10

PROGRAMMING THE NON-PROCEDURE MODE

This chapter describes programming that is required for communicating in the non-procedure communication mode.

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10-2 Communication Specifications 10-4
10-3 Communication Format 10-5
10-4 Making the Ladder Program 10-10
10-5 When Communicating with a PC 10-44

10-1 Non-procedure Mode

This section briefly describes the non-procedure mode.

■ Application

The communication specifications and data format can be set as desired to match the connected equipment. Up to 512 bytes of data can be sent and received in a single communication. Communication programs are required by CPU unit.

■ Communication configuration

When the non-procedure mode is used, the format (header, delimiter, data length) of the communication modes can be set as desired to match the communication formats of peripherals. Note, however, that the format must be set entirely on the ladder program.

- The format of data that is received from peripherals can be selected from “Variable length data with specified delimiters” and “Fixed length data with specified data length”.
- A handshake is performed by the I/O relays to send and receive data.
- Three modes can be selected for sending/reception operation: “normal mode”, “response receiving mode” and “buffer clear mode”. The operation (communication procedure) in sending/reception on the KV-XL202/XL402 is determined by setting these modes. When the KV-XL202/XL402 is connected to an peripherals other than a PC, check which mode the communication of that peripherals is matched to in the User's Manual provided with the peripherals. The mode can be set with the ladder program.

  “Set Mode” (Page 10-21)

Reference

The KV-XL202/XL402 can process sending and receiving simultaneously. Simultaneous sending and receiving will not result in an error if sending and receiving can be processed simultaneously on the peripherals, too. (This applies when the interface is the RS-232C, RS-422A/485 4-wire.) When the port is RS-422A/485 (2-wire), receiving and sending cannot be performed at the same time.

■ Required Program

Check the program required for performing communication in the non-procedure mode.

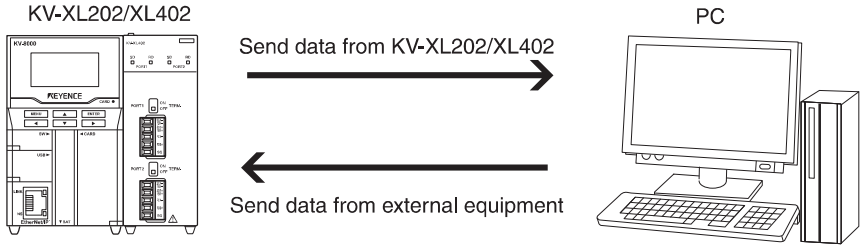
● When communicating with a PC

A ladder program is required on the KV-XL202/XL402 side (the CPU unit, specifically speaking). Create the ladder program using the Keyence Ladder Support Software KV STUDIO.

“10-4 Making the Ladder Program” (Page 10-10)

A communication program is also required on the PC side. The communication program can be made using Microsofts Visual-Basic or other similar software.

"10-5 When Communicating with a PC" (Page 10-44)

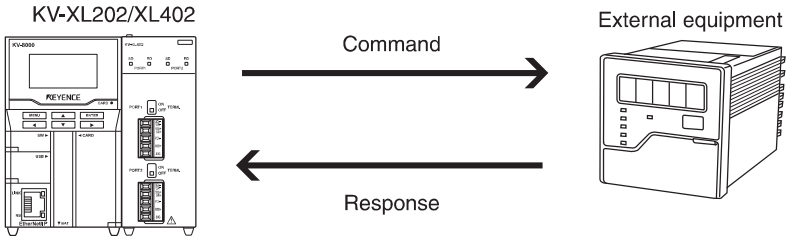


● When communicating with a peripheral that has a set communication procedure

A ladder program is required on the KV-XL202/XL402 side (the CPU unit, specifically speaking). Create the ladder program using the Keyence Ladder Support Software KV STUDIO.

"10-4 Making the Ladder Program" (Page 10-10)

Generally, no program on the peripherals side is required. (For details, refer to the User's Manual of the Peripherals.



Point **Explanations in this section refer to the program on the KV-XL202/XL402 side as the "ladder program" and the program on the PC or other peripherals as the "communication program".**

10-2 Communication Specifications

This section briefly describes the non-procedure mode. Settings for the KV-XL202/XL402 are set with Unit Editor.

Setting Items on Unit Editor

Use Unit Editor to set up KV-XL202/XL402 communication. The setting items on Unit Editor are as follows. For details on how to set these setting items, please see "2-5 Set Up with Unit Editor" (Page 2-11)

Point **Match the communication specifications of peripherals with those of the KV-XL202/XL402. communication cannot be performed correctly if the settings are different.**

KV-XL202

Item		Setting item	Defaults
Port 1 Port 2	Device assignment type	DM (data memory), UG (buffer memory)	DM (data memory)
	Interface	RS-232C	RS-232C
	Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps	9600bps
	Data bit length	7 bits, 8 bits	8 bits
	Start bit	1 bit	1 bit
	Stop bit	1 bit, 2 bits	1 bit
	Parity bit	None, Even, odd	Even
	Checksum	None	None
	RS/CS flow control	OFF, ON	OFF

KV-XL402

Item		Setting item	Defaults
Port 1 Port 2	Device assignment type	DM (data memory), UG (buffer memory)	DM (data memory)
	Interface	RS-422A/485 (4-wire), RS-422A/485 (2-wire)	RS-422A/485 (4-wire)
	Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps	9600bps
	Data bit length	7 bits, 8 bits	8 bits
	Start bit	1 bit	1 bit
	Stop bit	1 bit, 2 bits	1 bit
	Parity bit	None, Even, Odd	Even
	Checksum	None	None

10-3 Communication Format

This section describes details you should know before starting programming in the non-procedure mode.

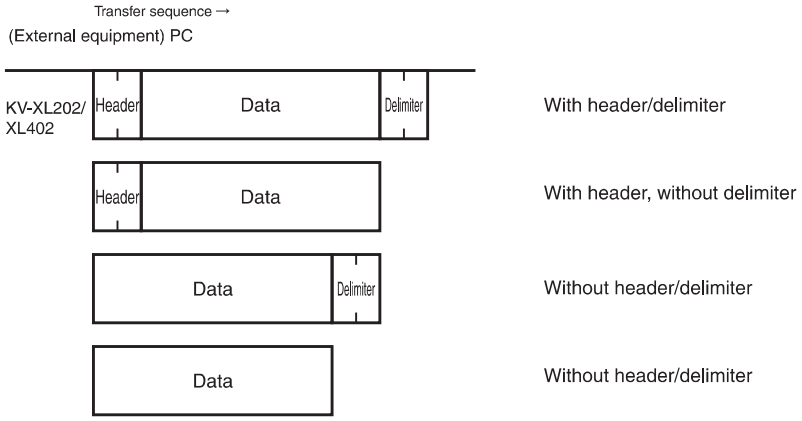
Format of Data to be Sent/Received

KV-XL202/XL402 can receive and send the data format for the definition mode (header, delimiter, data length). When communicating with a PC, determine the format of the data before you start programming.When the KV-XL202/XL402 is connected to peripherals other than a PC, check the format of that equipment in the User's Manual provided with the peripherals. Set the format in the ladder program.

"Set Mode" (Page 10-21)

■ Format of send data (KV-XL202/XL402 to peripherals)

When using the normal mode or the response receiving mode, one of the following formats can be used for the data (commands) to be sent to peripherals from the KV-XL202/XL402. In the buffer clear mode, data cannot be sent from the KV-XL202/XL402.



- Header (for example: $^{S}T_{X}$) can be appended or omitted.
  A header up to 2 bytes can be used.
  "Setting the Header for Sending" (Page 10-22)

- Delimiter (for example, $^{m}T_{X}$, ^{C}R, ^{L}F) can be attached or omitted.
  A delimiter up to two bytes long can be used.
  "Setting the Delimiter for Sending" (Page 10-23)

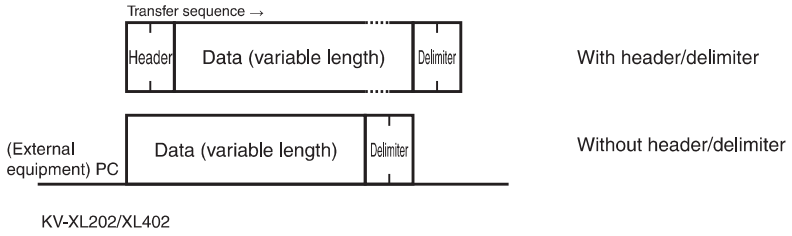
- Up to 512 bytes are allowed as the data length.
  Data of the length specified in the ladder program can be sent.
  "Setting the Send Data Length" (Page 10-30)

Point **The same code (character) cannot be used for headers and delimiters.**

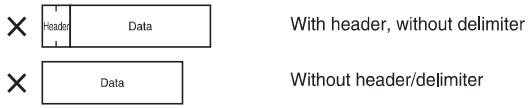
■ Format of receive data (peripherals to KV-XL202/XL402)

The format of data that can be received from peripherals by the KV-XL202/XL402 can be selected from "variable length data with specified delimiters" and "fixed length data with specified data length".

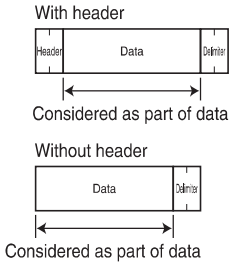
Variable length data with specified delimiters



- Delimiter (for example : [ETX], [CR], [LF]) must be available.
  A delimiter up to two bytes (two characters) long can be used.
  "Setting the Delimiter for Receiving" (Page 10-26)
  Data without delimiters appended cannot be received successfully.



- Header (for example : [STX]) can be appended or omitted.
  A header up to 2 bytes (two characters) can be used.
  "Setting the Receive Header" (Page 10-24)
  Data without a header is not treated as data when a header has been specified.
- When prefixing the data with a header, the KV-XL202/XL402 regards the part between the header and delimiter as the data to write to the CPU Unit.
- When data is not prefixed with a header, the KV-XL202/XL402 regards the data from the start of the data up to the delimiter as the data to write to the CPU Unit.
  The length of the data varies with the content of the data from the peripherals to be connected.
  The length of data is set within the range 1 to 512 bytes.
  "Setting the Receive Data Length" (Page 10-27)



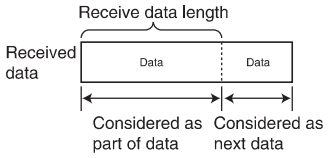
Point **The same code (character) cannot be used for headers and delimiters.**

Fixed length data with specified data length

The KV-XL202/XL402 regards the data of the length (receive data length) set in the ladder program as the data to write to the CPU Unit. Headers and delimiters are not used. “Fixed length data with specified data length” can be used in the normal mode and response receiving mode. It cannot be used in the buffer clear mode.

Point

- **When the KV-XL202/XL402 has received data longer than the receive data length, the receive data length from the start of the data is regarded as the data, and the remaining data is processed as the next receive data.**

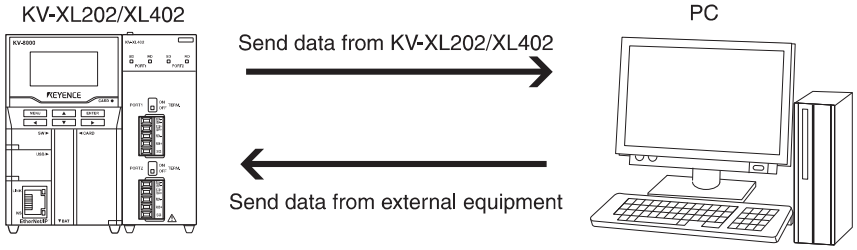


- **When the KV-XL202/XL402 has received data shorter than the receive data length, the KV-XL202/XL402 stands by until data equivalent to the receive data length arrives.**

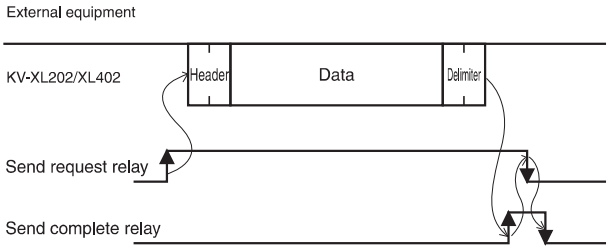
Transfer Method

■ Normal mode

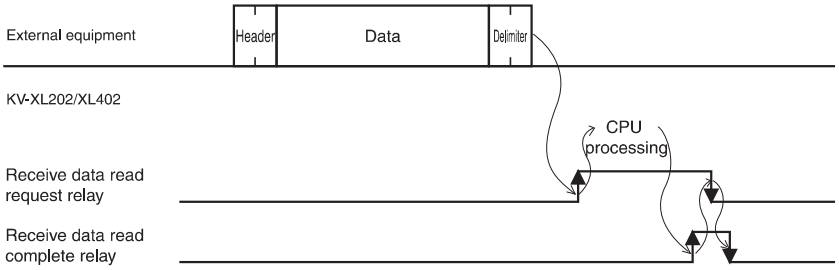
When a PC is connected, normally select the normal mode. In this mode, data can be sent to peripherals from the KV-XL202/XL402 and sent to the KV-XL202/XL402 from peripherals. Accordingly, data on the CPU Unit can be written to peripherals, or data on peripherals can be captured on the CPU Unit. Processing by the program for both of sending and receiving is required.



The following illustrates the communication procedure during sending:



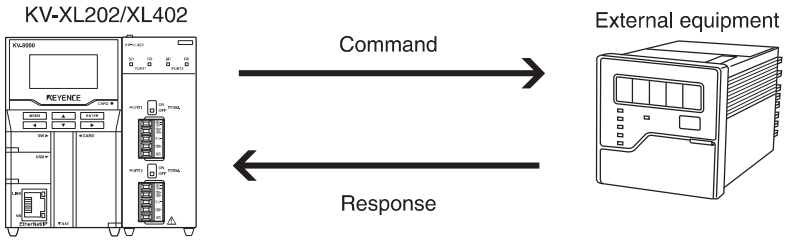
The following illustrates the communication procedure during receiving.



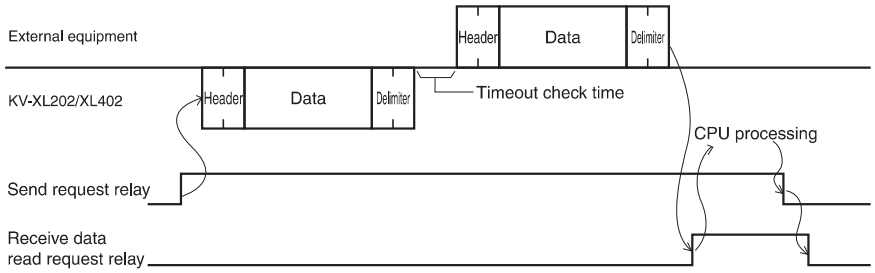
■ Response receiving mode

Select the response receiving mode when connecting the peripherals to send data to only when requested. For example, select this mode when connecting to a Keyence BL Series Barcode Reader, JC Series Digital Load Indicator, and RD Series Analog Controller. For the RD Series, measurement values can be captured on the KV-XL202/XL402 by sending the “M” command.

The processes of sending a commands and receiving a response is completed in a single operation. (That is, there is no need to separate relay processing at receiving and sending.) The time (timeout verify time) from sending the command to receiving the response can also be set.



The communication procedure is as follows.

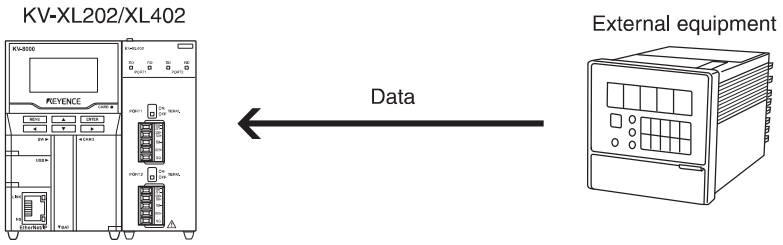


■ Buffer clear mode

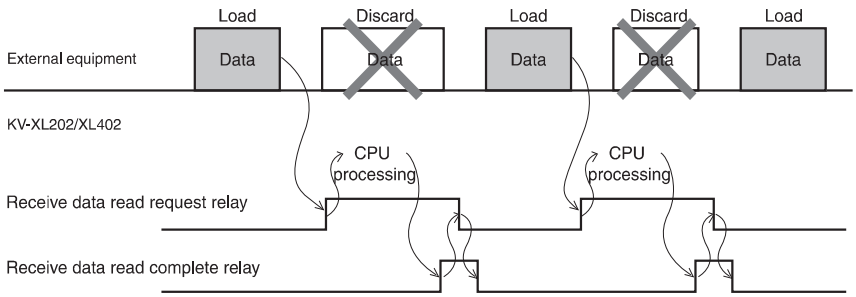
The buffer clear mode is a method generally referred to as “streaming”, and is selected when connecting peripherals that send data in one direction at high speed. Select this mode when connecting to a Keyence BL Series Barcode Reader.

In the normal mode or response receiving mode, all data received by the KV-XL202/XL402 is captured as valid data. For this reason, when communicating with peripherals that sends data at high speed, processing of the receive buffer on the KV-XL202/XL402 may not be able to keep up with arriving data, and data corruption may occur. In the buffer clear mode, new data that is received while previous received data is being processed is ignored, and only the latest data is captured at all times.

In the buffer clear mode, data cannot be sent from the KV-XL202/XL402.



The communication procedure is as follows.



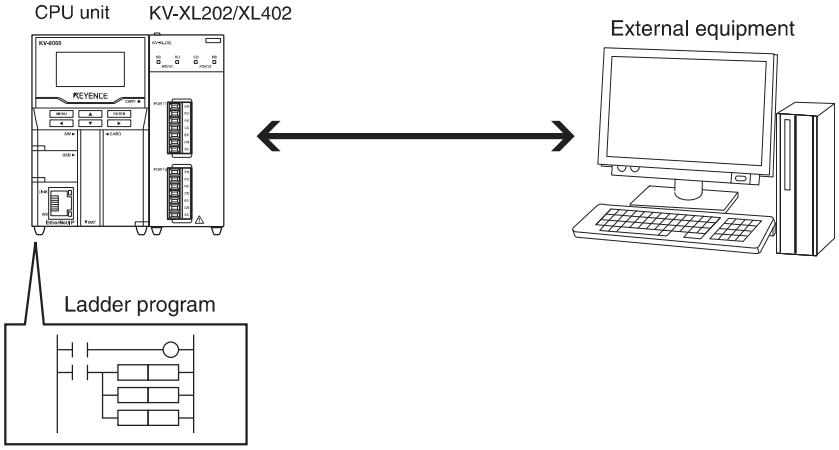
Point

- **The buffer clear mode can be used only when the data that is sent by the peripherals contains a delimiter. This mode cannot be used in the case of data that does not contain a delimiter.**
- **When using buffer clear mode, the data that is being received is discarded once after the delimiter is received, so that it is not processed, and is loaded from the start of the next receive data. For this reason, loading of the receive data is performed only once for two data receiving operations. To capture all received data, do not use the buffer clear mode.**

10-4 Making the Ladder Program

This section describes how to create a ladder program required for communicating in the non-procedure mode. Ladder program can be made using the Keyence Ladder Support Software KV STUDIO. Start programming after setting the leading relay No. and the data memory No. to be used for communication with Unit Editor.

"2-5 Set Up with Unit Editor" (Page 2-11)



Setting relays and DM Nos. to be used for communication

The following describes the procedure for setting relays and DM Nos. using Unit Editor.
This setting must be performed before starting programming. These relays and DMs (data memories) are used, for example to send/receive data or verify communication errors.

1 Start the Unit Editor, and click "Auto-assign Relay/DM" button.

Relays and DM Nos. of each unit are set automatically.
Relays and DM Nos. of that have been set can be changed in "Unit setup" window.

Other procedure

- Select "Convert (P)" → "Auto-assign Relay/DM" from the menu.
- Press F5 key

Point

When setting manually, it can not be same as the system relay/system DM range occupied by other units.
"2-5 Set Up with Unit Editor" (Page 2-11)
To reduce the number of occupied DMs of the DV-XL202/XL402, specify the setting of "Device assignment type" to "UG (buffer memory)". In this case, data memories for communication are assigned only to the buffer memory. The buffer memory can be read or written directly from the flow. When programming with ladder, please read and write using the UREAD/UWRIT instructions.
When using the unit interrupt, be sure to set the "Device assignment type" to "UG (buffer memory)".

Assigning relays for communication

- The "leading relay" is the relay having the smallest No. of the relays that are used for communication. 16-point (1-channel) relays starting from the leading relay are assigned as input relays and the following 16-point (1 channel) relays are assigned as output relays.

Point

- **Explanations in this section describe the relays that are secured for communication as "leading relay", "leading relay + 1" ... "leading relay +110".**
- **Take care to prevent the relays to be secured for communication from overlapping relays that are used for other functions in the ladder program.**

Assigning data memories for communication

- The "leading data memory" is the data memory having the smallest No. of the data memories that are used for communication.

Point

- **Explanations in this section describe the data memories that are secured for communication as "leading DM + 1" ... "leading DM + 600".**
- **Take care to prevent the data memories that are occupied for communication from overlapping data memories that are used for other functions in the ladder program.**

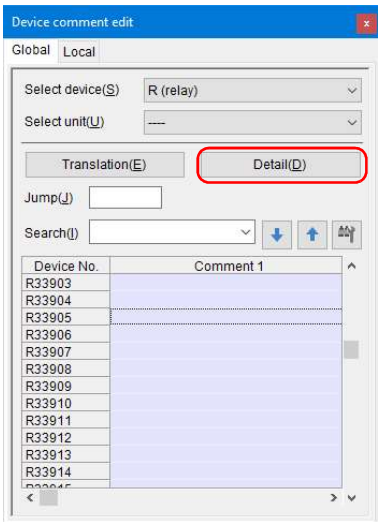
■ Register unit device comments

Intrinsic device comments are registered in relays and DMs reserved for system in each KV series unit. After setting relay/DM No. with Unit Editor, register unit device comments with KV STUDIO.

1 Select "View (V)"→ "Device comment edit window(C)" from the menu, and "Device comment edit window" appears. Then click "Detail (D)" button.

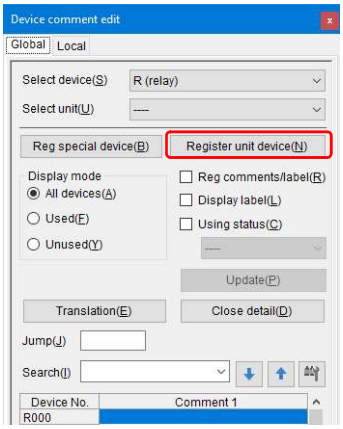
Other procedure

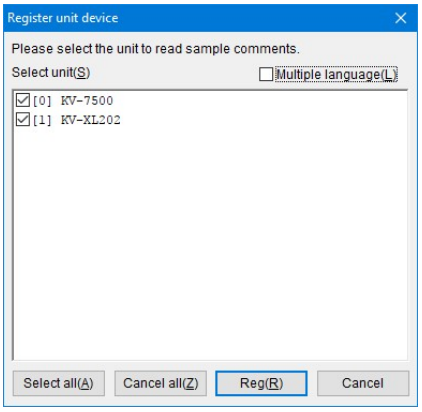
-
- Ctrl + F7 key
- Double-click "Device comments" in workspace
- Right-click and select "Comments edit window".



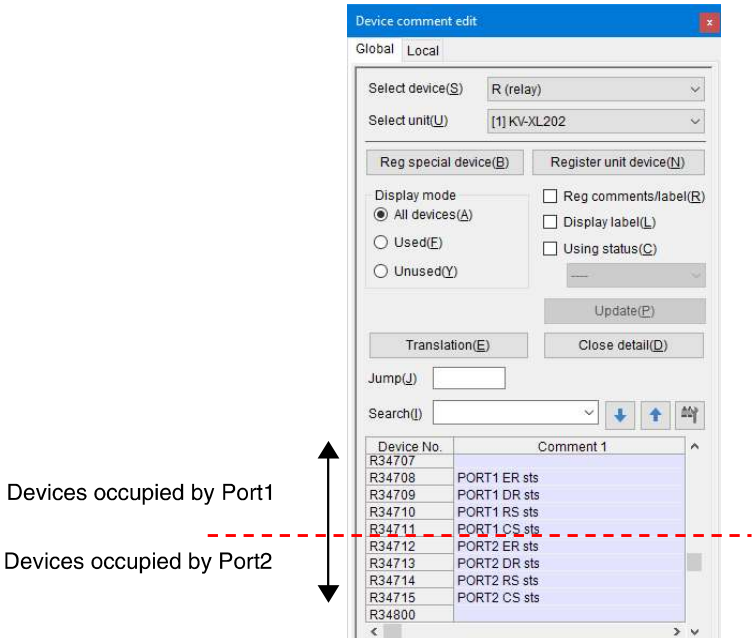
<Device comment edit window>

2 **Click "Register unit device (N)" button and select "KV-XL202" or "KV-XL402" from the "Register unit device" dialog box that pops up.**





3 **Click "Reg" to complete the registration.**



Devices Used in the Non-procedure mode

The following describes the lists of relays and DMs (data memories) used for the non-procedure mode.

n : For Port 1: Leading relay No. + Number of occupied relays common to port 1 and port 2 (2 ch)

: For Port 2: Leading relay No. + Number of occupied relays common to port 1 and port 2 (2 ch) + Number of port 1 occupied relays

"Device Map Overview" (Page 2-14)

■ Output relays

Output relays are used for controlling the KV-XL202/XL402, and are turned ON/OFF by the ladder program.

Relay	Name	Function	See page
n+000	Non-procedure communications enabled relay	When this relay is turned ON, data can be sent and received.	10-28
n+001	Non-procedure send request relay	When this relay turns ON, transmission from the KV-XL202/XL402 to external devices begins. This relay is used for sending data.	10-31
n+002	Non-procedure RX data read end relay	This relay turns ON when reception processing of data is completed. This relay is used for controlling data reception.	10-31
n+003	Non-procedure default set request relay	When this relay turns ON, default values are stored to the data memory for setting communications at the up edge of the communication enable relay.	10-37
n+005	Non-procedure sequence clear request relay	When this relay turns ON during transmission/ reception, the communications sequence is cleared, and the state that was active before transmission/ reception is returned to.	10-38
n+007	Non-procedure break signal TX request relay	When this relay turns ON, the break signal is transmitted. When it turns OFF, transmission of the break signal is stopped.	10-39
n+010*	Non-procedure ER OFF request relay	When this relay turns ON, the data terminal ready signal (pin No.5) is set to Low. When this relay turns OFF, the data terminal ready signal (pin No.5) is set to High.	10-40

* Enabled only for KV-XL202 and disabled for KV-XL402.

■ Input relays

Input relays are turned ON/OFF by the KV-XL202/XL402.

Relay	Name	Function	See page
n+100	Non-procedure communication OK relay	This relay is turned ON when the communication enable relay is ON and data can be sent or received. It turns OFF when the communications enable relay turns OFF.	10-39
n+101	Non-procedure send end relay	This relay turns ON when transmission to an external device from KV-XL202/XL402 is completed. This relay is used for sending data.	10-31
n+102	Non-procedure RX data read request relay	This relay turns ON when data is received by KV-XL202/XL402 from an external device. This relay is used for receiving data.	10-31
n+103	Non-procedure processing error relay	This relay turns ON when data received by the KV-XL202/XL402 from an external device can no longer be processed. It turns OFF when the data can be processed.	10-40
n+104	Non-procedure communications error relay	This relay turns ON when a communications error occurs. It turns OFF when communications was successful.	10-40
n+105	Non-procedure sequence clear end relay	This relay turns ON when the sequence clear request relay turns ON and clearing of the sequence is completed. It turns OFF when the sequence clear request relay turns OFF.	10-38
n+106	Non-procedure data setting error relay	This relay turns ON when the data of the data memory for setting communications is inappropriate.	10-41
n+107	Non-procedure break signal sending relay	This relay turns ON while the break signal is being sent.	10-39
n+108*	ER state relay	Data terminal ready signal. This relay turns ON/OFF by the state of (pin No.5).	10-39
n+110*	DR state relay	Data set ready signal. This relay turns ON/OFF by the state of (pin No.6).	10-39
n+111*	RS state relay	This relay turns ON/OFF by the state of the transmission request signal (pin No.3).	10-39
n+112*	CS state relay	This relay turns ON/OFF by the state of the send enable signal (pin No.4).	10-39

* Enabled only for KV-XL202 and disabled for KV-XL402.

■ Data memories and expansion unit buffer memory

For communications in the Non-procedure mode, continuous 600 data memories are used.

N : For Port 1: Leading DM No. + Number of occupied DMs common to port 1 and port 2 (10 words)

: For Port 2: Leading DM No. + Number of occupied DMs common to port 1 and port 2 (10 words) + Number of port 1 occupied DMs

"Device Map Overview" (Page 2-14)

M : Leading buffer memory (UG) address in the non-procedure mode

For Port 1 M=#12000

For Port 2 M=#13000

DM	Buffer memory address	Name	Function	Default	See page
N + 000	M + 000	Non-procedure send data length	Specify the length (number of words or number of bytes) of the data to send to external devices from the KV-XL202/XL402.	–	10-30
N + 001	M + 001	Non-procedure send data 1	Write the data to send.	–	10-28
...		...	...	...	...
N + 256	M + 256	Non-procedure send data 256	Write the data to send.	–	10-28
N + 257	M + 257	Non-procedure receive data length	The length (number of words or number of bytes) of data received by the KV-XL202/XL402 from an external device is written.	–	10-35
N + 258	M + 258	Non-procedure receive data 1	The data received by the KV-XL202/XL402 from an external device is written.	–	10-35
...		...	...	...	...
N + 513	M + 513	Non-procedure receive data 256	The data received by the KV-XL202/XL402 from an external device is written.	–	10-35
N + 514	M + 514	Non-procedure data storage unit	Specify which unit, word unit or byte unit, to write by when data is stored to the data memory.	0 (Byte unit)	10-20
N + 515	M + 515	Non-procedure mode setting	Specify one of normal mode, response reception mode or buffer clear mode.	0 (normal mode)	10-21
N + 516	M + 516	Non-procedure timeout check setting	Specify the timeout check time when using the response reception mode.	0	10-22
N + 517	M + 517	Non-procedure TX header setting (2 bytes)	Specify the header for during transmission.	–	10-22

DM	Buffer memory address	Name	Function	Default	See page
N + 518	M + 518	Non-procedure TX delimiter setting (2 bytes)	Specify the delimiter for during transmission.	CR, LF	10-23
N + 519	M + 519	Non-procedure RX header setting (2 bytes)	Specify the header for during reception.	–	10-24
N + 520	M + 520	Non-procedure RX delimiter setting (2 bytes)	Specify the delimiter for during reception.	CR, LF	10-26
N + 521	M + 521	Non-procedure RX data length setting	Specify the length (receive data length) that is to be regarded as data during reception of data by the KV-XL202/XL402.	512	10-27
N + 522 to N + 599	M + 522 to M + 599	Reserved for system	–	–	–

Point

- **The values of each DM can be set to their defaults in a single operation by using the default set relay.**
  "Setting Default Values to Data Memories" (Page 10-37)
  Be sure to set each of the DMs by the ladder program except when setting to default values.
- **Leading DM + 522 to + 599 cannot be used other functions in the ladder program as they are occupied by the KV-XL202/XL402.**
- **When using the X-Unit function, set the "Device assignment type" to "UG (buffer memory)" with the Unit Editor. In this case, the DMs of the specified port will not be occupied.**
- **"A-4 Buffer Memory Address" (Page A-5)**

Flow of Ladder Program

To perform communications in the non-procedure mode, programming for “Preparing for communications” and “Sending/receiving text” is required. Program for confirmation of communications errors, for example, as required. Check the flow of the programs in the figure below.

■ Preparing for communications (common to all modes)

Setting of relays and DM Nos. to be used for communications
“Setting relays and DM Nos. to be used for communication” (Page 10-10)

■ Transmission/reception in the normal mode

Data transmitted (KV-XL202/XL402 → external device)

Setting of data storage unit
“Setting the Data Storage Unit” (Page 10-20)

▼

Setting to normal mode
“Set Mode” (Page 10-21)

▼

Setting of header for transmission
“Setting the Header for Sending” (Page 10-22)

▼

Setting of delimiter for transmission
“Setting the Delimiter for Sending” (Page 10-23)

▼

Communications with external devices enabled
“Enabling Communication with Peripherals” (Page 10-28)

▼

Setting of data to send
“Setting the Data to be Sent” (Page 10-28)

▼

Setting of send data length
“Setting the Send Data Length” (Page 10-30)

▼

Start of communications
“Sending/Receiving Data” (Page 10-31)

▼

Transmission completed

Data received (external device → KV-XL202/XL402)

Setting of data storage unit
“Setting the Data Storage Unit” (Page 10-20)

▼

Setting to normal mode
“Set Mode” (Page 10-21)

▼

Setting of header for reception
“Setting the Receive Header” (Page 10-24)

▼

Setting of delimiter for reception
“Setting the Delimiter for Receiving” (Page 10-26)

▼

Setting of received data length
“Setting the Receive Data Length” (Page 10-27)

▼

Communications with external devices enabled
“Enabling Communication with Peripherals” (Page 10-28)

▼

Data received
“Sending/Receiving Data” (Page 10-31)

▼

▼

Reception completed

“ Reference Ladder Program” (Page 10-42)

■ Transmission/reception in the response reception mode

Setting of data storage unit
"Setting the Data Storage Unit" (Page 10-20)

▼

Setting to response reception mode
"Set Mode" (Page 10-21)

▼

Setting of timeout check time
"Setting the Timeout Verify Time" (Page 10-22)

▼

Setting of header for transmission
"Setting the Header for Sending" (Page 10-22)

▼

Setting of delimiter for transmission
"Setting the Delimiter for Sending" (Page 10-23)

▼

Setting of header for reception (response)
"Setting the Receive Header" (Page 10-24)

▼

Setting of delimiter for reception (response)
"Setting the Delimiter for Receiving" (Page 10-26)

▼

Setting of received data length
"Setting the Receive Data Length" (Page 10-27)

▼

Communications with external devices enabled
"Enabling Communication with Peripherals" (Page 10-28)

▼

Setting of data to send
"Setting the Data to be Sent" (Page 10-28)

▼

Setting of send data length
"Setting the Send Data Length" (Page 10-30)

▼

Start of synchronized transmission
"Sending/Receiving Data" (Page 10-31)

▼

Transmission completed

■ Reception in the buffer clear mode

Setting of data storage unit
"Setting the Data Storage Unit" (Page 10-20)

▼

Setting of data storage unit
"Set Mode" (Page 10-21)

▼

Setting of header for reception
"Setting the Receive Header" (Page 10-24)

▼

Setting of delimiter for reception
"Setting the Receive Data Length" (Page 10-27)

▼

Setting of received data length
"Setting the Receive Data Length" (Page 10-27)

▼

Communications with external devices enabled
"Enabling Communication with Peripherals" (Page 10-28)

▼

Data received
"Sending/Receiving Data" (Page 10-31)

▼

Reception completed

■ Other (common to all modes)

Program as required.

- Checking for communication errors
  “Checking the Presence of a Communication Error” (Page 10-40)

- Initializing data memories
  “Setting Default Values to Data Memories” (Page 10-37)

- Clearing the communication sequence
  “Clearing the Communication Sequence” (Page 10-38)

- Capturing received data
  “Data Received from Peripherals” (Page 10-35)

- Sending the break signal
  “Sending the Break Signal” (Page 10-39)

- Checking viability of communication with peripherals
  “Checking Viability of Communication with Peripherals” (Page 10-39)

- Checking the control line status
  “Checking Viability of Communication with Peripherals” (Page 10-39)

- Controlling the ER signal
  “Checking Viability of Communication with Peripherals” (Page 10-39)

Setting the Data Storage Unit

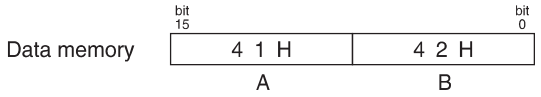
Normal | Response receiving | Buffer clear

When writing the data to send/receive to the send data area or the receive data area, set whether to write in word unit or in byte unit.

Byte unit

The characters currently written to the low 8 bits (bits 0 to 7) of the data memory and the characters currently written to the high 8 bits (bits 8 to 15) are regarded as the characters to send/ receive. Almost all of the text processing instructions of the dedicated instructions handle data in byte unit. When processing data to send/receive by these kind of instructions, it is handy to set the data storage unit to byte unit. The maximum number of bytes (512 characters) that can be sent/received in a single operation is 512 bytes.

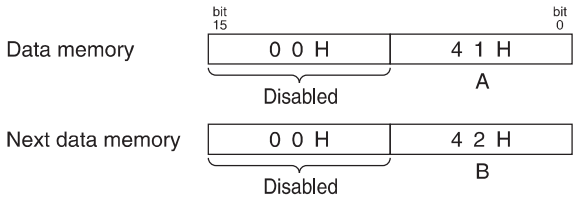
Example **When writing "AB"**



Word unit

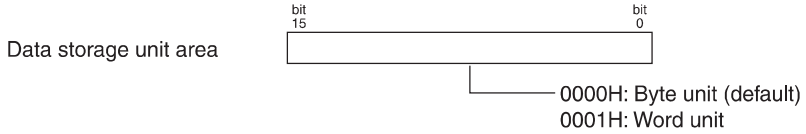
Only the characters currently written to the low 8 bits of the data memory are regarded as the characters to sent/receive. (The data of the high 8 bits are ignored.) In ladder programming language, data is basically processed in word unit. For this reason, it is convenient to set the data storage unit to word unit when monitoring ladder programs by the KV STUDIO ladder support software. The maximum number of bytes (256 characters) that can be sent/received in a single operation is 256 bytes.

Example **When writing "AB"**

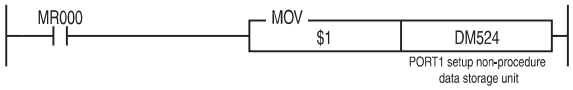


■ How to setup

To set the data storage unit, write the following values to “data storage unit area (Leading DM +524)”.



Example **Set the data storage unit of port 1 to word unit when the leading data memory is set to DM00000.**



Set Mode

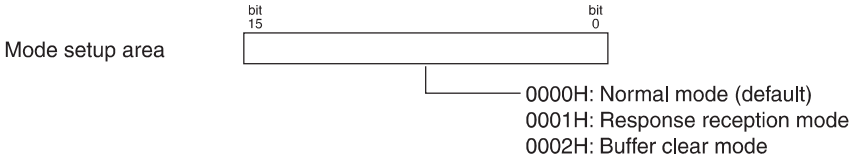
Normal **Response receiving** **Buffer clear**

Select the appropriate mode from among the normal mode, response receiving mode, and buffer clear mode to match the communication procedure of peripherals to be connected.

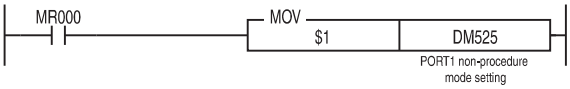
“Normal mode” (Page 10-7)
“Response receiving mode” (Page 10-8)
“Buffer clear mode” (Page 10-9)

■ How to setup

To set the mode, write the following values to “mode setup area (Leading DM +525)”.



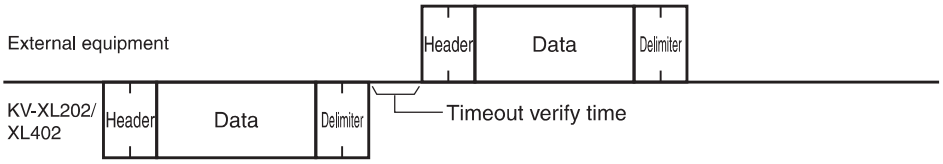
Example **Set port 1 to the response receiving mode when setting the leading data memory to DM00000.**



Setting the Timeout Verify Time

Normal | **Response receiving** | Buffer clear

Set the timeout verify time of responses when using the response receiving mode. The “timeout verify time” is the maximum time from sending of data by the KV-XL202/XL402 to the peripherals up to receiving of the response. If there is no response within the preset timeout verify time, the timeout error occurs, and the communication error relay (leading relay +304) turns ON.

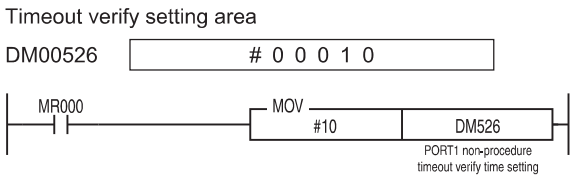


■ How to setup

Write the timeout verify time to the “timeout verify time setup area (leading DM +526)”.

- Set 10 ms as “1”.
  For example, to set to 100 msec, write “10” in decimal.
  100 msec = 10 msec x 10
- The range is 1 to 4095 (10 to 40950 msec).
- When “0” is set, the timeout check is not performed.

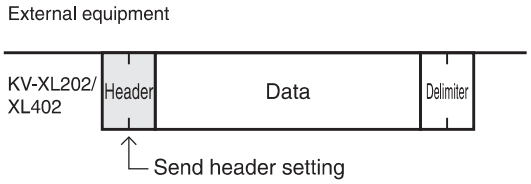
Example **Set the timeout verify time of port 1 to 100 msec when the leading data memory is set to DM00000.**



Setting the Header for Sending

Normal | **Response receiving** | Buffer clear

Set the header of the data to send to peripherals from the KV-XL202/XL402 when using the normal mode or the response receiving mode. Set the type of header when prefixing the data with a header. When the data is not to be prefixed with a header, disable the header. This setting is not required when the buffer clear mode is used, and will be ignored even if it is set.

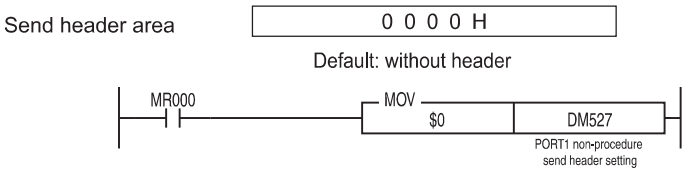


Point **The same code (character) cannot be used for headers and delimiters.**

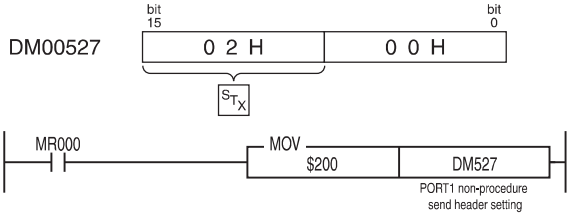
■ How to setup

To set the header for sending, write the ASCII code (Hex) of the header to the “send header setup area (leading DM +527)”.

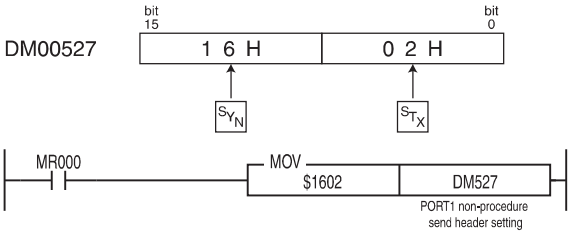
- A header of up to two bytes can be set. In this case, set in order high byte followed by low byte.
- When the data is not to be prefixed with a header, write “0000H”.



Example **One header: Set the header of port 1 to ST_X when the leading data memory is DM00000.**



Two headers: Set the header of port 1 to SY_N ST_X when the leading data memory is DM00000.



Setting the Delimiter for Sending

Normal **Response receiving** **Buffer clear**

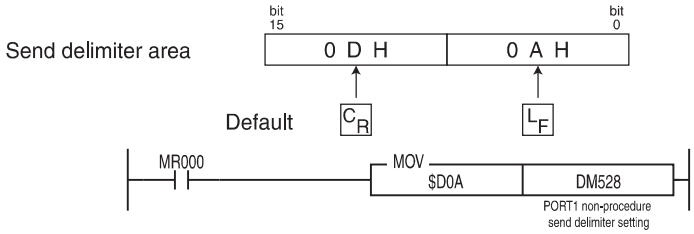
Set the delimiter of the data to send to peripherals from the KV-XL202/XL402 when using the normal mode or the response receiving mode. Set the type of delimiter when prefixing the data with a delimiter. When delimiters are not to be inserted in the data, disable delimiters.
This setting is not required when the buffer clear mode is used, and will be ignored even if it is set.

Point **The same code (character) cannot be used for headers and delimiters.**

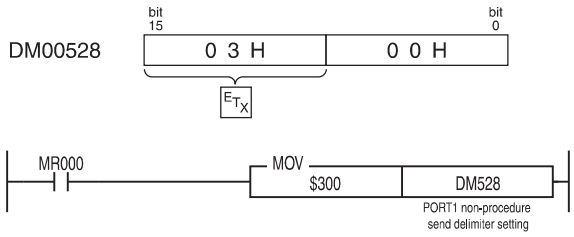
■ How to setup

To set the delimiter for sending, write the ASCII code (Hex) of the delimiter to the “send header setup area (leading DM +528)”.

- A delimiter of up to two bytes can be set. In this case, set in order high byte followed by low byte.
- When delimiters is not to be prefixed with a header, write “0000H”.



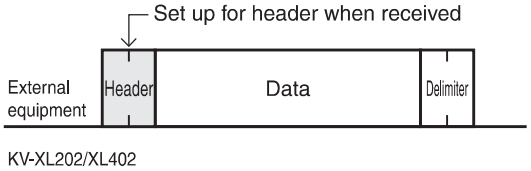
Example **One delimiter: When the leading data memory is DM00000, the Port 1 delimiter is set to ETX.**



Setting the Receive Header

Normal | **Response receiving** | **Buffer clear**

Set the header of the data (response) to be received by the KV-XL202/XL402 from peripherals. Set the type of header when prefixing the data with a header. When the data is not to be prefixed with a header, disable the header.

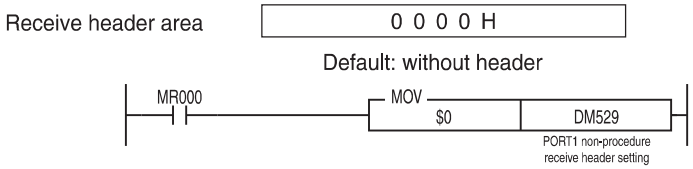


Point **The same code (character) cannot be used for headers and delimiters.**

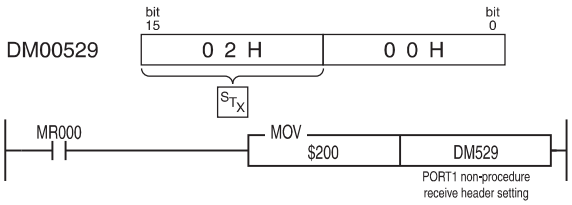
■ How to setup

To set the header for receiving, write the ASCII code of the header to the “reception header setup area (leading DM +529)”.

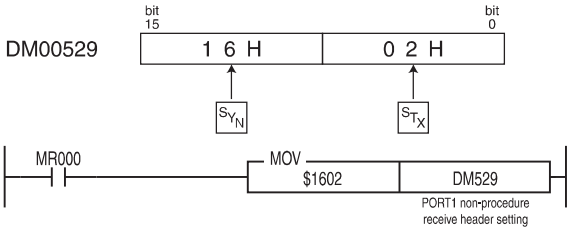
- A header of up to two bytes can be set. In this case, set in order high byte followed by low byte.
- When the data is not to be prefixed with a header, write “0000H”.



Example **One header: Set the header of port 1 to S_{T_X} when the leading data memory is DM00000.**



Two headers: Set the header of port 1 to S_{Y_N} S_{T_X} when the leading data memory is DM00000.



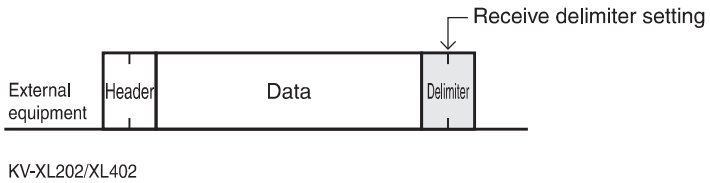
Setting the Delimiter for Receiving

Normal | Response receiving | Buffer clear

Set the delimiter to be used when data (response) is to be received by the KV-XL202/XL402 from peripherals. Set the type of delimiter when prefixing the data with a delimiter. When delimiters are not to be inserted in the data, disable delimiters.
Be sure to set the type of delimiter when receiving variable data, and when using the buffer clear mode. Otherwise, data cannot be received successfully as completion of data receiving cannot be recognized.

Point

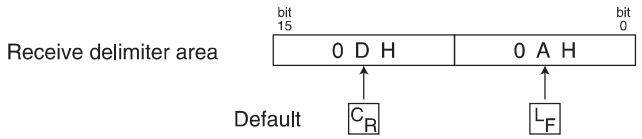
- **The same code (character) cannot be used for headers and delimiters.**
- **When receiving fixed length data, set the receiving delimiter to "00H" and receive data with the delimiter setting set to OFF. When the delimiter is set, receiving of data is completed once it is judged that the received data contains the delimiter that was set.**



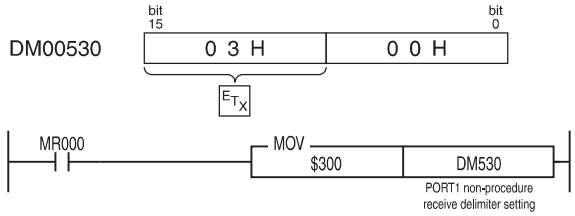
■ How to setup

To set the delimiter for receiving, write the ASCII code of the delimiter to the "reception delimiter setup area (leading DM +530)".

- A delimiter of up to two bytes can be set.In this case, set in order high byte followed by low byte.
- When delimiters is not to be prefixed with a header, write "0000H".



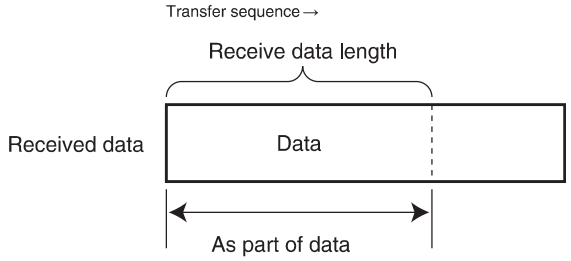
Example **One delimiter: Set the delimiter of port 1 to ETX when the leading data memory is DM00000.**



Setting the Receive Data Length

Normal | Response receiving | Buffer clear

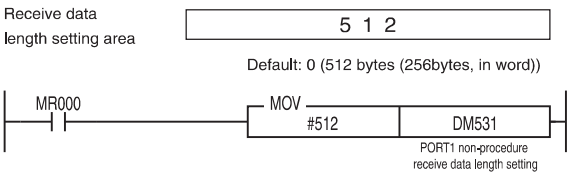
The “receive data length” is the number of bytes in the section, that is regarded as data to be written to the CPU Unit by the KV-XL202/XL402, in the received data (response). When receiving fixed length data of a specified data length, set the length of the data to receive. When the receive data length is set to “0”, the KV-XL202/XL402 processes data on the assumption that the receive data length is set to 512 bytes (256 bytes in the case of word unit when the data storage unit is set to byte unit).



■ How to setup

To set the receive data length, write the data length to the “receive data length setup area (leading DM +531)”.

- When receiving fixed length data of a specified data length, set the receive data length within the range 1 to 512 bytes matched to the data to be received.
- When receiving variable length data with specified delimiters, set the receive data length to 0 or 512 (256 in the case of word unit when the data storage unit is set to byte unit).

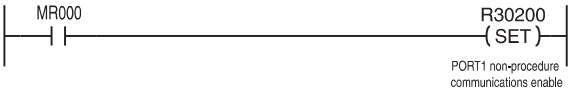


Point **When receiving fixed length data, set the receiving delimiter to “00H” and receive data with the delimiter setting set to OFF. When the delimiter is set, receiving of data is completed once it is judged that the received data contains the delimiter that was set.**

Enabling Communication with Peripherals Normal Response receiving Buffer clear

When communication conditions have been set to occupied DMs, set the communication enable relay (leading relay +200) to ON. At the up edge of the communication enable relay, the preset communication conditions are registered, and the KV-XL202/XL402 is ready for communication with peripherals. communication with peripherals is not possible when the communication enable relay is OFF. When the communication enable relay is ON and communication with peripherals is possible, the communication ready relay (leading relay) turns ON. When the communication enable relay is OFF and communication with peripherals is not possible, the communication ready relay (leading relay) turns OFF.

Example **Enable communication between peripherals and port 1 on the KV-XL202/XL402 when the leading relay is R30000.**



Setting the Data to be Sent Normal Response receiving Buffer clear

Set the data to send to peripherals from the KV-XL202/XL402 when using the normal mode or the response receiving mode. The data setting method differs according to the currently set data storage unit.

"Setting the Data Storage Unit" (Page 10-20)

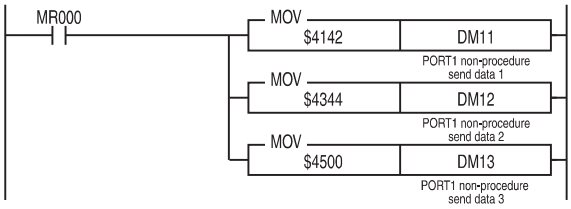
This setting is not required when the buffer clear mode is used,

■ How to set in byte unit

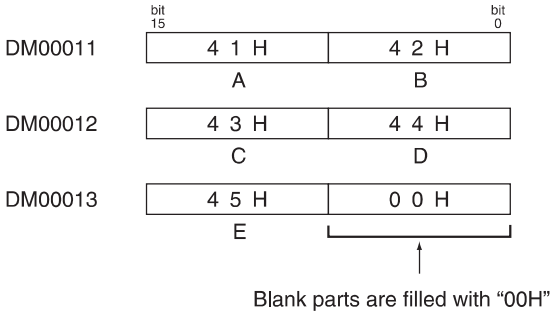
Write the data to send to peripherals to "send data area (leading DM +11 to +266)".

- Up to 512 bytes (512 characters) of data can be sent in a single operation.

Example **Set the send data from port 1 to "ABCDE (41H, 42H, 43H, 44H, 45H)" when the leading data memory is DM00000.**



Send data area

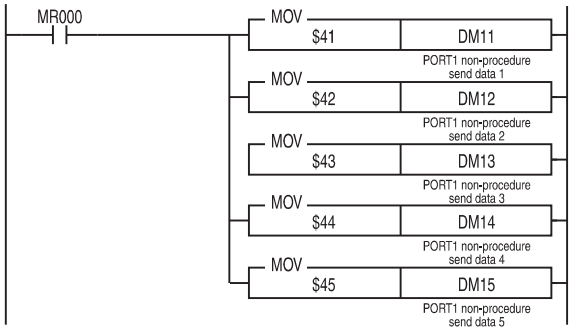


■ How to set in word unit

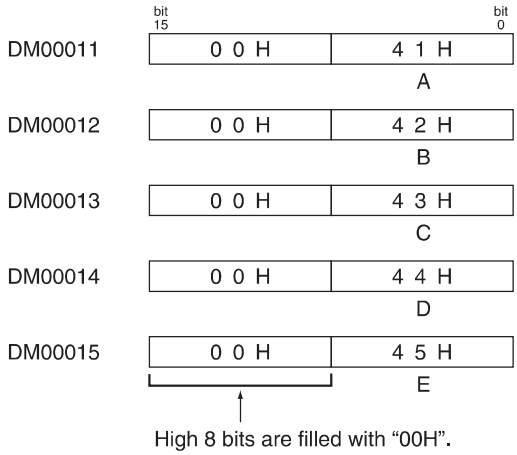
To set the data to send to peripherals, write the data to “send data area (leading DM +2 to +257)”.

- Up to 256 bytes (256 characters) of data can be sent in a single operation.

Example **Set the send data from port 1 to “ABCDE (41H, 42H, 43H, 44H, 45H)” when the leading data memory is DM00000..**



Send data area



Setting the Send Data Length

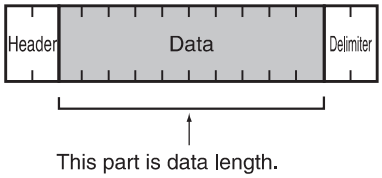
Normal | Response receiving | Buffer clear

Set the length of the data (data length) to send to peripherals from the KV-XL202/XL402 when using the normal mode or the response receiving mode. In other words, of the data currently written to the send data area (leading DM +11 to +266), set how many bytes (or how many words) of data from the leading DM +11 are to be sent to peripherals.
This setting is not required when the buffer clear mode is used.

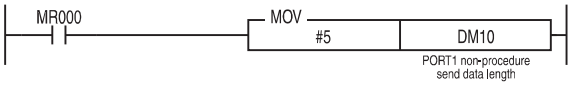
■ How to setup

Write the length of the data to send to the "send data length setup area (leading DM +10)".

- When the data storage unit is set to byte unit, write the number of bytes, and when set to word unit, write the number of words.
  "Setting the Data Storage Unit" (Page 10-20)
- Do not enter the number of bytes taken up by the header and delimiters to the data length.



Example **Set the send data length of port 1 to "5 bytes" when the leading data memory is DM00000.**



In byte

Send data length area	DM00010	0 0 0 0 5		Data length: 5 bytes
Send data area	DM00011	4 1 H (A)	4 2 H (B)	Sent data "ABCDE"
	DM00012	4 3 H (C)	4 4 H (D)	
	DM00013	4 5 H (E)	0 0 H	
	DM00014	0 0 H	0 0 H	Not used
	:	:		
	DM00266	0 0 H	0 0 H	

In word

Send data length area	DM00010	0 0 0 0 5		Data length: 5 bytes
Send data area	DM00011	0 0 H	4 1 H (A)	Sent data "ABCDE"
	DM00012	0 0 H	4 2 H (B)	
	DM00013	0 0 H	4 3 H (C)	
	DM00014	0 0 H	4 4 H (D)	
	DM00015	0 0 H	4 5 H (E)	
	DM00016	0 0 H	0 0 H	Not used
	:	:		
	DM00266	0 0 H	0 0 H	

High 8 bits are filled with "00H".

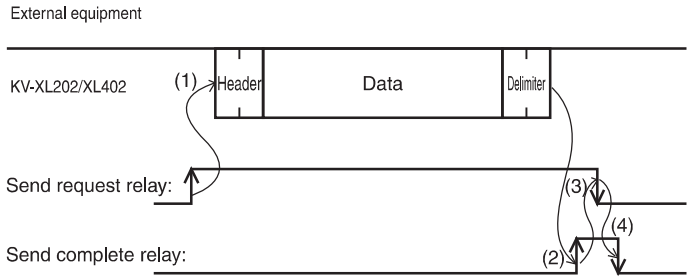
Sending/Receiving Data

Normal | Response receiving | Buffer clear

Input/output relays are used for sending/receiving data between the KV-XL202/XL402 and peripherals. The figures below show programs for sending/receiving data in each of the modes.

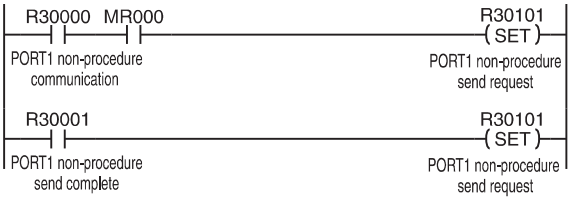
■ Standard mode

Sending

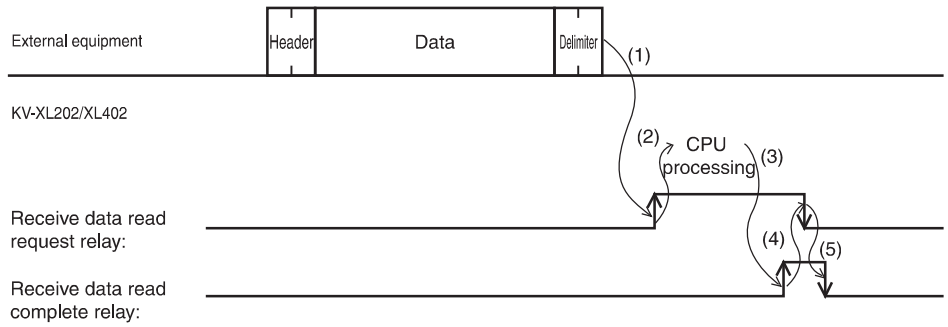


(1) When the sending request relay (leading relay +201) is turned ON by the ladder program, sending of data to peripherals from the KV-XL202/XL402 is started.
(2) When sending is completed, the KV-XL202/XL402 turns the sending completed relay (leading relay +1) ON.
(3) When the sending completed relay turns ON, turn the sending request relay OFF by the ladder program.
(4) When the sending request relay is turned OFF, the KV-XL202/XL402 turns the sending completed relay OFF.

Example **Send data to peripherals from port 1 on the KV-XL202/XL402 when the leading relay is R30000.**



Receiving



(1) When the KV-XL202/XL402 receives data, the receive data read request relay (leading relay +302) turns ON.
- The received data is stored to the receive data storage area (leading DM +268 to +523).
- When the receive data read request relay turns ON, the CPU Unit is enabled to process the received data.

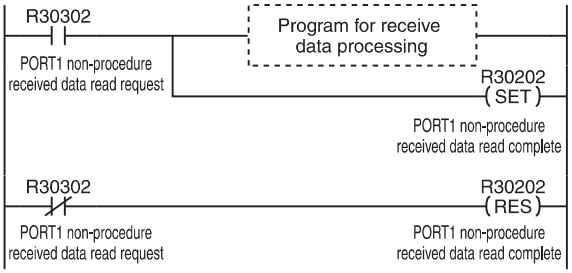
(2) Process the received data on the CPU Unit as necessary.

(3) When processing of received data by the CPU Unit is completed, turn the receive data read completed relay (leading relay +202) ON by the ladder program.

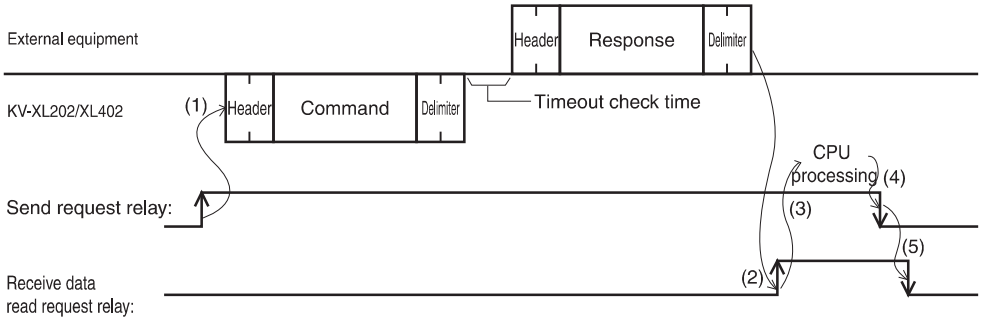
(4) When the receive data read completed relay is turned ON, the receive data read request relay is turned OFF.

(5) When the receive data read request relay is turned OFF, turn the receive data read completed relay OFF by the ladder program.

Example **Receive data from peripherals on port 1 on the KV-XL202/XL402 when the leading relay is R30000.**



■ In the response receiving mode



(1) Turn the sending request relay (leading relay +201) ON by the ladder program.
- Sending of the data from the KV-XL202/XL402 to peripherals begins.

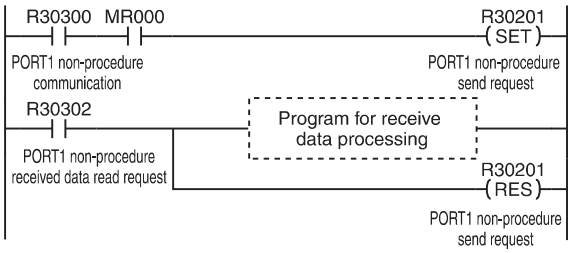
(2) When receiving of the response is completed, the KV-XL202/XL402 turns the receive data read request relay (leading relay +302) ON.
- The received data is stored to the receive data storage area (leading DM +368 to +523).
- When the receive data read request relay turns ON, the CPU Unit is enabled to process the received data.

(3) Process the received data on the CPU unit as necessary.

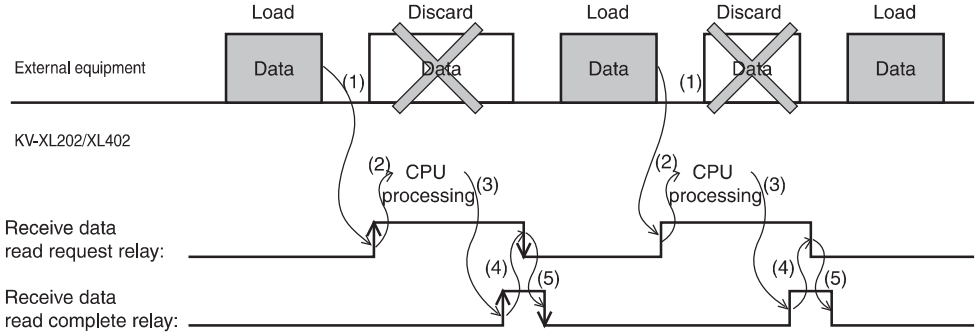
(4) When processing by the CPU unit is completed, turn the sending request relay OFF by the ladder program.

(5) When the sending request relay is turned OFF, the KV-XL202/XL402 turns the receive data read request relay OFF.

Example **Send data to peripherals from port 1 on the KV-XL202/XL402 when the leading relay is R30000.**



■ In the buffer clear mode



(1) When the KV-XL202/XL402 receives data, the receive data read request relay (leading relay +302) turns ON.
- The received data is stored to the receive data storage area (leading DM +268 to +523).
- When the receive data read request relay turns ON, the CPU Unit is enabled to process the received data.

(2) Process the received data on the CPU Unit as necessary.

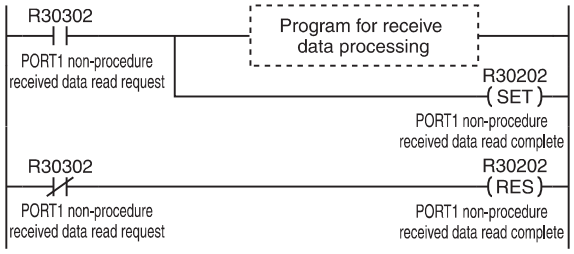
(3) When processing of received data by the CPU Unit is completed, turn the receive data read completed relay (leading relay +202) ON by the ladder program.

(4) When the receive data read completed relay is turned ON, the receive data read request relay is turned OFF.

(5) When the receive data read request relay is turned OFF, turn the receive data read completed relay OFF by the ladder program.

Point
- **In the buffer clear mode, data that arrives from peripherals while the previous received data is being processed is discarded.**
- **When using the buffer clear mode, set the receiving delimiter. When the receiving delimiter is not set, data is not received correctly.**

Example **Receive data from port 1 on the KV-XL202/XL402 when the leading relay is R30000.**



Data Received from Peripherals

Normal | Response receiving | Buffer clear

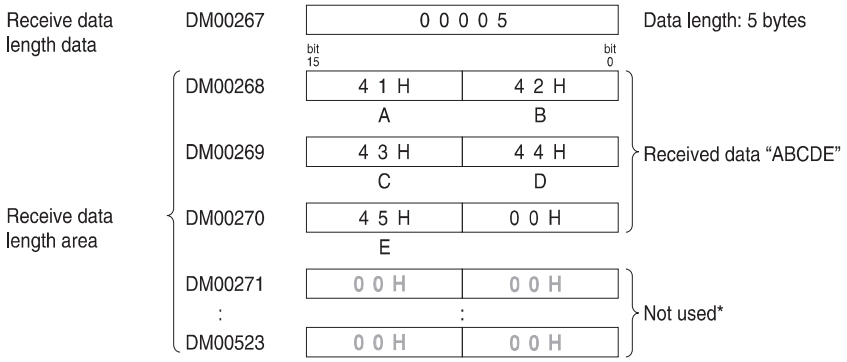
When data is received from peripherals by the KV-XL202/XL402, the length (number of bytes) of that data is written to receive data length area (leading DM +267). The content of the received data is written to receive data storage area (leading DM +268 to 523). Note, however, that how the data is stored differs according to the data storage unit setting.

"Setting the Data Storage Unit" (Page 10-20)

■ When the data storage unit is set to byte unit

The data received by the KV-XL202/XL402is written one character at a time to the low 8 bits (bit 0 to 7) and high 8 bits (bits 8 to 15) of the receive data storage area (leading DM +268 to 523). The data length's worth of data from the leading DM + 268 is the latest data.

Example **When text data is received on port 1 in order "ABCDE" (41H, 42H, 43H, 44H, 45H) when the leading data memory is DM00000.**

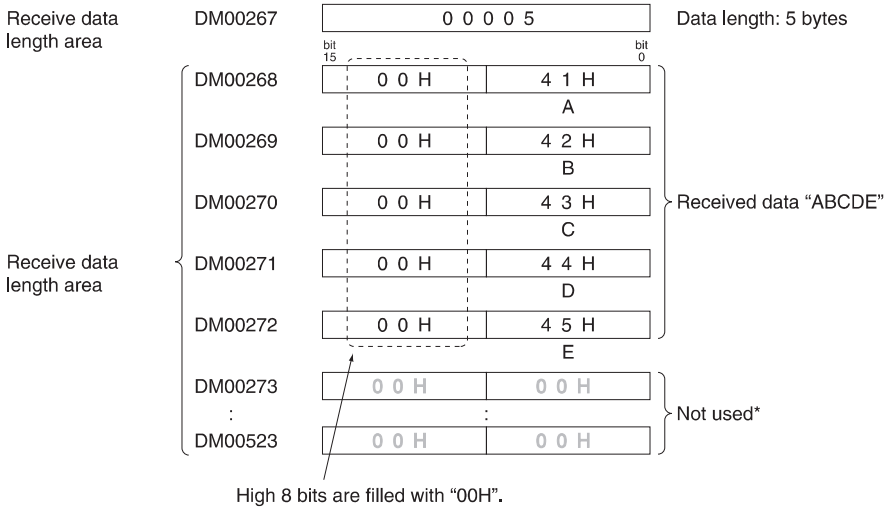


* Data received before remains as it is.

■ When the data storage unit is set to word unit

The data received by the KV-XL202/XL402 is written to only the low 8 bits (bits 0 to 7) of the receive data storage area (leading DM + 268 to +523). The high 8 bits are not used, and 00H is written. The data length's worth of data from the leading DM + 268 is the latest data.

Example **When the leading data memory is DM0, the text data for Port 1 are received in the order of ABCDE (41H, 42H, 43H, 44H, 45H)**



* If you have received data before, the previously received data is held.

* DM264 is filled with "00H (NUL)".

Setting Default Values to Data Memories

Normal | **Response receiving** | **Buffer clear**

Default values can be set to data memories that are currently occupied for communication. When using the data storage unit, header, delimiter, mode, etc. at their defaults, programming can be made a lot easier by using this function to return settings to their defaults. The table below summarizes the defaults of each data memory.

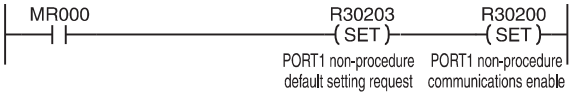
(N: Leading DM No.)

DM	Name	Default
N+000	Error No.	(none)
N+001	Error detailed information 1	(none)
N+002	Error detailed information 2	(none)
N+010	Send data length area	(none)
N+011 to +266	Send data area	(none)
N+267	Receive data length area	(none)
N+268 to +523	Receive data area	(none)
N+524	Data storage unit setup area	0: byte unit
N+525	Mode setup area	0: Normal mode
N+526	Timeout check setup area	0
N+527	TX header setup area	0000H: Without header
N+528	TX delimiter setup area	0D0AH: CR LF
N+529	RX header setup area	0000H: Without header
N+530	RX delimiter setup area	0D0AH: CR LF
N+531	RX data length setup area	0: 512 bytes (in case of byte unit) : 256 bytes (in case of word unit)

■ How to setup

To set up default DM value, please open the Default Setup Relay (leading relay + 203). After this, set up the default DM value in the rising edge of the Communication Enable Relay (leading relay + 200).

Example **Set the data memory for communication to its default values when the leading relay is R30000.**

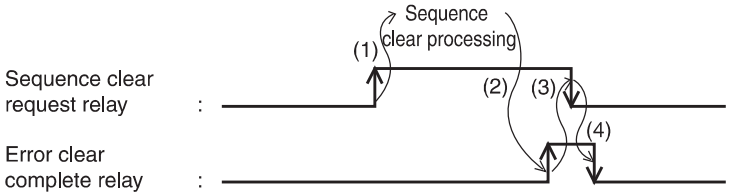


Clearing the Communication Sequence Normal Response receiving Buffer clear

The communication sequence (details of communication transactions) during sending/ receiving of data to and from peripherals can be cleared to return to the KV-XL202/XL402 to the status that was active before sending/reception was begin. Program this as required.

■ How to setup

To clear the communication sequence, program as follows:



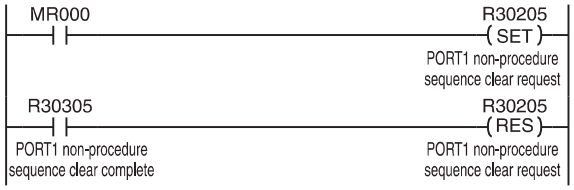
(1) Turn the sequence clear request relay (leading relay +205) ON by the ladder program.
Clear processing of the sequence begins at the up edge of the sequence clear request relay.

(2) When clearing of the sequence is completed, the KV-XL202/XL402 turns the sequence clear completed relay (leading relay + 305) ON.

(3) When the sequence clear completed relay turns ON, the sequence clear request relay is turned OFF by the ladder program.

(4) When the sequence clear request relay turns OFF, the KV-XL202/XL402 turns the sequence clear completed relay OFF.

Example **Clear the communication sequence of port 1 when the leading relay is R30000.**



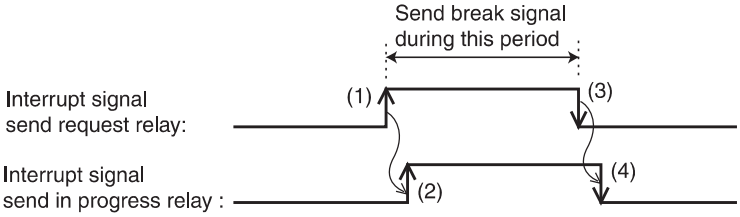
Sending the Break Signal

Normal | Response receiving | Buffer clear

The break signal can be sent to peripherals from the KV-XL202/XL402 to initialize their communication port. Program this as required.

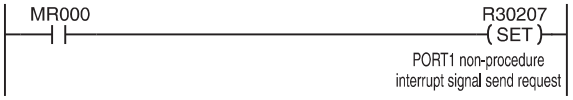
■ How to setup

To send the break signal to peripherals, program as follows:



(1) Turn the break signal sending request relay (leading relay +207) ON by the ladder program. Sending of the break signal is started at the up edge of the break signal sending request relay.
(2) During sending of the break signal, the break signal sending in progress relay (leading relay + 307) turns ON.
(3) When the break signal sending request relay is turned OFF by the ladder program, sending of the break signal stops.
(4) When the break signal sending request relay turns OFF, the break signal sending in progress relay turns OFF.

Example **Send the break signal from port 1 when the leading relay is R30000.**



Checking Viability of Communication with Peripherals

Normal | Response receiving | Buffer clear

You can check the viability of communication between the KV-XL202 and peripherals. Program this as required.

■ How to check the status of the control line

To check viability of communication, monitor the ON/OFF status of the communication ready relay (leading relay). This relay turns ON when the communication enable relay (leading relay + 200) is ON and communication with peripherals is possible. If the communication enable relay is OFF and communication with peripherals is not possible, communication ready relay turns OFF.
(n: Leading relay No.)

Relay	Name	Corresponding Signal	KV-XL202 port 1 PIN No.
n+308	ER status relay	ER (data terminal ready)	5
n+310	DR status relay	DR (data set ready)	6
n+311	RS status relay	RS (send request)	3
n+312	CS status relay	CS (send relay)	4

Relay	Status of Control Line
ON	High
OFF	Low

Controlling the ER signal

Normal | Response receiving | Buffer clear

The status of the ER (data terminal ready) signal (pin No.4) on KV-XL202's port (port 1 only) can be switched between High and Low to notify peripherals. Program this as required.

■ How to switch the ER signal

To set the ER signal to a High (terminal ready status), turn the ER OFF request relay (leading relay +210) to OFF. To set the signal to Low (terminal not ready status), turn the ER OFF request relay to ON. The status of the ER signal can be checked by monitoring the ON/OFF status of the ER status relay (leading relay +308).

Example **Set the ER signal on port 1 to Low when the leading relay is R30000.**

Checking the Presence of a Communication Error

Normal | Response receiving | Buffer clear

You can check for communication errors during communication between the KV-XL202/XL402 and peripherals. Program this as required.

■ How to check for communication errors

communication errors appear when communication data is corrupted, for example, by noise being applied to the data on the communication line.
To check for communication errors, monitor the ON/OFF status of the communication error relay (leading relay +304).
This relay turns ON when there is an error, and turns OFF when there is no error.

Communication error relay	Communication error
ON	Yes
OFF	No

■ How to check for receiving errors

To check whether or not data received by the KV-XL202/XL402 from peripherals is being processed normally, monitor the ON/OFF status of the processing error relay (leading relay +303). When data can no longer be processed by the KV-XL202/XL402, for example, when a large volume of data is sent from an peripherals, the processing error relay turns ON. It turns OFF when the data can be processed.

Processing error relay	Receiving Processing Error
ON	Yes
OFF	No

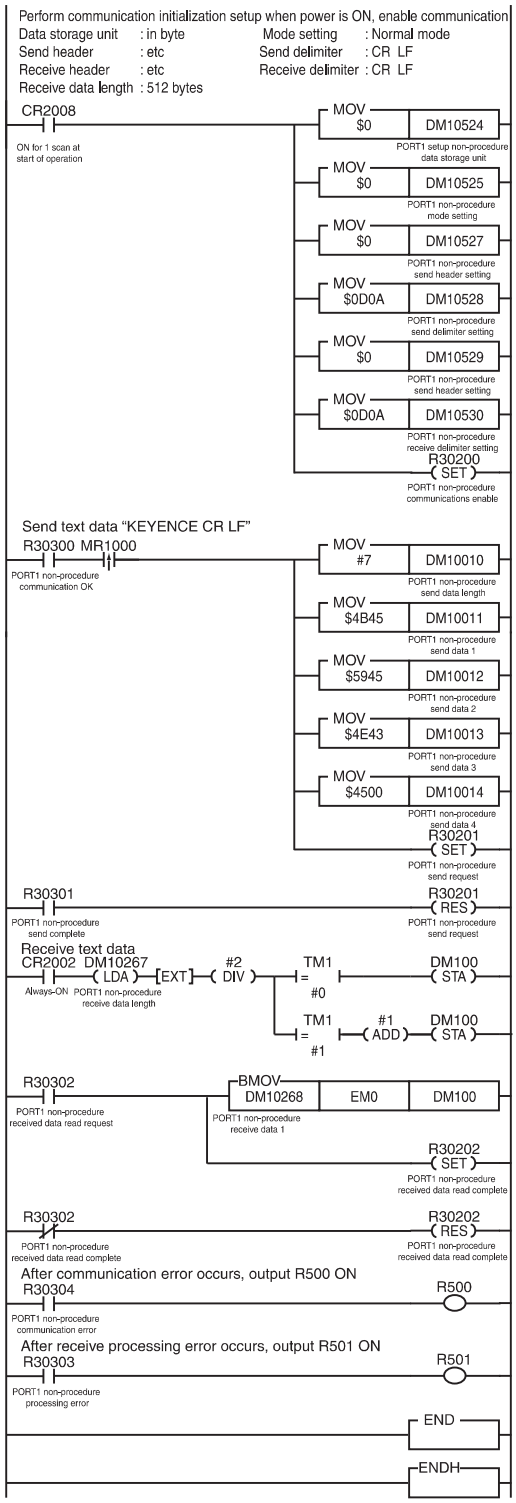
■ How to check for setting data errors

To check whether or not the setting data of the communication conditions currently set to occupied DMs is appropriate, monitor the ON/OFF status of the setting data error relay (leading relay +306). When the communication enable relay (leading relay +200) is turned ON, the setting data error relay turns ON if the setting data is inappropriate. If you correct the setting data to create it appropriate and turn the communication enable relay ON, the setting data error relay turns OFF.

Data setting error relay	Setting Data
ON	Inappropriate
OFF	Appropriate

Reference Ladder Program

The following shows an example ladder program for sending and receiving data from port 1 in the normal mode when the leading data memory is DM10000 and the leading relay is R30000.

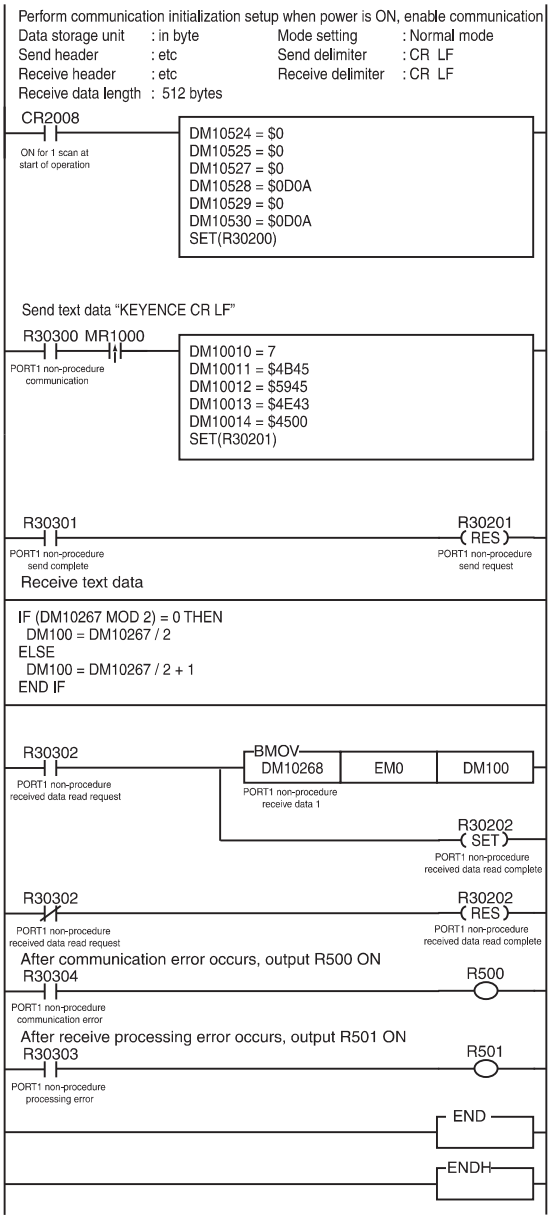



```
; Perform communication initialization setup when power is ON, enable communication
; Data storage unit    : in byte     Mode setting      : Normal mode
; Send header          : etc         Send delimiter    : CR LF
; Receive header       : etc         Receive delimiter : CR LF
; Receive data length  : 512 bytes
LD CR2008              ; on for 1 scan at start of operation
MOV $0 DM10524
MOV $0 DM10525
MOV $0 DM10527
MOV $0D0A DM10528
MOV $0 DM10529
MOV $0D0A DM10530
SET R30200             ; PORT1 non-procedure communications enable
; Send text data "KEYENCE CRLF"
LD R30300              ; PORT1 non-procedure communication
ANP MR1000
MOV #7 DM10010
MOV $4B45 DM10011
MOV $5945 DM10012
MOV $4E43 DM10013
MOV $4500 DM10014
SET R30201             ; PORT1 non-procedure send request
LD R30301              ; PORT1 non-procedure send complete
RES R30201             ; PORT1 non-procedure send request
; Receive text data
LD CR2002
LDA DM10267
CON
EXT
CON
DIV #2
CON
MPS
AND= TM1 #0
STA DM100
MPP
AND= TM1 #1
ADD #1
CON
STA DM100
LD R30302              ; PORT1 non-procedure received data read request
; BMOV DM10268 EM0 DM100 ; Port 1 receive data 1
SET R30202             ; PORT1 non-procedure received data read complete
LDB R30302             ; PORT1 non-procedure received data read request
RES R30202             ; PORT1 non-procedure received data read complete
; After communication error occurs, output R500 ON
LD R30304              ; PORT1 non-procedure communication error
OUT R500
; After receive processing error occurs, output R501 ON
LD R30303              ; PORT1 non-procedure processing error
OUT R501
```

If a mnemonics list is used, it is convenient to enter the ladder program on the left.

"How to Utilize Mnemonics List" (Page 17)

Reference Create reference ladder programs by using scripts as follows.

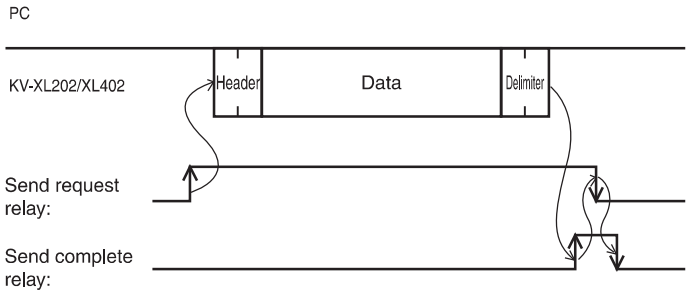


10-5 When Communicating with a PC

When communicating with a PC in the non-procedure mode, create a communication program on the PC side. The communication program can be made using Microsoft's Visual-Basic or other similar software. Use the same header, delimiter and data length (in case of a fixed length) settings that are set on the ladder program. The following describes the communication procedure using variable length data in the normal mode.

Sending Data to the PC from the KV-XL202/XL402 (KV-XL202/XL402 → PC)

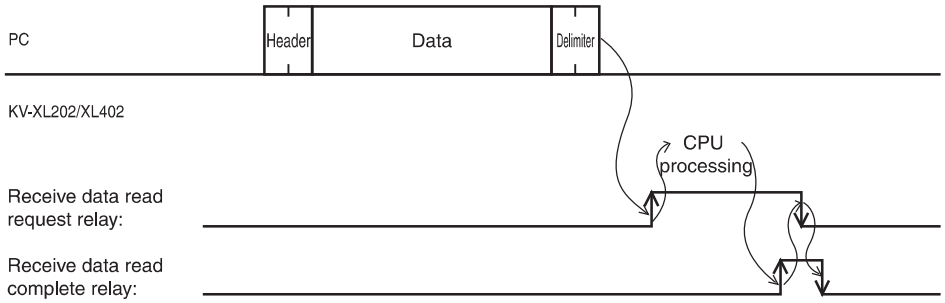
The following illustrates the communication procedure when sending data to a PC from the KV-XL202/XL402 (that is, when the PC receives data from the KV-XL202/XL402).



Send request relay → [leading relay +201]
Send complete relay → [leading relay +301]

Receiving Data on the KV-XL202/XL402 from the PC (PC → KV-XL202/XL402)

The following illustrates the communication procedure when the KV-XL202/XL402 receives data from the PC (that is, when the PC sends data to the KV-XL202/XL402).



Receive data read request relay → [leading relay +302]
Receive data read complete relay → [leading relay +202]