

**CNC SYSTEM FOR MACHINING CENTERS****YASNAC J50M****UPGRADING FUNCTION MANUAL**

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

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## FOREWORD

Thank you for selecting YASNAC J50M. The YASNAC J50M upgrades the specification of several functions.



This manual describes the function upgrades and how to handle them.

## CAUTIONS

This manual describes all the option functions (identified by the “\*” symbol) but some of these may not be available with your YASNAC J50M. To determine the option functions installed in your NC, refer to the specification document or manuals published by the machine tool builder.

For the items not covered by this manual, please refer to the YASNAC J50M Instruction Manual (manual No. T0E-C843-12.30).

Unless otherwise specified, the following conditions apply in programming explanations and programming examples.

- Metric system for input and metric system for output/movement
-  : Zero point in the base coordinate system
-  : Reference point

Yaskawa has made every effort to describe individual functions and their relationships to other functions as accurately as possible. However, there are many things that cannot or must not be performed and it is not possible to describe all of these. Accordingly, readers are requested to understand that unless it is specifically stated that something can be performed, it should be assumed that it cannot be performed.

Also bear in mind that the performance and functions of an NC machine tool are not determined solely by the NC unit. The entire control system consists of the mechanical system, the machine operation panel and other machine related equipment in addition to the NC. Therefore, read the manuals published by the machine tool builder for detailed information relating to the machine.

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## General Precautions

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe the detail with more clarity. Make sure all covers and shields are replaced before operating this product, and operate it in accordance with the directions in the manual.
- The figures and photographs in this manual show a representative product for reference purposes and may differ from the product actually delivered to you.
- This manual may be modified when necessary because of improvement of the product, modification, or changes in specifications. Such modification is made as a revision by renewing the manual No.
- To order a copy of this manual, if your copy has been damaged or lost, contact your Yaskawa representative listed on the last page stating the manual No. on the front page.
- If any of the nameplates affixed to the product become damaged or illegible, please send these nameplates to your Yaskawa representative.
- Yaskawa is not responsible for any modification of the product made by the user since that will void our guarantee.

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## NOTES FOR SAFE OPERATION

Read this programming manual thoroughly before installation, operation , maintenance or inspection of the YASNAC J50M. In this manual, the NOTES FOR SAFE OPERATION are classified as “WARNING” or “CAUTION”.

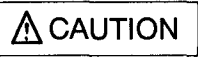


Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to personnel and damage to equipment.

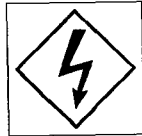
It may also be used to alert against unsafe practice.

Even items described in  may result in a vital accident in some situations. In either case, follow these important items.

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## KEY TO WARNING LABELS

The following warning labels are used with the YASNAC J50M.

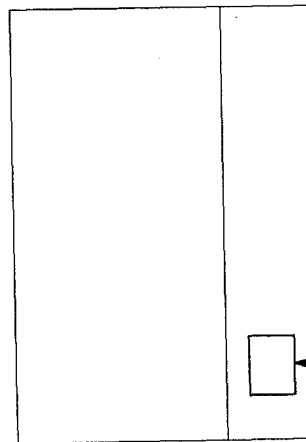


Electric shock hazard

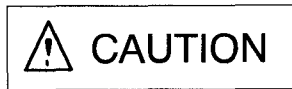
Do not touch the terminals while the power is on, and for 5 minutes after switching off the power supply!

Location of label

NC unit

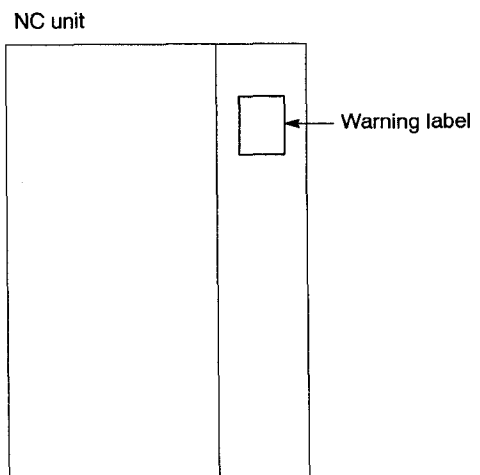


Warning label



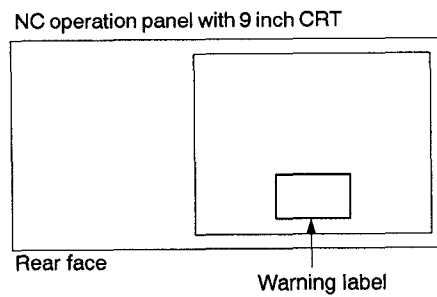
Grounding wires must be connected to the unit's grounding terminals.

Location of label



Electric shock hazard  
Do not touch inside.

Location of label



## TABLE OF FUNCTIONS ADDED FOR J50M UPGRADE

Class		Item/Function	Description	Applicable Unit	
				J50 Upgraded	
				Standard spec.	High-speed spec.
Upgrades to reduce cycle time	○	Upgraded "at-reference-point" output signal	Permits pulse width of the zero point return output signal to be changed.	✓	✓
	○	Select in-position waiting in G53 execution	Disregards in-position waiting for the G53 command during G00 mode.	✓	✓
	*	Upgraded spindle indexing	Enables spindle indexing by NC during a deceleration stop movement.	✓	✓
Upgrades to improve ease-of-operation	*	Key input lock	Prevents malfunctions due to incorrect key operations during automatic operation.	✓	✓
	*	Position monitoring	Always checks if the machine position is in a designated area and outputs the status to I/O.	✓	✓
	*	Program check screen	Adds the position, G code and S, T and F information to the program screen.	✓	✓
	*	Absolute position detection	Makes zero point return unnecessary at power ON.	✓	
	○	ROM-based programs	Stores required programs such as macro programs for machine movements in ROM.	✓	
Upgrades to improve safety	○	Deceleration stop on reset during movement	Enables deceleration stop after reset operation performed during axis movement.	✓	✓
	○	Upgraded software overtravel (S-OT)	Improves software overtravel accuracy and enables simplified software overtravel check before axis movement in manual operation.	✓	✓
Upgrades to improve speed	○	G00 S-curve acceleration/deceleration	Reduces shocks during high-speed axis movement executed with acceleration and deceleration in a short time.	✓	✓
	*	Upgraded solid tap function	Enables tapping operation at high speed and high acceleration/deceleration.		✓
	○	S-curve acceleration/deceleration for solid tapping	Reduces acceleration fluctuations during spindle acceleration or deceleration to achieve shorter spindle acceleration and deceleration time settings.	✓	✓
Other additional functions	*	Deep-hole solid tap function	Permits a deep-hole drilling cycle with the solid tap function.	✓	

○: Standard software function (may be subject to hardware restrictions)

\*: Optional software function (may be subject to hardware restrictions)

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# 1

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## HARDWARE RELATED TO J50M UPGRADES

Chapter 1 describes the hardware that has been modified due to upgrades of the J50M.

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# 1.1 CONNECTIONS BETWEEN EQUIPMENT

This sections explains the points changed from previous connections. Connections not described in this section are the same as the original specification.

## 1.1.1 Connection Diagrams

The connections between equipment differ according to the operation panel specification.

### (1) Operation Panel with High-definition CRT

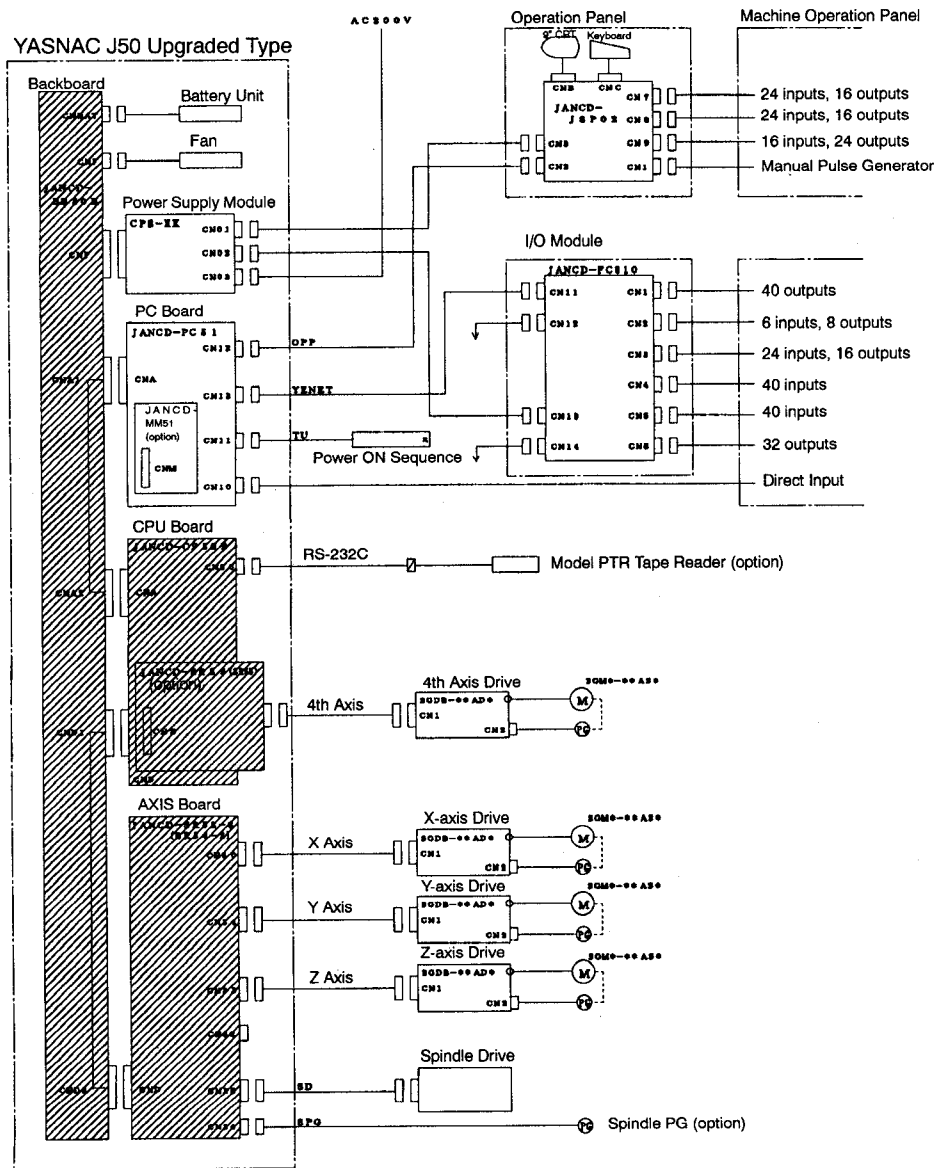


Fig. 1.1 High-definition CRT Specification

(2) Operation Panel with Monochrome LCD

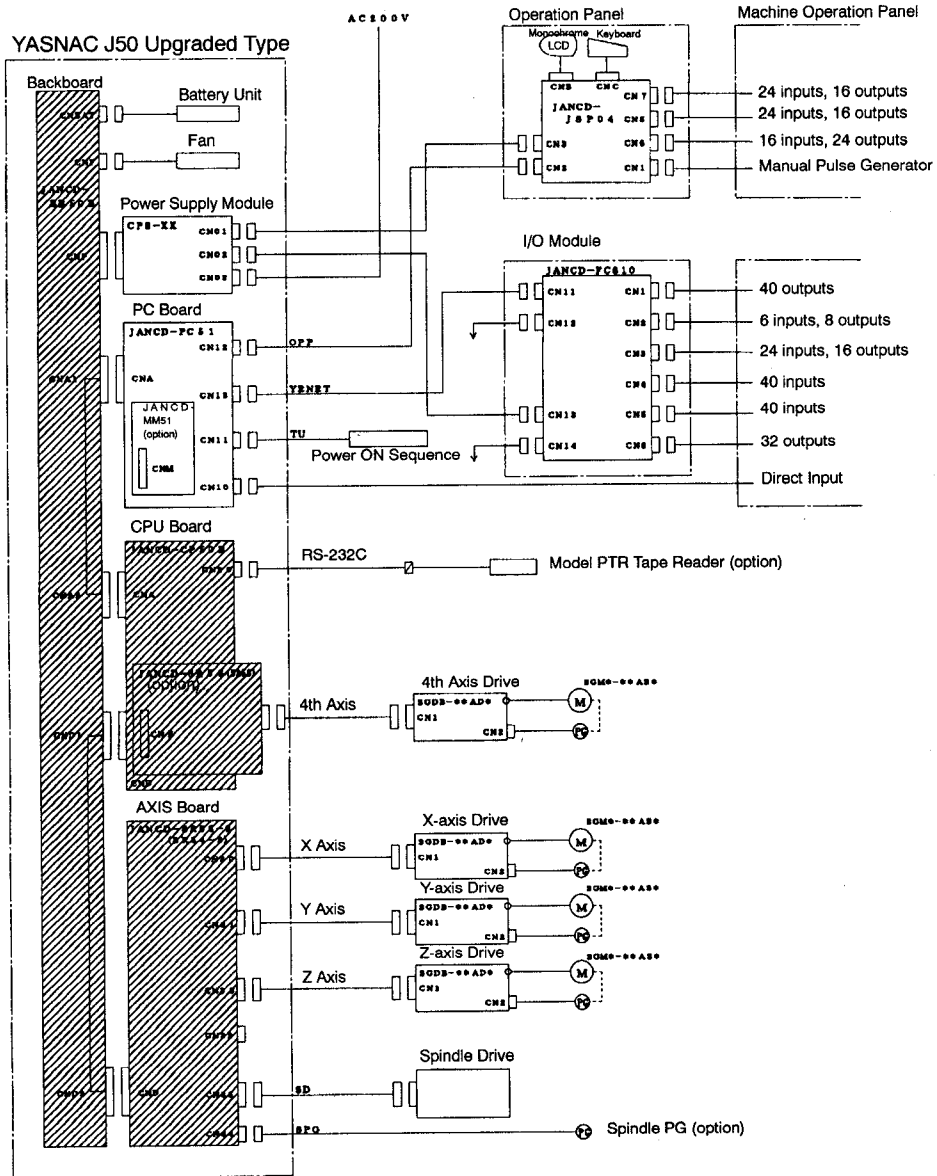


Fig. 1.2 Monochrome LCD Specification

1

### 1.1.2 Detailed Connection Diagram

The X-axis connection diagram of the AXIS board (SR52-2) is shown below. The OL and FU connections on the previous SR50 board have disappeared and SEN and BAT have been added.

The Y-, Z-, and 4th-axis connectors are identical.

The connections are also the same if the SR54-2 board is used.

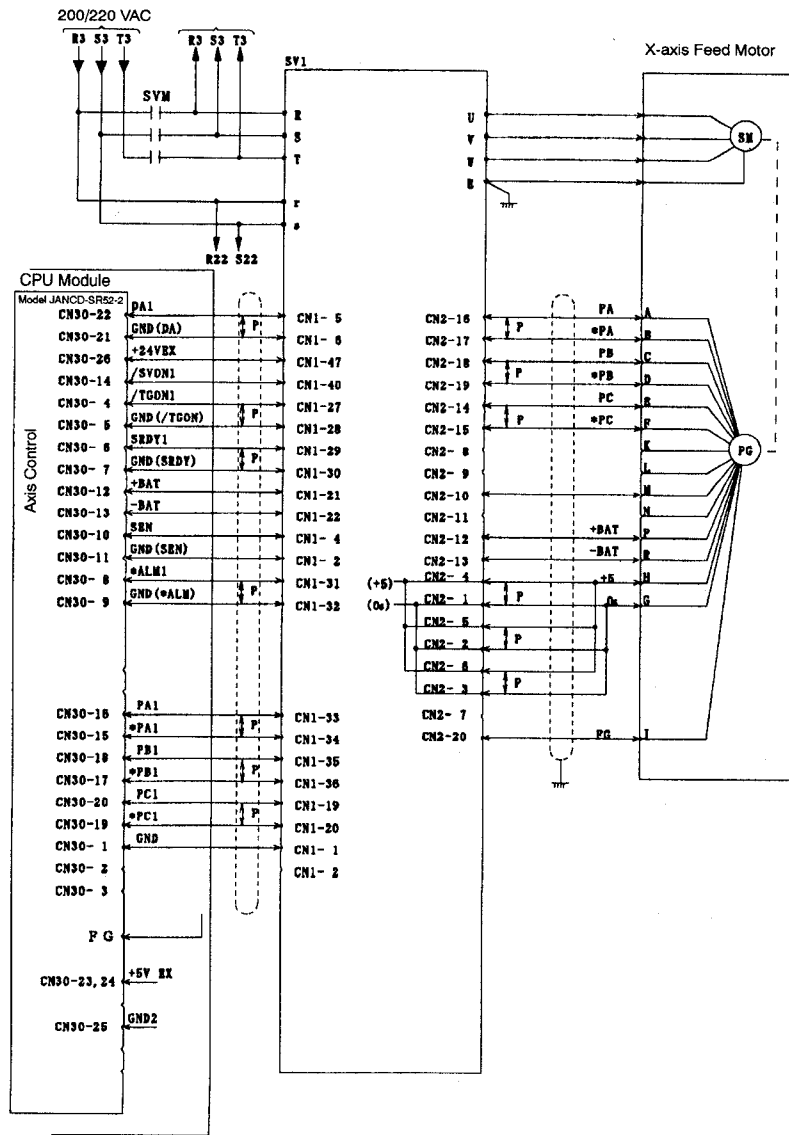


Fig. 1.3

## 1.2 DISPLAY UNIT SPECIFICATIONS

The table below shows the specifications of the original display unit and the upgraded J50 display unit.

Note that the original display unit and the upgraded J50 display unit are not compatible.

Table 1.1 Display Unit Specifications

Specification	Resolution of Screen		Original Specification
	High Resolution		
Display	Monochrome LCD	High-resolution CRT	Original specification
Screen Size	9 inch		9 inch
Max. Characters	40 × 20		32 × 16
Displayed Characters	Numbers Letters Special codes		Numbers Letters Special codes
Keyboard	Symbol keys		Letter and symbol keys
Language	L Series: English, Japanese, German, French, Italian, Hangul Korean (planned), Chinese (planned) M Series: English, Japanese, German, French, Hangul Korean (planned), Chinese (planned)		L Series: English, Japanese, German, French, Italian M Series: English, Japanese, German, French
External Dimensions (front)	Horizontal: 200(H) 520 (W) 120 (D) Vertical: 420 (H) 290 (W) 120 (D)	Horizontal: 200(H) 520 (W) 230 (D) Vertical: 420 (H) 270 (W) 230 (D)	Horizontal: 200(H) 520 (W) 230 (D) Vertical: 420 (H) 270 (W) 230 (D)

# 2

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## UPGRADED FUNCTIONS

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This Chapter describes the upgraded function of the J50M.

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## 2.1 UPGRADES TO REDUCE CYCLE TIME

Several upgrades have been conducted to reduce cycle times. The times quoted in the explanations are reference values only. The same time reductions may not be achieved in an actual machine because of differences in factors such as the servo system settings and machine rigidity.

### 2.1.1 Upgraded “At-reference-point” Output Signal

#### (1) Outline of the Function

The start condition normally used for M codes which include machine movements (tool change, turret indexing, etc.), is the evaluation whether an axis is in the area near the zero point.

For this evaluation, YASNACJ50 normally uses the “at-reference-point” output signal, one of the signals output by the NC. Because the signal output range is fixed at  $\pm 3$  pulses relative to the zero point, the signal can only be used as a “complete output (COIN)”, not as a “near-zero-point (NEAR)” output.

However, the upgrade makes the “at-reference-point” output signal variable so that it can be used as a “near-zero-point (NEAR)” output. Although the positioning settling time remains unchanged, a reduction in cycle time of several hundred milliseconds is possible because machine movement is enabled during the settling time instead of after it is complete.

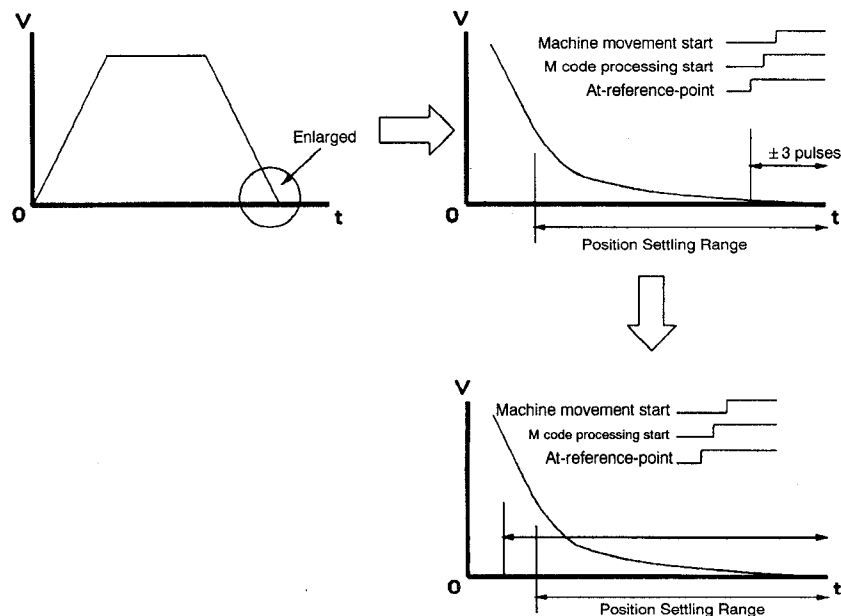


Fig. 2.1 At-reference-point Output Signal



## (2) Specifications

This item explains the original specification and the upgraded specification.

### (a) Original Specification

The I/O outputs the “at-reference-point” signal when the axis is within  $\pm 3$  pulses of the zero point.

This is also used as the start condition for automatic coordinate system set-up after zero point return is complete.

### (b) Upgraded Specification

The following parameters have been added.

Table 2.1 At-reference-point Signal Output Parameters

Parameter No.	Description	Setting Units	Setting Range
pm6668	No. 1 at-reference-point signal output range	1 = 1 pulse	3 to 99999999
pm6669	No. 2 at-reference-point signal output range		
pm6670	No. 3 at-reference-point signal output range		
pm6671	No. 4 at-reference-point signal output range		

The “at-reference-point” signal is output when the axis is within the range set by the parameter relative to the zero point.

The range reverts to the original 3 pulses (fixed) if the parameter is set out of range.

When used as the start condition for automatic coordinate system set-up after zero point return is complete, the range remains the original 3 pulses.

## (3) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.1.2 Select In-position Waiting in G53 Block

### (1) Outline of the Function

Even if the in-position wait/no in-position wait parameter is set to “No in-position wait”, in-position waiting does occur during the execution of a move command in the G53 block (temporary movement in the machine coordinate system) in the G00 mode.

The “No in-position wait” state is normally used to reduce the cycle time. The upgraded function offers additional selection parameters to call up “No in-position wait” in the G53 block to reduce the cycle time.

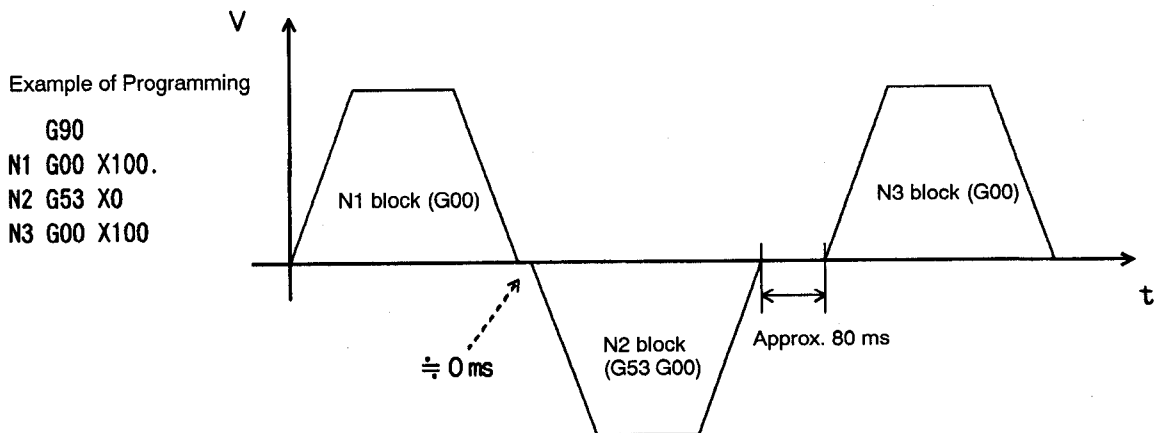
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### (2) Specifications

This item explains the original specification and the upgraded specification.

#### (a) Original specification

Fig. 2.2 shows the X-axis feedrate waveform during G00 block program execution when the selection parameter is set to “No in-position wait” (pm6018 D3 = 1). Despite the parameter setting, in-position waiting occurs in the G53 block, resulting in approximately 80 ms stop time between blocks.



## (b) Upgraded specification

The following parameters have been added.

Table 2.2 Parameters to Select In-position Waiting in G53 Block

Parameter No.	Bit No.	Description
pm6074	D0 = 0	In-position wait during execution of G53 block
	D0 = 1	No in-position wait during execution of G53 block

In the G01 mode, the execution mode of a G53 block is set by the pm6018 D3.

Table 2.3 Parameters to Select In-position Waiting

Parameter No.	Bit No.	Description
pm6018	D3 = 0	In-position wait in G00 mode and at mode change from G01 to G00
	D3 = 1	No in-position wait in G00 mode and at mode change from G01 to G00

## (3) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.1.3 Upgraded Spindle Indexing Function\*

## (1) Outline of the Function

Spindle indexing is used during cycles such as the automatic tool change (ATC) and tapping cycles. The spindle normally makes a deceleration stop before indexing at the set indexing speed.

To increase machine speed and reduce the cycle time, the function has been upgraded to conduct indexing while the spindle is still rotating during the deceleration stop.

(2) Specifications

This item explains the original specification and the upgraded specification.

(a) Original Specification

The rotating spindle first makes a deceleration stop before indexing starts. After stopping, the spindle then accelerates again to the “indexing start speed” set in the parameter. Indexing to the target position starts when the spindle reaches the set “indexing start speed.”

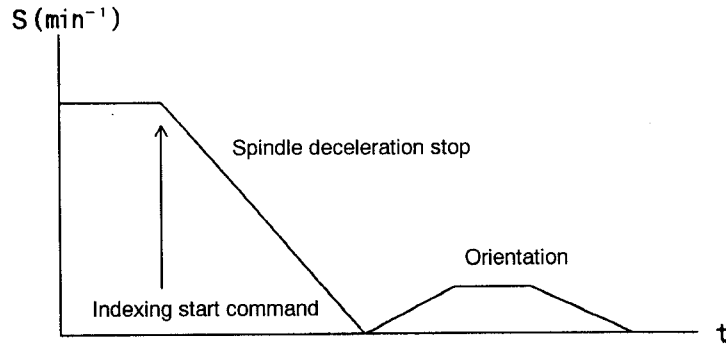


Fig. 2.2

(b) Upgraded Specification

The following parameter has been added.

Table 2.4 Spindle Indexing Parameter

Parameter No.	Description
# option	0: Use the original spindle indexing function
	1: Use the upgraded spindle indexing function

The original spindle indexing start speed and spindle indexing creep speed parameters can be used as before.

The spindle indexing operation depends on the spindle rotational speed when indexing is started.

- Spindle rotational speed when indexing is started exceeds the spindle indexing start speed set for parameter

The spindle decelerates to the set indexing start speed before starting spindle zero point indexing. The spindle then makes a deceleration stop. If the indexing position is not the C-phase position, the spindle decelerates to creep speed and stops at the position as close as possible to the indexing position.

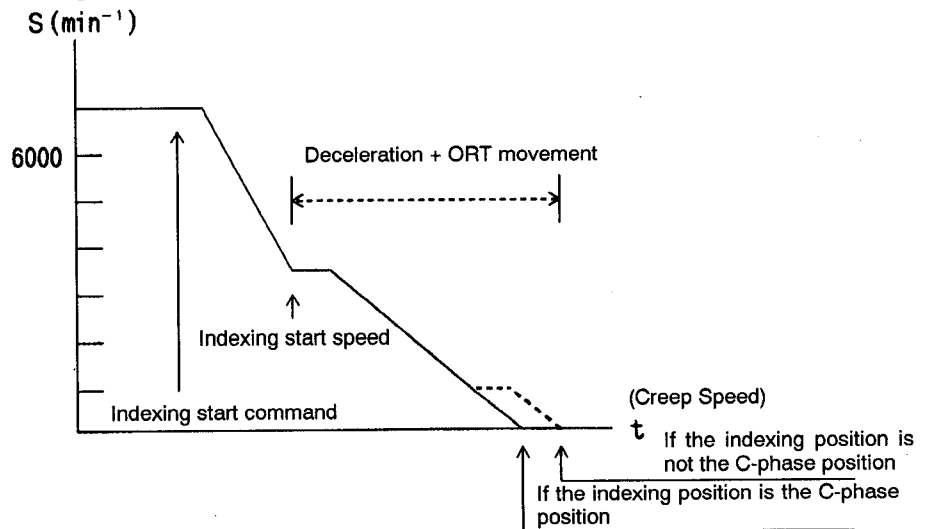


Fig. 2.3

- Spindle rotational speed when indexing is started is below the spindle indexing start speed set for parameter or spindle is stopped

The spindle accelerates to the set indexing start speed before starting spindle zero point indexing.

(3) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.2 UPGRADES TO IMPROVE EASE-OF-OPERATION

Several upgrades have been conducted to improve ease of operation. Some of the functions are subject to hardware limitations outside the NC.

### 2.2.1 Key Input Lock Function

#### (1) Outline of the Function

With the keyboard provided on the NC operation panel, key input is always enabled. But in some machine operation environments key input must be disabled to prevent malfunctions due to incorrect key operations during automatic operation.

This function is interlocked with the key lock switch to disable inputs from the NC operation panel keyboard.

#### (2) How to Use the Function

The key lock switch mounts on the machine operation panel. When the key lock switch is turned ON, input is disabled from all keys on the NC operation panel keyboard, including the mode function and reset keys.

Set the key lock switch to the OFF position to enable input from the keyboard on the NC operation panel.

The key lock switch also disables screen switching using the mode function keys. However, screen switching is possible with the external screen switching function that uses I/O signals even when the key lock switch is ON.



- 
1. This function cannot be made valid by the forced contact input.
  2. Turn the key lock switch ON or OFF while no input is being made from the keyboard.
-

### (3) Parameters and Input Signal

The parameter and input signal for the key lock function are shown in the tables below.

Table 2.5 Key Lock Function Parameter

Parameter No.	Bit No.	Description
pm6015	D7	0: Key input lock function OFF
		1: Key input lock function ON

Table 2.6 Key Input Lock Function Input Signal

Signal No.	Description
13117	Key input lock function input switch

### (4) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.2.2 Position Monitoring Function

### (1) Outline of the Function

This function always checks whether the machine position is inside the range designated by a parameter and outputs the status as the position monitor signal to I/O.

This function is used to provide machine protection interlock for the position of the machine at power on for the machine equipped with the absolute position detection function.

### (2) How to Use the Function

First, set in the parameters which axis is to be checked and the position monitor area limit values in the positive and negative directions.

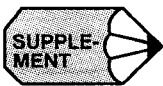
A maximum of six position monitor areas can be set, regardless of the axis name.

The NC always monitors the machine position of the designated axis and turns the position monitor signal ON if the axis lies in the designated area. The machine position is considered to be inside the position monitor area if it lies on the limit of a designated area.

The position monitor function is enabled in the following situations.

- Incremental specification: After the completion of the first manual reference point return
- If absolute position detection function is used: After power ON (however, invalid if zero point setting has not been completed.)

This function is valid in both manual and automatic operation modes.



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The area is monitored and output to I/O once approximately every 500 ms. Consequently, the position monitor function is not appropriate for overtravel check and other processing requiring immediate action. Use the function for position monitoring of an axis which is static or moving at low-speed.

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(3) Parameters and Output Signals

The parameters and output signals for the position monitor function are shown in the tables below.

Table 2.7 Position Monitor Function Parameters

Parameter No.	Description	Setting Range	Setting Units
# option	0: Position monitor function OFF 1: Position monitor function ON		
pm6100 to pm6105	Axis designation for position monitor areas 1 to 6	0 to 3 0: OFF 1: X-axis 2: Y-axis 3: Z-axis	
pm6948	Positive direction limit value for No. 1 position monitor area	± 99999999	1 = 1 pulse
pm6949	Negative direction limit value for No. 1 position monitor area	± 99999999	1 = 1 pulse
pm6950	Positive direction limit value for No. 2 position monitor area	± 99999999	1 = 1 pulse
pm6951	Negative direction limit value for No. 2 position monitor area	± 99999999	1 = 1 pulse
pm6952	Positive direction limit value for No. 3 position monitor area	± 99999999	1 = 1 pulse
pm6953	Negative direction limit value for No. 3 position monitor area	± 99999999	1 = 1 pulse
pm6954	Positive direction limit value for No. 4 position monitor area	± 99999999	1 = 1 pulse
pm6955	Negative direction limit value for No. 4 position monitor area	± 99999999	1 = 1 pulse
pm6956	Positive direction limit value for No. 5 position monitor area	± 99999999	1 = 1 pulse
pm6957	Negative direction limit value for No. 5 position monitor area	± 99999999	1 = 1 pulse
pm6958	Positive direction limit value for No. 6 position monitor area	± 99999999	1 = 1 pulse
pm6959	Negative direction limit value for No. 6 position monitor area	± 99999999	1 = 1 pulse

Table 2.8 Position Monitor Function Output Signals

Signal No.	Description
#12280 to #12285	Position monitor No. 1 to No. 6 area output

(4) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

2

### 2.2.3 Program Check Screen

(1) Outline of the Function

The program screen is able to display the program only. However, it is often necessary to confirm positions and other statuses while checking the program during memory or MDI operation but it can be inconvenient to switch between screens with the function keys. Consequently, the upgrade provides information such as positions and spindle speed on the program check screen to allow work to proceed without pressing function keys.

(2) How to Use the Function

Press the PRG function key to display the program check screen. A parameter setting determines which type of screens is displayed - the original program screen showing the program only or the program check screen.

PROGRAM (MEM)			01234	N1234
O1;			G**	G80
N1;				G98
N2 G50 X100. Z100.;			G00	G54
N3 G96 S150 M03;			G17	G64
N4 X20.3 Z1.5;			G90	G67
N5 G01 X-100. Y-150. Z100. F50;			G23	G50
N6 Z-10.5F5;			G94	G123
N7 X10.5 F10;			G21	G69
N8 Z-15.5F5;			G40	
N9 X5.;			G49	
(UNIVERSAL)	(INCREMENT)	S (ACT)	12345	
X-99999.999	X-99999.999	S (COM)	12345	
Y-99999.999	Y-99999.999	T CODE	0101	
Z-99999.999	Z-99999.999	FEED	500. mm/min	
			LSK	RDY

Fig. 2.4 Program Check Screen

### (3) Parameter

The parameter used for the selection of the screen type is indicated below.

Table 2.9 Program Check Screen Parameter

Parameter No.	Description
pm6015	0: Do not display the program check screen
	1: Display the program check screen

2

### (4) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.2.4 Absolute Position Detection

### (1) Outline of the Function

Machine movements are detected and held even when the power is turned OFF so that the machine coordinate system and workpiece coordinate system are automatically set without conducting home position return when the power is turned ON, that is, the machine is in operation status.

This function gives the following advantages:

- Home position return is unnecessary after the power is turned ON. Operation is quickly and easily restarted.
- Stroke check is enabled immediately after the power is turned ON.
- Deceleration dog and limit switches such as the machine end limit switch are not required.

### (2) Method of Absolute Position Detection

Absolute positions are detected under semi-closed control using an absolute encoder attached to the end of the motor.

The detector comprises of an encoder that detects the position within one revolution and a counter that detects and counts rotations.

(a) Reading absolute data at power ON

Absolute data comprises the number of revolutions (N) from the absolute reference position and the position within one motor revolution. When the SEN signal is input, the number of motor revolutions is read as serial data and the position within one motor revolution is read as the number of initial incremental pulses. The number of motor revolutions can be read only once after the encoder power is turned ON.

Subsequently, output operation is identical to a normal incremental encoder.

The absolute position is calculated as:

$$P = (N \times RP) + PO$$

where,

N is the number of motor revolutions

RP is the number of pulses per motor revolution

PO is the counted number of incremental pulses

(b) Holding absolute data at power OFF

When the power turns OFF, the rotation detector continues to detect rotations using the NC backup battery. It can therefore follow machine rotations and detect the machine absolute position when the power is OFF.

(c) Reading absolute encoder data to NC

The NC reads stores the result of the equation  $P = (N \times RP) + PO$ , above, to establish the machine coordinate system and set the workpiece coordinate system.

(3) Starting Up the Absolute Position Detection System

The absolute position detection system requires an initial setting of the machine home position when the absolute position detector is started.

The NC gives an alarm if the initial setting of the machine home position has never been made or if the absolute position is lost. Set the home position again if this problem occurs.

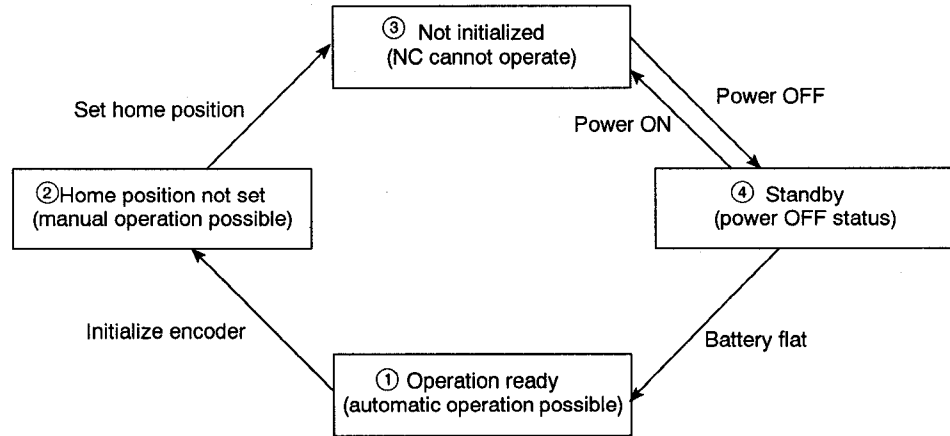


Fig. 2.5 Absolute Position Detector Status Transition Diagram

① Not Initialized

Encoder operation cannot be guaranteed in this status.

Encoder initialization: Encoder operation cannot be guaranteed if the voltage of the super-capacitor in the encoder is unstable. Discharge the super-capacitor to completely stop encoder operation.

② Home Position Not Set

The home position had not been set. Normal automatic operation is possible, providing that absolute position detection is not required.

③ Operation Ready

The home position has been set, absolute position detection is operating, and normal operation is possible.

④ Standby

The machine movements are detected and held while the power is OFF. This operation is powered by the super-capacitor or a battery.

(4) Home Position Setting

The home position must be set before absolute position detection can be carried out.

The machine coordinate system and machine home position are created when the machine home position (machine reference point) is set during home position initialization. The automatic coordinate system setting function is enabled when the home position is set.

The home position setting is required in the following cases:

- During machine initial adjustment (when the home position is determined)
- After a motor is replaced.
- After an alarm related to the absolute position encoder.

The machine coordinate values are set to zero (0) if the power is turned ON before the home position setting is complete.

The home position can be set from the home position setting screen.

The zero point setting screen is available from the [SET] functions.

The zero point setting screen shows the zero point setting statuses and position error information.

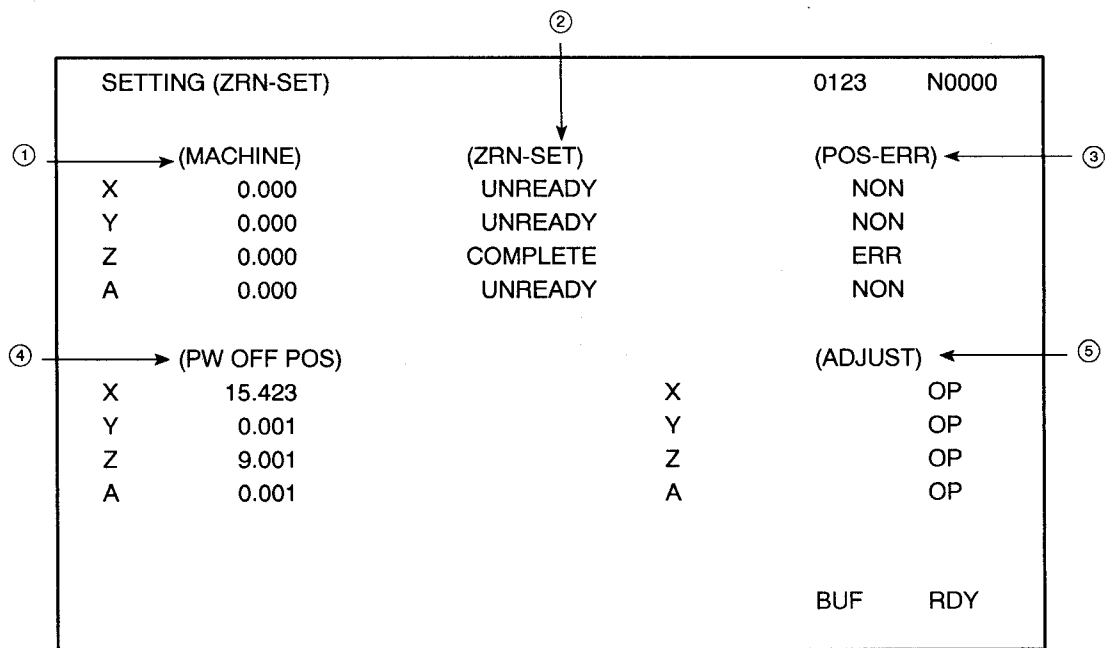


Fig. 2.6 Zero Point Setting Screen

① Machine Coordinate Position

Displays the machine coordinate position of each axis.

② Zero Point Setting Status

Displays whether the zero point is set for each axis.

UNREADY: zero point setting is not complete

COMPLETE: zero point setting is complete

③ Position Error Information

Displays position error information for each axis.

NON: Normal status with no error occurred

ERR: A position error occurred

A position error occurs if the difference between the machine coordinate value when the power is turned ON and when it was previously turned OFF differs by the value set in parameters pm6861 to pm6864 or more.

However, the position error check is not made for an axis if the corresponding parameter pm6916 to pm6919 is set to "0".

④ Power OFF Position

Displays the machine coordinate positions when the power turned OFF.

If the function is enabled for only one axis, values are displayed for all axes but the setting operation applies only to the axis for which the function is enabled. A warning is displayed if a setting operation is carried out on an axis which has the function is disabled.

⑤ Zero Point Setting Adjustment

Displays the zero point adjustment if no deceleration dog is fitted.



2

<Cursor Movement>

The movement of the cursor when cursor up or down key is pressed is shown in the diagram below.

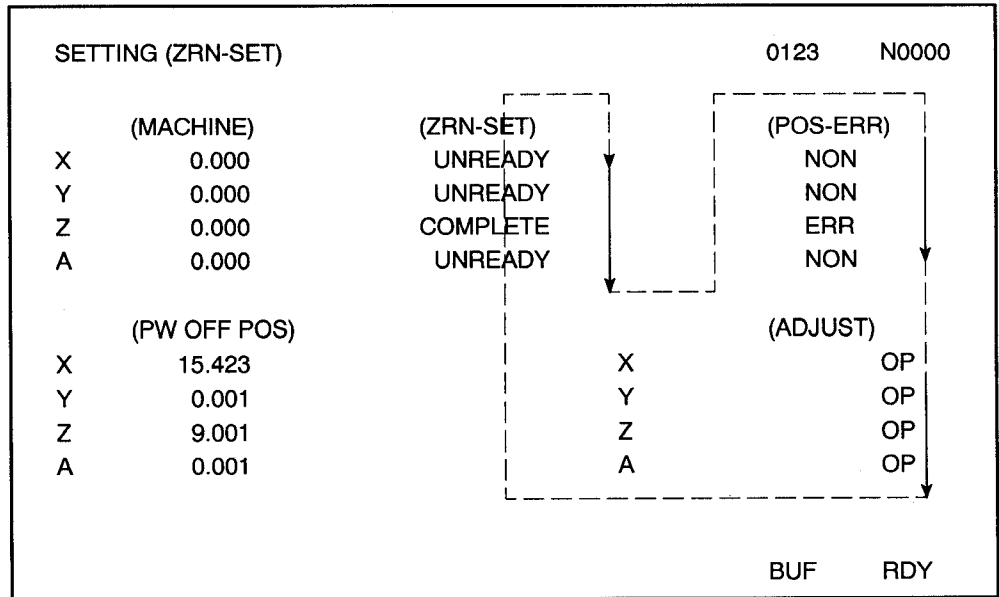


Fig. 2.7 Cursor Movement when the Cursor Down Key is Pressed

## (a) Operations from the zero point setting screen

## &lt;Changing the Zero Point Setting Status&gt;

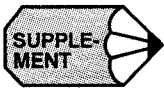
Press the cursor down keys to move the cursor to the axis to select.

- Setting the zero point setting to COMPLETE

Enter “1” and press [WR]. The zero point setting status changes from UNREADY to COMPLETE. The status remains unchanged if it was already COMPLETE.

- Setting the zero point setting to UNREADY

Enter “0” and press [WR]. The zero point setting status changes from COMPLETE to UNREADY. The status remains unchanged if it was already UNREADY.



The zero point setting status does not change if only the [WR] key is pressed.

After the status is changed from COMPLETE to UNREADY, a message prompts the operator to turn OFF the power. Turn the power OFF and back ON.

## &lt;Changing the Position Error Status&gt;

The following operation resets an alarm after a position error (alarm 0335 to 0338) occurs.

- Enter “0” and press [WR] and [RESET]. The position error status changes from ERR to NON. The status remains unchanged if it was already NON.



1. The position error status does not change if only the [WR] key is pressed.
2. The setting can be changed only when pm6219 = 1 or 4.

## &lt;Changing the Zero Point Setting Adjustment&gt;

A value can be input whether or not a deceleration dog is fitted, but the zero point setting function is only enabled if no deceleration dog is fitted. The settings are made in units of pulses, with no decimal point.

## (5) Setting the Zero Point

When manual low-speed zero point return is conducted for an axis with the absolute positioning function enabled but no zero point set, the zero point and machine coordinate system are set automatically.

To reset the zero point set the zero point setting (ZRN-SET) on the zero point setting screen to UNREADY. Turn the power OFF and back ON then conduct manual low-speed zero point return.

The zero point setting method differs according to whether a zero point deceleration dog is fitted.

### (a) Zero point deceleration dog fitted

Carry out the appropriate zero point setting method described below for the situation.

#### <Initial Status>

The zero point is not set and no absolute position error has occurred.

- ① On the zero point setting screen, check that the zero point setting (ZRN-SET) is UNREADY and no absolute position error (POS-ERR) has occurred.
- ② Conduct manual low-speed zero point return.

#### <If an Absolute Position Error Occurs>

Reset the absolute position error from the zero point setting screen with pm6219 = 1 or 4.

#### <Zero Point is Set but Needs to be Set Again>

- ① Set the zero point setting (ZRN-SET) to UNREADY on the zero point setting screen with pm6219 = 4.
- ② Turn the power OFF and back ON.
- ③ Conduct manual low-speed zero point return.

The second and subsequent zero point return operation differs according to the parameter setting. This method is only valid for parameter pm6013 D7 = 0 (use deceleration dog for zero point setting with absolute position detection function).

## (b) No Zero Point Deceleration Dog Fitted

If no deceleration dog for zero point return is fitted, the zero point setting differs for machines with and without a zero point detection mechanism.

<No Zero Point Detection Mechanism>

Follow the procedure below to manually move to the zero point and set the zero point.

- ① In the manual operation mode, move to the machine position to be set as the zero point 2).
- ② Still in the manual operation mode, use the zero point setting screen to set the zero point setting (ZRN-SET) for the appropriate axis to COMPLETE.
- ③ If a zero point adjustment from the position set in ① above is required, carry out the reset operation then set the adjustment amount.

The following diagram shows the relationship between the machine position and zero point setting position.

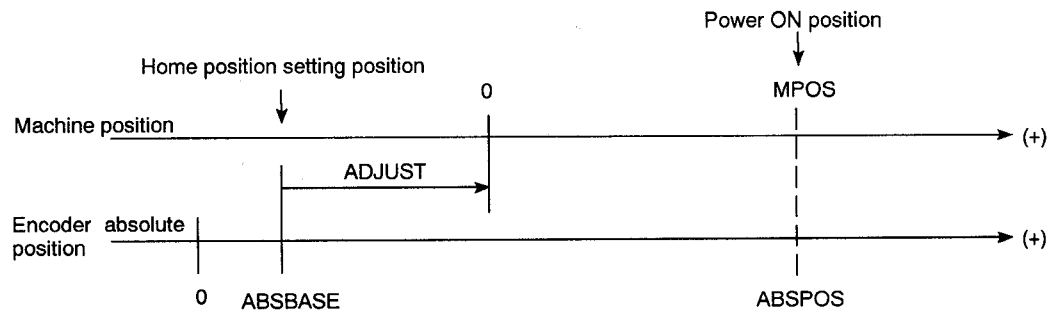


Fig. 2.8 Relationship Between Machine Position and Zero Point Setting Position

$$\text{Machine position at power ON} = (\text{ABSPOS} - \text{ABSBASE}) / \alpha\text{PG} - \text{ADJUST}$$

Where,

ABSPOS (pulses) is the encoder absolute position at power ON

ABSBASE (pulses) is the zero point setting position at power ON (stored in NC)

ADJUST ( $\mu\text{m}$ ) is the set adjustment for zero point setting  $\alpha\text{PG}$  ( $\mu\text{m}/\text{pulse}$ ) is the movement distance per encoder pulse



1. Because ABSBASE is not determined, the machine position set to zero (0) if the power is turned ON before the zero point setting is complete.
2. The adjustment for zero point setting can only be changed if pm6219 = 1 or 4.

<Zero Point Detection Mechanism Fitted>

Follow the procedure below to set the zero point if a zero point detection mechanism using proximity switches and a Servopack is fitted.

- ① In the manual operation mode, move to the machine position to be set as the zero point.
- ② Stop movement using the zero point detect signal.
- ③ Turn ON the zero point setting external input signal (13440 to 13443) with the PLC.

The NC clears the deviation pulses when the zero point setting external signal is input. (If the torque limit were released with the deviation pulses retained, a movement would absorb the amount of deviation at maximum torque. Therefore, the deviation pulses are cleared for safety reasons.)

- ④ If a zero point adjustment from the position set in ① above is required, carry out the reset operation then set the adjustment amount.

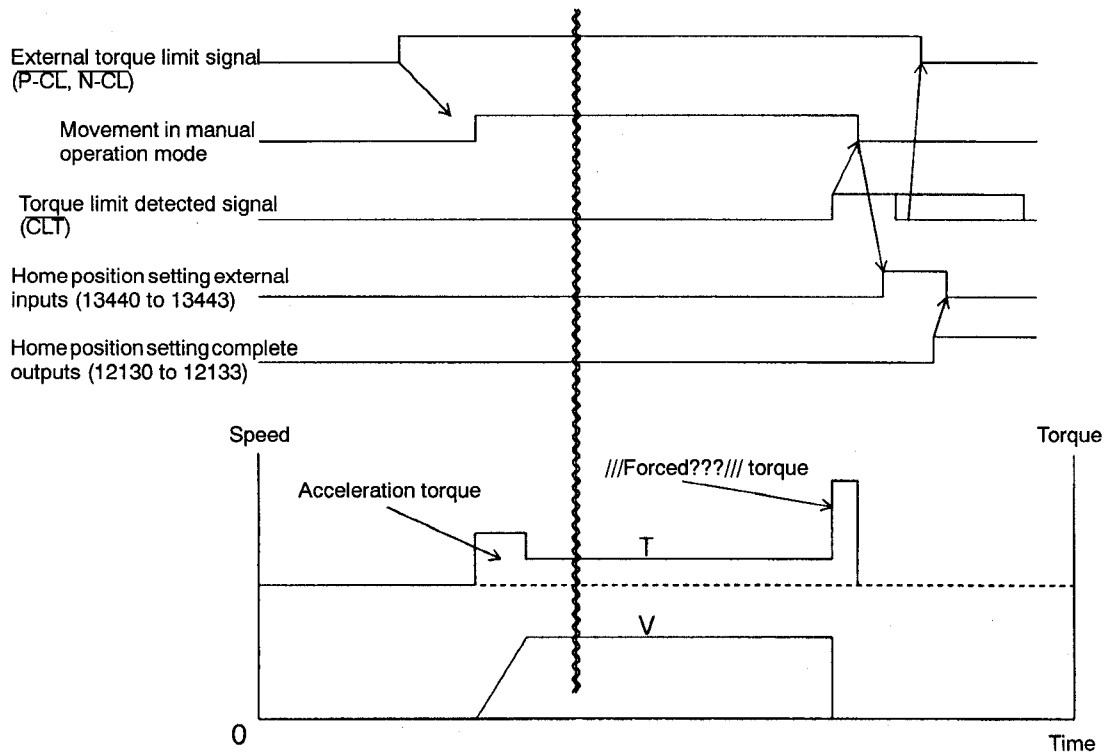
Example: If a SGDB Servopack torque limit function is used.

Follow the procedure below to set the zero point if a SGDB Servopack is used.

- ① Apply the torque limit to the Servopack using the external torque limit signals ( $\overline{P-CL}$ ,  $\overline{N-CL}$ ).
- ② Move to the zero point in the manual operation mode.

If the axis is forced to the stroke end, the torque increases and when it reaches the external torque limit value, the SGDB outputs the torque limit detected signal ( $\overline{CLT}$ ).

- ③ Refer to ( $\overline{CLT}$ ) and carry out the following operations with the PLC.
  - Stop movement.
  - Turn ON zero point setting external inputs (13440 to 13443) for at least two scans.
- ④ If a zero point adjustment from the position set in ① above is required, carry out the reset operation then set the adjustment amount.



2

Fig. 2.9

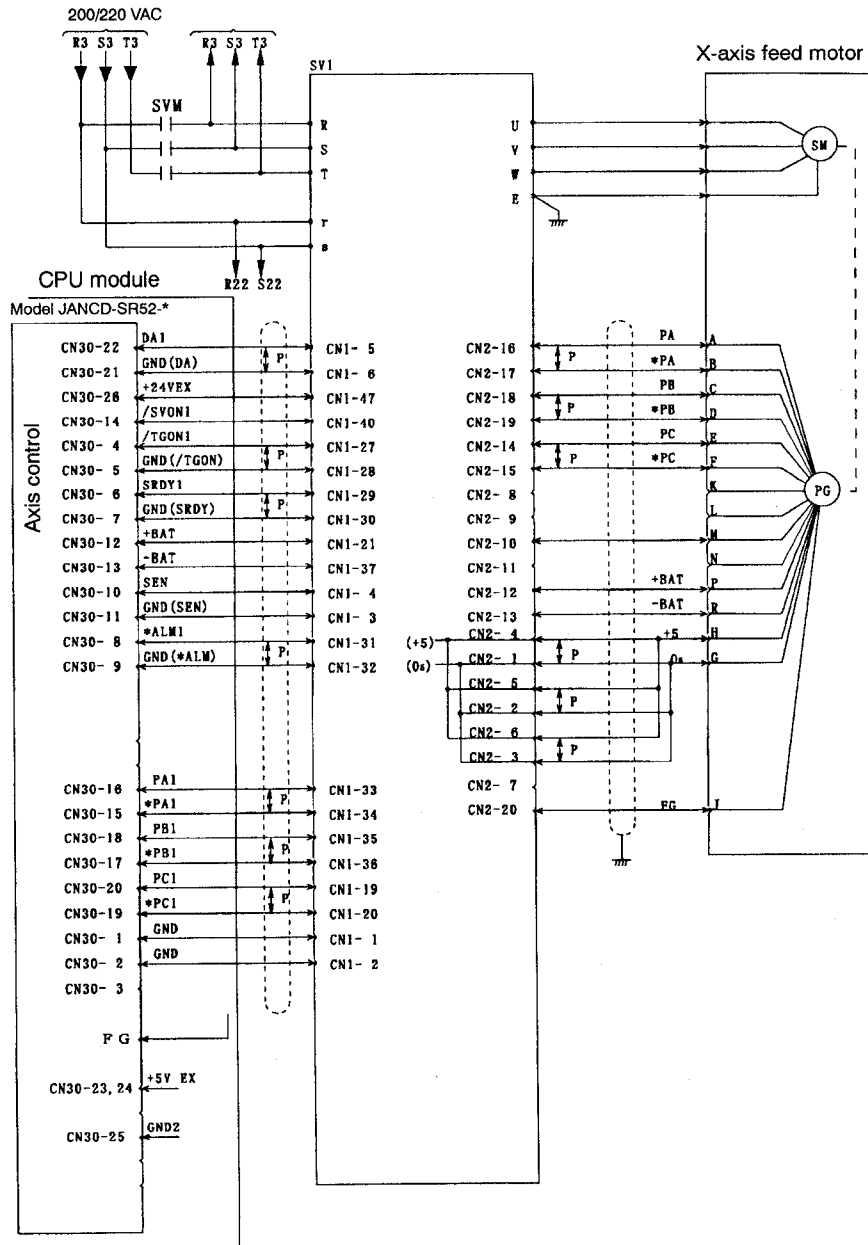


1. Before resetting the external torque limit signal, stop movement so that the torque limit detected signal ( $\overline{CLT}$ ) is no longer output.
2. If a high torque limit value is set, a large load is exerted to the machine when an axis is being forced to the stroke end. As a guideline, set the torque limit value slightly higher than the acceleration/deceleration torque for low-speed feed during the zero point setting operation.
3. See the SGDB User's Manual for details about the SGDB Servopack I/O signals and parameter settings.

(6) Connections Between Devices

The diagram below shows the connections for the absolute position detection function.

Feed servo unit: SGDB Series



Note: See the Technical Sheet about the high-capacity Σ Series for the details specifications about the SGDB Servopack.

Fig. 2.10 Connections for the Absolute Position Detection Function

## (7) Related Parameters, I/O Signals, and Alarms

Table 2.10 Parameters for the Absolute Position Detection Function

Parameter No.	Bit No.	Description
#option		0: Absolute position detection function disabled 1: Absolute position detection function enabled
pm6050	D2	0: X-axis absolute position detection function disabled 1: X-axis absolute position detection function enabled
	D3	0: Use X-axis SGDB parameter (Cn-02) Bit 0 = 0 (available only when absolute position detection function is enabled) 1: Use X-axis SGDB parameter (Cn-02) Bit 0 = 1 (available only when absolute position detection function is enabled)
	D4	0: Use incremental encoder for X axis 1: Use absolute encoder for X axis
pm6051	D2	0: Y-axis absolute position detection function disabled 1: Y-axis absolute position detection function enabled
	D3	0: Use Y-axis SGDB parameter (Cn-02) Bit 0 = 0 (available only when absolute position detection function is enabled) 1: Use Y-axis SGDB parameter (Cn-02) Bit 0 = 1 (available only when absolute position detection function is enabled)
	D4	0: Use incremental encoder for Y axis 1: Use absolute encoder for Y axis
pm6052	D2	0: Z-axis absolute position detection function disabled 1: Z-axis absolute position detection function enabled
	D3	0: Use Z-axis SGDB parameter (Cn-02) Bit 0 = 0 (available only when absolute position detection function is enabled) 1: Use Z-axis SGDB parameter (Cn-02) Bit 0 = 1 (available only when absolute position detection function is enabled)
	D4	0: Use incremental encoder for Z axis 1: Use absolute encoder for Z axis
pm6053	D2	0: 4th-axis absolute position detection function disabled 1: 4th-axis absolute position detection function enabled
	D3	0: Use 4th-axis SGDB parameter (Cn-02) Bit 0 = 0 (available only when absolute position detection function is enabled) 1: Use 4th-axis SGDB parameter (Cn-02) Bit 0 = 1 (available only when absolute position detection function is enabled)
	D4	0: Use incremental encoder for 4th axis 1: Use absolute encoder for 4th axis



Parameter No.	Bit No.	Description
pm6016	D7	0: Use deceleration dog for the zero point setting of the absolute position detection function (available only when absolute position detection function is enabled) 1: Do not use deceleration dog for the zero point setting of the absolute position detection function (available only when absolute position detection function is enabled)
pm6900		Zero point setting complete status (This parameter is processed internally by the NC. Do not set this parameter.)
	D0	X-axis zero point setting complete status 0: incomplete, 1: complete
	D1	Y-axis zero point setting complete status 0: incomplete, 1: complete
	D2	Z-axis zero point setting complete status 0: incomplete, 1: complete
	D3	4th-axis zero point setting complete status 0: incomplete, 1: complete
pm6901		Absolute position error status (This parameter is processed internally by the NC. Do not set this parameter.)
	D0	X-axis absolute position error 0: None, 1: Error
	D1	Y-axis absolute position error 0: None, 1: Error
	D2	Z-axis absolute position error 0: None, 1: Error
	D3	4th-axis absolute position error 0: None, 1: Error

Table 2.11 Parameters for the Absolute Position Detection Function

Parameter No.	Description	Setting Range	Setting Units
pm6910 to pm6913	Zero point setting adjustment (X axis to 4th axis)	± 99999999	1 = 1 pulse
pm6916 to pm6919	Position error limit value (X axis to 4th axis)	0 to 32767	1 = 1 pulse
pm6922 to pm6925	Table movement per motor rotation (X axis to 4th axis)	0 to 99999999	1 = 1 μm (for rotary axis: 1=1/1000°)
pm6930 to pm6933	Zero point setting offset (X axis to 4th axis) (These parameters are processed internally by the NC. Do not set these parameters.)		
pm6936 to pm6939	Machine position at power interruption (X axis to 4th axis) (These parameters are processed internally by the NC. Do not set these parameters.)		

Table 2.12 I/O Signals for Absolute Position Detection Function

I/O Signal No.	Description
13440 to 13443	Zero point setting external input signal for absolute position detection function (X axis to 4th axis)
12120 to 12123	Position error output signal for absolute position detection function (X axis to 4th axis)
12130 to 12133	Zero point setting complete output signal for absolute position detection function (X axis to 4th axis)

2

Table 2.13 Alarms for Absolute Position Detection Function

Alarm No.	Description
0335 to 0338	Absolute position detection error (X axis to 4th axis) The difference between the position at power ON and when it was previously turned OFF differs by more than a set distance.
0395 to 0398	Absolute error (X axis to 4th axis) Absolute encoder malfunction was detected at power ON.

**(8) Conditions for Use**

This function is available with the upgraded standard specification.

This function is subject to the following restrictions:

**(a) Hardware-related**

- Use JANCD-SR54 (-SR55) as the SR board. Not compatible with JANCD-SR50 (-SR51).
- Use an SGDB servopack.
- Use an absolute encoder.
- Not compatible with a separate pulse generator (linear scale)

---

(b) Function-related

- Backlash compensation is disabled if home position return has not be conducted.
- The function is not compatible with an infinitely long rotary axis.
- With a rotary axis, the position at the home position initial setting becomes the machine position reference. For example, if the power is turned OFF at the 720° position, a 720° machine position is used when the power is next turned ON.

## 2.2.5 ROM-based Programs

### (1) Outline of the Function

Programs can be pre-written to a sequence PROM that is mounted in the NC.

This function eliminates the need for program transfer via RS-232C when the machine is started. Restarting is simple if a program is deleted by mistake.

Use this function for machine-specific programs, such as ATC macros.

#### (a) Program output (CMOS to PROM writer)

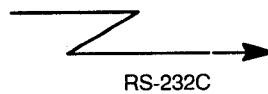
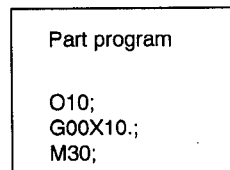
Programs in the NC program area (CMOS) are converted to Intel HEX format, transferred to the PROM writer, and written to the sequence ROM (#30).

See "Selecting the PROM Writer" in the YASNAC J50 PC System Instruction Manual (manual No. T0E-C843-12.1) for information on selecting and operating the PROM writer.

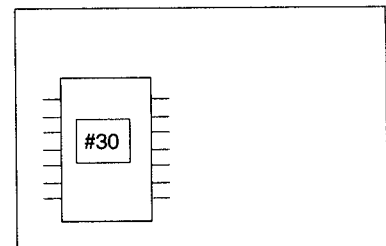
#### (b) Program writing (PROM to CMOS)

Transfers the programs written in the sequence PROM (#30) on the CP50B board to the NC program area (CMOS).

<NC (CMOS) to PROM Writer>  
NC



PROM writer



<PROM (#30) to NC (CMOS)>

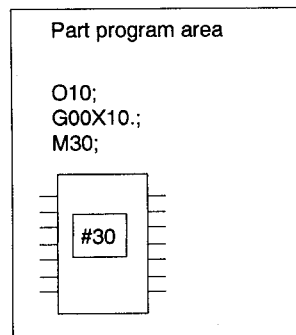


Fig. 2.11 Program Writing

## (2) How to Use the Function

This section describes how to transfer programs from NC to PROM writer or from PROM writer to NC.

### (a) Program Transfer from NC to PROM Writer

Follow the procedure below to transfer programs from NC to PROM writer.

- ① Set the NC in Edit mode. Use the erase function to remove all programs from the NC program area except the programs to be transferred to the PROM writer.
- ② Check that the total number of characters in the programs does not exceed the limit value.

#### <Size of Transferred Programs>

The number of program characters transferable to PROM is  $(32,768 - (\text{number of programs} \times 3))$ .  $(\text{number of programs} \times 3)$  occurs because the output format for each program “%;O10;-;M30;%” has three extra characters: “%;” at the start and “%” at the end.

A maximum of 100 programs can be output.

A warning is displayed (“CHARACTER OVER”) and transfer to the PROM writer is not possible if the number of characters or programs is too high.

Delete programs with the erase function in the Edit mode to reduce the number of characters within the permitted limit.

Even if the program to be output to the PROM writer contains only a few characters, the entire 32 KB contents of the NC program area are transferred to the PROM writer. Data apart from the program is output as null data “FFH”.

- ③ Connect the NC and PROM writer with an RS-232C cable. See the YASNAC J50 PC System Instruction Manual for details of the connections between NC and PROM writer.

The transfer Baud rate is set by the NC parameters, as shown in Table 2.14.

Table 2.14 Parameter Setting

Parameter	D3	D2	D1	D0	Baud Rate
pm6028	0	0	0	0	50
	1	0	0	0	100
	0	1	0	0	110
	1	1	0	0	150
	0	0	1	0	200
	1	0	1	0	300
	0	1	1	0	600
	1	1	1	0	1200
	0	0	0	1	2400
	1	0	0	1	4800

2

- ④ Check the number of characters in the transferred programs and the transfer Baud rate.
- ⑤ Set the system number switch to “6”, turn the power OFF and back ON.

The initial menu screen is displayed.

OPTIONAL JOB					
JOB MENU					
1.	XSD	- >	X, S, D	[ORG]	
2.	PROGRAM TRANS	- >	P, R, G	[ORG]	

Fig. 2.12 Initial Menu Screen

- ⑥ Press P, R, G [ORG].

- ⑦ The program transfer menu screen is displayed.

The previous screen is displayed again if the cancel key [CAN] is pressed. (See Supplement 1.)

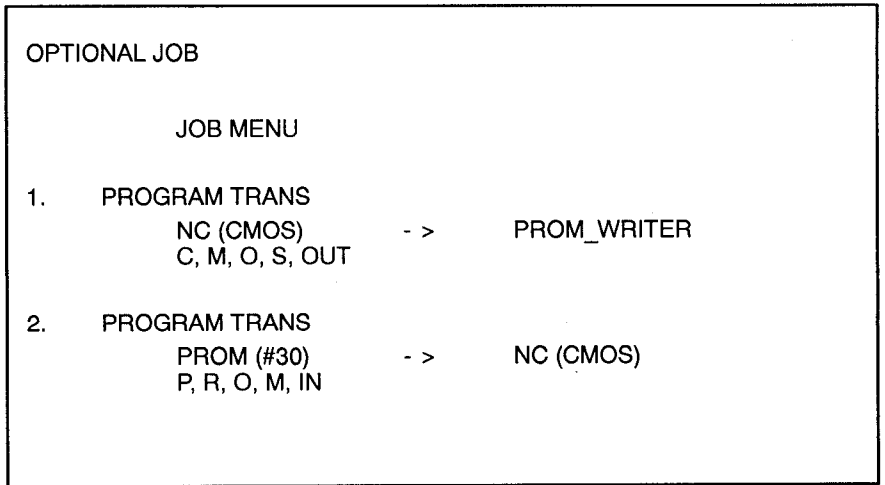


Fig. 2.13 Program Transfer Menu Screen

- ⑧ Enable data receiving at the PROM writer.
- ⑨ Press C, M, O, S [OUT].

The NC programs converted to Intel HEX format are transferred via the RS-232C to the PROM writer.

At the REMAINDER position on the screen, the asterisks (\*) indicate the amount of transfer remaining. Each asterisk (\*) is equivalent to 2 KB of program output remaining.

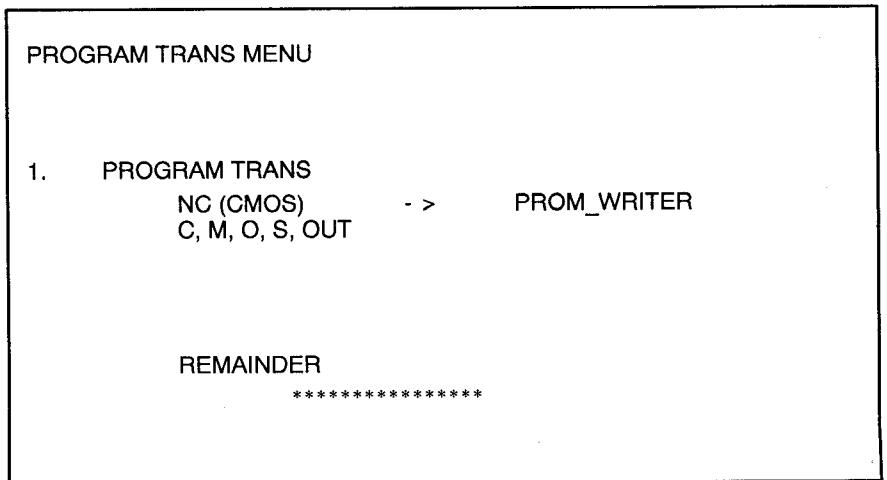


Fig. 2.14 Program Transfer (CMOS to PROM Writer)

- ⑩ The messages “TRANS COMPLETE!” and “POWER OFF!” are displayed when transfer is complete.

```
PROGRAM TRANS MENU

1.  PROGRAM TRANS
    NC (CMOS)   - >  PROM_WRITER
    C, M, O, S, OUT

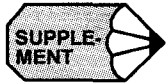
    TRANS COMPLETE!
    POWER OFF!
```

2

Fig. 2.15 Program Transfer Complete

- ⑪ Turn Power OFF.





2

1. The key inputs displayed at the bottom of the screen can normally be deleted one at a time by pressing the cancel key [CAN], but this is not possible in this screen. To change the input, press the reset key [RST] and make the key inputs again.
2. Ensure that the part program format begins with "O\*\*\*\*". A warning is displayed ("FORMAT ERROR!") and the NC format conversion processing stops if an attempt is made to output a program in a format that does not begin with "O\*\*\*\*".

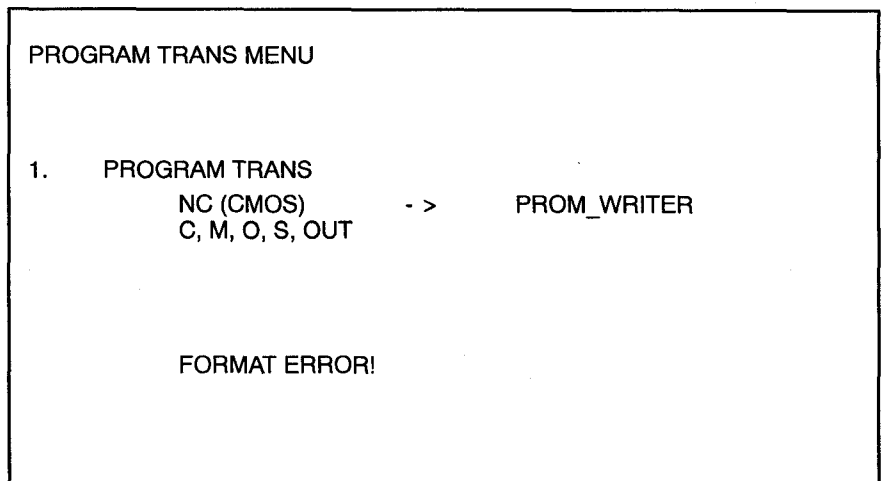


Fig. 2.16 Warning Displayed (FORMAT ERROR!)

3. Program output can be interrupted by a reset operation, but the output cannot be subsequently restarted. Repeat the program output by entering C, M, O, S [OUT].
4. Halt status after program output prevents other operations being carried out. Turn the power OFF and back ON.

## (b) Program Transfer from PROM to NC (CMOS)

Follow the procedure below to transfer programs from PROM to the NC CMOS memory.

- ① Before transfer, save any important part programs contained in the NC.  
All part programs existing in the NC are deleted when programs are transferred from PROM to NC CMOS memory.
- ② Check that the program PROM (which is also the sequence ladder PROM) is mounted at location #30 on the CP50B memory board.
- ③ Set the system number switch to “6”, turn the power OFF and back ON. The initial menu screen is displayed.
- ④ Press P, R, G [ORG].
- ⑤ The program transfer menu screen is displayed.
- ⑥ Press P, R, O, M [IN]. The programs stored in the #30 PROM are transferred to the CMOS program area and stored.

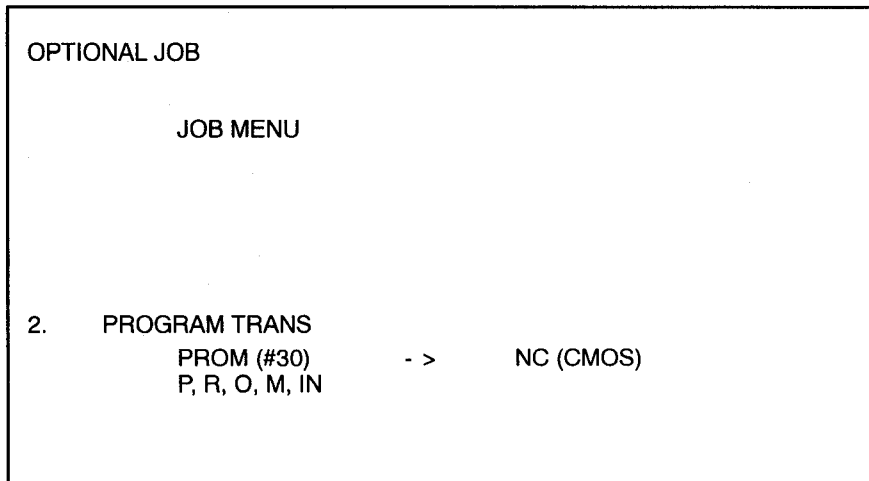


Fig. 2.17 Program Transfer (PROM to NC)

A warning is displayed (“MEMORY OVER!”) and program transfer is interrupted if the NC program memory area is unable to hold the transferred programs.

A warning is displayed (“FORMAT ERROR!”) and transfer stops if the PROM format is incorrect. Mount a PROM with the correct format and repeat the operation.

- ⑦ The messages “TRANS COMPLETE!” and “POWER OFF!” are displayed when transfer is complete.

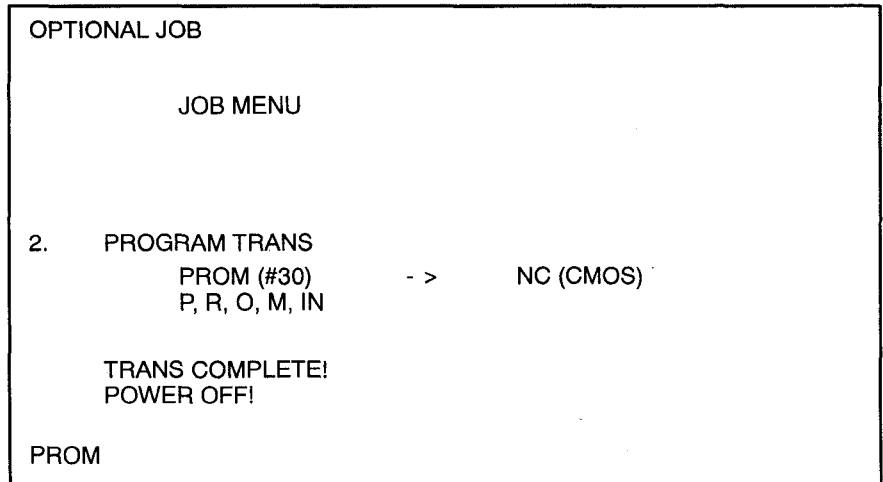


Fig. 2.18 Program Transfer Complete

- ⑧ Turn Power OFF.



1. Program transfer can be interrupted by a reset operation.
2. Programs are handled as follows when an interrupt occurs due to a warning or reset.

The program being transferred at the time of the interrupt is not a valid program.

Programs transferred before the time of the interrupt are valid programs.

### (3) Writing the PROM

The PROM containing programs is mounted at location #30, which is also the location of the sequence ladder ROM. Follow the procedure below to write the PROM after program transfer from NC to the PROM writer is complete.

- ① Insert the sequence ladder PROM from location #30 in the PROM writer.  
Copy all ladder data, including tables, to the PROM writer memory.  
The system will not operate correctly if this step is omitted because the PROM will contain no sequence data.
- ② Transfer the program data to the PROM writer memory.  
Program data is transferred to the area 10000H to 13FFFH (32 KB).

- ③ Insert a virgin PROM in the PROM writer and write the PROM writer memory contents to it. This now becomes the new PROM at location #30.

(4) Conditions for Use

This function is available with the upgraded J50 standard specification.

## 2.3 UPGRADES TO IMPROVE SAFETY

Several upgrades have been conducted to improve safety.

### 2.3.1 Deceleration Stop on Reset During Movement

#### (1) Outline of the Function

With the original specification, any moving axes stopped immediately a reset operation was conducted during program operation. However, this sudden stop caused large shocks to the machine if the axes had a high maximum speed. To reduce the loads and protect the machine, the upgraded function forces the feed axis to make a deceleration stop when a reset is conducted.

#### (2) Specifications

This section explains the original specification and the upgraded specification.

##### (a) Original specification

Axes moving due to program or manual operation stop immediately a reset operation is conducted. Axes stop under exponential deceleration if the reset occurs during a cutting feed command.

##### (b) Upgraded specification

The following parameters have been added.

Table 2.15 Deceleration Stop Parameters for Reset During Movement

Parameter No.	Description
pm6019	D5 0: Immediate stop of moving axes if a reset occurs during program operation 1: Deceleration stop of moving axes if a reset occurs during program operation

This function is available in both the automatic and manual operation modes.

As with the original specification, axes stop under exponential deceleration if the reset occurs during a cutting feed command.

Similarly, the axis makes a linear deceleration if a reset occurs during manual pulse generator operation, as with the original specification.

The reset operation can be a panel reset or external reset.

The axis stops using S-curve deceleration if the G00 S-curve acceleration/deceleration function is used.

### (3) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.3.2 Upgraded Software Overtravel (S-OT)

2

### (1) Outline of the Function

The distances from the machine movement range to the machine end naturally become shorter as machines are made more compact. Also, as feed speeds increase, the deceleration distance must increase in proportion to the speed. Under these conditions, hardware alone and in some cases even conventional software overtravel are unable to ensure sufficient overtravel safety.

Therefore, the software overtravel has been upgraded to meet these demands.

### (2) Specifications

This section explains the original specification and the upgraded specification.

#### (a) Original specification

Under steady movement at a feed speed of 36 m per minute (either automatic or manual operation mode)

The overtravel distance is  $(36000/60) \times 0.008 \times 2 = 9.6$  mm. That is, the axis moves approximately 9.6 mm too far, although the actual distance depends on the movement timing.

**(b) Upgraded specification**

The upgraded function restricts the overtravel distance to a maximum of 1  $\mu\text{m}$  outside the software overtravel range for both jog feed and rapid travel.

The overtravel distance is unchanged from the original specification for step feed and manual pulse generator feed.

In the automatic operation mode, the end position is checked before movement starts for all G codes except arc commands. If the end position lies outside the software overtravel #1 area, a software overtravel alarm occurs and movement does not start. The software overtravel alarm applies to all axes.

The software overtravel check is enabled after home position return is completed. If absolute position detection is used, the software overtravel check is enabled after the home position setting is completed. However, no software overtravel check is conducted during positioning using low-speed home position return.

The software overtravel check is carried out at each C-point when the deep-hole solid tap function is used so that the software overtravel check is conducted during the cycle.

**(3) Added Parameters and Alarms**

Table 2.16 Software Overtravel Parameter

Parameter No.	Bit No.	Description
pm6015	D6	0: No end point check before movement 1: Make end point check before movement

Table 2.17 Software Overtravel Alarm

Alarm No.	Description
0299	Check before movement indicates the end position reached the software overtravel #1 area.

**(4) Conditions for Use**

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.4 UPGRADES TO IMPROVE SPEED

Several upgrades have been conducted to achieve smoother control for high-speed feed or rotation.

### 2.4.1 G00 S-curve Acceleration/Deceleration Function

#### (1) Outline of the Function

In the original specification, linear acceleration and deceleration are used for positioning in the automatic operation mode (G00). When a servomotor is used in the high-speed area, the motor and servo characteristics cannot be fully exploited as peak torque is not available.

Also, attempts to reduce acceleration and deceleration times can cause shocks to the machine.

This function reduces the acceleration fluctuations at the start and end of acceleration and deceleration, thereby eliminating shock vibrations to the machine and achieves high-speed/high-acceleration positioning. In addition, torque can be more effectively utilized because acceleration levels in the high-speed area are less than for linear acceleration or deceleration.

#### (2) Specifications

This section explains the original specification and the upgraded specification.

##### (a) Original specification

Linear acceleration and deceleration and linear two-step acceleration and deceleration functions are available.

##### (b) Upgraded specification

The following parameters have been added.

Table 2.18 Parameters for G00 S-curve Acceleration/Deceleration Function

Parameter No.	Description	Setting Range
option	0: Disable G00 S-curve acceleration/deceleration function 1: Enable G00 S-curve acceleration/deceleration function	
pm6186	X-axis S-curve degree for G00 S-curve acceleration/deceleration Y-axis S-curve degree for G00 S-curve acceleration/deceleration Z-axis S-curve degree for G00 S-curve acceleration/deceleration 4th-axis S-curve degree for G00 S-curve acceleration/deceleration	0 to 15

Note: The S-curve degree parameter is enabled after a reset. Conduct a reset after changing the set value.



(3) How to Use the Function

Applying an S-curve acceleration or deceleration reduces the speed fluctuations at the start and end of acceleration and deceleration. The higher the setting of the S-curve degree parameter, the lower the speed fluctuations.

However, increasing only the S-curve degree parameter setting while the linear acceleration/deceleration time constant is unchanged results in an increased execution time for the acceleration/deceleration block. As a guideline, execution time increases 8 ms for each unit increase (1) in the S-curve degree parameter setting.

When setting the G00 acceleration/deceleration time, optimize the following set values to eliminate machine vibrations: rapid traverse speed (pm6280 to pm6283), linear acceleration/deceleration time constants (Step 1: pm6286 to pm6289, Step 2: pm6298 to pm6301), and S-curve degree (pm6091 to pm6094).

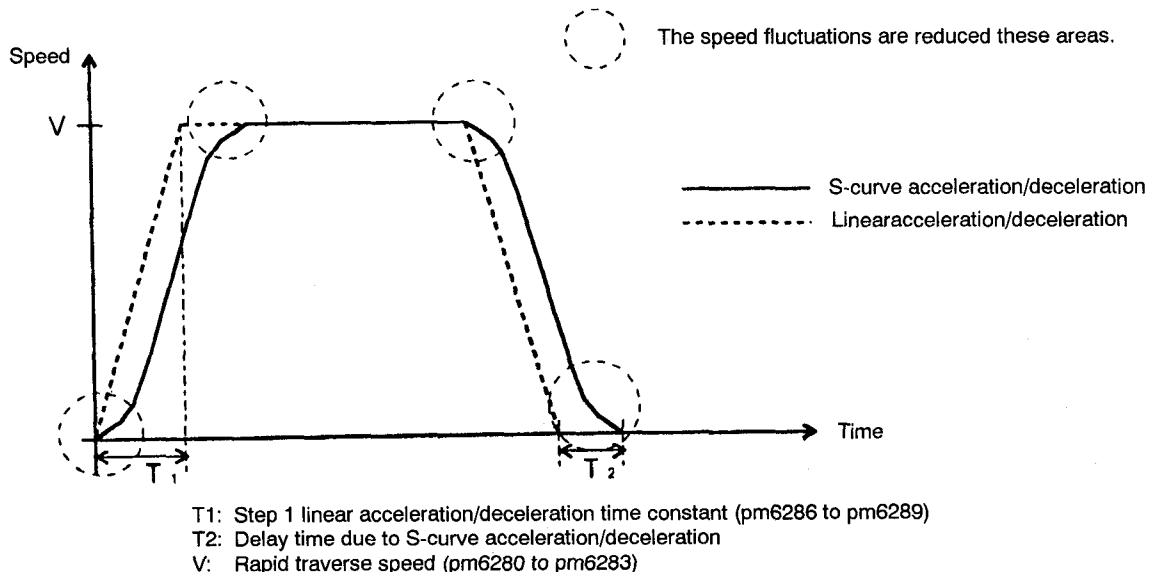
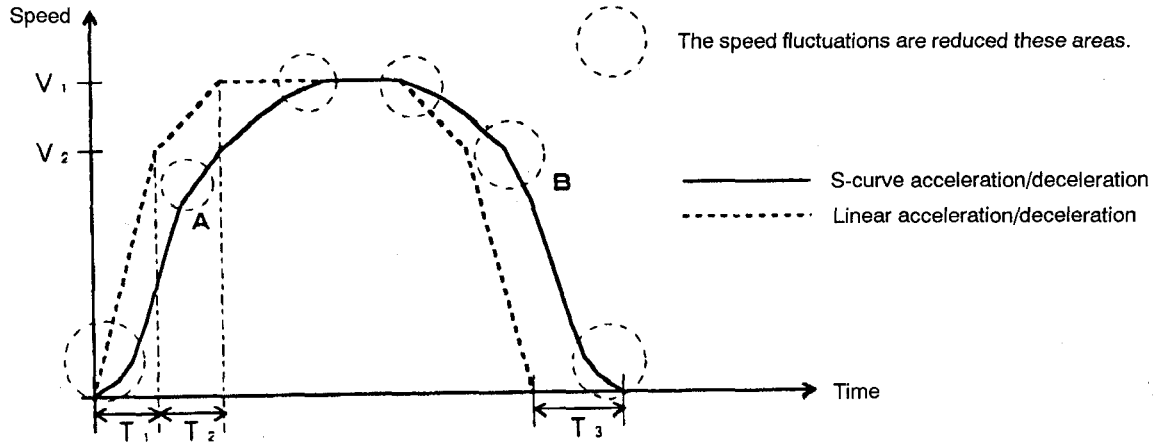


Fig. 2.19 Speed Fluctuations during S-curve Acceleration and Deceleration (Step 2 Acceleration/Deceleration not used)



- T1: Step 1 linear acceleration/deceleration time constant (pm6286 to pm6289)  
 T2: Step 2 linear acceleration/deceleration time constant (pm6298 to pm6301)  
 T3: Delay time due to S-curve acceleration/deceleration  
 V1: Rapid traverse speed (pm6280 to pm6283)  
 V2: Step 2 time constant switching speed (pm6292 to pm6295)

Fig. 2.20 Speed Fluctuations during Step 2 Acceleration and Deceleration and S-curve Acceleration and Deceleration

When Step 2 acceleration/deceleration and S-curve acceleration/deceleration are both used, the shape of the speed fluctuation curve at the acceleration/deceleration switching points (A and B in Fig. 2.20) are filtered with respect to the Step 1 and Step 2 accelerations and decelerations.

---

#### (4) Other Points About The G00 S-curve Acceleration/Deceleration Function

##### (a) Enabling and disabling G00 S-curve acceleration/deceleration

When this function is used, S-curve acceleration/deceleration is enabled in the following cases:

- G06: Positioning error detect OFF
- G27: Reference point return check
- G29: Return from reference point
- G30: Second, third, and fourth reference point return
- G60: Unidirectional positioning
- During fixed cycle rapid traverse
- During positioning after program restart

However, even if this function is used, S-curve acceleration/deceleration is disabled in the following cases:

- During feed in manual operation mode (jog, rapid traverse, manual pulse generator feed, step feed)
- When an alarm calling for immediate stop occurs

##### (b) Automatic reference point return (G28)

Whether S-curve acceleration/deceleration is enabled or disabled depends on whether low-speed or high-speed reference point return is used.

- For low-speed reference point return

S-curve acceleration/deceleration is enabled from the command position to the intermediate positioning point. Then, S-curve acceleration/deceleration is disabled from the intermediate positioning point to the reference point.

- For high-speed reference point return

S-curve acceleration/deceleration is enabled the entire distance from the command position through the intermediate positioning point to the reference point.

(c) Coasting distance when a stored stroke limit alarm occurs

In principle, the coasting distance after a stored stroke limit alarm occurs is the same whether S-curve acceleration/deceleration is enabled or disabled. However, the coasting distance does change if the stored stroke limit alarm occurs during acceleration.

(5) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

2

## 2.4.2 Upgraded Solid Tap Function

(1) Outline of the Function

Machine vibrations and poor motor follow-up at speed change points sometimes resulted when short spindle acceleration and deceleration times or high acceleration torques were required using the original solid tap function.

The upgraded solid tap function incorporates predictor control to overcome these problems at high rotational speeds.

(2) How to Use the Function

The upgraded solid tap differs from the original function only in the method of adjusting the synchronization error.

This section describes the adjustment procedure to optimize the synchronization error between the spindle and Z axis, using the upgraded solid tap function.



---

This manual describes the adjustment of electrical synchronization for the solid tap function. Note that, synchronization errors caused by the mechanical system cannot be eliminated by this adjustment method. Even if electrical synchronization is achieved, backlash in the spindle gears or slipping of the spindle belt, for example, can result in unsuccessful tapping.

---

## (a) Selecting the parameters

Follow the procedure below to select the parameters.

- ① Set Tpz (pm6092 D2) to 0.001 or 0.002.
- ② Set  $\alpha$  (pm6943) to -0.75 or -0.5.

One of the following setting patterns is selected.

Table 2.19 Setting Example

	Tpz	$\alpha$
Pattern 1	0.001	-0.75
Pattern 2	0.002	-0.75
Pattern 3	0.001	-0.5
Pattern 4	0.002	-0.5

- ③ Make the provisional parameter settings.

These provisional settings change later during the adjustment.

Set mk = 0.9 (pm6940 = 9000)

Cd = 8 (pm6942 = 8)

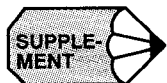
- ④ Adjust the Z-axis D/A gain.

Follow the D/A gain adjustment procedure below.

Spindle error pulses displayed during solid tapping (at the X-axis display position) if

- Set pm6065 D1 to "0" to set the synchronization error non-peak display for solid tapping.
- Carry out solid tapping.
- Observe the Z-axis error pulses during solid tapping.

Change parameter pm6458 to adjust the error pulses to approximately zero during steady operation. The adjustment will bring the error pulses into the range  $\pm 5$ .



Due to the resolution of the D/A gain, 5 or 6 error pulses may remain even after fine adjustment of pm6458.

**(b) Adjusting the Parameters**

Follow the procedure below to adjust the parameters.

① Set K2 (pm6941) = 0; Cd = 8.

② Set the cutting conditions:

S = maximum tapping rotary speed (rev/m)

F = maximum pitch (mm/rev)

TSACC (pm6291) = target acceleration/deceleration time constant (ms)

Set TSACC to the minimum value at which the spindle torque is unsaturated.

③ Adjust mk to achieve zero synchronization error during steady operation (out).

④ Adjust Ka to achieve zero synchronization error during steady operation (return).

The synchronization error for is minimized for both outward and return steady operation.

⑤ Adjust K2 to achieve a peak value of  $\pm 20$  pulses.

⑥ Change TSACC and measure the acceleration/deceleration - synchronization error characteristics.

⑦ Change the S command in increments of 1000 up to the maximum rotary speed and measure the speed - synchronization error characteristics.

⑧ The adjustment is complete if the synchronization error is within  $\pm 20$  pulses.

⑨ If the synchronization error is outside  $\pm 20$  pulses change Cd to another value in the range 5 to 12.

⑩ Repeat steps 5 to 8 above.

## (c) Adjustment Principle

The adjustments for setting the synchronization error adjustment parameters must be made using the strictest cutting conditions possible because the cutting conditions (acceleration and deceleration, pitch, rotational speed) have a considerable affect on the synchronization errors.

Item	Example	Problem
Make $T_{vs}$ as small as possible and $T_{vz}$ as large as possible.	$K_s = 20s^{-1}$ , $K_{vz} = 80$ Hz, $K_{vs} = 40$ Hz, $T_{vz} = 40$ ms, $T_{vs} = 80$ ms	Reduced resistance to external torque disturbances.
Reduce the Z-axis speed loop gain $K_{vz}$ .	$K_s = 20s^{-1}$ , $K_{vz} = 20$ Hz, $K_{vs} = 40$ Hz, $T_{vz} = 20$ ms, $T_{vs} = 100$ ms	Reduced resistance to heavy cutting.
Reduce $\alpha$ (equivalent to the Z-axis $K_p$ value).	$K_s = 20s^{-1}$ , $K_{vz} = 80$ Hz, $K_{vs} = 40$ Hz, $T_{vz} = 20$ ms, $T_{vs} = 100$ ms, $\alpha = -0.85$ (instead of $-0.75$ )	Cycle time may increase.
Reduce the spindle position loop gain $K_s$ .	$K_s = 15s^{-1}$ , $K_{vz} = 80$ Hz, $K_{vs} = 40$ Hz, $T_{vz} = 20$ ms, $T_{vs} = 100$ ms	Cycle time may increase.
Increase the spindle speed loop gain $K_{vs}$ .	$K_s = 20s^{-1}$ , $K_{vz} = 80$ Hz, $K_{vs} = 60$ Hz, $T_{vz} = 20$ ms, $T_{vs} = 100$ ms	Cannot be increased for some machine specifications. If the required adjustment cannot be achieved using the previous adjustment method, the servo or spindle parameters can be adjusted. The adjustment items and the potential problems with them are presented here for reference.

### (3) Solid Tapping Adjustment Screen

Unlike the original function, in some cases the upgraded solid tap function requires observation of the change in synchronization error during adjustment of the peak values in the acceleration and deceleration areas.

This is straightforward if a path measurement device or other measuring device is available, but for cases when no measuring device is available, the solid tapping adjustment screen is provided to display the solid tapping synchronization errors.

2

#### (a) Outline

The synchronization errors during acceleration are displayed as numeric values on the screen. Up to 480 ms can be displayed at a sampling interval of 16 ms. For the following three reasons, values are displayed for acceleration only:

- With the upgraded function, the adjustments for steady operation are possible using the original synchronization error display but correct adjustment in the acceleration and deceleration areas may not be possible.
- Often synchronization error hunting in the acceleration and deceleration areas is the reason that synchronization errors cannot be correctly adjusted. The adjustment direction can be determined if the hunting status is known.
- As the synchronization error characteristics are similar in the acceleration and deceleration areas, it is sufficient to make the adjustment for the acceleration area only.



(b) Screen Specification

If a position function is selected, press [NEXT] to display the solid tapping adjustment screen.

When the solid tapping adjustment screen is displayed, press [NEXT] to return to the previous screen.

This adjustment screen can be displayed only if the screen is enabled using the solid tapping option parameter.

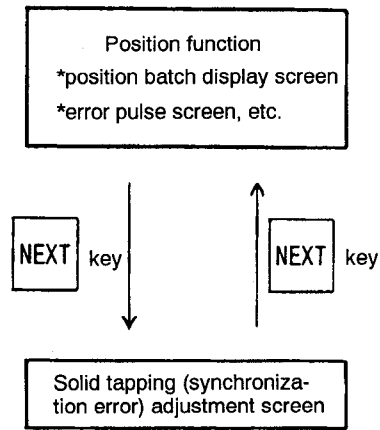


Fig. 2.21

<Screen Image (CRT Specification)>

SOLID-TAP ADJUSTMENT					O1234	N1234	
1	*	11	-	25	21	*	
2	*	12	-	15	22	*	
3	- 99999	13		10	23	*	
4	- 4000	14		5	24	*	
5	- 2000	15		3	25	*	
6	- 500	16		*	26	*	
7	200	17		*	27	*	
8	- 100	18		*	28	*	
9	50	19		*	29	*	
10	- 30	20		*	30	*	
(1 TIME = 16 MSEC)							
					LSK	ALM	RDY

2

Fig. 2.22 Solid Tapping Adjustment Screen

## ① Acceleration Number

The numbers 1 to 30 are displayed to the left of the synchronization errors. As synchronization errors are sampled at 16 ms intervals, each screen shows the change in synchronization error over 30 samplings, that is 480 ms.

An asterisk (\*) is displayed if the spindle is not accelerating or decelerating, for example, if spindle acceleration or deceleration is completed within 480 ms.

## ② Synchronization Error

Displays the synchronization error during spindle acceleration and deceleration.

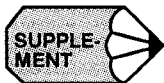
## Display Units

For metric input: 1 = 0.001 mm

For inch input: 1 = 0.0001 in

If the spindle acceleration or deceleration lasts more than 480 ms, subsequent synchronization errors are not displayed.

An asterisk (\*) is displayed if the synchronization error exceeds  $\pm 99999$ .



2

1. This screen is always displayed in English, whatever the displayed language setting.
2. Data is not updated in real time while this screen is displayed. To update the data, select another screen then revert to the adjustment screen.  
  
Do not switch between this screen and other screens during continuous operation.
3. Set the solid tapping block to single block operation and display this solid tapping adjustment screen after the tapping cycle is complete.

#### (4) Related Parameters

Parameter No.	Description	Setting Range	Setting Units
pm6940	<p>Predictor control parameter (mk)</p> <p>This parameter is used by the upgraded solid tap function to the adjust synchronization error during steady operation.</p> <p>The Z axis lags (when viewed from the spindle) if the parameter set value is decreased; or the Z axis advances if the set value is increased.</p> <p>“The Z axis lags when viewed from the spindle” means that the Y axis value displayed on the solid tapping adjustment screen increases; “the Z axis advances” means that the displayed Y axis value decreases.</p> <p>The upgraded solid tap function does not operate correctly if this parameter is set to 0. The NC disables the upgraded solid tap function and uses the original solid tap function.</p>	<p>0 to 99999999</p> <p>Standard setting range: 5000 to 15000</p>	1 = × 0.0001
pm6941	<p>Predictor control parameter (K2)</p> <p>This parameter is used to adjust the synchronization error during acceleration and deceleration.</p> <p>This parameter is used in combination with the Cd parameter (pm6942).</p>	<p>0 to 99999999</p> <p>Standard setting range: 0 to 20000</p>	1 = × 0.00001
pm6942	<p>Predictor control parameter (Cd)</p> <p>This parameter is used in combination with the K2 parameter (pm6941) to adjust the synchronization error during acceleration and deceleration.</p> <p>This parameter should normally be set to “10”, and the adjustment made using the K2 parameter. However, if the synchronization error cannot be adjusted into the standard range when Cd = 10, increase or decrease the Cd setting by 1 and adjust again with K2.</p>	<p>0 to 99999999</p> <p>Initial setting : 10</p>	1 = × 1

Parameter No.	Description	Setting Range	Setting Units
pm6943	<p>Predictor control parameter (<math>\alpha</math>)</p> <p>This parameter is related to the Z-axis loop gain during predictor control. It can normally be left at 75, the standard setting.</p> <p>The set value must be an absolute value.</p> <p>The Z-axis movement becomes more stable if the parameter set value is increased but the follow-up lag increases. The Z-axis movement oscillates if the parameter set value is increased but the follow-up lag decreases.</p> <p>The NC uses a Z-axis position loop gain calculated as <math>(1 - \alpha)</math>.</p> <p>The upgraded solid tap function does not operate correctly if this parameter is set to 100. The NC disables the upgraded solid tap function and uses the original solid tap function.</p>	<p>0 to 99999999</p> <p>Initial setting: 75</p>	1 = $\times 0.01$
pm6092	<p>D2 = 0: Sets Tpz = 0.001 for the predictor control parameter.</p> <p>D2 = 1: Sets Tpz = 0.002 for the predictor control parameter.</p> <p>This selects Tpz for the calculation of NC internal parameters for predictor control. Tpz affects the strength of the predictor command on the Z axis. Normally use Tpz = 0.001. Over-compensation can occur in some cases if Tpz = 0.002.</p> <hr/> <p>D0 = 0: Check PSET for the upgraded solid tap function at the bottom of the hole (Z point).</p> <p>D0 = 1: Do not check PSET for the upgraded solid tap function at the bottom of the hole (Z point).</p>	Initial setting = 0	
pm6909	<p>D0 = 0: Disable the spindle forward/reverse balance compensation parameter pm6944 (Ka) for the upgraded solid tap function.</p> <p>D0 = 1: Enable the spindle forward/reverse balance compensation parameter pm6944 (Ka) for the upgraded solid tap function.</p> <p>Set bit D0 to 1 to compensate for the increase in synchronization error due to the spindle forward/reverse balance. Parameter pm6944 (Ka) is used for the compensation.</p> <hr/> <p>D1 = 0: Do not use enhanced predictor accuracy in the spindle torque saturation area for the upgraded solid tap function.</p> <p>D1 = 1: Use enhanced predictor accuracy in the spindle torque saturation area for the upgraded solid tap function.</p> <p>Set bit D1 to 1 to switch to the NC predictor control parameter values and high accuracy for the predictor circuits in the spindle torque saturation area. However, accuracy may deteriorate outside the torque saturation area.</p> <p>It is sufficient just to set this parameter; other parameters do not need to be changed.</p>		

Parameter No.	Description	Setting Range	Setting Units
pm6944	<p>Spindle forward/reverse balance compensation parameter</p> <p>This parameter is enabled only when bit pm6909 D0 is set to "1".</p> <p>This parameter can be adjusted to provide balance in cases where there is a difference in error pulse amount* between the spindle forward and reverse rotation during solid tapping.</p> <p>Use this parameter when the synchronization error forward/reverse balance is poor.</p> <p>The effect of the parameter adjustment can be easily checked by looking at the synchronization error forward/reverse balance during steady operation (even at peak value)</p> <p>* Spindle error pulses displayed during solid tapping (at the X-axis display position) if pm6065 D1 is set to "0".</p>	<p>-99999999 to 99999999</p> <p>Standard setting range: -300 to 300</p>	

Table 2.20 Optional Parameters for Solid Tapping Upgrade

#option Bit setting	<p>0: Disable high-speed solid tapping B function</p> <p>1: Enable high-speed solid tapping B function</p>
#option Bit setting	<p>0: Disable solid tapping adjustment screen</p> <p>1: Enable solid tapping adjustment screen</p> <p>The solid tapping adjustment screen can be used if this parameter is set to "1". If the POS function is selected, press the [NEXT] key to display the solid tapping adjustment screen.</p> <p>The values displayed on this screen are synchronization errors sampled at 16 ms intervals from the start of solid tapping.</p> <p>Data is not updated while this screen is displayed. To update the data, select another screen then revert to the adjustment screen.</p> <p>The solid tapping adjustment screen should be enabled only while tapping adjustments are made. Disable the screen when the adjustments are complete.</p>

(5) Conditions for Use

This upgraded solid tapping function is available with the high-speed specification.

### 2.4.3 S-curve Acceleration/Deceleration for Solid Tapping

#### (1) Outline of the Function

The original solid tap function used linear accelerations and decelerations for spindle movements. However, this method resulted in machine vibrations and poor motor follow-up at speed change points when short spindle acceleration and deceleration times or high acceleration torques were required.

To overcome this problem, the upgraded function provides constant acceleration control (S-curve acceleration and deceleration) for linear accelerations and decelerations of the spindle.

#### (2) Specifications

This section explains the original specification and the upgraded specification.

##### (a) Original specification

Use linear acceleration and deceleration.

##### (b) Upgraded specification

The following parameters have been added.

Set the S-curve time constant (dead time) for S-curve acceleration/deceleration with the following parameter.

Table 2.21

Parameter No.	Description	Setting Units	Setting Range
pm6474	S-curve degree for spindle acceleration/deceleration during solid tapping	0 = Use original linear acceleration, not S-curve acceleration/deceleration 1 to 15, where 1 = approx. 8 ms	0 to 15

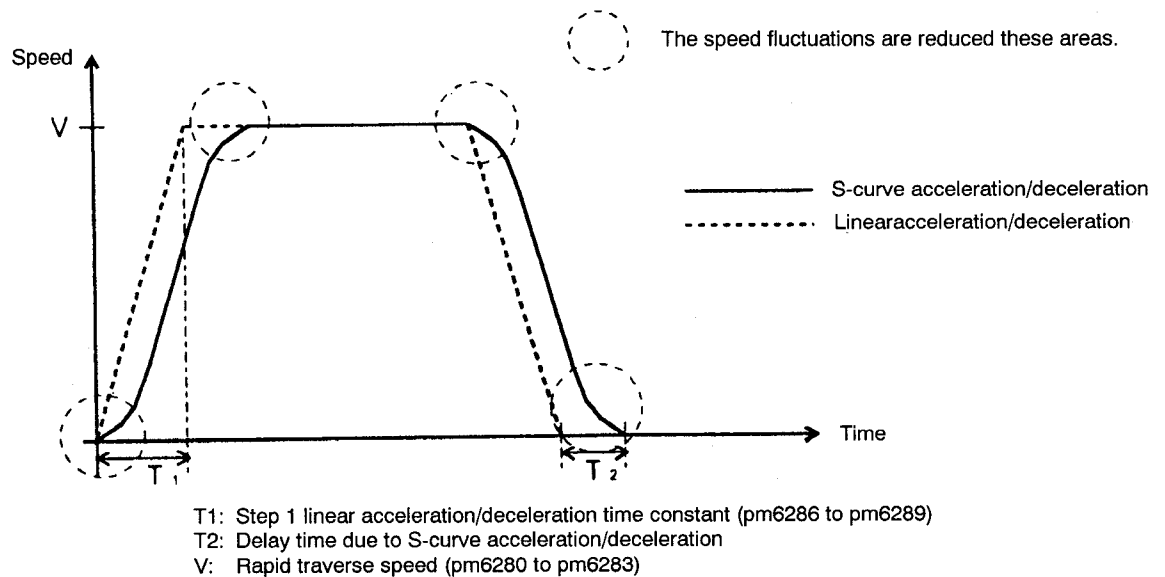
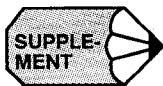


Fig. 2.23 S-curve Acceleration and Deceleration for Solid Tapping



1. Do not set the S-curve degree parameter above 15. Correct operation cannot be guaranteed if this parameter is set to 16, or above.
2. The S-curve parameter is enabled after a reset.
3. Readjust the solid tapping after changing the S-curve degree parameter.

### (3) Conditions for Use

This function is available with the upgraded J50 standard specification and high-speed specification.

## 2.5 OTHER ADDITIONAL FUNCTIONS

### 2.5.1 Deep-hole Solid Tap Function

#### (1) Outline of the Function

For large-diameter tapping and deep-hole tapping, the increase in cutting resistance due to build-up of chips in the hole makes it difficult to complete tapping with a single command. In these cases, several separate tapping commands must be used to complete tapping to the bottom of the hole. This function allows this to be achieved with a single block command.

#### (2) How to Use the Function

Designate G184 or G174 in the solid tap mode (G93) to carry out tapping with a single command.

Solid tapping can be designated as a fixed pitch command or variable pitch command, but a command address is required in either case.



## (a) Command address

Basically, the same addresses as used in the G84 / G74 solid tapping cycle are used in the G184 / G174 deep-hole solid tapping operation in the same format. The addresses that are used specially for the deep-hole solid tapping are indicated below.

Table 2.22 Addresses Used for Deep-hole Solid Tapping

Address	Description	Unit	Programmable Range
Q	Used to specify the depth of feed for each infeed cycle in an unsigned incremental value.	1 = 0.001 mm, 0.0001 inch	0.001 to 999999.999 mm
I	Used to specify the depth of feed for the first infeed cycle in an unsigned incremental value.	1 = 0.001 mm, 0.0001 inch	0.001 to 999999.999 mm, 0.0001 to 99999.9999 inch
J	Used to specify increment / decrement amount of depth of feed in an unsigned incremental value.	1 = 0.001 mm, 0.0001 inch	0.001 to 999999.999 mm, 0.0001 to 99999.9999 inch
K	Used to specify the depth of feed for the last infeed cycle in an unsigned incremental value. When " $I - (n - 1) \times J < K$ ", the value specified for K is taken as the depth of feed.	1 = 0.001 mm, 0.0001 inch	0.001 to 999999.999 mm, 0.0001 to 99999.9999 inch
E	Used to specify the feedrate multiplication ratio to be applied when moving up the Z-axis (retraction operation). If no E command is specified, the value set for pm1252 is used.	1 = 0.1 (Note) 1, 2	0.1 to 25.5
C	Used to specify the levels (tool retraction start levels) where the tool is retracted to the R-point level in an unsigned incremental value. These levels (C-point levels) are set in intervals of the value set for address C starting from the R-point level in the direction to the Z-point level.	1 = 0.001 mm, 0.0001 inch	0.001 to 999999.999 mm, 0.0001 to 99999.9999 inch
$\delta$	Used to specify the chamfering amount for G184 / G174 cycle by parameter pm0873. Note that the value must always be input in "mm" even if the tapping cycle is programmed in the inch mode.	1 = 0.001 mm (Note)3	0 to 999999999

Note 1: An E command specified in a canned cycle is usually treated as the command for E feed (mm/min, inch/min). However, if an E command is specified in the G184 / G174 mode, it is treated as the feedrate multiplying command and, therefore, the unit of command differs from the unit applied to normal E commands.

2: Although the E command is modal if it is used in a canned cycle, the modal value before the change of a G code becomes invalid if a G code of 09 group is changed to G184 / G174 from a G code other than these.

3: With the G174 command, the same tapping operation is executed as with the cycle called by the G184 command with the exceptions that the tapping is carried out in the reverse rotation or the spindle and that the spindle rotates in the forward direction for tap retraction operation.

## (b) Fixed Pitch Commands

Executing deep-hole solid tapping.

Sample Program

```
G93;
G184 (or G174) X± ·· Y± ·· Z± ·· R± ·· W± ·· Q··C··P··F··
E ·· S ·· L··;
X ··· Y ··· ;
G94;
```

2

G93/G94	Solid tap mode ON, G94: Solid tap mode OFF
G184/G174	Deep-hole solid tap, G174: Reverse deep-hole solid tap
X, Y	Hole position (mm, inch)
Z	Distance from the R-point level to the bottom of the hole, or the position of the hole bottom (mm, inch)
R	R-point level (mm, inch)
W	W-point return level (mm, inch)
Q	Depth of feed in each infeed operation (mm, inch)
P	Dwell time at the Z-point level (bottom of the hole) (sec)
F	Thread pitch (mm/rev, inch/rev)
E	Feedrate multiplication ratio for retraction to the R-point level
S	Spindle speed (r/min)
L	Number of repetitions
C	C-point level (mm, inch)

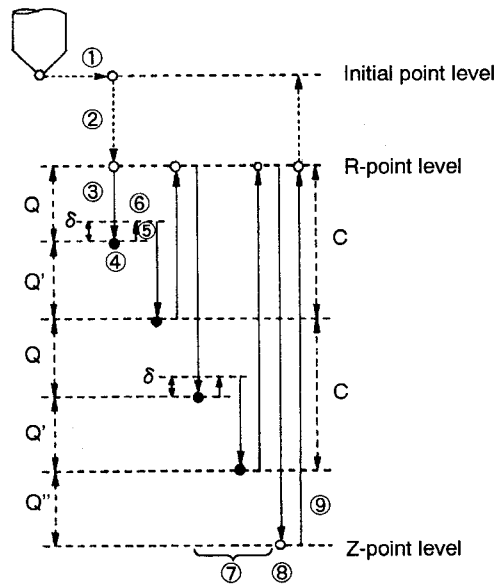
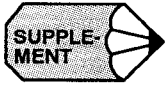


Fig. 2.24 Tapping Cycle with Fixed Pitch Command

Operation (G184 mode)

- ① Positioning at the hole position specified by X, Y
- ② Positioning at the R-point level
- ③ Starting the spindle in the forward direction; Z-axis feed by the distance specified by Q at the specified feedrate
- ④ Stopping the spindle
- ⑤ Starting the spindle in the reverse direction; Z-axis retraction by " $\delta$ " at the specified feedrate
- ⑥ Stopping the spindle
- ⑦ Starting the spindle in the forward direction; Z-axis feed by " $Q + \delta$ " at the specified feedrate. This is repeated until the Z-position level is reached.
- ⑧ When the Z-point level is reached, the spindle stops and dwell is executed according to the P command.
- ⑨ Starting the spindle in the reverse direction; Z-axis retraction to the R-point level at the specified feedrate
- ⑩ In the G98 mode: Positioning at the initial point level  
 In the G98 mode with a W command: Positioning at the W-point level  
 In the G99 mode: Cycle completes at the R-point level.



1. If a C command is specified, the following operation is executed when the cut level reaches the C-point level.
    - The spindle stops and then starts rotating in the reverse direction; Z-axis retracts to the R-point level at the specified feedrate.
    - The spindle stops.
    - The spindle starts rotating in the forward direction; Z-axis is fed to “C + Q” level at the specified feedrate.
  2. The E command is valid for the retraction operation from the C-point level to the R-point level and from the Z-point level to the R-point level. It is not valid for the Z-axis retraction by “ $\delta$ ”.
-

(c) Variable Pitch Commands

Variable pitch commands are designated as shown in the sample program below.

Sample Program

```
G93;
G184 (or G174) X± ·· Y± ·· Z± ·· R± ·· W± ·· I··J··K··C··
P ·· F ·· E ·· S ·· L··;
X ··· Y ··· ;
G94;
```

G93/G94	Solid tap mode ON, G94: Solid tap mode OFF
G184/G174	Deep-hole solid tap, G174: Reverse deep-hole solid tap
X, Y	Hole position (mm, inch)
Z	Distance from the R-point level to the bottom of the hole, or the position of the hole bottom (mm, inch)
R	R-point level (mm, inch)
W	W-point return level (mm, inch)
I	Initial value of feed distance (mm, inch)
J	Decrement value of feed distance (mm, inch)
K	Last value of feed distance (mm, inch)
P	Dwell time at the Z-point level (bottom of the hole) (sec)
F	Thread pitch (mm/rev, inch/rev)
E	Feedrate multiplication ratio for retraction to the R-point level
S	Spindle speed (r/min)
L	Number of repetitions
C	C-point level (mm, inch)

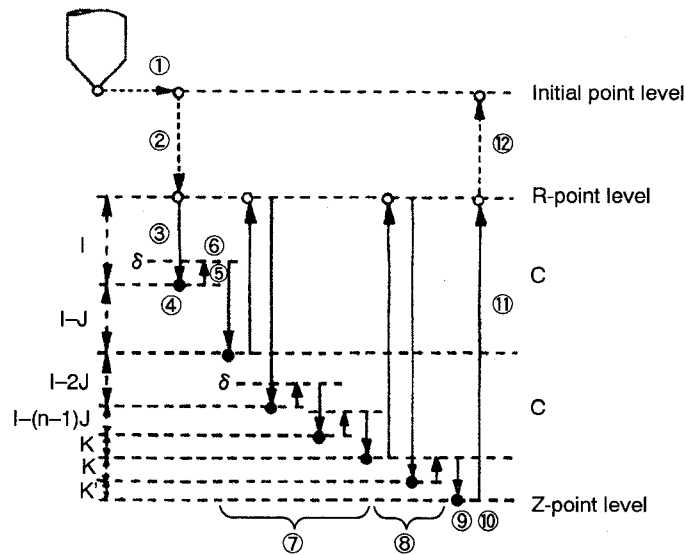


Fig. 2.25 Tapping Cycle with Variable Pitch Command

Operation (G184 mode)

- ① Positioning at the hole position specified by X, Y
- ② Positioning at the R-point level
- ③ Starting the spindle in the forward direction; Z-axis feed by the distance specified by I at the specified feedrate
- ④ Stopping the spindle
- ⑤ Starting the spindle in the reverse direction; Z-axis retraction by “ $\delta$ ” at the specified feedrate
- ⑥ Stopping the spindle
- ⑦ Repeats steps ③ to ⑥ by changing the feed distance to “ $I - (n - 1)J + \delta$ ” until “ $I - (n - 1)J \leq K$ ” is satisfied.
- ⑧ If “Feed distance  $< K$ ”, the value of “ $K + \delta$ ” is taken as the feed distance and the cycle is repeated until the Z-position level is reached.
- ⑨ When the Z-point level is reached, the spindle stops.
- ⑩ Dwell is executed according to the P command.
- ⑪ Starting the spindle in the reverse direction; Z-axis retraction to the R-point level at the specified feedrate.
- ⑫ In the G98 mode: Positioning at the initial point level  
In the G98 mode with a W command: Positioning at the W-point level  
In the G99 mode: Cycle completes at the R-point level.



1. If a C command is specified, the following operation is executed when the cut level reaches the C-point level.
  - The spindle stops and then starts rotating in the reverse direction; Z-axis retracts to the R-point level at the specified feedrate.
  - The spindle stops.
  - The spindle starts rotating in the forward direction; Z-axis is fed to “C + I + (n – 1) J” level at the specified feedrate.
2. The E command is valid for the retraction operation from the C-point level to the R-point level and from the Z-point level to the R-point level. It is not valid for the Z-axis retraction by “δ”.
3. The tapping operation is executed in the fixed pitch cycle if J = 0, or there is no J command.

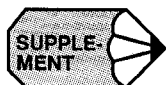
If K = 0, or there is no K command, alarm 0162 “LACK OF ADDRESS” occurs.

### (3) Related Parameters

Table 2.23 Parameters for Deep-hole Solid Tapping

Parameter No.	Description	Setting Range	Setting Units
pm6557	G184/G174 chamfering amount (Δ)	1 = minimum setting unit	0 to 99999999
pm6470	Solid tapping return magnification	1 = magnification of 0.1	0 to 32767

Note: If this parameter is set to “0”, it is handled internally as “1”.



1. To use this function, the fixed cycle, step 2 fixed cycle, and solid tapping option, as well as the deep-hole solid tapping option, must be enabled.

Alarm 0020 occurs if all these parameters are not enabled.

1. When the G184/G174 commands are designated in the G94 mode, G84/G74 are executed using the X, Y, Z, F, S, R, and P addresses.

Deep-hole tapping with the G184/G174 commands is possible only in the solid tap mode (G93).

2. The feed override and spindle override in G184/G174 are fixed at 100%.  
However, the rapid traverse override setting is enabled.

3. Fixed pitch operation occurs if J=0 or if no J command exists.

Alarm 013 occurs if K=0 or if no K command exists.

4. If a Q command and I, J or K command are duplicated in single block, fixed pitch operation is conducted using the Q command.

5. E Command

The E command normally designates E feed (mm/min./inch/min.) during fixed cycle operation. However, with the G184/G174 commands, the E command is the speed magnification command and the units are different.

The E command is a modal value during fixed cycle operation. However, the previous modal values (E) are discarded when the 09 group changes to a G184/G174 G code from another G code. Consequently, E code values outside the G184/G174 mode are discarded. Also, the E command value becomes "0" when the G184/G174 mode is exited.

When the return speed magnification is designated with the E command, if the spindle speed exceeds the maximum speed (pm6471), it is limited to the pm6471 value.

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#### (4) Conditions for Use

This function is available with the upgraded J50 standard specification.



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