INTEGRATION MANUAL

Adv 400 Integration Manual

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DELTA TAU
Data Systems, Inc.
NEW IDEAS IN MOTION ...

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REVISION HISTORY

REV.	DESCRIPTION	DATE	CHG	APPVD
1	NEW MANUAL CREATION – PRELIMINARY	12/20/04	N/A	N/A
2	UPGRADE FROM PRELIM TO FULL RELEASE	11/02/07	CP	VB

Table of Contents

INTRODUCTION

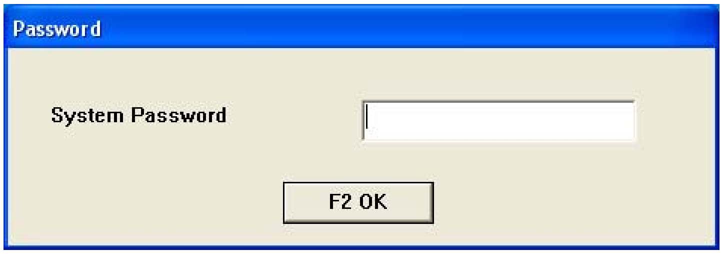
The Adv 400 is a flexible CNC system able to run different types of Milling or Lathe machines.

This manual describes the different options for setting the CNC controller to a dedicated machine:

- Setting machine and axis specifications
- Tuning the axis
- Writing custom M-codes
- Writing tool changer code

Passwords

The system contains three levels of use, protected with passwords. The system password must be entered every time the system is started. It also can be called at any time from the File menu.



User Level

If a password is not entered (F2 is pressed instead), the system will be at machine User level. The User level homes the axis, moves the axis manually and runs the present part program.

Manager Level

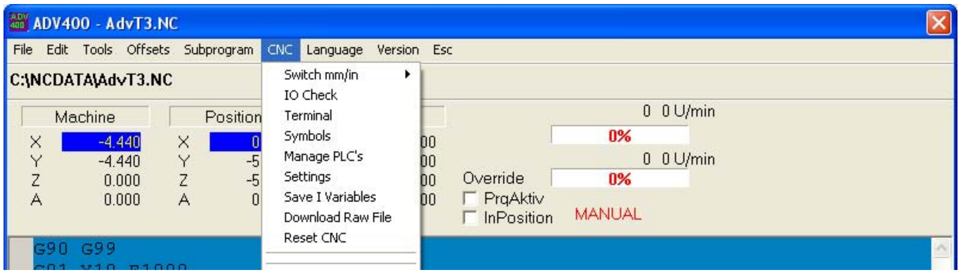
If the first password (**400USER**) is entered, the system will be at machine Manager level. This level permits modification of the part program and accesses the different menus for managing the production (Tool menu, Work Offset menu, subprograms, etc.).

Integration Level

If the second password (**400MC**) is entered, the system will be at machine Integration level. This level accesses all menus to perform the machine integration (PLCs, tuning, etc.). This level must be used for the machine integration. It is at this level that the password choices are given to the machine operator.

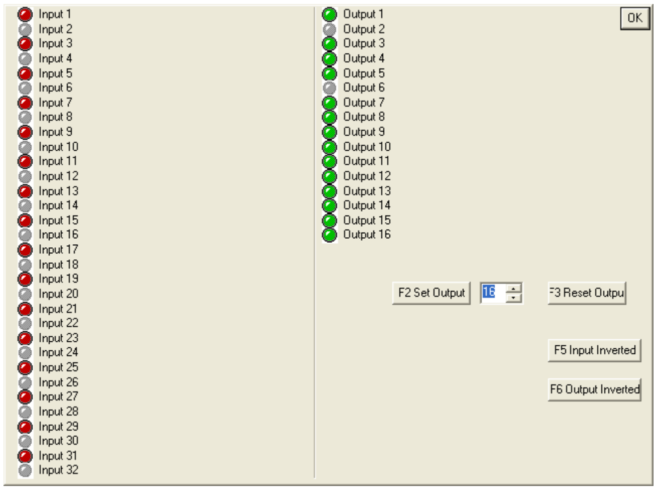
Integration Menu

On the Menu bar, the CNC menu accesses the different configuration menus.

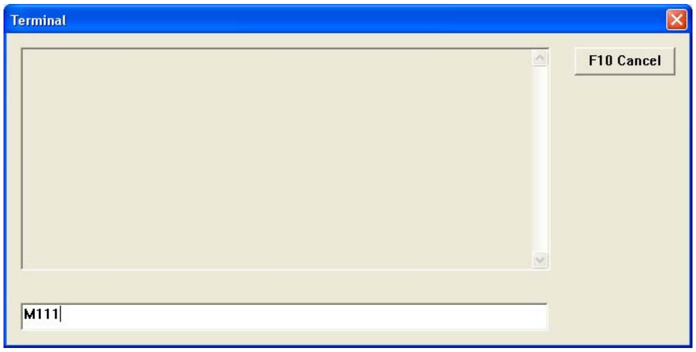


This menu gives access to different tools:

- **Switch mm/in** designates the CNC system to use millimeters or inches.
- **IO-check** shows the digital inputs and outputs state.



- **Terminal** sends commands to the CNC controller.



```
M111
```

The terminal function is used for checks and debugging. The commands sent here are the motion controller commands.

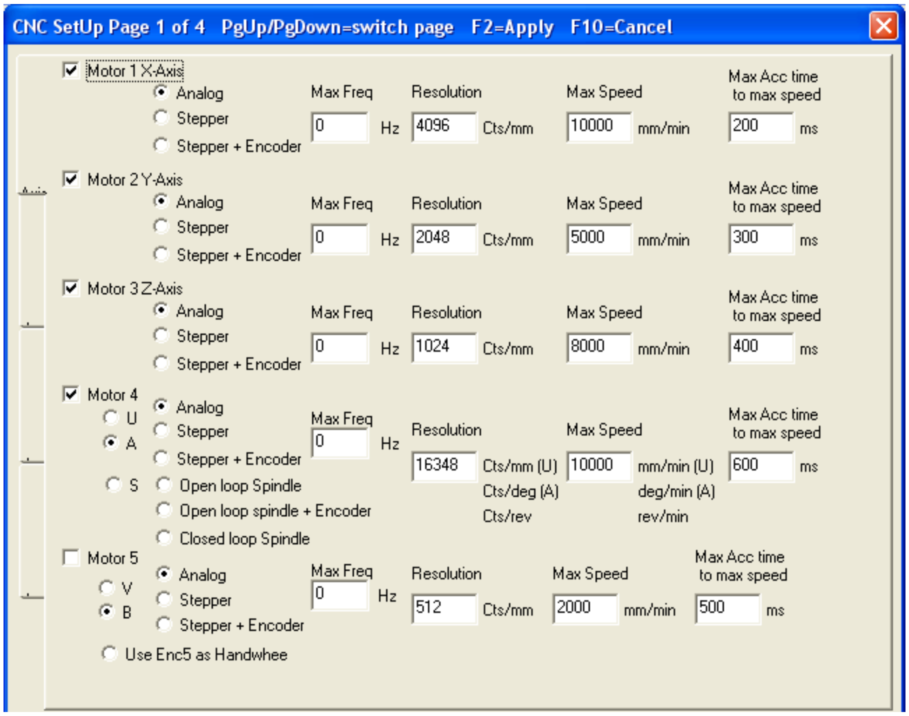
Command	Description
Symbols and Manage-PLCs	Creates and manages customs PLCs for the machine. Refer to the Custom PLCs section of this manual for details.
Settings	Opens the machine setting pages. Refer to the Machine Settings section of this manual for details.
Save I Variables	Performs a backup of the I-variables on the system. The I-variables contains several settings of the machine (e.g., PID gains of axis) and any change to these variables must be saved to recover the same setting after shutting down the system.
Download Raw File	Sends a text file to the controller. This is used for maintenance, as this file must contain only pure Motion Controller code.
Reset CNC	Restarts the CNC system (e.g., after a shutdown). If, for any reason, the configuration must be resent to the controller, this menu will perform the job. Remove the power of drives or press the E-stop button before performing this action.

MACHINE SETTINGS

Before using the axis, the machine must be set.

There are four pages for the machine setting which define the details about the machine that must be managed by this CNC controller (number of axis, type of each axis, spindle, limits, homing procedure, etc.).

Setting Page 1: General Axis Setup 1



CNC SetUp Page 1 of 4   PgUp/PgDown=switch page   F2=Apply   F10=Cancel

☑ Motor 1 X-Axis
● Analog ○ Stepper ○ Stepper + Encoder
Max Freq: 0 Hz | Resolution: 4096 Cts/mm | Max Speed: 10000 mm/min | Max Acc time to max speed: 200 ms

☑ Motor 2 Y-Axis
● Analog ○ Stepper ○ Stepper + Encoder
Max Freq: 0 Hz | Resolution: 2048 Cts/mm | Max Speed: 5000 mm/min | Max Acc time to max speed: 300 ms

☑ Motor 3 Z-Axis
● Analog ○ Stepper ○ Stepper + Encoder
Max Freq: 0 Hz | Resolution: 1024 Cts/mm | Max Speed: 8000 mm/min | Max Acc time to max speed: 400 ms

☑ Motor 4
○ U ● A ○ S
● Analog ○ Stepper ○ Stepper + Encoder ○ Open loop Spindle ○ Open loop spindle + Encoder ○ Closed loop Spindle
Max Freq: 0 Hz | Resolution: 16348 Cts/mm (U) Cts/deg (A) Cts/rev | Max Speed: 10000 mm/min (U) deg/min (A) rev/min | Max Acc time to max speed: 600 ms

□ Motor 5
○ V ● B
● Analog ○ Stepper ○ Stepper + Encoder
Max Freq: 0 Hz | Resolution: 512 Cts/mm | Max Speed: 2000 mm/min | Max Acc time to max speed: 500 ms

○ Use Enc5 as Handwhee

The Adv 400 is capable of using up to five axes.

To use an axis, check the box in front of motor number (Motor x).

Motors 1, 2 and 3

Motors 1, 2 and 3, respectively named X, Y and Z, are always linear axis and can be analog (+/-10V) or stepper (pulses and direction) type of axis.

- If Analog axis is selected, an encoder must be present on this axis.
- For stepper axis, the Adv 400 can work with or without real encoder feedback. The maximum frequency for pulse output must be entered also when an axis is used in stepper.
- In both cases (analog or stepper), the resolution (counts per millimeters), the maximum speed (millimeters per minute) and the maximum acceleration (time in milliseconds from 0 to maximum speed) must be indicated.

If analog axis or stepper + encoder is selected, perform a position-loop tuning before this axis can be used. (See the Axis Tuning section.)

If stepper (without an encoder) is selected, do not perform the position-loop tuning. The controller simulates the encoder internally and the axis PID gains are calculated automatically.

Motor 4

Motor 4 can be an axis (linear named U or rotary named A). In this case, like motors 1, 2 and 3, this motor can be analog or stepper with the same setup.

Motor 4 can be a spindle named S (open-loop without an encoder, open-loop with encoder, or closed-loop automatically with encoder). In this case, the analog type is used (no stepper).

The resolution (counts per millimeters if linear axis U, counts per degree if rotary axis A or counts per revolution in case of spindle), the maximum speed (millimeters per minute if linear axis U, degrees per minute if rotary axis A or revolution per minute in case of spindle) and the maximum acceleration (time in milliseconds from 0 to maximum speed) must be indicated.

If analog axis, stepper + encoder or closed-loop spindle is selected, perform a position-loop tuning before this axis can be used. (See the Axis Tuning section.)

If stepper (without an encoder) or open-loop spindle (with or without an encoder) is selected, do not perform the position-loop tuning. For stepper, the controller simulates the encoder internally and the axis PID gains are calculated automatically. For open-loop spindle case, the amplifier must be an inverter or an amplifier closing the velocity-loop internally.

Motor 5

Motor 5 can be an axis (linear named V or rotary named B). This motor is always an analog axis with encoder feedback.

The resolution (counts per millimeters in linear axis V or counts per degree if rotary axis B), the maximum speed (millimeters per minute if linear axis V, degrees per minute if rotary axis B) and the maximum acceleration (time in milliseconds from 0 to maximum speed) must be indicated. A position-loop tuning must be performed before this axis can be used. (See the Axis Tuning section.)

When Motor 5 is not used, the encoder feedback can be used for an external handwheel. To enable this function, uncheck the Motor 5 box and check the **Use ENC5 as Handwheel** box.

In this case, some Inputs/Outputs will not be for general-purpose use anymore, but must have dedicated functions to indicate whether to use an external box for manual movements of the axis:

Input7 will indicate whether to use the internal Adv 400 functions or the external box buttons:

```
If INPUT7 is OFF -> use internal Adv 400 functions
If INPUT7 is ON  -> use external box buttons
```

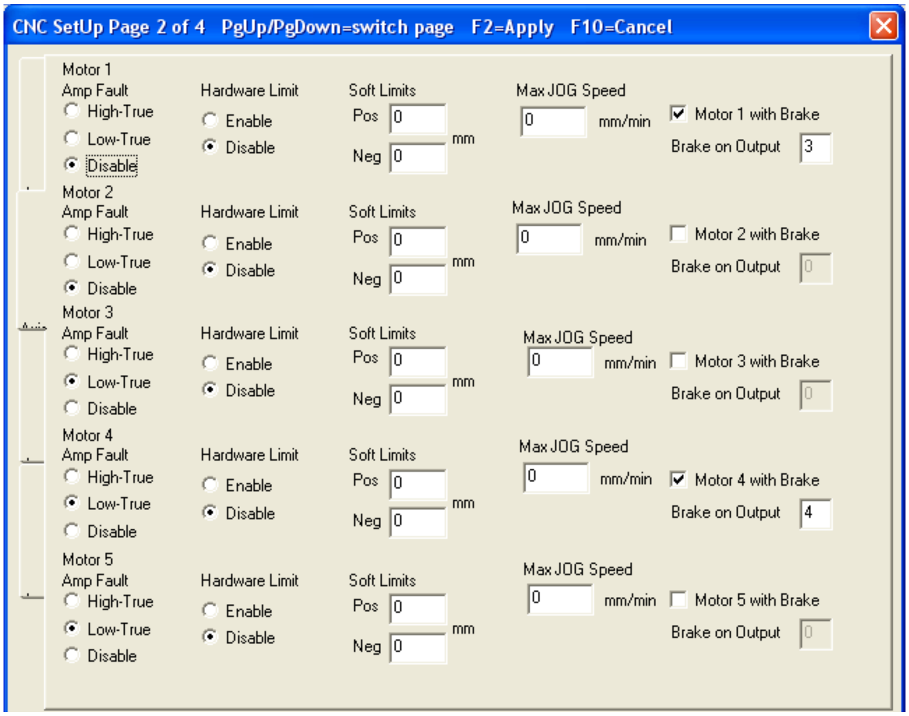
The external box buttons are:

INPUT9, INPUT10 and INPUT10 for axis select
With INPUT9=Off and INPUT10=Off and INPUT11=Off axis X is selected
With INPUT9=On and INPUT10=Off and INPUT11=Off axis Y is selected
With INPUT9=On and INPUT10=On and INPUT11=Off axis Z is selected
With INPUT9=Off and INPUT10=On and INPUT11=Off axis A or U is selected

INPUT13, INPUT14 and INPUT15 for step move size with handwheel
With INPUT13=On and INPUT14=Off and INPUT15=Off, axis moves of 0.001mm per Handwheel step
With INPUT13=On and INPUT14=On and INPUT15=Off, axis moves of 0.01mm per Handwheel step
With INPUT13=Off and INPUT14=On and INPUT15=Off, axis moves of 0.1mm per Handwheel step
With INPUT13=Off and INPUT14=On and INPUT15=On, axis moves of 0.2 mm per Handwheel step

INPUT12 for JOG axis in minus direction
INPUT16 for JOG axis in plus direction

Setting Page 2: General Axis Setup 2



CNC SetUp Page 2 of 4 PgUp/PgDown=switch page F2=Apply F10=Cancel

Motor 1
Amp Fault: ○ High-True ○ Low-True ● Disable
Hardware Limit: ○ Enable ● Disable
Soft Limits: Pos 0 Neg 0 mm
Max JOG Speed: 0 mm/min
☑ Motor 1 with Brake
Brake on Output 3

Motor 2
Amp Fault: ○ High-True ○ Low-True ● Disable
Hardware Limit: ○ Enable ● Disable
Soft Limits: Pos 0 Neg 0 mm
Max JOG Speed: 0 mm/min
☐ Motor 2 with Brake
Brake on Output 0

Motor 3
Amp Fault: ○ High-True ● Low-True ○ Disable
Hardware Limit: ○ Enable ● Disable
Soft Limits: Pos 0 Neg 0 mm
Max JOG Speed: 0 mm/min
☐ Motor 3 with Brake
Brake on Output 0

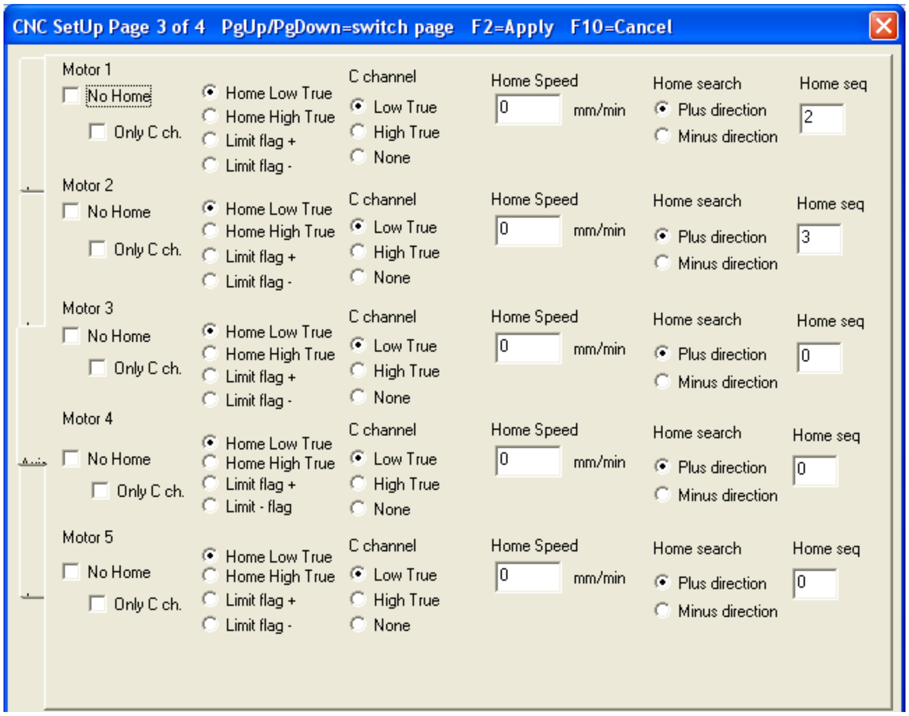
Motor 4
Amp Fault: ○ High-True ● Low-True ○ Disable
Hardware Limit: ○ Enable ● Disable
Soft Limits: Pos 0 Neg 0 mm
Max JOG Speed: 0 mm/min
☑ Motor 4 with Brake
Brake on Output 4

Motor 5
Amp Fault: ○ High-True ● Low-True ○ Disable
Hardware Limit: ○ Enable ● Disable
Soft Limits: Pos 0 Neg 0 mm
Max JOG Speed: 0 mm/min
☐ Motor 5 with Brake
Brake on Output 0

If an axis is used (box checked on Setting page 1), information on this page must be entered.

- The **Amp Fault** (amplifier fault signal) returning from the drive can be true (amplifier on default) at level high or at level low. Also, the management of the amplifier fault signal can be disabled if the drive does not have one.
- The **Hardware Limits** (plus and minus) can be enabled or disabled. If enabled, if one of these limits is reached, the axis will stop automatically.
- The **Software Limits** in millimeters can be used to limit the travel of the axis. These limits are only for linear axis (X, Y, Z, U and V). A zero (0) value disables the software limit.
- The **Max JOG Speed** indicates the maximum speed of the axis on manual JOG moves.
- If a motor has an internal **Brake** (vertical axis, for example), a digital output must be attached to the brake and the Adv 400 will manage this output automatically with the status (open-loop or closed-loop) of this motor. In this case, check the **Motor x with Brake** box and enter a number for the digital output between 1 and 16. (See the Digital Outputs section on Adv 400, connector OUT1.)

Setting Page 3: Axis Homing Setup



CNC SetUp Page 3 of 4   PgUp/PgDown=switch page   F2=Apply   F10=Cancel

Motor 1
□ No Home
□ Only C ch.
● Home Low True ○ Home High True ○ Limit flag + ○ Limit flag -
C channel: ● Low True ○ High True ○ None
Home Speed: 0 mm/min
Home search: ● Plus direction ○ Minus direction
Home seq: 2

Motor 2
□ No Home
□ Only C ch.
● Home Low True ○ Home High True ○ Limit flag + ○ Limit flag -
C channel: ● Low True ○ High True ○ None
Home Speed: 0 mm/min
Home search: ● Plus direction ○ Minus direction
Home seq: 3

Motor 3
□ No Home
□ Only C ch.
● Home Low True ○ Home High True ○ Limit flag + ○ Limit flag -
C channel: ● Low True ○ High True ○ None
Home Speed: 0 mm/min
Home search: ● Plus direction ○ Minus direction
Home seq: 0

Motor 4
□ No Home
□ Only C ch.
● Home Low True ○ Home High True ○ Limit flag + ○ Limit - flag
C channel: ● Low True ○ High True ○ None
Home Speed: 0 mm/min
Home search: ● Plus direction ○ Minus direction
Home seq: 0

Motor 5
□ No Home
□ Only C ch.
● Home Low True ○ Home High True ○ Limit flag + ○ Limit flag -
C channel: ● Low True ○ High True ○ None
Home Speed: 0 mm/min
Home search: ● Plus direction ○ Minus direction
Home seq: 0

If an axis is used (box checked in Setting Page 1), the information on this page must be entered.

This page gives the setting for the homing (home reference) of each axis.

The No Home box indicates that no homing routine has to be performed on this axis. In this case, during the homing sequence, the zero position will be forced to this axis.

If this box is checked, all information for this axis on this page is not used.

An axis reference can be entered on the **C channel** (zero encoder) or on one of the fast inputs **Home Flag** (high-true or low-true), **Limit+** or **Limit-**. If one of these three fast inputs is selected, it is possible to use it in combination with the **C channel**.

Depending on the encoder used, the **C channel** active can be low true or high true.

- To perform the homing routine on the C channel only, check the **Only C ch** box.
- To perform the homing on one of the fast input flags only, uncheck the **Only C ch box**. Check the **None** box under the C channel section and check the desired fast input (Home Low True, Home High True, Limit flag + or Limit flag -).
- To perform the homing on a combination of the **C channel** and one of the fast input flags, uncheck the Only C ch box, check the Low True or High True box under the C channel section and check the desired fast input (**Home Low True**, **Home High True**, **Limit flag** + or **Limit flag -).**

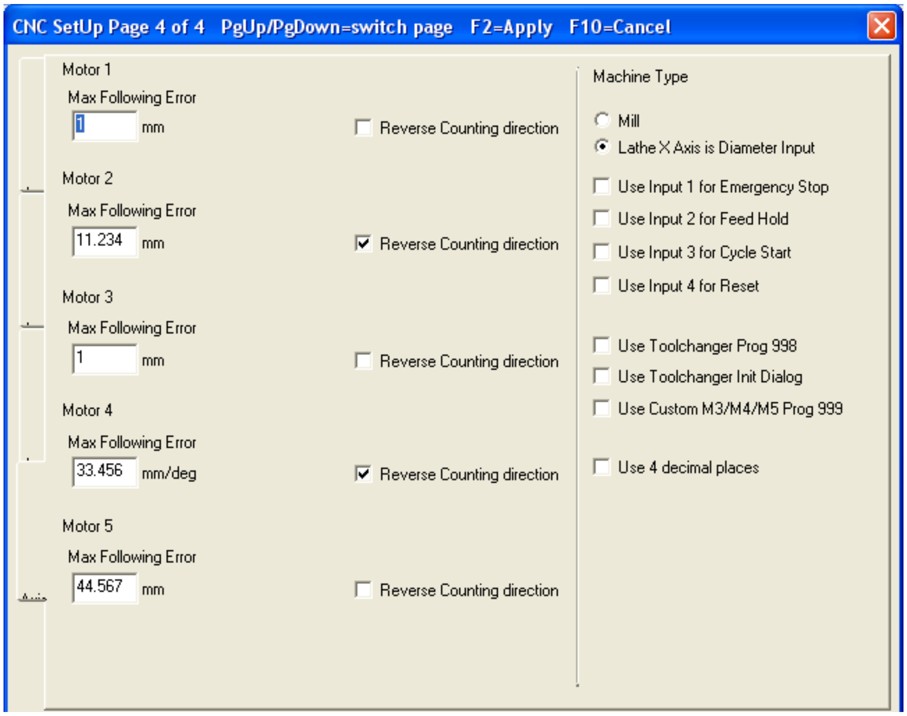
The home speed must be entered in millimeters per minute.

In addition, the direction for the home search must be entered. The direction is where the axis is going to the selected flag direction.

The **Home Seq** box must be set with a number between 1 and 5, indicating the desired sequence of the homing. Axis homing will be performed one-by-one following this sequence (first axis will be this with number 1, second axis will be this with number 2, etc.).

If Motor 4 is used as a spindle, no homing sequence will be performed on this motor.

Setting Page 4: Miscellaneous



CNC SetUp Page 4 of 4   PgUp/PgDown=switch page   F2=Apply   F10=Cancel

Motor 1
Max Following Error
1 mm
□ Reverse Counting direction

Motor 2
Max Following Error
11.234 mm
☑ Reverse Counting direction

Motor 3
Max Following Error
1 mm
□ Reverse Counting direction

Motor 4
Max Following Error
33.456 mm/deg
☑ Reverse Counting direction

Motor 5
Max Following Error
44.567 mm
□ Reverse Counting direction

Machine Type
○ Mill
● Lathe X Axis is Diameter Input

□ Use Input 1 for Emergency Stop
□ Use Input 2 for Feed Hold
□ Use Input 3 for Cycle Start
□ Use Input 4 for Reset

□ Use Toolchanger Prog 998
□ Use Toolchanger Init Dialog
□ Use Custom M3/M4/M5 Prog 999

□ Use 4 decimal places

This page indicates the Maximum Following Error allowed for an axis in millimeters.

If for any reason during operation an axis has more following error than the one indicated here, all axes will be stopped and disabled and an error message will appear.

The Reverse Counting Direction box changes the encoder counting direction. As the encoder counting direction must be always in correlation with the command output (a positive command on the analog or stepper output must move the motor in the direction where the encoder counts positive, and a negative command on the analog or stepper output must move the motor in the direction where the encoder counts negative), checking this box creates this correlation by inverting the encoder counting direction.

On the right of this setting page, indicate the Machine Type to manage (Mill or Lathe). A Lathe selection will make the X axis with a diameter input.

The Use Input 1 for Emergency Stop box uses the INPUT1 as the ESTOP input, low true. If this box is checked, the INPUT1 must be high to have the machine running.

- The **Use Input 2 for Feed Hold** box gives the Feed Hold function to INPUT2.
- The **Use Input 3 for Cycle Start** box gives the Cycle Start function to INPUT3.
- The **Use Input 4 for Reset** box gives the Reset function to INPUT4.

The Use Toolchanger Prog998 box creates an automatic jump to sub-routine 998 when a tool code Txxyy is programmed. This creates some tool changing routines. Refer to the Tool Changer section of this manual for details.

The Use Toolchanger Init Dialog box gives a special dialog menu at power-up of Adv 400-CNC, and then special tool changer positions can be initialized. Refer to the Tool Changer section of this manual for details.

The Use Custom M3/M4/M5 Prog999 box writes custom M-codes for spindle in sub-routine 999. If this box is checked, these custom M-codes must be written, otherwise the normal M3/M4/M5 codes of the system will be used. Refer to the Custom M-Codes section of this manual for details.

The Use 4 decimal places box allows four decimal digits in the axis position windows. Default is three digits.

AXIS TUNING

The tuner tool of the Executive Program (Pewin32 or Pewin32Pro) is used to tune the axis.

The following steps must be performed:

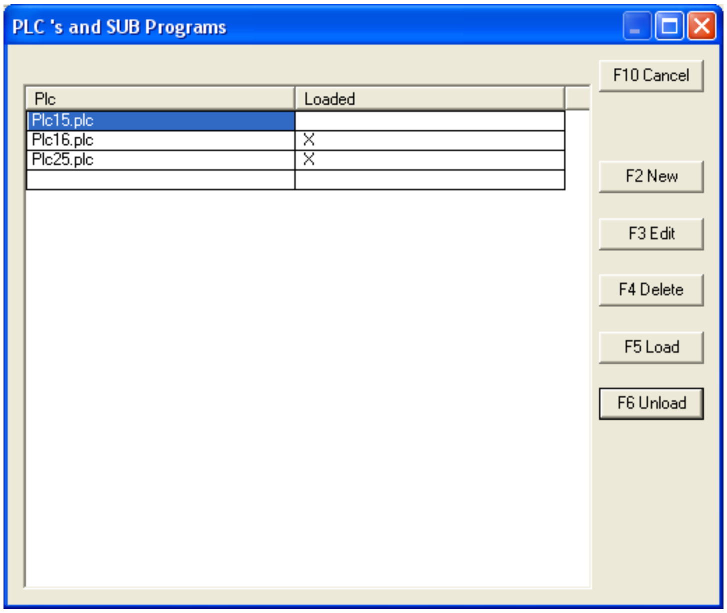
1. Boot the Adv 400 system and let the HMI start.
2. Exit from the HMI using the File /Exit menu.
3. Connect an external computer with the Executive program to the RS232 connector of the Adv 400.
4. Start the Executive Program and tune the axis with this external computer.
5. When the tuning is finished, quit the Executive program and without shutting down the Adv 400 controller, start the Adv 400 HMI again (the program is called ADV400.EXE and is located on the Hard Disk/CNC/ directory).
6. Save the I-Variables using the CNC/Save_I_variables menu of the Adv 400 HMI.
7. Reboot the Adv 400 unit.

CUSTOM PLCS

Create custom PLCs to managing certain functions of the machine with this feature. PLCs numbers 15 to 24 are available for these customs PLCs. PLC25 is present already and creates some additional conditions for the use of some machine control buttons.

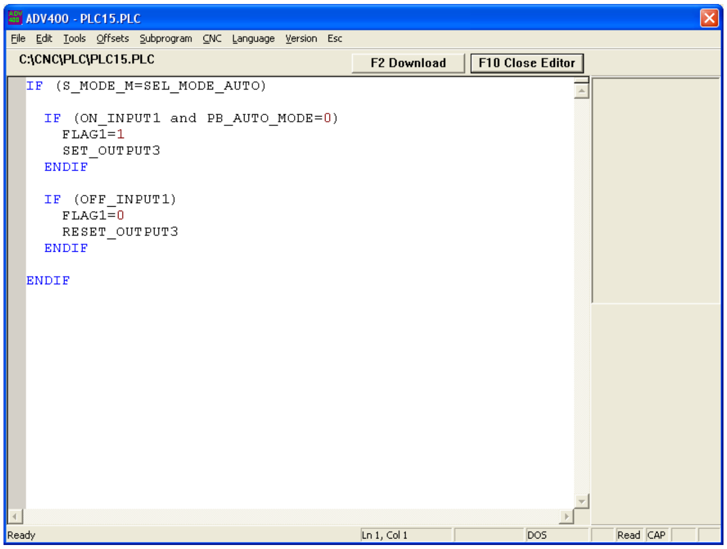
PLCs Management

Under the CNC menu, a management page creates (New), Edit, Delete, Load and Unload for a custom PLC.



Plc	Loaded
Plc15.plc	
Plc16.plc	X
Plc25.plc	X

- **New** (or F2 on the keyboard) creates a new custom PLC (opening text editor with blank page).
- **Edit** (or F3 on the keyboard) opens an existing custom PLC (opening text editor with this PLC inside) for consulting or modification.
- **Delete** (or F4 on the keyboard) removes an existing custom PLC from the list.
- **Load** (or F5 on the keyboard) loads an existing custom PLC in the controller and enables it. An X appears in the Loaded section for this PLC and the PLC is used until it is unloaded.
- **Unload** (or F6 on the keyboard) removes an existing custom PLC from the controller. The X does not appear in the Loaded section for this PLC.



```
IF (S_MODE_M=SEL_MODE_AUTO)

  IF (ON_INPUT1 and PB_AUTO_MODE=0)
    FLAG1=1
    SET_OUTPUT3
  ENDIF

  IF (OFF_INPUT1)
    FLAG1=0
    RESET_OUTPUT3
  ENDIF

ENDIF
```

When creating a new PLC or editing an existing PLC, a text editor is opened and the PLC code can be entered.

- **Download** (or F2 on the keyboard) is sending the PLC to the controller and uses it automatically (like the Load button on the Managing PLC page).
- **Close Editor** (or F10 on the keyboard) is providing a quit of this page, asking to save to entered code if not done.

Writing a PLC

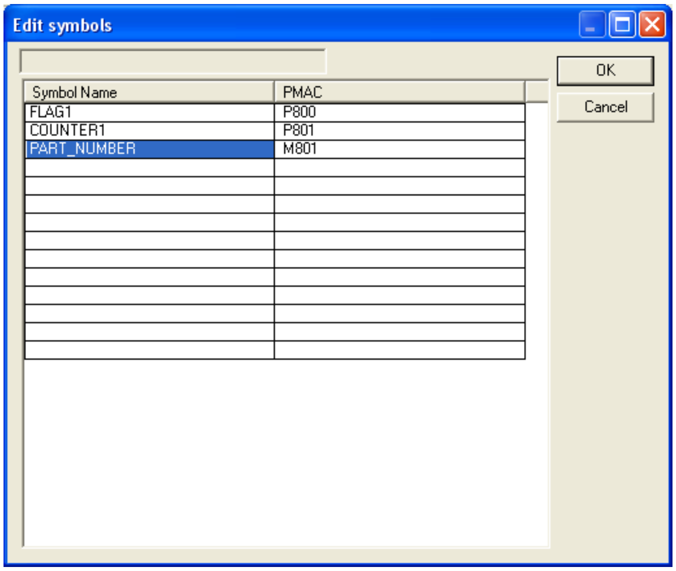
The Custom PLCs use the symbol table. Refer to the Table of Symbols section for a list of all available symbols. Personal symbols can be created with Adv 400 free variables.

The free variables are:

- P800 to P1023
- Q800 to Q1023
- M800 to M1023

P and Q-Variables are 48-bits floating-point format and any calculation can be performed or flag designated.

M-Variables are 24-bits format and any calculation can be performed or any flag designated. Normally, they are used for pointing any memory of the Adv 400 system, but the needed memories for writing applications are already done, accessible with the Table of Symbols.



Symbol Name	PMAC
FLAG1	P800
COUNTER1	P801
PART_NUMBER	M801

In the CNC menu, there is a table to create symbols for free variables:

- PLC15 to PLC24 are available for customs PLCs.
- A special PLC25 is present in the system already and must be downloaded in the CNC in order to have all buttons (Cycle Start, Feed Hold, etc.) working. Refer to the PLC25 section of this manual for details.
- A PLC is scanned all the time, asynchronously as part of the program. It reads inputs, writes outputs, and tests conditions.

Testing an Input

```
If (ON_INPUT1)                ; test is Input1 true
  ; action
Endif
If (OFF_INPUT4)               ; test is Input4 false
  ; action
Else
  ; other action
Endif
```

Waiting State of an Input

```
While (ON_INPUT2)             ; wait as long as Input2 is true
  ; action
Endw
```

Setting an Output

```
SET_OUTPUT2                   ; set Ouput2
RESET_OUTPUT3                 ; Reset Ouput3
```

Testing or Waiting an Information

With an If condition or a While loop, it is possible to test or wait for some other information coming from the CNC.

The Table of Symbols gives the list of information available.

```
If (CS_SPND_AT_ZERO != 0)     ; test is spindle is at zero speed
          ; action
Endif
While (CS_SPND_AT_SPEED = 0)  ; wait that spindle is at programmed speed.
Endif
```

Using a Timer

```
SET_OUTPUT2                   ; set ouput2
USER_TIMER_1=150              ; timer of 150ms
While (USER_TIMER_1>0)        ; wait timer finished
Endw
RESET_OUTPUT2                 ; reset ouput2
```

Specific PLC25

The PLC25 adds some conditions to the use of buttons.

The buttons managed in this PLC25 that have conditions are:

- MANUAL mode button
- AUTO mode button
- MDI mode button
- HOME mode button
- CYCLE START button
- FEED HOLD button
- JOG PLUS button
- JOG MINUS button
- SINGLE MODE button
- OPTIONNAL MODE button
- BLOCK DELETE button

As an example, here is the standard code (no conditions) for the Cycle Start button:

```
If (PB_CYCLE_START!=0)
```

```
  IPB_CYCLE_START = 1
Else
  IPB_CYCLE_START = 0
Endif
```

For example, to add the condition that Input 1 is ON to allow a Cycle Start of the program, modify this section:

```
If (PB_CYCLE_START!=0 and ON_INPUT3)
  IPB_CYCLE_START = 1
Else
  IPB_CYCLE_START = 0
Endif
```

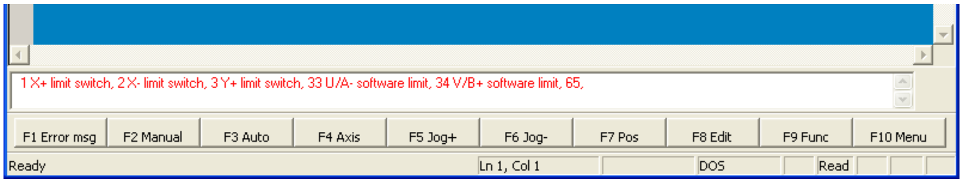
As another example, to reset the Output 2 and 3 when in manual mode:

```
If (PB_MANUAL_MODE!=0)
  IPB_MANUAL_MODE = 1
  RESET_OUTPUT2
  RESET_OUTPUT3
Else
  IPB_MANUAL_MODE = 0
Endif
```

Messages

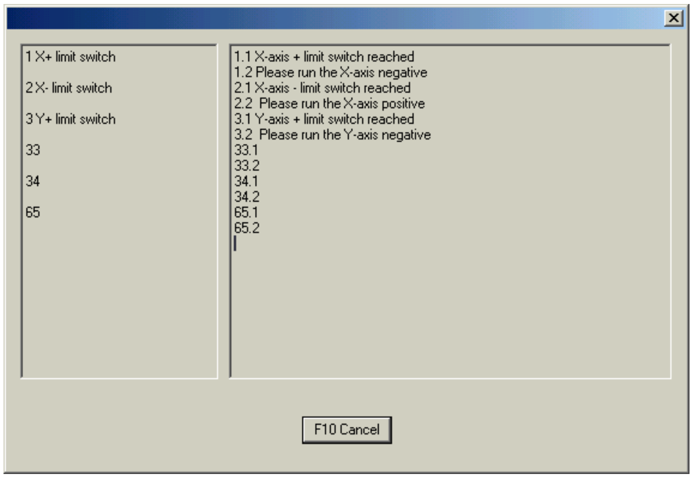
From PLCs, it is possible to create messages (information, warning or error) for the machine user.

These messages will appear then in the message window on the bottom of the main screen



1 X+ limit switch, 2 X- limit switch, 3 Y+ limit switch, 33 U/A- software limit, 34 V/B+ software limit, 65,

When any message is present, use the F1 key to go to the detailed message window.



1 X+ limit switch
2 X- limit switch
3 Y+ limit switch
33
34
65

1.1 X-axis + limit switch reached
1.2 Please run the X-axis negative
2.1 X-axis - limit switch reached
2.2 Please run the X-axis positive
3.1 Y-axis + limit switch reached
3.2 Please run the Y-axis negative
33.1
33.2
34.1
34.2
65.1
65.2

A maximum of 96 messages are possible, but messages 1 to 59 are reserved for the system. So, messages 60 to 96 can be used by custom PLCs.

To display or remove a message, use the following code:

```
SET_ER_60                     ; this will display message number 60
RESET_ER_71                   ; this will remove message number 71
```

To test if a message is displayed (present) or not:

```
IF (ERH_81)                   ; test if message 81 is display (present)
IF (ERL_68)                   ; test if message 68 is not present
```

The text message must be entered in the Adv4Err.dtx file which is on the system under the Hard Disk/CNC/01 directory for the first language English, or under Hard Disk/CNC/02 for the second language.

In this file, any message is contained in three lines.

For the message 60, for example, the following lines appear:

```
60
60.1
60.2
```

The first line of a message is the one displayed on the bottom of the main screen.

In the detailed message window, all three lines will appear, giving detailed messages.

For example, to have message 65 give an error about a door open:

```
65 DOOR OPEN
65.1 Please, close the door
65.2 to allow cycle starting
```

Table of Symbols

The Table of Symbols present on the system contains all symbols permitting access to all system information, like Input and Output, status of axis, status of spindle.

These symbols can be used mainly in custom PLCs, but it is possible also to use them in part programs or in the sub-routines.

Refer to Appendix A: Table of Symbols to view the complete list.

CUSTOM M-CODES PROGRAMMING

In several applications, custom M-codes are created and used in the part program to perform some specific actions. The sub-routine 999 allows this.

Some M-codes are reserved (already used by the system) and cannot be created in this sub-routine.

List of reserved M-codes:

- M00 Program Stop
- M01 Optional Stop
- M02 Program End & Rewind
- M19 Spindle Orient
- M30 Program End & Rewind
- M50 C-Axis Call
- M51 Spindle Call
- M98 Subprogram Call

Usually the M03, M04, and M05 M-codes are used for a spindle. If a spindle is present in the system, these codes are reserved and cannot be created in this sub-routine. If no spindle is present, use M03, M04 and M05 codes by checking the **Use Custom M3/M4/M5 Prog999** box on the machine Setting Page 4.

The part program M-code will call the same label number as the code number:

- M06 code will call sub-routine 999 at label N6
- M09 code will call sub-routine 999 at label N9
- M10 code will call sub-routine 999 at label N10
- M12 code will call sub-routine 999 at label N12
- M252 code will call sub-routine 999 at label N252

In the sub-routine 999, a **RET** command must be entered at the end of the program code to exit this sub-routine and return to the main program.

For example, the following code uses M07 code to set the output to 1 and the M08 code to reset the output 1. The **Dwell0** command waits until a previous move is finished before starting the action of this M-code. If a **Dwell0** command is not entered in front of the action, the action is performed before the previous move is finished.

```
// Prog 999
;
 ;
// M07 code
N7
   Dwell0
  SET_OUTPUT1                  ; set Ouput1
RET

// M08 code
N8
  Dwell0
  RESET_OUTPUT1                ; reset Ouput1
RET
```

TOOL CHANGER

Sub-Routine 998

The sub-routine 998 is used to create the code for a tool changer.

To use this function, check the **Use Toolchanger Prog998** box on the Machine Setting Page 4.

In this case, when the T-code Txxyy is programmed in the part program, two jumps to this sub-routine will be done automatically.

- A first jump on label N1000 will be done with the actual Tool offset, creating some axis movements out with the actual tool offset.
- A second jump on label N2000 will then be done with the new tool offset, the one called by Txxyy T-code, permitting to create axis movements in with the new tool offset.

At the end of these two sections, a **RET** command must be present to indicate that this section is finished (jump back to main program). Even if one of the two labels has no code because one of these two jumps is not needed, the **RET** command must be present.

The structure of an empty sub-routine 998:

```
// Prog 998
// Create the tool changer in this file
// put the code before new tool offset at label N1000
// put the code with new tool offset at label N2000

// put the code here before tacking new tool offset
N1000
    ; put the code here
RET
// put the code here after tacking new tool offset
N2000
    ; put the code here
RET
```

As an example, to move X and Y axis to positions 0 before changing tool, ask a PLC with variable P810 to make the tool change, then move back X and Y axis to position 10.

In this example, there are some **Dwell0** commands. A **Dwell0** command waits until the previous axis movement is finished before starting the next job. A **Dwell0** command must be present in a While loop of a part program (as sub-routines are running in part programs).

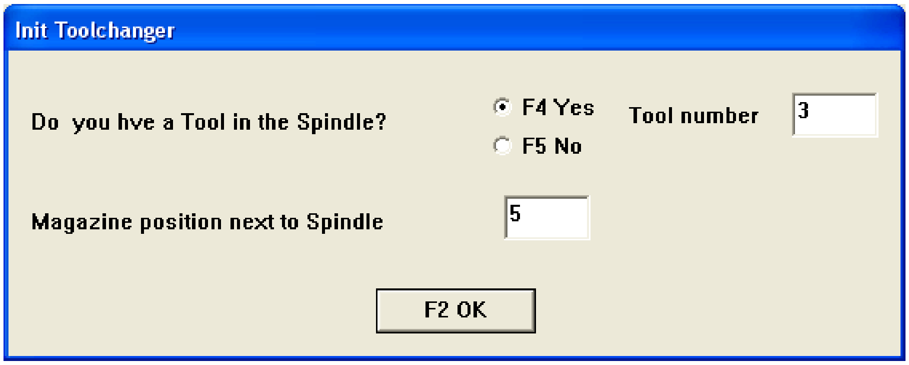
```
// Prog 998
// Create the tool changer in this file
// put the code before new tool offset at label N1000
// put the code with new tool offset at label N2000

// put the code here before tacking new tool offset
N1000
    G00 X0 Y0                 ; move axis with actual tool offset
    Dwell0                    ; this waits previous movement is finished
    P801=1                    ; ask PLC to make tool change
    While (P810=1)            ; wait that the tool change is finished
       Dwell0                 ; this means that PLC puts back P801 to 0
    Endwhile
RET
```

```
// put the code here after tacking new tool offset
N2000
    G00 X10 Y10   ; move axis with new tool offset
RET
```

Tool Changer Initialization

With certain types of Tool Changers, it is necessary to initialize some data every time the CNC is started to indicate to the system what tool is present.

Therefore, when the Use Toolchanger Init Dialog box is checked in Machine Setting Page 4, a menu appears at power-up of the Adv 400 CNC software:



Do you hve a Tool in the Spindle? ● F4 Yes ○ F5 No

Tool number 3

Magazine position next to Spindle 5

These two values, tool number and magazine position, are just memorized on some variables so that the tool changing code can be used later.

- The first value is entered in the variable P355, named TOOL_IN_SPINDLE.
- The second value is entered in the variable P356, named MAGAZINE_POSITION.

Use these two variables for a tool changer where an initialization must be made whenever the system is started, telling what tool is in the spindle and what the magazine position is next to the spindle. For any other type of tool changer, these two variables can be used in another way, such as telling what tool is active at power-up.

APPENDIX A: TABLE OF SYMBOLS

Inputs

Inputs True

Symbol	Comment
ON_INPUT1	Input 1 true
ON_INPUT2	Input 2 true
ON_INPUT3	Input 3 true
ON_INPUT4	Input 4 true
ON_INPUT5	Input 5 true
ON_INPUT6	Input 6 true
ON_INPUT7	Input 7 true
ON_INPUT8	Input 8 true
ON_INPUT9	Input 9 true
ON_INPUT10	Input 10 true
ON_INPUT11	Input 11 true
ON_INPUT12	Input 12 true
ON_INPUT13	Input 13 true
ON_INPUT14	Input 14 true
ON_INPUT15	Input 15 true
ON_INPUT16	Input 16 true
ON_INPUT17	Input 17 true
ON_INPUT18	Input 18 true
ON_INPUT19	Input 19 true
ON_INPUT20	Input 20 true
ON_INPUT21	Input 21 true
ON_INPUT22	Input 22 true
ON_INPUT23	Input 23 true
ON_INPUT24	Input 24 true
ON_INPUT25	Input 25 true
ON_INPUT26	Input 26 true
ON_INPUT27	Input 27 true
ON_INPUT28	Input 28 true
ON_INPUT29	Input 29 true
ON_INPUT30	Input 30 true
ON_INPUT31	Input 31 true
ON_INPUT32	Input 32 true

Inputs False

Symbol	Comment
`OFF_INPUT1`	Input 1 false
`OFF_INPUT2`	Input 2 false
`OFF_INPUT3`	Input 3 false
`OFF_INPUT4`	Input 4 false
`OFF_INPUT5`	Input 5 false
`OFF_INPUT6`	Input 6 false
`OFF_INPUT7`	Input 7 false
`OFF_INPUT8`	Input 8 false
`OFF_INPUT9`	Input 9 false
`OFF_INPUT10`	Input 10 false
`OFF_INPUT11`	Input 11 false
`OFF_INPUT12`	Input 12 false
`OFF_INPUT13`	Input 13 false
`OFF_INPUT14`	Input 14 false
`OFF_INPUT15`	Input 15 false
`OFF_INPUT16`	Input 16 false
`OFF_INPUT17`	Input 17 false
`OFF_INPUT18`	Input 18 false
`OFF_INPUT19`	Input 19 false
`OFF_INPUT20`	Input 20 false
`OFF_INPUT21`	Input 21 false
`OFF_INPUT22`	Input 22 false
`OFF_INPUT23`	Input 23 false
`OFF_INPUT24`	Input 24 false
`OFF_INPUT25`	Input 25 false
`OFF_INPUT26`	Input 26 false
`OFF_INPUT27`	Input 27 false
`OFF_INPUT28`	Input 28 false
`OFF_INPUT29`	Input 29 false
`OFF_INPUT30`	Input 30 false
`OFF_INPUT31`	Input 31 false
`OFF_INPUT32`	Input 32 false

Set Outputs Non Synchrone

Symbol	Comment
SET_OUTPUT1	Set Output 1 true
SET_OUTPUT2	Set Output 2 true
SET_OUTPUT3	Set Output 3 true
SET_OUTPUT4	Set Output 4 true
SET_OUTPUT5	Set Output 5 true
SET_OUTPUT6	Set Output 6 true
SET_OUTPUT7	Set Output 7 true
SET_OUTPUT8	Set Output 8 true
SET_OUTPUT9	Set Output 9 true
SET_OUTPUT10	Set Output 10 true
SET_OUTPUT11	Set Output 11 true
SET_OUTPUT12	Set Output 12 true
SET_OUTPUT13	Set Output 13 true
SET_OUTPUT14	Set Output 14 true
SET_OUTPUT15	Set Output 15 true
SET_OUTPUT16	Set Output 16 true

Set Outputs Synchrone for Programming Only

Symbol	Comment
SETS_OUTPUT1	Set Output 1 true synchronously (for Part Prog only)
SETS_OUTPUT2	Set Output 2 true synchronously (for Part Prog only)
SETS_OUTPUT3	Set Output 3 true synchronously (for Part Prog only)
SETS_OUTPUT4	Set Output 4 true synchronously (for Part Prog only)
SETS_OUTPUT5	Set Output 5 true synchronously (for Part Prog only)
SETS_OUTPUT6	Set Output 6 true synchronously (for Part Prog only)
SETS_OUTPUT7	Set Output 7 true synchronously (for Part Prog only)
SETS_OUTPUT8	Set Output 8 true synchronously (for Part Prog only)
SETS_OUTPUT9	Set Output 9 true synchronously (for Part Prog only)
SETS_OUTPUT10	Set Output 10 true synchronously (for Part Prog only)
SETS_OUTPUT11	Set Output 11 true synchronously (for Part Prog only)
SETS_OUTPUT12	Set Output 12 true synchronously (for Part Prog only)
SETS_OUTPUT13	Set Output 13 true synchronously (for Part Prog only)
SETS_OUTPUT14	Set Output 14 true synchronously (for Part Prog only)
SETS_OUTPUT15	Set Output 15 true synchronously (for Part Prog only)
SETS_OUTPUT16	Set Output 16 true synchronously (for Part Prog only)

Reset Outputs

Symbol	Comment
RESET_OUTPUT1	Reset Output 1
RESET_OUTPUT2	Reset Output 2
RESET_OUTPUT3	Reset Output 3
RESET_OUTPUT4	Reset Output 4
RESET_OUTPUT5	Reset Output 5
RESET_OUTPUT6	Reset Output 6
RESET_OUTPUT7	Reset Output 7
RESET_OUTPUT8	Reset Output 8
RESET_OUTPUT9	Reset Output 9
RESET_OUTPUT10	Reset Output 10
RESET_OUTPUT11	Reset Output 11
RESET_OUTPUT12	Reset Output 12
RESET_OUTPUT13	Reset Output 13
RESET_OUTPUT14	Reset Output 14
RESET_OUTPUT15	Reset Output 15
RESET_OUTPUT16	Reset Output 16

Reset Outputs Synchronously for Programming Only

Symbol	Comment
RESETS_OUTPUT1	Reset Output 1 synchronously
RESETS_OUTPUT2	Reset Output 2 synchronously
RESETS_OUTPUT3	Reset Output 3 synchronously
RESETS_OUTPUT4	Reset Output 4 synchronously
RESETS_OUTPUT5	Reset Output 5 synchronously
RESETS_OUTPUT6	Reset Output 6 synchronously
RESETS_OUTPUT7	Reset Output 7 synchronously
RESETS_OUTPUT8	Reset Output 8 synchronously
RESETS_OUTPUT9	Reset Output 9 synchronously
RESETS_OUTPUT10	Reset Output 10 synchronously
RESETS_OUTPUT11	Reset Output 12 synchronously
RESETS_OUTPUT12	Reset Output 13 synchronously
RESETS_OUTPUT13	Reset Output 14 synchronously
RESETS_OUTPUT14	Reset Output 15 synchronously
RESETS_OUTPUT15	Reset Output 16 synchronously
RESETS_OUTPUT16	Reset Output 17 synchronously

Outputs On

Symbol	Comment
ON_OUTPUT1	Output 1 true
ON_OUTPUT2	Output 2 true
ON_OUTPUT3	Output 3 true
ON_OUTPUT4	Output 4 true
ON_OUTPUT5	Output 5 true
ON_OUTPUT6	Output 6 true
ON_OUTPUT7	Output 7 true
ON_OUTPUT8	Output 8 true
ON_OUTPUT9	Output 9 true
ON_OUTPUT10	Output 10 true
ON_OUTPUT11	Output 11 true
ON_OUTPUT12	Output 12 true
ON_OUTPUT13	Output 13 true
ON_OUTPUT14	Output 14 true
ON_OUTPUT15	Output 15 true
ON_OUTPUT16	Output 16 true

Outputs Off

Symbol	Comment
OFF_OUTPUT1	Output 1 false
OFF_OUTPUT2	Output 2 false
OFF_OUTPUT3	Output 3 false
OFF_OUTPUT4	Output 4 false
OFF_OUTPUT5	Output 5 false
OFF_OUTPUT6	Output 6 false
OFF_OUTPUT7	Output 7 false
OFF_OUTPUT8	Output 8 false
OFF_OUTPUT9	Output 9 false
OFF_OUTPUT10	Output 10 false
OFF_OUTPUT11	Output 11 false
OFF_OUTPUT12	Output 12 false
OFF_OUTPUT13	Output 13 false
OFF_OUTPUT14	Output 14 false
OFF_OUTPUT15	Output 15 false
OFF_OUTPUT16	Output 16 false

Timers

```
; example of a timer of 100ms
;   USER_TIMER_1=100
;   While (USER_TIMER_1>0)
;   Endwhile
```

Symbol	Comment
USER_TIMER_1	User timer 1 (for PLC)
USER_TIMER_2	User timer 2 (for PLC)
USER_TIMER_3	User timer 3 (for PLC)
USER_TIMER_4	User timer 4 (for PLC)
USER_TIMER_5	User timer 5 (for PLC)
USER_TIMER_6	User timer 6 (for PLC)
USER_TIMER_7	User timer 7 (for PLC)
USER_TIMER_8	User timer 8 (for PLC)

Status

```
; test if a status is false : If (CS_SPND_AT_SPEED=0)
; test if a status is true  : If (CS_SPND_AT_SPEED!=0)
```

Symbol	Comment
;; CS_MACHINE_LOCK	Not used
;; CS_RESET	Not used
CS_SINGLE_BLOCK	Part program single block status
CS_OPT_STOP	Part program optional stop status
CS_BLOCK_DELETE	Part program block delete status
;; CS_CLNT_FLOOD	Not used
;; CS_CLNT_MIST	Not used
;; CS_JOG_PLUS	Not used
;; CS_JOG_MINUS	Not used
;; CS_JOG_STOP	Not used
;; CS_JOG_RETURN	Not used
;; CS_HOME	Not used
;; CS_CYCLE_START	Not used
;; CS_CYCLE_RESTART	Not used
;; CS_FEED_HOLD	Not used
;; CS_DRY_RUN	Not used
;; CS_SPND_CW	Not used
;; CS_SPND_CCW	Not used
;; CS_SPND_BRAKE	Not used
;; CS_SPND_NEUTRAL	Not used
;; CS_PRG_REWIND	Not used
;; CS_CHUCK_OPEN	Not used
;; CS_CHUCK_CLOSE	Not used
;; CS_CHUCK_OD_GRIP	Not used
;; CS_CHUCK_ID_GRIP	Not used
;; CS_TOOL_RELEASE	Not used
;; CS_TOOL_ENGAGE	Not used
CS_SPND_DETECT	Spindle speed detection status
CS_SPND_CSS	Spindle constant surface speed status
CS_SPND_AT_SPEED	Spindle at speed status
CS_SPND_AT_ZERO	Spindle at zero speed status
CS_SPND_FEED	Spindle feed per revolution status

Buttons

```
; test if a button is not pressed   : If (PB_AUTO_MODE=0)
; test if a button is pressed       : If (PB_AUTO_MODE!=0)
```

Symbol	Comment
;; PB_MACHINE_LOCK	Not used
PB_RESET	Reset button
PB_SINGLE_BLOCK	Single block button
PB_OPT_STOP	Optional stop button
PB_BLOCK_DELETE	Block delete button
;; PB_CLNT_FLOOD	Not used
;; PB_CLNT_MIST	Not used
PB_JOG_PLUS	Jog Plus button
PB_JOG_MINUS	Jog Minus button
;; PB_JOG_STOP	Not used
;; PB_JOG_RETURN	Not used
PB_HOME	Home mode button
PB_CYCLE_START	Cycle start button
;;PB_CYCLE_RESTART	Not used
PB_FEED_HOLD	Feed Hold button
;; PB_DRY_RUN	Not used
;; PB_SPND_CW	Not used
;; PB_SPND_CCW	Not used
;; PB_SPND_BRAKE	Not used
;; PB_SPND_NEUTRAL	Not used
;; PB_PRG_REWIND	Not used
;; PB_CHUCK_OPEN	Not used
;; PB_CHUCK_CLOSE	Not used
;;PB_CHUCK_OD_GRIP	Not used
;;PB_CHUCK_ID_GRIP	Not used
;; PB_TOOL_RELEASE	Not used
;; PB_TOOL_ENGAGE	Not used
PB_AUTO_MODE	Auto mode button
PB_MANUAL_MODE	Manual mode button
PB_MDI_MODE	MDI mode button
PB_HOME_MODE	Home mode button
;; PB_FREE_TWO	Not used

Read a Number Value — Buttons

Symbol	Comment
; VS_SPINDLE_RPM_M	Not used
VS_SPINDLE_MAX_RPM_M	Maximum spindle speed
VS_SPINDLE_MAX_LIM_M	Maximum spindle speed
VS_SPINDLE_CMD_RPM_M	Actual commanded spindle speed
VS_SPINDLE_ACT_RPM_M	Actual spindle speed
; VS_SPINDLE_COUNTS_REV_M	Not used
; VS_SPINDLE_CSS_M	Not used
; VS_SPINDLE_CSS_UNITS_M	Not used
VS_SPINDLE_OVERRIDE_M	Actual spindle override
; VS_HAND_STEP_M	Not used
VS_FEED_OVERRIDE_M	Actual feed override
VS_RAPID_OVERRIDE_M	Actual rapid override

Mode, Axis Selected

```
; test the actual mode   : If (S_MODE_M=SEL_MODE_AUTO)
; test the axis selected : If (S_AXIS_M=SEL_AXIS_X)
; test of spindle status : If (S_SPND_M=SEL_SPND_CCW)
```

Symbol	Comment
S_MODE_M	Tell actual mode
SEL_MODE_AUTO	Auto mode
SEL_MODE_MANUAL	Manual mode
SEL_MODE_MDI	MDI mode
SEL_MODE_HOME	Home mode

Symbol	Comment
S_AXIS_M	Tell axis selected
SEL_AXIS_X	X axis selected
SEL_AXIS_Y	Y axis selected
SEL_AXIS_Z	Z axis selected
SEL_AXIS_A	A/U axis selected
SEL_AXIS_B	B/V axis selected

Symbol	Comment
S_SPND_M	Tell spindle status
SEL_SPND_CCW	Spindle turning CCW
SEL_SPND_OFF	Spindle stopped
SEL_SPND_CW	Spindle turning CW
;SEL_SPND_ORIENT1	Not used
;SEL_SPND_ORIENT2	Not used
;SEL_SPND_LOCK	Not used

Read a Number Value — Mode, Axis Selected

Symbol	Comment
VS_TOOL_NUM_M	Give active tool and correction numbers
VS_X_ABS_M	Give actual offset (G54-G59 + G52 + Tool) of X axis
VS_Y_ABS_M	Give actual offset (G54-G59 + G52 + Tool) of Y axis
VS_Z_ABS_M	Give actual offset (G54-G59 + G52 + Tool) of Z axis

Read a Number Value or Bit — Mode, Axis Selected

To write DAC5 or DAC6 from –512 to +512 for –10V to +10V

Symbol	Comment
SERVO_COUNTER_M	Servo counter incremented by one every Servo inter.
HANDLE5IN_COUNT_M	Encoder 5 value (if motor 5 not used)
HANDLE6IN_COUNT_M	Encoder 6 value
ADC1_M	ADC1 value (feed potentiometer)
ADC2_M	ADC2 value
ADC3_M	ADC3 value
ADC4_M	ADC4 value
; TIMER_1_M	
; TIMER_2_M	
; TIMER_3_M	
; TIMER_4_M	
; FEED_HOLD_M	
PROG_RUNNING_M	Program running bit
HOME_COMPLETE_1_M	Axis 1 (X) home completed bit
HOME_COMPLETE_2_M	Axis 2 (Y) home completed bit
HOME_COMPLETE_3_M	Axis 3 (Z) home completed bit
HOME_COMPLETE_4_M	Axis 4 (A/U) home completed bit
HOME_COMPLETE_5_M	Axis 5 (B/V) home completed bit
; PROG_STEPPING_M	
; MOTION_MODE_M	
IN_POSITION_M	Coordinate system one all axis in position
; CONT_MOTION_REQ_M	
; SPINDLE_MOTOR_VEL	
; SPINDLE_CSS_POS	
; SPINDLE_DAC_M	
; SPINDLE_ENA_M	
; ABORT_DECEL_1_M	
; ABORT_DECEL_2_M	
; ABORT_DECEL_3_M	
DES_VEL_ZERO_1_M	Axis 1 (X) desired velocity zero bit
DES_VEL_ZERO_2_M	Axis 2 (Y) desired velocity zero bit
DES_VEL_ZERO_3_M	Axis 3 (Z) desired velocity zero bit
DES_VEL_ZERO_4_M	Axis 4 (A/U) desired velocity zero bit
DES_VEL_ZERO_5_M	Axis 5 (B/V) desired velocity zero bit
POS_BIAS1_M	Axis 1 (X) position bias (G92 offset)
POS_BIAS2_M	Axis 2 (Y) position bias (G92 offset)
POS_BIAS3_M	Axis 3 (Z) position bias (G92 offset)
POS_BIAS4_M	Axis 4 (A/U) position bias (G92 offset)
POS_BIAS5_M	Axis 5 (B/V) position bias (G92 offset)
PLUS_LIMIT1_M	Axis 1 (X) plus limit active (hard or soft)
PLUS_LIMIT2_M	Axis 2 (Y) plus limit active (hard or soft)
PLUS_LIMIT3_M	Axis 3 (Z) plus limit active (hard or soft)
PLUS_LIMIT4_M	Axis 4 (A/U) plus limit active (hard or soft)
PLUS_LIMIT5_M	Axis 5 (B/V) plus limit active (hard or soft)
NEG_LIMIT1_M	Axis 1 (X) minus limit active (hard or soft)
NEG_LIMIT2_M	Axis 2 (Y) minus limit active (hard or soft)
NEG_LIMIT3_M	Axis 3 (Z) minus limit active (hard or soft)
NEG_LIMIT4_M	Axis 4 (A/U) minus limit active (hard or soft)
NEG_LIMIT5_M	Axis 5 (B/V) minus limit active (hard or soft)

MOT1_ACTUAL_POS_M	Axis 1 (X) actual position
MOT2_ACTUAL_POS_M	Axis 2 (Y) actual position
MOT3_ACTUAL_POS_M	Axis 3 (Z) actual position
MOT4_ACTUAL_POS_M	Axis 4 (A/U) actual position
MOT5_ACTUAL_POS_M	Axis 5 (B/V) actual position
CS1_PROG_FEED_M	
HOME_FLAG_1	Axis 1 (X) home flag hardware input
HOME_FLAG_2	Axis 2 (Y) home flag hardware input
HOME_FLAG_3	Axis 3 (Z) home flag hardware input
HOME_FLAG_4	Axis 4 (A/U) home flag hardware input
HOME_FLAG_5	Axis 5 (B/V) home flag hardware input
HWLIM1_PLUS	Axis 1 (X) limit plus hardware input
HWLIM1_MINUS	Axis 1 (X) limit minus hardware input
HWLIM2_PLUS	Axis 2 (Y) limit plus hardware input
HWLIM2_MINUS	Axis 2 (Y) limit minus hardware input
HWLIM3_PLUS	Axis 3 (Z) limit plus hardware input
HWLIM3_MINUS	Axis 3 (Z) limit minus hardware input
HWLIM4_PLUS	Axis 4 (A/U) limit plus hardware input
HWLIM4_MINUS	Axis 4 (A/U) limit minus hardware input
HWLIM5_PLUS	Axis 5 (B/V) limit plus hardware input
HWLIM5_MINUS	Axis 5 (B/V) limit minus hardware input
USER_FLAG_1	Axis 1 (X) User flag hardware input
USER_FLAG_2	Axis 2 (Y) User flag hardware input
USER_FLAG_3	Axis 3 (Z) User flag hardware input
USER_FLAG_4	Axis 4 (A/U) User flag hardware input
USER_FLAG_5	Axis 5 (B/V) User flag hardware input
AMP1_ENA_M	Axis 1 (X) Amplifier enable hardware output
AMP2_ENA_M	Axis 2 (Y) Amplifier enable hardware output
AMP3_ENA_M	Axis 3 (Z) Amplifier enable hardware output
AMP4_ENA_M	Axis 4 (A/U) Amplifier enable hardware output
AMP5_ENA_M	Axis 5 (B/V) Amplifier enable hardware output
FATAL_FE1_M	Axis 1 (X) Fatal following error bit
FATAL_FE2_M	Axis 2 (Y) Fatal following error bit
FATAL_FE3_M	Axis 3 (Z) Fatal following error bit
FATAL_FE4_M	Axis 4 (A/U) Fatal following error bit
FATAL_FE5_M	Axis 5 (B/V) Fatal following error bit
AMP_FAUT1_M	Axis 1 (X) Amplifier fault hardware input
AMP_FAUT2_M	Axis 2 (Y) Amplifier fault hardware input
AMP_FAUT3_M	Axis 3 (Z) Amplifier fault hardware input
AMP_FAUT4_M	Axis 4 (A/U) Amplifier fault hardware input
AMP_FAUT5_M	Axis 5 (B/V) Amplifier fault hardware input
DAC5_OUT	DAC 5 output value (when motor 5 not used)
DAC6_OUT	DAC 6 output value

P-Variables

Symbol	Comment
TOOL_GEOMWEAR	Actual tool correction number
TOOL_NUMBER	Actual tool number
VERSION_NUMBER	PLC program version number
DATE_VERSION	PLC program date
HOME_COMPLETE_P	All axis Home completed bit
DES_VEL_ZERO_P	All axis Desired Velocity zero bit
USER_DISABLE_OVRD	User bit to force feed to 100% (disable feed pot.)
AMP_ARE_ENABLED_P	All axis amplifier are enabled
LATHE_MACHINE	0 = Milling machine 1 = Lathe machine
MMI_OK	HMI running
TOOL_PREVIOUS	Actual (previous) tool active when tool change called
HAVE_TOOL_CHANGER	Tool changer option checked in setting page 4
S1_IN_C_AXE	Spindle used in C axe
TOOL_IN_SPINDLE	Tool in spindle from tool changer initialization page
MAGAZINE_POSITION	Magazine positive from tool changer initialization page
INCH_MODE	Metric or Inch mode

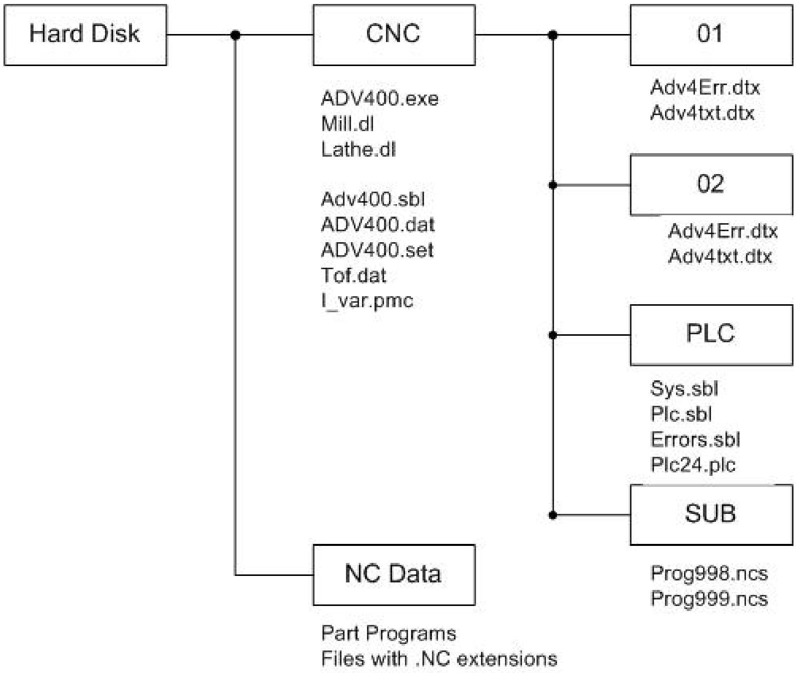
Constants

Symbol	Comment
TRUE	Value True
FALSE	Value False
ON	Value ON
OFF	Value OFF

APPENDIX B: HARD DISK CNC ARCHITECTURE

This section explains the structure of directories and files in the flash memory (DOM) of the Adv 400. This structure is needed for the Adv 400 HMI software.

Disk Architecture for Adv 400 CNC:



- The main directory is called Hard Disk. It is the root of the disk and it contains the Windows CE files.
- The sub-directory NCDATA contains the part programs (G-codes programs) created by the user. These files are managed automatically by the HMI while creations/modifications of part programs. They have a .NC extension.
- The sub-directory CNC contains sub-directories (01, 02, PLC and SUB) and some files needed by the HMI. The Adv400.exe file is the HMI software.
  - The Mill.dl and Lathe.dl files are the system PLCs sent to the controller at power-up.
  - If a Milling machine was selected in the Machine Setting Page 4, the Mill.dl file is used. If a Lathe machine was selected, the Lathe.dl file is used.
- The HMI software creates all other files in this CNC sub-directory during the setting of the machine.
- The sub-directory 01 contains the error file and the text file used for first language. The first language is English by default.
- The sub-directory 02 contains the error file and the text file used for the second language. The second language can be any language. The machine integrator must make the translations.
- The sub-directory PLC will contain the PLC15 to 24 the machine integrator may create. A PLC25 exists already and can be modified by the machine integrator. It is used to put extra conditions on the use of the Adv 400 buttons (e.g., Cycle Start button, JOG button, etc.). In addition, this sub-directory contains the different symbol tables (files Sys.sbl, Errors.sbl and Plc.sbl) containing all symbol names used for PLC or Sub-program development.
- The sub-directory SUB will contain the sub-programs 2-997 the user may create. The sub-program 998 and 999 are present already and must be completed by the machine integrator. Program 998 is used for integration of a tool changer. Program 999 is used to create custom M-codes.