✴ This user manual describes all items concerning the operation of the system in detail as much as possible. However, it is impractical to give particular descriptions of all unnecessary and/or unavailable operations of the system due to the manual content limit, product specific operations and other causes. Therefore, the operations not specified herein shall be considered impossible or unallowable.

Preface

Dear user,

We are really grateful for your patronage and purchase of this product of GSK CNC Equipment Co., Ltd..

PLC User Manual of GSK 983M Series Machining Center CNC Systems describes the matters associated with systems and their PLC in details.

To ensure the safety of the equipment as well as normal and efficient operation, always carefully read this manual before attempting to install and use the unit.

Safety Warning

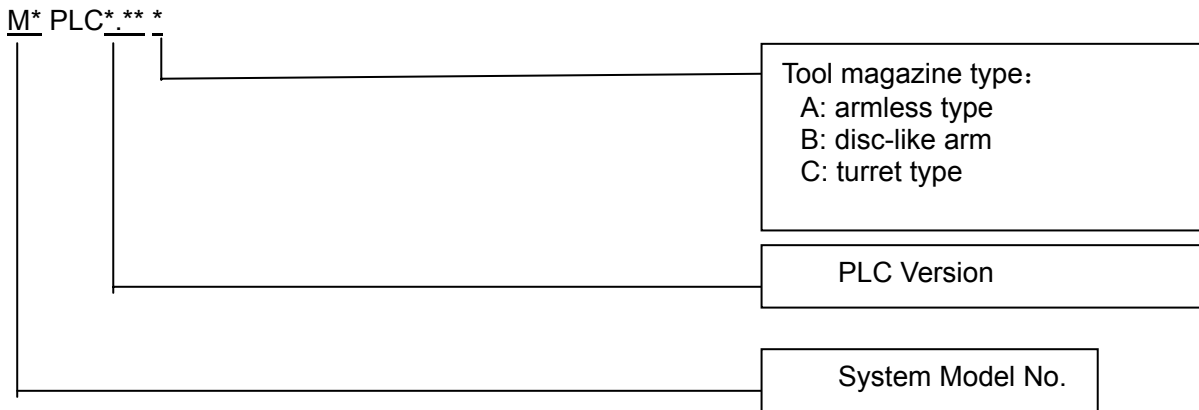Improper operations may cause accidents. Only qualified operators are allowed to operate the system.

Important: The power supply unit fitted on (inside) the chassis is specially designed for the CNC system. Never use the power supply unit for other purposes as this may lead to severe risks!

Description

I. This PLC user manual applies to the following systems:

System type	Brief description
983M-H	Split display and main frame, horizontal type operation panel and analog quantity control of feed axis
983M-V	Split display and main frame, vertical type operation panel and analog quantity control of feed axis
983Ma-H	Integrated display and main frame, horizontal type operation panel and analog quantity control of feed axis
983Ma-V	Integrated display and main frame, vertical type operation panel and analog quantity control of feed axis

II. Description of Identification in PLC Version

M* PLC*.** *

Tool magazine type：
A: armless type
B: disc-like arm
C: turret type

PLC Version

System Model No.

Example

Ma PLC V2.0 A

III. The PLC user manual is applicable to armless, disc arm and turret tool magazines.

Precautions

■Transport and Storage
- No more than six layers of packing cases shall be stacked.
- Never climb up, stand on or place any heavy object on the packing cases.
- Do not pull or handle the unit using the cable connecting it;
- Do not knock and scratch the panel and display.
- Avoid exposing the packing case to dampness, direct sunlight and rain.

■Unpacking and Inspection
- Unpack the unit and check that it is what you bought.
- Check that the unit is not damaged during transport.
-
- Check that all the parts are complete without damage against the checklist.
- In case of inconsistent product model, accessory missing or damage in transport, duly contact us.

■Wiring
- All personnel involved in wiring and examination shall be qualified with corresponding competence.
- The unit must be securely grounded with earth resistance less than 0.1Ω. Never use a neutral (null line) as the earth wire.
- The wiring must be correct and secure in order to avoid fault or unexpected consequence.
- The surge absorbing diode connecting the unit shall be corrected in the specified direction; otherwise it may cause damage to the unit.
- Always disconnect the power supply before attempting to unplug or plug the power cord or open the casing.
-

■Maintenance
- Make sure to disconnect the power supply before maintenance or replacement of any component.
- In case of short circuit or overload, check the unit for fault and eliminate it before restarting the unit.
- Do not frequently power on and off the unit. When it is turned off, wait for at least one minute before restarting it.

Statement!

● In this manual we have tried as much as possible to describe all the various matters. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities. Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

Warning!

● Before programming and operating the unit, make sure to carefully read this manual and the operating instructions of the machine and perform the relevant operations by strictly observing the precautions and requirements in them. Otherwise it may cause damage to products and machine, workpiece rejection or even personal injury.

Caution!

● Before programming and operating the unit, make sure to carefully read this manual and the operating instructions of the machine and perform the relevant operations by strictly observing the precautions and requirements in them. Otherwise it may cause damage to products and machine, workpiece rejection or even personal injury.

Caution!

● The product functions and technical data (e.g. accuracy and speed) stated herein only apply to this unit. The actual functional configuration and technical performance of a CNC machine equipped with this unit depend on the design of the machine. Refer to the user manual of the CNC machine for its functional configuration and technical indicators.
● Although this system is equipped with a standard machine operation panel, the functions of the keys on it are defined by PLC programs (trapezoidal pattern).
● Refer to the user manual of the machine for the functions and meanings of the keys on the machine panel.

The contents of this manual are subject to modification without further notice.

Safety Responsibilities

Safety Responsibilities of Manufacturer

——The manufacturer is responsible for the eliminated and/or controlled dangers in the design and structure of supplied CNC system and accessories accompanied with it.

——The manufacturer is responsible for the safety of the supplied CNC system and accessories accompanied with it.

——The manufacturer is responsible for the information and recommendation for use furnished to the user.

Safety Responsibilities of User

——The user shall be fully familiar with the safe operations of the CNC system by study and training.

——The user shall be responsible for the risks arising from the addition, change or modification of the original CNC system.

——The user shall be responsible for the dangers as a result of failure to abide by the requirements of the manual with regard to the operation, adjustment, maintenance, installation, storage and transport of the unit.

This manual shall be reserved by the final user.

Heartfelt thanks are given to you for your support in use of the products of GSK CNC Equipment Co., Ltd..

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1. Address of Keys on Operation Panel

Key (Addr1 / Addr2)	Key (Addr1 / Addr2)	Key (Addr1 / Addr2)	Key (Addr1 / Addr2)
AUTO — 36.0 / 7.0	+Z — 37.0 / 8.0	+X — 46.0 / 9.0	+4 — 41.0 / 10.0
EDIT — 36.1 / 7.1	+Y — 37.1 / 8.1	RAPID — 46.1 / 9.1	-Y — 41.1 / 10.1
MDI — 36.2 / 7.3	-4 — 37.2 / 8.2	-X — 46.2 / 9.2	-Z — 41.2 / 10.2
MANUAL — 36.3 / 7.4	X1/F0 — 37.3 / 8.3	X10/F50 — 46.3 / 9.3	X100/F — 100 / 41.3 / 10.3
MPG — 36.4 / 7.5	SINGLE — 37.4 / 8.4	OPTIONAL STOP — 46.4 / 9.4	CCW — 41.4 / 10.4
MACHINE ZERO — 36.5 / 7.5	SKIP — 37.5 / 8.5	MACHINE LOCK — 46.5 / 9.5	STOP — 41.5 / 10.5
DNC — 36.6 / 7.6	DRY — 37.6 / 8.6	M.S.T LOCK — 46.6 / 9.6	CW — 41.6 / 10.6
USER1 — 36.7 / 7.7	USER2 — 37.7 / 8.7	PROG. RESTART — 46.7 / 9.7	ORIENTATION — 41.7 / 10.7
USER2 — 47.0 / 13.0	USER4 — 47.1 / 12.0	USER5 — 47.2 / 12.5	USER6 — 45.0 / 11.0
USER7 — 50.0 / 13.1	USER8 — 50.5 / 12.1	USER9 — 47.3 / 12.6	USER10 — 45.1 / 11.1
CHIP REMOVAL — 50.1 / 13.2	WASHING CHIP — 50.6 / 12.2	BLOWING WORKPIECE — 47.4 / 12.7	COOLING — 45.2 / 11.2
INDEXER RELEASE/CLAMP — 50.2 / 13.3	LUBRICATING — 50.7 / 12.3	OVERTRAVEL — 47.5 / 11.7	LIGHT — 45.3 / 11.3
X T.CASE VERTICAL — 50.3 / 13.4	Z T.CASE HORIZON — 51.0 / 12.4	47.6 / 11.6	FEED HOLD — 45.4 / 11.4
Y T.MAG DEBUGGING — 50.4 / 13.5	4 MANI. ROTATION — 51.1 / 13.6	15.0- / 15.7	CYCLE START — 45.5 / 11.5

List of PLC Programmed Function Configurations for Three Types of Tool Magazines			
O: The function is available.			
※: The function is unavailable.			
List of PLC Programmed Function Configurations for Three Types of Tool Magazines			
Function description	Armless magazine	Disc arm magazine	Turret magazine
Control over cooling pump	O	O	O
Automatic control over lubricating	O	O	O
Chip cleaner function	O	O	O
Machine tool working lamp	O	O	O
Water valve chip removal function	O	O	O
Protective door function	O	O	O
Spindle blowing	O	O	O
Cooling control inside spindle	O	O	※
Workpiece blowing	O	O	O
Overtravel release	O	O	O
Control over indexer for 4-axis	O	O	O
Tooling 2 clamping control	O	O	※
Control over hydraulic rotary table	O	O	
Rigid tapping output	O	O	O
The Z-axis contracting brake output	O	O	O
Automatic (manual) shift between high and low speed of spindle	O	※	※
Automatic shift of double-speed motor for spindle	O	※	※
Automatic start/stop of hydraulic oil pump for spindle shift mechanism	O	※	※
Spindle braking	O	O	※
Spindle tool release indicator	O	O	※
Selection of PC parameters for operation panel MPG and hand box MPG	O	O	O
MPG mode light output	O	O	O
Changeover between PC parameters for MPG mode and manual step mode	O	O	
Limitation of PC parameters for rapid override in zero return mode and manual mode	O	O	O
Spindle orientating function	O	O	O
Zero return in negative directions of X and Y axes	O	O	O
Tool pot JOG	O	O	※
Zero return of tool magazine	O	O	※
Output of magazine master air supply valve	O	※	※

2 Address List of I/O Input/Output Signal

Address	Signal name	Description	Armless magazine input	Disc arm magazine input	Turret magazine input
List of Addresses of PLC Programs of GSK983M Machining Center System Series O: Available; Void: Not defined or configured					
X32.0	*+LX	Positive limit of X-axis (Fixed signal)	O	O	O
X32.1	*-LX	Negative limit of X-axis (Fixed)	O	O	O
X32.2	LUB.LE.LOW	Low lubricating level alarm	O	O	O
X32.3	ARMOVL	Overload of arm motor		O	
X32.4	G.PUP.AL	Overload of hydraulic pump for gear shift of spindle	O		
X32.5	*DECX	Zero return deceleration of X-axis (fixed)	O	O	O
X32.6	USE.ALM	User-defined alarm	O	O	O
X32.7	ELCTOVER	Overload of tool magazine pot motor	O	O	O
X32.COM		Selection of X32.0~X32.7 input level	O	O	O
X33.0	*+LY	Positive limit of Y-axis (fixed)	O	O	O
X33.1	*-LY	Negative limit of Y-axis (fixed)	O	O	O
X33.2	BAROMET	Low magazine air pressure detection	O	O	
X33.3	COOL.OVL	Water pump overload alarm	O	O	O
X33.4	CHIP.ALM	Overload of chip cleaner motor	O	O	O
X33.5	*DECY	Zero return deceleration of Y-axis (fixed)	O	O	O
X33.6	COOL .LE.L	Low cooling water level detection	O		
X33.7	GUARD	Protective door input	O	O	O
X33.COM		Selection of X33.0~X33.7 input level	O	O	O
X34.0	*+LZ	Positive limit of the Z-axis (fixed)	O	O	O
X34.1	*-LZ	Negative limit of the Z-axis (fixed)	O	O	O
X34.2	LUB.PR. LOW	Lubricating pump pressure detection	O	O	
X34.3	S.HB.d.H	Electric cabinet overtemperature warning	O		
X34.4	INT.COOL	Intercooler alarm	O		
X34.5	*DECZ	Zero return deceleration of the Z-axis (fixed)	O	O	O
X34.6	LUB.OVL	Overload of lubricating pump	O		
X34.7	SP.Fan.OVL	Overload of spindle motor fan	O		
X34.COM		Selection of X34.0~X34.7 input level	O	O	O
X35.0	*+L4	Positive limit of 4-axis (fixed)	O	O	O
X35.1	*−L4	Negative limit of 4-axis (fixed)	O	O	O
X35.2					
X35.3	B.CW.IN	Confirmation of forward rotation of hydraulic rotary table in-position	O	O	
X35.4	B.CCW.IN	Confirmation of backward rotation of hydraulic rotary table in-position	O	O	
X35.5	*DEC4	Zero return deceleration of 4-axis (fixed)	O	O	O
X35.6	CLPI	Indexer (or Tooling 1 or hydraulic rotary table) clamping detection	O	O	O
X35.7	UCLPI	Indexer (or Tooling 1 or hydraulic rotary table) releasing detection	O	O	O
X35.COM		Selection of X35.0~X35.7 input level	O	O	O
X38.0	GR1.M	Detection of spindle Gear 1 in-position	O		

X38.1	GR2.M	Detection of spindle Gear 2 in-position	O		
X38.2	GR3.M				
X38.3	T-IN-SP	Spindle tool detection signal	O		
X38.4	*ESP	Emergency stop (fixed)	O	O	O
X38.5	TRLCK.I	Detection of tool released in-position	O	O	O
X38.6	TCLCK.I	Detection of tool clamped in-position	O	O	O
X38.7	CKST	Tool released/clamped button	O	O	
X38.COM		Selection of X38.0~X38.7 input level	O	O	O
X40.0					
X40.1					
X40.2	SOR.M	Drive feedback detection of orienting in-position	O	O	O
X40.3					
X40.4					
X40.5	SRDY	Spindle alarm input signal	O	O	O
X40.6	ZSP	Spindle zero speed detection	O	O	O
X40.7	SAR	Spindle speed arrival detection	O	O	O
X40.COM		Selection of X40.0~X40.7 input level	O	O	O
X43.0	TFN.I	Magazine moved forward in-position	O		
	TTDOWN	Tool pot put down in-position		O	
X43.1	ARMZRO	Arm origin		O	
X43.2	ARMHOLD	Holding of a tool in arm		O	
X43.3	T-BARE	Detection of current bare tool position	O		
	T-STOP	Arm stop		O	
X43.4	TCN2.I	Tool pot in-position signal	O	O	O
X43.5	TCN.I	Tool counting signal	O	O	O
X43.6	SKIP	Skip input (CNC fixed)	O	O	O
X43.7	TBK.I	Magazine backward in-position	O		
	TTUP	Pot up in-position		O	
X43.COM		Selection of X43.0~X43.7 input level	O	O	O
X48.0	*+L5	Positive limit of 5-axis (fixed)	O	O	O
X48.1	*-L5	Negative limit of 5-axis(fixed)	O	O	O
X48.2	T-ZRO	Magazine zero input	O	O	
X48.3					
X48.4	PLACE.M	Tool change area signal			O
X48.5	*DEC5	Zero return deceleration of 5-axis (fixed)	O	O	O
X48.6	SOR.PROV	Confirmation of mechanical position of orientation in-position	O	O	O
X48.7	ZPZ2.PROV	Confirmation of the 2nd reference mechanical positions of the Z-axis	O	O	
		Tool change enable input			O
X48.COM		Selection of X48.0~X48.7 input level	O	O	O

Address	Signal name	Description	Armless magazine input	Disc arm magazine input	Turret magazine input
Y0.0	GR1.O	Spindle Gear 1 output	O		
Y0.1	GR2.O	Spindle Gear 2 output	O		
Y0.2	CLN3.O	Spindle inside cooling (USER2 On/Off)	O	O	
Y0.3	GR4.O				
Y0.4	M03	Spindle CW	O	O	O
Y0.5	M04	Spindle CCW	O	O	O
Y0.6	lighting	Working lamp of machine tool	O	O	O
Y0.7	TRLCK.O	Tool released	O	O	
Y1.0	RED.ALL	Red light alarm	O	O	O
Y1.1	YEL.ALL	Yellow light	O	O	O
Y1.2	GRE.ALL	Green light	O	O	O
Y1.3	CLN.O	Cooling pump (coolant)	O	O	O
Y1.4	LUB.O	Lubricating pump output	O	O	O
Y1.5	OR.T	Overtravel release output	O	O	O
Y1.6	M19.O	Spindle orientation	O	O	O
Y1.7	CFN.O	Spindle blowing output	O	O	O
Y2.0	TC.O	Tool pot clockwise	O	O	O
Y2.1	TCC.O	Tool pot counterclockwise	O	O	O
Y2.2	SPZD	Spindle braking	O	O	
Y2.3	CLP.O	Clamping of indexer (or tooling)	O	O	O
Y2.4	MT.RST	External output of system resetting	O	O	O
Y2.5	UCLP.O	Releasing of indexer (or tooling)	O	O	O
Y2.6	TFR.O	Magazine forward output	O		
	POT.V.OUT	Pot down output		O	
Y2.7	TBK.O	Magazine backward output	O		
	POT.H.OUT	Pot uplift output		O	
Y3.0	ATC.MTO	Arm motor output		O	
	T.BRAKE	Tool pot motor brake output			O
Y3.1	CLN2.O	Chip clean valve output	O	O	O
Y3.2	MPG.L	MPG mode light output	O	O	O
Y3.3	CHIP.CW	Chip cleaner clockwise output	O	O	O
Y3.4	CLN-2O	Workpiece blowing output	O	O	O
Y3.5	CHIP.CCW	Chip cleaner counterclockwise output	O	O	O
Y3.6	CKST.L	Spindle releasing indicator	O	O	
Y3.7	M29.O	Rigid tapping output	O	O	O

Address	Signal name	Description	Armless magazine input	Disc arm magazine input	Turret magazine input
Y6.0	B.CW.OUT	Hydraulic rotary table clockwise	O	O	
Y6.1	B.CCW.OUT	Hydraulic rotary table counterclockwise	O	O	
Y6.2					
Y6.3	HYPR.O	Spindle gear shifting hydraulic oil pump	O		
Y6.4	UCLP2	Releasing of Tooling 2 (USER7 releasing/clamping)	O		
Y6.5	Z-BRAKE	The Z-axis contracting brake output	O	O	O
Y6.6	BAR.OUT	Output of armless magazine master air supply valve	O		
Y6.7					

Feed override/spindle override input addresses							
52.7	52.6	52.5	52.4	52.3	52.2	52.1	52.0
SPC	SPB	SPA	OV16	OV8	OV4	OV2	OV1
External feed hold and program lock input addresses							
53.7						53.1	53.0
KEY						SP	ST
External MPG gears and axis selection input addresses							
54.7	54.6	54.5	54.4	54.3	54.2	54.1	54.0
X100	X10	X1	OFF	H4	HZ	HY	HX

3 Description of I/O Signals of I/O Unit

3.1 Description of Input Signal High/Low Level Selection

The level selection of the input signal of the new I/O unit (X1) provided with the system is more flexible than the previous versions. It is possible to enable high level (+24 input enabled) or low level (0V input enabled) depending on different external signals as follows: The new I/O unit is provided with an additional public input COM terminal at the starting point of each group of input signals (e.g. a terminal with X32.COM at the starting point of input addresses X32.0～X32.7). When the corresponding COM terminal is connected to the +24V terminal of the switch power supply, the 8 input points in the group are active for 0V input. When the corresponding COM terminal is connected to the 0V terminal of the switch power supply, the 8 input points in the group are active for +24V input. For active input, the corresponding PLC diagnosis address point is 1.

Connection Method for Active Low-level Input
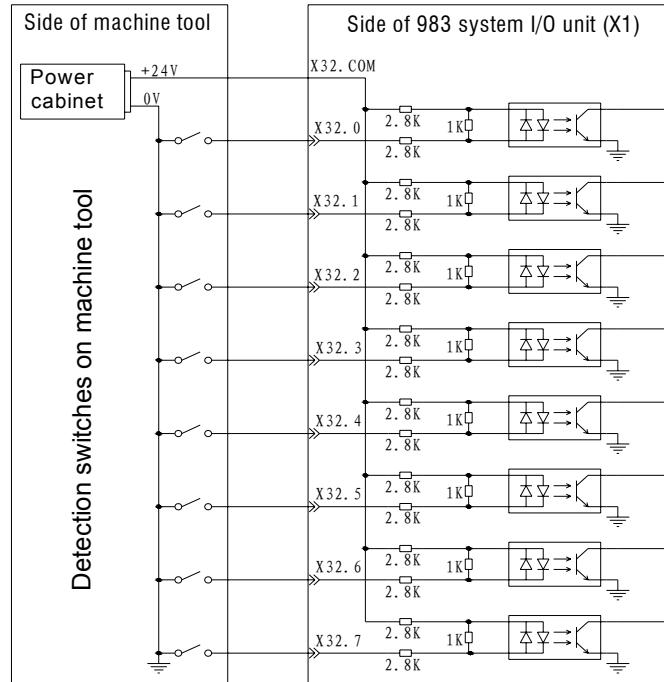
Connection Method for Active High-level Input
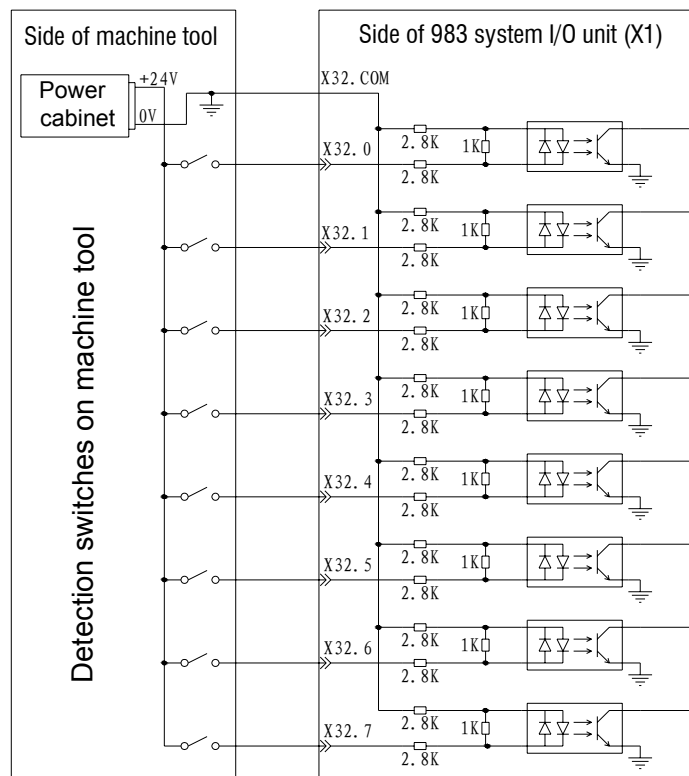
3.2 Description of Output Signal Level

All the output signals of the system are low-level outputs (0V output).

For active output, the corresponding PLC output address point is 1.

Output Connection Diagram
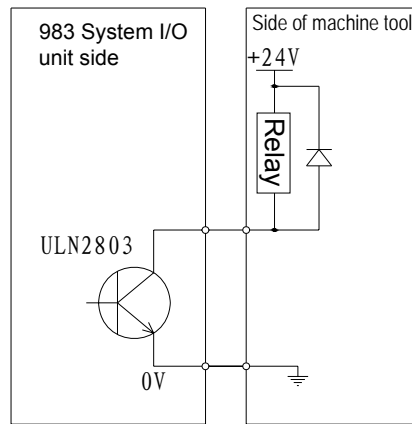
3.3 Detailed Description of Input Signals

☆ ***+LX, *－LX, *+LY, *－LY, *+LZ, *－LZ, *+L4, *－L4, *+L5 and *－L5** are the positive and negative limit input signals of X, Y, Z, 4 and 5 axes respectively. They are the fixed input signal points of CNC that cannot be defined and modified through PLC by user. Short-circuit them when they are not in use. (Short-circuit them with +24V for connection with active high-level input, and with 0V for connection with active low-level input.)

☆ ***DECX, *DECY, *DECZ, *DEC4 and *DEC5** are the zero return deceleration input signals of X, Y, Z, 4 and 5 axes respectively. They are the fixed input signal points of CNC that cannot be defined and modified through PLC by user. That "0" or "1" indicates deceleration at the corresponding input point may be selected and set through CNC No.11 Parameter BIT5.

☆ **YW.ALM** (PLC Address X32.2) is the low lubricating level or low lubricating pressure alarm input signal whose alarm logic is selected through the PC Parameter 3003.0. (The PC Parameter 3003.0 is factory-set to 0. Namely the system gives the alarm when the PLC Address X32.2 is 1. To allow the system to give the alarm when the PLC Address X32.2 is 0, set the PC Parameter 3003.0 to 1.)

☆*ARMOVL (PLC Address X32.3) is the arm motor overload signal. The system gives the alarm when PLC Address X32.3 is 0.

☆ **G.PUP.AL** (PLC Address X32.4) is the overload input signal of the hydraulic pump motor for the spindle shifting mechanism whose alarm logic is selected through the PC Parameter 3004.2. (It is factory-set to 0. Namely the system gives the alarm when the Input X32.4 is 1. To allow the system to give the alarm when the Input X32.4 is 0, set the PC Parameter 3004.2 to 1.)

☆ **ZDY.ALM1** (PLC Address X32.6) is the user-defined alarm input signal whose alarm logic is selected through the PC Parameter 3003.3. (The PC Parameter 3003.3 is factory-set to 0. Namely the system gives the alarm when the Input X32.6 is 1. To allow the system to give the alarm when the Input X32.6 is 0, set the PC Parameter 3003.3 to 1.)

☆**ELCTOVER** (PLC Address X32.7) is the tool pot motor overload input signal whose alarm logic is selected through the PC Parameter 3004.1. (It is factory-set to 0. Namely the system gives the alarm

when the Input X32.7 is 1. To allow the system to give the alarm when the Input X32.7 is 0, set the PC Parameter 3004.1 to 1.)

☆**BAROMETER** (PLC Address X33.2) is the low air pressure alarm input signal whose alarm logic is selected through the PC Parameter 3002.1. (The PC Parameter 3002.1 is factory-set to 0. Namely the system gives the alarm when the input is 1. To allow the system to give the alarm when the Input X32.2 is 0, set the PC Parameter 3002.1 to 1.)

☆**W.PUMP.ALM** (PLC Address X33.3) is the water pump motor overload alarm input signal whose alarm logic is selected through the PC Parameter 3002.0. (The PC Parameter 3002.0 is factory-set to 0. Namely the system gives the alarm when the Input X33.3 is 1. To allow the system to give the alarm when the Input X33.3 is 0, set the PC Parameter 3002.0 to 1.)

☆**CHIP.ALM** (PLC Address X33.4) is the chip cleaner motor overload detection signal whose alarm logic is selected through the PC Parameter 3004.0. (It is factory-set to 0. Namely the system gives the alarm when the Input X33.4 is 1. To allow the system to give the alarm when the Input X33.4 is 0, set the PC Parameter 3004.0 to 1.)

☆ **GUARD** (PLC Address X33.7) is the protective door interlocking input signal whose alarm logic is selected through the PC Parameter 3004.3. (The PC Parameter 3004.3 is factory-set to 0. Namely the system gives the alarm when the Input X33.7 is 1. To allow the system to give the alarm when the Input X33.7 is 0, set the PC Parameter 3004.3 to 1. In addition, whether the protective door function is active may be set through the PC Parameter 3004.4. It is factory-set to 0 and the protective door input is not active.)

☆B.CW.IN (PLC Address X35.3) is used to confirm that the hydraulic rotary table rotates clockwise to the designated position. It rotates clockwise to the designated position when the B.CW.IN signal is 1.

☆B.CCW.IN (PLC Address X35.4) is used to confirm that the hydraulic rotary table rotates counterclockwise to the designated position. It rotates counterclockwise to the designated position when the B.CCW.IN signal is 1.

☆ **CLPI** (PLC Address X35.6) is the signal for detecting that the indexer (or tooling) is clamped in-position. It is clamped in-position when the CLPI signal is 1. It is possible to set whether to detect any signal of clamping in-position through the PC Parameter 3002.4. (The corresponding clamping command is M85. When the PC Parameter 3002.4 is set to check the clamp-in-position signal, the corresponding clamp command M85 is not ended if the clamp-in-position signal is not performed.)

☆ **UCLPI** (PLC Address X35.7) is the signal for detecting that the indexer (or tooling) is released in-position. It is released in-position when the **UCLPI** signal is 1. It is possible to set whether to detect any signal of clamping in-position through the PC Parameter 3002.4. (The corresponding clamping command is M84. When the PC Parameter 3002.4 is set to check the release-in-position signal, the corresponding release command M84 is not ended if the release-in-position signal is not performed.)

☆ **GR1.M and GR2.M** (PLC Address X38.0 and X38.1) are the signals for detection of Gear 1 and 2 of the spindle respectively. Gear 1 is in-position when X38.0 is 1 and Gear 2 in-position when X38.1 is 1.

☆ **T-IN-SP** (PLC Address X38.3) is the signal for detecting that the spindle is fitted with a tool. When it is fitted with a tool, the inductive switch does not sense or output any signal and X38.3 is 0. When the spindle is not fitted with a tool, the inductive switch senses and outputs a signal and X38.3 is 1.

☆ ***ESP** (PLC Address X38.4) is the system emergency stop signal. The system is in emergency stop state when X38.4 is 0.

☆ **TRLCK.I** (PLC Address X38.5) is the signal for detection that the spindle releases a tool in-position. A tool is released in-position when X38.5 is 1.

☆ **TCLCK.I** (PLC Address X38.6) is the signal for detection that the spindle clamps a tool in-position. A tool is clamped in-position when X38.6 is 1.

☆ **CKST** (PLC Address X38.7) is the input signal of the tool released/clamping button. The input is active when X38.7 is 1.

☆ **SOR.M** (PLC Address X40.2) is the signal for detection that the spindle is oriented in-position (output of spindle drive unit). The orientation is completed when X40.2 is 1.

☆ **SRDY** (PLC Address X40.5) is the signal for detection of spindle alarm. The logic of the alarm is selected through the PC Parameter 3001.4. (It is factory-set to 0. Namely the system gives the alarm when the Input X40.5 is 0. To allow the system to give the alarm when the Input X40.5 is 1, set the PC Parameter 3001.4 to 1.)

☆ **ZSP** (PLC Address X40.6) is the signal for detection of zero speed of the spindle. The spindle reaches zero speed when X40.6 is 1.

☆ **SAR** (PLC Address X40.7) is the signal for detecting that the spindle reaches the set speed. The spindle reaches the set speed when X40.7 is 1.

☆ **TFN.I** (PLC Address X43.0) is the signal for detecting that the armless magazine moves forward to the designated position. It moves forward to the designated position when X43.0 is 1.

☆**TTDOWN** (PLC Address X43.0) is the signal of the tool case putting-down in-position of the tool magazine with a disc manipulator.

☆**ARMZRO** (PLC Address X43.1) is the origin signal of the manipulator arm of the tool magazine with a disc manipulator.

☆**ARMHOLD** (PLC Address X43.2) is the signal of the manipulator arm holding tool of the tool magazine with the a disc manipulator.

☆ **T-BARE** (PLC Address X43.3) is the signal for checking that current position in tool pot   of the armless type magazine is empty. Its alarm logic is selected through the PC Parameter 3004.5. (The PC Parameter 3004.5 is set to 0 by factory). Namely the system considers that there is a tool in the current clamping position in the tool pot of the armless type magazine when X43.3 is 1.)

☆ **T-STOP** (PLC Address X43.3) is the signal indicating that the arm of the disc arm magazine stops.

☆ **TCN2.I** (PLC Address X43.4) is the signal indicating that the pot is in-position.

☆ **TCN.I** (PLC Address X43.5) is the tool counting input signal.

☆ **SKIP** (PLC Address X43.6) is the skip input signal that is used in combination with the G31 command.

☆ **TBK.I** (PLC Address X43.7) is the signal for detecting that the armless magazine moves back to the designated position. It moves back to the designated position when X43.7 is 1.

☆ **TTUP** (PLC Address X43.7) is the signal of the tool case uplifting in-position of the tool magazine with a disc manipulator.

☆ **T-ZRO** (PLC Address X48.2) is the tool magazine pot zero input signal (No.1 pot or No.1 clamp input signal).

☆**PLACE.M** (PLC Address X48.4) is the signal from the tool change area of the turret type magazine.

☆ **SOR.PROVE** (PLC Address X48.6) is the signal for verifying the proper orientation of the spindle in the specified mechanical position (output of external sensor).

To ensure the orienting accuracy of the spindle and protect the magazine, the user may add a sensor for detecting the mechanical position of spindle orienting. Before changing a tool, the system checks the orient-in-position signal output by the servo drive unit for the spindle as well as the signal for verifying the position of the orienting mechanism fitted in the specific position on the spindle.

☆**ZPZ2.PROVE** (PLC Address X48.7) is the signal for verifying the mechanical position of the Z-axis at the tool removing point of the armless or disc arm magazine. Generally the tool removing point of the magazine is the 2nd reference point for the Z-axis. To ensure the orienting accuracy of the Z-axis and protect the magazine, the user may add a sensor for detecting the mechanical position of Axis-Z tool removing point. Before changing a tool, the system checks the 2nd reference point signal determined based on the zero point on the Z-axis as well as the detection verifying signal from the tool removing position sensor fitted on the Z-axis.

☆**ZPZ2.PROVE** (PLC Address X48.7) is the signal for enabling tool change of the turret magazine. Generally the tool change point is also the 2nd reference point of the Z-axis.

3.4 Signals with "*"

The signals with an "*" in the list of the input signals of I/O unit are those to be set to ⊡**1** after power-on.

4 Zero return of the Feed axis of Machine Tool

4.1 Description of Automatic Hold of Buttons in Zero Return Direction of Axes

PC parameters of the PLC cannot be set to execute the automatic zero return function, namely, in zero return mode, pressing the keys ⊡+X , ⊡+Y, ⊡+Z, ⊡+4 , and each axis returns to the reference point automatically in the positive direction, and the press keys are held automatically when zero return, and zero point indicator of each axis lights after reference point return. Press ⊡X , ⊡-Y, ⊡-Z, ⊡-4 , the emergency stop button or the reset key to cancel the zero return operation in the course of zero return.

4.2 Setting of Automatic Hold Buttons for Zero Return in Negative Directions of X-axis and Y-axis

When this PLC program is used as a machining center with magazine control functions, some machine tool manufacturers set their machine tools to zero in the negative directions of the X-axis and Y-axis. Therefore make sure to keep consistent with the set zero return direction while attaching zero return buffer blocks to the machine tools.

The zero return auto-hold in the negative direction of the X-axis can be set through the PC Parameter 3001.7. To select zero return in the negative direction, always set the NC parameter 12.0 to 1.

Always set BIT7 of PC3001 to 1 for zero return auto-hold in the negative direction of the X-axis								
PC3001	**1**	0	0	0	0	0	0	0
Always set BIT0 of NC12 to 1 for zero return auto-hold in the negative direction of the X-axis								
NC12	0	0	0	0	0	0	0	1

The zero return auto-hold in the negative direction of Y-axis can also be set through the PC parameter 3001.1. To select zero return in the negative direction, always set the NC 12.1 to 1.

Always set BIT1 of PC3001 Parameter to 1 for zero return auto-hold in the negative direction of Y-axis								
PC3001	0	0	0	0	0	0	1	0
Always set BIT1 of NC12 Parameter to 1 for zero return auto-hold in the negative direction of Y-axis								
NC12	0	0	0	0	0	0	1	0

5 Setting of PC Parameters for Manual Fast Speed Limitation of Machine Tool

For the operating safety of the machine tool at its high G0 speed, it is possible to limit the speed in manual and zero return modes by setting PC parameters so that the high speeds of the feed axis in the manual and zero return modes are limited within the scope set through the parameter (no limit in automatic mode). The specific setting method is as shown in the table below:

PC3005.7	PC3005.6	Rapid override
0	0	100%
1	0	50%
0	1	25%
1	1	F0 (setting of the NC Parameter 113)

After setting the above PC bit parameter (except for 100%), the adjustment using the fast override button on the operating panel is no longer effective in the manual and zero return modes and the fast override is limited to the percentages listed in the table. In automatic, MDI and DNC modes, the limit factor set

through the above PC parameter is not active while the fast override button on the operating panel is effective and may be adjusted at any time.

Pay attention to the setting of the relevant NC Parameters while setting the speed limit:

To set the PC parameter for limitation of rapid speed override in manual and zero return modes, it is advisable to set the following NC Parameters: 1.Set the Bit of the NC Parameter 10 to 0, which means that the rapid speed is not valid until the machine tool returns to the origin. 2. Set the Bit3 of the NC Parameter 2 to 1,which means that the first software travel limit is enabled. 3. Set the travel limit data for each axes by the NC Parameter 143 through 150.

6 Spindle Functions

6.1 Analog Spindle without Gear Shift

6.1.1 Setting of Relevant NC Parameters
1. NC Parameter 0.4=1 (The analog spindle is active.)

2. NC Parameter 1.5=0 (The 2-bit BCD code of the spindle is inactive.)

3. NC Parameter 132 = The max. speed of the spindle corresponds to the 10V output of the system.

6.1.2 Programming Example

Command: M3 S××××; (speed command)

To allow a servo motor or variable-frequency motor to rotate clockwise

Command: M4 S××××; (speed command)

To allow a servo motor or variable-frequency motor to rotate counterclockwise

Command: M5 or S0 may stop the rotation of the spindle.

6.2 Mechanically Automatic Shift between High and Low Speed of Spindle (Analog Spindle)

6.2.1 Setting of NC Parameters in respect of Automatic Gear Shift
1. NC 0.4=1 (Namely the analog spindle is active.)

2. NC No.132 = max. spindle speed for low-speed gear

3. NC No.133 = max. spindle speed for high-sped gear

4. NC No.37 =   speed of spindle jog

6.2.2 Setting of PC Parameters in respect of Automatic Shift

1. PC 3003.6=1 (Mechanical shift-in-position check)

2. PC1019= Total time of spindle shift

3. PC1014= JOG rotating time of spindle shift

4. PC1015= JOG stopping time of spindle shift

5. PC1016= A shift signal is output in the time delay after zero speed is reached.

6.2.3 Description of Time Sequence and Operations of Automatic Shift

For command M3 S**** (or M4 S****), the system automatically judges whether the command speed is consistent with the present gear. In case of inconsistency, the spindle enters the jog state (the jog speed is set by NC37 parameter). The spindle does not escape from the jog state and end the gear shift operation until the gear shifting time set by PC1019 parameter arrives or a correct shifting in-position signal is input. The next block directly runs after gear shift. If the command speed conforms to the present gear, the system directly starts and rotates at the command speed and then run the next block of CNC program. (Note that the relevant input signals GR1.M (X38.0), GR2.M (X38.1) and ZSP (X40.6) must be correctly connected.)

6.2.4 Setting of Whether the Spindle Gear Output Signal Is Held

It is possible to set through PC parameters whether the spindle gear output signal is held after the automatic high/low speed gear shift of the spindle is completed.

PC3002.2=0 The gear output signal is held.

PC3002.2=1 The gear output signal is not held.

Note 1: When it is set that the gear output signal is not held, the hydraulic oil pump motor will stop upon the expiration of the delay time set by PC1018 after gear shift.

Note 2: When it is set that the gear output signal is not held, it is impossible to select automatic start of the hydraulic oil pump motor upon power-on. That means PC Parameter 3002.3 is not 1; otherwise the hydraulic oil pump always keeps outputting.

6.3   Manual Mechanical Gear Shift between High and Low Speeds of Spindle

6.3.1 Setting of NC Parameters regarding manual mechanical gear shift
1. NC 04=1 (Namely the analog spindle is active.)

2. NC No.132= max. spindle speed for low-speed gear

3. NC No.133= max. spindle speed for high-sped gear

4. NC No.37= speed of spindle jog

6.3.2 Setting of PC Parameters regarding manual mechanical gear shift
1. PC 3003.6=1 (Shift gear in-position check)
2. PC 3003.4=1 (Active manual high-low speed shift of spindle)
3. PC1019= Total time limit of spindle shift

4. PC1014= JOG rotating time of spindle shift

5. PC1015= JOG stopping time of spindle shift

6. PC1016= A shift signal is output in the time delay after zero speed is reached.

6.3.3 Description of Time Sequence and Operations of Manual Shift

For command M3 S**** (or M4 S****), the system automatically judges whether the command speed is consistent with the present gear. In case of inconsistency, the spindle enters the jog state (the jog speed is set by NC37 parameter). The spindle does not quit the jog state until the gear shifting time set by PC1019 parameter expires or a shift-in-position signal is input. The CNC is in feed hold state after manual shift. The next block of CNC program cannot be run unless the CYCLE START key is pressed again. If the command speed conforms to the present gear, the system directly starts and rotates at the command speed and then run the next block of CNC program.

6.4 **Control over Double-speed Motor for Spindle** (non-analog spindle)

6.4.1 Setting of NC Parameters Related to Control over Double-speed Motor for Spindle
1. CNC 0.4=0, (non-analog spindle)

2. CNC 1.5=1 (Output of spindle BCD code, gear spindle)

6.4.2 Setting of PC Parameters Related to Control over Double-speed Motor for Spindle
1. PC 3003.6=0 (Shift-in-position signal is not checked)

2. PC1016= Interval of shift between two speeds of motor

6.4.3 Description of Double-speed Motor Control Commands
For Command M3 S1 (M4 S1), the system outputs and holds Gear 1 signal. For Command M3 S2 (M4 S2), the system cuts off the output of Gear 1 signal and outputs and holds Gear 2 signal. The interval of shift between the two gears is adjustable by setting PC1016 in order to guarantee the reliable switching of the controlled external DC relay and AC contactor and to avoid shooting phenomenon.

6.5 Setting of Start/Stop of Hydraulic Oil Pump for Spindle Gear Shift Mechanism

Whether the hydraulic oil pump is automatically started upon power-on may be set through PC Parameter 3002.3 provided that the spindle shift mechanism and the tool released/clamping mechanism share one hydraulic station.

When PC3002.3=1:

The hydraulic oil pump is automatically started upon power-on and kept running (only stops in case of power failure and oil pump overload alarm);

When PC3002.3=0:

The hydraulic oil pump is not automatically started when power on. When the tool is clamped or released manually or the gear shift is executed, the start is done. After the tool change or gear shift is completed, the hydraulic oil pump stops run after the time set by PC 1017, PC1018 is delayed.

When PC Parameter No. 3002.2＝1 and No. 3002.3＝0, the hydraulic oil pump is started when the tool is clamped or released manually, or the gear shift is executed, After the tool change or gear shift is

completed, the hydraulic oil pump stops run after the time set by PC 1017, PC1018 is delayed..

6.6 Spindle Orientation Functions

6.6.1 Description of Tasks of CNC System in Spindle Orientation

For a machine tool equipped with a servo spindle drive unit, the I/O unit of the CNC system outputs orientation start (ON/OFF) signal to the spindle servo drive unit and the position control unit of the CNC system sends a servo spindle enable signal when the SPINDLE ORIENTATION key on the operation panel is pressed in manual mode or M19 is run in AUTO and MDI modes.

6.6.2 Description of Tasks of Spindle Servo Drive Unit in Orientation

After receiving the orientation start signal and servo enable signal from the CNC system, the spindle servo drive unit performs the orienting operations of the spindle servo motor and when it is oriented in-position, sends orientation completion signal to the CNC system as per the orienting speed and position information preset on the drive unit.

6.6.3 CNC and PC Parameters concerning Spindle Orientation

The NC Parameter 38 of the system is not set to 0; otherwise no enable signal is output when orientation.

To ensure the correct completion of orienting operations and commands and prevent misreading of orientation completion signal, the user is required to set the following PC parameters:

1. PC 1032=160 (delayed reading of orientation completion signal)
2. PC 1026=5000 (setting of maximum time of orientation)

7 Selection and Setting of MPG on Operation Panel and Handheld MPG (Handheld Unit)

A external MPG is allocated by default. The user may select the length of single-pulse step by pressing X1 (0.001mm), X10 (0.01mm) and X100 (0.1mm) on the operation panel.

Note: To use an external handheld box, make sure to set PC Parameter #3002.5=1 and handheld box (handheld unit) control.

8. Setting of Change between MPG mode and Manual Single Step Mode

It is possible to set PC Parameter 3005.4 to 1 if the MPG is damaged or it is required to use the manual single step mode. The manual single step mode is enabled by pressing the MPG mode key on the operation panel while the single step function is active. The step feed of the corresponding axes may be achieved by pressing the axial JOG keys (+X, -X, +Y, -Y, +Z, -Z, +4 and -4). The length of a feed step

is selected using the X1 (0.01mm), X10 (0.10mm) and X100 (1.0mm) on the operation panel. The operations of MPG are not effective while the manual single step mode is active.

9 Adjustment of High Speed of Movable Shaft (G0 Speed Adjustment)

When the Rapid key on the operation panel of the system is pressed, it is possible to switch between the fast overrides of the feed axis using F0, F50 and F100. The fast overrides are ineffective when overtravel, the magazine is in advancing position or the zero return and manual override limits of PC3005.7 and PC3005.6 have been set.

10 Cooling Function

Press the key COOLING on the operation panel to directly control the cooling pump ON or OFF in AUTO or MANUAL mode. Press it and the cooling pump is ON, press it again and the cooling pump is OFF. When the cooling pump is ON in MANUAL mode, it is OFF by M09 in MDI/AUTO mode. It is ON by M8 in MDI/AUTO mode, it is OFF by pressing the key COOLING or M09.

Once M8 is enabled, the internal cooling of the spindle may be started with the Command M18 and stopped with M9. The internal cooling of the spindle may also be started or stopped by the key USER2 on the panel.

11 Chip Cleaning Function of Water Valve

The water valve may be directly opened or closed by pressing the WAHSING CHIP key on the panel, irrespective of automatic or manual mode. Pressing it once opens the valve and pressing it again closes the valve.

12 Air Blowing and Internal Cooling of Spindle

The air blowing of the spindle is controlled with the solenoid valve for blowing air to the inside of the spindle.
The internal cooling of the spindle is controlled with the solenoid valve for water or oil cooling inside the spindle.

12.1 Two Methods for Controlling Air Blowing of Spindle

1. In Manual or MDI mode, the spindle blowing is ON when the tool is released and the spindle Blowing is OFF when the tool is clamped. In Auto or MDI mode, the spindle blowing output is activated when the tool is released by M54, the spindle Blowing stops when the tool is clamped by M55.

2. In Auto or MDI mode, the air blowing inside the spindle can also be activated by M7. The air blowing duration may be set by PC Parameter 1029. The system automatically stops the air blowing inside the spindle upon the expiration of the set time.

12.2 Methods for Controlling Internal Cooling of Spindle

When the machine tool is provided with a solenoid valve for switchover between the internal cooling of spindle and the external cooling of the machine tool, the external cooling solenoid valve of the machine tool can be switched to the internal cooling of the spindle, i.e. Y0.2 output, with Command M18. (The switchover between the internal cooling of spindle and the external cooling of the machine tool can also be performed using the USER2 on the panel of the machine tool.) After switchover to the internal cooling of the spindle, the external cooling of the machine tool shall keep on. The internal cooling of the spindle may be turned off by using M9 Command or depressing the COOLING key on the panel of the machine tool.

13 Workpiece Air Blowing

The workpiece air blowing function intends to control the external workpiece air-cooling solenoid valve of the machine tool. The air-blowing valve may be directly opened or closed by depressing the BLOWING WORKPIECE key on the panel irrespective of automatic or manual mode. Pressing the key once switches on the air-blowing valve and pressing it again switches off the valve. A valve that is on in manual mode may be switched off in the automatic and MDI modes with Command M59. A valve that is on in the automatic mode can also be turned off at any time using the BLOWING WORKPIECE key and Command M59.

14 Light of Machine Tool

The lighting on the machine tool may be directly switched on or off by pressing the LIGHT key on the panel irrespective of working mode. Pressing the LIGHT key once switches on the lighting and pressing it again switches off the lighting.

15 Chip cleaner

1)   Clockwise rotation of the chip cleaner: The chip cleaner can be directly started and stopped by just pressing the CHIP REMOVAL key on the panel. The cleaner rotates clockwise when the key is pressed and stops when it is pressed again. It also rotates clockwise when Command M74 is given and stops when Command M75 is given. Its clockwise rotation started with the manual key may be stopped with Command M75. The clockwise rotation started with Command M74 can also be stopped with the manual key.

2)   Counterclockwise rotation of the chip cleaner: Its counterclockwise rotation is only used for maintenance. The counterclockwise rotation is started with Command M76 and stopped with Command M75 or CHIP REMOVAL or RESET key.

16 Overtravel release

The PLC Address 1.5 of the I/O unit outputs 0V when the OVERTRAVEL key is depressed and opens 0V when it is released. The user may use an external DC relay to close the emergency stop chain opened as a result of overtravel. The high speed of the machine is disabled once the emergency stop chain opens and the OVERTRAVEL key is depressed.

17 Control over Releasing/clamping of Indexer (or Tooling 1) (Selecting Whether to Detect In-Position signal)

M84 is the command for releasing of the indexer (or Tooling 1) and M85 for clamping it. The releasing and clamping signals are output by Y2.3 and Y2.5 of the IO unit respectively. Whether the release/clamp-in-position signal (X35.6/X.35.7) of the indexer (or tooling) is checked is set through the PC Parameter 3002.4. When it is set to be checked, Command M84 or M85 does not end and the CYCLE START key light keeps illuminating if there is no release/clamp-in-position signal. In the manual mode, the releasing signal is output when the INDEX RELEASE/CLAMP button on the operation panel is pressed and the signal is disabled and the clamping signal is output when it is pressed again.

For the setting of PC Parameter 3003.1, it is possible to select the 4-axis (Note: The CNC indexer is optional). When M85 output is set to lock the 4-axis, the indexer is clamped and the system does no execute the 4-axis running command.

18 Control over Releasing/clamping of Tooling 2 (w/o signal detection)

The releasing/clamping of some tooling is not related to the displacement of 4-axis or detected of in-position signal. To adapt to the requirements for control over the part of tooling, M86 is added as the Tooling 2 releasing command and M87 as Tooling 2 clamping command. The releasing signal is output from Y6.4. USER7 is the operational key for manual mode. In the manual mode, the releasing signal is output when USER7 is pressed and deactivated when it is pressed again.

19 Control over Releasing/clamping of Tooling 3 (with signal detection)

The releasing/clamping of some tooling is not related to the displacement of 4-axis but detected of release/clamp in-position signal. To adapt to the requirements for control over the part of tooling, the commands for control over the clockwise and counterclockwise rotation of the hydraulic rotary table may be used to control the releasing/clamping of the tooling when no hydraulic indexer (namely PC3006.5=0) is provided.

Proceed as follows: When Command M82 is given, Y6.0 may be used for output of clamping signal, X35.3 for clamp in-position detection and PC1035 for confirmation of clamp in-position delay time. When Command M83 is given, Y6.1 may be used for output of releasing signal, X35.4 for release in-position detection and PC1036 for confirmation of release in-position delay time. When the above outputs are

used for control over Tooling 3, the output point Y is not influenced by the emergency stop and resetting of the system.

20 Protective Door Function

The protective door function is an interlocking function for the safety protection of the machine tool. When the protective door of the machine tool is open, the door switch contact operates and the door opening signal is sent to the CNC system via the I/O unit connected to the switch. Once the system receives the signal, it immediately enters the feed hold state and stops the rotation of the spindle, thereby protecting the safety of the machine tool and operators. The interlocking function of the protective door can be shielded by setting PC Parameter 3004.4 to 0. It is possible to select the switch contact to activate or deactivate the alarm through PC Parameter 3004.3.

21 Lubricating

PC Parameter 1003 is used to set the start time of oil supply from the automatic lubricating pump and Parameter 1002 the end time in milliseconds. The JOG output from the lubricating pump is enabled by depressing the LUBRICTING key on the panel of the machine.

22 Adjustment of Hydraulic Indexer

22.1 Setting of NC Parameters and Storage of Macro programs Related to Hydraulic Indexer

1. CNC Parameter 322 shall be set to 20.
2. The control macro programs for the hydraulic indexer must be saved in O9003.

22.2 Setting of PLC Parameters Related to Hydraulic Indexer

1. The functions of the hydraulic indexer are enabled when the PC Parameter 3006.5 is set to 1.
2. The total number of stations of the hydraulic indexer is set through the PC Parameter 2009 (The user shall set it to the real number).
3. The present number of stations is set through the PC Parameter 2109 (The user shall set it to the real number).
4. The delay of clamping confirmation of the hydraulic indexer is set through the PC Parameter 1033. Reference value: 560
5. The delay of releasing confirmation of the hydraulic indexer is set through the PC Parameter 1034. Reference value: 560
6. The confirmation delay of the clockwise rotation in-position of the hydraulic indexer is set through the PC Parameter 1035. Reference value: 560
7. The confirmation delay of the counterclockwise rotation in-position of the hydraulic indexer is set

through the PC Parameter 1035. Reference value: 560

The specific items shall be set by following the instruction of the PC time parameter setting herein or the actual conditions of the rotary table.

22.3 Command for Rotation of Hydraulic Indexer: M20 B xx

Example: Command for Station 1:

　　M20　B1;

　　Command for Station 2:

　　M20　B2;

　　……..

22.4 Manual Operation of Rotation of Hydraulic Indexer:

The +4 and -4 keys on the operation panel of the machine tool are used for the manual clockwise and counterclockwise rotation of the hydraulic rotary table.

Example: To rotate the hydraulic indexer by one station number in manual mode:

1. Press the INDEXER RELEASE/CLAMP key on the operation panel of the machine tool so that the indexer is in clamped state (the key light on the panel is on).

2. Rotate the internal rack of the rotary table counterclockwise to the limit position by press the -4 key.

3. Place the indexer in released state by pressing the INDEXER RELEASE/CLAMP key (the key light on the panel goes out).

4. The indexer rotates clockwise by one station number when the +4 key is pressed.

To rotate the indexer counterclockwise, just operate the above Step 2 and 4 in reverse order.

Attention: The manual rotation of the indexer is only an auxiliary form of adjustment. Operate it with commands under normal circumstances.

22.5 Countermeasures against Emergency Stop and Accidental Power Failure during

Rotation of Hydraulic Index Table

22.5.1 Emergency Stop and Accidental Power Failure when the rotary table is at an incorrect station

Exit the emergency stop or restart the system. Just release the rotary table (the rotary table is in the released state after restart), switch the system to manual mode, press the +4 or -4 key so that the rotary table naturally rotates to the specified position and then check that the present number of stations indicated by the PC Parameter 2109 is consistent with the user's setting. In case of inconsistency, activate the parameter switch of the CNC system and change PC2109 to the user's setting.

Press the +4 or -4 key in manual mode and released state of the rotary table. In the event the rotary table fails to rotate to the correct position, use a screwdrive unit to drive the solenoid valve piston

controlling clockwise and counterclockwise rotation on the hydraulic station to force the rotary table to rotate to the correct position, then manual clamp the table, press the +4 or -4 key, pull the internal rack of the table to the limit position and set the PC Parameter 2109 to the current station number as defined by the user.

22.5.2 Emergency Stop and Accidental Power Failure when the rotary table is at a correct station

After exiting emergency stop or restart the system, execute or run the following command for rotation of the rotary table: M20 B xx, then check that the present number of stations indicated by the PC Parameter 2109 is consistent with the user's setting. In case of inconsistency, activate the parameter switch of the CNC system and change PC2109 to the user's setting.

22.6 Station Number with Command Limit of Hydraulic Indexer

For machining of some workpieces, the user may set a station number with command inhibition. The station number with command limit may be selected at OPTIONAL BLOCK SKIP 9 on Page 02 of SET menu switch of the 983 system. When OPTIONAL BLOCK SKIP 9 is set to 0 and Command M20 B4 is given, the system gives an alarm and B code command fails (B CODE IS WRONG). (For a hydraulic rotary station with more than four stations, the station number with command limit involves the modification of macro programs in addition to the setting at the menu switch.)

22.7 Relevant Macro Programs to Be Modified for a Hydraulic Rotary Station with More than 4 Stations

For a machine tool supplied with a hydraulic rotary station with more than four stations, make sure to set PC2009 (total number of stations) and modify the relevant variables in the macro program O9003 of the hydraulic rotary station. Please contact the 983 Project Team, Development Department of GSK for the concerned details.

23 Functions of Armless Tool Magazine

23.1 Tool Change Command M6 Txx

1. The operation panel is not provided with a key for manual change of tool. Tools can only be changed by executing Command M6 Txx in the automatic and MDI modes.
2. The tool change command is ignored when the tool number in the command is equal to the present one.
3. A command error alarm will be raised when the tool number in the command is equal to or greater than the total number of tools.

23.2 Description of Tool change Operation of Armless Tool Magazine

1. When M6 Txx Command is executed in the automatic and MDI modes, the program firstly judges whether the MDI of a tool number command satisfies the requirements of the specification. If it satisfies the requirements, the spindle stops and performs orientation.

2. The Z-axis returns to the first origin (when tool length compensation has not been canceled before tool change).

3. The Z-axis reaches the tool removing position, i.e. the 2nd reference point on the magazine (omit the second step when tool length compensation has been canceled before tool change).

4. The magazine moves forward and catches the tool on the present spindle.

5. The air cylinder releases the tool.

6. The Z-axis is uplifted to a safe position (the first origin) so that the tool breaks away from the spindle.

7. Rotate the tool pot to the specified tool number.

8. The Z-axis drops to the tool arresting position (the 2nd reference point).

9. Clamp the tool.

10. Withdraw the magazine and finish tool change.

    The entire course of tool change is automatically performed by the CNC and the user only needs to enter and execute Command M6 Txx.

23.3 LED Indication of Tool Numbers

The current spindle tool number is indicated by the LED on the operation panel in decimal form.

23.4 Clamping and Releasing of Tool

1. Tool clamped and releasing operations and commands can only be performed and executed when the spindle is in stop position. They are not active during the rotation of the spindle.

2. In manual mode and the stop position of the spindle, the spindle releasing signal is output when the TOOL RELEASE/CLAMP button is pressed and the tool is clamped when the button is released. It is also possible to select the TOOL RELEASE/CLAMP button self-locking function by setting the PC Parameter 3003.5. Namely the tool released signal is output and held when the button is pressed once and disabled when it is pressed again. The TOOL RELEASE/CLAMP button and command are inactive when the EMERGENCY STOP button is pressed irrespective of the use of the TOOL RELEASE/CLAMP button self-locking function.

3. M codes are used for tool released and clamping in the automatic and MDI mode, i.e. M55 for tool clamped and M54 for releasing.

4. PC parameters in respect to tool released and clamping: Tool released and clamping detection is enabled when the PC Parameter 3001.3 is set to 1. When M55 Command is executed while the detection is active, the feed hold lamp on the panel is lit and the command does not end if

no tool clamp-in-position signal returns to the system. Similarly, M54 command does not end if no tool release-in-position signal returns to the system after its execution.

23.5 Zero Return of Armless Tool Magazine

23.5.1 Operating procedure for tool magazine zero return

While the magazine is in backing position in MACHINE ZERO mode, the tool pot rotates clockwise to the zero position (position of No.1 tool) once the USER1 key on the operation panel of the machine is pressed. When zero return is completed, the system automatically sets the present tool number to No.1.

23.5.2 Precautions after Magazine Zero return:

After the use of the magazine zero return function, the user shall make sure no tool is fitted in No.1 tool slot before automatic operation. Otherwise the magazine must firstly remove the tool on the spindle before rotary exchange in automatic tool change as No.1 tool in the slot may collide with the spindle.

23.5.3 Two Methods for Removing the Tool from the Current Slot of the Tool pot after Zero return:

Method 1:

Return the Z-axis to the first origin, then concurrently press the T. MAG DEBUGGING key and FEED HOLD key on the operation panel of the machine tool to quickly enter the magazine debugging state (with key light flashing), concurrently press the T. MAG DEBUGGING key and T. CASE VERTICAL key so that the magazine moves forward under the spindle and remove the tool in No.1 tool slot in the spindle that the tool pot   is currently aligned with (The setting of PC3004.6=1 is still active in the debugging state).

Method 2:

After zero return of the magazine, concurrently press the T. MAG DEBUGGING key and FEED HOLD key on the operation panel of the machine tool to quickly enter the magazine debugging state (with key light flashing), jog the rotary tool pot   until the empty slot aligns with the current tool number on the spindle by pressing the only (void) ☐ key or MANI. ROTATION key on the operation panel of the machine tool, press the RESET key to exit the magazine debugging state and enter the automatic mode for machining (The setting of PC3004.6=1 is still active in the debugging state. After setting and debugging, remember to restore the Parameter PC3004.6=0)

23.6 Debugging of Armless Magazine

23.6.1 Two Methods for Setting Armless Magazine Debugging State

① In the manual and MDI modes, the magazine debugging state is started by concurrently pressing the T. MAG DEBUGGING key and FEED HOLD key.

② In the MDI mode, the magazine debugging state is started by setting the PC Parameter 3004.6

to 1. "MAGAZINE DEBUGGING" is indicated in the debugging state.

23.6.2 Two Methods for Canceling Magazine Debugging State

① Method 1 for canceling magazine debugging state: 1. Press the `RESET` key; 2. Press the `EMERGENCY STOP` button; 3. Enter the automatic or DNC mode.

② Method 2 for canceling magazine debugging state: Set the PC Parameter 3004.6 to 0.

Attention:

1) In the magazine debugging state, most of the interlocking conditions of magazine advancing and backing are cancelled and its safety is under the control of debugging operator. While controlling the advancing and backing rotation of the magazine, the debugging operator shall take care to prevent it from colliding with the machine tool.

2) In the magazine debugging state, the system operates in the automatic and DNC modes and the interlocking conditions are recovered.

23.7 Correct Setting of Parameters with regard to Armless Magazine

23.7.1 Proper Setting of Relevant NC Parameters

① Set the 2nd reference point of the Z-axis (NC Parameter P161)

The tool arresting position of the magazine is at the 2nd reference point of the Z-axis. When the mechanical portion of the magazine has been properly set, make sure to correctly set the 2nd reference point of the Z-axis. The end user shall not change its setting as it may cause damage to the magazine. After service personnel change the system's board or adjust the zero return stop of the Z-axis, they must recalibrate and set the parameters of tool arresting position (the 2nd reference point of the Z-axis).

② Set the NC Parameter　300.5=0

The NC Parameter 300.5 must be set to 0; otherwise No.141 alarm will be given if the parameters associated with the service life of the tool have not been set before setting T codes.

③ Set the NC Parameter　320=6

The NC Parameter 320 must be set to 6; otherwise M6 cannot be used to recall the tool change program for tool change.

④ Set the NC Parameter　38=50

The NC Parameter 38 must not be 0; otherwise no enable signal is output for spindle orientation.

23.7.2 Proper Setting of Relevant PLC Parameters

(The following settings are only for reference. The specific settings depend on the actual configuration and parameter description of the machine tool.)

① Properly set the functions and configure and test PC parameters.

PC3001.6=1: The armless magazine function is enabled.

PC3001.3=1: Clamp/release-in-position signal is detected for tool clamped/releasing.

PC3001.2=1: Zero speed reaching signal of the spindle is detected (The signal is detected for tool change and M5.)

PC3002.7=1: The counter state (light on) is set to 1 when the tool pot correctly stops in-position; otherwise it is set to 0.

PC3002.6=1: The forward/backward movement of the magazine is controlled with a check valve (It is set to 1 if the magazine automatically returns in case of power failure in advancing position)

② Proper Setting of the PC Parameters concerning Magazine Counting

PC2001: the setting of total number of tool positions
PC2101: the setting of current tool number

③ Proper Setting of Timer Parameters concerning Magazine

PC1020   1. Alarm delays when the cutting override is zero. Reference value: 2000
2. Alarm delay of lubricating
3. Alarm delay in case of offset of tool pot position

PC 1025   Time setting at maximum tool change distance, reference value=[(Total number of tools *1000/2)+2000]

PC 1026   1. Limit of time for completion of spindle orientation, reference value:5000
2. Limit of advancing and backing time of magazine
3. Limit of tool released and clamping time of spindle

PC 1032   Reading delay of spindle orientation   Reference value:160

PC 1037   Confirming delay of spindle orientation   Reference value:1560

PC 1039   Flashing interval 1 of key light in magazine debugging state   Reference value: 1000

PC 1040   Flashing interval 2 of key light in magazine debugging state   Reference value:1000

23.7.3 Check of Input/Output Signals in relation to Armless Magazine in Debugging State

① Magazine Advancing Operations and Signal Check in Debugging State

The magazine advances toward the spindle when the T. MAG DEBUGGING and T. CASE VERTICAL buttons are pressed concurrently. It also moves toward the spindle when Command M65 is given in the MDI mode.

By observing whether the magazine moves forward and the corresponding output point outputs, the user can judge whether the system outputs the signals of the tool magazine moves forward/backward, which further confirms whether the connections between the relay for the tool magazine moving forward/backward and the magnetic valve are correct without fault.

Diagnosis of magazine advancing and backing output signals (the output is enabled when it is set to 1)								
Diagnosis 2	Magazine backing output	Magazine advancing output						
State	1	1						

Diagnosis of magazine advance/back-in-position signal (the output is enabled when it is set to 1)

Diagnosis 43	Magazine back-in-position detection						Magazine advance-in-position detection
State	1						1

② Magazine Backing Operations and Signal Check in Debugging State

The magazine advances toward the spindle when the T. MAG DEBUGGING and T. CASE HORIZTON buttons are pressed concurrently. It also moves backward the spindle when Command M66 is given in the MDI mode.

By observing whether the magazine moves backward and the corresponding output point outputs, the user can judge whether the system has received the in-position signal of the tool magazine moving forward/backward, which further confirms whether the connections of the check switch (sensor) for the tool magazine moving forward/backward are correct, whether the signal level output by the sensor is consistent with that of the required by the system, and whether the sensor is fault.

③ Magazine Rotating Operations and Signal Check in Debugging State

In the magazine debugging state, the clockwise rotation of the tool pot jogs and the tool number increases by one when the only ☐ (void) key is pressed in the magazine backing position. The tool pot counterclockwise rotates by one tool position and the tool number decreases by one when the MANI. ROTATTION key is pressed. The tool pot may also be rotated to the command tool number in backing position by giving Command T** (e.g. T5 or T6) in MDI mode.

Diagnosis of magazine counting input signal (the input is enabled when it is set to 1)							
Diagnosis 43		Tool number counting					
State		1					

Diagnosis of magazine clockwise and counterclockwise rotate outputs (the output is enabled when it is set to 1)							
Diagnosis 2						CCW rotation of magazine	CW rotation of magazine
State						1	1

By observing whether the tool pot rotates, whether its rotation CCW/CW output point is output, it is possible to judge whether the CNC system executes tool pot rotation CCW/CW signals, which further checks whether the connections of relay for the tool pot rotation CCW/CW are correct; by observing the rotation direction of the tool pot, the user can check whether the phase sequence of the 3-phase AC current of the motor for the tool pot is correct, the user must regulate the phase sequence (any two wires of 3-phase AC wires can be exchanged) and set the current tool number (PC No. 2101) of the tool magazine or execute the tool magazine zero return to automatically set the tool number when the rotation direction of the tool pot is inconsistent with that the commanded (or jogging the tool pot) .

23.7.4 Setting of Fast and Cutting Overrides in Magazine Debugging State

While the magazine is in the advancing limit position, the speed of manual displacement of the feed axis is restricted, the maximum cutting override limited to 70% and manual fast traverse disabled.

23.7.5 Adjustment and Setting of Spindle Orienting Angle

In addition to the above functions and connections, the safe forward and backward movements of the magazine are also closely related to the setting and adjustment of the spindle orienting angle. When the system matches the servo spindle drive unit, the general orienting functions are performed by their coordination: The CNC outputs orientation start and enable signals (while outputting an orienting analog voltage corresponding to the NC Parameter　38, yet the matching servo drive unit will not necessarily use the analog voltage signal). The orienting position information is set and determined by the servo spindle drive unit (Example: for GSK 983M being allocated with a GSK DAP01 spindle servo drive unit, the information is determined by reading the absolute position information of the motor rotator during spindle orientation from the monitoring window DP-APO of the drive unit and writing it in the PA58 parameter of DAP01 drive unit by the commissioning personnel.).

23.8 Precautions for Normal Use of Magazine

1. For tool change, do not lock the machine tool and the auxiliary functions.
2. For normal start of the tool change program, no tool shall be fitted in the magazine clamping position corresponding to the current spindle.
3. The magazine tool change macro program must be saved at No. O9001 program.
4. The correct countermeasures against the emergency stop, power failure, resetting and alarm during operation of the magazine

For tool change in MDI or automatic mode, the feed axis of the machine tool is locked (it cannot move or receive any operational command) in case of emergency stop, power failure, resetting and alarm when the magazine moves forward to the limit position. To unlock the machine tool, first enter the machine tool debugging state, release the tool with the Command M54 in MDI mode, move the Z-axis to a safe height by hand or with the MPG, remove the tool aligning with the spindle from the current slot in the magazine and then withdraw the magazine with Command M66. (The above operations may also be performed in the manual and MDI modes: Concurrently press the T. MAG DEBUGGING and FEED HOLD keys to enter the magazine debugging state and press the T. MAG DEBUGGING and T. CASE HORIZTON keys to withdraw the magazine backward.)

If No. 2051 message appears when the magazine is withdrawn, it indicates that the tool magazine pot stops in an incorrect position. It means that the tool pot has not rotated to the specified position and the Z-axis is stilled locked and cannot be used. Now it is required to perform magazine zero return operation once or run Txx (e.g. T5) once in the debugging state in order to align the position of the tool pot, then quit the debugging state and restore normal operation.

23.9 Setting of Protection of Magazine and Limit of the Z-axis Travel

Set the NC Parameter　#303.4 to 1 (The Z limiting function of the ATC of is active) and the NC Parameter　#167 slightly smaller than the coordinate value of the machine tool at the 2nd reference point

of the Z-axis. (Example: If the No.161 Parameter – the tool arresting position on the Z-axis is set to -125000, the Z-limiting Parameter #167 of ATC may be set to -125020.) The movement of the Z-axis in negative direction is limited by the setting of the CNC Parameter #167 when the magazine moves forward in-position after the Z-axis passes the origin. The system will give No. 200 (PROGRAM) and 231 (－Z OT) alarms to limit the running range of the Z-axis and protect the magazine when the setting is exceeded.

24 Function Description and Adjustment of Disc Arm Magazine

The PLC for the disc arm magazine allows tool change at random without fixed pot and supports pot preselection and selection of nearest tool. Preselection of tool prior to tool change may improve tool change efficiency and shorten tool change time.

24.1 Correct Setting of Parameters Related to Disc Arm Magazine

1. Proper Setting of Relevant CNC Parameter s

① Set the 2nd reference point of the Z-axis (CNC Parameter　P161).

The tool arresting position of the arm is at the 2nd reference point of the Z-axis. After partial adjustment of the mechanical portion of the magazine, always correctly set the 2nd reference point of the Z-axis. The end user must not change its setting as this may cause damage to the magazine. The serviceman shall properly set the 2nd reference point of the Z-axis after changing the mainboard of the system or adjusting the position of the zero return stop of the Z-axis.

② Set the CNC Parameter　300.5 to 0.

The CNC Parameter 300.5 must be set to 0; otherwise No.141 alarm will be given if no parameter associated with the service life of the tool has been set before specifying the T codes.

③ Set the CNC Parameter 320 to 6.

The CNC Parameter 320 must be set to 6; otherwise the tool change program cannot be recalled with M6 for tool change.

④ Set the CNC Parameter　38 to 50.

The CNC Parameter 320 must not be set to 0; otherwise no enable signal is output for orientation of the spindle.

2. Proper Setting of Relevant PLC Parameters

(The following settings are for reference. Refer to the actual configuration and parameter description of the machine tool for setting.)

① Set functions and configure and detect PC parameters.

PC3001.6=1 The arm magazine functions are active.

PC3001.3=1 The clamp/release-in-position signals are detected.
PC3001.2=1 The spindle zero speed reaching signal is detected. (The signal is detected in case of tool change and M5.)

PC3002.7 Set the counter induction state to 1 for correct stop of the tool pot in-position (light on);

otherwise set it 0.

PC3006.6 Set it to 0 when a dedicated in-position detection switch is used for positioning of the tool magazine pot and to 1 when positioning and tool counting share one detection switch.

② Set the PC parameters for counting of magazine.

PC2001 is used to set the total number of tool positions.
PC2101 is used to set the current tool number.

③ Set the timer parameters related to the magazine.

PC1020   1. Alarm delay when the cutting override is zero   Reference value: 2000

2. Delay time of lubricating alarm;

3. Delay time of alarm for tool pot position offsetting error

PC 1025 Time limit of maximum tool-changing distance reference value=[(Total number of tools*1000/2)+2000]

PC 1026   1. Limit of spindle orientation completing time   Reference value:5000

2. Limit of pot put-down/up time

3. Limit of spindle releasing/clamping time

PC 1032   Reading delay time of spindle orient-in-position   Reference value:160

PC 1037   Delay of spindle zero speed reaching confirmation   Reference value:560

PC 1039   Magazine debugging state key light flashing interval 1   Reference value:1000

PC 1040   Magazine debugging state key light flashing interval 2   Reference value:1000

24.2 Command Rules for Tool Selection and Preselection

1. Tool change can only be carried out in the automatic and MDI modes. The tool pot rotates for tool selection or preselection when commands Txx are given. When Command M6 is given, the arm performs tool change operations. In real usage, it is possible to first preselect tools for Txx and when it is required, to give Command M6 for tool change.

2. The tool change command is ignored when the tool number of the command is equal to that of the spindle.

3. An alarm is given when the tool number of the command is bigger than the total number of tools.

24.3 Description of Tool change Operations

1. In the automatic and MDI modes, the program judges whether the tool number entering command satisfies the requirements of the specification and select a tool after execution of the Txx M6 Command.

2. The Z-axis returns to the second reference, the spindle stops its rotation and executes its orientation.

3. The selected pot in the tool pot is put down.

4. The arm catches a tool.

5. The spindle tool cylinder releases the tool.

6. The arm rotates by 180 degrees to change the tool.

7. The spindle tool cylinder clamps the tool.

8. The arm returns to the origin.

9. The pot is put up.

10. Orientation is canceled and tool change completed.

   The complete tool change process is automatically completed by the CNC. The user only needs to enter and run the Command M6 T<u>xx.</u>

24.4 Setting and Cancellation of Disc Arm Magazine Debugging State

   Method for setting the magazine debugging state: The magazine debugging state can be enabled by concurrently pressing the T. MAG DEBUGGING and FEED HOLD keys in the manual mode.

   Method for canceling the magazine debugging state: ① Press the RESET key; ② Press the EMERGENCY STOP button; and ③ Enter the automatic or DNC mode.

   Attention:

   In the debugging state, most of the interlocking conditions of the magazine are cancelled and its safety is under the control of the commissioning personnel. The commissioning personnel shall prevent the arm from colliding with the operator and the tool from colliding with the machine tool!

   In the magazine debugging state, the system operates in the automatic and DNC modes and the interlocking conditions are recovered.

24.5 Tool Change Programming Example

   The tool change in the automatic and MDI modes is realized with M06. M06 automatically recalls the tool change subprogram O9001.

   The following is an example of the programming format in the automatic mode:

   T××(Example T1) M06;   Select a tool, recall the tool change subprogram and change and fit No.1 tool to the spindle.

   T××(Example T2);   Preselect No.2 tool.

   G01   X100.0   F1200   Machining program of No.1 tool

   ……   ……

   M06;   Change No.2 tool to the spindle and return No.1 tool to the magazine.

   T××(Example for T3);   Preselect No.3 tool.

   ……   ……   Machining program of #2 tool

G01 Z-50.0 F1200

…… ……

M06; Change No.3 tool to the spindle and return No.2 tool to the magazine.

T0; Get ready for tool emptying.

…… …… Machining program of #3 tool

M06; Recall the tool change subprogram and return No.3 to the magazine.

M30; The program comes to an end.

24.6 Precautions for Use of the Disc Arm Magazine

1. Do not lock the machine tool and auxiliary functions during tool change.

2. The enabled conditions of tool change of arm are that the pot is put down, the return to the 2dn reference point completed and spindle orientation finished.

3. After replacement of system mainboard or positioning of the Z-axis zero return stop, make sure to calibrate and set the tool catching position again (The tool-change position is at the 2nd reference point of the Z-axis, which is set through the CNC Parameter P161 and may not be changed by user as it may cause damage to the magazine.)

4. Always set the CNC Parameter 320 to 6; otherwise the magazine cannot operate normally.

5. The tool change macro program for the magazine shall be stored as No. O9001 program.

24.7 Tool Pot Zero return Operations of Disc Arm Magazine

In the MACHINE ZERO mode, press the USER1 key on the operation panel of the machine tool when the arm is in origin position and the pot is put up. Then the magazine rotates clockwise until it stops at the zero position (position of No.1 tool). After zero return of the magazine, the system automatically sets the present pot number to "1".

24.8 Relevant Setting of Magazine Data Sheet

24.8.1 Enabling and disabling of the indication of No. 4000～4099 in the data sheet
Whether No. 4000～4099 in the data sheet is displayed is set through the PC Parameter 3011.
When PC3011.7 is set to 1 and PC3011.6 to 1, the maximum 2-digit indication in the data sheet is 4099 and 4-digit indication 4060.

24.8.2 Selection of 2-digit and 4-digit indications in the data sheet
Whether Parameter 4000～40×× in the data sheet are displayed in two or four digits may be set through the PC Parameter 3010. Whether the data in it may be identical can also be set through the PC Parameter 3010 as shown in the following table.

	7	6	5	4	3	2	1	0
609								
3010							CHECK	BCD4

BCD4   0: 2-digit BCD code in the data sheet
        1: 4-digit BCD code in the data sheet
CHECK   0: Parameter 4001-4099 in the data sheet may be set to the same data.
        1: Parameter 4001-4099 in the data sheet may not be set to the same data.

24.8.3 One-key Initializing Operation for Arm Magazine Data Sheet
In the magazine debugging state, the data sheet may be automatically initialized by concurrently pressing USER1 and T. MAG DEBUGGING keys. After automatic setting, the sheet numbers in the data sheet will be identical with the settings.

Example:

Data sheet head address	Sheet No.	Setting
4000	00	00
4001	01	01
4002	02	02
4003	03	03
……	……	……
4024	24	24
……	……	……

24.9 JOG Rotating Operations of Arm Tool magazine pot

In the magazine debugging state, the clockwise rotation of the tool pot may be jogged by pressing the only ☐ (void) key while the arm is in the origin position. The tool number increases by one each JOG.

24.10 JOG Operation of Arm

In the magazine debugging state, the rotation of the arm may be jogged by concurrently pressing the T. MAG DEBUGGING and MANI. ROTATATION keys when the pot is put down.

Attention:
In the magazine debugging state, the safety interlocking of the magazine is partially disabled. The operator shall pay attention to the safety during the rotation of the arm to avoid it from colliding with the machine tool or personnel.

25 Commissioning of Turret Magazine

25.1 Tool change Command M6 Txx

25.2 Description of Tool change Operations of Turret Magazine

1. When M6 Txx Command is executed in the automatic and MDI modes, the program firstly judges whether the MDI of a tool number command satisfies the requirements of the specification. If it satisfies the requirements, the spindle stops and performs orientation.

2. The Z-axis returns to the first origin.

3. The Z-axis continues to move upward and reaches the 2nd reference point of the Z-axis (the mechanism automatically disengages the tool from the spindle.)

4. Rotate the tool pot to the command tool number.

5. The Z-axis moves down to return to the first origin (the mechanism automatically reengages the tool with the spindle).

25.3 Setting and Cancellation of Turret Magazine Debugging State

25.3.1 Method for Setting the Magazine Debugging State:

The magazine debugging state can be enabled by concurrently pressing the T. MAG DEBUGGING and FEED HOLD keys in the non-automatic and non-DNC modes. In the debugging state, the LCD indicates a "MAGAZINE DEBUGGING" message.

Precaution:

In the magazine debugging state, the conditions of turret magazine's rotation are: 1. The spindle is in orienting state; 2. The Z-axis moves to the tool change point (the position with signal of the detection switch). In the magazine debugging state and MDI mode, the magazine may be rotated to the command tool number with the commands T** (e.g. T5 or T6).

25.3.2 Method for Disabling the Magazine Debugging State

① Press the RESET key; ② Press the EMERGENCY STOP button; ③ Enter the automatic or DNC mode. 4. Restart the system.

25.4 Correct Setting of Parameters Related to Turret Magazine

25.4.1 Proper Setting of Relevant CNC Parameter s of Turret Magazine
① Set the 2nd reference point of the Z-axis (the CNC Parameter   P161).

The tool arresting position of the arm is at the 2nd reference point of the Z-axis. After partial adjustment of the mechanical portion of the magazine, always correctly set the 2nd reference point of the Z-axis. The end user must not change its setting as this may cause damage to the magazine. The serviceman shall recalibrate and set the parameters of the tool catching position (the 2nd reference point

of the Z-axis) after changing the mainboard of the system or adjusting the position of the zero return stop of the Z-axis.

② Set the CNC Parameter   320 to 6.

The CNC Parameter 300.5 must be set to 0; otherwise No.141 alarm will be given if no parameter associated with the service life of the tool has been set before specifying the T codes.

③ Set the CNC Parameter   320 to 6.

The CNC Parameter 320 must be set to 6; otherwise the tool change program cannot be recalled with M6 for tool change.

④ Set the CNC Parameter   38 to 50.

The CNC Parameter 320 must not be set to 0; otherwise no enable signal is output for orientation of the spindle.

25.4.2 Proper Setting of Relevant PC Parameters of Turret Magazine
① Set functions and limit and detect PC parameters

PC3001.6=1 The armless magazine functions are active.

PC3001.2=1 The spindle zero speed reaching signal is detected. (The signal is detected in case of tool change and M5.)

PC3005.7 (High speed clamping in manual mode and zero return mode)

PC3005.6 (High speed clamping in manual mode and zero return mode)

② Set the PC parameters for counting of magazine.

PC2001 is used to set the total number of tool positions.
PC2101 is used to set the current tool number.

③ Set the timer parameters related to the magazine.

PC1020   1. Delay time of zero cutting override alarm
         2. Delay time of lubricating alarm
         3. Delay time of alarm for tool pot position offsetting error

PC 1025   Time limit of maximum tool-changing distance

PC 1026   1. Limit of spindle orientation completing time   Reference value: 5000
          2. Limit of magazine advancing/backing time
          3. Limit of spindle releasing/clamping time

PC 1028   The braking time of turret tool magazine pot   motor

PC 1029   The air blowing time of the spindle

PC 1030   Calibrating time 1 of the accurate tool stop position of the tool magazine pot (adjustment of clockwise rotation)

PC 1031   Calibrating time 2 of the accurate tool stop position of the tool magazine pot (adjustment of counterclockwise rotation)

PC 1032   Reading delay time of spindle orient-in-position

25.5 Check and Description of Signals in relation to Magazine in Debugging State

Diagnosis of magazine input (the input is enabled when it is set to 1)

Diagnosis 43			Tool number counting	Verification of magazine in-position				
State			1	1				
Diagnosis of magazine input (the input is enabled when it is set to 1)								
Diagnosis 48	Tool change point signal			Tool change area				
State	1			1				
Diagnosis of magazine output (the output is enabled when it is set to 1)								
Diagnosis 2							CCW rotation of magazine	CW rotation of magazine
State							1	1
Diagnosis 3								Braking of magazine motor
								1

In the magazine debugging state, the tool pot may be rotated to the command tool number in tool change position of the Z-axis by giving Command T** (e.g. T5 or T6) in MDI mode. By observing whether the tool pot rotates, whether its rotation CCW/CW output point is output, it is possible to judge whether the connections of relay for the tool pot rotation CCW/CW is correct; by observing the rotation direction of the tool pot, the user can check whether the phase sequence of the 3-phase AC current of the motor for the tool pot is correct, the user must regulate the phase sequence (any two wires of 3-phase AC wires can be exchanged) and set the current tool number (PC No. 2101) of the tool magazine or execute the tool magazine zero return to automatically set the tool number when the rotation direction of the tool pot is inconsistent with that the commanded.

25.6 The correct countermeasures against the emergency stop, power failure, resetting and alarm during operation of the magazine

For tool change in MDI or automatic mode, the Z-axis of the machine tool is locked (it cannot move or receive any operational command) in case of emergency stop, power failure, resetting and alarm when the magazine moves forward to the limit position. To unlock the machine tool, operate as follows:

1. Quit the automatic or MDI mode and check that the stop position of the tool pot is correct. If it is not correct, first rotate the tool pot to the correct position by hand.
2. Manually rotate the spindle to the oriented position.
3. Press the OVERTRAVEL key on the operation panel and use the MPG or manual mode to move the spindle down out of the tool change area.
4. If the tool number indicated by the LED on the operation panel and the current tool pot tool number do not match up, modify the PC Parameter 2101 in the MDI mode so that they tally.

26 Description of PC Parameters

26.1 Description of Bit Parameters

600	7	6	5	4	3	2	1	0
3001	X+-ZRN	ATC.ZN		SP.ALM	TRLTCL.	ZSP.C	Y+-ZRN	ABS-1
Factory value	0	0	0	0	0	1	0	0

Bit7 X+-ZRN: Automatic hold of the key for the zero return direction of the X-axis

0: Automatic hold of zero return in positive direction

1: Automatic hold of zero return in negative direction

Note: To select automatic hold of zero return in negative direction, make sure to set the CNC Parameter 12.0 to 1. The negative direction key is inactive in the zero return mode when automatic hold of zero return in positive direction is selected. The positive direction key is inactive in the zero return mode when automatic hold of zero return in negative direction is selected.

Bit6 ATC.ZN: Whether a magazine is available for selection

0: The machine tool is not complete with a magazine.

1: The machine tool is fitted with a magazine.

Bit4 SP.ALM: To select the alarm logic for spindle alarm input signal (PLC Input Address X40.5)

0: To give an alarm when the spindle alarm input is 0

1: To give an alarm when the spindle alarm input is 1

Bit3 TRLTCL.: Whether the spindle tool released/clamp-in-position signal is checked (PLC Address X38.6: clamping in-position; X38.5: releasing in-position)

0: not to check

1: to check (This must be set when a magazine is equipped)

Bit2 ZSP.C: Whether the spindle zero-speed input signal is checked during tool released/ clamping/ spindle gear shift/spindle stop (PLC Input Address X40.6)

0: Not to check the spindle zero-speed input signal

1: To check the spindle zero-speed input signal (It must be set when a magazine is equipped)

Bit1 Y+-ZRN: Automatic hold of the key for the zero return direction of the Y-axis

0: Automatic hold of zero return in positive direction

1: Automatic hold of zero return in negative direction

Note: To select automatic hold of zero return in the negative direction of the Y-axis, make sure to set the CNC Parameter 12.1 to 1.

Bit0 ABS-1: Whether the MANUAL ABSOLUTE of the switch is enabled

0: The MANUAL ABSOLUTE of the menu switch is disabled (standard factory setting)

1: The MANUAL ABSOLUTE of the menu switch is enabled (take care)。

601	7	6	5	4	3	2	1	0
3002	T-STPLG	Valve	H>MPG	4CPIN	PUMP.AUT	LONG.ST	BARMT	W.PUP.AM
Factory value	0	0	1	0	0	0	0	0

Bit7 T-STPLG: Selection of tool pot stop position (it must be correctly set depending on the different types of magazines equipped)

0: The proximity switch is in non-inductive state when the tool magazine pot rotates to the

specified position (Figure A);

　　1: The proximity switch is in inductive state when the tool magazine pot rotates to the specified position (Figure B);

The switch is non-inductive state when the tool pot stops at in-position

(Fig. A)

Counting proximity switch

The switch is the inductive state when the tool pot stops at in-position

(Fig. B)

Counting proximity switch
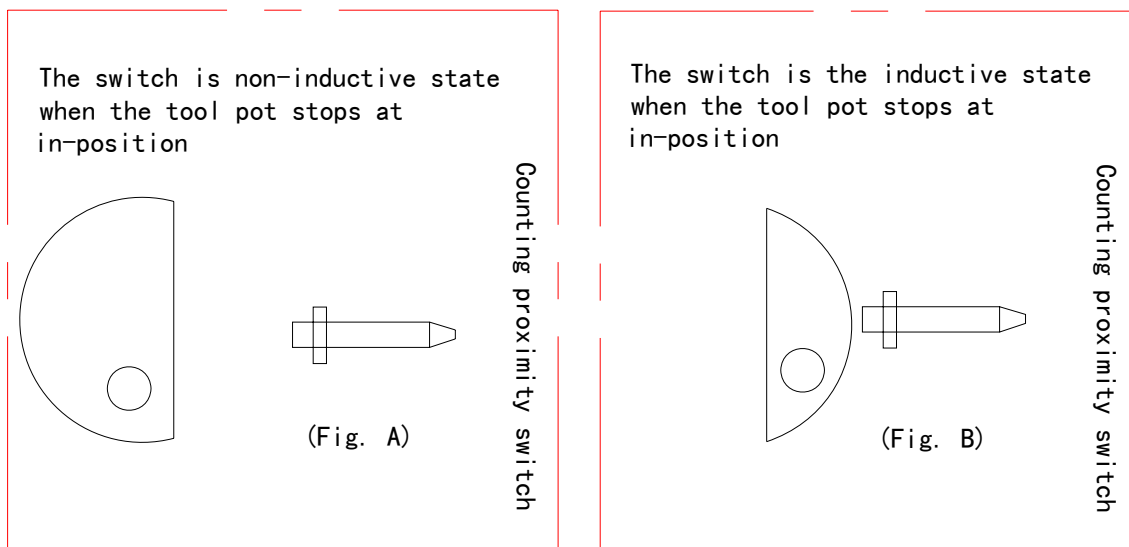
Bit6　VALVE: Selection of one-way or two-way valve for magazine (selection of solenoid valve for controlling the magazine advancing/backing for an armless magazine; selection of solenoid valve for controlling the pot put-down/up for a disc arm magazine)

　0: Two-way valve (the state of the valve remains unchanged in case of power failure)

　1: One-way valve (the state of the valve cannot be remained in case of power failure)

Bit5　H>MPG: Selection of control MPG

　0: Operation panel MPG control

　1: Hand-held box MPG control (factory-set to 1)

Bit4　4CPIN: Whether the indexer/tool released/clamping in-position signal is checked (Clamping in-position X35.7 and releasing in-position X35.6 correspond to the commands M84 and M85).

　0: Not to check: The command M84/M85 end immediately without check clamping/releasing in-position signal.

　1: To check: The feed hold lamp keeps lighting on and the command does not end when no in-position signal is sent after the Command M84 or M85 is given.

Bit3　PUMP.AUT: To start the hydraulic oil pump during the power-on of the system or gear shift of the spindle

　0: The hydraulic oil pump is not started during power-on. It is started during gear shift and stopped after that. (PLC Output Address Y6.3)

　1: The hydraulic oil pump is started during power-on. It is not stopped during gear shift.

Bit2　LONG.ST: Gear output signal is kept or not after the high/low gear shift of the spindle (PLC output addresses Y0.0 and Y0.1)

　0: The gear signal is kept outputting (factory default: 0)

　1: The gear signal is not held (not to be set when the spindle has no high/low gear shift function).

　Bit1　BARMT: To select the alarm logic for low magazine air pressure.

0: To give an alarm when the input of magazine air pressure detection is 1 (PLC Input Address X33.2)

1: To give an alarm when the input of magazine air pressure detection is 0.

Bit0   W.PUP.AM: To select the alarm logic for the overload of water pump motor.

0: To give an alarm when the overload input of water pump motor is 1 (PLC Input Address X33.3)

1: To give an alarm when the overload input of water pump motor is 0.

602	7	6	5	4	3	2	1	0
3003	SSGN	GER.LOCA	CKS.RST	GER..JOG	USE.ALM	4AXSL	4.CLP	LUB.LE.L
Factory setting	1	0	0	0	0	Set depending on configuration	0	0

Bit7   SSGN: Polarity selection of spindle analog voltage output

0: The spindle analog voltage output is single-polarity positive voltage 0 V～+10V;

1: The spindle analog voltage output is double-polarity voltage -10 V～+10V.

Bit6   GER.LOCA: Whether the mechanical gear shift-in-position signal is checked for high/low speed changeover of the spindle (PLC Address X38.0 and X38.1)

0: Not check (factory default: 0)

1: Check (A gear shift-in-position detection sensor or switch shall be fitted)

Bit5   CKS.RST: To select whether the tool released/clamping button is self-locked

0: Not self-lock (factory default: 0)

1: Self-lock

Bit4   GER.JOG: To select whether the high/low speed gear shift of the spindle is performed automatically or manually.

0: Automatic gear shift. The next block of the CNC program will automatically run after gear shift (factory default: 0)

1: Manual gear shift. The next block of the CNC program will run only when the CYCLE START key is pressed after gear shift.

Bit3   USE.ALM: Selection of user-defined alarm logic (PLC Input Address X32.6)

0: To give an alarm when the user-defined alarm point is 1;

1: To give an alarm when the user-defined alarm point is 0

Bit2 4AXSL   Whether the system has the fourth axis to select (It shall be set depending on factory configuration. It is set to 0 when it is configured as 3-axis rigid tapping and to 1 when configured as 4/5-axis software).

0: W/o a 4-axis

1: With a 4-axis

Bit1   4.CLP: Whether the 4-axis is locked for clamping of the indexer/tooling (during the output of M85)

0: The 4-axis is not locked. (The driving motor of the 4-axis may operate by system commands during the claming of indexer/tooling)

1: The 4-axis is locked. (The system does not accept the 4-axis running commands during the claming of indexer/tooling)

Bit0 LUB.LE.L: To select logic for low lubricating level (PLC Input Address X32.2)
0: To give an alarm when the lubricating level detection input is 1

1: To give an alarm when the lubricating level detection input is 0

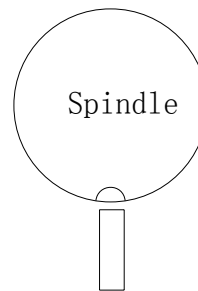| 603	7	6	5	4	3	2	1	0
3004	MT-M19	T-TZ1	BARE	GUARD.SHD	GUARDLM	PUP.ALM	ELTOV.LM	CHIP.ALM
Factory setting	0	0	0	0	0	0	0	0

Bit7   MT-M19: To select the logic for the signal for confirming the position of the spindle orienting mechanism. (PLC Input Address X48.6)

0: The switch is not induced upon orientation in-position when a normally open switch is used. (Namely concave detection, reverse the parameters for use of a normally close switch)

1: The switch is induced upon orientation in-position when a normally open switch is used. (Namely convex detection, reverse the parameters for use of a normally close switch)
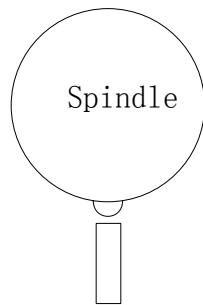
Convex detection of induction switch   Concave detection of induction switch

Bit6   T-TZ1: Whether to enter the armless magazine debugging state (parameters for mechanical adjustment of the magazine)

0:    Non-magazine debugging state (It is set to 0 when the vertical machining center uses a magazine normally.)

1:    Mechanical commissioning state of the magazine

Note: After the magazine debugging state is enabled, a part of the interlocking conditions of the magazine are disabled. When an armless magazine advancing or backing command is given, the user shall pay attention to the safety during the advancing and backing of the magazine in order to prevent the magazine from colliding with the machine tool. In the mechanical commissioning state and backing position of the magazine, the magazine is rotated when T codes are executed in the MDI mode.

Bit5   BARE: To Select the logic for the alarm of the current empty tool position of the armless magazine (PLC Input Address X43.3)

0: An alarm will be given when the empty tool position detection input is 1. (Factory default: 0)

1: An alarm will be given when the empty tool position detection input is 0.

Attention: The signal intends to check the current slot in the armless magazine corresponding to the spindle for tool. Do not set the parameter if the machine tool is not fitted with a corresponding detection switch.

Bit4   GUARD.SHD: Whether the interlocking functions of the protective door are screened

0: The protective door is screened and the interlocking input disabled (factory default: 0)

1: The interlocking input of the protective door is enabled.

Bit3　GUARD.LM: To select the logic for the interlocking of the protective door (PLC Input Address X33.7)

0: The protective door is interlocked when the input is 1.

1: The protective door is interlocked when the input is 0.

Bit2　PUP.ALM: To select the logic for the overload alarm of the hydraulic pump for the spindle shift mechanism. (PLC Input Address X32.4)

0: The system gives an alarm when the input is 1.

1: The system gives an alarm when the input is 0.

Bit1　ELTOV.LM: To select the logic for the overload alarm of the tool motor (PLC Input Address X32.7) Bit2

0: The system gives an alarm when the input is 1.

1: The system gives an alarm when the input is 0.

Bit0　CHIP.ALM: To select the logic for the overload alarm of the chip cleaner motor (PLC Input Address X33.4)

0: The system gives an alarm when the input is 1.

1: The system gives an alarm when the input is 0.

604	7	6	5	4	3	2	1	0
3005	RT50	RT25	CSK-MEM	STEP	ORIGIN	ZPZ2-VAL	ZPZ2-V	Key2
Factory setting	0	0	0	0	0	0	0	0

Bit7:　RT50，　　Bit6:　RT25 Rapid override limit in manual and mechanical zero return modes

RT50	RT25	Rapid override
0	0	100%
1	0	50%
0	1	25%
1	1	F0 (Setting of the CNC Parameter

(Attention: The rapid override limit in manual and mechanical zero return modes shall be used in combination with NC2 BIT3 soft-limit function and NC10 BIT0 parameter, the rapid function is disabled to ensure safety when the reference point return is not executed.)

Bit5: CSK-MEM　Whether it is allowed to manually operate the button for tool released/clamping in the automatic mode (non-operating state)

0: Not allowed

1: Allowed

Bit4:　STEP MPG/single-step selection

0: MPG

1: single step (manual single stepping in when the key is pressed in the MPG: the step length is selected through X1 , X10 and X100.)

Bit3:　To Select whether A message prompt is given when all the axes of the machine tool do not

execute the reference point return.

0: A message prompt is given when all the axes of the machine tool do not execute the reference point return.

1: No prompt

Bit2: ZPZ2-VAL Whether to detect the actual mechanical position of the 2nd reference point of the Z-axis (PLC Address X48.7)

0: Not to detect

1: To detect (Note: A sensor for detection of the 2nd reference point of the Z-axis shall be fitted if it is to be detected as set)

Bit1: ZPZ2-V To select the type of the sensor for checking the mechanical position of the 2nd reference point of the Z-axis

0: Normally open

1: Normally close (This option must not be enabled if no sensor for detection of the 2nd reference point of the Z-axis is fitted.)

Bit0: Key2 Special service parameters

0: Disable

1: Enable

605	7	6	5	4	3	2	1	0
3006	LUB2-aLM	TARIW	PUP-DX	LUB.OVL	INT.COOL	COOL .LE.L	4-INDX	S.HB.A
Factory setting	0	0	0	0	0	0	0	0

Bit7: LUB2-aLM To select the pressure detection function of the lubricating pump (X34.2)

0: The lubricating pump has the function for detection of low lubricating pressure (Input X34.2)

1: The lubricating pump has no the function for detection of low lubricating pressure

The lubricating pump has the function for detection of low lubricating pressure. (Attention: It only detects lubricating level. Do not set this option if no pressure detection function is provided.)

Bit6: TARIW The magazine pot in-position detection and tool number counting share one sensor.

0: A dedicated sensor is used to detect the pot-in-position signal (Input X43.4).

1: The pot-in-position detection and tool number counting share one sensor (Input X43.5).

Bit5: PUP.DX The 4-axis has the functions of a hydraulic indexer.

0: No

1: Yes (Note: Never set the 4-axis to an NC indexer when the functions of a hydraulic indexer have been set.)

Bit4: LUB.OVL To select the logic for the overload alarm of the lubricating pump (Input X34.6)

0: The system gives an alarm when the input is 1. (NO contact)

1: The system gives an alarm when the input is 0. (NC contact)

Bit3: INT.COOL To select the logic for the alarm of the intercooler (Input X34.4)

0: The system gives an alarm when the input is 1. (NO contact)

1: The system gives an alarm when the input is 0. (NC contact)

Bit2: COOL .LE.L To select the logic for the low cooling water level alarm (Input X33.6)

　　　　0: The system gives an alarm when the input is 1. (NO contact)

　　　　1: The system gives an alarm when the input is 0. (NC contact)

　　Bit1: 4-INDX: To set the 4-axis to an NC indexer or NC rotary table

　　　　0: To set the 4-axis to an NC rotary table

　　　　(Note: It is required to set the CNC Parameter 301.4 to 0 while setting the 4-axis to an NC rotary table via this parameter. The 4-axis then may be interlocked and interpolated with other axes.)

　　　　1: To set the 4-axis to an NC indexer

　　　　(Note: Make sure to set the CNC Parameter 301.4 to 1 when the 4-axis is set to an NC indexer. When it is set to an NC indexer, the 4-axis cannot be interlocked and interpolated and the control is active in the automatic/MDI mode rather than manual/MPG mode. Do not set the 4-axis to the functions of a hydraulic indexer if it has been set to an NC indexer.)

　　Bit0: S.HB.A　To select the logic for the overtemperature alarm of the electric cabinet

　　　　0: The system gives an alarm when the input is 1. (NO contact)

　　　　1: The system gives an alarm when the input is 0. (NC contact)

606	7	6	5	4	3	2	1	0
3007								SP.Fan.OVL
Factory setting	0	0	0	0	0	0		0

Bit0: SP.Fan.OVL To select the logic for the alarm of the spindle motor fan

　　　　0: The system gives an alarm when the input is 1. (NO contact)

　　　　1: The system gives an alarm when the input is 0. (NC contact)

609	7	6	5	4	3	2	1	0
3010							CHECK	BCD4
Factory setting	0	0	0	0	0	0	0	0

　　Bit1: CHECK To select whether the No.4001-4099 parameters in the data sheet can be set to the same values.

　　　　0: The No.4001-4099 parameters (or 4060) in the data sheet can be set to the same values.

　　　　1: The No.4001-4099 parameters in the data sheet cannot be set to the same values.

　　Bit0: BCD4 To select whether the No.4001-4099 parameters (or 4060) in the data sheet are indicated by 2- or 4-digit codes.

　　　　0: 2-digit BCD code of data sheet

　　　　1: 4-digit BCD code of data sheet

610	7	6	5	4	3	2	1	0
3011	DATA1	DATA2						
Factory setting	1	1	0	0	0	0	0	0

　　Bit7: DATA1 The No.4000～4*** parameters in the data sheet indicate Switch 1.

　　　　0: Not to indicate

1: To indicate

Bit6: DATA2 The No.4000～4*** parameters in the data sheet indicate Switch 2.

0: Not to indicate

1: To indicate

26.2 Description of Time Parameters and the Parameters in Data Sheet of Total Number of Tools and

Tool Numbers

Parameter No.	Description of the functions of PC parameters	Reference value	Factory setting	Magazine type
1002	Setting of time point of oil supply stop (in ms)	900000	900000	A, B
1003	Setting of oil supply time	10000	10000	A, B
1004	The shut-off of lubricating output is delayed for the time after reaching of the lubricating pressure.	5000	5000	
1005	The lubricating pump does not deactivate the low lubricating pressure alarm after the expiration of the oil supply time.	240000	240000	
1006	An alarm is delayed for the time after the low cooling water level signal is detected.	240000	240000	
1012	The braking signal is delayed for the time after the spindle stops.	1000	0	
1013	The output holding duration of the spindle braking signal	1500	0	
1014	The duration of jog rotation during spindle gear shift (do not set the parameter when no spindle high/low speed function is provided)	2000	0	
1015	Time of JOG stop during spindle gear shift (do not set the parameter when no spindle high/low speed function is provided)	1000	0	
1016	The delay of zero-speed signal for high/low gear shift (do not set the parameter when no spindle high/low speed function is provided).	3000	0	
1017	After the operations of the releasing/clamping and gear shifting solenoid, the time is delayed before deactivation of the gear shift signal.	15000	0	
1018	After the deactivation of the gear shift signal, the time is delayed before shutting off the hydraulic oil pump.	15000	0	
1019	Setting of the total time of spindle high/low gear shift (do not set the parameter when no spindle high/low speed function is provided)	13000	0	
1020	1. Alarm delay when the cutting override is zero 2. Delay of lubricating alarm 3. Alarm delay of tool pot position offsetting error	2000	2000	
1022	Closing delay of the master air supply valve for the magazine	60000	60000	
1024	Limit of arm tool change time	3000	3000	
1025	Time setting for maximum tool change distance	15000	15000	
1026	1. Limit of spindle orienting time 2. Limit of magazine advancing and backing time 3. Limit of spindle releasing/clamping time	5000	5000	
1028	Braking time of tool magazine pot motor	1000	0	C
1029	Spindle air blowing time	3000	3000	
1030	Time 1 for correcting the accurate tool stop position of the magazine tool (adjustment of CW rotation time)	208		C
1031	Time 2 for correcting the accurate tool stop position of the magazine tool (adjustment of CCW rotation time)	208		C
.1032	Time for confirming the orient-in-position delay of the spindle	160	160	
1033	The delay time for confirmation of clamp-in-position of NC rotary table, NC indexer or hydraulic indexer	560	560	
1034	The delay time for confirmation of release-in-position of NC rotary table, NC indexer or hydraulic indexer	560	560	
1035	The delay time for Confirmation of CW rotate-in-position of hydraulic rotary table	560	560	
1036	The delay time for Confirmation of CCW rotate-in-position of hydraulic rotary table	560	560	
1037	The delay time for Confirmation of zero speed arrival of the spindle	560	560	
1038	The time is delayed before release of the contracting brake after the Z-axis is powered on.	2500	2500	
1039	Flashing interval 1 of the debugging key light	96	96	

1040	Flashing interval 2 of the debugging key light	96	96	
2001	Setting of the total number of tools in the magazine	Set it to the real number.	16	
2009	Setting of the total number of stations for the hydraulic indexer	Set it to the real number.	4	
2101	Setting of the current tool number of the magazine	Set it to the real number.	0	
2109	Setting of the current station number of the hydraulic indexer	Set it to the real number.	1	
2006	Occupation of arm magazine operation	Setting is not required.	0	
3010	Selection of indication of 4- or 2-digit codes in the data sheet and whether it is allowed to set the parameters to the same data	00000000	00000000	
3011	To enable or disable the indication of the data sheet	11000000	11000000	
4***	the PC Parameter 4000~4099 (2-digit codes) or 4000～4060 (4-digit codes) in the data sheet			

27 Description of the Functions of M Codes

M3: The spindle rotates clockwise.

M4: The spindle rotates counterclockwise.

M5: The spindle stops

M6: T×× magazine changes a tool.

M7: The spindle blows air.

M8: The water pump is on.

M9: The water pump is off.

M15: The indexer rotates counterclockwise (NC Functional Parameter 301.4 is activated)

M18: The internal cooling of the spindle is started (M9 may be disabled)

M19: The spindle is oriented.

M29: The rigid tapping is enabled.

M39: The rigid tapping is disabled.

M54: The spindle releases a tool.

M55: The spindle clamps a tool.

M58: The air blowing to workpiece is ON.

M59: The air blowing to workpiece is OFF.

M65: The magazine moves forward (armless magazine).

The pot is put down (disc arm magazine).

M66: The magazine moves backward (armless magazine).

The pot is put up (disc arm magazine).

M68 The arm catches a tool.

M69 The arm changes a tool.

M70 The arm returns to the origin.

M74: The chip cleaner rotates clockwise.

M75: The chip cleaner stops.

M76: The chip cleaner rotates counterclockwise.

M82: The hydraulic rotary table rotates clockwise (The Tooling 3 is clamped in special

usage).

M83: The hydraulic rotary table rotates counterclockwise (The Tooling 3 is released in special usage).

M84: The indexer (or tooling) is released.

M85: The indexer (or tooling) is clamped.

M86: The Tooling 2 is released.

M87: The Tooling 2 is clamped.

28 List of PLC Alarms and Messages

Alarm No.	Indication in English	Chinese meaning	Causes of alarm	Solutions
1000	EMERGENCY STOP	Emergency stop alarm	1. The EMEREGENCY STOP button is depressed. 2. The EMEREGENCY STOP button is damaged. 3. The EMEREGENCY STOP circuit is open. 4. System failure	1. Check that the EMEREGENCY STOP button is depressed. 2. Replaced the EMEREGENCY STOP button. 3. Check that the EMEREGENCY STOP circuit connected to the alarm input address X38.4 is open. 4. Replace the main frame.
1016	USER-DEFINED ALARM	User-defined alarm	1. Determine the possible causes of the alarm by referring to the user manual of the machine tool.	1. Eliminate the possible causes of the alarm by referring to the user manual of the machine tool. 2. It is possible to select to give an alarm when the PC Parameter 3003.3 of the alarm input address X32.6 is set to 1 or 0.
1100	SPINDLE ALARM	Spindle alarm	1. Alarm of the spindle drive unit; 2. Incorrect setting of the alarm level parameters of spindle drive unit; 3. Incorrect selection the logic for the alarm via the PC Parameter 3001.4 of the CNC system; 4. The external wiring is disconnected from the circuit connected to the X40.5 of the I/O unit.	1. Eliminate the causes of the alarm of the spindle drive unit; 2. Correctly set the level parameters for the alarm of the spindle drive unit(Example, reverse the alarm output of DAP01 Parameter PA72. 3. Correctly set the logic for the alarm via the PC Parameter 3001.4 of the CNC system; 4. Check that the wiring connected to the alarm input address X40.5 of the machine tool is not open.
1101	SPINDLE ORIENT ERROR	Spindle orienting error	1. The spindle orienting time set through the PC parameter 1026 is too short. 2. The spindle drive unit does not output any orienting completion signal or the orienting completion signal output is unstable. 3. The external sensor for detecting the oriented mechanical position of the spindle malfunctions or fails to reach a correct point during orientation.	5. Set an appropriate spindle orienting time in ms through the PC parameter 1026. 6. Check that the output level of the orienting completion signal from the spindle drive unit matches the CNC or that the parameter regarding to the window width of the oriented position of the drive unit is correct, e.g. DAP01 Parameter PA56. 7. Check the external sensor for detecting the oriented mechanical position of the spindle for or the drive unit for fault.
1106	RELEASE & CLAMP SIG ABNORMAL	Abnormality of the spindle release/clamp-in-position signal	1. The releasing/ clamping detection switch outputs release- and clamp-in-position signals because of the bonding of its contacts. 2. The releasing/ clamping detection switch does not output any tool released/ clamping signal owing	1. Check the tool released/ clamping detection switch and its connecting wires. The input address X38.5 is used to detect releasing in-position and X38.6 clamping in-position. 2. Check that the tool released/ clamping detection switch is

			its incorrect or loose installation. 3. The setting of the tool released/clamping time in the PC Parameter 1026 is inappropriate.	installed in an incorrect position or is loose or defective. 3. Correctly set the tool released/clamping time through the PC Parameter 1026.
1107	CLAMPE SIG LOSE OVERTIME	Overtime of spindle tool clamp-in-position signal loss	1. The clamp-in-position signal spindle joggles and flashes during the spindle rotation and its loss exceeds the time limit set via the PC Parameter 1020.	1. Check that the tool released/clamping detection switch and its connecting wires are not loose and that the time set via the PC Parameter 1020 is not too short. PLC Address X38.6 is the input point for detection of tool clamped in-position.
1108	GEAR SHIFT OR DETECT ERROR	Gear shift failure of gear detection error of the spindle	1. The two shift-in-position signals of the spindle are input concurrently. 2. No shift-in-position signal 3. The gear shift time exceeds the setting of PC1019.	1. Check that the spindle gear shift detection switch is not defective and its wiring is correct. PLC Address X38.0 and X38.1 are Gear 1 and 2 in-position detection inputs of the spindle respectively. 2. Properly set the limit of the gear shift time through the PC Parameter 1019.
1109	TOOL RELEASE& CLAMP OVERTIME	Spindle tool released/clamping overtime alarm	1. The tool released/ clamping cylinder is not supplied with air. 2. The spindle release/clamp-in-position detection switch malfunctions. 3. The spindle zero speed signal is not connected to the I/O unit. 1. The time set through the PC Parameter 1026 is too short.	1. Supply air to it. 2. Change the defective detection switch. PLC Address Y0.7 is the tool released output. 3. Check that the spindle zero speed signal X40.6 is not connected to the I/O unit. 4. Properly set the PC Parameter 1026 and limit the tool released/clamping time.
1110	TOOL NOT CLAMPED	The spindle gives an alarm as it is started with the tool not clamped.	1. The CW/CCW rotation of the spindle is started with the tool not clamped. 2. The spindle orientation is started with the tool not clamped.	1. Start the CW/CCW rotation of the spindle after it is well clamped. 2. The spindle is oriented after the spindle is clamped.
1111	MAGAZINE UNSAFE POSITION	The spindle is started with the magazine in an unsafe position.	1. The CW/CCW rotation of the spindle is started without back-in-position signal to the magazine. 2. The back-in-position signal to the magazine is lost during the CW/CCW rotation of the spindle.	1. Check the magazine for air supply and back-in-position detection switch for fault. The PLC input address of the back-in-position detection switch is X43.7.
1112	CAN NOT REVERSE DIRECTION	The spindle can not be directly reversed during rotation.	1. CCW rotation signal is input or CCW rotation button is pressed during the CW rotation of the spindle. 2. CW rotation signal is input or CW rotation button is pressed during the CCW rotation of the spindle.	In case of operating or programming error, first stop the spindle and then rotate it in reverse direction.
1113	SP.MOTO Fan OVER LOAD	Overload of spindle motor fan		
1205	Z SECOND ORIGIN ERROR	Error of the 2nd reference point of the Z-axis	1. The failure of the Z-axis to reach the 2nd reference point and the drift of the Z-axis are detected while the magazine is moving forward. 2. The external mechanical position detection sensor for the 2nd reference point is defective or loose. 3. The PC parameter for the mechanical position detection sensor is set incorrectly.	1. Finely adjust the mounting position of the Z-axis slowdown block, recalibrate the 2nd reference point of the Z-axis and set the CNC Parameter 161. 2. Replace the external mechanical position detection sensor for the 2nd reference point of Z-axis or fasten the switch components. The PLC Input Address X48.7. 4. Correctly set the PC Parameter 3005.1 so that it is consistent with the sensor.

1301	DOOR INTERLOCK	The interlocking of the protective door	1. The protective door is opened. 2. The protective door detection circuit connected to the 32.3 of the I/O unit is open. 3. The PC Parameter 3004.3 is set incorrectly.	1. Close the protective door. 2. Review the PLC Address 33.7 and check the wiring of the protective door. 3. Check the PC Parameter 3004.3 and set the logic of the protective door input. 4. The protective door interlocking function may be disabled with the PC Parameter 3004.4.
1400	COOLANT MOTOR OVER LOAD	Alarm of coolant motor overload	1. The water pump is overloaded and an alarm is given. 2. The logic for the alarm is set incorrectly in the PLC Parameter 3002.0. 3. The circuit connected to X33.3 of the I/O unit is open.	1. Review the Diagnosis Address X33.3 and check the thermal relay or air-break switch for the pump motor for tripping. 2. Check that the alarm logic is correctly set via the PC Parameter 3002.0. 3. Check that the overload alarm circuit of the pump motor is not open.
1401	COOLANT LEVEL LOW	Low coolant level		
1403	HY MOTOR OVER LOAD	The hydraulic motor of the spindle gear shift mechanism is overloaded.	1. The hydraulic motor is overloaded. 2. The setting of the PLC Parameter 3004.2 is incorrect. 3. The circuit connected to X32.4 of the I/O unit is open.	1. Review the Diagnosis Address X32.4 and check the thermal relay or air-break switch for the hydraulic motor for tripping. 2. Check that the setting of the alarm logic through the PC Parameter 3004.2 is correct. 3. Check that the lubricating alarm circuit is not open.
1405	LUBRICATING LEVEL LOW	Alarm of low lubricating level	1. The lubricating level is low and an alarm is given. 2. The setting of the PC Parameter 3003.0 is incorrect. 3. The lubricating alarm circuit is open.	1. Review the Diagnosis Address X32.2, check that an alarm was given and refill lubricating. 2. Check that the setting of the alarm logic through the PC Parameter 3003.0 is correct. 3. Check that the lubricating alarm circuit is not open.
1406	LUBRICATING PRESSURE LOW	Low lubricating pressure X34.2PC3006.7	1. Failure of the pressure detection switch 2. Leakage of the lubricating tube	
1407	LUB MOTOR OVER LOAD	The lubricating motor is overloaded.	1. Fault and tripping of the air-break switch 2. Fault of the lubricating motor	
1500	AIR PRESSURE LOW	Alarm of low air pressure in the magazine	1. The air valve is not open. 2. Incorrect adjustment of air pressure 3. The air valve is blocked. 4. The setting of the PC Parameter 3002.1 is incorrect.	1. Open the air valve. 2. Properly adjust the pressure relief value of the air valve. 3. Clean the air valve. 4. Check that the setting of the alarm logic through the PC Parameter 3002.1 is correct. 5. For an alarm caused by air pressure fluctuation, continue the operation by pressing the CYCLE START key without exiting the automatic mode when the air pressure meets the requirements.
1607	T.PALLET ROTATION OVERTIME	Alarm of excessive tool change time	1. The tool pot is mechanically blocked. 2. The air-break switch supplying power the tool pot motor is not close. 3. The setting of the tool change time through the PC Parameter 1025 is not correct.	1. Check the mechanical portion of the tool pot for blockage. 2. Check that the air-break switch supplying power the tool pot motor is close and supplies power normally. 3. Check that the tool change time set through the PC Parameter 1025 is

			4. The magazine rotates endlessly as a result of wiring error of the counter induction switch or counting switch.	not too short. 4. Check the counter induction switch or its wiring for damage. The diagnosis address is X43.5.
1608	MAGAZINE MOTOR OVER LOAD	Overload alarm of the magazine motor	1. The magazine is mechanically blocked. 2. The setting of the thermal relay for the magazine motor is too low or its performance is poor. 3. The air-break switch for the magazine is not close. 4. The alarm logic set through the PC Parameter 3004.1 is incorrect.	1. Check that the mechanical rotation part of the tool pot is fastened with screws. 2. Properly adjust the pick-up value of the thermal relay or change it. 3. Close the air-break switch. 4. Review the Diagnosis Address X32.7 and check that the setting of the PC Parameter 3004.1 is correct.
1609	T-CODE COMMAND ERROR	Alarm of command tool number error	1. The tool number of the command is incorrect. The T code is bigger than the total number of tools. 2. The tool number of the command is 0 (armless). 3. The tool number entered is not found (arm). 4. The total number of tools is not set through the PC Parameter 2001. 5. The data sheet has not been set.	1. Correctly enter the T code. 2. Correctly set the total number of tools through the PC Parameter 2001.
1614	HAVE TOOL IN CURRENT POT	An alarm is given as the current pot is fitted with a tool.	The tool pot slot corresponding to the current spindle is fitted with a tool.	If the tool pot slot corresponding to the current spindle is fitted with a too, lift the Z-axis to a safe position, set the PC Parameter 3004.6 to 1, enter the magazine debugging state, move forward the magazine with the Command M65 in the MDI mode, remove the tool from the slot and exit the magazine and debugging state.
1615	MAGAZINE FR&BACK OVERTIME	Overtime alarm of advancing and backing of the magazine	I. An alarm is given during commissioning. 1. No air 2. Incorrect wiring 3. Mechanical blockage 4. The coils in the forward and back solenoid valve for the magazine are installed reversely and the forward and back relay is defective. 5. The advancing and backing time set through the PC Parameter 1026 is incorrect.	I. An alarm is given during commissioning. 1. Supply air 2. Check the output addresses Y0.4 (Magazine forward) and Y0.5 (Magazine back) for output and that the relevant connection is correct. 3. Check that the set screws on the magazine are not removed. 4. Reverse the coils in the forward and back solenoid valve or change the forward and back relay. 5. Properly set the time via the PC Parameter 1026.
			II. An alarm is given during tool change or machining. 1. The magazine fails to move forward and the spindle orientation signal is lost. 2. A tool is fitted in a tool position that shall be empty. 3. The magazine fails to move back and no spindle clamping signal is output.	II. An alarm is given during tool change or machining. 1. Check the orientation completion signal X40.2 for input and flashing. 2. Check the empty tool position detection signal X43.3 for input (that the logic selection of the PC Parameter 3004.5 is correct). 3. Check that the X38.6 tool clamp-in-position detection signal is output.
1616	MAGAZINE UNSAFE POSITION	The program is started while the magazine is in an unsafe position.	The program is started without magazine back-in-position signal	1. Check the air supply. 2. Run the program when the magazine moves back in-position.
1620	ARM MOTOR OVER	The tool change arm motor is overloaded:	1. Incorrect wiring 2. The tripping of the air-break switch for the arm motor	1. The external arm overload wiring is connected to NC contacts. X32.3 is 1 in normal use.

	LOAD	X32.3.		2. Check that the set current of the air-break switch is too low, its performance is poor and it is mechanically blocked.
1622	ARM SWING OVERTIME	Alarm PC1024 of arm swing overtime	1. The spindle is not oriented in-position. 2. The Z-axis is not in tool change position. 3. The pot is not put down in-position.	
1623	TOOL POT NOT UPLIFT	The tool pot fails to uplift the tool pot X43.7X43.0.	The tool pot fails to uplift the tool pot.	
1624	TOOL POSITION ERROR	The tool pot stops in a correct position (disc arm magazine).	1. The tool pot fails to rotate in-position. 2. The counter is defective. 3. The stop logic of the PC Parameter 3002.7 is set incorrectly. 4. The pot motor is overloaded, causing the interruption of tool selection during the rotation of the tool pot. 5. The tool selection is interrupted by accidental power failure. 6. The time of tool selection set through the PC Parameter 1025 is too short, causing the interruption of the tool selection.	1. Set the PC Parameter 3004.6 to 1, enter the magazine debugging state, execute any T code to align the tool pot in the MDI mode and reconfigure the current tool number PC Parameter 2101 (see the instructions for magazine debugging). 2. Change the proximity switch for the counter. 3. Correctly set the tool stop parameter through the PC Parameter 3002.7 (see the description of the PC Parameter 3002.7 for details). 4. Check that the tool selection is interrupted by the overload of the tool pot motor, eliminate the causes of the overload and set the magazine to zero again. 5. Zero the magazine again after power-on. 6. Properly extend the time limit of tool selection set via the PC Parameter 1025 and zero the magazine again.
1625	POT PUT UP&DOWN OVERTIME	Alarm of pot put-down/up overtime: PC1026***		
1802	CHIP MOTOR OVER LOAD	Overload alarm of the chip cleaner motor	1. The chip cleaner is blocked. 2. The thermal relay is defective and gives a false alarm. 3. The overload limit of the air-break switch is set incorrectly. 4. The alarm logic set via the PC Parameter 3004.0 is incorrect.	1. Remove the blockage. 2. Replace the thermal relay. 3. Adjust the air-break overload limit. 4. Review the diagnosis address 33.4 and correctly set the PC Parameter 3004.0.
2010	MACHINE NOT ORIGIN	Not all the axes have returned to the origin.	At least one of the X, Y and Z axes does not execute the reference point return.	1. Separately return X, Y and Z axes to the origin. 2. The message indicating that the axes does not execute the reference point return may be disabled by setting the PC Parameter 3005.3 to 1.
2012	4-aXIS NOT RELEASED	The 4-axis is not released.	The 4-axis is clamped. The 4-axis is displaced by manual operation.	1. Give the Command M84, release the tooling and displace the 4-axis in the MDI mode. 2. Set the PC Parameter 3003.1 to 0 and do not lock the 4-axis during the clamping of the tooling (taking into account the safety after the clamping of the 4-axis).
2013	INDEX NOT CLAMPED	The hydraulic indexer is not clamped.		Operate the unit after clamping the hydraulic rotary table.
2014	INTERCOO	Alarm of the		

	LER ALM	intercooler		
2015		Over-temperature alarm of the electric cabinet		
2051	TOOL POSITION ERROR	The tool pot stops in an incorrect position.	1. The tool pot fails to rotate to the specified position. 2. The counter is defective. 3. The tool stop logic set via the PC Parameter 3002.7 is incorrect.	1. Set the PC Parameter 3004.6 to 1, enter the magazine debugging state, execute any T code to align the tool pot in the MDI mode and reconfigure the current tool number PC Parameter 2101 (see the instructions for magazine debugging). 2. Change the proximity switch for the counter. 3. Correctly set the tool stop parameter through the PC Parameter 3002.7 (see the description of the PC Parameter 3002.7 for details).
2053	NO SIGNAL IN MAGAZINE LEFT	No magazine back-in-position signal is output. Relevant PLC Input Address X43.7 and R229.4	The system indicates that no back-in-position signal has been detected. 1. No air in the magazine advancing and backing cylinder. 2. The forward/backward in-position detection wires are connected incorrectly. 3. The detection switch malfunctions or becomes loose.	Check the diagnosis addresses X43.7 and R229.4 for back-in-position signal. 1. Check the air supply. 2. Check the wiring. 3. Check that the in-position detection switch is not damaged or loose.
2054	ARM NOT IN ORIGIN	No arm origin detection signal	1. Incorrect wiring 2. Interruption of tool change	1. Observe the diagnosis addresses X43.3, X43 2 and X43.1, set X43.3 to 0, X43.2 to 1 and X43.0 to 0 with the arm at the origin and correct the wiring. 2. Set the arm motor shaft to the origin by manual rotation.
2056	FIRST POT CANNOT HAVE TOOL	A tool is fitted in the No.1 tool position on the current magazine. Zero the magazine and operate it without any tool in the No.1 slot. Correct the Input X48.2.		
2090	FEED OVERRIDE 0%	The feed override is zero.	1. The feed override button stops in zero position. 2. The PC Parameter 1020 has not been set.	1. Change the position of the cutting override button. 2. Set the time to over 1000ms through the PC Parameter 1020.
2091	MAGAZINE DEBUGGING	The magazine is being commissioned.	Prompt of magazine debugging	Set the PC Parameter 3004.6 to 0.
2102	SPINDLE GEAR SHIFTING	The spindle is shifting gear.	Prompt message for high/low speed gear shift of the spindle	1. The PC Parameter 3003.6 is incorrectly set to 1. Namely the spindle is ordered to rotate while the shift-in-position signal is checked for the high/low speed gear shift of the spindle. 2. The message is indicated after gear shift in-position for high/low speed gear shift of the spindle.
2999	PLC V*.**	PLC Version V*.**		

29 Magazine and Hydraulic Rotary Table Control Macro Programs

The configuration of macro programs depends on the types of magazine. The macro programs vary with the types of magazine. Please specify it in ordering so that we may transfer matching user macro programs.

29.1 Tool change Macro program s for Armless Magazine

```
%
:9001
(20090925)
N0010 M5
N0040 G04 X50
N0045 I F[#4120 EQ#1032] G O T O660
N0050 M19
N0060 #146=#4003
N0070 I F[#4008 NE 49] G O T O250
N0100 G30 G91 Z0
N0110 M65
N0120 G04 X10
N0130 M54
N0140 G04 X1.5
N0150 G28 G91 Z0
N0160 M60
N0170 G04 X10
N0190 G30 G91 Z0
N0200 M55
N0210 G04 X50
N0220 M66
N0230 G#146
N0235 M5
N0240 G O T O660
N0250 G28 G91 Z0
N0260 G40 G49
N0310 G30 G91 Z0
N0320 M65
N0330 G04 X10
N0340 M54
N0350 G04 X1.5
N0360 G28 G91 Z0
N0370 M60
```

N0380 G04 X10

N0390 G30 G91 Z0

N0400 M55

N0406 G04 X50

N0410 M66

N0420 G#146

N0425 M5

N0430 G O T O660

N0660 M99

%

29.2 (MV2.10.4B or Later Versions of Macro program s for Disc Arm Magazines)

Macro program s for Disc Arm Magazines

```
:9001
(20100826)
M5
G04 X100
I F[#4120 E Q#1032] G O T O80
#130=#4003
#131=#4006
G91 G21 G30 Z0 M19
G#130 G#131
M65
M68
M54
G04 X0.3
M69
M55
G04 X0.3
M70
M66
M05
N80 M99
%
```

29.3   (MV2.10.4B or Earlier Versions of PLC Macro program s for Disc Arm Magazines)

```
:9001
I F[#1000 E Q1] G O T O80
#130=#4003
#131=#4006
G91 G21 G30 Z0 M19
G#130 G#131
M65
M68
M54
M69
M55
M70
M66
M05
```

N80 M99

29.4 Macro program s for Turret Magazine

```
:9001
N0010 G04 X5
N0020 I F[0 E Q#4120] G O T O290
N0030 I F[#4120 GE #1032] G O T O280
N0040 M5
N0050 G04 X5
N0060 I F[#4120 E Q#1032] G O T O270
N0070 #146=#4003
N0160 G28 G91 Z0 M19
N0200 G30 G91 Z0
N0210 M07
N0220 M60
N0230 G28 G91 Z0
N0260 G#146
N0265 M5
N0270 M99
N0280 #3000=198(CAN NOT RUN THE COMMAND)
N0290 #3000=199(NOT COMMAND TOOL)
```

29.5 Macro program s for Hydraulic Indexer

```
%
:9003
(20100826)
#140=4
G04 X100
IF[0EQ#4102]GO TO 860
/9 IF[#4102 GE #140] GO TO880
IF[#4102 GT #140] GO TO880
G04 X100
IF[[#4102-#1032]GE[[#140/2]+1]] GO TO700
IF[[#1032-#4102]GE[[#140/2]+1]] GO TO800
IF[#4102 EQ #1032] GO TO 999
IF[#4102GT #1032] GO TO 500
G04 X100
#145=[#1032-#4102]
WHILE[#145GE1]DO1
M85
M82
M84
M83
M85
#145=#145-1
G04 X100
END1
GO TO 999
N0500 #146=[#4102-#1032]
WHILE[#146GE1]DO2
M85
M83
M84
M82
M85
#146=#146-1
```

G04 X100
END2
GO TO999
N0700#141=[#140-[#4102-#1032]]
G04 X100
WHILE[#141GE1]DO3
M85
M82
M84
M83
M85
#141=#141-1
G04 X100
END3
GO TO999
N0800#142=[#140-[#1032-#4102]]
G04 X100
WHILE[#142GE1]DO1
M85
M83
M84
M82
M85
#142=#142-1
G04 X100
END1
GO TO999
N0860#3000=196(NOT COMMAND B CODE)
N0880#3000=195(B CODE IS WRONG)
N0999 M99
%

30 Indication of PLC Version

The LCD of the NC system indicates the version information of the PLC of present main frame when the STOP and FEED HOLD keys on the machine tool are pressed concurrently.