

Mitsubishi Industrial Robot

CR750-D/CR751-D series controller CRnD-700 series controller

GOT Direct Connection Extended Function Instruction Manual





Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.

All teaching work must be carried out by an operator who has received special training. (This also applies to maintenance work with the power source turned ON.)

Enforcement of safety training

CAUTION

For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan. (This also applies to maintenance work with the power source turned ON.)

Preparation of work plan

⚠ WARNING

Prepare a device that allows operation to be stopped immediately during teaching work. (This also applies to maintenance work with the power source turned ON.)

Setting of emergency stop switch

⚠ CAUTION

During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc. (This also applies to maintenance work with the power source turned ON.)

Indication of teaching work in progress

∕!\ DANGER

Provide a fence or enclosure during operation to prevent contact of the operator and robot.

Installation of safety fence

⚠ CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.

Signaling of operation start

⚠ CAUTION

As a principle turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc. Indication of maintenance work in progress

⚠ CAUTION

Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors. Inspection before starting work

The points of the precautions given in the separate "Safety Manual" are given below. Refer to the actual "Safety Manual" for details.

⚠ DANGER	When automatic operation of the robot is performed using multiple control
	devices (GOT, programmable controller, push-button switch), the interlocking of

CAUTION

Use the robot within the environment given in the specifications. Failure to do so could lead to a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)

Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.

Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

CAUTION Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque. Exceeding these values could lead to alarms or faults.

Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

WARNING

Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

CAUTION Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

WARNING
When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

CAUTION Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

CAUTION

Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.

CAUTION

Never carry out modifications based on personal judgments, or use non-designated maintenance parts.

Failure to observe this could lead to faults or failures.

↑ WARNING

When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

⚠ CAUTION

Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Moreover, it may interfere with the peripheral device by drop or move by inertia of the arm.

⚠ CAUTION

Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters. If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information of the robot controller may be damaged.

⚠ DANGER

Do not connect the Handy GOT when using the GOT direct connection function of this product. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

⚠ DANGER

Do not remove the SSCNET III cable while power is supplied to the controller. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

♠ DANGER

Attach the cap to the SSCNET III connector after disconnecting the SSCNET III cable. If the cap is not attached, dirt or dust may adhere to the connector pins, resulting in deterioration connector properties, and leading to malfunction.

A CAUTION

Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

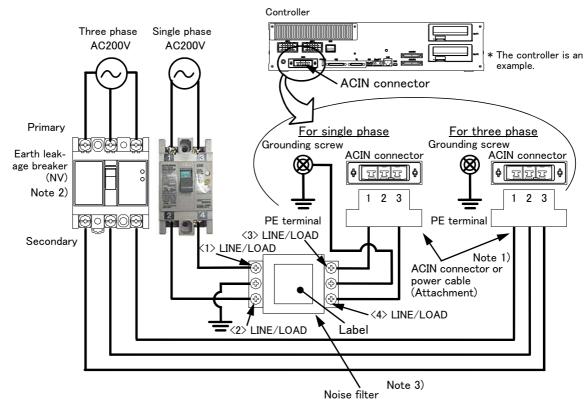
A CAUTION

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

Notes of the basic component are shown.

A CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller of CR751-D or CR751-Q because of leakage protection.



- Note 1) Crimping swage is recommended for connecting the attachment ACIN connector (soldering is also possible)
 Recommendation compression tools: 234171-1(Tyco Electronics)
- Note 2) The earth leakage breaker is the customer preparation. Always use the cover below.

 Recommendation: For single primary power supply NV30FAU-2P-10A-AC100-240V-30mA, (Cover: TCS-05FA2)

 For three primary power supply NV30FAU-3P-10A-AC100-240V-30mA, (Cover: TCS-05FA3)
- Note 3) If necessary, as shown in the figure, connects the noise filter between ACIN terminal blocks and primary power supply. (Recommended noise filter: SUP-EL20-ER6 *OKAYA ELECTRIC INDUSTRIES)
 - Please prepare the following: Leakage current breaker (with the terminal cover), cable for connecting the primary power supply (AWG #14 (2mm² or above), cables to ground the primary power supply (AWG #12 (3.5mm² or above).
 - The secondary power cable (with the ACIN connector) for single phase or three phase power is supplied with the product to match the specifications. When you build a cable suitable for your environment using the ACIN connector and the ACIN terminal supplied, prepare a secondary power cable (AWG #14 (2mm²) or above).
 - 2) Confirm that the primary power matches the specifications.
 - 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
 - 4) Connect the secondary power cable.
 - a) When using the supplied power cable with the ACIN connector

Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.

b) When building a power cable using the ACIN connector and the ACIN terminals supplied

Connect the ACIN terminals with the secondary power cable (prepared by customers), and insert the ACIN terminals to the ACIN connector pins with the following numbers. Crimping caulking is recommended to connect the ACIN terminals.

For single phase: 1 and 3
For three phase: 1, 2, and 3

Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.

- 5) Connect this ACIN connector to the ACIN connector on the front of the controller.
- 6) Connect the grounding cable to the PE terminal. (M4 screw)
- 7) Connect the primary power cable to the primary side terminal of the earth leakage breaker.

Revision history

	Revision history						
Date of print	Specifications No.	Details of revisions					
2011-07-01	BFP-A8849	First edition created					
2012-03-07	BFP-A8849-A	CR750-D/CR751-D series controller were added.					
2012-12-05	BFP-A8849-B	The statement about trademark registration was added.					
2014-08-06	BFP-A8849-C	The cover and corporate logo mark of this manual was changed. The statement about trademark registration was modified.					
2014-12-11	BFP-A8849-D	The corporate logo mark of illustrations in this manual was changed.					
2015-03-10	BFP-A8849-E	The new function of software version S3p was added. Long-precision integer number and single-precision real number can be used for reading/writing of numeric value variables.					

*Introduction

Thank you for buying the industrial robot MELFA manufactured by Mitsubishi Electric.

This manual explains the expanded function and operation when connecting the robot controller and the GOT directly in SD series robot controller (CR750-D/CR751-D series, CRnD-700 series). Monitoring of the robot information and the setup of the data are possible through the shared memory.

Please carefully read and fully understand this document before making use of the extended functions

Target controller of this document

This document supports the robot controller below:

- · CR750-D/CR751-D series controller: ... Ver. S3 or later
- CRnD-700 series controller: Ver. S2g or later

Robot language MELFA BASIC V or later

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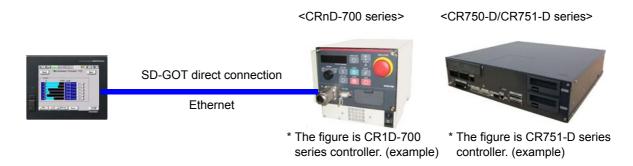
1 Overview

This manual explains the expanded function and operation when connecting the robot controller and the GOT directly in CR750-D/CR751-D series and CRnD-700 series robot controller.

Monitoring of the robot information and the setup of the data are possible through the shared memory. (The shared memory is extended.)

Note: These shared memory extended functions only support MELFA-BASIC V or later. They do not support MELFA-BASIC N.

(For more information, refer to Page 6, "2.1.2 Check Robot Language Setting")



1.1 Function List

These shared memory extended functions are largely classified into monitoring and operation functions. Monitoring function periodically updates and outputs the data in shared memory on the robot. Operation function outputs a request from the GOT to the robot as needed and exchanges the data.

No	Item		Item Description		Update Cycle
1	Monitor- ing func- tion	Monitor operation control setting values	Monitors the setting values relating to operation control command and operation control.	Motoring output (Robot side peri-	7.1msec
2		Monitor activities	Monitors the robot's activities (current speed, arrival factor to the aimed position, etc.)	odically updates the data in shared memory)	7.1msec
3		Monitor current and aimed positions	Monitors current and aimed positions of robot.		7.1msec
4		Monitor general position and joint information	Monitors various position type data (orientation at collision, etc.) and joint type data (current value, load factor, etc.)		It may differ according to each item. Refer to Page 16, "3.2.4 Monitor Position and Joint Information".
5		Monitor maintenance information	Monitors the maintenance information (battery and grease remaining times).		Depending on the parameter MFINTVL
6	Operation function	Read/write variables	Reads/ writes variables used in the robot's program.	Request reply method	Responds within 1s (It may vary accord-
7		Read program's current line	Reads currently performing line of the robot program on a per line basis (up to 128 characters).	(The robot side answers by the	ing to the load status of robot control)
8		Set up maintenance	Resets the servomotor information.	output request of	
9		Read error information	Reads detailed error information (program name, occurred line, etc.)	the GOT, and delivers the data	
10		Read product information	Reads the robot's product information (model name, version, and serial number).	on the shared memory)	

1.2 Features

- (1) Fulfilling functions to monitor and operate robot from GOT. Advances T/B and PC-less solution.
 - → Various functions can be performed by reading/ writing the data in shared memory from GOT.
 - Allows you to check activities, position information, and setting values of operation control command and thereby analyze the operation in case of debugging or problem. (Monitoring current and aimed positions, activities, and operation control setting values)
 - Allows you to read and write the contents of program and variables and thereby change the robot's operation in case of debugging or problem.
 - Allows you to check and set up maintenance status.
 - Allows you to check error's detailed content. (Reading error information)
 - Allows you to display and check various information in the robot (product, servo information, etc.)

1.3 Shared Memory Configuration

Here, describes the shared memory configuration among the GOT.

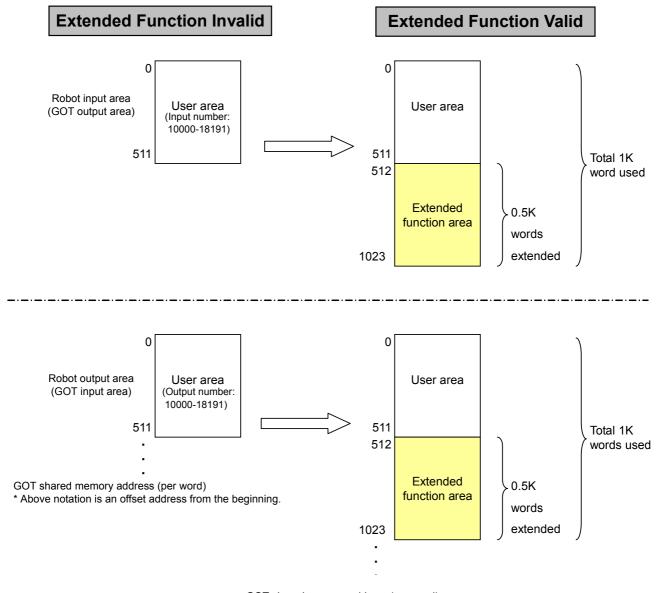
1.3.1 Memory Configuration for Valid/Invalid Extended Function

To use the shared memory extended functions, enable the shared memory extended functions with the parameter "IQMEM".

After enabling the shared memory extended functions, the shared memory is used by extending the robot I/ O area by 0.5 K word.

[Supplement]

In this manual, the shared memory address is written by offset. The top address outputted to the robot from the GOT is "U3E0\G10000", and this data is the robot's input signal 10000. And the data of the robot's output signal 10000 can be read by input top address"U3E1\G10000" of the GOT.



GOT shared memory address (per word)

Note) Only the user area can be referred to by robot program, signal monitor, and dedicated I/O signal allocation. They cannot refer to the extended function area.

^{*} Above notation is an offset address from the beginning.

1.3.2 Memory Map of Extended Function Area

The table below lists the memory map of extended function area in the shared memory among the GOT. * The GOT address is described in the offset address from start address.

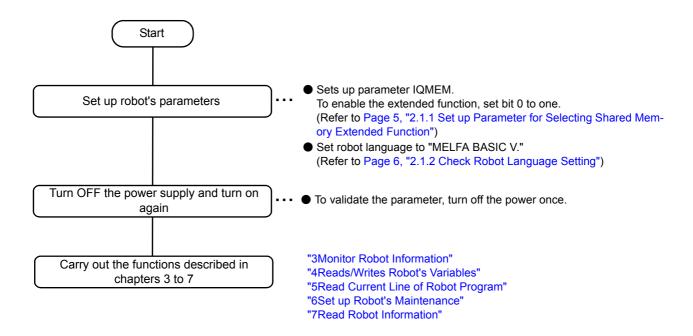
- * When not otherwise specified, the values are stored in binary format.
- (1) Robot input (GOT output) area

(2) Robot output (GOT input) area

Shared Memory Addr GOT Addr	Description	Shared Memory Addr GOT Addr	Description
512	Common setting area of extended function (Reserved: Future extended area)	512	Common setting area of extended function (Reserved: Future extended area)
	(Reserved. Future extended area)		Common area of operation function Read/write variables
			Reading area of program's current line
600		600	
			Reset area of servo monitor information Reading area of information
700	Common area of operation function Reading/ writing/ teaching area of variables	700	
			Common area of monitoring function
800	Reading area of program's current line	800	Monitoring area of operation control setting values
000		000	Monitoring area of activities
	Reset area of servo monitor information Reading area of error and product information Common area of monitoring function Monitoring area of general position and joint information (Reserved: Future extended area)		Monitoring area of current and aimed positions
900		900	Monitoring area of general position and joint information Monitoring area of maintenance information
1000		1000	
1023		1023	(Reserved)
1023	1	1023	

2 Preparation for Using Extended Function

2.1 Operation flow



2.1.1 Set up Parameter for Selecting Shared Memory Extended Function

The parameter "IQMEM" for selecting the shared memory extended function is 16bit data. Set the bit 0 to one to use the extended functions.

For information on how to set up a parameter, refer to Supplement volume "Instruction Manual, Detailed Description of Functions and Operations."

Parameter	Parameter Name	Array Qty Character Qty	Description	Factory Default
Select shared memory extended function	IQMEM	1 digit integer	Set validity (1)/ invalidity (0) for the function. Sets each bit by allocating a function to each bit. 000000000000000000 bit1-15: Not used +- bit0: Use the shared memory extended function	00000000000000000

2.1.2 Check Robot Language Setting

The shared memory extended functions can be carried out only when the robot language is set to MELFA-BASIC V.

Check the value of robot language setting parameter "RLNG".

To use the shared memory extended function, set the parameter "RLNG" to 2.

For information on how to set up a parameter, refer to Supplement volume "Instruction Manual, Detailed Description of Functions and Operations."

Parameter	Parameter Name	Array Qty Character Qty	Description	Factory Default
Robot language	RLNG	1 digit inte- ger	Select the robot language to be used: 2: MELFA-BASIC V 1: MELFA-BASIC IV	2

The robot controller's factory default is MELFA-BASIC V. But, when you have selected MELFA-BASIC IV, an error "L3994" occurs on controller startup.



CAUTION When the robot language setting is changed from MELFA-BASIC V to MELFA-BASIC M, the extended variable area is cleared. Consequently, be aware that the teaching and setting data for shared memory extended function will disappear.

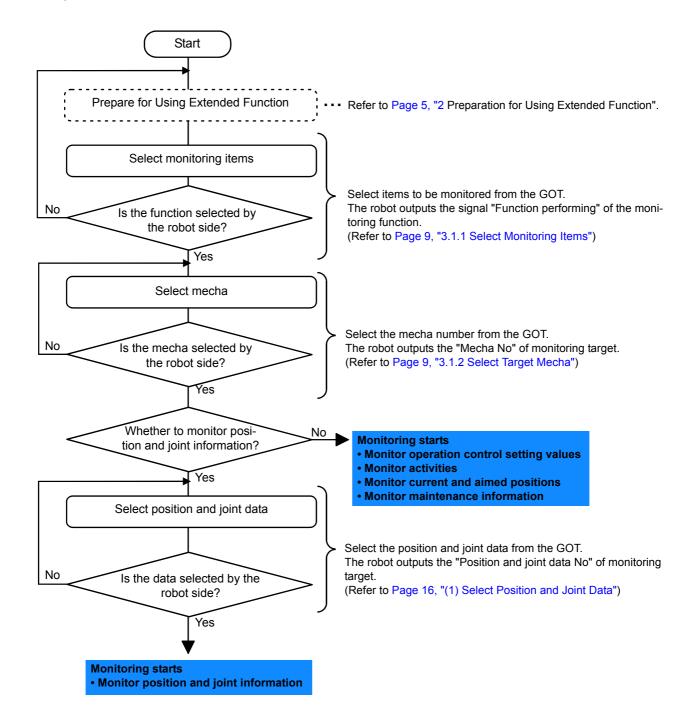
3 Monitor Robot Information

The Table 3-1 lists the robot information monitored from GOT.

Table 3-1:Monitoring item list

No	Item	Description	I/F betw Robots	Update Cycle	Mecha No Setting	Section No
1	Monitor operation control setting values	Monitors the setting values relating to operation control command and operation control	Monitoring output (Robot side peri-	7.1msec	O (necessary)	"3.2.1"
2	Monitor activities	Monitors the robot's activities (current speed, arrival factor to the aimed position, etc.)	odically updates the data in shared memory	7.1msec	0	"3.2.2"
3	Monitor current and aimed positions	Monitors current and aimed positions of robot		7.1msec	0	"3.2.3"
4	Monitor position and joint information	Monitors various position type data (orientation at collision, etc.) and joint type data (current value, load factor, etc.)		Differ accord- ing to items	0	"3.2.4"
5	Monitor mainte- nance information	Monitors the maintenance information (battery and grease remaining times)		Depending on the parameter MFINTVL	0	"3.2.5"

3.1 Operation Flow



3.1.1 Select Monitoring Items

Here, selects the monitoring functions output by the robot from the GOT.

Only the data specified by items (set to "1") selected with each bit can be monitored. For more information on each monitoring data, refer to Page 11, "3.2 Monitoring Item" and after.

(1) GOT output data

a) Word data

GOT Addr (offset)	Description	Remarks
512	Function selection [Allocated to each bit, 0: invalid, 1: valid] bit15 0 00000000000000000 +bit0: (Reserved) +bit1: (Reserved) +bit2: Monitor operation control settings +bit3: Monitor activities +bit4: Monitor current and aimed positions	
	+bit5: Monitor position and joint information +bit6: Monitor maintenance information +bit7: (Reserved)	

(2) Robot output data

a) Word data

GOT Addr (offset)	Description	Remarks
512	Function performing [allocated to each bit, 0: invalid, 1: valid] bit15 0 0000000000000000000 +bit0: (Reserved) +bit1: (Reserved) +bit2: Monitor operation control settings +bit3: Monitor activities +bit4: Monitor current and aimed positions +bit5: Monitor position and joint information bit6: Monitor maintenance information	
	+bit7: (Reserved)	

3.1.2 Select Target Mecha

Here, selects the target mecha number of monitoring data output by the robot from the GOT.

The robot outputs the data with selected mecha number. The number (1 to 3) is selectable for mecha numbers. When the number other than 1 - 3 is specified, the data is initialized (zeros are put in the whole target area)

(1) GOT output data

a) Word data

GOT Addr (offset)	Description	Remarks
841	Specify a mecha number [1 - 3]	

(2) Robot output data

a) Word data

GOT Addr (offset)	Description	Remarks
731	Mecha number [1 - 3]	

3.1.3 Timing Chart

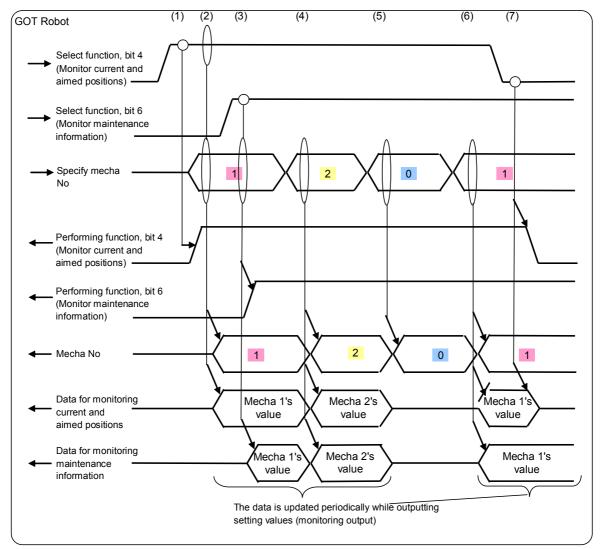


Fig.3-1:Timing chart for selecting monitoring items and target mecha

- (1) When the GOT sets the target bit of "Select function" to "ON", the robot sets the target bit of "Performing function" to "ON" to start the monitoring output of target item. Here, when "Specify mecha number" is other than 1 3, the robot waits to update the data.
- (2) When the GOT sets "Specify mecha number" to one, the robot starts to update mecha 1's data.
- (3) When the target bit of "Select function" is set to "ON" while the GOT sets "Specify mecha number", the robot starts to update the data of target item while at the same time the robot sets the target bit of "Performing function" to "ON".
- (4) When the GOT changes "Specify mecha number", the robot outputs the data of specified mecha.
- (5) When the GOT sets "Mecha number" to other than 1 3, the robot clears the output data.
- (6) When the GOT re-sets "Mecha number", the robot outputs the data of target mecha.
- (7) When the GOT sets the target bit of "Select function" to "OFF", the robot sets the target bit of "Performing function" to "OFF" to initialize the output data.

⚠ CAUTION

The synchronization of data in shared memory is guaranteed on a per 32bit (2 word) basis. But, the synchronization in the unit more than this bit cannot be guaranteed. Therefore, be aware that the position type and joint type data is guaranteed for each axis, the data is not guaranteed as a whole.

3.2 Monitoring Item

3.2.1 Monitor Operation Control Setting Values

Here, periodically outputs the robot's operation control commands and the setting values for operation control to the shared memory.

(1) Monitoring data list

GOT Addr (Offset)	Description		Supported State Variable	Update Cycle
777	ColChk setting value	Collision detection setting [0: Invalid/ 1: Valid (error occurred)/ 2: Valid (error not occurred)		7.1msec
778	ColLvl setting value	Collision detection level, J1 axis [%: 1 - 500]		
779		Collision detection level, J2 axis [%: 1 - 500]		
780		Collision detection level, J3 axis [%: 1 - 500]		
781		Collision detection level, J4 axis [%: 1 - 500]		
782		Collision detection level, J5 axis [%: 1 - 500]		
783		Collision detection level, J6 axis [%: 1 - 500]		
784		(Reserved)		
785		(Reserved)		
794	CMP Pos/Tool/Jnt set- ting values	Compliance coordinate type [0: Invalid/ 1: Perpendicular/ 2: Tool/ 3: Joint]		
795		Specify a compliance coordinate type [Specify target axis with bit] [Setting values to specify compliance axis of CMP Pos/Tool/Jnt setting values] The values below are set by setting up bit: bit7 0 00000000 +bit0:J1/X axis +bit1:J2/Y axis +bit2:J3/Z axis +bit3:J4/A axis bit5:J6/C axis +bit6: (Reserved) +bit7: (Reserved)		
796	CmpG setting value	Compliance J1/X axis gain [10 ⁻² : 1 - 100]		
797		Compliance J2/Y axis gain [10 ⁻² : 1 - 100]		
798		Compliance J3/Z axis gain [10 ⁻² : 1 - 100]		
799		Compliance J4/A axis gain [10 ⁻² : 1 - 100]		
800		Compliance J5/B axis gain [10 ⁻² : 1 - 100]		
801		Compliance J6/C axis gain [10 ⁻² : 1 - 100]		
802		(Reserved)		
803		(Reserved)		
804	MvTune/Prec setting values	Operation characteristic [1: Standard/ 2: High- speed/ 3: Track preferred/ 4: Vibration restricted]		

<Pre><Pre>cautions>

- When the target mecha does not exist, outputs the data zero.
- The value below is output as ColChk:
 - When multiple mechas are in use or when the element 1 of parameter COL is zero (collision detection unavailable),
 - → zero is output
 - Otherwise (collision detection available):

When being in operation (including step feed, position jump operation),

→ the initial value is the value of element 2 of parameter COL, and then the output value is the value changed by ColChk command.

When not being in operation (including suspension and jog operation),

- → it is set to the value of element 3 of parameter COL.
- The value below is output as ColLvl:
 - When multiple mechas are in use or when the element 1 of parameter COL is zero (collision detection unavailable) and

being in operation,

→ the initial value is the value of parameter COLLVL, and then the output value is the value changed by ColLvl command.

When not being in operation,

- → it is the value during automatic operation is held when being in suspension, and it is the value of parameter COLLVL when being stopped.
- Otherwise (collision detection available),

When being in operation,

→ the initial value is the value of parameter COLLVL, and then the output value is the value changed by ColLvl command.

When not being in operation,

- → it is the value of parameter COLLVLJG.
- CMP Pos/Tool/Jnt setting values are set to zero when mechas 2, 3 are selected during using multiple mechas.

(User mecha cannot use compliance)

3.2.2 Monitor Activities

Here, periodically outputs the robot's activities (current speed, arrival factor to the aimed position, etc.) to the shared memory.

(1) Monitoring data list

GOT Addr (offset)	Description	Supported State Variable	Update Cycle
810	Current instruction speed [10 ⁻⁴ mm/s]	M_RSpd	
811			
812	Current distance remained [10 ⁻⁴ mm]	M_RDst	
813			
814	Distance between instructed and feedback positions [10 ⁻⁴ mm]	M_Fbd	
815			
816	Arrival factor [%] to the current aimed position	M_Ratio	7.1msec
817	Current acceleration and deceleration state [0: Stopped/ 1: Accelerated/ 2: Constant speed/ 3: Decelerated]	M_AclSts	7.1111000
818	Collision detection [1: Collided/ 0: Otherwise] Note1)	M_ColSts	
819	Going over the limit during performing compliance [1: Almost go over the limit/ 0: Does not go over the limit]	M_CmpLmt	
820	Deviance amount between instructed and actual positions during performing	M_CmpDst	
821	compliance [10 ⁻⁴ mm]		

Note1) Robot state variable (M_ColSts) is "1" for about 7.1ms between collision detection and servo OFF. But, the data "1" is output to the shared memory for 1sec after the collision is detected.

<Pre><Precautions>

- When the target mecha does not exist, outputs the data zero.
- When the data is dependent on a slot and the slot does not exist which has the control of target mecha, outputs the data zero. The data dependent on a slot is as follows:
 - Current distance remained (M RDst)
 - Arrival factor to the current aimed position (M_Ratio)
 - Current acceleration and deceleration state (M_ActSts)

3.2.3 Monitor Current and Aimed Positions

Here, periodically outputs robot's current and aimed positions to the shared memory.

(1) Monitoring data list

GOT Addr (offset)	Description		
830		X coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	7.1msec
831			
832		Y coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
833 834			
835		Z coordinate value [10 ⁻⁴ mm/10-4deg]	
836			
837		A coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
838		D 11 1 1 140-4 140-4 1	
839	Current position (perpendicular)	B coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
840	Current position (perpendicular)	C coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
841		C coordinate value [10 11111/10 deg]	
842		L1 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
843			
844 845		L2 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
846			
847		Structure flag	
848			
849		Multi-turn data	
850		X coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
851		X coordinate value [10 'mm/10 'deg]	
852		Y coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
853		1 coordinate value [10 mm/10 deg]	
854		Z coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
855 856			
857		A coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
858		, .	
859		B coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
860	Aimed position (perpendicular)	0 11 1 1104 1154	
861		C coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
862		L1 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
863		Li coordinate value [10 11111/10 deg]	
864		L2 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
865			
866		Structure flag	
867 868			
869		Multi-turn data	

GOT Addr (offset)	Description		Update Cycle
870		J1 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
871			
872		J2 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
873		. 3.	
874 875		J3 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
876			
877		J4 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
878	Current position (joint)	4 4	
879		J5 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
880		10	
881		J6 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
882		J7 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
883		37 Coordinate value [10 11111/10 deg]	
884		J8 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
885		oo oooramato valao [10 mm#10 dog]	
886		J1 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
887		. 0,	
888 889		J2 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
890			
891		J3 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
892		14 15 1 1 140-4 140-4 1	
893	Aimed position (joint)	J4 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
894	Amed position (joint)	J5 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
895		35 coordinate value [10 mm/10 deg]	
896		J6 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
897		oo coordinate value [10 mm/10 deg]	
898		J7 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
899			
900		J8 coordinate value [10 ⁻⁴ mm/10 ⁻⁴ deg]	
901		. 57	

<Pre><Pre>cautions>

- When the target mecha and axis do not exist, outputs the data zero.
- When the origin is not established, outputs zero for the both perpendicular and joint components of current position.

(2) Data description

[Perpendicular data]

- The unit is 10⁻⁴mm or 10⁻⁴deg.
- Only lower one word is used for the structure flag. Upper one word is a reserved area.

[Joint data]

• The unit is 10⁻⁴mm or 10⁻⁴deg.

3.2.4 Monitor Position and Joint Information

Here, periodically outputs the robot's various position type and joint type data to the shared memory. The GOT selects the data output by the robot. The area exists for one pieces of position type data and three pieces of joint type data and the data output for monitoring can be individually set by the GOT.

(1) Select Position and Joint Data

In the GOT, set up the number for position and joint data output by the robot.

The robot outputs the monitoring data corresponding to the selected data number.

The area exists for one pieces of position type data and three pieces of joint type data and the data can be individually set.

When the GOT specifies the data with the number which is out of range, the robot sets all monitoring data to zero.

(1) Data list

a) GOT output

GOT Addr (offset)	Description
850	Position data selection [1 - 4] 1: (Reserved) 2: (Reserved) 3: (Reserved) 4: Direction at the time of collision
851	Joint data selection-1 [1 - 13] 1: (Reserved) 2: (Reserved) 3: Difference between estimated and actual torques when detecting a collision 4: (Reserved) 5: Current instruction 6: Maximum current instruction 1 7: Maximum current instruction 2 8: Current feedback 9: Allowable current instruction, minus side 10: Allowable current instruction, plus side 11: Effective current 12: Axis load level 13: Maximum axis load level
852	Joint data selection-2 [1 - 13] For setting values, refer to 851 above.
853	Joint data selection-3 [1 - 13] For setting values, refer to 851 above.

b) Robot output

GOT Addr (offset)	D	escription
906	Position data number [1 - 4]	
907	Joint data number-1 [1 - 13]	
908	Joint data number-2 [1 - 13]	
909	Joint data number-3 [1 - 13]	

(2) Timing chart

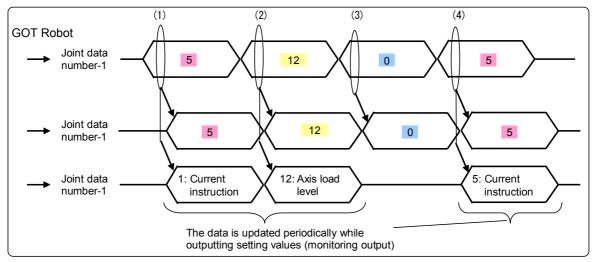


Fig.3-2: Joint data output, Timing chart

- (1) When the GOT selects "Joint data selection-1," the robot outputs the target data to "Joint data-1" area.
- (2) When the GOT changes "Joint data selection-1," the robot outputs the changed target data to "Joint data-1" area.
- (3) When the GOT selects the data out of valid range for "Joint data selection-1," the robot clears "Joint data-1" (set all components to zero) and outputs zero for "Joint number-1."
- (4) When the GOT reselects "Joint data selection-1", the robot outputs the target data to "Joint data-1" area.

^{*} The same applies to Joint data-2, 3 and position data.

(2) Position and Joint Data

(1) Data list

b) Robot output

b) Robot outp			
GOT Addr (offset)	Description		
910		X coordinate value	
911			
912		Y coordinate value	
913 914			
915		Z coordinate value	
916			
917		A coordinate value	
918	Position data [1 - 4]	D artin -t t	
919	1: (Reserved) 2: (Reserved)	B coordinate value	
920	3: (Reserved)	C coordinate value	
921	4: Direction at the time of collision	o dedicantate value	
922		L1 coordinate value	
923			
924 925		L2 coordinate value	
926			
927		Structure flag	
928			
929		Multi-turn data	
930		J1 coordinate value	
931	loint data 1 [1 12]	31 Coordinate value	
932	Joint data-1 [1 - 13] 1: (Reserved)	J2 coordinate value	
933	2: (Reserved)		
934	3: Difference between estimated and actual torques when	J3 coordinate value	
936	detecting a collision 4: (Reserved)		
937	5: Current instruction	J4 coordinate value	
938	6: Maximum current instruction 1 7: Maximum current instruction 2		
939	8: Current feedback	J5 coordinate value	
940	9: Allowable current instruction, minus side	J6 coordinate value	
941	10: Allowable current instruction, plus side 11: Effective current	oo oooramate value	
942	12: Axis load level	J7 coordinate value	
943	13: Maximum axis load level		
944		J8 coordinate value	
946			
947		J1 coordinate value	
948		12 goordingto value	
949		J2 coordinate value	
950		J3 coordinate value	
951		23 333.3	
952		J4 coordinate value	
953 954	Joint data-2 [1 - 13] * The data is similar to Joint data-1.		
954	THE data is similar to some data-1.	J5 coordinate value	
956			
957		J6 coordinate value	
958		17 goordingto value	
959		J7 coordinate value	
960		J8 coordinate value	
961		To observation value	

GOT Addr (offset)	Description		
962			J1 coordinate value
963			or coordinate value
964			J2 coordinate value
965			32 coordinate value
966			J3 coordinate value
967			33 cooldinate value
968			J4 coordinate value
969	Joint data-3 [1 - 13]		34 cooldinate value
970	* The data is similar to Joint data-1		J5 coordinate value
971			33 coordinate value
972			J6 coordinate value
973			30 coordinate value
974		J7 coordinate value	
975		or cooldinate value	
976			J8 coordinate value
977			oo oooramate value

<Precautions>

 $[\]bullet$ When the target mecha and axis do not exist, outputs the data zero.

(2) Data description

The table below lists the content of each data item.

Item		Item Description		Supported State Variable	Update cycle
Position data	4: Direction at the time of collision Note1)	Robot's direction when the collision is detected	Divides the direction at the time of collision to components X, Y, Z. Specify the value with the proportion when the	P_ColDir	7.1msec
	3: Difference between estimated and actual torques when detect- ing a collision Note1)	Maximum difference value between esti- mated and actual torques when detecting a collision is valid	[10 ⁻³ %]	J_Colmxl	7.1msec
	5: Current instruction	Outputs the current instruction value.	[10 ⁻³ Arms]		57msec
	6: Maximum current instruction 1	Outputs the maximum current instruction value after power-up. Reset when the robot power supply is shut off.	[10 ⁻³ Arms]		1.8sec
	7: Maximum current instruction 2	Outputs the maximum current instruction value for past 2sec.	[10 ⁻³ Arms]		1.8sec
Joint data	8: Current feedback	Outputs the current value generated in the servo motor.	[10 ⁻³ Arms]		7.1msec
	9: Allowable current instruction, minus side	Outputs the maximum allowable value (minus side) of the current generated in the servo motor. * The value may vary according to jog and automatic operations.	[10 ⁻³ Arms]		7.1msec
	10: Allowable current instruction, plus side	Outputs the maximum allowable value (plus side) of the current generated in the servo motor. * The value may vary according to jog and automatic operations.	[10 ⁻³ Arms]		7.1msec
	11: Effective current	Outputs the effective value of current feedback.	[10 ⁻³ Arms]		57msec
	12: Axis load level	Outputs the motor's load level. The bigger this value, the heavier the load on the motor. Roughly it should be 80% or less. * It takes a few minutes until the value will stable.	[10 ⁻³ %]		1.8sec
	13: Maximum axis load level	Outputs the maximum value of axis load level after power-up. Reset when the power supply is shut off.	[10 ⁻³ %]		1.8sec

Note1) Because the collision detection function is unavailable during using multiple mechas, outputs zero.

3.2.5 Monitor Maintenance Information

Here, periodically outputs the robot's scheduled maintenance data (battery, grease, and belt remaining times) to the shared memory.

(1) Monitoring data list

GOT Addr (offset)	Description	Update Cycle
980	Battery remaining time [Hr]	
981	Battery remaining time [rin]	
982	Grease remaining time - J1 axis [Hr]	
983		
984 985	Grease remaining time - J2 axis [Hr]	
986		
987	Grease remaining time - J3 axis [Hr]	
988		
989	Grease remaining time - J4 axis [Hr]	
990	Crosse remaining time IE evic [Hr]	
991	Grease remaining time - J5 axis [Hr]	
992	Grease remaining time - J6 axis [Hr]	
993	Croace romaning time to axio [riii]	
994	Grease remaining time - J7 axis [Hr]	Updated at sched-
995		uled interval set up
996 997	Grease remaining time - J8 axis [Hr]	in the second ele-
998		ment of parameter "MFINTVL"
999	Belt remaining time - J1 axis [Hr]	IVII IINI VL
1000	D. II	
1001	Belt remaining time - J2 axis [Hr]	
1002	Belt remaining time - J3 axis [Hr]	
1003	beit femaining time - 33 axis [m]	
1004	Belt remaining time - J4 axis [Hr]	
1005	3	
1006	Belt remaining time - J5 axis [Hr]	
1007 1008		
1008	Belt remaining time - J6 axis [Hr]	
1010		
1011	Belt remaining time - J7 axis [Hr]	
1012	Dolt remaining time 10 axis [1]	
1013	Belt remaining time - J8 axis [Hr]	

<Precautions>

- When the target mecha does not exist, outputs all the data with zero.
- When the target mecha exists but the maintenance schedule is not supported, outputs all the data with "-1".
- When the target axis is not updated by the maintenance schedule, outputs the data "-1".

(2) Data description

[Battery remaining time]: Outputs the remaining time until the battery exchange. [Grease remaining time]: Outputs the remaining time until the grease-up of each axis. [Belt remaining time]: Outputs the remaining time until the belt exchange of each axis.

4 Reads/Writes Robot's Variables

4.1 Function Description

(1) Function list

The table below lists the variable operations performed from the GOT:

Table 4-1:Variable operation function list

No	Item	Description	Robot's response time					
1	Read numeric variable	Reads variable content by specifying slot number and variable name.						
2	Write numeric variable Rewrites variable content by specifying slot number, variable name, and variable content.							
3	Read position variable	1sec (it may vary according to the robot control's						
4	Write position variable							
5	Read joint variable	load state)						
6	Write joint variable	Rewrites variable content by specifying slot number, variable name, and variable content.						

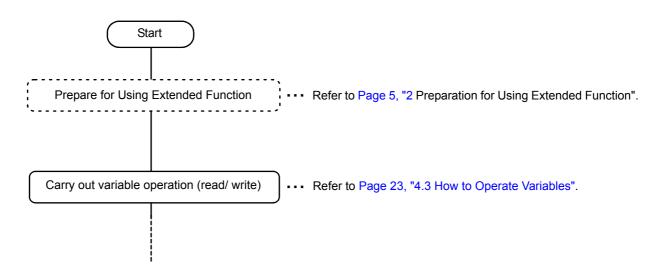
(2) Functional requirements

Always available when a program is selected for robot's target slot and the target variable exists. When the target is external variable, the variable operation is possible by specifying zero for a slot number, even when a program is not selected.

! CAUTION Be careful fully to change variable value.

The robot's location and behavior may be changed by changing the variable value, thereby interfering with surrounding devices. Because it is especially dangerous when the robot is in operation, sufficiently check the value to be changed.

4.2 Operation Flow



4.3 How to Operate Variables

Here, in the GOT, operates the robot's variables (read/ write variables) by specifying function number, slot number, variable name, and variable data.

Function number setting allows you to select work type (read/ write variable) and variable type (numeric/ position/ joint variables) and specify a variable name (designation of ASCII character).

Long-precision integer number and single-precision real number can be used for reading/writing of numeric value variables since software version S3p.

4.3.1 Data List

(1) GOT output data

1) Word data

Setting values when specifying ASCII character for variable and program names

Solit No
701 (Reserved) (Reserved) 702 Function No 101 102 104 105 107 108 111 112 121 12 703 Slot No Slot number [0, 1 to the value of parameter TASKMAX] 704 705 706 707 708 708 708 (Not used)
Total Tota
703 Slot No Slot number [0, 1 to the value of parameter TASKMAX] 704 705 706 706 707 708 (Not used) (Not used) (Not used) 708 708 (Not used) 708 708 (Not used) 708
704 705 706 707 708 Program name (Not used)
705 706 707 708 Program name (Not used) (Not used)
706 707 708 Program name (Not used) (Not used)
707 708 (Not used)
708 (Not used)
709
710
711
712
713 Variable Variable name [ASCII data, up to 16 characters]
714 Hame
715
716
717
718 Integer X coordinate value X coordinate
720 Y coor- J2 coor-
721 dinate value dinate value
722 Z coor- J3 coor-
723 dinate value dinate value
724 A coor- J4 coor-
725 dinate value dinate value
726 B coor- J5 coor-
Variable (Not used) (Not used) (Not used) (Not used) (Not used) (Not used)
728 used) C coor- J6 coor- (Not V
729 dinate value used) used) used)
730 L1 coordinate J7 coordinate
value value
732 L2 coor-
733 dinate value dinate value
734 Struc-
735 ture flag
736 Multi- used)
737 turn data

Note1) This number can be used since software version S3p.

2) Bit signal

Ī	GOT Address		Description			
ĺ	Addr (offset)	Bit position		Description		
Ī	700	0	Request for variable operation			

(2) Robot output data

1) Word data

Setting values when specifying ASCII character for variable and program names

		Setting Value for Specifying ASCII Character											
GOT Addr (offset)	I Itam Itam			Position Var		Joint Var		Numeric Var (Long-precision integer number Note1))		Numeric Var (Single-precision real number Note1)			
		Read	Write	Read Write		Read	Write	Read	Write	Read	Write		
551	Completion status			Completion status [1: OK/ other than 1: NG]									
552	Function No	101	102	104	105			111	112	121	122		
553	Slot No	Slot number [0, 1 to the value of parameter TASKMAX]											
554													
555													
556	Program	Program name, ASCII data, up to 12 characters]											
557	name		Flogram name, ASON data, up to 12 characters										
558													
559													
560													
561													
562													
563 Variable		Variable name [ASCII data, up to 16 characters]											
564	name												
565													
566													
567		linte		ı				Ι.		01 1			
568 569		inte	eger	X coordina	ite value	J1 coor		Long-precision integer number value		Single-precision real number value			
570						value J2 coordina		ger num	Jer value	real Hullin	Jei value		
570				Y coordina	ite value	J2 cool val							
571													
573		/ariable data (Not	Not (Not	Z coordinate value	J3 coordinate value								
574													
575				A coordinate value	ite value	J4 coordinate value							
576				B coordinate value		.I5 coordinate							
577	Variable				ite value								
578						J6 coordinate value		(Not	(Not	(Not	(Not		
579		used)	used)	C coordina	ite value			used) used)	`	used)	used)		
580				L1 coordi			,						
581				valu		value							
582				L2 coord		J8 coordinate value		:					
583				valu									
584 585				Structure	e flag	(Not (Not used)							
586 587				Multi-turi	n data								

Note1) This number can be used since software version S3p.

2) Bit signal

GOT Address		Description			
Addr (offset)	Bit position	Description			
550	0	Variable operation completed			

(3) Completion status

The values below are established as completion status:

Setting Value	Description
1	Successfully completed
2	Specified data (function number, slot number, variable number, element number, or external variable specification) out of range
3	Program not selected for the target slot
4	Target variable does not exist
5	(Reserved)
6	Not the formal variable data (at the time of writing variable)
7	Target variable not writable (at the time of writing variable)
8	Target variable value out of range at the time of reading variable: Not in the range between -32768 and 32767 (at the time of reading numeric variable)
10	NG because of a factor other than 2 to 8

(4) Data description

[Function No]

Select the target function.

Function number setting allows you to select work type (read/ write variable) and variable type (numeric/ position/ joint variables) and specify a variable name (designation of ASCII character).

[Slot number]

Select the target slot.

In general, specify a value between 1 and the value of parameter TASKMAX (factory default: 8). In case of external variable, "0" can be specified.

[Program name]

Program name is displayed in ASCII character.

Specifying ASCII character

- Specify ASCII program name in 6 words area (12 characters).
- To specify ASCII characters, specify all 12 characters or string data including terminating code. However, leading and ending blank characters (space) are ignored.
- When target is an external variable and zero is specified for slot number, the program name becomes NULL.

[Variable name]

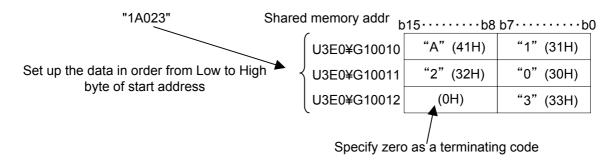
To specify a variable name, specify ASCII characters.

Specifying ASCII character

- Specify the variable name (including leading character) in the 8 words area (16 characters, robot specification).
- To specify ASCII characters, specify all 16 characters or string data including terminating code. However, leading and ending whitespace characters (space) are ignored.
- The character underscore (_) used in array and external variable is also available, and array or external variable can be specified.

<ASCII data setting example>

- Set up the data in order from low to high byte of start address.
- Specify zero as a terminating code.
 (Be compliant with the character input specification of the GOT)



<Available character>

Available characters are compliant with robot specification. (Refer to the table below.)

Category	Available Characters	Program Name	Variable Name
Alphabetic	ABCDEFGHIJKLMNOPQRSTUVWXYZ	0	0
character	abcdefghijklmnopqrstuvwxyz	×	0
Figure	0123456789	0	△ Note1)
Symbol	"'&()*+,/:;=<>?[\]^{}~ !#\$%	×	× Note2)
Symbol	'_' (underscore)	×	△ Note3)
White space	Whitespace character	×	×

Note1) Only the alphabetic characters are available at the beginning of variable name. A figure is available for second and after characters.

Note2) Parentheses "()" for specifying an array are available.

Note3) Available for second and after characters. The variable whose second character is underscore '_' is an external variable.

[Variable data: numeric variable (Integer)]

- One word is prepared for a numeric variable and only an integer can be specified.
- Therefore, its range is between -32768 and 32767, and digits after decimal point are discarded.

[Variable data: numeric variable (Long-precision integer number)]

- Two words are prepared for a numeric variable and only an integer can be specified.
- Therefore, its range is between -2147483648 and 2147483647, and digits after decimal point are discarded.

[Variable data: position, joint, and numeric (Single-precision real number) variables]

- The unit is 10⁻⁴mm or 10⁻⁴deg. However, the number of significant figures for position and joint variable data output from the robot is dependent on the parameter PRGDPNTM (digits after decimal point: factory default is 2 or 3 digits (it may vary according to the robot model)), and the portion less than the significant figures is rounded off. For example, when PRGDPNTM is two, to round off 1,2345 gives 12300 and to round off 6,7890 gives
- For example, when PRGDPNTM is two, to round off 1.2345 gives 12300 and to round off 6.7890 gives 67900.

 Only lower one word is used for the structure flag of position variable, and upper one word is a reserved
- area.
- When a variable in undefined state (a variable exists but its data is empty) is read, zero is set to the undefined portion of data.
- Because each component value is handled as a single-precision floating type real number in the robot, <u>the number of significant figures is about 7 digits.</u>
- (The value which can be expressed with 24bit when expressed in binary number is about 7 digits when expressed in decimal number).

· When the data is successfully written into a variable, the variable data in the robot after the writing is read again and sent.

Therefore, even when writing into a position or joint variable is successfully ended, the data specified by the GOT may be different from the data to be sent by the robot. The robot's posture data or the number of significant figures of data's digits after decimal point may differ.

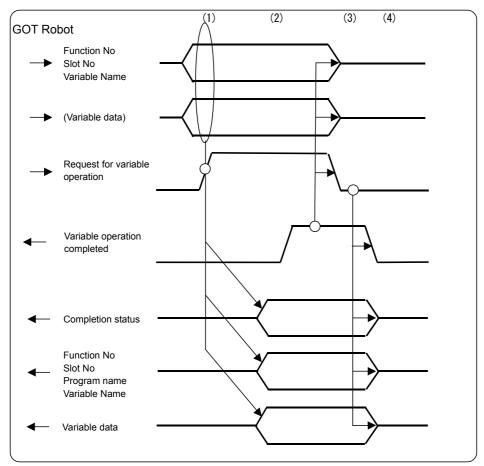


Fig.4-1: Variable operation timing chart

- (1) The GOT sets up "Function number", "Slot number", "Variable name", and "Variable data" (only for writing variable) and turns ON "Request for variable operation".
- (2) When the robot receives "Request for variable operation ON", the robot operates the variable based on received data. When "Function number", "Slot number", "Variable name", "Variable data", and "Completion status" are specified after the operation, the robot turns ON "Variable operation completed".
 - When the operation cannot be carried out, the robot specifies a number indicating NG and turns ON "Variable operation completed".
- (3) When "Variable operation completed ON" is received, the GOT turns OFF "Request for variable oper-
- (4) When received "Request for variable operation OFF", the robot turns OFF "Variable operation completed" and clears the data.

5 Read Current Line of Robot Program

5.1 Function Description

(1) Function list

The Table 5-1 lists the program operations performed from the GOT.

Table 5-1:Program operation function list

No	Item	Description	Robot's Response Time
1	Read program's cur- rent line	 Reads currently performing robot program (one line, 128 characters) by specifying a slot number. Practicable when a program is selected for robot's slot. 	Responds within 1s (it may vary accord- ing to the robot con- trol's load state)

(2) Program data

The program data is as follows:

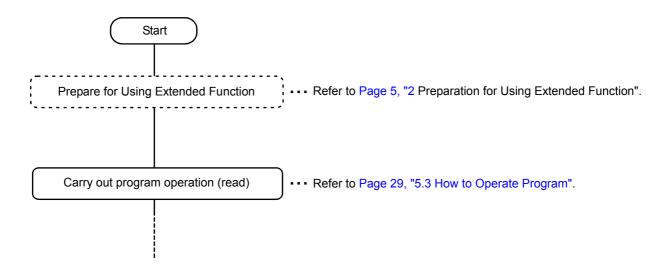
- The data is one line of program (up to 128 characters) in ASCII.
- When the data is less than 128 characters, terminating code 0 (NULL) is added at the end of string.
- Shift JIS codes are used for kanji character (similar to GOT specification).

A CAUTION

When a program line can be longer than 128 characters, the data after 128th character cannot be read.

Consequently, when the program whose line is longer than 128 characters is read and the data is written as-is into the robot, be careful that the data which exceeds 128 characters will be deleted.

5.2 Operation flow



5.3 How to Operate Program

Here, in the GOT, operates the robot program by specifying function number, slot number, program name, and program data.

Setting function number to '103' allows you to select a work type (read current line) and specify a program name (designation of ASCII character).

5.3.1 Data List

(1) GOT output data

1) Word data

		Cotting Value for Chapitaing ACCII
GOT Addr	Item	Setting Value for Specifying ASCII Character
(offset)		Program
		Read current line
740	(Reserved)	(Reserved)
741	Function No	103
742	Slot No	Slot number [1 to the value of parameter TASKMAX]
743		
744		
745	Program name	(Not used)
746	i Togram name	(Not used)
747		
748		
749	Line No	(Not used)
750	(Reserved)	(Reserved)
751		
752		
	Program data	(Not used)
	r rogram data	(1101 0000)
813		
814		

GOT Address		
Addr (offset)	Bit position	Description
700	1	Request for program operation

(2) Robot output data

1) Word data

,		
GOT Addr		Setting Value for Specifying ASCII Character
(offset)	Item	Program
		Read current line
590	Completion status	Completion status [1: OK/ other than 1: NG]
591	Function No	103
592	Slot No	Slot number [1 to the value of parameter TASKMAX]
593		
594		
595	Program name	Program name, ASCII data, up to 12 characters
596	Fiogrammame	Program marie, ASCII data, up to 12 characters
597		
598		
599	Line No	Line No [1 - 32767]
600	Number of pro- gram characters	Number of program characters
601		
602		
		Program to be read
	Program data	[ASCII data, up to 128 characters]
		* Shift JIS code for kanji
200	_	
663		
664		

GOT Address		
Addr (offset)	Bit position	Description
550	1	Program operation completed

(3) Completion status

The values below are established as completion status:

Setting Value	Description
1	Successfully completed
2	Specified data (function number, slot number, program number) out of range
3	Program not selected for the target slot
4	(Reserved)
5	(Reserved)
6	(Reserved)
7	(Reserved)
10	NG because of a factor other than 2 to 7

(4) Data description

[Function No]

Selects the target function.

Function number setting allows you to select a work type (read current line) and specify a program name (designation of ASCII character).

[Slot number]

Select the target slot. Specify a value (factory default: 8) in the range between 1 and the value of parameter TASKMAX.

[Program name]

ASCII characters of the output program name.

- Specifying ASCII character
- Specify ASCII program name in 6 words area (12 characters).
- To specify ASCII characters, specify all 12 characters or string data including terminating code. However, leading and ending whitespace characters (space) are ignored.

For information about ASCII data, available characters, refer to Page 25, "(4) Data description".

[Line No]

The line number of the read line is output.

When a program is selected but program is in abeyance (program is not running), the line number of first line is output.

[Number of program characters]

Outputs the number of characters of target line in the target program.

Count and specify the number of characters from the leading to final character (exclusive of line feed/ terminating characters) including comment line (exclusive of line number).

When the target line is longer than 128 characters, up to 128 characters are read as a program data, but the number of counted characters is set as-is as the number of program characters.

When writing into a program, the number of characters of written line is set.

Example 1: A line is less than 128 characters:

Number of program characters

Stored in program data area (25 characters + terminating code (0))

MOV P1 ' Move to the aimed position <CR>

Specify the number of characters from the leading to the final character (exclusive of terminting character)

Example 2: A line is more than 128 characters:

Stored in program data area (128 characters)

PHOSEI=PBASE*INV(PTOOL)*PDATA 'Calculate·····correction calculation <CR>

Number of program characters

132

Specify the number of characters from the leading to the final character (exclusive of terminting character)

[Program data]

- The data is in ASCII format and up to 128 characters of program content are stored.
- · Shift JIS codes are used for kanji.
- Line number is excluded from the program data.

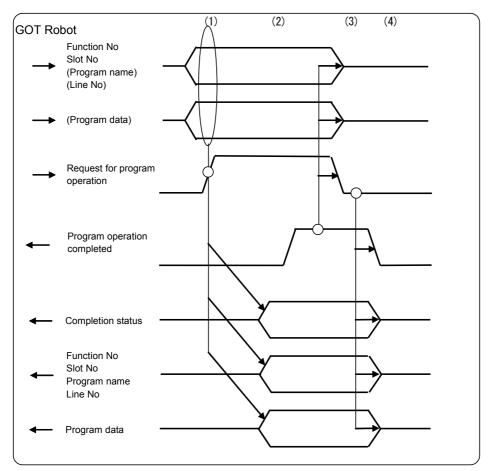


Fig.5-1:Program operation timing chart

- (1) The GOT sets up necessary data of "Function number", "Slot number", "Program name", "Line number", and "Program data" and turns ON "Request for program operation".
- (2) When the robot receives "Request for program operation ON", the robot operates the program based on received data. When "Function number", "Slot number", "Program name", "Program data", and "Completion status" are specified after the operation, the robot turns ON "Program operation completed".
 - When the operation cannot be carried out, the robot specifies a number indicating NG and turns ON "Program operation completed".
- (3) When "Program operation completed ON" is received, the GOT turns OFF "Request for program operation".
- (4) When received "Request for program operation OFF", the robot turns OFF "Program operation completed" and clears the data.

6 Set up Robot's Maintenance

6.1 Function Description

(1) Function list

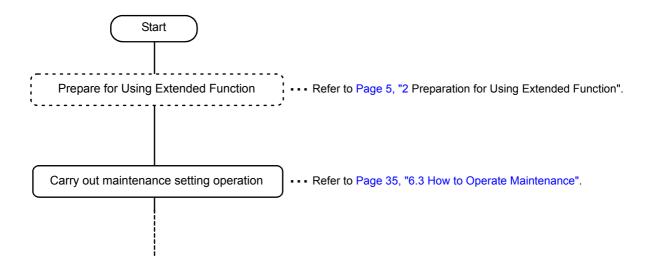
The Table 6-1 lists the maintenance setting performed from the GOT.

Table 6-1:Maintenance setting function list

No	Item	Description	Robot's Response Time
1	Reset maximum ser- vomotor value	Resets the servo monitor's maximum values (current value, load factor, etc.) stored by robot to zero.	Responds within 1s (it may vary according to the robot control's load state)

(2) Functional requirements Always practicable.

6.2 Operation flow



6.3 How to Operate Maintenance

Here, in the GOT, operates the maintenance setting by specifying function number and setting data corresponding to the function.

Function number setting allows you to select function items.

6.3.1 Data List

(1) GOT output data

1) Word data

		Setting Value
GOT Addr (offset)	Item	Reset Servo Monitor's Maximum/Minimum Values
820	(Reserved)	(Reserved)
821	Function No	6
822	Mecha No	Mecha No[1-3]
823		(Not used)
824		
825	Mecha No	
826	iviecha No	(Not used)
827		
828		

2) Bit signal

GOT Address		
Addr (offset)	Addr (offset)	Description
700	2	Request for maintenance setting

(2) Robot output data

1) Word data

GOT Addr	Item	Setting Value	
(offset)		Reset Servo Monitor's Maximum/Minimum Values	
670	Completion sta- tus	Completion status [1: OK/ other than 1: NG]	
671	Function No	6	
672	Mecha No	Mecha No[1-3]	
673		(Not used)	
674			
675	Mecha No		
676	Mecha No		
677			
678			

GOT Address		
Addr (offset)	Addr (offset)	Description
550	2	Maintenance setting completed

(3) Completion status

The values below are established as completion status:

Setting Value	Description
1	Successfully completed
2	Specified "Function number" and "Mecha number" are out of range (including the case that the target mecha does not exist).
3	(Not used)
4	No target function (the function specified by target mecha does not exist)
10	NG because of a factor other than 2 to 4

(4) Data description

[Function No]

Selects the target function.

[Mecha No]

Select the target mecha. Specify a mecha in the range of mechas 1 - 3.

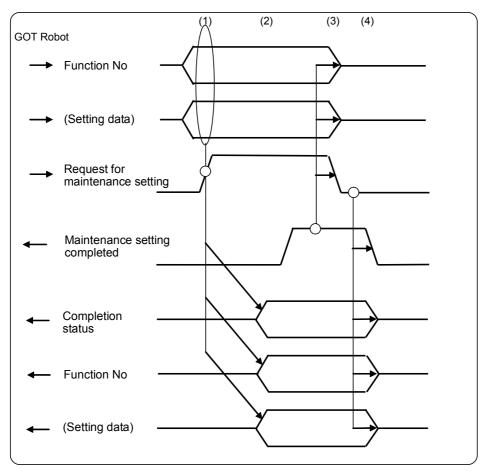


Fig.6-1:Maintenance function timing chart

- (1) The GOT sets up necessary data of "Function number" and "Setting data" and turns ON "Request for maintenance setting."
- (2) When the robot received "Request for maintenance setting ON," the robot operates the maintenance setting based on received data. When "Function number", "Setting data", and "Completion status" are specified after the operation, the robot turns ON "Maintenance setting completed." When the operation cannot be carried out, the robot specifies a number indicating NG and turns ON "Maintenance setting completed."
- (3) When "Maintenance setting completed ON" is received, the GOT turns OFF "Request for maintenance setting."
- (4) When "Request for maintenance setting OFF" is received, the robot turns OFF "Maintenance setting completed" and clears the data.

7 Read Robot Information

7.1 Function Description

(1) Function list

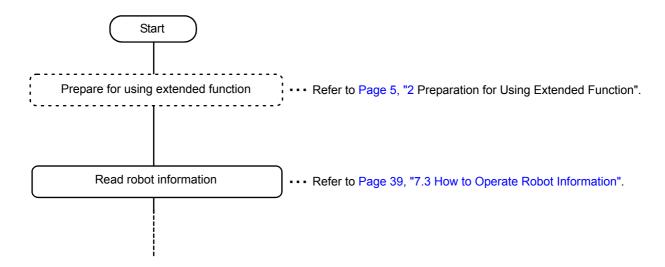
The Table 7-1 lists the robot information reading performed from the GOT.

Table 7-1:Robot information reading function list

No	Item	Description	Robot's Response Time
1	Read error information	Reads the detailed error information generated in the robot. When multiple errors occur, three information can be read at the same time, and the information to be read can be changed by specifying the start number.	Responds within 1s (it may vary according to the robot control's load
2	Read product information	Read the robot's product information.	state)

(2) Functional requirements Always practicable.

7.2 Operation flow



7.3 How to Operate Robot Information

Here, reads the robot information from the GOT by specifying function number and setting data. Function number allows you to select the robot information to be read.

7.3.1 Data List

(1) GOT output data

1) Word data

		Setting	y Value Read Product Information
GOT Addr (offset)	Item	Read Error Information	
830	(Reserved)	(Rese	erved)
831	Function No	3	4
832	Setting No	Start number [1 -]	(Not used)

1	GOT Address			
	Addr (offset)	Addr (offset)	Description	
l	700 3		Request for reading information	

(2) Robot output data

1) Word data

1) Word data		Setting Value		
GOT Addr (offset)	Item	Read Error Information	Read Product Information	
680	Completion status	Completion status [1: OK/	other than 1: NG]	
681	Function No	3 4		
682		Start number [1 -]	(Not used)	
683		Number of errors occurred		
684		Information 1 (error No)		
685				
686		Information 1 (error occurred program	Robot type name	
687		name)	[ASCII data, up to 20	
688		[ASCII data, up to 12	characters]	
689		characters]		
690				
691		Information 1 (occurred line No)		
692		Information 1		
693		(detailed error No)	Controller version	
694		Information 1 (occurred slot No)	[ASCII data, up to 6 characters]	
695			Glaracicisj	
696		(Reserved)		
697				
698		Information 2 (error No)		
699			Controller serial No	
700		Information 2	[ASCII data, up to 16 characters]	
701		(error occurred program name)	onaractoroj	
702		[ASCII data, up to 12		
703		characters]		
704	Read data	-		
705		Information 2 (occurred line No)		
706		Information 2	Dahat sadal Na	
707		(detailed error No)	Robot serial No [ASCII data, up to 16	
708		Information 2 (occurred slot No)	characters]	
709			=	
710		(Reserved)		
711				
712		Information 3 (error No)		
713				
714		Information 3		
715		(error occurred program name)		
716		[ASCII data, up to 12		
717		characters]		
718				
719		Information 3 (occurred line No)	(Not used)	
720		Information 3		
721		(detailed error No)		
722		Information 3 (occurred slot No)		
723				
724		(Reserved)		
725				

2) Bit signal

GOT Address			
Addr (offset)	Addr (offset)	Description	
550 3		Reading information completed	

(3) Completion status

The values below are established as completion status:

Setting Value	Description
1	Successfully completed
2	Specified "Function number" out of range
3	Specified "Setting data" out of range
10	NG because of a factor other than 2 and 3

(4) Data description

[Function No]

Selects the target function.

[Start No of read data]

Specify the information's start number to be read.

The robot reads and stores three pieces of information from the specified number in the shared memory.

Specify 1: Reads first to third pieces of registered information.

Specify 2: Reads second to fourth pieces of registered information.

Specify 3: Reads third to fifth pieces of registered information.

Of information 1 - 3, the information with small number is a new error.

When the target information with the specified number does not exist, the robot sets all read data to zero.

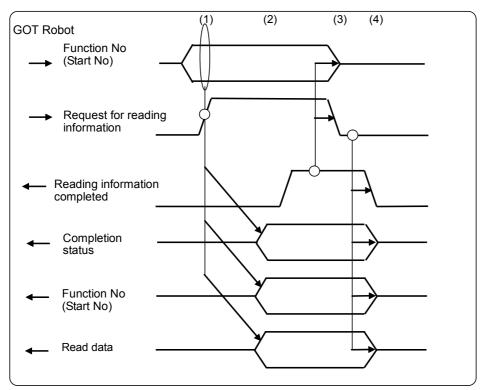


Fig.7-1:Information reading timing chart

- (1) The GOT sets up necessary data of "Function number" and "Start number" and turns ON "Request for reading information."
- (2) When "Request for reading information ON" is received, the robot specifies requested "Read data" and "Completion status" and turns ON "Reading information completed." When the operation cannot be carried out, the robot specifies a number indicating NG and turns ON "Reading information completed."
- (3) When "Reading information completed" is received, the GOT turns OFF "Request for reading information."
- (4) When "Request for reading information OFF" is received, the GOT turns OFF "Reading information completed."

8 Function Relevant Parameter

8.1 Function Definition Parameter

Parameter	Parameter Name	Array Qty Character Qty	Description	Factory Default
Define function	IQSPEC	1 digit integer	Set up function for robots. Set each function allocated by each bit. 000000000000000000 bit1-15: Not used + bit0: Direction to write into shared memory	0000000000000001
			Reads/writes in order from first to last address Reads in order from first to last address, writes in order from last to first address (communication specification among robot CPU of GOT)	

The access sequence of the shared memory of the robot controller is direction to the final address from the top address for both of reading and writing. However, the GOT's communication specification among robot controllers is direction from last to start address for writing. Thus, when a system is designed according to the shared memory map specification, the interlock of dataset may be impossible. (For more information, refer to the Fig. 8-1.)

Therefore, when utilizing shared memory expanded function, it is necessary to make the shared memory access order the same as the specification of the GOT. We provide the parameter (IQSPEC) to solve it. The initial value is set to the same specification as the GOT, so its change by customer is not necessary at all. If the access sequence of the shared memory direction to the final address from the top address for both of reading and writing is necessary, it can specify with this parameter.

Prevention of separation of data over 32 bits

When user's free area is used

The program reads in order from start of user's free area. In write command, the transmission data is written in order from last to start address of user's free area.

Consequently, the interlock device at the start of data for communication can prevent separation of data for communication

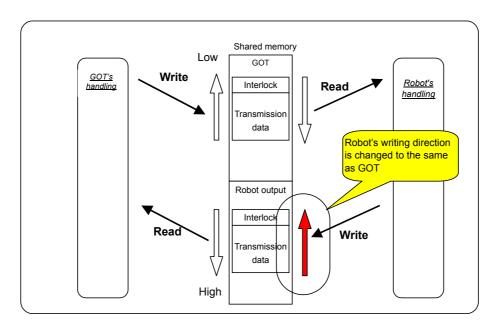


Fig.8-1: Change the writing order of shared memory data

9 Extended Function Relevant Error List

(1) Error occurred when MELFA-BASIC IV is selected while shared memory extended function is valid

Error No	Error Cause and Measure				
L3994	Error message	Shared memory extended function unavailable (MB4)			
	Cause	Shared memory extended function is unavailable in MELFA-BASIC IV. The parameter RLNG=1 (MELFA-BASIC IV) is selected while shared memory extended function is valid. Make sure to set the parameter RLNG to 2 (MELFA-BASIC V).			
	Measure	Set the parameter RLNG to 2 (MELFA-BASIC V).			

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