

K3NX/K3NV/K3NH/K3NR/K3NP/K3NC

Communication Output-type Intelligent Signal Processor

OPERATION MANUAL

OMRON

K3NX/K3NV/K3NH/K3NR/K3NP/K3NC Communication Output-type Intelligent Signal Processor


Operation Manual


Produced February 1998


Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

 **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PC" means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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About this Manual:

This manual explains the communications functions of the K3N□ Intelligent Signal Processors and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to use the communications functions in K3N□ Intelligent Signal Processors. Also read the operation manual for the K3N□ Intelligent Signal Processor to be used.

Manual	Catalog No.
K3NX Operation Manual	N90-E1-1
K3NH Operation Manual	N92-E1-1
K3NR Operation Manual	N93-E1-1
K3NP Operation Manual	N94-E1-1
K3NC Operation Manual	N95-E1-1
K3NV Operation Manual	N91-E1-1

When the K3N□ Intelligent Signal Processor is being used in one of the following applications, be sure to allow ample margin in the ratings and characteristics, use the necessary safety measures such as fail-safe systems, and consult with your OMRON representative.

Section 1 describes communications using the CompoWay/F format. CompoWay/F is OMRON's standard communications format for general serial communications, so it can simplify communications between components or between personal computers and components.

Section 2 provides information on host link communications. Host link communications provide compatibility with earlier K3T□-series Units.

Section 3 provides the basic operational elements required in order to use the BCD output model and gives two programming examples.

Appendix A provides an ASCII list.

Appendix B provides a list of optional accessories.



WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

PRECAUTIONS

This section provides precautions for using the Intelligent Signal Processor and related devices.

The information contained in this section is important for the safe and reliable application of the Intelligent Signal Processor. You must read this section and understand the information contained before attempting to set up or operate the Intelligent Signal Processor.

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1 General Precautions


The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Be sure to read this manual before attempting to use the product and keep this manual close at hand for reference during operation.

2 Safety Precautions

 **WARNING** Never attempt to disassemble any Units while power is being supplied. Doing so may result in serious electrical shock or electrocution.

 **WARNING** Never touch any of the terminals while power is being supplied. Doing so may result in serious electrical shock or electrocution.

3 Application Precautions

Observe the following precautions when using the product.

- Always use the power supply voltage specified in the specifications.
- Do not use the product in locations subject to flammable gases or combustible objects.
- Be sure to confirm terminal names when wiring.
- Be sure to tighten the screws on the terminal blocks.

Observe the following precautions when mounting the product.

- Mount the product on level surfaces.
- Mount the product on a panel which has a thickness of 1 to 3.2 mm.

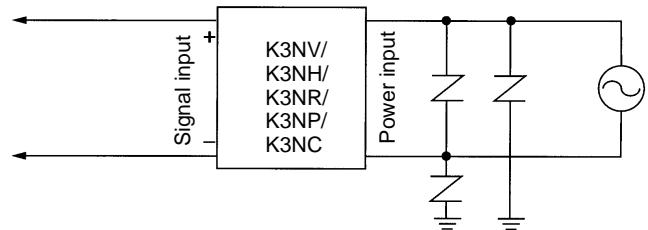
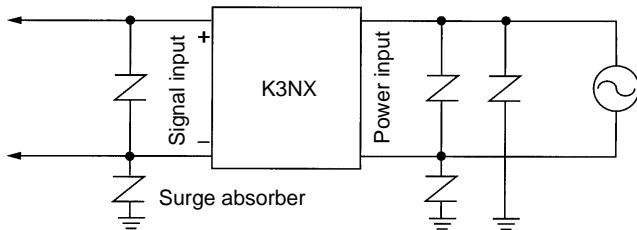
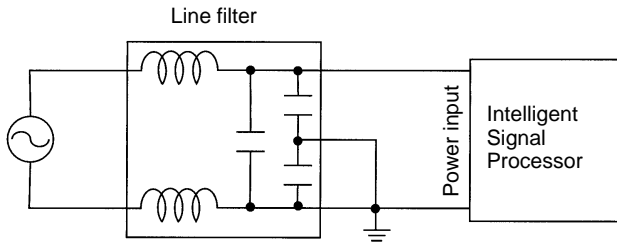
Do not mount the product in the following places.

- Locations subject to strong shock or vibration.
- Locations subject to temperature or humidity exceeding the rated levels or where icing is liable to occur.
- Locations subject to dust.
- Locations subject to corrosive gases (particularly sulfuric gases or ammonium gases).
- Locations subject to direct sunlight or outdoor conditions.
- Locations near devices (high-frequency welders or high-frequency sewing machines) that produce high-frequency noise.

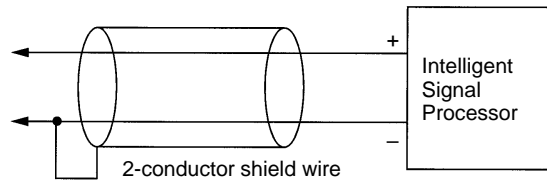
4 Noise Prevention

Provide the following countermeasures when using the product in an environment where the product is exposed to noise.

- Countermeasures for protecting the product against high-frequency noise or abnormal voltages.



- Countermeasures for protecting the product against inductive noise produced from the input line.



SECTION 1

CompoWay/F Communications Procedures

This section describes communications using the CompoWay/F format.

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1-1 Introduction

CompoWay/F Communications

The program for the communications functions is created in the host computer and the K3N□'s parameters are monitored/set from the host computer, so the explanation provided here is from the viewpoint of the host computer.

CompoWay/F is OMRON's standard communications format for general serial communications. This format uses a standard frame format as well as the FINS commands which have proven successful in OMRON's PCs, so it can simplify communications between components or between personal computers and components.

The FINS (Factory Interface Network Service) protocol provides message communications between PCs in OMRON FA networks.

Use a K3N□ with Communications Output Board, FLK1/2/3/4/5/6 for CompoWay/F communications. The K3N-series has the following communications functions.

- Reading/Writing parameters
- Operational control
- Switching setting levels

The communications functions are limited to the following conditions.

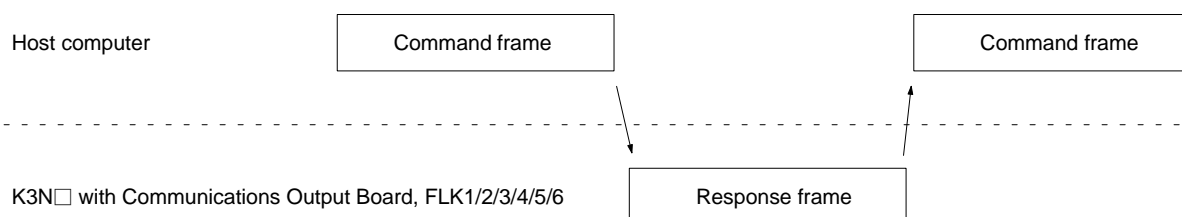
- Parameters can be written only during remote operation.
- Only the set value can be written while in RUN mode. All other parameters are read-only.
- Parameters cannot be written or read when a sensor error has occurred (K3NH).
- Parameters cannot be written or read during startup lock (K3NX).

Communications Specifications

Transmission line connection:	Multiple point
Communications method:	RS-232C or RS-422 (4-wire, half-duplex) RS-485 (2-wire, half-duplex)
Synchronization method:	Start-stop synchronization
Communication speed:	1,200/2,400/4,800/9,600/19,200/38,400 bps (default: 9,600 bps)
Communication code:	ASCII
Data bits:	7 or 8 bits (default: 7 bits) (An 8-bit code is made by adding a 0 to the 7-bit code.)
Stop bits:	1 or 2 bits (default: 2 bits)
Error detection:	Vertical parity (none, even, or odd) (default: even parity) BCC (block check character) Start-stop synchronization data composition

Transmission Procedure

When the host computer transmits a command frame, the K3N□ transmits a response frame that corresponds to the command frame. A single response frame is returned for each command frame. The following diagram shows the operation of the command and response frames.



Interface

Communications with the host computer are carried out through a standard RS-232C, RS-422, or RS-485 interface. The model numbers indicate which interface is incorporated in the models.

- K3N□ with Communications Output Board, FLK1/4: RS-232C
- K3N□ with Communications Output Board, FLK2/5: RS-422
- K3N□ with Communications Output Board, FLK3/6: RS-485

1-2 Preparation For Operation

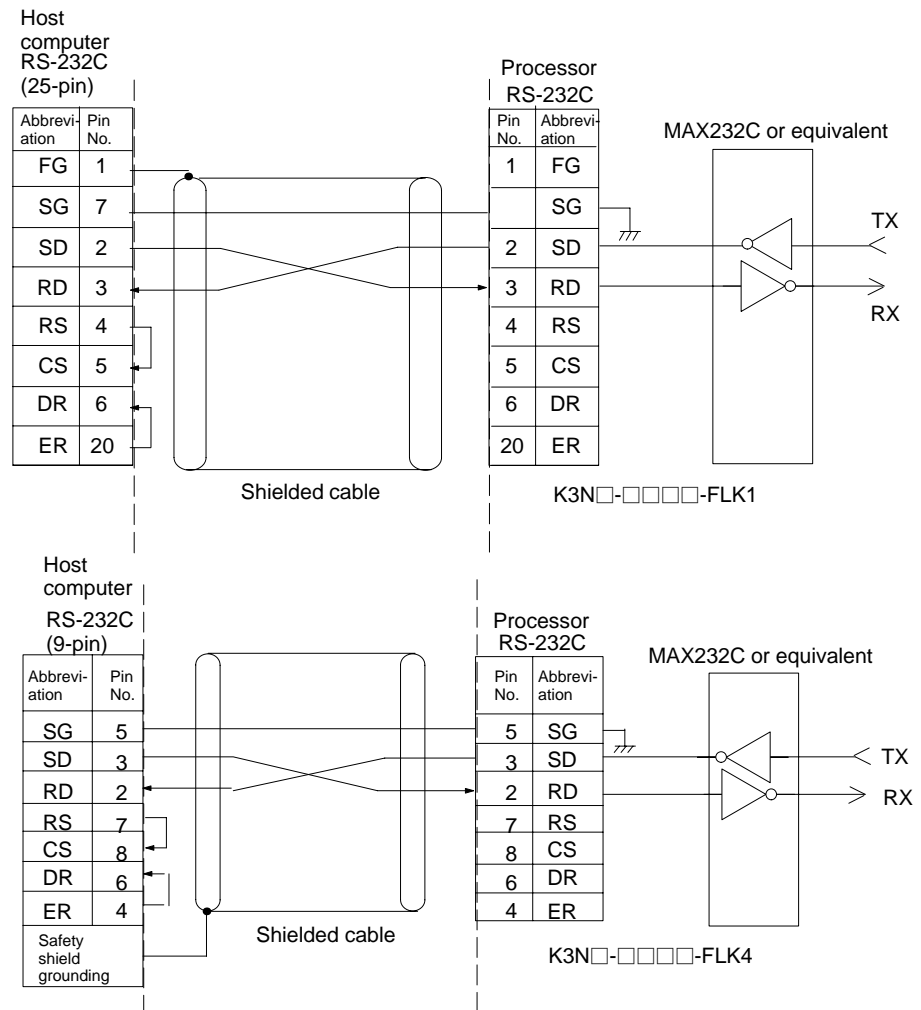
1-2-1 Wiring

RS-232C

RS-232C connections are one-to-one.

The max. cable length is 15 m. Use an RS-232C optical interface when extending the transmission line beyond 15 m.

Use a shielded, twisted-pair cable (AWG 28 or larger).



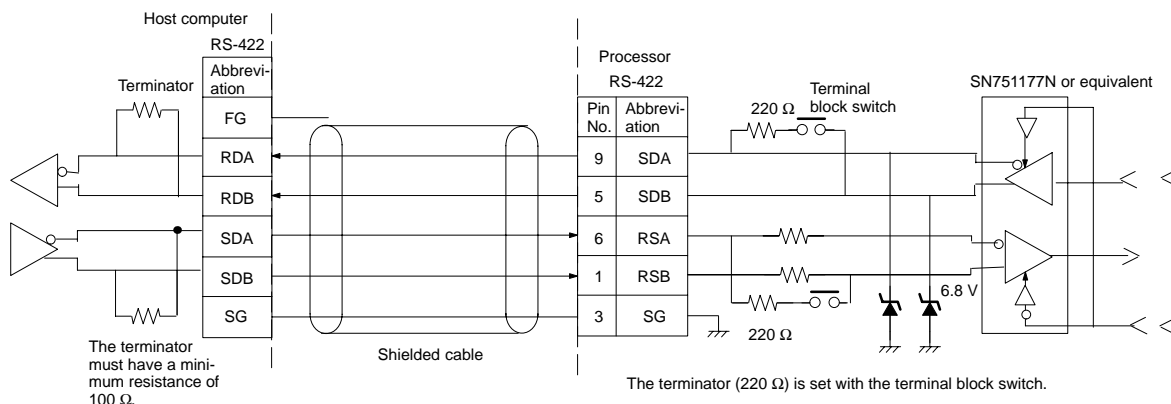
RS-422

RS-422 connections can be one-to-one or one-to-N when a 3G2A9-AL001 Link Adapter is used. A maximum of 32 Units (including the host computer) can be connected in one-to-N systems.

The total cable length can be 500 m max.

Use a shielded, twisted-pair cable (AWG 28 or larger).

Be sure to turn ON the terminator switches only in the devices at each end of the transmission line.



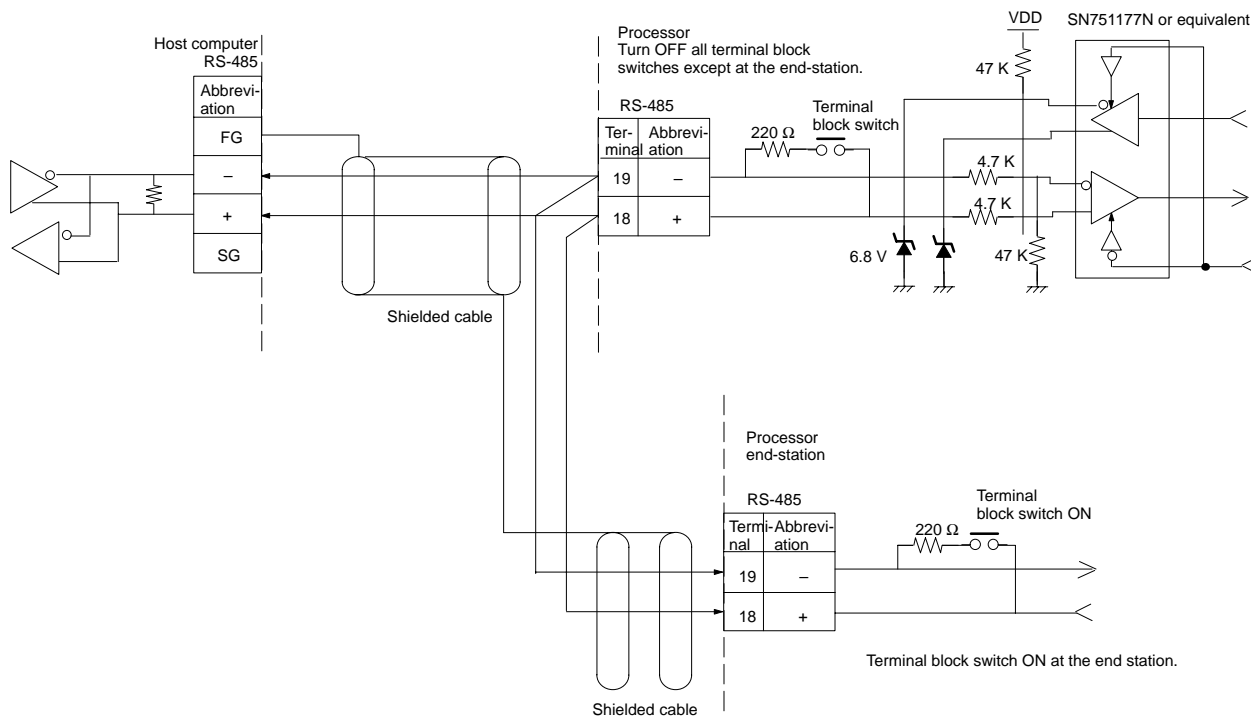
RS-485

RS-485 connections can be one-to-one or one-to-N. A maximum of 32 Units (including the host computer) can be connected in one-to-N systems.

The total cable length can be 500 m max.

Use a shielded, twisted-pair cable (AWG 28 or larger).

Be sure to turn ON the terminator switches only in the devices at each end of the transmission line.



Note SYSMAC BUS Wired Remote I/O devices cannot be connected.

Match the communications format of the K3N□ and the host computer. If a one-to-N system is being used, be sure that the communications formats of all devices in the system (except individual Unit numbers) are the same. This section explains how to set the K3N□'s communication format. Refer to your computer's user's manual for details on changing its communications settings.

1-2-2 Communications Parameters

The K3N□'s communication format is set with the communications parameters. These parameters are set with the K3N□'s front panel. The following table shows the communications parameters (option mode) and their setting ranges.

Parameter/Code		Setting range	Default setting
Unit number	$U-n\bar{o}$	0 to 99	0
Baud rate	$bP5$	1.2, 2.4, 4.8, 9.6, 19.2, or 38.4 (kbps)	9.6
Data bits	LEn	7 or 8 (bit)	7
Parity	$Pr\bar{t}Y$	$n\bar{o}nE$, $EuEn$, or $\bar{o}dd$	$EuEn$
Stop bits	$Sb\bar{c}t$	1 or 2	2

1-3 Data Format

Unless otherwise indicated, numbers in the following tables are hexadecimal. Values in double quotation marks, such as "00," are ASCII.

Command Frame

STX	Node No.	Sub-address	SID	Command text			ETX	BCC
(02)	($\times 10^1$) ($\times 10^0$)	"00"	"0"	MRC	SRC	Data	(03)	
1 byte	2 bytes	2 bytes	1 byte				1 byte	1 byte

Response Frame

STX	Node No.	Sub-address	End code	Response text				ETX	BCC
(02)	($\times 10^1$) ($\times 10^0$)	"00"	"00"	MRC	SRC	MRES	SRES	Data*	(03)
1 byte	2 bytes	2 bytes	2 bytes						1 byte

Note There will be no data if there was an error in the command frame. (In this case, there will be an end code other than "00" or "0F.")

STX	This code (02) indicates the beginning of the transmission frame. Always set this character in the first byte.
Node number	This number specifies the transmission's destination. Specify the K3N□'s unit number to transmit to the K3N□. Specify "XX" for a broadcast transmission. No responses will be returned for broadcast transmissions.
Sub-address	Not used for the K3N□. Always set the sub-address to "00."
SID (Service ID)	Not used for the K3N□. Always set the SID to "0."
End code	Indicates the execution result for the corresponding command frame.
Command text	This is the main component of the command. Refer to 1-4-2 <i>Command Text Composition</i> for details.
MRC, SRC (Command code)	Indicate the service being used. Refer to 1-4-2 <i>Command Text Composition</i> for details.
MRES, SRES (Response code)	Indicate the transmission results.
ETX	This code (03) indicates the end of the text.
BCC	Block Check Character <ul style="list-style-type: none"> This is the BCC result for the data from just after STX until ETX. Horizontal parity (1 character display)

The BCC result is found by calculating the exclusive OR of the bytes from just after STX until ETX.

End Code Summary

End code	Name	Meaning
"00"	Normal completion	The command was completed normally, without any of the following errors.
"0F"	Command error	The specified command couldn't be executed. The response code should indicate why the command couldn't be executed.
"10"	Parity error	A parity error occurred in one of the characters during reception.
"11"	Framing error	A framing error occurred in one of the characters during reception.
"12"	Overrun error	An overrun error occurred in one of the characters during reception.
"13"	BCC error	The received frame's BCC was incorrect.
"14"	Format error	The command text was incorrect. This error will occur when a character other than "0" to "9" or "A" to "F" is included in the command text.
"16"	Sub-address error	The received frame's header or address is incorrect.
"18"	Frame length error	The received frame exceeded the prescribed number of bytes.

1-4 Commands and Responses

1-4-1 Memory Area Read

Command Text within the Command Frame

MRC	SRC	Memory type	Starting read address	Number of elements
"01"	"01"	"C0"	See section 1-5.	"0001"
2 bytes	2 bytes	2 bytes	4 bytes	4 bytes

1, 2, 3... 1. Memory type

Memory type	Meaning
"C0"	Present value (PV), MAX value, MIN value, status, or set value

2. Starting read address

Specify the address of the data which you want to read in 4-digit hexadecimal. Refer to *1-5 Memory/Parameter Area Details* for details on the starting addresses of each memory type.

3. Number of elements (4-digit hexadecimal)

Number of elements	Process
"0001"	Executes the read operation and completes it normally.

Note If "0000" is specified, the read operation won't be executed but the command will be completed normally. Any value other than "0000" or "0001" will cause a parameter error.

Response Text within the Response Frame

MRC	SRC	Response code	Read data
"01"	"01"		
2 bytes	2 bytes	4 bytes	8 bytes

1, 2, 3... 1. Response code

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"1002"	Command too short
"1100"	Parameter error
"1101"	Area type error
"1103"	Starting address out-of-range error
"2203"	Operating error

2. Read data

The specified data is transferred in 8-digit hexadecimal. Only the status data is bit information. (Refer to 1-5 Memory/Parameter Area Details for details on the data.)

1-4-2 Command Text Composition

Valid Command Codes

Command		Action	Comments
MRC	SRC		
"01"	"01"	Memory area read	Reads or writes the present value (PV), maximum value, minimum value, status, or set value.
"01"	"02"	Memory area write	
"02"	"01"	Parameter area read	Reads or writes settings other than present values.
"02"	"02"	Parameter area write	
"05"	"03"	Properties read	Reads information such as model number and buffer size, which the host computer uses to verify the upper limit of the data length.
"06"	"01"	Controller status read	Reads operational status information.
"08"	"01"	Internode echo test	Returns data sent from the host computer unchanged.
"30"	"05"	Operating command	Executes hold, reset, forced-zero, max./min. value reset, remote/local selection, or mode selection.

Command Frame Composition

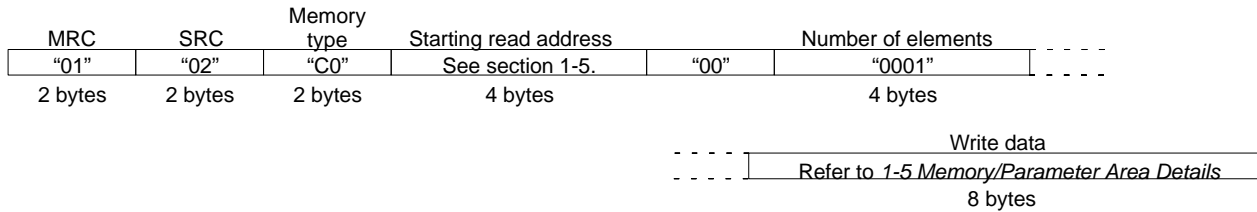
STX	Node No.	Sub-address	SID	Command text	ETX	BCC
(02)	(x10 ¹)	(x10 ⁰)	"00"	"0"	(03)	

MRC	SRC	Data
-----	-----	------

Command	Code		Data				Page	
Memory area read	"01"	"01"	Memory type	Address	"00"	Number of elements	---	6
Memory area write	"01"	"02"	Memory type	Address	"00"	Number of elements	Write data	8
Parameter area read	"02"	"01"	Parameter type	Address	Number of elements		---	9
Parameter area write	"02"	"02"	Parameter type	Address	Number of elements		Write data	11
Properties read	"05"	"03"	---					12
Controller status read	"06"	"01"						13
Internode echo test	"08"	"01"	Test data					14
Operating command	"30"	"05"	Command code					15

1-4-3 Memory Area Write

Text within the Command Frame



1, 2, 3... 1. Memory type

Memory type	Meaning
"C0"	Set value

2. Starting write address

Specify (in 4-digit hexadecimal) the address of the data which you want to write. Refer to *1-5 Memory/Parameter Area Details* for details on the starting addresses of each memory type.

3. Number of elements (4-digit hexadecimal)

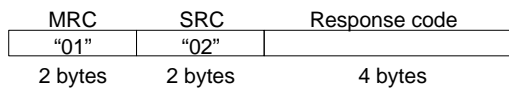
Number of elements	Process
"0001"	Executes the write operation and completes it normally.

Note If "0000" is specified, the write operation won't be executed but the command will be completed normally. Any value other than "0000" or "0001" will cause a parameter error.

4. Write data

Specify the data which you want to write. Refer to *1-5 Memory/Parameter Area Details* for details on the write data.

Response Text within the Response Frame



Response codes

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"1002"	Command too short
"1100"	Parameter error
"1101"	Area type error
"1103"	Starting address out-of-range error
"2203"	Operating error
"3003"	Read-only data

Note The write operation won't be executed unless the response code is "0000."

1-4-4 Parameter Area Read

Text within the Command Frame

MRC	SRC	Parameter type	Starting read address	Number of elements
"02"	"01"	See 1.	See section 1-5.	"8001"
2 bytes	2 bytes	2 bytes	4 bytes	4 bytes

1, 2, 3... 1. Parameter type

K3NH

Type	Meaning
"8000"	Input type, decimal point position (see note), average processing, hysteresis, and comparative output pattern
"C00C"	Scaling upper limit value, scaling lower limit value, upper-limit compensation value, and Lower-limit compensation value
"8824"	Temperature unit, standby sequence, and display digit change

Note An error response will be returned if a temperature input ($\bar{c}n-t$) has been selected for the input type.

K3NX

Type	Meaning
"8000"	Input range, decimal point position, average processing, startup compensation time, hysteresis, and comparative output pattern
"C00C"	Scaling input value 2, scaling display value 2, scaling input value 1, and scaling display value 1
"8824"	Power supply frequency

K3NV

Type	Meaning
"8000"	Input range, decimal point position, average processing, startup compensation time, hysteresis, and comparative output pattern
"C00C"	Scaling input value 2, scaling display value 2, scaling input value 1, and scaling display value 1
"8824"	Power supply frequency

K3NR

Type	Meaning
"8000"	Operating mode, decimal point position, process time for averaging measured value, startup compensation time, hysteresis, and comparative output pattern
"C00C"	Prescaling value X (mantissa) of input A, prescaling value Y (exponent) of input A, prescaling value X (mantissa) of input B, and prescaling value Y (exponent) of input B
"8824"	Sensor type, time unit, power failure memory
"C82A"	Auto zero time of input A X (mantissa), auto zero time of input A Y (exponent), auto zero time of input B Y (mantissa), and auto zero time of input B Y (exponent)

K3NP

Type	Meaning
"8000"	Operating mode, decimal point position, and comparative output pattern
"C00C"	Prescaling value X (mantissa) of input A and prescaling value Y (exponent) of input A
"8824"	Sensor type and time unit

K3NC

Type	Meaning
"8000"	Operating format, decimal point position, and comparative output pattern
"C00C"	Prescaling value X (mantissa) of input A and prescaling value Y (exponent) of input A
"8824"	Sensor type, power failure memory, and compensation input condition
"C82A"	Compensation value

2. Starting read address

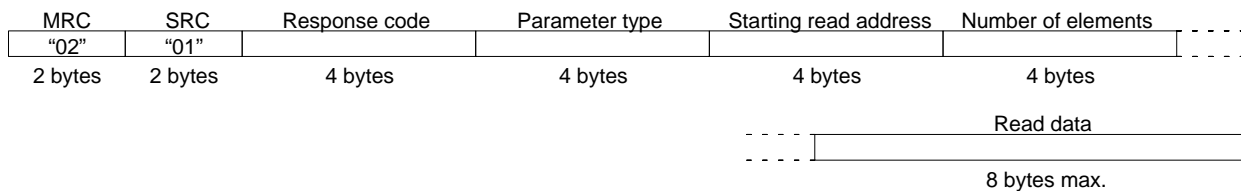
Specify (in 4-digit hexadecimal) the address of the data which you want to read. Refer to *1-5 Memory/Parameter Area Details* for details on the starting addresses of each parameter type.

3. Number of elements

Number of elements	Process
"8001"	Executes the read operation and completes it normally.

Note If "8000" is specified, the read operation won't be executed but the command will be completed normally. Any value other than "8000" or "8001" will cause a parameter error.

Response Text within the Response Frame



1, 2, 3... 1. Response codes

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"1002"	Command too short
"1100"	Parameter error
"1101"	Area type error
"1103"	Starting address out-of-range error
"2203"	Operating error

2. Parameter type and starting read address

The parameter type and starting read address specified in the command will be returned.

3. Read data

The data specified in the command will be returned.

4. Number of elements

The number of elements specified in the command will be returned.

1-4-5 Parameter Area Write

Text within the Command Frame

MRC	SRC	Parameter type	Starting write address	Number of elements	-----
"02"	"02"	See 1., below.	See section 1-5.	"8001"	-----
2 bytes	2 bytes	4 bytes	4 bytes	4 bytes	

					Write data

					Refer to 1-5 Memory/Parameter Area Details
					8 bytes max.

1, 2, 3... 1. Parameter type

K3NH

Type	Meaning
"8000"	Input type, decimal point position, average processing, hysteresis, and comparative output pattern
"C00C"	Scaling upper limit value, scaling lower limit value, upper-limit compensation value, and lower-limit compensation value
"8824"	Temperature unit, standby sequence, and display digit change

K3NX

Type	Meaning
"8000"	Input range, decimal point position, average processing, startup compensation time, hysteresis, and comparative output pattern
"C00C"	Scaling input value 2, scaling display value 2, scaling input value 1, and scaling display value 1
"8824"	Power supply frequency

K3NV

Type	Meaning
"8000"	Input range, decimal point position, average processing, startup compensation time, hysteresis, and comparative output pattern
"C00C"	Scaling input value 2, scaling display value 2, scaling input value 1, and scaling display value 1
"8824"	Power supply frequency

K3NR

Type	Meaning
"8000"	Operating mode, decimal point position, process time for averaging measured value, startup compensation time, hysteresis, and comparative output pattern
"C00C"	Prescaling value X (mantissa) of input A, prescaling value Y (exponent) of input A, prescaling value X (mantissa) of input B, and prescaling value Y (exponent) of input B
"8824"	Sensor type, time unit, power failure memory
"C82A"	Auto zero time of input A X (mantissa), auto zero time of input A Y (exponent), auto zero time of input B Y (mantissa), and auto zero time of input B Y (exponent)

K3NP

Type	Meaning
"8000"	Operating mode, decimal point position, and comparative output pattern
"C00C"	Prescaling value X (mantissa) of input A and prescaling value Y (exponent) of input A
"8824"	Sensor type and time unit

K3NC

Type	Meaning
"8000"	Operating format, decimal point position, and comparative output pattern
"C00C"	Prescaling value X (mantissa) of input A and prescaling value Y (exponent) of input A
"8824"	Sensor type, power failure memory, and compensation input condition
"C82A"	Compensation value

2. Starting write address

Specify (in 4-digit hexadecimal) the address of the data which you want to write. Refer to *1-5 Memory/Parameter Area Details* for details on the starting addresses of each parameter type.

3. Number of elements (4-digit hexadecimal)

Number of elements	Process
"8001"	Executes the write operation and completes it normally.

Note If "8000" is specified, the write operation won't be executed but the command will be completed normally. Any value other than "8000" or "8001" will cause a parameter error.

4. Write data

Specify the data which you want to write. Refer to *1-5 Memory/Parameter Area Details* for details on the write data.

Response Text within the Response Frame

MRC	SRC	Response code
"02"	"02"	
2 bytes	2 bytes	4 bytes

Response codes

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"1002"	Command too short
"1100"	Parameter error
"1101"	Area type error
"1103"	Starting address out-of-range error
"2203"	Operating error

Note The write operation won't be executed unless the response code is "0000."

1-4-6 Properties Read

Text within the Command Frame

MRC	SRC
"05"	"03"
2 bytes	2 bytes

Response Text within the Response Frame

MRC	SRC	Response code	Model number	Buffer size
"05"	"03"			
2 bytes	2 bytes	4 bytes	10 bytes	4 bytes

1, 2, 3... 1. Response codes

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"2203"	Operating error

2. Model number

The 10-byte ASCII model number will be returned as is (from the left). The overall format is "K3N [1]-[2][3]-[4]."

[1]: This is the fourth character in the model number (H, R, P, C, X, or V).

[2][3]: These characters indicate the input specifications, as shown below.

Characters [2][3]	Meaning
TA	K3NH
NB	NPN input for the K3NR, K3NP, or K3NC
PB	PNP input for the K3NR, K3NP, or K3NC
VD	K3NX (DC voltage input)
AD	K3NX (DC current input)
VA	K3NX (AC voltage input)
AA	K3NX (AC current input)
LC	K3NV

[4]: This is the Output Unit's code.

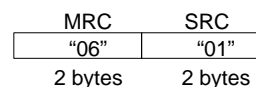
Number	Code	Meaning
1	FLK1	Communications (RS-232C)
2	FLK2	Communications (RS-485)
3	FLK3	Communications (RS-422)
4	FLK4	Communications + Transistor output (RS-232C + NPN open collector)
5	FLK5	Communications + Transistor output (RS-485 + NPN open collector)
6	FLK6	Communications + Transistor output (RS-422 + NPN open collector)

3. Communications buffer size

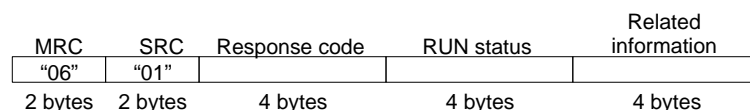
Indicates the size of the communications buffer in 4-digit hexadecimal. The hexadecimal number is represented in ASCII and is always "0025" (37 bytes).

1-4-7 Controller Status Read

Text within the Command Frame



Response Text within the Response Frame



1, 2, 3... 1. Response codes

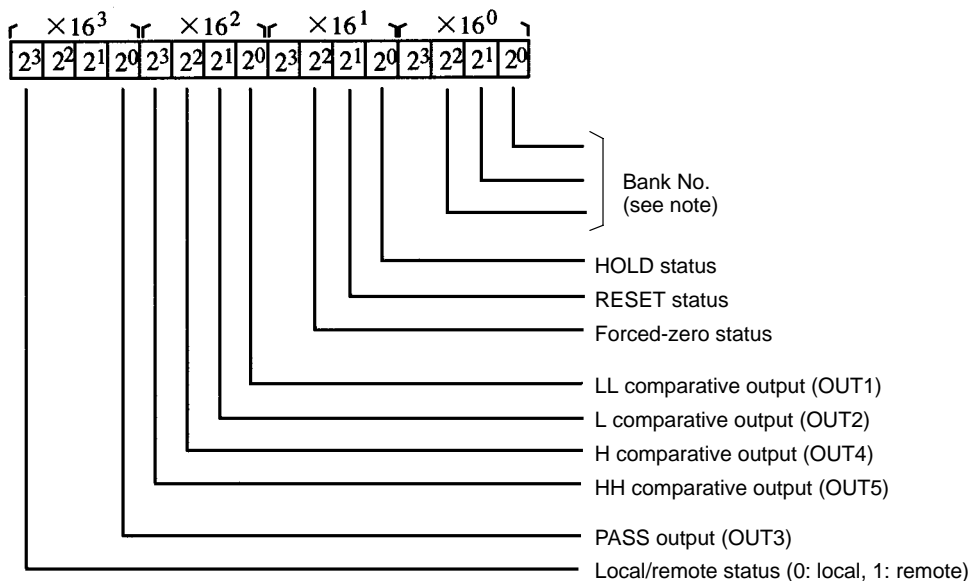
Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"2203"	Operating error

2. RUN status

"00"	Operating in RUN mode
"01"	Operating in setting mode
"02"	Performing output test

3. Related information

The related information (binary) is returned as 2-digit ASCII code.



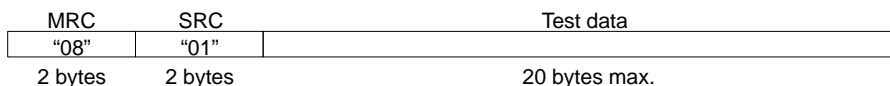
A "0" will be returned for a function if the Unit isn't equipped with that function. The output numbers in parentheses are for the K3NC.

Note Refer to the following table for the bank number that has been set. These are valid only for the K3NR, K3NP, and K3NC.

Bank No.	2 ²	2 ¹	2 ⁰
Bank 0	OFF	OFF	OFF
Bank 1	OFF	OFF	ON
Bank 2	OFF	ON	OFF
Bank 3	OFF	ON	ON
Bank 4	OFF	OFF	OFF

1-4-8 Internode Echo Test

Text within the Command Frame

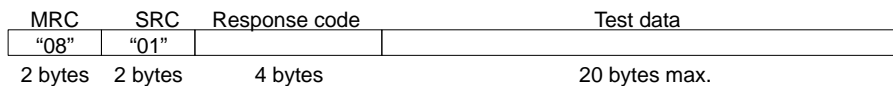


The test data can be any arbitrary data (1 to 20 bytes), although the bytes of data must be within the following ranges:

- 20 to FF hexadecimal when the number of data bits is set to 8.
- 20 to 7F hexadecimal when the number of data bits is set to 7.

Note The test data isn't checked for out-of range values.

Response Text within the Response Frame



1, 2, 3... 1. Response codes

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"2203"	Operating error

2. Test data

The test data sent by the command is returned unchanged.

1-4-9 Operating Command

Text within the Command Frame

MRC	SRC	Command code	Sub-code
"30"	"05"		
2 bytes	2 bytes	2 bytes	2 bytes

The following table shows the four command codes and the sub-codes for commands that require them.

Code	Command	Sub-code
"10"	Reset maximum and minimum values.	None
"11"	Forced-zero	"00": Clear forced-zero setting. "01": Execute (Invalid for the K3NR, K3NP, K3NC, and K3NH.)
"12"	Remote/local programming	"00": Local "01": Remote
"13"	Switch mode.	"00": RUN mode "01": Setting mode

Response Text within the Response Frame

MRC	SRC	Response code	Command code
"30"	"05"		
2 bytes	2 bytes	4 bytes	2 bytes

1, 2, 3... 1. Response code

Response code	Meaning
"0000"	Normal completion
"1001"	Command too long
"1002"	Command too short
"1100"	Parameter error
"2203"	Operating error

2. Command code

The command code sent by the command is returned unchanged when the command was completed normally or an operating error occurred.

1-4-10 Summary of Response Codes

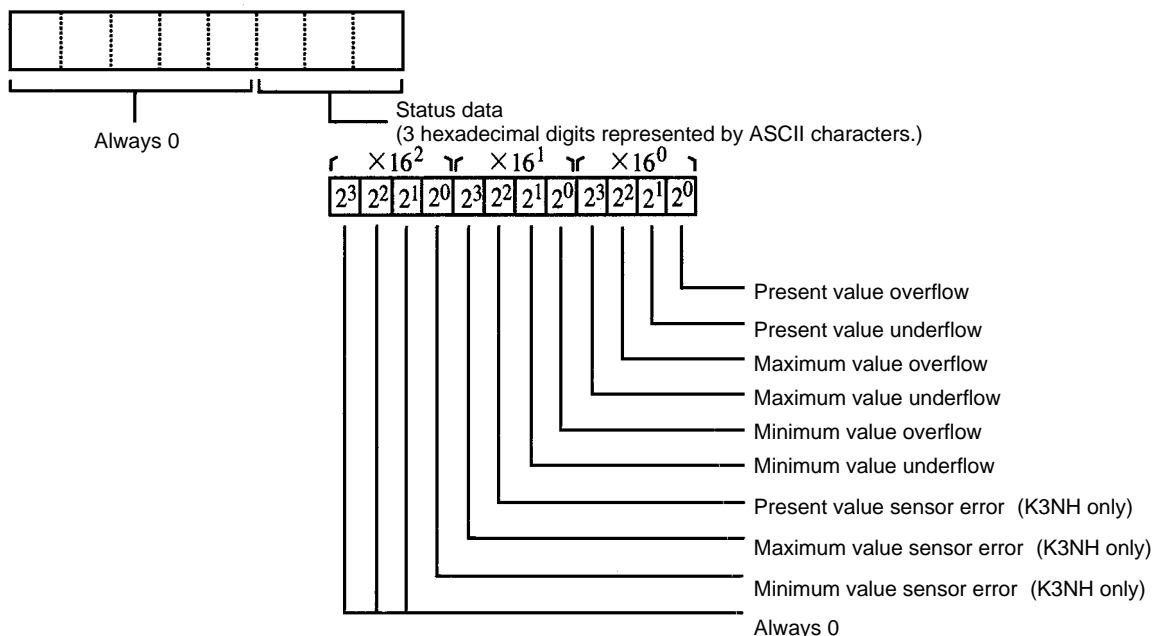
Response code	Name	Meaning
"0000"	Normal completion	The command was completed properly.
"0401"	Undefined command	The command was incorrect.
"1002"	Command too short	Some required data was missing from the command.
"1003"	Number of elements/Data mismatch	An error occurred while writing data. The specified number of elements and amount of data didn't agree.
"1100"	Parameter error	The specified parameters(s) were incorrect.
"1101"	Area type error	The area type (memory/parameter) specification was incorrect.
"1103"	Starting address out-of-range error	The specified starting address was outside of the allowed range.
"1104"	End address out-of range error	The specified end address (starting address + number of elements) was outside of the allowed range.
"110B"	Response too long	The response exceeded the maximum response length (37 bytes).
"2203"	Operating error	Attempted to change a set value while in local mode. Attempted to change a setting other than a set value while in RUN mode. Execution wasn't possible because the startup compensation time function was being executed. (K3NX)
"3003"	Read-only data	Couldn't write data because the specified area is read-only.

1-5 Memory/Parameter Area Details

Memory: K3NH, K3NX, K3NV, K3NR, and K3NP

Type	Address	Data contents	Data length
"C0"	"0000"	Present value (PV) "F0019999" to "00099999" (See note 1.)	Double words
	"0001"	Maximum value "F0019999" to "00099999" (See note 1.)	
	"0002"	Minimum value "F0019999" to "00099999" (See note 1.)	
	"0003"	Status data: Bit 0: Present value overflow Bit 1: Present value underflow Bit 2: Maximum value overflow Bit 3: Maximum value underflow Bit 4: Minimum value overflow Bit 5: Minimum value underflow Bit 6: Present value sensor error (K3NH only) Bit 7: Maximum value sensor error (K3NH only) Bit 8: Minimum value sensor error (K3NH only) Others: The remaining bits are always 0.	
	"X004"	HH set value "F0019999" to "00099999" (See note 1.)	
	"X005"	H set value "F0019999" to "00099999" (See note 1.)	
	"X006"	L set value "F0019999" to "00099999" (See note 1.)	
	"X007"	LL set value "F0019999" to "00099999" (See note 1.)	

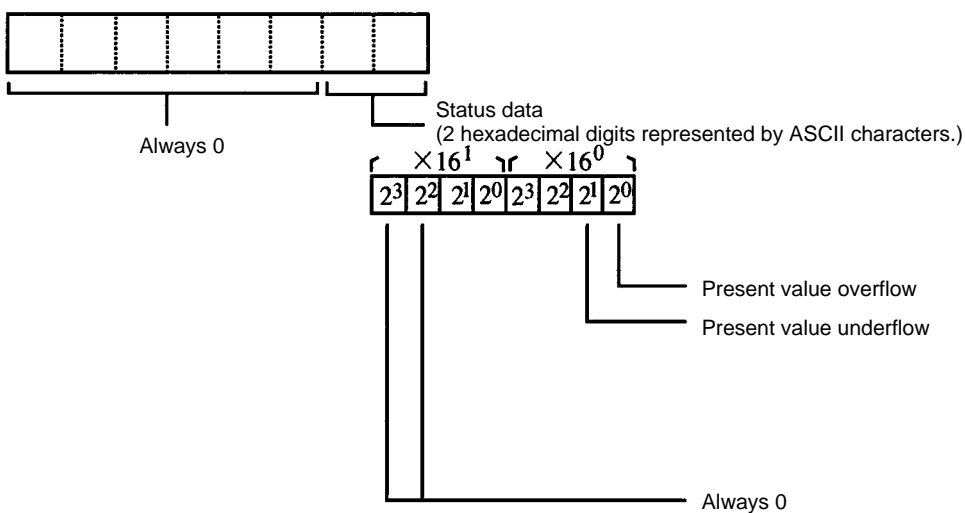
- Note**
1. In the K3NH, the range is "F0001999" to "00009999" when the display digit change is set to 4 digits.
 2. The leading "X" in the addresses represents the bank number in the K3NR and K3NP. (This digit is always 0 in the other models.)
 3. Data values which begin with an "F" are negative values.
 4. The following diagram shows the details of the status bits:



Memory: K3NC

Type	Address	Data contents	Data length
"C0"	"0000"	Present value (PV) "F0019999" to "00099999"	Double words
	"0003"	Status data: Bit 0: Present value overflow Bit 1: Present value underflow Others: The remaining bits are always 0.	
	"X004"	OUT1 set value "F0019999" to "00099999"	
	"X005"	OUT2 set value "F0019999" to "00099999"	
	"X006"	OUT3 set value "F0019999" to "00099999"	
	"X007"	OUT4 set value "F0019999" to "00099999"	
	"X008"	OUT5 set value "F0019999" to "00099999"	

- Note**
1. The leading "X" in the addresses represents the bank number.
 2. Data values which begin with an "F" are negative values.
 3. The following diagram shows the details of the status bits:



Parameters: K3NH

Type	Address	Data contents	Data length
"8000"	"0000"	Input type "0000" to "0021"	Words
	"0001"	Decimal point position "0000" to "0003" (See note 1.)	
	"0002"	Average processing "0000" No averaging "0001" to "0004" Moving average: 2, 4, 8, or 16 times "0011" to "0014" Simple average: 2, 4, 8, or 16 times	
	"0003"	Not used.	
	"0004"	Hysteresis "0001" to "9999"	
	"0005"	Comparative output pattern "0000" Standard output "0001" Zone output "0002" Level output	
"C00C"	"0000"	Scaling upper limit value "F0019999" to "00099999"	Double words
	"0001"	Scaling lower limit value "F0019999" to "00099999"	
	"0002"	Upper-limit compensation value "F0019999" to "00099999"	
	"0003"	Lower-limit compensation value "F0019999" to "00099999"	
"8824"	"0000"	Temperature unit "0000" °C (Celsius) "0001" °F (Fahrenheit)	Words
	"0001"	Standby sequence "0000" OFF "0001" ON	
	"0002"	Display digit change "0000" 4 digits "0001" 5 digits	

- Note**
1. An error response will be returned if a temperature input ($\bar{L}n-t$) has been selected for the input type.
 2. Data values which begin with an "F" are negative values.

Parameters: K3NX

Type	Address	Data contents	Data length
"8000"	"0000"	Input range "0000" to "0004"	Words
	"0001"	Decimal point position "0000" to "0004"	
	"0002"	Average processing "0000" No averaging "0001" to "0005" Moving average: 2, 4, 8, 16, or 32 times "0011" to "0015" Simple average: 2, 4, 8, 16, or 32 times	
	"0003"	Startup compensation time "0000" to "0999"	
	"0004"	Hysteresis "0001" to "9999"	
	"0005"	Comparative output pattern "0000" Standard output "0001" Zone output "0002" Level output	
"C00C"	"0000"	Scaling input value 2 "F0019999" to "00099999"	Double words
	"0001"	Scaling display value 2 "F0019999" to "00099999"	
	"0002"	Scaling input value 1 "F0019999" to "00099999"	
	"0003"	Scaling display value 1 "F0019999" to "00099999"	
"8824"	"0000"	Power supply frequency "0000" 50 Hz "0001" 60 Hz	Words

Note Data values which begin with an "F" are negative values.

Parameters: K3NV

Type	Address	Data contents	Data length
"8000"	"0000"	Input range "0000" to "0002"	Words
	"0001"	Decimal point position "0000" to "0004"	
	"0002"	Average processing "0000" No averaging "0001" to "0005" Moving average: 2, 4, 8, 16, or 32 times "0011" to "0015" Simple average: 2, 4, 8, 16, or 32 times	
	"0003"	Startup compensation time "0000" to "0999"	
	"0004"	Hysteresis "0001" to "9999"	
	"0005"	Comparative output pattern "0000" Standard output "0001" Zone output "0002" Level output	
"C00C"	"0000"	Scaling input value 2 "F0019999" to "00099999"	Double words
	"0001"	Scaling display value 2 "F0019999" to "00099999"	
	"0002"	Scaling input value 1 "F0019999" to "00099999"	
	"0003"	Scaling display value 1 "F0019999" to "00099999"	
"8824"	"0000"	Power supply frequency "0000" 50 Hz "0001" 60 Hz	Words

Note Data values which begin with an "F" are negative values.

Parameters: K3NR

Type	Address ¹	Data contents	Data length
"8000"	"0000"	Operating mode "0000" to "0006"	Words
	"X001"	Decimal point position "0000" to "0004"	
	"0002"	Process time for averaging measured value "0000" to "0006"	
	"0003"	Startup compensation time "0001" to "0999"	
	"0004"	Hysteresis "0001" to "9999"	
	"0005"	Comparative output pattern "0000" Standard output "0001" Zone output "0002" Level output	
"C00C"	"X000"	Prescaling value X (mantissa) of input A "00000001" to "00099999"	Double words
	"X001"	Prescaling value Y (exponent) of input A "F0000009" to "00000009"	
	"X002"	Prescaling value X (mantissa) of input B "00000001" to "00099999"	
	"X003"	Prescaling value Y (exponent) of input B "F0000009" to "00000009"	
"8824"	"0000"	Sensor type "0000" to "1111" (binary)	Words
	"0001"	Time unit "0000" Prescaling value "0001" Seconds "0002" Minutes "0003" Hours, minutes, and seconds "0004" Minutes and seconds	
	"0002"	Power failure memory "0000" Disabled "0001" Enabled	
"C82A"	"0000"	Auto zero time of input A X (mantissa) "00000001" to "00099999"	Double words
	"0001"	Auto zero time of input A Y (exponent) "F0000009" to "00000009"	
	"0002"	Auto zero time of input B Y (mantissa) "00000001" to "00099999"	
	"0003"	Auto zero time of input B Y (exponent) "F0000009" to "00000009"	

- Note**
1. The leading "X" in the addresses represents the bank number.
 2. Data values which begin with an "F" are negative values.

Parameters: K3NP

Type	Address ¹	Data contents	Data length
"8000"	"0000"	Operating mode "0000" to "0005"	Words
	"X001"	Decimal point position "0000" to "0004"	
	"0002"	Not used.	
	"0003"	Not used.	
	"0004"	Not used.	
	"0005"	Comparative output pattern "0000" Standard output "0001" Zone output "0002" Level output	
"C00C"	"X000"	Prescaling value X (mantissa) of input A "00000001" to "00099999"	Double words
	"X001"	Prescaling value Y (exponent) of input A "F0000009" to "00000009"	
"8824"	"0000"	Sensor type "0000" to "1111" (binary)	Words
	"0001"	Time unit "0000" Prescaling value "0001" Seconds "0002" Minutes "0003" Hours, minutes, and seconds "0004" Minutes and seconds	

- Note**
1. The leading "X" in the addresses represents the bank number.
 2. Data values which begin with an "F" are negative values.

Parameters: K3NC

Type	Address ¹	Data contents	Data length
"8000"	"0000"	Input mode "0001" or "0002"	Words
	"X001"	Decimal point position "0000" to "0004"	
	"0002"	Not used.	
	"0003"	Not used.	
	"0004"	Not used.	
	"0005"	Output mode "0000" ALL-H "0001" ALL-L	
"C00C"	"X000"	Prescaling value X (mantissa) of input A "00000001" to "00099999"	Double words
	"X001"	Prescaling value Y (exponent) of input A "F0000009" to "00000009"	
"8824"	"0000"	Sensor type "0000" to "1111" (binary)	Words
	"0001"	Power failure memory "0000" Disabled "0001" Enabled	
	"0002"	Compensation input condition "0000" Unconditional "0001" Only when adding	
"C82A"	"0000"	Compensation value "F0019999" to "00099999"	Double words

- Note**
1. The leading "X" in the addresses represents the bank number.
 2. Data values which begin with an "F" are negative values.

1-6 Restricting Communications Access

Control of the Unit through the communications interface can be restricted in two ways:

- **Restricting Access with Protect Settings**
The protect mode's security setting can be used to write-protect the set values. The write-protected set values can be read through the communications interface, but not changed.
- **Restricting Access with the Remote/Local Processing Setting**
The remote/local processing setting determines whether set values can be overwritten by key operations or through the communications interface. Change the mode setting as necessary to enable settings to be changed locally or remotely. The remote/local processing setting can be changed through the communications interface or by key operations (in the option menu).

1, 2, 3...

1. Restrictions in remote processing

In remote processing, settings cannot be changed with key operations. Only the remote/local switch (operating command) is valid.

If you attempt to change a displayed setting in remote processing with the keys, a message will appear indicating that the Unit is in remote processing and the display will revert to the previous set value display.

All settings which aren't write-protected can be changed through the communications interface when the Unit is in settings mode. Only set values can be changed while the Unit is in RUN mode. Changes to settings are reflected in the display immediately.

2. Restrictions in local processing

In local processing, settings cannot be changed through the communications interface (data-write commands).

If you attempt to change a setting in local processing with a data-write command, a mode error response will be returned and the setting will not be overwritten. There are no restrictions on the data-read commands.

1-7 Command Lists

1-7-1 Read Command Lists

K3NX

Command	Code	Type	Starting read address	Filler	Number of elements
Present value read	"0101"	"C0"	"0000"	"00"	"0001"
Maximum value read			"0001"		
Minimum value read			"0002"		
Status read			"0003"		
HH set value read			"0004"		
H set value read			"0005"		
L set value read			"0006"		
LL set value read			"0007"		
Input type	"0201"	"8000"	"0000"	"8001"	
Decimal point position			"0001"		
Average processing			"0002"		
Startup compensation time			"0003"		
Hysteresis			"0004"		
Comparative output pattern		"0005"			
Scaling input value 2		"C00C"	"0000"		
Scaling display value 2			"0001"		
Scaling input value 1			"0002"		
Scaling display value 1		"0003"			
Power supply frequency		"8824"	"0000"		

K3NH

Command	Code	Type	Starting read address	Filler	Number of elements
Present value read	"0101"	"C0"	"0000"	"00"	"0001"
Maximum value read			"0001"		
Minimum value read			"0002"		
Status read			"0003"		
HH set value read			"0004"		
H set value read			"0005"		
L set value read			"0006"		
LL set value read			"0007"		
Input type	"0201"	"8000"	"0000"	"8001"	
Decimal point position			"0001"		
Average processing			"0002"		
Hysteresis			"0004"		
Comparative output pattern			"0005"		
Scaling upper limit value		"C00C"	"0000"		
Scaling lower limit value			"0001"		
Upper-limit compensation value			"0002"		
Lower-limit compensation value		"0003"			
Temperature unit		"8824"	"0000"		
Standby sequence			"0001"		
Display digit change			"0002"		

K3NR

Command	Code	Type	Starting read address	Filler	Number of elements
Present value read	"0101"	"C0"	"0000"	"00"	"0001"
Maximum value read			"0001"		
Minimum value read			"0002"		
Status read			"0003"		
HH set value read			"X004"		
H set value read			"X005"		
L set value read			"X006"		
LL set value read			"X007"		
Operating mode	"0201"	"8000"	"0000"		"8001"
Decimal point position			"0001"		
Process time for averaging measured value			"0002"		
Startup compensation time			"0003"		
Hysteresis			"0004"		
Comparative output pattern		"0005"			
Prescaling value X (mantissa) of input A		"C00C"	"X000"		
Prescaling value Y (exponent) of input A			"X001"		
Prescaling value X (mantissa) of input B			"X002"		
Prescaling value Y (exponent) of input B		"X003"			
Sensor type		"8824"	"0000"		
Time unit			"0001"		
Power failure memory			"0002"		
Auto zero time of input A X (mantissa)		"C82A"	"0000"		
Auto zero time of input A Y (exponent)			"0001"		
Auto zero time of input B Y (mantissa)	"0002"				
Auto zero time of input B Y (exponent)	"0003"				

K3NP

Command	Code	Type	Starting read address	Filler	Number of elements
Present value read	"0101"	"C0"	"0000"	"00"	"0001"
Maximum value read			"0001"		
Minimum value read			"0002"		
Status read			"0003"		
HH set value read			"X004"		
H set value read			"X005"		
L set value read			"X006"		
LL set value read			"X007"		
Operating mode	"0201"	"8000"	"0000"	"8001"	
Decimal point position			"0001"		
Comparative output pattern			"0005"		
Prescaling value X (mantissa) of input A		"C00C"	"X000"		
Prescaling value Y (exponent) of input A			"X001"		
Sensor type		"8824"	"0000"		
Time unit			"0001"		

K3NC

Command	Code	Type	Starting read address	Filler	Number of elements
Present value read	"0101"	"C0"	"0000"	"00"	"0001"
Status read			"0003"		
OUT1 set value read			"X004"		
OUT2 set value read			"X005"		
OUT3 set value read			"X006"		
OUT4 set value read			"X007"		
OUT5 set value read			"X008"		
Input mode			"0201"		
Decimal point position	"0001"				
Output mode	"0005"				
Prescaling value X (mantissa) of input A	"C00C"	"X000"			
Prescaling value Y (exponent) of input A		"X001"			
Sensor type	"8824"	"0000"			
Power failure memory		"0001"			
Compensation input condition		"0002"			
Compensation value		"C82A"	"0000"		

K3NV

Command	Code	Type	Starting read address	Filler	Number of elements
Present value read	"0101"	"C0"	"0000"	"00"	"0001"
Maximum value read			"0001"		
Minimum value read			"0002"		
Status read			"0003"		
HH set value read			"X004"		
H set value read			"X005"		
L set value read			"X006"		
LL set value read			"X007"		
Input type	"0201"	"8000"	"0000"		"8001"
Decimal point position			"0001"		
Average processing			"0002"		
Startup compensation time			"0003"		
Hysteresis			"0004"		
Comparative output pattern			"0005"		
Scaling input value 2			"C00C"		
Scaling display value 2		"0001"			
Scaling input value 1		"0002"			
Scaling display value 1		"0003"			
Power supply frequency		"8824"	"0000"		

1-7-2 Write Command Lists

K3NX

Command	Code	Type	Starting write address	Filler	Number of elements	Write data	
HH set value write	"0102"	"C0"	"0004"	"00"	"0001"	"F0019999" to "00099999"	
H set value write			"0005"				
L set value write			"0006"				
LL set value write			"0007"				
Input range	"0202"	"8000"	"0000"		"8001"	"0000": A "0001": B "0002": C "0003": D "0004": E	
Decimal point position			"0001"			"0000": □□□□□ "0001": □□□□.□ "0002": □□□.□□ "0003": □□.□□□□ "0004": □.□□□□	
Average processing			"0002"			"0000": No averaging "0001": Moving average, 2 times "0002": Moving average, 4 times "0003": Moving average, 8 times "0004": Moving average, 16 times "0005": Moving average, 32 times "0011": Simple average, 2 times "0012": Simple average, 4 times "0013": Simple average, 8 times "0014": Simple average, 16 times "0015": Simple average, 32 times	
Startup compensation time			"0003"			"0000" to "0999" (0.1 s units)	
Hysteresis			"0004"			"0001" to "9999"	
Comparative output pattern			"0005"			"0000": Standard output "0001": Zone output "0002": Level output	
Scaling input value 2			"C00C"			"0000"	"F0019999" to "00099999"
Scaling display value 2						"0001"	"F0019999" to "00099999"
Scaling input value 1						"0002"	"F0019999" to "00099999"
Scaling display value 1						"0003"	"F0019999" to "00099999"
Power supply frequency	"8824"	"0000"	"0000": 50 Hz "0001": 60 Hz				

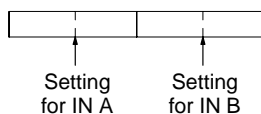
K3NH

Command	Code	Type	Starting write address	Filler	Number of elements	Write data	
HH set value write	"0102"	"C0"	"0004"	"00"	"0001"	"F0019999" to "00099999"	
H set value write			"0005"				
L set value write			"0006"				
LL set value write			"0007"				
Input type	"0202"	"8000"	"0000"		"8001"	"0000": Jpt100 "0001": Pt100 "0002": K1 "0003": K2 "0004": J1 "0005": J2 "0006": T "0007": E "0008": L1 "0009": L2 "0010": U "0011": N "0012": R "0013": S "0014": B "0015": W "0016": PLII "0017": 4 to 20 mA "0018": 0 to 20 mA "0019": 1 to 5 V "0020": 0 to 5 V "0021": 1 to 10 V	
Decimal point position			"0001"			"0000": □□□□ "0001": □□□.□ "0002": □□.□□ "0003": □.□□□	
Average processing			"0002"			"0000": No averaging "0001": Moving average, 2 times "0002": Moving average, 4 times "0003": Moving average, 8 times "0004": Moving average, 16 times "0011": Simple average, 2 times "0012": Simple average, 4 times "0013": Simple average, 8 times "0014": Simple average, 16 times	
Hysteresis			"0004"			"0001" to "9999"	
Comparative output pattern			"0005"			"0000": Standard output "0001": Zone output "0002": Level output	
Scaling upper limit value			"C00C"			"0000"	"-1999" to "9999"
Scaling lower limit value						"0001"	"-1999" to "9999"
Upper-limit compensation value						"0002"	"-1999" to "9999"
Lower-limit compensation value						"0003"	"-1999" to "9999"
Temperature unit			"8824"			"0000"	"0000": °C "0001": °F
Standby sequence						"0001"	"0000": OFF "0001": ON
Display digit change						"0002"	"0": 4 digits "1": 5 digits

K3NR

Command	Code	Type	Starting write address	Filler	Number of elements	Write data
HH set value write	"0102"	"C0"	"X004"	"00"	"0001"	"F0019999" to "00099999"
H set value write			"X005"			
L set value write			"X006"			
LL set value write			"X007"			
Operating mode	"0202"	"8000"	"0000"		"8001"	"0000": F1 "0004": F5 "0001": F2 "0005": F6 "0002": F3 "0006": F7 "0003": F4
Decimal point position			"X001"			"0000": □□□□□ "0001": □□□□.□ "0002": □□□.□□ "0003": □□.□□□ "0004": □.□□□□
Process time for averaging measured value			"0002"			"0000": 60 ms "0004": 4 s "0001": 500 ms "0005": 8 s "0002": 1 s "0006": 16 s "0003": 2 s
Startup compensation time			"0003"			"0000" to "0999" (0.1 s units)
Hysteresis			"0004"			"0001" to "9999"
Comparative output pattern			"0005"			"0000": Standard output "0001": Zone output "0002": Level output
Prescaling value X (mantissa) of input A			"C00C"			
Prescaling value Y (exponent) of input A	"0001"	"F0000009" to "00000009"				
Prescaling value X (mantissa) of input B	"0002"	"00000001" to "00099999"				
Prescaling value Y (exponent) of input B	"0003"	"F0000009" to "00000009"				
Sensor type	"8824"		"0000"			See note.
Time unit			"0001"			"0000": Prescaling value "0001": Seconds "0002": Minutes "0003": Hours, minutes, seconds "0004": Minutes and seconds
Power failure memory			"0002"			"0000": Disabled "0001": Enabled
Auto zero time of input A X (mantissa)	"C82A"		"0000"			"00000001" to "00099999"
Auto zero time of input A Y (exponent)			"0001"			"F0000009" to "00000009"
Auto zero time of input B Y (mantissa)			"0002"			"00000001" to "00099999"
Auto zero time of input B Y (exponent)			"0003"			"F0000009" to "00000009"

Note

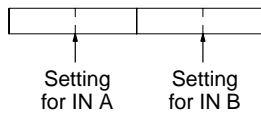


Setting	Meaning
"00"	Normally-open transistor input or active-H voltage pulse input
"01"	Normally-closed transistor input or active-L voltage pulse input
"10"	Normally-open relay input
"11"	Normally-closed relay input

K3NP

Command	Code	Type	Starting write address	Filler	Number of elements	Write data
HH set value write	"0102"	"C0"	"X004"	"00"	"0001"	"00000000" to "00099999"
H set value write			"X005"			
L set value write			"X006"			
LL set value write			"X007"			
Operating mode	"0202"	"8000"	"0000"	"8001"	"8001"	"0000": F1 "0003": F4 "0001": F2 "0004": F5 "0002": F3 "0005": F6
Decimal point position			"X001"			"0000": □□□□□ "0001": □□□□.□ "0002": □□□.□□ "0003": □□.□□□ "0004": □.□□□□
Comparative output pattern			"0005"			"0000": Standard output "0001": Zone output "0002": Level output
Prescaling value X (mantissa) of input A		"C00C"	"X000"			"00000001" to "00099999"
Prescaling value Y (exponent) of input A			"X001"			"F0000009" to "00000009"
Sensor type		"8824"	"0000"			See note.
Time unit			"0001"			"0000": Prescaling value "0001": Seconds "0002": Minutes "0003": Hours, minutes, seconds "0004": Minutes and seconds

Note



Setting	Meaning
"00"	Normally-open transistor input or active-H voltage pulse input
"01"	Normally-closed transistor input or active-L voltage pulse input
"10"	Normally-open relay input
"11"	Normally-closed relay input

K3NC

Command	Code	Type	Starting write address	Filler	Number of elements	Write data		
OUT1 set value write	"0102"	"C0"	"X004"	"00"	"0001"	"F0019999" to "00099999"		
OUT2 set value write			"X005"					
OUT3 set value write			"X006"					
OUT4 set value write			"X007"					
OUT5 set value write			"X008"					
Input mode	"0202"	"8000"	"0000"		"8001"	"0000": Individual inputs "0001": Phase difference inputs		
Decimal point position			"X001"			"0000": □□□□□ "0001": □□□□.□ "0002": □□□.□□ "0003": □□.□□□ "0004": □.□□□□		
Output mode			"0005"			"0000": ALL-H "0001": ALL-L		
Prescaling value X (mantissa) of input A		"C00C"	"0000"	"00000001" to "00099999"				
Prescaling value Y (exponent) of input A			"0001"	"F0000009" to "00000009"				
Sensor type		"8824"	"0000"			"0000": Normally-open transistor input or active-H voltage pulse input "0100": Normally-closed transistor input or active-L voltage pulse input "1000": Normally-open relay input "1100": Normally-closed relay input		
Power failure memory							"0001"	"0000": Disabled "0001": Enabled
Compensation input condition							"0002"	"0000": Disabled "0001": Enabled
Compensation value		"C82A"	"0000"				"F0019999" to "00099999"	

K3NV

Command	Code	Type	Starting write address	Filler	Number of elements	Write data	
HH set value write	"0102"	"C0"	"0004"	"00"	"0001"	"F0019999" to "00099999"	
H set value write			"0005"				
L set value write			"0006"				
LL set value write			"0007"				
Input range	"0202"	"8000"	"0000"		"8001"	"0000": A "0001": B "0002": C	
Decimal point position			"0001"			"0000": □□□□ "0001": □□□□.□ "0002": □□□.□□ "0003": □□.□□□ "0004": □.□□□□	
Average processing			"0002"			"0000": No averaging "0001": Moving average, 2 times "0002": Moving average, 4 times "0003": Moving average, 8 times "0004": Moving average, 16 times "0005": Moving average, 32 times "0011": Simple average, 2 times "0012": Simple average, 4 times "0013": Simple average, 8 times "0014": Simple average, 16 times "0015": Simple average, 32 times	
Startup compensation time			"0003"			"0000" to "0999" (0.1 s units)	
Hysteresis			"0004"			"0001" to "9999"	
Comparative output pattern			"0005"			"0000": Standard output "0001": Zone output "0002": Level output	
Scaling input value 2			"C00C"			"0000"	"F0019999" to "00099999"
Scaling display value 2						"0001"	"F0019999" to "00099999"
Scaling input value 1						"0002"	"F0019999" to "00099999"
Scaling display value 1						"0003"	"F0019999" to "00099999"
Power supply frequency	"8824"	"0000"	"0000": 50 Hz "0001": 60 Hz				

1-8 Communications Program Example

Program Example for RS-232C Communication

In this program, transmission data is input in command format from the computer keyboard. When the corresponding response data is returned from the Processor, it is displayed on the computer screen.

Input the data to be transmitted, beginning with the "unit number" and ending with the "number of elements." If this program is not executed correctly, there may be a transmission error; check the communications settings, cable connections, etc.

(This program is written in N88 BASIC. An NEC PC-9801 personal computer is used as the host system.)

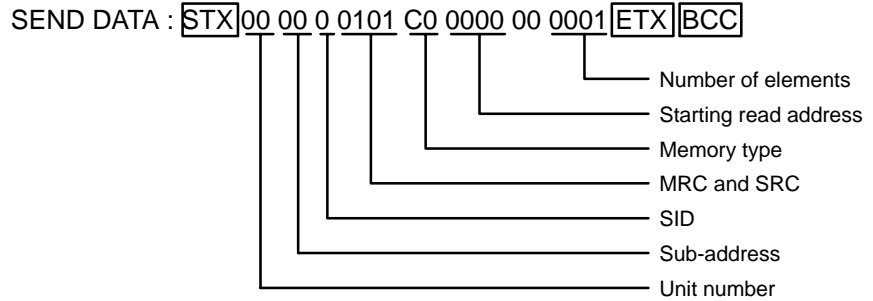
```
1000 ' -----
1010 ' PROGRAM:K3N* Communication Sample Program(CompoWay/F)
1020 ' VERSION:1.00
1030 ' (C)Copyright OMRON Corporation 1997
1040 ' All Rights Reserved
1050 ' -----
1060 '
1070 ' ==== COM port settings (even parity, 7 data bits, 2 stop bits) ====
1080 OPEN"COM:E73"AS#1
1090 '
1100 *REPEAT
1110 ' ==== Transmission process ====
1120 ' --- Input transmission data. ---
1130 INPUT"SEND DATA:",SEND$
1140 '
1150 ' --- Jump to exit process if there is no input. ---
1160 IF SEND$=""THEN *EXIT
1170 '
1180 ' --- BCC calculation ---
1190 BCC=0:SEND$=SEND$+CHR$(3)
1200 FOR I=1 TO LEN(SEND$)
1210 BCC=BCC XOR ASC(MID$(SEND$,I,1))
1220 NEXT I
1230 BCC$=CHR$(BCC)
1240 '
1250 ' --- Transmission ---
1260 SDATA$=CHR$(2)+SEND$+BCC$
1270 PRINT#1,SDATA$;
1280 '
1290 ' ==== Reception process ====
1300 RDATA$="":TIMEOUT=0
1310 *LOOP
1320 ' --- No-response detection ---
1330 TIMEOUT=TIMEOUT+1
1340 IF TIMEOUT>20000 THEN RESP$="No Response":GOTO *REND
1350 IF LOC(1)=0 THEN *LOOP
1360 '
1370 ' --- End character discrimination (Read if it isn't end character.) ---
1380 RDATA$=RDATA$+INPUT$(LOC(1),#1)
1390 IF LEN(RDATA$)<2 THEN *LOOP
1400 IF MID$(RDATA@,2,LEN(RDATA$)-2)
1420 *REND
1430 '
1440 ' --- Display received data. ---
1450 PRINT"Response:";RESP$
1460 GOTO *REPEAT
1470 '
1480 *EXIT
1490 ' ==== Exit process ====
1500 CLOSE#1
1510 END
```

Operation Example

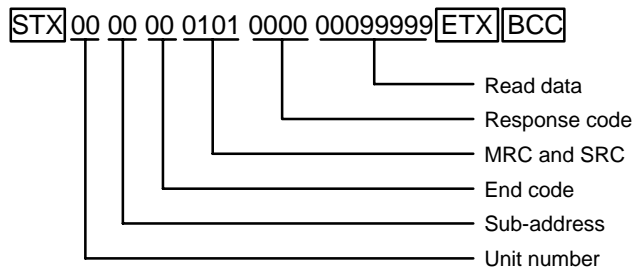
The following is an execution example of the previous program (read display data for Unit No. 00):

The “↵” symbol represents the Return Key. This program cannot execute transmission normally unless the initial transmission settings of the personal computer are: even parity, 7 data bits, 2 stop bits, and the computer’s baud rate is the same as the Processor’s. If the connectors are not properly connected, the program may stop midway.

RUN ↵



The response is as follows:



SECTION 2

Host Link Communications

This section provides information on host link communications, which provides compatibility with earlier K3T□-series Units. When a new system is being created, we recommend using the CompoWay/F communications exclusively.

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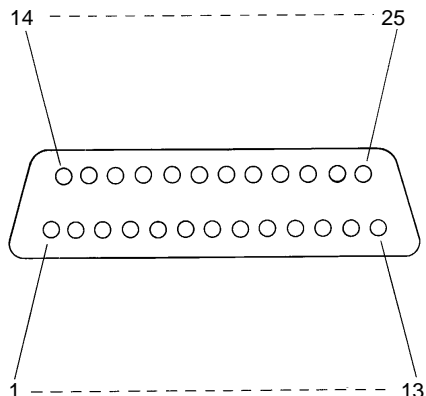
2-1 Interface Specifications

2-1-1 RS-232C (25-pin)

Electrical characteristics: Conforms to EIA RS-232C

Communications Signals

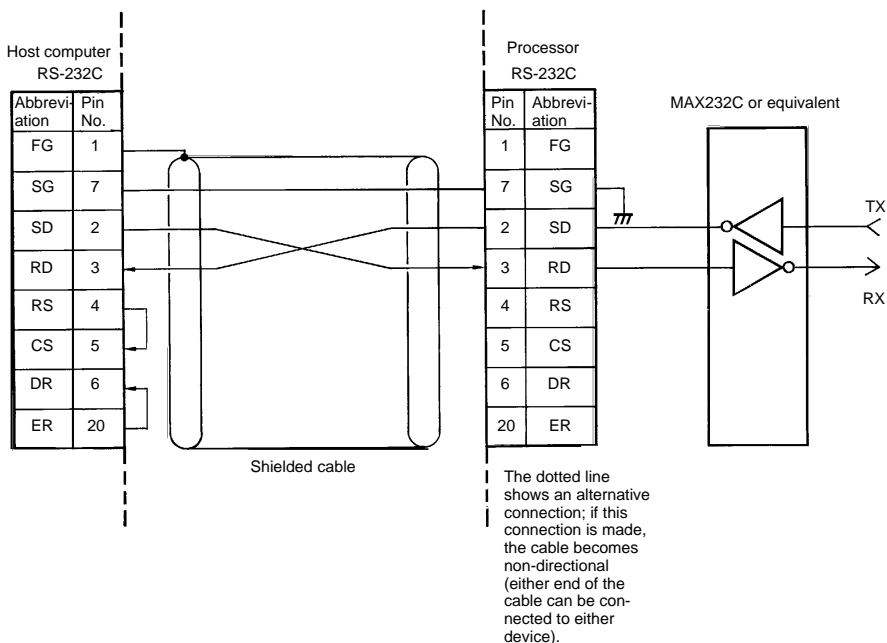
The following information identifies the key input/output signals of the interface.



Signal	Abbreviation	Signal direction	Pin No.
Frame Ground (safety ground)	FG	---	1
Signal Ground or common return	SG	---	7
Send Data	SD	Output	2
Receive Data	RD	Input	3
Request To Send	RS	Output	4
Can Send	CS	Input	5
Data Set Ready	DR	Input	6
Data Terminal Ready	ER	Output	20

Connection Diagram

The following example provides information on how the RS-232C Intelligent Signal Processor is to be connected to the host computer.



Synchronization clock:

Internal clock

Cable length: 15 m maximum. If increasing the cable length, use OMRON's RS-232C optical interface (Z3RN).

Applicable connectors: Plug: XM2A-2501 (OMRON) or equivalent
Hood: XM2S-2511 (OMRON) or equivalent

Connection method (RS-232C direct connection): 1:1 connection only

The RS-232C Intelligent Signal Processor is configured as DTE (Data Terminal Equipment), therefore no host-side CD (Carrier Detect) can be supported. If the host computer requires a CD signal, support this signal by pulling up from the host side.

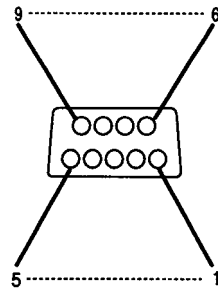
When using this connection, short-circuit RS with CS and DR with ER at the host computer side.

2-1-2 RS-232C (9-pin)

Electrical characteristics: Conforms to EIA RS-232C

Communications Signals

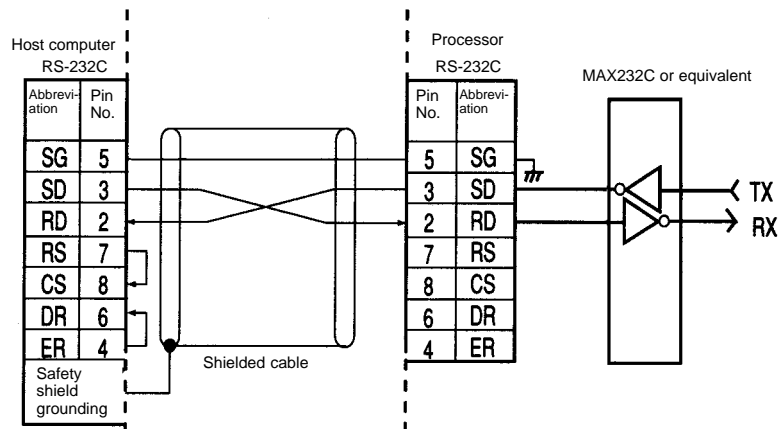
The following information identifies the key input/output signals of the interface.



Signal	Abbreviation	Signal direction	Pin No.
Frame Ground (safety ground)	FG	---	---
Signal Ground or common return	SG	---	5
Send Data	SD	Output	3
Receive Data	RD	Input	2
Request To Send	RS	Output	7
Can Send	CS	Input	8
Data Set Ready	DR	Input	6
Data Terminal Ready	ER	Output	4

Connection Diagram

The following example provides information on how the RS-232C Intelligent Signal Processor is to be connected to the host computer.



- Synchronization clock: Internal clock
- Cable length: 15 m maximum. If increasing the cable length, use OMRON's RS-232C optical interface (Z3RN).
- Applicable connectors: Plug: XM2D-0901 (OMRON) or equivalent
Hood: XM2D-0911 (OMRON) or equivalent
- Connection method (RS-232C direct connection): 1:1 connection only

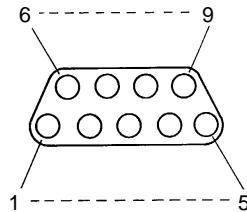
- Note**
1. The Processor's RS-232C connection is a DTE connection, so the host's CD (carrier detect) signal can't be supported. When the CD signal is required in the host, take the necessary measures at the host, such as a pull-up, so that the signal is supported.
 2. Short-circuit the RS with CS and the DR with ER on the host computer side.

2-1-3 RS-422

Electrical characteristics: Conforms to EIA RS-422

Communications Signals

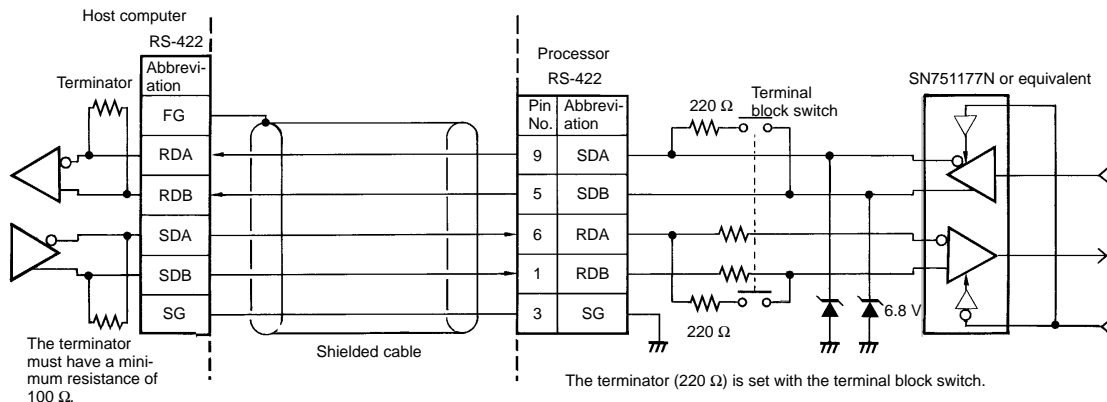
The following information identifies the key input/output signals of the interface.



Signal	Abbreviation	Signal direction	Pin No.
Send Data A	SDA	Output	9
Send Data B	SDB	Output	5
Receive Data A	RDA	Input	6
Receive Data B	RDB	Input	1
Signal Ground	SG	---	3
Frame Ground (safety ground)	FG	---	7

Connection Diagram

The following example provides information on how the RS-422 Intelligent Signal Processor is to be connected to the host computer.



- Synchronization clock: Internal clock
- Total line length: 500 m maximum
- Recommended cable: CO-HC-ESV-3P x 7/0.2 (Hirakawa Densen)
- Applicable connectors: Plug: XM2A-0901 (OMRON) or equivalent
Hood: XM2S-0911 (OMRON) or equivalent

Connection method (RS-422 connection): Maximum 1:32 connection

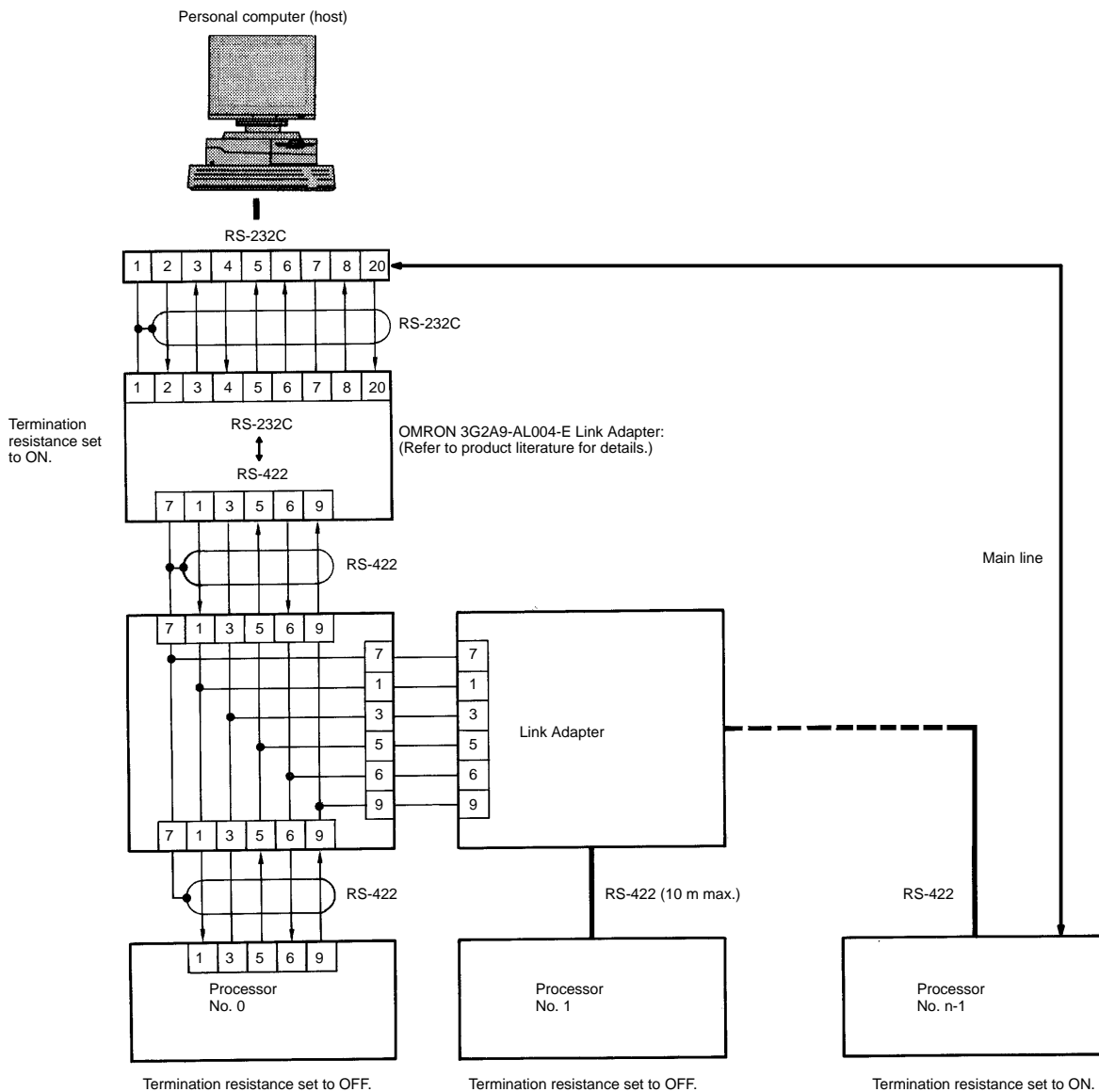
When using this connection:

Turn ON the terminal block switch at the end station.

Turn OFF all other terminal block switches.

RS-422 System Example

The following example shows several Intelligent Signal Processors connected to a personal computer using the RS-422 connection method.



Maximum number of connections is 32; total line length is 500 m maximum.

Use shielded, twisted-pair cable and route the cable separately from other signal lines.

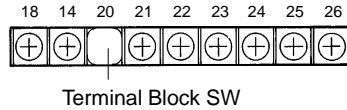
The total length of the cable must be less than 500 m, including the branch lines. Each branch line may be up to 10 m long.

Wire the system so that short branch lines branch from the main line. Turn ON the termination resistance only at the two Unit's at each end of the main line. All intermediate Units must have their termination resistance turned OFF. Data won't be transferred properly if an intermediate Unit has its termination resistance ON.

2-1-4 RS-485

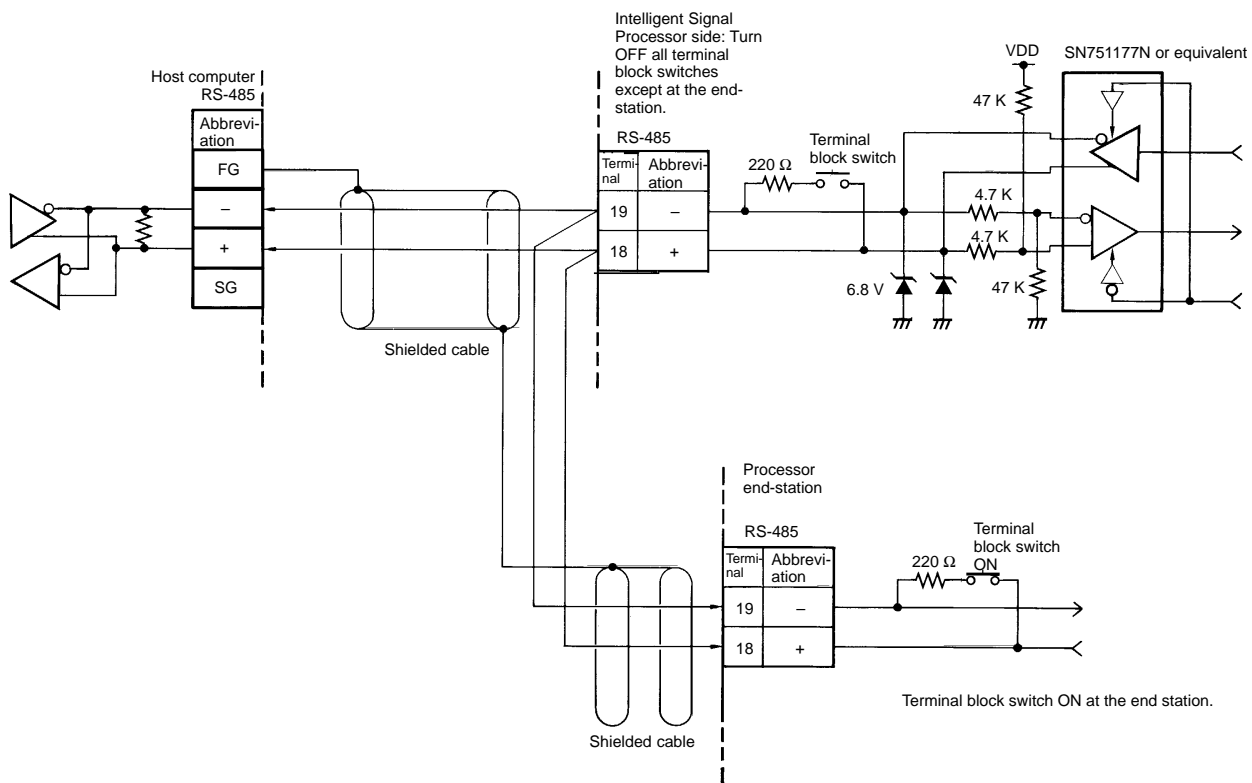
Electrical characteristics: Conforms to EIA RS-485

Communications Signals The following information identifies the key input/output signals of the interface.



Signal	Abbreviation	Signal direction	Terminal No.
Inverted output	Negative (-) side	Input/output	19
Non-inverted output	Positive (+) side	Input/output	18

Connection Diagram The following example provides information on how the RS-485 Intelligent Signal Processor is to be connected to the host computer.



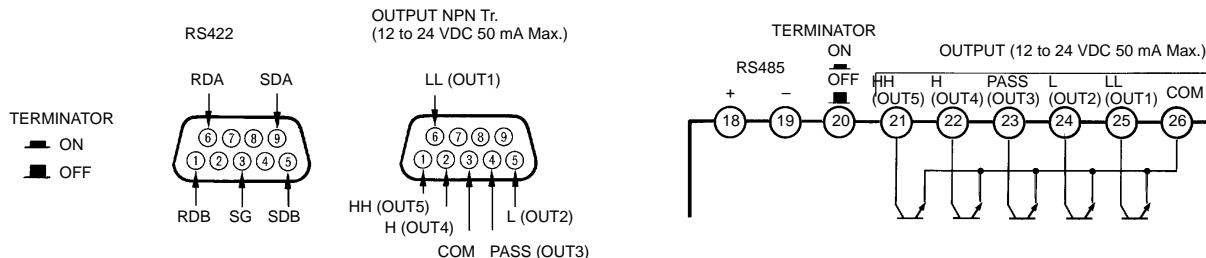
- Synchronization clock: Internal clock
- Total line length: 500 m maximum
- Recommended cable: CO-HC-ESV-3P x 7/0.2 (Hirakawa Densen)
- Connection method (RS-485 connection): Maximum 1:32 connection

In this case, the SYSMAC BUS wire type cannot be connected.

t2-2 Before Applying Power

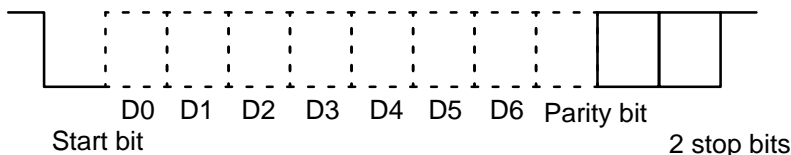
Terminator Designation

For the RS-422 and RS-485 Models, designate the Intelligent Signal Processor located at the right end of the transmission line as an end station by setting the terminator switch of that unit to ON. (End-station designation is not required for the RS-232C Model.)



2-3 General RS-232C/RS-422/RS-485 Specifications

- Transmission line connection: Multiple point
- Communication system: RS-232C/RS-422 (4-wire, half-duplex)
RS-485 (2-wire, half-duplex)
- Synchronization system: Start-stop synchronization (2 stop bits)
- Communication speed: 1,200/2,400/4,800/9,600/19,200/38,400 bps (key-selectable)
- Communication code: ASCII (7 bits)
- Error detection: Vertical parity (even) and FCS (frame check sequence)
- Interface: RS-232C/RS-422/RS-485
- Start-stop synchronization data configuration:

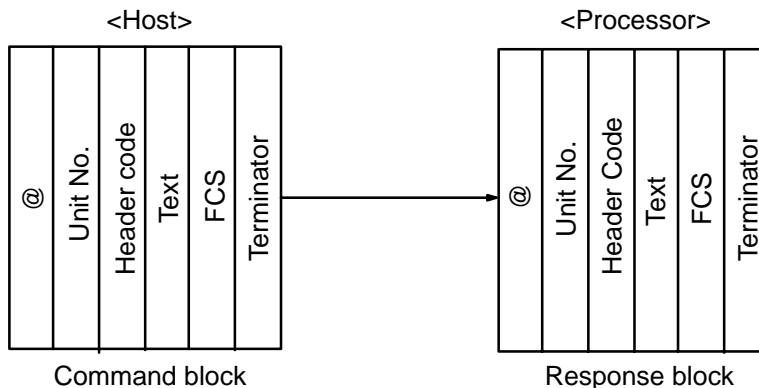


When a personal computer is used as the host system, do not select either 19,200 bps or 38,400 bps as the communication speed.

2-4 Communications and Error Control

2-4-1 Communications Control Procedures

The host link procedure for the Intelligent Signal Processor series is conversational, based on PC host link procedures. The prior data transmission right belongs to the host computer, and the data transmission right is shifted with every one block of data transmitted. When a command block is transmitted, a response block is always returned.

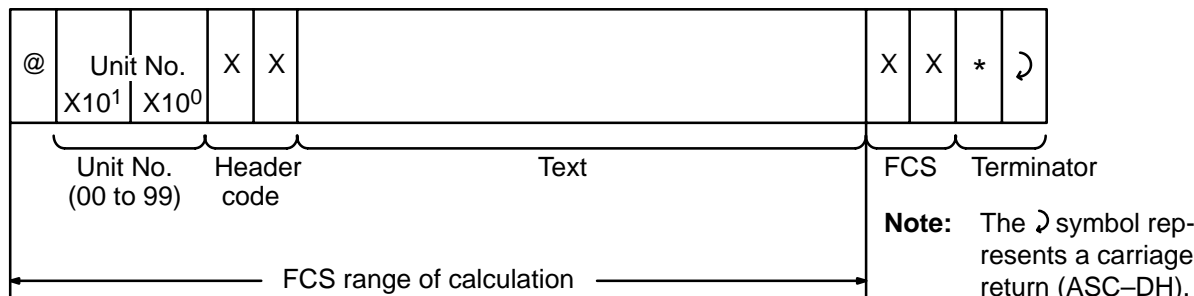


Unit numbers correspond to device numbers in a PC system. When assigning unit numbers for several units, be sure to avoid duplication of the settings.

2-4-2 Block Format

The block transmitted from the host computer is referred to as a command block. The block transmitted from the Processor is referred to as a response block.

One block begins with the start character “@” and communication address, and ends with the FCS and terminator.

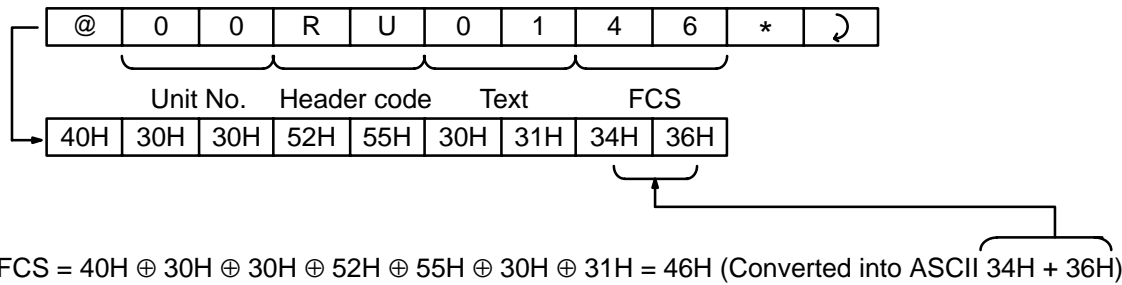


Data characters are in ASCII.

The FCS (frame check sequence) is formed by converting the 8-bit data obtained by converting the exclusive logical sum of @ to the last text character into two ASCII characters. Be sure to attach the FCS to the end of the text.

FCS calculation example:

The following command would cause an error if actually transmitted; it is shown simply to help explain calculation of the FCS.



$$\text{FCS} = 40\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 52\text{H} \oplus 55\text{H} \oplus 30\text{H} \oplus 31\text{H} = 46\text{H} \text{ (Converted into ASCII 34H + 36H)}$$

The ⊕ symbols indicate exclusive OR operations and the “H” indicates hexadecimal code.

2-4-3 Error Control

With the Processor, responsibility for error recovery rests with the host computer. The host computer controls the following error recovery procedures:

- When execution is impossible (end code) because of an undefined command error (header code) or setting, communication is terminated.
- If an error other than as described in 1 above occurs, a retry operation (re-transmission of the same command block) is executed.
- If no response block is returned within 5 seconds from the command block re-transmission, an error is assumed and a retry operation is executed.
- If an error occurs after three retry operations, communication is terminated.
- Note that when a Processor is connected to a system currently in use, the host computer of that system executes an error recovery operation.

The following error detection is performed at the Processor:

- 1, 2, 3... 1. Character check (check of every character)
 - Vertical parity check (even parity). Exclusive OR (EOR) check for each character.
 - Frame check. If a “0” is detected at the stop bit position, it is assumed that an error has occurred during communication.
 - Overrun check. Overrun occurs when the next character is received while the current character is being processed.
2. Block check (check of each block)
 - Format check. Command format construction is checked.
 - Registration data check. Check of numerical range of numbers such as unit number and bank number.
 - FCS check. Exclusive logical sumcheck of @ to the last text character.

If the above checks detect that an error has occurred during communication, error recovery control is requested at the host computer by the response block end code. Note, however, that when it is determined that the communication address is different through the registration data check, no response block is transmitted.

2-5 Commands and Responses

2-5-1 Command/Response Format Data

The hexadecimal data and decimal data relevant to command format and response format must be converted into ASCII.

(Example)

Hexadecimal data: \$F → \$46

Decimal data: 8 → \$38

Hereafter, hexadecimal data and decimal data in command/response format are expressed as follows:

Hexadecimal Data

	X16 ³	X16 ²	X16 ¹	X16 ⁰	
--	------------------	------------------	------------------	------------------	--

X16³ through X16⁰ mean hexadecimal data.

Therefore, the numbers to be processed are \$0(0000) through \$F(1111).

Decimal Data

	X10 ³	X10 ²	X10 ¹	X10 ⁰	
--	------------------	------------------	------------------	------------------	--

X10³ through X10⁰ mean hexadecimal data.

Therefore, the numbers to be processed are \$0(0000) through \$9(1001).

2-5-2 Command List

Header code	RUN mode		Test mode	Setting mode	Name
	RUN	During change of setting			
KR	Yes	Yes	Yes	---	Reset control (maximum/minimum value resetting)
W%	Yes	Yes	Yes	---	Set value write (See Note 1)
W#	Yes	Yes	Yes	---	Set value write (only with bank) (See Note 2)
R%	Yes	Yes	Yes	---	Set value read (See Note 1)
R#	Yes	Yes	Yes	---	Set value read (only with bank) (See Note 2)
RH	Yes	Yes	---	---	Hold data read (See Note 3)
RX	Yes	Yes	Yes	---	Display value (PV) read
RU	Yes	Yes	Yes	---	Model data read
TS	Yes	Yes	Yes	Yes	Test

- Note**
1. Effective only in communication plus comparative output type.
 2. Effective only in K3NR, K3NP, and K3NC communication plus comparative output type.
 3. Not effective in K3NC.

2-6 Reset Control (Maximum/Minimum Value Reset)

The same operation resulting from input to the reset terminal is executed through communication.

The reset control for the K3NC functions as a reset for the measured values.

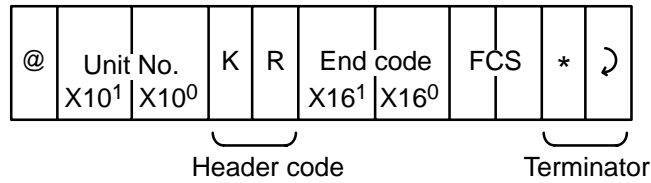
Command Format

@	Unit No. X10 ¹	X10 ⁰	K	R	FCS	*	↻
---	------------------------------	------------------	---	---	-----	---	---

Header code Terminator

Response Format

Response at normal end. End code: "00"

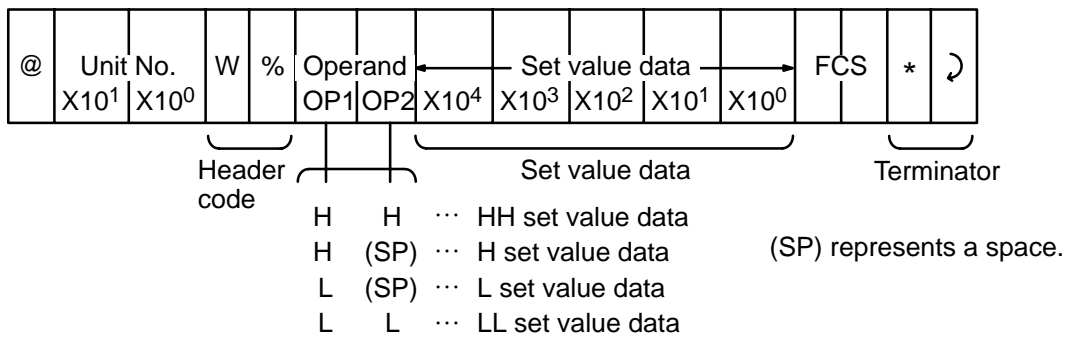


When this command ends normally, a reset is performed.

2-7 Set Value Write (K3NX/K3NV/K3NH Communication/Comparative Output)

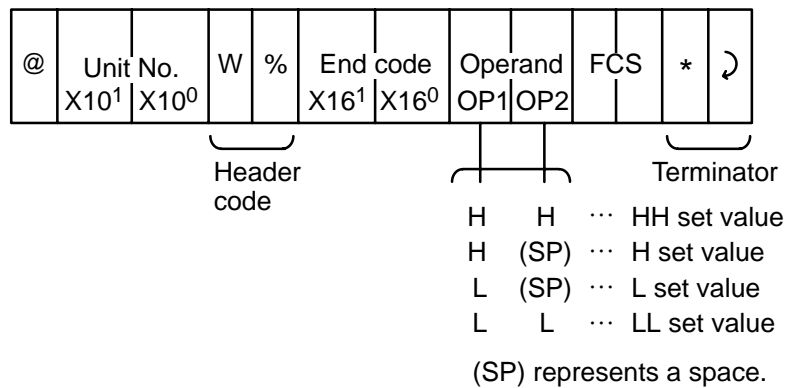
This set value write is effective only in models with communication and comparative output. The set values (HH, H, L, and LL) are written individually.

Command Format



Response Format

Response at normal end. End code: "00"



End code when error occurs:

- In non-comparative output type: End code is "16" (without corresponding command).
- In comparative output type without corresponding set value: End code is "22" (without corresponding memory).

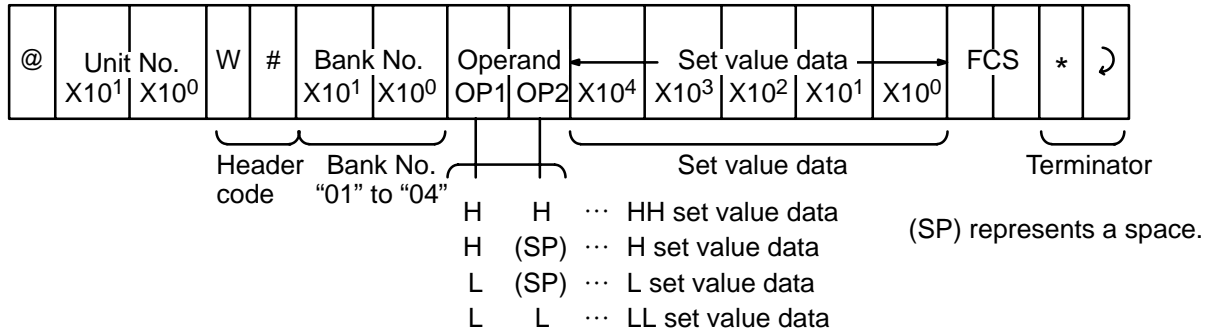
Note Set value is expressed in five figures of ASCII. Negative sign is represented by "F" at the position of the X10⁴ digit.

2-8 Set Value Write (K3NR/K3NP/K3NC Communication/Comparative Output)

This set value write is effective only in models with K3NR/K3NP/K3NC communication and comparative output. The set values (HH, H, L, and LL) of the banks not in use are written individually. Other set values (HH, H, L, and LL) are written individually.

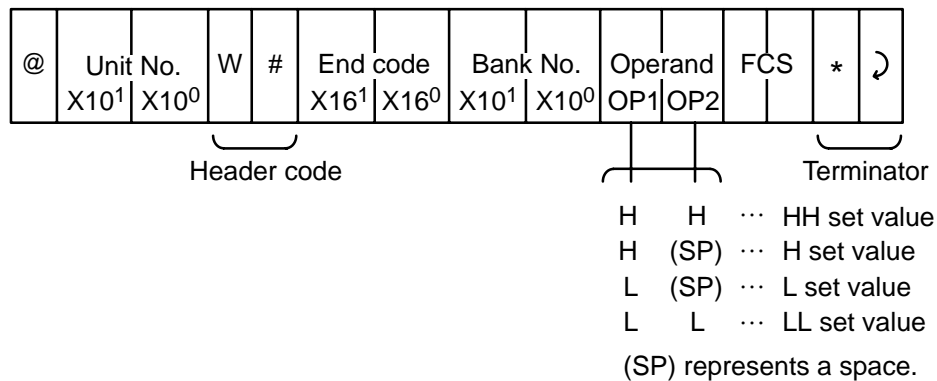
Refer to the following Note 2 for K3NC operands.

Command Format



Response Format

Response at normal end. End code: "00"



End code when error occurs:

- In non-comparative output type: End code is "16" (without corresponding command).
- In comparative output type without corresponding set value: End code is "22" (without corresponding memory).

Note

1. Set value is expressed in five figures of ASCII. Negative sign is represented by "F" at the position of the X10⁴ digit.
2. Comparative operands for the K3NC are as follows:

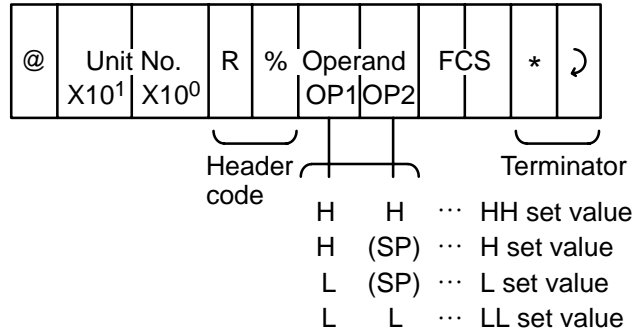


- | | | | |
|---|---|-----|-------------------------------------|
| 0 | 5 | ... | Comparative set value data for OUT5 |
| 0 | 4 | ... | Comparative set value data for OUT4 |
| 0 | 3 | ... | Comparative set value data for OUT3 |
| 0 | 2 | ... | Comparative set value data for OUT2 |
| 0 | 1 | ... | Comparative set value data for OUT1 |

2-9 Set Value Read (K3NX/K3NV/K3NH Communication/Comparative Output)

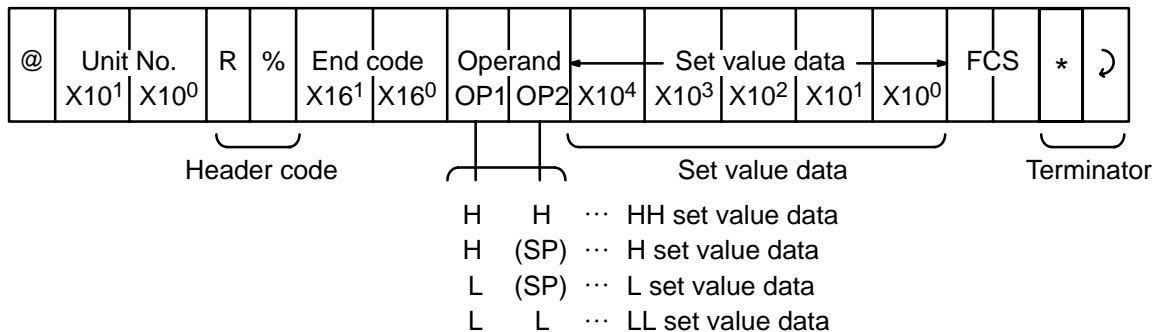
This set value read is effective only in models with communication and comparative output. The set values (HH, H, L, and LL) are read individually.

Command Format

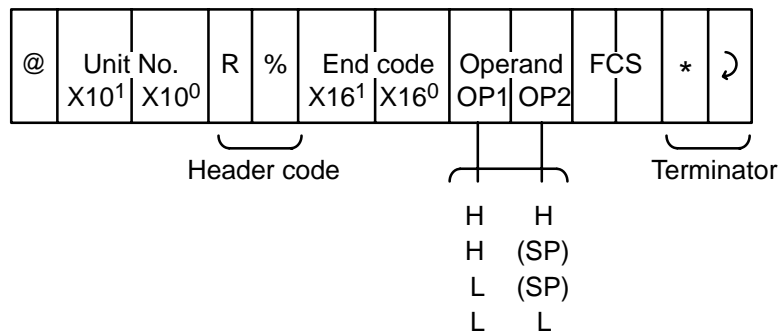


Response Format

Response at normal end. End code: "00"



Response format when an error occurs:



End code when error occurs:

- In non-comparative output type: End code is "16" (without corresponding command).
- In comparative output type without corresponding set value: End code is "22" (without corresponding memory).
- When set value is changed in RUN mode: End code is "0D" (not executable due to change of setting in RUN mode).

Note

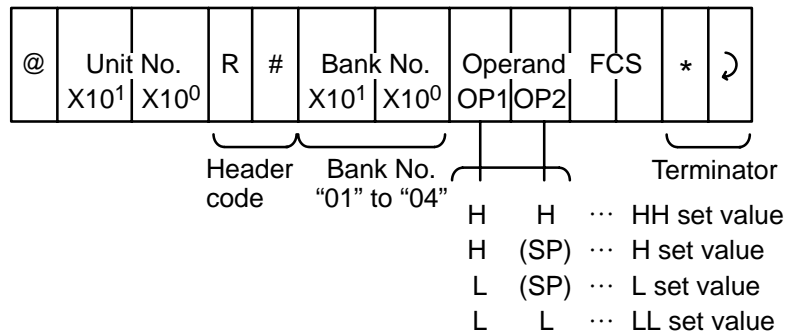
Set value is expressed in five figures of ASCII. Negative sign is represented by "F" at the position of the X10⁴ digit.

2-10 Set Value Read (K3NR/K3NP/K3NC Communication/Comparative Output)

This set value read is effective only in models with RS-422/485 capability, T_R comparative output, and bank function, and special models with K3TR communication and comparative output. The set values (HH, H, L, and LL) of the banks not in use are read individually.

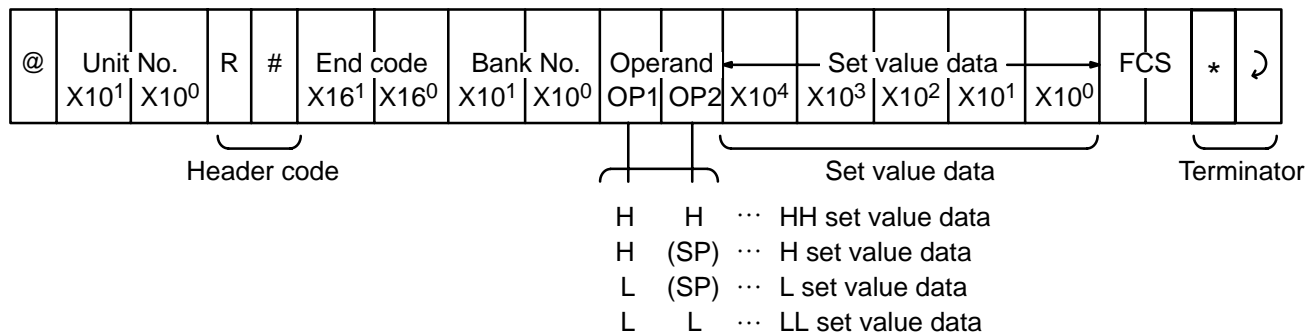
Refer to the following Note 2 for K3NC operands.

Command Format

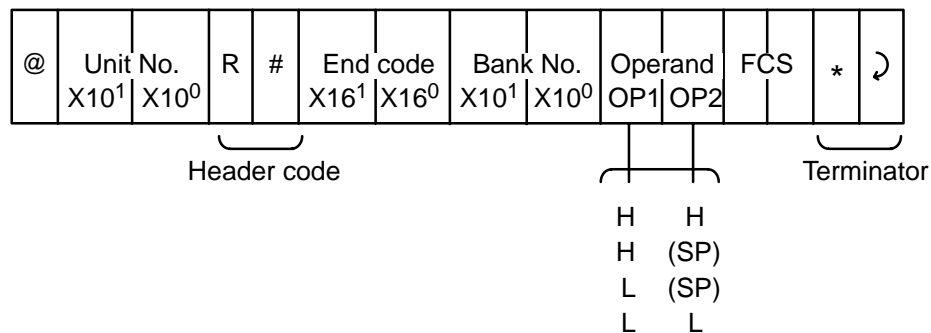


Response Format

Response at normal end. End code: "00"



Response format when an error occurs:



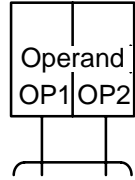
End code when error occurs:

- In non-comparative output type: End code is "16" (without corresponding command).
- In comparative output type without corresponding set value: End code is "22" (without corresponding memory).

Note

1. Set value is expressed in five figures of ASCII. Negative sign is represented by "F" at the position of the X10⁴ digit.

2. The comparative operands for the K3TC are as follows:



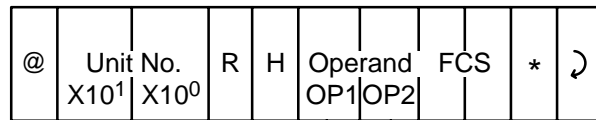
- 0 5 ... Comparative set value data for OUT5
- 0 4 ... Comparative set value data for OUT4
- 0 3 ... Comparative set value data for OUT3
- 0 2 ... Comparative set value data for OUT2
- 0 1 ... Comparative set value data for OUT1

2-11 Maximum/Minimum Read

Reads maximum/minimum hold data (maximum/minimum values).

This command is not effective in the K3NC.

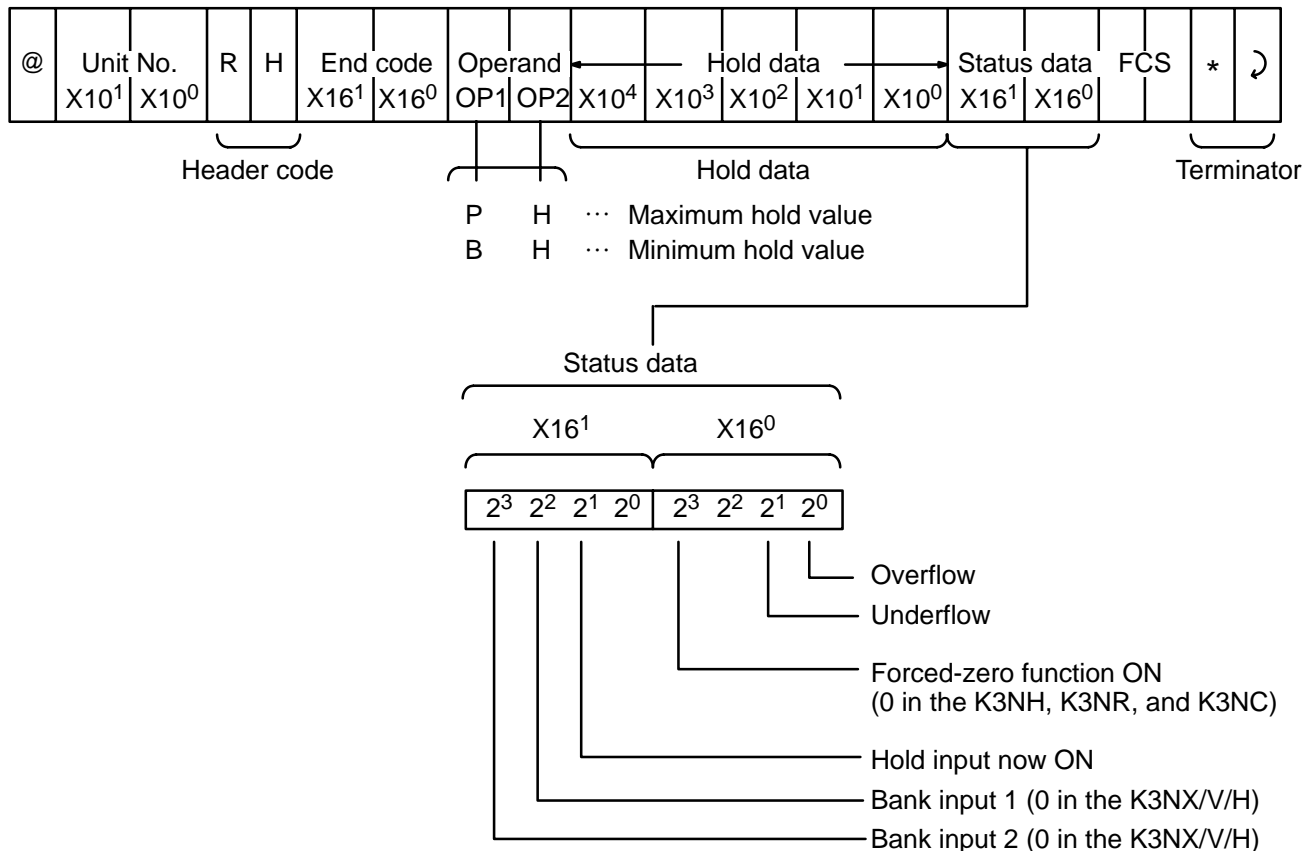
Command Format



- P H ... Maximum hold value
- B H ... Minimum hold value

Response Format

Response at normal end. End code: "00"

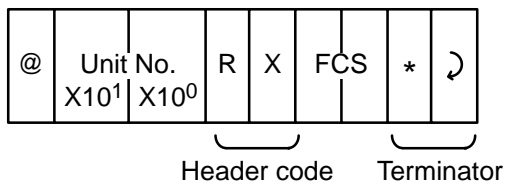


Hold data is expressed in five figures of ASCII. Negative value is indicated by "F" at the position of the X10⁴ digit.

2-12 Display Value (PV Value) Read

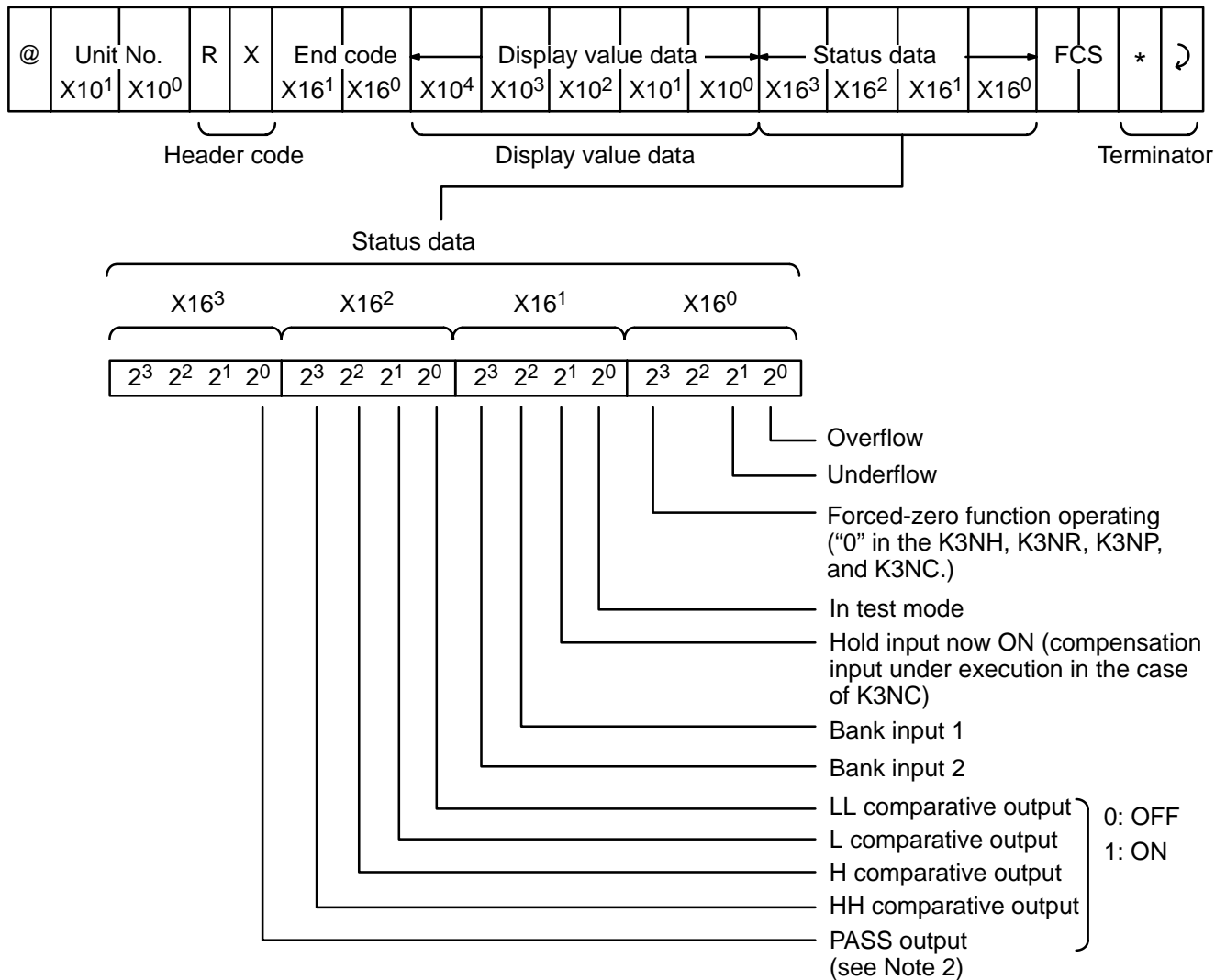
Reads display value (PV value).

Command Format



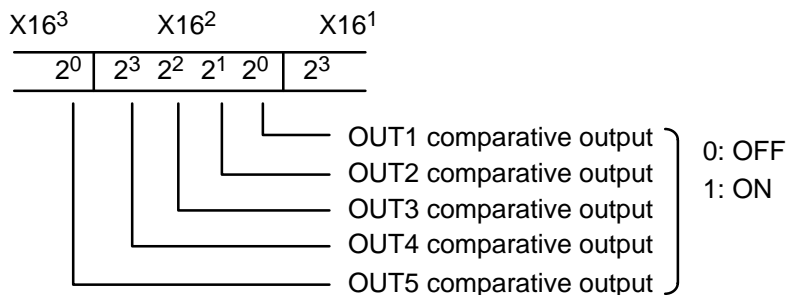
Response Format

Response at normal end. End code: "00"



Note

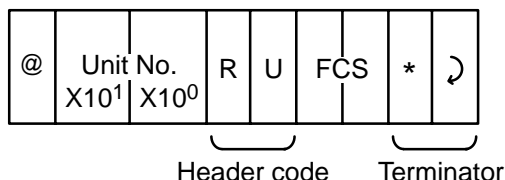
1. Display value is expressed in five figures of ASCII. Negative sign is represented by "F" at the position of the X10⁴ digit.
2. The comparative outputs of K3NC status data are as follows:



2-13 Model Data Read

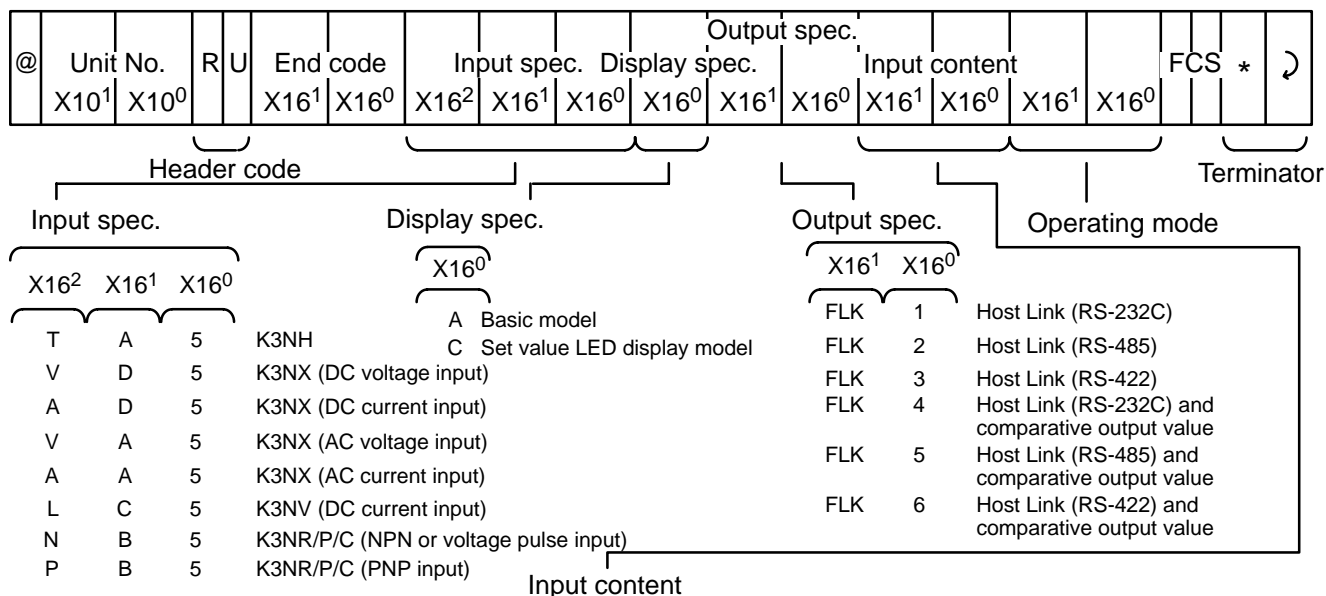
Reads model data.

Command Format



Response Format

Response at normal end. End code: "00"



K3NX			K3NH						K3NR/K3NP/K3NC			K3NV					
X16 ¹	X16 ⁰	Content	X16 ¹	X16 ⁰	Content	X16 ¹	X16 ⁰	Content	X16 ¹	X16 ⁰	Content	X16 ¹	X16 ⁰	Content			
0	0	Range A	0	0	JPt100°C	2	9	N°C	3	7	L2°F	Input A	Input B	Content	0	0	A
0	1	Range B	0	1	Pt100°C	2	A	R°C	3	8	V°F	0		None	1	1	B
0	2	Range C	1	0	JPt100°F	2	B	S°C	3	9	N°F	1		Non-contact	2	2	C
0	3	Range D	1	1	Pt100°F	2	C	B°C	3	A	R°F	2		Contact			
0	4	Range E	2	0	K1°C	2	D	W°C	3	B	S°F						
			2	1	K2°C	2	E	PLII°C	3	C	B°F						
			2	2	J1°C	3	0	K1°F	3	D	W°F						
			2	3	J2°C	3	1	K2°F	3	E	PLII°F						
			2	4	T°C	3	2	J1°F	4	0	4 to 20 mA						
			2	5	E°C	3	3	J2°F	4	1	0 to 20 mA						
			2	6	L1°C	3	4	T°F	5	0	1 to 5 V						
			2	7	L2°C	3	5	E°F	5	1	0 to 5 V						
			2	8	V°C	3	6	L1°F	5	2	0 to 10 V						

Operating mode

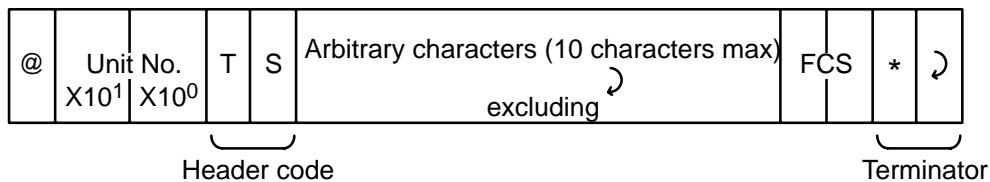
K3NX/K3NV/K3NH		K3NR			K3NP			K3NC		
X16 ¹	X16 ⁰	X16 ¹	X16 ⁰	Content	X16 ¹	X16 ⁰	Content	X16 ¹	X16 ⁰	Content
0	0	0	1	Rotational/circ. speed	0	1	Linear speed	0	2	Individual inputs
		0	2	Absolute ratio	0	2	Cycle	0	3	Phase difference inputs
		0	3	Error ratio	0	3	Time difference			
		0	4	Rotational difference	0	4	Elapsed time			
		0	5	Flow rate ratio	0	5	Length measurement			
		0	6	Passing time	0	6	Interval			
		0	7	Pulse counting						

The command content is expressed in ASCII.

2-14 Test

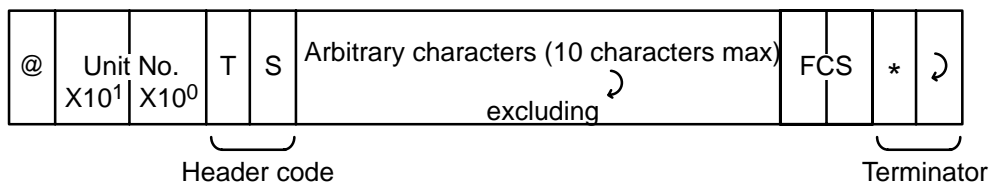
One block of data (with FCS) sent from the host computer is returned without altering anything.

Command Format



Response Format

Response at normal end. End code: "00"

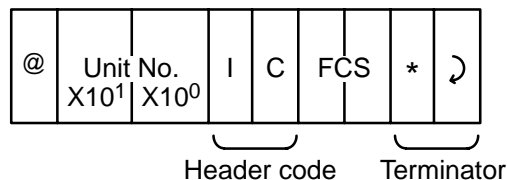


2-15 Undefined Command Error

The following response is returned when a command header code cannot be decoded.

Response Format

Response at normal end. End code: "00"



2-16 End Code List

End code		Contents
x 16 ¹	x 16 ⁰	
0	0	Normal completion
0	4	Address over (data overflow)
0	B	Not executable because of setting mode
0	C	Not executable because of test mode
1	0	Parity error
1	1	Framing error
1	2	Overrun error
1	3	FCS error
1	4	Format error (parameter length error, parameter error, data code error, data length error)
1	6	No corresponding command
2	0	Not executable due to sensor failure (K3NH), not executable due to startup compensation time function (K3NX)
2	1	Not executable due to Processor failure
2	2	No corresponding memory

2-17 Communication Program Example

2-17-1 Program Example of RS-232C Communication

In this program, when inputting transmission data in command format from a computer keyboard, data returned from the Processor that conforms to the response format is displayed on the computer screen. Input the data to be transmitted from the start character "@" to the last piece of text data. After data input, FCS is calculated and transmitted with a terminator. If this program is not executed correctly, there will be an error in the transmission section; check the connection of communication cables, etc.

(This program is written in N88 BASIC. An NEC PC-9801 personal computer is used as the host system.)

```

1000 ' -----
1010 ' PROGRAM:K3N* Communication Sample Program K3T* Compatible)
1020 ' VERSION:1.00
1030 ' (C)Copyright OMRON Corporation 1997
1040 ' All Rights Reserved
1050 ' -----
1060 '
1070 ' ==== COM port settings (even parity, 7 data bits, 2 stop bits) ====
1080 OPEN"COM:E73:AS#1
1090 '
1100 *REPEAT
1110 ' ==== Transmission process ====
1120 ' --- Input transmission data. ---
1130 INPUT"SEND DATA:",SEND$
1140 '
1150 ' --- Jump to exit process if there is no input. ---

```

```
1160 IF SEND$="" THEN *EXIT
1170 '
1180 ' --- BCC calculation ---
1190 FCS=0
1200 FOR I=1 TO LEN(SEND$)
1210 FCS=FCS XOR ASC(MID$(SEND$,I,1))
1220 NEXT I
1230 FCS$=CHR$("0"+HEX$(FCS),2)
1240 '
1250 ' --- Transmission ---
1260 SDATA$=SEND$+FCS$+"*"+CHR$(13)
1270 PRINT#1,SDATA$;
1280 '
1290 ' ==== Reception process ====
1300 RDATA$="":TIMEOUT=0
1310 *LOOP
1320 ' --- No-response detection ---
1330 TIMEOUT=TIMEOUT+1
1340 IF TIMEOUT>20000 THEN RESP$="No Response":GOTO *REND
1350 IF LOC(1)=0 THEN *LOOP
1360 '
1370 ' --- End character discrimination (Read if it isn't end character.) ---
1380 RDATA$=RDATA$+INPUT$(LOC(1),#1)
1390 IF RIGHT$(RDATA$,1)<>CHR$(13) THEN *LOOP
1400 RESP$=RDATA$
1410 *REND
1420 '
1430 ' --- Display received data. ---
1440 PRINT"Response: ";RESP$
1450 GOTO *REPEAT
1460 '
1470 *EXIT
1480 ' ==== Exit process ====
1490 CLOSE#1
1500 END
```


2-17-2 Operation Example

The following is an execution example of the previous program:

Bold characters represents operation and the carriage return symbol represents the RETURN Key. This program cannot execute transmission normally unless the initial transmission settings of the personal computer are: even parity, 7 bits, 2 stop bits, and the same baud rate as the Processor. If the connectors are not properly connected, the program may stop halfway.

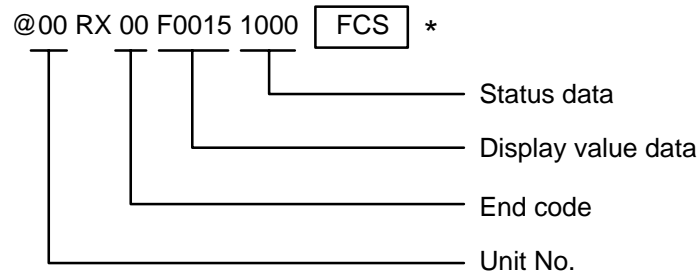
RUN ↵

SEND DATA : **@00RX** ↵

RESPONSE : @00RX00F00151000 **FCS** *

(Unit No. 00 display value is read.)

Response is as follows:



SECTION 3

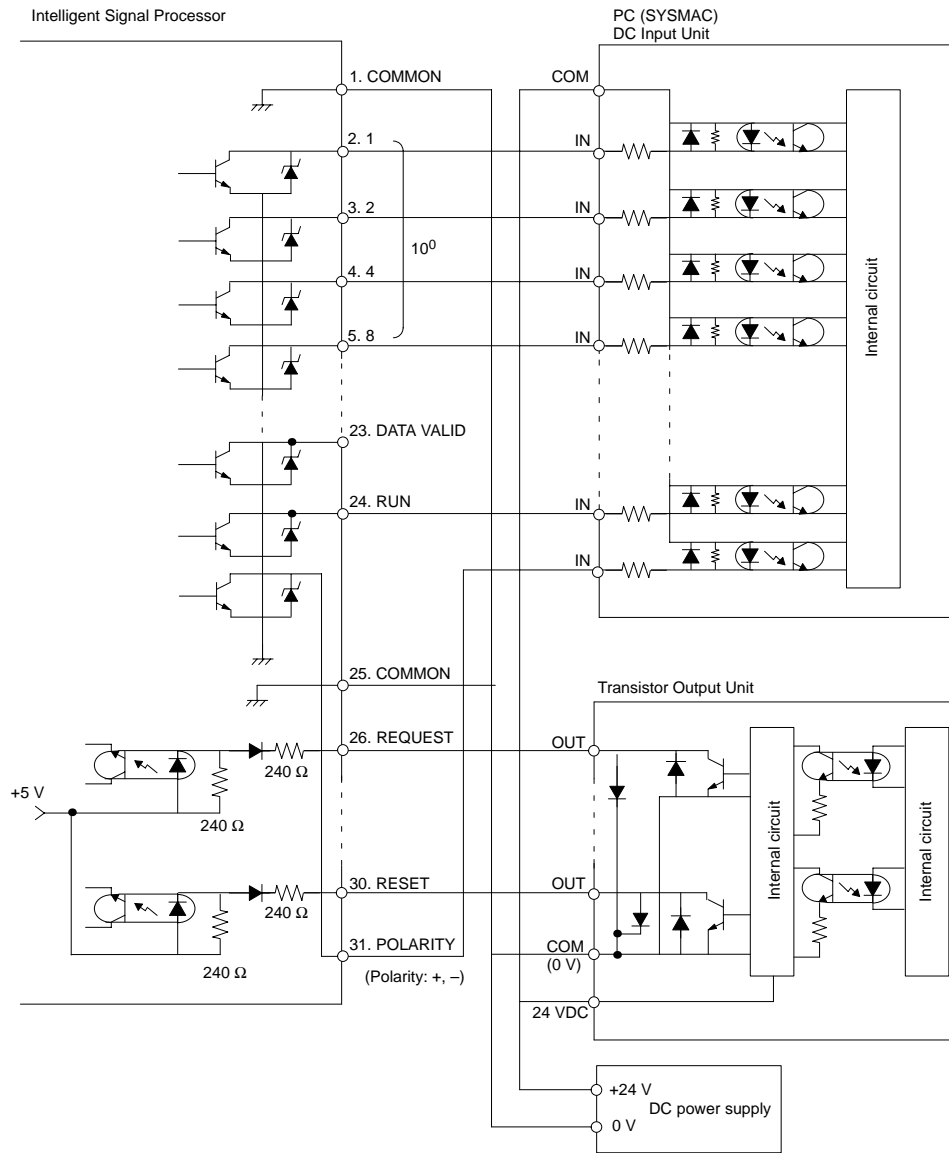
BCD Communications

This section provides the basic operational elements required in order to use the BCD output model. Included in this section is a PC connection example. Two program examples are also given.

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3-1 Connecting BCD Outputs

The BCD output type Processor is convenient when connecting directly with a PC or personal computer. Refer to the following connection example.



Operation

When a REQ signal is input to the Processor from a PC, the data is confirmed after an interval of approx. 30 ms, and a DATA VALID (D.V.) signal is output from the Processor. Read the data when the DATA VALID signal is ON.

Connection between PC and Processor should be performed with a rear panel transmission connector.

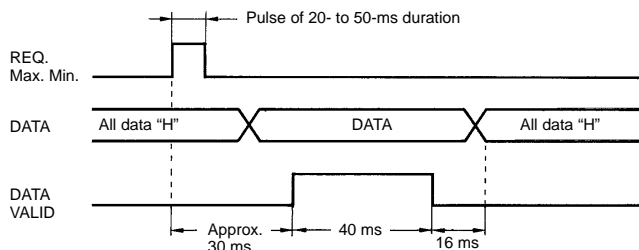
When one PC Unit is connected with several Processor Units, it is possible to achieve a wired OR connection between the DATA (including POL OVER) and DATA VALID signals.

Data cannot be written from a PC to a Processor.

Timing Charts

Sampling Data Output (at Each Sample)

Data is confirmed after approx. 30 ms from the REQ signal rising time, and DATA VALID signal is output. Read data while DATA VALID signal ON. The DATA VALID signal is turned OFF after an interval of 40 ms, then data is turned OFF after an interval of 16 ms.

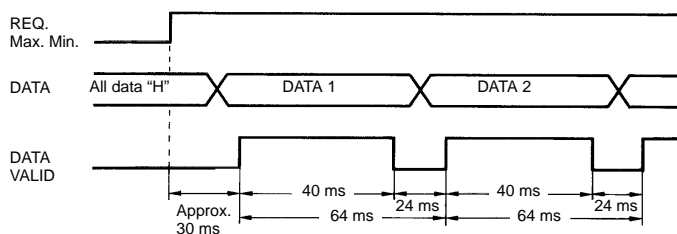


Note The above Max. and Min. are not effective in the K3NC.

Continuous Data Output

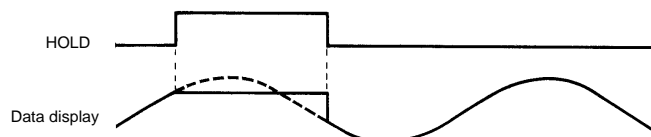
When the REQ signal remains ON, measurement data is output at intervals of 64 ms. When a hold operation or another operation is performed during the change from DATA 1 to DATA 2, the BCD data output is either DATA 1 or DATA 2 at the hold signal timing. Read maximum or minimum data when DATA VALID signal turns ON, after a 30 ms interval from maximum or minimum signal ON time to confirm measurement data.

The RUN signal is ON during RUN mode or TEST mode. (Note that the RUN signal is turned OFF when an error other than overflow or underflow occurs.)

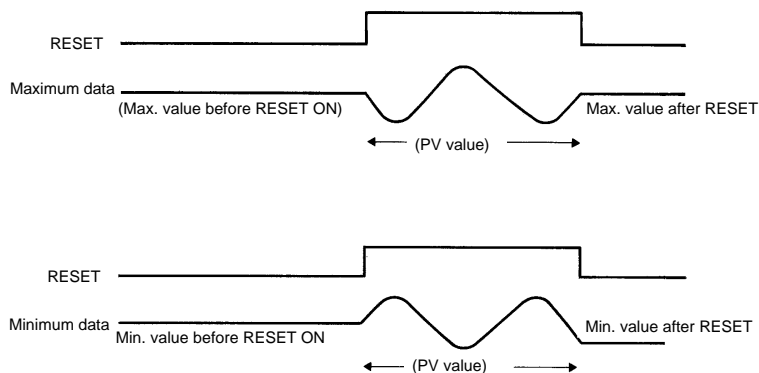


Note The above Max. and Min. are not effective in the K3NC.

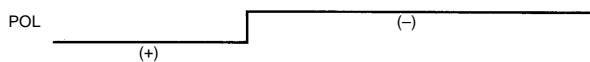
When a HOLD signal is input, the Processor stops accepting input and the data received just before the HOLD signal is retained and displayed. The same function is available in (5)-(7) terminal ON.



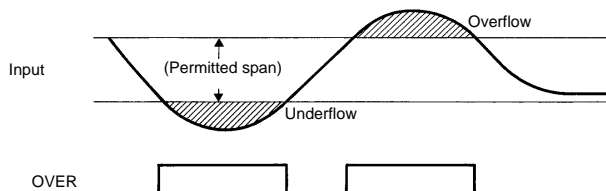
When RESET signal is input (ON), the maximum or minimum value becomes the current PV value.



POL output becomes L at positive (+) pole or H at negative (-) pole.



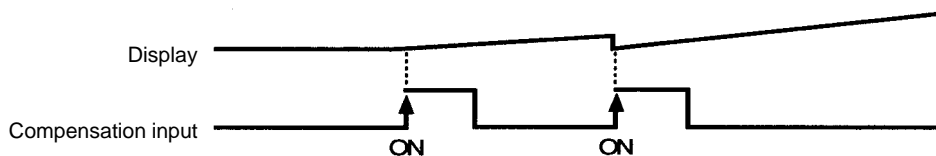
OVER output is formed when BCD output data becomes overflow or underflow data.



In set value mode or scaling mode, no BCD output is formed (all outputs become "H"). In TEST mode, the test PV value currently input is output in both REQ maximum and REQ minimum signals. When two or more input signals are input simultaneously, or when a signal is input during another input, all the output data is turned OFF. Do not turn ON two or more input signals at the same time (except for the HOLD signal).

COMPENSATION is available only in the K3NC.

The compensation input changes the display to a value (the compensation value) set in advance. The compensation input operates on the leading edge of the signal.



The display is changed to the preset value when the compensation input goes from OFF to ON.

K3NX/K3NV/K3NH/K3NR/K3NP I/O Ratings

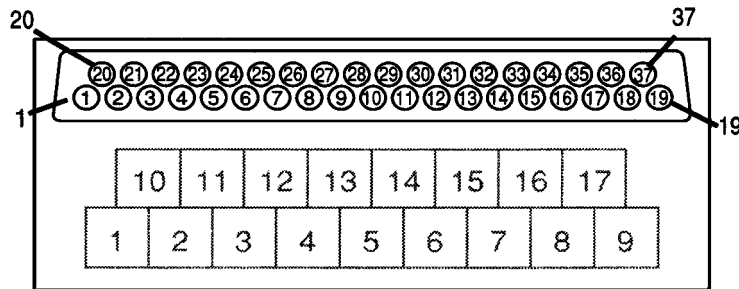
I/O signal name		Item		Rating
Input	REQ HOLD Max. Min. RESET	Input voltage		No-voltage contact input
		Input current		10 mA (max.)
		Signal level voltage	High (When OFF)	3 V min.
			Low (When ON)	1.5 V max.
Output	DATA POL OVER DATA VALID RUN	Rated load voltage		12 to 24 VDC ^{+10/-15%}
		Maximum load current		10 mA
		Leakage current		100 µA

K3NC I/O Ratings

I/O signal name		Item		Rating
Input	REQUEST COMPENSATION RESET	Input voltage		No-voltage contact input
		Input current		10 mA
		Operating voltage	OFF	3 V min.
			ON	1.5 V max.
Output	DATA POLARITY OVERFLOW DATA VALID RUN	Rated load voltage		12 to 24 VDC ^{+10/-15%}
		Maximum load current		10 mA
		Leakage current		100 µA max.

Note Logic method: negative logic

Terminal Numbers



Terminal number	Signal name	Signal direction	Use
1	COM	---	GND: VO (See Note 1)
2	RD1-1	Output	1 Read data: 10 ⁰ digit
3	RD1-2	Output	2 Read data: 10 ⁰ digit
4	RD1-4	Output	4 Read data: 10 ⁰ digit
5	RD1-8	Output	8 Read data: 10 ⁰ digit
6	RD2-1	Output	1 Read data: 10 ¹ digit
7	RD2-2	Output	2 Read data: 10 ¹ digit
8	RD2-4	Output	4 Read data: 10 ¹ digit
9	RD2-8	Output	8 Read data: 10 ¹ digit
10	RD3-1	Output	1 Read data: 10 ² digit
11	RD3-2	Output	2 Read data: 10 ² digit
12	RD3-4	Output	4 Read data: 10 ² digit
13	RD3-8	Output	8 Read data: 10 ² digit
14	RD4-1	Output	1 Read data: 10 ³ digit

Terminal number	Signal name	Signal direction	Use
15	RD4-2	Output	2 Read data: 10 ³ digit
16	RD4-4	Output	4 Read data: 10 ³ digit
17	RD4-8	Output	8 Read data: 10 ³ digit
18	RD5-1	Output	1 Read data: 10 ⁴ digit
19	RD5-2	Output	2 Read data: 10 ⁴ digit
20	RD5-4	Output	4 Read data: 10 ⁴ digit
21	RD5-8	Output	8 Read data: 10 ⁴ digit
22	OVER	Output	Output when input value is not within the display range.
23	D - V	Output	Data confirmation signal
24	RUN	Output	Operation signal
25	COM	---	GND: VO (See Note 1)
26	REQ	Input	PV output request
27	MAX REQ	Input	Maximum value output request (See Note 2)
28	MIN REQ	Input	Minimum value output request (See Note 2)
29	HOLD	Input	Hold input (See Note 3)
30	RESET	Input	Reset input
31	POL	Output	Positive/negative polarity signal
32	HH	Output	HH output (See Note 4)
33	H	Output	H output (See Note 4)
34	PASS	Output	PASS output (See Note 4)
35	L	Output	L output (See Note 4)
36	LL	Output	LL output (See Note 4)
37	COM	Output	GND: VO (See Note 1)

- Note:**
1. Terminals No. 1, 25, and, 37 have the same COM.
 2. The above Max. and Min. are not effective in the K3NC.
 3. HOLD is effective only in the K3NH, K3NR, K3NP, and K3NX and is not effective in the K3NC. COMPENSATION is effective only in the K3NC.
 4. OUT1 to OUT5 are effective only in the K3NC.

Applicable Connectors

Plug: XM2A-3701 (OMRON) or equivalent
Hood: XM2S-3711 (OMRON) or equivalent

3-2 Setting before Power Application

No specification setting before power application is required for the BCD output type.

3-3 Operations: Front Key Section

No setting with front keys is required for the BCD output type.

3-4 BCD Programs

With the BCD output type, only the PV value (display value), maximum value, and minimum value can be read. The marks (+) and (-) correspond respectively to L polarity and H polarity. Read the read data after the DATA VALID signal rises.

Data cannot be written from the PC to the Processor.

3-5 Program Example 1: Connection to a PC

The following program example 1 shows a single Processor connected to the SYSMAC C500 PC (OMRON).

3-5-1 Explanation of Operation

In this program, by turning ON PC 0013, the PV (process value) of the Processor is read into the PC to be stored in data memory. Without regard to 0013 ON time, only one data sample is read.

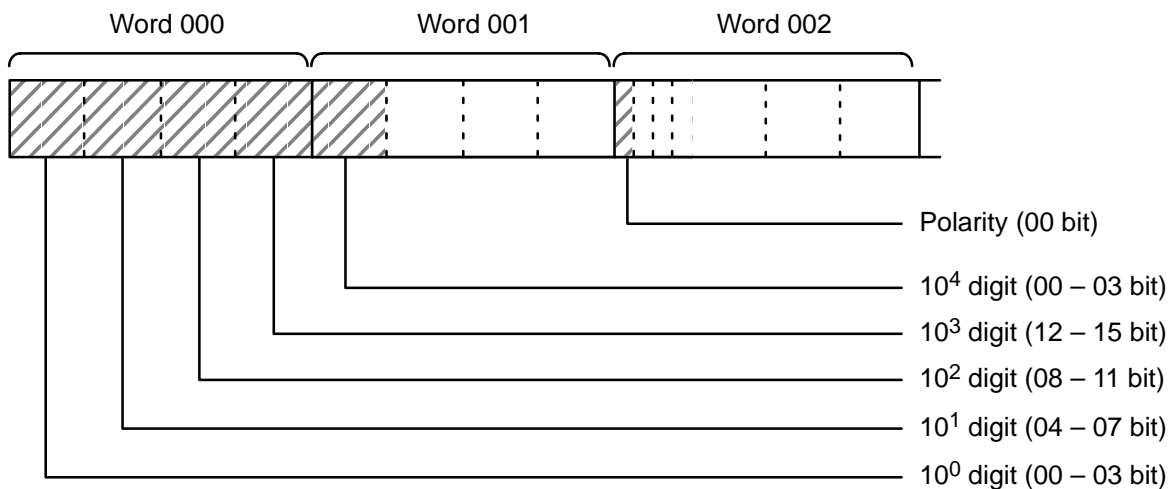
3-5-2 I/O Allocation in Use

Terminal No.	Signal name	Signal direction	Description	I/O allocation
1	COM	---	GND: VO* (See Note)	---
2	RD1-1	Output	1 Read data: 10 ⁰ digit	Input unit 0000
3	RD1-2	Output	2 Read data: 10 ⁰ digit	Input unit 0001
4	RD1-4	Output	4 Read data: 10 ⁰ digit	Input unit 0002
5	RD1-8	Output	8 Read data: 10 ⁰ digit	Input unit 0003
6	RD2-1	Output	1 Read data: 10 ¹ digit	Input unit 0004
7	RD2-2	Output	2 Read data: 10 ¹ digit	Input unit 0005
8	RD2-4	Output	4 Read data: 10 ¹ digit	Input unit 0006
9	RD2-8	Output	8 Read data: 10 ¹ digit	Input unit 0007
10	RD3-1	Output	1 Read data: 10 ² digit	Input unit 0008
11	RD3-2	Output	2 Read data: 10 ² digit	Input unit 0009
12	RD3-4	Output	4 Read data: 10 ² digit	Input unit 0010
13	RD3-8	Output	8 Read data: 10 ² digit	Input unit 0011
14	RD4-1	Output	1 Read data: 10 ³ digit	Input unit 0012
15	RD4-2	Output	2 Read data: 10 ³ digit	Input unit 0013
16	RD4-4	Output	4 Read data: 10 ³ digit	Input unit 0014
17	RD4-8	Output	8 Read data: 10 ³ digit	Input unit 0015
18	RD5-1	Output	1 Read data: 10 ⁴ digit	Input unit 0100
19	RD5-2	Output	2 Read data: 10 ⁴ digit	Input unit 0101
20	RD5-4	Output	4 Read data: 10 ⁴ digit	Input unit 0102
21	RD5-8	Output	8 Read data: 10 ⁴ digit	Input unit 0103
22	OVER	Output	Output when input value exceeds display range	Input unit 0104* (See Note)
23	DATA VALID	Output	Data confirmation signal	Input unit 0105
24	RUN	Output	Operation signal	Input unit 0106
25	COM	---	GND: GO* (See Note)	---
26	REQ	Input	PV output request	Output unit 0200
27	Max.	Input	Maximum value output request	Output unit 0201* (See Note)
28	Min.	Input	Minimum value output request	Output unit 0202* (See Note)
29	HOLD	Input	Hold input	Output unit 0203* (See Note)
30	RESET	Input	Reset input	Output unit 0204* (See Note)
31	POL	Output	Positive/negative polarity signal	Input unit 0107

Note: I/O marked with an asterisk is not used in this program.

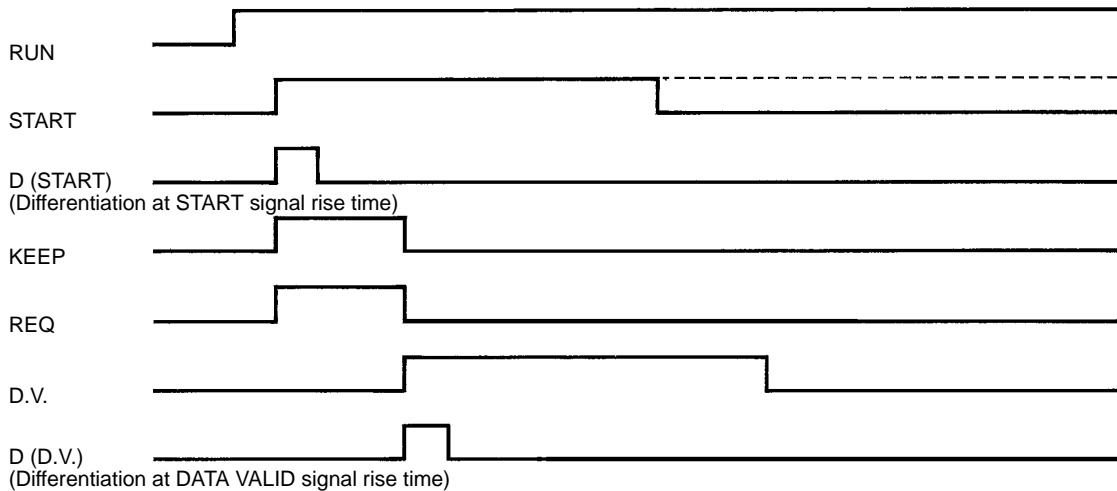
3-5-3 DM (Data Memory) Area

Read data is stored in the memory below.



3-5-5 Timing Chart

The following example illustrates the relative timing and duration of each input/output signal.



3-6 Program Example 2: Connection to a PC

The following program example 2 shows 3 Processors (designated as ISP-A, ISP-B, and ISP-C Units) connected to the SYSMAC C500 PC (OMRON).

3-6-1 Explanation of Operation

In this program, by turning ON PC 0013, PV (process values) of three Processors (A, B, and C) are successively read into the PC, to be stored into data memory. Without regard to 0013 ON time, only one data sample is read from each Processor.

3-6-2 I/O Allocation in Use

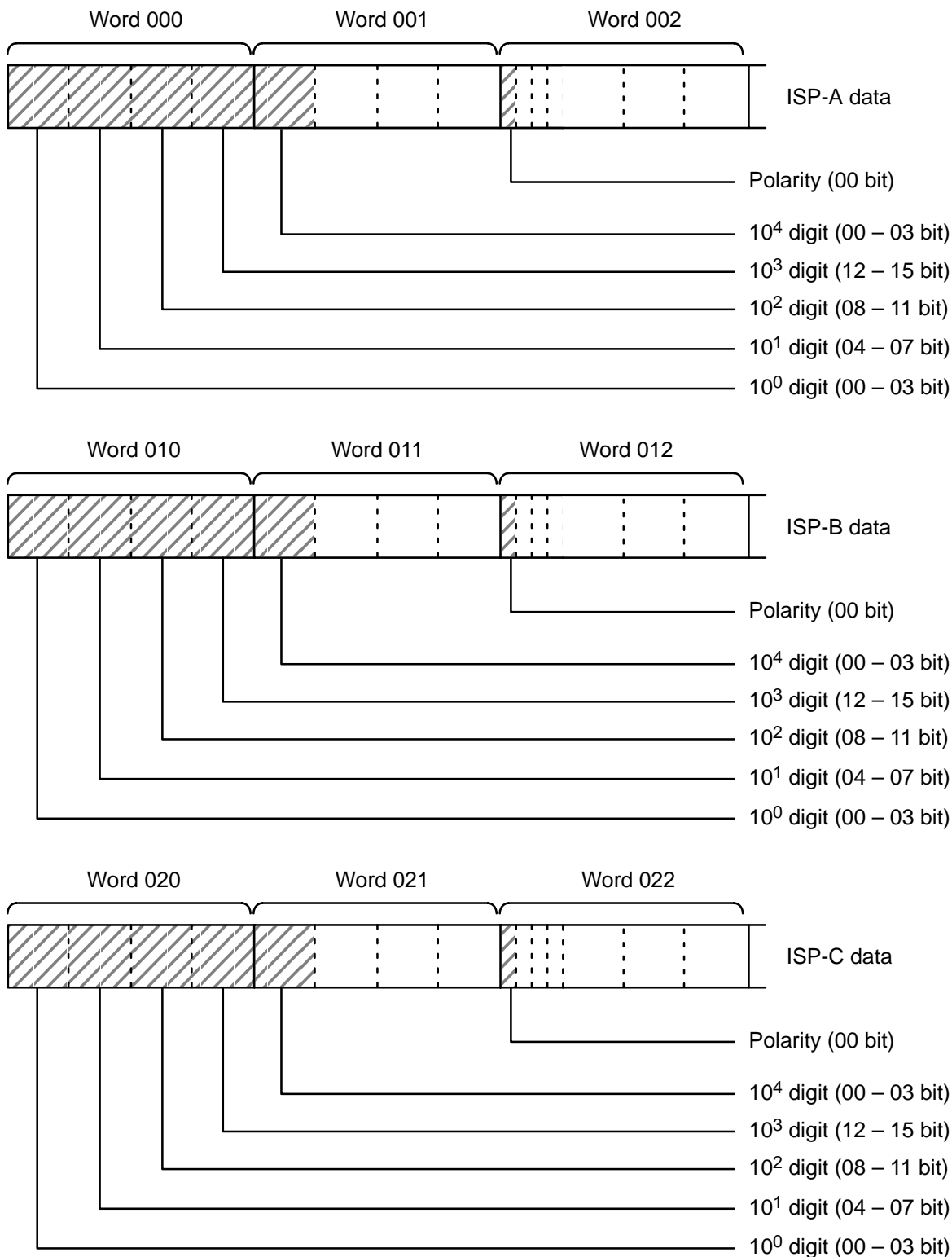
Terminal No.			Signal name	Signal direction	Description	I/O allocation
ISP-A	ISP-B	ISP-C				
1	1	1	COM	---	GND: VO	---
2	2	2	RD1-1	Output	1 Read data: 10 ⁰ digit	Input unit 0000
3	3	3	RD1-2	Output	2 Read data: 10 ⁰ digit	Input unit 0001
4	4	4	RD1-4	Output	4 Read data: 10 ⁰ digit	Input unit 0002
5	5	5	RD1-8	Output	8 Read data: 10 ⁰ digit	Input unit 0003
6	6	6	RD2-1	Output	1 Read data: 10 ¹ digit	Input unit 0004
7	7	7	RD2-2	Output	2 Read data: 10 ¹ digit	Input unit 0005
8	8	8	RD2-4	Output	4 Read data: 10 ¹ digit	Input unit 0006
9	9	9	RD2-8	Output	8 Read data: 10 ¹ digit	Input unit 0007
10	10	10	RD3-1	Output	1 Read data: 10 ² digit	Input unit 0008
11	11	11	RD3-2	Output	2 Read data: 10 ² digit	Input unit 0009
12	12	12	RD3-4	Output	4 Read data: 10 ² digit	Input unit 0010
13	13	13	RD3-8	Output	8 Read data: 10 ² digit	Input unit 0011
14	14	14	RD4-1	Output	1 Read data: 10 ³ digit	Input unit 0012
15	15	15	RD4-2	Output	2 Read data: 10 ³ digit	Input unit 0013
16	16	16	RD4-4	Output	4 Read data: 10 ³ digit	Input unit 0014
17	17	17	RD4-8	Output	8 Read data: 10 ³ digit	Input unit 0015

Terminal No.			Signal name	Signal direction	Description	I/O allocation
ISP-A	ISP-B	ISP-C				
18	18	18	RD5-1	Output	1 Read data: 10 ⁴ digit	Input unit 0100
19	19	19	RD5-2	Output	2 Read data: 10 ⁴ digit	Input unit 0101
20	20	20	RD5-4	Output	4 Read data: 10 ⁴ digit	Input unit 0102
21	21	21	RD5-8	Output	8 Read data: 10 ⁴ digit	Input unit 0103
22	22	22	OVER	Output	Output when input value exceeds display range	Input unit 0104* (See Note)
23	---	---	DATA VALID	Output	Data confirmation signal-A	Input unit 0105
24	---	---	RUN	Output	Operation signal-A	Input unit 0106
---	23	---	DATA VALID	Output	Data confirmation signal-B	Input unit 0109
---	24	---	RUN	Output	Operation signal-B	Input unit 0110
---	---	23	DATA VALID	Output	Data confirmation signal-C	Input unit 0111
---	---	24	RUN	Output	Operation signal-C	Input unit 0112
25	25	25	COM	---	GND: VO	---
26	---	---	REQ	Input	PV output request-A	Output unit 0200
---	26	---	REQ	Input	PV output request-B	Output unit 0201
---	---	26	REQ	Input	PV output request-C	Output unit 0202
27	---	---	Max.	Input	Maximum value output request-A	Output unit 0203* (See Note)
---	27	---	Max.	Input	Maximum value output request-B	Output unit 0204* (See Note)
---	---	27	Max.	Input	Maximum value output request-C	Output unit 0205* (See Note)
28	---	---	Min.	Input	Minimum value output request-A	Output unit 0206* (See Note)
---	28	---	Min.	Input	Minimum value output request-B	Output unit 0207* (See Note)
---	---	28	Min.	Input	Minimum value output request-C	Output unit 0208* (See Note)
29	---	---	HOLD	Input	Hold input-A	Output unit 0209* (See Note)
---	29	---	HOLD	Input	Hold input-B	Output unit 0210* (See Note)
---	---	29	HOLD	Input	Hold input-C	Output unit 0211* (See Note)
30	---	---	RESET	Input	Reset input-A	Output unit 0212* (See Note)
---	30	---	RESET	Input	Reset input-B	Output unit 0213* (See Note)
---	---	30	RESET	Input	Reset input-C	Output unit 0214* (See Note)
31	31	31	POL	Output	Positive/negative polarity signal	Input unit 0107

Note: I/O marked with an asterisk is not used in this program.

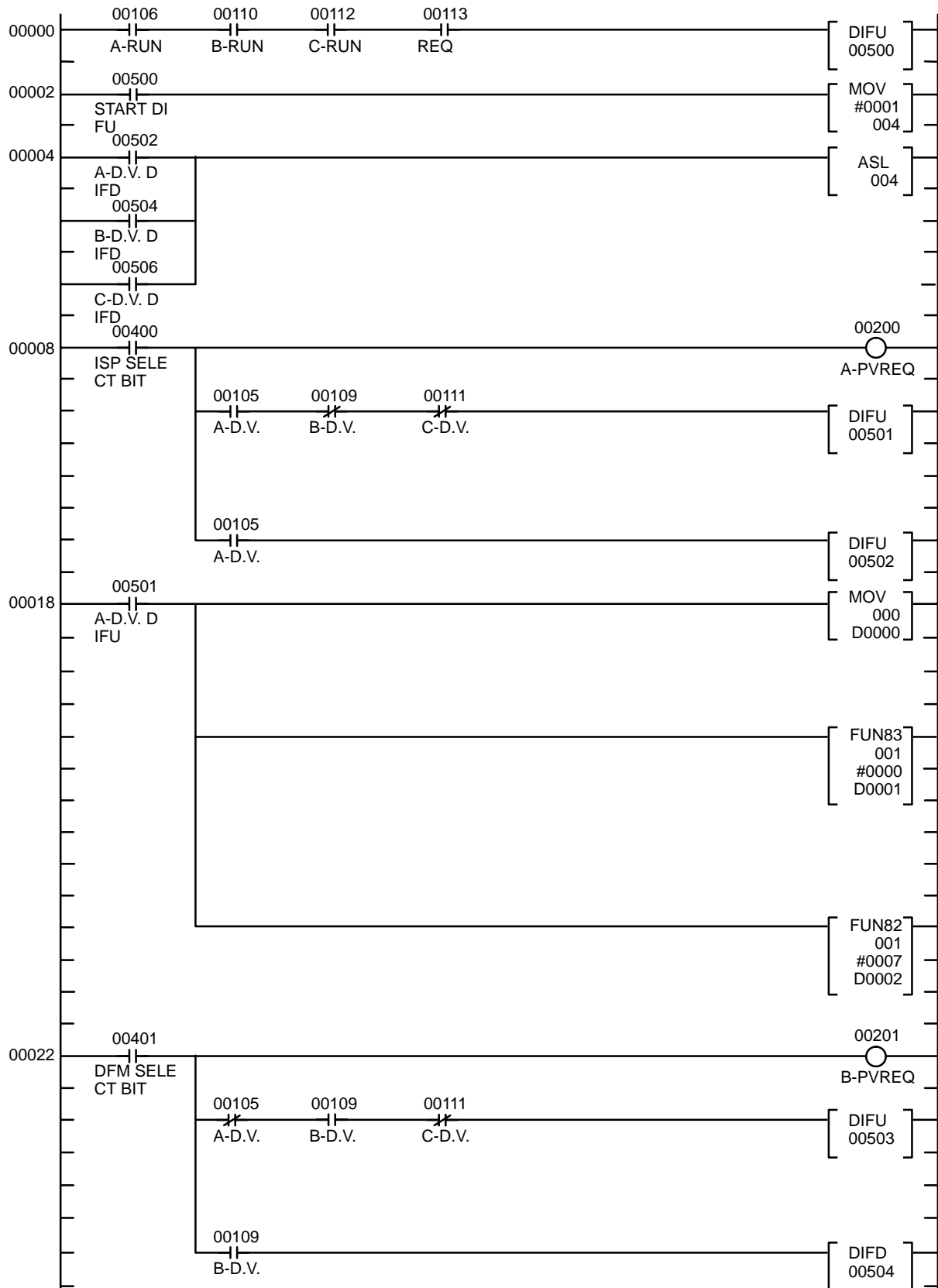
3-6-3 DM (Data Memory) Area

Read data is stored in the memory below.

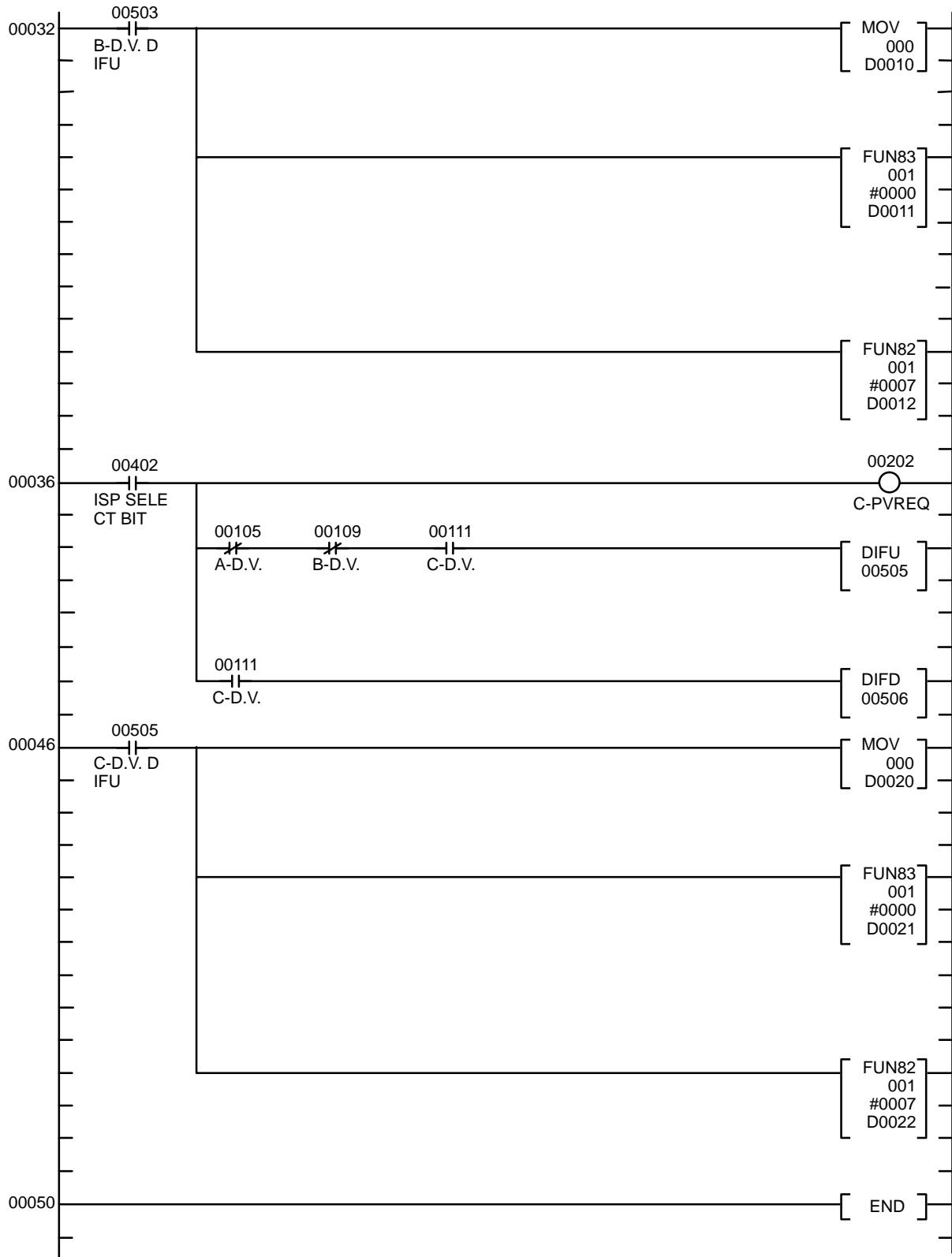


3-6-4 Ladder Program

The following diagram illustrates the flow and order of signals.

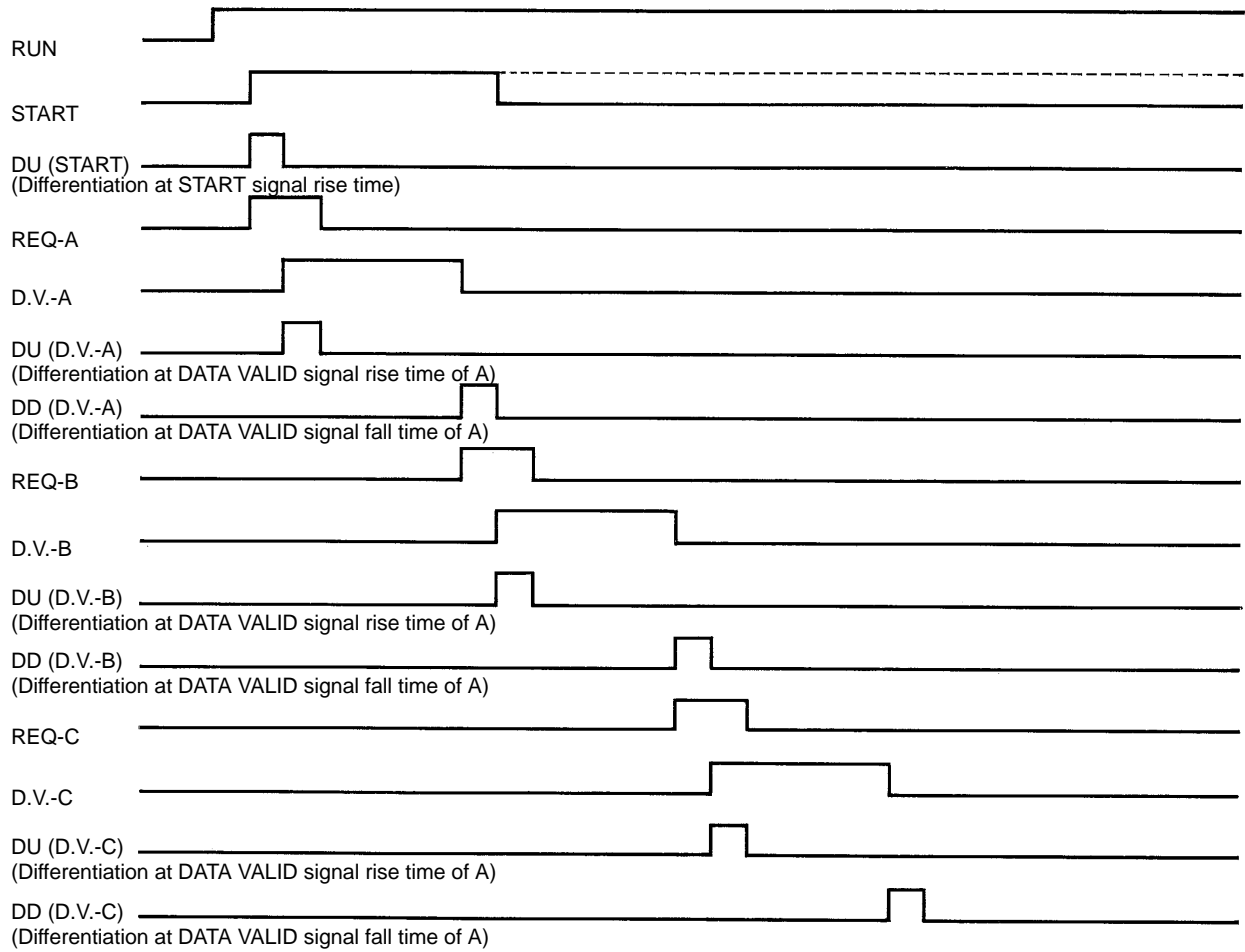


(This diagram is a continuation from the previous page)



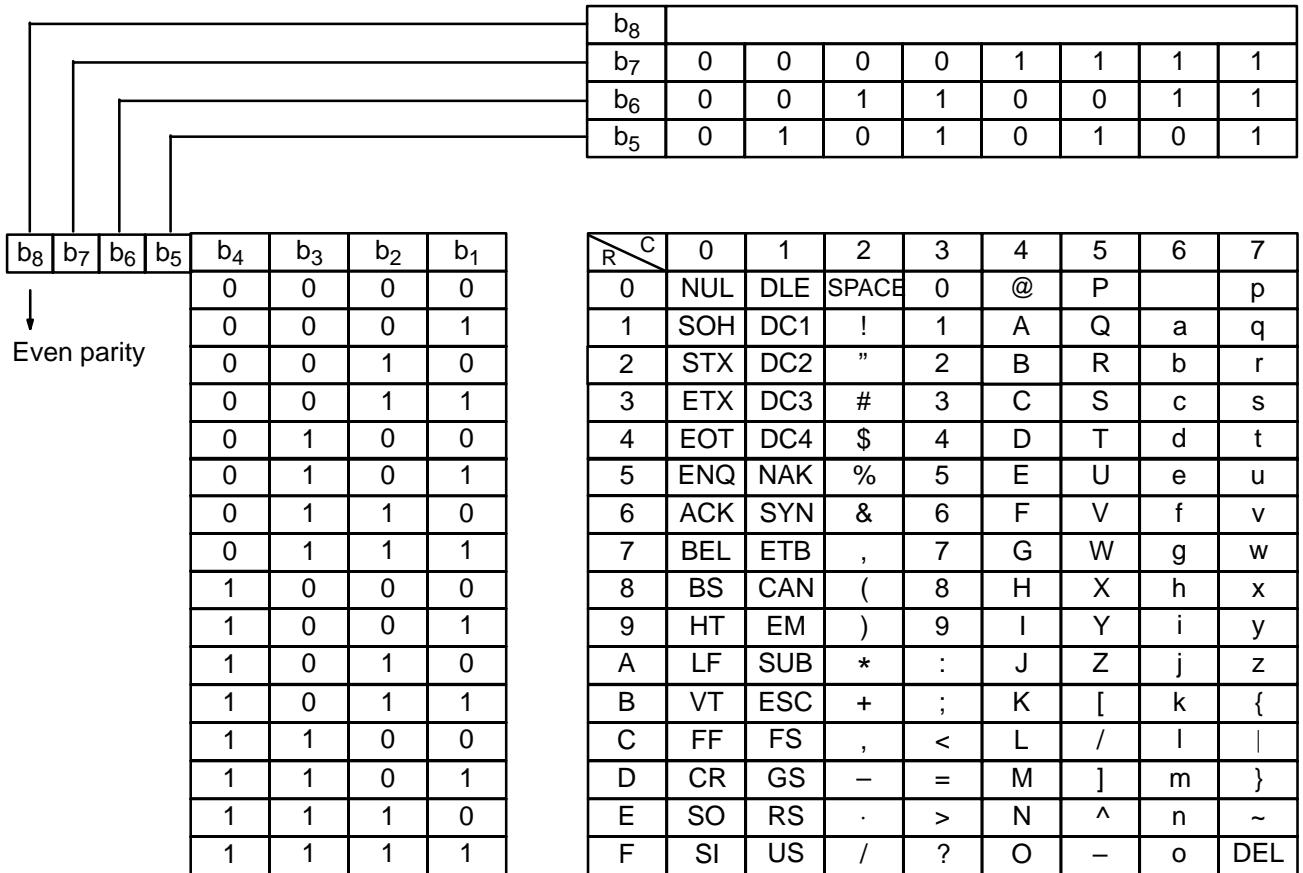
3-6-5 Timing Chart

The following example illustrates the relative timing and duration of each input/output signal.



Appendix A

ASCII List



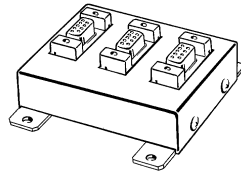
Appendix B

List of Optional Accessories

Link Adapters

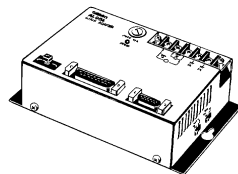
B500-AL001

Three RS-422 adapters for RS-422 line distribution.



B500-AL004

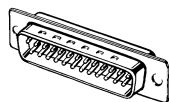
One RS-232C adapter and two RS-422 adapters for RS-232C and RS-422.



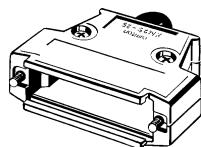
Connectors

XM2A-0901, XM2A-2501, XM2D-0901 (Plug)

D-sub connector. Use in combination with a Hood.



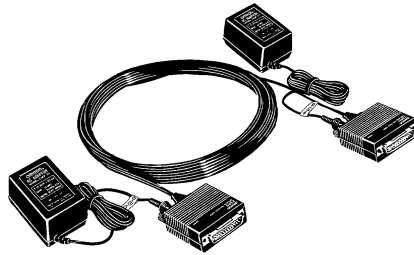
XM2S-0911, XM2S-2511, XM2D-0911 (Hood)



Optical Link Adapter

Z3RN

To extend RS-232C line.



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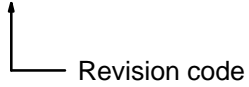
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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. N96-E1-1



The following table outlines the changes made to the manual during each revision. Page numbers refer to previous version.

Revision code	Date	Revised content
1	February 1998	Original production