YASKAWA

A World of Automation Solutions™

YASNAC PC NC
I/O Signal Function Manual

Version: Beta 1.0

SAFETY INFORMATION

PRECAUTIONS

1. Read this instruction manual in its entirety before using the I/O Signal Functions available in the YASNAC PCNC.

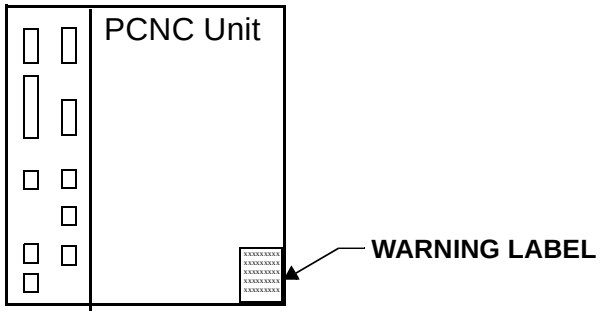
2. The following warning symbols are used to indicate precautions that the user must be aware of to safely use this equipment. Failure to follow these precautions can result in serious or possibly even fatal injury and damage to products or related equipment or systems.

WARNING

This symbol indicates the presence of a potentially *hazardous condition* which, if not avoided, could result in serious personal injury or death.

This precautionary symbol appears in labels attached to YASNAC products to alert the user to conditions requiring concern for safety.

SPECIAL SAFETY NOTE: This symbol indicates that **ELECTRICAL SHOCK HAZARD** condition exists. DO NOT TOUCH any electrical connection terminals when the power is on, and for at least 5 minutes **after** switching off the power supply. Warning label is located on the CNC enclosure as shown:



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PURPOSE OF THIS MANUAL

This manual describes the functions of I/O signals between the YASNAC PCNC and PLC. Read this manual thoroughly so that you will be able to use the YASNAC PCNC correctly. Keep this manual in a safe place and refer to it whenever necessary.

RELATED MANUALS

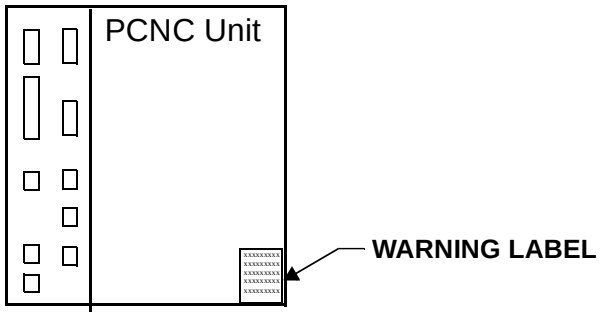
Refer to the following manuals when necessary.

Name of Manual	Manual Number	Contents
YASNAC PCNC OPERATING MANUAL	YEA-SIE-C844-2.1	Describes the basic configuration and operational procedures.
YASNAC PCNC PROGRAMMING MANUAL	YEA-SIE-C844-2.2	Describes the necessary information how to create a PCNC program.
YASNAC PCNC/PLC PROGRAMMING MANUAL	YEA-SIE-C844-0.1	Describes the PLC instructions and the process for developing PLC programs
YASNAC PCNC CONNECTING MANUAL	YEA-SIE-C844-0.2	Instrucions for connecting YASNAC to machines, machine interface and external equipment.

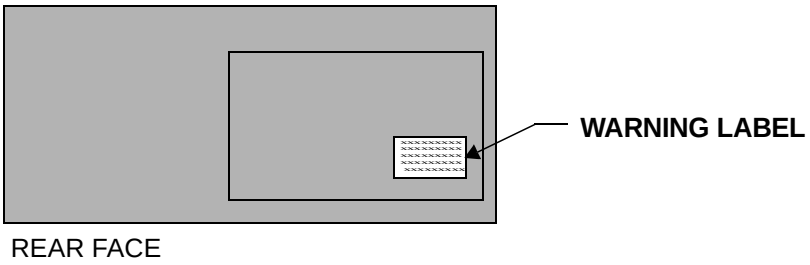
NOTES REGARDING SAFE OPERATION

Read this manual thoroughly before installing, operating, maintaining or inspecting the YASNAC PCNC. Since the efficient and safe operation of a CNC machine tool is not determined by the CNC only, it is important to also read the machine tool builder's documentation about the machine tool itself.

SPECIAL SAFETY NOTE: This symbol indicates that **ELECTRICAL SHOCK HAZARD** condition exists. DO NOT TOUCH any electrical connection terminals when the power is on, and for at least 5 minutes **after** switching off the power supply. Warning label is located on the CNC enclosure as shown:

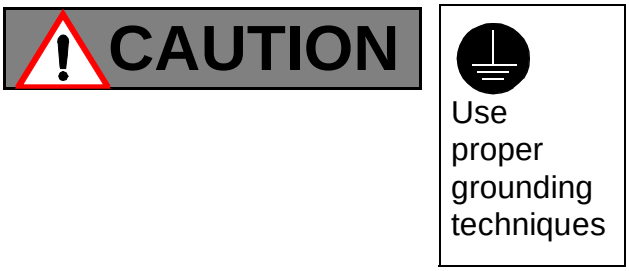


Warning label is located on the CNC operator panel (with 14” CRT) as shown:

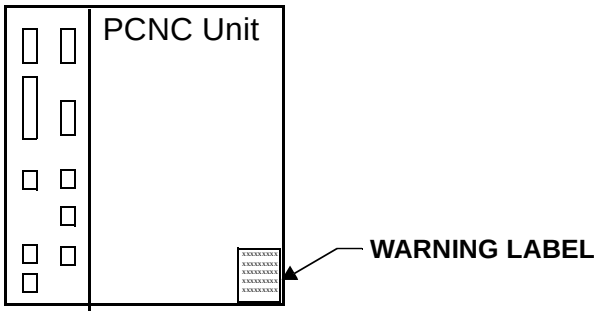


This symbol indicates that care should be used in this area.

This instruction label appears on the enclosure as follows:



Warning label is located on the PCNC enclosure as shown:



1

Feed Function

Chapter 1 describes the signals related to the feed function

1.1 F-1 Digit Selection Signal

F-1 Digit	F-1	#30076

By the designation of a single-digit number (1 to 9) following address F, the feedrate corresponding to the designated number is selected. Actual feedrates to be called in respond to designated one-digit numbers are set for setting parameters pm0820 to pm0828.

When the “F1” input signal is in the “closed state”, the currently selected feedrate can be increased or decreased by turning the manual pulse generator.

When the “F1” input signal is in the “open state”, it is not possible to change the feedrate by turning the manual pulse generator.

IMPORTANT!

1. If the F1 digit feed function is selected, it is not possible to designate feedrates of 1mm/min. to 9mm/min. by the F function. In this case, designation is only possible for feedrates of 10mm/min. or greater.
2. If the dry run switch is ON, the feedrate set for dry run operation is valid.
3. The feed override function is invalid when the F-1 digit feed function is used.
4. Feedrates set for setting parameters pm0820 to pm0828 remain valid even if the power is turned OFF.
5. Feedrates called by the designation F1 digit codes are clamped in the following manner:

If a parameter in the range from pm0820 to pm0923 exceeds the value set for pm2864, the feedrate to be called is clamped at the value set for pm2865. If a parameter setting in the range from pm0824 to pm0828 exceeds the value set for pm2866, the feedrate to be called is clamped at the value set for pm2867.

If the value set for the maximum feedrate setting parameter for F-1 figit feed function is greater than the value set for the maximum feedrate setting parameter for the normal F function, the maximum feedrate for the F-1 digit feed function is clamped at the feedrate set for the maximum feedrate setting parameter for the normal F function.

1.2 No. 2 G00 Mode Signal

No. 2 G00 Mode Input	G002X to G0025	#31010 to #31014
No. 2 G00 Mode Output	G002XS to G0025S	#36280 to #36284

Axis feed in the G00 mode is controlled by the setting for parameters, i.e. feedrates, acceleration/ deceleration, time constants and S-curve accel/decel coefficients. This funtion has two sets of parameters related to the execution of the G00 code to control feedrate, and the effect of the accel/decel time constant and S-curve accel/decel according to theinput signal (G002X to G0025).

1.2.1 No. 2 G00 Mode Input Signals (#31019 to #31014)

These signals change over the control mode between the G00 and the second G00 control mode for the individual axes (X-axis to the 5th-axis).

If these signals are “open” the G00 control mode is called.
If these signals are “closed”, the second G00 control mode is called.

1.2.2 No. 2 G00 Mode Input Signals (#36280 to 36284)

These signals are second G00 control mode outptut signals for the individual axes (X-axis to the 5th-axis).

If these signals are “open” the G00 control mode is called.
If these signals are “closed”, the second G00 control mode is called.

1.3 Feed Completed Output Signal

Feed Completed Output Signal	DEN	#35374

For the execution of a part in the automatic mode, if an axis movement command isdesignated with a M, S, T and/or B command in the same block, this output signal indicates the completion of axis movement.

In a block where axis movement command is designated with a M, S, T and/or B command, if the axis movement command has been completed even though a M, S, T and/or B command has not been completed, the feed completed output DEN is “closed”.

When the FIN input is “opened” from the “closed” state after the closing if the feed completed output DEN, the M, S, T and/or B command is assumed to have been executed and the feed completed output DEN is “opened”.

1.4 Feed Override Input and Feedrate Override Cancel Input Signals

Feed Override Input Signal	OV1 to OV16	#30400 to #30404
Feed Override Input Cancel Signal	OVC	#30407

(1) Feedrate Override Input Signal

The feedrate override input signal overrrides feedrates specified in a part program in increments of 10% in the range from 0 to 549%. These input signals are valid in the automatic mode.

Feedrate Override Input Signal Table

OV1	OV2	OV4	OV8	OV16	Feedrate Override (Automatic Mode)
0	0	0	0	0	0%
1	0	0	0	0	10%
0	1	0	0	0	20%
1	1	0	0	0	30%
0	0	1	0	0	40%
1	0	1	0	0	50%
0	1	1	0	0	60%
1	1	1	0	0	70%
0	0	0	1	0	80%
1	0	0	1	0	90%
0	1	0	1	0	100%
1	1	0	1	0	110%
0	0	1	1	0	120%
1	0	1	1	0	130%
0	1	1	1	0	140%
1	1	1	1	0	150%
0	0	0	0	1	160%
1	0	0	0	1	170%
0	1	0	0	1	180%
1	1	0	0	1	190%
0	0	1	0	1	200%
1	0	1	0	1	220%
0	1	1	0	1	240%
1	1	1	0	1	260%

Feedrate Override Input Signal Table (continued)

OV1	OV2	OV4	OV8	OV16	Feedrate Override (Automatic Mode)
0	0	1	1	1	420%
1	0	1	1	1	460%
0	1	1	1	1	500%
1	1	1	1	1	540%

Note: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

IMPORTANT!

Feedrate override value of 200% and greater is optional.

(2) Feedrate Override Cancel Input Signal

The feedrate override cancel input signal fixs the override value at “100%”.

If the “OVC” inut signal is “closed”, cutting feed designated in a part program is executed at the feedrate specified in the program, regardless of the status of the feedrate override input signals.

1.5 Pulse Handle Axis Selection Signals

Pulse Handle Axis Selection Signals	HX to H5	#30700 to #30704
	2HX to 2H5	#30800 to #30804
	3HX to #H5	#30810 to #30814

(1) Pulse Handle Axis Selection Signal

The pulse handle axis selection signals desinate which of the axes can be moved by the operation of the pulse handle for machines so equipped.

By “closing” the signal when the pulse handle is selected, the corresponding axis can be moved by turning the pulse handle. If more than one signal is “closed” at the same time, “closed ”signals is valid and the corresponding axis can be moved by turning the pulse handle.

Prioriry of the Signals (highest to lowest): HX, HY, HZ, H4, H5

(2) Simultaneous 3-axis Pulse Handle Axis Selection Signal

If the machine is equipped with a simultaneous 3-axis feed pulse handle, up to three axes can be moved at the same time when the signal is “closed”.

No. 1 pulse handle selection (HX to H5)
No. 2 pulse handle selection (2HX to 2H5)
No. 3pulse handle selection (3HX to 3H5)

IMPORTANT!

For each pulse handle axis selection, selection is possible only for one axis.

If more than one pulse handle is selected for one axis, feed distances generated by the selected pulse handles will overlap.

1.6 Rapid Traverse Override Input Signal

Rapid Traverse Override Input Signal	ROV1 to ROV4	#30034 to #30036

The rapid traverse override input signal determines the rapid traverse rate used in the execution of positioning in automatic operation of CNC program, and also for manual rapid traverse operation with the RT input “closed”.

IMPORTANT!

ROV4 can only be used when the extension override function (option) is selected.

Input Signals and Rapid Traverse Rates

Input Signal			Rapid Traverse Rates				
ROV4	ROV2	ROV1	No. 1 Axis	No. 2 Axis	No. 3 Axis	No. 4 Axis	No. 5 Axis
0	1	1	Feedrate set for pm2801	Feedrate set for pm2802	Feedrate set for pm2803	Feedrate set for pm2804	Feedrate set for pm2805
0	1	0	(Feedrate set for pm2801) x 1/2	(Feedrate set for pm2802) x 1/2	(Feedrate set for pm2803) x 1/2	(Feedrate set for pm2804) x 1/2	(Feedrate set for pm2805) x 1/2
0	0	1	(Feedrate set for pm2801) x 1/4	(Feedrate set for pm2802) x 1/4	(Feedrate set for pm2803) x 1/4	(Feedrate set for pm2804) x 1/4	(Feedrate set for pm2805) x 1/4
0	0	0	F_0 pm2801 to pm2805 x pm2447 (%), or traverse set for pm2447 (see Note 2)				
1	0	0	F_0 pm2801 to pm2805 x pm2448 (%)				
1	0	1	F_0 pm2801 to pm2805 x pm2449 (%)				

Note 1: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

Note 2: Interpretation of the value set for ppm 2447, used for determining the traverse rate F_0 is indicated below.

pm2000 D3=0: The units of the value set forpm2447 are “mm/min.”.
pm2000 D3=1: The units of the value set forpm2447 are “%”.

1.7 Manual Feed Axis/Direction Selection Input Signal

Manual Feed Axis/Direction Selection Input Signal	+X to +5	#30710 to #30714
	-X to -5	#30720 to #30724

The manual feed axis/direction selection input signals determine the direction of axis movement and the axis to be moved when the CNC is in the jog mode, rapid traverse mode or manual step feed mode.

When the “+” or “-” signals are “closed”, the corresponding axes are moved. If more than one axis is selected, simultaneous axis movement is possible for up to the designated number or simultaneously controllable axes.

IMPORTANT!

If both the “+” or “-” signals of the selected axis are “closed” or “opened” at the same time, the axis cannot be moved. If this occurs during axis movement, the axis decelerates and stops.

1.8 Solid Tap

Solid Tap Mode	G93M	#35381
Spindle Position Loop Command	SLPC	#31174
Spindle Position Loop Mode	SLPS	#36512
Solid Tap Gear Selection	STPGR	#31155

(1) Solid Tap Mode Signal

The output signal is in response to the execution. At the machine, the spindle start (forward) signal should be “opened” at this signal. Then return the spindle positin control loop command input signal (SLPC) after confirming that the spindle has been stopped by the spindle zero-speed signal.

IMPORTANT!

1. If the spindle controller has a soft start circuit, cancel it at the same time when the SLPC is “opened”, since acceleration and deceleration are controlled by the NC.

2. All of the following input signals must be “closed”.

   Spindle reverse rotation (SINV)
   Gear shifting (GRO)
   Spindle fixed speed (SOR)

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(2) Spindle Position Loop Command

The signal is used to configure the spindle position control loop in the NC.

When this input signal is “opened”, the CNC configures the position control loop for the spindle after confirming that the spindle has stopped. It then returns the spindle position control loop mode output signal (SLPS).

(3) Spindle Position Loop Mode Output Signal

The output signal occurs when the CNC has set the position control loop for the spindle to execute solid tapping.

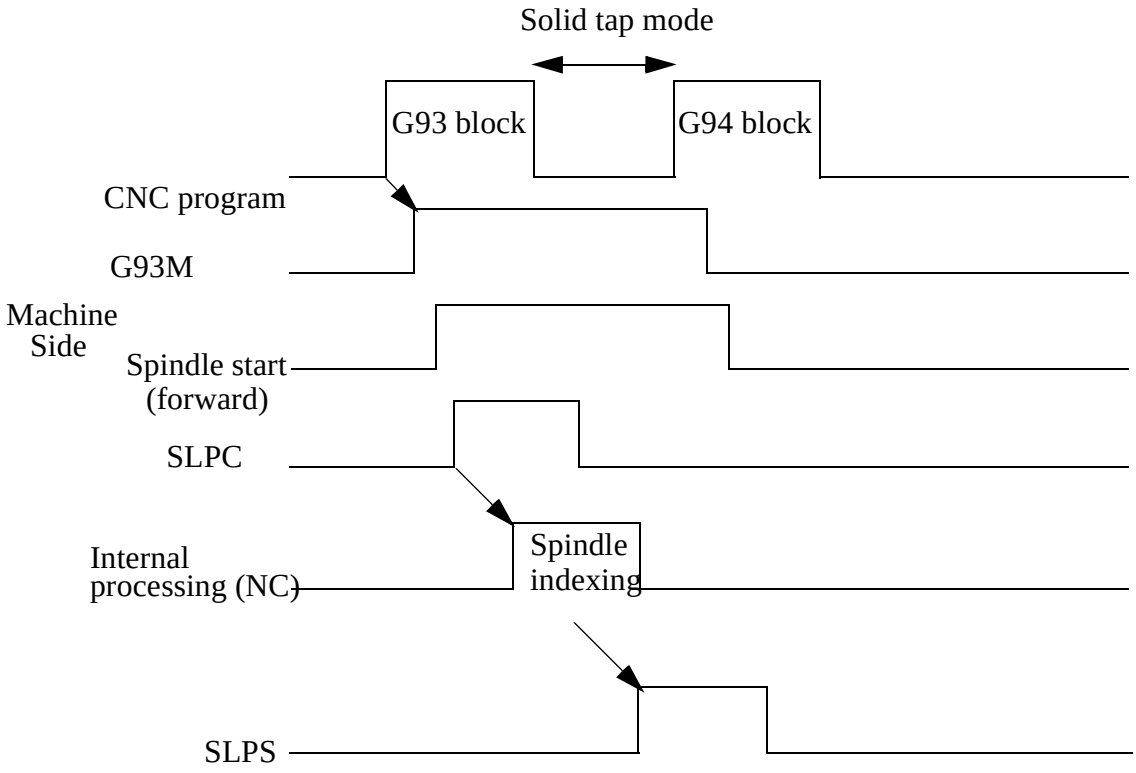
The execution of the G93 block is completed by the output of this signal.

(4) Solid Tap Gear Selection Signal

For the machine equipped withtw0-step gear range, it is possible to execute solid tapping in both gear ranges A and B (Low and High). When the signal is “open”, the A gear range is selected, and when it is “closed”, the B gear range is selected.

The signal must be set before the designation of the G93 (solid tap command) block. Once set, the signal status must not be changed until the solid tap mode is cancelled.

(5) Time Chart for Solid Tap Operation



SUPPLEMENT

1. The G93M signal is “opened” when the G93 block is executed with both the dry run and MST function lock OFF.

2. The G93M signal is “closed” when the execution of the G94 block starts or the CNC is reset.

3. The G93 block is assumed to have been completed when the SLPS is “opened”, and the program advances to the next block.

4. The G94 block is assumed to have been completed when the SLPS is “closed”, and the program advances to the next block.

2

SAVING AND EDITING PROGRAMS

Chapter 2 describes the signals for storing and editing programs.

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3

Operation And Display

Chapter 3 describes the signals related to operation and display.

3.1 Calendar Output Signal

Calendar Output Signal	CALEN1 TO CALEN4	#35064 TO #35067

By comparing the internal calendar of the CNC with the parameter (date) setting and by out-putting the result of the comparison, it is possible to dispaly a message such as a regular maintenance warning by using the sequence program.

The calendar is in the CNC. By comparing the calendar to the data parameter setting, the result of the comparison is output. If the parameter setting is smaller than the CNC calendar value, the signals (CALEN1 to CALEN4) are output corresponding to the parameter used for comparison.

For such processing, up to four parameters can be used to save the calendar data.

The following shows an example of calendar data setting for a parameter:

pm0905 = 19961020 (October 20,1996)
pm0906 = 19960301 (March1,1996)

(1) Calendar Output Signals (CALEN1 to CALEN4)

The following table shows the relationship between the CNC calendar and the calendar signals to be output.

Signal	Description
#35064	The status of No. 1 calendar *Output when the CNC calendar data exceed the setting for pm0905
#35065	The status of No. 2 calendar *Output when the CNC calendar data exceed the setting for pm0906
#35066	The status of No.3 calendar *Output when the CNC calendar data exceed the setting for pm0907
#35067	The status of No. 1 calendar *Output when the CNC calendar data exceed the setting for pm0908

(2) Calendar Status

The relationship between the CNC calendar data and a parameter setting is indicated below.

Parameter Value	I/O
19960714	1
19960715	0
1995999	1
2000000	0

Since the calendar data treated as binary data, comparison is possible even if the month value exceeds “12”or day value exceeds “31”.

For example, if the setting for a parameter is “19999999”, and if the CNC calendar data is “19960715” (July 15,1996), comparison is made as indicated below.

$$19960715 - 19999999 \leqq 0$$

Since the result of comparison is negative, the output is “0” (status of the calendar).

To clear the calendar status, reset an appropriate value for a calendar parameter. When a value greater than the CNC calendar data is et, the status of the calendar is cleared.

The parameters used as the calendar parameter are indicated below.

pm0905 No. 1 calendar parameter
pm0906 No. 2 calendar parameter
pm0907 No. 3 calendar parameter
pm0908 No. 4 calendar parameter

4

M, S, T And B Functions

Chapter 4 desribes the signals for M, S, T, and B functions.

4.1 Input/Output Signals of M,S,T and B Codes

(1) M, S, T and B Code Output Signals and M, S, T and B Code Read Output Signals

M code output	MA0 to MA9	#35200 to #35211
S code output	SD00 to SDO23	#36540 to #36567
Tcode output	TO to T19	#35300 to #35323
B code output	B0 to B15	#35330 to #35347
M code read output	MF	#35350
S code read output	SF	#36517
T code read output	TF	#35357
B code read output	BF	#35355

Kinds and Addresses of M, S, T and B Code Output Signals & Read Output Signals

These are output signals for the M, S, T and B commands specified in a program.

If a M, S, T and B command is read during the execution of a part program in the automatic mode, then CNC outputs the signals according to the numeric value specified with address M, S, T or B.

Then, the M, S, T or B code read output signal is “closed” after the elapse of the time set for a parameter.

IMPORTANT!

In the case of an S4 digit command, an S code signal and S code read signal are not output since the output is a 12 bit no-contact output or analog output for a S4 digit command.

1.M commands for logic circuit processing (M90 to M99)

Neither M code nor MFA code is output. M codes are those for internal processing of the CNC, and accordingly, they cannot be used as external M codes.

2.M decode output signals (M00R, M01R, M02R and M30R)

Among the M codes, if M00, M01, M02 or M30 is executed, the corresponding M decode output signals (M00R(#35214); M01R(#35215); M02R(#35216); M30R(#35217) appear in addition to the M code and M code read output signals. The M decode output signal is “opened” at the start of automatic operation or when the CNC is reset.

If an M command with a decode output signal is specified together/along with an axis movement command in the same block, the M decode output signal appears only after the

completion of the specified axis movement although the M code out put signal appears at the start of the execution of that block.

An example of the M decode outpt is shown in Fig. 4.1.

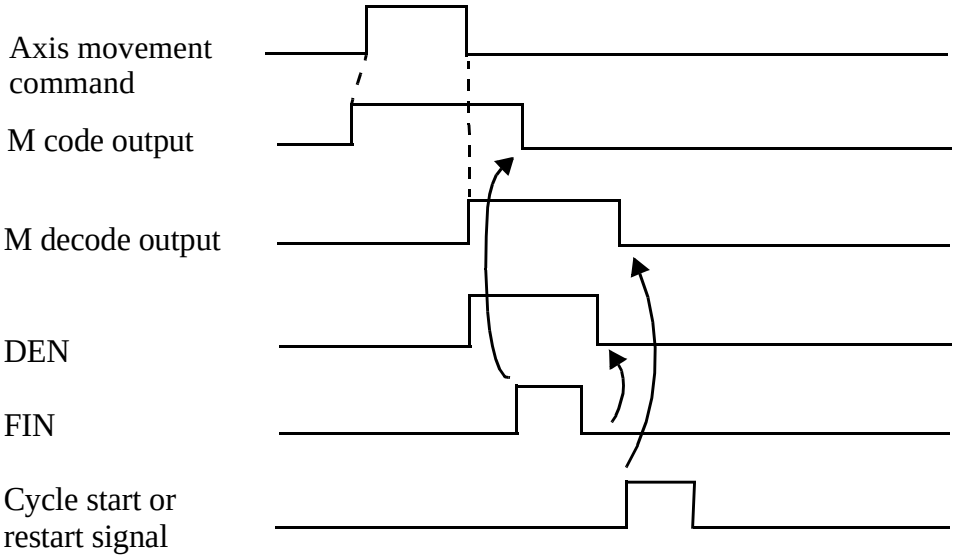


Fig. 4.1 M Decode Output Time Chart

(2)M, S, T and B Function Completion Inut Signals

These input signals indicate the comletion of a M,S,T or B command to the CNC.

Output signals MF,SF,TF and BF are “opened” if input signal FIN is “closed” while the M, S, T and B code read (MFA,SF,TF and BF) output signal is “open”. Then, when input signal FIN is “opened” after the confirmation of “opening” of the output signal, the CNC assumes that the execution of M,S,T or B command has been competed and execures thye next step operation.

IMPORTANT!

1. The M code outptu signal is “opened” when the status of input signal FIN changes from “closed” to “open”. For the S, T and B code outptut signals, the “open” or “closed” state is maintained.

2. For T and B codes, there are only bunary outputs and BCD outputs are not given.

(3)Time Chart of M, S, T and B Signals

(a) When an M command is specified:

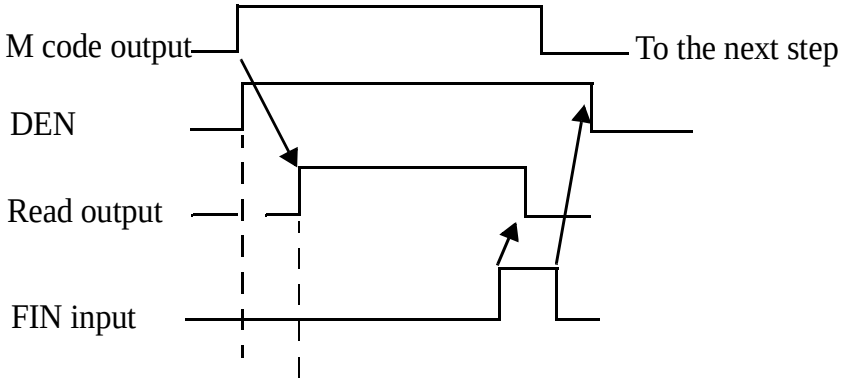


Fig. 4.2 M Code Signal Time Chart

(b) When an S,T and/or B command is specified

Fig. 4.2 S/T/B Code Signal Time Chart

(c) When M/S/T/B command is specified with an axis movement command in the same block.

If an M/S/T/B command is specified along with an axis movement command in the same block, the M/S/T/B command is executed simultaneously with the axis movement.

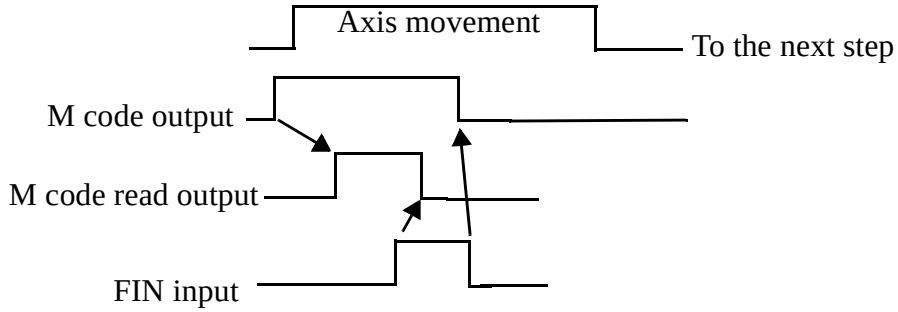


Fig. 4.4 M/S/T/B Code Signal Time Chart when Specified with an Axis Movement Command in the Same Block

4.2 S5-Digit Command Input Signal

S Code Analog Output Inverse Input	SINV	#31104
S Code Analog Output Status Output	SINVA	#36500
Spindle Gear Range Input	GR1 to GR4	#31100 to #31103

The CNC outputs these signals to determine the rotation speed of the spindle motor for “S5-digit non-contact output” or “S5-digit analog output” signals.

GR1 to GR4 (#31100 to #31103) signals input the status of gear range to the CNC to determine the spindle motoe speed according to the spindle speed specified in a part program.

Input signal SINV is used to invert the polartiy of the analog output signal for the S5-digit analog output specification.

The M04s (#3538d0) is “opened” at the start of the M03 command, and it is “closed” at the start of the M04 command.

(1) 24-bit Non-contact Output for S5-digit Command

In response to the specified spindle speed and the gear range input (GR1 to GR4), a 23-bit binary code (0 to +8388608: spindle speed) is output as shown in Fig. 4.5.

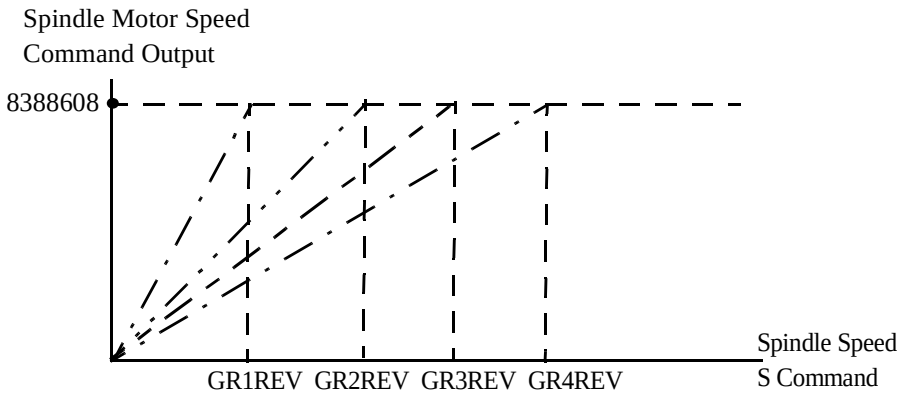


Fig. 4.5 Non-contact Output for S5-digit Command

: Output when GR1 is “closed”.
The saturated spindle motor speed of gear range “GR1” should be
set for parameter pm1408.
: Output ehen GR2 is “closed”.
The saturated spindle motor speed of gear range “GR2” should be
set for parameter pm1409.
: Output ehen GR3 is “closed”.
The saturated spindle motor speed of gear range “GR3”

(2) Analog Output for S50-digit Command

In response to the specified spindle speed and the gear range input (SINV), analog voltage (-10V to 0V to +10V) is output as shown in Fig. 4.6.

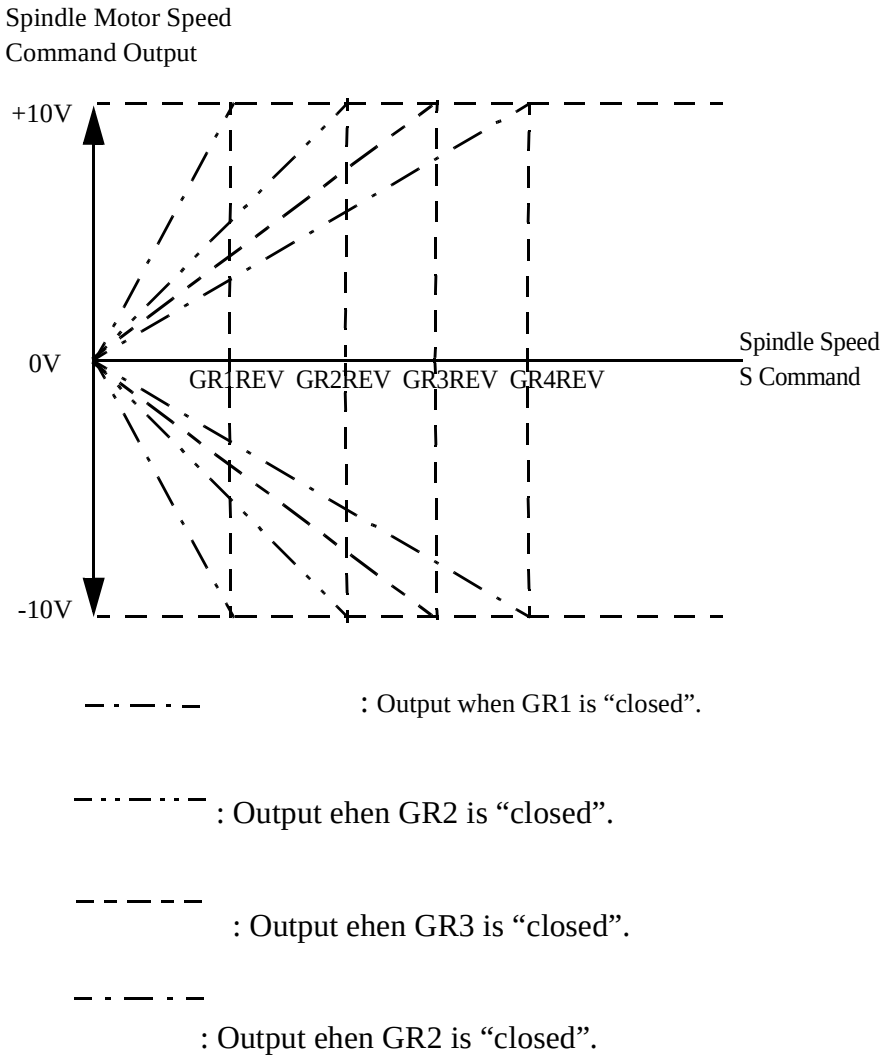


Fig. 4.6 Analog Output for S5-digit Command

(3) Time Chart of SINV Inut and SINV Ouput

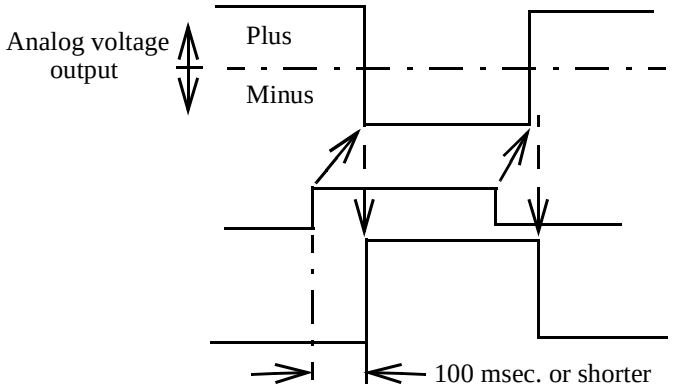


Fig. 4.7 Time Chart of SINV Inut and SINV Ouput

(4) Spindle Speed Clamp

It is possible to set the maximum and minimum spindle speed with parameters for each of the gear ranges.

Setting the Maximum and Minimum Spindle Speeds

Parameter	Description	Nos. in Chart
pm1404	Max. spindle speed when “GR1” input is “closed”	⑤
pm1405	Max. spindle speed when “GR2” input is “closed”	⑥
pm1406	Max. spindle speed when “GR3” input is “closed”	⑦
pm1407	Max. spindle speed when “GR4” input is “closed”	⑧
pm1400	Max. spindle speed when “GR1” input is “closed”	①
pm1401	Max. spindle speed when “GR2” input is “closed”	②
pm1402	Max. spindle speed when “GR3” input is “closed”	③
pm1403	Max. spindle speed when “GR4” input is “closed”	④

An example of S5-digit analog output signals which are clamped by the set maximum and minimum spindle speed is shown in Fig. 4.8.

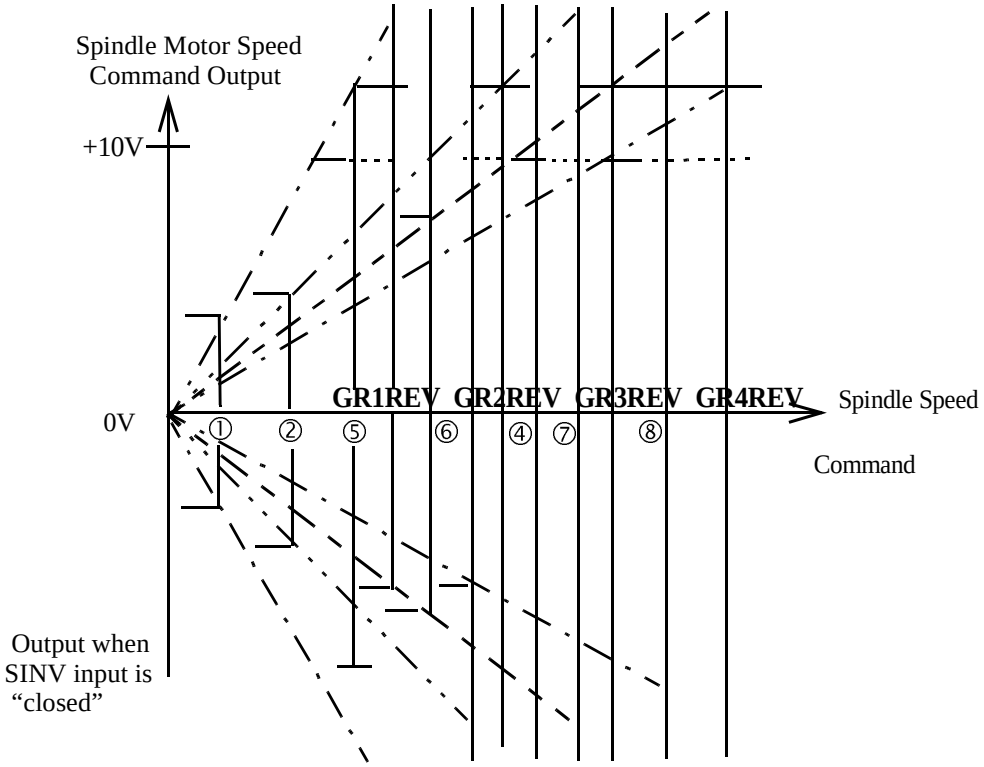


Fig. 4.8 S5-digit Analog Outputs Clamped by the Maximum and Minimum Spindle Speeds Param Setting

---

IMPORTANT!

1. The spindle motor speed command output is calculated by the following formula:

$$\frac{\text{(Spindle speed command) x } (2^{23} \text{ or } 10\text{V})}{\text{Spindle gear ramge determined by the}}$$

Or, spindle speed that corresponds to 10V output: #1408 to #1411

2. When analog signals appear for the spindle motor, the polarity can be changed by internally processing M03 (spindle forward rotation) and M04 (spindle reverse rotation) by the NC.

4.3 Gear Range Selection Input and Output Signals

Gear Range Selection Command Output	GR1S to GR4S	#36504 to #36507
S Function Finish Input	SFIN	#31117

When an S command is executed, the CNC checks the maximum speed commands of the individual gear ranges while at the same time it outputs the SF, and then outputs the gear selection command (GR1S to GR4S) meeting the secified S command.

It then compares the present gear range and returns the FIN if the present gear range is the same as the output gear selection command. If the gear range must be changed, the CNC enters the gear range selection sequence. If a fixed speed output is necessary for changing the gear range, the CNC closes the GRO. The CNC outputs the fixed speed signal by giving top priority to this signal.

“Open” the gera range selection inut signal (GR1 to GR4) before the completion of gear range selection and return the S gear range selection finish (SFIN) at the completion of gear selection range. The specified spindle speed command is then output as the non-contact or D/A output signal.

Then return the FIN when spindle speed agrees with the specified spindle speed.

(1) Gear Selection Signal Output Timing

When an S command is read, the controller judges whether or not the gear range must be changed and exceutes necessary range selection automatically. How this is exceuted is shown in the time chart shown in Fig. 4.9.

In this example, gear range of GR@ is selected by the commands of “S1000 M03” and a new spindle speed command “S2000” is specified which requires the gear range to be changed to GR3.

SEQUENCE:

1.The CNC judges that gear range must be changed to GR3 and and outputs GR3S signal.

2.At the machine side, this signal (GR3S) should be read by the read-command SF which has a time delay of “t”, and the gear range should be changed. If the spindle motor must be rotated to execute gear range change, “open” the GRO.

3.After the completion of gear range changing to GR3, “open” GR3 input and then “open” SFIN (S command finish input).

4.At the time the SFIN is “opened”, a new S command is calculated and sent.

5. ..... FIN should then be “opened” when actuall spindle speed agrees with the specified spindle speed (S2000, in this example).

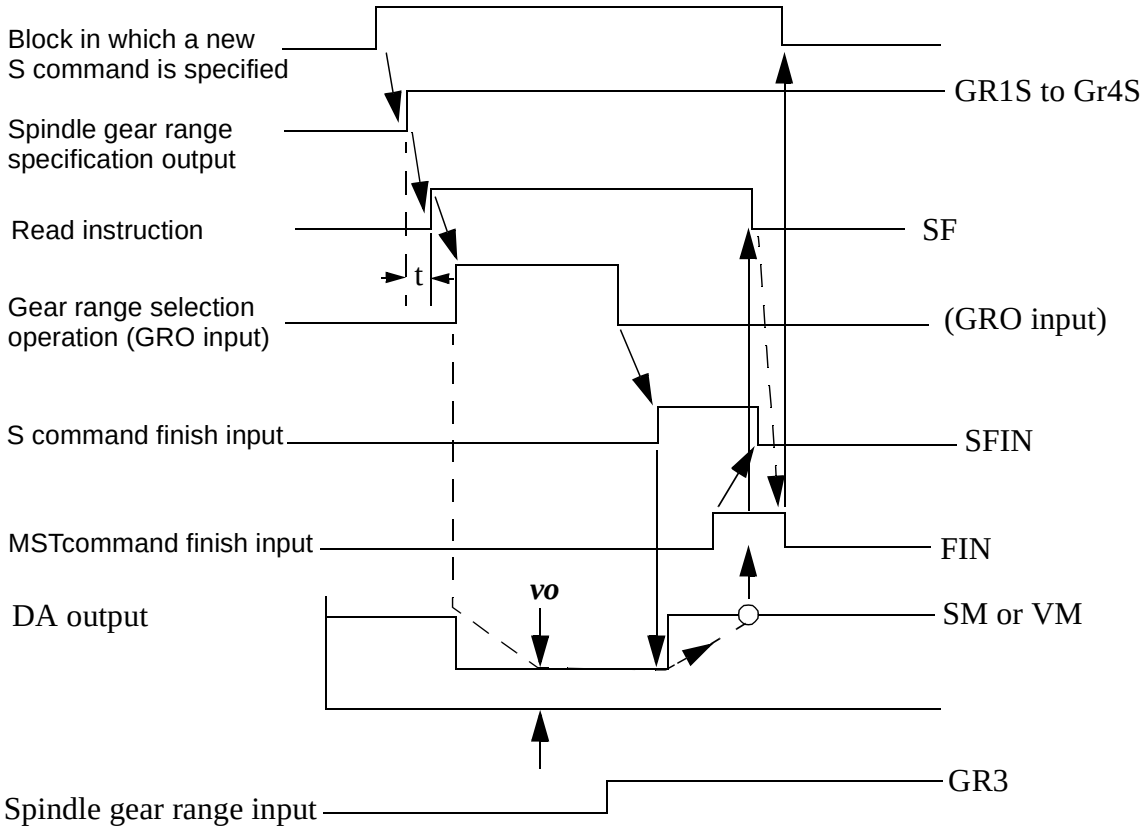


Fig. 4.9 Gear Range Selection Signal Output Timing

4.4 Gear Shift Input and Spindle Fixed Speed Input Signals

Gear Shift Input Signal	GRO	#31107
Spindle Fixed Speed Input Signal	SOR	#31106

These input signals are used to output an S command (other than the one specified) in a

part program as analog or non-contact output signal for an S5-digit command.

If GRO input is “closed”, the voltage set for parameter pm1413 is output.

If SOR input is “closed”, spindle speed set for parameter pm1412 resulting from the spindle gear range input and spindle motor speed command voltage that correspond to the gear ranges, is output.

Setting of GRO and SOR Input Signals

GRO Input	SOR Input	Analog Voltage for S5-digit Command
0	0	Voltage corresponding spindle speed specified in CNC program
0	1	Voltage set for parameter pm1412
1	0	Voltage set for parameter pm1413
1	1	Voltage set for parameter pm1413, 0 V

Note: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

IMPORTANT!

1.It is possible to invert the voltage command (analog output for GRO, SOR input) by the input of a S5-digit analog output inversion (SINV#31104) input signal.

2.The length of time in which an analog voltage value responds to the setting of the GRO and SOR inputs is less than 100msec.

4.5 Spindle Speed Agreed Input Signal

Spindle Speed Agreed Input Signal	SAGR	#31116

If the CNC specification is a S5-digit analog command or non-contact output, this input signal indicates that the spindle speed has reached the specified speed at the point where cutting starts during the execution of a part program in automatic mode.

When cutting should start (axis feed mode is changed from the positioning mode to an

interpolation mode), the CNC starts cutting after confirming that the SAGR input signal has been “closed”.

4.6 Spindle Speed Override Input Signals

Spindle Speed Override Input Signal	SPA to SPE	#31110 to #31114

If the CNC specification is a S5-digit analog command or non-contact output, the spindle speed override input signal is used to override an S-command specified in a part program in the range from 50 to 120%.

Spindle Speed Override Input Setting and Override Values

SPA Input	SPB Input	SPC Input	Override Value
1	1	1	50%
0	1	1	60%
0	1	0	70%
1	1	0	80%
1	0	0	90%
0	0	0	100%
0	0	1	110%
1	0	1	120%

Note: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

20-step override specification is optional.

Spindle Speed Override Input Setting and Override Values

SPA Input	SPB Input	SPC Input	SPD Input	SPE Input	Override Value
0	0	0	1	0	10%
0	0	1	1	0	20%

SPA Input	SPB Input	SPC Input	SPD Input	SPE Input	Override Value
0	1	1	1	0	30%
1	1	1	1	0	40%
1	1	1	0	0	50%
0	1	1	0	0	60%
0	1	0	0	0	70%
1	1	0	0	0	80%
1	0	0	0	0	90%
0	0	0	0	0	100%
0	0	1	0	0	110%
1	0	1	0	0	120%
1	0	1	1	0	130%
1	0	0	1	0	140%
1	0	0	1	0	150%
0	1	0	1	0	160%
0	1	0	1	1	170%
0	1	0	0	1	180%
0	0	0	0	1	190%
1	0	0	0	1	200%

Note: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

IMPORTANT!

In a tap cycle in the solid tap mode, spindle override is invalid if override value is fixed at 100%.

4.7 Binary S Command Input Signals

Binary S Command Input Signals	SDI0 to SD123	#36540 to #36567

These input signals are used to specify spindle speed in a 24-bit digital signal instead of analog voltage.

Note:Although the resolution of the CNC is 24 bits, the resolution is restricted by the input resolution of the spindle drive where the binary S command signal is output.

5

Coordinate Systems

Chapter 5 describes the signals related to the coordinate system.

5.1 Reference Point Return Control Input/Output Signals

Reference Point Return Input Signal	ZRN	#30070
Reference Point Return Deceleration LS	*DCX to *DC5	#30730 to #30734
Second Reference Point Return Input Signal	ZRN2	#30071
At the Reference Point Output Signal	ZPX TO ZP5	#36300 TO #36304
At the Second Reference Point Output Signal	2ZPX to 2ZP5	#36310 to #36314
At the Third Reference Point Output Signal	3ZPX to 3ZP5	#36320 to #36324
At the Fourth Reference Point Output Signal	4ZPX to 4ZP5	#36330 to #36334

These are input/output signals used for the return function which positions the axes at the pre-determined reference point when the CNC power is turned ON.

(1) Reference Point Return Methods

For the execution of the reference point return, the following methods are provided:

Grid type

High-speed type

(a) Grid type Reference Point Return

With this method, the reference point is determined by the zero-point pulse of the position encoder (1 pulse/turn).

After turning the CNC power ON, close the ZRN input with the manual jog operation mode or rapid feed mode, and move the axis in the reference point return direction. Then, the reference point return operation is executed in the sequence as shown in Fig. 5.1.

The G28 command in automatic mode is executed in the same manner as above.

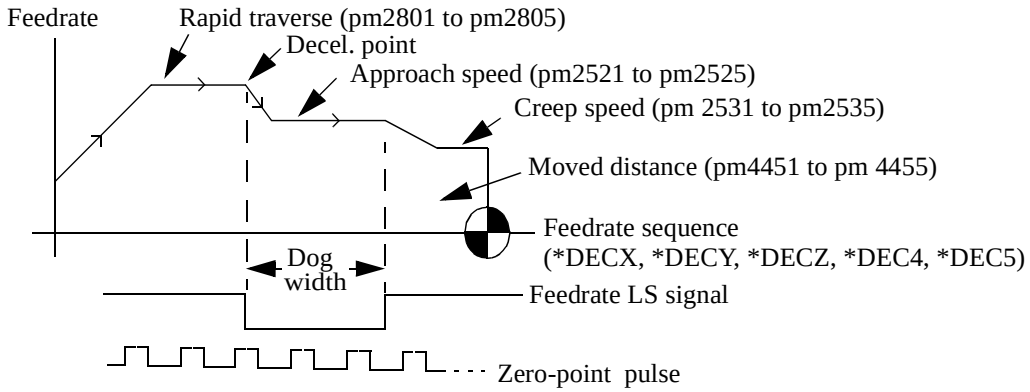


Fig. 5.1 Reference Point Return Sequence (Grid type)

(b) High-speed type reference point return

When the high-speed type (automatic, amunual) is selected, once the reference point return is executed, the second and later reference point returns are executed by the positioning mode to the reference point which is determined in the first reference point operation.

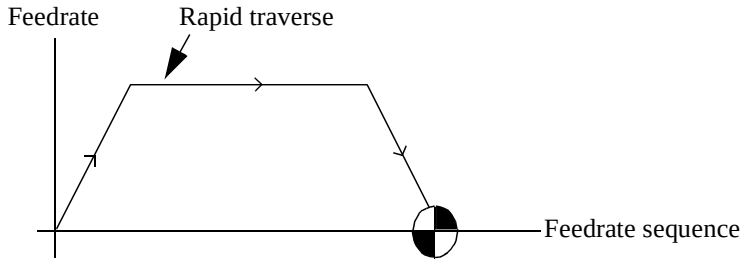


Fig. 5.2 Reference Point Return Sequence
(High-speed type, Second and Later Operation)

SUPPLEMENT

By setting parameters pm4003D6 and D7, it is possible to select the grid type for the second and later reference point return operations.

(2) Reference Point Return Signals

The reference point return signals are described as follows:

(a) Second reference point return input signal

When the second reference point is ste by the shift amount from the first reference point.

(b) At the reference point output signal

When a numerically controlled axis exists at the reference point as a result of the reference point return operation or the positioning to the reference point, the corresponding output signals (ZPX to ZP5) are closed. Note that the output signal is closed only when the corresponding axis exits in the range of $\pm$3 pulses from the reference point position.

(c) At the second reference point output signal

In the automatic operation, when an axis is positioned at the second reference point by the execution of the “G30” command in a part program, the corresponding output signals (2ZPX to 2ZP5) are closed to indicate that the axis is at the second reference point.

(d) At the third reference point output signal

In automatic operation, when an axis is positioned at the third reference point through the execution of the “G30 P3” command in a part program, the corresponding output signals (3ZPX to 3ZP5) are closed indicating that the axis is at the third reference point.

(e) At the fourth reference point output signal

In automatic operation, when an axis is positioned at the fourth reference point through the execution of the “G30 P4” command in a part program, the corresponding output signals (4ZPX to 4ZP5) are closed indicating that the axis is at the fourth reference point.

6

Operation Support Functions

Chapter 6 describes the signals related to the operation support functions

6.1 Input and Output Signals of CNC Operation Modes

(1) Operation Mode Input Signals

These input signals define the operation modes of the CNC by the programmable controller. For the CNC, the following eight (8) operation modes are provided.

RT	#30000	Manual rapid traverse mode	Manual mode
JOG	#30001	Manual jog feed mode	
H	#30002	Manual pulse handle mode	
STP	#30003	Manual skip feed mode	
MDI	#30005	Manual data input mode	Automatic mode
MEM	#30006	Memory mode	

An operation mode is determined by closing one of these input signals.

(a) RT: Manual Rapid Traverse Input Mode

When the “RT” input signal is “closed” with other “open”, the CNC enters the manual rapid traverse mode. In this mode, it controls axis feed according to the input signal of the manual feed direction and also the rapid override signal.

(b) JOG: Manual Jog Feedrate Selection Input Signals

When the “JOG” input signal is “closed” with other inputs “open”, the CNC enters the manual jog feed mode. In this mode, it controls axis feed according to the input signal of the manual feed direction.

(c) H: Pulse Handle Mode Input

When the “H” input signal is “closed” with other inputs “open”, the CNC enters the pulse handle mode. In this mode, it controls axis feed according to axis selection and the multiply setting signals by operation of the manual pulse generator.

(d) STP: Manual Step Feed Mode Input

When the “STP” input signal is “closed” with other inputs “open”, the CNC enters the tape mode. In this mode, operation using CNC tape which is read by the tape reader is enabled.

By setting the appropriate parameter, it is possible to input a part program from the RS-232C interface instead of using the tape reader.

(e) MDI: Manual Data Input Mode
When the “MDI” input signal is “closed” with other inputs “open”, the CNC enters the MDI mode. In this mode, operation using a part program entered by the manual data input operation is enabled.

(f) MEM: Memory Mode Input

When the “MEM” input signal is “closed” with other inputs “open”, the CNC enters the memory mode. In this mode, operation by using a part storage program stored in the CNC part program memory is enabled.

(2) Operation Mode Output Signals

The operation mode output signals indiacte the present CNC mode.

Manual Mode Output Signal	MAN	#35010
Automatic Mode Output Signal	AUTO	#35011

(a) MAN: Manual Mode Ouput

This signal is output when the CNC is in any of the following states:

H (handle mode)
STP (manual step mode)
JOG (manual jog mode)
RT (rapid feed mode)

(b) AUTO: Automatic Mode Output

This signal is output when the CNC is in any of the following states:

TP (tape mode)
MEM (memory mode)
MDI (manual jog mode)
EDT (program edit mode)

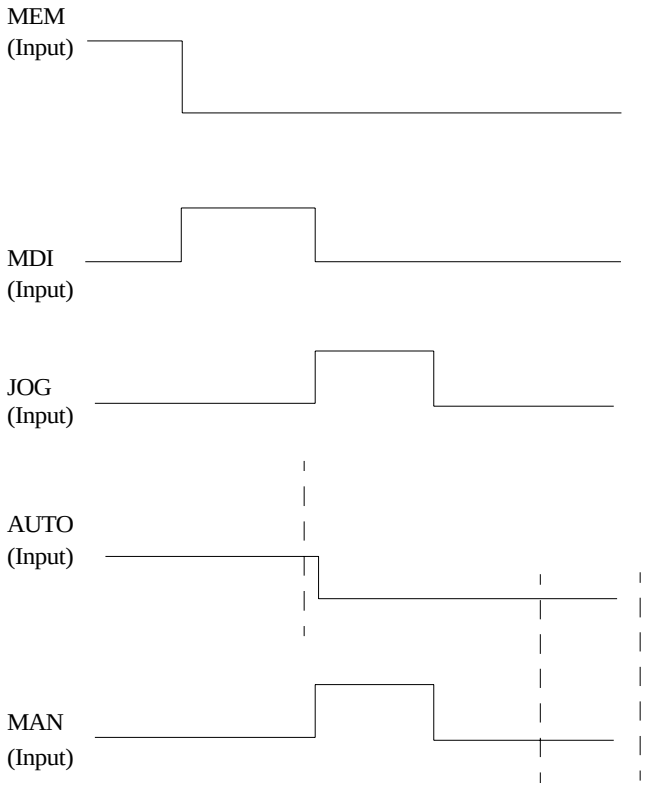


Fig. 6 Time Chart of Operation Mode Input and Output Signals

(3) Supplements to Operation Mode Input/Output Signals

The items that must be taken into consideration concerning the operation mode input/output signals are indicated below:

1. If an operation mode input signal other than manual mode input signals is given during the memory mode operation, the CNC stops execution of a part program after the completion of the block presently being executed.

   This is also true during a part program execution in the tape or MDI mode.

2. If a manual mode input signal is given during the execution of a part program in the memory mode, the following occurs:

   • Axis movment commands

The axes are decelerated and stopped, then the program is interrupted. The remaining axis movement commands can be continuously executed by turning the automatic start (ST) input signal ON after returning to the automatic mode.

- M, S and T commands

  These commands are processed depending on the setting for pm4009D7 (forced FIN mode selection).

  pm4009D7=0 (forced FIN mode set)
  Both the sampling output (MFB to MFE) and the M code output are turned OFF, and the M S and/or T command is assumed to have been completed. Therefore, the interrupted M, S and/or T commands is not output even when an automatic mode is recovered. SPL indicator is not lit.

  pm4009D7=1 (forced FIN mode not set)
  The M, S and/or T command is saved and the SPL indicator is lit.

3. If an automatic mode input signal or program edit mode input signal is given while an axis is moved in a manual mode, the axis is decelerated and stopped.

4. An operation mode input is valid if only one of the input signals is “closed”. Under other status conditions, the previously selected operation mode remains valid.

   If there is no operation mode input signal or if more than one operation mode input signal is given after the power is turned ON, the PCNC enters the manual jog feed mode.

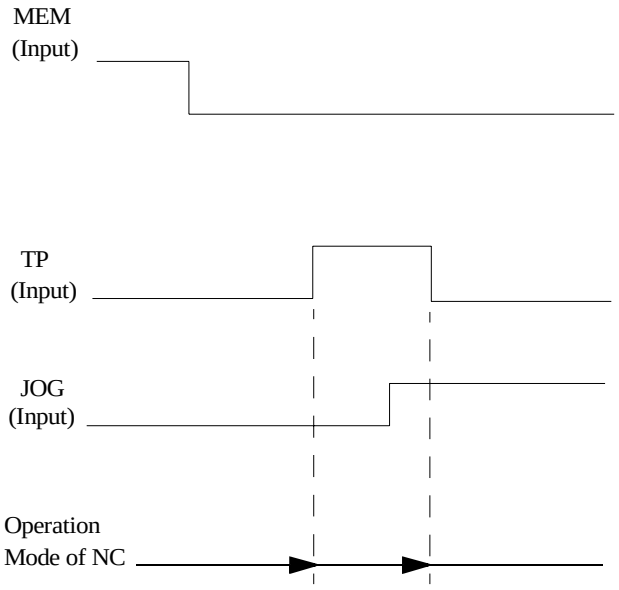


Fig. 6.2 Operation Mode Input Signal

5. If a manual operation mode input signal is given while a tapping cycle is executed in automatic mode, the automatic mode is maintained until thread cutting is completed.

(4) System Number Switch Monitor Output Signals

The status (0 to F) of the rotary switch “SW2” on the JCP01 board is output by the system number switch monitor output signal.

CAUTION

The rotary switch SW2 defines the CNC operation and must not be changed without consulting your Yaskawa representative, or the machine tool builder.

System Number Switch Functions Table

#35023 to #35020	Rotary Switch Setting	Function	ROM Check	Watchdog	Remarks
0000	0	Normal operation	✓	✓	With ladder debug function
0001	1	End user parameter change mode	✓	✓	With ladder debug function
0010	2	Standard/option parameter change mode	✓	✓	With ladder debug function
0011	3	Not used			
0100	4	Ladder program exit mode	✓	✓	With ladder debug function
0101	5	Not Used			
0110	6	Not Used			
0111	7	Not Used			
1000	8	On-line maintenance mode			These positions must not be selected since they call the modes on for Yaskawa.
1001	9	Software debug mode 1	✓		
1010	A	Software debug mode 2			
1011	B	Running test mode	✓	✓	
1100	C	PCB test mode	✓		
1101	D	Not used			
1110	E	Operation to check contents in memory			
1111	F	Total make made (for maintenance)			

Note: Rotary switch settings 8 through F are for the Yaskawa Mode.

6.2 Manual Jog Feedrate Selection Input Signal

Manual Jog Feedrate Selection Input Signal	JV1 to JV16	#30020 to #30024

These signals determine feedrate for manual jog feed operation.

The manual feedrate is also used for the feedrate when executing a part program in automatic mode with the dry run function set ON.

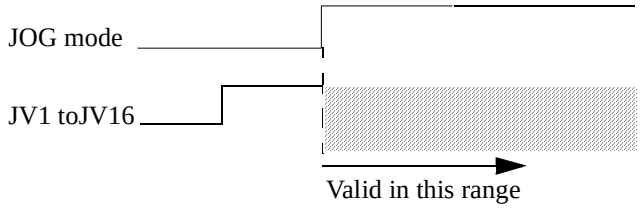


Fig. 6.3 Manual Jog Feedrate Time Chart

Manual Jog Feedrate Table

JV1	JV2	JV4	JV8	JV16	Jog Feedrate (Manual Mode)
0	0	0	0	0	Feedrate set for pm2400
1	0	0	0	0	Feedrate set for pm2401
0	1	0	0	0	Feedrate set for pm2402
0	1	0	0	0	Feedrate set for pm2403
0	0	1	0	0	Feedrate set for pm2404
1	0	1	0	0	Feedrate set for pm2405
0	1	1	0	0	Feedrate set for pm2406
1	1	1	0	0	Feedrate set for pm2407
0	0	0	1	0	Feedrate set for pm2408
1	0	0	1	0	Feedrate set for pm2409
0	1	0	1	0	Feedrate set for pm2410
1	1	0	1	0	Feedrate set for pm2411
0	0	1	1	0	Feedrate set for pm2412
1	0	1	1	0	Feedrate set for pm2413
0	1	1	1	0	Feedrate set for pm2414
1	1	1	1	0	Feedrate set for pm2415
0	0	0	0	1	Feedrate set for pm2416
1	0	0	0	1	Feedrate set for pm2417

JV1	JV2	JV4	JV8	JV16	Jog Feedrate (Manual Mode)
0	1	0	0	1	Feedrate set for pm2418
1	1	0	0	1	Feedrate set for pm2419
0	0	1	0	1	Feedrate set for pm2420
1	0	1	0	1	Feedrate set for pm2421
0	1	1	0	1	Feedrate set for pm2422
1	1	1	0	1	Feedrate set for pm2423
0	0	0	1	1	Feedrate set for pm2424
1	0	0	1	1	Feedrate set for pm2425
0	1	0	1	1	Feedrate set for pm2426
1	1	0	1	1	Feedrate set for pm2427
0	0	1	1	1	Feedrate set for pm2428
1	0	1	1	1	Feedrate set for pm2429
0	1	1	1	1	Feedrate set for pm2430
1	1	1	1	1	Feedrate set for pm2431

Note: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

SUPPLEMENT

For a rotary axis, jog feedrate can be set 1/10 of the feedrate applied for a linear axis by setting the parameter as indicated below.

pm2000 D7=0: Feedrate set for pm2400 to 2431 are applied to both linear and rotary axes.
pm2000 D7=1: For a rotary axis, 1/10 of the feedrate set for pm2400 to pm 2431 is applied.

6.3 Manual Pulse/Step Multiplication Ratio Setting Input Signals

Manual Pulse/Step Multiplication Ratio Setting Input Signal	MP1 to MP4	#30025 TO #30027

These signals determine axis feed amount per step when the PCNC is in the manual handle or manual step feed mode.

Manual Handle/Step Multiplication Ratio Setting Table

MP1	MP2	MP4	Manual Step Feed	Manual Handle Feed
0	0	0	1 pulse/step	
1	0	0	10 pulses/step	
0	1	0	100 pulses/step	
1	1	0	1000 pulses/step	100 pulses/step
0	0	1	10000 pulses/step	100 pulses/step
1	0	1	100000 pulses/step	100 pulses/step
0	1	1	Do not set	
1	1	1		

Note: The status of signals is indicated by “0” or “1”.

0 : Open

1 : Closed

6.4 Automatic Operation Start/Stop Input Signals and Running/Stopped Output Signals

Automatic Operation Start Input Signal	ST	#30030
Automatic Operation Stop Input Signal	*SP	#30031
Running Output Signal		#35370
Stopped Output Signal		#35371

(1) Automatic Operation Start Input Signal

By “closing” and the “opening” the ST input signal when the tape, memory, MDI or edit mode is selected for PCNC operation, the PCNC starts automatic operation to execute a part program. At the same time, it turns the running STL output signal ON.

Note that input of the ST signal is ignored in the following states:

- The PCNC is in an alarm state. (alarm output or input error signal is ON).
- Automatic operation stop “*SP” input is “opened”.
- External reset “ERS” input is “closed”.
- The RESET button on the operation panel is “closed”.
- Emergency stop “*ESP” is not closed.
- STL signal is output during automatic operation.

(2) Automatic Operation Stop Input Signal

After start of automatic operation, the PCNC completes automatic operation and turns the automatic start (STL) output signal OFF when any of the following states is satisfied.

- In the MDI mode, execution of a part program is completed by the manually input data.
- Execution of one block of a part program is completed with the single-block (SBK) input is “closed”.
- The end of a program (EOP) input is “closed” by the execution of an M command in a part program.

(3) Running Output Signal

If the automatic operation stop input “SP” is “opened” during auomatic operation, axis movement, etc. is interrupted and the running ouput signal “STL” is opened. Then, the stopped output signal “SPL” is closed.

The input of automatic operation stop signal is ignored if it is input in the following state.

- While a thread cutting block is being executed.

(4) Stopped Output Signal

If the automatic operation start input “ST” is “closed” and then “opened” with the automatic operation stop input “*SP” closed, the stopped output “SPL” is opened and automatic operation is restarted.

The running ouput “STL” is closed.

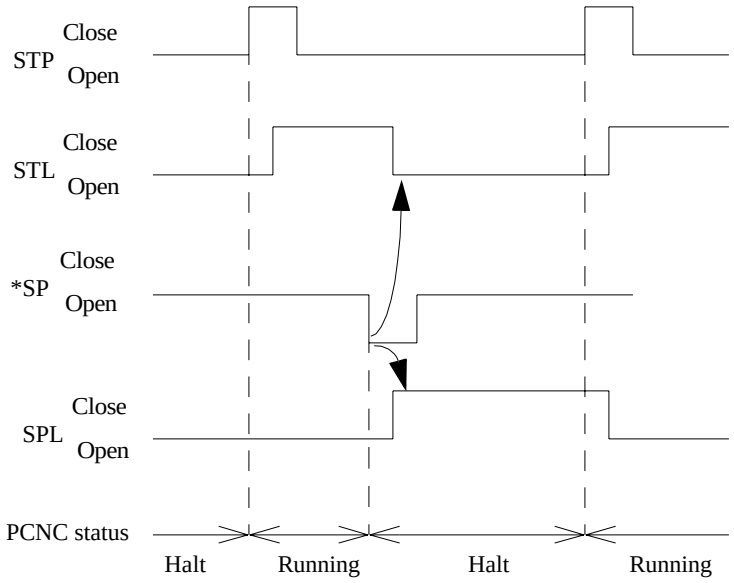


Fig. 6.4 Time Chart of ST and *SP Input Signals and STL and SPL Output Signals

IMPORTANT

1. The automatic operation start (ST) and automatic stop (*SP) input signals must be “closed” or “opened” for more than 100msec. If it is less than 100 msec., such input signals may be ignored.

2. If automatic operation stop (*SP) input signal is “closed” in the state where the CNC is waiting for the completion of M,S,T or B commands (waiting for “FIN” input), the automatic stopped (SPL) output signal is turned ON. If M,T or B command complete (FIN) input signal is “opened”, the PCNC enters the automatic operation stopped state.

3. The STL is opened in the single-block stop state.

4. The STL stays closed in the alarm state (ALM).

6.5 Single-Block Input Signal

Single-Block Input Signal	SBK	#30060

This input signal is used to execute a part program block by block in automatic operation. When the PCNC is in the automatic mode with SBK input signal “closed”, if automatic operation is started, the PCNC executes one block of a part program and stops, the closes the STL (running, #35370) output signal.

If the SBK input signal is “closed” during the execution of a part program, the PCNC stops after the completion of the block presently being executed.

6.6 Manual Absolute Input Signal

Manual Absolute Input Signal	ABS	#30061

(1) When the Absolute Input Signal is “Open”

Tool path of a part program executed continuously in automatic mode after manual interruption of axis movement is shifted by the manually moved distance.

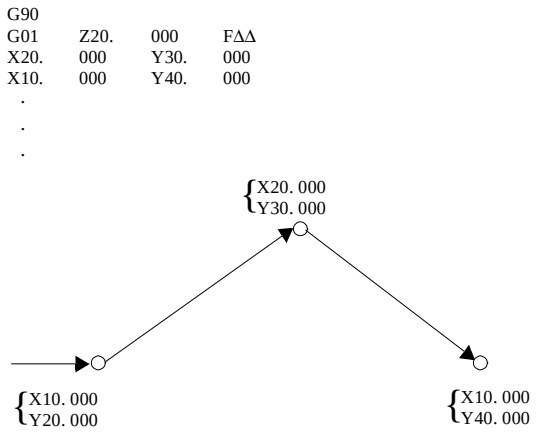


Fig.6.5 Tool Path in Automatic Mode Operation

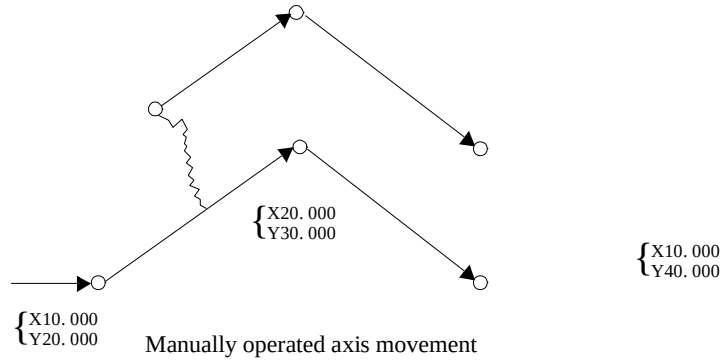


Fig.6.6 Tool Path after Manual Interruption (ABS Input Signal “Open”)

(2) When the ABS Input Signal is "Closed"

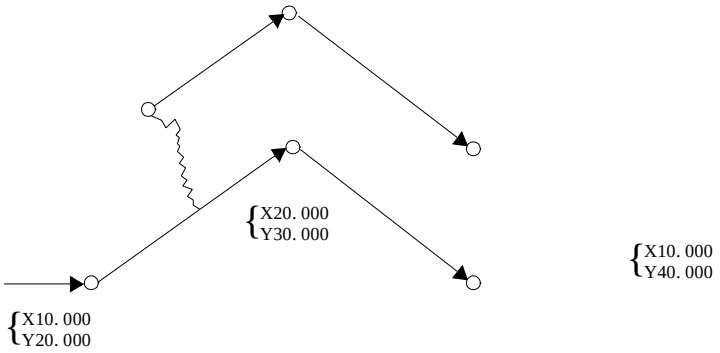


Fig.6.7 Tool Path with ABS Input Signal "Closed"

6.7 Display Lock Input Signal

Display Lock Input Signal	DLK	#30062

This input signal is used to prevent output of the PCNC to the external position display.

If the DLK input signal is "closed", although axis movement is executed (both in automatic and manual modes), the position data pf the external position display (CRT, POS display "EXTERNAL") are not updated.

6.8 Program Restart Input Signal

Program Restart Input Signal	PRST	#30063

This signal is used to restart machinig from a designated point in a part program.

After "closing" the PRST input signal, select the memory mode and search the number for program restart at the PCNC operation panel.

The M,S and T codes existing in the blocks from start of the part program to the specified sequence number are displayed on the screen.

6.9 Dry Run Input Signal

Dry Run Input Signal	DRN	#30064

The input signal uses the manual jog feedrate selection input signals (JV1, JV2, JV4, JV8, JV16) for the execution of a part program in automatic mode.

When a part program is executed in automatic mode with the DRN input signal “closed”, axis feed is executed not by the feedrate specified in the part program but by the feedrate defined by the manual jog feedrate selection input signals.

If the DRN input signal changes from “open” to “close” or from “closed” to “open” while the PCNC isexecuting automatic operation, feedrate is changed according to the selected feed mode as indicated below:

- In the “mm/rev” mode: The feedrate is not changed for the block presently executed.
- In the “mm/min” mode: The feedrate is changed even during the execution of commands in a block.

Note: During the execution of a tapping cycle, the feedrate is not changed during the execution of commands in a block and a new feedrate becomes valid after the completion of the commands in the block.

Concerning a rapid feed, whether the rapid feedrate or jog feedrate is used can be selected by the setting for a parameter. If rapid feedrate is selected, rapid feedrate override function is not valid.

The acceleration/deceleration time constant is not influenced by whether or not the dry run is turned ON.

<Parameters>

- Dry run internal toggle switch ON/OFF pm0000 D3
- Valid/invalid dry run for rapid feed pm2000 D0

6.10 Machine Lock Input Signal

Machine Lock Input Signal	MLK	#30066
Axis-dependent Machine Lock Input Signal	AMLKX to AMLK5	#30840 to #30844

The machine lock input signal is used to prevent output of the output pulses of the PCNC to servo units.

The machine lock function is used to check a new program without actually moving the axes.

When the MLK input signal is “closed”, although the logic circuit distributes pulses, the axes are not moved (both in automatic and manual mode operations).

Since the logic circuit distributes pulses, the position data is updated as the axis move commands are executed.

To change the status of the MLK input signal from “closed” to “opened” or from “opened” to “closed”, the PCNC must be stopped. In other words, if the MLK input signal status should be changed, the PCNC must be in the Block Stop state or Feed Hold state. If it is changed when the PCNC is in other states, attempted change is ignored.

By using the AMLKX(#30840) to AMLK5(#30844) input signals, the machine lock function can be called for the individual axes.

If the MLK input signal is “closed” during single-block mode operation, the machine lock function becomes valid after the block stops.

6.11 Auxiliary Function Lock Input Signal

Auxiliary Function Lock Input Signal	ALK	#30067

The auxiliary function lock input signal is used to omit the execution of the M,S,T and B functions for the execution of a part program in automatic mode.

If the AFL input signal is “closed”, the PCNC ignores the M,S,T and B commands specified in a part program. The code/decode output sugnals (M00R, M01R, M02R and M30R) are output, however. Analog D/A signal is also output to the spindle.

If the AFL input signal status is changed from “opened” to “closed” or from “closed” to “opened” during the execution of a part program, the program is executed according to the selected AFL input signal state from the block next to the one currently being executed.

6.12 Edit Lock Input Signal

Edit Lock Input Signal	EDTLK	#30072

The edit lock input signal protects part programs stored in the PCNC part program memory from being altered.

When the EDTLK input signal is “closed”, key operation of the [INSET], [ALTER] and [ERASE] keys, and the data storing opertion are ignored.

If program edit operation is attempted in this state, the following warning message is displayed: “EDIT LOCK!”

6.13 Automatic Mode Handle Offset Input Signal

Automatic Mode Handle Offset Input Signal	HOFS	#30081

When the HOFS input signal is “closed”, axis movement generated by the pulse handle can be overlapped with the axis movement executed in the automatic operation.

The axis for which overlapping of axis movement by the pulse handle is the one which selected by the pulse handle feed axis selection input signal. Axis movement distance per pulse can be changed by setting the multiplication ratio setting switch.

IMPORTANT!

1. Axis movement by the automatic mode handle offset function is always valid even during block stop or when a block which does not include axis movement commands is executed.

2. If the axis interlock input (*ITX to *IT5) signal is “closed”, axis movement by the automatic mode handle offset function is not possible.

6.14 Interruption Point Return Input Signal

Interruption Point Return Input Signal	CPNR	#30082

By moving axes manually after interrupting automatic operation to remove chips or performing measurements, close the CPRN input signal and then the manual axis feed direction selection input signal in the direction the axis can move to the point where operation was interrupted, and the axis returns to the operation interrupted point.

Note that if the reference point return input or the second reference point return input signal is “closed”, the axis does not return to the operation interrupted point, but returns to the reference point or to the second reference point.

6.15 Optional Stop Input Signal

Optional Stop Input Signal	OPT	#30406

The optional stop input signal determines whether or not the M01 command should be executed in automatic operation mode (tape, memory, MDI).

- ON: After the execution of the block that includes M01, the PCNC stops with the automatic operation start (ST) input signal “closed”. This is “opened” when the FIN signal input is returned. Suspended operation restarts when the ST signal is “open”.
- OFF: The M01 command is ignored.

The OPT input signal is invalid for the block presently executed. If it is given during automatic operation, it becomes valid from a newly read block.

6.16 Axis Disconnection Designation Input Signals

Axis Disconnection Designation Input Signals	DTCH4 to DTCH5	#30833 TO #30834

By using the axis disconnection designation input signals, it is possible todisconnect the fourth and fifth axes.

For the disconnected axies, an alarm is ignored if it occurs to the disconnected axis; the result is the sam as in the machine lock state.

IMPORTANT!

1. Axis disconnection operation must be executed only after the servo power is turned OFF. When the axis disconnection designation input signal (DTCH4, DTCH5) is “closed” with the servo power ON, the alarm output signal (ALM) is “closed”.

2. When re-installing an axis which has been disconnected, the power must be OFF and then ON again.

3. When disconnecting an axis, disconnect the cable between the AC SERVOPACK (lamp) and the AC servomotor.

4. If the servo power is turned ON (after turning the servo power ON with an axis disconnected), the alarm output signal (ALM) is “closed”.

5. For disconnected axes, overtravel input signals (*+4 to*+5,*-4 to*-5) are not detected.

6. For disconnected axes, servo power is not turned OFF. Therefore, the servo ON signals (SVOF4 to SVOF5) are valid for such axes.

7

Programming Support Functions

Chapter 7 describes the signals related to the programming suport functions.

7.1 Time Count Input Signals

Time Count Input Signals	EXTC	#30051

The time count input signal is used to operate the external timer for displaying operating time while it is “closed”.
The external time counts the duration while the input signal is “closed”.

How the accumulated time is reset differs according to the parameter setting.

Parameter No.	Bit No.	Description
pm3007	D4	0: The timer value is reset when the [0 CLR] softkey, on the operation time screen, is pressed. 1: The timer value is reset when this signal state changes from the “opened” state to the “closed” state. It is possible to reset the accumulated timer data by using the Reset Button on the Run | Timers screen.

7.2 Optional Block Delete Input Signals

Optional Block Delete Input Signals	BDT	#30405
	BDT2 to BDT9	#30420 to #30427

The optional block delete input signal (BDT) determines whether or not the information between the slash code (/) and the end of block code (EOB) in the block in which the slash code is specified is valid. See Table 7.1.

The signal is valid in the memory, tape and MDI modes.

Table 7.1 Optional Block Delete Input Signals and the Information to be Ignored

Signal	Information to be Ignored
BDT input signal is “closed”	From “/” or “/1” to “EOB”
EDT2 input signal is “closed”	From “/2” to “EOB”
EDT3 input signal is “closed”	From “/3” to “EOB”
EDT4 input signal is “closed”	From “/4” to “EOB”
EDT5 input signal is “closed”	From “/5” to “EOB”
EDT6 input signal is “closed”	From “/6” to “EOB”

Signal	Information to be Ignored
EDT7 input signal is “closed”	From “/7” to “EOB”
EDT8 input signal is “closed”	From “/8” to “EOB”
EDT9 input signal is “closed”	From “/9” to “EOB”

IMPORTANT!

1. The part program information is ignored only when the part program is executed. Accordingly, this optional block delete input signal does not have influence when storing part programs into the CNC part program memory.

2. Whether the information is treated as significant information or ignored is determined by the status of the optional block delete input signal does not have influence when storing part programs into the CNC part program memory.

   Therefore, if the optional block delete input signal status should be controlled by the external circuit using the auxiliary function, attention must be paid so that the status of the input signal is established before the block containing the “/” code is stored into the buffer area.

3. If more than one optional block delete code is specified in one block, it is treated as follows:

   Example: When BDT3 input signal is “closed”

   /G01 /2 X____/3 Y____/4 Z____/5 F____;

   Significant information — insignificant information

4. For a macro program, the optional block delete function cannot be used.

7.3 Optional Block Delete Input Rewind Input Signals, and Rewinding Output Signal

End of Program Input Signal	EOP	#30410
Rewind Input Signal	RWD	#30411
Rewinding Output Signal	RWDS	#35376

(1) End of Program and Rewind Input Signals

These signals determine the processing to be taken by the CNC when the M02 or M30 command is executed.

Processing by the CNC is determined by the status of the EOP and RWD input signals when the FIN input signal (the complete input for M02 or M30) is closed.

Status of EOP and RWD Input Signals and Corresponding CNC Processing Table

EOP	RWD	Processing
1	1	Rewinds the part program and executed program reset. After that the CNC enters the halt state.
1	0	After exceuting program reset, the CNC enters the halt state.
0	1	After rewinding the program, the CNC enters the halt state
0	0	The CNC enter the halt state.

IMPORTANT!

When the “program reset” is executed, the resetting output signal RST is maintained “closed” for one second.

(2) Rewinding Output Signal

This output signal indicated that a part program is being rewound.

While a part program is rewound by the RWD input signal, in response to the M02 or M30 command, the RWDS output signal remains “closed”.

TERMINOLGY

- Program Reset

The “program reset” is basically the same as the reset operation executed by pressing the [RESET] soft-key on the PCNC Operation Panel or the reset operation executed in response to the “closing” of the external reset [ERS] input signal. With the “program reset”, however, the CNC memory rewind is not executed. For details of the reset operation, refer to “Safety and Maintenance Functions” Section 2 of Chapter 10.

7.4 System Variables for Interface Input/Output Signals

Interface Input Signal	U10 to U131	#30460 to #30497
Interface Output Signal	UO0 to UO31	#35400 to #30437

(1) System Variables for Interface Input Signals

By entering a system variable for interface signals at the right part of an operation expression, the ON/OFF state of 32-point input signals special for macro programs are read. The relationship between the input signals and the system variables is indicated in Table 7.3.

Interface Input Signals and System Variables Table

System Variable	#1007	#1006	#1005	#1004	#1003	#1002	#1001	#1000
Input Signal	UI7 2^7	UI6 2^6	UI5 2^5	UI4 2^4	UI3 2^3	UI2 2^2	UI1 2^1	UI0 2^0
System Variable	#1015	#1014	#1013	#1012	#1011	#1010	#1009	#1008
Input Signal	UI15 2^{15}	UI14 2^{14}	UI13 2^{13}	UI12 2^{12}	UI11 2^{11}	UI10 2^{10}	UI9 2^9	UI8 2^8
System Variable	#1023	#1022	#1021	#1020	#1019	#1018	#1017	#1016
Input Signal	UI23 2^{23}	UI22 2^{22}	UI21 2^{21}	UI20 2^{20}	UI19 2^{19}	UI18 2^{18}	UI17 2^{17}	UI16 2^{16}
System Variable	#1031	#1030	#1029	#1028	#1027	#1026	#1025	#1024
Input Signal	UI31 2^{31}	UI30 2^{30}	UI29 2^{29}	UI28 2^{28}	UI27 2^{27}	UI26 2^{26}	UI25 2^{25}	UI24 2^{24}

- The values read by the system variables indicated in Table 7.3 are either “1.0” or “0.0” depending on whether the corresponding input signal is ON or OFF.

Variable Value Table

Input Signal	Variable Value
ON	1.0
OFF	0.0

- By entering system variable #1032 in the right part of the operation expression, it is possible to read the ONN/OFF state of the 32 points of the input signals (UI0 to UI31) collectively in a positive decimal value.

$$\#1032 = \sum_{i=o}^{31} \#[1000 + i] \times 2^{1}$$

- It is not possible to substitute a numeric value by entering system variables #1000 to #1030 in the left part of the operation expression.

(2) System Variables for Interface Output Signals

By entering a system variable for interface signals at the left part of an operation expression, the ON/OFF state of 32-point input signals special for macro programs are set. The relationship between the output signals and the system variables is indicated in following table.

Interface Output Signals and System Variables Table

System Variable	#1107	#1106	#1105	#1104	#1103	#1102	#1101	#1100
Input Signal	UO7 2^7	UO6 2^6	UO5 2^5	UO4 2^4	UO3 2^3	UO2 2^2	UO1 2^1	UO0 2^0
System Variable	#1115	#1114	#1113	#1112	#1111	#1110	#1109	#1108
Input Signal	UO15 2^{15}	UO14 2^{14}	UO13 2^{13}	UO12 2^{12}	UO11 2^{11}	UO10 2^{10}	UO9 2^9	UO8 2^8
System Variable	#1123	#1122	#1121	#1120	#1119	#1118	#1117	#1116
Input Signal	UO23 2^{23}	UO22 2^{22}	UO21 2^{21}	UO20 2^{20}	UO19 2^{19}	UO18 2^{18}	UO17 2^{17}	UO16 2^{16}
System Variable	#1131	#1130	#1129	#1128	#1127	#1126	#1125	#1124
Input Signal	UO31 2^{31}	UO30 2^{30}	UO29 2^{29}	UO28 2^{28}	UO27 2^{27}	UO26 2^{26}	UO25 2^{25}	UO24 2^{24}

- By setting either “1.0” or “0.0” to the system variables indicated in the following table , the coorresponding output signals are output either in “ON” or “OFF” according to the set value.

Variable Value Table

Output Signal	Variable Value
ON	1.0
OFF	0.0

If a value other than “1.0” or “0.0” is set for #1100 to #1131, it is treated as indicated below:

<empty> or a value smaller than 0.5	0.0
Other than above	1.0

- By entering system variable #1132 in the left part of the operation expression, it is possible to output the ONN/OFF state of the 32 points of the output signals (UO0 to UO31) collectively.

$$\#1132 = \sum_{i=o}^{31} \#[1100 + i] \times 2$$

- It is possible to read the ON/OFF state (1.0, 0.0, positive decimal value) of the last signals output by entering system variables #1100 to #1130 in the right part of the operation expression.

7.5 Mirror Image Input Signals

Mirror Image Input Signal	MIX to MI5	#30820 to #30824

The mirror image inoput signal reverses the direction of axis movements in automatic operation.

When a part program is executed with any of MIX to MI5 input signals “closed” in automatic operation, the direction of axis movement of the corresponding axis (X-axis to 5th axis) is revered from the direction specified in the part program.

IMPORTANT

1. The mirror image input signals do not have influence on axis movement executed in manual mode.
2. In the M95 mode, designation of mirror image application cannot be changed. The axes specified at the entry to the M95 mode remain valid until the mirror image mode is cancelled by M94.

7.6 Canned Cycle Operation Status Monitor Output Signals

Canned Cycle Output Signal	G80S	#35390
Tapping Cycle Output Signal	G84S	#35391
Tapping Output Signal	TAP	#35392

When a canned cycle is executed, the following monitor signals are output. During the execution of a canned cycle, spindle rotation is controlled by the M codes.

(1) Canned Cycle Output Signal (G80S)

When a canned cycle is started, the canned cycle output signal (G80S) is ouput within 8 msec after the start of the canned cycle. The canned cycle (G80S) is “opened” at the canned cycle cancel block.

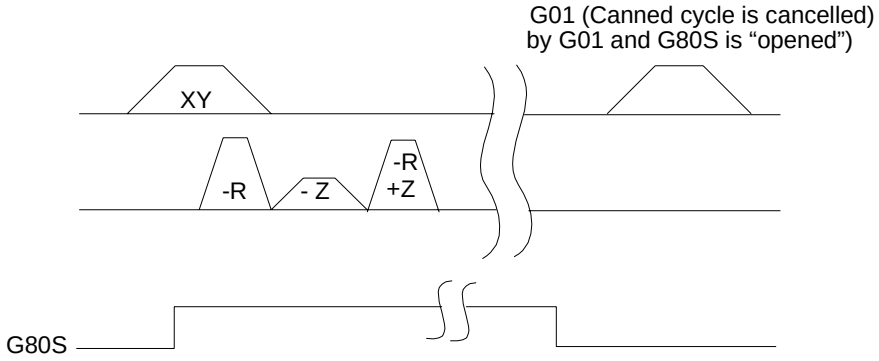


Fig. 7.1 Canned Cycle Output Signal (G80S)

(2) Tapping Cycle Signal (G84S)

When a tapping cycle (G74,G84) is started, the tapping cycle output signal (G84S) is output within 8 msec after the start of the tapping cycle. The tapping cycle output signal (G84S) is “closed” at the tapping cycle cancel block.

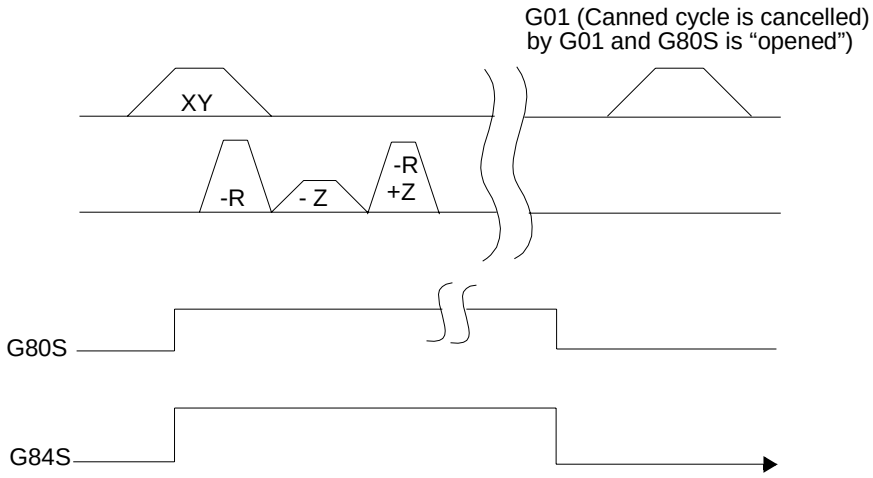


Fig. 7.2 Tapping Cycle Output Signal (G84S)

(3) Tapping Output Signal (TAP)

This output signal indicates that the CNC is executing tapping during the execution of a part program in automatic operation.

The tapping output signal is output within 8 msec after the start of cutting from R-point level to Z-point level. The signal is “opened” at the completion of cutting from Z-point level to R-point level.

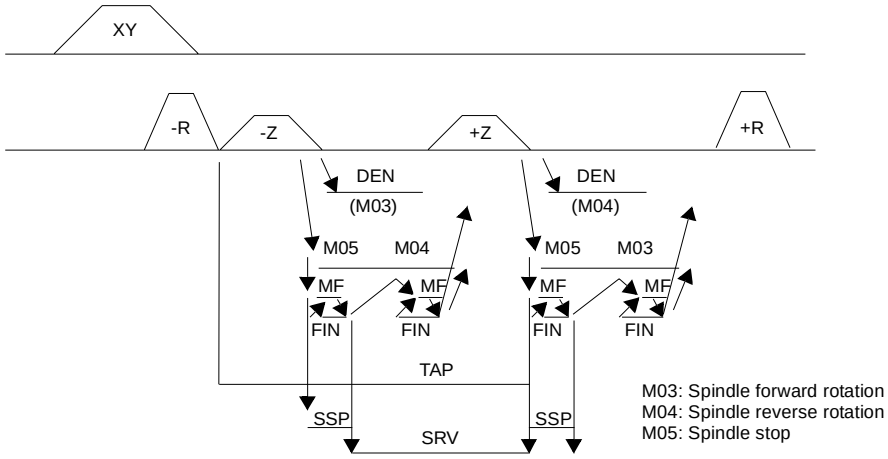


Fig. 7.3 Time Chart (G74, G84 Cycle)

SUPPLEMENT

It is possible to omit M05 by setting an appropriate parameter.

(4) M Codes in a Canned Cycle

During the execution of a canned cycle, the M codes are output as shown in time charts shown below.

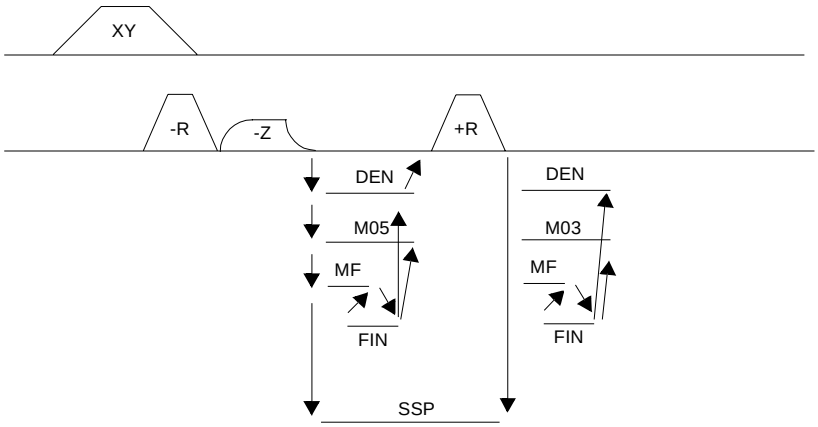


Fig. 7.4 Time Chart (G86 to G88)

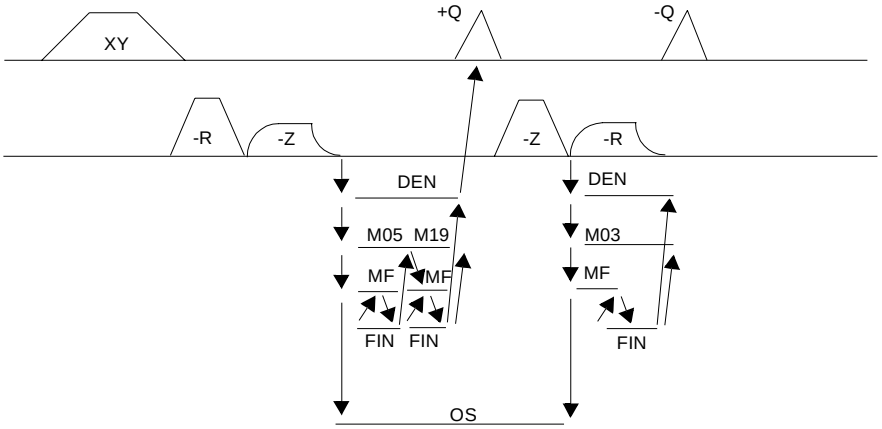


Fig. 7.5 Time Chart (G76)

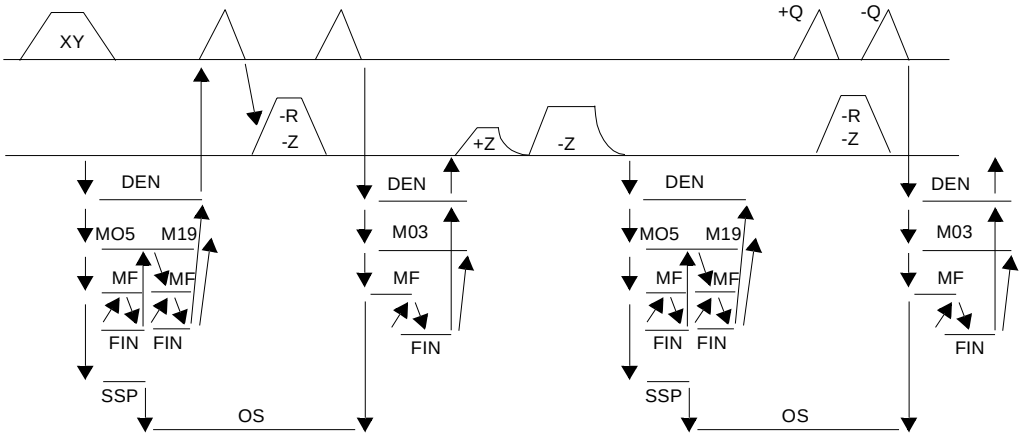


Fig. 7.6 Time Chart (G77)

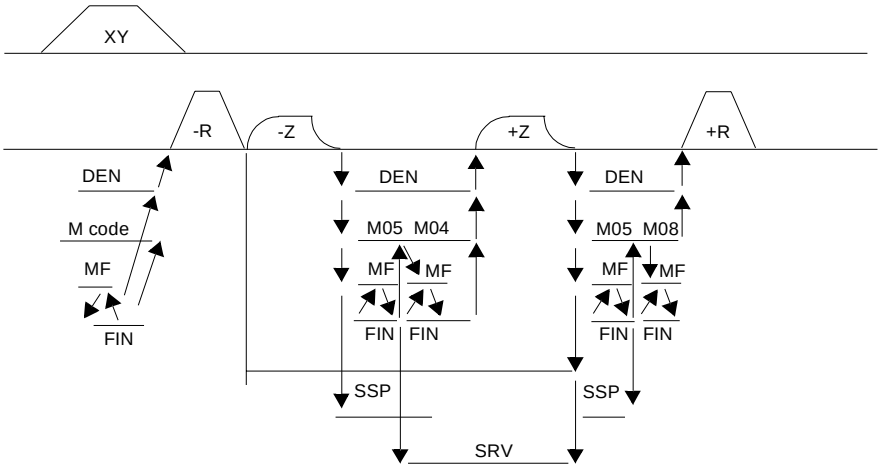


Fig. 7.7 Time Chart (M Code Specified during Canned Cycle)

If an M code is specified during the execution of a canned cycle, it is processed as indicated below.

8

Machine Support Function

Chapter 8 describes the signals related to the machine support function.

8.1 Internal Toggle Switch Monitor Output Signals

The status of the setting parameters can be output to the I/O variables to be read by the programmable controller. The relationship between the parameters and the addresses of the I/O variables is as shown in the following tables.

Setting Parameter #0000 and the Output Signals

Setting Parameter No.		Output Signal
#0000		
D0: SBKT	Single block switch	#35150 (SETS SBK)
D1: MLKT	Machine lock switch	#35156 (SETS MLK)
D2: DRNT	Dry run switch	#35154 (SETS DRN)
D3: BDTT	Block delete switch	#35382 (SETS BDT)
D4: ABST	Manual absolute switch	#35151 (SETS ABS)
D5: AFLT	Auxiliary function lock switch	#35157 (SETS AFL)
D6: DLKT	Display lock switch	#35152 (SETS DLK)
D7: INHET	Edit lock switch	#35162 (SETS EDLK)

Setting Parameter #0001 and the Output Signals

Setting Parameter No.		Output Signal
#0001		
D0: OPST	Optional stop switch	#35383 (SETS OPT)
D1: STLKT	Start lock switch	#35176 (SETS STLK)
D2: ZNGT	Z-axis neglect switch	#35175 (SETS ZNG)

Setting Parameter #0005 and the Output Signals

Setting Parameter No.		Output Signal
#0005		
D0: ZRN	Manual zero return switch	#35160 (SETS ZRN)
D1: ZRN2	Manual 2nd zero return switch	#35161 (SETS ZRN2)
D2: CPRN	Manual interruption point return switch	#35172 (SETS CPRN)
D3: HOFS	Auto mode handle offset switch	#35171 (SETS HOFS)
D5: PLBKT	Playback switch	#35177 (SETS PLBK)
D6: F1T	F1-digit switch	#35166 (SETS F1)
D7: PRST	Program restart switch	#35153 (SETS PRST)

Setting Parameter #0002 and the Output Signals

Setting Parameter No.		Output Signal
#0002		
D0: MI1	Manual Image (X-axis) switch	#35180 (SETS MIX)
D0: MI2	Manual Image (Y-axis) switch	#35181 (SETS MIY)
D0: MI3	Manual Image (Z-axis) switch	#35182 (SETS MIZ)
D0: MI4	Manual Image (4th-axis) switch	#35183 (SETS MI4)
D0: MI5	Manual Image (5th-axis) switch	#35184 (SETS MI5)

9

Automatic Support Functions

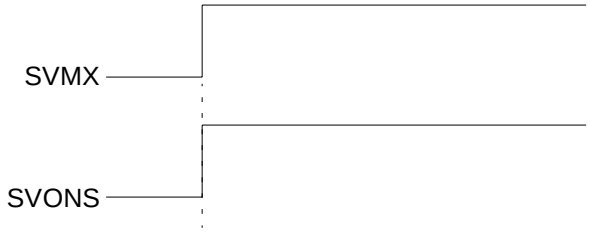
Chapter 9 describes the signals related to the automatic support functions.

9.1 Servo ON Monitor Output Signal

Servo ON Monitor Output Signal	SVONS	#35030

The servo ON monitor outptu signal is “closed” when the SVMX (servo power ON) output signal of the power supply circuit is “opened”.

This signal can be used for reading the servo power ON status by the programmable controller.

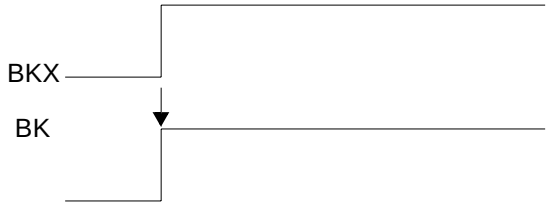


9.2 Brake ON Monitor Output Signal

Brake ON Monitor Output Signal	BK	#35031

The brake ON monitor output signal is “opened” when the brake release output signal BKX of a vertical axis is “opened” in the power ON sequence.

This signal can be used for reading the brake reease information by the programmable controller.



9.3 External Servo ON Input Signal

External Servo ON Input Signal	SVON	#30050

When the power is turned ON by the operator (either by inputting the corresponding signal or pressing the servo switch on the PCNC operation panel), the second power ON sequence is executed-the servo power of the PCNC is turned ON and the system is set for operation after confirmation of the ready state by the PCNC. This second power ON sequence is triggered by pressing the power switch again or the external servo ON signal (SVON) input by the PLC.

IMPORTANT!

The SVON Signal is valid when pm5012D0 = ON.

9.4 Tool Life Management Input/Output Signals

Tool Skip Input Signal	TLSKP	#30126
Tool Life Count Ignore Input Signal	TLCTN	#30127
Tool Skip Group Number Input Signal	TGN0 to TGN7	#30250 to #30257
New Tool Selection Output Signal	TLCHB	#35086
Tool Change Output Signal	TLCHA	#35087
Life Expiration Check Request Input Signal	TLCH	#30124
Life Expiration Group Number Input Signal	TLTGN0 to TLTGN7	#30230 to #30237
Life Expiration Check Complete Output Signal	TLCEND	#35085
Life Expired/Not-Expired Output Signal	TLANS	#35084

(1) Tool Skip Input Signal

If the tool skip input signal is “closed” during the exceution of the tool life management function, the life status of the tool presently used is forcibly set as “skipped”.

This signal is also used to skip the tools in the specified groups. By setting these tool group numbers by te tool skip number input signals (TGN0 to TGN7), the tools in these groups are skipped when the tool skip input signal (TLSKP) is “closed” under the condition that the parameter pm4029D1 = 1.

(2) Tool Life Count Ignore Input Signal

Tool life counting is suspended when this signal is “closed” during the execution of the tool life management function.

(3) New Tool Selection Output Signal

When a new tool is selected in a tool group and if the status of use of the new tool is “0”, this signal is “closed” at the same time that a T code is output.

(4) Tool Change Output Signal

If all tools in a tool group have been used-up to life expiration during the execution of the tool life management function, this signal is “closed”.

(5) Life Expiration Group Check Signals

It is possible to check the life expiration status of a specific tool group.

- Life Expiration Check Request Input Signal (TLCH, #30124)
  This is the check start signal.

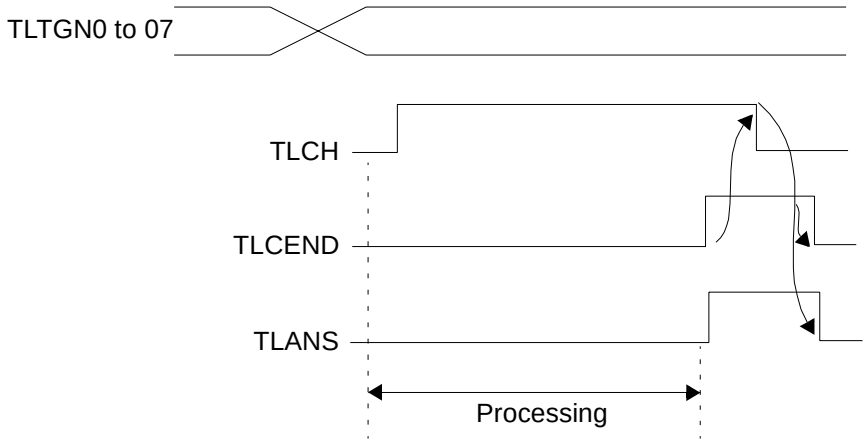
- Life Expiration Group Number Input Signal (TLTGN01 to TLTGN7, #30230 to #30237)
  This signal is output at the completion of the check.

- Life Expiration Check Complete Output Signal (TLCEND, #35085)
  This signal is output at the completion of the check.

- Life Expired/Not-Expired Output Signal (TLANS, #35084)
  At the completion of the check, this signal indicates whether the tools in the group have been used to life expiration or not. If this signal is “closed”, it indicates that the tools in the group have been used to life expiration and if the signal is “opened”, it indicates that the group has tools available.

IMPORTANT

The tool group number to be checked (TLTGN0 to TLTGN7) must be input before the TLCH is input.



9.5 External Data Input/Output Signals

External Data Input Signal	ED0 to ED31	#30300 to #30337
External Data Selection Input Signal	EDSA to EDSD	#30340 to #30343
External Data Axis Selection Input Signal	EDAS0 to EDAS2	#30344 to #30346
External Data Selection Strobe Input Signal	EDCL	#30347
External Data Input Complete Output Signal	ER END to ES END	#35045 to #35046

(1) External Data Input/Output Function

(a) External work number search input signal

By specifying any of the following proram numbers externally in BCD, the required work number can be selected.

Program numbers: 1 to 99999

(b) External tool offset input signal

It is possible to correct the offset data (tool length offset data, tool radius offset data) by using the external data input signal.

(c) External workpiece coordinate system shift input signal

It is possible to correct the shift amount of workpiece coordinate systems by using the external data input signal.

By inputting the correction data for the individual axes, the input data is added to the present shift data of G54 to G59 to obtain the new shift data.

(2) Input Signals Used for External Data Input

(a) External data input signal

The external data input signal is used for the workpiece number input signal, offset data input signal and workpiece coordinate system shift data input signal.

Table 9.1 External Data Input Signals

External Data Input Signals							
ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0
ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8
ED23	ED22	ED21	ED20	ED19	ED18	ED17	ED16
ED31	ED30	ED29	ED28	ED27	ED26	ED25	ED24

(b) External data selection signals

These are input signals used to designate the tyoe of inout data according to the external data input signal.

External Data Selection Signals Table

	External Data Selection Signal			
	EDSD	EDSC	EDSB	EDSA
External work number designation	0	0	0	1
External tool offset (H)	0	0	1	0
External tool offset (D)	0	0	1	1
External coordinate system shift	0	1	0	0

Note: The status of signals is indicated by “0” or “1”.
0: Open
1: Closed

(c) External Data Axis Selection Signals

The external data axis selection is the 3-bit input signal used to designate the axis for the external data that need the axis data.

External Data Axis Selection Signals Table

	External Data Axis Selection Signal		
	EDAS2	EDAS1	EDAS0
No.1 axis	ABS/INC	0	0
No.2 axis	ABS/INC	0	1
No.3 axis	ABS/INC	1	0
No.4 axis	ABS/INC	1	1
No.5 axis	1	0	1

Note: ABS=1, INC=0
External work coordinate system shift: A11 INC

(d) External data selection strobe signal
Input of the external data begins at the rising edge of this signal.

(3) Output Signals Used for Externka Data Input

When writing the data, explained in above Item 2(a) to (d), to the internal memory is completed, the complete output signal is output. (ER END #3545 or ES END #35046)

(4) External Data Input Time Chart

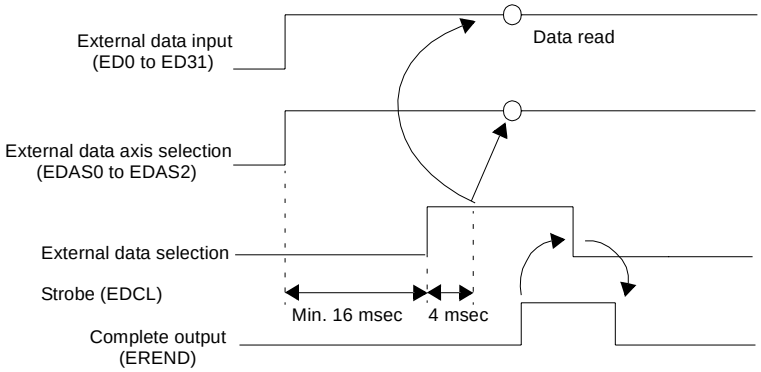


Fig. 9.1 External Data Input Time Chart

In the case of external work number input, ESEND is output instead of EREND as the complete output signal upon completion of the input.

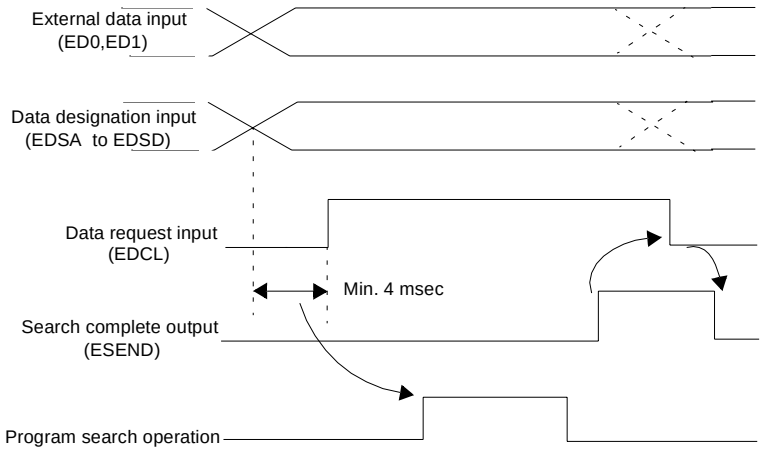


Fig. 9.2 External Work Number Input Time Chart

(5) External Data Input/Output Data

(a) Input

(b) Output
ESEND: External search end
EREND: External data input end

External Data Input/Output Data Table

	Input Strobe	Axis Selection			Data Selection				External Data							
Symbol	EDCL	EDAS2	EDAS1	EDAS0	EDSD	EDSC	EDSB	EDSA	ED 31	ED 30	ED 29	ED 28	ED 27	ED 26	ED 25	ED 24
External work number desig-nation					0	0	0	1	WND10000000				WND10000000			
									ED 23	ED 22	ED 21	ED 20	ED 19	ED 18	ED 17	ED 16
									WND100000				WND100000			
									ED 15	ED 14	ED 13	ED 12	ED 11	ED 10	ED 9	ED 8
									WND1000				WND1000			
									ED 7	ED 6	ED 5	ED 4	ED 3	ED 2	ED 1	ED 0
									WND10				WND10			
External tool offset (H)			ABS/ INC		0	0	1	0	SIGN	±79999999 (BCD)						
External tool offset (D)			ABS/ INC		0	0	1	1	SIGN	±79999999 (BCD)						
External workpiece coordinate shift					0	1	0	0	SIGN	Selection is made according to the parameter setting						

SUPPLEMENT

1. External work number designation

   - In the external work number input state, if the specified work number is not in the range from 1 to 9999 or if the specified work number is not found, the ALMS is output.

   - If the operating output signal (OP) is “closed”, external work number search is not allowed.

2. External tool offset

   - The offset data are corrected for the offset number which is specified by the program.
   - Offset data correction is executed either by adding the external input value to the existing offset data or by replacing the existing offset data with the external input value. Which of the correction methods should be used is determined by the following external inputs (axis selection bit is used).

     EDAS2 = 0 Addition
     EDSA2 = 1 Replacement

- An external tool number address is selected ny the two bits of external data select (EDSA and EDSB).
  EDSA = 0, EDSB = 1 Tool length offset
  EDSA = 1, EDSB = 1 Tool radius offset

- If no offset number has been selected (H00/D00), the completion signal is output without offset data corrected.
- After the correction of the offset data by the external input, the new offset data becomes valid from the newly read block after the correction in the case of tool length offset (G43,G44) mode and tool radius offset (G41,G42) mode. In the case of tool position offset A (G45 to G48) mode, the new offset data becomes valid when the G code calling this mode is specified next.
- In the external tool offset designation, it is not necessary to designate the axis selection inputs EDAS0 and EDAS1. They are ignored even if designated.
- The offset data corrected by the external input data are equivalent to the offset data corrected by the MDI operation.

3. External workpiece coordinate systems

   The shift data corrected by the external input data are equivalent to the shift data corrected by the MDI operation.The externally input shift data is added to the present shift data for all of G54 to G59 workpiece coordinate systems.

9.6 Manual Skip Mode Input/Output Signals and Touch Sensor Input Signals

Manual Skip Mode Input Signal	MSKP	#30096
Manual Skip Mode Output Signal	MSKPO	#35077
Touch Sensor Input Signal	SPST	#30097

If the manual skip input signal MSKP is “closed”, the CNC enters manual skip mode and then the manual skip mode output signal MSKPO is “closed”.

When the touch sensor input signal SPST is “closed” by manually bringing the touch sensor into the contact with a workpiece while the CNC is in the manual skip mode, the coordinate values (in the machine coordinate system) of the contact point and the direction of the approach for the detaction of contact are read.

It is possible to use the direct in (DIN) input signal instead of the touch sensor input signal SPST. The manual skip mode is classified into manual skip A mode and manual skip B mode according to the input signal to be used. Skip A if SPST is used and skip B if DIN is used.

Manual skip B mode makes high accuracy measurement possible.

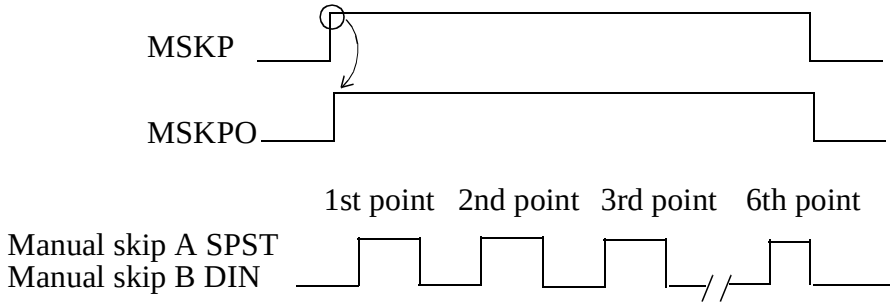


Fig. 9.3 Time Chart of Manual Skip.

IMPORTANT!

1. When the manual skip mode input signal is opened from the machine, then manual skip mode input signal (MSKP) is ignored unless the CNC is in the manual mode. In this case, the manual skip mode output signal (MSKPO) is not output, either. If the CNC mode is changed from manual to automatic while it is in the manual skip mode, the manual skip mode is cancelled. In this case, however, one-line MDI operation is possible.

2. If all axis zero return has not been executed after power ON when the rising edge of touch sensor input signal is ignored and measurement is not executed.

3. When the touch sensor input signal is opened, the contract detaction axis must be retracted once. (pm6847). If the next touch sensor input signal is opened before the axis is retracted, an alarm occurs (2070).

4. Manual skip A and manual skip B are selected by the setting for parameter pm5010 D7.

   pm5010 D7 = 0: Manual skip A
   pm5010 D7 = 1: Manual skip B

5. In the manual skip mode, low-speed type zero-point return is not possible.
   If low-speed type zero-point return is attempted, an alarm occurs (2060).
   Measurement point monitor parameter

   pm0107: This indicates the number of points for which the point data have been saved. (Initial value is "0", and the value is increased by one each time the measurement has been completed.)

   Position information parameters

   "1" = 0.001 mm
   pm0920..... No. 1 point information (X-Axis)
   pm0921..... No. 1 point information (Y-Axis)
   pm0922..... No. 1 point information (Z-Axis)
   pm0923..... No. 2 point information (X-Axis)
   pm0924..... No. 2 point information (Y-Axis)
   pm0925..... No. 2 point information (Z-Axis)

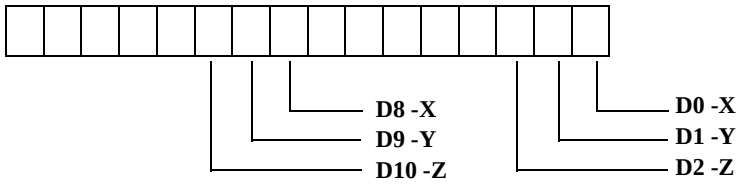
   •
   •
   •
   •

   pm0935..... No. 6 point information (X-Axis)
   pm0936..... No. 6 point information (Y-Axis)
   pm0937..... No. 6 point information (Z-Axis)

   Contact direction parameters

   pm0420..... No. 1 point contact direction
   pm0421..... No. 2 point contact direction
   pm0422..... No. 3 point contact direction
   pm0423..... No. 4 point contact direction
   pm0424..... No. 5 point contact direction
   pm0425..... No. 6 point contact direction

   (pm0420 to pm0425) Contact Direction



9.7 Manual Centering Mode Input Signal

Manual Centering Mode Input Signal	MSI	#30095

It is possible to set the coordinate values of the center of two points by manual operation.

When the manual centering mode input signal MSI is “closed”, the CNC enters the manual centering mode. At the same time, the manual skip mode input (MSKP, #30096) should be “closed”.

IMPORTANT!

1. When the manual cnetering mode signal is input, it is ignored unless the CNC is in the manual mode.

2. When the manual centering mode input signal MSI is “closed”, the manual skip mode must be used in combination with the manual centering mode. Otherwise, the manual centering function cannot be executed.

9.8 Program Interrupt Input Signal

Program Interrupt Input Signal	PINT	#30363

By using the program interrupt input signal PINT, it is possible to jump the part program being executed to the required position.

M91 P...;

When the commands indicated above are specified in a part program, if the program interrupt input signal is opened during the execution of the part program, execution of the program is interrupt (axis movements decelerate and stop) and the program jumps to the program number specified by address P.

M90;

The program interrupt function is cancelled by M90.

IMPORTANT!

1. The program interrupt function is invalid during DNC operation.
2. If the PINT input signal is “closed’ during block stip (single block stop), the program jumps to the part program specifiedby the address P when the operation is started by cycle start.

9.9 Direct Processing Signal Monitor Output Signal

Direct Processing Signal Monitor Output Signal	HIN1	#35140

The direct processing signal monitor output signal outputs the status of the direct IN signal (DIN0), which is directly read from the CN01 of JCP03 board to the NC.

The relationship between the direct IN common input signal and the parameters setting is indicated below.

Table 9.5 Relationship between Direct IN Signal and Parameter Setting

	Common Input	pm5001 D0
1	24 V common, NO	0: Negative logic
2	24 V common, NC	1: Positive logic
3	0 V common, NO	1: Positive logic
4	0 V common, NC	0: Negative logic

For HIN1 (#35140), the open status can be changed by the setting of the following parameter.

pm5010 D5 = 0: Open by “0” “1”
pm5010 D5 = 1: Open by “1” “0”

9.10 Position Monitor Output Signal

Position Monitor Output Signal	MPON1 to PMON10	#36340 to #363451

The function monitors the position of the axis which is specified by the parameter to detect if it is within the preset range.

This signal is “closed” while the axis specified by the following parameters is within the preset range. It is “opened” if the axis moves beyond the specified range.

Parameter No.	Description
pm6130 to pm6139	1st to 10th position monitor check axis number (0: invalid)
pm6920 to pm6929	Axis movable range boundary in the positive direction for the 1st to 10th position monitoring
pm6930 to pm 6939	Axis movable range boundary in the negative direction for the 1st to 10th position monitoring

Set the axis number (1 to 5) of the axis to be monitored for the position monitor check axis number parameters. For the axis movable range boundary setting parameters, set the movable range of the axis to be monitored in the machine coordinate system values.

Axis position is monitored in intervals of 64 msec and the result of monitoring for the 1st to 10th position monitor range is output to PMON1 to PMON10.

The position monitor function is valid disregarding of the operation mode after the completion of origin return.

IMPORTANT!

1. The position monitor function is not valid for a rotary axis.

2. If the machine coordinate position of an axis is on the boundary of position monitor range, the output signal “closes”.

3. The boundary of the position monitor range is always set in the mm unit system. Setting it in an inch unit system value is not allowed.

With the PCNC, position monitor is possible for up to eight ranges (#36340 to #36347). High-speed monitoring is possible for on of these eight ranges. Designation of the high-speed monitoring is made by the high-speed monitor range designation input signal. For details of the high-speed monitoring, refer to 9.11.

9.11 High-Speed Position Monitor Input Signal

High-speed Position Monitor Input Signal	PMONIN1 to PMONIN8	#31060 to #31067

Among the position monitor ranges, this function designates the ranges where high-speed monitoring is performed.

The 1st to 8th position monitor ranges, which are set by the parameters correspond to the PMONIN1 to PMONIN8 input signals. By “closing” any of these inputs signals, the corresponding range is subject to high-speed monitoring (8 msec). High-speed monitoring is possible only in one range.

Parameter No.	Description
pm6130 to pm6137	1st to 8th position monitor check axis number (0: invalid)
pm6920 to pm6927	Axis movable range boundary in the positive direction for the 1st to 8th position monitoring
pm6930 to pm 6937	Axis movable range boundary in the negative direction for the 1st to 8th position monitoring

IMPORTANT!

If more than one signal is “closed” among PMONIN1 to PMONIN8 signals, the input signal of the smallest number is valid.

10 Safety and Maintenance Functions

Chapter 10 describes the signals related to the safety and maintenance functions

10.1 Machine Ready Input Signal

Machine Ready Input Signal	MRD	#30040

This input signal indicates that the external power circuit is ready for operation.

The MRD input signal should be “closed” when machine side preparation (hydraulic pressure, lubricating oil pressure, coolant pressure, etc.) is ready with the PCNC side ready for operation.

After power ON, when the MRD input signal is “closed” after the servo power ON input (SVMX) and the brake release input (BRX) form the CNC have been opened, the PCNC gets ready for operation and the “RDY’ message is displayed on the screen.

If the MRD input signal is “opened” when the PCNC is in the ready state, it enters the alarm state (alarm 2190: MACHINE NOT READY) and the operation is stopped.

10.2 External Reset Input Signal and Resetting Output Signals

External Reset Input Signal	ERS	#30041
Resetting Output Signal	RSTS	#35001

The external reset (ERS) is the input signal to reset the PCNC.

When the ERS input signal is “closed”, the PCNC stops the entire operation and closes the resetting output signal for one second.

The output signals are “opened” with the exception as shown in Table 10.1.

Table 10.1 Output Signals which are “Closed”

Output Signal Name	Output when ERS Input is “Closed”
AUT, MAN ZPX to ZP5 2ZPX to 2ZP5 3ZPX to 3ZP5 4ZPX to 4ZP5 5ZPX to 5ZP5 4NGC, 5NGC	The previous state is maintained.
RSTS	“Closed” while ERS input is “closed”, and “closed” for one second after the ERS input is changed from “closed” to “opened”.
ALMS	Remains “opened” unless the cause of alarm remains
SDO0 to SDO23	The previous state is maintained.
UO0 to UO31	The previous state is maintained.

IMPORTANT!

When the ERS input is “closed”, the CNC is in the label skip state. In this case, however, the tape is not rewound; although, the memory is rewound.

Label skip: When the PCNC is in the label skip state, the information having been read until the first end of the block code is read after power ON or reset, is ignored. There is no parameter to cancel the label skip state.

10.3 Start Interlock Input Signal

Start Interlock Input Signal	STLK	#30042

This is the input signal that disables cycle start in automatic mode operation.

If the STLK input signal is “closed”, cycle start is impossible even if the ST input signal is “closed”.

When the STLK input signal is “closed” after the PCNC has started, it keeps operating. The “closed” state of the STLK input signal becomes valid when the operation is interrupted by the single-block stop or feed hold.

10.4 Alarm State Output Signal

Alarm State Output Signal	ALMS	#35000

The alarm state output signal indicates that the PCNC is in the alarm state.

When an alarm state is detected, the ALMS ouput signal is “closed”. (Note that the alarm state is excluded due to the PCNC logic circuit operation error.)

The output signal is “opened” by reset operation after removing the cause of alarm.

10.5 External Error Detection Input Signals

External Error Detection Input Signal	ERR0 to ERR2	#30055 to #30057

The external error detection input signal forcibly places the PCNC in the alarm state.

ERR0	When this input signal is “closed”, the PCNC displays an alarm code and enters the alarm state. If the part program executing input signal is “closed” during automatic operation, the PCNC stops operating after completing the execution of the block presently executed.
ERR1	When this input signal is “closed”, the PCNC displays an alarm code and enters the alarm state. If the part program executing input signal is “closed” during automatic operation, the PCNC stops operating with the axes stopped after deceleration.
ERR2	When this input signal is “closed”, the PCNC displays an alarm code and enters the alarm state. If the part program executing input signal is “closed” during automatic operation, the PCNC stops operating immediately and the servo is turned OFF.

10.6 Servo Alarm Output Signals

Servo Alarm Output Signal	SVALM	#35033

This output signal notifies the machine that an alarm has occurred when the PCNC detects any of the following alarm factors:

- DSP Detecton Alarm
  - Overload (OL)
  - Runaway
  - PG open
  - Excessive deviation
  - Overspeed (OS)

- Monitor CPU Detection Alarm
  - Position error
  - ABSO error (encoder error)
  - Communication error

- I-AMP Detection Alarm
  - Overcurrent (OC)
  - MCCB trip
  - Regeneration error
  - Overvoltage (OV)
  - Undervoltage (UV)
  - Heat Sink overheat
  - Current command cable open
  - Open phase detection

10.7 Warning State Output Signal

Warning State Output Signal	WARNS	#35004

The warning state output signal WARNS is “closed” when a minor error such as key operation error or editing is detected.

It is “opened” by the successive key operation.

10.8 Absolute Position Detection Error Output Signal

Absolute Position Detection Error Output Signal	ABSALX to ABSAL5	#36290 TO #36294

The absolute position detection error output signal is output if an absolute position detection error is detected with the absolute position detection system.

The signal is output for the individual axes.

10.9 System Number Setting Monitor Output Signal

System Number Setting Monitor Output Signal	SSWS0 to SSWS3	#35060 to #35063

This signal outputs the status of setting parameter #0109 to I/O variable.

10.10 Operating Output Signal

Operating Output Signal	OP	#35375

This signal is output at the start of automatic operation to indicate that the PCNC is operating.

The operating output signal OP is “closed” when the machine starts operating, and its “closed” by the reset operation (includes the execution of M02, M30).

This signal is output only while the PCNC is operating in the G01 or G00 mode of automatic operation.

10.11 Power Loss Detection Monitor Output Signal

Power Loss Detection Monitor Output Signal	PWLOST	#35035

The power loss detection monitor output signal PWLOST is output when the power failure state is detected. If input voltage is lowered to 145 to 165 VAC, it is assumed to be due to power failure.

Response time after the detection is less than 50 msec.

10.12 Overtravel Input Signals

Overtravel Input Signals	*+X to *+5	#30740 to #30744
	*-X to *-5	#30750 to #30754

The overtravel input signal indicates that the movable machine unit has reached the stroke end.

When the overtravel input signal is “closed”, axis movment is stopped in the manner as indicated in Table 10.2, then the alarm output signal ALM is “closed” and the alarm message is displayed on the screen.

Table 10.2 Axis Movement Stop Mode at “Opening” of Overtravel Input Signal

	Manual Mode	Automatic Mode
*+X to *+5 input is“opened”	Axis movement in the positive (+) direction stops.	Movement of all axes and in all directions are stopped.
*-X to *-5 input is“opened”	Axis movement in the negative (-) direction stops.	

If the overtravel input signal is “closed”, manually move the related axis in the direction opposite to the “closed” signal direction (jog, manual pulse generator) until the input signal is “closed”. After that, execute reset operation to close the alarm state output signal and clear the alarm display.

IMPORTANT!

1. Even when an alarm occurred due to the “opening” of the overtravel input signal, the M, S andT code read output signals MFA, SF and TF are not closed. If it is necessary to interrupt the operation by M, S and T codes after the occurrence of an overtravel alarm, take the interlock by the external sequence.

2. If the overtravel alarm occurs, an alarm number in the range from 2001 to 2005 is displayed. In this case, axis movement is stopped. (Servo power is not turned OFF.)

10.13 Stored Stroke Limit Check Input Signal

Stored Stroke Limit Check Input Signals	STSEL0	#30120
	STSEL1	#30121

The stored stroke limit check input signals are used to select valid/invalid of the stored stroke limit check for No.3 to No.5 ranges.

The setting for STSEL0 and STSEL1 is indicated below.

STSEL1 (#30121)	STSEL0 (#30120)	
0	0	Stored stroke limit check is OFF for ranges No.3 to No.5
0	1	Stored stroke limit check is ON for range No.3
1	0	Stored stroke limit check is ON for range No.4
1	1	Stored stroke limit check is ON for range No.5

Note: The status of signals indicated by “0” or “1”.

0: Open
1 : Closed

10.14 Axis Interlock Input Signal

Axis Interlock Input Signal	*ITX to *IT5	#30780 to #30784

The axis interlock input signal is “opened” during axis movement, the corresponding axis stops after deceleration. When the signal is “closed” after that, the axis continues moving for the remaining distance, the program to the next block after the completion of axis movement.

For two or three axis simultaneous interpolation, if the axis interlock signal of any one of these axis is “opened”, interpolation processing is prohibited and the axes stop after deceleration.

SUPPLEMENT

If this input signal is “opened” while the CNC is in the cycle start state, the STL remains open.

10.15 Direction Specified Axis Interlock Input Signal

Positive direction axis interlock input signal	*+ITX to *+IT5	#31040 to #31044
Negative direction axis interlock input signal	*-ITX to *-IT5	#31050 to #31054

These input signals are interlok input signals which are used to disable axis movement only in the specified direction. The signal is provided for the individual axes.

If this input signal is “opened” while an axis is moving, the axis decelerates to a stop. When it is “closed” in the state the axis stops, the axis continuously moves by the remaining distance. After the completion of movements, the program advances to the next block.

These signals are valid regardless of the operation mode.

If the axis interlock signal (#30780 to #30784) is “open”, axis movement is disables in both the positive and negative directions disregarding of he status of the direction specified axis interlock input signals.

During interpolation operation by simultaneous multiple axis movements, if any one of the input signals of the corresponding axis movement direction is “opened”, all axes stop after deceleration.

SUPPLEMENT

In the circular interpolation operation, these signals function as the normal axis interlock regardless of the direction of of movement.

10.16 Servo OFF Input Signal

Serv OFF Input Signal	SVOFX to SVOF5	#30790 to #30794

The servo OFF input signal is used to clamp an axis mechanically for carrying out heavy duty cutting, etc.

When the contact of the signal SVOFX to SVOF5 is ”closed”, the servo lock of the X- to 5th-axis is released. For clamping the machine, use an M function or other appropriate function.

The time chart of the servo OFF signal, mechanical clamp, auxiliary function and servo ready (SRDX to SRD5) is shown in Fig. 10.1. Note that the clamp signal must be output only after the output of the positioning complete signal (DEN).

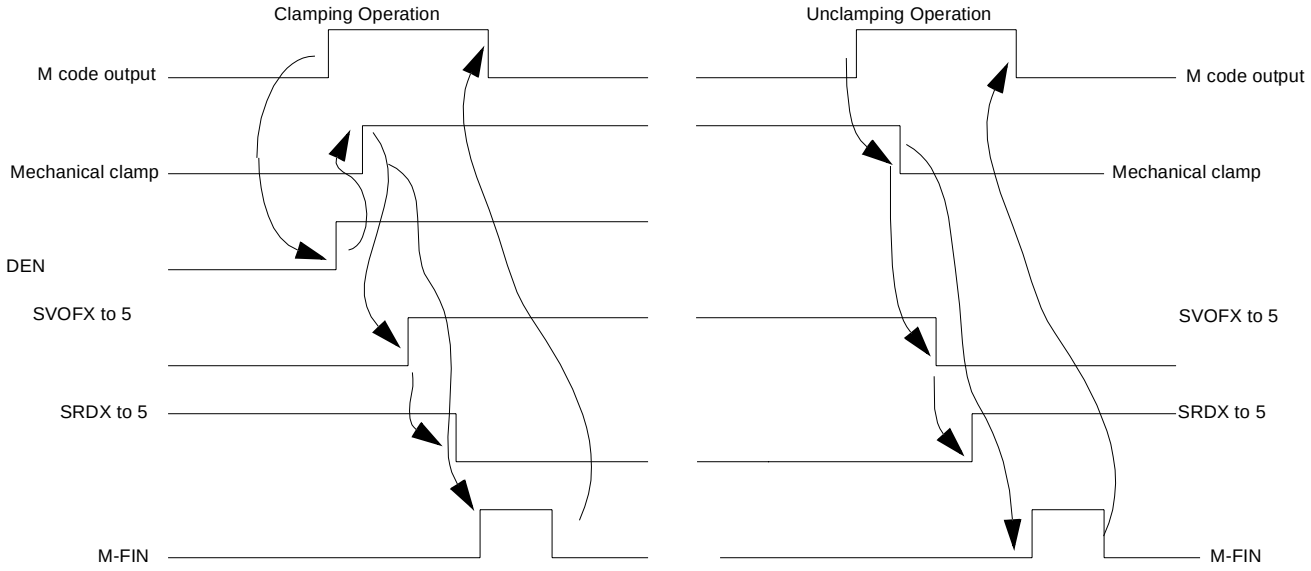


Fig. 10.2 Servo OFF Time Chart

Follow-up processing is possible by setting an appropriate parameter.

Follow-up Processing:
If the machine is moved due to mechanical clamping/unclamping operation, the PCNC present position data is changed so that the error counter value will be “0”, assuming that the corresponding movement command has been given. In this case, although the machine stays in the offset position even if the SVOFF signal returns to the “opened” state, the machine moves to the correct position when an absolute command is given next, since the PCNC present position data corresponds to the actual machine position.

Conversely, if follow-up processing is not executed, the mechanically moved amount remains in the errorcounter as the servo controlled movement distance. In this case, the machine will move to cancel this error amount when the servo OFF signal returns to the “closed” state requiring special attention.

10.17 Servo Axis Load Monitor Output Signals

The load of servo axes is output in “%”.

X-axis	Low byte ... #3740, High byte ... #3741
Y-axis	Low byte ... #3742, High byte ... #3743
Z-axis	Low byte ... #3744, High byte ... #3745
4th-axis	Low byte ... #3746, High byte ... #3747
5th-axis	Low byte ... #3748, High byte ... #3749

Note: Output is given in binary and value “1” corresponds to 1%.

Appendix 1

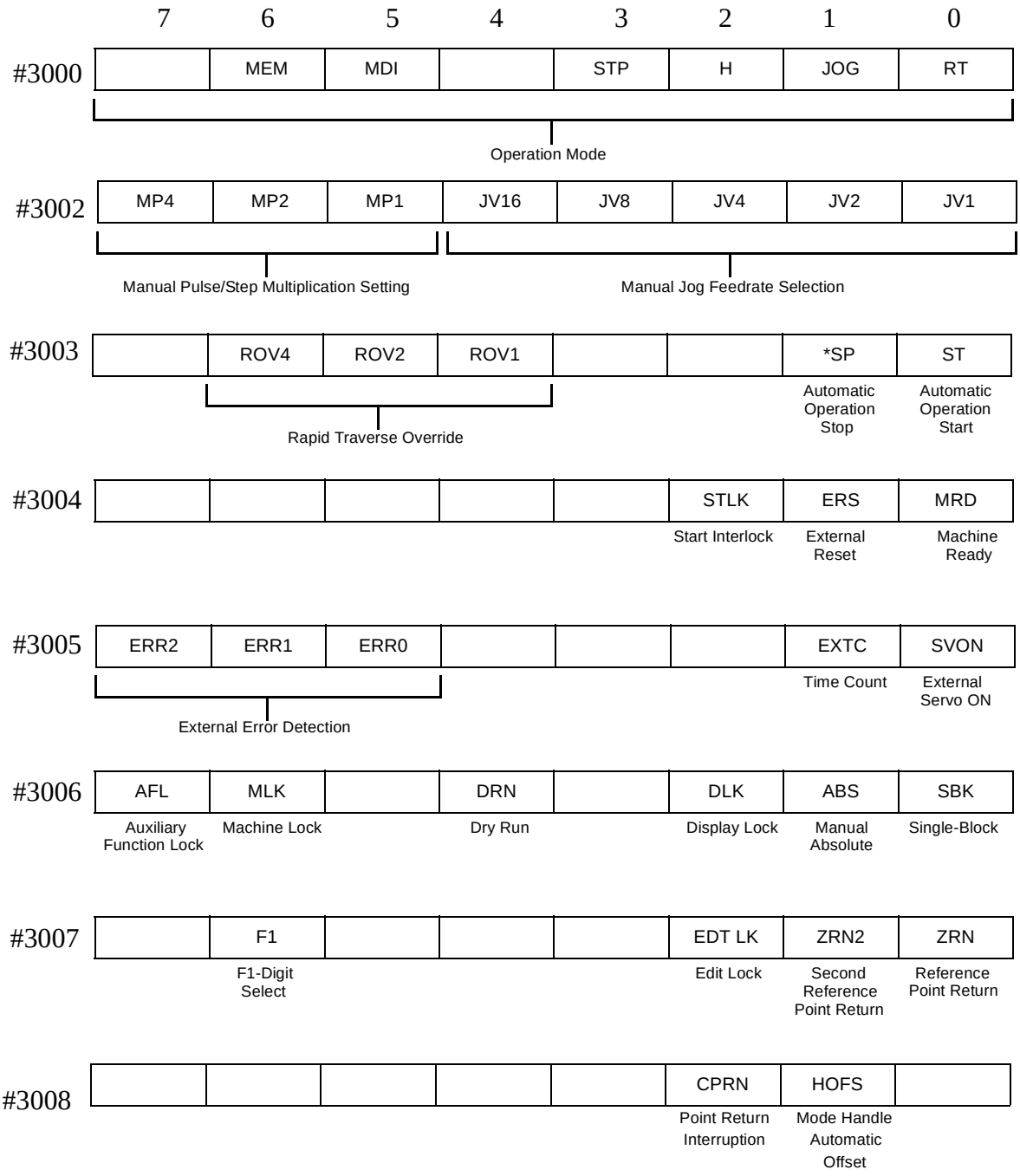
TABLE OF CNC INPUT/OUTPUT SIGNAL DIAGNOSIS NUMBERS

Appendix 1 describes the diagnosis numbers of the input/output signals between the CNC and the PLC

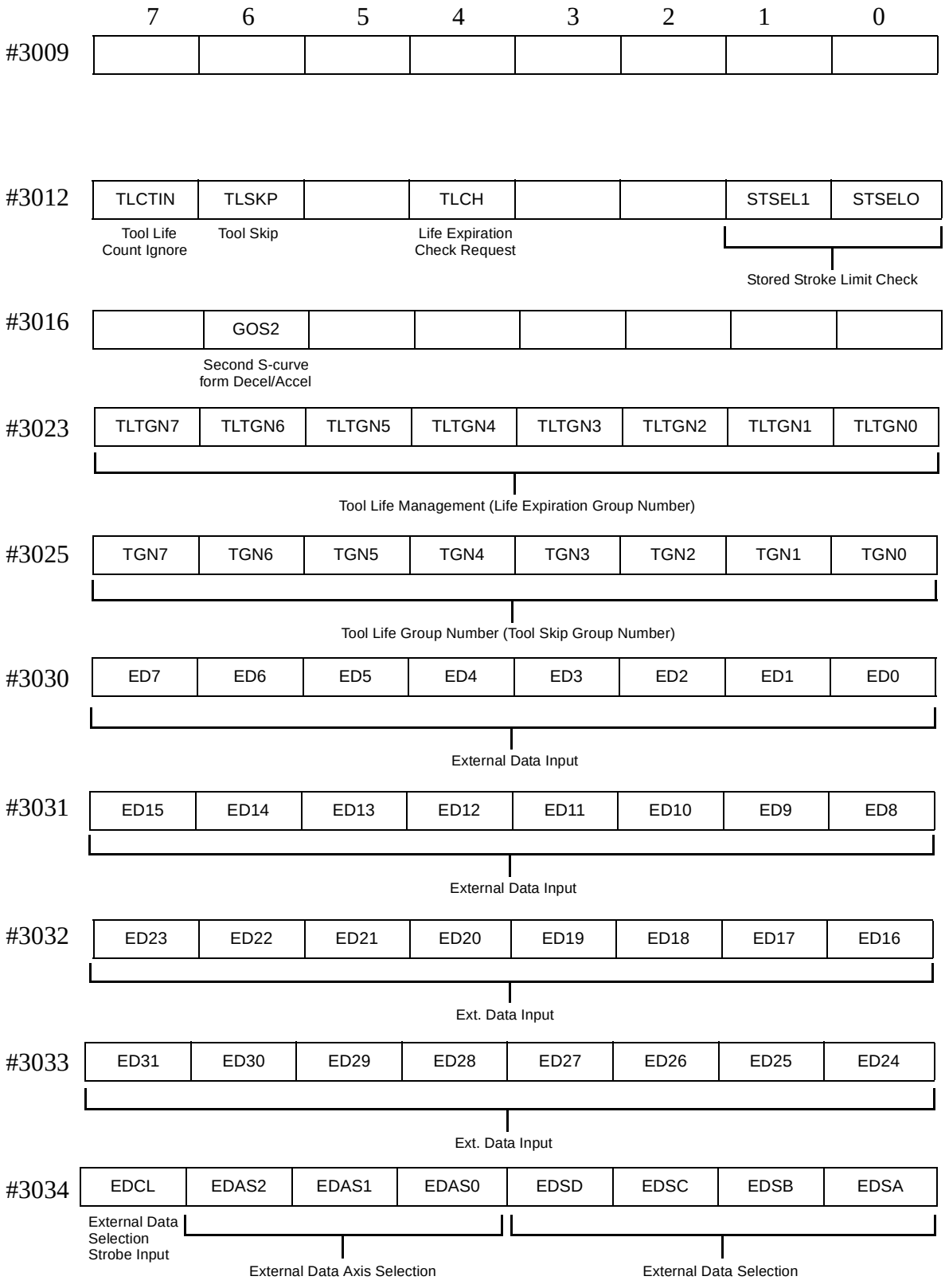
APPENDIX 1.1 Input Signals (PLC→CNC)

1.1.1 Operation Mode Control Signals Table

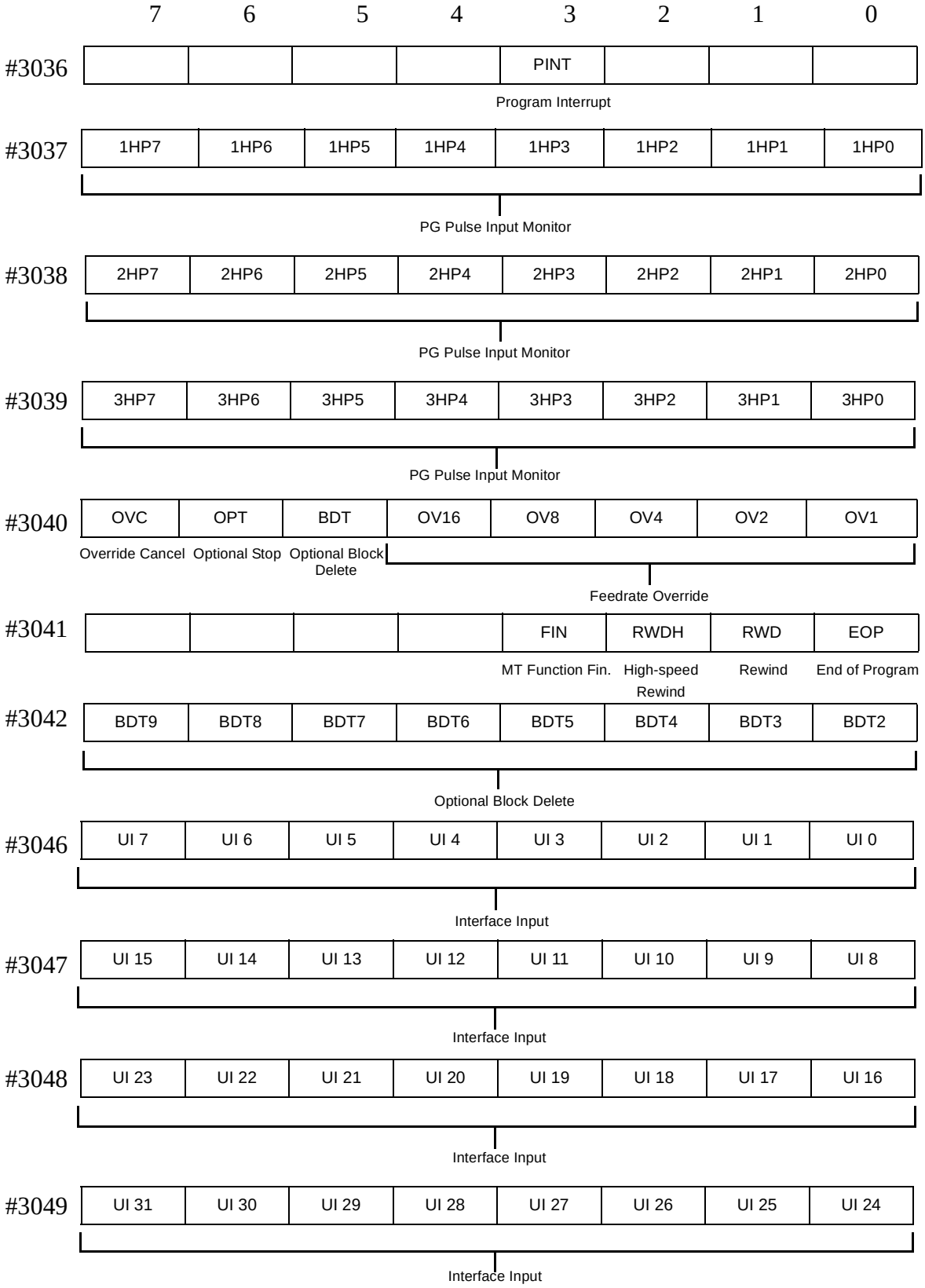
Appendix Table 1.1 Operation Mode Control Signals



Appendix Table 1.1 Operation Mode Control Signals Table (cont'd)



Appendix Table 1.1 Operation Mode Control Signals Table (cont'd)

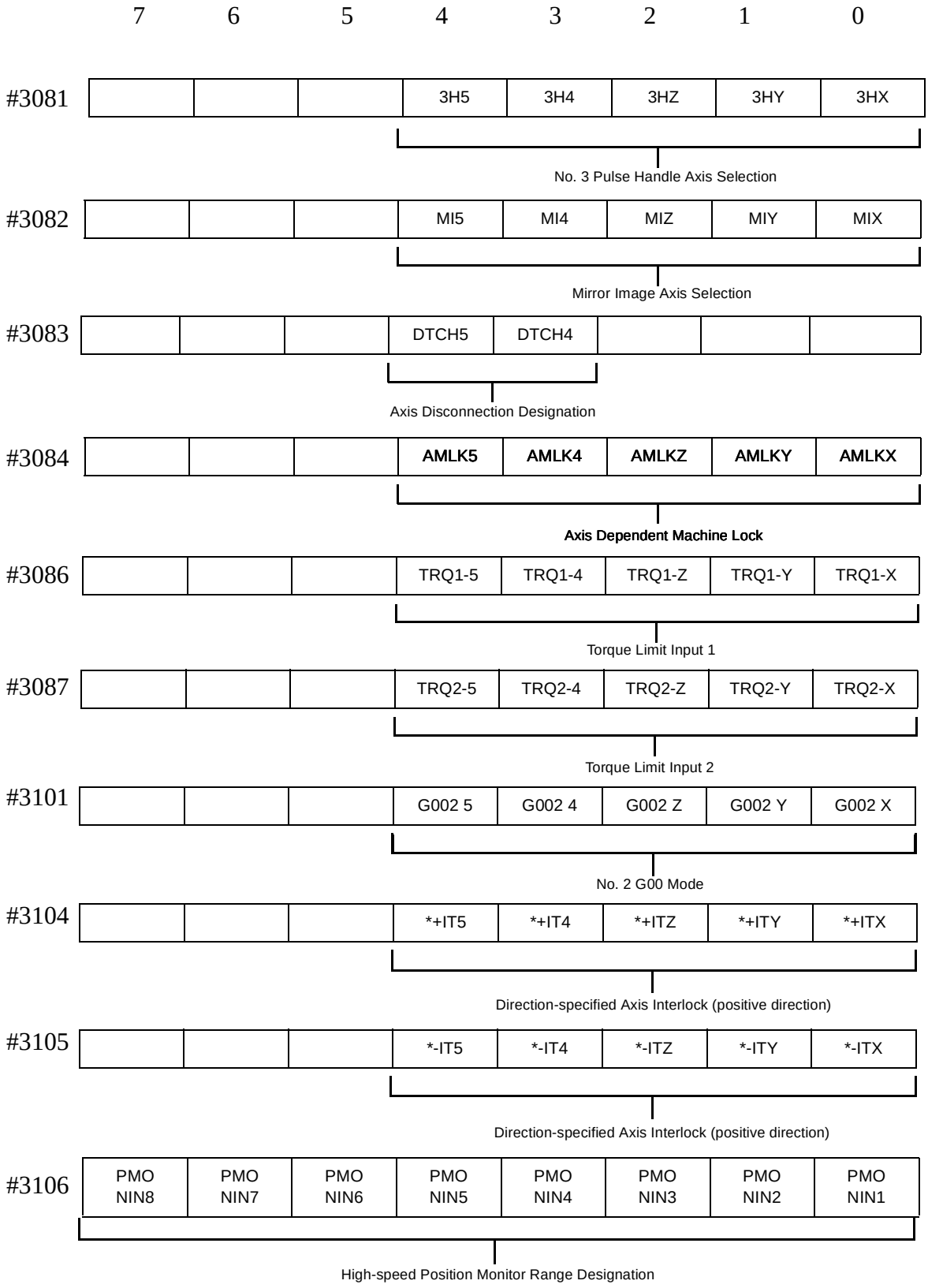


1.1.2 Servo Axis Control Signals (X-axis to 5th-axis)

Appendix Table 1.2 Servo Axis Control Signals (X-axis to 5th-axis)

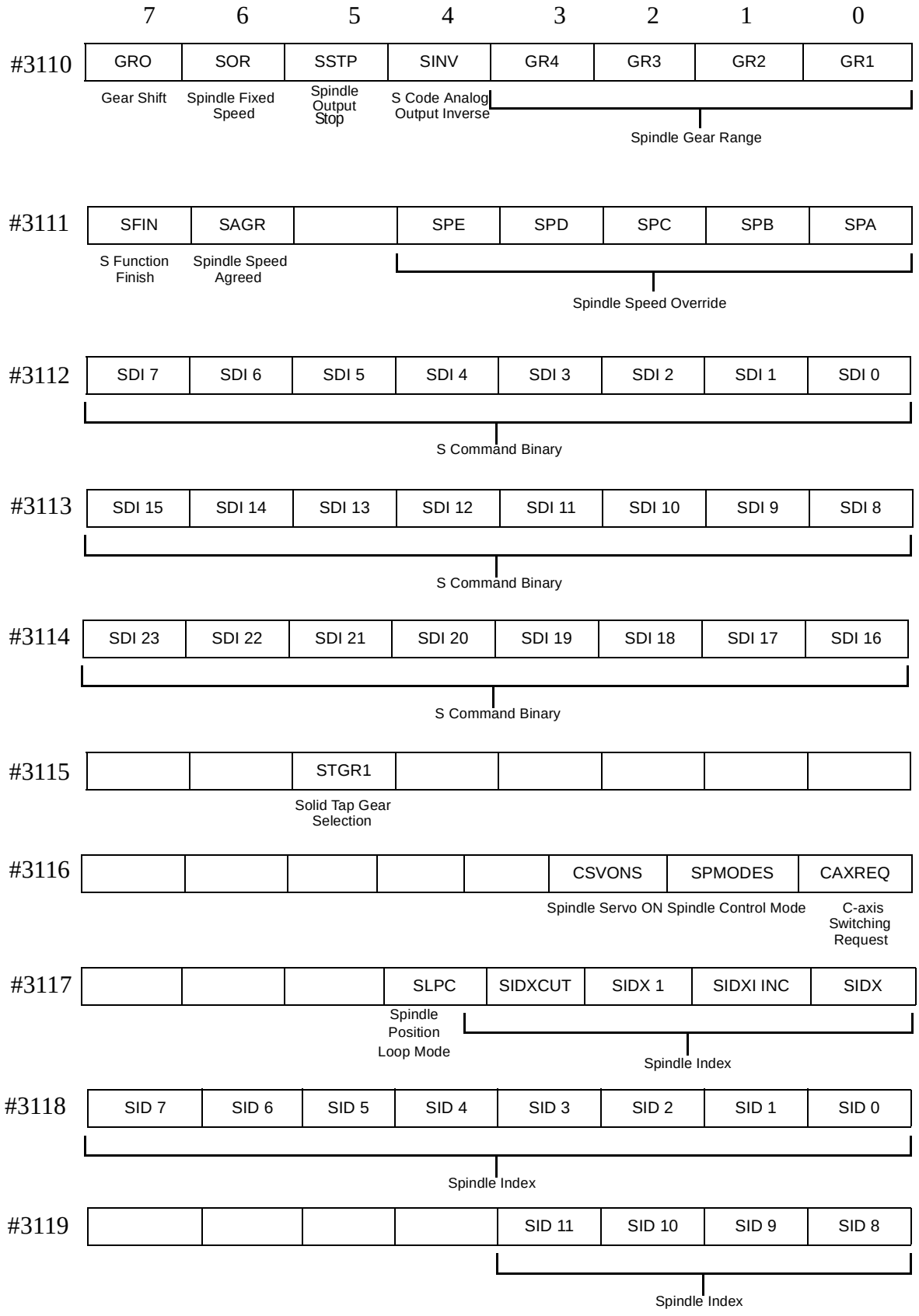
	7	6	5	4	3	2	1	0
#3070				H5	H4	HZ	HY	HX
	Pulse Handle Control Axis							
#3071				+5	+4	+Z	+Y	+X
	Manual Feed Axis/Direction Selection							
#3072				-5	-4	-Z	-Y	-X
	Manual Feed Axis/Direction Selection							
#3073				*DC5	*DC4	*DCZ	*DCY	*DCX
	Reference Point Return Decel. LS							
#3074				*+OT5	*+OT4	*+OTZ	*+OTY	*+OTX
	Overtravel LS							
#3075				*-OT5	*-OT4	*-OTZ	*-OTY	*-OTX
	Overtravel LS							
#3076				*+EDLS5	*+EDLS4	*+EDLSZ	*+EDLSY	*+EDLSX
	External Deceleration LS							
#3077				*-EDLS5	*-EDLS4	*-EDLSZ	*-EDLSY	*-EDLSX
	External Deceleration LS							
#3078				*IT5	*IT4	*ITZ	*ITY	*ITX
	Axis Interlock							
#3079				SVOF5	SVOF4	SVOFZ	SVOFY	SVOFX
	Axis Servo OFF							
#3080				2H5	2H4	2HZ	2HY	2HX
	No. 2 Pulse Handle Axis Selection							

Appendix Table 1.2 Servo Axis Control Signals (X-axis to 5th axis) (cont'd)

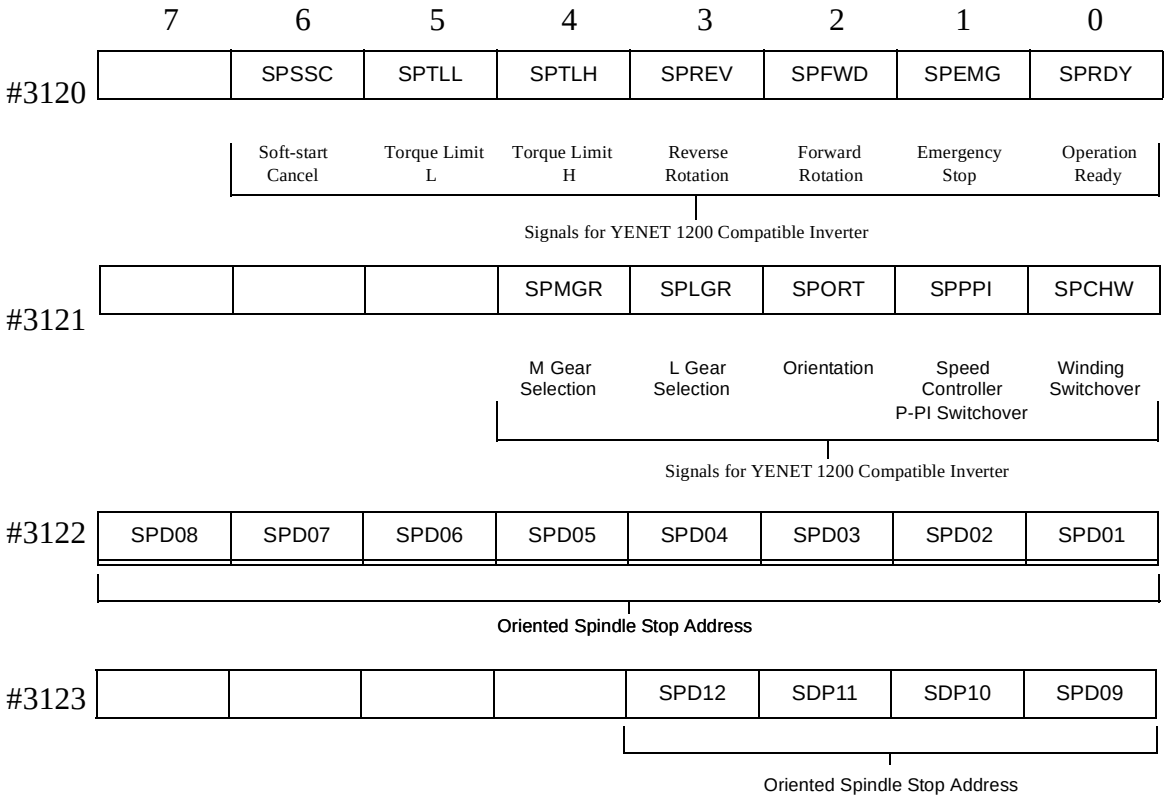


1.1.3 Spindle Control

Appendix Table 1.3 Spindle Control

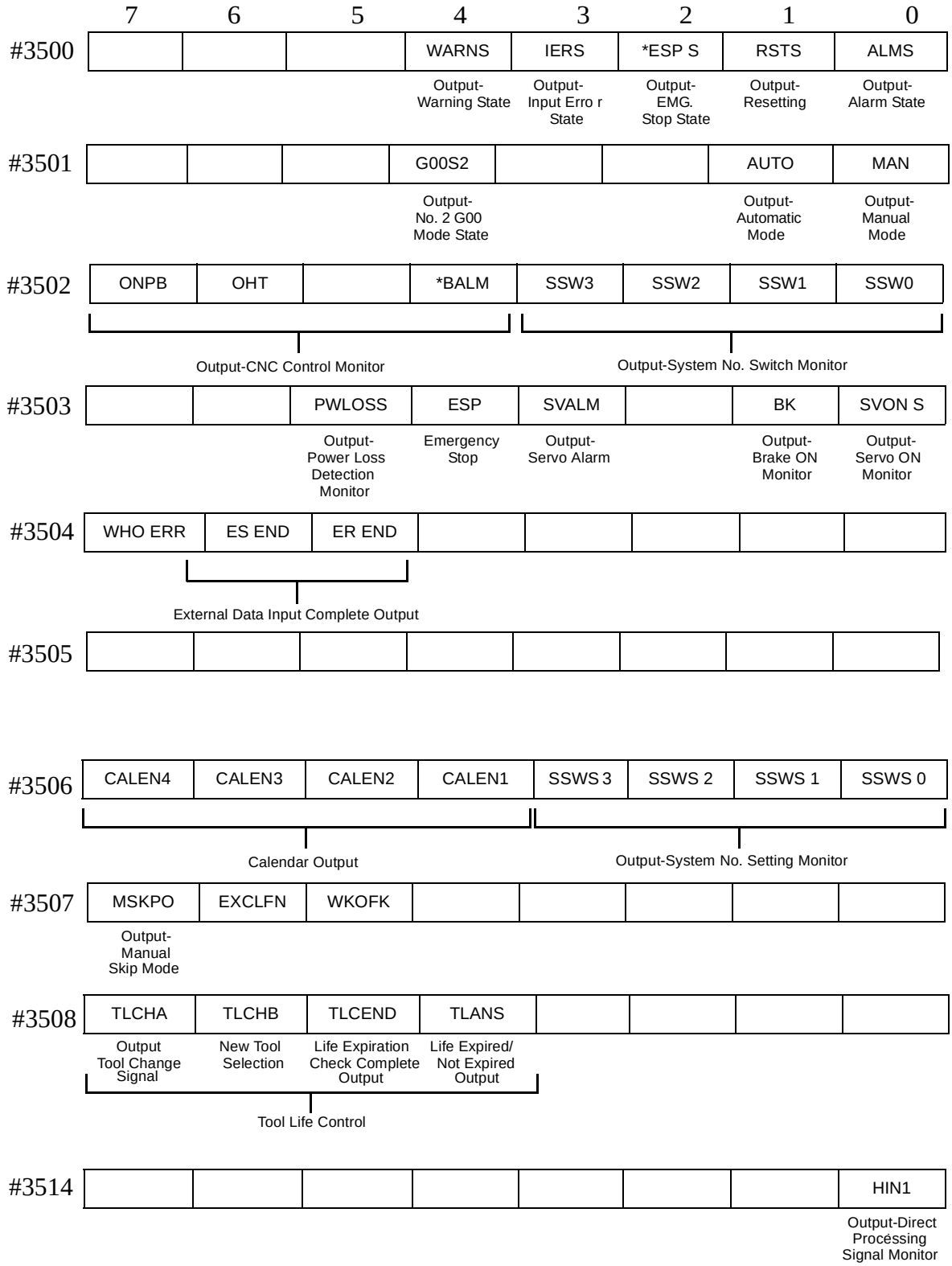


Appendix Table 1.3 Spindle Control (cont'd)

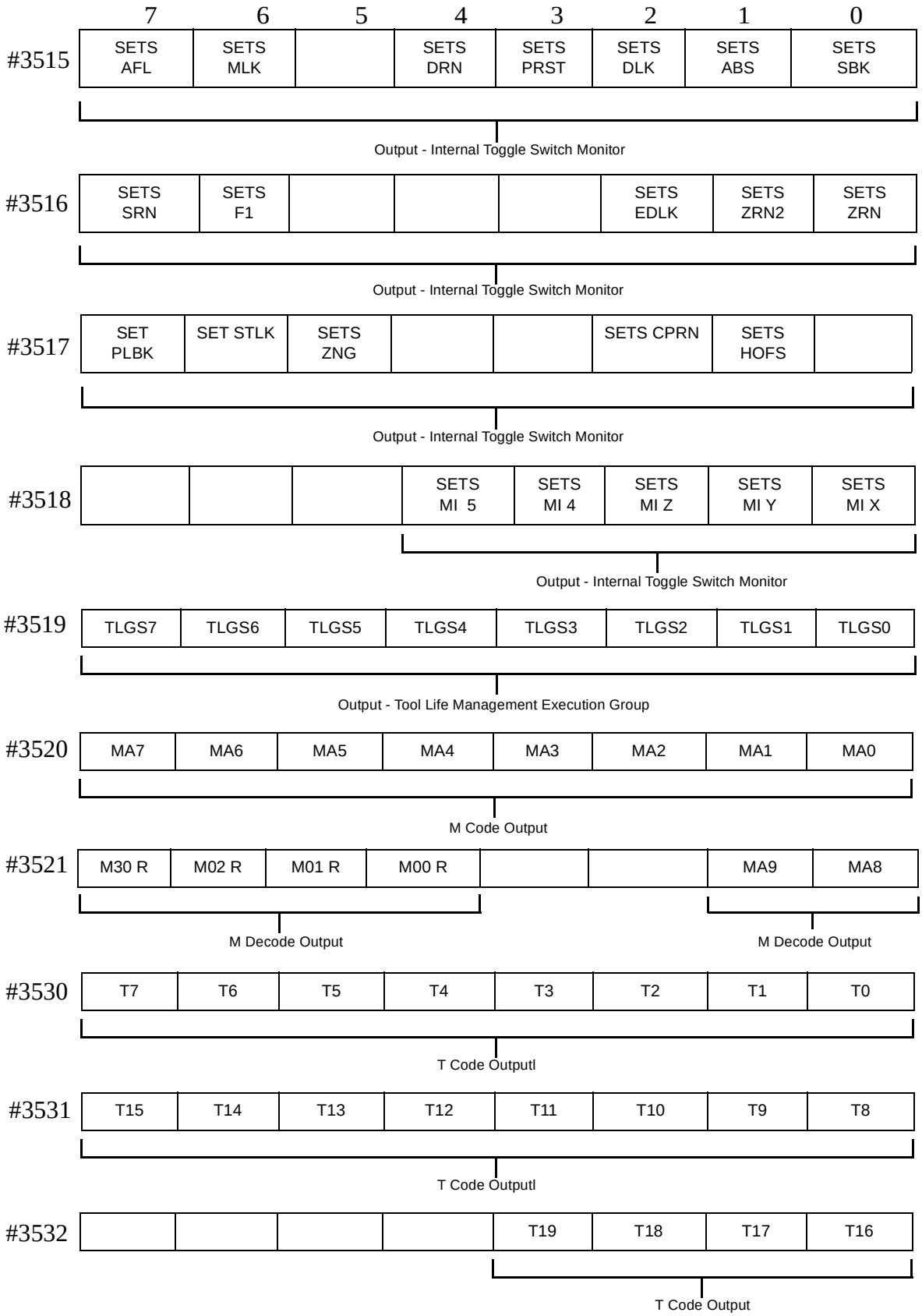


1.2.1 Operation Mode Control Signals

Appendix Table 1.4 Operation Mode Control Signals



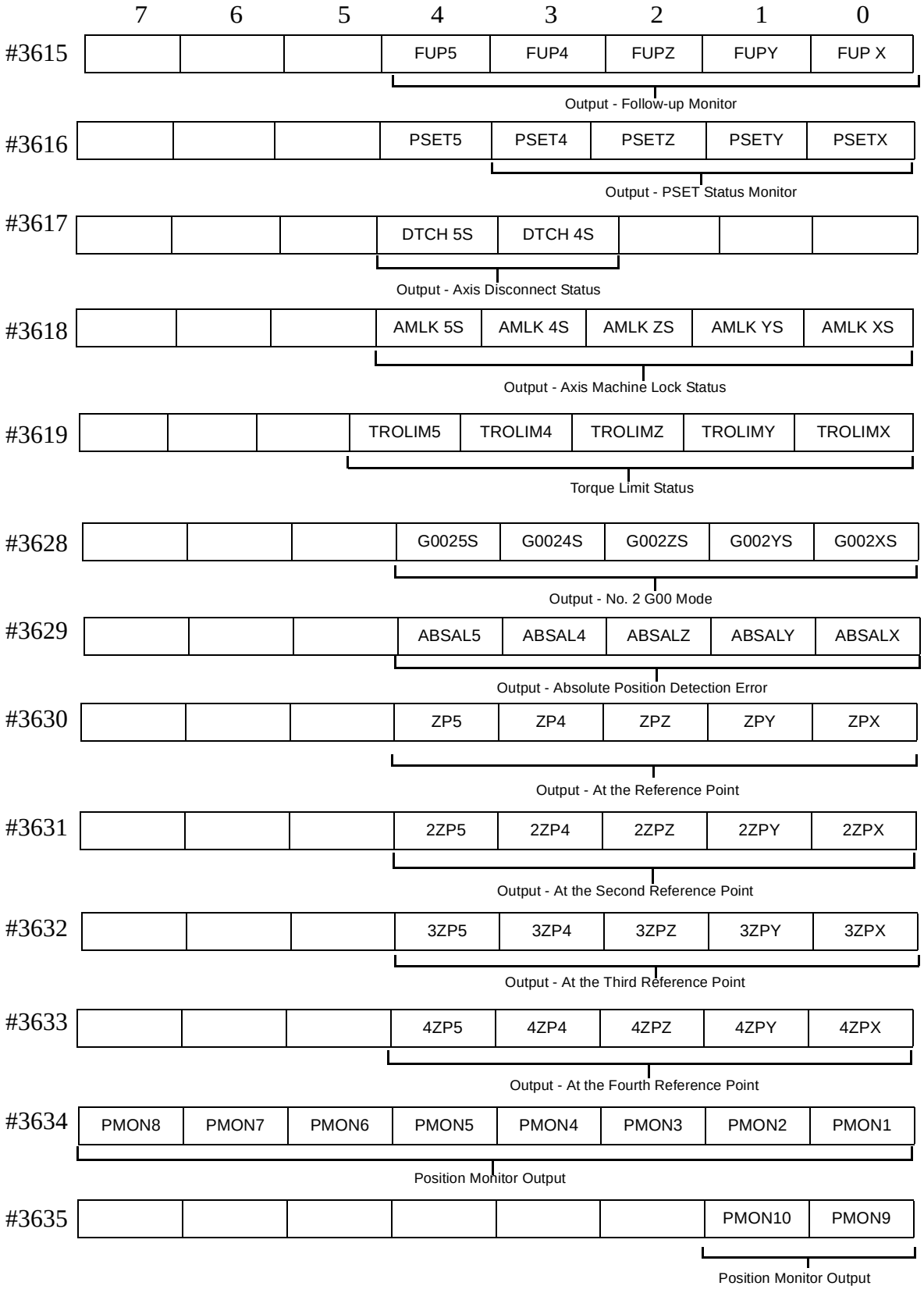
Appendix Table 1.4 Operation Mode Control Signals (cont'd)



Appendix Table 1.4 Operation Mode Control Signals (cont'd)

1.2.2 Servo Axis Control (X -Axis to 5th Axis)

Appendix Table 1.5 Servo Axis Control (X-Axis to 5th Axis)

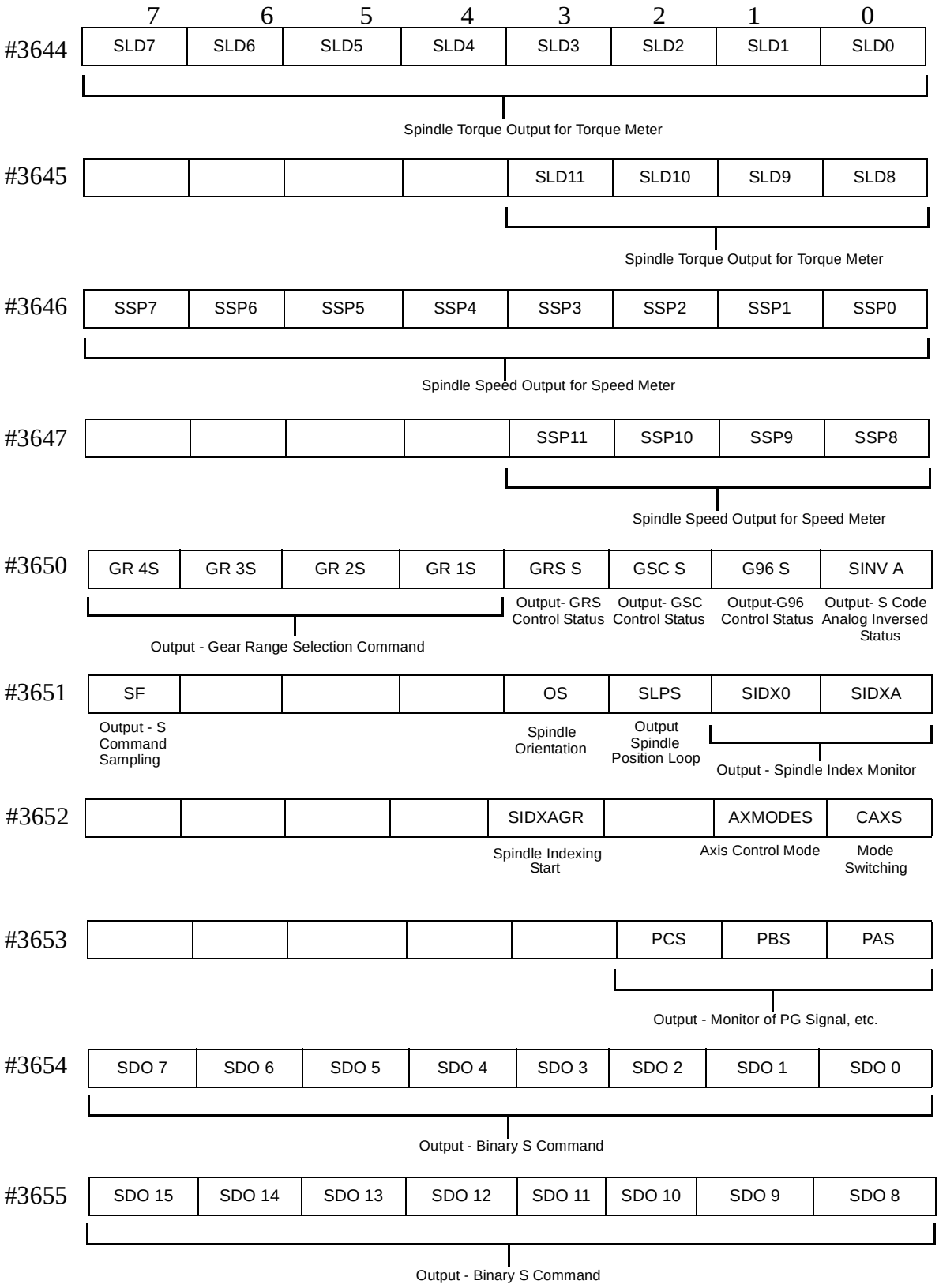


Appendix Table 1.5 Servo Axis Control (X-Axis to 5th Axis) (cont'd)

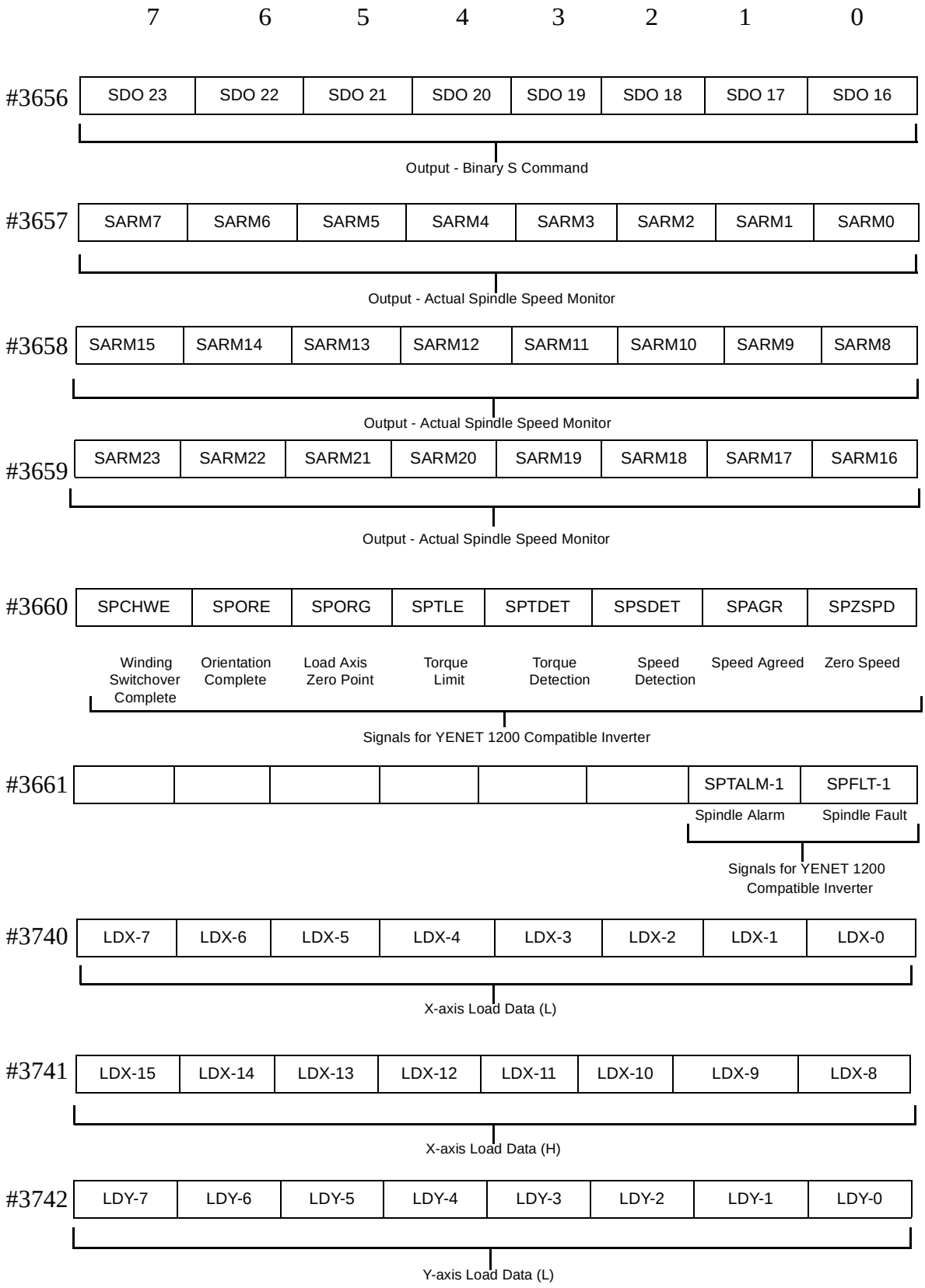
	7	6	5	4	3	2	1	0
#3637				XBA5	XBA4	XBAZ	XBAY	XBAX
				External Encoder Battery Alarm Monitor				
#3638				ZPSET5	ZPSET4	ZPSETZ	ZPSETY	ZPSETX
				Zero Position Set Monitor				

1.2.3 Spindle Control

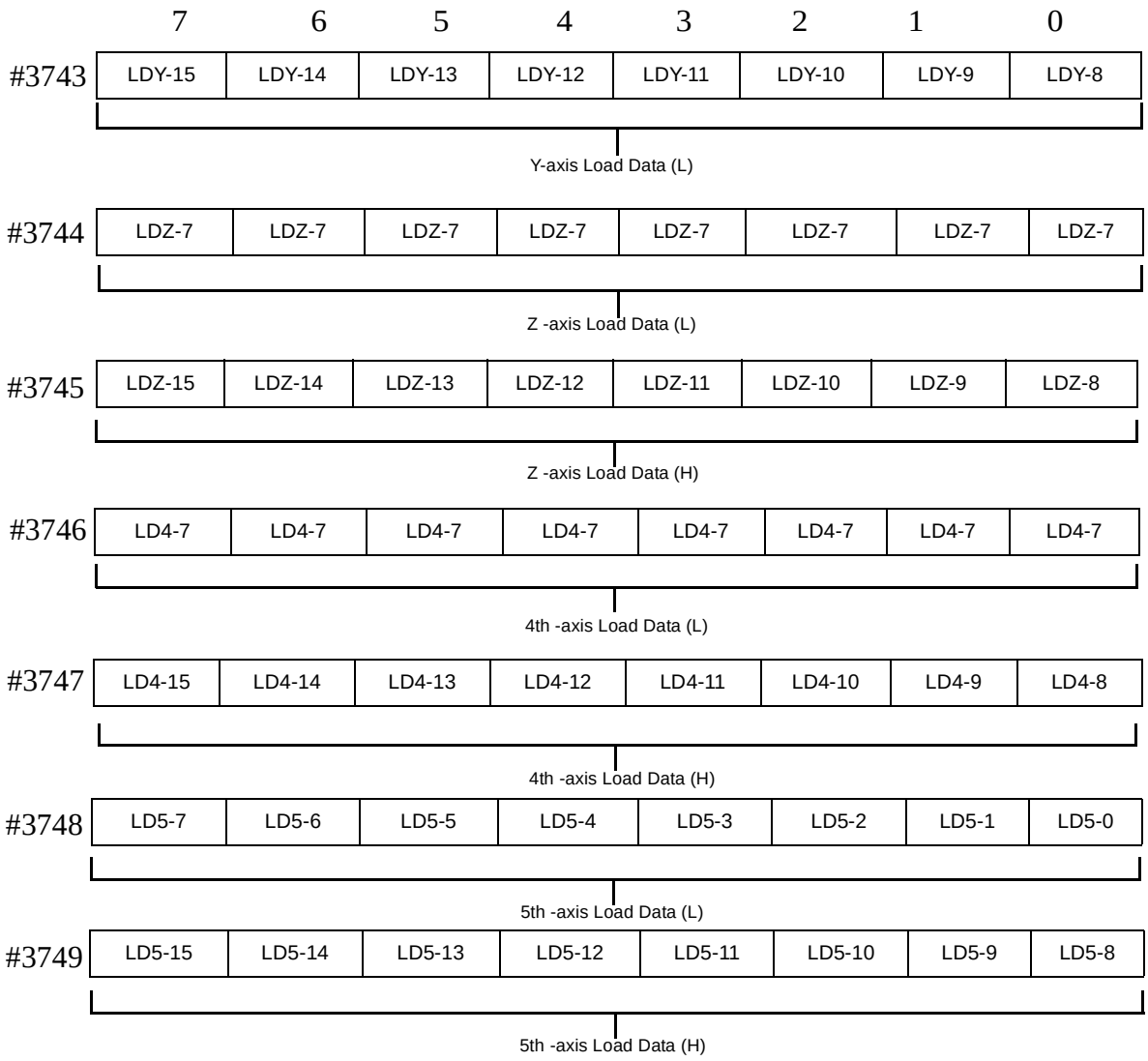
Appendix Table 1.6 Spindle Control



Appendix Table 1.6 Spindle Control (cont'd)

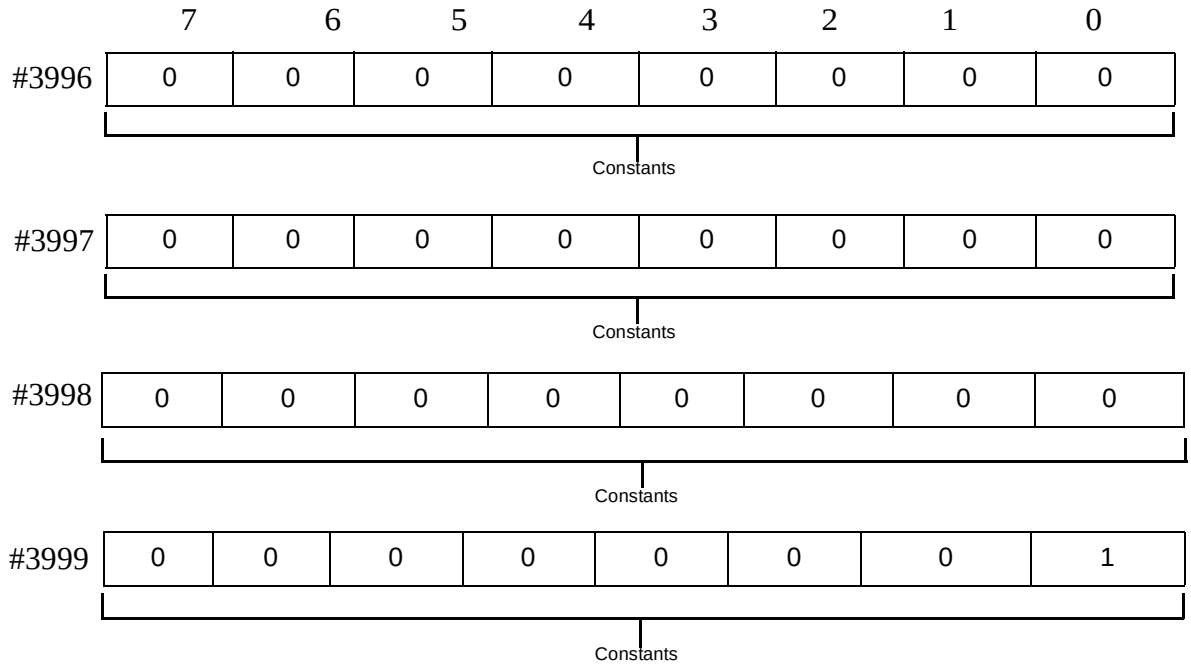


Appendix Table 1.6 Spindle Control (cont'd)



1.2.4 Constants

Appendix Table 1.7 Constant



Appendix 2

INDEX

Appendix 2 describes the signal names used by the PCNC, arranged in alphabetical order
Please refer to this key code index of signal names when looking for descriptions of signals

APPENDIX 2.1 DETAILS OF INPUT/OUTPUT SIGNALS

A

B

C

D

E

F

G

H

I

M

N

O

P

R

S

T

W

Specifications

Classification	Item and Function	Remarks
Controlled Axes	Number of axes	3 (X,Y and Z) + 1 (spindle axis)
	Number of simultaneously controlled axes	3
	Number of additional controled axes	Max. 5 (X,Y,Z,4,5) + 1 (spindle axis)
Programming Methods	Least input increment	0.001mm/0.0001inch/0.001 deg.
	Least command increment	0.001mm/0.0001inch/0.001 deg.
	Maximum programmable dimensions	±9 digits
	Absolute/incremental programming	G90/G91
	Decimal point programming	Usable in an address word for distance, angle speed or time
	Inch/metric selection	G20, G21
	Program resolution X 1/10	
	Program resolution X 10	
	Tape code	EIA code/ISO code
	NC tape	8-unit black paper, JIS C6246
	Buffer resister	2-block pre-reading
	Multi-active resister	7-block pre-reading
Interpolation	Positioning	G00, G06
	Linear interpolation	G01
	Circular interpolation	G02/G03
	Manual interpolation	Feedrate interpolation manually
	G00 interpolation	Interpolation type G00
	2nd G00	Accel.decel speed change by input signal
	Helical interpolation	G02/G03 (Circular interpolation + Max. 3 axes linear interpoltaion)
Controlled Axes	Number of axes	3 (X,Y and Z) + 1 (spindle axis)
	Number of simultaneously controlled axes	3
	Number of additional controled axes	Max. 5 (X,Y,Z,4,5) + 1 (spindle axis)

Classification	Item and Function	Remarks

Feed	Machining feedrate	100m/min.,G01,tangential speed constant control
	Rapid traverse rate	240m/min.
	F1 digit feed	F1 to F9
	Dwell	G04
	Feed per minute	
	Manual feed	x1/x1/x100
	Simultaneous 3-axis manual feed	3 manual pusle generators
	Incremental feed	x1/x1/x100/x1000/x10000/x100000
	Automatic accel/decel	Feed: exponentail accel/decel Rapid traverse: linear accel/decel
	Rapid traverse rate override	100%, 50%, 25% F0
	Extended rapid traverse rate override	F1,F2
	Feedrate override	0 to 200%, every 10% step
	Extended machining feed override	0 to 540%
	Feedrate override cancel	OVR input
	Solid tapping	G93/G94 High-speed solid type
	Deep hole solid tapping	G184/G174
	S-curve accel/decel	At positioning
	Corner speed specification (G107)	Part finishing (medium precision) with automatic accel/decel function at the corner
	Form error compensation	Form error compensation for servo related delay
	Automatic form error compensation (G-HSC)	Part finishing, accel/decel speed before shift + form error compensation
	High-speed machining (S-HSC)	Mold finishing, automatic corner accel/decel before shift + form error compensation
	Variable P SET	
Part Program Storage and Edit	O9000 to O9999 edit/display/output interlock	
	Playback function	Program edit by keying or external input
	Directory display	
	Background edit	Program edit during automatic operation

Classification	Item and Function	Remarks
STM Functions (Spindle Tool Miscellaneous)	Spindle speed function (S)	S instruction, 6 digits
	Spindle speed override	50% to 120%
	Extended spindle speed override	10% to 200%
	Tool function (T)	T instruction, 2 digits
	Tool function (T)	T instruction, 4 digits
	Miscellaneous function (M)	M instruction, 3 digits
	Second miscellaneous function (B)	B instruction, 3 digits
	Spindle motor speed instruction PLC I/O	SDI 0 to 23/SDO 0 to 23
	Spindle indexing	DID 0 to 11
	Spindle constant speed, gear shift input	SOR, GRO
	High-speed MTSB instruction	Alternate method FIN input
	Spindle speed coincidence standby	SAGR
	High-speed spindle indexing	
Tool Offset	Tool length offset	G34,G44,G49
	Tool position offset	G45 to G48
	Tool radius offset	G40/G41/G42
	Number of tool offset	99 pairs (H and D can be seperated)
	Additional number of tool offset	299/999/1199 pairs
	3-dimension tool offset	
	Tool wear offset	Form compensation + wear compensation
Classification	Item and Function	Remarks

Coordinate System	Manual return to reference point	JOG/RAPID
	Automatic return to reference point	G28
	Return to 2nd reference point	G30Pn
	Return to 3rd, 4th reference point	G30Pn
	Reference point return check	G27
	Return from reference point	G29
	Automatic coordinate system setting	
	Coordinate system setting	G92
	Work coordinate system setting	G54 to G59
	Move on machine coordinate system	G53
	Local coordinate system	G52O2
	Return to easy reference point	Virtual phase C must be set by parameter
	Plane specification	G17 to G19
	Manual 2nd home return	
	Rotation of work coordinate system	G54R
Classification	Item and Function	Remarks

Operation Support Functions	Label skip	LSK
	Single block	SBK
	Optional stop	M01,OPT
	Optional block skip	“/”, BDT
	Optional block skip B	/2 to /9
	Dry run	DRN
	Machine lock	MLK
	Auxiliary function lock	AFL
	Display lock	DLK
	Mirror image	MIX to MI5
	Manual absolute	ABS
	Z-axis feed cancel	ZENG
	Calibration (set zero) and numerical value se-tup	Uses CNC control panel
	Hand wheel feed interruption	HOFS
	Program restart*	PRST
	Sequence No. collation stop (break-point function)	Stops the operation at specified sequence No.
	Tool length measurement	TLM1,RET
	Measuring function	Work pre-setter, offset pre-setter
	Output of NC power-on state	PWLOST
	Output of servo power-on state	SVONS
	Output of NC alarm state	ALMS
	Output of input error state	IERS
	Output of NC mode selection	MAN,AUTO,EDTS
	Output of operating monitor	STL,SPL,FEEDS,RPDS,DEN,OP,RWDS
	External display selection	SPJ 0 to 3, DSPP 0 to 3, DSPF 0 TO 4, DSPCHG
Classification	Item and Function	Remarks

Operation Support Functions (continued)	Return to interrupted point in machining	CPRN
	Axis removal specification	DTCH4,DTCH5
	Individual axis machine lock	AMLK x to 5
	Manual threading function	MSI
	Mechanical handle feed	Servo-off + follow-up
	Operation mode	RAPID/JOG/HANDLE · STEP/TAPE/ MDI/MEM modes
	Cycle start	ST
	Temporary stop	SP
Program Support Functions	Circular interpolation radius programming	G02,G03R···
	Champhering and corner radius programming	G01,GO2,GO3P...
	Canned cycle	G73···, G181···
	Complete circle cutting	G12/G13
	Sub program	M98
	Macro-program	G65 to G67
	Programmable mirror image	M94/M95
	Scaling	G50/G51
	Coordinate system rotation	G68/G69
	Automatic corner override	G106
	Exact stop check	G09
	Exact stop check mode	G61/G64
	Programmable data input	G10
	Program rewind and end	RWD,EOP
	Time count input	EXTC
	Hole pattern cycle	G70 to G72
	Program copy	G25
	Reception full circular interpolation	G02/G03···L···
	Complete circle cutting of outside diameter	G12/G13
Mechanical and Servo Error Compensation	Backlash compensation	-32767P to +32767P
	Pitch error compensation	1152 points, 5 axes
	Undirectional positioning	G60
	Circle stub compensation	

Classification	Item and Function	Remarks
Disturbance Observer Functions	Feed interlock	ITX to 5
	Positioning axis interlock	
	Servo shift distance change	
	Absolute position detection	Uses absolute encoder
	PLC auxiliary machine axis control*	*under development
	Seperated PG absolute position detection	
Automatic Support Functions	Skip function	G31
	Tool life management function	MG125, 256 management tools (Number of groups x Number of tools), rate per time
	External servo-on input	SVON
	External power ON/OFF input	ON/OFF by using other than CNC control panel
	Program interruption	PINT
	Manual skip function	MSKP
	DNC operation (RS-232C)	No remote buffer, 2.4 to 19.2kbps
	Memory operation	
	DNC operation (Ethernet)*	* under development 10 BASE-5/10BASE-T Windows® NT4.0
Safety and Maintenance Functions	Emergency stop	
	Overtravel	OT
	Stored stroke limit	
	Self-diagnosis	
	Door interlock	
	Output of external reset input and resetting	ERS,RSTS
	Machine ready input	MRD
	External error detection input	EER 0,1,2
	Follow-up	
Classification	Item and Function	Remarks

Safety and Maintenance Functions (continued)	Individual axis servo OFF input	SVOFX to 5
	Alarm display	Displays alarms or user's messages
	Key historic log	
	Servo monitor function	
	Spindle monitor function	Requires spindle with YENET support
	Position monitor function	PMON 1 to 8
	Stored stroke limits B and C	2nd to 5th areas
	Stored stroke limit before movement	
	Active stroke limit function	Movable areas by input signal
	System ID display	Maintenance display
	Memory dump function	Maintenance display
	NC status monitor development paackage (Ethernet)*	*under development 10 BASE-5/10BASE-T Windows® NT4.0

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YASKAWA ELECTRIC AMERICA, INC.
Chicago-Corporate Headquarters 2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone: (847) 887-7000 Fax: (847) 887-7310 Internet: http://www.yaskawa.com

MOTOMAN INC.
805 Liberty Lane, West Carrollton, OH 45449, U.S.A.
Phone: (937) 847-6200 Fax: (937) 847-6277

YASKAWA ELECTRIC CORPORATION
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo, 105-0022, Japan
Phone: 81-3-5402-4511 Fax: 81-3-5402-4580 Internet: http://www.yaskawa.co.jp

YASKAWA ELETRICO DO BRASIL COMERCIO LTDA.
Avenida Fagundes Filho, 620 Bairro Saude Sao Paolo-SP, Brasil CEP: 04304-000
Phone: 55-11-5071-2552 Fax: 55-11-5581-8795 E-mail: yaskawabrasil@originet.com.br

YASKAWA ELECTRIC EUROPE GmbH
Am Kronberger Hang 2, 65824 Schwalbach, Germany
Phone: 49-6196-569-300 Fax: 49-6196-888-301 Internet: http://www.yaskawa.de

MOTOMAN ROBOTICS AB
Box 504 S38525, Torsas, Sweden
Phone: 46-486-48800 Fax: 46-486-41410

MOTOMAN ROBOTEC GmbH
Kammerfeldstraβe 1, 85391 Allershausen, Germany
Phone: 49-8166-900 Fax: 49-8166-9039

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, Scotland, United Kingdom
Phone: 44-12-3673-5000 Fax: 44-12-3645-8182

YASKAWA ELECTRIC KOREA CORPORATION
Paik Nam Bldg. 901 188-3, 1-Ga Euljiro, Joong-Gu, Seoul, Korea
Phone: 82-2-776-7844 Fax: 82-2-753-2639

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
Head Office: 151 Lorong Chuan, #04-01, New Tech Park Singapore 556741, SINGAPORE
Phone: 65-282-3003 Fax: 65-289-3003

TAIPEI OFFICE (AND YATEC ENGINEERING CORPORATION)
10F 146 Sung Chiang Road, Taipei, Taiwan
Phone: 886-2-2563-0010 Fax: 886-2-2567-4677

YASKAWA JASON (HK) COMPANY LIMITED
Rm. 2909-10, Hong Kong Plaza, 186-191 Connaught Road West, Hong Kong
Phone: 852-2803-2385 Fax: 852-2547-5773

BEIJING OFFICE
Room No. 301 Office Building of Beijing International Club,
21 Jianguomanwai Avenue, Beijing 100020, China
Phone: 86-10-6532-1850 Fax: 86-10-6532-1851

SHANGHAI OFFICE
27 Hui He Road Shanghai 200437 China
Phone: 86-21-6553-6600 Fax: 86-21-6531-4242

SHANGHAI YASKAWA-TONJI M & E CO., LTD.
27 Hui He Road Shanghai 200437 China
Phone: 86-21-6533-2828 Fax: 86-21-6553-6677

BEIJING YASKAWA BEIKE AUTOMATION ENGINEERING CO., LTD.
30 Xue Yuan Road, Haidian, Beijing 100083 China
Phone: 86-10-6232-9943 Fax: 86-10-6234-5002

SHOUGANG MOTOMAN ROBOT CO., LTD.
7, Yongchang-North Street, Beijing Economic & Technological Development Area,
Beijing 100076 China
Phone: 86-10-6788-0551 Fax: 86-10-6788-2878

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