

YASNAC XRC OPTIONS INSTRUCTIONS

FOR DATA TRANSMISSION FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN SETUP MANUAL
MOTOMAN-□□□ INSTRUCTIONS
YASNAC XRC INSTRUCTIONS
YASNAC XRC OPERATOR'S MANUAL
YASNAC XRC OPERATOR'S MANUAL for BEGINNERS

The YASNAC XRC operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual.

Do not submit this electronic data to the customer.

THIS MATERIAL IS FOR STUDY PURPOSE ONLY.
YOU MUST READ THE MANUAL WHICH ENCLOSED
WITH A ROBOT.





MANDATORY

- **This manual explains the data transmission function of the YASNAC XRC system and general operations. Read this manual carefully and be sure to understand its contents before handling the YASNAC XRC.**
- **General items related to safety are listed in Section 1: Safety of the Setup Manual. To ensure correct and safe operation, carefully read the Setup Manual before reading this manual.**



CAUTION

- **Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.**
- **The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.**
- **YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.**
- **If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.**
- **YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.**

NOTES FOR SAFE OPERATION

Read this manual carefully before installation, operation, maintenance, or inspection of the YASNAC XRC.

In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.



WARNING

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



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.



MANDATORY

Always be sure to follow explicitly the items listed under this heading.



PROHIBITED

Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items.



To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.



WARNING

- **Before operating the manipulator, check that servo power is turned off when the emergency stop buttons on the playback panel or programming pendant are pressed.**

When the servo power is turned off, the SERVO ON READY lamp on the playback panel and the SERVO ON LED on the programming pendant are turned off.

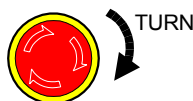
Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.



Emergency Stop Button

- **Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON**

Injury may result from unintentional or unexpected manipulator motion.



Release of Emergency Stop

- **Always set the Teach Lock before entering the robot work envelope to teach a job.**

Operator injury can occur if the Teach Lock is not set and the manipulator is started from the playback panel.

- **Observe the following precautions when performing teaching operations within the working envelope of the manipulator :**

- **View the manipulator from the front whenever possible.**
- **Always follow the predetermined operating procedure.**
- **Ensure that you have a safe place to retreat in case of emergency.**

Improper or unintended manipulator operation may result in injury.

- **Confirm that no persons are present in the manipulator's work envelope and that you are in a safe location before:**

- **Turning on the YASNAC XRC power**
- **Moving the manipulator with the programming pendant**
- **Running check operations**
- **Performing automatic operations**

Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop button is located on the right side of both the YASNAC XRC playback panel and programming pendant.



CAUTION

- **Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.**
 - Check for problems in manipulator movement.**
 - Check for damage to insulation and sheathing of external wires.**

- **Always return the programming pendant to the hook on the XRC cabinet after use.**

The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- **Read and understand the Explanation of the Alarm Display in the setup manual before operating the manipulator.**

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product.


The manipulator usually consists of the controller, the playback panel, the programming pendant, and supply cables.

The MOTOMAN manipulator is the YASKAWA industrial robot product.

In this manual, the equipment is designated as follows.

Equipment	Manual Designation
YASNAC XRC Controller	XRC
YASNAC XRC Playback Panel	Playback Panel
YASNAC XRC Programming Pendant	Programming Pendant

Descriptions of the programming pendant and playback panel keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with []. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [] but depicted with a small picture. ex. page key  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}
Playback Panel	Buttons	Playback panel buttons are enclosed in brackets. ex. [TEACH] on the playback panel

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and the SELECT key is pressed.

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1 Outline

The data transmission function is for communication with a host computer such as a personal computer in BSC complying protocol.

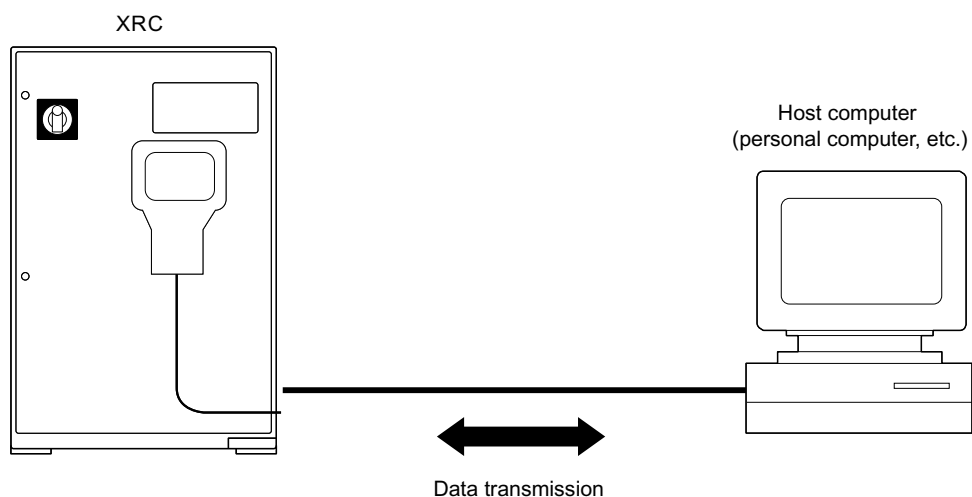
The data transmission function adopts a serial transmissin line and standard protocol, making easy connection to a host computer.

The data transmission function is not only for transmission of job but also for controlling robot system by a host computer using a set of commands.

The robot commands in the ASCII code command format are easy to use and helpful for a quick development of necessary software to be run on the host computer.

The data transmission function is divided into the following three functions.

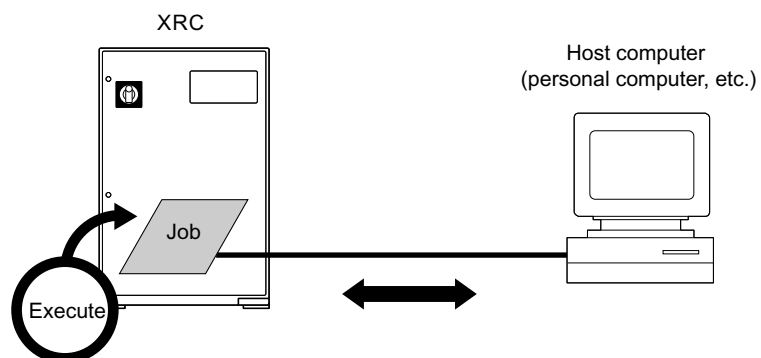
- DCI (Data Communication by Instruction)
- Stand-alone function
- Host control function



1.1 DCI Function

1.1 DCI Function

The DCI function executes instructions described in a job to perform data transmission with a host computer. This function loads and saves jobs and variables.

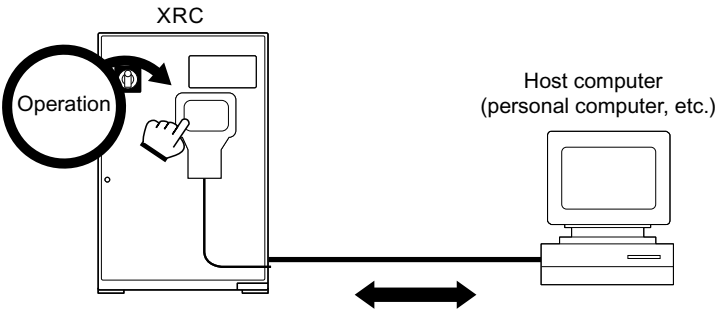


DCI Function

Job Transmission	Load	Job can be transmitted in either mode. • Single job • Related job
	Save	
	Delete	
Variable Transmission	Load	• Byte type global variables • Integer type global variables • Double precision type global variables
	Save	• Real number type global variables • Position type global variables (Robot axes, base axes, station axes)

1.2 Stand-alone Function

The stand-alone function is for data transmission with host computer by operation on the programming pendant. This function loads and saves jobs and condition data.



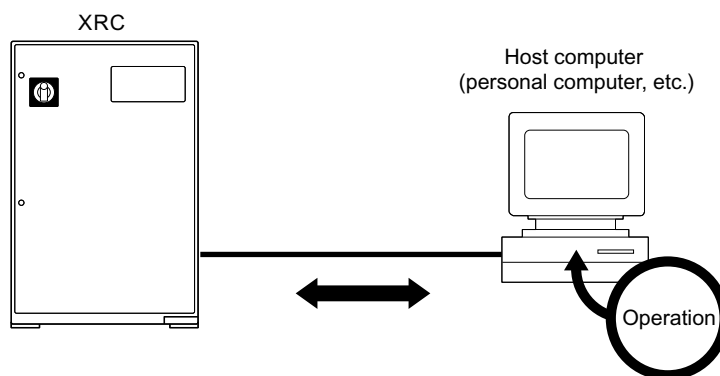
Stand-alone Function

Job Transmission	Load	Job can be transmitted in either mode. <ul style="list-style-type: none">• Single job• Related job
	Save	
	Verify	
Condition Data/ General Data Transmission	Load	<ul style="list-style-type: none">• Tool data• Weaving data• User coordinate data• Welding data• Variable data
	Save	
	Verify	
System Information Transmission	Save	<ul style="list-style-type: none">• System information• Alarm history

1.3 Host Control Function

1.3 Host Control Function

The host control function is for loading and saving jobs, reading robot status, and controlling the system by sending a command from a host computer.



Host Control Function

File Data Transmission Function	Job Transmission	Load	Jobs can be transmitted in either mode : • Single job • Related job
		Save	
	Condition Data/ General Data Transmission	Load	• Tool data • Weaving data • User coordinate data • Welding data • Variable data
		Save	
	System Information Transmission	Save	• System information • Alarm history

Host Control Function		
Robot Control Function	Status Reading	<ul style="list-style-type: none"> • Read of error and alarm codes • Read of current position in a joint coordinate system • Read of current position in a specified Cartesian coordinate system • Read of mode, cycle, motion, alarm error and servo status • Read of current job name, line No. and step No. • Read of all job names or related job names • Monitoring completion of manipulator operation • Read of specified user coordinate data • Read of control group and task selected status • Read of variable data
	System Control	<ul style="list-style-type: none"> • Start, hold • Reset, cancel • Job deletion • Master job setup • Job, line No. and step No. setup • Mode and cycle selection • Servo power supply ON/OFF • Programming pendant and playback panel interlock setup/release • Message display • Joint motion and linear motion to a specified Cartesian coordinate system • Linear motion by increments in a specified coordinate system • Joint motion and linear motion to a specified joint coordinate system • Conversion/reverse conversion of related job of a specified job (Relative job function is necessary) • Write of specified user coordinate data • Change of control group • Change of task to be controlled • Write of variable data

1.3 Host Control Function

2 For Using Data Transmission Function

2.1 Remote Mode

The data transmission function can be used with XRC in remote mode.

2.1.1 Remote Mode

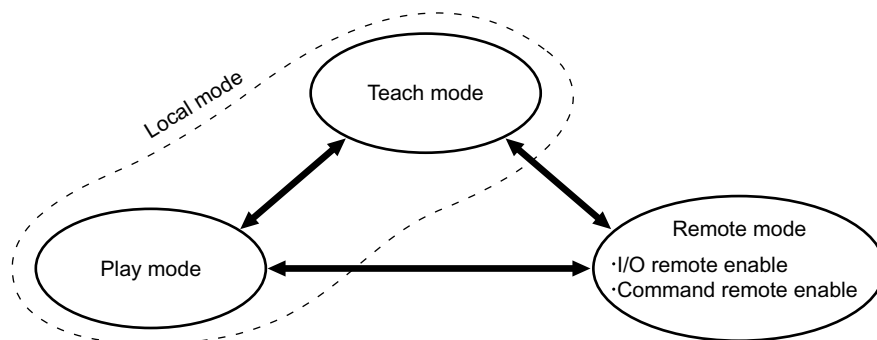
To use the data transmission function, set XRC to remote mode.

In remote mode, the operation is ordered from a host computer ; whereas in local mode, teach mode, and play mode, the programming pendant and playback panel are used for operating the system.

To switch to the remote mode or the local mode, either

- Press [REMOTE] on the playback panel, or
- Turn ON the remote selection signal of the external input signals.

The remote mode has two sub-modes ; “I/O remote enable” and “Command remote enable”. Which sub-mode takes effect in remote mode is set in the pseudo input display. Refer to Section 8 “Remote Function Setting”.



2.1 Remote Mode

Operation-site Mode	Operation-site	Condition to Enable the Operation
Local Mode	Programming pendant or playback panel	The remote lamp is OFF, or "INHIBIT PP/PANEL" in the pseudo input display is set to invalid.
Remote Mode I/O remote enable	External I/O control board	The remote lamp is ON, and "INHIBIT IO" in the pseudo input display is set invalid.
Command remote enable	External computer	The remote lamp is ON, and "CMD REMOTE SEL" in the pseudo input display is set valid.



In remote mode, usually operations of the programming pendant or the playback panel is disabled, but they can be also enabled. To enable all operations, refer to Section 8 "Remote Function Setting". To selectively enable some of the operations, set the parameter S2C110. For details, refer to Section 6.2 "Parameter List".

In remote mode, operations on the programming pendant and playback panel are valid except the operation-related entries. This holds true in "I/O remote enable" and "Command remote enable" submodes. The concept is based on the conventional I/O control introduced to command control.

Note that the edit-related operations can not be entered from more than one operating device.

In "Command remote enable" submode, to enable command remote controls only, issue the HLOCK command. When the HLOCK command is ON, operations on the programming pendant and playback panel are valid only hold and emergency stop. In this state, remote mode cannot be canceled, and the following I/O operations are disabled : selection between remote mode and local mode, external start, external servo ON, cycle selection, I/O prohibit, P.P/P.PANEL prohibit, and master job call. Other I/O operations are valid.

2.1.2 Command Remote Valid/Invalid

Availability of each function of data transmission differs depending on the command remote setting (Enabled / Disabled).

When the command remote is set invalid, the read/monitor system commands (hereinafter called read-only function) in the host control function in addition to the DCI function and stand-alone function can be used. For the details of read/monitor system commands, refer to Section 5.2.2 “List of Interlock for Commands of Host Control Function”..

Command Remote Setting	Function Availability
Invalid	DCI function available Stand-alone function available Host control function (only read-only function) available
Valid	Host control function (all commands) available

To validate the read-only function in the above host control function, set the parameter RS005 to “1”. When the command remote is validated by pressing [REMOTE] with the read-only function valid, the command remote status is entered so that all commands can be used. When the command remote is invalidated by pressing [REMOTE] again, the read-only function becomes validated again.

Parameter	Contents and Set Value	Initial Value
RS005	BSC port function specification when the command remote is invalidated 0 : DCI or stand-alone function 1 : Read-only function in host control	0

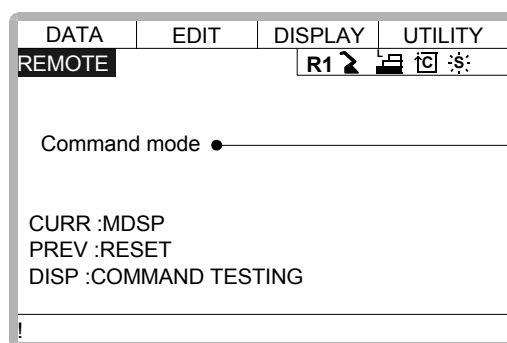
2.1.3 Display in Command Remote Mode

Even in command remote enabled submode, it is not necessary to call the command remote display because operations from XRC is available. To call the command remote display, select “REMOTE” from “I/O” under the top menu.

This display is used in common with the I/O remote mode display.

The message in the remote display changes according to the remote function selection. (Refer to Chapter 8 “Remote Function Setting”.)

2.2 Serial I/F Port Assignment



A message shown in the table below is displayed.

Remote Select Status		Message	Remarks
I/O Remote	Command Remote		
×	×	"Remote mode not specified"	Same when the remote lamp is OFF.
○	×	"I/O mode"	Only when the remote lamp is ON.
×	○	"Command mode"	
○	○	"I/O and Command mode"	
Read-only Function Valid		"Remote mode not specified"	"CURR" and "PREV" are displayed.

○ : Valid, × : Invalid

2.2 Serial I/F Port Assignment

The XRC has one serial interface port. The FC1 protocol and the BSC complying protocol (for data transmission function : option) can be assigned to the port to communicate with external devices.

A change in assignment can be made only in local mode.

Parameter	Contents and Set Value	Initial Value
RS000	Standard port protocol specification 0 : NON 1 : System reserved 2 : BSC LIKE (Data transmission function) 3 : FC1	2

2.3 Parallel Operation of XRC

The XRC is capable of parallel processing. For instance, it can check signals with programming pendant while saving files to YASNAC FC2, or can edit files with the programming pendant while monitoring operation status by the host control function.

The parallel operation has the following restrictions. When an operation against these restrictions is made, a warning message is displayed.

Operation	Warning
YASNAC FC2 Stand-alone Programming pendant Playback panel	Error message for 3 seconds
DCI	Alarm
Host control	Interpreter message (or error message)

2.3.1 No Multiple-operation of DCI, Stand-alone, and Host Control Functions

All DCI, stand-alone, and host control use BSC LIKE protocol and the same port, therefore these functions can not be performed by parallel processing.

Warning message : Serial port not defined

Warning message : Serial port being used

Warning message : Protocol being used

2.3.2 File Access and Editing for a Single Target

Access to a single target file is available. Parallel processing of reads from two or more sources is impossible.

During access to a file for other function, the HLOCK command of the host control function can not be issued.

Key operations are ignored while the HLOCK command is ON.

Warning message : Data accessed with other functions

2.4 Differences from MRC

The data transmission function in XRC is intended to reuse basically the user applications with succession to the data transmission of MRC.

There are some differences resulted from functional differences between the MRC and the XRC.

2.4.1 Multiport Processing

The XRC is not applicable for multiport processing.

2.4.2 Group Axes

The control group information used for the CGROUP and RGROUP commands in the host control function differs depending on the number of manipulators.

2.4.3 Coodinated Operation and Independent Operation

Up to 6 tasks can be changed by the CTASK command. No command related to coordinated operation is available.

2.4.4 Condition Data and System Data

Condition data and system data have different file name in option function, accordingly their communication header differ.

2.5 Transmission Specifications

This section explains the transmission specifications for the data transmission.

2.5.1 Basic Specifications

Interface	Complies to RS-232C (RS/CS method)
Transmission Speed	9600 bps
Transmission Mode	Half-duplex transmission system (point-to-point)
Synchronization system	Asynchronous (stop bit 1 * ¹)
Protocol	BSC LIKE
Transmission Code	ASCII, shift JIS 8-bit data length * ¹ Even parity * ¹ Nontransparent
Error Check	BCC
Response Method	ACK alternating response

*¹ Can be changed by transmission parameter setting

2.5.2 Transmission Control Characters

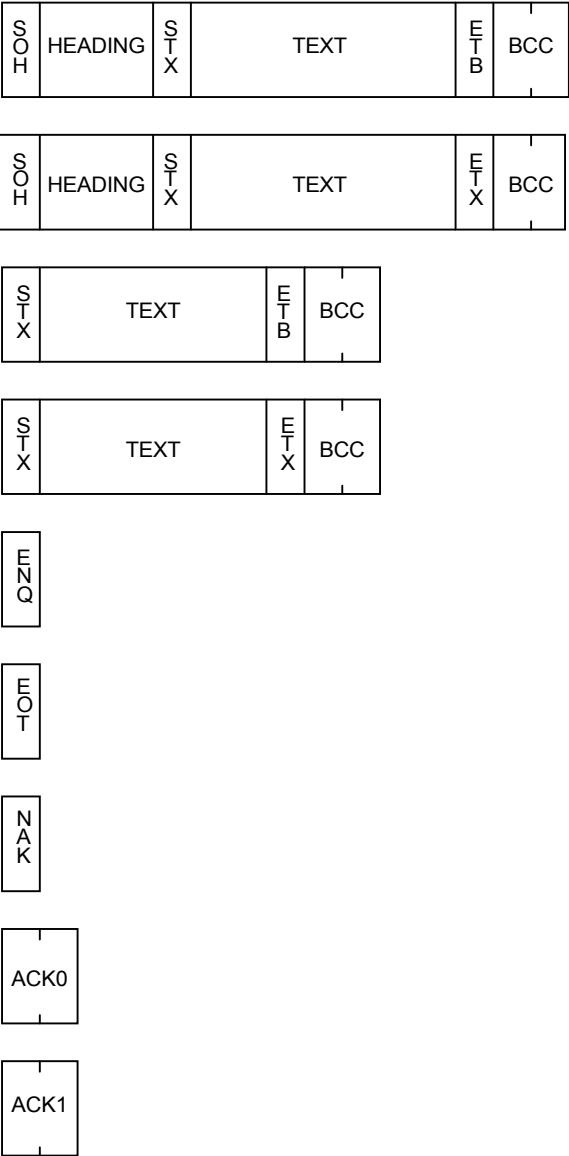
The transmission control characters are shown in the table below.

Transmission Control Characters and Codes

Control Character	Code (hexadecimal)	Meanings of Control Character
DLE	10	Data Link Escape
SOH	01	Start of Heading
STX	02	Start of Text
ETX	03	End of Text
EOT	04	End of Transmission
ENQ	05	Enquiry
NAK	15	Negative Acknowledgment
ETB	17	End of Text Block
ACK0	10, 30	Even Affirmative Acknowledgment
ACK1	10, 31	Odd Affirmative Acknowledgment

2.5.3 Transmission Format

The transmission format is as follows.

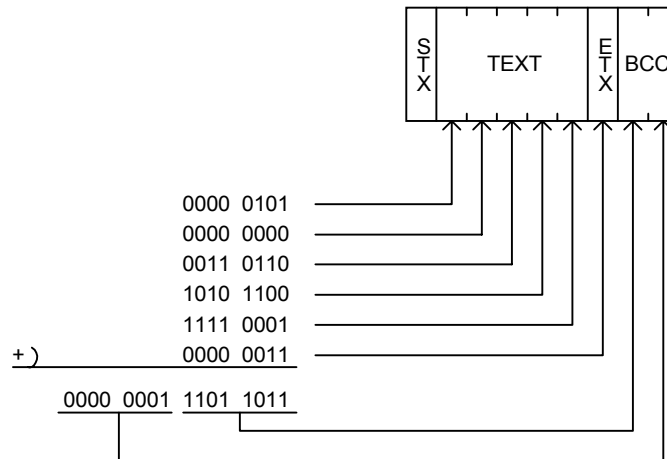


2.5.4 Error Control System

The error control is performed by a check sum of all the characters from SOH or STX to ETB or ETX.

The check sum is calculated as shown below.

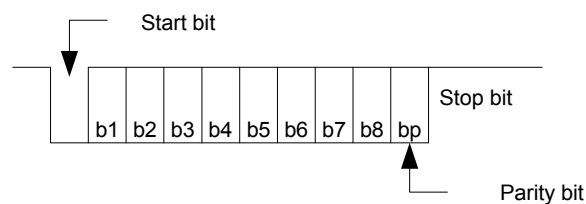
<Example>



- Start of calculation : Calculation is started when SOH or STX used as the block start sequence appears. These block start sequence are not included in the sum. As for a STX led by a SOH, STX is included in the sum.
- End of calculation : Calculation is ended when ETB or ETX used as the block end sequence appears, with the ETB or ETX included in the sum.

2.5.5 Character Configuration

The character configuration is as follows.



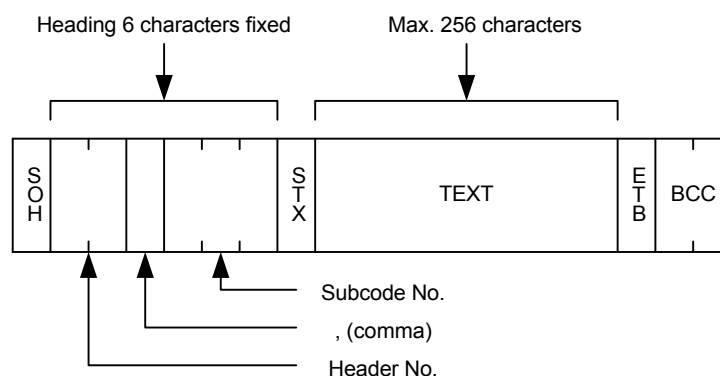
2.5.6 Data Link Establishment

A data link is established by responding ACK0 to ENQ.

2.5 Transmission Specifications

2.5.7 Configuration of Heading and Text

The configuration of heading and text is as follows.



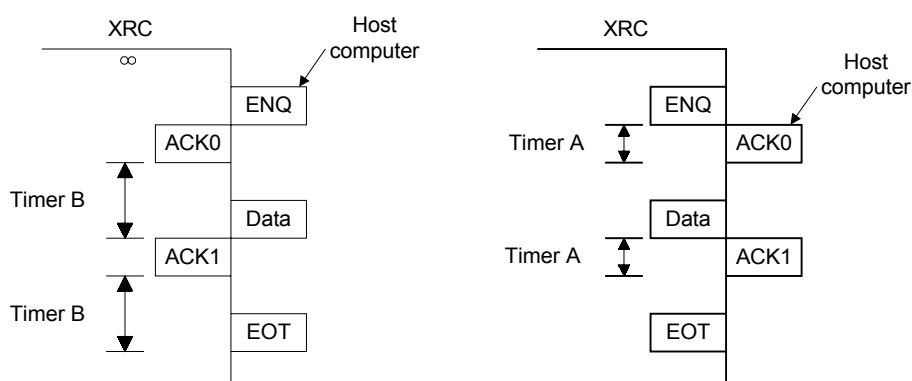
2.5.8 Transmission Parameters

■ Transmission Control Monitoring Timer

Two timers are provided for transmission control monitoring. Both are transmission parameters so that their settings can be changed for each system.

Timer A : Sequence monitoring timer. Serves as protection against invalid or no response. Recommended value is 3 sec.

Timer B : Text reception monitoring timer. Serves as protection against no response of text end character. Recommended value is 20 sec.



■ Transmission Control Resending Sequence

Two constants below are related to the transmission control resending sequence. Both are transmission parameters like the transmission control monitoring timers, whose settings can be changed for each system.

- Retry 1 : Number of resendings of a sequence character at an invalid or no response at all. Recommended value is 10 times.
- Retry 2 : Number of resendings of a text at a block check error (reception of NAK). Recommended value is 3 times.

Parameter	Contents and Set Value		Initial Value
RS030	Number of data bits	7 : 7 (bit) 8 : 8 (bit)	8
RS031	Number of stop bits	0 : 1 (bit) 1 : 1.5 2 : 2	0
RS032	Parity specification	0 : No specification 1 : Odd parity 2 : Even parity	2
RS033	Transmission speed specification	1 : 150 (baud rate) 2 : 300 3 : 600 4 : 1200 5 : 2400 6 : 4800 7 : 9600	7
RS034	Timer A	Sequence monitoring timer Serves as protection against invalid or no response Unit : 0.1 sec. (Setting range : 0 to 100)	30
RS035	Timer B	Text reception monitoring timer Serves as protection against no response of text end character Unit : 0.1 sec. (Setting range : 0 to 255)	200
RS036	Retry 1	Number of resendings of a sequence character at an invalid or no response (Setting range : 0 to 30)	10
RS037	Retry 2	Number of resendings of a text at a block check error (reception of NAK). (Setting range : 0 to 10)	3
RS038	Block check method	0 : Check sum	0

2.5.9 Connection of D-SUB Connector Pins

The connection of D-SUB connector pins is shown below.

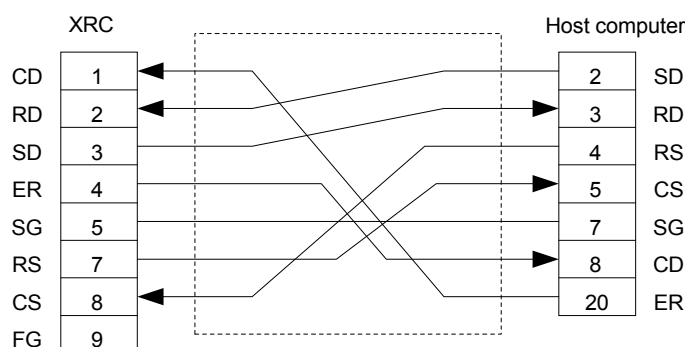
XCP01 board (D-SUB9P)

XRC		
CD	1	Carrier detect
RD	2	Data receive
SD	3	Data send
ER	4	Data terminal ready
SG	5	Grounding for signal
RS	7	Request to send
CS	8	Sending enabled
FG	9	Protective grounding

2.5.10 Connection

Since the system is “null-modem”, connect the pins as shown below.

XCP01 board



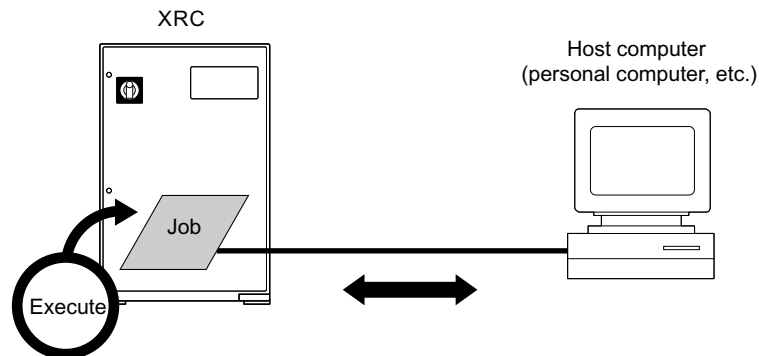
- Connect “RS” of the XRC to “CS” of a host computer. This prevents data overrun when reception processing speed of the XRC cannot catch up with data sending from the host computer. In other words, “RS” signal from the XRC controls start-hold of data transmission from the host computer. The sending interface controller must be capable of coping with CS input displacement in units of a single byte.
- The XRC sends data when the “CS” signal is ON.
- The “ER” signal of the XRC is always ON when transmission is ready. Use this signal on a host computer side whenever necessary.
- The “CD” signal of the XRC is connected to the “ER” signal of a host computer. However, the XRC does not use this signal.

3 DCI Function

3.1 Outline

The data communication by instruction (DCI) function loads, saves jobs and variables according to an instruction that executes data transmission with a host computer. The DCI function is classified as follows.

- Job load, save and delete functions
- Variable load and save functions



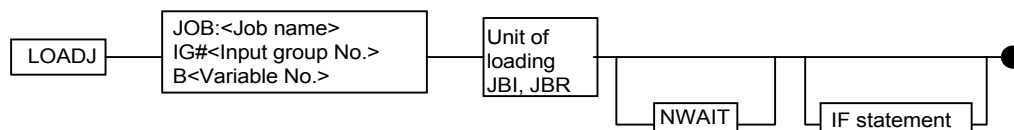
3.2 Commands for Job Transmission

3.2.1 LOADJ

■ Function

Loads specified jobs as single or related jobs, from the external memory unit to the memory of the XRC.

■ Configuration



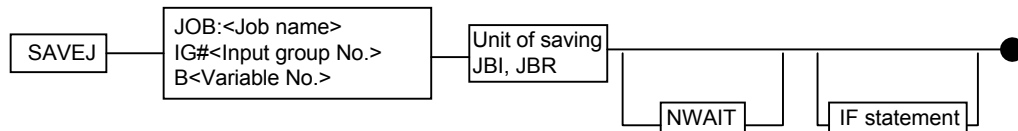
- If the XRC memory already contains a job having the same name as the job to be loaded, the existing job is deleted and the new job is loaded. However, if the job to be loaded is as follows, an alarm occurs.
 - Execution starting job
 - Job under execution/halting
 - Job registered in job call stack
- Specify input group numbers (BCD/BIN, parity specification), and variable numbers in the same way as for the CALL command. If the pattern input value is 0, the operation is not executed. A variable number 0 is valid.
- Unit of loading : Select either a single job (JBI) or related jobs (JBR)
- When the NWAIT is specified, the next instruction is executed without waiting completion of job loading.
- While a job is being loaded by the LOADJ command for which NWAIT is specified, if an access is attempted to a job called by the CALL command or JUMP command, an alarm occurs. If a LOADJ or SAVEJ command has already been executed, a job is loaded after completion of the execution.

3.2.2 SAVEJ

■ Function

Saves a specified job as single or related jobs, from the memory of the XRC to the external memory unit.

■ Configuration



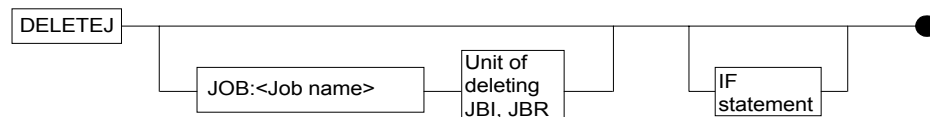
- Specify input group numbers (BCD/BIN, parity specification), and variable numbers in the same way as for the CALL command. If the pattern input value is 0, the operation is not executed. A variable number 0 is valid.
- Unit of saving : Select either a single job (JBI) or related jobs (JBR).
- When the NWAIT is specified, the next command is executed without waiting completion of job saving. When a LOADJ or SAVEJ command has already been executed, a job is saved after completion of the execution.

3.2.3 DELETEJ

■ Function

Deletes all jobs except its own job or specified jobs as single or related jobs, from the memory of the XRC.

■ Configuration



- Unit of deleting : Select either a single job (JBI) or related jobs (JBR).
- The following jobs can not be deleted.
 - Execution starting job
 - Job under execution/halting
 - Job registered in job call stack

3.3 Commands for Variable Transmission

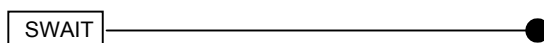
3.2.4 SWAIT

■ Function

Waits for completion of loading or saving jobs or variables.

Use this command to recognize a completion of LOADJ, SAVEJ, LOADV, and SAVEV commands when a NWAIT is specified for these instructions.

■ Configuration



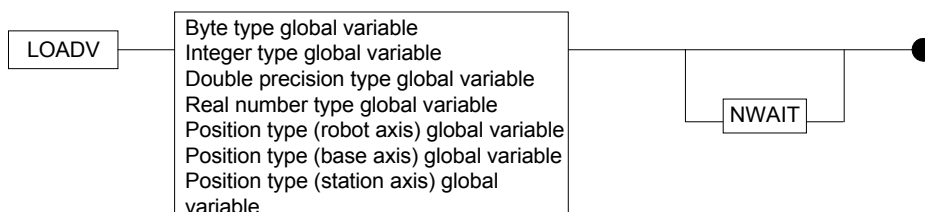
3.3 Commands for Variable Transmission

3.3.1 LOADV

■ Function

Loads the specified global variables from an external memory unit to the XRC memory.

■ Configuration

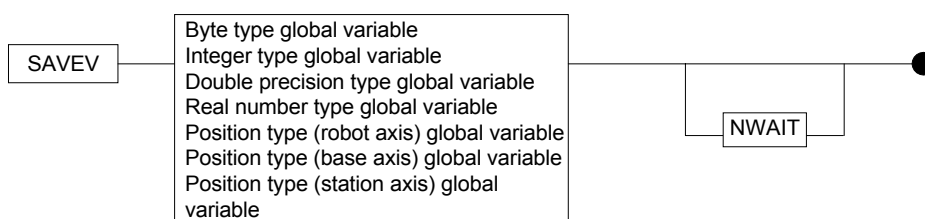


3.3.2 SAVEV

■ Function

Saves the specified global variables from the XRC memory to a external memory unit.

■ Configuration



3.4 Registrating DCI Instruction

Operation

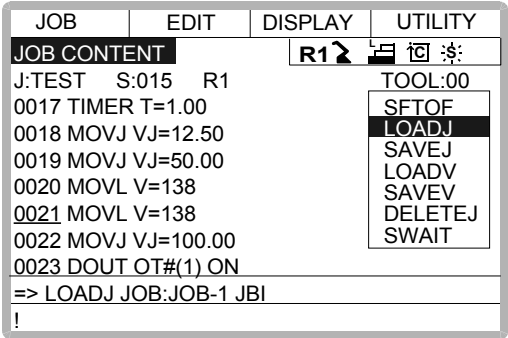
Move the cursor to the address area ➡ Move the cursor to the line where an instruction is to be registered in the job content display^{*1} ➡ Press [INFORM LIST]^{*2} ➡ Select an instruction to be registered^{*3} ➡ Change the additional items and variable data^{*4} ➡ Press [INSERT] and [ENTER]^{*5}

Explanation

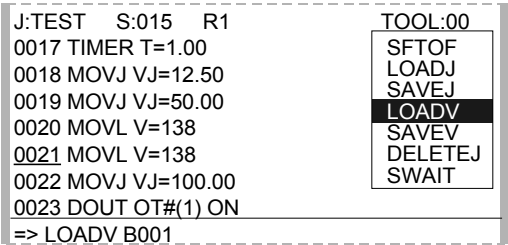
***1** In the job content display in teach mode, move the cursor to the line just above the place where an instruction is to be registered.



***2** The instruction list dialog is displayed. The cursor moves to the instruction list dialog while the cursor in the address area changes to an underline.

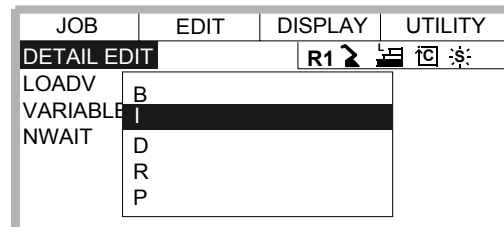


***3** The instruction where the cursor is positioned is displayed with the previously registered additional items in the input buffer line.



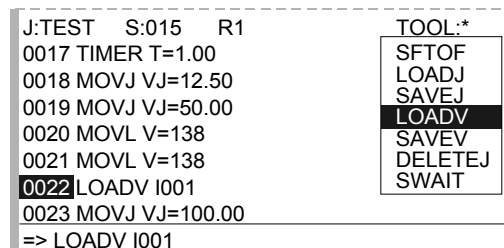
- Changing the data type

To change the data type of additional item, move the cursor to the ☒ of the additional item and press [SELECT] to select a data type.



After having added, changed or deleted the additional items, press [ENTER]. The detail edit display is ended and the job content display appears.

- *5** The instruction displayed in the input buffer line is registered.
To register an instruction just before an END instruction, it is not necessary to press [INSERT].



3.5 Concurrent Tasks from Multiple Jobs

As an option, commands related to DCI function can be executed from more than one job simultaneously. The operations are explained below.

- The DCI related commands can be executed in any job regardless of distinction among the ordinary job, concurrent job (option), or job activated in series (option).
- Multiplexing of DCI transmission function is not supported. Therefore, it is impossible to manipulate files on two or more external memory units (such as personal computer) connected to the XRC.
- If two or more commands related to DCI function are issued concurrently, the execution starts after completion of processing of the currently executing command. Therefore, if a module issues a command request while another module is executing DCI function, the request has to wait until the ongoing processing completes.

3.6 DCI Parallel Execution

By using the function described below, the DCI instruction can be executed in parallel with general instructions such as a move instruction and operating instruction. When this function is used, the robot can be moved or the calculation is executed during data transmission ; this function is effective for reduction of tact time, etc.

■ Parallel Execution Using NWAIT

```

NOP
MOVJ VJ=50.00
MOVJ VJ=50.00
LOADJ JOB:ABC JBI NWAIT.....①
MOVJ VJ=50.00 .....②
MOVJ VJ=50.00 .....③
SWAIT .....④
CALL JOB:ABC.....⑤
. . .
END

```

In the above job, when the command ① is executed, loading of the host computer and the job are executed. Normally, when NWAIT is not specified, the commands of ② and after are not executed until the job loading is completed. However, when NWAIT is specified, the commands ② and ③ are executed sequentially during the job loading ; at execution of SWAIT command ④, the execution of command ⑤ is waited for the job “ABC” loading is completed. At the time of completion of job “ABC” loading, the command ⑤ is executed to execute the job “ABC”.

At this time, if SWAIT command is not specified before the command ⑤, the command ⑤ is executed during the loading of job “ABC”, and an alarm occurs. Therefore, be sure to verify that loading is completed before executing a job to be loaded, by using SWAIT command. To load/save variables, be sure to input a SWAIT command before using variables to be loaded/saved as shown below.

(Correct)

```

NOP
. . .
LOADV B000 NWAIT
. . .
SWAIT
SET B001 B000

```

(Wrong)

```

NOP
. . .
LOADV B000 NWAIT
. . .
SET B001 B000

```

■ Parallel Execution Using PSTART (Optional)

By using an independent control command (optional), DCI commands can be executed in parallel with general commands. For example, to execute the job “R1” for robot 1 is to be executed in parallel with the job “S1” for station 1 during job loading, the following procedure is taken :

Job “R1” : Job for robot 1

Job “S1” : Job for station 1

[JOB:R1]	[JOB:S1]
NOP	NOP
MOVJ VJ=50.00	MOVJ VJ=50.00
MOVJ VJ=50.00	MOVJ VJ=50.00
PSTART JOB:S1 SUB1.....①	END
LOAD JOB:ABC.....②	
PWAIT.....③	
CALL JOB:ABC.....④	
END	

When PSTART command ① is executed, the job “S1” starts execution in parallel with the job “R1”. The job “ABC” is loaded by the command ② during execution of the job “S1” ; when loading is completed, the XRC waits for the job “S1” to be completed by the command ③. When the execution of job “S1” is completed, the job “ABC” is executed by the command ④.

3.7 Transmission Procedure

3.7.1 Job Transmission

■ Saving Procedure

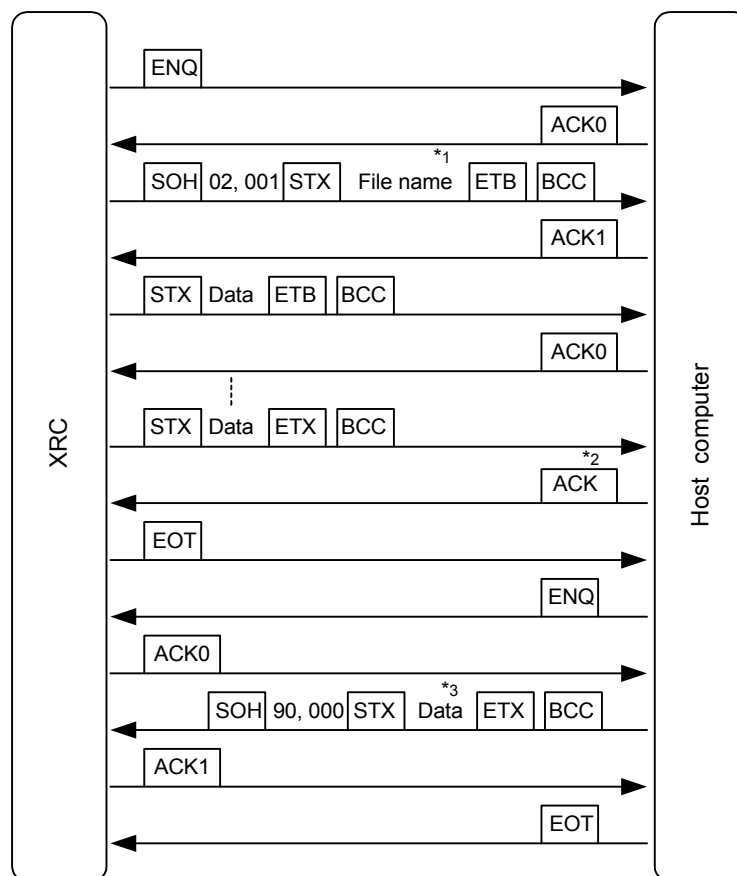
The transmission from the XRC to a host computer proceeds as follows.

XRC → Host computer

1. The ENQ code is sent out to establish a data link.
2. After the data link is established, data are sent out to the host computer.
3. After the transmission completes, the XRC waits for a response from the host computer to verify the completion of transmission. Therefore, the host computer should return a response.
4. The transmission is terminated upon receipt of the response from the host computer.

3.7 Transmission Procedure

The data type is distinguished by the header number and the subcode number. Refer to the header number list.



***1** File name : CR (File name does not include extension.)

***2** ACK0 or ACK1

***3** Normal completion : 0000CR (ASCII code)

Abnormal completion : Integer except 0000 CR (ASCII code)

■ Loading Procedure

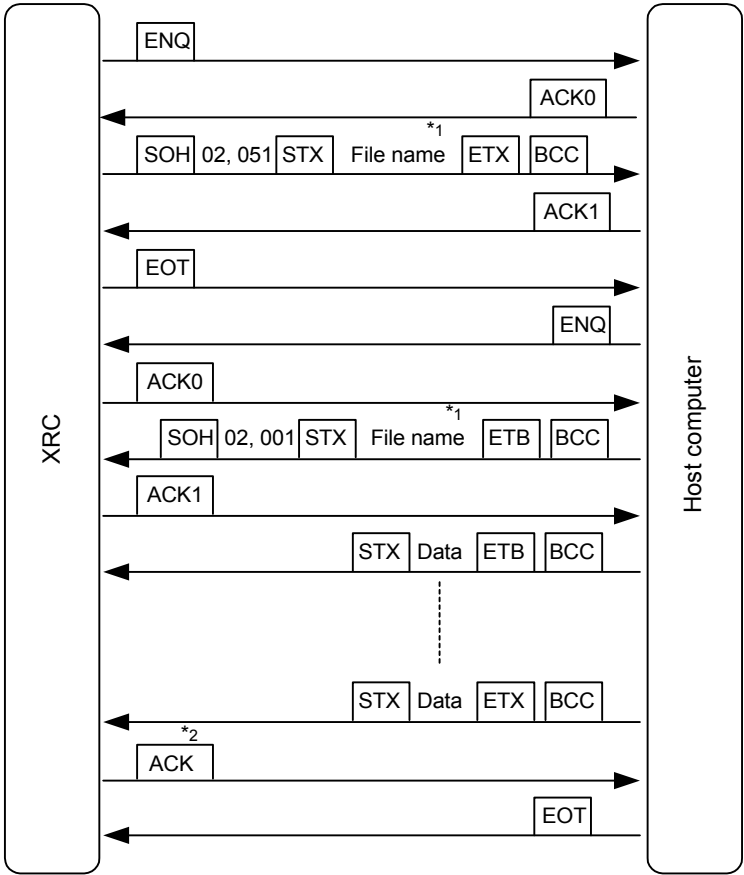
The transmission from a host computer to the XRC proceeds as follows.

Host computer → XRC

1. The ENQ code is sent out to establish a data link.
2. After the data link is established, a request to send is sent out to the host computer.
3. When the request to send is accepted, the XRC enters receiving status, waiting for the ENQ code from the host computer. Therefore, the host computer should send data after the data link is established.
4. The transmission is terminated at completion of data reception from the host computer.

A request to send consists of a header number and a subcode number. Refer to the header number list.

At transmission, memory capacity is checked and if received data can not be stored, an alarm occurs. If the transmission itself is normal, reception is continued and an alarm is displayed after the transmission is terminated. If an error occurs during reception, the job data will not be stored.



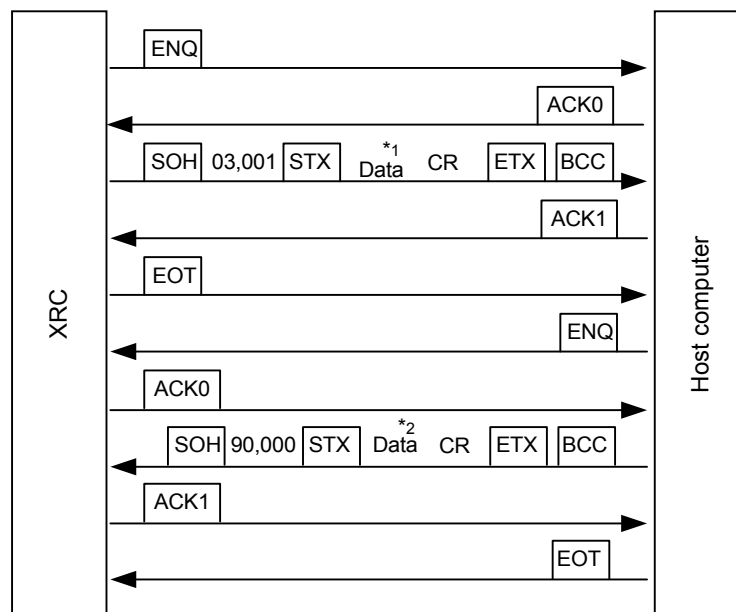
***1** File name : CR (File name does not include extension.)
***2** ACK0 or ACK1

3.7 Transmission Procedure

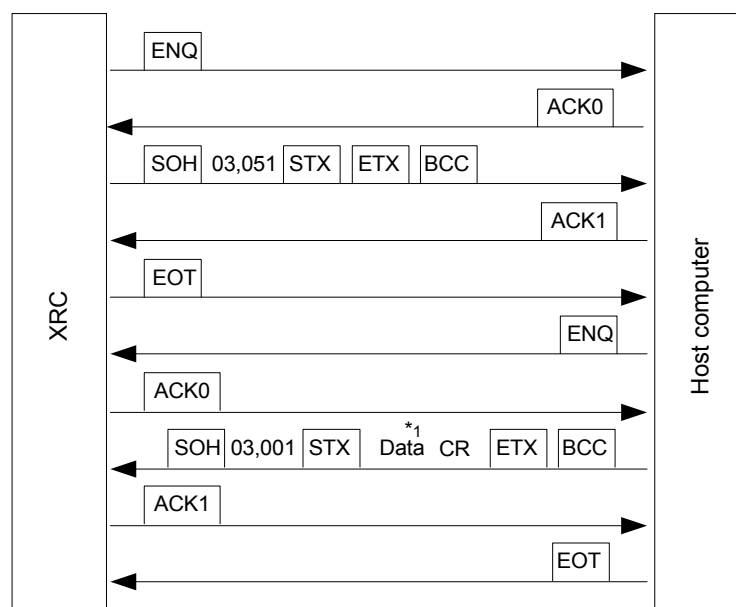
3.7.2 Variable Transmission

The variable transmission is performed in the same way as for the data as shown below.

■ Saving Procedure



■ Loading Procedure



For headers, refer to the header number list.

***1**

Byte type global variable :	□□□	(0 to 255)
Integer type global variable :	± □□□	(-32768 to +32767)
Double precision type global variable :	± □□□□□□□□□□	(-2147483648 to 2137383647)
Real number type global variable :	7 significant digits	(-1.70141E+38 to +1.70141E+38)
Position type (robot axis) global variable :	Pulse type or XYZ type depending on the internal setting status <div style="margin-left: 40px;"> Pulse type S, L, U, R, B, T (Unit : pulse) (-999999999 to 999999999) XYZ type X, Y, Z, TX, TY, TZ, TYPE </div> <div style="margin-left: 100px; margin-top: -10px;"> <hr style="width: 100%;"/> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> Unit : mm, significant 3 decimal points -999999.999 to 999999.999 </div> <div style="text-align: center;"> Unit : degree (°), significant 2 decimal points -9999.99 to 9999.99 </div> <div style="text-align: right;"> d0 = 0 : Flip d0 = 1 : No flip d2 = 0 : Up d2 = 1 : Back </div> </div> </div>	
Position type (base axis) global variable :	Pulse type or XYZ type depending on the internal setting status <div style="margin-left: 40px;"> Pulse type 1, 2, 3 (Unit : pulse) (-999999999 to 999999999) XYZ type X, Y, Z (Unit : mm, significant 3 decimal points) (-999999.999 to 999999.999) </div>	
Position type (station axis) global variable :	Pulse type 1, 2, 3, 4, 5, 6 (Unit : pulse) (-999999999 to 999999999)	

***2** 0000 or error code

The response is as follows when an error occurs in response.

[SOH]	90,000	[STX]	DATA	[CR]	[ETX]	[BCC]
-------	--------	-------	------	------	-------	-------

If a stop operation (hold and emergency stop) is done during data transmission (while jobs or variables are loaded or saved), the robot stops but the data transmission continues. In this case, the start lamp goes OFF. The restart will not be accepted until completion of the data transmission.

3.8 Axis Data Transmission Format

The XRC data transmission function has the following restrictions on transmission of the XRC internal data.

The robot axes are fixed to a 6-axis set.

A base axis and a station axis are recognized as an external axis. Up to three base axes are available. With station axis data added after base axis data, up to six axes can be handled.

For example, SAVEV BP005 is read as SAVEV BP005 + EX005.

If the system lacks one of the variables, only the existing one is used. If the system has both variables but not registered, an error occurs.

The definition of the robot, base, and station axes is used as it is, free of the predetermined axis data R1, B1, and S1.

<Example>

Transmission data of SAVEV in different system configurations are shown below.

- In a system having two base axes (X and Z) and no station axis
 If BP005 is pulse type and 1st axis is 100 and 2nd axis is 200, then
 SAVEV BP005 → 03, 007 100, 200, 0, 0, 0, 0
 If BP005 is XYZ type and X-axis is 123.456 and Z-axis is 234.567, then
 SAVEV BP005 → 03, 008 123.456, 234.567, 0, 0, 0, 0
- In a system having no base axis and three station axes
 If EX005 is pulse type and 1st axis is 500, 2nd axis is 600, and 3rd axis is 700
 SAVES EX005 → 03, 007 500, 600, 700, 0, 0, 0
- In a system having two base axes (X and Z) and three station axes
 If BP005 is pulse type, 1st axis is 100 and 2nd axis is 200, and
 EX005 is pulse type, 1st axis is 500, 2nd axis is 600, and 3rd axis is 700, then
 SAVEV BP005 → 03, 007 100, 200, 500, 600, 700, 0
 (Same as for SAVEV EX005)
 If BP005 is XYZ type, X axis is 123.456, and Z axis is 234.567, and
 EX005 is pulse type, 1st axis is 500, 2nd axis is 600, and 3rd axis is 700, then
 SAVEV BP005 → 03, 008 123.456, 234.567, 500, 600, 700, 0
 (same as for SAVEV EX005)

3.9 Alarm Codes

Code	Message	Data
4104	WRONG EXECUTION OF LOAD INST	Refer to the table below.
4105	WRONG EXECUTION OF SAVE INST	
4106	WRONG EXECUTION OF DELETE INST	

Data	Contents
001	Insufficient memory capacity
002	Job editing prohibited
003	Attempted to load or delete a job being executed.
004	No specified job
012	Position data destroyed
013	Position variable not registered
017	Instruction destroyed
019	Invalid character in job name
020	Invalid character in label
023	Invalid character in this system
024	Syntax error
104	Error response from host computer
111	Syntax error
112	Error in position data
113	No NOP or END instruction
117	Format error
118	Invalid number of data

3.9 Alarm Codes

Data	Contents
120	Data range exceeded
122	Destroyed file exists
125	No serial port setting
126	This serial port already used.
127	This protocol already used.
128	File accessing in other function
211	System block error (Receiving EOT while waiting ACK)
212	System block error (Receiving EOT at starting receiving)
213	System block error (Receiving EOT before receiving the last block)
214	System block error (Receiving codes other than EOT before receiving the last block)
221	Sending error (Retry for NAK exceeded)
222	Sending error (Timeup for timer A retry)
223	Sending error (ACK0/ACK1 order error after retry)
231	Receiving error (Timeup for timer A while waiting ACK after ENQ, timeup for timer A while waiting ENQ response)
232	Receiving error (Timeup for timer B while receiving a text)
233	Receiving error (Heading length is shorter than 6 characters)
234	Receiving error (Heading length is longer than 6 characters)
235	Receiving error (Header number error)
236	Receiving error (Text length exceeds 256 bytes)
240	Software error
241	Hardware error (Overrun)
242	Hardware error (Parity error)
243	Hardware error (Framing error)
244	Hardware error (Sending timeup (timer A))
245	Hardware error (Sending timeup (timer B))

4 Stand-alone Function

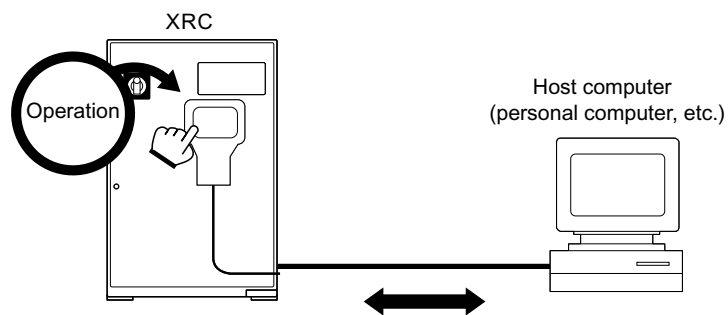
4.1 Outline

In stand-alone mode, the file data transmission function is available. By the operations on the XRC programming pendant, file data can be sent from the XRC to a host computer such as personal computer to be saved, and from a host computer to the XRC memory to be loaded.

Load : Transmits file data from a host computer to the XRC.

Save : Transmits file data from the XRC to a host computer.

Verify : Verifies data between the XRC and the host computer and informs if some parts are not matched.

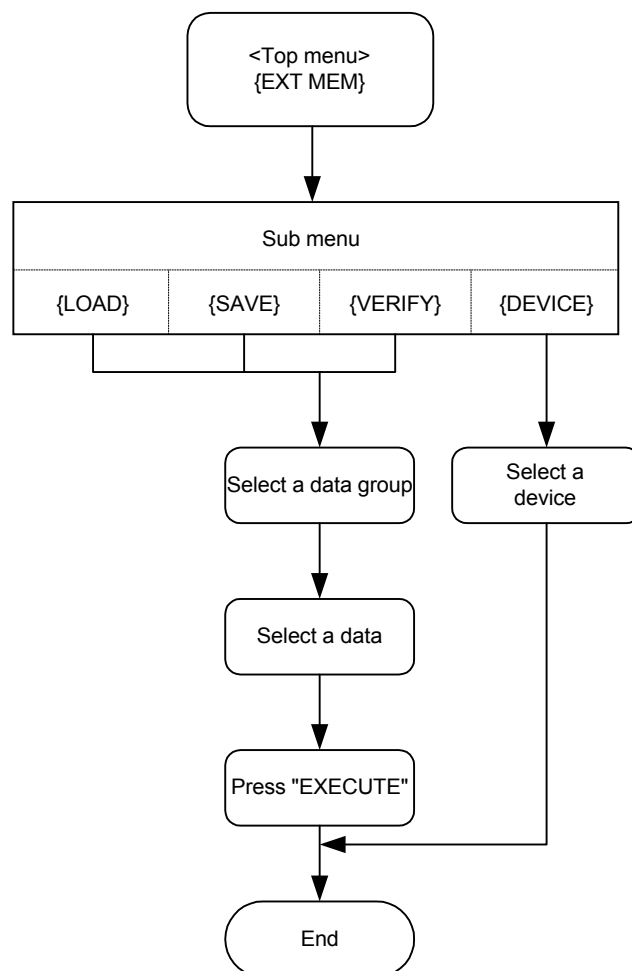


The following data can be transmitted between the XRC and a host computer. System information can be saved but not loaded.

- Job data
- Condition data/General data
- System information

4.2 Operation Flow

Transmission of file data is performed in the following manner.



4.3 Operation

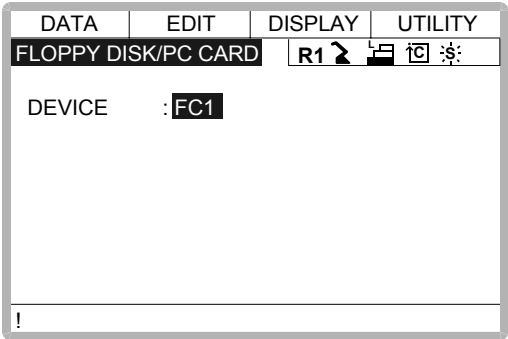
4.3.1 Selecting External Memory Unit

Operation

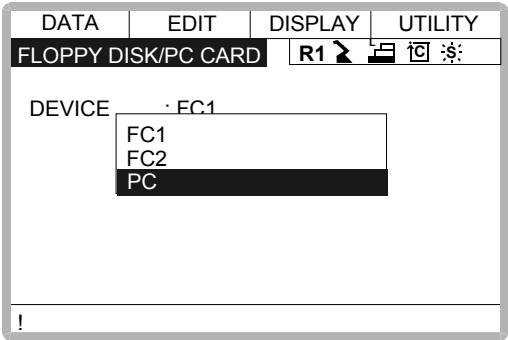
Select {FD/PC CARD} under the top menu ➡ Select {DEVICE}^{*1} ➡ Select “DEVICE”^{*2}
➡ Select the device to be changed^{*3}

Explanation

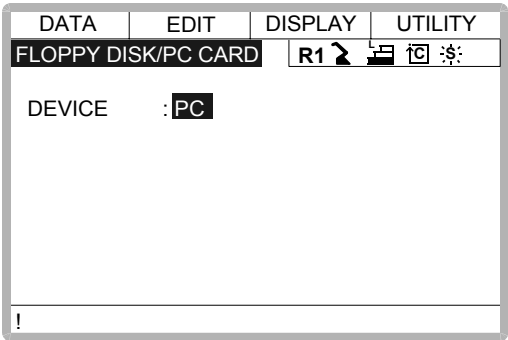
^{*1} The device selection display is shown.



^{*2} The selection dialog is shown.



^{*3} The device is changed.



4.3 Operation

4.3.2 Save

The operation to transmit data from the XRC to the external memory unit is explained in the following.





■ Saving Job

Operation





Select {FD/ PC CARD} under the top menu ➡ Select {SAVE}^{*1} ➡ Select "JOB"^{*2} ➡ Select the job to be saved^{*3} ➡ Press [ENTER]^{*4} ➡ Select "YES"^{*5}

Explanation





^{*1} The external memory menu display is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD	R1		  
PC(SAVE)	UN-USED MEM :123.4 KB		
<input type="checkbox"/> JOB	8		
<input type="checkbox"/> FILE/GENERAL DATA	0		
<input type="checkbox"/> ALL CMOS AREA	0		
!			

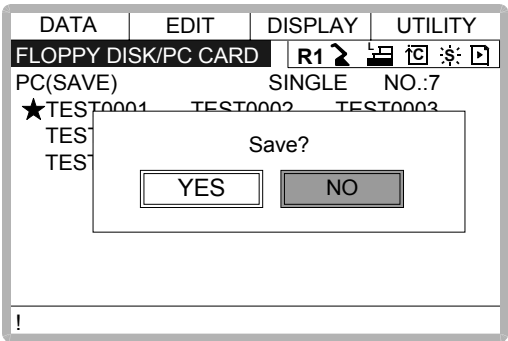
^{*2} The external memory job list display is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	   
PC(SAVE)	SINGLE		NO.:7
TEST0001	TEST0002	TEST0003	
TEST0004	TEST0005	TEST0006	
TEST0007			
!			

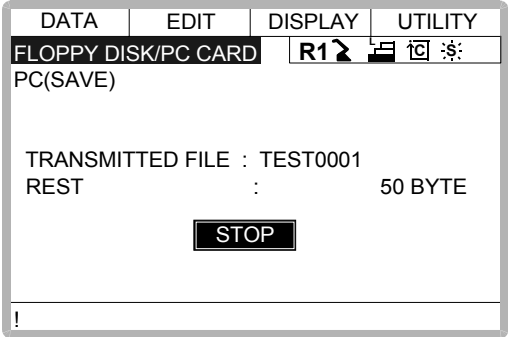
^{*3} The selected job is marked with "★".

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	   
PC(SAVE)	SINGLE		NO.:7
★TEST0001	TEST0002	TEST0003	
TEST0004	TEST0005	TEST0006	
TEST0007			
!			

***4** The confirmation dialog is shown.



***5** The job starts to be saved, and the transmission display is shown.



To interrupt the saving, press [SELECT].
When the saving is completed or interrupted, the job content display appears.

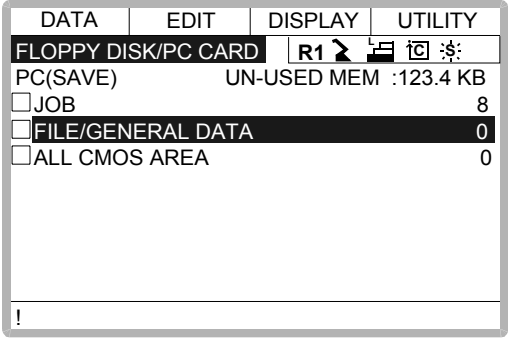
■ Saving File

Operation

Select {FD/PC CARD} under the top menu ➡ Select {SAVE}^{*1} ➡ Select the file group to be saved^{*2} ➡ Select the file to be saved^{*3} ➡ Press [ENTER]^{*4} ➡ Select "YES"^{*5}

Explanation

***1** The external memory menu display is shown.



4.3 Operation

- *2** The file selection display is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	⏏ ⏏ ⏏
PC(SAVE)			
<input type="radio"/>	TOOL DATA	TOOL	.CND
<input type="radio"/>	WEAVING DATA	WEAV	.CND
<input type="radio"/>	USER COORDINATE DATA	UFRAME	.CND
<input type="radio"/>	VARIABLE DATA	VAR	.DAT
<input type="radio"/>	ARC START COND DATA	ARCSRT	.CND
<input type="radio"/>	ARC END COND DATA	ARCEND	.CND
<input type="radio"/>	ARC AUXILIARY COND DATA	ARCSUP	.DAT
<input type="radio"/>	WELDER CONDITION DATA	WELDER	.DAT
!			

- *3** The selected file is marked with “★”.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	⏏ ⏏ ⏏
PC(SAVE)			
<input checked="" type="radio"/>	★ TOOL DATA	TOOL	.CND
<input type="radio"/>	WEAVING DATA	WEAV	.CND
<input type="radio"/>	USER COORDINATE DATA	UFRAME	.CND
<input type="radio"/>	VARIABLE DATA	VAR	.DAT
<input type="radio"/>	ARC START COND DATA	ARCSRT	.CND
<input type="radio"/>	ARC END COND DATA	ARCEND	.CND
<input type="radio"/>	ARC AUXILIARY COND DATA	ARCSUP	.DAT
<input type="radio"/>	WELDER CONDITION DATA	WELDER	.DAT
!			

- *4** The confirmation dialog is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	⏏ ⏏ ⏏
PC(SAVE)			
<input checked="" type="radio"/>	★ TOOL DATA	TOOL	.CND
<input type="radio"/>	WEAVING DATA	WEAV	.CND
<input type="radio"/>	USER COORDINATE DATA	UFRAME	.CND
<input type="radio"/>	VARIABLE DATA	VAR	.DAT
<input type="radio"/>	ARC START COND DATA	ARCSRT	.CND
<input type="radio"/>	ARC END COND DATA	ARCEND	.CND
<input type="radio"/>	ARC AUXILIARY COND DATA	ARCSUP	.DAT
<input type="radio"/>	WELDER CONDITION DATA	WELDER	.DAT
!			

Save?

YES NO

- *5** The file starts to be saved, and the transmission display is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	⏏ ⏏ ⏏
PC(SAVE)			
TRANSMITTED FILE : TOOL .CND			
REST : 1523 BYTE			
STOP			
!			

To interrupt the saving, press [SELECT].

When the saving is completed or interrupted, the file selection display reappears.

4.3.3 Load

The operation to transmit data from the external memory unit to the XRCis explained in the following.

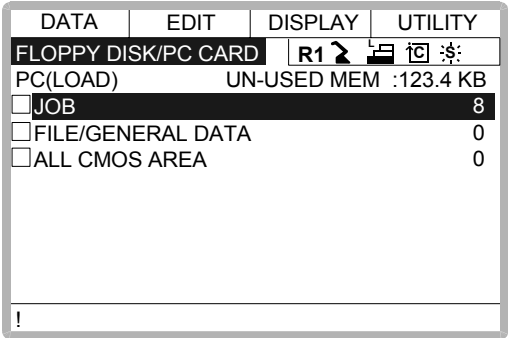
■ Loading Job

Operation

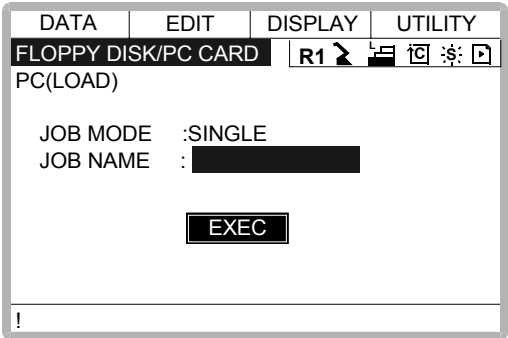
Select {FD/ PC CARD} under the top menu ➡ Select {LOAD}*1 ➡ Select “JOB”*2 ➡ Enter the job to be loaded ➡ Select “EXEC”

Explanation

*1 The external memory menu display is shown.



*2 The display to input the job name to be loaded is shown.



4.3 Operation




■ Loading File

Operation




Select {FD/ PC CARD} under the top menu ➡ Select {LOAD}*¹ ➡ Select the file group to be loaded*² ➡ Select the file to be loaded*³ ➡ Press [ENTER]*⁴ ➡ Select "YES"*⁵

Explanation




*¹ The external memory menu display is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD R1   			
PC(LOAD)		UN-USED MEM :123.4 KB	
<input type="checkbox"/>	JOB		8
<input type="checkbox"/>	FILE/GENERAL DATA		0
<input type="checkbox"/>	ALL CMOS AREA		0
!			

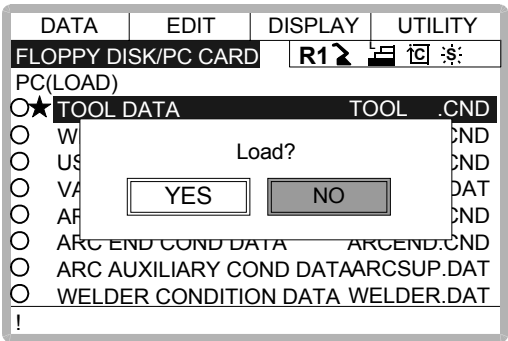
*² The file selection display is shown.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD R1   			
PC(LOAD)			
<input checked="" type="radio"/>	TOOL DATA	TOOL	.CND
<input type="radio"/>	WEAVING DATA	WEAV	.CND
<input type="radio"/>	USER COORDINATE DATA	UFRAME	.CND
<input type="radio"/>	VARIABLE DATA	VAR	.DAT
<input type="radio"/>	ARC START COND DATA	ARCSRT	.CND
<input type="radio"/>	ARC END COND DATA	ARCEND	.CND
<input type="radio"/>	ARC AUXILIARY COND DATA	ARCSUP	.DAT
<input type="radio"/>	WELDER CONDITION DATA	WELDER	.DAT
!			

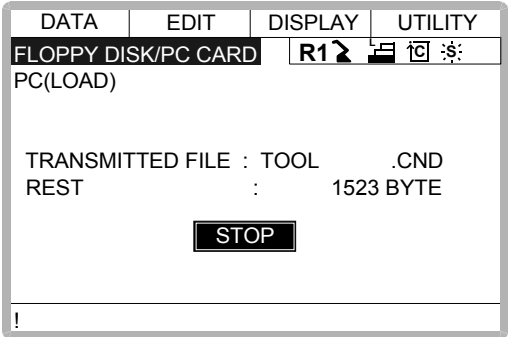
*³ The selected file is marked with "★".

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD R1   			
PC(LOAD)			
<input checked="" type="radio"/>	★ TOOL DATA	TOOL	.CND
<input type="radio"/>	WEAVING DATA	WEAV	.CND
<input type="radio"/>	USER COORDINATE DATA	UFRAME	.CND
<input type="radio"/>	VARIABLE DATA	VAR	.DAT
<input type="radio"/>	ARC START COND DATA	ARCSRT	.CND
<input type="radio"/>	ARC END COND DATA	ARCEND	.CND
<input type="radio"/>	ARC AUXILIARY COND DATA	ARCSUP	.DAT
<input type="radio"/>	WELDER CONDITION DATA	WELDER	.DAT
!			

***4** The confirmation dialog is shown.



***5** The file starts to be loaded, and the transmission display is shown.



To interrupt the loading, press [SELECT].
When the loading is completed or interrupted, the file selection display reappears.

4.3.4 Job Selection Mode

To select a job to save, load, or verify, the following selection modes are available.

■ **Single Selection Mode**





Only the selected job is loaded, saved, or verified.

■ **Related Selection Mode**

The selected job and the related jobs and data files are loaded, saved, or verified.

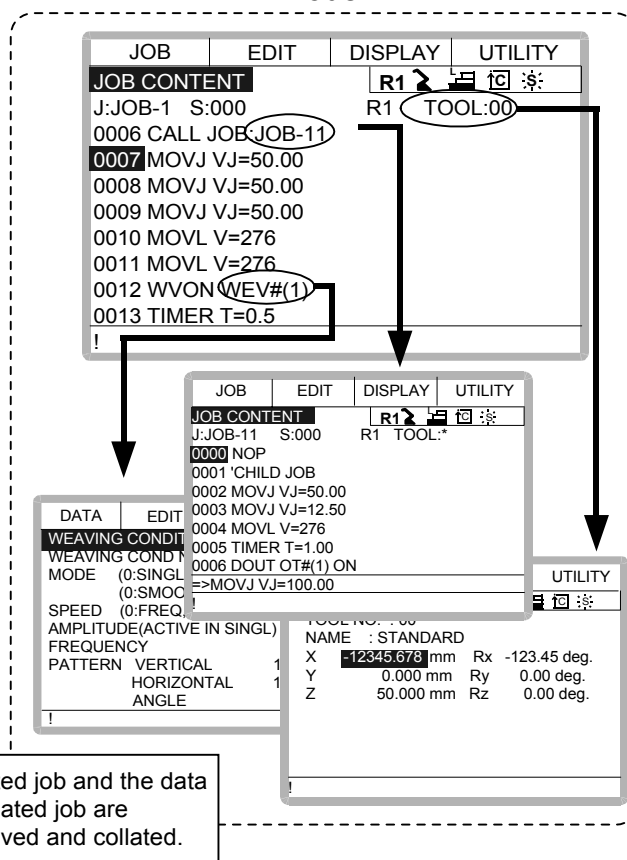
4.3 Operation

For single selection mode

JOB	EDIT	DISPLAY	UTILITY
JOB CONTENT		R1	   
J:TEST	S:000	R1	TOOL:*
0000 NOP			
0001 MOVJ VJ=50.00			
0002 MOVL V=276			
0003 WVON WEV#(1)			
0004 ARCON ASF#(1)			
0005 MOVL V=138			
0006 MOVL V=138			
=>MOVJ VJ=100.00			
!			

Only the selected job is loaded, saved, and collated.

For related selection mode




■ Switching Selection Mode

Operation

Press the page key in the external memory job list display ^{*1}

Explanation

- ^{*1} Each time the page key  is pressed, the displays in “single selection mode” and in “related selection mode” appears alternately.

DATA	EDIT	DISPLAY	UTILITY
FLOPPY DISK/PC CARD		R1	9 10 11
PC(SAVE)		RELATED	NO.:7
TEST0001	TEST0002	TEST0003	
TEST0004	TEST0005	TEST0006	
TEST0007			
!			

4.3.5 Selecting Job and Data File

There are two ways to select a job and various data files to be loaded, saved, verified, or deleted.

■ EACH Selection

Selects job and data file one by one.

■ BATCH Selection

Selects all the jobs and data files at once.

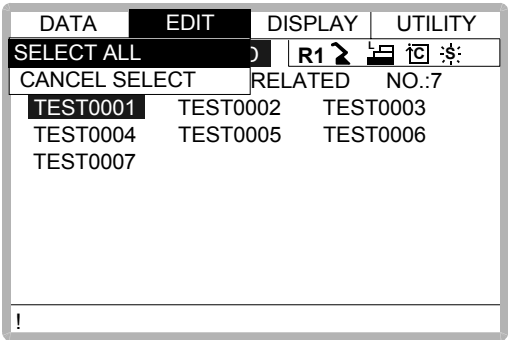
For BATCH selection, proceeds the following operation.

Operation

Select {EDIT} of the menu in the external memory job list display or the file selection display*1 ➡ Select {SELECT ALL}

Explanation

*1 The pulldown menu is displayed.



4.4 Transmission Procedure

The transmission procedure is the same as for DCI function. Refer to Section 3.7 “Transmission Procedure”.

4.4 Transmission Procedure

5 Host Control Function

The XRC supports the host control function which carries out the following file data transfer or robot control according to the commands given by the host computer.

- File data transfer function
- Robot control function

To use the host control function, the following settings should be made.

- The “COMMAND REMOTE” described in Chapter 8 “Remote Function Setting”, should be set valid (marked with “●”).
- The parameter RS000 should be set to “2”.
- The host control function should be validated. Whether the host control function is validated, can be verified in the “remote display” described in Section 2.1.3 “Display in Command Remote Mode”.

5.1 File Data Transmission Function

According to commands from a host computer, the host control function sends the stored data of user memory of the XRC to the host computer or receives data from the host computer. The following data can be transmitted between the XRC and a host computer. The system information can be sent only to a host computer.

- Job data
- Condition file/General data
- System information

5.1.1 Transmission Procedure

■ Load

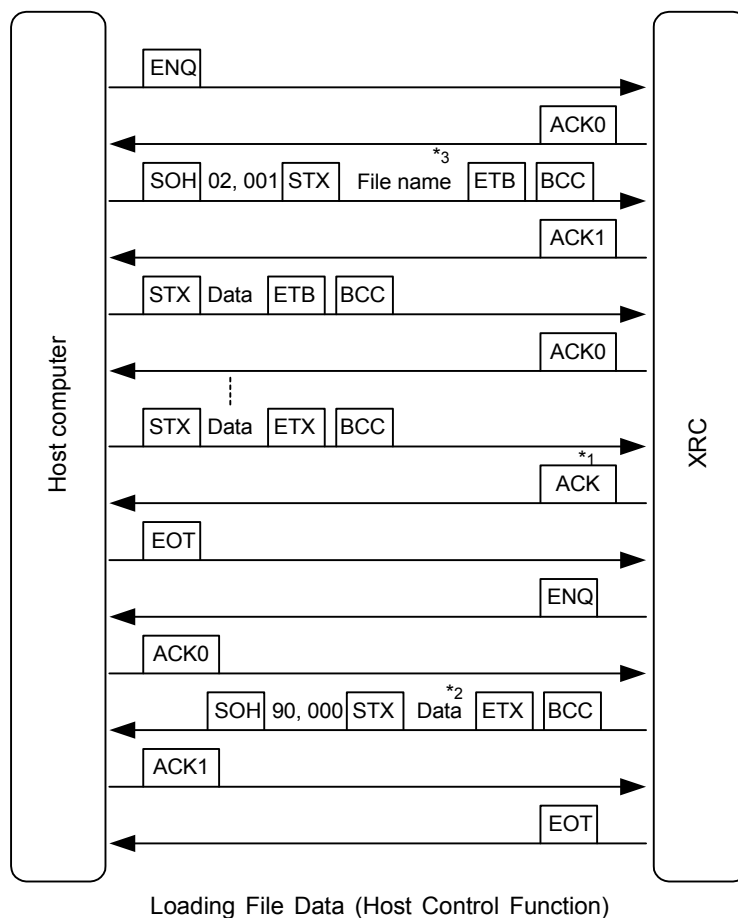
The transmission from a host computer to the XRC proceeds as follows.

Host computer → XRC

1. The ENQ code is sent from the host computer to establish a data link.
2. After the data link is established, the data is sent from the host computer.
3. After the transmission is completed, the host computer should get ready to receive.
4. After the data link is established, a response to the data sent from the host computer is returned from the XRC to terminate the transmission.

5.1 File Data Transmission Function

The data type is distinguished by the header number and the subcode number. Refer to the header number list.



- *1 ACK0 or ACK1
- *2 Normal completion : 0000CR (ASCII code)
Abnormal completion : "Integer except 0000"CR (ASCII code)
- *3 File name : CR (File name does not include extension)

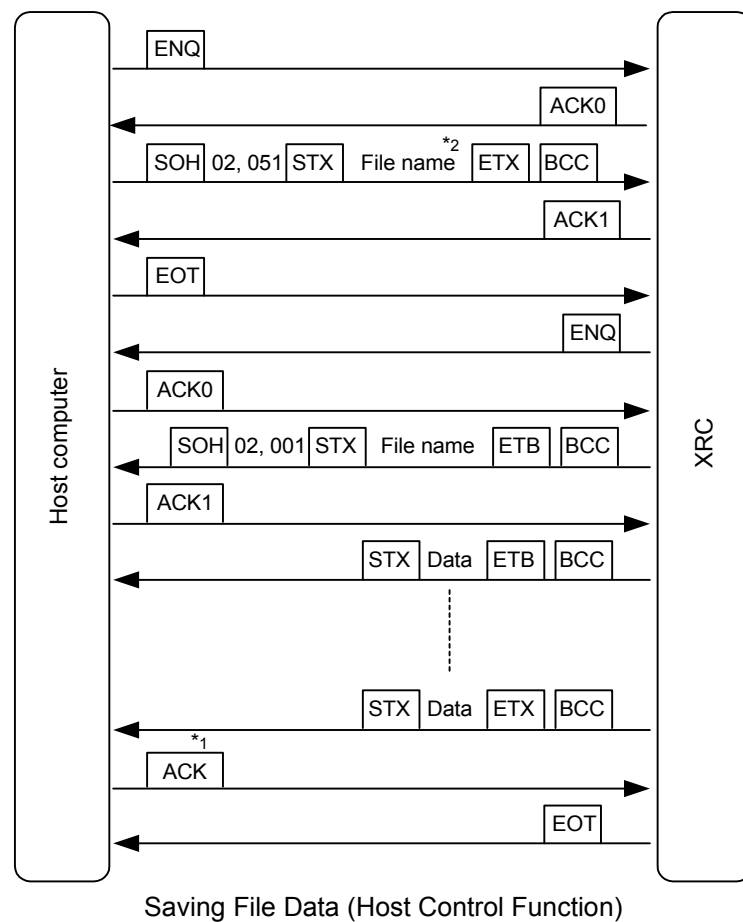
■ Save

The transmission from the XRC to a host computer proceeds as follows.

XRC → Host computer

1. The ENQ is sent from the host computer to establish a data link.
2. After the data link is established, a request to send is sent from the host computer.
3. The request to send consists of a header number and a subcode number. Refer to the header number list.
4. After the request to send is accepted, the host computer should get ready to receive data. The XRC sends the ENQ code to establish a data link
5. After the data link is established, receive the data sent from the XRC. The transmission terminates at completion of reception. If the data requested to send are not found, or the header of the request to send has an error, the XRC sends the following response message instead of data. Check the header and take an appropriate action.

[SOH] 90,000 [STX] DATA [CR] [ETX] [BCC]



***1** ACK0 or ACK1

***2** File name : CR (File name does not include extension)

5.1.2 Data Management

The jobs for the XRC may refer to another job or condition data according to instructions. When saving a single job or condition data to the host computer, the correspondence between job and files should be controlled.

To reduce this labor, the related jobs and condition data can be transmitted in a batch as the related job data. When specification of "related job data" is made, the master job, the related job, and the related condition data are transmitted sequentially. The header number and the subcode number indicate that the related job data are added.

Refer to the header number list.

5.2 Robot Control Function

To control manipulators by a host computer, the host control function can execute the commands listed in the outline.

5.2.1 Command Transmission

The command transmission proceeds as follows.

1. The ENQ code is sent from the host computer to establish a data link.
2. After the data link is established, commands are sent. Commands and file data are distinguished by the header number. Refer to the header number list. The transmission of a command should be completed in a single block. The XRC can not receive divided single command, nor receive to execute more than one command in a single block.
3. After the sending is completed, the host computer should get ready to receive. The XRC sends the ENQ code to establish a data link.
4. After the data link is established, the XRC sends the response for the command and terminates the transmission. The command format and the response format are explained in the following.

For the command that requires returning data as a response, the response format at normal completion of transmission is as shown in (2).

Command Format

[SOH] 01,000 [STX] COMMAND Data1, Data2, Data3 [CR][ETX][BCC]

Response Format

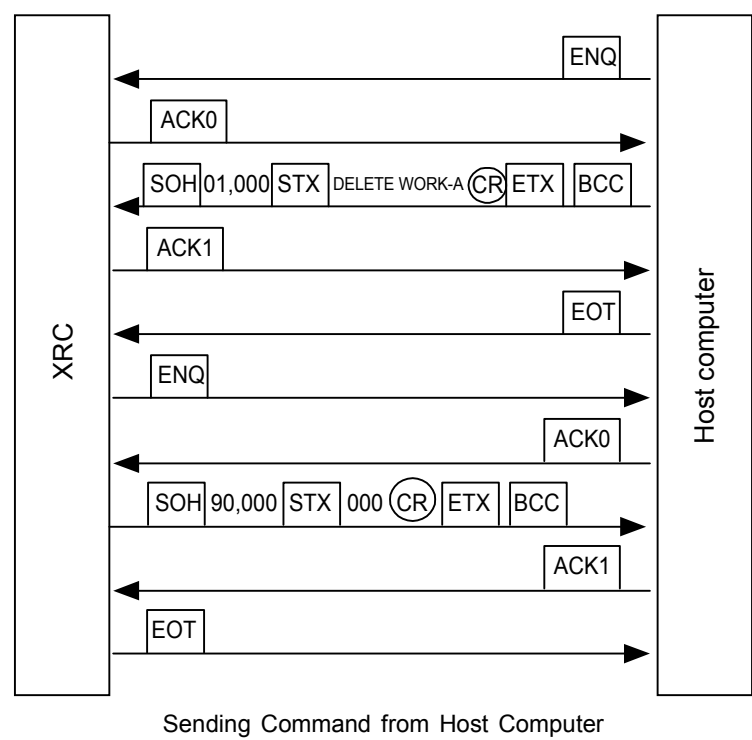
- (1) [SOH] 90,000 [STX] {0000 or Error code} [CR][ETX][BCC]

0000 : Normal completion

Error code : Number with 4 digits other than 0000. In case of smaller than 1000, 0 is added before the number.

- (2) [SOH] 90,001 [STX] Data1, Data2, ...,DataN [CR][ETX][BCC]

If the XRC can not execute the sent command, the XRC returns an interpreter message. An example of DELETE command (delete a job) is shown.



5.2.2 List of Interlock for Commands of Host Control Function

The executability of each command differs depending on the status of the XRC as shown in the following table.

Command Name		Read/Write Enabled				Only Read Enabled		
		Non-alarm/Non-error				Alarm/ Error	Non- alarm/ Non- error	Alarm/ Error
		Teach Mode		Play Mode				
		Stop	Operat- ing	Stop	Operat- ing			
Read or Monitor	RALARM					○		○
	RPOSC					○		○
	RPOSJ					○		○
	RSTATS	○	○	○	○	○	○	○
	RJSEQ					○		○
	JWAIT					A		A
	RGROUP					○		○
Read or Data Access	RJDIR					○	C	
	RUFRAME					○		
	UPLOAD	○	○	○	○	A		
	SAVEV					A		

5.2 Robot Control Function

Command Name		Read/Write Enabled					Only Read Enabled	
		Non-alarm/Non-error				Alarm/ Error	Non- alarm/ Non- error	Alarm/ Error
		Teach Mode		Play Mode				
		Stop	Operat- ing	Stop	Operat- ing			
Operation	HOLD RESET CANCE MODE CYCLE SVON 0 (OFF) SVON 1 (ON) HLOCK MDSP CGROUP CTASK	○	○	○	○	○ ○ ○ ○/A* ³ ○/A* ³ ○ A ○ ○ ○ ○ ○	C	
Activation	START MOVJ MOVL IMOV PMOVJ PMOVL	M	M	○/H* ¹	MOVE/ ○* ²	A	C	
Editing	DELETE CVTRJ CVTSJ WUFRAME DOWNLOAD LOADV	○	MOVE	M ○	M MOVE	A	C	
Job selection	SETMJ JSEQ	○	MOVE	○	MOVE	A	C	

<Interpreter message>

○ : Possible to execute

A : Alarm/error occurring 2060

M : Incorrect mode 2080

H : Hold 2020 to 2050

MOVE : Manipulator moving 2010

C : No command remote setting 2100

- *1 “○” if not being held ; “H” if being held
- *2 “MOVE” if the manipulator is moving by operation other than command ; “○” if the manipulator is moving by command since a single command can be accepted.
- *3 “○” during an alarm ; “A” during error

5.2.3 Command that Handle Axis Data

The data transmission function of the XRC has restrictions on handling control axis data. Since the manipulator axes are fixed to a six-axis set, any manipulator having more than seven axes can not use the following commands.

A base axis and a station axis are recognized as an external axis. Up to three base axes can be used. With station axis data added to the base axis data, up to six axes can be handled.

This applies to the following commands.

RPOSJ, RPOSC, RUFRAME

MOVJ, MOVL, IMOV, PMOVJ, PMOVL, WUFRAME

5.2.4 Response to MOV-type Command

The responses to MOV-type command are as follows.

- If the manipulator is moving by operations other than commands, the interpreter message 2010 (manipulator moving) is returned and the manipulator does not move.
- If the manipulator is in stop status, it turns ON the start lamp and moves according to the command, and returns a response immediately.
- If the manipulator is moving according to the previous commands, only a single command is accepted and the response is held up. After completing execution of the preceding commands, when starting execution of the suspended command, the manipulator returns a response.

This applied to the following commands.

MOVJ, MOVL, IMOV, PMOVJ, PMOVL

5.2.5 Status Read Function

The details of each command are described.

■ Read/Monitor Command

RALARM

Reads the error alarm code. Although the XRC has the subcode to error code, it can not read by RALARM because the command has no argument of the subcode.

Command format : RALARM

Response format : Data-1, Data-2, ..., Data-9 or Error code

Data-1 = Error code (0 to 9999)
 Data-2 = Alarm code (0 to 9999)
 Data-3 = Alarm data (0 to 256)
 Data-4 = Alarm code (0 to 9999)
 Data-5 = Alarm data (0 to 256)
 Data-6 = Alarm code (0 to 9999)
 Data-7 = Alarm data (0 to 256)
 Data-8 = Alarm code (0 to 9999)
 Data-9 = Alarm data (0 to 256)

<Example>

Command RALARM

Response 0, 1234, 12, 0, 0, 0, 0, 0, 0

RPOSJ

Reads the current position in joint coordinate system.

Command format : RPOSJ

Response format : Data-1, Data-2, ..., Data-12 or Error code

Data-1 = Number of S-axis pulses
 Data-2 = Number of L-axis pulses
 Data-3 = Number of U-axis pulses
 Data-4 = Number of R-axis pulses
 Data-5 = Number of B-axis pulses
 Data-6 = Number of T-axis pulses
 Data-7 = Number of 7th axis pulses
 Data-8 = Number of 8th axis pulses
 Data-9 = Number of 9th axis pulses
 Data-10 = Number of 10th axis pulses
 Data-11 = Number of 11th axis pulses
 Data-12 = Number of 12th axis pulses

<Example>

Command RPOSJ

Response 500, 2600, 1250, 10789, 624, 36, 0, 0, 0, 0, 0, 0

RPOSC

Reads the current position in a specified coordinate system. Whether there is an external axis or not can be specified.

Command format : RPOSC Data-1, Data-2

Data-1 = Specification of coordinate system

0 : Base coordinate

1 : Robot coordinate

2 : User coordinate 1

⋮

25 : User coordinate 24

Data-2 = With or Without external axis

0 : Without external axis

1 : With external axis

Response format : Data-1, Data-2, ..., Data-14

Data-1 = X coordinate value (unit : mm, significant 3 decimal points)

Data-2 = Y coordinate value (unit : mm, significant 3 decimal points)

Data-3 = Z coordinate value (unit : mm, significant 3 decimal points)

Data-4 = Wrist angle TX (unit : degree (°), significant 2 decimal points)

Data-5 = Wrist angle TY (unit : degree (°), significant 2 decimal points)

Data-6 = Wrist angle TZ (unit : degree (°), significant 2 decimal points)

Data-7 = Type

Data-8 = Tool number (0 to 23)

Data-9 = Number of 7th axis pulses (for travel axis, mm)

Data-10 = Number of 8th axis pulses (for travel axis, mm)

Data-11 = Number of 9th axis pulses (for travel axis, mm)

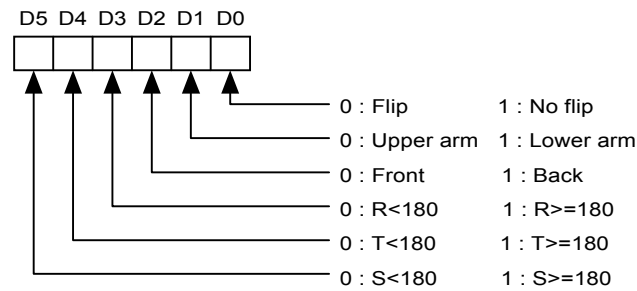
Data-12 = Number of 10th axis pulses

Data-13 = Number of 11th axis pulses

Data-14 = Number of 12th axis pulses

- Data-9 to Data-14 are added only when "With external axis" is specified.
- If the specified user coordinate system is undefined, an error occurs.
- The data of type is represented by the following bit data coded into a decimal number.

5.2 Robot Control Function



<Example>

Command RPOSC 2, 0

Response 100.0, 50, 34, 12.34, 180.0, 0, 0, 0, 0, 0, 0

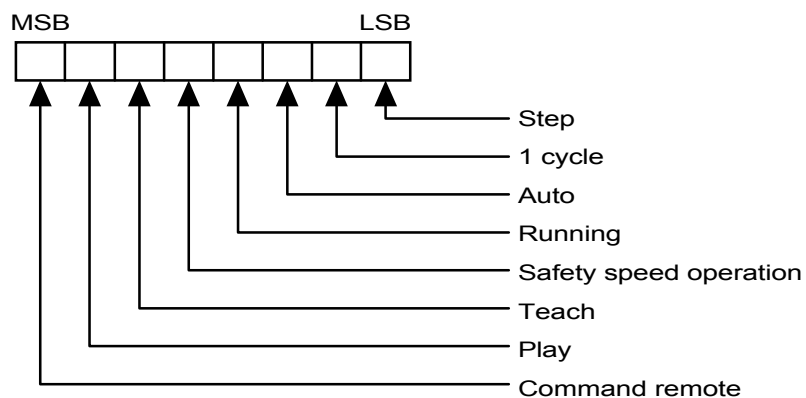
RSTATS

Reads the status of mode, cycle, operation, alarm error, and servo.

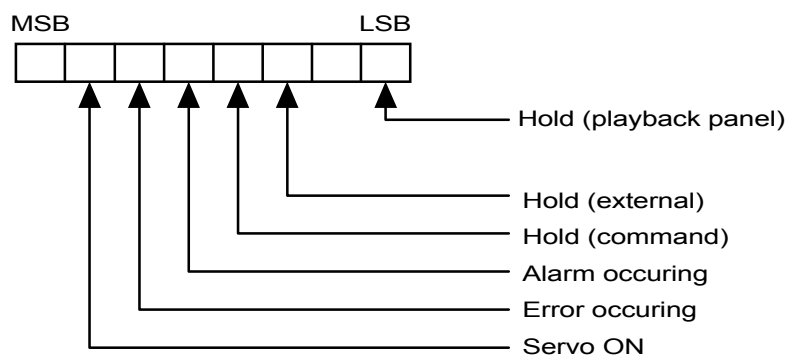
Command format : RSTATS

Response format : Data-1, Data-2 or Error code

Data-1



Data-2



<Example>

Command RSTATS

Response 1, 0

RJSEQ

Reads the current job name, line No. and step No.

Command format : RJSEQ

Response format : Data-1, Data-2, Data-3 or Error code

Data-1 = Read job name (8 characters which can be processed in MS-DOS)

Data-2 = Read line No. (0 to 9999)

Data-3 = Read step No. (0 to 999)

<Example>

Command RJSEQ

Response WORK-A, 10, 5

JWAIT

JWAIT is for checking operations (job) of the manipulator. If a response is returned immediately after the job is started, in such a case with START command, completion of the job can not be known.

Specify a waiting time as an operand for JWAIT command.

No response is sent out until the operation of manipulator is completed or the specified waiting time has elapsed. JWAIT returns as a response, the information whether the operation has completed or not.

Command format : JWAIT Time

Time = Waiting time (-1.0 to 32767 sec.)

-1.0 indicates infinite time.

Response format : Data or Error code

Data = Operation status (0 : completed, -1 : not completed)

Waits for stop of job execution. The response varies depending on the following status.

<Status>	<Response>
END or PAUSE execution during waiting time	Completed
Step execution during waiting time	Completed
Stopped by hold, alarm, emergency stop, servo OFF during waiting time	Not completed
Stopped by changing mode during waiting time	Not completed
Test run is interrupted during waiting time	Not completed

5.2 Robot Control Function

<Status>

Waiting timeout

Stopped (including when the control power ON)

Stopped (hold)

Stopped (alarm/error occurring)

Stopped (servo OFF)

<Response>

Not completed

Completed

Interpreter message 2020 to 2050

Interpreter message 2060

Interpreter message 2070

<Example>

Command JWAIT 10

Response 0000

RGROUP

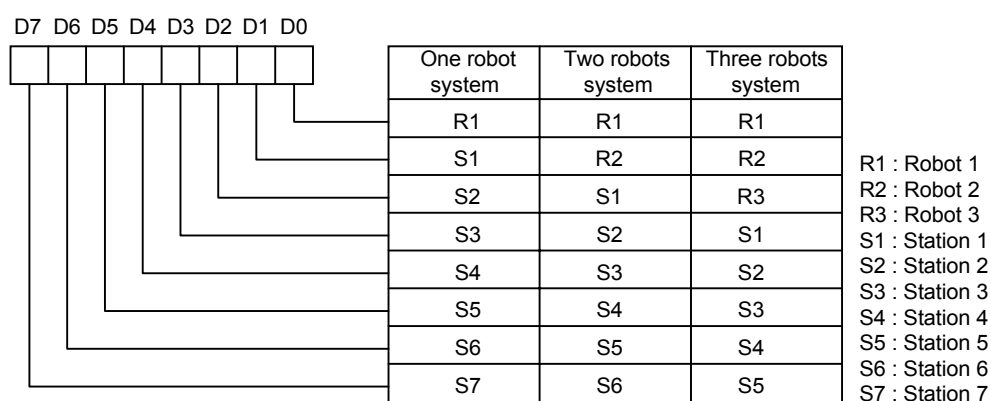
Reads the current control group set by CGROUP command or CTASK command, and the task selection status.

For details, refer to Section 5.3 “Commands for Multi-control Group and Independent Control Functions”.

Command format : RGROUP

Response format : Data-1, Data-2 or Error code

Data-1 = Control group information. The control group information differs depending on the number of manipulators in the system.



Data-2 : Task information

0 : Master task

1 : Sub 1 task

2 : Sub 2 task

3 : Sub 3 task

4 : Sub 4 task

5 : Sub 5 task

In a system where independent control is not allowed, “0” is returned.

<Example>

Command RGROUP

Response 3, 0

In a system with one manipulator, the above example shows that the current control group is robot 1 and station 1, and the task selection status is master task.

■ Read/Data Access System Commands

RJDIR

Reads all job names, or the names of jobs related to the parent job.

Command format : RJDIR Job-Name

Job-Name = All the job names currently registered

= Parent job name (8 characters which can be processed in MS-DOS)

If a parent job name is specified, RJDIR reads the name of related jobs excluding the parent job. If there is no related child job, the command returns the null list. If the parent job has related child jobs but they are not registered in the system, an error occurs.

Response format : Name-1, Name-2, ..., Name-N or Error code

Name-1 = Job name-1 (8 characters)

Name-2 = Job name-2 (8 characters)

⋮
Name-N = Job name-N (8 characters)

<Example>

Command RJDIR MASTER-1

Response WORK-A, WORK-B, SAMPLE-1

RUFRAME

Reads a specified user coordinate data.

Command format : RUFRAME Data-1

Data-1 = User coordinate No.

0 : Reserved

1 : Reserved

2 : User coordinate 1

⋮

25 : User coordinate 24

Response format : Data-1, Data-2, ..., Data-28

Data-1 = ORG X coordinate value (unit : mm, significant 3 decimal points)

5.2 Robot Control Function

Data-2 = ORG Y coordinate value (unit : mm, significant 3 decimal points)
 Data-3 = ORG Z coordinate value (unit : mm, significant 3 decimal points)
 Data-4 = ORG wrist angle TX (unit : degree (°), significant 2 decimal points)
 Data-5 = ORG wrist angle TY (unit : degree (°), significant 2 decimal points)
 Data-6 = ORG wrist angle TZ (unit : degree (°), significant 2 decimal points)
 Data-7 = ORG type
 Data-8 = XX X coordinate value (unit : mm, significant 3 decimal points)
 Data-9 = XX Y coordinate value (unit : mm, significant 3 decimal points)
 Data-10 = XX Z coordinate value (unit : mm, significant 3 decimal points)
 Data-11 = XX wrist angle TX (unit : degree (°), significant 2 decimal points)
 Data-12 = XX wrist angle TY (unit : degree (°), significant 2 decimal points)
 Data-13 = XX wrist angle TZ (unit : degree (°), significant 2 decimal points)
 Data-14 = XX type
 Data-15 = XY X coordinate value (unit : mm, significant 3 decimal points)
 Data-16 = XY Y coordinate value (unit : mm, significant 3 decimal points)
 Data-17 = XY Z coordinate value (unit : mm, significant 3 decimal points)
 Data-18 = XY wrist angle TX (unit : degree (°), significant 2 decimal points)
 Data-19 = XY wrist angle TY (unit : degree (°), significant 2 decimal points)
 Data-20 = XY wrist angle TZ (unit : degree (°), significant 2 decimal points)
 Data-21 = XY type
 Data-22 = Tool No. (0 to 23)
 Data-23 = Number of 7th axis pulses (for travel axis, mm)
 Data-24 = Number of 8th axis pulses (for travel axis, mm)
 Data-25 = Number of 9th axis pulses (for travel axis, mm)
 Data-26 = Number of 10th axis pulses
 Data-27 = Number of 11th axis pulses
 Data-28 = Number of 12th axis pulses

- ORG, XX, XY coordinates are read in the base coordinate system.
- In a system having no external axis, Data-23 to Data-28 are "0".
- If the specified user coordinate system is not registered, an error occurs.
- If the group axis of the specified user coordinate system is not R1, an error occurs.
- If ORG, XX, and XY have different base axis data, an error occurs.

<Example>

Command RUFRAME 2

Response 600.0, 12.34, 500.0, 180.0, 0.0, 0.0, 0, ..., 0

SAVEV

Sends variable data to a host computer.

Command format : SAVEV Data-1, Data-2

Data-1 : Type of variables

0 : Byte type variables

1 : Integer type variables

2 : Double precision type variables

- 3 : Real number type variables
- 4 : Robot axis position type variables
- 5 : Base axis position type variables
- 6 : Station axis position type variables (only pulse type)

Data-2 : Variable No.

Response format : Data-1, Data-2, Data-3, ..., Data-10 or Error code

Data-1 = Byte value / Integer value / Double precision integer value / Real number value /
Position data type

Position data type = 0 : Pulse type
1 : Cartesian type

(When the position data type is "0")

Data-2 = Number of S-axis pulses / Number of base 1st axis pulses / Number of station 1st axis pulses

Data-3 = Number of L-axis pulses / Number of base 2nd axis pulses / Number of station 2nd axis pulses

Data-4 = Number of U-axis pulses / Number of base 3rd axis pulses / Number of station 3rd axis pulses

Data-5 = Number of R-axis pulses / Number of base 4th axis pulses / Number of station 4th axis pulses

Data-6 = Number of B-axis pulses / Number of base 5th axis pulses / Number of station 5th axis pulses

Data-7 = Number of T-axis pulses / Number of base 6th axis pulses / Number of station 6th axis pulses

Data-8 = Tool No.

(When the position data type is "1")

Data-2 = Coordinate data

- 0 : Base coordinate
- 1 : Robot coordinate
- 2 : User coordinate 1
- 3 : User coordinate 2
- ⋮
- 25 : User coordinate 24
- 26 : Tool coordinate
- 27 : Master tool coordinate

Data-3 = X coordinate value / Base 1st Cartesian value (unit : mm, significant 3 decimal points)

Data-4 = Y coordinate value / Base 2nd Cartesian value (unit : mm, significant 3 decimal points)

Data-5 = Z coordinate value / Base 3rd Cartesian value (unit : mm, significant 3 decimal points)

Data-6 = Wrist angle RX coordinate value (unit : degree (°), significant 2 decimal points)

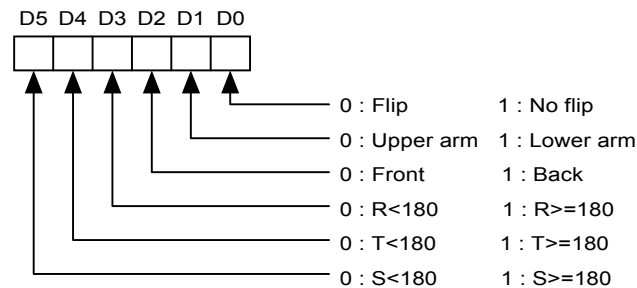
5.2 Robot Control Function

Data-7 = Wrist angle RY coordinate value (unit : degree (°), significant 2 decimal points)

Data-8 = Wrist angle RZ coordinate value (unit : degree (°), significant 2 decimal points)

Data-9 = Form

Data of the form is a value obtained by converting the following bit data to decimal notation.



Data-10 = Tool No.

<Example>

Command SAVEV 0, 0

Response 123

In the above example, 123, the value of byte type variable B000, is sent to the host computer.

5.2.6 System Control Function

■ Operation System Commands

HOLD

Turns HOLD ON/OFF

Command format : HOLD [Data]

Data = Specification of HOLD ON/OFF status
(0 : OFF, 1 : ON)

Response format : 0000 or Error code

<Example>

Command HOLD 1

Response 0000

RESET

Resets an alarm of manipulator.

The transmission alarms can be reset only by the programming pendant.

Command format : RESET

Response format : 0000 or Error code

<Example>

Command RESET

Response 0000

CANCEL

Cancels an error.

Command format : CANCEL

Response format : 0000 or Error code

<Example>

Command CANCEL

Response 0000

MODE

Selects a mode.

Command format : MODE Mode-No

Mode-No.=1 or 2

1 : Teach mode

2 : Play mode

Response format : 0000 or Error code

<Example>

Command MODE 2

Response 0000

CYCLE

Selects cycle.

Command format : CYCLE Cycle-No

Cycle-No = Cycle specification (1 to 3)

1 : Step

2 : 1 cycle

3 : Auto

Response format : 0000 or Error code

<Example>

Command CYCLE 2

Response 0000

5.2 Robot Control Function

SVON

Turns servo power supply ON/OFF.

To turn the servo ON/OFF by this command, connect the external servo ON (EXSVON) signal CN05-9 of the XIO board, to the CN05-10.

Command format : SVON Data

Data = Specification of servo power supply ON/OFF status
(0 : OFF, 1 : ON)

Response format : 0000 or Error code

<Example>

Command SVON 1

Response 0000

HLOCK

Sets an interlock between the programming pendant or playback panel and I/O operation signals. While the interlock is ON, all operations except the followings are prohibited.

- Emergency stop from the programming pendant
- Hold and emergency stop from the playback panel
- Input signals except I/O mode change, external start, external servo ON, cycle change, I/O prohibited, P.P/PANEL prohibited, and master call

HLOCK is invalid while the programming pendant is in edit mode or accessing to a file for other function.

Command format : HLOCK Data

Data = Interlock status setting (0 : OFF, 1 : ON)

Response format : 0000 or Error code

<Example>

Command HLOCK 1

Response 0000

MDSP

Receives message data and displays the message in the remote display of the programming pendant. If the currently shown display is not the remote display, it is changed forcibly to the remote display to display the MDSP command message.

Command format : MDSP Data

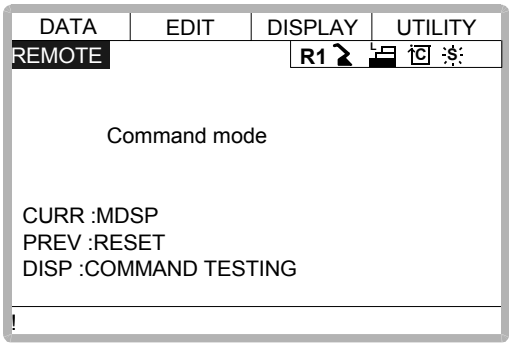
Data = Message to be displayed (Max. 30 characters)

Response format : 0000 or Error code

<Example>

Command MDSP auto running

Response 0000



CGROUP

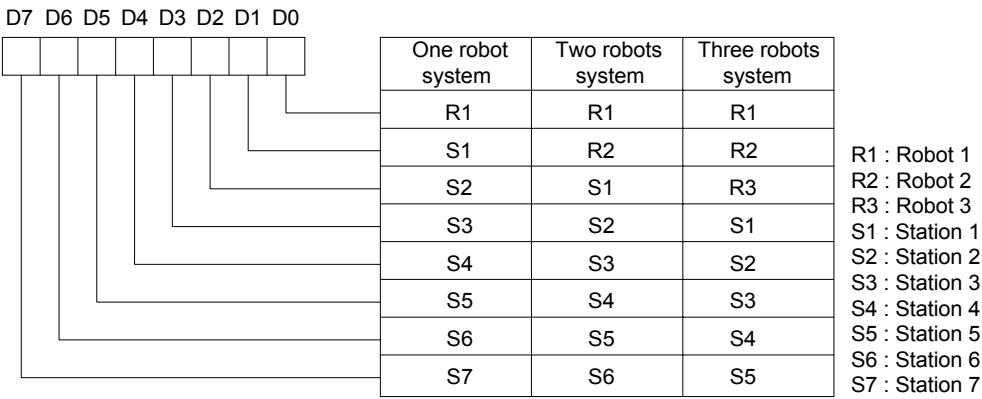
Changes an objective control group of various commands used in the host control function. The XRC can support multiple number of manipulators and stations. In this case, CGROUP is used when any control group for commands such as RPOSC is to be changed. For details, refer to Section 5.3 “Commands for Multiple-control Group and Independent Control Functions”. When the power supply is started up, robot 1, base 1, and station 1 (when a base and a stations exist) are specified.

Command format : CGROUP Data-1

Data-1 = Control group specification. A control group can be specified according to the following data. The specifications of control group differs depending on the number of manipulators in a system. The following settings can not be made.

- Selection of control axis which does not exist
- Simultaneous specification of R1 and R2
- Specification of multiple number of stations

In a system with a base axis (such as travel axis), when the manipulator with this base axis is specified, this base axis is automatically specified.



Response format : 0000 or Error code

5.2 Robot Control Function

<Example>

Command CGROUP 6

Response 0000

In the above example with two manipulators, robot 2 and station 1 are validated. By issuing RPOS after this command is issued, the current positions of robot 2 and station 1 can be read.

CTASK (Optional)

Changes the task for control in the host control function.

When the power supply is started up or in a system where an independent control is not allowed, this command is to be used as follows.

For details, refer to Section 5.3 “Commands for Multi-control Group and Independent Control Functions”.

- When the power supply is started up, a master task is selected as an task to be controlled.
- CTASK can not be used in a system where an independent control is not allowed.

Command format : CTASK Data-1

Data-1 = Specified task
 0 : Master task
 1 : Sub 1 task
 2 : Sub 2 task
 3 : Sub 3 task
 4 : Sub 4 task
 5 : Sub 5 task

Response format : 0000 or Error code

<Example>

Command CTASK 1

Response 0000

■ Start-up System Commands

START

Starts a job.

If a job name is specified for an operand, the relation between the job and the master job is checked and the execution is started from the beginning of the job. If no job name is specified, the execution is started from the current line number of the set execution job.

Command format : START [Job-Name]

Job-Name = Starting job name (8 characters)
 Can be omitted.

Response format : 0000 or Error code

<Example>

Command : START WORK-A

Response : 0000

MOVJ

Moves a manipulator to a specified coordinate position in joint motion.

Command format : MOVJ Data-1, Data-2, ..., Data-16

Data-1 = Motion speed (0.01 to 100.0%)

Data-2 = Coordinate specification

0 : Base coordinate

1 : Robot coordinate

2 : User coordinate 1

⋮

25 : User coordinate 24

Data-3 = X coordinate value (unit : mm, significant 3 decimal points)

Data-4 = Y coordinate value (unit : mm, significant 3 decimal points)

Data-5 = Z coordinate value (unit : mm, significant 3 decimal points)

Data-6 = Wrist angle TX (unit : degree (°), significant 2 decimal points)

Data-7 = Wrist angle TY (unit : degree (°), significant 2 decimal points)

Data-8 = Wrist angle TZ (unit : degree (°), significant 2 decimal points)

Data-9 = Type

Data-10 = Tool No. (0 to 23)

Data-11 = Number of 7th axis pulses (for travel axis, mm)

Data-12 = Number of 8th axis pulses (for travel axis, mm)

Data-13 = Number of 9th axis pulses (for travel axis, mm)

Data-14 = Number of 10th axis pulses

Data-15 = Number of 11th axis pulses

Data-16 = Number of 12th axis pulses

- In a system without external axis, Data-11 to Data-16 should be set to "0".
- If a specified user coordinate is not defined, an error occurs.

Response format : 0000 or Error code

<Example>

Command MOVJ 50.0, 2, 123.1, 50.34, 10.8, 180.0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

Response 0000

MOVL

Moves a manipulator to a specified coordinate position in linear motion.

Command format : MOVL Data-1, Data-2, ..., Data-17

5.2 Robot Control Function

Data-1 = Motion speed selection (0 : V (speed), 1 : VR (posture speed))

Data-2 = Motion speed (0.1 to □□□.□□ mm/s, 0.1 to □□□.□° /s)

Data-3 = Coordinate specification

0 : Base coordinate

1 : Robot coordinate

2 : User coordinate 1

⋮

25 : User coordinate 24

Data-4 = X coordinate value (unit : mm, significant 3 decimal points)

Data-5 = Y coordinate value (unit : mm, significant 3 decimal points)

Data-6 = Z coordinate value (unit : mm, significant 3 decimal points)

Data-7 = Wrist angle TX (unit : degree (°), significant 2 decimal points)

Data-8 = Wrist angle TY (unit : degree (°), significant 2 decimal points)

Data-9 = Wrist angle TZ (unit : degree (°), significant 2 decimal points)

Data-10 = Type

Data-11 = Tool No. (0 to 23)

Data-12 = Number of 7th axis pulses (for travel axis, mm)

Data-13 = Number of 8th axis pulses (for travel axis, mm)

Data-14 = Number of 9th axis pulses (for travel axis, mm)

Data-15 = Number of 10th axis pulses

Data-16 = Number of 11th axis pulses

Data-17 = Number of 12th axis pulses

- In a system without external axis, Data-12 to Data-17 should be set to "0".
- If a specified user coordinate is not defined, an error occurs.

Response format : 0000 or Error code

<Example>

Command MOVL 0, 500.0, 2, 123.1, 50.34, 10.8, 180.0, 0, 0, 0, 0, 0, 0, 0, 0, 0

Response 0000

IMOV

Moves a manipulator from the current position for a specified coordinate incremental value in linear motion.

Command format : IMOV Data-1, Data-2, ..., Data-17

Data-1 = Motion speed selection (0 : V (speed), 1 : VR (posture speed))

Data-2 = Motion speed (0.1 to □□□.□□ mm/s, 0.1 to □□□.□° /s)

Data-3 = Coordinate specification

0 : Base coordinate

1 : Robot coordinate

2 : User coordinate 1
 ⋮
 25 : User coordinate 24
 26 : Tool coordinate

Data-4 = X coordinate incremental value (unit : mm, significant 3 decimal points)
 Data-5 = Y coordinate incremental value (unit : mm, significant 3 decimal points)
 Data-6 = Z coordinate incremental value (unit : mm, significant 3 decimal points)
 Data-7 = Wrist angle TX incremental value (unit : degree (°), significant 2 decimal points)
 Data-8 = Wrist angle TY incremental value (unit : degree (°), significant 2 decimal points)
 Data-9 = Wrist angle TZ incremental value (unit : degree (°), significant 2 decimal points)
 Data-10 = Reserved
 Data-11 = Tool No. (0 to 23)
 Data-12 = Number of 7th axis pulses (for travel axis, mm)
 Data-13 = Number of 8th axis pulses (for travel axis, mm)
 Data-14 = Number of 9th axis pulses (for travel axis, mm)
 Data-15 = Number of 10th axis pulses
 Data-16 = Number of 11th axis pulses
 Data-17 = Number of 12th axis pulses

- In a system without external axis, Data-12 to Data-17 should be set to "0".
- If a specified user coordinate is not defined, an error occurs.

Response format : 0000 or Error code

<Example>

Command IMOV 0, 100.0, 2, 10.0, 10.0, 10.0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

Response 0000

PMOVJ

Moves a manipulator to a specified pulse position in joint motion.

Command format : PMOVJ Data-1, Data-2, ..., Data-14

Data-1 = Motion speed (0.01 to 100.0 %)
 Data-2 = Number of S-axis pulses
 Data-3 = Number of L-axis pulses
 Data-4 = Number of U-axis pulses
 Data-5 = Number of R-axis pulses
 Data-6 = Number of B-axis pulses
 Data-7 = Number of T-axis pulses
 Data-8 = Tool No. (0 to 23)
 Data-9 = Number of 7th axis pulses
 Data-10 = Number of 8th axis pulses
 Data-11 = Number of 9th axis pulses
 Data-12 = Number of 10th axis pulses
 Data-13 = Number of 11th axis pulses

5.2 Robot Control Function

Data-14 = Number of 12th axis pulses

- In a system without external axis, Data-9 to Data-14 should be set to "0".

Response format : 0000 or Error code

<Example>

Command PMOVJ 20.0, 100, 200, 300, 400, 500, 0, 0, 0, 0, 0, 0, 0, 0

Response 0000

PMOVL

Moves a manipulator to a specified pulse position in linear motion.

Command format : PMOVL Data-1, Data-2, ..., Data-15

Data-1 = Motion speed selection (0 : V (speed), 1 : VR (posture speed))

Data-2 = Motion speed (0.1 to □□□.□□ mm/s, 0.1 to □□□.□° /s)

Data-3 = Number of S-axis pulses

Data-4 = Number of L-axis pulses

Data-5 = Number of U-axis pulses

Data-6 = Number of R-axis pulses

Data-7 = Number of B-axis pulses

Data-8 = Number of T-axis pulses

Data-9 = Tool No. (0 to 23)

Data-10 = Number of 7th axis pulses

Data-11 = Number of 8th axis pulses

Data-12 = Number of 9th axis pulses

Data-13 = Number of 10th axis pulses

Data-14 = Number of 11th axis pulses

Data-15 = Number of 12th axis pulses

- In a system without external axis, Data-10 to Data-15 should be set to "0".

Response format : 0000 or Error code

<Example>

Command PMOVL 0, 123.0, 10, 200, 300, 400, 500, 0, 0, 0, 0, 0, 0, 0, 0

Response 0000

■ Editing System Commands

DELETE

Deletes a specified job.

Command format : DELETE Job-Name

Job-Name = Job name to be deleted (8 characters which can be processed in MS-DOS)

= * : Delete all jobs

Response format : 0000 or Error code

<Example>

Command DELETE WORK-B

Response 0000

CVTRJ (Optional)

Converts a specified job to a relative job of a specified coordinate.

Command format : CVTRJ Data-1, Data-2

Data-1 = Name of job to be converted

Data-2 = Conversion coordinate system specification

0 : Base coordinate

1 : Robot coordinate

2 : User coordinate 1

⋮

25 : User coordinate 24

26 : Reserved

- If the specified user coordinate is not defined, an error occurs.

Response format : 0000 or Error code

<Example>

Command CVTRJ TESTJOB, 2

Response 0000



This function requires the relative job function of the XRC.

CVTSJ (Optional)

Converts a specified job to a standard job (pulse job) in a specified converting method.

Command format : CVTSJ Data-1, Data-2, Data-3

Data-1 = Name of job to be converted

Data-2 = Converting method specification

0 : Previous step regarded (B-axis sign same)

1 : Form regarded

2 : Previous step regarded (R-axis travel amount minimum)

Data-3 = Reference position variable. Position variable No. indicating the first step conversion reference position when the previous step is regarded.

Response format : 0000 or Error code

5.2 Robot Control Function

<Example>

Command CVTSJ SAMPLE01, 1, 0

Response 0000

In the above example, P000 is to be the reference point and the job "SAMPLE01" is converted to a standard job with the form regarded.



This function required the relative job function of the XRC.

WUFRAME

Writes a user coordinate data to a specified user coordinate system.

Command format : WUFRAME Data-1, Data-2, ..., Data-29

Data-1 = User coordinate No.

0 : Reserved

1 : Reserved

2 : User coordinate 1

⋮

25 : User coordinate 24

Data-2 = ORG X coordinate value (unit : mm, significant 3 decimal points)

Data-3 = ORG Y coordinate value (unit : mm, significant 3 decimal points)

Data-4 = ORG Z coordinate value (unit : mm, significant 3 decimal points)

Data-5 = ORG wrist angle TX (unit : degree (°), significant 2 decimal points)

Data-6 = ORG wrist angle TY (unit : degree (°), significant 2 decimal points)

Data-7 = ORG wrist angle TZ (unit : degree (°), significant 2 decimal points)

Data-8 = ORG type

Data-9 = XX X coordinate value (unit : mm, significant 3 decimal points)

Data-10 = XX Y coordinate value (unit : mm, significant 3 decimal points)

Data-11 = XX Z coordinate value (unit : mm, significant 3 decimal points)

Data-12 = XX wrist angle TX (unit : degree (°), significant 2 decimal points)

Data-13 = XX wrist angle TY (unit : degree (°), significant 2 decimal points)

Data-14 = XX wrist angle TZ (unit : degree (°), significant 2 decimal points)

Data-15 = XX type

Data-16 = XY X coordinate value (unit : mm, significant 3 decimal points)

Data-17 = XY Y coordinate value (unit : mm, significant 3 decimal points)

Data-18 = XY Z coordinate value (unit : mm, significant 3 decimal points)

Data-19 = XY wrist angle TX (unit : degree (°), significant 2 decimal points)

Data-20 = XY wrist angle TY (unit : degree (°), significant 2 decimal points)

Data-21 = XY wrist angle TZ (unit : degree (°), significant 2 decimal points)

Data-22 = XY type

Data-23 = Tool No. (0 to 23)

Data-24 = Number of 7th axis pulses (for travel axis, mm)

Data-25 = Number of 8th axis pulses (for travel axis, mm)

Data-26 = Number of 9th axis pulses (for travel axis, mm)

Data-27 = Number of 10th axis pulses

Data-28 = Number of 11th axis pulses

Data-29 = Number of 12th axis pulses

Response format : 0000 or Error code

- ORG, XX, and XY coordinate are written in the base coordinate system.
- In a system without external axis, Data-24 to Data-29 should be set to "0".
- If the group axis of the specified user coordinate system is not R1, an error occurs.
- For base axis data of ORG, XX, and XY, the same data should be used.

<Example>

Command WUFRAME 2, 600.0, 12.34, 500.0, 180.0, 0.0, 0.0, 0, ..., 0

Response 0000

LOADV

Receives variable data from a host computer and writes it in a specified variable.

Command format : LOADV Data-1, Data-2, ..., Data-12

Data-1 = Type of variables

- 0 : Byte type variables
- 1 : Integer type variables
- 2 : Double precision type variables
- 3 : Real number type variables
- 4 : Robot axis position type variables
- 5 : Base axis position type variables
- 6 : Station axis position type variables (only pulse type)

Data-2 = Variable No.

Data-3 = Byte value / Integer value / Double precision type integer value / Real number value / Position data type

- Position data type = 0 : Pulse type
- 1 : Cartesian type

(When the position data type is 0)

Data-4 = Number of S-axis pulses / Number of base 1st axis pulses / Number of station 1st axis pulses

Data-5 = Number of L-axis pulses / Number of base 2nd axis pulses / Number of station 2nd axis pulses

Data-6 = Number of U-axis pulses / Number of base 3rd axis pulses / Number of station 3rd axis pulses

Data-7 = Number of R-axis pulses / Number of base 4th axis pulses / Number of station 4th axis pulses

5.2 Robot Control Function

Data-8 = Number of B-axis pulses / Number of base 5th axis pulses / Number of station 5th axis pulses

Data-9 = Number of T axis pulses / Number of base 6th axis pulses / Number of station 6th axis pulses

Data-10 = Tool No.

(When the position data type is 1)

Data-4 = Coordinate data

Coordinate data = 0 : Base coordinate
 1 : Robot coordinate
 2 : User coordinate 1
 3 : User coordinate 2
 ⋮
 25 : User coordinate 24
 26 : Tool coordinate
 27 : Master tool coordinate

Data-5 = X coordinate value / Base 1st axis Cartesian value (unit : mm, significant 3 decimal points)

Data-6 = Y coordinate value / Base 2nd axis Cartesian value (unit : mm, significant 3 decimal points)

Data-7 = Z coordinate value / Base 3rd axis Cartesian value (unit : mm, significant 3 decimal points)

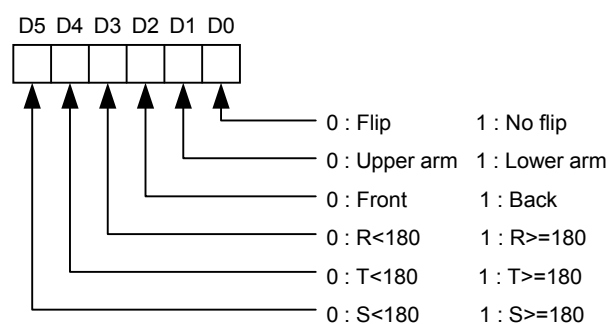
Data-8 = Wrist angle RX coordinate value (unit : degree (°), significant 2 decimal points)

Data-9 = Wrist angle RY coordinate value (unit : degree (°), significant 2 decimal points)

Data-10 = Wrist angle RZ coordinate value (unit : degree (°), significant 2 decimal points)

Data-11 = Form

Data of the form is a value obtained by converting the following bit data to decimal notation.



Data-12 = Tool No.

Response format : 0000 or Error code

<Example>

Command LOADV 0, 0, 123

Response 0000

In the above example, 123 is stored in the XRC byte type variable B000.

■ Job Selection System Commands

SETMJ

Sets a specified job as a master job.

At the same time, the specified job is set as a execution job.

Command format : SETMJ Job-Name

Job-Name = Job name to be set (8 characters which can be processed in MS-DOS)

Response format : 0000 or Error code

<Example>

Command SETMJ WORK-C

Response 0000

JSEQ

Sets a job name and a line No.

Command format : JSEQ Data-1, Data-2

Data-1 = Job name to be set (8 characters which can be processed in MS-DOS)

Data-2 = Line No. to be set (0 to 9999)

Response format : 0000 or Error code

<Example>

Command JSEQ WORK-A, 10

Response 0000

5.2.7 I/O Read/Write Function

The host control function can read out or write in (change) I/O signal status using the host computer.

The following table shows the number of signals and the types of signals to be sent or received by the host control function.

○ : Possible to execute

Signal	Signal Range (Qty)	Classification	Read-out	Write-in
0xxx	0010 to 0247 (192)	General input signal	○	
1xxx	1010 to 1247 (192)	General output signal	○	
2xxx	2010 to 2327 (256)	External input signal	○	
3xxx	3010 to 3327 (256)	External output signal	○	
4xxx	4010 to 4287 (224)	Specific input signal	○	
5xxx	5010 to 5387 (304)	Specific output signal	○	
7xxx	7010 to 7887 (704)	Auxiliary relay	○	
8xxx	8010 to 8107 (80)	Control status signal	○	
82xx	8210 to 8247 (32)	Pseudo input signal	○	
9xxx	9010 to 9327 (256)	Network input	○	○

■ Transmission Procedure

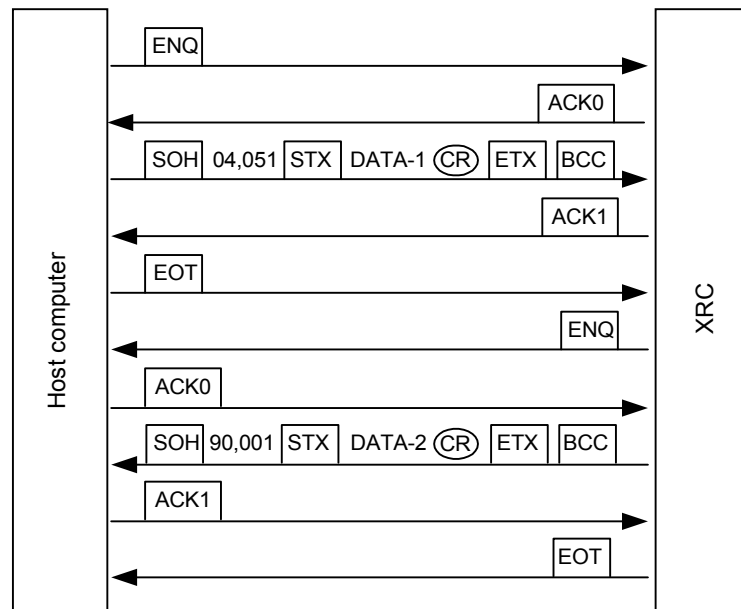
The transmission from the host computer proceeds as follows.

1. The ENQ code is sent from the host computer to establish a data link.
2. After the data link is established, the data is sent from the host computer. The data transmission should be completed in a single block.
3. After the request to send is accepted, the host computer should be ready to receive. The XRC sends the ENQ code to establish the data link.
4. After the data link is established, the data sent from the XRC is received to terminate the transmission at completion of receipt.

The read/write function can be distinguished by the header number. Refer to the header number list.

■ Read-out of I/O Signal Status

The I/O signal status can be read out when the read/write function is enabled and an alarm or an error is not occurring.



DATA-1

Command format : Data-1, Data-2

Data-1 = Start No.

Data-2 = Number of data points

DATA-2

Response format (at normal completion) : Data-1, Data-2, ..., Data-256

Data-1 = First 8 points of data

Data-2 = Second 8 points of data

⋮

Data-256 = Last (up to 256th) 8 points of data

Response format (at abnormal completion) : SOH 90,000 STX Error code CR ETX BCC

Error code Number with 4 digits other than 0000

Number smaller than 1000, 0 is added before the number.

<Example>

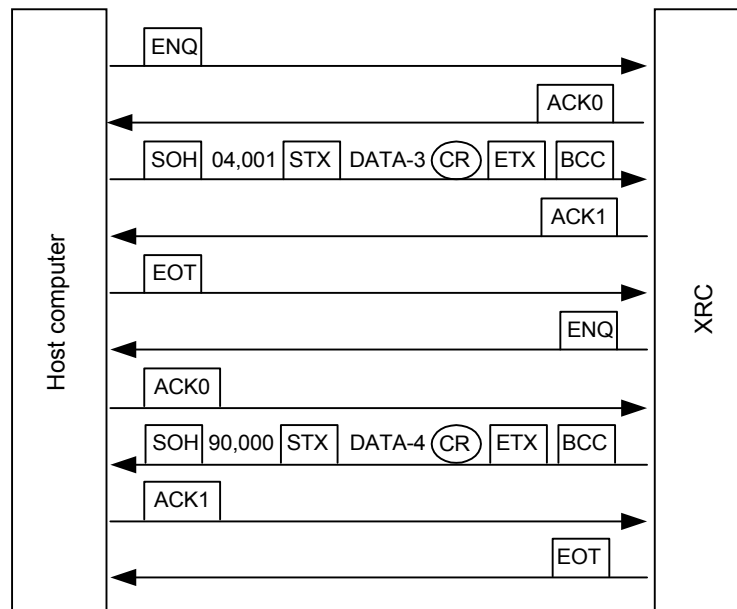
When 3 points are read out from 7010

Command 7010, 3

Response 2, 0, 5

■ Write-in of I/O Signal Status

The write-in of I/O signal status is enabled when the manipulator is stopped in teach mode and when no alarm or error is occurring.



DATA-3

Command format : Data-1, Data-2, Data-3, Data-4, ..., Data-258

Data-1 = Start No.

Data-2 = Number of data points

Data-3 = First 8 points of data

Data-4 = Second 8 points of data

⋮

Data-258 = Last (up to 256th) 8 points of data

DATA-4

Response format (at normal completion) : 0000

Response format (at abnormal completion) : Number with 4 digits other than 0000

Number smaller than 1000, 0 is added before the number.

<Example>

When status of 3 points is changed from 9010

Command 9010, 3, 4, 3, 12

Response 0000

5.3 Commands for Multi-control Group and Independent Control Functions

5.3.1 Commands for Multi-control Group

The XRC can control more than one manipulator or station simultaneously. The following commands are available for this multi-control function.

- CGROUP : Changing the control group
- RGROUP : Reading the control group and task selected status

The following table shows the combination which can be set by using the above commands.

R1 (robot 1)	R2 (robot 2)	R3 (robot 3)	S□ ^{*1}
×	×	×	●
● ^{*2}	×	×	×
●	×	×	●
×	●	×	×
×	●	×	●
×	×	●	×
×	×	●	●

^{*1} Either one station among S1 to S6 can be selected in a system having several stations.

^{*2} Base axes is included in robot axes.

The following commands have influence when the above commands are used. The operations of these commands are applicable to the set control group.

Read System Commands	Startup System Commands	Editing System Command
RPOSJ RPOSC RUFRAME	MOVJ MOVL IMOV PMOVJ PMOVL	WUFRAME

5.3.2 Commands for Independent Control Function

The XRC supports the independent control function which can execute more than one job simultaneously. For this independent function, the following commands are available.

- CTASK : Changing the tasks
- RGROUP : Reading the control group or task selected status

By using the above commands, a task to be controlled can be changed.

The following commands have influence when the independent control function is used.

① Job startup (START)

Starts up a job. When a job name specification is provided for operand, execution of that job is started from the head of job as a task that is currently selected. When a job name is not specified, all tasks that are currently set are executed from the current line No.

② Waiting for completion of startup (JWAIT)

As a response, returns the information whether the currently selected task operation has been completed.

③ Master job registration (SETMJ)

Sets a specified job as a master job, to the currently selected task.

④ Job selection (JSEQ)

Sets a job name, a line No. to the currently selected task.

⑤ Read of selected job (RJSEQ)

Reads the job name, line No., and step No. of the currently selected task.

⑥ Read of status (RSTATS)

Returns the system status disregarding the selected task status.

However, the “running” status differs from the conventional status ; the “running” is entered even if only one task was operating.

5.4 Alarm Codes

Code	Contents	Remarks
4112	Data sending error 1 : NAK retry over 2 : Timer A timeout retry over 3 : Alternating response error retry over	The EOT code is sent out and the data link is canceled.
4113	Data receiving error 1 : Receiving timeout (Timer A) 2 : Receiving timeout (Timer B) 3 : Short heading length 4 : Long heading length 5 : Illegal header No. 6 : Text longer than 256 characters	For 3 to 6, the EOT code is sent out and the data link is canceled.
4114	Transmission hardware error 1 : Overrun error 2 : Parity error 3 : Framing error 4 : Sending timeout (Timer A) 5 : Sending timeout (Timer B)	The EOT code is not sent.
4115	Transmission system block This alarm notifies that the transmission procedure is correct but the received contents makes inconsistency in the system. Usually this alarm is resulted from violation of rules on the other party or illegal notification. 1 : EOT was received while waiting for ACK 2 : EOT was received while waiting for ENQ 3 : EOT was received before receiving the last block 4 : Code other than EOT was received after receiving the last block	For 4, the EOT code is sent out and the data link is canceled.
4206	Transmission system error This alarm notifies an error on processing of transmission system. This alarm occurs in the following cases. 100 Error in transmission task • A job containing position type variable of which the value is not set, was to be saved. • A job which does not exist on the memory, was to be saved.	The EOT code is not sent.

5.5 Interpreter Message List

5.5 Interpreter Message List

The interpreter messages are classified into the following categories.

- 1xxx : Command text general error
- 2xxx : Command execution mode error
- 3xxx : Command execution error
- 4xxx : Job registration error
- 5xxx : File contents error

Interpreter Message List

Code	Contents
1010	Command error
1011	Error in number of command operands
1012	Command operand value range over
1013	Command operand length error
1020	Disk full of files
2010	Manipulator operating
2020	Hold by programming pendant
2030	Hold by playback panel
2040	External hold
2050	Command hold
2060	Error/alarm occurring
2070	Servo OFF
2080	Incorrect mode
2090	File accessing by other function
2100	Command remote not set
2110	This data can not be accessed.
2120	This data can not be loaded.
2130	Editing
3010	Turn ON the servo power.

Interpreter Message List	
Code	Contents
3040	Perform home positioning.
3050	Confirm positions.
3070	Current value not made
3220	Panel lock ; mode/cycle prohibit signal is ON.
3230	Panel lock ; start prohibit signal is ON.
3350	User coordinate not taught
3360	User file destroyed
3370	Incorrect control group
3380	Incorrect base axis data
3390	Relative job conversion prohibit (at CVTRJ)
3400	Master call prohibit (parameter)
3410	Master call prohibit (lamp On during operation)
3420	Master call prohibit (teach lock)
3430	Robot calibration data not defined
4010	Insufficient memory capacity (job registered memory)
4012	Insufficient memory capacity (position data registered memory)
4020	Job editing prohibit
4030	Same job name exists
4040	No specified job
4060	Set a execution job.
4120	Position data destroyed
4130	Position data not exist
4140	Incorrect position variable type
4150	END instruction for job which is not master job
4170	Instruction data destroyed

5.5 Interpreter Message List

Interpreter Message List	
Code	Contents
4190	Invalid character in job name
4200	Invalid character in label name
4230	Invalid instruction in this system
4420	No step in job to be converted
4430	Already converted
4480	Teach user coordinate.
4490	Relative job/Independent control function not permitted
5110	Syntax error (syntax of instruction)
5120	Position data error
5130	No NOP or END instruction
5170	Format error (incorrect format)
5180	Incorrect number of data
5200	Data range over
5310	Syntax error (except instruction)
5340	Error in pseudo instruction specification
5370	Error in condition data record
5390	Error in job data record
5430	System not matched
5480	Incorrect welding function type

6 Data List

6.1 Header Number List

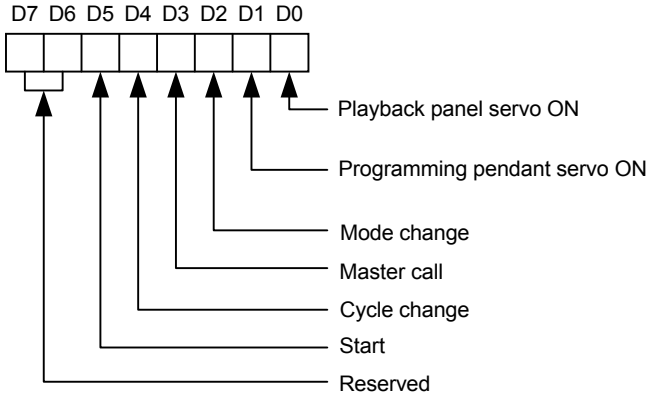
		Contents	File Name
01,	000	Command from a external computer	
02,	001	Single job data	xxxxxxxx. JBI
	002	Related job data	xxxxxxxx. JBR
02,	051	Request for single job data	
	052	Request for related job data	
02,	200	Tool data	TOOL. CND
	201	Weaving condition data	WEAV. CND
	202	User coordinate data	UFRAME. CND
	203	Welding start condition data	ARCSRT. CND
	204	Welding end condition data	ARCEND. CND
	232	Variable data	VAR. DAT
	240	System information	SYSTEM. SYS
	241	Alarm history data	ALMHIST. DAT
02,	300	Request for tool data	
	301	Request for weaving condition data	
	302	Request for user coordinate data	
	303	Request for welding start condition data	
	304	Request for welding end condition data	
	332	Request for variable data	
	340	Request for system information	
	341	Request for alarm history data	

6.1 Header Number List

		Contents	File Name
03,	001	Byte type variable	
	002	Integer type variable	
	003	Double precision type variable	
	004	Real number type variable	
	005	Robot axis position type variable (pulse type)	
	006	Robot axis position type variable (XYZ type)	
	007	External axis position type variable (pulse type)	
	008	External axis position type variable (XYZ type)	
03,	051	Request for byte type variable	
	052	Request for integer type variable	
	053	Request for double precision type variable	
	054	Request for real number type variable	
	055	Request for robot axis position type variable (pulse type)	
	056	Request for robot axis position type variable (XYZ type)	
	057	Request for external axis position type variable (pulse type)	
	058	Request for external axis position type variable (XYZ type)	
04,	001	Request for write-in of I/O signals	
	051	Request for read-out of I/O signals	
90,	000	Command or data response (normal/error)	
	001	Command or data response (data)	

6.2 Parameter List

Parameter for Transmission

Parameter	Contents and Set Value	Initial Value
S2C110	<p>Playback panel operation (in remote) specification</p> <p>0 : Invalid 1 : Valid</p> 	0
RS000	<p>Standard port protocol specification</p> <p>0 : NON 1 : System reserved 2 : BSC LIKE 3 : FC1</p>	2

Parameter for Transmission (for BSC protocol)

Parameter	Contents and Set Value	Initial Value
RS030	<p>Number of data bits</p> <p>7 : 7 (bit) 8 : 8</p>	8
RS031	<p>Number of stop bits</p> <p>0 : 1 (bit) 1 : 1.5 2 : 2</p>	0

6.2 Parameter List

Parameter for Transmission (for BSC protocol)		
Parameter	Contents and Set Value	Initial Value
RS032	Parity specification 0 : No specification 1 : Odd parity 2 : Even parity	2
RS033	Transmission speed specification 1 : 150 (baud rate) 2 : 300 3 : 600 4 : 1200 5 : 2400 6 : 4800 7 : 9600	7
RS034	Timer A : Sequence monitoring timer Serves as protection against invalid response or no response Unit : 0.1 sec. (Setting range : 0 to 100)	30
RS035	Timer B : Text reception monitoring timer Serves as protection against no response of text end character Unit : 0.1 sec. (Setting range : 0 to 255)	200
RS036	Retry 1 : Number of resendings of a control character for invalid response or no response Setting range : 0 to 30	10
RS037	Retry 2 : Number of resendings of a text for a block check error (reception of NAK) Setting range : 0 to 10	3
RS038	Block check method 0 : Check sum	0

7 Comparison of Data Transmission Functions

Comparison of Functions Related to Controller Basic Functionality

Function	XRC	MRC
Multiport Function Setup	Not supported	Supported Two ports are available for FC1 and data transmission • Serial processing is possible but parallel processing impossible • Not supported with MRC II.

Comparison of Functions Related to Data Transmission (DCI)

Function	XRC	MRC
LOADJ, SAVEJ	Supported	Supported
LOADV, SAVEV	Supported	Supported

Comparison of Functions Related to Data Transmission (Stand-alone)

Function	XRC	MRC
Job (Single/Related) Save, Load, Verify	Supported	Supported
Condition data Save, Load, Verify	Supported File names of option function are incompatible.	Supported
System data Save	Supported	Supported

Comparison of Functions Related to Data Transmission (Host Control)

Function	XRC	MRC
UPLOAD, DOWNLOAD	Supported File names of condition data option function are incompatible.	Supported
RALARM	Supported	Supported
RPOS	Not supported	Supported

Comparison of Functions Related to Data Transmission (Host Control)

Function	XRC	MRC
RPOSJ	Supported	Supported
RSTATS	Supported	Supported
RJSEQ	Supported	Supported
RJDIR	Supported	Supported
RPOSC	Supported	Supported
JWAIT	Supported	Supported
RUFRAME	Supported	Supported
START	Supported	Supported
HOLD	Supported	Supported
RESET	Supported	Supported
CANCEL	Supported	Supported
DELETE	Supported	Supported
SETMJ	Supported	Supported
JSEQ	Supported	Supported
MODE	Supported	Supported
CYCLE	Supported	Supported
SVON	Supported	Supported
HLOCK	Supported	Supported
MDSP	Supported	Supported
MOVJ	Supported	Supported
MOVL	Supported	Supported
IMOV	Supported	Supported
PMOVJ	Supported	Supported
PMOVL	Supported	Supported
CVTRJ	Supported	Supported
WUFRAME	Supported	Supported
CGROUP	Supported Control group information differs depending on number of manipulators in a system.	Supported
RGROUP	Supported	Supported
CTASK	Supported	Supported

Comparison of Functions Related to Data Transmission (Host Control)

Function	XRC	MRC
CVTSJ	Supported	Supported
SAVEV	Supported	Supported
LOADV	Supported	Supported

8 Remote Function Setting

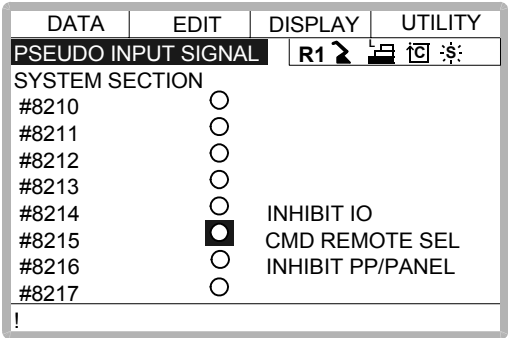
Whether I/O remote control or command remote control should be enabled in the remote mode can be set in the pseudo input display.

Operation

Select {IN/OUT} under the top menu ➡ Select {PSEUDO INPUT SIG} ➡ Select an item ^{*1}

Explanation

- ^{*1} Select “INHIBIT IO” or “CMD REMOTE SEL”.
The item enabled is marked with “●” while the item disabled is marked with “○”.



When INHIBIT IO is marked with ○ (disabled), the I/O remote function is enabled.
When CMD REMOTE SEL is marked with ● (enabled), the command remote function is enabled.

When INHIBIT IO is marked with ○ (disabled), the I/O remote function is enabled so that the operation from external I/O is enabled with the P.PANEL remote key pressed.
When INHIBIT IO is marked with ● (enabled), the operation from external I/O is disabled.

When CMD REMOTE SEL is marked with ● (enabled), the host control function is enabled with the P.PANEL remote key pressed.
When CMD REMOTE SEL is marked with ○ (disabled), the host control function is disabled.

When INHIBIT PP/PANEL is marked with ○ (disabled), the operation from P.P/P.PANEL is enabled even in remote mode. When INHIBIT PP/PANEL is marked with ● (enabled), the operation from P.P/P.PANEL is disabled, except for the operations of emergency stop, hold, and remote key.

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