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│                                                     │
│                   Ladder Template                   │
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Table of contents

1   Overview

This document describes the specifications of ladder templates for the Lathe system and for the Machining center system.

Although these ladder templates have been checked to work in the machine composition described in this document, please modify the ladder program properly to fit your machine and inspect the behavior of the ladder program carefully when you use them actually.

And as for the machine of different composition, please modify the ladder template to fit the machine.

2   Applicable PMC models

This ladder template can be used for the PMC models listed below:

Applicable PMC models

> Series 0*i* -MODEL F PMC/L
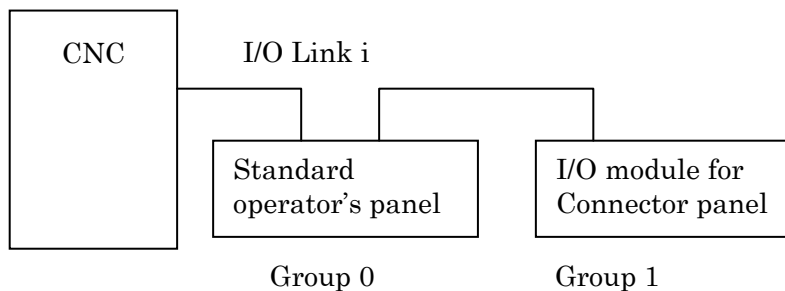
3   Machine Composition

There are two kinds of the ladder templates; one for the lathe system and one for the machining center system. The target machine compositions are as follows.

Machine composition)

Table 4.1

Kind	Lathe (T) system	Machining center (M) system

Controlled axis	Number of controlled axes : 3
	   X axis
	   Z axis
	   A axis (for Turret control)
		Number of controlled axes : 4
		   X axis
		   Y axis
		   Z axis
		   A axis (for ATC control)

Spindle	Number of Spindle : 1
	   Number of gears : 3
		Number of Spindles : 1
		   Number of gears : 3

Machine operator's panel	Standard Machine Operator's panel (Main panel) Standard Machine Operator's panel (Sub panel) Manual pulse generator (1 unit)	Standard Machine Operator's panel (Main panel) Standard Machine Operator's panel (Sub panel) Manual pulse generator (1 unit)

I/O device	I/O module for connector panel
	   Basic module
	   Extension module (3 unit)
		I/O module for connector panel
		   Basic module
		   Extension module (3 unit)

I/O Link type	I/O Link i	I/O Link i

Connection of I/O devices)

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4   Composition of Ladder Program

This chapter explains the program composition of the ladder template of lathe (T) system and machining

4.1   Lathe (T) system

4.1.1   File name

Template_T_system_jp.LAD   ・・・・・ Ladder template (T system) Japanese
Template_T_system_en.LAD   ・・・・・ Ladder template (T system) English
Template_IO_Device.FIL   ・・・・・ I/O Link assignment data for I/O Link i

4.1.2   Composition of Subprograms

The composition of the subprograms is as follows.

Table 4.1.2

Subprogram	Functions
LEVEL1	Control of the emergency stop signals and the over travel signals
LEVEL2	Control of the standard operator's panel
P0010	Preparations for operation (control of CNC ready signals, state report of alarm and reset)
P0030	Jog operation
P0040	Handle feed
P0050	Manual reference position return
P0060	Program edit
P0070	Automatic operation
P0080	M function
P0090	S function
P0100	Turret control
P0140	Message

4.2 Machining center (M) system

4.2.1 File name

Template_M_system_jp.LAD ・・・・・ Ladder template (M system) Japanese
Template_M_system_en.LAD ・・・・・ Ladder template (M system) English
Template_IO_Device.FIL ・・・・・ I/O Link assignment data for I/O Link i

4.2.2 Composition of Subprograms

The composition of the subprograms is as follows.

Table 4.2.2

Subprogram	Functions
LEVEL1	Control of the emergency stop signals and the over travel signals
LEVEL2	Control of the standard operator's panel
P0010	Preparations for operation (control of CNC ready signals, state report of alarm and reset)
P0030	Jog operation
P0040	Handle feed
P0050	Manual reference position return
P0060	Program edit
P0070	Automatic operation
P0080	M function
P0090	S function
P0100	ATC control
P0140	Message

5 Machine Operator's Panel

This ladder template uses the following a machine operator's panel.
- Standard machine operator's panel (Main panel)
- Standard machine operator's panel (Sub panel)

5.1 Allocation of DI/DO

The I/O allocation addresses of standard machine operator's panel are as follows:
DI (12 bytes)   X20-X31
MPG (1 byte)   X32
DO (8 bytes)   Y24-Y31

5.2 Standard Machine Operator's panel (Main panel)

The key layout of standard key sheet of standard machine operator's panel is as follows. For details of the key allocated in the standard key sheet, see the "CONNECTION MANUAL (HARDWARE)" of corresponding CNC.

In this ladder template, a part of the general-purpose key (blank key) in the standard machine operator's panel is used. The used general-purpose keys locate at two places of the red frames below. See Chapter 5.2.1 for details.
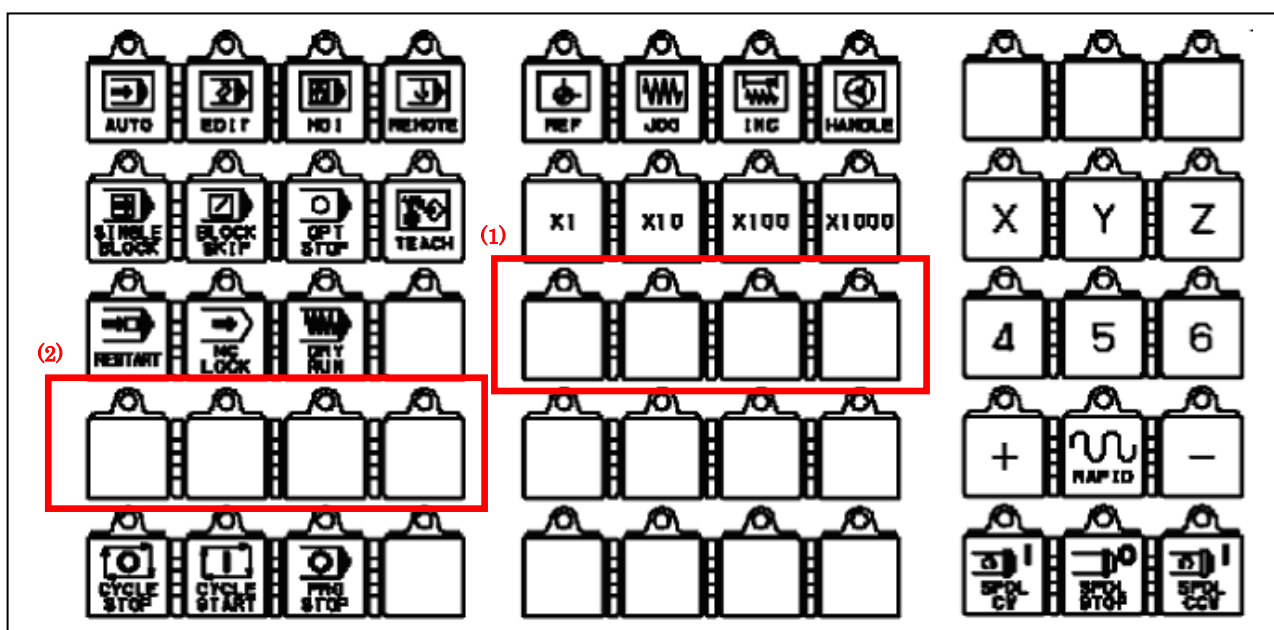

Figure 5.2 Key sheet of the standard machine operator's panel

5.2.1   General-purpose key

In this ladder template, some of the general-purpose keys (blank key) of the standard machine operator's panel are used. The used general-purpose keys are as follows.

General-purpose key (1)
The keys in the frame (1) in "Figure 5.2 Key sheet of the standard machine operator's panel" are used.
These keys are used to change the rapid traverse override at the job operation. The rapid traverse rate can be switched to 4 steps. These keys are the common keys in the ladder templates of lathe (T) system and machining center (M) system.
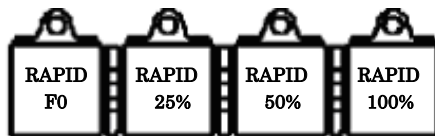
General-purpose key (2)
The keys in the frame (2) in "Figure 5.2 Key sheet of the standard machine operator's panel" are used.
These keys are different between the ladder templates of lathe (T) system and machining center (M) system.

In lathe (T) system, the keys are as follows.

MST LOCK (Auxiliary function lock) key: Inhibits execution of the auxiliary function (M, S, T, B function)

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In machining center (M) system, the keys are as follows.
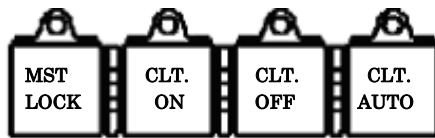
MST LOCK (Auxiliary function lock) key: Inhibits execution of the auxiliary function (M, S, T, B function).

CLT. ON (Coolant ON) key: Coolant is turned on.

CLT. OFF (Coolant OFF) key: Coolant is turned off.

CLT. AUTO (Coolant automatic mode) key: Switches to the coolant automatic mode.
(ON: Automatic mode / OFF: Manual mode)
Case of the automatic mode, the coolant ON / OFF is switched by the following M codes.
M08: Coolant ON
M09: Coolant OFF
Case of the manual mode, the coolant ON / OFF is switched by the "CLT. ON" key and the "CLT. OFF" key.
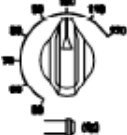
5.3   Standard Machine Operator's panel (Sub panel)

The switches of standard machine operator's panel (sub panel) are as follows.

Switch	Description
	Rotary switch for the feedrate override.
	Rotary switch for the spindle speed override.
	Protection switch.

Note

1   In this ladder template, the memory protection signals (KEY1-KEY4 <G46.3 to G46.6>) are operated by the protection switch.

6 I/O Devices

This ladder template uses the following I/O devices for input/output signals from/to the machine.
- I/O module for connector panel   Basic module
- I/O module for connector panel   Extension modules (3 units)

This chapter explains the signals and the functions to control with these I/O devices.

6.1   Allocation of DI/DO

The I/O allocation addresses of each I/O module for connector panel are as follows.

	DI address	DO address
Basic module	X0 – X2	Y0 – Y1
Extension module (1st unit)	X3 – X5	Y2 – Y3
Extension module (2nd unit)	X6 – X8	Y4 – Y5
Extension module (3rd unit)	X9 – X11	Y6 – Y7

6.2   Emergency Stop

The hardware signal of the emergency stop signal is as follows. The emergency stop is applied to the CNC and the spindle by this signal.
This is the common signal in the ladder template of lathe (T) system and machining center (M) system.

	#7	#6	#5	#4	#3	#2	#1	#0
X0008				*ESP_I				

*ESP_I   0: Emergency stop
1: Release of emergency stop

6.3   CNC ready signals

These signals indicate that the CNC and the servo system are ready.
These are the common signals in the ladder template of lathe (T) system and machining center (M) system.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0000	MA_O	SA_O						

SA_O   1: Servo system is ready.
0: Not ready.

MA_O   1: CNC is ready.
0: Not ready.

6.4 Over travel check

When a control axis tries to move beyond the stroke end set by the limit switch, the limit switch works and an OVER TRAVEL is displayed. The limit switch of each control axis (hardware switch) uses the followings.

	#7	#6	#5	#4	#3	#2	#1	#0
X0000	*-L4_I	*-L3_I	*-L2_I	*-L1_I	*+L4_I	*+L3_I	*+L2_I	*+L1_I

*+Lx_I / *-Lx_I   (x: control axis number, +/-: direction)
            1: In the range of stroke limit.
            0: Out of the range of stroke limit.

Note

1   The limit switch for the 4th axis (*-L4_I, *+L4_I) is effective only in the ladder template of machining center (M) system.

Setting)

The over travel check of each control axis with the limit switch (hardware switch) can be invalidated by setting keep relays. The keep relays to set are as follows.

	#7	#6	#5	#4	#3	#2	#1	#0
K0010					ILS4_P	ILS3_P	ILS2_P	ILS1_P

ILSx_P   (x: control axis number)
            0: Limit switch is effective.
            0: Limit switch is invalid.

6.5 Status output signals

These signals indicate the state of the CNC.

1) Alarm status
The alarm signal reports that the CNC is in an alarm state.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0001	AL_O							

MA_O   0:   The CNC alarm has been released.
                  Blinking (1 sec):   The CNC is in an alarm state.
                  Blinking (200ms):   The CNC is the following states.

- The voltage of the battery for the memory has fallen below the specified level.
- The voltage of the battery for the absolute position detector becomes lower than the rated voltage.
- The number of revolutions of the fan motor in the CNC control part has decreased (warning level).
- Abnormality of the retry counter value of I/O Link is detected.
- PMC (1st path) is in the state of Alarm / Warning.

Setting)
By setting a keep relay, an operator message is displayed when the voltage of the battery for the memory has fallen below the specified level. The keep relay to set is as follows.

	#7	#6	#5	#4	#3	#2	#1	#0
K0012					MSG_P			

MSG_P   0: Message is not displayed.
              1: Message is displayed.

      Message)
              2005   BATTERY LOW

2) Reset status
The resetting signal reports that the CNC is being reset.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0002		RST_O						

RST_P   1: CNC is being reset.
             0: Reset of CNC is completed.

6.6 Interlock

Each control axis can be interlocked to inhibit the axis movement.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0000	*IT_I				*IT4_I	*IT3_I	*IT2_I	*IT1_I

*IT1_I   0: Interlock the 1st axis
           1: Release interlock of the 1st axis

*IT2_I   0: Interlock the 2nd axis
           1: Release interlock of the 2nd axis

*IT3_I   0: Interlock the 3rd axis
           1: Release interlock of the 3rd axis

*IT4_I   0: Interlock the 4th axis
           1: Release interlock of the 4th axis

*IT_I   0: Interlock all axes
           1: Release interlock of all axes

Note

1   The interlock for the 4th axis (*IT4_I) is effective only in the ladder template of machining center (M) system.

Setting)

By setting a keep relay, an operator message is displayed when the moving axis interlocks. The keep relay to set is as follows.

	#7	#6	#5	#4	#3	#2	#1	#0
K0012					MSG_P			

MSG_P   0: Message is not displayed.
           1: Message is displayed.

      Message)

2000	INTERLOCK(*IT)ON
2001	INTERLOCK(*IT1)ON
2002	INTERLOCK(*IT2)ON
2003	INTERLOCK(*IT3)ON
2004	INTERLOCK(*IT4)ON

6.7   Reference position establishment

These signals indicate the state of the reference position establishment.

1) Reference position return end

	#7	#6	#5	#4	#3	#2	#1	#0
Y0000					ZP4_O	ZP3_O	ZP2_O	ZP1_O

ZP1_O	1:	Report the 1st reference position return end for the 1st axis
	Blinking:	Report the 2nd, 3rd, or 4th reference position return end for the 1st axis

ZP2_O	1:	Report the 1st reference position return end for the 2nd axis
	Blinking:	Report the 2nd, 3rd, or 4th reference position return end for the 2nd axis

ZP3_O	1:	Report the 1st reference position return end for the 3rd axis
	Blinking:	Report the 2nd, 3rd, or 4th reference position return end for the 3rd axis

ZP4_O	1:	Report the 1st reference position return end for the 4th axis
	Blinking:	Report the 2nd, 3rd, or 4th reference position return end for the 4th axis

Note
1   The 4th axis (ZP4_O) is effective only in the ladder template of machining center (M) system.

2) Reference position establishment

	#7	#6	#5	#4	#3	#2	#1	#0
Y0001					ZRF4_O	ZRF3_O	ZRF2_O	ZRF1_O

ZRF1_O	1:	The reference position for the 1st axis is established
	0:	The 1st reference position for the 1st axis is lost

ZRF2_O	1:	The reference position for the 2nd axis is established
	0:	The 1st reference position for the 2nd axis is lost

ZRF3_O	1:	The reference position for the 3rd axis is established
	0:	The 1st reference position for the 3rd axis is lost

ZRF4_O	1:	The reference position for the 4th axis is established
	0:	The 1st reference position for the 4th axis is lost

Note
1   The 4th axis (ZRF4_O) is effective only in the ladder template of machining center (M) system.

6.8 Automatic operation

The signals that relate to the execution of automatic operation are described as follows.

1) Automatic operation state
The signal reports that automatic operation is in progress.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0002	OP_O							

ZP1_O　　1: Automatic operation state
　　　　　　　There are the following three states of operation in the automatic operation, and this signal is set to 1 in all of these three states.
　　　　　　　　　　- Cycle start state
　　　　　　　　　　- Feed hold state
　　　　　　　　　　- Automatic operation stop state

2) Block start interlock
The signals disable the start of the next block during automatic operation.

	#7	#6	#5	#4	#3	#2	#1	#0
X0001							*CSL_I	*BSL_I

*BSL_I　　Block start interlock
　　　　　　　0: The next block is not started
　　　　　　　1: The next block is started

*CSL_I　　Cutting block start interlock
　　　　　　　0: The next block is not started when the next block specifies movement commands other than positioning.
　　　　　　　1: The next block is started

3) Start check
The traverse distance and modal can be checked before execution.

	#7	#6	#5	#4	#3	#2	#1	#0
X0001						STCHK_I		

STCHK_I　1: The remaining traverse distance and modal are displayed before executing a block. Performing cycle start again starts the execution.
　　　　　　　0: Block is executed.

4) Specification of the executed workpiece number

These signals specify a workpiece number to be executed in the memory operation mode.
When automatic operation is started in the memory operation mode during the reset state, the program is searched for from the specified workpiece number and then executed from the beginning.

	#7	#6	#5	#4	#3	#2	#1	#0
X0003				PN16_I	PN8_I	PN4_I	PN2_I	PN1_I

PN1_I – PN16_I: These signals specify a workpiece number to be executed in the memory operation mode. These signals correspond to workpiece number as follows (binary codes).

Workpiece number	PN16_I	PN8_I	PN4_I	PN2_I	PN1_I
00	0	0	0	0	0
01	0	0	0	0	1
02	0	0	0	1	0
Omission					
30	1	1	1	1	0
31	1	1	1	1	1

6.9 Coolant on / off

The coolant can be controlled by the ladder template of machining center (M) system. The method of controlling coolant is different according to the automatic mode or the manual mode.

[Coolant automatic mode]
   The lamp of the CLT.AUTO key turns on.
   In the automatic mode, the coolant is controlled by M code commands.
    - M08: Coolant on
    - M09: Coolant off

[Coolant manual mode]
   The lamp of the CLT.AUTO key turns off.
   In the manual mode, the coolant is controlled by the following keys.
    - The lamp of the CLT.ON key turns on: Coolant on
    - The lamp of the CLT.OFF key turns on: Coolant off

The coolant control is output to the following signal. Please switch on/off of the coolant by this signal.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0002				CLNT_O				

CLNT_O 1: Coolant on
          0: Coolant off

Note

1   The coolant is not controlled in the ladder template of lathe (T) system.

6.10 Rigid tapping

The rigid tapping mode is controlled by the ladder template of machining center (M) system. The rigid tapping mode is commanded by the following M code.
- M29: Command to switch to the rigid tapping mode

The state of rigid tapping mode is output to the following signal.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0001			RTAP_O					

RTAP_O   1: During the rigid tapping mode
            0: Release the rigid tapping mode

Note
1   The rigid tapping function cannot be used in the ladder template of lathe (T) system.

6.11 Gear selection

The signals that relate to the gear switching for the spindle are described below.

1) Lathe (T) system
The ladder template of lathe (T) system commands the gear switching by M code of the machining program.
- M40: Neutral selection
- M41: Gear 1 selection
- M40: Gear 2 selection
- M40: Gear 3 selection

The gear number selected by M code command is output to the following signals. Please switch the gear according to the output gear number.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0002					GRSFT_O	GR3_O	GR2_O	GR1_O

GR1_O – GR3_O   The type of the selected gear is output.
                              These signals correspond to the selected gear as follows.

Selected gear	GR3_O	GR2_O	GR1_O
Neutral	0	0	0
Gear 1	0	0	1
Gear 2	0	1	0
Gear 3	1	0	0

GRSFT_O   1: Notification of state that gear can be shifted.
                         0: The shift of the gear is unnecessary.

These signals notify the gear number that has been currently selected. Please input the current gear number.

	#7	#6	#5	#4	#3	#2	#1	#0
X0002						GR3_I	GR2_I	GR1_I

GR1_I – GR3_I   The gear type that has been selected is input.
These signals correspond to the selected gear as follows.

Selected gear	GR3_I	GR2_I	GR1_I
Neutral	0	0	0
Gear 1	0	0	1
Gear 2	0	1	0
Gear 3	1	0	0

2) Machining center (M) system

The ladder template of machining center (M) system commands the gear switching by M code of the machining program.

The gear number that CNC determines according to the S code command is output. Please switch the gear to the output gear number.

	#7	#6	#5	#4	#3	#2	#1	#0
Y0002					GRSFT_O	GR3_O	GR2_O	GR1_O

GR1_O – GR3_O   The type of the selected gear is output.
These signals correspond to the selected gear as follows.

Selected gear	GR3_O	GR2_O	GR1_O
Gear 1	0	0	1
Gear 2	0	1	0
Gear 3	1	0	0

GRSFT_O   1: Notification of state that gear can be shifted.
0: The shift of the gear is unnecessary.

These signals notify the gear number that has been currently selected. Please input the current gear number.

	#7	#6	#5	#4	#3	#2	#1	#0
X0002						GR3_I	GR2_I	GR1_I

GR1_I – GR3_I   The type of the gear that has been selected is input.
These signals correspond to the selected gear as follows.

Selected gear	GR3_I	GR2_I	GR1_I
Gear 1	0	0	1
Gear 2	0	1	0
Gear 3	1	0	0

7 ATC/Turret Control

These ladder templates control the turret or ATC with A axis controlled by PMC axis control.
- Lathe (T) system   Turret control
- Machining center (M) system   ATC control

The axis control uses the following function block of the PMC function library.
- Function block for the ATC/Turret control (Automatic operation)
  PFL1_ATC_TURRET_CNTL_AUTO_01

Note

1 It is necessary to set the related CNC parameters such as one that contains the amount of travel per rotation of the PMC axis, which is specified to be a rotation axis, are properly set in order to use this function block. See the document in the PMC function library for PMC axis control for the details.

7.1 Turret control (Lathe (T) system)

The ladder template of lathe (T) system controls the rotation of the turret using the 3rd axis controlled by the PMC axis control. The tool is selected by specifying the turret number by T code.

1) Setting
The settings concerning the turret control are as follows.

D1000	Number of tools on turret

[Data format]   Word
Specify the number of tools on the turret.
When the number of tools on turret is 8, the turret rotation is divided to 8 positions for each tool. The first turret number is 1.

D1002	Rotational speed

[Data format]   Word
Specify the rotational speed of turret.
When CNC parameter RPD (No.8002#0) is 1, this setting is effective.

D1004	Rotation direction

[Data format]   Byte
Specify the direction of the axis rotation of turret.
  1: shortcut rotation
  2: positive direction
  3: negative direction

7.2 ATC control (Machining center (M) system)

The ladder template of machining center (M) system controls the rotation of the magazine of ATC using the 4rd axis controlled by the PMC axis control. The tool is selected by specifying the magazine number by T code.

1) Setting
The setting concerning the ATC control is as follows.

D1000	Number of tools in magazine

[Data format] Word
Specify the number of tools in the magazine.
When the number of tools in the magazine is 8, the magazine rotation is divided to 8 positions for each tool. The first magazine number is 1.

D1002	Rotational speed

[Data format] Word
Specify the rotational speed of turret.
When CNC parameter RPD (No.8002#0) is 1, this setting is effective.

D1004	Rotation direction

[Data format] Byte
Specify the direction of the axis rotation of tool magazine.
  1: shortcut rotation
  2: positive direction
  3: negative direction

8   Auxiliary Function

The auxiliary functions (M, S, and T function) supported by the ladder templates of lathe (T) system and machining center (M) system are described as follows.
The execution of the auxiliary functions can be inhibited by the following key of the standard machine operator's panel.

   - MST LOCK (Auxiliary function lock) key: Inhibits execution of the auxiliary functions (M, S, and T function).

Note
1   The standard interface of the auxiliary function (A, S, T, and B) is used. (MHI(No.3001#7)=0)

8.1   M function

M function can control the rotation/stop of spindle, switching gears, the coolant on/off, and etc.
M functions supported by ladder templates of lathe (T) system and machining center (M) system are as follows.

1) Lathe (T) system
Available M codes are as follows.

M code	Function	Usage
M00	Program stop	Command that interrupts execution of program. When the automatic operation start button is pressed, the automatic operation is restarted. (Note1)
M01	Optional stop	Command that operates as well as M00 (Program stop) when the lamp of the optional stop button is turned on. When the lamp of the optional stop button is turned off, this command is ignored. (Note1)
M02	End of program	Command that ends the machining program. CNC enters the state of reset after completing the operation of this block.
M03	Spindle forward rotation	Command that rotates spindle in positive direction.
M04	Spindle reverse rotation	Command that rotates spindle in negative direction.
M05	Spindle stop	Command that stops spindle.
M19	Spindle specified position stop	Command that stops spindle at specific angle (Spindle orientation) (Note2)
M30	End of tape	Command that ends the machining program. CNC enters the state of reset after completing the operation of this block. When memory operation is selected, the program is rewound to the beginning.
M40	Gear selection (neutral)	Command that switches gear. (neutral)
M41	Gear selection (gear 1)	Command that switches gear. (gear 1)
M42	Gear selection (gear 2)	Command that switches gear. (gear 2)
M43	Gear selection (gear 3)	Command that switches gear. (gear 3)

Note
1. The lamp of the following key in the standard operator's panel blinks when the execution of the program is interrupted by command of M00 or M01.
     - PRG STOP key (Program stop)
2. The lamp of the following keys in the standard operator's panel blinks when the spindle has stopped by M19 command.
     - SPDL CW key (Spindle forward rotation)
     - SPDL STOP key (Spindle stop)

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2) Machining center (M) system

Mo code that can be used is as follows.

M code	Function	Usage
M00	Program stop	Command that interrupts execution of program. When the automatic operation start button is pressed, the automatic operation is restarted. (Note1)
M01	Optional stop	Command that operates as well as M00 (Program stop) when the lamp of the optional stop button is turned on. When the lamp of the optional stop button is turned off, this command is disregarded. (Note1)
M02	End of program	Command that ends the machining program. CNC enters the state of reset after completing the operation of this block.
M03	Spindle forward rotation	Command that rotates spindle in positive direction.
M04	Spindle reverse rotation	Command that rotates spindle in negative direction.
M05	Spindle stop	Command that stops spindle.
M06	Tool exchange	Command that executes tool exchange. The operation of the tool selection is not included. (Note2)
M08	Coolant on	Command that turns on the coolant. This command is effective when the lamp of CLT.AUTO key is turned on.
M09	Coolant off	Command that turns off the coolant. This command is effective when the lamp of CLT.AUTO key is turned on.
M19	Spindle specified position stop	Command that stops spindle at specific angle (Spindle orientation) (Note3)
M29	Rigid tapping mode	Command that switches to the rigid tapping mode. When CNC enters the state of reset, the rigid tapping mode is released.
M30	End of tape	Command that ends the machining program. CNC enters the state of reset after completing the operation of this block. When memory operation is selected, the program is rewound to the beginning.
M40	Gear selection (neutral)	Command that switches gear. (neutral)
M41	Gear selection (gear 1)	Command that switches gear. (gear 1)
M42	Gear selection (gear 2)	Command that switches gear. (gear 2)
M43	Gear selection (gear 3)	Command that switches gear. (gear 3)

Note

1. The lamp of the following key in the standard operator's panel blinks when the execution of the program is interrupted by command of M00 or M01.
    - PRG STOP key (Program stop)
2. In this ladder template, the FIN signal is automatically set 1500 ms after M06 is commanded, and the M06 will be completed. Please modify the ladder program to set FIN on the proper condition of completing the tool exchange of the actual machine.
3. The lamp of the following keys in the standard operator's panel blinks when the spindle has stopped by M19 command.
    - SPDL CW key (Spindle forward rotation)
    - SPDL STOP key (Spindle stop)

8.2　S function

S function controls the spindle rotation speed and the gear shift, etc.

1) Lathe (T) system

S function commands the rotation speed of the spindle.
The gear shift is commanded by the gear selection M code.

2) Machining center (M) system

S function commands the rotation speed of the spindle.
The gear is shifted according to the rotation speed of the spindle.