1408, TFDEN-007-009, 001

NACHI

FD CONTROLLER INSTRUCTION MANUAL EXTERNAL INPUT/OUTPUT

9th edition

- Before attempting to operate the robot, please read through this operating manual carefully, and comply with all the safety-related items and instructions in the text.
- The installation, operation and maintenance of this robot should be undertaken only by those individuals who have attended one of our robot course.
- When using this robot, observe the low related with industrial robot and with safety issues in each country.
- This operating manual must be given without fail to the individual who will be actually operating the robot.
- Please direct any queries about parts of this operating manual which may not be completely clear or any inquiries concerning the after-sale service of this robot to any of the service centers listed on the back cover.

NACHI-FUJIKOSHI CORP.

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The numbers of logical signals used as status signals can be set freely in order to fit the physical I/O capacity which is actually used. This is known as “signal attribute assignment”.
At the factory, the standard assignment is set although this can easily be changed. Set the alternative assignment in accordance with the system design.
Please refer to the instruction manual “SETUP”,”4.6 Signal attribute settings” for the detail of operation and standard assignment as factory setting.

NOTE

Chapter 1 Input/output signals

This chapter explains the meaning of input/output signals.

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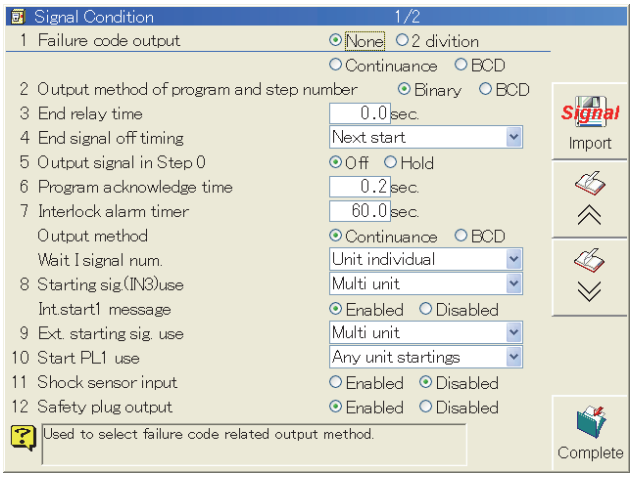
1.1 Setting conditions for signals

The output time of the end relay output signals and the other conditions for a number of other input/output signals can be changed. This section describes how to make the changes in these conditions.

Setting the input/output signal conditions

1 **Select teach mode.**

2 **Select <Constant Setting> - [6 Signals] – [1 Signal Condition].**
>>The screen shown below now appears.



3 **Upon completion of the settings, press f12 [Complete]. What has been set is now saved in the constant file.**
>> After the settings have been saved, the display returns to the input signal assignment menu.

The significance of each of these conditions is described on the following pages.

1 Failure output

Explanation	When abnormal status (error/alarm/information) happens, its code number can be outputted. Here its rule is defined.	
Selections	None	Serious grade output only (error or alarm or information). Error code, unit number and axis number are not outputted.
	2 deviation	Error code is converted to binary and outputted, dividing to upper 8 bits and lower 8 bits.
	Continuous	Error code is converted to binary and outputted, continuous 16 bits.
	BCD	Error code is converted to BCD code and outputted, 4 bits * 4 digit = 16 bits.
Operator	***EXPERT*** or above	

Maximum 16 signals can be assigned for error code. Its meaning differs depending on 2 deviation / Continuous / BCD.

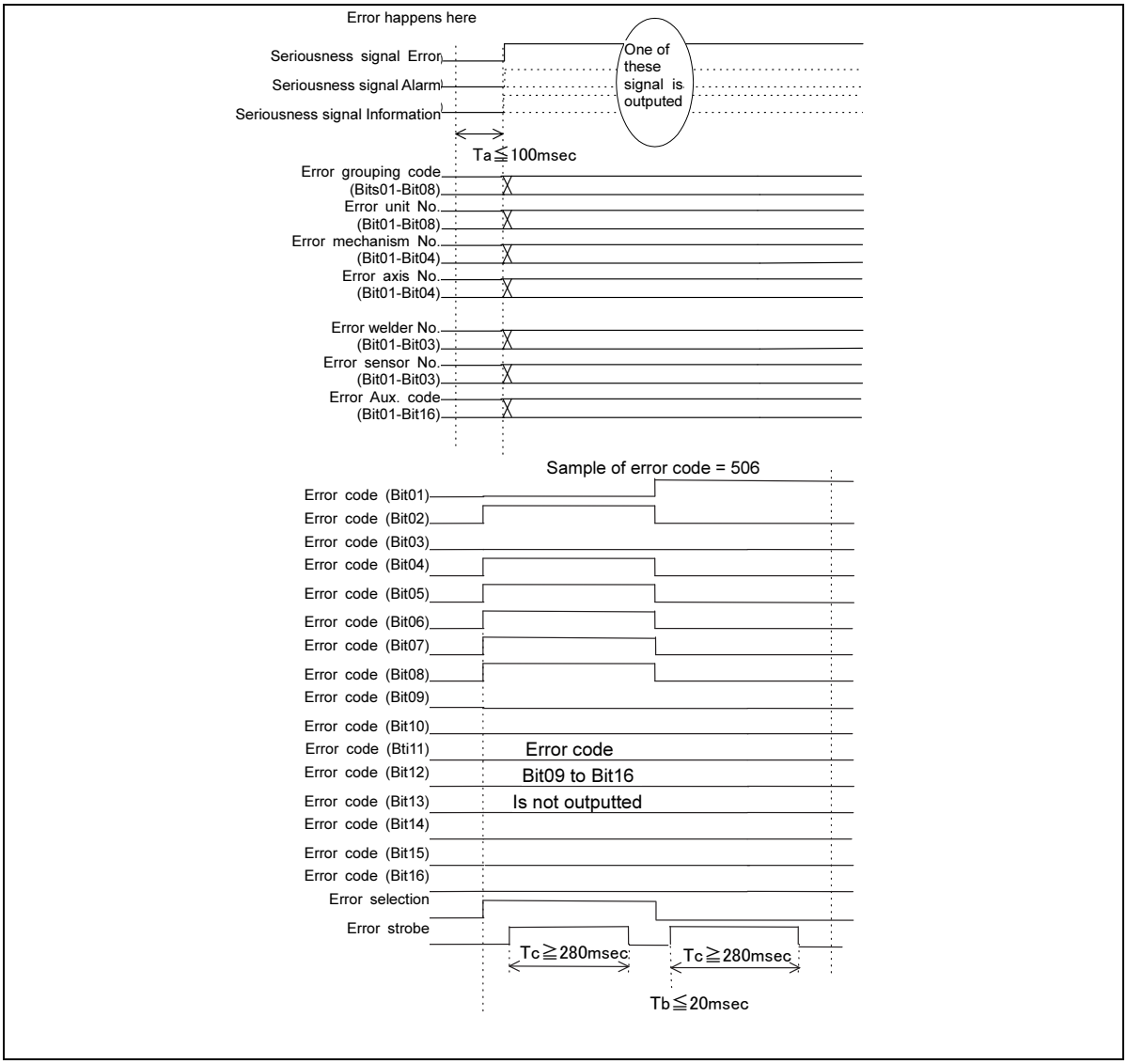
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
2 deviation	(not used)								8 bits, time sharing							
Continuous	Binary 16 bits															
BCD	Place of 1000 binary				Place of 100 binary				Place of 10 binary				Place of 1 binary			

Output method = 2 deviation

"Error code", "Error select" and "Error strobe" signals are used.

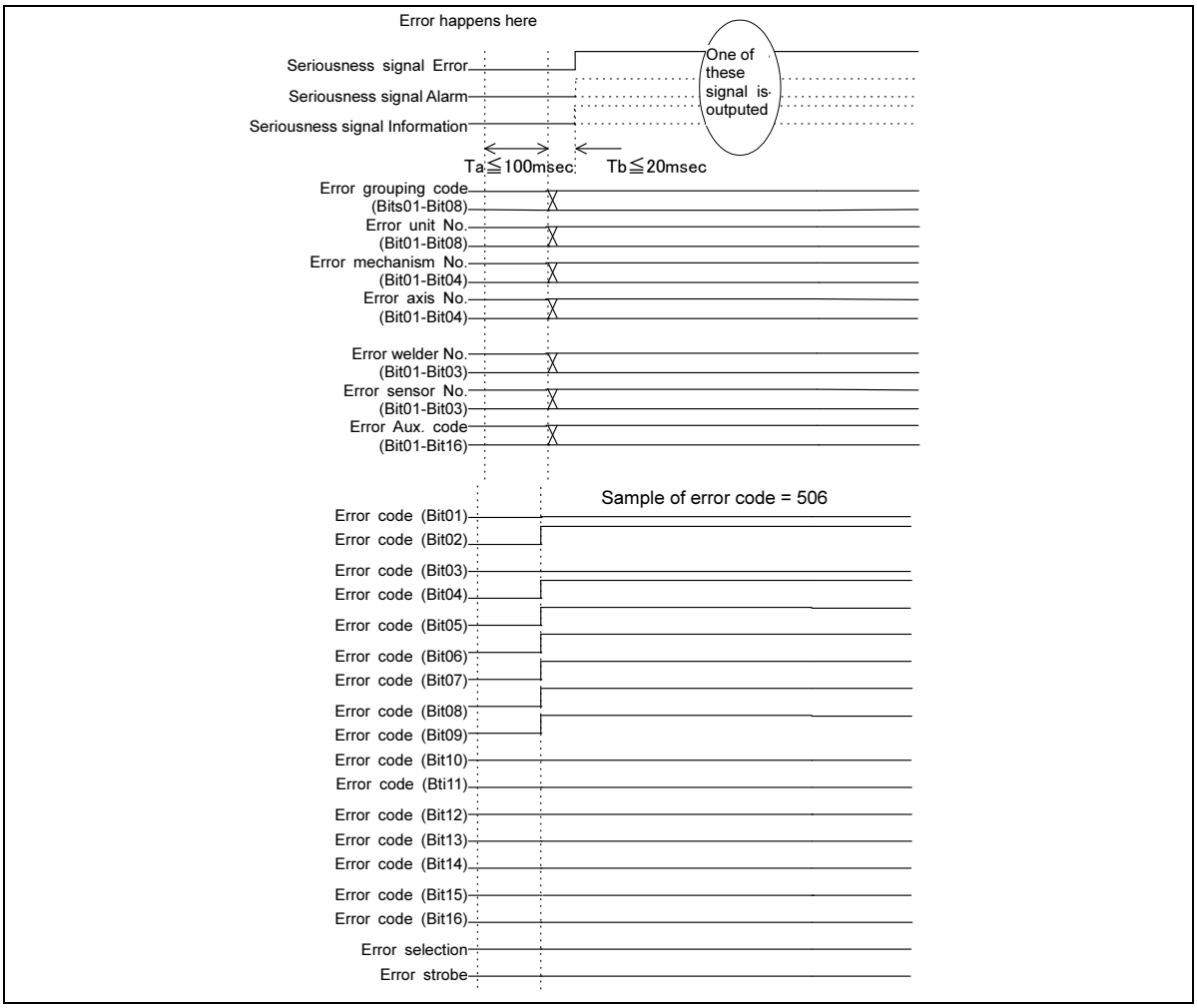
"Error code" occupies 8 signals and upper 8 bit and lower 8 bit is selected by "Error select" signal. "Error strobe" signal determines the timing to be read.

Following diagram shows the time chart of Error 506.



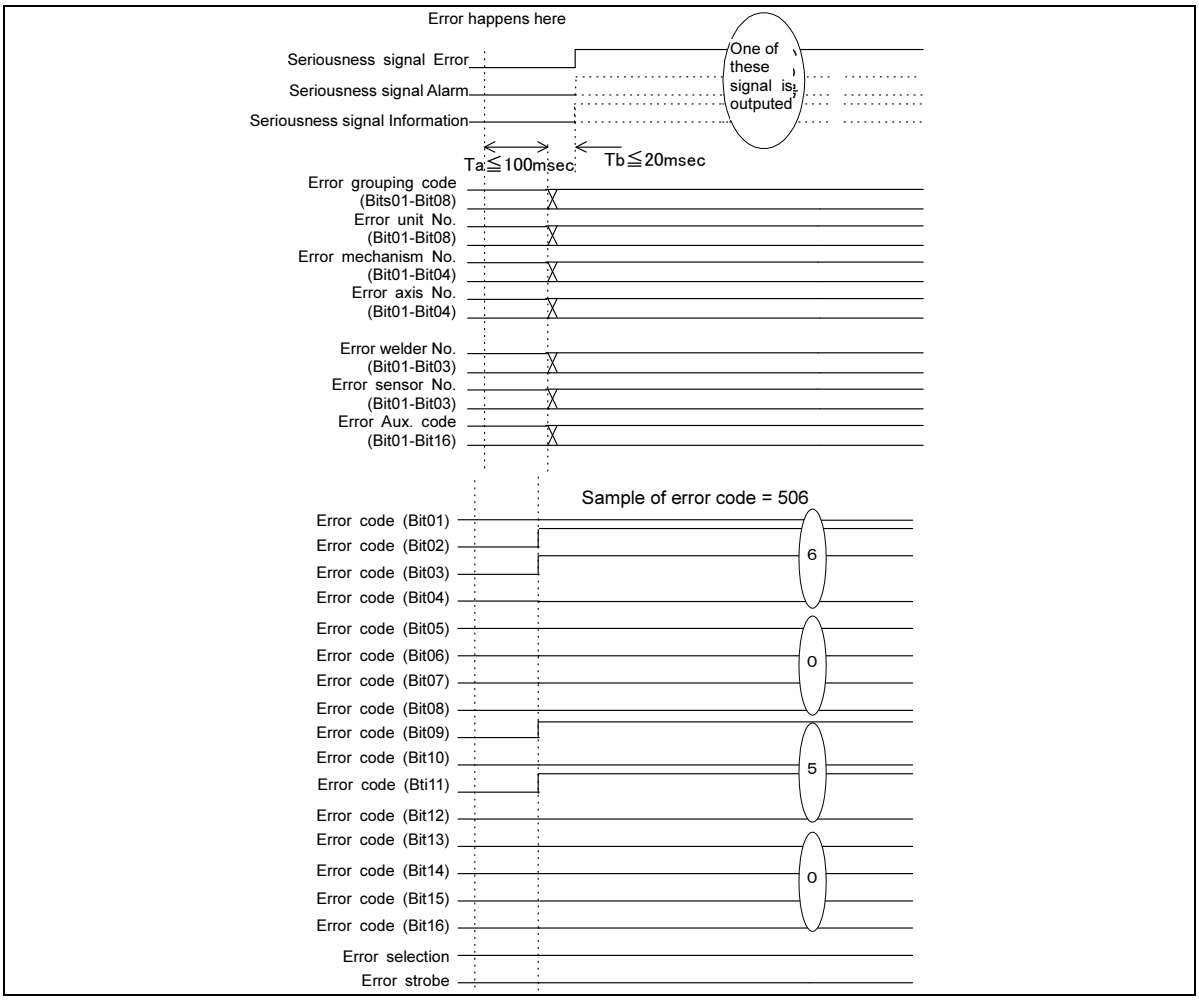
Output method = Continuous

Only "Error code" signal is used. One of "Error" or "Alarm" or "Information" is outputted as a strobe signal.
Following diagram shows the time chart of Error 506.



Output method = BCD

Only "Error code" signal is used. One of "Error" or "Alarm" or "Information" is outputted as a strobe signal.
Following diagram shows the time chart of Error 506.



Following list shows the concerning output signals.

Signal name	Explanation
Fail. classific. ☞ 1-42	Grouped cause signal is outputted BCD 8 bits.
Failure code ☞ 1-43	Error code is outputted under the rule of "2 deviation" or "Continuous" or "BCD".
Failure selector ☞ 1-43	When error code output rule is "2 deviation", this signal is used to clarify upper 8 bits and lower 8 bits.
Failure strobe ☞ 1-43	When error code output rule is "2 deviation", this signal is used to know the timing to read the code.
Fail. unit num. ☞ 1-43	Error unit number is outputted, BCD 8 bits. If happened error was not related to unit, this signal is not outputted.
Fail. mecha. number ☞ 1-44	Error mechanism number is outputted, 4 bits. If happened error was not related to mechanism, this signal is not outputted.
Fail. axis. number ☞ 1-44	Error axis number is outputted, 4 bits. If happened error was not related to axis, this signal is not outputted.
Fail. weld number ☞ 1-44	Error welder number is outputted, 3 bits. If happened error was not related to welder, this signal is not outputted.
Fail. sensor number ☞ 1-44	Error sensor number is outputted, 3 bits. If happened error was not related to sensor, this signal is not outputted.
Fail. assist number ☞ 1-45	Error supplement code is outputted, 16 bits. If happened error did not have supplement code, this signal is not outputted.

2 Output method of program and step number

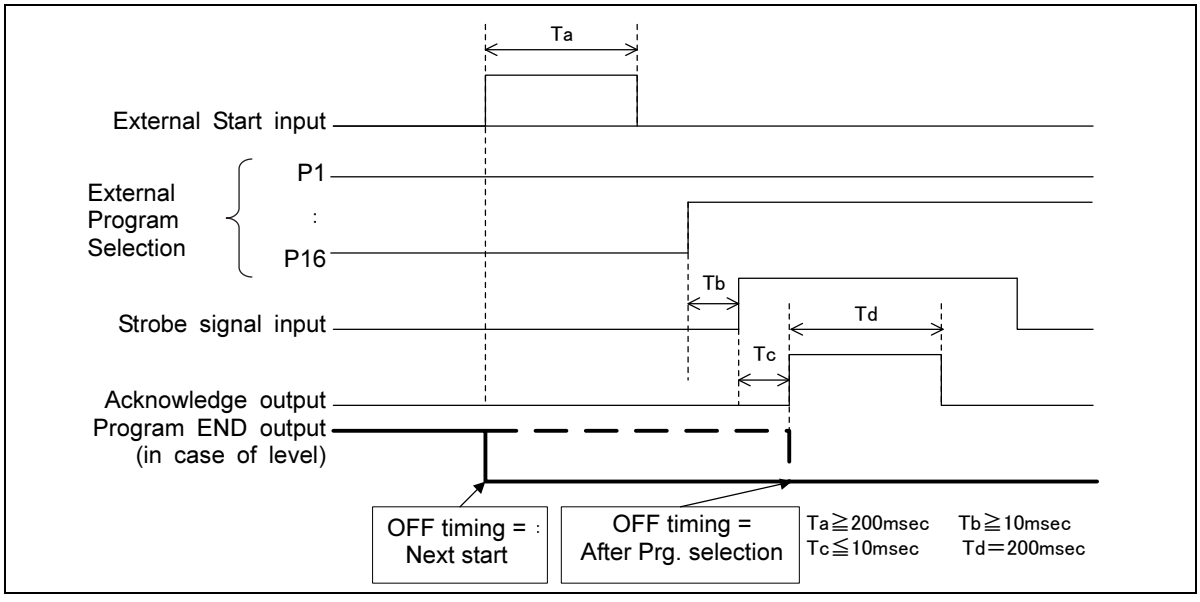
Explanation	Current program and step No. is outputted. This is directly same with the number that is selected by the operator in teaching procedure and that changing by program call or step jump function in playback. **Related output signals:** **Program No. monitor (16bit)** ☞ 1-40 **Step number monitor (16bit)** ☞ 1-40	
Selections	Binary	Program and step No. is outputted, binary 16 bits.
	BCD	Program and step No. is outputted, BCD 4 bits * 4 digits.
Operator	***EXPERT*** or above	

3 End relay time

Explanation	This condition setting will be enabled when [Continue] is set in [Service Utilities] - [Playback mode]. The output time of program END signal can be set (0.0～10 sec.) which is to be output by the program end (END:FN92) when [Continue] is set in [Service Utilities] - [Playback mode]. Since the next cycle will not start until the set time passes, the program END signal can be surely turned on. The program END signal may not be turned on when 0.0 second is set. Because the program END signal will be then turned off by setting the "End signal timing" described in the next section. However, when the END in the called program is executed, the signal will not be output. **Related output signal:** **Program end** ☞ 1-29
Operator	***EXPERT*** or above

4 End signal timing

Explanation	This is to select when "program end" signal is OFF. **Related output signal:** **Program end** ☞ 1-29	
Selections	Next start	Program END signal is OFF when next start command is accepted or next cycle started in case of continuous playback mode.
	After prog. Selected.	Regardless of playback mode, program END signal is OFF after next program selection of next cycle is completed. Even in playbacking, program END signal is kept ON while waiting for program selection or waiting for program queue.
Operator	***EXPERT*** or above	



5 Output signal in Step 0

Explanation	Normally, all of general output signals except status signals are forcibly turned OFF at the top of program execution (step 0). When restarted, signals never turned OFF.	
Selections	Off	All of general output signals are forcibly turned OFF at the top of program execution (step 0).
	Hold	All of general output signals are kept as they were at the top of program execution (step 0).
Operator	***EXPERT*** or above	

6 Program acknowledge time

Explanation	This is to set the output time of program acknowledge signal that shows program has been selected by input signals. (0.2 to 10 seconds) **Related output signal:** **Program selected** ☞1-32
Operator	***EXPERT*** or above

7 Interlock alarm timer / Output method

Explanation	When robot waits for interlock signal longer than the defined time, alarm signal can be outputted. Here its waiting time is defined. Default time is 60 seconds. (0 to 255 seconds) At the same, waiting unit number and input signal number is outputted also. **Related output signals:** **Interlock alarm** ☞ 1-31 **Waiting unit number** ☞ 1-31 **Waiting I signal number (16bit)** ☞ 1-31	
Selections	Continuance	Waiting input signal number is outputted 16 bits binary.
	BCD	Waiting input signal number is outputted 4 bits * 4 digit BCD (binary coded decimal).
Operator	***USER*** or above	

8 Starting sig. (IN3) use / Int.start1 message

Explanation	In a robot with the multi-unit specifications, these parameters specify the application of internal start signal 1 (unit 1 start button) if the robot is to be operated automatically by the internal start method. If "Int. start1 message" is enabled, a message appears to prompt the user to check the number of the unit which will be started when internal start signal 1 is pressed at the stage when the mode is switched to playback. These parameters do not function when external start or station start serves as the start method and when the robot has the regular single-unit specifications.	
Selections	Unit1 only	When the start button of unit 1 is pressed, only unit 1 starts up.
	Multi unit	When the start button of unit 1 is pressed, the multiple numbers of units specified start up. The units which are to be started up simultaneously are set using f10 <Unit Setting>.
Operator	***EXPERT*** or above	

9 Ext. starting sig. use

Explanation	In a robot with the multi-unit specifications, this parameter specifies the application of "Ext. play start. U1" signal if the robot is to be operated automatically by the external start method. This parameter does not function when internal start or station start serves as the start method or when the robot has the regular single-unit specifications. **Related output signal:** **Ext. play start. U1** ☞ 1-11	
Selections	Unit1 only	Only unit 1 starts up when the "Ext. play start. U1" signal has been input.
	Multi unit	The multiple number of units specified start up when the "Ext. play start. U1" signal has been input. The units which are to be started up simultaneously are set using f10 <Unit Setting>.
Operator	***EXPERT*** or above	

10 Start PL1 use

Explanation	In a robot with the multi-unit specifications, this parameter specifies the application of start lamp 1 (start lamp on the operation box). This parameter does not function when station start serves as the start method or when the robot has the regular single-unit specifications.	
Selections	Any unit startings	Start lamp 1 lights when any of the units are operating.
	Unit1 starting	Start lamp 1 lights when unit 1 is now operating.
Operator	***EXPERT*** or above	

11 Shock sensor input

Explanation	Shock sensor can detect the interference of robot and peripheral equipments by the mechanical switch. **Related output signal:** **Shock sensor activated** ☞ 1-46	
Selections	Enabled	Shock sensor is enabled. Shock sensor signal must be connected to the IPM drive unit. When this parameter is disabled, shock sensor input signal must be kept OFF without fail. If this parameter is disabled and sensor input signal is ON, motor power can not be turned ON with no error message when motor ON button was pushed.
	Disabled	Shock sensor is disabled.
Operator	***EXPERT*** or above	

12 Safety plug output

Explanation	This parameter is used to set whether or not the failure output is to be provided when a safety plug unplugged error has occurred.	
Selections	Enabled	The failure output is provided when a safety plug unplugged error has occurred.
	Disabled	The failure output is not provided when a safety plug unplugged error has occurred.
Operator	***EXPERT*** or above	

13 Output signal reset range / Reset range in play mode

Explanation	These parameters specify the range of the general-purpose output signals (0 to 2048) to be reset (set to OFF) at the times listed below when the general-purpose output signals are reset. • When the signals are reset by the soft keys on the teach pendant • When the input signal for resetting the general-purpose logical output signals is set to ON • When the mode was transferred from teach to playback **Related output signal:** **Reset out. signal** 1-22
Operator	***EXPERT*** or above

14 Error Signal

Explanation	This parameter is used to enable or disable the failure signal outputs for each type of error. It is enabled when the box is checked.
Operator	***EXPERT*** or above

15 Step set alarm

Explanation	Used to make setting of timing of outputting the step set alarm.	
Selections	Step	Used to output the alarm if steps away from each other by 2 or more steps are executed in step set. However, if Step 0 is executed, the alarm will not be output.
	Step/Program	Used to output the alarm in the event of any of the following events: ・ Steps away from each other by 2 or more steps were executed in step set. ・ The current Step number is “1” or higher and a different program was selected. ・ The current Step number is “2” or higher and the same program was selected ・ The currently-selected program was updated by the File Delete or File Copy parameter in the “File Manager” menu. ・ The currently-selected program was updated by “R115”,”R116” or “R117”. ・ The currently-selected program was updated from the robot language format to the executable format.
Operator	***EXPERT*** or above	

16 Keep of temporary stop signal

Explanation	The temporary stop signal turns ON by making a temporary stop in Playback mode. Then, it turns OFF when proceeding to Teach mode. You need to specify Yes/No for or for not outputting the temporary stop signal when proceeding to Playback mode again.	
Selections	Yes	Outputs the temporary stop signal when proceeding from Teach mode to Playback mode.
	No	Does not output the temporary stop signal when proceeding from Teach mode to Playback mode.
Operator	***EXPERT*** or above	

17 CPU thermo warning level

Explanation	Used to set the CPU temperature level or CPU thermo warning. **(The initial value is not normally changed but used as is.)**
Operator	***SPECIALIST***

19 Detect fetch error

Explanation	Used to select the behavior when the fetched input signal has been changed before the target function is executed.	
Selections	Disabled	Nothing happens when the fetched input signal has been changed before the target function is executed.
	Enabled	An alarm is detected when the fetched input signal has been changed before the target function is executed.
Operator	***EXPERT*** or above	

20 Effective span of a fetched signal

Explanation	Used to determine the quantity of move steps where the fetched input signal is kept effective. If the quantity of move steps were more than this value before executing the target function, an alarm is detected and robot stops. Initial value is 0 (= unlimited). (0 to 9999)
Operator	***EXPERT*** or above

24 Switching MS-ON/OFF timeout

Explanation	At the moment of motor ON (or OFF) control, if the fixed input signal “Magnet-ON” can not be confirmed ON (or OFF) within the time defined here, an error “E1046 Master-ON circuit is inconsistent” is detected. Initial value is 500+500msec. **(The initial value is not normally changed but used as is.)**
Operator	***EXPERT*** or above

25 Reset of the production volume

Explanation	When multi-station operations are to be performed, by inputting the “reset attained” signal defined by <Constant Setting> - [6 Signals] - [2 Input Signal Assignment] – [9 Multi-station Inputs], the production count will be “0”. However, if the production count has not reached the allotment count, the production count will not be “0”. The factory default of this parameter is “Disabled”.	
Selections	Disabled	When the “reset attained” signal is input, the production count will not be “0”.
	Enabled	When the “reset attained” signal is input, the production count will be “0”. However, if the production count has not reached the allotment count, the production count will not be “0”.
Operator	***EXPERT*** or above	

26 Update failure code output

Explanation	Used to select Enabled/Disabled as needed for the output signal of **"Failure code 1-16"**(☞1-43) when failures occur in succession (two or more failures occurred on the "The failure monitor"). The default is 'Enabled (Update)'. In using **"Next Failure output**" input (☞1-25), select Disabled (Not update).	
Selections	Enabled	When failures occur in succession, the output signal related to **"Failure code 1-16"**(☞1-43) is updated as needed. **Related output signal:** "Fail. classific. 1-8", "Failure selector", "Failure strobe", "Fail. unit num. 1-4", "Fail. mecha num. 1-4", "Fail. axis number 1-4", "Fail. weld number 1-3", "Fail. sensor num. 1-4", "Fail. assist number 1-16" However the signal is not updated in the following cases. ・When the failure of the higher level of importance has occurred first (Error > Alarm > Information). ・When the type of failure corresponds to the one which has been set disabled by **"14 Error Signal"**(☞1-8).
	Disabled	The output signal related to **"Failure code 1-16"**(☞1-43) is not updated when failures occur in succession. Regardless of the level of importance, **"Failure code 1-16"**(☞1-43) of the failure first occurred is output.
Operator	***EXPERT*** or above	

If selecting Disabled (not update), it is available to obtain all the failure codes occurred in succession in the order of the time and date using the **"Next Failure output"** input (☞1-25).

Fig. 1.1.1 shows the flowchart for the obtaining process of all the failure codes.

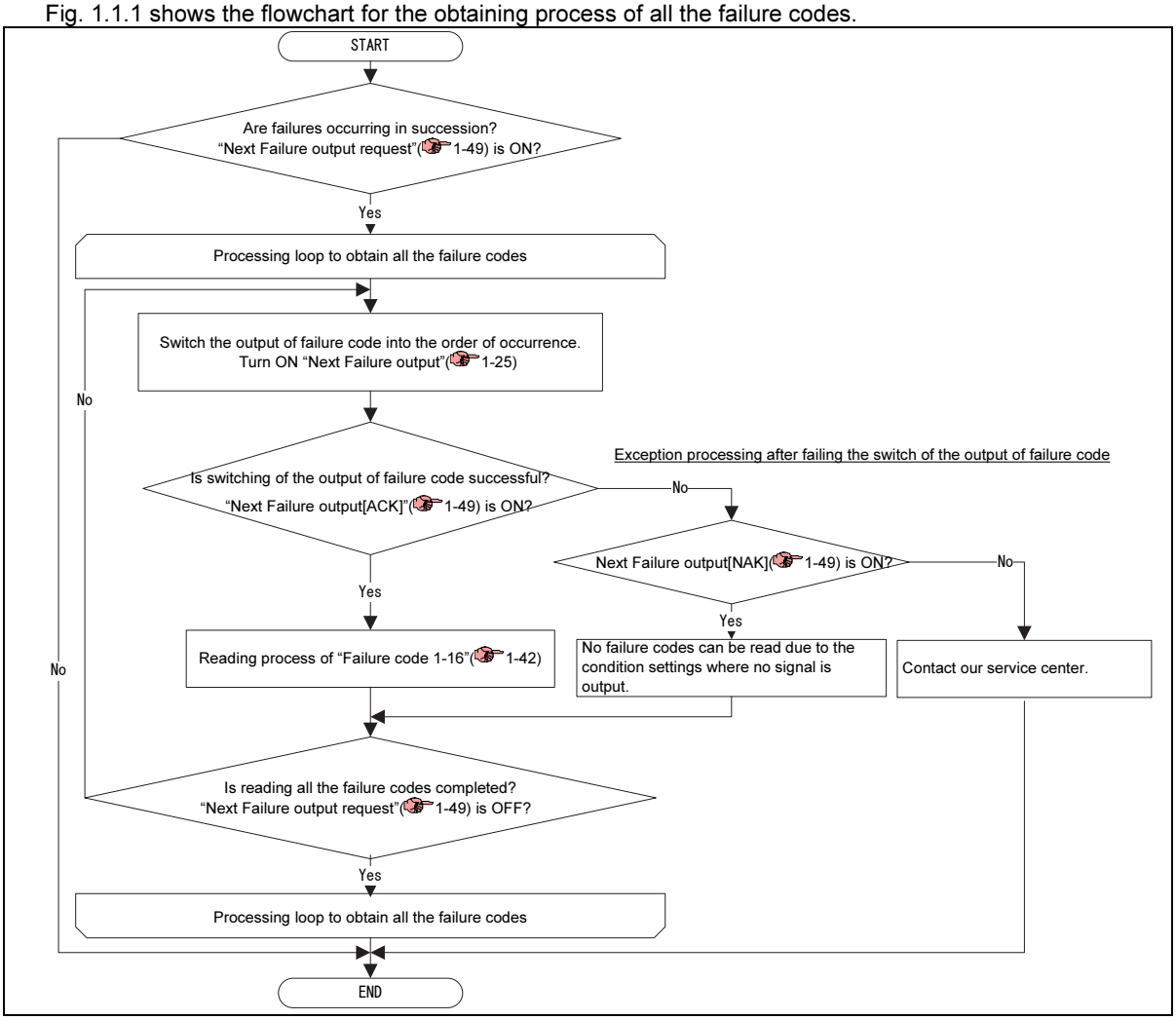


Fig. 1.1.1 Flowchart for the obtaining process of all the failure codes occurred in succession

1.2 Basic input/output signals

1.2.1 Basic input signals

This section explains the basic input signals. (Signals other than those shown below may be displayed on screen, but consider any signals not described here to be unavailable for use or to be optionally available for use.)

POINT

The [U1–U9] or [M1–M9] letter/number combinations at the sides of a signal name respectively indicate the number of the unit or mechanism which is the operation target of the signal concerned. For instance, U1 indicates a signal which works for unit 1 whereas M1 indicates a signal which works for mechanism 1.
With a robot featuring the multi-unit or multi-mechanism specifications, the number of signals displayed is equivalent to that of units or mechanisms which have been defined, so allocate the signals appropriately as befits the application.
With a robot featuring a discrete manipulator, there is no need to heed these numbers.

Ext. play start. [U1-U9]

Initial allocation No.	30
Meaning of the signal	This signal is for starting a program using instructions from an external controller, without using the motor power ON button or start button on the operation box.
Behavior when turned ON	• The rise of this signal causes the program specified by "**Program sel. bits**" signal (☞ 1-13) to start. There is no need to maintain the signal. • It starts the program whose number has been specified by the "**Program sel. bits**" signal only when that program starts from step 0. When a program is restarted after stopping or started in response to the designation of a particular step (a step other than step 0), it always starts the program indicated on the teach pendant regardless of the status of the "**Program sel. bits**" signal. To start the program specified by "**Program sel. bits**" signal regardless, input "**External reset**" signal (☞ 1-14) before starting the program. The step is set to 0 by this signal. • To stop the program, set "**Ext. unit play stop**" signal (☞ 1-12) to OFF. This operation can be performed from the teach pendant or operation box. • "**Robot moving**" (☞ 1-33), "**Robot running**" (☞ 1-33), "**Running in AUTO**" (☞ 1-37) and "**Executing program**" (☞ 3-38) output signals are set to ON. • To start a multiple number of units simultaneously in a robot featuring the multi-unit specifications, the signals corresponding to the units (U1 to U9) to be started must be input. If one unit is be started first and operation is to be branched from that unit to other units, input the signal only for the unit which is to be started first.
Behavior when turned OFF	Nothing happens.
Remarks	When using this signal, it is necessary to set <Service Utilities> – [1 Teach/Playback Condition] – [2 Motors ON/START sel. source] to “External”.
Operator	***USER*** or above

Int. unit play stop [U1-U9]

Initial allocation No.	0
Meaning of the signal	• This signal individually stops units (programs) that have been started with an internal start. It stops only that unit which corresponds to the signal which has been input. • However, bear in mind that if this signal is allocated, it will take effect at all times regardless of the setting of the start selection (internal, external or station start).
Behavior when turned ON	• The rise of the signal stops the unit (program) that is running. • Once this signal has been input, automatic operation start or check GO/BACK operations cannot be performed.
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

Ext. All unit play stop

Initial allocation No.	0
Meaning of the signal	• This signal stops the robot from an external source. It stops all the units together. • Bear in mind that if a number other than “0” is allocated, the signal will always be enabled regardless of the start selection (internal, external and station start) setting. • This signal uses a B contact point, so “OFF” will stop it. When ON, it means that Start is permitted.
Behavior when turned ON	Nothing happens (which means that Start is permitted).
Behavior when turned OFF	• The rise of the signal stops all the units (programs) which are running. • Once this signal has been input, automatic operation start and check GO/BACK operations cannot be performed. • "**Under stopping [U1–U9]**" (☞ 1-29), "**Holding**" (☞ 1-37) and "**Stopping (System)**" (☞ 1-38) output signals are set to ON.
Remarks	When “0” is allocated, the signal state is not monitored. In other words, there is no need for this signal to be on in order to start.
Operator	***USER*** or above

Ext. unit play stop [U1-U9]

Initial allocation No.	31 or 0
Meaning of the signal	• This signal stops the robot from an external source. It stops only that unit which corresponds to the signal which has been input. • If allocated, this signal will always be enabled regardless of the start selection setting (internal, external, station start). • This signal uses a B contact point, so “OFF” will stop it. When ON, it means that Start is permitted.
Behavior when turned ON	Nothing happens (which means that Start is permitted).
Behavior when turned OFF	• The rise of the signal stops the unit (program) that is running. • Once this signal has been input, automatic operation start or check GO/BACK operations cannot be performed. • "**Under stopping [U1–U9]**" (☞ 1-29), "**Holding**" (☞ 1-37) and "**Stopping (System)**" (☞ 1-38) output signals are set to ON.
Remarks	When “0” is allocated, the signal state is not monitored. In other words, there is no need for this signal to be on in order to start.
Operator	***USER*** or above

Motors ON external

Initial allocation No.	0
Meaning of the signal	This signal turns on the motor power (servo power) from an external source. When using this signal, it is necessary to set <Service Utilities> – [1 Teach/Playback Condition] – [2 Motors ON/START sel. source] to “External”.
Behavior when turned ON	Turns the motor power on.
Behavior when turned OFF	Nothing happen
Operator	***USER*** or above

Motors OFF external

Initial allocation No.	0
Meaning of the signal	This signal turns off the motor power (servo power) from an external source. This signal is always enabled regardless of the start selection setting (internal, external, station start).
Behavior when turned ON	Turns the motor power off.
Behavior when turned OFF	Nothing happen
Operator	***USER*** or above

Program sel. bits 1-16 [U1-U9]

Initial allocation No.

Bit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial allocation No.	17	18	19	20	21	22	23	24	0	0	0	0	0	0	0	0

Meaning of the signal

- This signal is for selecting the program using external instructions, rather than the teach pendant. Select programs 1 to 9999 using signals for bits 1 to 16 (16 bits).
- The format for reading the signal expressed with the 16 bits is “Binary”, “BCD” or “Discrete”.

When Binary is selected

Program selection bit :	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Value :	–	–	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
	–	–	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

When, for instance, bits 3 and 5 are ON, program no.20 ($2^2 + 2^4 = 4 + 16$) is selected.
Bit numbers 15 and 16 exceed 9999, so they are meaningless, even if used.

When BCD is selected

Program selection bit :	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Value :	8000	4000	2000	1000	800	400	200	100	80	40	20	10	8	4	2	1
	1000’s digit				100’s digit				10’s digit				1’s digit			

For example, when the number 3 bit and number 5 bit are ON, the 1's digit is “4” and the 10's digit is “1”, so Program # 14 is selected.

When Discrete is selected

Program selection bit :	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Value :	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

The input bit numbers are read as is to be the program number.
For example, when bit number 3 is ON, Program # 3 is selected.
If two programs are input at the same time, the one with the lower number is selected.

- The input signal that determines the timing when reading signals is "**Program strobe**" signal (☞ 1-14).
- When a multiple number of units are to be started up simultaneously with a robot featuring the multi-unit specifications, this signal must be input for each unit.

Behavior when turned ON	Selects the program. **Ext. play start.** signal (☞ 1-11) deeply concerns this behavior. Please refer to it.
Behavior when turned OFF	Nothing happens.
Remarks	• When using this, it is necessary to set <Service Utilities> – [1 Teach/Playback Conditions] – [3 Playback mode prog. sel.] to “External”. • Select one of the read formats using <Service Utilities> – [1 Teach/Playback Condition] – [Selection type].
Operator	***USER*** or above

Program strobe [U1-U9]

Initial allocation No.	25
Meaning of the signal	This is the signal for determining the timing for reading "**Program sel. bits**" signal (☞ 1-13) to select the program from external device.
Behavior when turned ON	Reads the signals input in "**Program sel. bits**" signal and recognizes them as the number of the program to be started.
Behavior when turned OFF	Nothing happens.
Remarks	When this signal is not used, select [Strobe signal] to [Unused] in <Service Utilities> – [1 Teach/Playback Condition].
Operator	***USER*** or above

External reset [U1-U9]

Initial allocation No.	0
Meaning of the signal	• This signal is input when executing fault reset and clearing the step No. from an external source at the same time. • In case of multi-unit, the above execution for each unit is available. • "**Fault Reset**" signal (☞ 1-15) is used for resetting only fault. • This is enabled in both teach mode and playback mode, but be careful when it is input in playback mode. • If this signal is input while the robot is stopped in automatic operation, the step numbers will be cleared (be set to 0). In other words, it will start from the top of the program with the next start input. When inputting this signal, make sure that the robot will not interfere with jigs around it when it moves from its stopped position to the top step of the program. If there is a risk of interfering with them, first switch to teach mode to take precautionary measures such as manually moving it to somewhere safe.
Behavior when turned ON	Resets the fault and simultaneously sets the current step to 0.
Behavior when turned OFF	Nothing happens.
Remarks	It functions in the same way as short-cut R0.
Operator	***USER*** or above

Reduce speed [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal forcibly sets the playback speed to a “safe speed”. The safety speed refers to the movement of the tool tip at a speed of 250 mm/sec. In case of multi-unit, the above execution for each unit is available.
Behavior when turned ON	• Sets the playback speed to a safe speed. Sets the “Speed reduced” output signal to ON. • "**Speed reduced**" signal (☞ 1-34) is set to ON.
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

Reservation cancel [U1-U9]

Initial allocation No.	0
Meaning of the signal	• This signal is for canceling all programs that were reserved by “FIFO” function. • “FIFO” function is for an external start, and is different from the reservation of multi-station start. Therefore, programs reserved by multi-station start will not be canceled even if this signal is input.
Behavior when turned ON	Cancels all reservations.
Behavior when turned OFF	Nothing happens.
Remarks	Set by <Service Utilities> – [1 Teach/Playback Condition] – [4 Program queue].
Operator	***USER*** or above

Ext. Machine Lock

Initial allocation No.	0
Meaning of the signal	• This signal is input to switch the machine lock status from an external source. • “Machine lock” is a function that prohibits movement of a mechanism.
Behavior when turned ON	Enables the machine lock.
Behavior when turned OFF	Nothing happens.
Remarks	The signal serves the same function as the R123 shortcut or as <Service Utilities> – [1 Teach/Playback Conditions] – [6 Machine Lock].
Operator	***USER*** or above

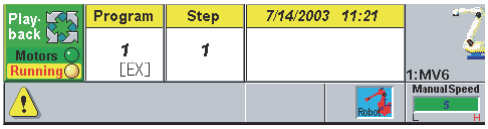
Territory Position 1-16

Initial allocation No.	0
Meaning of the signal	This signal indicates that another robot gets into this robot’s working envelope.
Behavior when turned ON	Another robot controlled by other controller is working outside this robot’s working envelope, so this robot continues working.
Behavior when turned OFF	Another robot controlled by other controller is working in this robot’s working envelope, so this robot begins waiting.
Remarks	Set by <Constant Setting> – [9 Territory Definition] – [2 Territory Field].
Operator	***USER*** or above

Fault reset

Initial allocation No.	0
Meaning of the signal	This signal is input when executing fault reset from an external source.
Behavior when turned ON	Resets the fault.
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

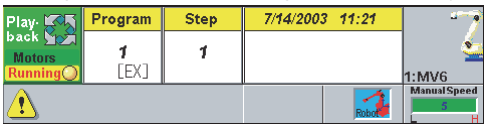
Pause

Initial allocation No.	0
Meaning of the signal	• This signal temporarily stops the program being played back with keeping motor power ON (servo ON). • In case of multi-unit, all the units temporarily stop together. • This is normal closed contact. Pause status is established when contact OFF.
Behavior when turned ON	The pause status is released, and operation is resumed straight away.
Behavior when turned OFF	• The program being played back is temporarily stopped. • The servo power is not set to OFF. • Since it is just temporarily stopped, the robot is in the same status as the running status. In other words, the display and running output signals are all the same as in the running status, and they remain unchanged. • During pause status, warning mark is displayed as shown below. 
Remarks	• Use "**Ext. Pause**" signal (☞ 1-16) for specific unit to be paused. • The only difference between this signal and "**Hold**" signal (☞ 1-17) is whether the motor power is turned OFF. The motor power (servo power) is turned OFF with "Hold" signal.
Operator	***EXPERT*** or above

Ext. Pause 1-4 [U1-U9]

Initial allocation No.	0
Meaning of the signal	• This signal temporarily stops the program being played back with keeping motor power ON (servo ON). • This signal is used when specific unit is to be paused In case of multi-unit. Up to four signals can be registered for one unit. • This is normal closed contact. Pause status is established when contact OFF.
Behavior when turned ON	Same as "Pause" input signal.
Behavior when turned OFF	Same as "Pause" input signal.
Operator	***EXPERT*** or above

Hold

Initial allocation No.	0
Meaning of the signal	• This signal temporarily stops the program being played back, and sets servo OFF (but motor power is kept ON) This signal is applied to all the units, and is not applied to each individual unit. • This is normal closed contact. Hold status is established when contact OFF.
Behavior when turned ON	• If "**Hold Reset**" signal (☞ 1-17) has not been allocated (set to "0"), the hold status is released, the motor power (servo power) is turned ON, and operation is resumed, simply by the ON input of this signal. • If "**Hold Reset**" signal has been allocated, nothing happens. (To release the hold, "**Hold Reset**" signal must be input.)
Behavior when turned OFF	• This signal temporarily stops the program being played back, and sets servo OFF (but motor power is kept ON). • Since it is just temporarily stopped, the robot is in the same status as the running status. In other words, the display and running output signals are all the same as in the running status, and they remain unchanged. • During hold status, warning mark is displayed as shown below. 
Operator	***EXPERT*** or above

Hold Reset

Initial allocation No.	0
Meaning of the signal	This signal releases the hold and resumes operation.
Behavior when turned ON	Servo power is set to ON, and operation is resumed.
Behavior when turned OFF	Nothing happens.
Operator	***EXPERT*** or above

Ext. Hold

Initial allocation No.	0
Meaning of the signal	This has exactly the same significance as "**Hold**" signal (☞ 1-17). It does not matter which one is used. In cases where there are two input systems in the form of the robot operation board and line control panel, it is convenient to use "Hold" signal for one input system and "Ext. Hold" signal for the other.
Behavior when turned ON	Same as "Hold" signal.
Behavior when turned OFF	Operation is the same as for "Hold" signal, but when both signals are used together, the hold status is established when one of the signals is set to OFF.
Operator	***EXPERT*** or above

Ext. Hold Reset

Initial allocation No.	0
Meaning of the signal	This has exactly the same significance and it functions in exactly the same way as "**Hold Reset**" signal (☞ 1-17).
Behavior when turned ON	Same as "**Hold Reset**" signal. When both signals are used together, the hold status is established when both signals are set to ON.
Behavior when turned OFF	Same as "**Hold Reset**" signal.
Operator	***EXPERT*** or above

Mecha Disconnect [M1-M9]

Initial allocation No.	0
Meaning of the signal	This signal temporarily disconnects the mechanism from the control source. The input of the signal is accepted only while the robot is stopped. The signal is not accepted during playback. One signal is provided for each mechanism. (For instance, the M1 signal is provided for mechanism 1.)
Behavior when turned ON	• The specified mechanism is disconnected from the control source. The disconnected mechanism can no longer be operated manually, and operation does not move to the taught steps even during playback. • When steps have been taught with the mechanism disconnected, the current position is recorded without fail regardless of whether the mechanism is manually operated or not. • "**Mech. Disconnection**" signal (☞ 1-45) is set to ON.
Behavior when turned OFF	• The specified mechanism is re-connected to the control source. • "**Mech. Disconnection**" signal is set to OFF
Remarks	A mechanism can be disconnected manually by selecting <Service Utilities> – [1 Teach/Playback Conditions] – [7 Mech. Disconnection]. It is disconnected at the "Enabled" setting and connected at the "Disabled" setting.
Operator	***USER*** or above

CAUTION

If check operation or automatic operation (playback) is performed while this function is used, the robot may interfere with peripheral jigs or other robots.
In particular, if **mechanism isolation** is performed for an external axis such as a slider or positioner, the robot and external axis operations will not synchronize. Pay close attention to ensure that the robot does not interfere with peripheral objects.
Example of interference: In a robot + slider system, while “mechanism disconnection” is being performed for a slider, the slider does not move to the teach position, and the robot operates and interferes with the work piece.

Dryrun Enabled

Initial allocation No.	0
Meaning of the signal	This signal is for setting playback restrictions (dry run) for function commands.
Behavior when turned ON	• Enables the playback restrictions (dry run) for function commands. • "**Dryrun**" signal (☞ 1-45) is set to ON.
Behavior when turned OFF	• Disables the playback restrictions (dry run) for function commands. • "**Dryrun**" signal is set to OFF.
Remarks	• When setting playback restrictions (dry run) for function commands using this signal, it is necessary to set <Service Utilities> – [1 Teach/ Playback Condition] – [8 Playback with func. (Dryrun)] to “Signal”. • The function command to be restricted is set by aligning the cursor with [Object to restrict] on the same menu, and pressing f11 <Dryrun Condition>.
Operator	***EXPERT*** or above

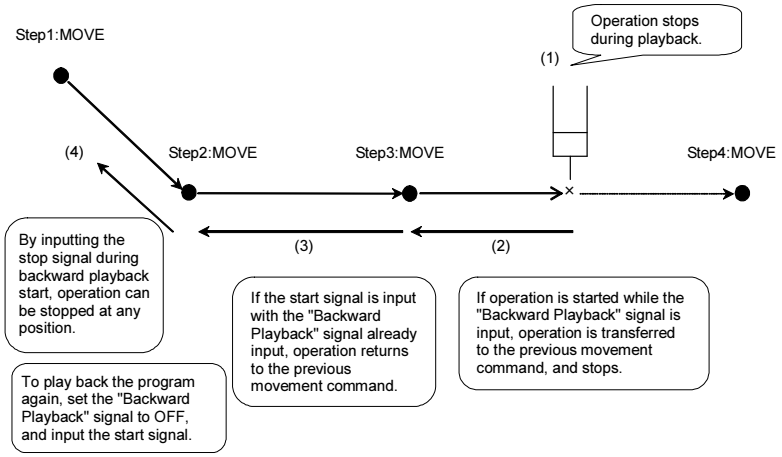
Dryrun Unit / System

Initial allocation No.	0
Meaning of the signal	This signal is for selecting whether to apply the function command playback restrictions (dry run) by unit or whether to apply them to all units.
Behavior when turned ON	Applies the function command playback restrictions (dry run) by unit. The unit to be restricted is selected with "**Dryrun Enabled [U1– U9]**" signal (☞ 1-19).
Behavior when turned OFF	Applies the function command playback restrictions (dry run) to all units.
Remarks	• When setting playback restrictions (dry run) for function commands using this signal, it is necessary to set <Service Utilities> – [1 Teach/ Playback Condition] – [8 Playback with func. (Dryrun)] to “Signal”. • The function command to be restricted is set by aligning the cursor with [Object to restrict] on the same menu, and pressing f11 <Dryrun Condition>.
Operator	***EXPERT*** or above

Dryrun Enabled [U1-U9]

Initial allocation No.	0
Meaning of the signal	This is the signal for determining the unit to be restricted when "**Dryrun Unit/System**" signal (☞ 1-19) is set to ON.
Behavior when turned ON	• Enables the function command playback restrictions (dry run) in regards to the specified unit. • "**Dryrun [U1–U9]**" signal (☞ 1-45) is set to ON.
Behavior when turned OFF	• Disables the function command playback restrictions (dry run) in regards to the specified unit. • "**Dryrun [U1–U9]**" signal is set to OFF.
Remarks	• When setting playback restrictions (dry run) for function commands using this signal, it is necessary to set <Service Utilities> – [1 Teach/ Playback Condition] – [8 Playback with func. (Dryrun)] to “Signal”. • The function command to be restricted is set by aligning the cursor with [Object to restrict] on the same menu, and pressing f11 <Dryrun Condition>.
Operator	***EXPERT*** or above

Backward Playback [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal is for playing back the program in the reverse sequence of steps after playback has stopped.
Behavior when turned ON	If, after the program has stopped during playback, this signal is set to ON and the start signal is input, the program is played backward to one step (taught position) before the current position, where it stops. When this signal remains at ON and the start signal is input again, the program is played backward to another step. 
Behavior when turned OFF	Nothing happens.
Remarks	It is impossible return to the original program from in the first step in the call destination program.
Operator	***EXPERT*** or above

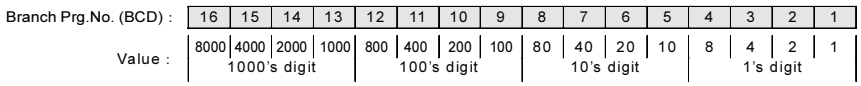
User chk complete 1-8 [M1-M9]

Initial allocation No.	0
Meaning of the signal	• It is used to treat the items which were requested to be checked as having been already checked for the target mechanism. • When the check time arrives for a check item which has been set by the user check function, the robot outputs "**User maintenance"** signal (☞ 1-46) indicating that the check time has now arrived. In such a case, first conduct the check and take an appropriate action for the item concerned, and then input this signal to notify the robot that the check has been completed.
Behavior when turned ON	The check is considered to be completed, and the time set for the next inspection timing.
Behavior when turned OFF	Nothing happens.
Remarks	The user check function can be set by selecting <Service Utilities> – [25 Robot Diagnosis] – [5 User Check].
Operator	***EXPERT*** or above

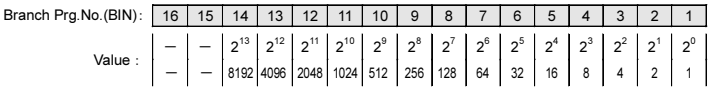
User chk complete 1-8 [W1-W4]

Initial allocation No.	0
Meaning of the signal	• It is used to treat the items which were requested to be checked as having been already checked for the target arc welding power supply. • When the check time arrives for a check item which has been set by the user check function, the robot outputs "**User maintenance"** signal (☞ 1-46) indicating that the check time has now arrived. In such a case, first conduct the check and take an appropriate action for the item concerned, and then input this signal to notify the robot that the check has been completed.
Behavior when turned ON	The check is considered to be completed, and the time set for the next inspection timing.
Behavior when turned OFF	Nothing happens.
Remarks	The user check function can be set by selecting <Service Utilities> – [25 Robot Diagnosis] – [5 User Check].
Operator	***EXPERT*** or above

Jump Prg.No.(BCD) 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	These signals are used to input the numbers of the task programs at the branch destination using the following function commands. • JMPPBCD (FN400: BCD external program select jump) • CALLPBCD (FN402: BCD external program select call)
Behavior when turned ON	Select programs 1 to 9999 using signals for bits 1 to 16 (16 bits). No action is performed by inputting this signal. When the JMPPBCD or CALLPBCD command is executed, operation branches to the program whose number has been input by the signal. 
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

Jump Prg.No.(BIN) 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	These signals are used to input the numbers of the task programs at the branch destination using the following function commands. • JMPPBIN (FN401: BIN external program select jump) • CALLPBIN (FN403: BIN external program select call)
Behavior when turned ON	Select programs 1 to 9999 using signals for bits 1 to 16 (16 bits). No action is performed by inputting this signal. When the JMPPBIN or CALLPBIN command is executed, operation branches to the program whose number has been input by the signal. 
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

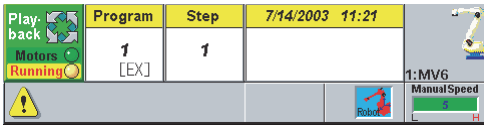
Reset out. signal

Initial allocation No.	0
Meaning of the signal	This signal forcibly sets all the general-purpose output signals except the status signals to OFF.
Behavior when turned ON	The signal sets to OFF the general-purpose output signals excluding the status signals in the range set by <Constant Setting> - [6 Signal] - [1 Signal Condition] - [13 Output signal reset range]. If 0-0 has been set, nothing will happen even when the signals are set to ON. General-purpose output signals can not be set to OFF while the robot is operating. Any attempt to set the signals to OFF will result in the "I3218 Command not possible while running program." information.
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

Reboot system

Initial allocation No.	0
Meaning of the signal	This signal is for reboot this controller.
Behavior when turned ON	Reboot this controller.
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

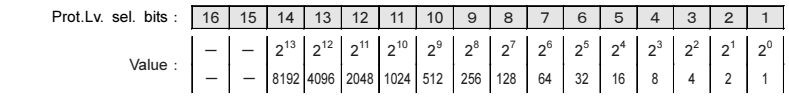
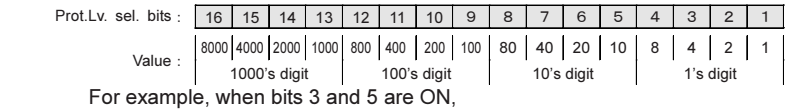
Pause Input 1-4 [U1-U9]

Initial allocation No.	0
Meaning of the signal	·This signal temporarily stops the program being played back with keeping motor power ON (servo ON) while robot is in the zone that is designated by Pose input function (FN252). ·In case of multi-unit, each unit can be temporarily stopped. Up to four signals can be registered for one unit. ·This is normal closed contact. Pause status is established when contact OFF.
Behavior when turned ON	The pause status is released, and operation is resumed straight away.
Behavior when turned OFF	• The program being played back is temporarily stopped. • The servo power is not turned OFF. • Since it is just temporarily stopped, the robot is in the same status as the running status. In other words, the display and running output signals are all the same as in the running status, and they remain unchanged. • During pause status, warning mark is displayed as shown below. 
Operator	***EXPERT*** or above

G-STOP Reset

Initial allocation No.	0
Meaning of the signal	When G-STOP input signal (fixed input : terminal block TBEX1 on the sequence board) is opened while playback, robot stops immediately and servo power is turned OFF. This input signal is one of necessary condition to resume playback. (Playback operation itself can not be resumed by this signal.) As for the detail of G-STOP input signal, please refer to instruction manual "SETUP", "Chapter 3 Connections".
Behavior when turned ON	While this signal is ON, servo power is turned ON and playback operation is resumed after G-STOP input signal is turned ON.
Behavior when turned OFF	Nothing happens. (Servo power is never turned ON even when G-STOP input signal is turned ON.)
Operator	***USER*** or above

Prot.Lv. sel. bits 1-16

Initial allocation No.	0
Meaning of the signal	• This signal is used to change the operator qualifications externally instead of using the teaching pendant. Select ID numbers 1 to 9999 using signals for bits 1 to 16 (16 bits). • Signals expressed by 16 bits can be read in "Binary" or "BCD" format. When Binary is selected  For example, when bits 3 and 5 are ON: $2^2 + 2^4 = 4 + 16$ = ID number 0020 Bits 15 and 16 would exceed 9999, so these bits are not used. When BCD is selected  For example, when bits 3 and 5 are ON, The 1s digit is "4" and the 10s digit is "1", so the ID number is 0014. • No operation is performed when this signal is input. When "**Change prot. Level"** signal (☞ 1-24) is input, this signal is read and the operator qualifications are changed to the corresponding level.
Behavior when turned ON	Select the operator qualifications ID number.
Behavior when turned OFF	Nothing happens.
Remarks	• The format for reading is selected from "Binary" or "BCD" by selecting <Constant Setting> and then pressing [1 Control Constants] – [19 Protecting Level Signal Input] – [Sel. Bit Input]. • A separate ID number can be set for each operator qualifications level within the same menu.
Operator	***EXPERT*** or above

Change prot. level

Initial allocation No.	0
Meaning of the signal	This signal is used to change the operator qualifications.
Behavior when turned ON	When this signal rises, the ID number specified by "**Prot.Lv. sel. Bits"** signal (☞ 1-23) is read and the operator qualifications change to the corresponding level (***USER***, ***EXPERT***, ***SPECIALIT***). The changed operator qualifications are valid only while this signal is ON.
Behavior when turned OFF	The operator qualifications are set to ***BEGINNER***.
Remarks	• This signal cannot be used in playback mode. • This signal cannot be used when using the user management function. • Even after the operator qualifications are changed using this signal, the operator qualifications can be changed using the shortcut code (R314). • Initial passwords for ***EXPERT*** and ***SPECIALIT*** are given openly in manual, so ***BEGINNER*** or ***USER*** can easily switch to ***EXPERT*** or ***SPECIALIT***. They may mistakenly change constants or other settings required for robot operation, so be sure to change these initial passwords. • When the control power supply is turned on, the operator qualifications are set to the level set by <Constant Setting> – [1 Control Constants] – [8 Protect level selection] until this signal is set to ON. (Factory setting is ***USER***.) When using this signal, change [8 Protect level selection] setting to ***BEGINNER***. • For the methods of changing the initial passwords or the protect level selected at startup, see instruction Manual "SETUP".
Operator	***EXPERT*** or above

Next Failure output

Initial allocation No.	0
Meaning of the signal	This signal is used to switch the output of **"Failure code 1-16"**(☞1-43) in the order of the time and date of occurrence when failures occur in succession (two or more failures occurred on "The Failure monitor") and **"Next Failure output request"** output (☞1-50) is ON at the same time. Before use, go to <Constant Setting>-[6 Signals]-[1 Signal Condition]-[26 Update failure code output](☞1-10) and set it to "Disabled". See Fig. 1.2.1 for the use example.
Behavior when turned ON	• When turning ON first, switch the output of **"Failure code 1-16"**(☞1-43) to the failure code which was detected first. • From then onward, switch the output of **"Failure code 1-16"**(☞1-43) where turning ON every time to the failure code detected in the next. • After switched to the failure code which was detected at the last, no change is made even if turning it ON.
Behavior when turned OFF	Nothing special to do.
Remarks	• At the same time as switching the output of **"Failure code 1-16"**(☞1-43)**,** the related output signal is also switched. **Related output signal:** "Fail. classific. 1-8", "Failure selector", "Failure strobe", "Fail. unit num. 1-4", "Fail. mecha num. 1-4", "Fail. axis number 1-4", "Fail. weld number 1-3", "Fail. sensor num. 1-4", "Fail. assist number 1-16" • On completion of switching the output signal (when the switched output signal turns readable), **"Next Failure output[ACK]"** output (☞1-50) turns ON. • If it is not available to switch the output signal (when the output signal is not readable), **"Next Failure output[NAK]"** output (☞1-50) does not turn ON. • After turning ON to the failure which was detected at the last, the following input turns disabled, **"Next Failure output request"** output (☞1-50) turns OFF.
Operator	***EXPERT*** or above

Fig. 1.2.1 shows the signal timing chart for the obtaining process of all the failure codes by using the **"Next Failure output"**(☞1-25).

- This timing chart is the case in which four failures occur in succession.
- In addition, the 3rd failure is the case of the information(has been set not to output the signal by the condition).

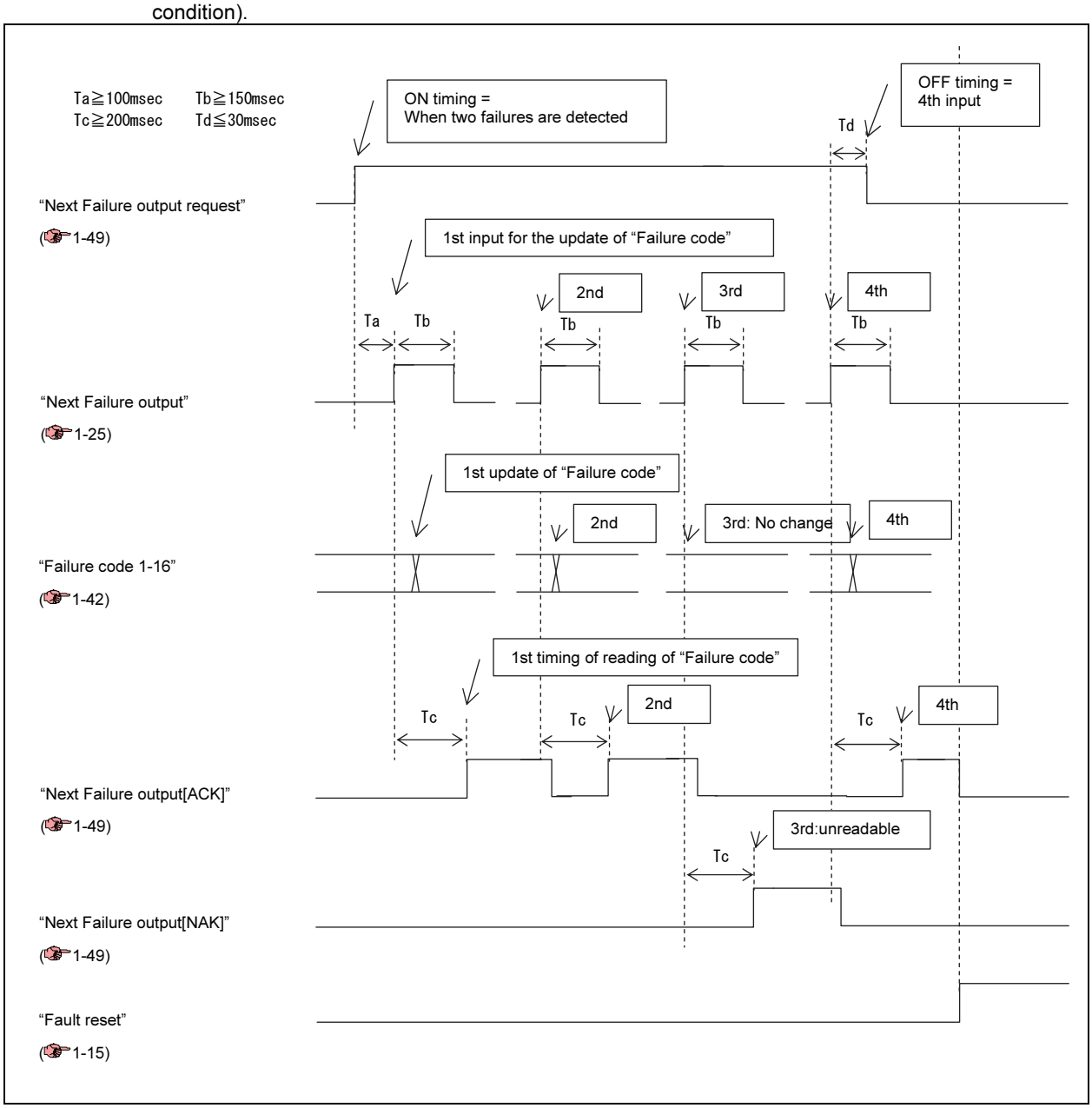


Fig. 1.2.1 Signal timing chart of all failure code reading process

Emergency Hold

Initial allocation No.	0
Meaning of the signal	This signal stops the robot. The program being played back is stopped and moor power is turned OFF. This signal is similar with “Pause” and “Hold” signal to stop the robot, but is same as “Emergency Stop” signal to stop robot with immediate deceleration. This signal is for all units. This signal uses a B contact point. So when signal is turned OFF, robot stops. This signal is available on software version FDV03.28 or later.
Behavior when turned ON	Nothing happens.
Behavior when turned OFF	The program being played back is stopped and moor power is turned OFF.
Remarks	When “0” is allocated, the signal state is not monitored.
Operator	***EXPERT*** or above

Following signals are optionally available for use.
Refer to each corresponding manual for detail.

Input signals	Option manuals to be referred
Conveyor running **Conv. Normal** **Conv. Simulation** **Conv. Test** **Conv. start LS**	Instructions manual “Conveyor Synchronization”
Mech.chng connect [M1-M9] **Mech chng discon. [M1-M9]** **Sub Mechanism No [M1-M9]**	Instructions manual ”Mechanism change function”
Speed O/R input 1-7【1～4】	Instructions manual ”Velocity Override by input signal”
Mech.Servo ON [M1-M9]	Instructions manual ” Mechanism-by-mechanism servo ON/OFF function”
Vision Ext.Trig. **Vision start No. 1～9** **Vision end No. 1～9**	Instructions manual ”Vision system”

1.2.2 Basic output signals

This section explains the basic output signals. (Signals other than those shown below may be displayed on screen, but consider any signals not described here to be unavailable for use or to be optionally available for use.)

POINT

The [U1–U9] or [M1–M9] letter/number combinations at the sides of a signal name respectively indicate the number of the unit or mechanism which is the operation target of the signal concerned. For instance, U1 indicates a signal which works for unit 1 whereas M1 indicates a signal which works for mechanism 1.
With a robot featuring the multi-unit or multi-mechanism specifications, the number of signals displayed is equivalent to that of units or mechanisms which have been defined, so allocate the signals appropriately as befits the application.
With a robot featuring a discrete manipulator, there is no need to heed these numbers.

Under stopping [U1-U9]

Initial allocation No.	0
Meaning of the signal	• This level signal is output at all times except during the robot running and check GO/BACK. • Since check GO/BACK operation in teach mode is treated as start, these signals are output even when check GO/BACK is stopped. • These signals are used to output the stop conditions of each of the units. Use "**Holding**" signal (☞ 1-17) as the signal which indicates the stop status of all the units.
Conditions for turning ON	• In teach mode, check GO/BACK operation have not been performed. • When none of the units is operating in playback mode
Conditions for turning OFF	• When check GO/BACK operation is underway in teach mode • When one of the units is operating in playback mode
Remarks	• Even if the mode is changed, these signals remain unchanged. (They are not set to OFF even if operation is transferred to teach mode when they have been set to ON in playback mode.) • Use "**Stopping (System)**" signal (☞ 1-38) to output the stop status to an external device only in playback mode. "**Stopping (System)**" signal is output only while automatic operation is stopped. (It is not output in teach mode.)
Operator	***USER*** or above

Program ended [U1-U9]

Initial allocation No.	20
Meaning of the signal	This level signal is output at the end of a program during playback. It is provided for each unit.
Conditions for turning ON	The END command is executed and playback of the task program has ended.
Conditions for turning OFF	The timing is met set in the <Constant Setting> - [6 Signals] - [1 Signal Condition] - [4 End signal off timing].
Remarks	If, when the output time has been set with [3 End relay time] and "Enabled" has been set for the power failure detection function, the power of the controller is turned off while this signal is being output, its ON status will continue to be retained when the power is next turned back on.
Operator	***USER*** or above

Emergency stopped

Initial allocation No.	24
Meaning of the signal	This level signal is output while the emergency stop button or external emergency stop button is held down.
Conditions for turning ON	The emergency stop button or external emergency stop button is being pressed.
Conditions for turning OFF	The emergency stop button or external emergency stop button has been released.
Operator	***USER*** or above

In playbk mode

Initial allocation No.	33
Meaning of the signal	This level signal is output while playback mode is selected.
Conditions for turning ON	Playback mode was selected.
Conditions for turning OFF	A mode other than playback mode was selected.
Remarks	This signal is not dependent on the status of TP selector switch on teach pendant.
Operator	***USER*** or above

In teach mode

Initial allocation No.	25
Meaning of the signal	This level signal is output when teach mode has been selected.
Conditions for turning ON	Teach mode was selected.
Conditions for turning OFF	A mode other than teach mode was selected.
Remarks	This signal is not dependent on the status of TP selector switch on teach pendant.
Operator	***USER*** or above

Hi-spd teach mode

Initial allocation No.	0
Meaning of the signal	This is a level signal that is output when high speed teach mode (option) is selected.
Conditions for turning ON	High Speed teach mode (option) is selected.
Conditions for turning OFF	A mode other than high speed teach mode (option) is selected.
Operator	***USER*** or above

Step-set alarm

Initial allocation No.	0
Meaning of the signal	This signal is output when a step which is two or more steps away from the current step has been specified in teach/playback mode. This is a 200 msec pulse signal.
Conditions for turning ON	A step is specified that is 2 or more steps away from the current step in teach/playback mode.
Conditions for turning OFF	200 msec have elapsed.
Operator	***USER*** or above

Interlock alarm [U1-U9]

Initial allocation No.	0
Meaning of the signal	This is a level signal that is output when the interlock wait (waiting for an external signal input) state has exceeded the specified time. It is reset when the interlock wait is reset. This time is specified in <Constant Setting> – [6 Signals] – [1 Signal Condition] – [7 Interlock alarm timer]. In case of multi-unit, the signal for each unit can be output.
Conditions for turning ON	The interlock wait (waiting for an external signal input) state has exceeded the specified time.
Conditions for turning OFF	The interlock waiting status is released due to input of the relevant signal or by a forced release f key operation.
Operator	***User*** or above

Waiting unit num. 1-4

Initial allocation No.	0
Meaning of the signal	This signal is for outputting the number of the unit currently waiting for a signal input.
Conditions for turning ON	There is a unit waiting for a signal input.
Conditions for turning OFF	The signal input wait has been cleared.
Operator	***USER*** or above

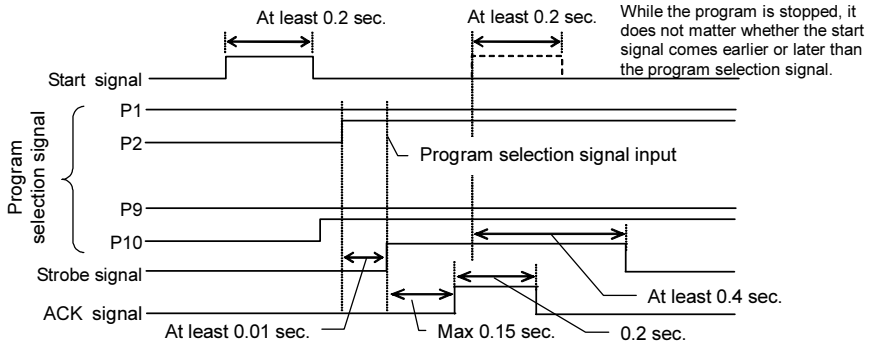
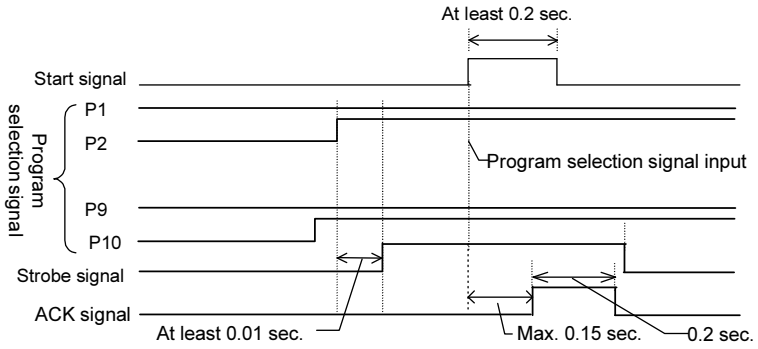
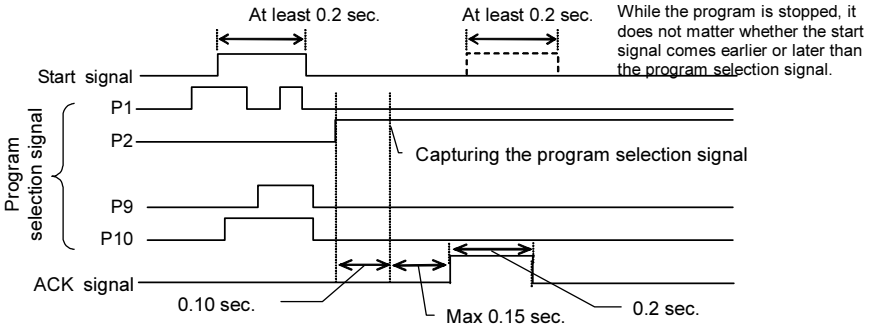
Wait I signal num. 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal is for outputting the signal number waiting for input. In case of multi-unit, the signal for each unit can be output.
Conditions for turning ON	Input wait is underway.
Conditions for turning OFF	Input wait has been cleared.
Operator	***USER*** or above

Over run

Initial allocation No.	0
Meaning of the signal	This signal is output when an overrun has occurred.
Conditions for turning ON	When an overrun is occurring
Conditions for turning OFF	When the overrun has been released
Operator	***USER*** or above

Program selected [U1-U9]

Initial allocation No.	0
Meaning of the signal	This is a signal that is output immediately after a program has been started, when started externally, and is used to verify that the read of the program number was completed. This is a 200 msec pulse signal.
Conditions for turning ON	(1) When using "**Program strobe**" signal (☞ 1-14): As shown in the figure below, a pulse will be output within 0.15 seconds after the program number is read by the strobe signal. When the start signal input comes before the strobe signal  When the start signal input comes after the strobe signal  (2) When "**Program strobe**" signal is not used: As shown in the figure below, a pulse will be output within 0.15 seconds after the program selection signal is automatically read.  Whether or not the strobe signal is used, set it so that if the "Program selected" signal (program acknowledge output signal) is output, "**Program sel. bits**" signal (☞ 1-13) and "**Program strobe**" signal (☞ 1-14) are set to OFF.
Conditions for turning OFF	200 msec have elapsed.

Remarks	• The output time of 200 msec is the initial setting. This can be changed in <Constant Setting> – [6 Signals] – [1 Signal Condition] – [6 Program acknowledge time]. Operator certification of ***EXPERT*** or above is necessary. • If, when the power failure detection function has been set to "Enabled," the power of the controller is turned off while this signal is being output, its ON status will continue to be retained when the power is next turned back on.
Operator	***USER*** or above

Ext. reset ackno. [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal is output when "**External reset**" signal (☞ 1-14) is received while the robot is stopped and the run mode is 1 cycle or continuous. The signal is a 200 msec pulse. In case of multi-unit, the signal for each unit can be output.
Conditions for turning ON	"**External reset**" signal was received.
Conditions for turning OFF	200 msec have elapsed.
Operator	***USER*** or above

Robot moving [U1-U9]

Initial allocation No.	0
Meaning of the signal	This level signal is output while the robot is operating.
Conditions for turning ON	In manual operation, or check GO/BACK operation, or playback operation.
Conditions for turning OFF	Not in manual operation, nor check GO/BACK operation, nor playback operation.
Operator	***USER*** or above

Robot running [U1-U9]

Initial allocation No.	26
Meaning of the signal	This signal is output during the robot running or check GO/BACK operation. It is a level signal which coincides with the lighting of the start lamp.
Conditions for turning ON	The relevant unit is running.
Conditions for turning OFF	The relevant unit is not running.
Operator	***USER*** or above

Ext. prg.sel. enabled [U1-U9]

Initial allocation No.	27
Meaning of the signal	This is a level signal that is output when “external program selection” is selected.
Conditions for turning ON	“External” is selected with <Service Utilities> – [1 Teach/ Playback Condition] – [3 Playback mode prog. sel.].
Conditions for turning OFF	“Internal” is selected with <Service Utilities> – [1 Teach/Playback Condition] – [3 Playback mode prog. sel.].
Operator	***USER*** or above

Ext.start enabled

Initial allocation No.	28
Meaning of the signal	This is a level signal that is output when “External Start” is selected.
Conditions for turning ON	“External” is selected with <Service Utilities> – [1 Teach/ Playback Condition] – [2 MotorsON.START sel. source].
Conditions for turning OFF	“Controller” is selected with <Service Utilities> – [1 Teach/ Playback Condition] – [2 MotorsON.START sel. source]. Or, a number other than “0” is set in <Constant Setting> – [5 Operation Constant] – [6 Number of station] and station start is selected.
Operator	***USER*** or above

Speed reduced [U1-U9]

Initial allocation No.	0
Meaning of the signal	This level signal is output while the robot is running at safety speed. Safe speed means a speed of 250 mm/sec or less. In case of multi-unit, the signal for each unit can be output.
Conditions for turning ON	Program is played back in a state of “Reduce speed” input signal ON.
Conditions for turning OFF	“Reduce speed” input signal has been cleared.
Operator	***USER*** or above

Motors energized

Initial allocation No.	29
Meaning of the signal	This level signal is output while the servo power (motor power) is ON.
Conditions for turning ON	Servo power (motor power) is ON.
Conditions for turning OFF	Servo power (motor power) is OFF.
Operator	***USER*** or above

Unit ready [U1-U9]

Initial allocation No.	0
Meaning of the signal	This level signal is output in a status in which the auto operation (starting in playback mode) is acknowledged. Starting cannot be initiated if the conditions have not been satisfied. A combination of several conditions can be set.
Conditions for turning ON	All of the conditions set by <Constant Setting> – [6 Signals] – [4 Unit Ready Signal] have been satisfied.
Conditions for turning OFF	One or more of the conditions set by <Constant Setting> – [6 Signals] – [4 Unit Ready Signal] has not been satisfied.
Remarks	It cannot be started every time the Unit Ready Signal is turned ON. Unit Ready Signal is the one which means that the minimum necessary check for start is passed.
Operator	***USER*** or above

State output 1-16

Initial allocation No.	State output No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Initial allocation No. 30 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Meaning of the signal	It is possible to create output signals for combinations of several states, such as the run mode and program selection state. Up to 16 types of combination states can be defined, and, of those, the first signal is allocated when the robot is shipped.
Conditions for turning ON	All of the conditions set by <Constant Setting> – [6 Signals] – [5 State output customization] have been satisfied.
Conditions for turning OFF	One or more of the conditions set by <Constant Setting> – [6 Signals] – [5 State output customization] has not been satisfied.
Remarks	The state outputs 1 to 16 correspond to the signals 1 to 16 created in [5 State output customization].
Operator	***USER*** or above

Home position 1-32 [U1-U9]

Initial allocation No.	Status output No 1 2 ··· 32 Initial allocation No. 31 All "0"
Meaning of the signal	This level signal is output when the robot is in home position. Up to 32 positions / unit can be defined in <Constant Setting> – [9 Territory Definition] – [1 Home position].
Conditions for turning ON	The robot is in home position.
Conditions for turning OFF	The robot is not in home position.
Operator	***USER*** or above

Territory position 1-16

Initial allocation No.	0	
Meaning of the signal	This is a level signal that indicates the robot is working within the interference territory.	
Conditions for turning ON	Within the interference territory.	It is recommended to change the logic of these signals, by referring to instruction manual "SETUP" chapter 7.
Conditions for turning OFF	Outside of the interference territory.	
Operator	***USER*** or above	

Prog.echoback bits 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal outputs the number of the program reserved with "FIFO" function (program reservation function in external start).
Conditions for turning ON	When a program reservation is executed, the corresponding bit is set to ON.
Conditions for turning OFF	This signal will not be turned OFF automatically. This signal will change only when a program reservation is executed.
Operator	***USER*** or above

Start Program No. 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	The first task program number executed after start-up is output. The output form of number can be selected to either “Binary” of “BCD” on the screen in ＜Constant setting＞-“6. Signals” – “1.Signal condition” – “2.Output method of program and step number”. The default is set to “Binary”. This signal doesn’t change even if the execution program No. is changed by Program call / jump function.
Conditions for turning ON	It turns ON in any of the following cases. a) When starting the automatic operation b) During a temporary stop of the automatic operation c) When proceeding to Teach mode with “Restart method in Play Mode” set to ”Specified restoration” after making a temporary stop during automatic operation d) When returning to Play back mode with “Restart method in Play Mode” set to “Specified restoration” during a temporary stop of the automatic operation
Conditions for turning OFF	It turns OFF in any of the following cases. a) When finishing the work b) When proceeding to teach mode with “Restart method in Play Mode” set to “Clear Step” after making a temporary stop during automatic operation. c) When canceling the temporary stop status of automatic operation.
Remarks	It turns ON as long as set to “Specified restoration” in returning to playback mode even if previously set to “Clear Step” when having proceeded to teach mode and then turned OFF.
Operator	***USER*** or above

Controller ready

Initial allocation No.	0
Meaning of the signal	This level signal is output after the power has been turned on when the operating system (Windows) and the robot software have started up in sequence and normal control is exercised. It is only when this signal has been output that the status in which I/O (Input/Output) control is enabled is established.
Conditions for turning ON	The OS and system software has been started up and normal control is possible.
Conditions for turning OFF	Power to the controller is shut off; or the period of time until the OS and system software start running.
Operator	***USER*** or above

Excuting prog. (Sys)

Initial allocation No.	0
Meaning of the signal	This is one of the level signals output in executing the task program of any units for automatic operation. It is output as long as the task program is being executed in any units.
Conditions for turning ON	When any of “Executing program [U1-U9]” is turned ON.
Conditions for turning OFF	When all of “Executing programs [U1-U9]” are turned OFF.
Operator	***USER*** or above

Executing program [U1-U9]

Initial allocation No.	0
Meaning of the signal	This is the level signal output in executing the task program of a specified unit for automatic operation.
Conditions for turning ON	It turns ON in any of the following cases. a) During the automatic operation b) During a temporary stop of the automatic operation c) When proceeding to Teach mode with “Restart method in Play Mode” set to ”Specified restoration” after making a temporary stop during automatic operation d) When returning to Play back mode with “Restart method in Play Mode” set to “Specified restoration” during a temporary stop of the automatic operation
Conditions for turning OFF	It turns OFF in any of the following cases. a) When finishing the work b) When proceeding to teach mode with “Restart method in Play Mode” set to “Clear Step” after making a temporary stop during automatic operation. c) When canceling the temporary stop status of automatic operation.
Remarks	It turns ON as long as set to “Specified restoration” in returning to playback mode even if previously set to “Clear Step” when having proceeded to teach mode and then turned OFF.
Operator	***USER*** or above

Running in AUTO [U1-U9]

Initial allocation No.	0
Meaning of the signal	This level signal is output while the robot is operating automatically in playback mode. It is not output in the check GO/BACK status or when operation is stopped even if playback mode is established. In case of multi-unit, the signal for each unit can be output.
Conditions for turning ON	During automatic operation in playback mode
Conditions for turning OFF	When automatic operation has been stopped in playback mode
Operator	***USER*** or above

Holding

Initial allocation No.	0
Meaning of the signal	• This level signal is output at all times except during the robot running and check GO/BACK. • Since the check GO/BACK operation in teach mode is treated as start, this signal is output even when check GO/BACK is stopped. • This signal is used to output the stop conditions of the entire robot. Use the stopped "**Under stopping [U1–U9]**" signal (☞ 1-29) as the signals which indicate the stop status of each unit.
Conditions for turning ON	• In teach mode, check GO/BACK have not been performed. • In playback mode, a program is not running.
Conditions for turning OFF	• In teach mode, check GO/BACK are being performed. • In playback mode, a program is running.
Remarks	• Even if the mode is changed, this signal remains unchanged. (When this signal was ON in playback mode and mode is changed to teach, this signal is still ON.) • Use "**Stopping (System)**" signal (☞ 1-38) to output the stop status to an external device only in playback mode. "**Stopping (System)**" signal is output only while automatic operation is stopped. (It is not output in teach mode.)
Operator	***USER*** or above

Stopping (System)

Initial allocation No.	0
Meaning of the signal	This level signal is output when the automatic operation of any of the units has been stopped in playback mode. This signal will be output while any of the units is temporarily stopped even if other units are operating. They are not output while the END command is executed.
Conditions for turning ON	When the automatic operation of any of the units was stopped in mid-step.
Conditions for turning OFF	• When the automatic operation of all the stopped units was started up again (when none of the units are stopped). • When mode is switched to teach while operation is stopped in playback mode.
Remarks	
Operator	***USER*** or above

Stopping [U1-U9]

Initial allocation No.	0
Meaning of the signal	These level signals are output when the automatic operation of the relevant units has been stopped in mid-step. They are not output while the END command is executed.
Conditions for turning ON	• When the automatic operation of the relevant unit was stopped in mid-step. If, for instance, unit 1 has been stopped while unit 1 and unit 2 were in the automatic operation mode concurrently, "Stopping U1" signal is set to ON while "Stopping U2" signal remains OFF. • When switching from Teach mode to Playback mode with “Keep of temporary stop signal” set to “Yes” after having set to Teach mode during temporary stop of the automatic operation.
Conditions for turning OFF	• When the automatic operation of the relevant unit was restarted. • When teach mode was selected while automatic operation was temporarily stopped. • When canceling the temporary stop status of automatic operation.
Remarks	The temporary stop status of automatic operation is to be cancelled in any of the following cases. • When executing the short-cut RO under the condition that the unit at halt has been the current unit. • When one or more of "**External reset [U1–U9]**" signal (☞ 1-14) corresponding to the stopped unit or units have been input. • When selecting the task program again in the unit at halt. • When modifying the task program at halt by copying the program • When changing the task program No. of the program at halt by renaming the program No. • When modifying the task program at halt by renaming the program No. • When removing the task program at halt by the operation of removing the program. • When modifying the task program at halt by the task program conventional tool. • When returning to Playback mode with “Restart method in Play Mode” set to “Clear Step” • When writing on the multi-station start allocation screen. • When changing the number of stations. • When the F key for temporary stop cancellation was pressed in the multi-station start method
Operator	***USER*** or above

Machine disabled

Initial allocation No.	0
Meaning of the signal	A level signal that is output when machine lock is enabled.
Conditions for turning ON	<Service Utilities> – [1 Teach/Playback Condition] – [6 Machine lock] is set to “Enabled”.
Conditions for turning OFF	<Service Utilities> – [1 Teach/Playback Condition] – [6 Machine lock] is set to “Disabled”.
Operator	***USER*** or above

Continuous cycles

Initial allocation No.	0
Meaning of the signal	A level signal that is output when playback mode is “Continue”.
Conditions for turning ON	<Service Utilities> – [1 Teach/Playback Condition] – [1 Playback mode] is set to “Continue”.
Conditions for turning OFF	<Service Utilities> – [1 Teach/Playback Condition] – [1 Playback mode] is not set to “Continue”.
Operator	***USER*** or above

Single cycle

Initial allocation No.	0
Meaning of the signal	A level signal that is output when playback mode is “1 cycle”.
Conditions for turning ON	<Service Utilities> – [1 Teach/Playback Condition] – [1 Playback mode] is set to “1 cycle”.
Conditions for turning OFF	<Service Utilities> – [1 Teach/Playback Condition] – [1 Playback mode] is not set to “1 cycle”.
Operator	***USER*** or above

Single step

Initial allocation No.	0
Meaning of the signal	A level signal that is output when playback mode is “1 step”.
Conditions for turning ON	<Service Utilities> – [1 Teach/Playback Conditions] – [1 Playback mode] is set to “1 step”.
Conditions for turning OFF	<Service Utilities> – [1 Teach/Playback Conditions] – [1 Playback mode] is not set to “1 step”.
Operator	***USER*** or above

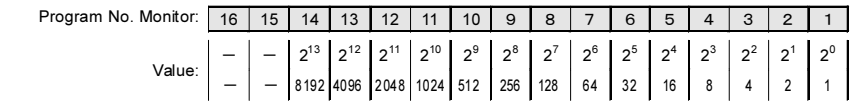
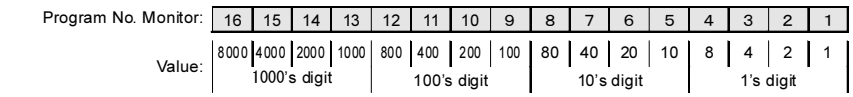
Check go

Initial allocation No.	0
Meaning of the signal	This level signal is output while check GO is being processed in teach mode.
Conditions for turning ON	Executing Check Go in teach mode.
Conditions for turning OFF	Not executing Check Go in teach mode.
Operator	***USER*** or above

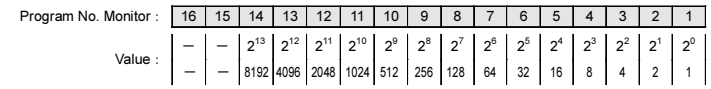
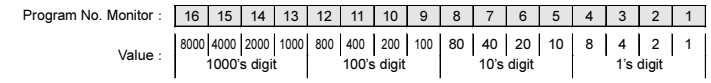
Check backward

Initial allocation No.	0
Meaning of the signal	This level signal is output while check BACK is being processed in teach mode.
Conditions for turning ON	Executing Check Back in teach mode.
Conditions for turning OFF	Not executing Check Back in teach mode.
Operator	***USER*** or above

Prog. No. monitor 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	These signals output the currently selected program No. It is possible to select whether the output format of the number should be “Binary” or “BCD” with, <Constant Setting> – [6 Signals] – [1 Signal Condition] – [2 Output method of program and step number]. The initial setting is “Binary”. When Binary is selected  When BCD is selected 
Conditions for turning ON	The bits corresponding to the selected program number are set to ON.
Operator	***USER*** or above

Step No. monitor 1-16 [U1-U9]

Initial allocation No.	0
Meaning of the signal	These signals output the currently selected step No. It is possible to select whether the output format of the number should be “Binary” or “BCD” with, <Constant Setting> – [6 Signals] – [1 Signal Condition] – [2 Output method of program and step number]. The initial setting is “Binary”. When Binary is selected  When BCD is selected 
Conditions for turning ON	The bits corresponding to the selected program number are set to ON.
Operator	***USER*** or above

Battery warning [M1-M9]

Initial allocation No.	0
Meaning of the signal	This is a level signal that is output when the voltage of the encoder battery drops.
Conditions for turning ON	The voltage of the encoder battery has dropped.
Conditions for turning OFF	The encoder battery is normal.
Operator	***USER*** or above

Failure

Initial allocation No.	0
Meaning of the signal	This level signal is output with the occurrence of an error or alarm or information.
Conditions for turning ON	Either an error, alarm or information has occurred.
Conditions for turning OFF	The error, alarm or information has been cleared.
Operator	***USER*** or above

Error port

Initial allocation No.	21
Meaning of the signal	This level signal is output when an error (serious failure) has occurred.
Conditions for turning ON	An error has occurred.
Conditions for turning OFF	The error has been cleared.
Operator	***USER*** or above

Alarm port

Initial allocation No.	23
Meaning of the signal	This level signal is output when an alarm (warning level failure) has occurred.
Conditions for turning ON	An alarm has occurred.
Conditions for turning OFF	The alarm has been cleared.
Operator	***USER*** or above

Information port

Initial allocation No.	32
Meaning of the signal	This level signal is output when an information has occurred.
Conditions for turning ON	An information has occurred.
Conditions for turning OFF	The information has been cleared.
Operator	***USER*** or above

Fail. classific. 1-8

Initial allocation No.	0
Meaning of the signal	The causes of the detected fault are classified into several categories, and these signals output the corresponding classification code that applies. Classifications are listed below, and the 2 digit (01 to 99) sort code is output in 8-bit BCD format. The output format of the signal is as follows. Bit : 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 Value : 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 10's digit / 1's digit
Conditions for turning ON	The bit corresponding to the failure that occurred is set to ON.
Conditions for turning OFF	When the failure is cleared, it is set to OFF.
Operator	***USER*** or above

Code	Category	Main fault
01	Emergency stop fault	Emergency stop triggered by input from overrun, shock sensor, etc...
02	Control sequence fault	Fault detected by monitoring or control systems such as magnet switches and circuit protects, etc.
03	CPU board failure	Watchdog timer detection or other CPU board-related fault occurrence
04	Servo fault	Fault detected by servo driver
05	Amplifier unit fault	Fault detected by amplifier
06	Encode fault	Encoder-related fault
07	Teach pendant fault	Fault detected by teach pendant
08	PLC fault	Fault detected by PLC
09	User fault	Fault detected by the operator
10	Operation fault	Fault caused by error in operation made by operator
11	Spot welding fault	Fault inherent to spot welding application (other than those included in above)
12	Arc welding trouble	Fault inherent to arc welding application (other than those included in above)
13	Sensor malfunction	Fault inherent to sensor application (other than those included in above)
14	Fieldbus fault	Fault inherent to Fieldbus function (other than those included in above)
15	Shift fault	Fault inherent to shift function (other than those included in above)
16	Calibration fault	Fault inherent to automatic calibration function (other than those included in above)
17	Sealing fault	Fault inherent to sealing application (other than those included in above)
17	Vision system fault	Fault inherent to vision sensing application (other than those included in above)
19	FLEX hand fault	Fault inherent to FLEX hand function (other than those included in above)
20	Preventive maintenance	Messages of preventive maintenance (other than those included in above)
21	Requiring inspection	Messages of requiring inspection (other than those included in above)

Failure code 1-16

Initial allocation No.	0
Meaning of the signal	These signals output the code number of the detected failure. The output format of the failure code is determined by <Constant Setting> – [6 Signals] – [1 Signal Condition] – [1 Failure code output]. One of the following 5 options can be selected. The initial setting is “None”.

Setting choice	Description
o None	Only output the importance classification of “Error/Alarm/Information”, and do not output such things as the error number, the number of the unit that failed, or the number of the axis that failed to an external device.
o 2 divition	Convert the error number to binary, and separate the data into the lower 8 bits and upper 8 bits to output it.
o Continuance	Convert the error number into binary and separate it into 16-bit data to output it.
o BCD	Convert the error number to BCD, and output it as 4 bits x 4 rows = 16 bit data.
o Serial	Output the error number as ASCII code from RS232C.

The 16 “error output bits” are used as follows depending on the output format

Program No. Monitor:	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
2 divition	(Not used)								These 8 bits are output at staggered times.							
Continuance	Binary 16 bits															
BCD	Binary for the 1000's digit				Binary for the 100's digit				Binary for the 10's digit				Binary for the 1's digit			

Conditions for turning ON	A failure has occurred.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Failure selector

Initial allocation No.	0
Meaning of the signal	This signal is output simultaneously with the low-order bit, when Failure code output is set to “2 Divition”.
Conditions for turning ON	The low-order bit is output, when the Failure code output is set to “2 Divition”.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Failure strobe

Initial allocation No.	0
Meaning of the signal	This signal is output simultaneously with the output of the high-order and low-order bits, when Failure code output is set to “2 Divition”.
Conditions for turning ON	The low-order and high-order bits are output, when Failure code output is set to “2 Divition”.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Fail. unit num. 1-4

Initial allocation No.	0
Meaning of the signal	The number of the mechanism in which a failure was detected is output with 4 bits. The output format is shown right.

Bit :	4	3	2	1
Value :	8	4	2	1

Conditions for turning ON	The bits corresponding to the unit in which the failure occurred are set to ON.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Fail. mecha num. 1-4

Initial allocation No.	0
Meaning of the signal	The number of the mechanism in which a failure was detected is output with 4 bits. The output format is shown right. Bit : 4 3 2 1 Value : 8 4 2 1
Conditions for turning ON	The bits corresponding to the mechanism in which the failure occurred are set to ON.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Fail. axis number 1-4

Initial allocation No.	0
Meaning of the signal	The number of the mechanism in which a failure was detected is output with 4 bits. This is not output when a failure unrelated to the mechanism occurs. The output format is shown right. Bit : 4 3 2 1 Value : 8 4 2 1
Conditions for turning ON	The bits corresponding to the mechanism in which the failure occurred are set to ON.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Fail. weld number 1-3

Initial allocation No.	0
Meaning of the signal	The number of the welder in which a failure was detected is output with 3 bits. This is not output when a failure unrelated to the welder occurs. The output format is shown right. Bit : 3 2 1 Value : 4 2 1
Conditions for turning ON	The bits corresponding to the welder in which the failure occurred are set to ON.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Fail. sensor num. 1-4

Initial allocation No.	0
Meaning of the signal	The number of the sensor in which a failure was detected is output with 4 bits. This is not output when a failure unrelated to the sensor occurs. The output format is shown right. Bit : 4 3 2 1 Value : 8 4 2 1
Conditions for turning ON	The bits corresponding to the sensor in which the failure occurred are set to ON.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Fail. assist number 1-16

Initial allocation No.	0
Meaning of the signal	Auxiliary code number of occurring failure, with 16 bits. Not output when there is no auxiliary code.
Conditions for turning ON	The bits corresponding to the sensor in which the failure occurred are set to ON.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Failure reset port

Initial allocation No.	0
Meaning of the signal	This is output when the occurring failure requires a failure reset operation.
Conditions for turning ON	A failure requiring a failure reset operation has occurred.
Conditions for turning OFF	The failure has been cleared.
Operator	***USER*** or above

Mech. Disconnection [M1-M9]

Initial allocation No.	0
Meaning of the signal	This level signal is output during mechanism disconnected.
Conditions for turning ON	When mechanism has been disconnected by manual operation or by "**Mechanism Disconnect**" signal (☞ 1-18).
Conditions for turning OFF	When mechanism has been connected by manual operation or by "**Mechanism Disconnect**" signal (☞ 1-18).
Operator	***USER*** or above

Dryrun

Initial allocation No.	0
Meaning of the signal	This is output when playback restrictions (dry run) have been set for a function command.
Conditions for turning ON	Playback restrictions (dry run) have been set for an function command.
Conditions for turning OFF	The playback restrictions (dry run) for an application have been canceled.
Operator	***USER*** or above

Dryrun [U1-U9]

Initial allocation No.	0
Meaning of the signal	This is output when the function command playback restrictions (dry run) have been set to “Individual Unit” and that unit is set to dry run.
Conditions for turning ON	Dry run is set for the relevant unit with “Individual Unit”.
Conditions for turning OFF	Dry run is canceled for the relevant unit with “Individual Unit”.
Operator	***USER*** or above

User maintenance 1-8 [M1-M9]

Initial allocation No.	0
Meaning of the signal	This is one of the level signals output when the check item set in the user check function reaches the inspection timing for the target mechanism to be checked.
Conditions for turning ON	When the check item reaches the inspection timing.
Conditions for turning OFF	• When inputting "**user check complete**" signal (☞ 1-20) • When executing the check complete operation.
Remarks	The user check function can be set by selecting <Service Utilities> – [25 Robot Diagnosis] – [5 User Check].
Operator	***EXPERT*** or above

User maintenance 1-8 [W1-W4]

Initial allocation No.	0
Meaning of the signal	This is one of the level signals output when the check item set in the user check function reaches the inspection timing for the target arc welding power supply to be checked.
Conditions for turning ON	When the check item reaches the inspection timing.
Conditions for turning OFF	• When inputting "**user check complete**" signal (☞ 1-20) • When executing the check complete operation.
Remarks	The user check function can be set by selecting <Service Utilities> – [25 Robot Diagnosis] – [5 User Check].
Operator	***EXPERT*** or above

Shock sensor act.

Initial allocation No.	0
Meaning of the signal	This level signal is output when the shock sensor installed inside the torch has been activated.
Conditions for turning ON	When the shock sensor installed inside the torch has been activated
Conditions for turning OFF	When the shock sensor installed inside the torch has been released
Operator	***USER*** or above

Fieldbus act. 1～4

Initial allocation No.	0
Meaning of the signal	This signal is output when the field bus is connected normally.
Conditions for turning ON	The field bus is connected correctly.
Conditions for turning OFF	Field bus error or field bus is not connected.
Operator	***USER*** or above

TP EnableKey ON

Initial allocation No.	0
Meaning of the signal	This signal is output when the enable key of teach pendant is pressed.
Conditions for turning ON	The enable key of teach pendant is pressed.
Conditions for turning OFF	The enable key of teach pendant is not pressed.
Operator	***USER*** or above

PLC logical IN/OUT

Initial allocation No.	0
Meaning of the signal	This signal is output to inform the PLC logical relay No. condition.
Conditions for turning ON	PLC logical I/O relay No. is defined “1-2048”.
Conditions for turning OFF	PLC logical I/O relay No. is defined “0-2047”.
Operator	***EXPERT*** or above

Start enable area [U1～U9]

Initial allocation No.	0
Meaning of the signal	This level signal is output when the mechanism in the unit is in the start enable area. The start enable area can be registered with <Constant Setting> - [9 Territory Definition] - [3 Possible Field to start].
Conditions for turning ON	All the mechanism in the unit is in the start enable area. The control unit is turned ON when all the mechanism in the system is in the start enable area.
Conditions for turning OFF	Any mechanism in the unit is out of the start enable area.
Operator	***USER*** or above

Log backup

Initial allocation No.	0
Meaning of the signal	This level signal is output during the auto-backup of the debugging data.
Conditions for turning ON	The debugging data auto-backup started.
Conditions for turning OFF	The debugging data auto-backup is completed.
Operator	***EXPERT*** or above

Fan stop

Initial allocation No.	0
Meaning of the signal	This signal output when the cooling fan is stopped.
Conditions for turning ON	When the cooling fan is stopping.
Conditions for turning OFF	When the cooling fan is activating.
Operator	***USER*** or above

Auto backup Fail

Initial allocation No.	0
Meaning of the signal	This signal is output when the auto-backup is failed.
Conditions for turning ON	When the auto-backup is failed. This signal is outputs until the auto-backup is succeed.
Conditions for turning OFF	When the auto-backup is succeed.
Operator	***USER*** or above

Pause enabled 1-4 [U1～U9]

Initial allocation No.	0
Meaning of the signal	This signal described the status of pause input command (FN252). This signal can be used in playback mode. Each unit can be set 4 signals.
Conditions for turning ON	When the pause input command (FN252) is enabled.
Conditions for turning OFF	When the pause input command (FN252) is disabled.
Operator	***EXPERT*** or above

Proc. out pause I 1-4 [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal is OFF when the ROBOT status is waiting by the pause input function. Then the Robot starts running, the signal become ON. In case of multi-unit, the signal for each unit can be output.
Conditions for turning ON	When robot resumes running after pause status by the pause input function.
Conditions for turning OFF	When robot is in pause status by the pause input function.
Operator	***EXPERT*** or above

CPU thermo warning

Initial allocation No.	0
Meaning of the signal	This signal is output when controller detects the CPU over heat.
Conditions for turning ON	When the controller detects the CPU over heat
Conditions for turning OFF	When the CPU temperature is in the allowable one.
Operator	***USER*** or above

G-STOP

Initial allocation No.	0
Meaning of the signal	When G-STOP input signal (fixed input : terminal block TBEX1 on the sequence board) is opened while playback, robot stops immediately and servo power is turned OFF. This output signal is echo-back output of G-STOP input signal.
Conditions for turning ON	This output signal is echo-back output of G-STOP input signal.
Conditions for turning OFF	
Operator	***USER*** or above

In G-STOP

Initial allocation No.	0
Meaning of the signal	When G-STOP input signal (fixed input : terminal block TBEX1 on the sequence board) is opened while playback, robot stops immediately and servo power is turned OFF. This output signal is to inform whether robot is in pause status by G-STOP or not.
Conditions for turning ON	When robot is in pause status by G-STOP on emergency stop is input.
Conditions for turning OFF	When robot resumes running after pause status by G-STOP.
Operator	***USER*** or above

Axis status 1-12 [1-4]

Initial allocation No.	0
Meaning of the signal	Output the current or speed of the axis at 12 bit data which is set by axis status output setting.
Conditions for turning ON	The data output when the axis status output is set.
Operator	***USER*** or above

Shift [U1-U9]

Initial allocation No.	0
Meaning of the signal	This signal output the status of shift function to the external PLC.
Conditions for turning ON	The shift function is executing.
Conditions for turning OFF	The shift function is not executing.
Remarks	The shift instruction that becomes an object is as follows. FN47 PALLET2 "Palletize start" FN48 PALLET2_END "Palletize end" FN52 SHIFTR "Shift" FN53 LOCCVT "Coord. Trans(shift value)" FN54 LOCCVT1 "Coord. Trans(posi value)" FN58 SHIFTA " YZ shift" FN275 LOCCVT3 "Base angle shift"
Operator	***USER*** or above

Next Failure output request

Initial allocation No.	0
Meaning of the signal	This is a level signal to be output when failures occur in succession (two or more failures occurred on "The Failure monitor"). This informs whether the input of **"Next Failure output"** signal (☞1-25) is valid or not.
Conditions for turning ON	When failures occur in succession.
Conditions for turning OFF	• When **"Next Failure output"**(☞1-25) is inputted for the failure last detected. • When the failure is released.
Remarks	After this signal was turned to OFF by input to the **"Next Failure output"**(☞1-25) for the failure last detected, if another failure occurs, it will turn to ON again. (In this case, the rising change may not be output.)
Operator	***EXPERT*** or above

Next Failure output[ACK]

Initial allocation No.	0
Meaning of the signal	This is a level signal to be output on completion of switching the output of **"Failure code 1-16"**(☞1-43) after inputting **"Next Failure output"** signal (☞1-25). This informs the readability of **"Failure code 1-16"**.
Conditions for turning ON	On completion of switching the output of **"Failure code 1-16"**(☞1-43) (when the switched output signal turns readable) after inputting **"Next Failure output"** signal (☞1-25).
Conditions for turning OFF	• Soon after inputting **"Next Failure output"** signal (☞1-25). • When the failure is released.
Operator	***EXPERT*** or above

Next Failure output[NAK]

Initial allocation No.	0
Meaning of the signal	This is a level signal to be output when switching the output of "Failure code 1-16"(☞1-43) is failed due to the reasons given below after inputting "**Next Failure output**" signal (☞1-25). This informs the read impossibility of **"Failure code 1-16"**(☞1-43). • The failure targeted for switching has been set not to output the signal by the condition settings in <Constant Setting>-[6 Signals]-[1 Signal Condition]-[14 Error Signal](☞14 Error Signal).
Conditions for turning ON	When the output switching fails due to the above reason after inputting **"Next Failure output"** signal (☞1-25).
Conditions for turning OFF	• Soon after inputting **"Next Failure output"** signal (☞1-25). • When the failure is released.
Operator	***EXPERT*** or above

Following signals are optionally available for use.
Refer to each corresponding manual for detail.

Output signals	Option manuals to be referred
On searching [U1-U9] **Write search org.**	Instructions manual “Shifty function by external input”
Conv. count reset **Conv. Normal** **Conv. Simulation** **Conv. test**	Instructions manual “Conveyor Synchronization”
Sub Mechanism No. [M1-M9] **Encoder Power OFF [M1-M9]** **Mech. Discon. Prmit [M1-M9]**	Instructions manual ” Mechanism change function”
Mech Servo OFF [M1-M9]	Instructions manual ” Mechanism-by-mechanism servo ON/OFF function”
Vision connect **Vision monitor off** **Vision Ext.Trig** **Vision buffering** **Vision buffer full** **Vision buffer warm** **Vision conv.limit** **Vision Trigger**	Instructions manual ”Vision system”
TCP speed output ✱ 1-12	Instructions manual ” TCP Velocity Out function”
Force Sensor	Instructions manual ” Force sensor I/F”

1.3 Multi-station input/output signals

There are input/output signals specifically for multi-station startup.
When multi-station startup is adopted as the startup method, allocate the necessary signals.
These items are displayed only when 1 or larger value is registered in “The number of stations” of <Constant setting> - <5 Operation Constants> - <6 Number of station>.

1.3.1 Multi-station input signals

This section explains the input signals that are specific to multi-stations.
They are setup using <Constant Setting> – [6 Signals] – [2 Input Signal Assignment] – [9 Multi-station Inputs].

Reset attained

Initial allocation No.	0
Meaning of the signal	When multi-station operations are to be performed, any program which is to be started by each station can be allocated, and the allotment count (projected production count) can also be set at the same time. When this allotment count is set ahead of time, the allotment reached signal will be output to an external device when the production count (number of times the END command has been executed) has reached the allotment count. This signal is used to reset the allotment reached signal.
Behavior when turned ON	The allotment count is presumed to be reached by the production count , and "**Attained St. ***" signal (☞ 1-53) is set to OFF.
Behavior when turned OFF	Nothing happens.
Operator	***USER*** or above

Start station * (* = 5 to 10)

Initial allocation No.	0
Meaning of the signal	Up to maximum of 4 stations are supported as standard, so when stations 5 to 10 are used, it is necessary to allocate signals so that startup signal from operation box is input to input signal. (Startup signals for Stations 1 to 4 are fixed input, so it’s not necessary to allocate these.)
Behavior when turned ON	Start the program allocated to Station * (* = 5 to 10)
Behavior when turned OFF	Nothing happens.
Operator qualifications	***USER*** or above

1.3.2 Multi-Station output Signals

This section explains the output signals that are specific to multi-stations.
They are setup using <Constant Setting> – [6 Signals] – [3 Output Signal Assignment] – [9 Multi-station Outputs].

Reserved unit St.* 1-4

Initial allocation No.	0
Meaning of the signal	This outputs the unit number(s) reserved by station * (*: 1 to 10). Unit numbers 1 to 9 are indicated as follows using four signals. Signal: 4 3 2 1 Binaly: 2^3 2^2 2^1 2^0
Conditions for turning ON	The bits corresponding to the unit number reserved by the station * are set to ON.
Conditions for turning OFF	This is set to OFF either when the reserved program starts up or when the reservation is canceled.
Operator qualifications	***USER*** or above

Reserved prog. St.* 1-16

Initial allocation No.	0
Meaning of the signal	This outputs the program number reserved by Station * (*: 1 to 10). Program numbers 1 to 9999 are indicated as follows using 16 signals. Signal: 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 Binary: 2^{15} 2^{14} 2^{13} 2^{12} 2^{11} 2^{10} 2^9 2^8 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0 BCD: 1000's digit / 100's digit / 10's digit / 1's digit Whether the output format is binary or BCD is determined by the setting in <Constant Setting> – [6 Signals] – [1 Signal Condition] – [1 Failure code output].
Conditions for turning ON	The bits corresponding to the program number reserved by the station # are set to ON.
Conditions for turning OFF	This is set to OFF either when the reserved program starts up or when the reservation is canceled.
Operator qualifications	***USER*** or above

Attained St. *

Initial allocation No.	0
Meaning of the signal	This is output when the production count of the station * (*: 1 to 10) reaches the allotment count.
Conditions for turning ON	The production count of the station * (*: 1 to 10) has reached the allotment count.
Conditions for turning OFF	"**Reset attained**" signal (☞ 1-52) is input.
Operator	***USER*** or above

Start lamp St. *

Initial allocation No.	0
Meaning of the signal	Allocate these signals when the fact that station * (*: 1 to 10) is operating or reserved is to be output to an external device. These signals have exactly the same function as the signals of the start lamps on the operation box or start box of each station.
Conditions for turning ON	Station * (*: 1 to 10) is now operating (level output). Station * (*: 1 to 10) is reserved (pulse output).
Conditions for turning OFF	When station * (*: 1 to 10) is neither operating nor reserved
Operator	***USER*** or above

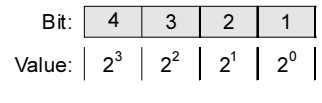
Running St. *

Initial allocation No.	0
Meaning of the signal	The level signal corresponding to station * (*: 1 to 10) indicates that the station is now operating. It is output when the program in which start has been allocated is being run for an automatic operation in playback mode.
Conditions for turning ON	When station * (*: 1 to 10) is now operating
Conditions for turning OFF	When station * (*: 1 to 10) is not operating
Operator	***USER*** or above

Reserved St. *

Initial allocation No.	0
Meaning of the signal	The level signal corresponding to station * (*: 1 to 10) indicates that the station is reserved. Whereas the reserved signals indicated by the start button or "**Station * start lamp**" signal (☞ 1-54) are pulse output signals, this signal is a level output signal.
Conditions for turning ON	When station * (*: 1 to 10) is reserved
Conditions for turning OFF	When station * (*: 1 to 10) is not reserved
Operator	***USER*** or above

Order St. * 1-4

Initial allocation No.	0
Meaning of the signal	These level signals indicate the sequence in which stations * (*: 1 to 10) are reserved. The reservation sequence from 1 to 10 is expressed by four signal lines.  For example, when bits 1 and 3 are ON, the reservation sequence No. is 5 (1+4).
Conditions for turning ON	When station * (*: 1 to 10) is reserved, the bit indicating the reservation sequence is set to ON.
Conditions for turning OFF	When station * (*: 1 to 10) is not reserved
Operator	***USER*** or above

1.4 Another input/output signals

As for the signals not described in this document, please refer to the instruction manual provided for the respective application.

Example;

Arc welding input/output signals: Instruction manual “Application (Arc welding)”
Spot welding input/output signals: Instruction manual “Application (Spot welding)”
Sensor input/output signals: Instruction manual of respective sensor devices

NOTE

Chapter 2 Helpful Hints

Some useful functions which are frequently used are described in this section.

2.1 Assigning names to general-purpose input and output signals 2-1
2.2 Monitoring the Input/Output Signals.....2-3
2.3 Outputting pulse/delay output signals 2-6

2.1 Assigning names to general-purpose input and output signals

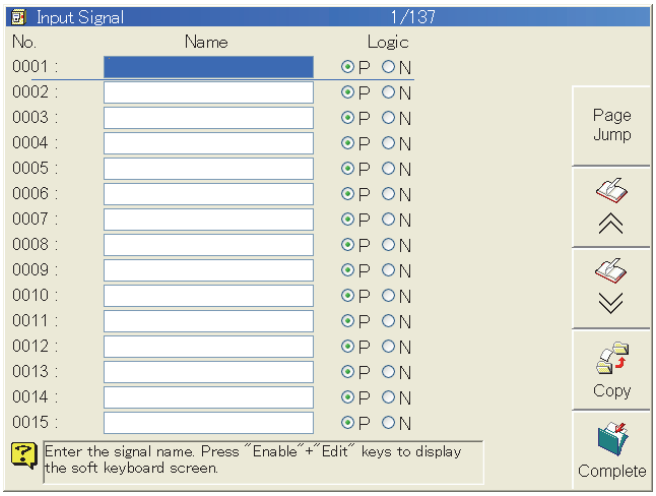
It is possible to assign names to general-purpose input and output signals.
Assigning names has the following benefits.

- When application commands related to input/output are recorded, both the signal number and the signal name will be displayed together in the recorded step.
- When input/output signals are monitored either with “General Purpose Input Signal Monitor” or “General Purpose Output Signal Monitor”, the signal name will be displayed along with the signal number.

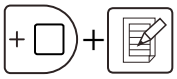
Assigning names to general-purpose input and output signals

1 Select <Constant Setting> - [6 Signals] - [7 Signal Attribute] – [1 Input Signal].

>> The attributes setup screen for input signals will be displayed.
When [6 Signals] → [7 Signal Attributes] → [2 Output Signal] is selected, the attributes setup screen for output signals will be displayed.

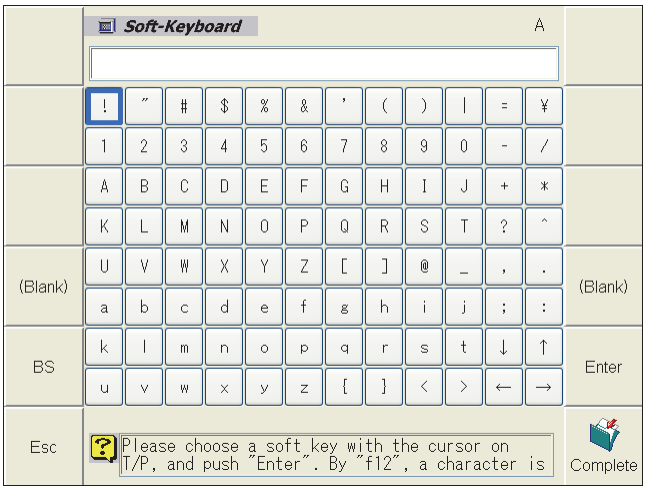


The signals with blank spaces are the general-purpose signals. It is possible to assign names and define the logic to be positive or negative.
The portions displayed in gray are signals that have already been allocated. The names and logic for these signals cannot be changed.



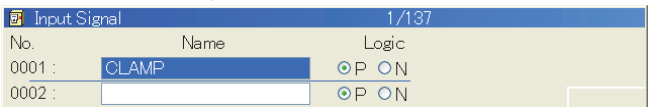
2 When assigning names to general-purpose signals, align the cursor with the number you want, and press [EDIT] while holding down [ENABLE].

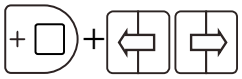
>> The soft keyboard now starts up.



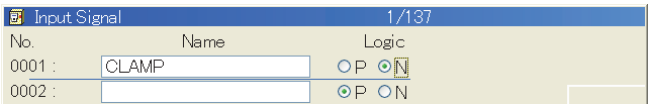
3 **After the name is input, press f12 <Complete>.**

>> The name will be registered.



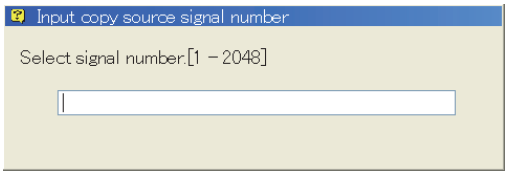


4 **When switching the logic, move the cursor to the "Logic" field and then press [ENABLE] + [LEFT/RIGHT].**



5 **When assigning a name to another general-purpose signal, repeat steps 2 through 4.**

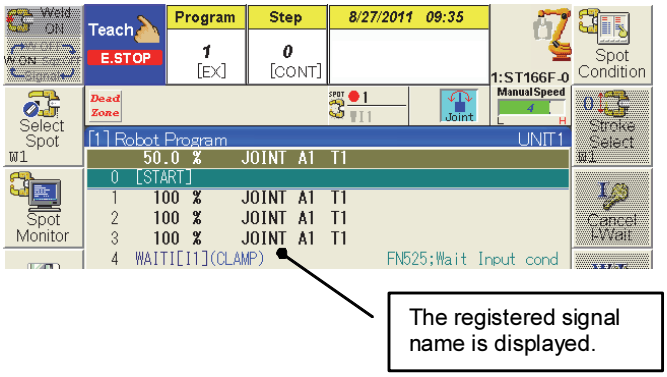
6 **Signal name can be copied easily.**
Move the cursor to the destination signal line and press f11 <Copy>. Following message will appear and set the number of source signal number and press [Enter].



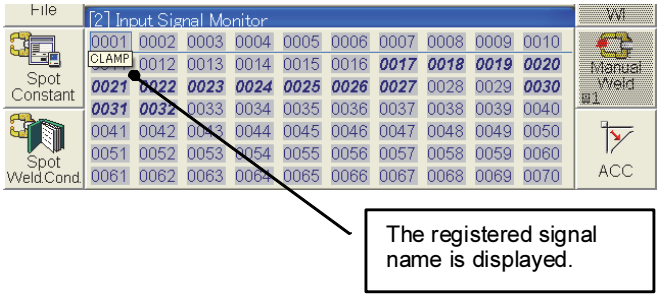
>> Source signal name is copied to the cursor position (destination signal name).

7 **After all the names have been registered, press f12 <Complete>.**

8 **If the names are registered, the signal names will be displayed along with the signal numbers when teaching input/output commands.**



In addition, the signal names will also be displayed on the input/output monitor.

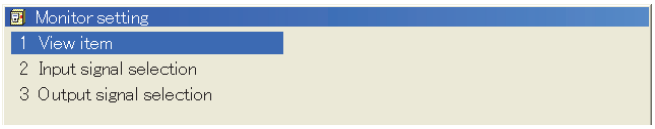


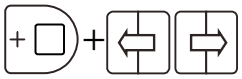
2.2 Monitoring the Input/Output Signals

If the general-purpose input and output monitors are started, it will be possible to see the ON/OFF status of the input and output signals.
Please refer to the instruction manual “BASIC OPERATION”, “7.2 Monitoring various information of the robot” for the operation on monitor screen. Here in this section, further convenient utilities are described.

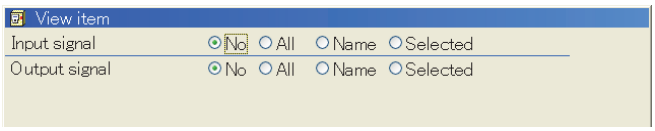
Setting the view item (on “Constant Setting”)

1 **Select <Constant Setting> - [6 Signals] - [17 Monitor setting] .**





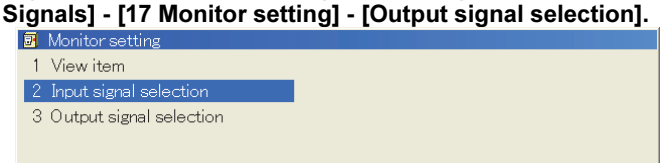
2 **Select [1. View item], and press f12 <Complete>.**

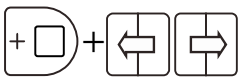


No. : Displays general-purpose I/O signal by its number.
All : Displays general-purpose I/O signal by a comment for all signals.
Name : Displays general-purpose I/O signal by a comment for only the named ones.
Selected : Displays general-purpose I/O signal by a comment for only selected signals.

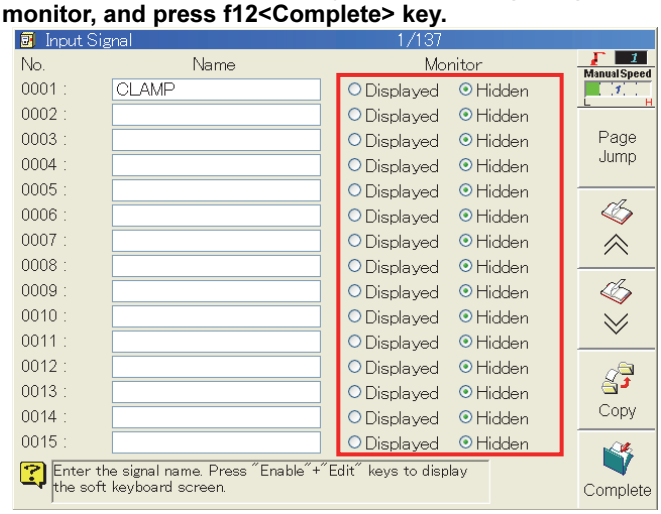
Selecting the signals to display when view item is “Selected”

1 **Select <Constant Setting> -**
[6 Signals] - [17 Monitor setting] - [Input signal selection] or
[6 Signals] - [17 Monitor setting] - [Output signal selection].





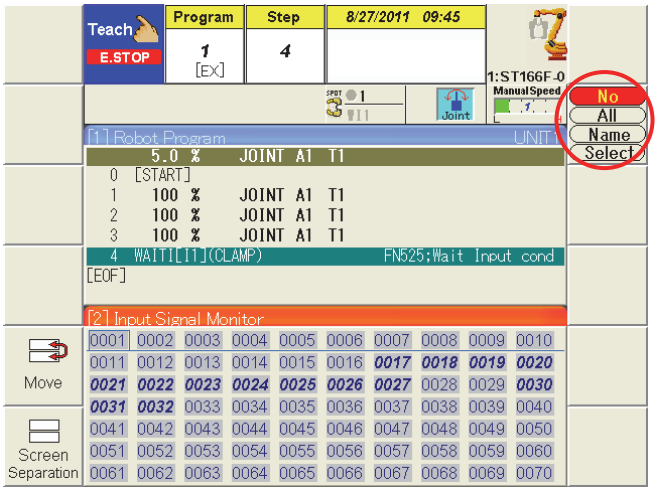
2 **Choose the radio button “Displayed” for the target signal numbers to display on the monitor, and press f12<Complete> key.**



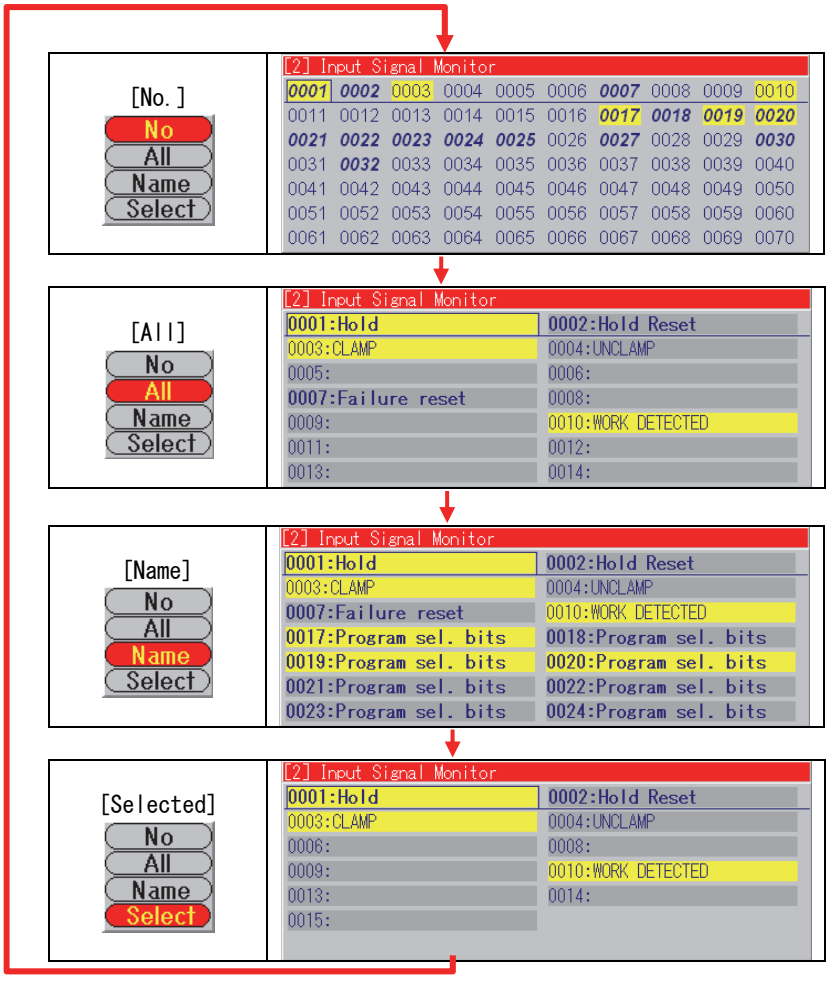
>> When [Selected] is chosen for the view item, only the signals you selected here can be displayed on the monitor.

Setting the view item on I/O monitor screen

1 **Move over from the general-purpose Input/Output signal monitor screen to the screen edit mode.**
>> F8 key shows the current view item.



2 **Use F8 key to change the view item.**
>> On pressing F8 key every time, the view item changes and the monitor screen is updated accordingly.

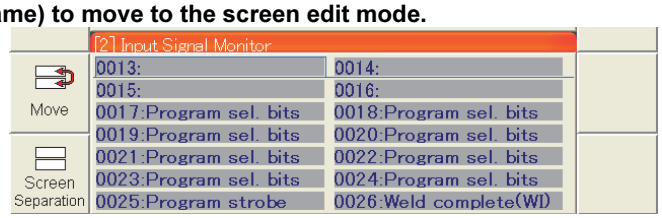


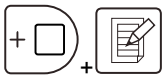
3 **Press [Reset/R] key to finish the screen edit mode.**

Naming the general-purpose I/O signals (on I/O monitor screen)

Signals can be named on the monitor screen when the general-purpose Input/Output signal monitor allows to set either ”All", ”Name” or ”Selected” for the view item on the screen.

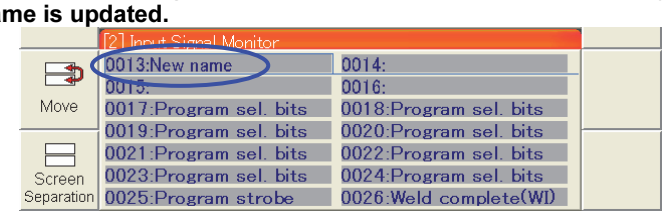
1 **Press [EDIT] key on the general-purpose Input/Output signal monitor screen (Name) to move to the screen edit mode.**





2 **Align the cursor to the signal you are going to change the name, hold down [ENABLE] and press [EDIT] key.**
>> Then, the soft keyboard screen appears. (same as ☞ 2-1)

Enter the new signal name, and press f12 <Complete> key. Then, the signal name is updated.



3 **Press [Reset/R] key to finish the screen edit mode.**

2.3 Outputting pulse/delay output signals

Although level signals are normally output as the output signals, they can be changed to pulse or delay output signals. The function which accomplishes this is called the output signal attribute allocation function.
Both status output signals (dedicated output signals) and general-purpose output signals can be provided with attributes.

The following steps must be taken.

1	Defining the pulse output or delay output pattern

Select <Constant Setting> – [6 Signals] – [7 Signal Attribute] – [4 Pulse Table Setting] or [5 Delay Table Setting], and define the pulse or delay pattern for the output signals in pulse tables 1 to 15 or delay tables 16 to 30.

2	Allocating pulse tables 1 to 15 or delay tables 16 to 30 to the output signals

Select <Constant Setting> – [6 Signals] – [7 Signal Attribute] – [3 Output Signal Attribute], and allocate pulse tables 1 to 15 or delay tables 16 to 30 designed in 1 for the output signals.
By allocating these tables, the output signals will be output in the patterns defined by the pulse tables or delay tables.

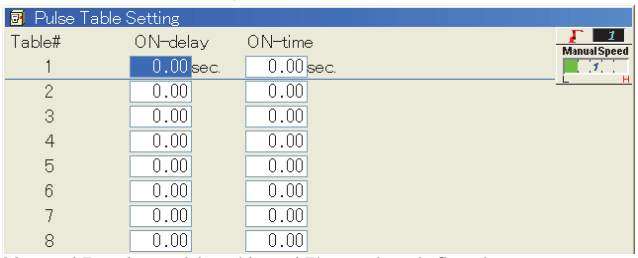
CAUTION

Pulse outputs or delay outputs can also be provided using the function command SETM <FN35>. However, heed the following caution: if, by following the steps in this section, a particular output signal is provided with a pulse or delay attribute, the SETM <FN35> command is taught for this signal, and then the program is played back, the signal output will accord with the attribute provided rather than with what has been taught.

Defining the pulse output patterns

1 Select <Constant Setting> – [6 Signals] – [7 Signal Attribute] – [4 Pulse Table Setting].

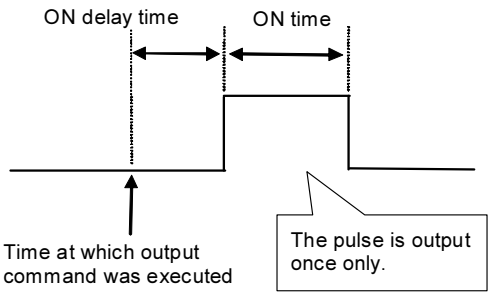
>> The pulse table setting screen now appears.



Up to 15 pulse tables (1 to 15) can be defined.

2 Select the number of the table, and define the pulse output setting pattern by setting the ON delay times and ON times.

The pulse is output once only.

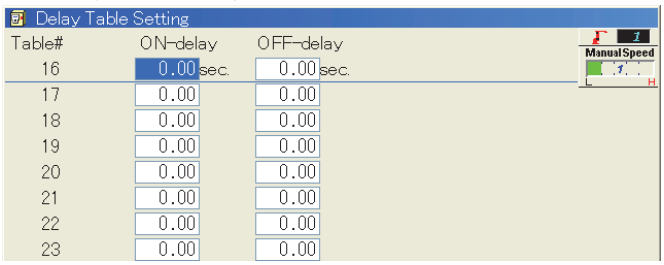


3 Finally, press f12 <Complete>.

Defining the delay output patterns

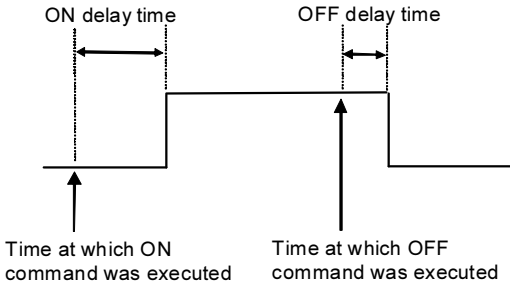
1 **Select <Constant Setting> – [6 Signals] – [7 Signal Attribute] – [5 Delay Table Setting].**

>> The delay table setting screen now appears.



Up to 15 delay tables (16 to 30) can be defined.

2 **Select the number of the table, and define the delay output setting pattern by setting the ON delay times and OFF delay times.**

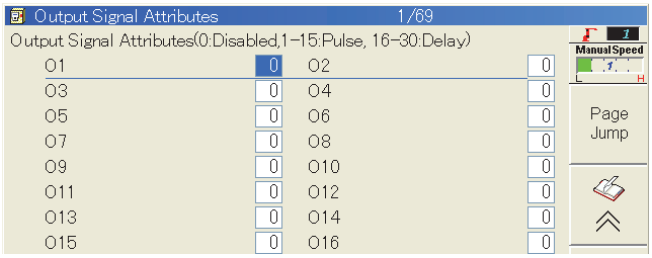


3 **Finally, press f12 <Complete>.**

Providing the output signals with pulse or delay attributes

1 **Select <Constant Setting> – [6 Signals] – [7 Signal Attribute] – [3 Output Signal Attribute].**

>> The output signal attribute allocation screen now appears.



All output signals (01 to 02048) can be provided with attributes.

2 **Select the signal to be provided with the attribute, and input the number of the pulse table or delay table. The "0" setting disables the delay output, and it results in a level output.**

All output signals (01 to 02048) can be provided with attributes.

3 **Finally, press f12 <Complete>.**

Notes

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