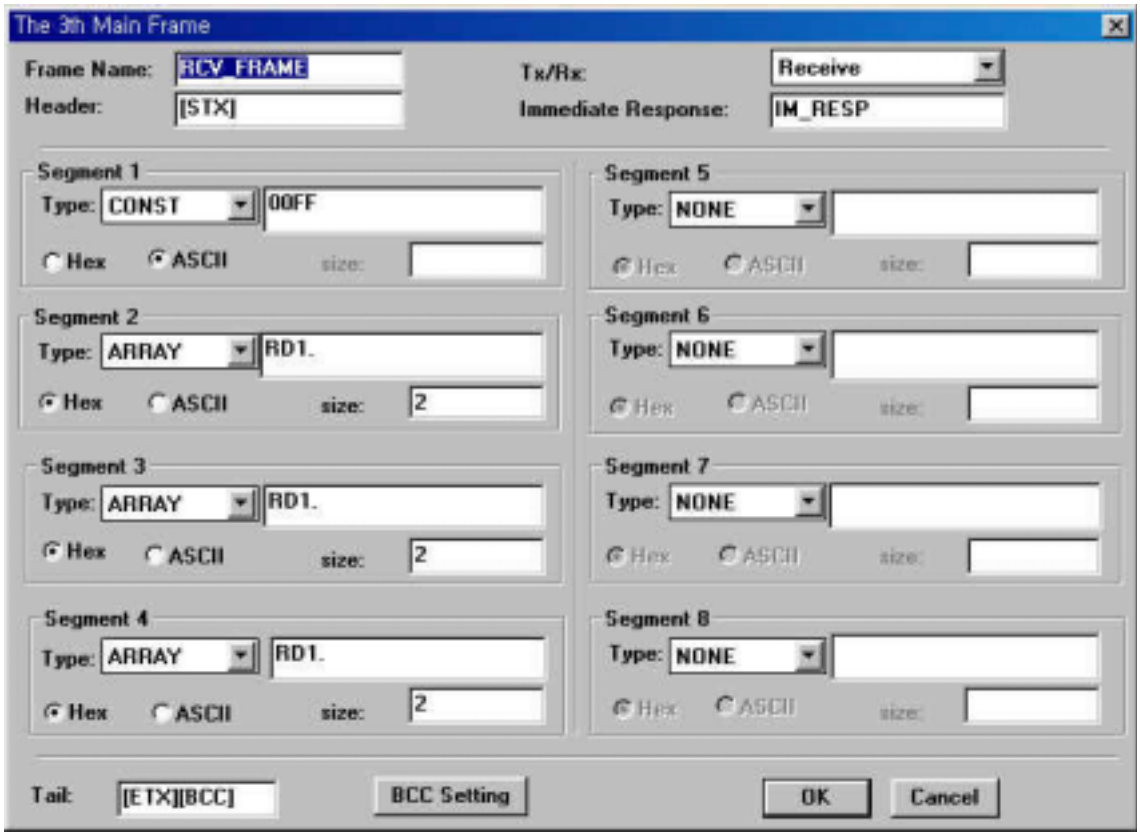


Fig. 6.11 An example of receiving frame

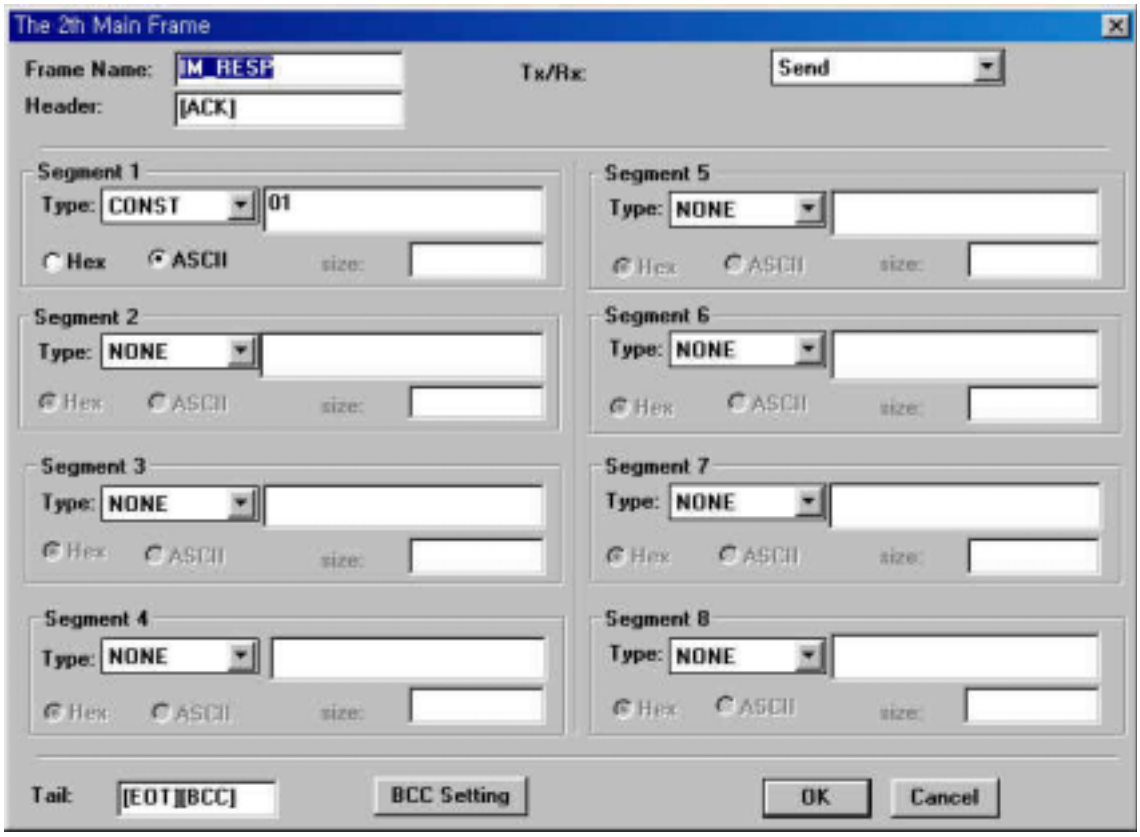


Fig. 6.12 An example of immediate response frame

6.2.4 Writing and reading frame

In this chapter, it will described how to write (download) and read (upload) user-defined frame to/from Cnet module.

1) Writing frame or parameter (download)

① First, connect the PC and CPU module with the KGL-WIN cable.

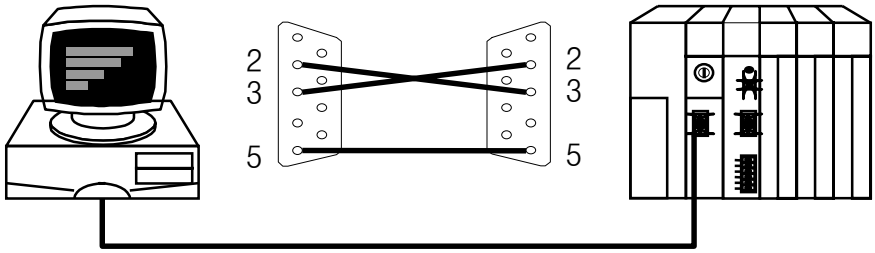


Fig. 6.13 KGL-WIN cable connection

② Run the frame editor, and connect to Cnet module by choosing ***Online-Connect*** in menu. If the connection is completed successfully, the message as the figure 6.14 will appear. Before trying connection, make sure to quit the other software using COM port such as KGL-WIN.

Fig. 6.14 Connection completion

③ Choose ***Online-Write*** in menu. Then the screen of the figure 6.15 will appear.

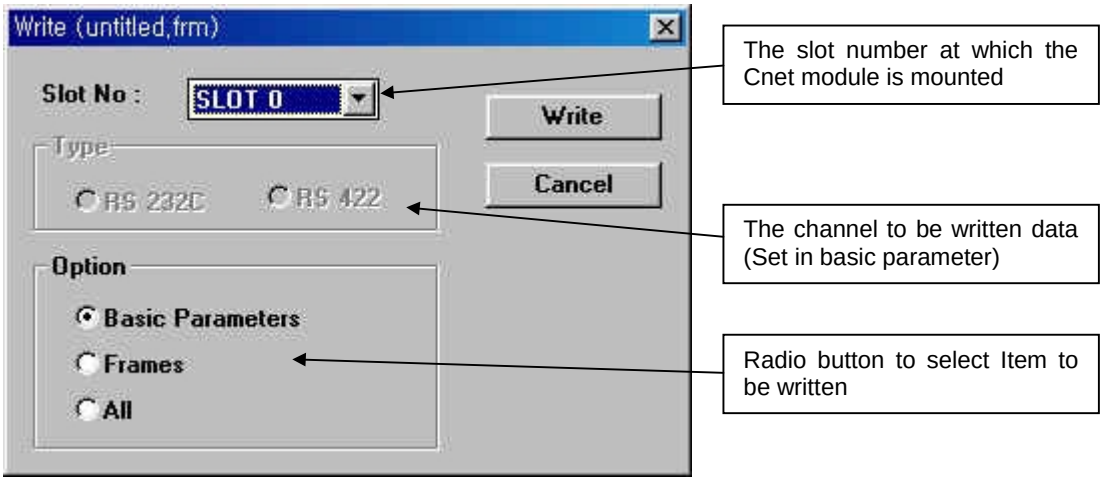


Fig. 6.15 Writing dialog box

④ Select the slot at which the Cnet module is mounted, and items to be written (parameter, frame, or both). Channel to be written is selected in the basic parameter setting. (See the figure 6.1)

⑤ After setting is completed, press the 'Write' button. Then the following confirmation dialog box will appear. (figure 6.16) Press 'OK' to download data.

Fig. 6.16 Confirmation message box

Fig. 6.17 Writing completion message

⑥ After downloading is completed, switch the Cnet module to RUN mode by choosing ***Online – Change Comm.*** in menu as following figure 6.18

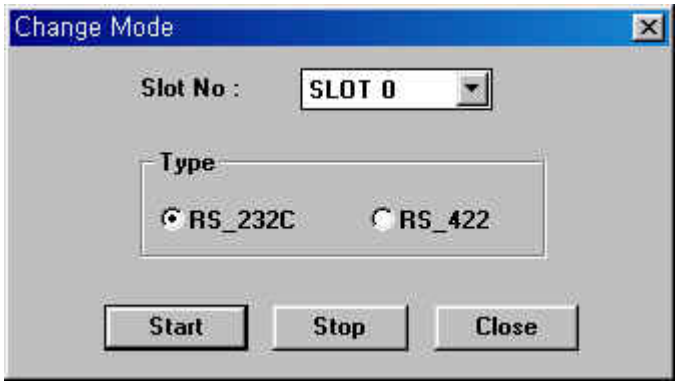


Fig. 6.18 Change operation mode of Cnet module

Remark

When downloading the new frame or parameter, the Cnet module is switched to the STOP mode automatically. For more reliable operation of Cnet module, however, we recommend to switch the Cnet module to STOP mode before starting download.

2) Reading frame or parameter (upload)

① Connect the frame editor to the Cnet module. The connection procedure is same as that of downloading.

② Choose Online – Read to read frame, parameter, or both from Cnet module. The following screen will appear.

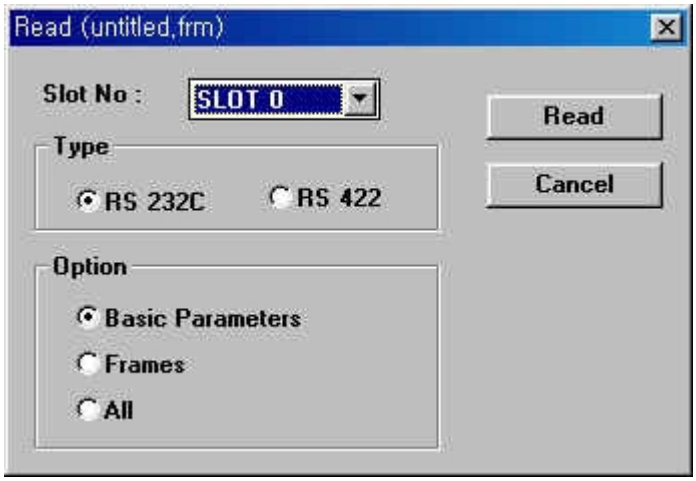


Fig. 6.19 Reading from Cnet module

③ Select the slot at which the Cnet module is mounted, and choose the channel and data type to be read. Then, push 'Read' button to upload data.

Fig. 6.20 Confirmation message box

6.2.5 Operation mode change (Online mode)

See the chapter 4.4 On-line mode for details

6.2.6 Monitoring

To check the network operating status, it is need to monitor the actual transmitted data between Cnet and other devices. A protocol analyzer is generally used for monitoring, but it is very expensive and need to connect between Cnet module and other device.

The frame editor provides a monitoring function, and it is possible to monitor sending / receiving data without additional cost or device.

1) Monitoring receiving data

① Run the frame editor, and connect to the CPU module by choosing ***Online – Connect*** in menu.

② Choose Monitor – Receive frame to start monitoring. The following screen will appear.

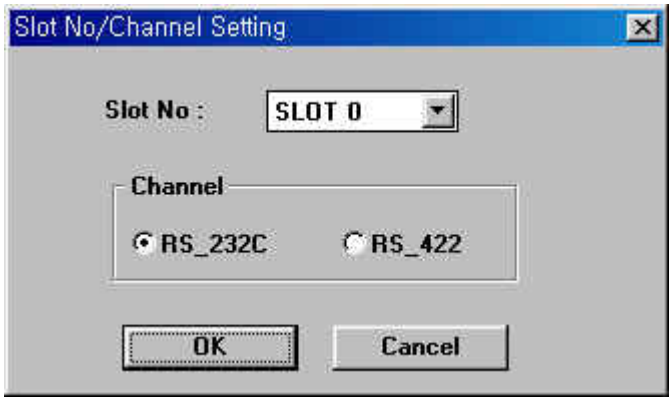


Fig. 6.21 Selecting slot/channel to be monitored

③ Select the slot at which the Cnet module is mounted, and channel to be monitored. Then press 'OK' button.

④ After the following screen (figure 6.21) appeared, press 'Start' button to start monitoring.

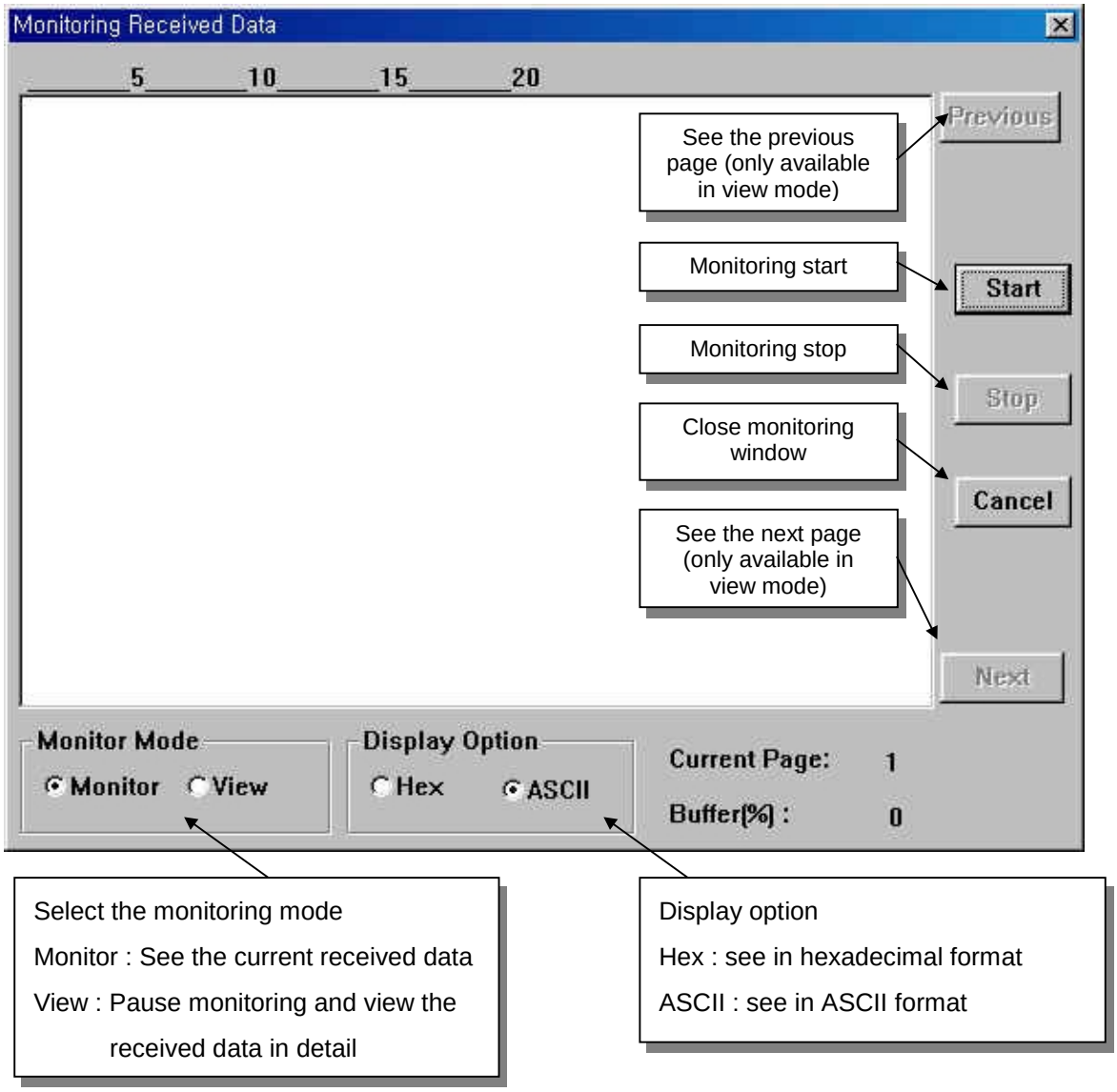


Fig. 6.22 Monitoring received frame

⑤ The following screen shows the frame editor is monitoring received frame.

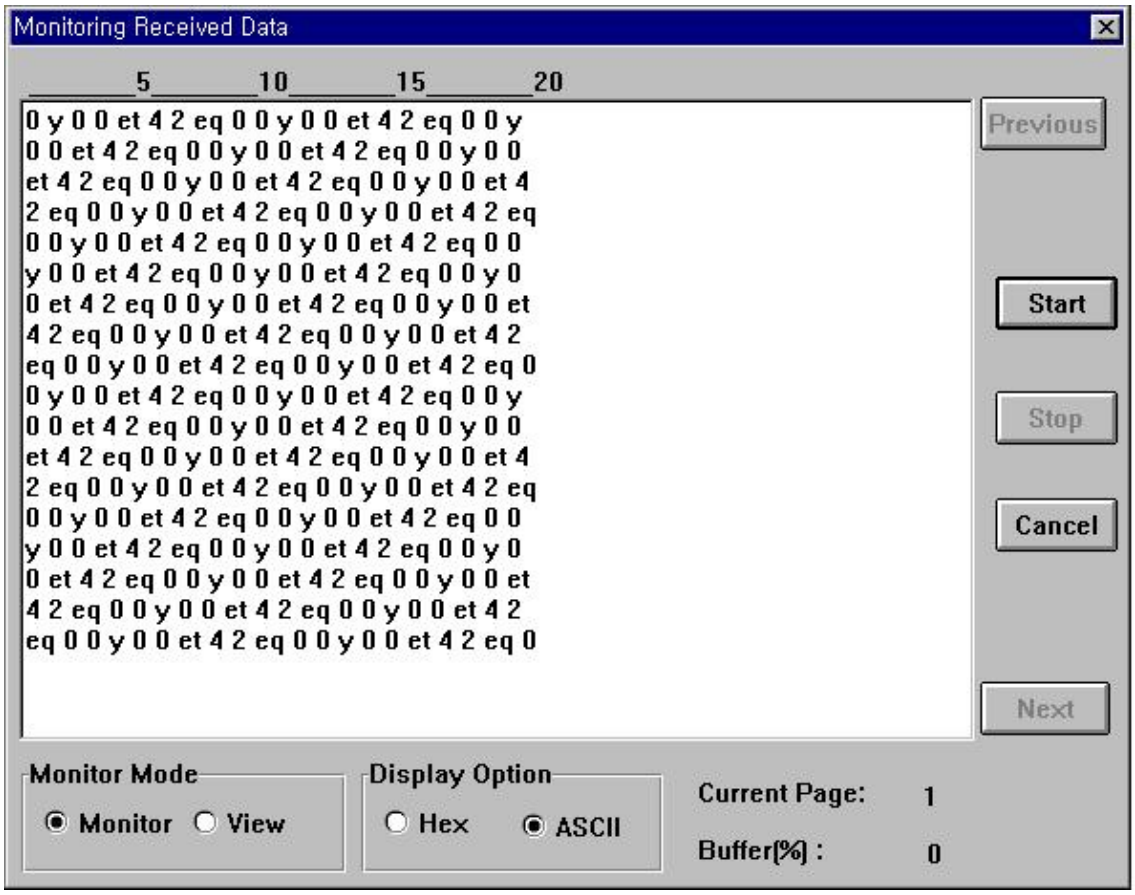


Fig. 6.23 An example of monitoring received frame

2) Monitoring send frame

① To monitor send frame, connect the frame editor to the RS-232C port of Cnet module. (Do not connect frame editor to CPU module.) Also, pin connection is different with that of receive frame monitoring.

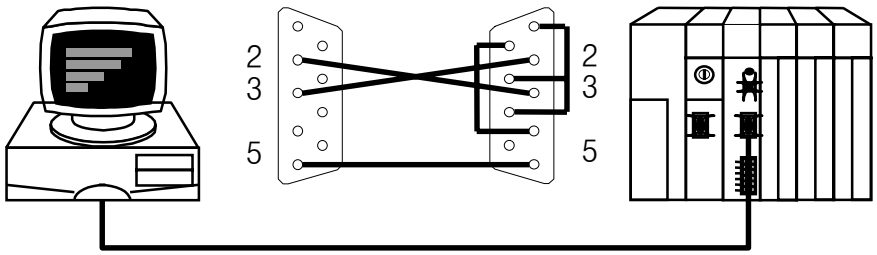


Fig. 6.24 The cable connection of send frame monitoring

② Select Monitor – Send Frame in menu. The following screen will appear, and select the basic parameter such as baud rate, data bit, parity bit, and stop bit. Then, press 'OK' button.

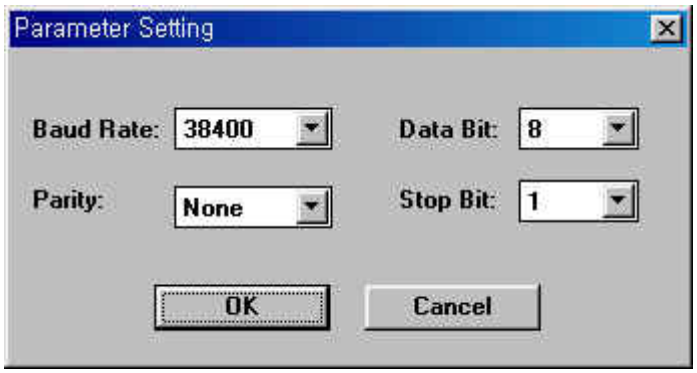


Fig. 6.25 Parameter setting dialog box

③ After the following screen appeared, press ‘Start’ button to start monitoring. The function of each buttons are similar with that of receive frame monitoring window. (see the figure 6.22)

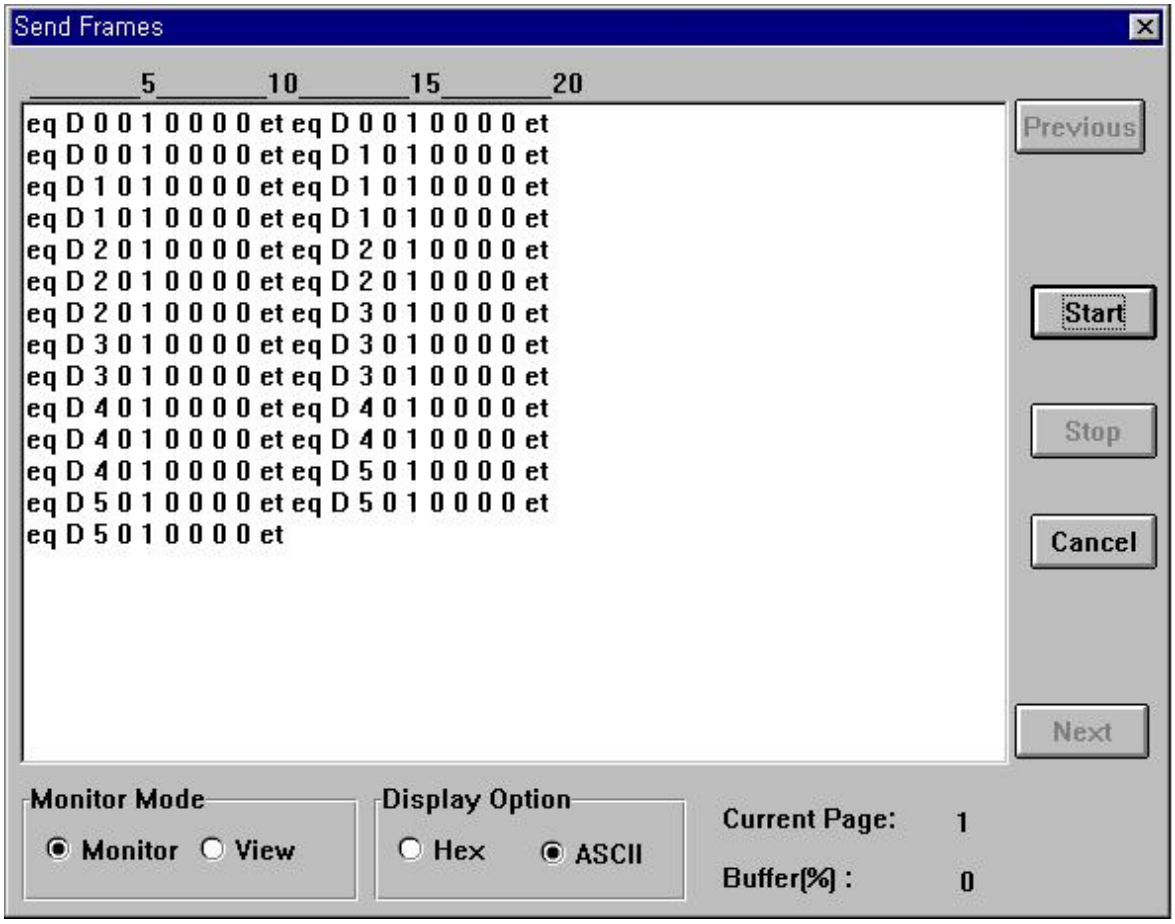


Fig. 6.26 Send frame monitoring window

④ To see the send frame data in detail, press the ‘Stop’ button, and change the monitor mode to ‘View’ mode.

Remark

Send frame monitoring is available with only RS-232C channel. When monitoring RS-422 channel, use RS422-RS232C converter.

6.3 Instructions for Cnet module

6.3.1 SND instruction

Instructions		Available Device										Steps	Flag		
		M	P	K	L	F	T	C	S	D	#D	Integer		Error (F110)	Zero (F111)	Carry (F112)
SND	sl											O	11	O		
	Fnam	O	O	O			O	O		O	O					
	snd	O	O	O			O	O		O	O					
	n									O		O				
	SS	O	O	O			O	O		O	O					

SND sl Fnam snd n SS

The configuration of 'sl'

AB	CD

Lower 8 bits (CD) : Slot No. of Cnet module
Higher 8 bits (AB) : Type of channel
h00 : RS232C
h01 : RS422

Operand setting

sl	Slot number of Cnet module is mounted & Type of channel (RS232C or RS422)
Fnam	The name of frame (8 words)
snd	Start address of device that stores source data to be sent
n	Numbers of byte to be sent
SS	Device at which the link status is stored

1) Functions

- Sends 'n' bytes which begin with the device specified as [snd] to the Cnet module that mounted on the slot 'sl'. The name of frame is stored as ASCII format into 8 words which begin with the device [Fnam]. The link status is stored at the device specified as [SS].
- The maximum size of data block to be sent is 256 bytes.

2) Program example

- Program that send 10 bytesm (5 words) from D1234 and frame name (8 words from D0000) to the Cnet module at slot 3, channel 0 (RS232C). The link status is stored at K015 word.

SND h0003 D0000 D1234 h0010 K015

6.3.2 RCV instruction

Instructions		Available Device										Steps	Flag		
		M	P	K	L	F	T	C	S	D	#D	Integer		Error (F110)	Zero (F111)	Carry (F112)
RCV	sl											O	11	O		
	Fnam	O	O	O			O	O		O	O					
	snd	O	O	O			O	O		O	O					
	n									O						
	SS	O	O	O			O	O		O	O					

RCV sl Fnam rcv n SS

The configuration of 'sl'

AB	CD

Lower 8 bits (CD) : Slot No. of Cnet module
Higher 8 bits (AB) : Type of channel
h00 : RS232C
h01 : RS422

Operand setting

sl	Slot number of Cnet module is mounted & Type of channel (RS232C or RS422)
Fnam	The name of frame (8 words)
rcv	Start address of device that stores source data to be sent
n	Numbers of byte to be read
SS	Device at which the link status is stored

1) Functions

- Receives data from the Cnet module mounted on the slot 'sl' with the frame of which name is stored as ASCII format into 8 words which begin with the device [Fnam], then stores the data from the device specified as [rcv], and the length of data is stored at [n] The link status is stored at the device specified as [SS].
- The maximum size of data block to be sent is 256 bytes.

2) Program example

- Program that receive data from channel 1 (RS-422) of the Cnet module at slot 5, with the frame of which name is stored at 8 words from D0100, and stores received data to the block which begin with D0200. The number of received data (bytes) are stored at D1000, and the link status is stored at K016 word.

RCV h0105 D0100 D0200 D1000 K016

6.3.3 READ instruction

Instructions		Available Device										Steps	Flag		
		M	P	K	L	F	T	C	S	D	#D	Integer		Error (F110)	Zero (F111)	Carry (F112)
READ	sl											O	13	O		
	St	O	O	O	O	O	O	O		O	O					
	D	O	O	O	O*		O	O		O	O					
	S	O	O	O	O	O	O	O		O	O					
	n									O		O				
	SS	O	O	O	O*		O	O		O	O					

READ sl st D S n SS

Operand setting

sl	Slot number on which the Cnet module is mounted	St	Station number of remote station and comm. channel. (4 words)
D	Start address of master station at which read data is stored	S	Start address of remote station at which data to be read
n	Numbers of word to be read	SS	Device at which the link status is stored

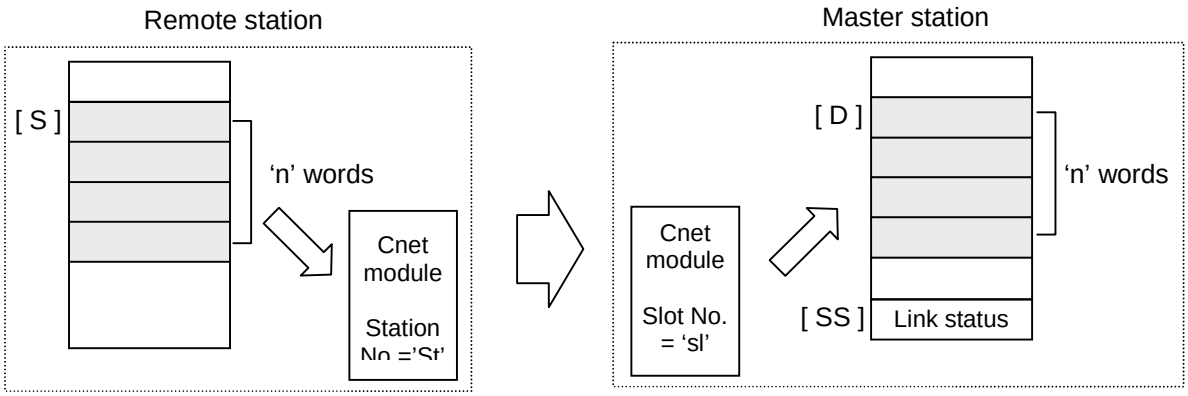
Configuration of 'St'

Upper 2 words	Lower 2 words
Station number	Channel selection 0: RS-232C 1: RS-422

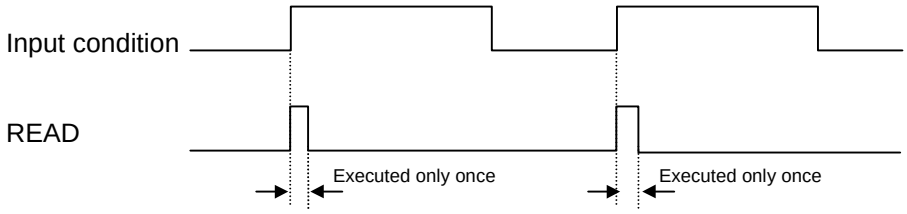
* Available only when do not use computer link module or data link module

1) Functions

- Reads 'n' words which begin with the address [S] of the remote station that has station number 'St' through the Cnet or Fnet module mounted at the slot 'sl', and store the read data to the block which begin with the address [D] of the master station. The link status is stored at the address 'SS' of the master station.

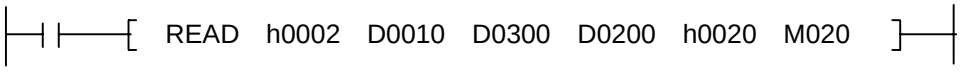


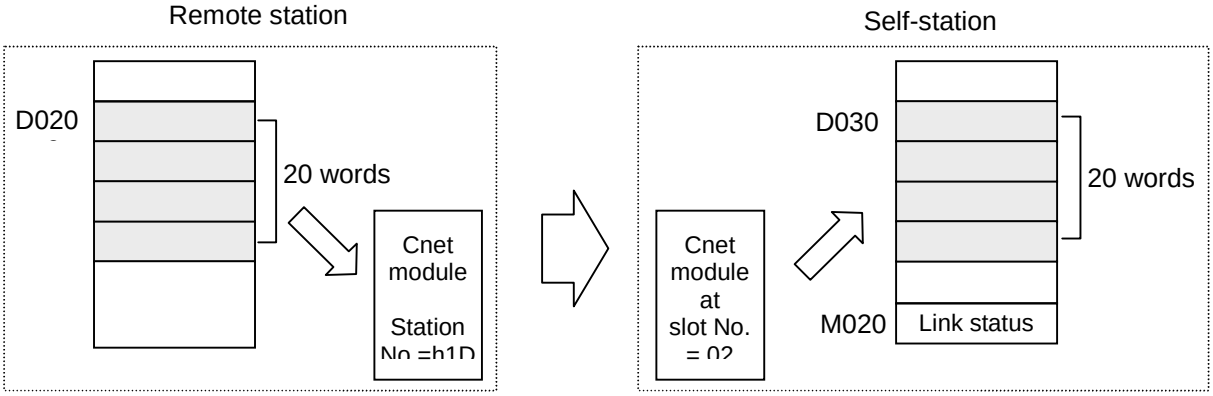
- An instruction error occurs when the assress [S+n] or [D+n] is out of the range of specified device.
- Execution conditions



2) Program example

- Program that read 20 words which begin with D0200 of remote station (Station No. of FUEA module is stored at 4 words block begin with D0010) through the FUEA module of slot number 2, and store the read data to the block which begin with D0300. The link status is stored at the M020 word. Assume that the value of D0010 ~ D0013 is h0000 001D 0000 0000 (Station number : h1D, Channel : RS-232C)





6.3.4 WRITE instruction

Instructions		Available Device										Steps	Flag		
		M	P	K	L	F	T	C	S	D	#D	Integer		Error (F110)	Zero (F111)	Carry (F112)
WRITE	sl											O	13	O		
	St	O	O	O	O	O	O	O		O	O					
	D	O	O	O	O*		O	O		O	O					
	S	O	O	O	O	O	O	O		O	O					
	n									O		O				
	SS	O	O	O	O*		O	O		O	O					

WRITE sl st D S n SS

Operand setting

sl	Slot number on which the Cnet module is mounted	St	Station number of remote station and comm. channel. (4 words)
D	Start address of master station at which source data is stored	S	Start address of remote station at which data to be stored
n	Numbers of word to be written	SS	Device at which the link status is stored

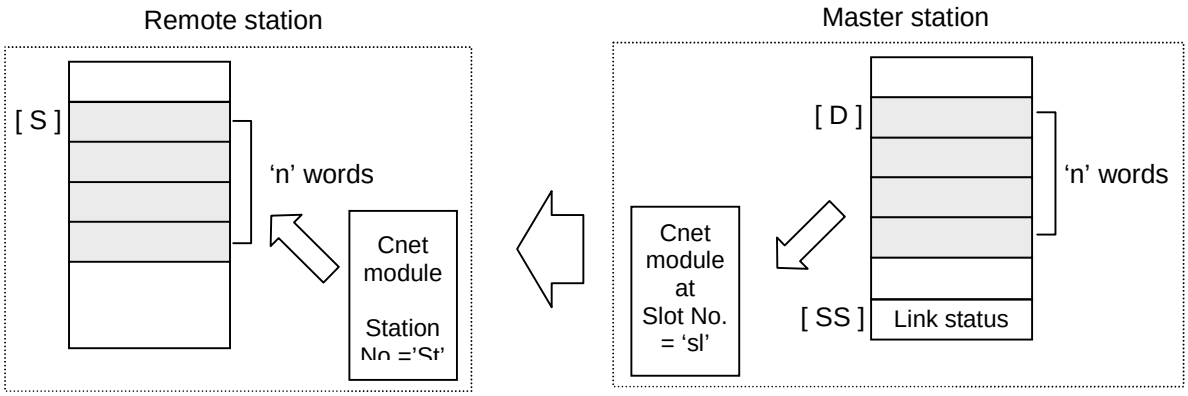
Configuration of 'St'

Upper 2 words	Lower 2 words
Station number	Channel selection 0: RS-232C 1: RS-422

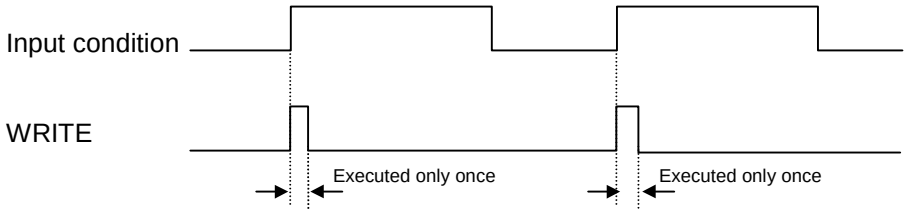
* Available only when do not use computer link module or data link module

1) Functions

- Transmits the data block (n words) begin with [D] of master station to the data block (n words) begin with [S] of remote station. Data transmission is performed via a Cnet (or Fnet) module mounted at the slot 'sl' of master station. The station number of remote station and communication channel is assigned by 'St' (4 words). After communication is completed, the status is stored at the [SS] of master station.

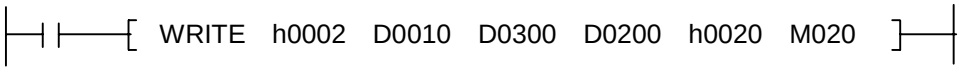


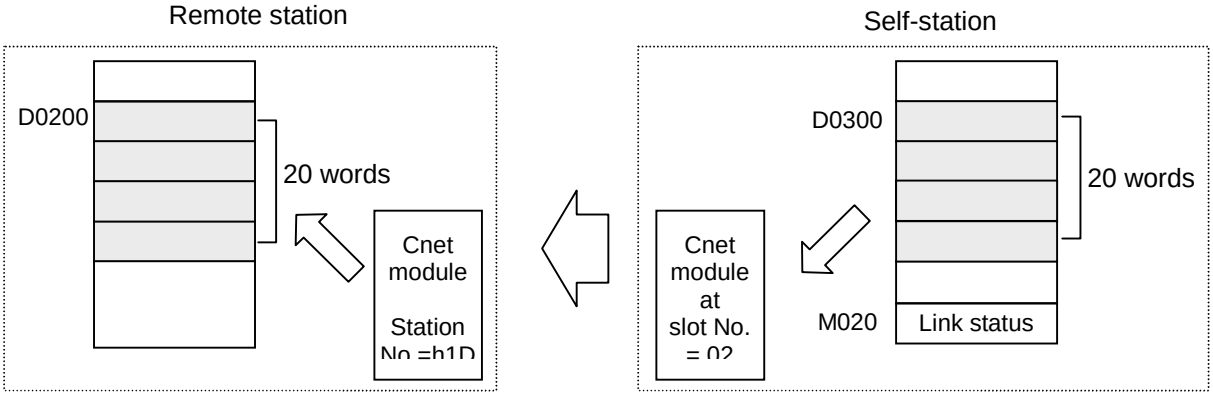
- An instruction error occurs when the assress [S+n] or [D+n] is out of the range of specified device.
- Execution conditions



2) Program example

- Program that writes 20 words which begin with D0200 of remote station (Station No. of FUEA module is stored at 4 words block begin with D0010) through the FUEA module of slot number 2, and store the read data to the block which begin with D0300. The link status is stored at the M020 word. Assume that the value of D0010 ~ D0013 is h0000 001D 0000 0001 (Station number : h1D, Channel : RS-422)





6.4 Library mode (Cnet v2.0 or later)

6.4.1 Introduction

To communicate with other manufacturer's PLC without writing an user-defined frame, the 'Library mode' is added to the MASTER-K Cnet module v2.0. In the library mode, the Cnet module will communicate with other manufacturer's device according to the library downloaded to the Cnet module, and no frame setting is required. (Set basic parameters only)

The following figure 6.52 shows an example of system configuration.

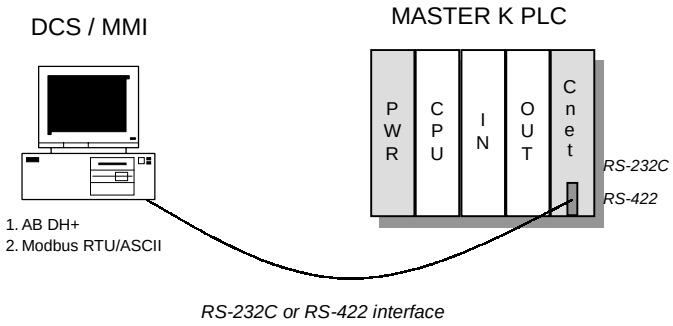


Fig. 6.27 A system configuration of library mode

The frame editor includes two libraries for AB Data Highway and MODBUS. With these libraries, the MASTER-K Cnet module can operate as a 'Server' station. It can not operate as 'Client'.

Remark

Make sure a library file is downloaded to the Cnet module before changing the operation mode of Cnet module to the 'Library mode'. The Cnet module will be malfunctioned immediately if a library mode is selected without downloaded library file. The Cnet module will operate normally after downloading a library file.

1) Download a library file

Set the Cnet module to 'Flash memory write mode' with the mode selection switch. Then the LED of Cnet module will blink with 1 second period.

Run the frame editor (v2.0 or later), and connect to the Cnet module. Then, select ***File – Open Lib*** in menu. Select a library file to be downloaded as following figure 6.27.

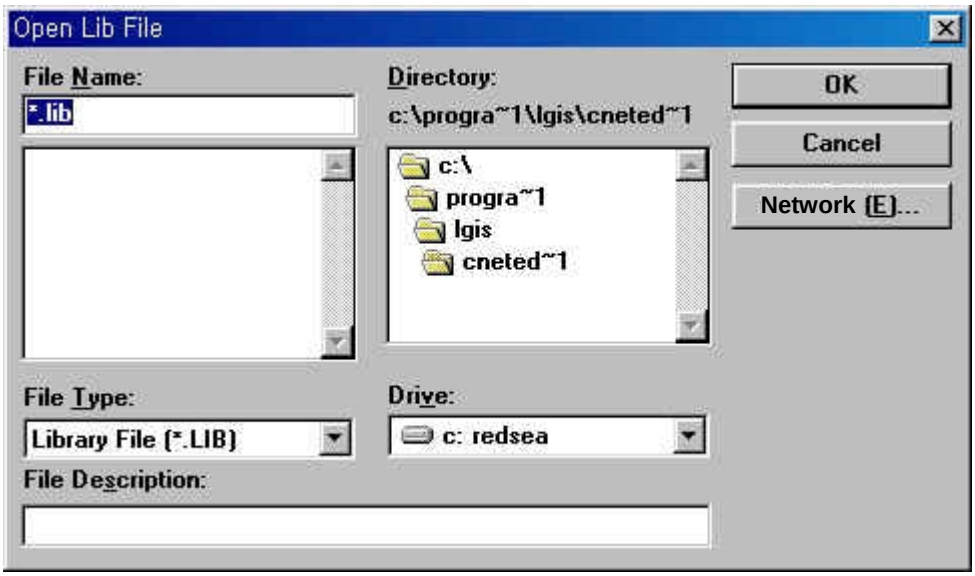


Fig. 6.28 Open library file

Select a library file, and press 'OK' button. Then select ***Online – Flash Memory – Write*** in the menu. Type the slot number at which the Cnet module is mounted, and press 'Write' button.

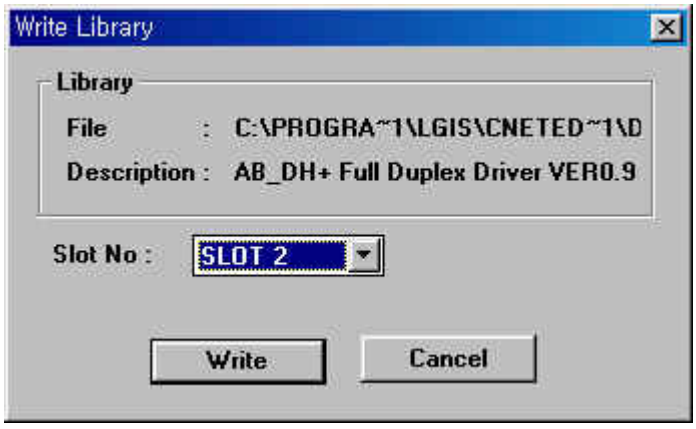


Fig. 6.29 Write library

If the library is successfully downloaded, the following message will be displayed.

Fig. 6.30 Download is completed

When the following message appears, check the slot number or operation mode of Cnet module.

Fig. 6.31 Error message

It is also available to read information of library file previously downloaded in the flash memory. Select ***Online – Flash Memory – Information*** in menu, then following screen will appear. Choose the slot number at which the Cnet module is mounted, then press the 'Read' button.

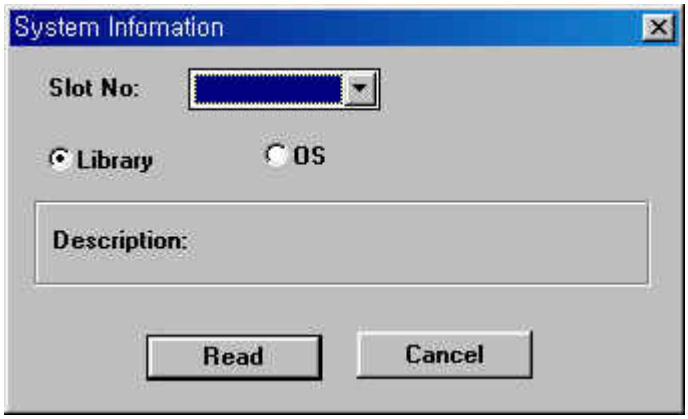


Fig. 6.32 Read information of library file

After library is downloaded successfully, disconnect the frame editor and turn off the power of PLC system. Then set the operation mode of Cnet module to 'Online' mode, turn on the power of PLC system, and connect the frame editor.

Remark

To use 'Library mode', the Cnet module should be set as 'Online mode'. The library mode only can be available through online mode selection. Please refer the chapter 4.4 for details.

Select ***Online – Mode*** in menu, then following screen will appear. Choose communication channel (Stand-alone / Interlocking) and operation mode for each channels (RS-232C / RS-422).

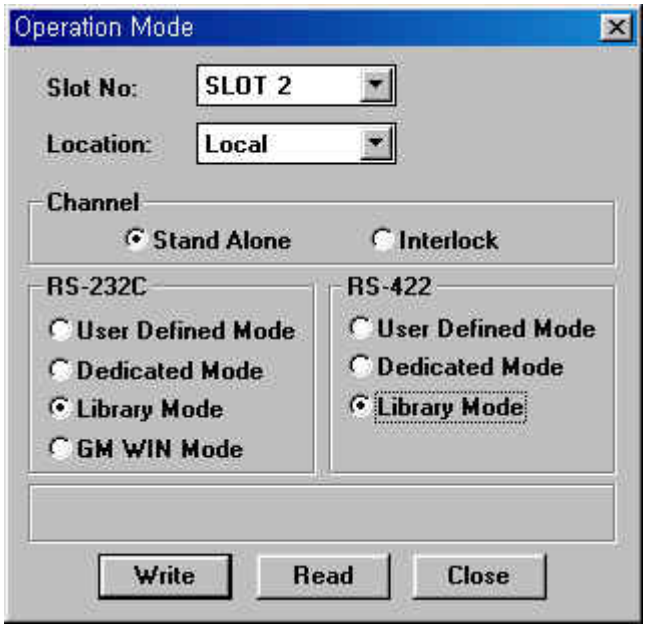


Fig. 6.33 Online mode selection

Remark

Do NOT quit frame editor or turn off the PC while a library file is being downloaded to the Cnet module. It may cause a fatal error to the Cnet module by damaging the O/S data of Cnet module.

6.4.2 AB DH+ full duplex driver

The AB DH+ full duplex driver is used for communication with AB devices via the library mode of MASTER-K Cnet v2.0 or later.

The driver is included in frame editor v2.0 as 'dh_plus.lib' file, and has following features;

- The MASTER-K Cnet module can operate as 'Server' only. It is not available 'Client' operation.
- Supports the AB PLC-5 command set.
- Basic parameters should be set by frame editor before running Cnet module.
- RS-232C and RS-422 channel can operate independently.

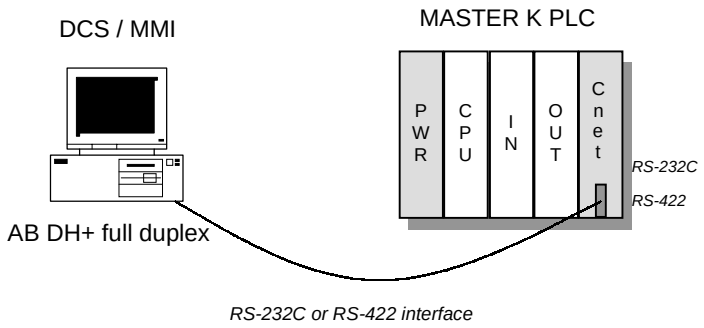


Fig. 6.34 System configuration of AB DH+ network

1) Basic specifications
   - Character setting : Start / Stop / Data / Parity setting (using frame editor)
   - Supports AB DH+ full duplex protocol
   - Baud rate : 300 ~ 38,400 bps.
   - Supported control symbols

Symbol	Type	Description
DLE STX	Control	Start symbol of message (Client)
DLE ETX BCC / CRC	Control	End symbol of message (Client)
DLE ACK	Control	Receiving completion message (Server)
DLE NAK	Control	Receiving failure message (Server)
DLE ENQ	Control	Request symbol of re-send response frame (Client)
APP DATA	Data	User data (h00 ~ h0F or h11 ~ h1F)
DLE DLE	Control	A hexadecimal data of h0x10

   - BCC check : 2's complement value of the sum of application data excludes message start / end symbols. It follows after the end symbol of application data.

2) PLC-5 Family command set

The AB library file of MASTER-K Cnet module supports the AB PLC-5 command set as following table.

Message	Command	Function	Description
Word Write Range	h0F	h00	Write block word data
Word Read Range	h0F	h01	Read block word data
Read Modify Write	h0F	h26	Write bit data
Diagnostic Status	h06	h03	Read self-diagnosis data

The MASTER-K Cnet module will not response at other commands than those of above table.

3) Response status code

Status code	Extended status code	Description
h0xF0	h0x7	File is too long
	h0x9	Data or file is too large
	h0xA	Transaction size plus word address is too large
	h0X11	Illegal data type
	h0X12	Invalid parameter or invalid data

4) MASTER-K PLC address mapping

The AB Cnet driver can access only 384 bytes of M area (M000 ~ M191) of MASTER-K PLC, and the B3 (bit) of AB PLC-5. The address of PLC-5 is mapped to the M area of MASTER-K.

AB		MASTER-K	Remark
I/O type	Address format	Address	
Bit	Word : B3:xxx	Mxxx	xxx : decimal number (000 ~ 191) yy : bit position of AB (1 ~ 16 : decimal) z : bit position of MASTER-K (0 ~ F : hexadecimal)
	Bit : B3:xxx/yy	Mxxxz	

5) Other features

- Maximum size of a frame : 110 bytes
- Supports both of ‘logical binary addressing’ and ‘ASCII addressing’

6.4.3 Modbus driver

The Modbus driver is used for communication with Modbus devices via the library mode of MASTER-K Cnet v2.0 or later.

The driver is included in frame editor v2.0 as 'modbus.lib' file, and has following features;

- The MASTER-K Cnet module can operate as 'Server' only. It is not available 'Client' operation.
- Supports the ASCII / RTU mode of Modbus protocol.
- Basic parameters should be set by frame editor before running Cnet module.
- RS-232C and RS-422 channel can operate independently.

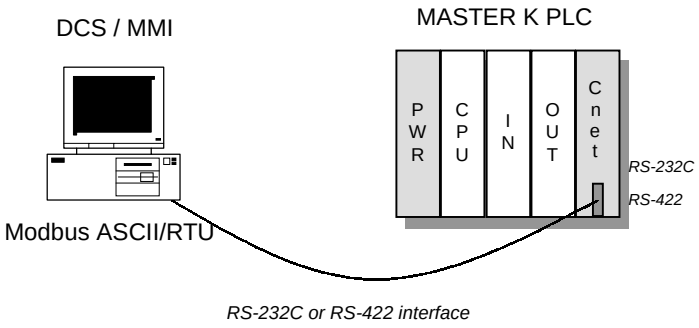


Fig. 6.35 System configuration of Modbus network

1) Basic specifications

Character : Start / Stop / Data / Parity can be set with frame editor.

Baud rate : 300 ~ 38,400 (independent setting for RS-232C and RS-422 channels)

Station number : 1 ~ 31

2) Serial transmission mode : Supports ASCII mode and RTU mode

① ASCII mode : communicate with ASCII code.

- Check error by LRC
- Frame structure

Item	Start (:)	Address	Function	Data*	LRC	End (CR LF)
Size	1 byte	2 byte	2 byte	n byte	2 byte	2 byte

* Data length : Max. 120 bytes or 960 bits

② RTU mode : communicate with hexadecimal data

- Check error by 16-bits CRC
- Frame structure

Item	Start (:)	Address	Function	Data*	LRC	End (CR LF)
Size	T4 idle	1 byte	1 byte	n byte	2 byte	T4 idle

* Data length : Max. 120 bytes or 960 bits

3) Device and function code specifications

The Modbus driver supports bit read/write and word read/write commands to access internal memory of MASTER-K through MK Cnet module. The following table shows a list of command supported by MK Cnet module. The MK Cnet module will not response according other commands than described in following table.

Code	Name	Address	Remark
01	Read coil status	0xxxx (bit output)	Bit read
02	Read input status	1xxxx (bit input)	Bit read
03	Read holding register	4xxxx (word output)	Word read
04	Read input register	3xxxx (word input)	Word read
05	Force single coil	0xxxx (bit output)	Bit write
06	Preset single register	4xxxx (word output)	Word write
16	Preset multiple register	4xxxx (word output)	Word write

4) Address mapping to MASTER-K PLC

All addresses of Modbus device will be mapped to the M area of MASTER-K PLC. Because the range of M area of MASTER-K is M000 ~ M191 (192 words), only 192 words (384 bytes = 3,072 bits) of Modbus device can be corresponded to the M area of MASTER-K PLC. See following table for detailed mapping between Modbus and MASTER-K PLC.

Modbus address		MASTER-K address	Remarks
Bit (0xxxx)	00000	M0010	M0000 ~ M000F (16 bits) are not used
	00001	M0011	
	⋮	⋮	
	00015	M001F	
	00016	M0020	
	⋮	⋮	
	03070	M191E	
	03071	M191F	
Word	3xxxx	Mxxxx + 1	M000 word is not used xxxx : 0 ~ 190
	4xxxx		

5) Error (Exception) code list

Code	Name	Description
01	Illegal function	Invalid function code
02	Illegal address	Invalid address (range over)
03	Illegal data value	Invalid data type

Chapter 7 Dedicated communication

7 Dedicated communication

7.1 Introduction

MASTER-K Cnet module includes a dedicated protocol for communication with external devices. It enables that an external device reads/writes data from/to the MASTER-K PLC through Cnet module if the external device send a data frame complying with the dedicated protocol. The features of dedicated protocol is as following;

- RS-232C and RS-422 channels can communicate independently according to mode setting.
- Multi-drop network is available by assigning a station number to Cnet modules. (Max. 32 station can be connected.)
- Error check (BCC check) is available (Optional)

The communication is performed as following figure, request by external device / response by Cnet module.

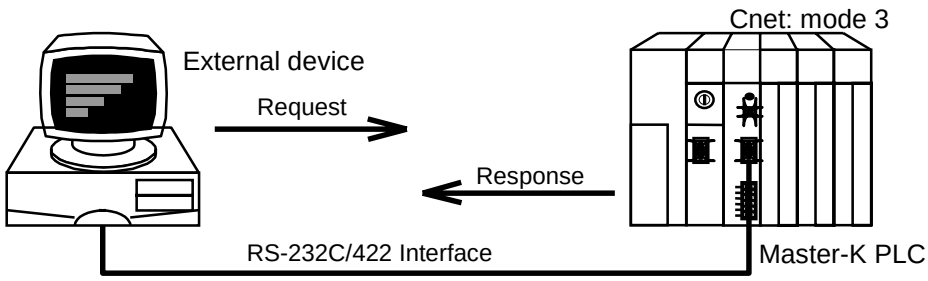


Figure 7.1 A system configuration of dedicated communication

To use dedicated communication, set the mode switch of Cnet module as following table.

Switch position	Operation mode		Remarks
	RS-232C	RS-422	
1	Dedicated	Dedicated	Interlocking mode
3	Dedicated	Dedicated	Stand-alone mode
4	User-defined	Dedicated	
5	Dedicated	User-defined	
7	KGL-WIN	Dedicated	
9	On-line [4)]	On-line mode change	

Remark

With K200S (K3F-CU2A / K3F-CU4A), set the mode switch at '1'.

7.2 Frame structure

All frames in dedicated communication can not exceed 256 bytes, and only ASCII characters can be used.

7.2.1 Basic structure

1) Request frame (External device → Cnet module)

Header (ENQ)	Station number	Command	Command type	Structured data area	Tail (EOT)	Error check (BCC)

2) ACK Response frame (Cnet module → External device : No error)

Header (ACK)	Station number	Command	Command type	Structured data area or Null	Tail (ETX)	Error check (BCC)

3) NAK Response frame (Cnet module → External device : Error occurred)

Header (NAK)	Station number	Command	Command type	Error code (ASCII 4 bytes)	Tail (ETX)	Error check (BCC)

Remark

The following table describes several control codes. They are importantly used in dedicated or other serial communication, so they should be well acquainted.

Code	Hex value	Original word	Description
ENQ (Header)	h05	Enquire	Start of request frame
ACK (Header)	h06	Acknowledge	Start of ACK response frame
NAK (Header)	h15	Not acknowledge	Start of NAK response frame
EOT (Tail)	h04	End of text	End or request frame
ETX (Tail)	h03	End of transmission	End of response frame

7.3 Instruction list

The following table shows instructions used in the dedicated communication.

Item		Instruction				Description
		Main command		Command type		
		Symbol	ASCII code	Symbol	ASCII code	
Read	Single	r (R)	h72 (h52)	SS	h5353	Read a single bit or word from PLC
	Continuous	r (R)	h72 (h52)	SB	h5342	Read a block (multiple words) from PLC
Write	Single	w (W)	h77 (h57)	SS	h5353	Write a single bit or word to PLC
	Continuous	w (W)	h77 (h57)	SB	h5342	Write a block (multiple words) to PLC
Monitoring registration		x (X)	h78 (h58)	–	–	Register devices to be monitored
Monitoring execution		y (Y)	h79 (h59)	–	–	Execute monitoring function
Read CPU status		r (R)	h72 (h52)	ST	h5354	Read a status of CPU module

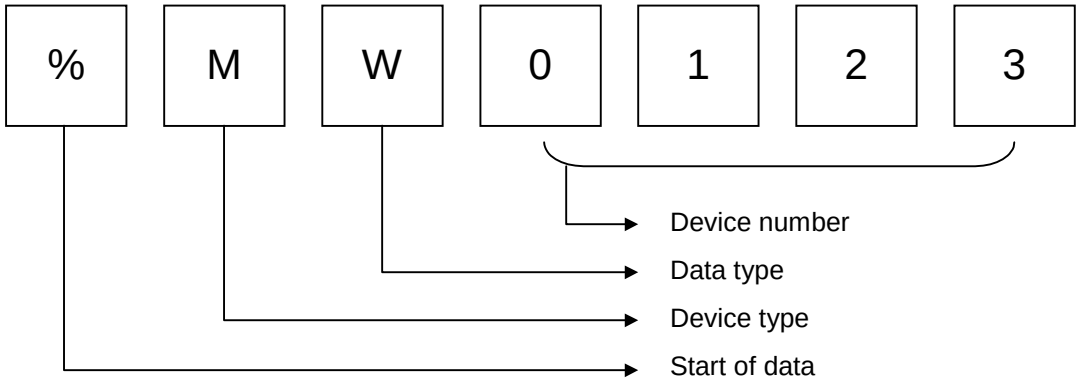
Remark

1. The CPU doesn't care capital or small letter in frame except main command. For example, '%MW100' and '%mw100' have same meaning. However, if the main command is written in small letter, the BCC check will be executed.
2. When read or write a bit, the last digit of address should be a capital letter.
   Example) %mx001f (X)
   %mx001F (O)

7.4 Data addressing

This chapter describes how to assign the address of memory device of MASTER-K series.

[Example of data structure]



7.4.1 Start of data

The '%' symbol indicates the start of data address. It must be located at the start of data address.

7.4.2 Device type

Device type	Device range	Remark
P (I/O relay)	%PW0000 ~ %PW0031 (32 words) %PX0000 ~ %PX031F (32 × 16 bits)	Read / Write
M (auxiliary relay)	%MW0000 ~ %MW0191 (192 words) %MX0000 ~ %MX191F (192 × 16 bits)	Read / Write
K (keep relay)	%KW0000 ~ %KW0031 (32 words) %KX0000 ~ %KX031F (32 × 16 bits)	Read / Write
L (link relay)	%LW0000 ~ %LW0063 (64 words) %LX0000 ~ %LX063F (64 × 16 bits)	Read / Write
F (special relay)	%FW0000 ~ %FW0063 (64 words) %FX0000 ~ %FX063F (64 × 16 bits)	Read
T (timer contact relay)	%TX0000 ~ %TX0255 (256 bits)	Read / Write
T (timer elapsed value)	%TW0000 ~ %TW0255 (256 words)	Read / Write
C (counter contact relay)	%CX0000 ~ %CX0255 (256 bits)	Read / Write
C (counter elapsed value)	%CW0000 ~ %CW0256 (256 words)	Read / Write
S (step controller)	%SW0000 ~ %SW0099 (100 sets)	Read / Write
D (data register)	%DW0000 ~ %DW4999 (5000 words)	Read / Write

Remark

When read or write S device, address should be assigned in word type although step controllers are handled as bit type. See following examples for details.

1) Turn on S00.07 : Write 07 (decimal) to the %SW0000
2) Turn on S05.15 : Write 15 (decimal) to the %SW0005
3) Clear S10 set : Write 00 to the %SW0010
4) Read S23 set : Read the %SW0023. Returned ASCII value shows which bit is turned on among 00 ~ 99 of the assigned set. (If the S23.47 is on, the CPU will return h3437 = 37)

7.4.3 Data type

Symbol	Data type	Examples
X (h58)	bit	%mx0003, %PX001C, %TX0002
W (h57)	word	%mw0003, %PW0012, %CW0120

7.4.4 Device number

When the data type is assigned as word, all device number is expressed in decimal number. When the data type is bit, however, the last digit of device number is hexadecimal number. (other digits are decimal number)

Please refer the chapter 4.6.1 ‘ memory configuration’ or the ‘MASTER-K programming manual’ for details.

Examples) %MX010E : indicates bit E (15th bit) of M010 word
%MW0100 : indicates M100 word
%DW0200 : indicates D0200 word
%PX031A : indicates bit A (10th bit) of P031 word
%TX0012 : indicates output relay of timer 12
%TW0012 : indicates elapsed value of timer 12
%SW0024 : indicates 24th set (S24.00 ~ S24.99) of step controller

Remark

In the above examples, device numbers are consist of 4 digits and it is the recommended format of MASTER-K series. However, 2 ~ 8 digits are allowed to express a device number.

Example) %MX01 = %MX001 = … = %MX0000001 = %MX00000001
%DW31 = %DW031 = … = %DW0000031 = %DW00000031

7.5 Examples of command execution

7.5.1 Read single device (RSS)

1) Introduction

This command is used for reading single devices. Max. 16 separated devices can be read with a command. See the chapter 13.6 for accessible device type.

2) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Number of blocks	Length of device definition	Device definition	…	Tail	Frame check
Frame example	ENQ	h20	R (r)	SS	h01	h06	%MW100	…	EOT	BCC
ASCII value	h05	h3230	h52 (h72)	h5353	h3031	h3036	h254D57313030		h04	

1 block
(Max. 16 blocks available)

① BCC : When the main instruction is small character (r), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

② Number of blocks : It indicates how many blocks (block : length of device definition + device definition) are following, and maximum number of blocks is 16. Therefore, the range of block number is h01 ~ h10 (ASCII code : h3031 ~ h3130).

③ Length of device definition : It indicates that the device definition include '%' occupies how many bytes after converted to ASCII code (1byte = 2 ASCII codes). The available range is h01 ~ h10 (ASCII format : h3031 ~ h3130)

Example : %MW000 = h06
%MX0000 = h07

④ Device definition : It indicates an actual address to be read. It should be consist of '%', device type (capital or small letter), and numbers only.

Remark

1. The 'h' is added to show the numeric data is hexadecimal format. When you write frame, please do not add 'h' to actual numeric data.
2. All blocks in one frame should have same data type. If the data type of first block is bit and that of second is word, an error will occurs.

3) Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Number of blocks	Length of data	Data	…	Tail	Frame check
Frame example	ACK	h20	R (r)	SS	h01	h02	hA9F3	…	ETX	BCC
ASCII value	h06	h3230	h52 (h72)	h5353	h3031	h3032	h41394633		h03	

1 block
(Max. 16 blocks available)

① Station number, main instruction, instruction type, and number of blocks are same as the request format.

② When the main instruction is small character (r), the lower byte of summation from ACK to ETX is converted into ASCII format and added to frame as BCC check.

③ The length of data indicates that the following data occupies how many bytes before converted to ASCII code. It is determined on basis of the data type included in request format.

Data type	Length of data
Bit (X)	1
Word (W)	2

④ In data area, the contents of assigned device are stored after converted to ASCII code.

Example : When the contents is h48B0, the ASCII code will be h34384230

Remark

Although the data type is bit, the data should be a byte because the minimum data unit is a byte. If the content of bit is 0, the data is h00 (ASCII code : h3030) and if the content is 1, the data is h01(ASCII code : h3031).

4) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code (Hex 2 byte)	Tail	Frame check
Frame example	NAK	h20	R (r)	SS	h2232	ETX	BCC
ASCII value	h15	h3230	h52 (h72)	h5353	h32323332	h03	

① Station number, main instruction, and instruction type are same as the request format.

② When the main instruction is small character (r), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.

③ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

5) Example

Read the contents of first word of P area (P000) and 21th word of M area (M020) from the PLC of that station number is h01. Assume the contents of P000 is h1234, and M020 is h3456. (No BCC check)

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Number of blocks	Length of device definition	Device definition	Length of device definition	Device definition	Tail
Frame example	ENQ	h01	R	SS	h02	h06	%PW000	h06	%MW020	EOT
ASCII value	h05	h3031	h52	h5353	h3032	h3036	h255057 303030	h3036	h254D57 303230	h04

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Number of blocks	Length of data	Data	Length of data	Data	Tail
Frame example	ACK	h01	R	SS	h02	h02	h1234	h02	h3456	EXT
ASCII value	h06	h3031	h52	h5353	h3032	h3032	h31323334	h3032	h3334 3536	h03

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code	Tail
Frame example	NAK	h01	R	SS	error code (2 byte)	ETX
ASCII value	h15	h3031	h52	h5353	ASCII value (4 byte)	h03

7.5.2 Read continuous devices (RSB)

6) Introduction

This command is used for reading continuous devices by assigning start address and word number. Only word data type is available for this command, and Max. 60 words can be read with one command.

7) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Length of device definition	Device definition	Number of data	Tail	Frame check
Frame example	ENQ	h10	R (r)	SB	h06	%MW100	h02	EOT	BCC
ASCII value	h05	h3130	h52 (h72)	h5342	h3036	h254D57313030	h3032	h04	

④ BCC : When the main instruction is small character (r), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

⑤ Length of device definition : It indicates that the device definition include '%' occupies how many bytes after converted to ASCII code (1byte = 2 ASCII codes). The available range is h01 ~ h10 (ASCII format : h3031 ~ h3130)

Example : %MW000 = h06

%PW0000 = h07

⑥ Device definition : It indicates an actual address to be read. It should be consist of '%', device type (capital or small letter), and numbers only.

⑦ Number of data : It indicates that how many words will be read from the start address. The range is h01 ~ h3C (1 ~ 60).

Remark

The continuous reading command does not support bit data type.

8) Response frame (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Number of data	Data	Tail	Frame check
Frame example	ACK	h10	R (r)	SB	h04	h12345678	ETX	BCC
ASCII value	h06	h3130	h52 (h72)	h5342	h3034	h3132333435363738	h03	

① Station number, main instruction, and instruction type are same as the request format.

② When the main instruction is small character (r), the lower byte of summation from ACK to ETX is converted into ASCII format and added to frame as BCC check.

③ Number of data : It indicates that the following data occupies how many bytes in hexadecimal format (before converted to ASCII code). It can be obtained by multiplying data type (1 word = 2 byte) and number of data in the request format.

Example : The number of data in request format = h02

The number of data in response format : 2×2 = h04

④ In data area, the hexadecimal data is stored in ASCII code format.

9) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code (Hex 2 byte)	Tail	Frame check
Frame example	NAK	h10	R (r)	SB	h2232	ETX	BCC
ASCII value	h15	h3130	h52 (h72)	h5342	h32323332	h03	

⑤ Station number, main instruction, and instruction type are same as the request format.

⑥ When the main instruction is small character (r), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.

⑦ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

10) Example

Read the contents of 2 words from the first word of M area (M000), and the station number of PLC is 10 (h0A). Assume that the content of M000 is h1234 and M0001 is h5678.

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Length of device definition	Device definition	Number of data	Tail	Frame check
Frame example	ENQ	h0A	R (r)	SB	h06	%MW000	h02	EOT	BCC
ASCII value	h05	h3041	h52 (h72)	h5342	h3036	h254D57303030	h3032	h04	

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Number of data	Data	Tail	Frame check
Frame example	ACK	h0A	R (r)	SB	h04	h12345678	ETX	BCC
ASCII value	h06	h3041	h52 (h72)	h5342	h3034	h3132333435363738	h03	

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code	Tail	Frame check
Frame example	NAK	h0A	R (r)	SB	Error code (2 byte)	ETX	BCC
ASCII value	h15	h3041	h52 (h72)	h5342	ASCII value (4 byte)	h03	

7.5.3 Write single device (WSS)

1) Introduction

This command is used for writing single devices. Max. 16 separated devices can be written with a command.

2) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Number of blocks	Length of device definition	Device definition	…	Tail	Frame check
Frame example	ENQ	h20	W (w)	SS	h01	h06	%MW100	…	EOT	BCC
ASCII value	h05	h3230	h57 (h77)	h5353	h3031	h3036	h254D57313030		h04	

1 block
(Max. 16 blocks available)

① BCC : When the main instruction is small character (w), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

② Number of blocks : It indicates how many blocks (block : length of device definition + device definition) are following, and maximum number of blocks is 16. Therefore, the range of block number is h01 ~ h10 (ASCII code : h3031 ~ h3130).

③ Length of device definition : It indicates that the device definition include '%' occupies how many bytes after converted to ASCII code (1byte = 2 ASCII codes). The available range is h01 ~ h10 (ASCII format : h3031 ~ h3130)

Example : %MW000 = h06
%MX0000 = h07

④ Device definition : It indicates an actual address where data is written. It should be consist of '%', device type (capital or small letter), and numbers only.

⑤ Data : This area contains the data to be written in ASCII code format. The length of data is determined on basis of data type. If the data type is word, the length is 2 byte (1word) and if the data type is bit, the length is 1 byte.

Example :
Write 0 to a bit device : h00
Write 1 to a bit device : h01
Write h0001 to a word device : h0001
Write h1234 to a word device : h1234

Remark

1. The ‘h’ is added to show the numeric data is hexadecimal format. When you write frame, please do not add ‘h’ to actual numeric data.
2. All blocks in one frame should have same data type. If the data type of first block is bit and that of second is word, an error will occurs.

3) Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Tail	Frame check
Frame example	ACK	h20	W (w)	SS	ETX	BCC
ASCII value	h06	h3230	h57 (h77)	h5353	h03	

① Station number, main instruction, and instruction type are same as the request format.
② When the main instruction is small character (w), the lower byte of summation from ACK to ETX is converted into ASCII format and added to frame as BCC check.

4) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code (Hex 2 byte)	Tail	Frame check
Frame example	NAK	h20	W (w)	SS	h2232	ETX	BCC
ASCII value	h15	h3230	h57 (h77)	h5353	h32323332	h03	

③ Station number, main instruction, and instruction type are same as the request format.
④ When the main instruction is small character (w), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.
⑤ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

5) Example

Write h1234 to the first word of P area (P000) of the PLC of that station number is h01. (No BCC check)

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Number of blocks	Length of device definition	Device definition	Data	Tail
Frame example	ENQ	h01	W	SS	h01	h06	%PW000	h1234	EOT
ASCII value	h05	h3031	h57	h5353	h3031	h3036	h255057 303030	h31323334	h04

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Tail
Frame example	ACK	h01	W	SS	EXT
ASCII value	h06	h3031	h57	h5353	h03

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code	Tail
Frame example	NAK	h01	W	SS	error code (2 byte)	ETX
ASCII value	h15	h3031	h57	h5353	ASCII value (4 byte)	h03

7.5.4 Write continuous device (WSB)

1) Introduction

This command is used for writing continuous devices by assigning start address and word number. Only word data type is available for this command, and Max. 120 words can be written with one command.

2) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Length of device definition	Device definition	Number of data	Data	Tail	Frame check
Frame example	ENQ	h10	W (w)	SB	h06	%MW100	h02	h11112222	EOT	BCC
ASCII value	h05	h3130	h57 (h77)	h5342	h3036	h254D57 313030	h3032	h31313131 32323232	h04	

① BCC : When the main instruction is small character (w), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

② Length of device definition : It indicates that the device definition include '%' occupies how many bytes after converted to ASCII code (1byte = 2 ASCII codes). The available range is h01 ~ h10 (ASCII format : h3031 ~ h3130)

Example : %MW000 = h06

%PW0000 = h07

③ Device definition : It indicates an actual start address where data is written. It should be consist of '%', device type (capital or small letter), and numbers only.

④ Number of data : It indicates that how many words to be written from the start address assigned by device definition. If the number of data is 5, for example, it means that the length of data is 5 words. The range is 0 ~ 60 words (h00 ~ h3C)

Data : This area contains the data to be written in ASCII code format.

Remark

The continuous writing command does not support bit data type.

3) Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Tail	Frame check
Frame example	ACK	h10	W (w)	SB	EXT	BCC
ASCII value	h06	h3130	h57 (h77)	h5342	h03	

① Station number, main instruction, and instruction type are same as the request format

② When the main instruction is small character (w), the lower byte of summation from ACK to ETX is converted into ASCII format and added to frame as BCC check.

4) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code (Hex 2 byte)	Tail	Frame check
Frame example	NAK	h20	W (w)	SB	h2232	ETX	BCC
ASCII value	h15	h3230	h57 (h77)	h5342	h32323332	h03	

① Station number, main instruction, and instruction type are same as the request format.

② When the main instruction is small character (w), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.

③ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

5) Example

Write hAA15 and h056F to the P000 and P001 of station number h01. (Without BCC)

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Length of device definition	Device definition	Number of data	Data	Tail
Frame example	ENQ	h01	W	SB	h06	%MW100	h02	h11112222	EOT
ASCII value	h05	h3031	h57	h5342	h3036	h254D57 313030	h3032	h31313131 32323232	h04

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Tail
Frame example	ACK	h01	W	SB	EXT
ASCII value	h06	h3031	h57	h5342	h03

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code (Hex 2 byte)	Tail
Frame example	NAK	h01	W	SB	h2232	ETX
ASCII value	h15	h3031	h57	h5342	h32323332	h03

7.5.5 Register monitoring number

1) Introduction

The monitoring number registration function is executed with the reading device command (RSS, RSB). User can register maximum 10 monitoring numbers, and execute registered monitoring number with the monitoring execution command.

2) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Registration number	Registration format	Tail	Frame check
Frame example	ENQ	h01	X (x)	h06		EOT	BCC
ASCII value	h05	h3031	h58 (78)	h3036		h04	

① BCC : When the main instruction is small character (x), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

② Registration number : Max. 10 numbers can be registered. If a registration number is already exist, the old registration number is replaced with new one.

③ Registration format

The registration format is same as the read single/continuous device command, but the header, station number, EOT, and BCC is not included. See the following examples for details.

a) Read single device

Main instruction	Instruction type	Number of blocks	Length of device definition	Device definition	
R (r)	SS	h01	h06	%MW100	…
h52 (h72)	h5353	h3031	h3036	h254D57313030	

1 block
(Max. 16 blocks available)

b) Read continuous device

Main instruction	Instruction type	Length of device definition	Device definition	Number of data
R (r)	SB	h06	%MW100	h02
h52 (h72)	h5342	h3036	h254D57313030	h3032

3) Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Registration number	Tail	Frame check
Frame example	ACK	h01	X (x)	h06	ETX	BCC
ASCII value	h06	h3031	h58 (78)	h3036	h03	

① Station number, main instruction, and registration number are same as the request format.

② When the main instruction is small character (x), the lower byte of summation from ACK to ETX is converted into ASCII format and added to frame as BCC check.

4) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Registration number	Error code	Tail	Frame check
Frame example	ACK	h01	X (x)	h06	h1132	ETX	BCC
ASCII value	h06	h3031	h58 (78)	h3036	h31313332	h03	

① Station number, main instruction, and registration number are same as the request format.

② When the main instruction is small character (x), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.

③ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

5) Example

Register monitoring number 1 (Read D000 of station number 1)

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Registration number	Registration format				Tail	Frame check
					Instruction	Number of blocks	Length of device definition	Device definition		
Frame example	ENQ	h01	X (x)	h01	RSS	h01	h07	%DW0000	EOT	BCC
ASCII value	h05	h3031	h58 (78)	h3031	h525353	h3031	h3037	h4457 30303030	h04	

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Registration number	Tail	Frame check
Frame example	ACK	h01	X (x)	h01	ETX	BCC
ASCII value	h06	h3031	h58 (78)	h3031	h03	

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Registration number	Error code	Tail	Frame check
Frame example	ACK	h01	X (x)	h01	h1132	ETX	BCC
ASCII value	h06	h3031	h58 (78)	h3031	h31313332	h03	

7.5.6 Execute monitoring

1) Introduction

This command used for executing the pre-registered monitoring number. When this command is executed, the PLC returns the contents of devices that are registered with monitoring number.

2) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Registration number	Tail	Frame check
Frame example	ENQ	h01	Y (y)	h01	EOT	BCC
ASCII value	h05	h3031	h59 (79)	h3031	h04	

① The registration number should be registered on PLC before executing monitoring.

② BCC : When the main instruction is small character (y), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

3) Response format (PLC → External device : ACK response)

There are two response formats according to the type of registered format (read single device or read continuous devices).

① When registered format is reading single device

Format name	Header	Station number	Main instruction	Registration number	Number of blocks	Length of data	Data		Tail	Frame check
Frame example	ACK	h01	Y (y)	h01	h02	h02	h9183		ETX	BCC
ASCII value	h06	h3031	h59 (79)	h3031	h3032	h3032	h39313833		h03	

1 block
(Max. 16 blocks available)

② When registered format is reading continuous devices

Format name	Header	Station number	Main instruction	Registration number	Length of data	Data	Tail	Frame check
Frame example	ACK	h01	Y (y)	h01	h04	h9183AABB	ETX	BCC
ASCII value	h06	h3031	h59 (79)	h3031	h3034	h3931383341414242	h03	

4) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Registration number	Error code	Tail	Frame check
Frame example	ENQ	h01	Y (y)	h01	h1132	EOT	BCC
ASCII value	h05	h3031	h59 (79)	h3031	h31313332	h04	

① Station number, main instruction, and registration number are same as the request format.

② When the main instruction is small character (y), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.

③ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

5) Example

Execute the registration number 1 of station number 1. Assume that reading single device (D000, word) is already registered as number 1 and the contents of D000 is h3202. (No BCC check)

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Registration number	Tail
Frame example	ENQ	h01	Y	h01	EOT
ASCII value	h05	h3031	h59	h3031	h04

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Registration number	Number of blocks	Length of data	Data	Tail
Frame example	ACK	h01	Y	h01	h01	h02	h3202	ETX
ASCII value	h06	h3031	h59	h3031	h3031	h3032	h33323032	h03

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Registration number	Error code	Tail
Frame example	ENQ	h01	Y	h01	h1132	EOT
ASCII value	h05	h3031	h59	h3031	h31313332	h04

7.5.7 Read the status of PLC (RST)

1) Introduction

This command is used for reading the status of PLC such as operation status, error information, etc.

2) Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Tail	Frame check
Frame example	ENQ	h01	R (r)	ST	EOT	BCC
ASCII value	h05	h3031	h52 (72)	h5354	h04	

BCC : When the main instruction is small character (r), the lower byte of summation from ENQ to EOT is converted into ASCII format and added to frame as BCC check.

3) Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Status data	Tail	Frame check
Frame example	ACK	h01	R (r)	ST	(Hex 20 bytes)	ETX	BCC
ASCII value	h06	h3031	h52 (72)	h5354	(ASCII code 40 bytes)	h03	

① Station number, main instruction, and instruction type is same as those of the request format.

② When the main instruction is small character (r), the lower byte of summation from ACK to ETX is converted into ASCII format and added to frame as BCC check.

③ Status data : The status data is consist of 20 byte of hexadecimal numbers. When the PLC returns, it is converted to the ASCII code, and its size is doubled (40 bytes). See the next page for detail of status data configuration.

[Data configuration of status data]

→ Byte

20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	Not used			Error code				Not used				CPU mode	Key / Flash	Not used		O/S version		CPU type	

- **CPU type**

CPU type	Code
K200S A (K3P-07AS)	h3A
K200S B (K3P-07BS)	h3B
K200S B (K3P-07CS)	h3C
K300S A (K4P-15AS)	h33
K300S B (K4P-07AS)	h37
K1000S (K7P-30AS)	h32

- **O/S version** : (Use only lower 8 bits)

  Example) O/S version 1.2

1				2			
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	0	0	1	0	0	1	0

- **Key / Flash**

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Not used						Not used	

0 : Flash memory is mounted

1: Flash memory is not mounted

0 : Mode key is on local mode

1: Mode key is on remote mode

- **CPU mode** (Use only lower 4 bits) : Turn on one bit according to the operation mode of master CPU.

bit 3	bit 2	bit 1	bit 0
DEBUG	PAUSE	STOP	RUN

- **Error code** : Refer the chapter 12.5 ‘ Error code list’

4) Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code	Tail	Frame check
Frame example	NAK	h01	R (r)	ST	h1132	ETX	BCC
ASCII value	h15	h3031	h52 (72)	h5354	h31313332	h03	

① Station number, main instruction, and instruction type is same as those of the request format.

② When the main instruction is small character (r), the lower byte of summation from NAK to ETX is converted into ASCII format and added to frame as BCC check.

③ The error code is expressed as 2 byte of hexadecimal format (4bytes of ASCII codes) and indicates the type of error. Please refer the error code table for details.

5) Example

Read the CPU status of station number 1. (No BCC check)

① Request format (External device → PLC)

Format name	Header	Station number	Main instruction	Instruction type	Tail
Frame example	ENQ	h01	R	ST	EOT
ASCII value	h05	h3031	h52	h5354	h04

② Response format (PLC → External device : ACK response)

Format name	Header	Station number	Main instruction	Instruction type	Status data	Tail
Frame example	ACK	h01	R	ST	(Hex 20 bytes)	ETX
ASCII value	h06	h3031	h52	h5354	(ASCII code 40 bytes)	h03

③ Response format (PLC → External device : NAK response)

Format name	Header	Station number	Main instruction	Instruction type	Error code	Tail
Frame example	NAK	h01	R	ST	h1132	ETX
ASCII value	h15	h3031	h52	h5354	h31313332	h03

Chapter 8 Dedicated modem communication

8 Dedicated modem communication

8.1 Dial-up modem communication

Cnet module has a long distance communication function using public telephone line. This function enables long distance communication via public line by connecting external modem in Cnet module and calling/receiving phone.

8.1.1 External modem specifications

When using modem for communication, line connection status may be not good depending on modem's performance and public telephone line, so failure in communication may occur. Also even if being on connection, disconnection may occur. For reliable modem communication, therefore, the modem conformed to the following recommended specifications must be used.

1) Modem speed : 14,400 bps or more supported
2) DTE interface : CTS/RTS Flow Control supported.
3) Command : Hayes Interchangeable AT Command supported
4) Error correction : Error correction function(during data transmission).
5) Carrier control : Carrier detect transmission control supported

The modems tested so far are as follows, and use of other modem than these may cause problem in connection.

[Recommended external modem]

Maker (Co., LTD)	Model name
Smart Information Communication	SmartLink V32Te
Garnet Modem	GTM-288E3
US Robotics	Sportster 28800

8.1.2 How to connect to modem

1) Installation of modem

Before use, connect the modem meets the above specifications and the RS-232C port of Cnet module with RS-232C cable. [Figure 6.39] shows modem connection example.

The connecting sequence of Cnet module and modem is as follows :

① Connect recommended external modem of 6.3.1 and RS-232C port of Cnet module with RS-232C interface cable.

② Connect the interface cable connected following to connecting method pin of Figure 4.4 to RS-232C port of Cnet module and DTE connection terminal of modem.

③ Connect telephone line to line terminal of modem.

④ Verify initialization of modem after PLC power-on and modem power-on.

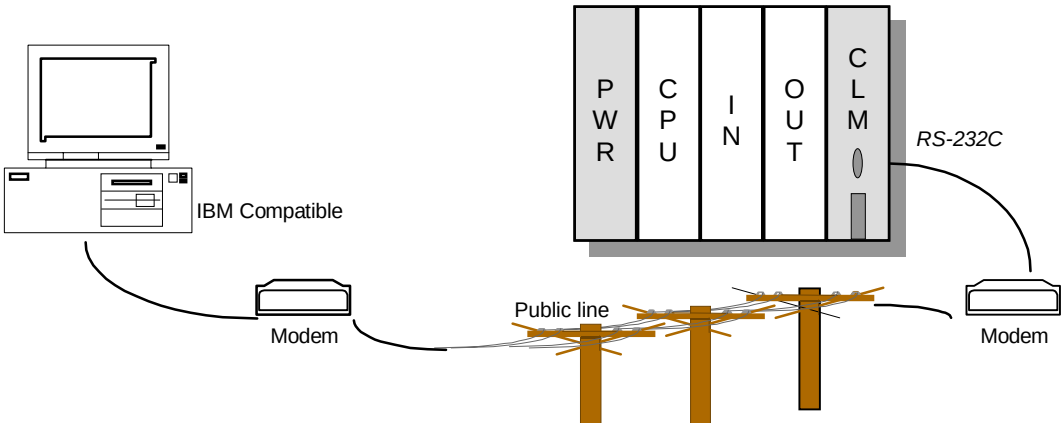


Fig. 8.1 An example of modem connection

⑤ When modem cannot be normally initialized, verify that the switch value of operation mode has been set to stand-alone mode(2 or more).

⑥ When operation mode has been set to stand-alone mode, verify that the connection state of RS-232C interface cable is OK or modem initialization command has been correctly set, and after modifying restart it.

2) Setting operation mode

[Modem connectable operation mode]

Switch value	Operation mode		Modem use or not
	RS-232C	RS-422	
0	User defined communication	User defined communication	Unavailable
1	Dedicated communication	Dedicated communication	Unavailable
2	User defined communication	User defined communication	Available
3	Dedicated communication	Dedicated communication	Available
4	User defined communication	Dedicated communication	Available
5	Dedicated communication	User defined communication	Available
6	KGLWIN	User defined communication	Available
7	KGLWIN	Dedicated communication	Available
8	Loop-back	Loop-back	Unavailable
9	Unused mode		Unavailable

[Modem connectable operation mode]

Switch value	Operation mode	Modem use or not
0	User defined communication	Available
1	Dedicated communication	
2	KGLWIN Service	
3	Remote Mode	
4	Test mode	Unavailable
5	Not used	
6		
7		
8		
9	Download mode	

The above table shows modem connectable operation modes. As shown in Table, modem connection is available in not interlocking but stand-alone mode only. When modem connection after setting to interlocking mode, the communication by using a modem operated by null modem is impossible. Attention must be paid to this point.

3) Modem initialization setting

Modem has various functions depending on manufacturer, and a communication control mode must be set. The initialization command of modem operation mode is set by frame editor as follows:

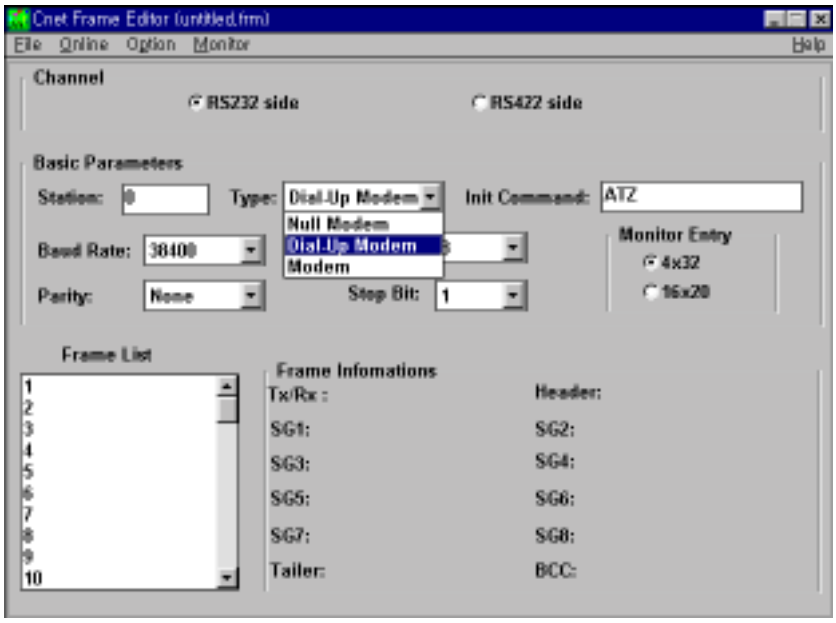


Fig. 8.2 Modem setting screen of frame editor

① Click the frame editor icon in Window

② Select communication channel to RS-232C, set communication type to modem in basic parameter setting items(Default is null modem).

③ Setting modem, setting initialization command is enabled. Enter modem initialization command(AT command) to be set in initialization command. (Default of initialization command is 'ATZ'. If there is not any setting, default is set.)

④ Set transmission specifications such as communication speed and data/stop bit in basic parameters items of [Figure 6.40]. Modem commands are shown in Table 4.4.

⑤ Setting values of communication speed and data/stop bit in basic parameter items are transmission specifications not between modems but between DTE(Cnet module) and DCE(Modem). Set basic parameters to default values, and communication speed to Max. speed of modem.

⑥ If connection is selected in on-line menu of frame editor, connection completion box is displayed after the completion :

Fig. 8.3 Connection completed

⑦ If, after connection completion, writing is selected, the following dialog box is displayed. At this time, select basic parameters in communication option, select the slot number which Cnet module is mounted, and click on the writing button.

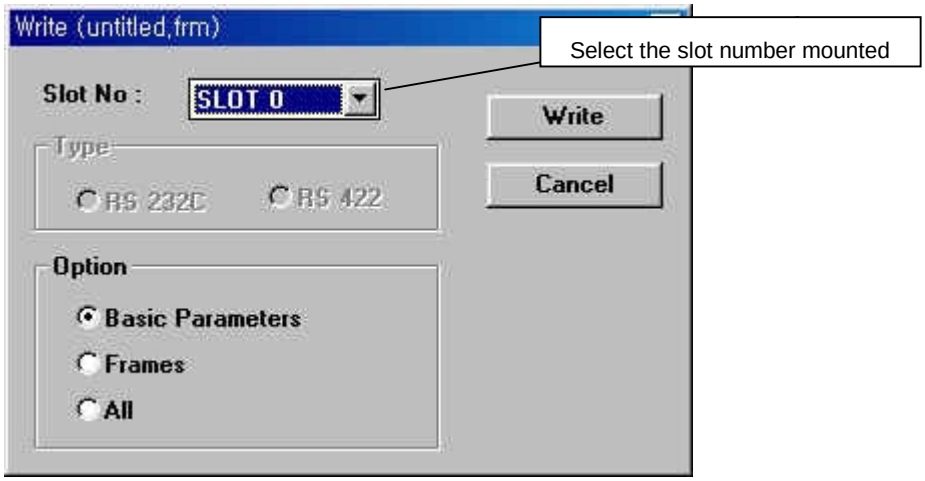


Fig. 8.4 Write parameter

⑧ After basic parameter writing is selected, the dialog box that confirms the operation cancel of Cnet module as shown in [Figure 8.5]. At this time, select OK to download the basic parameter to Cnet module.

Fig. 8.5 Write confirmation

⑨ If, after writing basic parameter, operation switch is selected, the following dialog box is displayed. At this time, select slot number and communication run to start the RS-232C channel.

Fig. 8.6 Mode change

⑩ If the LEDs of No.'0' 'RUN', 6 'MODEM', and 7 'SYS-RUN' are ON after starting channel, it means that writing basic parameters has been normally completed.

⑪ If the states of LEDs are abnormal, verify that channel operation mode is stand-alone mode. If channel mode is normal, verify the slot number.

⑫ When all LEDs are in normal state, connect modem to computer link following 8.3.2, how to install modem, power-on modem, and verify the initialization of modem.

⑬ When normal, No.'1' 'TX' LED flashes once, and the modem is initialized. When the modem has not been initialized, No.'1' 'TX' LED flashes continuously at interval of 1 sec., and the modem is not initialized.

⑭ When No.'1' LED 'TX' flashes at interval of 1 sec., it means that the modem has not been initialized. At this time, verify that the modem settings are fit. If fit, verify that RS-232C interface cable has been correctly connected.

8.1.3 KGLWIN connection service via modem

1) Introduction

This is a function so that PLC can remotely perform preparing program, downloading of user program, debugging program, and monitoring, etc. without moving physical connection of KGLWIN in network system connected via Cnet module.

Especially, when KGLWIN and PLC are distant away each other, this function enables easy access to PLC CPU by KGLWIN remote connection via public line using dialing function and remote connection function of KGLWIN, and modem connection function of computer link.

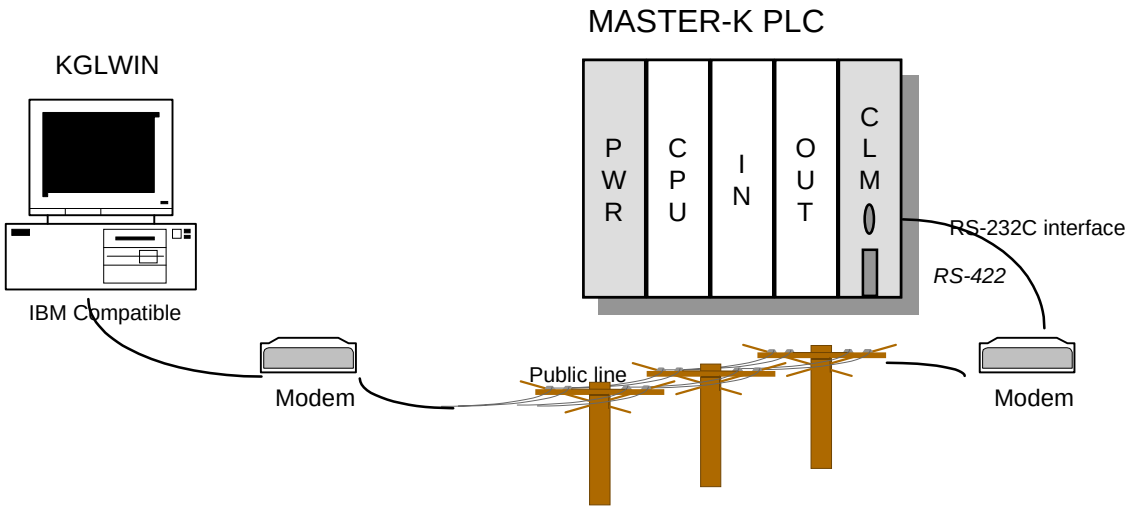


Fig. 8.7 Example of KGL-WIN modem connection

Figure 8.7 shows an example of remote connection by connecting modem to IBM-PC and Cnet link module.

Using KGLWIN communication service enables easy access to a remote PLC without moving. In addition, even if PLC is placed in position difficult to access, because access to remote PLC is possible, difficulty of program is dissolved. This function enables reduction of time and efforts for installation and modification.

For the details on KGLWIN communication service, see MASTER-K Mnet/Fnet technical manual.

2) How to connect KGLWIN modem

KGLWIN connection via Cnet module and modem has additional functions such as dialing and disconnecting in addition to KGLWIN connection of MASTER-K Fnet. Namely, KGLWIN first dials, and after the connection remote connection is performed. The procedure is as follows :

① Set the operation mode setting switch on the front of computer link module to '6' or '7' to set RS-232C channel to KGLWIN mode.

② After connecting modem to computer link module, connect it to telephone line, and power on.

③ After execution of KGLWIN, select modem of 'Method of Connection' menu.

④ If the dialog box is displayed like figure, click on the OK button after setting the data required.

⑤ Select [Connect] at on-line menu. When setting of COM port of modem is incorrect, or the connection with modem is error, error message is displayed. At this time, verify COM port or modem connection.

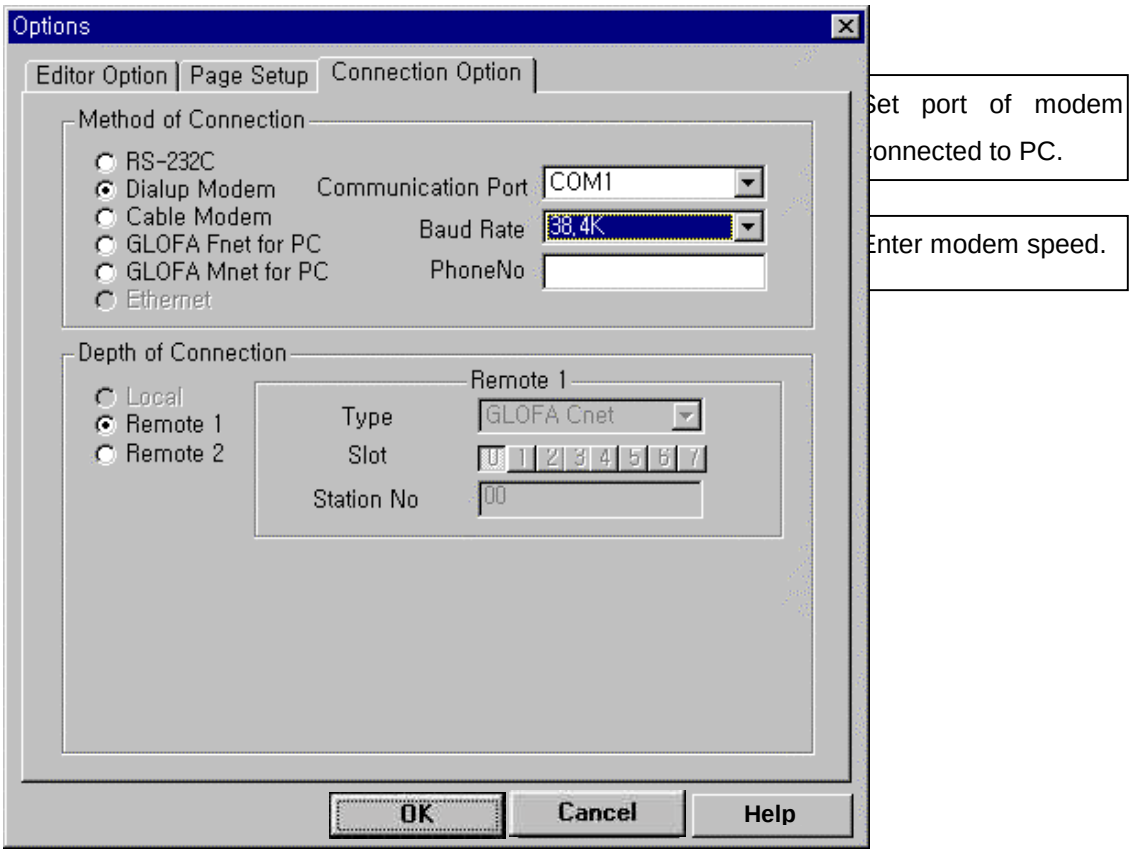


Fig. 8.8 Connection option of KGL-WIN

⑥ If connection is completed, message box like following figure will be displayed.

⑦ At this time, it means that the 1st step connection has been completed, it is a same status as linking with RS-232C connection cable. All functions of on-line menu can be used.

⑧ If disconnection in the state of remote connection is required, perform the sequence in reverse of connection. If the disconnection is selected in On-line menu, the disconnection menu box is displayed, and it means the connection has been closed.

Remarks

1) How to use KGLWIN after remote connection is the same as of local connection. For the details, see 6.3, KGLWIN communication service of MASTER-K Mnet/Fnet User's Manual.
2) The state of PLC control via modem depends on the performance of modem and the state of telephone line. Thus, if the state of telephone line is bad, the connection may be disconnected. At this time, reconnection must be tried not immediately but after waiting for 30 seconds. Try connection again from (1).

8.2 Dedicated modem communication

Computer link module has a long distance communication function using dedicated line with external dedicated modem. Also this has a function to control dedicated modem, and a data communication function using the dedicated line.

8.2.1 Specifications of dedicated modem

Performance of the dedicated modem communication using Cnet module is determined by the performance of dedicated modem and the state of dedicated line. Because low performance modem or bad line becomes a cause of performance deterioration, the modem fit to the following recommended specifications must be used for reliable communication.

1) Modem speed : 1200 bps or more supported
2) DTE interface : CTS/RTS Flow Control supported
3) Error correction : Error correction function in data transmission
4) Carrier control : Carrier detect transmission control supported
5) Line control : Full-duplex/Half-duplex communication supported(2 line type/4 line type)
6) RTS-CTS delay time : within Max. 500 ms

8.2.2 How to connect to modem

1) Installation of modem
   ① Before use, connect the modem meets the above specifications to Cnet module with RS-232C cable. Figure 6.42 shows an example of modem connection.
   The connecting sequence of computer link module and modem is as follows :
   ② Connect recommended external modem of 6.4.1 and RS-232C channel of Cnet module with RS-232C cable.
   ③ Connect the cable connected following to connecting method of Figure 4.4 to RS-232C channel of Cnet module and DTE connection terminal of modem.
   ④ Connect dedicated telephone line to line terminal of modem.

   ⑤ Set the operation mode switch of computer link to the position required, after that power on, and set communication type to dedicated modem mode by using frame editor.
   ⑥ Verify that the modem is initialized after power-on of modem.

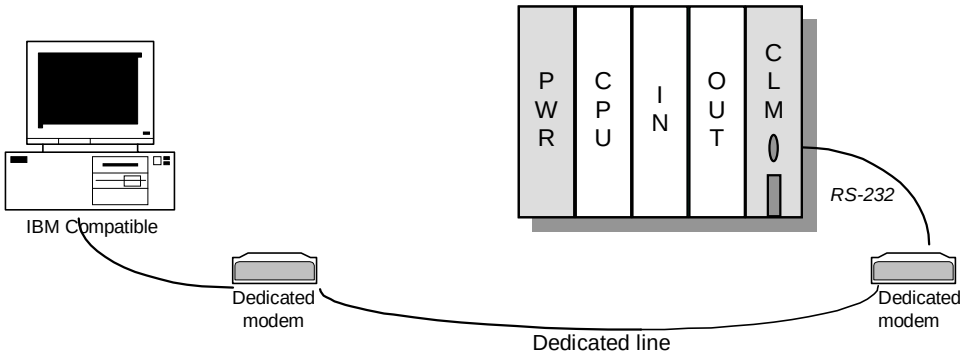


Fig. 8.9 Example of dedicated modem connection

⑦ When modem cannot be normally initialized, verify that the switch value of operation mode has been set to stand-alone mode(2 or more), and that the communication type is has been set to dedicated modem communication by using frame editor.

⑧ When channel mode and communication type has been correctly set, verify that the connection state of RS-232C cable is OK.

⑨ When the cable connection is OK, verify that setting of modem is correct by seeing modem manual.

2) Setting dedicated modem mode

[Dedicated modem connectable operation mode]

Switch value	Operation mode		Modem use or not
	RS-232C	RS-422	
0	User defined communication	User defined communication	Unavailable
1	Dedicated communication	Dedicated communication	Unavailable
2	User defined communication	User defined communication	Available
3	Dedicated communication	Dedicated communication	Available
4	User defined communication	Dedicated communication	Available
5	Dedicated communication	User defined communication	Available
6	KGLWIN	User defined communication	Available
7	KGLWIN	Dedicated communication	Available
8	Loop-back	Loop-back	Unavailable
9	Unused mode		Unavailable

[K3F-CU2A / K3F-CU4A]

Switch value	Operation mode	Modem use or not
0	User defined communication	Available
1	Dedicated communication	
2	KGLWIN Service	
3	Remote Mode	
4	Test mode	Unavailable
5	Not used	
6		
7		
8		
9	Download mode	

The above table shows modem connectable operation modes. As shown in Table, modem connection is available in not interlocking but stand-alone mode only. When modem connection after setting to interlocking mode, the communication by using a modem operated by null modem is impossible. Attention must be paid to this point.

3) Setting frame editor

When communication via dedicated modem, the dedicated modem communication type must be set through frame editor. The procedure is as follows :

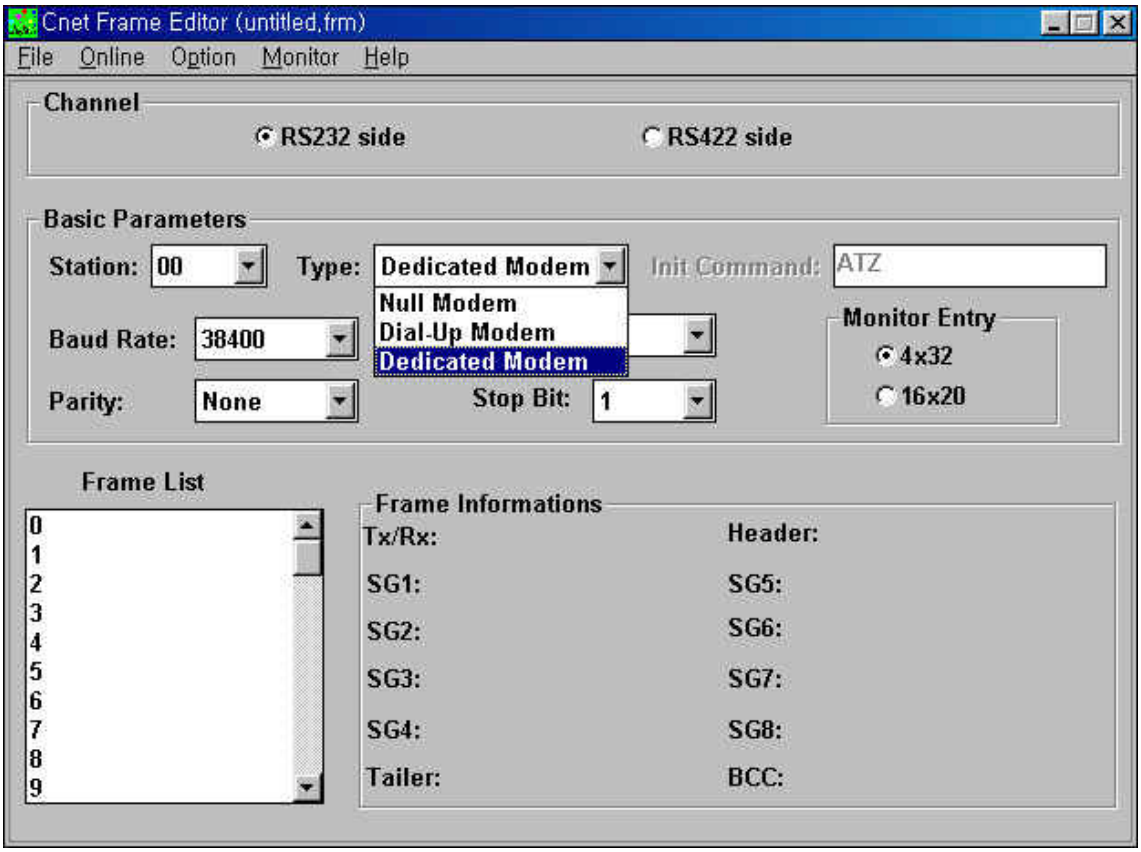


Fig. 8.10 Dedicated modem setting screen of frame editor

① Click the frame editor icon in widow.

② Select communication channel to RS-232C, set communication type to modem in basic parameter setting items of Figure 8.10, and set transmission specifications such as communication speed and data/stop bit. This must be the same as the transmission type set for dedicated modem.

③ Set communication type to dedicated modem in basic parameter setting.(Default is null modem.)

④ If connection is selected in on-line menu of frame editor, connection completion box as follows is displayed after the completion :

⑤ If, after connection completion on-line menu, writing is selected, the following dialog box is displayed. At this time, select basic parameters in communication option, select the slot number which Cnet module is mounted, and click on the writing button.

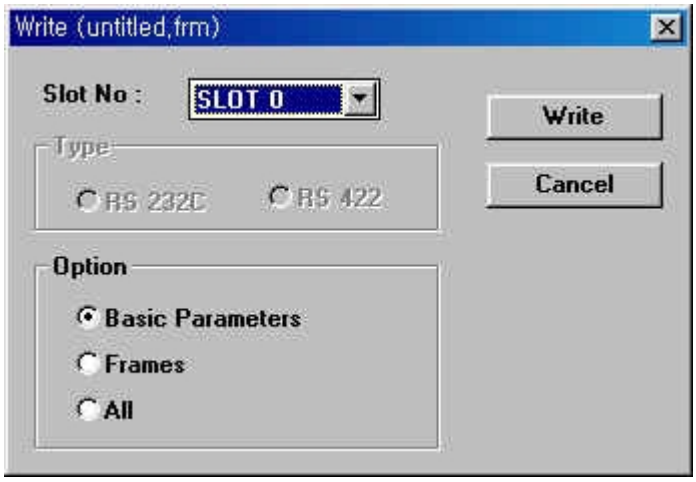


Fig. 8.11 Writing parameter

⑥ If basic parameter writing is selected, the dialog box that confirms the operation cancel of Cnet module as shown in Figure 8.12. At this time, select OK to download the basic parameter to Cnet module.

Fig. 8.12 Writing confirmation

⑦ After writing basic parameter, operation switch is selected, the following dialog box is displayed. At this time, select slot number and communication run to start the RS-232C channel.

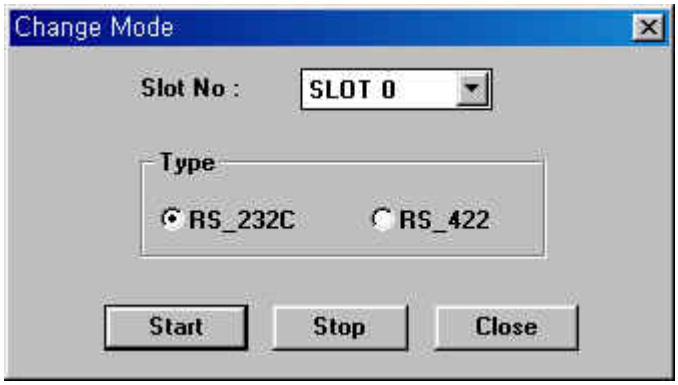


Fig. 8.13 Mode change screen

⑧ If the LEDs of No.'0' 'RUN', 6 'MODEM', and 7 'SYS-RUN' are lit by verifying LED indication after starting channel, it means that writing basic parameters has been normally completed.

⑨ If the states of LEDs are abnormal, verify that channel operation mode is stand-alone mode. If channel mode is normal, verify that the slot number fits to the mounting No. of computer link module.

⑩ When all LEDs are in normal state, connect modem to computer link following 6.4.2, how to install modem, power-on PLC and modem, and verify the normal operation of modem.

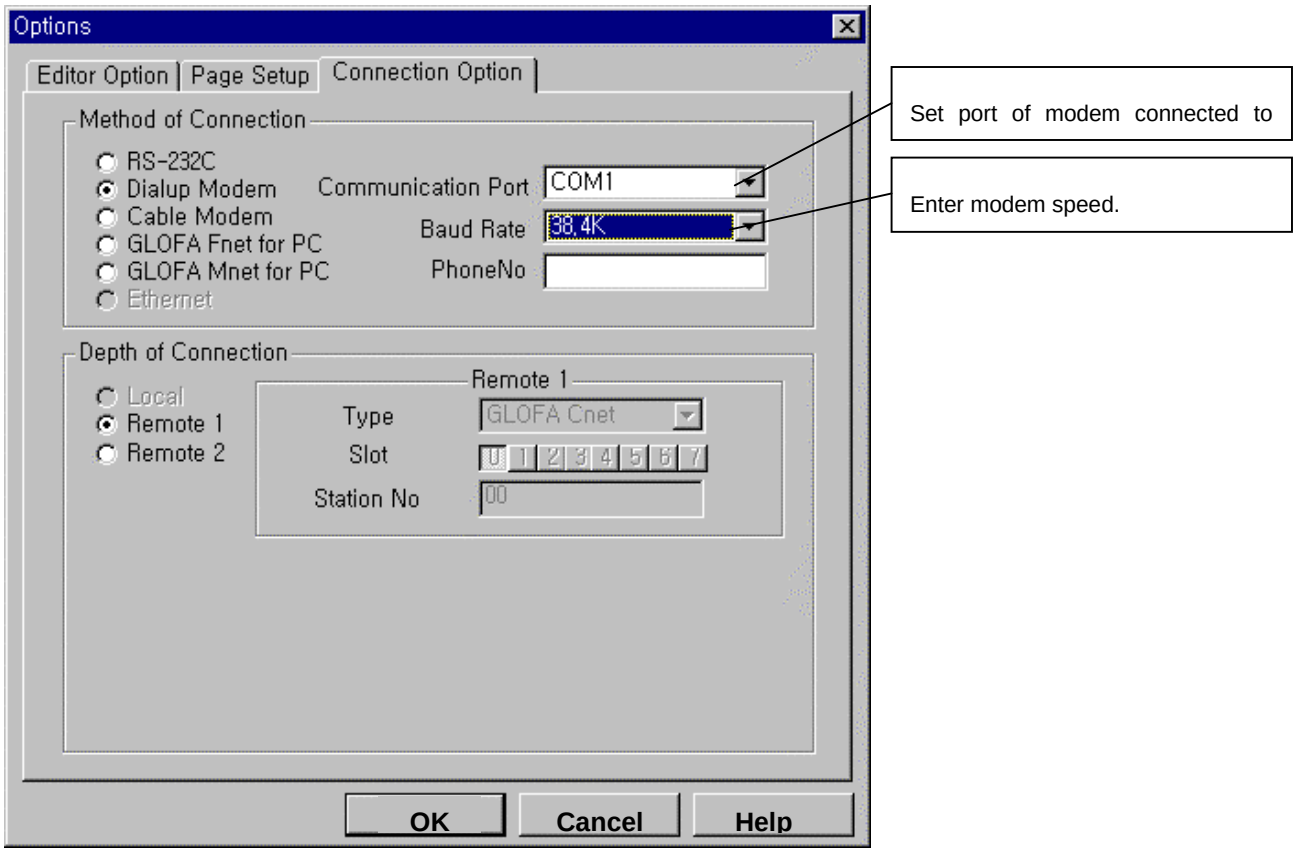
⑪ If modem operates abnormally, modify settings of modem operation by seeing modem manual, and then reconnect.

4) Remote connection with KGLWIN through dedicated modem connection

① Set the operation mode setting switch on the front of computer link module to '6' or '7' to set RS-232C channel to KGLWIN mode.

② After connecting modem to computer link module, connect it to telephone line, and power on.

③ After execution of KGLWIN, select modem of 'Method of Connection' menu.



④ If the dialog box is displayed like figure, click on the OK button after setting the data required.

Some of specification of communications are fixed as following, and they can not changed.

Data Bit : 8 bits
Stop Bit : 1 bit
Parity Bit : None

Remote 1 / Remote 2 means the connection status. When connection is performs through modem, default status is remote 1. When connect other PLC through the communication module (Fnet / Cnet) mounted at the remote PLC, set the depth of connection as 'Remote 2'.
When the connection is completed, the following message is displayed at the status bar.

K200S / Remote1 / Remote stop

Remarks

1) How to use KGLWIN after remote connection is the same as of local connection. For the details, see 6.3, KGLWIN communication service of MASTER-K Mnet/Fnet User's Manual.
2) The state of PLC control via modem depends on the performance of modem and the state of telephone line. Thus, if the state of telephone line is bad, the connection may be disconnected. At this time, reconnection must be tried not immediately but after waiting for 30 seconds. Try connection again from (1).

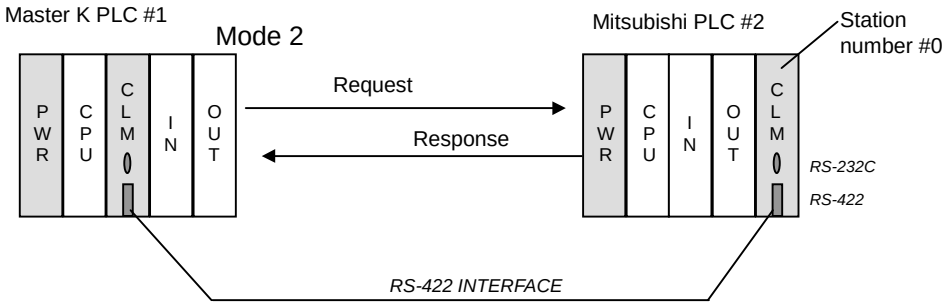
Chapter 9 Example programs

9 Example Programs

9.1 User-defined protocol

9.1.1 Communication with other manufacturer's PLC (MITSUBISHI)

The following example shows how to communicate with other manufacturer's PLC (in this example, Mitsubishi AJ71C24) via RS-422 channel. In this example, the MASTER-K Cnet module operates as a master station, and an user-defined frame is used to communicate with MITSUBISHI PLC. The following figure 6.26 shows the system configuration.



1:1 connection (User-defined, RS-422)

Fig. 9.1 An example of system configuration

The following table shows how to write, download, and execute an user-defined frame to communicate with MITSUBISH PLC.

Step	Action	Description
1	Setting basic parameters	By using frame editor, set basic parameters as it complies with the MITSUBISH's protocol.
2	Writing frame	Write an user-defined frame complies with the MITSUBISHI's protocol.
3	Download basic parameters and frames	Download the basic parameters and user-defined frame to the MASTER-K Cnet module. (Refer the chapter 6.2.4 for details)
4	Write sequence program	Write a sequence program by using SND, RCV instructions. Refer the chapter 6.3 for usage of each instructions.
5	Download a sequence program	Download the sequence program to the CPU module
6	Monitoring	By the monitoring function of KGL-WIN, check the communication status. If the communication is not operate normally, check the transmitted data by the monitoring function of frame editor.

1) MITSUBISHI's dedicated protocol

In this example, let's assume the other manufacturer's PLC is MITSUBISHI's AJ71C24 (PLC #2), and the MASTER-K PLC(PLC#1) reads the D000 of PLC#2 and store in P002. The MASTER-K Cnet module communicates with MITSUBISHI's dedicated protocol, and the structure of MITSUBISHI's dedicated protocol is as following;

① Send frame

Protocol : **[ENQ] 0 0 F F W R 0 D 0 0 0 0 0 1 [ETX]**

Description

Station number	: 00
PLC number	: FF (Self-station)
Command	: WR (Word Read)
Wait	: 0
Start address	: D0000
Numbers of word	: 01

② Receive frame

Protocol : [**STX] 0 0 F F A 1 2 B [ETX]**

Description

Station number	: 00
PLC number	: FF (Self-station)
Data	: hA12B

The following three figures (6.27, 6.28, and 6.29) show examples of user-defined frames written for MITSUBISHI's dedicated protocol.

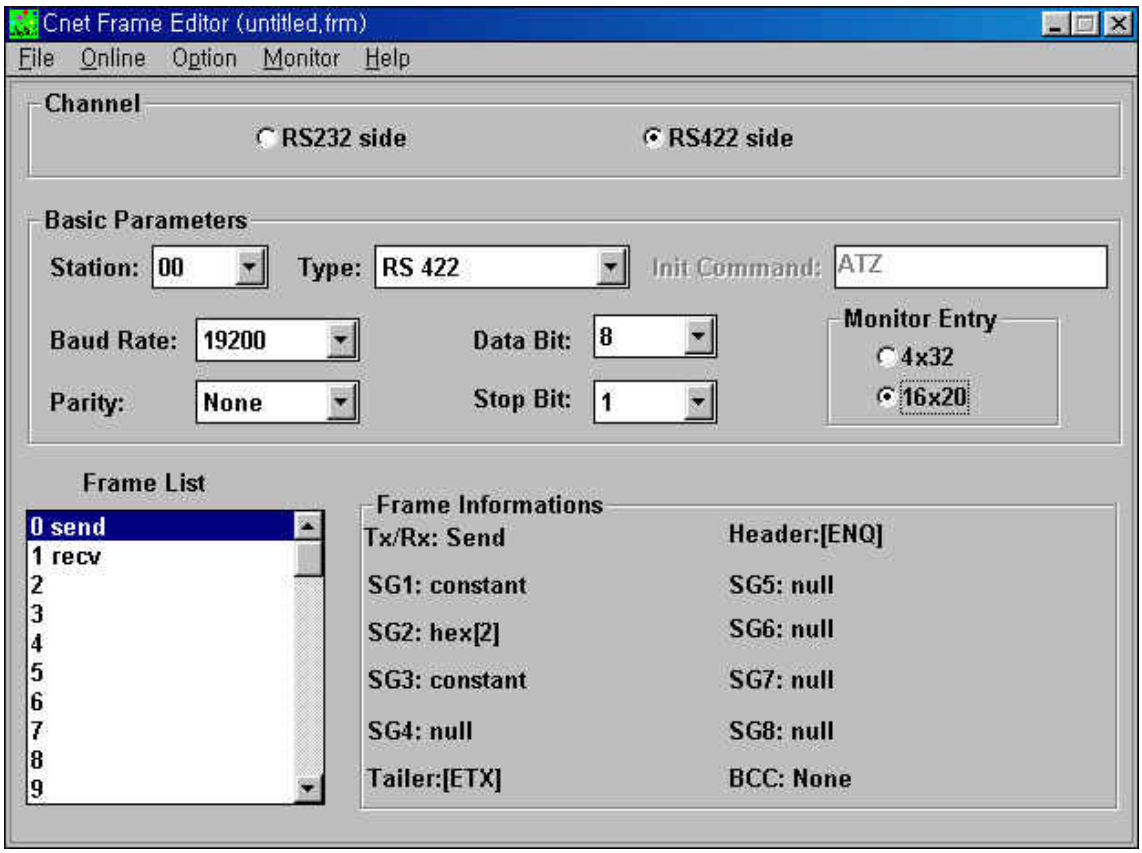


Fig. 9.2 Frame list

The following figure 6.28 shows an example of send frame setting. In the segment 1, the station number, PLC number, command, waiting, and device type is assigned. In the segment 2, the D area address to be read is assigned as 'array' type variable 'SD1.'. When write a sequence program, the address of D area should be stored in 'SD1.' as 2 bytes string (range : 0000 ~ 9999) format. Finally, the length of data to be read is assigned as constant. (in this example, h01)

In the segment 1 of receiving frame, the station number and PLC number is assigned as constant format. Then, the memory address of MASTER-K PLC at which the received data to be stored is assigned as array variable 'RD1.' It will be designated in sequence program with 'RCV' instruction.

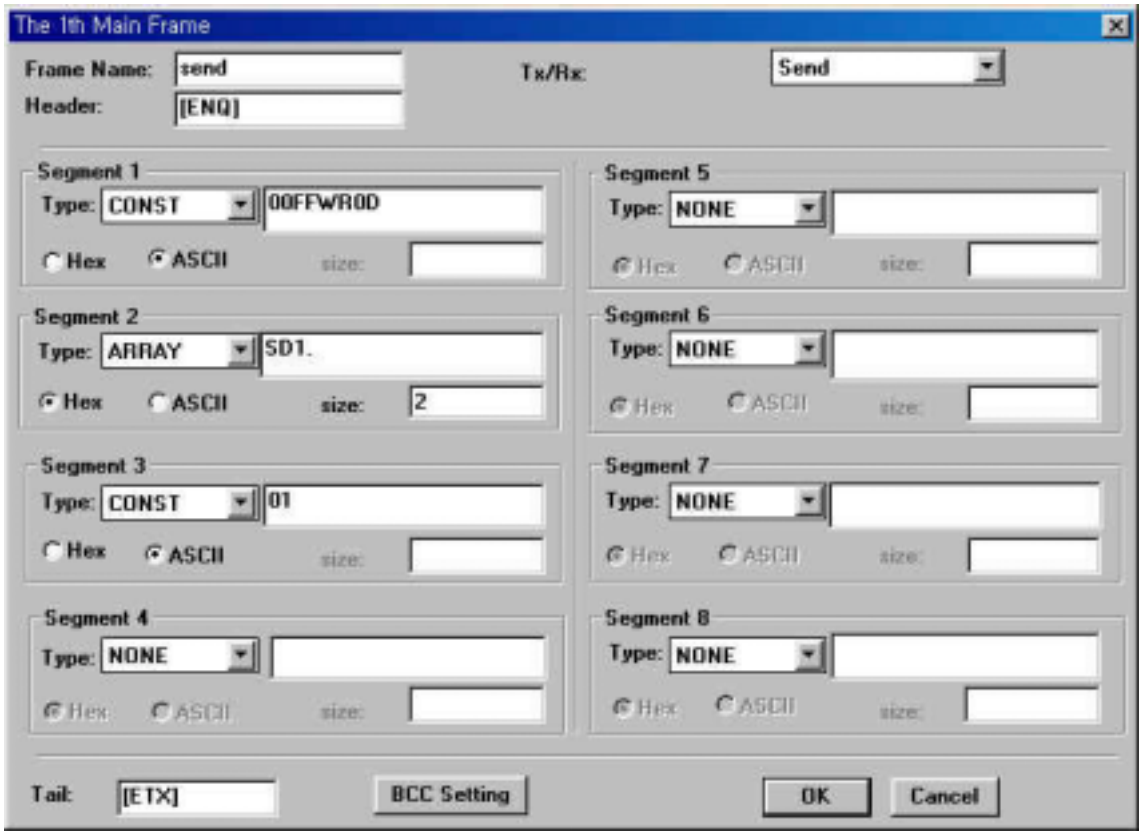


Fig. 9.3 Send frame

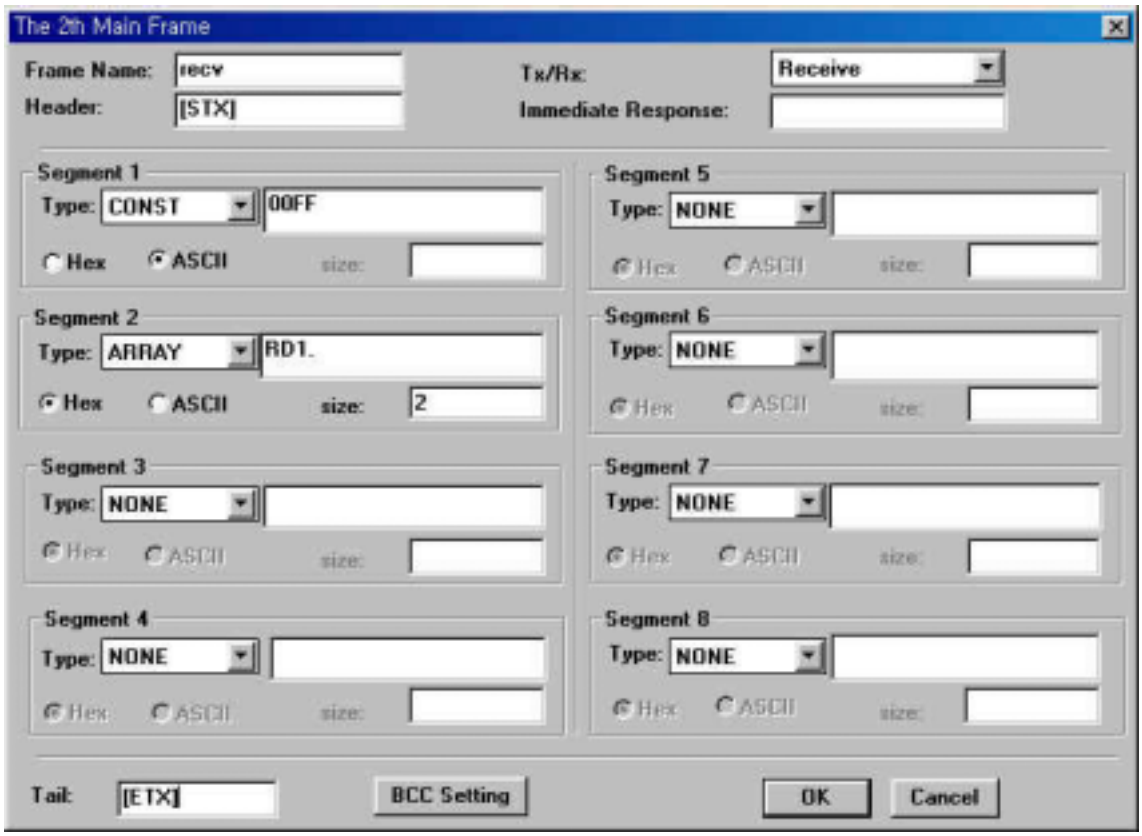


Fig. 9.4 Receive frame

The following figure 6.30 and 6.31 show examples of sequence program.

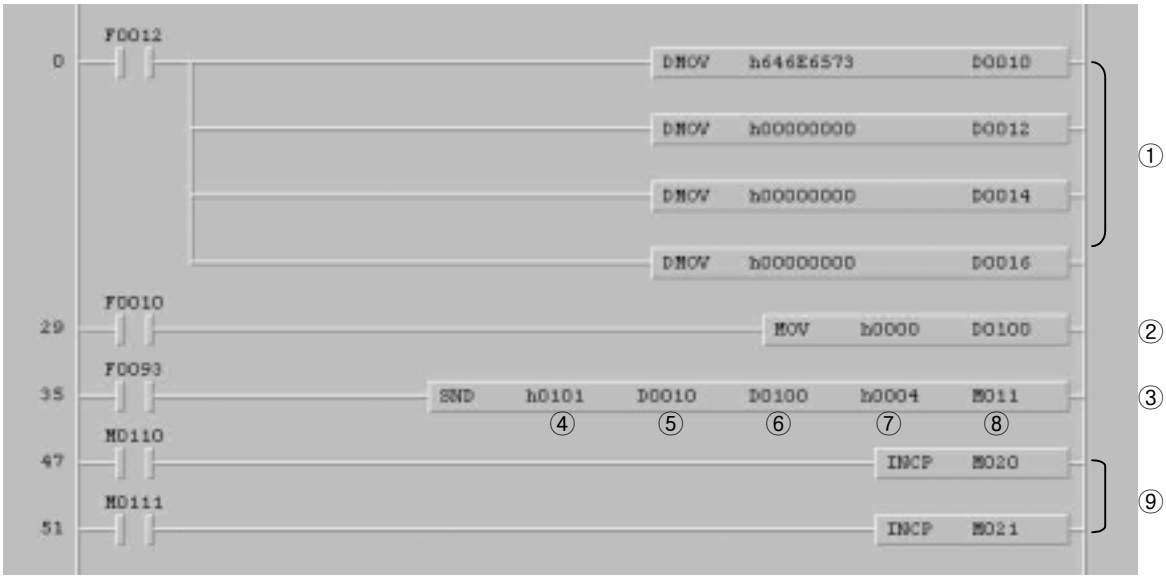


Fig. 9.5 An example of 'SND' instruction

① Store the name of sending frame ('send') in D010 ~ D017 (8 words). The name is stored as following;

D017		D016		D015		D014		D013		D012		D011		D010	
0	0	0	0	0	0	0	0	0	0	0	0	s	e	n	d

② Assign the address of PLC#2 to be read. In this example, h0000 (D0000) will be read.

③ Send the frame 'send' at every 0.5 second.

④ Assign the slot number at which the Cnet module is mounted, and communication channel. (h0101 : slot 1, RS-422)

⑤ Assign the start address of data block at which the name of frame is stored.

⑥ Assign the start address of data block at which the sending data (SD1.) is stored.

⑦ Assign the number of bytes to be sent.

⑧ Assign the address at which the communication status is stored (1 word).

Bit 0 : Done signal (No error : 1 scan on, Error : keep on state)

Bit 1 : Error signal (Normal : off, Error : on)

Bit 2 ~ 7 : Not used

Bit 8 ~ F : Error code (hexadecimal format)

⑨ M020 : Store the numbers of data transmission

M021 : Store the number of error occurrence

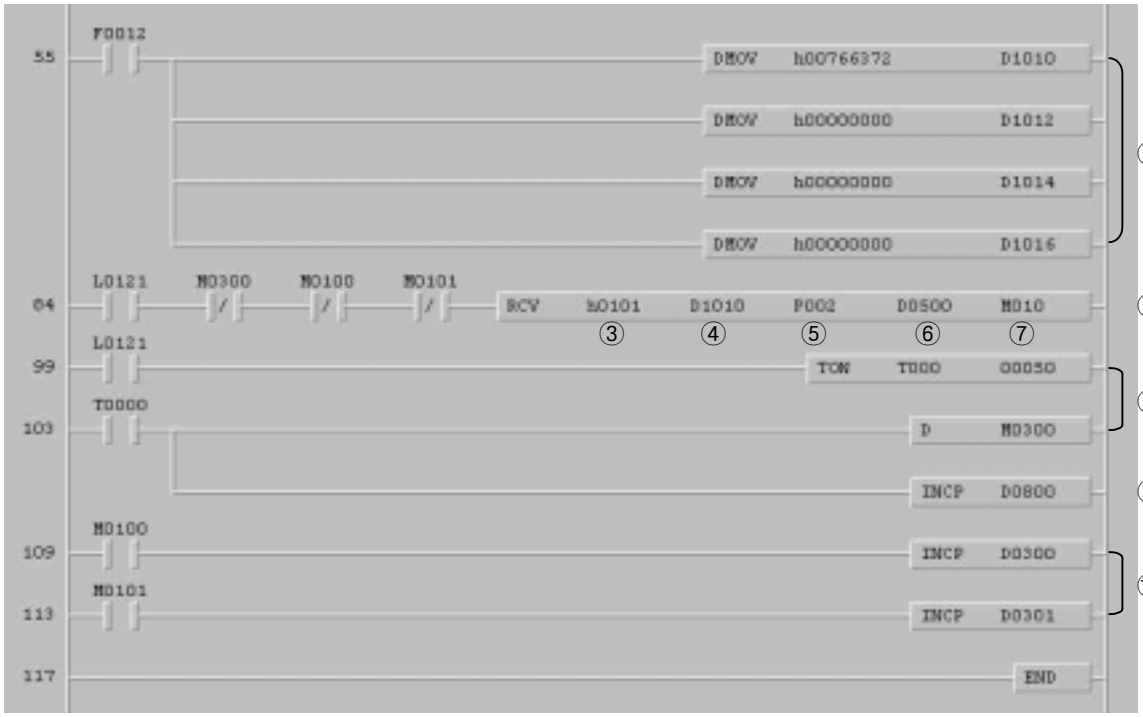


Fig. 9.6 An example of 'RCV' instruction

① Store the name of frame ('rcv') at D1010 ~ D1017 (8 words).

D1017		D1016		D1015		D1014		D1013		D1012		D1011		D1010	
0	0	0	0	0	0	0	0	0	0	0	0	0	r	c	v

② Receive the frame.

③ Assign the slot number and communication channel. (slot 1, RS-422)

④ Assign the start address of data block at which the name of frame is stored.

⑤ Assign the start address of data block at which the received data will be stored.

⑥ Assign the device at which the numbers of bytes of received data is stored.

⑦ Assign the device at which the communication status is stored.

⑧ Generates a pulse (M300) after 5 seconds from the L121 turns on. It makes the RCV instruction is executed every 5 seconds even if the L121 does not turn off (L121 error).

⑨ Counts the numbers of L121 error.

⑩ Counts the numbers of RCV execution and error occurrence.

Remark

For reliability of RCV instruction, please use those input conditions with RCV instruction as shown in above example.

L121 : Turns on per 1 scan when the 1st frame of RS-422 is received at the slot 1.

M100 : Turn on per 1 scan when the RCV instruction is executed normally.

M101 : Turn on when an error occurs during communication.

2) No-protocol mode

In this example, it will be described how to write frame to communicate with the AJ71C24 via 'No-protocol mode' of MITSUBISHI. Let's assume that the MASTER-K PLC reads D0049 of PLC#2, and sends D0100 to PLC#2. The D0100 of PLC#1 is increased by 1 every 0.5 seconds.

The frame structure is as following;

① Send frame

Protocol : **[ENQ] 0 0 F F W R 0 xxxx [ETX]**

In this example, only 'xxxx' is valid for communication. The previous data ([ENQ]00FFWR0) is used for dummy data filling the protocol format.

② Receive frame

Protocol : (No header) **xxxx** (No tail)

xxxx : the received data

The following figures (figure 6.32 ~ 6.34) show how to write an user-defined protocol for 'No-protocol' mode communication with AJ71C24.

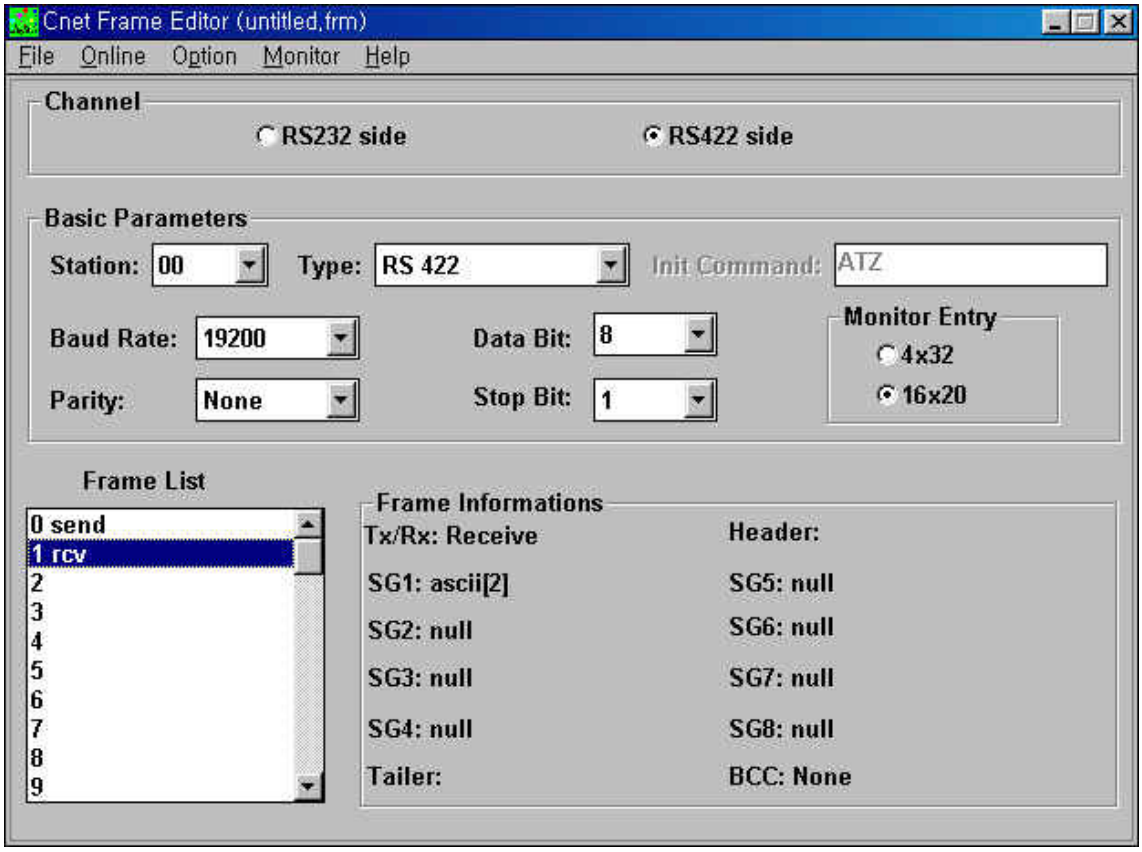


Fig. 9.7 Frame list

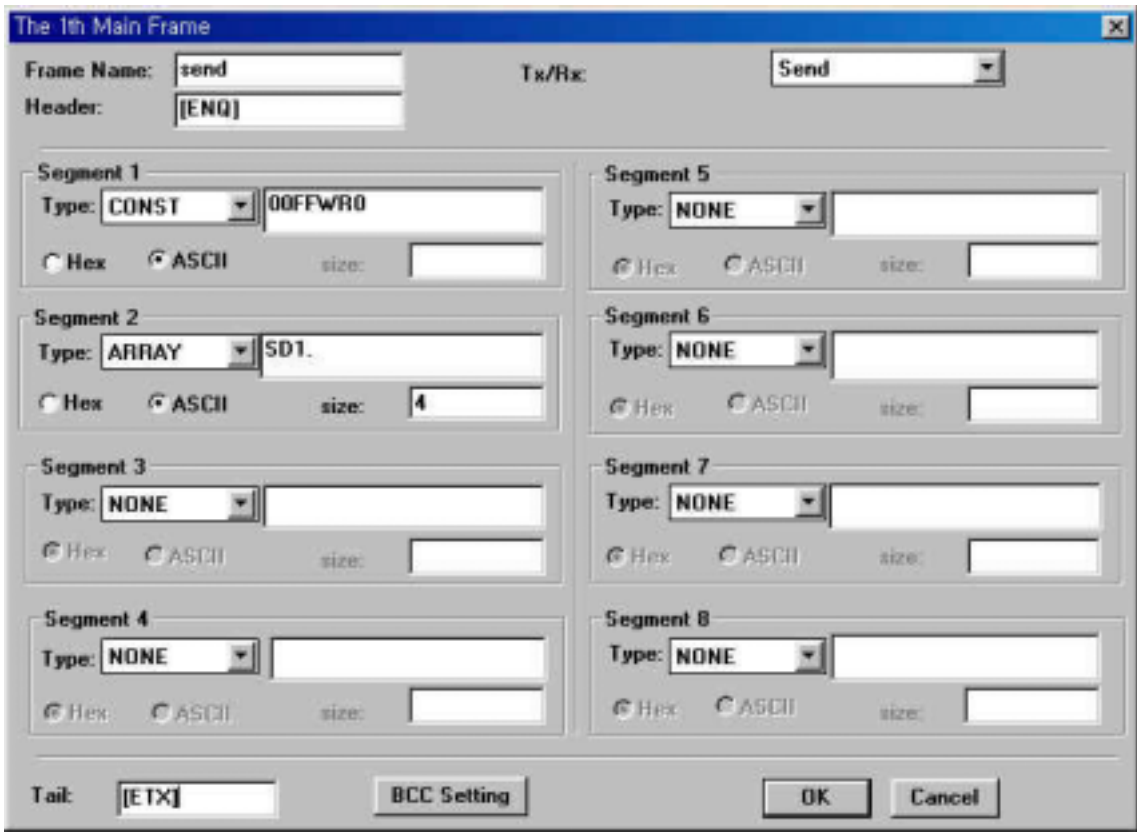


Fig. 9.8 Send frame

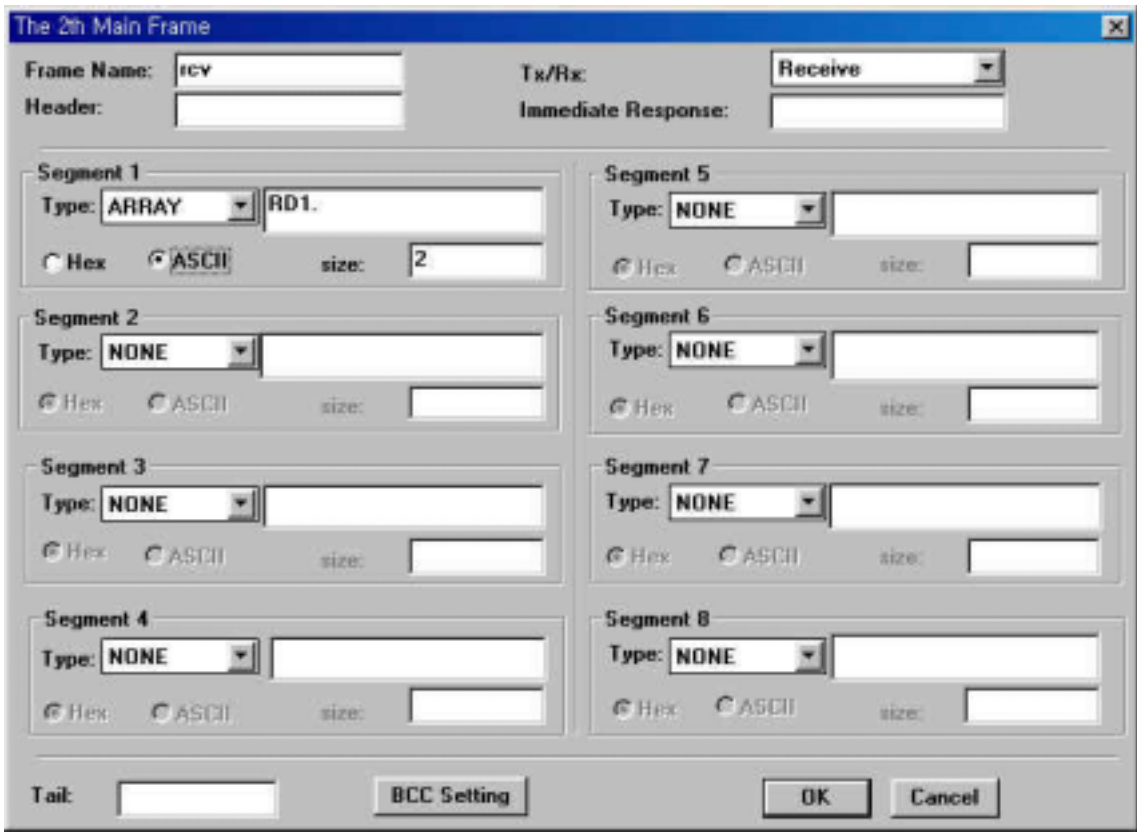


Fig. 9.9 Receive frame

The following two figures show an example of sequence program.

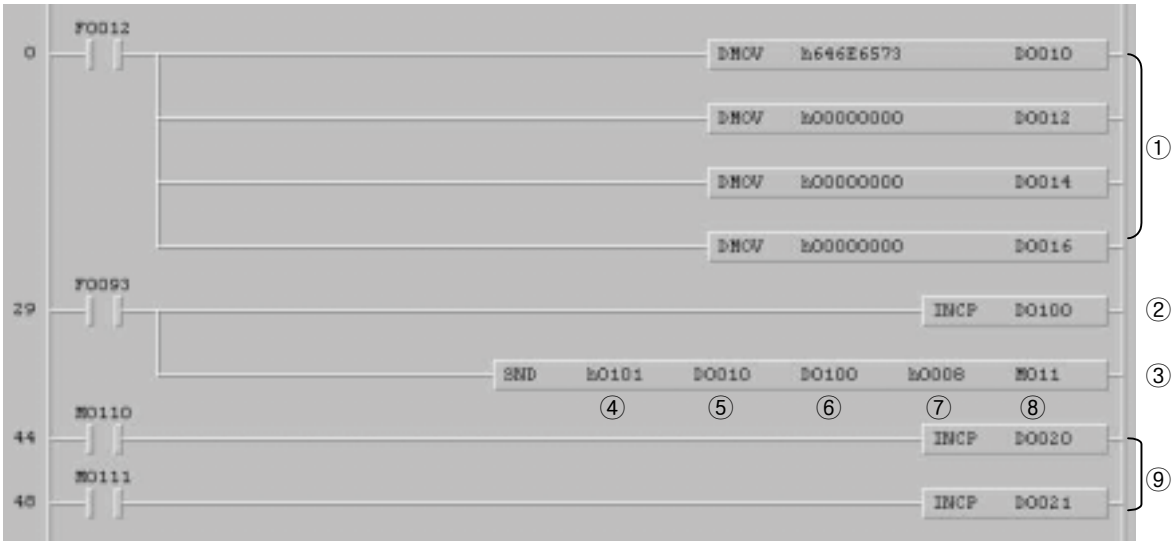


Fig. 9.10 An example of SND instruction

① Store the name of frame (send) at D0010 ~ D0017 (8 words).

D017		D016		D015		D014		D013		D012		D011		D010	
0	0	0	0	0	0	0	0	0	0	0	0	s	e	n	d

② Increase the data to be sent (SD1.) Because the SD1. is assigned as 4 ASCII characters array variable, 4 hexadecimal digits of D0100 (hxxxx) will be transmitted to the PLC#2.

③ Send the frame 'send' to the PLC#2.

④ Assign the slot number and communication channel. (slot 1, RS-422)

⑤ Assign the start address of data block at which the name of frame is stored.

⑥ Assign the start address of data block at which the 'SD1.' is stored.

⑦ Assign the number of bytes to be transmitted.

⑧ Assign the device at which the communication status is stored.

Bit 0 : Indicates the SND instruction is executed.
(No error : 1 scan on, Error : Keep on state)
Bit 1 : No error : off, Error : on
Bit 2 ~ 7 : Not used
Bit 8 ~ F : Indicates the error code

⑨ Counts how many times the SND instruction is executed and error occurred.

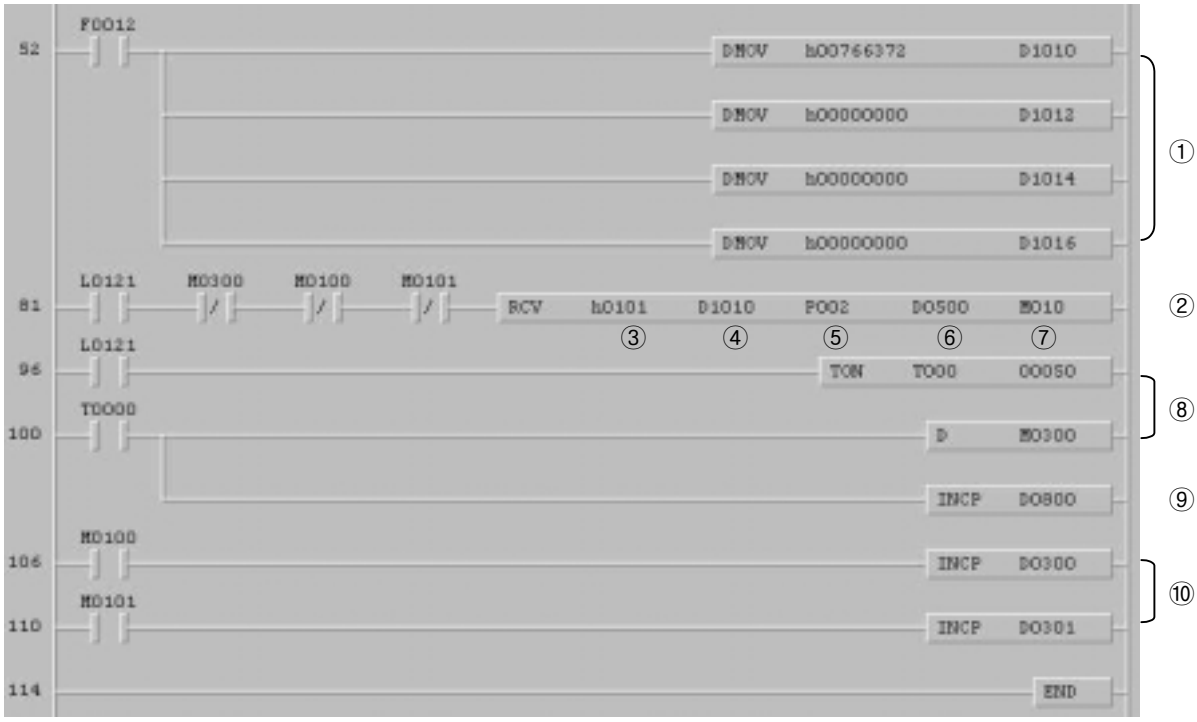


Fig. 9.11 An example of RCV instruction

① Store the name of frame ('rcv') at D1010 ~ D1017 (8 words).

D1017		D1016		D1015		D1014		D1013		D1012		D1011		D1010	
0	0	0	0	0	0	0	0	0	0	0	0	0	r	c	v

② Receive the frame.

③ Assign the slot number and communication channel. (slot 1, RS-422)

④ Assign the start address of data block at which the name of frame is stored.

⑤ Assign the start address of data block at which the received data will be stored.

⑥ Assign the device at which the numbers of bytes of received data is stored.

⑦ Assign the device at which the communication status is stored.

⑧ Generates a pulse (M300) after 5 seconds from the L121 turns on. It makes the RCV instruction is executed every 5 seconds even if the L121 does not turn off (L121 error).

⑨ Counts the numbers of L121 error.

⑩ Counts how many times the RCV instruction is executed and error occurred.

Remark

For reliability of RCV instruction, please use those input conditions with RCV instruction as shown in above example.

L121 : Turns on per 1 scan when the 1st frame of RS-422 is received at the slot 1.

M100 : Turn on per 1 scan when the RCV instruction is executed normally.

M101 : Turn on when an error occurs during communication.

The following figure 6.37 shows the sequence program of PLC#2. Please refer the MITSUBISHI's user's manual for details.

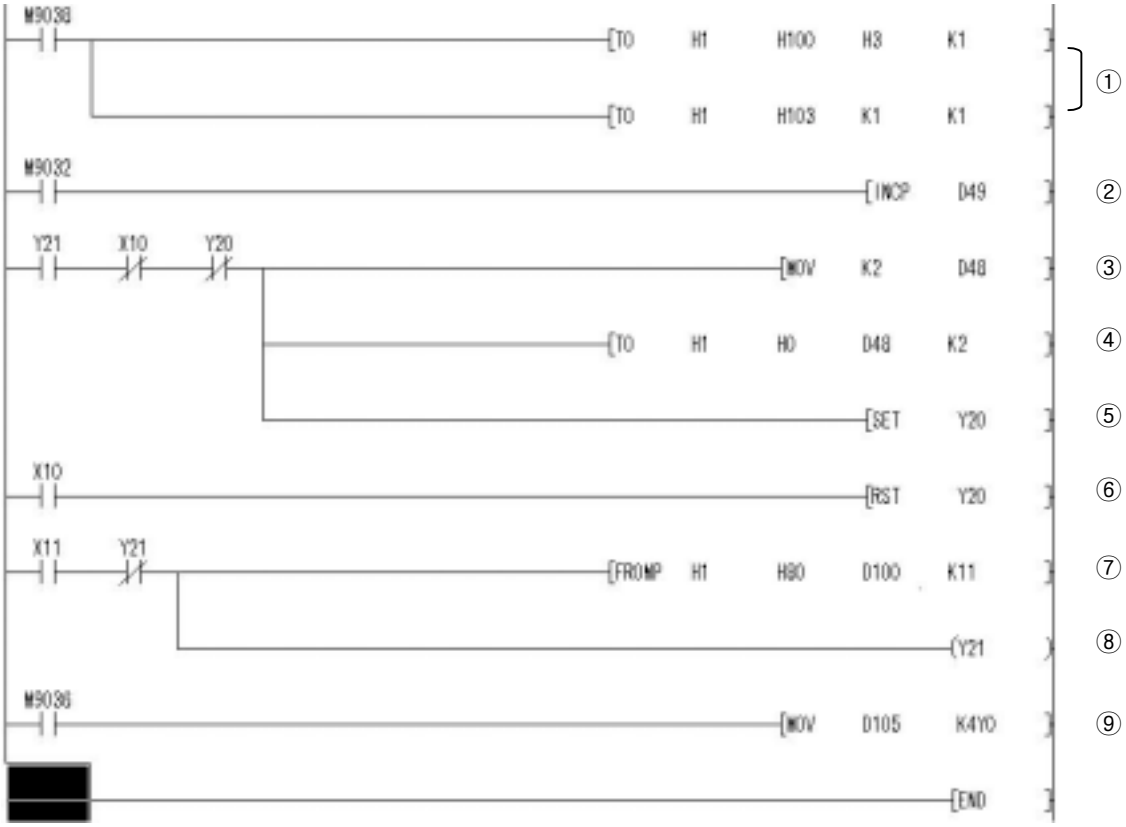


Fig. 9.12 An example of AJ71C24 sequence program

① Assign the receiving completion code and word / byte

② Transmitting data

③ The number of transmitting data

④ Write transmitting data and numbers to buffer memory

⑤ Turn on the data request signal after data writing is finished.

⑥ Turn off the data request signal when the transmission completed signal (Xn0) turns on.

⑦ Read the numbers of received data.

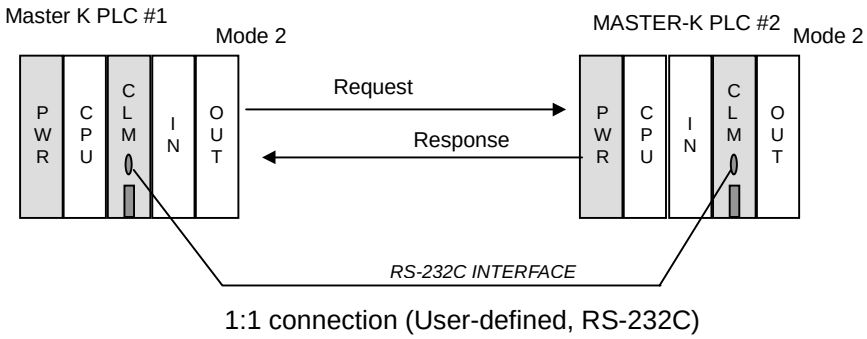
⑧ Receiving completion signal

⑨ Move received data to Y00.

9.1.2 Communication between MK-Cnet modules

The Cnet module v1.7 or earlier does not support READ/WRITE instruction. To communicate with MASTER-K Cnet module, therefore, the Cnet module should be set as 'User-defined' mode, and then an user-defined frame complying with LG's dedicated protocol should be written and downloaded. (After Cnet v2.0, no user-defined frame is required when use READ/WRITE instructions)

1) RS-232C, 1:1 connection



1:1 connection (User-defined, RS-232C)

Fig. 9.13 An example of system configuration

Increase the P002 of PLC#1, and transmit it to the P002 of PLC#2. The sending frame is named as 'A' and downloaded to the CLM#1, then the receiving frame 'B' is downloaded to the CLM#2.

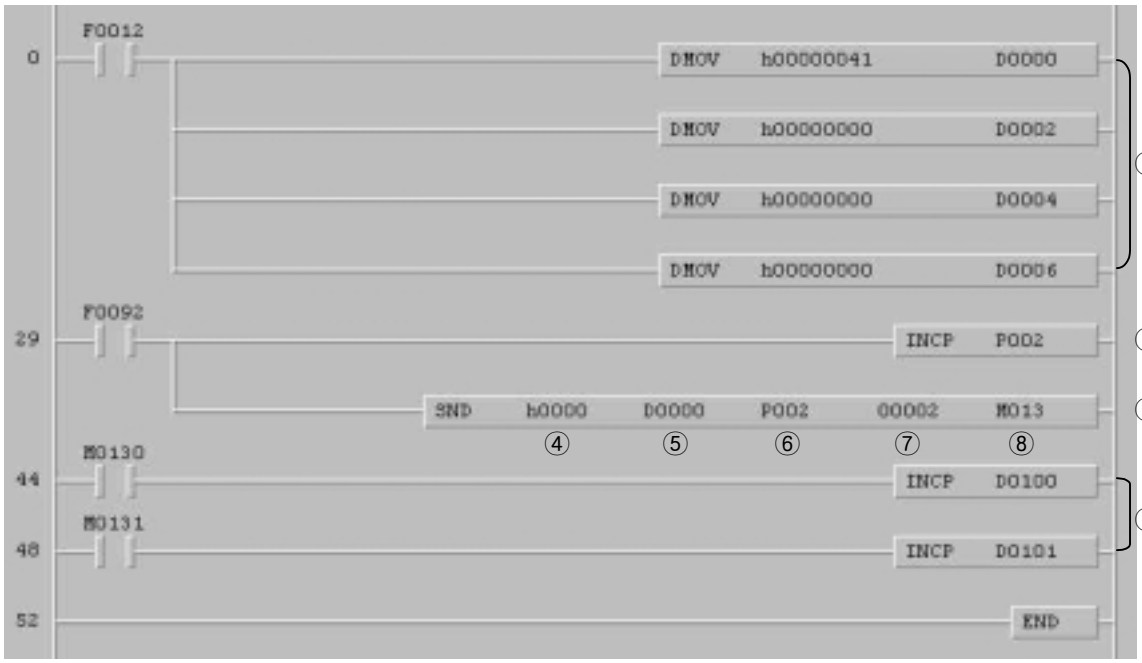


Fig. 9.14 An example of sending program of PLC #1

① Store the frame name (‘a’) at D0000 ~ D0007 (8 words)

② Increase P002 word by 1.

③ Send the frame ‘a’ to the PLC #2.

④ Assign the slot number and communication channel. (RS-232C, slot 0)

⑤ Assign the start address of data block at which the name of frame is stored.

⑥ Assign the start address of data block at which the array variable (SD1.) is stored.

⑦ Assign the data length of SD1. (byte)

⑧ Assign the device at which the communication status is stored.

Bit 0 : Turn on per 1 scan when the SND instruction is executed normally.

Bit 1 : No error : 0, Error occurrence : 1

Bit 2 ~ 7 : Not used

Bit 8 ~ F : Error code

⑨ Counts how many times the SND instruction is executed and error occurred.

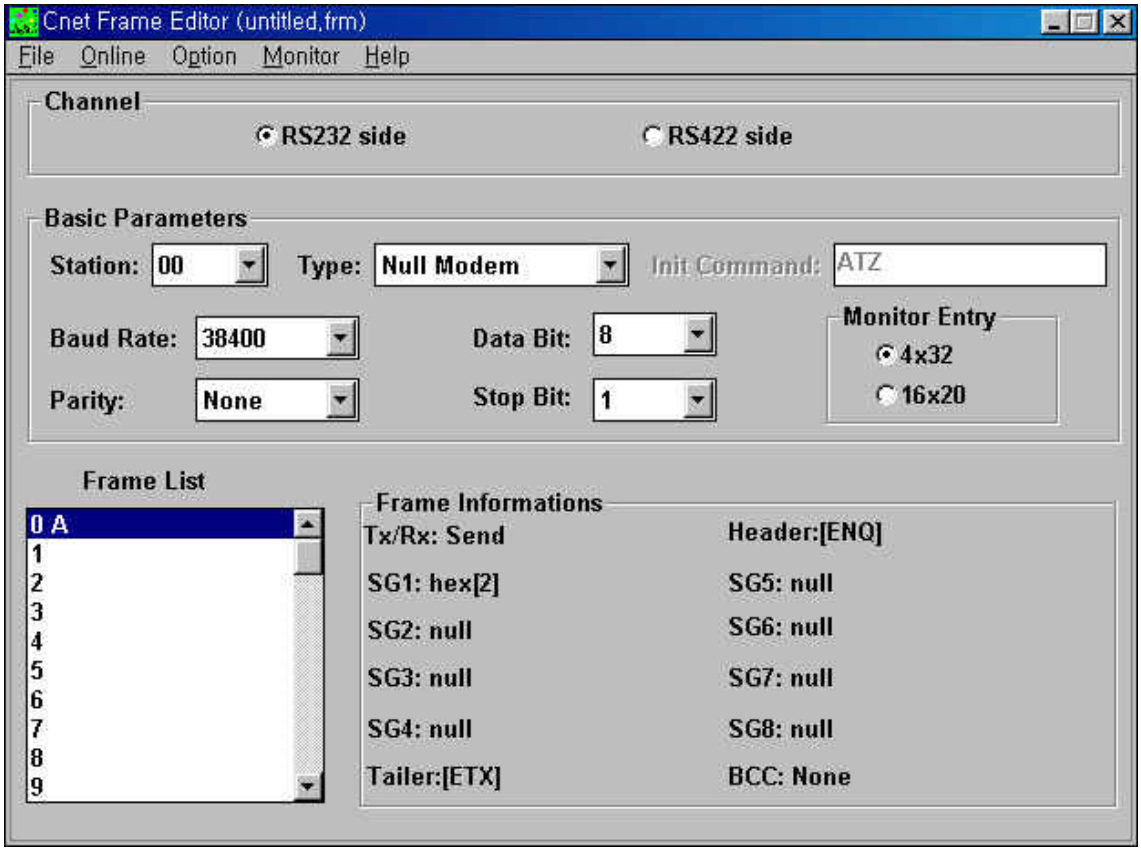


Fig. 9.15 Frame list

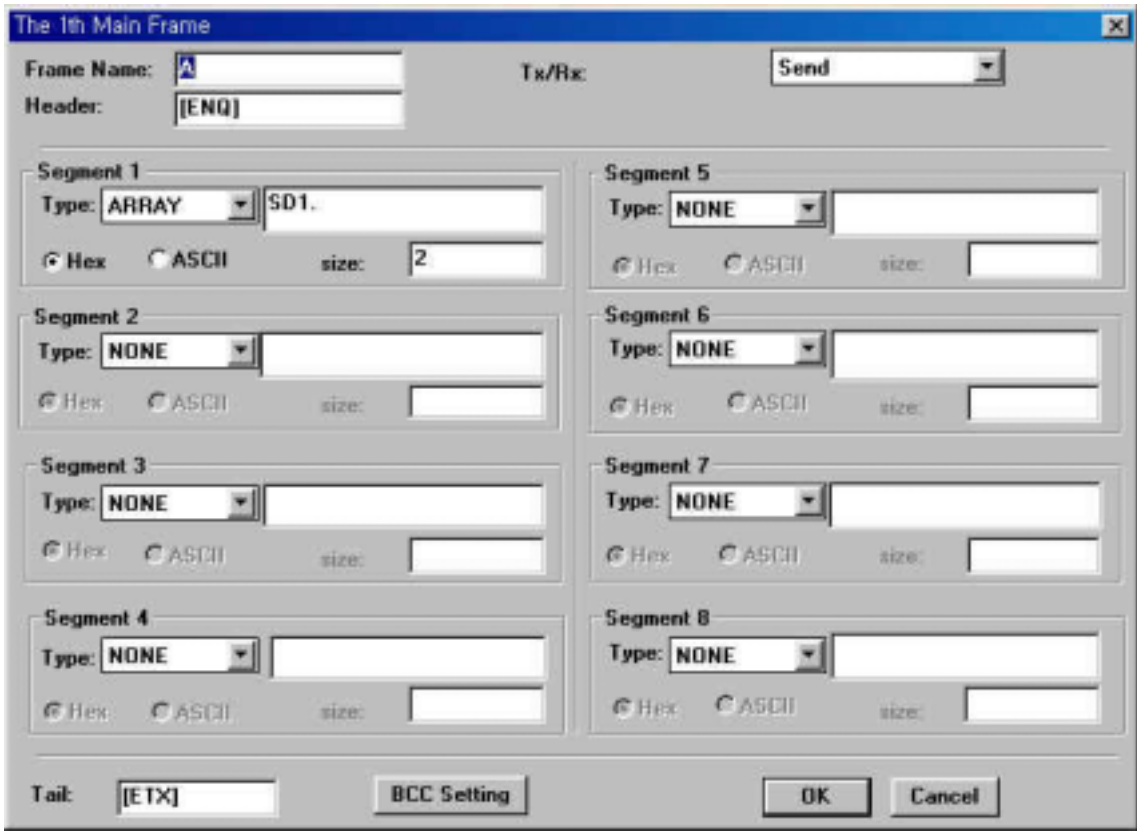


Fig. 9.16 Frame setting

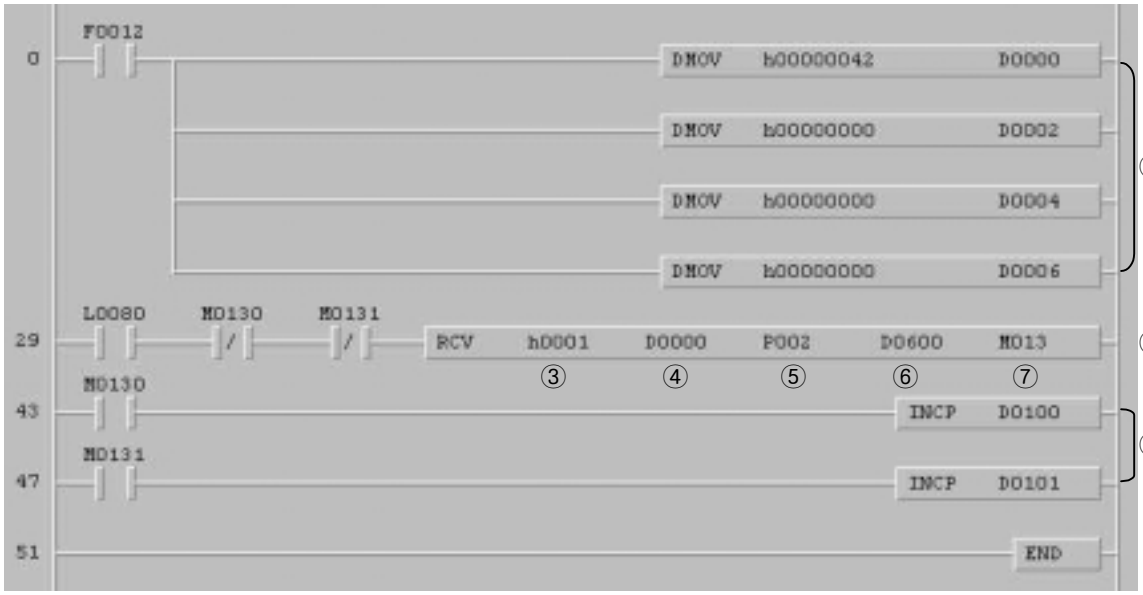


Fig. 9.17 An example of receiving program of PLC #2

① Store the name of frame (‘b’) at D0000 ~ D0007 (8 words)

② Receive the data from PLC#1.

③ Assign the slot number and communication channel (RS-232XC, slot 1)

④ Assign the start address of data block at which the name of frame is stored.

⑤ Assign the start address of data block at which the array variable (RD1.) is stored.

⑥ Assign the device at which the number of received data is stored.

⑦ Assign the device at which the communication status is stored.

Bit 0 : Turn on per 1 scan when the RCV instruction is executed normally.

Bit 1 : No error : 0, Error occurrence : 1

Bit 2 ~ 7 : Not used

Bit 8 ~ F : Error code

⑧ Counts how many times the RCV instruction is executed and error occurred.

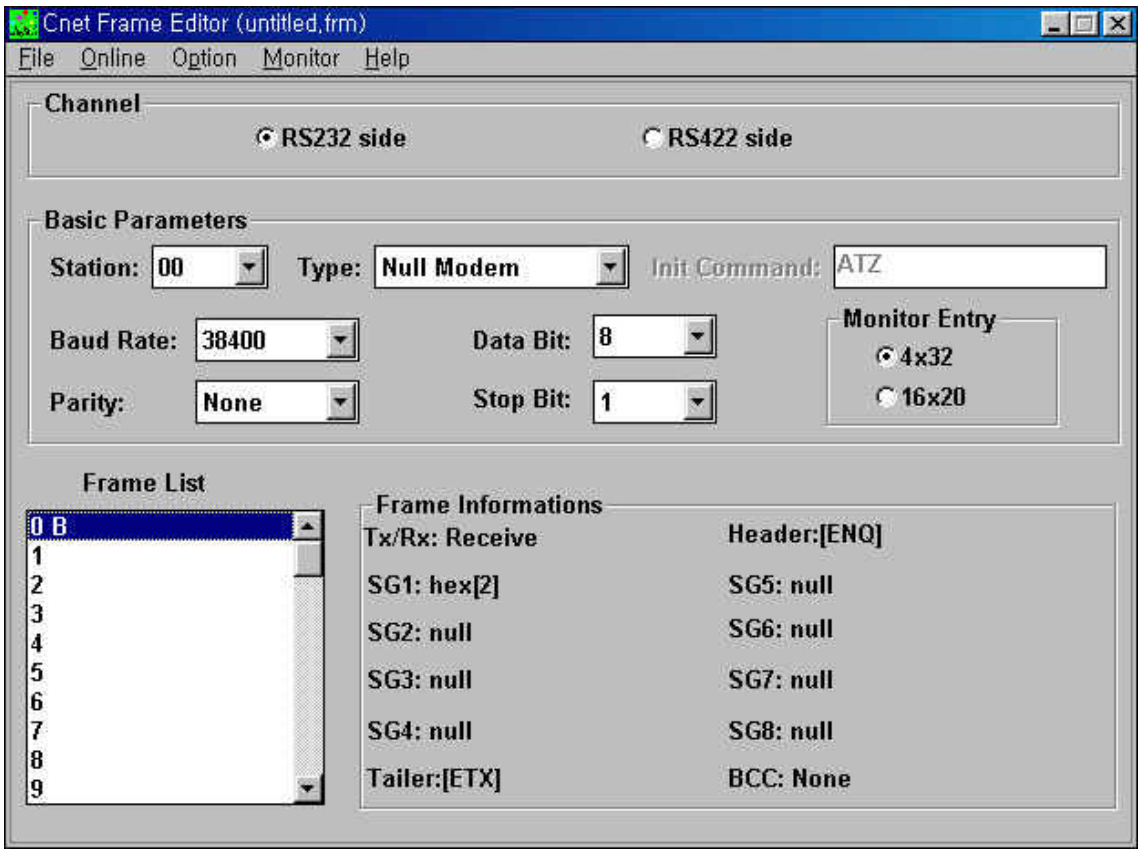


Fig. 9.18 Frame list

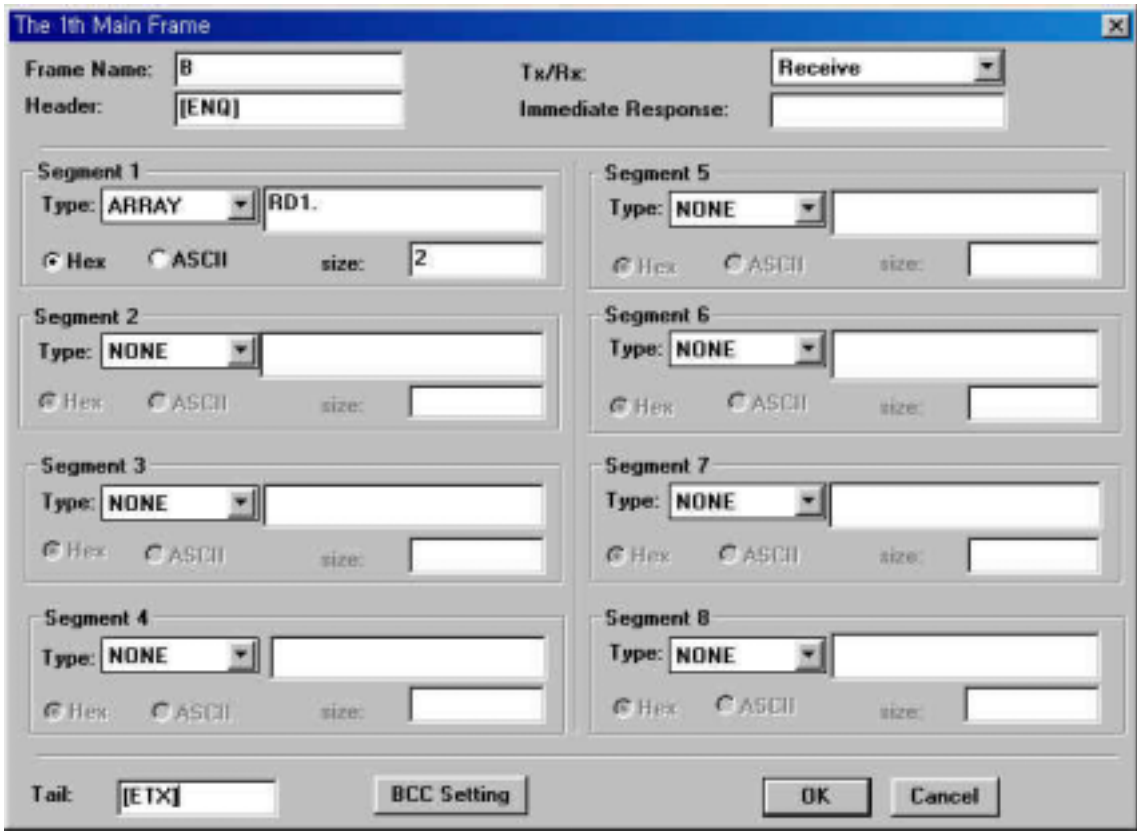
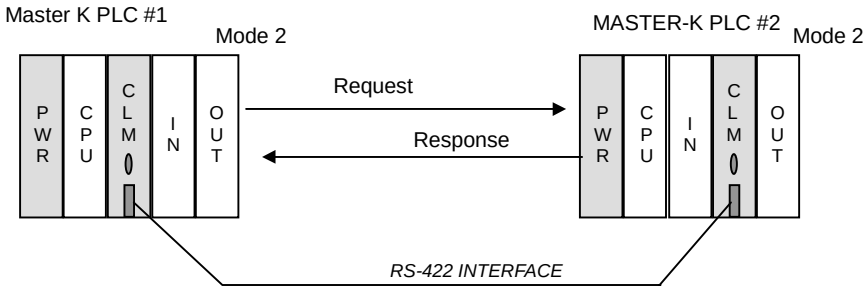


Fig. 9.19 Frame setting

2) RS-422, 1:1 connection



1:1 connection (User-defined, RS-422)

Fig. 9.20 An example of system configuration

Increase the P002 of PLC#1, and transmit P002 ~ P006 (10 bytes) to the P002 ~ P006 of PLC#2. The CLM#1 is mounted on the slot 0 and station number is 0. The CLM#2 is mounted on the slot 1 and station number is 1.

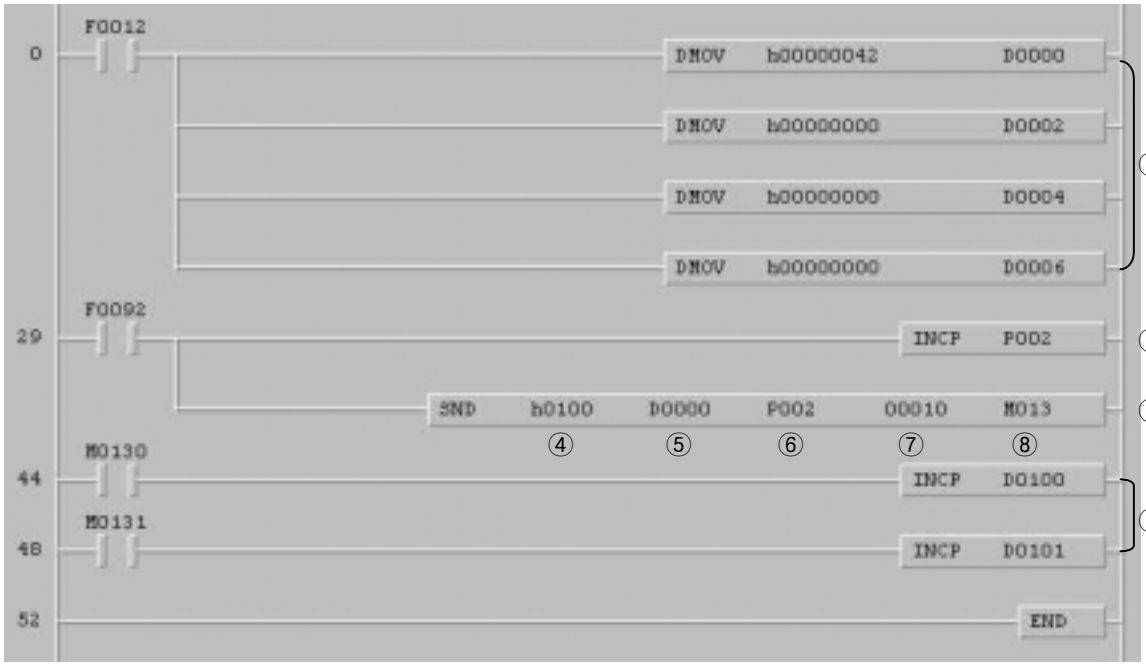


Fig. 9.21 An example of sending program of PLC#1

① ~ ③ : Same as RS-232C connection

④ : Assign the slot number and communication channel (RS-422, slot 0)

⑤ ~ ⑨ : Same as RS-232C connection

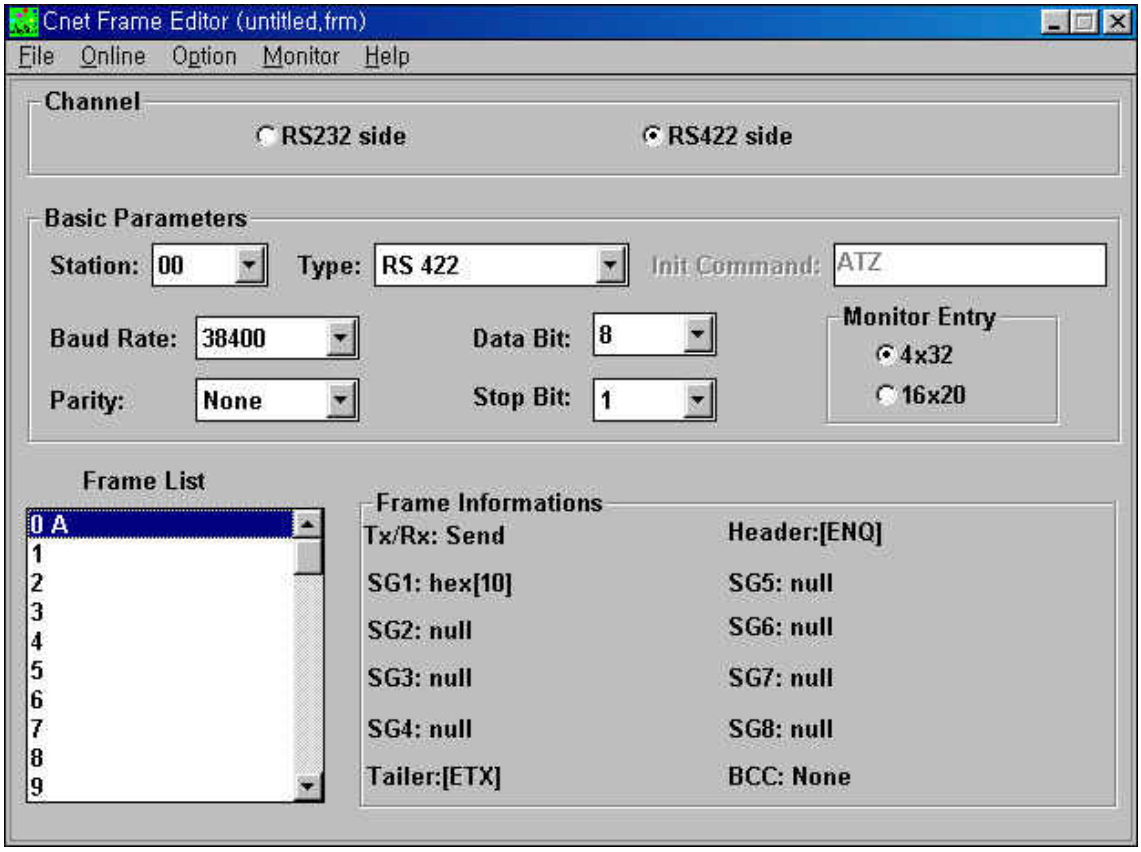


Fig. 9.22 Frame list

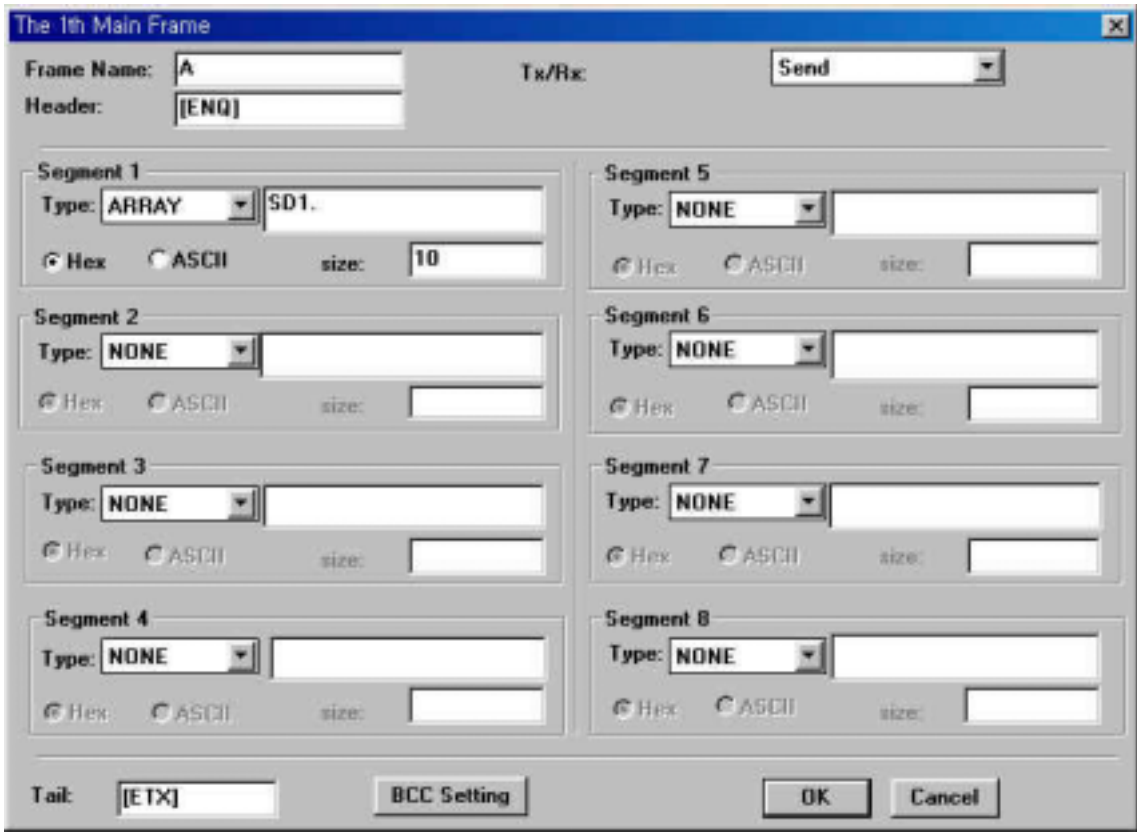


Fig. 9.23 Frame setting

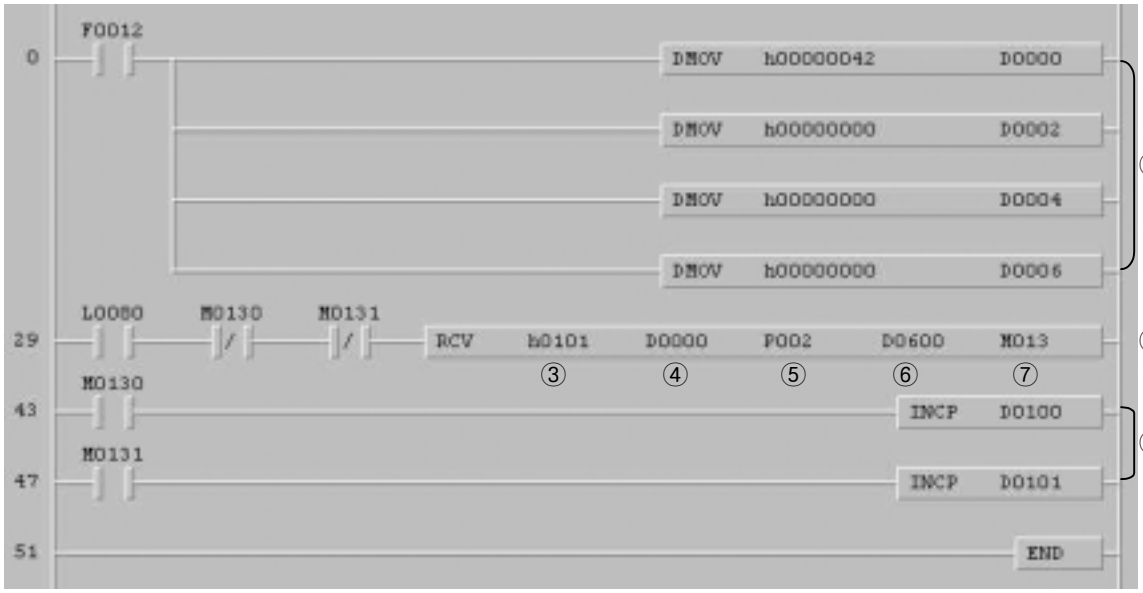


Fig. 9.24 An example of receiving program of PLC#2

① ~ ② : Same as RS-232C connection

③ : Assign the slot number and communication channel (RS-422, slot 1)

④ ~ ⑧ : Same as RS-232C connection

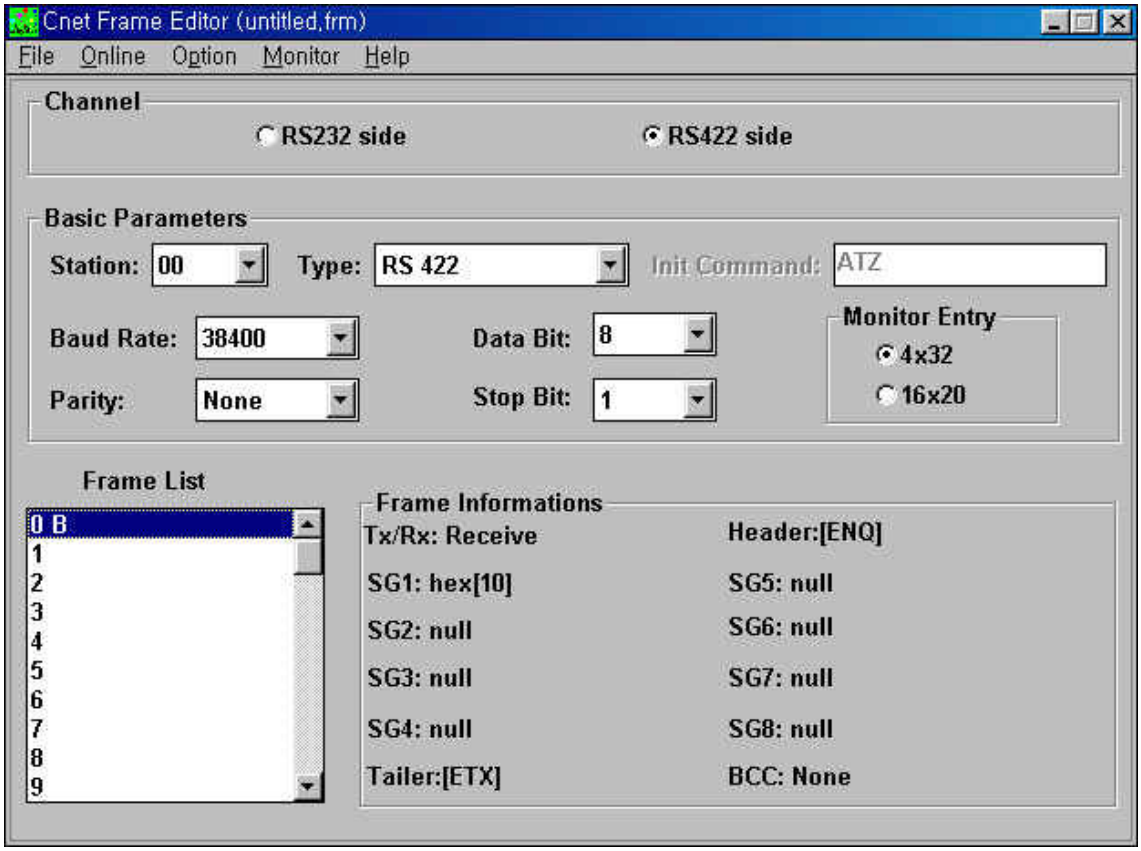


Fig. 9.25 Frame list

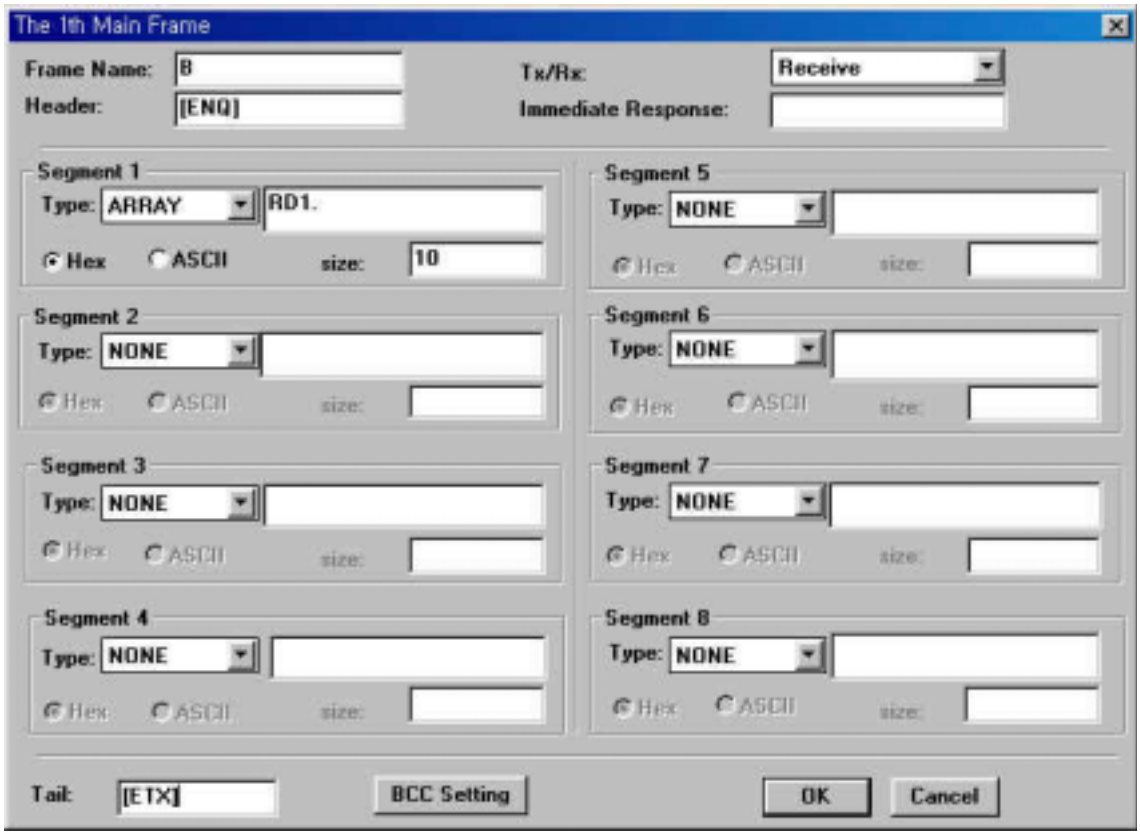


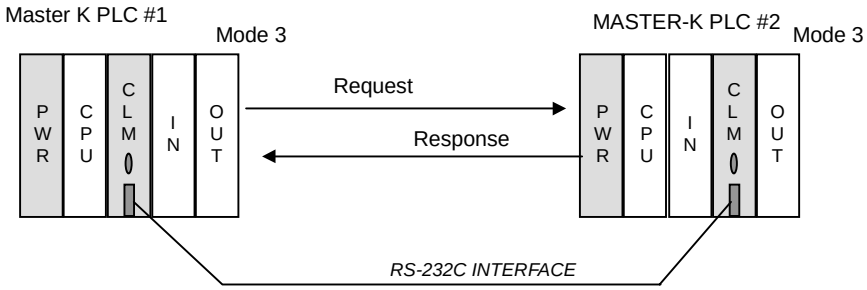
Fig. 9.26 Frame setting

9.2 Dedicated communication

9.2.1 Communication between MASTER-K Cnet modules

The READ / WRITE instructions are used for dedicated communication between MASTER-K Cnet modules. Only one Cnet module that sends request frame will be master station, and can use READ / WRITE instructions. If two or more Cnet modules use READ / WRITE instruction, it will cause malfunction of network operation.

1) RS-232C, 1:1 connection



1:1 connection (Dedicated, RS-232C)

Fig. 9.27 An example of system configuration

The following example shows a program that send 1 word from P004 of master station (PLC#1) to the P002 of slave station (PLC#2 : station number 1), and receive P002 of PLC#2 to the P005 of master station (PLC#1). The RS-232C channel of Cnet module mounted on the slot 0 is used for communication. The communication status of WRITE instruction is stored at M012 word.

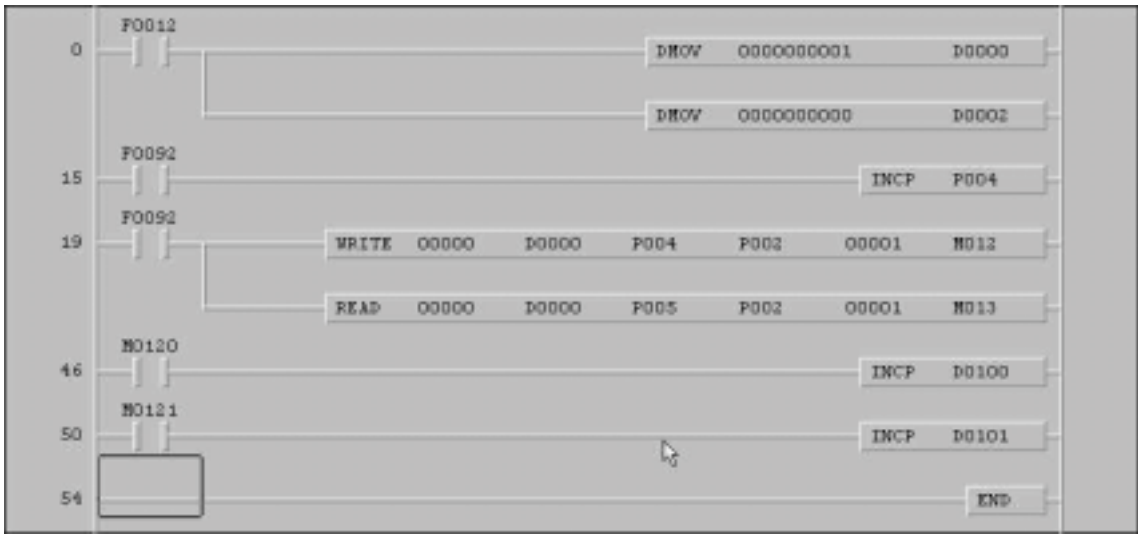


Fig. 9.28 An example of program (PLC #1 : master)

The following figure shows how to set basic parameters at master station and slave station. (No frame setting is required)

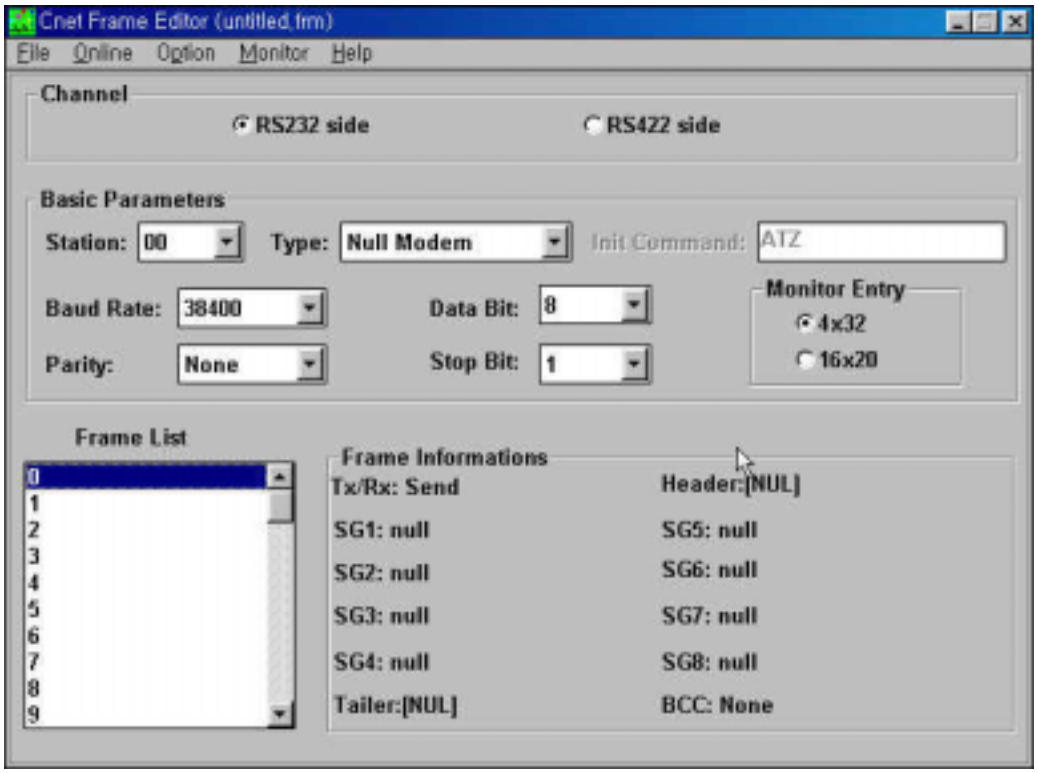


Fig. 9.29 Basic parameter of master station

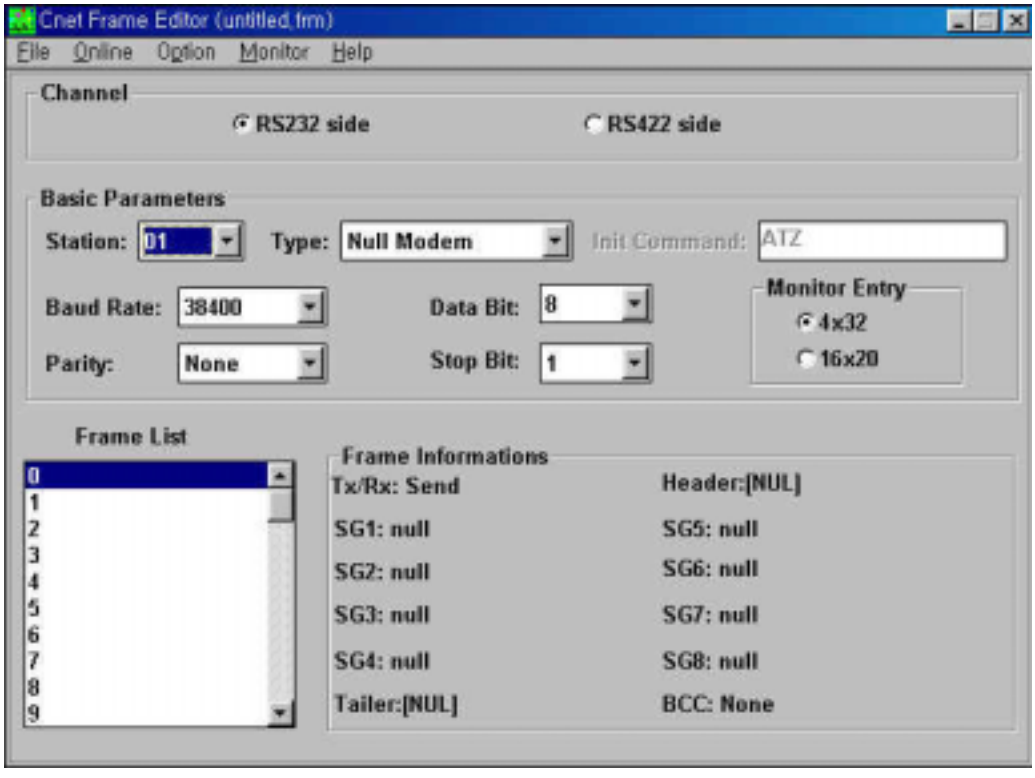
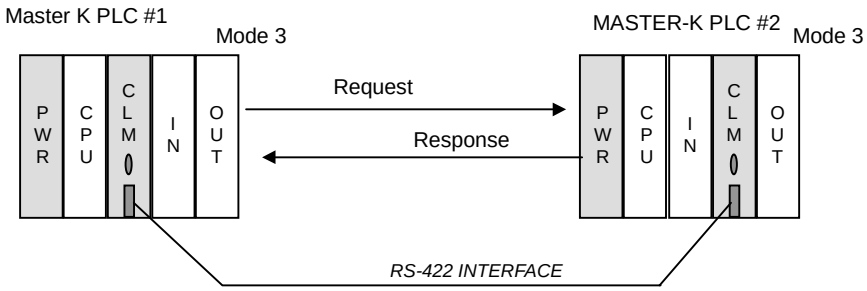


Fig. 9.30 Basic parameter of slave station

2) RS-422, 1:1 connection



1:1 connection (Dedicated, RS-422)

Fig. 9.31 An example of system configuration

The following example shows a program that send 1 word from P004 of master station (PLC#1) to the P002 of slave station (PLC#2 : station number 1), and receive P002 of PLC#2 to the P005 of master station (PLC#1). The RS-422 channel of Cnet module mounted on the slot 0 is used for communication. The communication status of WRITE instruction is stored at M012 word.

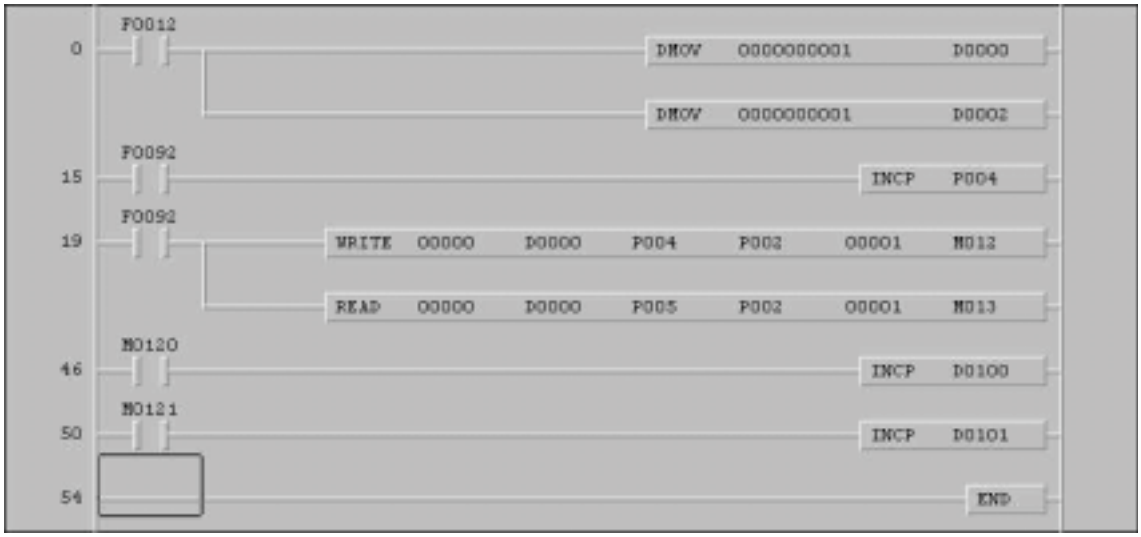


Fig. 9.32 An example of program (PLC #1 : master)

The following figure shows how to set basic parameters at master station and slave station. (No frame setting is required)

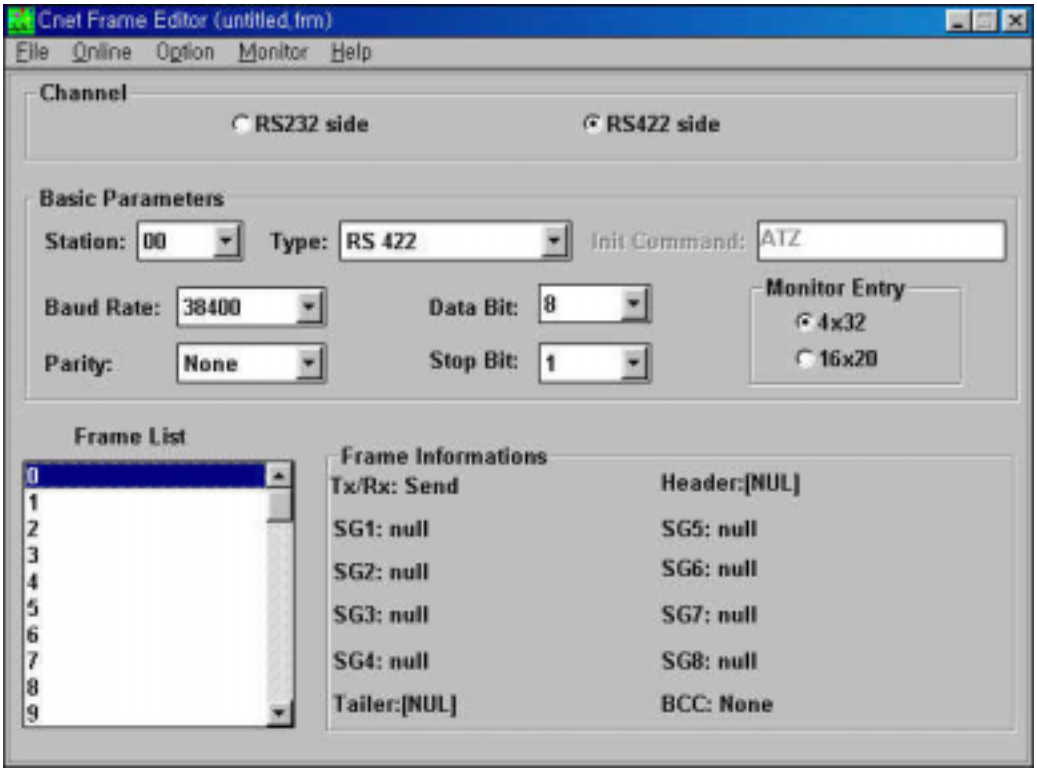


Fig. 9.33 Basic parameter of master station

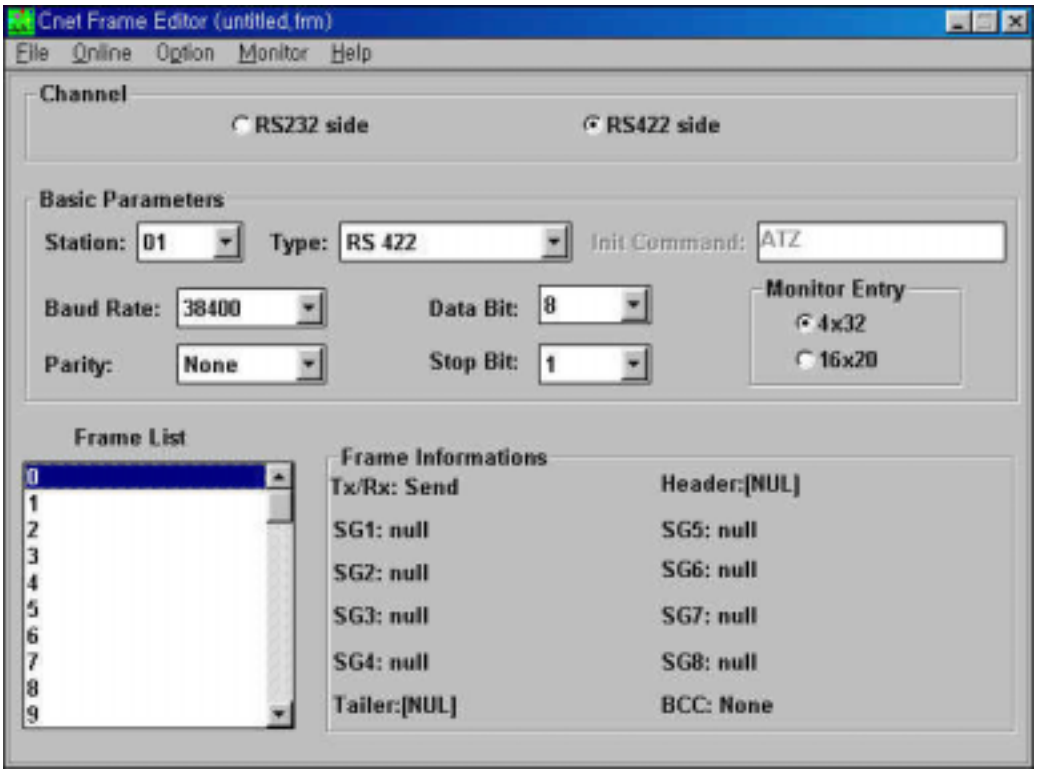


Fig. 9.34 Basic parameter of slave station

Chapter 10 Diagnostic functions

10 Diagnostic functions

10.1 Loop-back self-diagnosis

Loop-back self-diagnosis is a function which checks that computer link module operates normally by itself without connection to external devices and communication cable.

For loop-back self-diagnosis, set operation mode switch at ' 8' (Loop-back test mode).

10.1.1 Principle of operation

Loop-back test sends test data to RS-232C and RS-422 channel of Cnet module without external cable connection. Then it receives data, and compares it with sent data. The comparison result will be displayed through the LED display.

The following figure shows the data flow in the loop-back test mode.

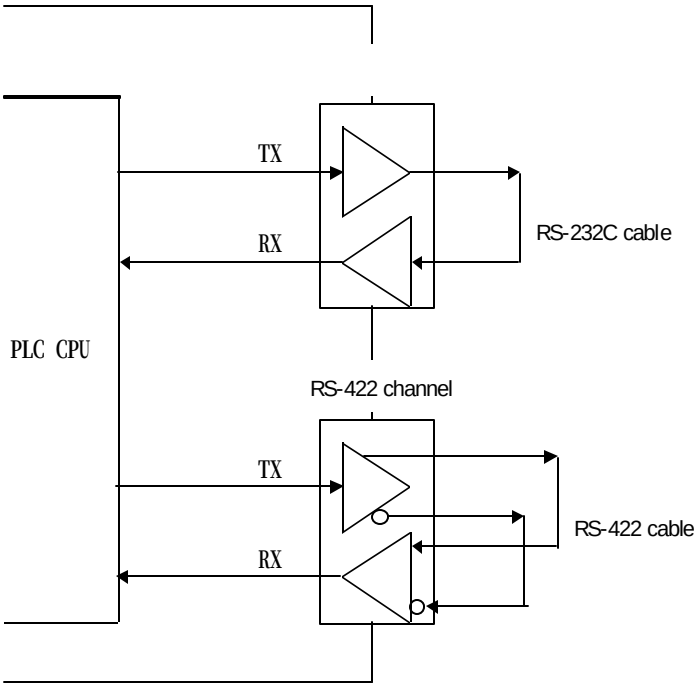


Fig. 10.1 The data flow in loop-back test mode.

10.1.2 The procedure of loop-back self diagnosis

The procedure of loop-back self diagnosis is as following;

1) Wiring the RS-232C and RS-422 connector as figure 10.2 and 10.3
2) Set the mode switch at ' 8' (Loop-back test mode)
3) After starting self-diagnosis by turning power on, check the result by LED module display.
4) If the LED state is abnormal, see the chapter 12 for troubleshooting.

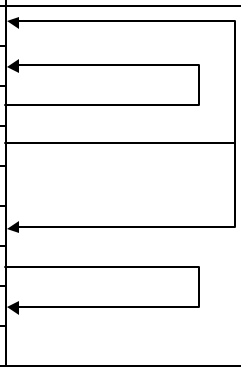
RS-232C connector (9-pin)		Wiring
Pin number	Name	
1	CD	
2	RxD	
3	TxD	
4	DTR	
5	SG	
6	DSR	
7	RTS	
8	CTS	
9	RI	

Fig. 10.2 Wiring of RS-232C channel

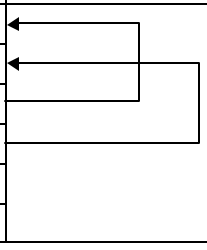
RS-422 connector (6-pin)		Wiring
Pin number	Name	
1	RDA	
2	RDB	
3	SDA	
4	SDB	
5	SG	
6	FG	

Fig. 10.3 Wiring of RS-422 channel

10.1.3 LED display of loop-back self-diagnosis

The LED display indicates the comparison result between sent and received data. It shows two different status according to the display switch at the front of Cnet module (press or not).

1) When the display switch is not pressed.

① K4F-CUEA / K7F-CUEA

LED #	Name		LED	Description	LED	Description
0	RS-232C	RUN	On	Operating	Off	Operation stopped
1		TX	Blink	Sending	Off	Not sending
2		RX	Blink	Receiving	Off	Not receiving
3		ACK	On	ACK responding	Off	No responding
4		NAK	On	NAK responding	Off	No responding
5		ERR	Blink	Receive error occur	Off	No error
6		MODEM	On	Modem mode setting	Off	Other mode
7		SYS-RUN	Blink	Executing I/F with CPU	Off	Stopping I/F with CPU
8	RS-422	RUN	On	Operating	Off	Operation stopped
9		TX	Blink	Sending	Off	Not sending
10		RX	Blink	Receiving	Off	Not receiving
11		ACK	On	ACK responding	Off	No responding
12		NAK	On	NAK responding	Off	No responding
13		ERR	Blink	Receive error occur	Off	No error
14		RS-485	On	On RS-485 mode	Off	On RS-422 mode
15		SYSTEM-ERR	On	Cnet operation error	Off	No error

② K3F-CU2A

LED #	Name	LED	Description	LED	Description
0	RUN	On	Operating	Off	Operation stopped
1	TX	Blink	Sending	Off	Not sending
2	RX	Blink	Receiving	Off	Not receiving
3	ACK	On	ACK responding	Off	No responding
4	NAK	On	NAK responding	Off	No responding
5	COM-ERR	Blink	Communication error occur	Off	No error
6	MODEM	On	Modem mode setting	Off	Other mode
7	SYS-RUN / ERR	Blink	Executing I/F with CPU	Off	Stopping I/F with CPU

③ K3F-CU4A

LED #	Name	LED	Description	LED	Description
0	RUN	On	Operating	Off	Operation stopped
1	TX	Blink	Sending	Off	Not sending
2	RX	Blink	Receiving	Off	Not receiving
3	ACK	On	ACK responding	Off	No responding
4	NAK	On	NAK responding	Off	No responding
5	COM-ERR	Blink	Communication error occur	Off	No error
6	RS-485	On	On RS-485 mode	Off	On RS-422 mode
7	SYS-RUN / ERR	On	Cnet operation error	Off	No error

2) When the display switch is pressed (Error counter)

Whenever the received data is not equal to the sent data, the Cnet module increases an error counter by 1. The value of error counter is displayed to the LED by pressing the display switch at the front of Cnet module. See the following table for details.

RS-232C channel (Hex)			RS-422 channel (Hex)		
LED#	Bit value	Conversion method	LED#	Bit value	Conversion method
0	D0	Converts the binary value indicated by LED display to hex value. (D0 = LSB, D7 = MSB)	8	D0	Converts the binary value indicated by LED display to hex value. (D0 = LSB, D7 = MSB)
1	D1		9	D1	
2	D2		10	D2	
3	D3		11	D3	
4	D4		12	D4	
5	D5		13	D5	
6	D6		14	D6	
7	D7		15	D7	

10.2 Power-on diagnosis

When the power is supplied to the Cnet module, it performs a power-on diagnosis by checking hardware and interface with CPU. See the following table for order of power-on diagnosis.

Step	Checking item	LED display
1	Internal memory	Turn on LED 0
2	Flash memory	Turn on LED 1
3	NS-16550 chip	Turn on LED 2
4	Buffer memory	Turn on LED 3
5	Interface with CPU	Turn on LED 4
6	Operation mode	Turn on LED 5

When all checking items are normal, the LED 0 ~ 5 turns on and off in order, and then 232-RUN / 422-RUN LEDs turned on. After two LEDs turns on, the Cnet module starts operation and the RUN LED turns on.

If there is an error during power-on diagnosis, the SYS-ERR LED blinks and the corresponding LED turns on. For example, the LED 3 will turn on when an error is detected at buffer memory.

Remarks

Because the operation mode checking is performed very quickly, the LED 5 turns on during very short time and it seems not to be turned on in visual.

Chapter 11 Installation and maintenance

11 Installation and maintenance

11.1 Installation and test run

The maximum number of Cnet modules that can be mounted simultaneously is different according to the CPU type. See following table for details.

CPU type	Max. mountable number	Mounting position	Remark
K200S	4	I/O slots of main base	Only mountable on main base. (not on expansion base)
K300S	4		
K1000S	8		

11.1.1 Installation of Cnet module

The following figure shows an example of installation with K1000S series. Max. 8 modules can be mounted on a main base board.

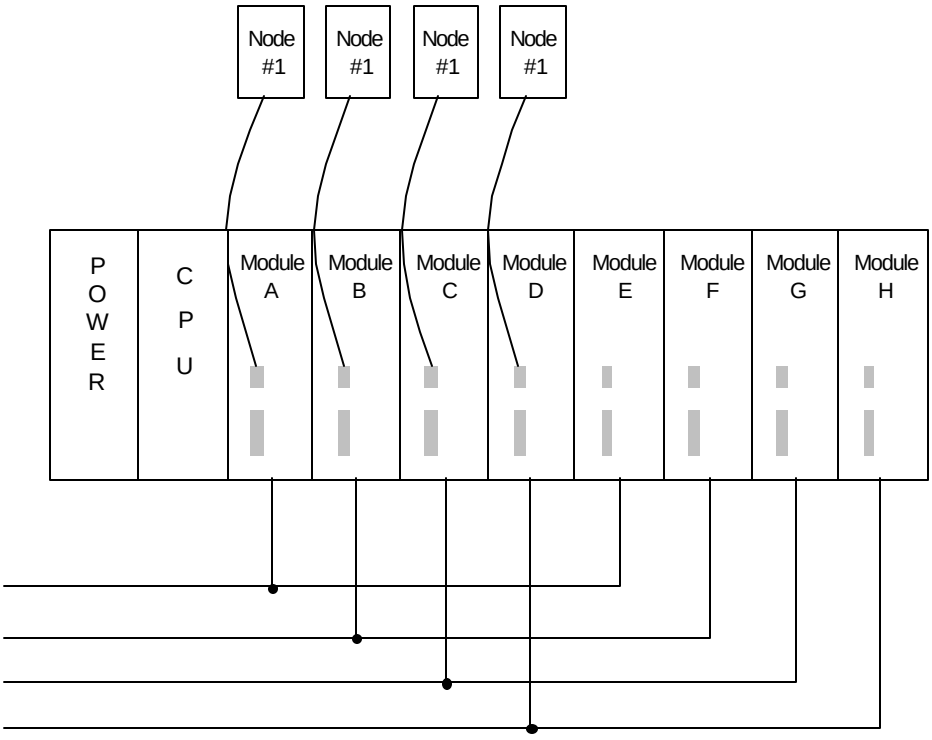


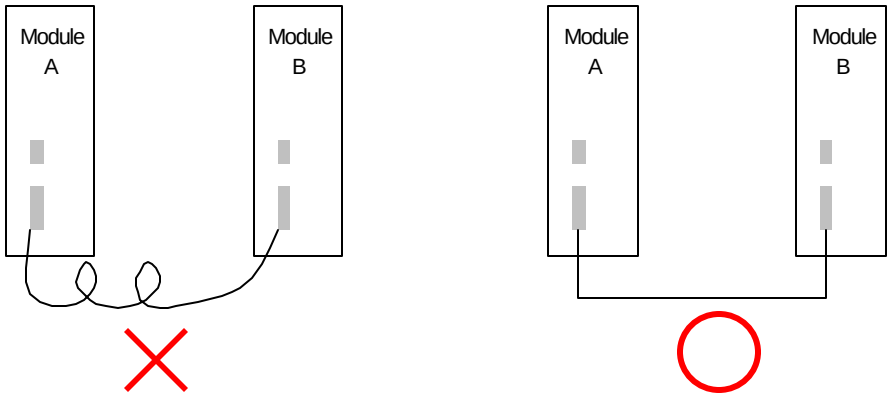
Fig. 11.1 An example of installation with K1000S

The procedure of installation is as following;

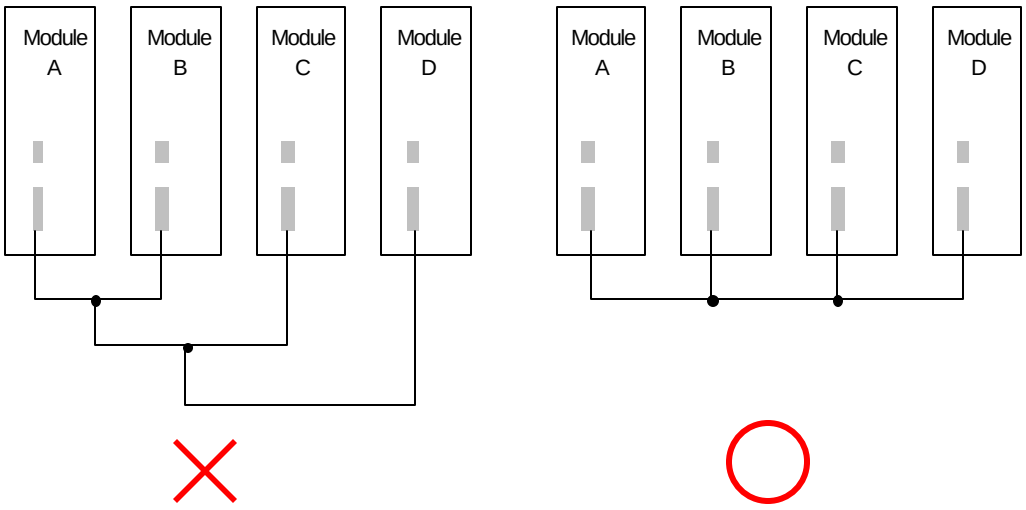
1) Prepare a basic system configuration required for Cnet module installation
2) Turn off the power of PLC system before starting installation.
3) Verity whether the connector of base on which the Cnet module to be mounted has any foreign substance, and connector pins of Cnet module is damaged.
4) Be careful to not mount Cnet modules exceeding the maximum number of mountable modules.
5) With communication cable not connected, correctly insert the projected part of module bottom into groove of base board. After applying enough force to lock the upper part to the locking device of base board. If the locking device is not tightly locked, CPU and interface may have abnormal conditions.
6) By using switch of the front of communication module, set to operation mode to be used. For operation mode descriptiion, see general specifications.
7) For cable connection of electric module, screw it in order to be tightly connected by using locking screw of cable connector.
8) Power on after connection of communication cable, observe the LED operation states, and verify its operation is normal or not. If it is normal, download and carry out frame and program via frame editor definition and KGLWIN.(User defined mode).

11.1.2 Cautions during installation

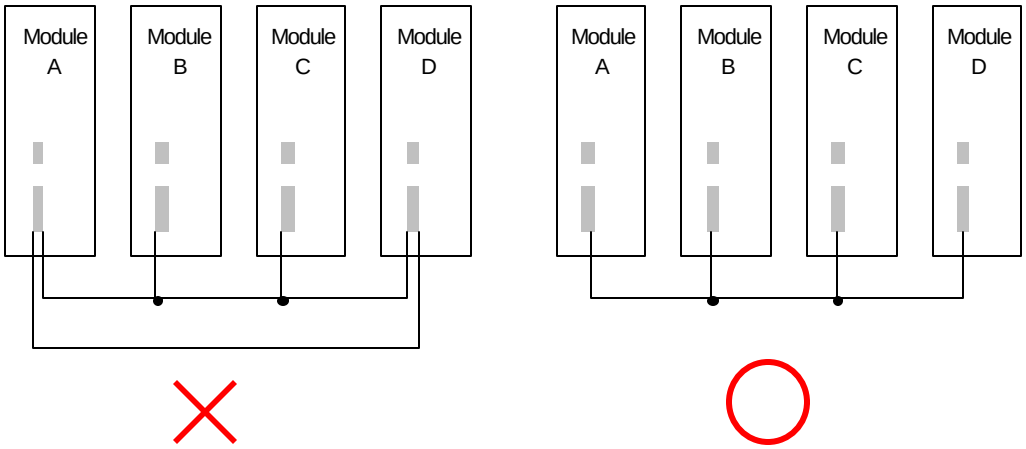
1) Correctly select which operation mode may be used by user for Cnet communication module, and set the operation mode according to it. If the operation mode is not correctly set, failure may be occur. Pay attention to this point.
2) Including self-station, station numbers of all stations must be different. If, in state of dedicated communication mode set, the station number is duplicated, the communication may has failure, and can not run normal communication.
3) For communication cable, use cable of specified specifications. If not so, serious communication failure may occur.
4) Inspect whether communication cable is cut off or shorted before installation.
5) Tightly screw communication cable connector to secure the cable connection. If cable connection is unstable, communication may have serious failure.
6) If communication cable is twisted as below or not normally connected, communication error may occur.



7) Bifurcation of cable is not allowed.



8) Network connected by communication cable must be connected in order not to make closed-circuit.



9) When long distance of communication cable is required, wire the cable in order to be apart from power line or inductive noise.

10) If LED operation is abnormal, see chapter 12 troubleshooting in this manual to verify abnormal cause. When problems occur continuously even if measuring, contact Service station.

11.1.3 Test run

1) Preparation before starting test run

The following table shows items to be checked before starting test run of Cnet module.

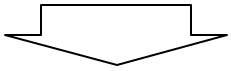
Preparation	Contents
Check for base module mounting	– Does the power module fit to power module specifications? – Is the battery of CPU module connected? – Is the mounting of the entire base module good? ⇒See user's manual according to each PLC type.
Communication cable connection (for cable connected only)	– Is the connection state of communication cable good? – Is the connection of each cable open loop type? ⇒See Cautions during system configuration of 11.1.2
Module mounting	– Is the mounting state of communication module mounted in main base good? ⇒See Mounting and installation of 11.1.1
Switch check	– Is the setting of mode switch correct? – Is the setting of frame definition correct?

2) Procedure of test run

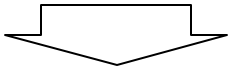
Start

Power on :

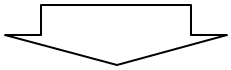
1) Confirm input power.
2) Confirm communication cable connection.
3) Power on.
4) Confirm the lighting of power LED for power module.
5) Confirm LED states of CPU module.
   ⇒If it is abnormal, see troubleshooting of each PLC type manual.
6) Verify whether the LED states of communication module are normal or not.
   ⇒If it is abnormal, see chapter 9, troubleshooting of this manual.



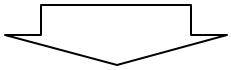
Frame definition : Define frame with frame definition and download to communication module.



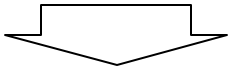
Programming : Perform programming in GMWIN and write to CPU module.



Sequence check : Confirm the operation of communication module according to program.



Program modification : If there is abnormality in sequence program, modify it.



Program preservation :

1) Save program to floppy or hard disk.
2) Print circuit drawing and the list with printer.
3) Write program to memory module if required.

Completion

11.2 Maintenance

11.2.1 Daily check

Perform the following daily checks at everyday,

Checking item		Contents to be checked	Criteria of decision	Action to take
Cable connection state		Cable loosened	Shall not be loosened	Tighten the cable
Module connection state		Module tightening screw loosened	Shall not be loosened	Tighten module screw
LED	System operation LED(7:SYS-RUN)	Flash checked	Flash(light off is abnormal) -of CPU and interface	See Appendix A1.
	Channel operation LED (0:RS-232C RUN 8:RS-422/485 RUN)	Light On checked	Only if channel active LED lights, data is normally sent/received (If light off, communication is disconnected.)	See Appendix A1.
	Communication error LED (5:RS-232C ERR 13:RS-422/485 ERR)	Light Off checked	Flash is abnormal (abnormal parameter setting or cable failure)	See Appendix A1.
	TX/RX LED (1/2 RS-232C TX/RX 9/10:RS-422/485 TX/RX)	Flash checked	Light off is abnormal (abnormal hardware of module)	See Appendix A1.
	System error LED (15:SYS-ERROR)	Light Off checked	If flash, it means system is abnormal.	See Appendix A1.

11.2.2 Regular check

Perform the following action 1 ~ 2 times per 6 months.

Check item		How to check	Criteria of decision	Action to take
Ambient conditions	Ambient temp.	Measure thermometer/hygrometer	0-55℃	Adjust it in order to fit to general specifications (for use in panel, inside panel ambient criteria)
	Ambient moisture		5-95% RH	
	Ambient pollution	Measure corrosive gas	Corrosive gas shall not be there.	
Module state	Loosening, Shaking	Move communication module	It shall be tightly mounted.	Tighten screw
	Dust, Foreign matters	Visual inspection	No dust or foreign matters shall be there.	
Connection state	Terminal screw loosened	Tighten with driver	No loosening shall be there.	Tighten
	Closeness of compressed terminal	Visual inspection	Distance shall be suitable.	Correct
	Connector loosening	Visual inspection	No loosening shall be there.	Tighten connector locking screw.
Power voltage check		AC 110/220V Measure voltage between terminals	AC 85-132V AC 170-264V	Modify power supply. Modify transformer tap.

Chapter 12 Troubleshooting

12 Troubleshooting

This chapter describes error contents that may occur during operating system, finding causes, and how to take action. For how to troubleshoot, tables that show Cnet communication errors is provided in 12.1, and the troubleshooting is performed according to each error code in 12.2.

12.1 Classification of abnormal operations

12.1.1 H/W or system error

Error type	Error indication	Error contents
C01-1	Error code values(1-6) of LED converted into hex value	H/W value
C01-2	Error code values(9-B) of LED converted into hex value	System

12.1.2 Command error (User-defined communication)

Error type	Error indication	Error contents
C02	The error flag of command becomes on, and status value is not 0.	The error flag becomes on. Or NDR of command does not become 1.

12.1.3 Receiving monitoring error

Error type	Error indication	Error contents
C03-01	[No received data] message occurs from the beginning during requesting receive monitor start.	Incorrect frame definition by using frame editor, or disagreement between command and frame. Or incorrectly connected cable.
C03-02	Monitor data is not received during operating receive monitor.	Bad cable connection Disagreement of basic parameters between communication stations

12.1.4 Sending monitoring error

Error type	Error indication	Error contents
C04-01	[No received data] message occurs from the beginning during requesting receive monitor start.	Incorrect frame definition by using frame editor, or disagreement between command and frame. Or incorrectly connected cable.(bad connection with communication module) CPU or communication module error occurs
C04-02	Monitor data is not received during operating transmission monitor.	Bad cable connection Disagreement of basic parameters between communication stations

12.1.5 NAK response during dedicated communication

Error type	Error indication	Error contents
C05	NAK frame is sent as response to request frame of other station.(NAK LED(4,12) of Cnet module flashes)	Protocol disagreement of dedicated communication frame Bad cable connection Disagreement of basic parameters between communication stations

12.1.6 No response during dedicated communication

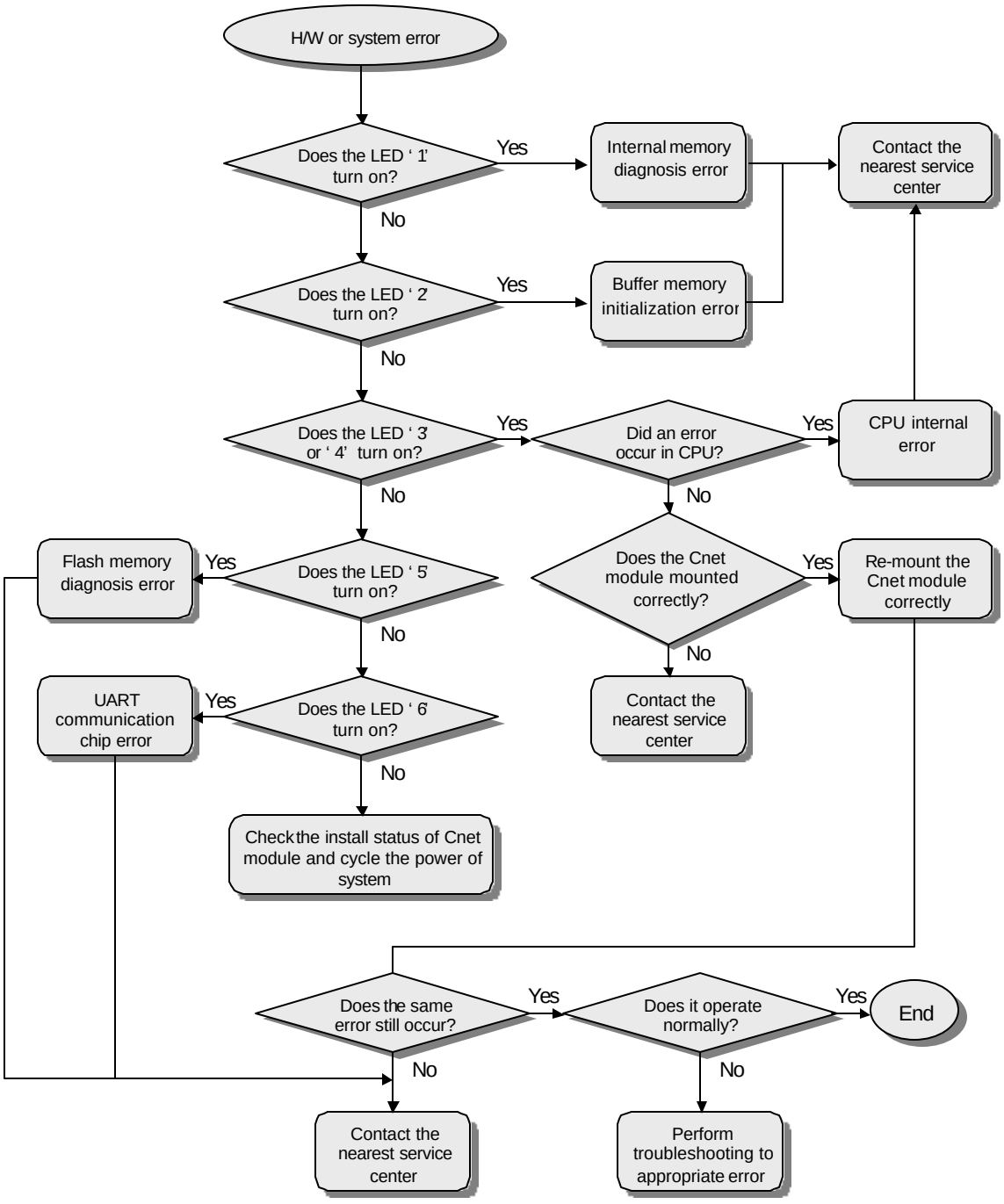
Error type	Error indication	Error contents
C06	No response is sent to request frame of other station.	Incorrectly specified station No. of frame editor Bad cable connection

12.1.7 Modem connection error during KGL-WIN mode

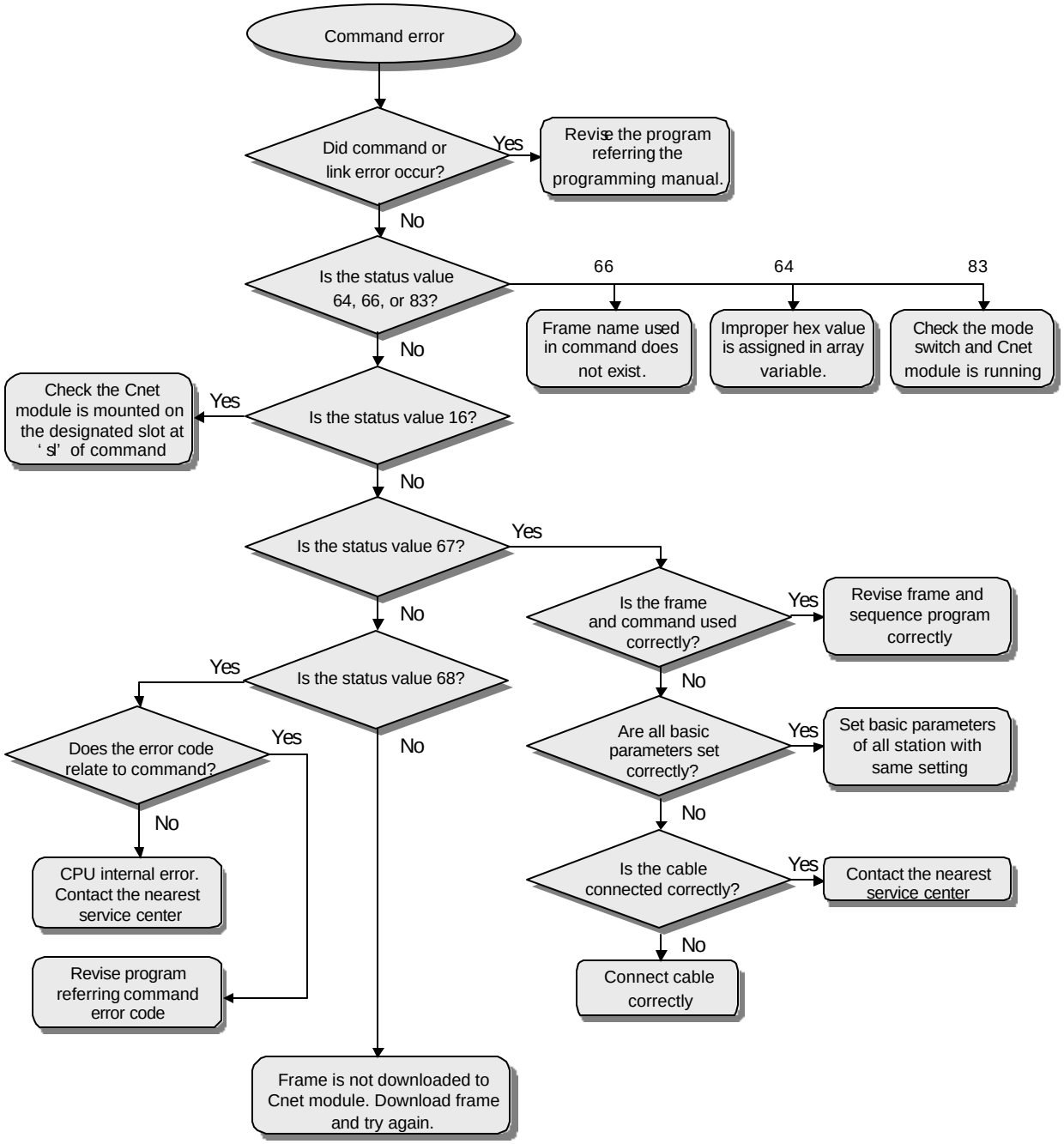
Error type	Error indication	Error contents
C07	Modem connection and initialization are not performed	Operation mode setting error of Cnet module. Disagreement of initialization command of modem. Bad connection of cable and telephone line.

12.2 Troubleshooting by each error code

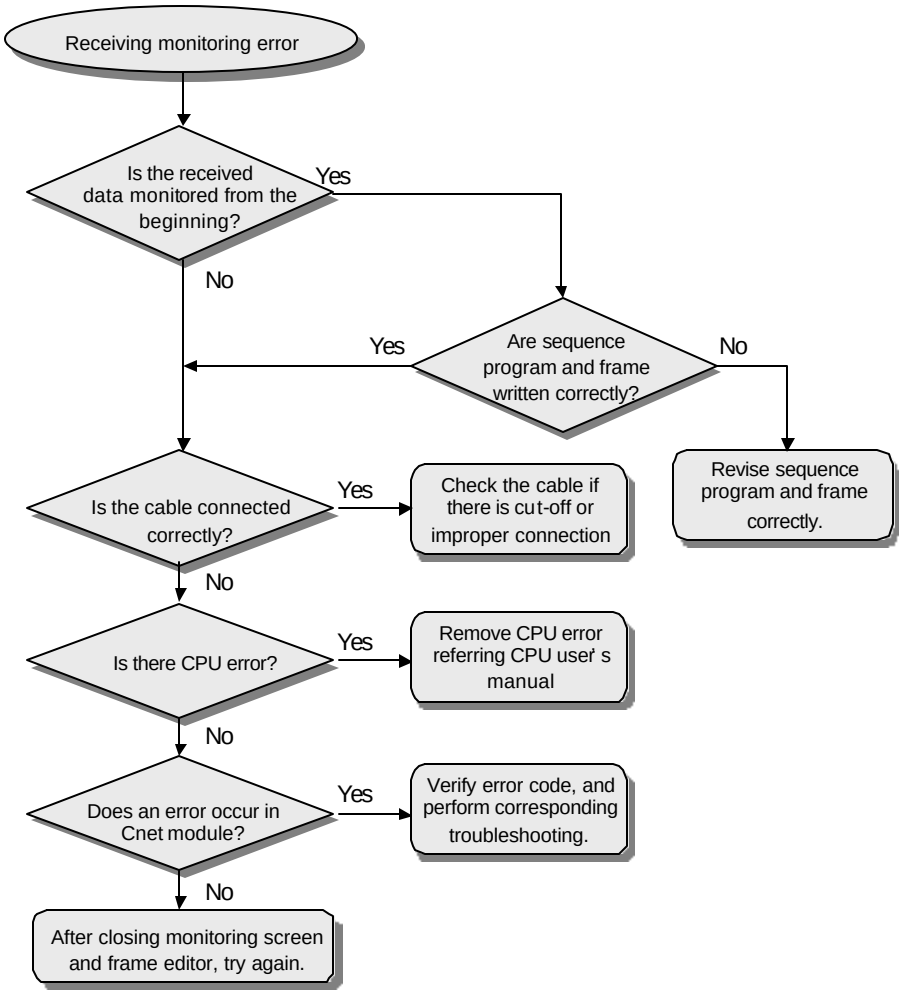
12.2.1 Error type C01 : H/W or system error



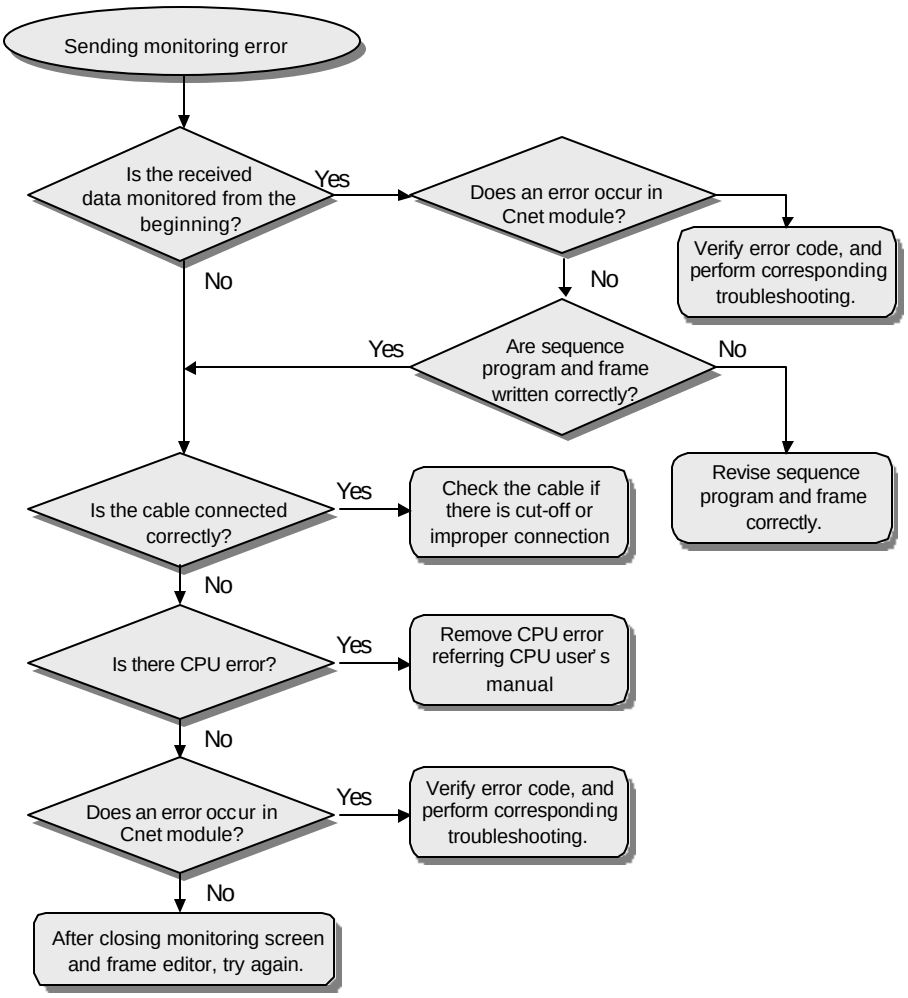
12.2.2 Error type C02 : Command error (User-defined communication)



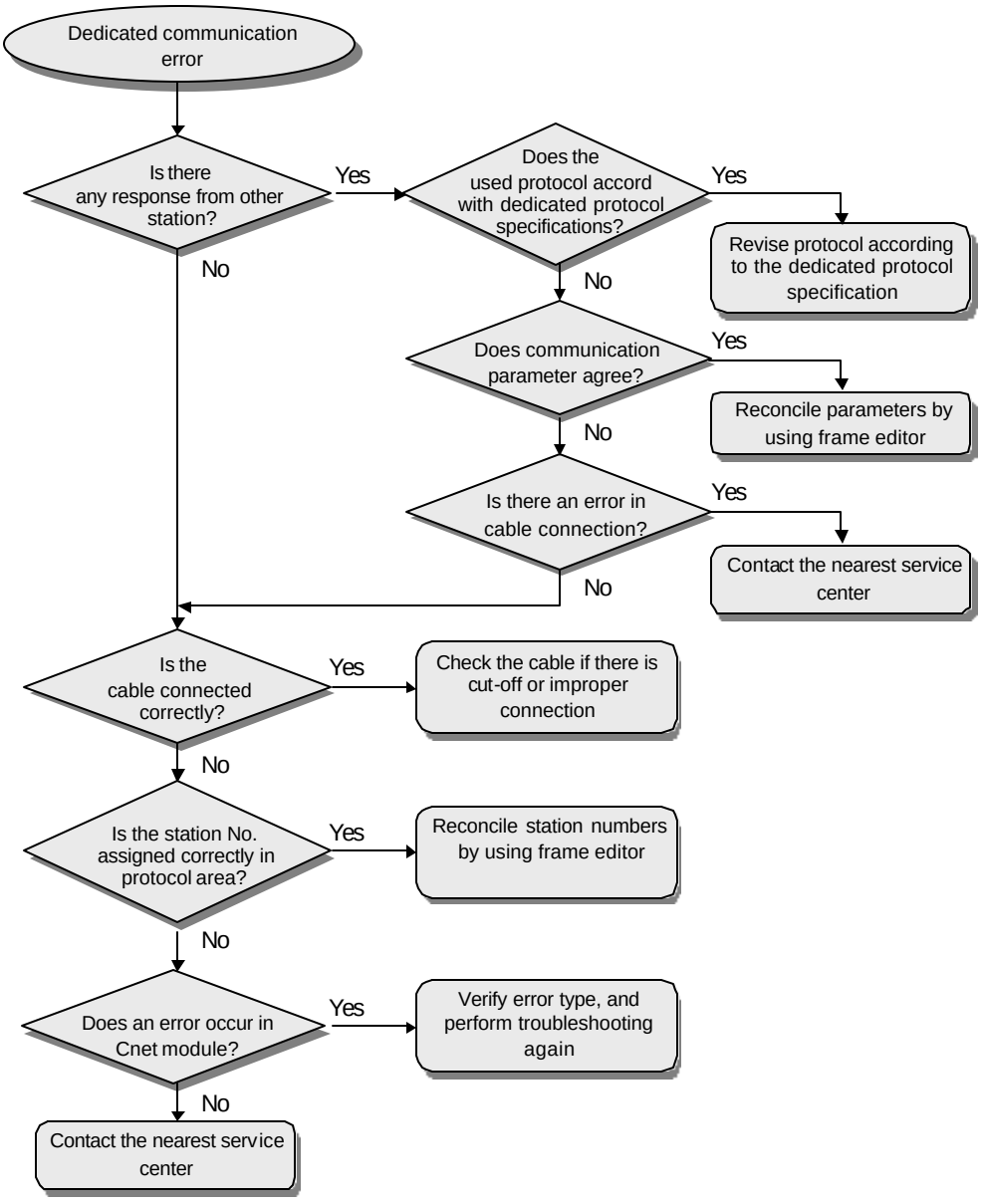
12.2.3 Error type C03 : Receiving monitoring error



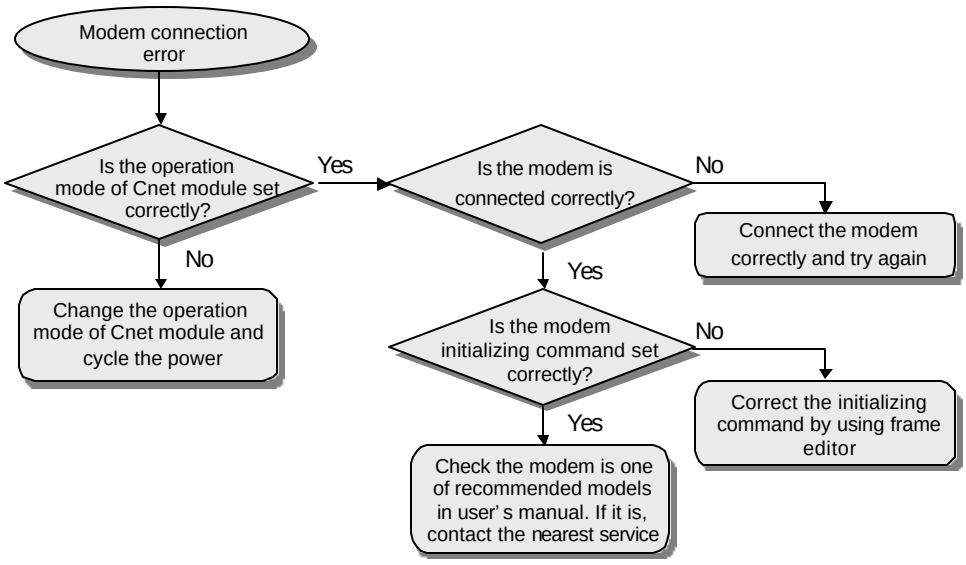
12.2.4 Error type C4 : Sending monitoring error



12.2.5 Error type C5, C6 : Error during dedicated communication



12.2.6 Error type C07 : Modem connection error during KGL-WIN mode



Appendices

A. LED display specifications

A.1 LED display during normal operation

When the Cnet module (K4F-CUEA, K7F-CUEA) operates normally, it shows the operation and transmission status via 16-point LED module. The display switch at the front panel of Cnet module is used for toggling the two indication modes.

A.1.1 Operation status indications (display switch is not pressed)

1) K4F-CUEA and K7F-CUEA

LED #	LED name		Description	Remarks
0	RS-232C	RUN	On during RS-232C channel operation	
1		TX	On during transmission via RS-232C	
2		RX	On during receive via RS-232C	
3		ACK	On during ACK transmission / Off after NAK transmission	
4		NAK	On during NAK transmission / Off after ACK transmission	
5		ERR	On during protocol error / SIO error	
6		MODEM	On during modem communication mode	
7		SYS-RUN	Blink during interfacing with CPU	On during normal operation
8	R422	RUN	On during RS-422 channel operation	
9		TX	On during transmission via RS-422	
10		RX	On during receive via RS-422	
11		ACK	On during ACK transmission / Off after NAK transmission	
12		NAK	On during NAK transmission / Off after ACK transmission	
13		ERR	On during protocol error / SIO error	
14		RS-485	On during RS-485 setting / Off during RS-422 setting	
15		SYS-ERROR	Blink during serious error occurrence	

Remarks

The LED 15 will blink when system hardware error or serious software error occurred, and the error status is indicated by upper 5 bits (LED 0 ~ 4). For details, see A.2 'LED display during abnormal operation'.

2) K3F-CU2A

LED #	LED name		Description	Remarks
0	RS-232C	RUN	On during RS-232C channel operation	
1		TX	On during transmission via RS-232C	
2		RX	On during receive via RS-232C	
3		ACK	On during ACK transmission / Off after NAK transmission	
4		NAK	On during NAK transmission / Off after ACK transmission	
5		ERR	On during protocol error / SIO error	
6		MODEM	On during modem communication mode	
7		SYS-RUN / ERR	Blink during serious error occurrence	On during normal operation

3) K3F-CU4A

LED #	LED name		Description	Remarks
0	RS-422	RUN	On during RS-422 channel operation	
1		TX	On during transmission via RS-422	
2		RX	On during receive via RS-422	
3		ACK	On during ACK transmission / Off after NAK transmission	
4		NAK	On during NAK transmission / Off after ACK transmission	
5		ERR	On during protocol error / SIO error	
6		RS-485	On during RS-485 setting / Off during RS-422 setting	
7		SYS-RUN / ERR	Blink during serious error occurrence	On during normal operation

A.1.2 Station number / transmission specifications indication

While the display switch is pressed, the LED display indicates station number and transmission status in turn.

When the display switch is pressed first time, the station number is indicated in binary format. When the display switch is pressed again after released, the transmission status is displayed. According to this sequence, station number and transmission status are repeatedly displayed in sequence whenever the display switch is pressed.

For distinguishing LED indications of station number and transmission status, the LED15 is used. When indicating station number, the LED 15 becomes on. It will turn off while the transmission status is displayed.

1) Station number indication

The LED 0 ~ 4 shows the station number of RS-232C channel, and LED 8 ~ 12 shows the station number of RS-422 channel in binary value.

LED#	Bit value	Description	Remark
0	d0	Display the station number of RS-232C channel. (Range : h00 ~ h1F)	Binary value
1	d1		
2	d2		
3	d3		
4	d4		
5	Not used	Off during station number is displayed	
6	Not used		
7	Not used		
8	d0	Display the station number of RS-422 channel. (Range : h00 ~ h1F)	Binary value
9	d1		
10	d2		
11	d3		
12	d4		
13	Not used	Off during station number is displayed	
14	Not used		
15	Station number / transmission status	On during station number is displayed	

2) Transmission status indication

LED #	Bit value	Description	Remark
0	d0	Communication speed of RS-232C channel (300 ~ 38400 bps)	Binary value
1	d1		
2	d2		
3	Data bit	On : 8 bits / Off : 7 bits	
4	Parity being/none	On : being / Off : none	
5	Parity type	On : even / Off : odd	
6	Stop bit	On : 2 bits / Off : 1 bit	
7	Not used	Off during transmission status indication	
8	d0	Communication speed of RS-422 channel (300 ~ 76800 bps)	Binary value
9	d1		
10	d2		
11	Data bit	On : 8 bits / Off : 7 bits	
12	Parity being/none	On : being / Off : none	
13	Parity type	On : even / Off : odd	
14	Stop bit	On : 2 bits / Off : 1 bit	
15	Station number / transmission status	On during station number is displayed	

Remarks

Transmission speed is converted from 3-bit values of d0 ~ d2 to hex, of which value is shown as below table. The 76800 bps is provided in RS-422 channel of Cnet module v1.3 or later.

LED status			Hex value	Communication speed (baud rate)
d2	d1	d0		
Off	Off	Off	0	300 / 76800 bps
Off	Off	On	1	300 bps
Off	On	Off	2	1200 bps
Off	On	On	3	2400 bps
On	Off	Off	4	4800 bps
On	Off	On	5	9600 bps
On	On	Off	6	19200 bps
On	On	On	7	38400 bps

A.2 LED display during abnormal operation

LED operations during abnormal operation are divided into two cases;

① When in state of SYS-ERROR LED is off, the other error LEDs blinks at intervals. It means that installation of communication cable or parameter setting is improper or program preparation is abnormal. At this time, it can be solved by seeing chapter 12, 'Troubleshooting'.

② When serious H/W error occur, the LED 15 blinks in 1 second period, and the error code is indicated by LED 0 ~ 4 in binary value as following table. When the serious H/W error occurs, contact the nearest service center.

Error code	Description	Remark
h01	Internal memory diagnosis error	H/W error
h02	Buffer memory reading / writing error	
h03	Buffer memory access error	
h04	CPU interface error	
h05	Flash memory read / write error	
h06	UART (NS-16550) access error	
h07	Operation mode setting error	
h08	Reserved	
h09	Address error	
h0A	Invalid instruction error	
h0B	Zero divide error	
h0C ~ h1F	Reserved	

A.3 LED indication during power-on

The Cnet module performs self-diagnosis through checking the H/W and interface with CPU. When the diagnosis is finished without error, LED 0 ~ 5 becomes on in sequence and then start normal operation. Please see chapter 10 for details of self-diagnosis

B. Error code list

B.1 STATUS value (user-defined communication)

STATUS value		Meaning	Action to take
hex	decimal		
H0E	14	There is no input or over 16 characters at the name of frame.	Check the input of the name of frame.
H10	16	Position of Cnet module is incorrectly specified.	Enter a correct slot number
H11	17	The specified slot for Cnet module is empty or Cnet module is not operating.	Check the specified slot and Cnet module
H12	18	Wrong operands at program (Example : CH, LEN1, .).	Check the operands of program
H14	20	Response frame not requested has been received.	Verify receive frame of self station or transmission frame of other station again.
H15	21	Response from Cnet module has not been received.(waiting time exceeded)	Verify whether Cnet module is user defined communication mode.
H40	64	Operation of RS-232C/422 channel is not RUN.	Perform operation RUN with frame editor. (Menu:[On-line-Operation switching])
H41	65	Name used in frame editor and name used in sequence program do not fit each other.	Reconcile frame name used in frame editor and frame entered in sequence program
H42	66	Frame name can not be found due to abnormal CPU during operation.	1) Download frame again. 2) Verify whether there is abnormality in CPU.
H43	67	Frame specified in command has not been received from other station.	1) Verify receive frame again. 2) Verify other station's transmission frame again.
H44	68	Frame has not been downloaded from frame editor.	Download frame.
H45	69	Error occurs during conversion ASCII ↔ HEX.	Verify whether received data is ASCII or HEX again.
H46	70	Array size specified in frame editor and data size(specified in LENx) used in program do not fit each other.	Confirm data size again and fit it. (Data size is Byte value.)
H67	103	Incorrect frame definition.	1) Verify contents of appropriate frame again with frame editor. 2) Download frame again.
H68	104	Frame has not been downloaded from frame editor.	Download frame.
H73	115	Operation mode is not user defined communication mode.	Correctly fit mode switch. User defined communication mode RS-232C : 0,2,4(0 is interlocking mode) RS-422/485 : 2,5,6

B.2 Error code during NAK occurrence (dedicated communication)

Error code	Error type	Contents	Action to take
H0001	PLC system error	Interface with PLC impossible	Power On/Off
H0011	Data error	Error occurred when ASCII data value is converted into digits	Check whether another character than upper and lower cases(‘ %’ ,’ -’ , ’ .’), and digits has been used, correct, and execute again.
H1132	Device memory error	Wrong specified device memory	Inspect device type
H1232	Data size error	Execution data number exceeding 120 Bytes	Correct data length
H1332	Data type error	Data type mismatch between variables	Equalize data type
H1432	Data value error	Data value not digits	Inspect data value
H2432	Data type error	Data type mismatch with actual variable	Equalize variable and data type of PLC program
H7132 H2232	Variable request format error	1) P, M, L, K, D, T, C, F, S area exceeding error 2) Request format not fit	Inspect format, correct, and then execute again.
H0090	Monitor execution error	Registration number of appropriate monitor not registered.	Execute again after registering monitor.
H0190	Monitor execution error	Registered number exceeding range	Execute again after adjusting monitor registration number to 31 or less.
H0290	Monitor registration error	Registered number exceeding range	Execute again after adjusting monitor registration number to 31 or less.
No response	No response	* Station number error * BCC error * Main command / command type error * Header and tail character error * Cable error * Operation mode error * Communication speed and stop/data/parity bit error * PLC error	Check and take actions for error contents that may occur