

Operation of NCT Vertical Machining Centres with Arm Type ATC

Changing Tools

Calling a Tool

Calling a tool takes place upon a T code:

Tnnnnnnnn

On a T code we can enter the type number of the tool on a maximum of 8 digits.

Upon the T type number the control unit starts the search for the tool.

At first it will check whether the tool with the referred type is in the spindle or in the magazine. If yes and under the same type number there are several tools in the magazine, it will hand over the place (magazine- and pot number) of the tool with the smallest but not yet expired tool life to the PLC. The PLC will rotate the magazine simultaneously with the machining process in order to get the called tool into a change position.

In case the referred T type number cannot be found neither in the magazine, nor in the spindle, the PLC will record a manual tool change.

Tool change

The change of the tool takes place upon the
M6 (or M06)

code.

In case there is a tool in the spindle loaded manually:

– the PLC will give a stop and call on the operator to take out the tool.:

Remove Tnnnnnnnn from spindle

– after this, if the incoming tool is coming from the magazine, it will put the new tool into the spindle by arm rotation,

– in case the incoming tool is not in the magazine, i.e. it has to be loaded manually, the PLC will give a stop and send a

Put Tool No. nnnnnnnn. in spindle

message to the operator, to put in the new tool. Upon the start the change terminates.

In case there is a tool in the spindle loaded from the magazine:

– if the incoming tool comes from the magazine, and the **figure code** of the tool in the spindle and that of the incoming tool **are the same**, it will exchange the two tools.

– if the incoming tool comes from the magazine, and the **figure code** of the tool in the spindle and that of the incoming tool **are not the same**, upon a T code it will search for a new pot for the returning tool. By the first arm operation it will put back the tool in the spindle into the magazine. After this, by magazine rotation it will bring the incoming tool into a change position and bring it in by the second arm operation.

– if the incoming tool is loaded manually, upon the T code it will search for an empty pot for the returning tool. First by an arm operation it will put the returning tool into the magazine, then it will give a stop, then send the

Put Tool No. nnnnnnnn. in spindle

message to the operator, to put in the new tool. Upon the start the change terminates.

Emptying of the spindle

The emptying of the spindle takes place upon the

T0 M6

block.

In case there is a tool in the spindle loaded manually:

– upon M6 it will send a message to the operator, to take out the tool:

Remove Tnnnnnnnn from spindle

In case there is a tool in the spindle loaded from the magazine:

– Upon T0 it will search for an empty pot for the returning tool, then upon M6 it will put the tool back into the magazine by an arm operation.

Execution order of T and M6 codes. Special cases.

In case T and M6 codes are specified in the same block

Tnnnnnnnn M6

the PLC will execute first the T than the M6 function.

If the tool is coming from the magazine, it is advisable for the T code to precede the M6 in the program by several blocks, in order to be able to rotate the magazine simultaneously with the machining process to a change position, by the time the execution of M6 starts. The execution of M6 always waits for the end of magazine rotation.

For example:

```
T1001 M6      (change of tool T1001)
T1002         (calling of T1002)
...          (machining, by tool T1001, and in the meantime, magazine
...          rotation to tool T1002)
...
...
...
M6           (change of tool T1002)
T1003         (calling of T1003)
...
```

The execution of the M6 code takes place always after the movement programmed in the block, if we programmed also an interpolation in the given block.

The T and M6 execution precedes the execution of all functions.

After the execution of M6 the PLC will set the spindle into M5 state.

If several T codes are written in the program after each other, without M6, it will always change the tool belonging to the last T code for M6. For example:

```
T1
T2530
T108
M6           (tool T108 is changed)
```

In case in the program we write several M6s after each other, only those ones will be effective which are preceded by a T code. For example:

```
T54
M6           (tool T54 is changed)
M6           (nothing happens)
M6           (nothing happens)
```

Tool change in manual modes

In manual modes (**Jog, Incremental jog, Handwheel**) it is not mandatory (but it is possible) to program an M6, and the tool change takes place also upon a T code. For example: upon the

T1016

code it will change the tool.

Manual operations during the execution of M6

If the tool has to be taken out from or loaded into the spindle manually, before issuing the message, the PLC will generate a STOP status. Till the STOP lamp is on and the message is displayed on the screen, even in Automatic or Manual Data Input mode we can push the Jog or Handwheel mode select buttons:

- upon it the lamp of Jog or Handwheel mode and that of the Z jog buttons starts to blink and
- axis Z can be moved according to the selected mode, by the jog buttons or the handwheel, in order to bring the spindle into a height suitable for manual takeout or input.

M62: T code=magazine number+pot number

If we program an M62 code besides the T code:

M62 Tiiiikkkk

the control unit will handle the T code as a reference to a **direct tool place (magazine+pot)**:

iiii: the number of the magazine we refer to

kkkk: the pot number of **iiii** magazine.

The leading zeros can be omitted. It will interpret the 8 digits that can be entered on the address T, as 2 pcs of four-digit groups: the upper 4 digits will mean the magazine number, and the lower 4 digits will mean the pot number.

Meaning of the T100001 code:

magazine number: 10 (spindle magazine)

pot number: 1 (pot No. 1, the spindle magazine has only one pot)

Meaning of the T10014 code:

magazine number: 1 (tool magazine)

pot number: 14 (pot No. 14)

After the call it will bring the pot of the referred magazine into a change position.

If the pot of the referred magazine is not empty, upon M6 it will change the tool in the pot.

If the pot is empty, nothing happens.

Registration of a tool in the table, loading a tool into the magazine through the spindle

We can register a tool in any of the manual modes (**Jog, Incremental jog, Handwheel**) in the tool management table, respectively, we can load a tool into the magazine through the spindle. Switch on the registration mode by pushing the **T reg button** on the control panel.

Enter the type number of the tool to be registered into a single block:

Tnnnnnnnnn

(M6 can be omitted).

Of course we can register several tools with the same type number in the magazine if the tools take place in the tool life management.

The steps of registration are the following:

- after starting the block containing T code the PLC will give a stop and ask the operator whether he would like to register the tool:

Do you want to register tool Tnnnn? (Yes: Start/No: Reset)

- Upon the Start the tool change will start, and upon pushing Reset the process will stop.
- If we selected the registration, it will have the returning tool taken out from the spindle manually, or put it back into the magazine, and it will have the tool - determined by the T code - put manually into the spindle,

- the PLC will register the tool T into the tool management table into the spindle magazine No. 10 and pot No. 1.
- it will give a stop, then it will send the message
Fill in coloumns tool info and figure No.
- The operator will fill in manually the tool info and figure number columns in the table. If the tool is too large, in the figure number table the settings belonging to the figure code shall be recorded.
- Upon the Start the PLC will check whether we filled in the above columns correctly or not.
- If the operator specified data which cannot be interpreted, such as
the tool is invalid (U), or
the tool is too large (L), but the figure number = 0, or
the tool has a normal size (N), but the figure number is not 0
upon the Start the PLC will give a stop and write out again the
Fill in coloumns tool info and figure No.
message.
- If we filled it in correctly, the registration will continue. The PLC will check whether for the tool with the given figure number there is an empty place in the magazine or not. If there is, the registration will be completed. If there isn't, the PLC will delete the registration from the table, give a stop and write out the
No empty place, registration cancelled
message. Upon the Start the process will terminate.

The tool registered in this way will get into the magazine either at the registration of the next tool, or upon the next tool change (T M6).

If we want to get the tool registered in this way into a given position of the magazine after the registration, we have to rotate the magazine by the M62 Tiiiikkkk command to an empty pot. In case of an unsuccessful registration, the tool will be manually taken out from the spindle at the next registration or upon the next tool change (T M6).

Deletion of a tool from the table, removing a tool from the magazine through the spindle

We can delete a tool in any of the manual modes (**Jog, Incremental jog, Handwheel**) from the tool management table, respectively, we can remove a tool from the magazine through the spindle. Switch on the tool deletion mode by pushing the **T del button** on the control panel. We determine the place (i.e. the magazine number and pot number) of the tool to be deleted by entering a single block, together with an M62 code:

M62 Tiiiikkkk

(M6 can be omitted). *If we omit the M62 code, the PLC will not execute a tool deletion but a tool change.*

- After starting the T code the PLC will give a stop and ask the operator whether he would like to delete the tool or not:
Do you want to delete tool Tnnnn? (Yes: Start/No: Reset)
- Upon the Start the tool change will start, and upon pushing Reset the process will stop.
- If we selected the deletion (Start), it will have the returning tool taken out from the spindle manually, or put it back into the magazine, and it will change the tool - determined by the M62 T code - into the spindle,
- the PLC will delete the tool from the tool management table
- then it will give a stop and send the
Remove Tnnnnn from spindle
message.

By this the process is completed.

Messages of tool management

Interrupted tool change

If the tool change process was interrupted, either due to an error, or upon the reset button or due to power failure, upon the Machine on or Start button the control unit will send the

Tool change interrupted. Push !T in manual mode.

message.

Before we push the !T button, we have to ensure that the tool can be removed from the spindle! In such case, by entering into some of the manual modes (**Jog, Incremental jog, Handwheel**) upon pushing the !T button the control unit will have the tool taken out from the spindle and delete it from the table.

After this we have to review the tool management table, and correct it if necessary, or register again the tool taken out.

Message during the execution of T tool function

If for all tools with the same type number, called on

Tnnnnnnnn

address, it is true that their tool life has expired, the PLC will give a stop and send the

Life of tool group Tnnnnnnnn has expired

message. The operator can react to this in two different ways:

- Upon the Start it releases the machining, but at this time it has to know that it is going to cut by a tool the life of which has expired.
- The operator changes into some of the manual modes (**Jog, Incremental jog, Handwheel**, it interrupts the machining process), switches to the tool deletion **T del** mode on and removes from the magazine and table the tools with expired tool lives. Afterwards, by switching to **T reg** mode the operator will load new tools into the magazine and register them in the table with the same type number. Machining can be continued after filling in the tool offsets.

Notice life message during machining

If during the machining, the difference between the Tool life and Tool life counter, set in the tool management table for the tool participating in the machining, reaches the value of the Notice life value, the control unit will warn the operator with a

Tool life of T will shortly expire

message that he should prepare for a tool change.

If we set the TMU bit of the 2900 Tool M. Config parameter to 1, the warning relates to the total tool life of the tool group.

During the message the machining will continue, and the message can be deleted by the delete button.

Message during machining, if the life of the tool in the spindle has expired

If during machining the life of the tool machining has expired, the PLC switches into block by block mode, and at the end of the block it will issue a

Life of tool Tnnnnnnnn in spindle has expired

message. Upon the Start, the machining will continue, but the control unit will remain in block by block mode and in the stop state it will repeatedly write out the message again.

To Do: by interrupting the machining, in a manual mode the operator should issue a single block, a new tool - belonging into the same group - shall be changed, then by returning back to automatic mode, the machining can be continued after filling in the tool offsets.

Message during machining, if the life of the tool group in the spindle has expired

If during the machining the tool life of the tool group (the group of tools with the same type numbers) has expired, the PLC switches into block by block mode, and at the end of the block it will issue a

Life of tool group Tnnnnnnnn has expired

message. Upon the Start, the machining will continue, but the control unit will remain in block by block mode and in the stop state it will repeatedly write out the message again.

To Do: by interrupting the machining, in a manual mode, the operator should switch the tool deletion T del mode on and remove the tools with expired tool lives from the magazine and the table. Afterwards, by switching to T reg mode the operator should load new tools with the same type number into the magazine and register them in the table. Machining can be continued after filling in the tool offsets.

Enabling/Canceling the tool life counter

From a part program, the tool life counter can be cancelled by the

M88

code. From a part program, the tool life counter can be enabled by the

M89

code.

After the power-on, the default state is

M89

i.e. the tool life counter is enabled.

The tool life counter can be enabled or disabled also by a button.

If the lamp of the button is on, the tool life counter is cancelled, whether we switched it off by a button or by M88 from a program.

M88 state can be revised, i.e. the tool life counter can be enabled by the button. Now the lamp of the button starts to blink.

Functions and the order of their execution

1 Tool call: T code

Case A: Tool preparation by a reference to T type code:

The tool preparation takes place upon a T code:

Tnnnnnnnn

On a T code we can enter the type number of the tool on a maximum of 8 digits. First it will call the tool with the smallest but not yet expired tool life. In case in the tool management table there is no tool with such a type number, the tool will be put in manually.

Case B: Tool preparation by a reference to M62 T code:

The tool preparation calls the tool located in the magazine and pot determined on the T code:

Tiiiikkkk

iiii: the number of the magazine we refer to

kkkk: the pot number of iiiii magazine.

2 Tool change: M6

Changes the tool prepared.

3 Range change: to an S code, or M11, ..., M18

Case A: Range change to an S code:

In case there is no overlap between the ranges of the spindle and the value of the parameter N1201 PLC Bits1 bit

N_P10=1

the range change will take place to an S code.

Case B: Range change to an M code:

In case there is an overlap between the ranges of the spindle or the value of the parameter N1201 PLC Bits1 bit

N_P10=0

the range change will take place to M11, ..., M18 code.

4 Spindle management functions

Functions to be executed, by indicating the related spindles:

M3: spindle rotation CW

M4: spindle rotation CCW

M5: spindle stop

M19: spindle orientation

M24: position loop closure without searching for the zero pulse

5 Execution of Code S

Code of the spindle speed.

Its execution is parallel to the spindle rotation if M3 or M4 has been programmed together with S function.

6 Coolants on/off

The PLC is able to switch on and off 4 different coolants by 4 different M code pairs:

M8: coolant on,

M9: coolant off,

M108: coolant through spindle on,

M109: coolant through spindle off,

M208: air coolant on,

M209: air coolant off,

M308: water curtain on,

M309: water curtain off,

The switch-on and -off of the coolants takes place simultaneously at the same time, provided that we wrote the codes into the same block. For example: upon the

N120 M8 M108 M208 M308

Of course we can combine the switch-offs and switch-ons in a block, too:

N210 M8 M109 M209 M308

7 Switch-on and switch-off of probes

The PLC is able to switch on and off two probes by 2 different M code pairs:

M80: workpiece setter on

M81: workpiece setter off

M82: tool setter on

M83: tool setter off

The switch-on and -off of the probes takes place simultaneously at the same time, after the execution of coolant functions, provided that we wrote the codes into the same block. For example: upon the

N120 M9 M109 M80 M82

Of course we can combine the switch-offs and switch-ons in a block, too:

N210 M80 M83

8 Chip conveyor cycle

It starts the operation of the chip conveyor cycle and after the time set in seconds on the PLC_DWord10 parameter lapses, it will stop it automatically.

M64: Chip conveyor cycle

9 Washer

It carries out the cleaning of the bed and the workpiece.

M67: washer on

M68: washer off

10 Starting and stopping the interval meter

We can view the time elapsed between the issuance of codes M84 and M85 in the Settings menu on the Timers/Counters screen, next to the Timer title.

M84: start interval timer,

M85: stop interval timer.

After power-on, the default state is

M85

i.e. the timer is switched off.

11 Cutting block feed enable with spindle in standstill

M86: cutting block feed enable with spindle rotating (default),

M87: cutting block feed enable with spindle in standstill.

After power-on, the default state is

M86

i. e. feed is enabled only with spindle rotating.

12 Cancelling of life counter of tool in spindle

M88: cancelling of life counter of tool in spindle

M89: enabling of life counter of tool in spindle

After power-on, the default state is

M89

i. e. life counter is enabled.

13 Switching on/off automatic clamping of axes

M400: switch on automatic clamping of axis A

M401: switch off automatic clamping of axis A

M500: switch on automatic clamping of axis C

M501: switch off automatic clamping of axis C

After power-on, the default state is

M400 and M500

i. e. automatic clamping of axes are on.

14 Program control codes

M0: programmed stop

M1: conditional stop

M2, M30: program end: stops the spindle and turns off the coolants and washer.

Switches for conditional block skip

1 Conditional block skip switch on the control panel: /1, or /

It is operated by the Conditional block skip switch on the control panel.

The blocks beginning with /, or /1 will be skipped, if the lamp of the button is on.

The blocks beginning with /, or /1 will be executed, if the lamp of the button is off.

2 Conditional block skip switches on the PLC function buttons

/2, /3: If the lamp on the PLC function buttons is on, blocks beginning with /2 or /3 will be skipped.

3 End of the series switch: /8

The block following **/8** will be skipped if the workpiece counter has not reached yet the set value.

The block following **/8** will be executed in case the workpiece counter has reached the value set in advance.

Indexing of spindle S

It is possible to index, i.e. position the spindle after the closure of position control loop (after the execution of M19 or M24 function). For example the command series

M19
CS120

orientates the spindle then rotates it to the 120-degree position.

Series ready message, night mode, automatic power-off of the machine

We can set an M code, to which the workpiece counter shall be increased, on the N2305 Part Count M parameter.

These can be for example M30 or M99, but we can set different codes, too.

In case the workpiece counter has reached the number of pieces set in advance, the control unit will issue a

Workpiece series ready

message.

If the control unit is switched into night mode and the series is ready, the control unit will stop the machining process and issue an emergency stop.

If the switch is built out on the machine, it will power-off the whole machine.

In the night mode it issues an emergency state, or optionally switches the power off if the control unit is in an error state for a period longer than 5 minutes.

Parameters setting the operation of the PLC

PLC Constants

N_P00=PREV_1=1: Prepositioning of magazin required

N_P01=M_BID=1: Magazine rotates in both directions

N_P02=M_NEG=1: Direction of rotation if magazine does not rotate in both directions

N_P04=OVRD_30: Override switch has 30 positions

N_P05=OVRD_ANA=1: Override from analogue pot

N_P06=NO_OILCLR=1: No oil cooler in spindle

N_P07=N_FOOLPRF=1: tool change not foolproof

N_P10=S1RNG=1: S1 spindle range change by S code

N_P17=TLNR=1: Tool life messages are not needed

N_P20=W_PULSE=1: workpiece touch probe switched by pulse

N_P21=T_PULSE=1: tool touch probe switched by pulse

N_P22=WT_EXL=1: Tool and workpiece touch probe can not be switched on simultaneously

N_P23=WPS_AUT=1: workpiece touch probe switch on, off automatically

N_P24=TLS_AUT=1: tool touch probe switch on, off automatically

N_P25=WPS_ROT=1: workpiece touch probe switched by spindle rotation

N_P33=A_CLMP=1: "A" axis can be clamped

N_P34=C_CLMP=1: C axis can be clamped

PLC DWord1 (N_PDW1): MAGAZINE: Number of tool pots in magazine

PLC DWord2 (N_PDW1+1): TREFPOS: Pot number of reference point in magazine

PLC DWord6 (N_PDW1+5): LUB_PAUSE: Pause between lubrication cycles [2+min]

PLC DWord7 (N_PDW1+6): LUB_TO: Slide lubrication timeout [5+sec]

PLC DWord8 (N_PDW1+7): LUB_KEEP: Lubrication keeping time after pressure build-up [2+sec]

PLC DWord10 (N_PDW1+9): CP_CNV_DLY: Chip conveyor working interval [5+sec]

PLC DWord11 (N_PDW1+10): S1_FAN_DLY: Spindle fan off delay [5+sec]

PLC_DWORD12 (N_PDW1+11): CLN_AIR_ON: Taper cleaning interval [2+sec]

PLC_DWORD13 (N_PDW1+12): 1. coolant on time [1+sec]

PLC_DWORD14 (N_PDW1+13): 2. coolant on time [1+sec]

PLC_DWORD15 (N_PDW1+14): 3. coolant on time [1+sec]

PLC_DWORD16 (N_PDW1+15): 4. coolant on time [1+sec]

PLC_DWORD17(N_PDW1+16): Workpiece touch probe on/off pulse width [30+msec]

PLC_DWORD18(N_PDW1+17): Tool touch probe on/off pulse width [30+msec]

PLC_DWORD19(N_PDW1+18): Tool number of workpiece touch probe

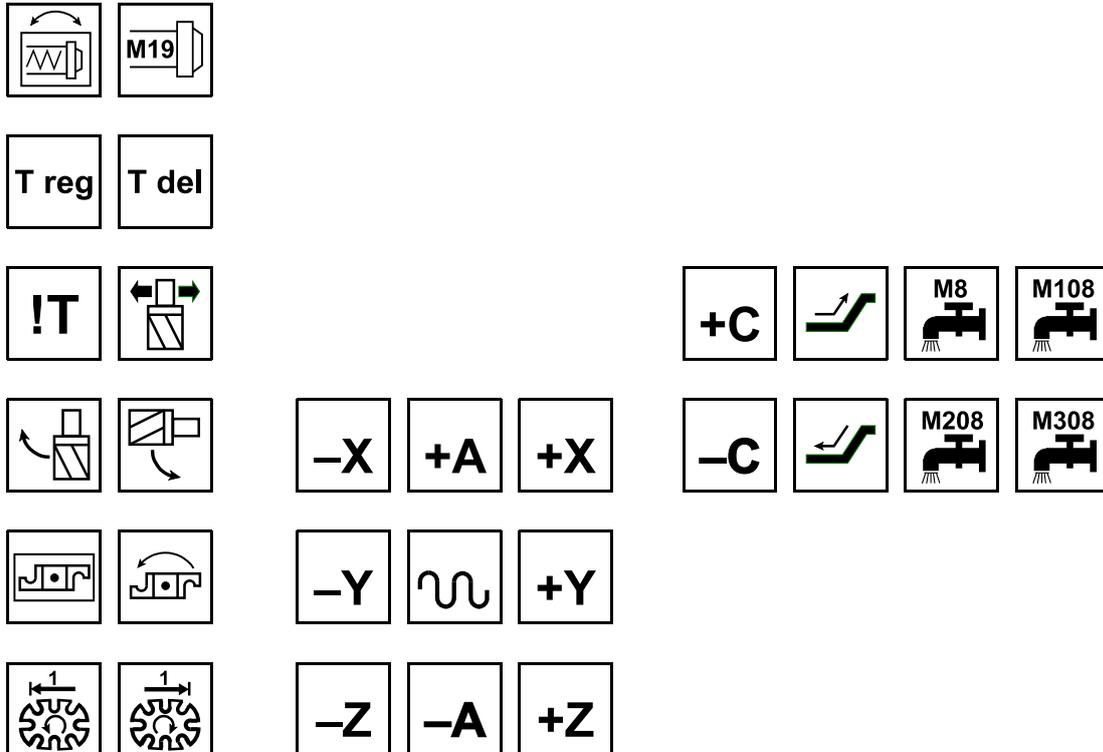
PLC_DWORD20(N_PDW1+19): Spindle speed of switch on of workpiece touch probe

Tool setter danger zone settings

Position Switches parameters:

- N1102 SW2 Axis Number=1 Tool setter X axis switch
- N1103 SW3 Axis Number=2 Tool setter Y axis switch
- N1134 SW2 Min Pos: X axis zone negative position
- N1135 SW3 Min Pos: Y axis zone negative position
- N1166 SW2 Max Pos: X axis zone positive position
- N1167 SW3 Max Pos: Y axis zone positive position

Optional buttons of the control panel of machines with arm type ATC



Spindle jog.

Can be switched on in Jog, Incremental jog or Handwheel mode.

By keeping the M3, respectively, M4 buttons pushed, the spindle is going to rotate slowly in the appropriate direction. By releasing button M3 or M4, the spindle will stop.



Switch-on and switch-off of spindle orientation .

Can be used on in Jog, Incremental jog or Handwheel mode.

If the spindle is not oriented, it will be oriented, or if it is oriented, it will switch the orientation off.



Registration of tools.

In Jog, Incremental jog or Handwheel mode, by pushing the button, it will enter into the tool registration mode.



Deletion of tools.

In Jog, Incremental jog or Handwheel mode, by pushing the button, it will enter into the tool deletion mode.



Tool change interrupted.

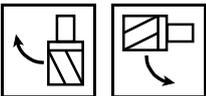
If the tool change was interrupted, or if the PLC variables stored in non-volatile RAM area has become faulty, the lamp of the button will blink. In Jog, Incremental jog or Handwheel mode, by pushing the button, it will have the tool taken out from the spindle by the operator and it will delete the tool from the tool management table.

Afterwards the tool management tables needs to be checked!



Tool unclamped lamp, tool clamp button.

In case the lamp of the button is on, the tool is unclamped. In certain error states, the tool becomes clamped upon the button. Tool can be never be unclamped by the button.



Tool pot up (horizontal), tool pot down (vertical) buttons.

The lamps of the buttons indicate that the tool pot is flapped up or down. In Jog, Incremental jog or Handwheel mode, by pushing the respective button, it will flap the pot into the selected direction. In case of a pot flapping error the operation of buttons are enabled.



Arm rotation mode button

The lamp of the button is on if

- Jog, Incremental jog or Handwheel mode is set,
- and the tool is not clamped and axis Z is on the positive stroke limit,
- or the spindle is oriented and axis Z is in change position.

In case in a manual mode we push the button, the PLC will send a message what should be done in order to enable the arm rotation.

In case the lamp of the button is on, the arm rotation button is enabled.

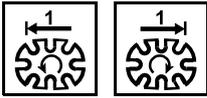


Arm rotation button

If the lamp of the *Arm rotation mode* is on, upon pushing the button the arm will step forward one operation. These are the following:

- grabbing of the tool
- tool change
- returning into basic (normal) position.

In case the lamp of the button is on, the arm is in the basic (normal) position. In any other case the lamp is blinking.



Magazine rotation buttons

The lamp of the buttons is on if the magazine rotates in the appropriate direction.

If on the magazine there is a rotation command, but the magazine cannot be rotated, the lamps of the buttons are blinking.

If Jog, Incremental jog or Handwheel mode is set, upon pushing the button, the magazine will step one position in the selected direction. If we keep the button pushed, the magazine is going to rotate continuously.



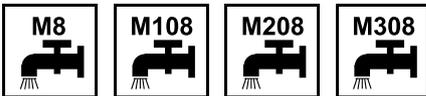
Chip conveyor forward

Upon pushing the button the chip conveyor will start. It will stop if we push again the button. The lamp of the button is on if the chip conveyor is moving forward.



Chip conveyor backward

If the chip stucked in and we push the button, the chip conveyor will move backwards. It will move backwards until we keep the button pushed.



Coolant buttons

M8: coolant button,

M108: coolant through spindle button,

M208: air coolant button,

M308: water curtain button,

Upon pushing the button, the respective coolant will switch on, and upon its repeated pushing it will switch off.

The lamp of the button is on if the coolant is flowing.

If the program switched on the coolant by an M function, but we switched it off by a button, the lamp of the button is blinking.

Operation of the PLC function buttons

F13 T BROKEN

Upon the button, it will set the status of the tool in the spindle to “broken” in the tool management table.

F14 TLC CANCEL

Tool life counter cancel button. Its effect is the same as that of M88, M89 functions. Upon pushing the button, it will cancel the tool life counter for the tool in the spindle, and it will enable it upon its repeated pushing.

If the lamp of the button is on, the tool life counter is cancelled.

If the tool life counter was switched off from a part program by the M88 function, but we switched it back by a button, the lamp of the button is going to blink.

F17 NIGHT MODE

By this button we can switch on or off the night mode.

If the lamp of the button is on, the control unit is in night mode.

F18 F HNDL

A special test mode. Upon pushing it the feed from handwheel function is switched on. In such case the program will go around the path of the tool upon the impact of the handwheel's rotation. We can switch on simultaneously the function lock button, as well.

F19 A CLAMP

In Jog, Incremental jog or Handwheel mode, upon pushing the button we can release the clamping of axis A, respectively, upon its repeated pushing we can clamp the axis.

If the lamp of the button is on, axis A is clamped.

F20 C CLAMP

In Jog, Incremental jog or Handwheel mode, upon pushing the button we can release the clamping of axis C, respectively, upon its repeated pushing we can clamp the axis.

If the lamp of the button is on, axis C is clamped.

F21 WASH DOWN

The button for switching on or off the washer. Its effect is the same as that of M67, M68 functions. Upon pushing the button, the button will switch on washer, and upon its repeated pushing it will switch it off.

The lamp of the button indicates the switched-on status of the washer.

F22 WATER GUN

It enables the use of the water gun in the opened state of the door.

If the lamp of the button is on, the water gun is enabled.

F23 LUBRICATION

Upon pushing the button, the control unit executes a lubrication cycle on the machine.

The lamp of the button is on if the lubrication pump is operating.

F25 TLS ON

In Jog, Incremental jog or Handwheel mode, upon pushing the button we can switch on or off the tool setter that can be switched automatically.

The lamp of the button is on if an automatic tool setter is switched on, or if a simple tool setter is connected.

F26 WPS ON

In Jog, Incremental jog or Handwheel mode, upon pushing the button we can switch on or off the workpiece setter that can be switched automatically.

The lamp of the button is on if an automatic workpiece setter is switched on, or if a simple workpiece setter is connected.

F28 HOB. T. RETRACT

If the G81.8 Electronic Gear Box function is switched on and if we push the hobbing tool retract button, the hob will be retracted from the cog on the axis determined in the Electronic Gear Box parameter group.

F29 /2, F30 /3

The second and third conditional block skip switch. Upon pushing the button, the button will switch on, and upon its repeated pushing it will switch off.

In case the lamp of the button is on, during the execution of the program it will skip blocks starting with /2, respectively, /3.

Messages of the PLC program

Upon the error messages sent by the PLC the control unit takes up the stop state. The error can be deleted by the cancel button. After the deletion of the error, the message “Restart with START button!” appears. Upon the START button the PLC tries to execute the function again.

If on the display we can see a message which can be eliminated by using any of the buttons, the PLC will enable the operation of the given button or group of buttons. In such case, before the deletion of the error state we can try to eliminate the error by using the buttons, then deleting the message by the delete button.

For example, if we receive the message “Tool pot isn't in change position”, we can try to bring the pot into a flapped down (vertical) position. After this we have to delete the error and after the message “Restart with the START button!” push the Start button.

```
001 $0 Change Gear Range No.{#0:F0}
002 $1 Spindle Fluctuation Error
003 $1 Spindle Acc/Dec Error
004 $1 Spindle Orientation Error
005 $0 Drive A not Ready
006 $0 Start Please
007 $1 Spindle on Error
008 $1 Spindle Drive not Ready
009 $1 Spindle off Error
010 $0 Put Tool No.{#0:F0}in spindle
011 $0 Emergency Stop Button not Released
012 $1 Emergency Circuit Error
013 $1 Interface 24VDC Power Supply Error
014 $1 Drive X not Ready
015 $1 Drive Y not Ready
016 $1 Drive Z not Ready
017 $1 Drive C not Ready
018 $0 Just After Release Tunrs on!
019 $0 External Handwheel not in NC Position!
020 $1 Spindle Stop Error
021 $1 Restart by Start Button!
022 $0 Tool Code Error!
023 $0 Magazine Reference Error
024 $0 Magazine Prepositioning Error
025 $0 Magazine Positioning Overtime
026 $0 Remove T{#0:F0} from spindle
```

027 \$0 Do you want to register tool T{#0:F0}? (Yes: Start/No: Reset)
 028 \$0 Do you want to delete tool T{#0:F0}? (Yes: Start/No: Reset)
 029 \$0 Spindle S{#0:F0} on! Last rotation code M03
 030 \$0 Spindle S{#0:F0} on! Last rotation code M04
 031 \$0
 032 \$0 Spindle error S{#0:F0}
 036 \$0 Loop closing error on spindle S{#0:F0}
 037 \$0 Spindle S not oriented
 038 \$0 Magazine not in position
 039 \$0 Tool pot isn't in change position
 040 \$0 Tool pot isn't in basic position
 041 \$0 Arm isn't in basic position
 042 \$0 Pot up timeout
 043 \$0 Pot down timeout
 044 \$0 Arm stuck
 045 \$0 Arm operation timeout
 046 \$0 Tool clamp timeout
 047 \$0 Tool unclamp timeout
 048 \$0 Ti ti ta error
 049 \$0 Program T function to unclamp tool!
 050 \$0 Position control loop closed on spindle S{#0:F0}
 051 \$0 Fill in coloumns tool info and figure No.
 052 \$0 No empty place, registration cancelled
 053 \$0 Magazine/pot number specification error on address T
 054 \$0 Life of tool group T{#0:F0} has expired
 055 \$0 Life of tool T{#0:F0} in spindle has expired
 056 \$0 Tool life of T will shortly expire
 057 \$0 1st empty pot search error in T. Error code: {#0:F0}
 058 \$0 1st figure No. read error inT. Error code: {#0:F0}
 059 \$0 2nd figure No. read error inT. Error code: {#0:F0}
 060 \$0 2nd empty pot search error in T. Error code: {#0:F0}
 061 \$0 Write error in tool registration. Error code: {#0:F0}
 062 \$0 Read error in tool registration. Error code: {#0:F0}
 063 \$0 Empty pot search error in tool registration. Error code: {#0:F0}
 064 \$0 Delete error in tool registration. Error code: {#0:F0}
 065 \$0 Delete error in tool deletion. Error code: {#0:F0}
 066 \$0 Data swap error in M6. Error code: {#0:F0}
 067 \$0 No empty pot for returning tool!
 068 \$0 Tool change interrupted. Push !T in manual mode.
 069 \$0 Tool management table is full!
 070 \$0 Lubrication pressure falt
 071 \$0 Lubrication oil level low
 072 \$0 Tool not clamped
 073 \$0 Tool not unclamped
 074 \$0 Axis Z not on change position
 075 \$0 Z axis not on positive overtravel position
 080 \$0 Power supply error
 081 \$0 Motor protection switch fault
 082 \$0 Air pressure fault
 083 \$0 Phase error arisen
 084 \$0 Cooler not ready

086 \$0 Door open
089 \$0 Battery fault
090 \$0 Workpiece series ready
091 \$0 Night mode on
092 \$0 Night mode off
093 \$0 Error arisen by night. See history!
094 \$0 Turn off the tool setter
095 \$0 Turn off the workpiece setter
096 \$0 Workpiece setter on fault
097 \$0 Workpiece setter off fault
098 \$0 Tool setter on fault
099 \$0 Tool setter off fault
105 \$0 Magazine not in position needed for return tool (reset)
106 \$0 Tool coming from magazine not in change position (reset)
107 \$0 M3, M4 forbidden. Probe in spindle {#0:F0}
108 \$0 Stylus in contact
110 \$0 Axis A on error
111 \$0 Axis A off error
112 \$0 Axis A clamp error
113 \$0 Axis A unclamp error
114 \$0 Axis C on error
115 \$0 Axis C off error
116 \$0 Axis C clamp error
117 \$0 Axis C unclamp error
120 \$0 Magazine position signal failure
121 \$0 Tool change data write error. Code: {#0:F0}
122 \$0 Tool change data read error. Code: {#0:F0}
123 \$0 Turn off data write error. Code: {#0:F0}
124 \$0 Turn off data read error. Code: {#0:F0}