# CONTENTS

# PLC Version Change Records

PLC of V2.08B-5AX version supports five-axis machining center with manipulator tool magazine, frequency conversion and servo motor.

| Date | PLC Version | Contents |
|---|---|---|
| 2012-3-27 | V2.08B-5AX | The first version |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

When there is the $5^{th}$ axis, the following functions of the system will be restricted.

① Screw cutting and synchronous feed can not be performed.

③ S4 digit analog output function is not available.

④ Constant surface speed control function is not available.

⑤ Rigid tapping function can not be performed.

⑥ Real-time display of the spindle speed can not be performed.

When there is the $5^{th}$ axis, change S4 digit analog output NC parameter (0.4) to 0, and set 0.3 to 1.

# 1　Address List of GSK983Ma-H/V Five-axis Operation Panel

(1). Key address distribution of machine operation panel

| Auto | Edit | MDI | Manual | MPG | Machine zero | DNC | USER 1 | USER 3 | USER 7 | Chip removal | Index table release /clamp | Tool pot vertical | Tool magazine debugging |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X36.0 | X36.1 | X36.2 | X36.3 | X36.4 | X36.5 | X36.6 | X36.7 | X47.0 | X50.0 | X50.1 | X50.2 | X50.3 | X50.4 |
| X | Y | Z | FO/ ×1 | Single step | Skip | Dry run | USER 2 | USER 4 | USER 8 | Chip flushing water valve | Lubricating | Tool pot horizontal | Manipulator rotation |
| X37.0 | X37.1 | X37.2 | X37.3 | X37.4 | X37.5 | X37.6 | X37.7 | X47.1 | X50.5 | X50.6 | X50.7 | X51.0 | X51.1 |
| 4 | Rapid move | 5 | F50/ ×10 | Optional stop | Machine lock | MST lock | Program restart | USER 5 | USER 9 | Workpiece blowing | Overtravel release | | |
| X46.0 | X46.1 | X46.2 | X46.3 | X46.4 | X46.5 | X46.6 | X46.7 | X47.2 | X47.3 | X47.4 | X47.5 | X47.6 | |
| + | | - | F100/ ×100 | Spindle CCW | Spindle stop | Spindle CW | Spindle orientation | USER 6 | USER 10 | Cooling | Working lamp | Feed hold | Cycle start |
| X41.0 | X41.1 | X41.2 | X41.3 | X41.4 | X41.5 | X41.6 | X41.7 | X45.0 | X45.1 | X45.2 | X45.3 | X45.4 | X45.5 |

(2) Key indicator address distribution of machine operation panel

| Auto | Edit | MDI | Manual | MPG | Machine zero | DNC | USER 1 | USER 3 | USER 7 | Chip removal | table release | X zero point | Y zero point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y7.0 | Y7.1 | Y7.2 | Y7.3 | Y7.4 | Y7.5 | Y7.6 | Y7.7 | Y13.0 | Y13.1 | Y13.2 | Y13.3 | Y13.4 | Y13.5 |
| X | Y | Z | FO/×1 | Single block | Skip | Dry run | USER 2 | USER 4 | USER 8 | Chip flushing water valve | Lubricating | Z zero point | 4 zero point |
| Y8.0 | Y8.1 | Y8.2 | Y8.3 | Y8.4 | Y8.5 | Y8.6 | Y8.7 | Y12.0 | Y12.1 | Y12.2 | Y12.3 | Y12.4 | Y13.6 |
| 4 | Rapid move | 5 | F50/×10 | Optional stop | Machine lock | MST lock | Program restart | USER 5 | USER 9 | Workpiece blowing | Overtravel release | 5 zero point | Nixie tube |
| Y9.0 | Y9.1 | Y9.2 | Y9.3 | Y9.4 | Y9.5 | Y9.6 | Y9.7 | Y12.5 | Y12.6 | Y12.7 | Y11.7 | Y11.6 | Y15.0 ~15.7 |
| + | | - | F100/×100 | Spindle CCW | Spindle stop | Spindle CW | Spindle orientation | USER 6 | USER 10 | Cooling | Working lamp | Feed hold | Cycle start |
| Y10.0 | Y10.1 | Y10.2 | Y10.3 | Y10.4 | Y10.5 | Y10.6 | Y10.7 | Y11.0 | Y11.1 | Y11.2 | Y11.3 | Y11.4 | Y11.5 |

**Note: Corresponding address Y15.7~Y15.0 of nixie tube is BCD code. It displays 00~99**

## 2  I/O Address List

This address list is used for PLC V2.08B-5AX version. The definition of input/ output may vary with different PLC version.

### 2.1  Input Signal List

| PLC input signal address | | | | |
|---|---|---|---|---|
| Address | Signal name | Signal function | Remarks | I/O |
| X32.0 | *+LX | X-axis positive direction limit (NC fixed signal) | | I |
| X32.1 | *-LX | X-axis negative direction limit (NC fixed signal) | | I |
| X32.2 | *YW.ALM | Lubricating oil low level or low pressure alarm | | I |
| X32.3 | *ARMOVL | Manipulator motor overload | | I |
| X32.4 | G.PUP.AL | Hydraulic pump overload input | | I |
| X32.5 | *DECX | X-axis zero return deceleration (NC fixed signal) | | I |
| X32.6 | ZDY.ALM | User-defined alarm | | I |
| X32.7 | ELCTOVER | Turrent motor overload | | I |
| | | | | |
| X33.0 | *+LY | Y-axis positive direction limit (NC fixed signal) | | I |
| X33.1 | *-LY | Y-axis negative direction limit (NC fixed signal) | | I |
| X33.2 | BAROMETER. | Pressure low detection input | | I |
| X33.3 | W.PUMP.ALM | Water pump overload alarm | | I |
| X33.4 | CHIP.ALM | Motor overload of chip cleaner | | I |
| X33.5 | *DECY | Y-axis zero return deceleration (NC fixed signal) | | I |
| X33.6 | | | | I |
| X33.7 | GUARD | Safety door input | | I |
| | | | | I |
| X34.0 | *+LZ | Z-axis positive direction limit (NC fixed signal) | | I |
| X34.1 | *-LZ | Z-axis negative direction limit (NC fixed signal) | | I |
| X34.2 | | | | I |
| X34.3 | | | | I |
| X34.4 | | | | I |
| X34.5 | *DECZ | Z-axis zero return deceleration (NC fixed signal) | | I |
| X34.6 | | | | I |
| X34.7 | | | | I |

| | | | | I |
|---|---|---|---|---|
| X35.0 | *+L4 | The 4<sup>th</sup> axis positive direction limit (NC fixed signal) | | I |
| X35.1 | *－L4 | The 4<sup>th</sup> axis negative direction limit (NC fixed signal) | | I |
| X35.2 | | | | |
| X35.3 | | | | I |
| X35.4 | | | | I |
| X35.5 | *DEC4 | The 4<sup>th</sup> axis zero return deceleration (NC fixed signal) | | I |
| X35.6 | CLPI | Index table (or assembly) clamp in position detection | | I |
| X35.7 | UCLPI | Index table (or assembly) release in position detection | | I |
| | | | | |
| X38.0 | GR1.M | | | I |
| X38.1 | GR2.M | | | I |
| X38.2 | GR3.M | | | I |
| X38.3 | GR4.M | | | I |
| X38.4 | *ESP | Emergency stop (NC fixed signal) | | I |
| X38.5 | TRLCK.I | Tool release in position detection | | I |
| X38.6 | TCLCK.I | Tool clamp in position detection | | I |
| X38.7 | CKST | Tool release/clamp key | | I |
| | | | | I |
| X40.0 | | | | I |
| X40.1 | | | | I |
| X40.2 | SOR.M | Spindle orientation in position detection | | I |
| X40.3 | | | | I |
| X40.4 | | | | I |
| X40.5 | *SRDY | Spindle alarm input signal | | I |
| X40.6 | ZSP | Spindle zero speed detection | | I |
| X40.7 | SAR | Spindle speed arrival detection | | I |
| | | | | I |
| X43.0 | TTDOWN | Toolpot turns down | | I |
| X43.1 | ARMZRO | Mechanical arm zero point | | I |
| X43.2 | ARMHOLD | Mechanical arm cutter hold | | I |
| X43.3 | ARMSTP | Mechanical arm stop | | I |
| X43.4 | TARIV.I | Tool arrival input signal | | I |
| X43.5 | TCN.I | Tool count signal | | I |
| X43.6 | SKIP | Skip input signal (NC fixed signal) | | I |
| X43.7 | TTUP | Toolpot turns up | | I |
| | | | | I |
| X48.0 | *+L5 | The 5<sup>th</sup> axis positive direction limit (NC fixed signal) | | I |

| X48.1 | *-L5 | The 5$^{th}$ axis negative direction limit (NC fixed signal) | | I |
|-------|------|-------------------------------------------------|---|---|
| X48.2 | | | | I |
| X48.3 | | | | I |
| X48.4 | | | | I |
| X48.5 | *DEC5 | The 5$^{th}$ axis zero return deceleration (NC fixed signal) | | I |
| X48.6 | SOR2.K | Spindle oriental mechanical confirmation signal | | I |
| X48.7 | | | | I |
| | | | | I |

## 2.2   Output Signal List

| PLC output signal address | | | |
|---|---|---|---|
| **Address** | **Signal name** | **Signal address** | **I/O** |
| Y0.0 | R9 | S12 digit binary output the 9$^{th}$ digit | O |
| Y0.1 | R10 | S12 digit binary output the 10$^{th}$ digit | O |
| Y0.2 | R11 | S12 digit binary output the 11$^{th}$ digit | O |
| Y0.3 | R12 | S12 digit binary output the 12$^{th}$ digit | O |
| Y0.4 | M03 | Spindle CCW | O |
| Y0.5 | M04 | Spindle CW | O |
| Y0.6 | GZD.L | Machine working lamp | O |
| Y0.7 | TRLCK.O | Tool release | O |
| | | | |
| Y1.0 | RED.ALL | Tower red indicator alarm output | O |
| Y1.1 | YEL.ALL | Tower yellow indicator output | O |
| Y1.2 | GRE.ALL | Tower green indicator output | O |
| Y1.3 | CLN.O | Cooling (cooling fluid) pump output | O |
| Y1.4 | LUB.O | Lubricating pump output | O |
| Y1.5 | OR.T | Overtraverl release output | O |
| Y1.6 | M19.O | Spindle orientation | O |
| Y1.7 | CFN.O | Spindle air blow output | O |
| | | | |
| Y2.0 | TC.O | Magazine CW rotation | O |
| Y2.1 | TCC.O | Magazine CCW rotation | O |
| Y2.2 | M20.O | M20 output | O |
| Y2.3 | CLP.O | Index table (or assembly) clamp output | O |
| Y2.4 | MT.RST | System reset external output | O |
| Y2.5 | UCLP.O | Index table (or assembly) release output | O |
| Y2.6 | TTDOWN.O | Tool pot down output | O |
| Y2.7 | TTUP.O | Tool pot up output | O |
| | | | |
| Y3.0 | ARMMOTOR.O | Arm motor output signal | O |
| Y3.1 | CLN2.O | Chip removal water valve output | O |

| Y3.2 | MPG.L | MPG mode indicator ouput | O |
|---|---|---|---|
| Y3.3 | CHIP.CW/ M24 | Chip cleaner CW output/M24 output | O |
| Y3.4 | CLN-2O/ M22 | Work piece blowing output/M22 output | O |
| Y3.5 | CHIP.CCW/ M26 | Chip cleaner CCW output/M26 output | O |
| Y3.6 | CKST.L | Spindle tool release indicator | O |
| Y3.7 | SP-SON | Spindle enable output | O |
|  |  |  | O |
| Y6.0 | R1 | S12 digit binary output the 1st digit | O |
| Y6.1 | R2 | S12 digit binary output the 2nd digit | O |
| Y6.2 | R3 | S12 digit binary output the 3rd digit | O |
| Y6.3 | R4 | S12 digit binary output the 4th digit | O |
| Y6.4 | R5 | S12 digit binary output the 5th digit | O |
| Y6.5 | R6 | S12 digit binary output the 6th digit | O |
| Y6.6 | R7 | S12 digit binary output the 7th digit | O |
| Y6.7 | R8 | S12 digit binary output the 8th digit | O |

**Note: 1. Initial state of the signal with * is 1, and the signal switch type is NC.**

**2. The address whose signal name is not defined is an undefined address. User can define it as requirements. It should match with corresponding PLC program.**

## 2.3   Other Input/output Address List

| Feedrate override/ Spindle override input address | | | | | | | |
|---|---|---|---|---|---|---|---|
| X52.7 | X52.6 | X52.5 | X52.4 | X52.3 | X52.2 | X52.1 | X52.0 |
| SPC | SPB | SPA | OV16 | OV8 | OV4 | OV2 | OV1 |
| External feed hold and program lock input address | | | | | | | |
| X53.7 |  |  |  |  |  | X53.1 | X53.0 |
| KEY |  |  |  |  |  | SP | ST |
| External MPG level and axis selection input address | | | | | | | |
| X54.7 | X54.6 | X54.5 | X54.4 | X54.3 | X54.2 | X54.1 | X54.0 |
| X100 | X10 | X1 | H5 | H4 | HZ | HY | HX |

# 3  Instruction of PLC Signal

## 3.1  Introduction of Input Signal Level

Input signal level selection of new IO unit (XI) matched with 983Ma-H/V is more flexible than the former ones. High level input valid or low level input valid can be selected based on the different external signals. The method is that the new IO unit adds one public input terminal COM at the start point of input signal in each group. While the corresponding COM is connected with switch power supply +24V, the eight input points of the group are valid when they are 0V; while the corresponding COM is connected with 0V, the eight input point of the group are valid when they are 24V. When the input is valid, the corresponding PLC diagnosis address point is 1.

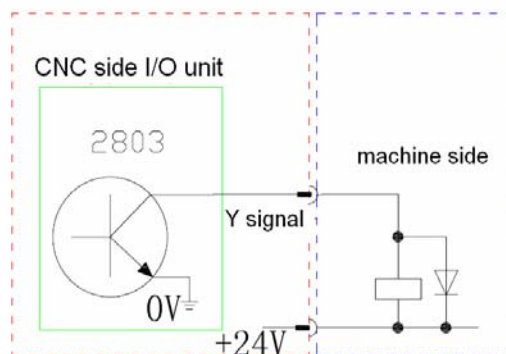## The connection with the enabled Low level
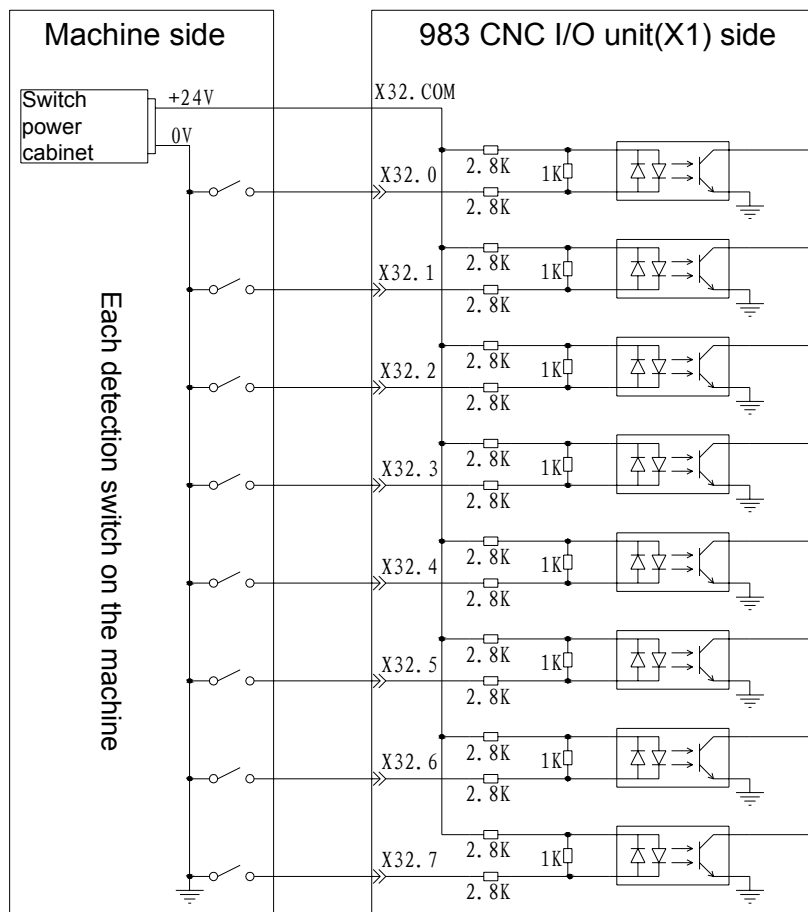
# The connection with the enabled High level
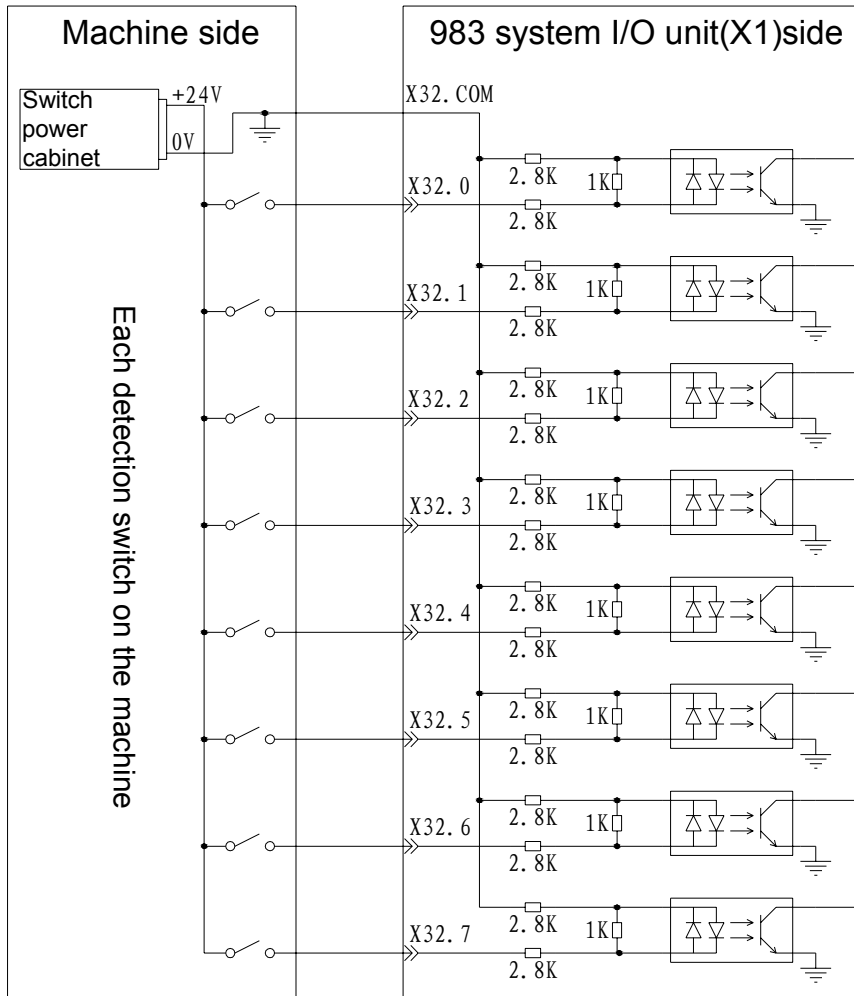


## 3.2 Introduction of Output Signal

All output signals in the system are low level output (0V output), which can not be selected or changed. When the output is valid, the corresponding PLC output address point is 1

## 3.3 Detailed Introductions for Each Input Signal

☆ *+LX, *－LX, *+LY, *－LY, *+LZ, *－LZ, *+L4, *－L4, *+L5 and *－L5 are input signals of X axis, Y axis, Z axis, the 4th axis, the 5th axis and limit input signal in negative direction. They are NC fixed input signal point, the user can't define and rewrite them, and they are in short circuit when they are not used. (When the high level input is valid, it is short connected with ＋24V; When the low level input is valid, it is short connected with 0V.)

☆ *DECX, *DECY, *DECZ, *DEC4 and *DEC5 are zero return deceleration input signals of X axis, Y axis, Z axis, the 4th axis and the 5th axis. They are NC fixed input signal input, the user can't define and rewrite them.

☆ YW.ALM signal (PLC address X32.2) is the alarm input signal of lubricating oil level low or lubricating oil pressure low. It is set by PC parameter 3003.0 selection alarm logic. (PC parameter 3003.0 is set to 0 by factory, that is to say, X32.2 of PLC address is 1, the system alarms. If it requires that the X32.2 of PLC address is 0 and the system alarms, PC parameter 3003.0 can be set as 1)

☆ G.PUP.AL signal (PLC address X32.4) is the overload input signal of hydraulic pump motor. It is set by PC parameter 3004.2. (The factory default setting is 0, that is to say, when the input port X32.4 is 1, the system alarms. If it requires that the input port X32.4 is set as 0 and the system alarms, PC parameter 3004.2 can be set as 1.)

☆ ZDY.ALM1 signal (PLC address X32.6) is the user self-defined alarm input signal, which is set by PC parameter 3003.3. (PC parameter 3003.3 is set as 0 by factory, that is to say, when the input port X32.6 is set as 1, the system alarms. If it requires that the input port X32.6 is set as 0 and the system alarms, PC parameter 3003.3 can be set as 1. )

☆ELCTOVER signal (PLC address X32.7) is turrent motor overload input signal, which is set by PC parameter 3004.1. (It is set as 0 by factory, that is to say, when X32.7 is 1, the system alarms. If it requires that the input port X32.7 is set as 0 and the system alarms, PC parameter 3004.1 can be set as 1.)

☆BAROMETER signal (PLC address X33.2) is the alarm input signal of pressure low, which is set by PC parameter 3002.1. (PC parameter 3002.1 is set as 0 by factory, that is to say, the input port is 1, the system alarms. If it requires that the input port X33.2 is 0 and the system alarms, PC

parameter 3002.1 should be set as 1. )

☆W.PUMP.ALM signal (PLC address X33.3) is the water pump motor overload alarm input signal, which is set by PC parameter 3002.0. (PC parameter 3002.0 is set as 0 by factory, that is to say, the input port X33.3 is 1, the system alarms. If it requires that the input port X33.3 is 0 and the system alarms, PC parameter 3002.0 can be set as 1.)

☆CHIP.ALM signal (PLC address X33.4) is the chip cleaner motor overload detection signal, which is set by PC parameter 3004.0. (It is set as 0 by factory, that is to say, the input port X33.4 is 1, the system alarms. If it requires that the input port X33.4 is 0 and the system alarms, PC parameter 3004.0 can be set as 1.)

☆ GUARD signal (PLC signal X33.7) is protection door interlock input signal, which is set by PC parameter 3004.3. (PC parameter 3004.3 is set as 0 by factory, that is to say, when the input port X33.7 is 1, the system alarms. If it requires that the input port X33.7 is 0 and the system alarms, PC parameter 3004.3 can be set as 1. Moreover, whether the protection door is valid can be set by PC parameter 3004.4. When it is 0 by default, the protection door is invalid.)

☆ CLPI signal (PLC address X35.6) is index table (or assembly) clamp in-position detection signal. When CLPI is 1, the tool clamps in-position. Whether detect the clamp in-position signal is set by PC parameter 3002.4. (The corresponding clamp command M85 sets PC parameter 3002.4 as the clamp in-position detection signal. If there isn't clamp in-position signal in command M85, the command doesn't end.)

☆ UCLPI signal (PLC address X35.7) is index table (or assembly) release in-position detection signal. When UCLPI signal is 1, the tool releases in-position. Whether the release in-position signal is detected is set by PC parameter 3002.4. (The corresponding release command M84 sets PC parameter 3002.4 as the release in-position detection signal. If there isn't the release in-position signal in M84, the command doesn't end.)

☆ *ESP signal (PLC address X38.4) is the system emergency stop signal. When X38.4 is 0, the system enters the emergency stop state.

☆ TRLCK.I signal (PLC address X38.5) is the spindle tool release in-position detection signal. When X38.5 is 1, the tool is released in-position.

☆ TCLCK.I signal (PLC address X38.6) is the spindle tool clamp in-position detection signal. When X38.6 is 1, the tool is clamped in-position.

☆ CKST signal (PLC address X38.7) is the button of clamp/release tool input. When X38.7 is 1, the input is valid.

☆ SOR.M signal (PLC address X40.2) is the spindle orientation in-position detection signal. When X40.2 is 1, the orientation is completed.

☆ SRDY signal (PLC address X40.5) is the spindle alarm input signal, which is set by PC parameter 3001.4 bit. (It is set as 0 by factory, that is to say, the input port X40.5 is 1, the system alarms. If it requires that the input port X40.5 is 0 and the system alarms, PC parameter 3001.4 can be set as 1.)

☆ ZSP signal (PLC address X40.6) is the spindle zero speed detection signal. When X40.6 is 1, the zero speed signal is reached.

☆ SAR signal (PLC address X40.7) is the spindle speed arrival detection signal. When X40.7 is 1, the speed is reached.

☆TTDOWN signal (PLC address X43.0) is that tool pot turns down in-position detection signal. When X43.0 is 1, toolpost is turned down in-position.

☆ TARIV.I (PLC address X43.5) signal is turrent rotation in-position input signal.

☆ TCN.I signal (PLC address X43.5) is counting tool number input signal.

☆ SKIP signal (PLC address X43.6) is skip input signal and it is used with G31 command.

☆**TTUP** signal (PLC address X43.7) is that toolpot turns up in-position detection signal. When X43.7 is 1, toolpot is turned up in-position.

**Note: In I/O unit input signal list, the signal with symbol * should be set as 1 after power on.**

# 4　PC Parameter Instruction

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

Bit7　X+-ZRN：　Selection of X axis zero-return automatic hold direction

　　0：　Zero-return automatic hold in positive direction

　　1：　Zero-return automatic hold in negative direction

**Note: Zero-return automatic hold in X axis negative direction should be set by NC parameter 12.0 =1.**

Bit6　ATC.ZN：　Magazine selection

　　0：　The machine doesn't have tool magazine function

　　1：　The machine has tool magazine function

Bit4　SP.ALM：　Alarm logic selection of spindle alarm input signal (PLC address X40.5).

　　0：　The system alarms when the spindle alarm input terminal X40.5 is 1.

　　1：　The system alarms when the spindle alarm input terminal X40.5 is 0.

Bit3　TRLTCL.：　Whether check the tool clamp in-position signal (PLC address X38.6) TCLCK.I and tool release in-position signal TRLCK.I (PLC address X38.5).

　　0：　Not check

　　1：　Check

Bit1　Y+-ZRN：　Selection of Y axis zero-return automatic hold direction

　　0：　Zero-return automatic hold in positive direction

　　1：　Zero-return automatic hold in negative direction

**Note: Zero-return automatic hold in Y axis negative direction should be set by NC parameter 12.1=1.**

Bit0　ABS-1：　Whether the menu switch MANUAL ABSOLUTE is valid

　　0：　The menu switch MANUAL ABSOLUTE is invalid (standard factory value)

　　1：　The menu switch MANUAL ABSOLUTE is valid (use it with caution)

| 601 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 3002 | T-STPLG | ARIV | | 4CPIN | 4AXSL | 4INDX | BARMT | W.PUP.AM |
| Factory value | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Bit7　T-STPLG：　The magazine turrent stop position selection (It should be correctly set when the magazines in different types are matched).

0：　When the magazine turrent is rotated in-position, the counter proximity switch is in non-inductive state (shown in figure A)

1：　When the magazine turrent is rotated in-position, the counter proximity switch is in inductive state (shown in figure B)
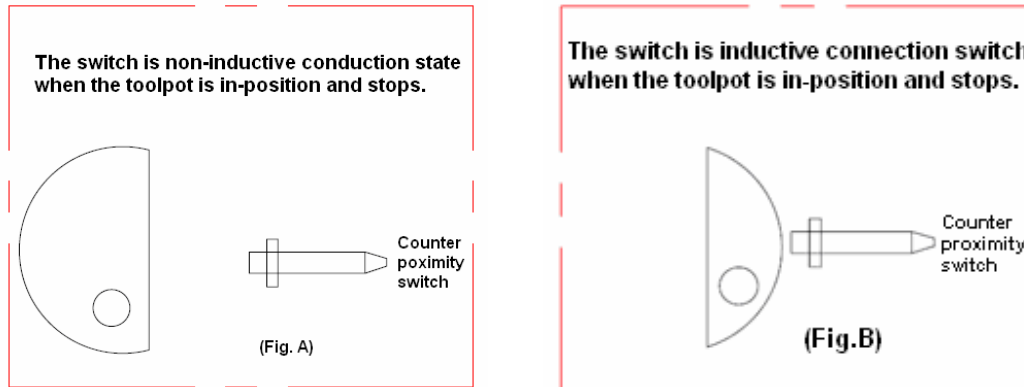


Bit6　ARIV：　Select the signal that controls the magazine rotation in-position

0：　In-position signal X43.4 controls tool magazine rotation in-position

1：　Counting signal X43.5 controls tool magazine rotation in-position

Bit4　4CPIN：　Whether detect the release in-position signal X35.7 and clamp in-position signal X35.6 when M84 and M85 are commanded.

0：　Not check.

1：　Check.

Bit3　4AXSL：　The 4th axis selection function

0：　The 4th axis is linear axis.

1：　The 4th axis is revolving axis.

Bit2　4INDX：　The 4th axis revolving working mode (3002 Bit34 AXSL the 4th axis should be set as revolving axis)

0：　NC working table (Working table release/clamp is controlled by PLC M84 and M85)

1：　Index working table (Working table release/clamp is controlled by NC)

Bit1　BARMT　The magazine pressure low alarm logic selection

0：　The system alarms when the magazine pressure detection input point is 1 (PLC address X33.2).

1：  The system alarms when the magazine pressure detection input point is 0 (PLC address X33.2).

Bit0  W.PUP.AM: The water pump motor overload alarm logic selection

0：  The system alarms when the water pump motor overload input point is 1 (PLC address X33.3)

1：  The system alarms when the water pump motor overload input point is 0 (PLC address X33.3)

| 602 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 3003 | SSGN | | | | ZIDY.C | | | YW.C |
| Factory value | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Bit3  ZIDY.C：  User self-defined alarm logic selection.

0：  The system alarms when the user self-defined alarm point is 1 (PLC address X32.6)

1：  The system alarms when the user self-defined alarm point is 0 (PLC address X32.6)

Bit0  YW.C：  Lubrication oil level low/pressure low alarm logic selection.

0：  The system alarms when the lubricating oil level low/pressure low input point (PLC address X32.2) is 1.

1：  The system alarms when the lubricating oil level low/pressure low input point (PLC address X32.2) is 0.

| 603 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 3004 | SOR2.K | | | GUARD.SHD | GUARDLM | PUP.ALM | ELTOV.LM | CHIP.ALM |
| Factory value | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Bit7 SOR2.K Whether spindle orientation mechanical position confirm signal is 1 or 0 when it is in-position.

0：  It is in-position (PLC address X48.6 is 0) when spindle orientation mechanical position confirm signal is 0

1：  It is in-position (PLC address X48.6 is 1) when spindle orientation mechanical position confirm signal is 1

Bit4  GUARD.SHD   Whether shield the guard door.

0：  The function of shielding guard door (PLC address X33.7 input is invalid) is invalid

1：  The guard door interlock (PLC address X33.7 input is valid) is valid

Bit3  GUARD.LM   Guard door interlock logic selection

0： Guard door interlock is valid when input port (PLC address X33.7) is 1

1： Guard door interlock is valid when input port (PLC address X33.7) is 0

Bit2　PUP.ALM　Hydraulic pump overload alarm logic selection.

0： The system alarms when the input point (PLC address X32.4) is 1.

1： The system alarms when the input point (PLC address X32.4) is 0.

Bit1　ELTOV.LM　Turrent motor overload alarm logic selection.

0： The system alarms when the input point (PLC address X32.7) is 1.

1： The system alarms when the input point (PLC address X32.7) is 0.

Bit0　CHIP.ALM　Alarm logic selection of chip cleaner motor overload.

0： The system alarms when the input point (PLC address X33.4) is 1.

1： The system alarms when the input point (PLC address X33.4) is 0.

| 604 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 3005 | | | | | MTZERO | 4SED.K | 4SSED.K | KEY |
| Factory value | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Bit3　MTZERO　Whether check machine zero return completion signal

0： Not check the machine zero return signal. It does not prompt that not all axes return to the reference point.

1： Check the machine zero return signal. It prompts that not all axes return to the reference point.

Bit2　4SED.K　Whether check in-position confirmation signal of the 4th axis reference point 2

0： Not check in-position confirmation signal X48.7 of the 4th axis reference point 2

1： Check in-position confirmation signal X48.7 of the 4th axis reference point 2

Bit1　4SSED.K　It is in-position when the confirmation signal of the 4th axis reference point 2 is 1 or 0

0： It is in-position when the confirmation signal is 1 (PLC address X48.7 is 1)

1： It is in-position when the confirmation signal is 0 (PLC address X48.7 is 0)

Bit0    KEY    Whether the program key switch is used

0：    Use program key switch to protect program edit

1：    Not use program key switch to protect program edit

| 606 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 3007 | | | | | | | | LASER.K |
| Factory value | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Bit0    LASER.K    Whether use M22/M23, M24/M25, M26/M27 switch output

0：    Y3.3，Y3.5，  Y3.4 are chip cleaner CCW output, chip cleaner CW output, workpiece blowing output function

1：    Y3.3，Y3.5，  Y3.4 are M24 output, M26 output and M22 output function

| PC parameter No. | Parameter function | Reference setting value |
|---|---|---|
| 1002 | Setting the time of stopping supplying oil. （Time unit: ms） | 1800000 |
| 1003 | Setting the time of supplying oil. （Time unit: ms） | 12700 |
| 1008 | The 4$^{th}$ axis release confirmation delay | 1000 |
| 1009 | The 4$^{th}$ axis clamp confirmation delay | 1000 |
| 1020 | Alarm delays when the cutting override is zero. | 3000 |
| 1021 | Lubrication oil alarm delay | 3000 |
| 1023 | Spindle tool release/ clamp overtime alarm delay | 3000 |
| 1024 | Toolpot turns up/down overtime alarm time | 4500 |
| 1025 | Manipulator tool change overtime alarm time | 3000 |
| 1026 | Alarm delays when spindle orientation overtime | 5000 |
| 2001 | Setting the total tool number controlled by the magazine program (24 tools for example) | 24 |
| 2101 | Setting the magazine current tool number | |
| 3011 | Setting of BCD code of the data list (the decimal value is equal to the one set by 2001) | 00100100 |
| 4000 | Spindle tool fixing number (original value is 0) | Original value is 0 |
| 4001 | Tool number of turrent 1 | Original value is 1 |
| 4002 | Tool number of turrent 2 | Original value is 2 |
| 4003 | Tool number of turrent 3 | Original value is 3 |
| ..... | ...... | ...... |
| | | |

# 5 Introduction of M Code Function

M3： Spindle positive rotation

M4： Spindle negative rotation

M5： Spindle stop

M6　T×× ： Magazine tool change

M7： Workpiece blowing ON

M8： Water pump ON

M9： Water pump OFF/ Workpiece blowing OFF

M19： Spindle orientation

M20： Y2.2 output

M21： Y2.2 output OFF

M22： Y3.4 output

M23： Y3.4 output OFF

M24： Y3.3 output

M25： Y3.3 output OFF

M26： Y3.5 output

M27： Y3.5 output OFF

M29： Rigid tapping

M39： Rigid tapping is finished

M54： Tool release

M55： Tool clamp

M65： Toolpot turns down

M66： Toolpot turns up

M68： Mechanical arm holds tool

M69： Mechanical arm changes tool

M70： Mechanical arm turns to the original point

M74： Chip cleaner CW rotation

M75： Chip cleaner stop

M76： Chip cleaner CCW rotation

M84： Index table (or assembly) release

M85： Index table (or assembly) clamp

**Note: M68, M69 and M70 are M codes for debugging. For easier operation, some safety limit conditions are released in debugging state. Improper operation may cause danger for equipment and personnel, therefore, use them with caution！**

# 6 Magazine Function

PLC version V2.08B-5AX supports disk type manipulator magazine, in which random tool changing, tool preselection and the nearest tool selection are available. Preselection before tool changing may improve changing efficiency and shorten changing time.

## 6.1　Total Tool Number Setting of Magazine

For PLC version V2.08B-5AX, total tool number of the magazine is directly set by PC parameter #2001.

## 6.2　Tool Changing

1.　For PLC version V2.08B-5AX, tool is selected by Txx command and it is changed by M6 command in Auto mode or MDI mode.

2.　When the tool number specified is the same as the tool number of the spindle, tool changing command is ignored.

3.　When the tool number is equal to 0 or bigger than the total tool number, alarm 1003 is issued.

## 6.3　Tool Changing Procedures

1. In Auto and MDI modes, after Txx M6 command is executed, firstly the program judges whether the input tool number command complies with the specification. If it complies, perform tool selection.

2. Z axis returns to the 1st reference point. Perform spindle orientation after the spindle is stopped.

3. Magazine toolpot turns down

4.　Mechanical arm holds tools once

5.　Spindle releases the tool.

6.　The manipulator turns $180^0$ to change the tool.

7. Spindle clamps the tool.

8. The manipulator returns to the reference point.

9. Toolpot turns up.

10. Cancel the orientation and tool change is completed.

The whole tool change process is automatically completed by CNC, the user just inputs command M6　Txx for running.

### Programming for tool change

In Auto and MDI mode, tool change is completed by M06. M06 calls tool changing subprogram O9001 automatically.

Example of programming format in Auto mode is as follows:

T××(example T1)M06;  Tool selection. Call tool changing subprogram to change the tool 1 to
the spindle

T××(example T2);  Preselection of tool 2

……  ……  Machining program of the tool 1

M06;  Change the tool 2 to the spindle and send the tool 1 to the magazine

T××(example T3);  Preselection of tool 3

……  ……  Machining program of the tool 2

M06;  Change the tool 3 to the spindle and send the tool 2 to the magazine

T0;  Prepare to empty the toolpost

……  ……  Machining program of the tool 3

M06;  Send the tool 3 to the tool magazine with tool changing program

M30;  Program end

## 6.4  Precautions for Using Tool Magazine

1.  The machine and miscellaneous function can't be locked during the tool-change.

2.  The toolpot has turned down, the 2nd reference return has finished and spindle orientation
has completed are preconditions for manipulator tool-change

3.  It is necessary to check and set tool hold position again after changing system main board or
adjusting Z axis motor and zero return block. (The tool change position is on the 2nd
reference point. It is set by NC parameter P161. After adjusting the machine, the end user
can't change the set value at random. Otherwise, the magazine may be damaged!)

4.  Set NC parameter 320＝6. Otherwise, the tool magazine can not work properly.

5.  The magazine tool-change macro program should be saved in ＃O9001 program.

## 6.5  Data Setting of Tool Magazine

When the system is turned on at the first time or during the operation, maloperation or other
reasons cause tool number disorder in the magazine, which will damage the workpiece or machine
mechanical parts. Therefore, tool magazine data reset is required.

In order to change tool correctly, ensure PC parameter in the data list (DATA) are as follows:

① Press parameter in MDI mode → enter PLC data interface, and press N××××→ press input
key, and the data to be viewed is displayed. Check the following data of the data list:

2001：  Total tool number

2101：The current toolpot number, namely, the number of the tool at the tool change position

3011：(BCD code), it's decimal value should equal to the value of PC parameter 2001

4000：The number of the tool of the spindle

4001～4024：The number of tools in 1～24 toolpot (take No.24 as an example)

Perform debugging for the first time or the condition of tool disorder appears, tool adjustment is necessary at the time. The detailed procedures are as follows:

Take out all tools form the magazine, and insert tools into magazine again according to the tool list or adjust tool list according the actual conditions of the tools in the magazine (the switch of parameter and program lock should be turned on)

After the above works are finished, the system will automatically identify corresponding relationship between the number of tool in the magazine and the number of toolpot. At this time, tool adjustment is completed.

## 6.6 Tool Number Display

The spindle tool number is displayed in decimal system on the nixie tube of operation panel.

## 6.7 Tool Clamp/Release

1. The operation of tool clamp and release can only be executed when the spindle stops.

2. In manual mode, the button of tool clamp/release is pressed, the tool release signal is output; while the button is released, the tool is clamped.

3. In auto and MDI modes, the release/clamp button is invalid. The M code is used for tool release/clamp, M55, tool clamp, M54, tool release.

4. Relative PC parameters of tool clamp/release: When PC parameter 3001.3＝1, the tool release/clamp detection is valid. If there isn't tool clamp in-position signal TCLCK.I＝1, (PLC address X38.6) the command M55 doesn't end. In a similar way, if there isn't tool release in-position signal TRLCK.I＝1 (PLC address X38.5), the command M54 doesn't end either.

# 7 Tool Magazine Debugging
## 7.1 Setting and Canceling of Magazine Debugging State

Method of setting the magazine debugging state: In Auto mode, press Magazine debugging and Feed hold on the operation panel at the same time (the system enters the magazine debugging state. The information "2004 MAGAZINE DEBUGGING" appears on LCD)

Method of canceling the magazine debugging state: 1. Press reset key 2. Enter auto mode 3.Enter DNC mode

## 7.2  Parameters to be set before Tool Magazine Debugging

1.  Set PC parameter 2001 to the total tool number of the magazine

2.  Set PC parameter 2101 to turrent number in the tool change position

3.  Set PC parameter 3011 (BCD code). Its decimal value should equal to the value of PC parameter 2001.

4.  Set original values in the data list with PC parameter 4000—4024 when there are 24 tools, and with 4000—4030 when there are 30 tools.

## 7.3  Function Test in the Debugging State

1. In Manual mode, press Y zero point/Magazine debugging and Feed hold keys simultaneously to enter magazine debugging state. In magazine debugging state, press X zero point /Toolpost vertical key for toolpot down, Z zero point /Toolpot horizontal for toolpot up, 5 zero point key for toolpot CW rotation, 4 zero point/Manipulator key for manipulator jog rotation, meanwhile, press Y zero point/ Magazine debugging key for releasing interlock of tool arm rotation part. After debugging is completed, in order to prevent magazine maloperation and ensure safety, press Reset key or change to other mode from Manual mode to release debugging state.

2. In magazine debugging state, manually perform some operation to check whether the connection is right or not via input/output point diagnosis.

3. In magazine debugging state, the turrent rotates to specified tool number from retract position by command Txx (T5 or T6). Tool magazine CW/CCW rotation output signal or power line of turrent motor can be checked by observing turrent rotation direction.

## 7.4  Precautions for Tool Magazine Debugging

1. In the magazine debugging state, the operator controls the magazine position. When the operator performs debugging operation, he should avoid the hit between the magazine and machine or personnel.

# 8  Zero Return of Machine Feeding Axis

## 8.1  Automatic Hold of Each Axis Zero Return Button

In zero return mode, press X , Y , Z , 4  and  5  buttons, each axis can automatically return to the reference point. When the reference point return completes, each axis zero indicator is ON. During zero return, zero return mode is active until the reference return completes, emergency stop or reset button is pressed. Reference return direction of X axis, Y axis is set by PC3001 bit7, bit1 separately.

## 8.2  Setting Method of Zero Return Button Automatic Hold in X Axis Negative Direction

When there is magazine control function, X axis is set as zero return in negative direction. When the zero return deceleration block is installed in the machine, the direction should contrary to that of the common milling machine! (Direction of X zero return automatic hold is set by PC parameter 3001.7. NC parameter 12.0 should be set as 1 when zero return is operated in negative direction.) Setting method of zero return automatic hold in Y axis negative direction is the same as X axis.

## 8.3  Limitation of Zero Return Override

In manual zero return, the system default zero return override is 50％ which can be adjusted at real time.

# 9  Spindle Function

## 9.1  Frequency Conversion Without Gear Change or Setting NC Parameters of Servo Spindle

When the spindle matches with servo drive unit or frequency conversion motor without the mechanical gear change control, set NC parameter 0.4=0, 0.3=1, NC parameter 1.5=0, NC parameter #132=the corresponding spindle maximum speed output by the system 10V.

Command: M3  S××××；(Commanded speed)

The servo motor or frequency conversion motor positive rotation can be realized.

Command: M4  S××××；(Commanded speed)

The servo motor or frequency conversion motor negative rotation can be realized.

Command: M5 or S0 can stop the spindle rotation.

## 9.2 Spindle orientation function

When the machine is configured with the servo spindle drive unit, press Spindle orientation in manual mode, or run M19 in auto or MDI mode, the system outputs the orientation start signal into the servo drive unit, and sends the servo enable signal. The orientation completion signal is sent after the drive unit finishes the spindle orientation operation, M19 command is finished after receiving the orientation completion signal.

# 10 Handwheel

MPG default by the system is external handheld box for 983Ma-H/V. In hand wheel mode, axis selection and override signal are selected by handheld box switch, and they are connected to CN2 of machine operation panel. Phases A and B pulse signals are connected to CN2 of CUP board of the chassis, the emergency stop is serial in the emergency stop chain on the machine operation panel, refer to external MPG connection interface of *983Ma-H/V connection manual* for the connection diagram. Step width are X1=0.001mm, X10=0.01mm, X100=0.1mm.

# 11 Adjusting the Movement Axis Rapid Speed (G0 speed adjustment)

In manual mode, press Rapid button and the indicator on the system operation panel is ON, the rapid override can be selected by pressing F0, F50 and F100 keys. In Auto mode, the rapid override can be switched by pressing F0, F50 and F100 keys.

Rapid button is valid in Manual, Zero return, MDI, Auto modes, and it is invalid in the limit and magazine alarm.

# 12 Cooling Function

No matter it is Auto mode or Manual mode, press Cooling pump on the panel (PLC address X47.1), ON/OFF of cooling pump can be directly operated. Pressing the key once is ON; pressing the key again is OFF. State ON in the Manual mode can be switched into OFF by pressing M09 command in MDI mode. While M8 commands ON in MDI mode, pressing Cooling pump and M09 command can switch it into OFF.

# 13  Water Valve Punching Function

No matter the mode is Auto or Manual, as long as press Water valve punching on the panel, ON/OFF of the water valve can be directly operated. Pressing the water valve once is ON; pressing the water valve again is OFF.

# 14  Spindle Blowing

In Manual mode, when the tool is released, the spindle blowing is ON; when the tool is clamped, the spindle blowing is OFF. In Auto or MDI mode, M54 commands the spindle release, the spindle blowing output; M55 spindle commands the spindle clamp, the spindle blowing stops.

# 15  Workpiece Blowing

No matter the mode is Auto or Manual, as long as press Work piece blowing key, ON/OFF of the blowing valve can be directly operated. Pressing the blowing valve once is ON; pressing the blowing valve again is OFF. ON in Manual mode can be switched into OFF by M9 in MDI mode. M7 commands ON in Auto mode, Work piece blowing key and M9 command can switch it into OFF. This function is invalid when PC parameter 300.0=1. Y3.4 is output by specifying command M22, it is OFF by specifying M23. ON/OFF of this function can be controlled by USER4 key on the panel.

# 16  Machine Working Lamp

No matter what the working mode is, as long as press Working lamp on the panel, ON/OFF of the lamp on the machine can be directly operated. Press Working lamp once, the lamp is ON; press it again, the lamp is OFF.

# 17  Chip Cleaner

1) Chip cleaner CW rotation. No matter what the working mode is, as long as press Chip clean key, CW rotation and stop of the chip cleaner can be directly operated. Pressing the key once is output, and pressing it again, CW rotation stops. In MDI mode, M74 commands CW rotation outputting Y3.3, M75 stops output. CW rotation output is started by the manual key, M75 can stop it. M74 commands CW rotation, the manual key can also stop it anytime.

2) Chip cleaner CCW rotation. CCW rotation is only used in repairing. Commanding M76 starts CCW rotation outputting Y3.5; while use M75 or Chip clean key to stop CCW rotation.

3) Chip cleaner is inactive when PC parameter is set as 3007.0=1. Command M24 turns on

input Y3.3, command M25 turns off output. ON/OFF operation can be performed by USER1 key on the panel. Command M26 turns on output Y3.5, command M27 turns off output. ON/OFF operation can be performed by USER2 key on the panel.

## 18 Overtravel Release

When Overtravel release key is pressed, I/O unit PLC address 1.5 outputs 0V; when the key is released, 0V is cut off. The user can connect the external relay for close up because the emergency stop chain breaks due to the overtravel.

## 19 The Forth Axis Rotation Release/Clamp Control or Assembly Control

A. When the 4th axis is set as linear axis (namely, PC parameter 3002 bit 3=0), the 4th axis dose not have release/clamp function. M84/M85 commands control assembly release/clamp.

   **Control method as follows:**

   In Auto or MDI mode, command M84 outputs assembly release signal Y2.3 and closes assembly clamp signal Y2.5. Command M85 outputs assembly clamp signal Y2.5 and closes assembly release signal Y2.3. Whether check release/clamp in-position signal, it is set by PC parameter 3002 bit 4. When PC parameter 3002 bit 4 is set as 0, the in-position signal is not checked. Set PC parameter 1008, 1009 time delay as completion signal. When 3002 bit 4 is set as 1, the system detects release/ clamp in-position signal. If there is no release/clamp signal, the command M84 or M85 does not end until receiving completion signal.

   In Manual mode, press Index table release/clamp key to output assembly release signal Y2.3 and close assembly clamp signal Y2.5; press Index table release/clamp key again to output assembly clamp signal Y2.5 and close assembly release signal Y2.3.

B. When the 4th axis is set as rotation axis (namely, PC parameter 3002 bit 3=1), the 4th axis has release/clamp function.

   1) When 4th axis rotation is controlled by NC workbench (linkage, namely, PC parameter 3002 bit 2=0), release/clamp of rotation axis is controlled by M84, M85 separately.

**Control method as follows:**

In Auto mode, command M84 is specified to release index table and Y2.3 is output; command M85 is specified to clamp index table and Y2.5 is output. Release/clamp signal is output by IO unit. Whether check index table release/clamp in-position, it is set by PC parameter 3002 bit 4. When PC parameter 3002 bit 4 is set as 0, the in-position signal is not checked. Set PC parameter 1008, 1009 time delay as completion signal. When 3002 bit 4 is set as 1, the system detects release/ clamp in-position signal. If there is no release/clamp signal, the command M84 or M85 does not end until receiving completion signal.

In Manual mode, press Index table release/clamp key once, the release is output; pressing the button again, the clamp is output.

2) When the 4th axis rotation is controlled by index workbench-B (not linkage, namely, PC parameter 3002 bit 2=1), release/clamp of rotation axis is automatically controlled by NC. M84/M85 commands are invalid.

Control method as follows: when the system executes movement command, the system automatically outputs release/clamp signal Y2.3/Y2.5 and receives release/clamp input signal. When PC parameter 3002 bit 4 is set as 0, the system does not check in-position signal. Set PC parameter 1008, 1009 time delay as completion signal. When 3002 bit 4 is set as 1, the system detects release/ clamp in-position signal. If there is no release/clamp signal, the movement command does not end until receiving completion signal.

At this time, B axis can not be operated in jog/step/handwheel mode. While it can return to reference point with jog mode. When it manually returns to reference point, as long as 4 key is ON, release signal is output automatically, and the axis moves until reference return completes. The movement stops immediately by pressing reset or emergency stop key. While the clamp command is not performed, zero return is required after releasing reset or emergency stop key.

# 20　Protection Door Function

PC parameter 3004.3 can select whether the alarm occurs when the door input point X33.7 connects to the common end or disconnects to the common end. When PC parameter 3004.3 is 0, the alarm occurs when the door input point X33.7 connects to the common end. When PC parameter 3004.3 is 1, the alarm occurs when the door input point X33.7 disconnects to the common end. When PC parameter 3004.4 is set as 0, the protection door interlock function is shielded.

# 21　Lubrication

PC parameter 1003 sets the supplying oil time of automatic lubrication pump. PC parameter 1002 sets the time of stopping supplying oil of automatic lubrication pump. The setting unit: ms. Press Lubricating key on the machine panel, and the lubrication pump jog output can be realized.

# 22　List of PLC Alarms and Information

| NO. | Display in English | Chinese meaning | Alarm reasons | Solutions |
|---|---|---|---|---|
| 1000 | EMERGENCY STOP | Emergency stop | 1. Emergency stop button is pressed.<br>2. Emergency stop is broken.<br>3. Emergency stop circuit is disconnected.<br>4. System fault. | 1. Check whether the emergency stop button is pressed or not.<br>2. Change the emergency stop button.<br>3. Check whether the emergency stop circuit is disconnected, which is connected with the alarm input address X338.4.<br>4. Change the host machine. |
| 1016 | USER-DEFINED ALARM | User-defined alarm | Refer to the manual of the machine | 1. Refer to the electrical |

| | | | | |
|---|---|---|---|---|
| | | | manufacturer to find the alarm reason | appliance manual of the machine manufacturer to find the solution. |
| | | | | 2. Alarm input address X32.6: PC parameter 3003.3 can select the input point is 1 for alarm or 0 for alarm. |
| 1100 | SPINDLE ALARM | Spindle motor or drive unit alarm | 1. Spindle drive unit alarm; <br> 2. The alarm level parameter of spindle drive unit is wrong. <br> 3. CNC system PC parameter 3001.4 alarm logic selection is wrong. <br> 4. The machine external circuit is disconnected with the circuit connected with I/O unit X40.5. | 1. Solve the program of spindle drive unit alarm. <br> 2. Correctly set the spindle drive unit alarm level parameters (For example: DAP01 parameter #PA72 alarm output negate.) <br> 3. Correctly set CNC system PC parameter 3001.4 alarm logic (select 1 is for alarm or 0 for alarm) <br> 4. Check whether the machine alarm input address X40.5 is disconnected or not. |
| 1101 | SPINDLE ORIENT ERROR | Spindle orientation position wrong | 1. The time set by the spindle orientation time PC parameter 1026 is too short. <br> 2. Spindle drive unit doesn't output the orientation finish signal or the output orientation | 5. Set the proper spindle orientation limit time, PC parameter #1026 numerical value. The setting unit: ms. <br> 6. Confirm whether the spindle drive unit orientation |

| | | | finish signal isn't stable and twinkles.<br>3. The external spindle orientation mechanical position detection sensor has troubles or the correct point isn't reached during orientation. | finish signal output level is matched with CNC or not or whether the drive unit orientation position window width parameter is proper or not, such as DAP01 parameter PA56.<br>7. Check whether there is default in the spindle orientation mechanical position detection sensor or in the drive unit. |
|---|---|---|---|---|
| 1106 | SPINDLE UN&CLAMP.SWT | Spindle release and clamp in-position detection signals are mixed | 1. The release and clamp tool detection contact are mixed, there is not only the clamp in-position detection signal, but also the release in-position detection signal.<br>2. The clamp/release tool detection switch installation position is wrong or the switch is not stabled | 1. Check the release/clamp tool detection switch and connection, input address X38.5 is the tool release in-position detection, X38.6 is the tool clamp in-position detection.<br>2. Detect whether the clamp/release tool detection switch installation position is correct or whether the switch is stable. |
| 1109 | SPINDLE UN&CLAMP OVERTIME | Spindle tool release/clamp overtime | 1. The cylinder of release/clamp is lack of the air.<br>2. Spindle clamp or release in-position detection switch | 1. Load the air supply.<br>2. Change the detection switch with fault. PLC address Y0.7 is tool release |

| | | | | 3. Spindle zero speed signal doesn't connect I/O unit.<br>4. The time set by PC parameter #1023 is too short. | 3. Check whether the spindle zero speed signal X40.6 is connected with I/O unit.<br>4. The release/clamp tool time limit is properly set by PC parameter #1023. |
|---|---|---|---|---|---|
| 1110 | SPINDLE TOOL NOT CLAMP | | Alarm: The tool isn't clamped, but the spindle is started. | 1. The tool isn't clamped, but the spindle starts CW/CCW rotation<br>2. The tool isn't clamped, but the spindle orientation is started | 1. Start CW/CCW rotation after spindle is clamped<br>2. Start spindle orientation after spindle is clamped. |
| 1112 | CAN NOT RIGHTABOUT TURN | | The reverse rotation can't be operated directly during the spindle rotation | 1. When the spindle CW rotates, CCW rotation signal is input, or CCW rotation button is pushed.<br>2. When the spindle CCW rotates, CW rotation signal is input, or CW rotation button is pushed. | Operation or programming is wrong, firstly stop the spindle, and rotate the spindle in the reverse direction. |
| 1205 | Z SECOND ORIGIN ERROR | | The 2$^{nd}$ reference point of Z axis is wrong. | 1. In the process of tool changing, it detects that Z axis doesn't reach the 2$^{nd}$ reference position and is with zero point drift<br>2. The external 2$^{nd}$ reference point of Z axis mechanical | 1. Fine adjust Z axis deceleration block installation position on the machine, check the 2$^{nd}$ reference position of Z axis again, and set NC parameter #161.<br>2. Change the mechanical |

| | | | position detection sensor has troubles or the units installation is unstable.<br>3. PC parameter setting of mechanical position detection sensor is wrong | position detection sensor of the 2nd reference point in Z axis or fasten the switch unit.<br>3. The PC parameter #3005.1 should be correctly set to match the sensor type. |
|---|---|---|---|---|
| 1301 | DOOR INTERLOCK | The protection door interlock state | 1. The protection door is open.<br>2. The protection door detection circuit connected with I/O unit 32.3 is disconnected.<br>3. PC parameter #3004.3 setting is wrong. | 1. Close the protection door.<br>2. Check the protection door circuit connection of PLC address #33.7.<br>3. Check the protection door logic set by PC parameter #3004.3.<br>4. PC parameter #3004.4 can shield the protection door interlock function. |
| 1400 | COOLANT MOTOR OVER LOAD | Alarm: The cooling liquid motor overload. | 1. The water pump motor overload alarm.<br>2. PLC parameter #3002.0 alarm logic setting is wrong.<br>3. The circuit connected with I/O unit X33.3 is disconnected. | Check the diagnosis address X33.3 to check whether the water pump motor thermorelay trips or whether the air switch trips.<br>Check whether PC parameter 3002.0 alarm logic selection is correct or not.<br>Check whether the water pump motor overload alarm wire is disconnected. |

| 1403 | HY MOTOR OVER LOAD | Spindle gear change device hydraulic motor overload | The hydraulic motor overload alarm. PLC parameter #3004.2 setting is wrong The circuit connected with I/O unit X32.4 is disconnected. | 1. Check the diagnosis address X32.4 to check whether the thermorelay of hydraulic motor trips or whether the air switch trips. 2. Check whether PC parameter #3004.2 alarm logic setting is correct is not. 3. Check whether the hydraulic motor overload alarm wire is disconnected. |
| --- | --- | --- | --- | --- |
| 1405 | LUBRICATION ALARM | Alarm: The lubrication oil | 1. Alarm: Lubrication oil level is low. 2. PC parameter 3003.0 setting is wrong. 3. Lubrication alarm wire is disconnected. | 1. Check the diagnosisi address X32.2 to check whether there is lubrication oil alarm and add up some the lubrication oil. 2. Check whether PC parameter 3003.0 alarm logic selection is right or not. 3. Check whether the lubrication alarm wire is disconnected. |
| 1500 | AIR PRESSURE LOW | Alarm: Pressure is low | 1. The air valve is closed. 2. The pressure adjustment isn't proper. 3. The air valve is blocked. 4. PC parameter #3002.1 alarm | 1. Open the air valve. 2. Properly adjust the starting value of air valve pressure. 3. Ventilate the air valve. 4. Check the |

| | | | | |
|---|---|---|---|---|
| | | | logic setting is wrong. | diagnosis X33.2 to check whether the alarm logic which is set by PC parameter 3002.1 is correct or not. |
| 1607 | TOOL CHANGE OVERTIME | Tool change overtime | 1. The mechanical part is stuck.<br>2. The air switch for power supply to the manipulator motor isn't closed.<br>3. The tool-change time set by PC parameter #1025 is not proper<br>4. Tool pot down is not in-position. Orientation or the $2^{nd}$ reference return is not finished | 1. Check whether the mechanical part is stuck.<br>2. Check whether the air switch for power supply to the manipulator motor is closed and whether the power supply is normal or not.<br>3. Check whether the tool change time set by PC parameter #1025 is too short.<br>4. Check whether the toolpot down is in-position or whether orientation and the $2^{nd}$ reference return is finished |
| 1608 | MAGAZINE MOTOR OVER LOAD | Alarm: The turrent motor overload | 1. The turrent mechanical part is stuck.<br>2. The turrent motor thermorelay setting value is too small or performance isn't well.<br>3. The turrent motor air switch isn't closed.<br>4. The alarm logic set by PC parameter #3004.1 is wrong. | 1. Check turrent mechanical rotation part<br>2. Properly adjust the starting value of the thermorelay or change the thermorelay.<br>3. Close the air switch.<br>4. Check the diagnosis X32.7 to check whether PC parameter 3004.1 is correct or not. |

| 1609 | T-CODE COMMAND ERROR | Alarm: The commanded tool number is wrong | 1. The commanded tool number is wrong. The system commands T code which is greater than the total tool number<br>2. The total number isn't set by PC parameter #2001.<br>3. The system commands the tool that is not included in data | 1. Correctly input T code.<br>2. The total tool number value should be correctly set by PC parameter #2001.<br>3. Correctly set the data list |
|------|------|------|------|------|
| 1615 | MAGAZINE FR&BACK OVERTIME | Alarm: toolpot down/up overtime | 1. Lack of air<br>2. Connection is wrong<br>3. Mechanical part is stuck<br>4. Coil of solenoid valve is installed reversely or relay has troubles<br>5. The magazine advance/retraction time isn't properly set by PC parameter #1026. | 1. Load air supply<br>2. Check whether output address Y0.4 (down), Y0.5 (up) is output, and whether the connection is right.<br>3. Check whether the magazine tighten screw is removed or not.<br>4. Change the solenoid coil, or the wire, or change the advance/retraction relay.<br>5. Time should be properly set by PC parameter #1024. |
| 1620 | ARM MOTOR OVERLOAD | Manipulator motor overload | 1. The turrent is stuck<br>2. The turrent motor thermorelay setting value is too small or performance isn't well. | 1. Repair the mechanical part<br>2. Properly adjust the starting value of the thermorelay or change the thermorelay.<br>3. Close the air |

| | | | | |
|---|---|---|---|---|
| | | | 3. The air switch for the turrent motor isn't closed.<br>4. Overload alarm signal input point X32.3 is disconnected or connection is wrong | switch.<br>4. Properly connect alarm signal intput signal |
| 1802 | CHIP MOTOR OVER LOAD | Alarm: Chip cleaner motor overload | 1. The chip is stuck in the motor.<br>2. The thermorelay poor performance causes the false alarm.<br>3. The dry run overload point is too small.<br>4. The alarm logic is wrongly set by PC parameter 3004.0. | Clear the chip.<br>Replace the thermorelay.<br>Adjust the dry run overload point.<br>Check the diagnosis address 33.4 and correctly set PC parameter 3004.0. |
| 2010 | MACHINE NOT ORIGIN | Not all axes return to the reference point. | At least one axis of X, Y and Z doesn't execute the reference point return. | 1. Respectively execute the reference point return in X, Y and Z axes.<br>2. Set PC parameter 3005.3 ＝ 1 to shield the information: Not all axes return to the reference point. |
| 2012 | 4-AXIS NOT UNCLAMPED | The 4$^{th}$ axis isn't released. | The 4$^{th}$ axis is still in the clamp state and the 4$^{th}$ axis is moved manually. | 1. Release the assembly by command M84 in Manual mode and then move the 4$^{th}$ axis in MDI mode.<br>2. Set PC parameter 3003.1＝0, the 4$^{th}$ axis isn't locked during the assembly clamps. |

| | | | | (Pay attention to whether the rotation is safe after the 4th axis is clamped.) |
|---|---|---|---|---|
| 2051 | TOOL POSITION ERROR | The turrent position error | 1. The turrent doesn't rotate in-position. <br> 2. The counter breaks down. <br> 3. Tool-stop logic is wrongly set by PC parameter 3002.6. | 1. T code is executed in MDI mode to rotate the turrent. The current tool number should be reset by PC parameter #2101. (About the details, refer to the magazine debugging introduction.) <br> 2. Change the in-position detection proximity switch. <br> 3. Tool stop logic parameters should be correctly set by PC parameter 3002.6. (About the details, refer to PC parameter 3002.6 introduction. |
| 2053 | ATC&ARM NOT AT HOME | No signal that manipulator or magazine is not at original point | The system hasn't detected the original signal and reminds: <br> 1. The manipulator is not at the original point <br> 2. Connection is wrong <br> 3. Detection switch has troubles or the switch is loose | Check the diagnosis address X43.1, X43.2, X43.3 <br> 1. Return to manipulator original position <br> 2. Check the connection <br> 3. Check whether in-position switch is damaged or loose |

| 2090 | FEED OVERRIDE 0% | Feedrate override is zero. | 1. The feedrate override knob is at 0 bit.<br>2. PC parameter #1020 isn't set. | 1. The cutting override knob position can be changed.<br>2. More than 1000ms can be set by PC parameter #1020. |
|------|-----------------|---------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 2091 | MAGAZINE DEBUGGING | Magazine debugging | Magazine debugging reminding information. | Reset or change the work mode |
| 2999 | PLC   V2.08B-5AX | PLC version V2.08B-5AX | | |

## 23   Tool Change Macro Program (for reference)

```
%
：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
%
```