E-FCS

CNC for Operator Manual

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EFFECTIVE FILAMENT WINDING® PIONEERS

E-FCS

CNC FOR OPERATOR MANUAL

TABLE OF CONTENTS

1. GENERALITIES

In this manual is explained how to operate with the CNC, for the control and correct programming of the machine.

The CNC is composed of a keyboard, a monitor unit and a panel of commands.

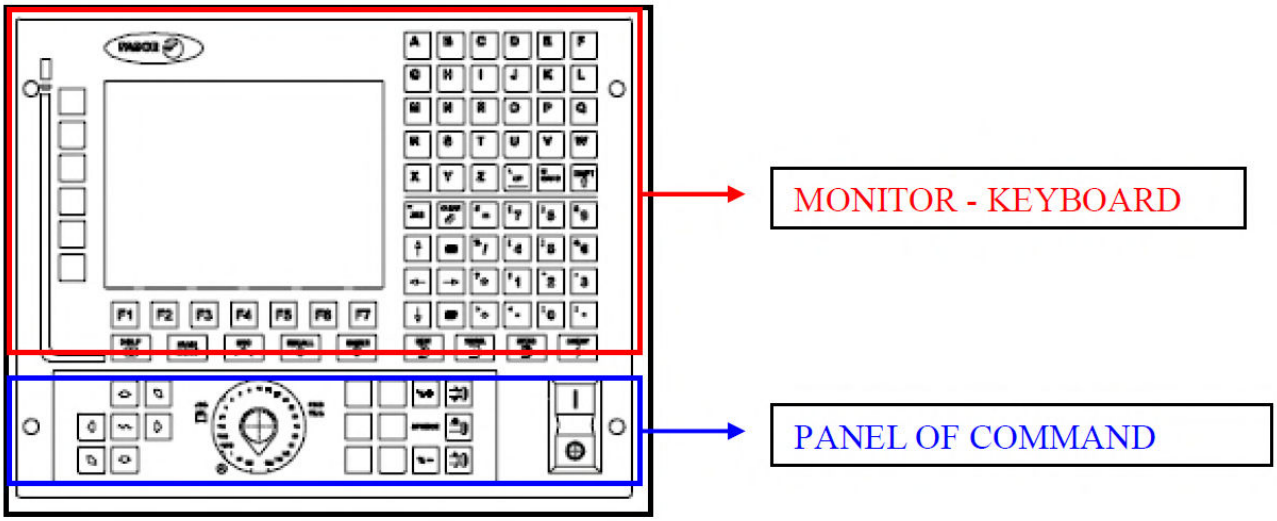


Figure 1

- The monitor shows the required information of the system.
- The keyboard permits communication with the CNC; you can request information with commands or change the CNC state using the generation of new instructions.
- The panel of command permits acts on the machine of cut of stone.

1.1. DISTRIBUTION OF THE INFORMATION IN THE MONITOR

The CNC monitor finds divided into the following areas or windows of representation:

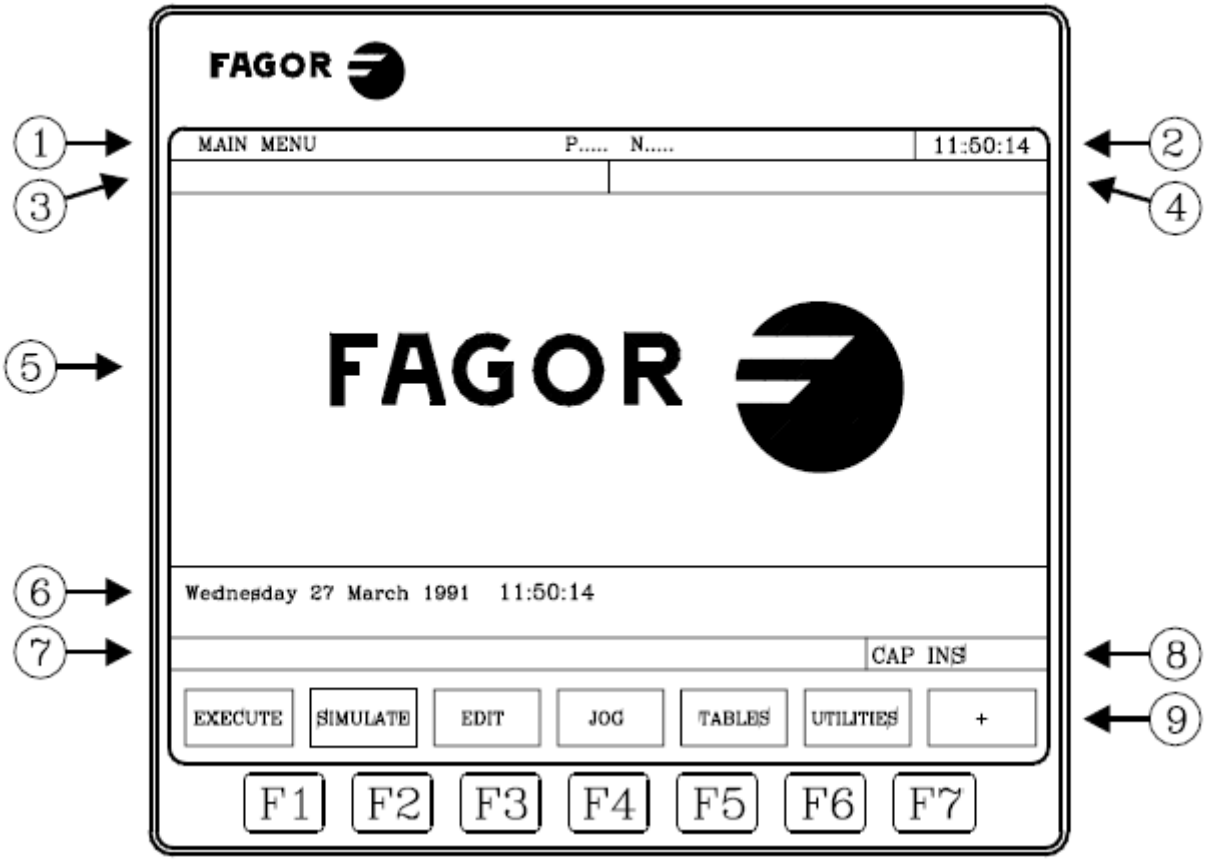


Figure 2

- In this window is indicated the mode of work selected (if you are in the "Main Menu", in the "Execute menu" in the "Simulation menu"...), as well as the number of programs and the number of active blocks. Also, it indicates the state of the program (in execution or interrupted) and if the execution program is activated.

- In this window it indicates the hour in the " hour's format: minutes: seconds ".

- In this window you visualize the messages sent to the operator from the Piece program or DNC path.

You can see the last received message without keeping in mind your origin.

- In this window you can see the messages of the PLC.

If the PLC activates two or more messages, the CNC will visualize always the more important ones. The most important is the message a that smaller number has, in this form, the MSG1 will be more important and the MSG128 less important.

In this case, the CNC will show the "+2 character, indicative that exist more activated messages for the PLC, it can be visualized the same if it accedes in the PLC mode to the ACTIVE MESSAGES option. Acceding to PLC mode and selecting the mentioned option will be able to delete the active messages.

- Main window.

Depending on the mode of the CNC operation it will show in this window all necessary information.

When it produces an error of CNC or PLC the system visualizes it in a horizontal window over this.

The CNC will visualize always the more serious error. The CNC will show the key [↓] to indicate that it has produced other less serious errors and you must use this key to accede it. The CNC will show the key [↑] to indicate that it has produced other more serious errors and you must use this key to accede to it.

- Window of edition.
- Window of communication of the CNC (detected errors in edition, not existent programs etc.).
- In this window is showed the following information:

- SHF indicates that has been pressed the SHIFT key, to activate the second function of the keys. For example, if following the key SHIFT you pulses the key 9, the CNC understand that it wants the character "$".
- CAP is indicative of capital letters (CAPS). The CNC understand that it wanted capital letters.
- INS/REP indicates if it is in the insertion mode (INS) or substitution (REP). It is selected to push to the INS key.

- MM/INCH indicates the system of units (millimetres or inches). Selected for the display.
    - Show the different options that you can select pushing the keys F1 to F7 (named Soft -Keys).

1.2. DISTRIBUTION OF THE KEYBOARD

In function of the utility that has the different keys, can consider that the CNC keyboard is divided into the following form:

- Alphanumeric keyboard for the insertion of data in memory, axis selection, compensation of tools ...

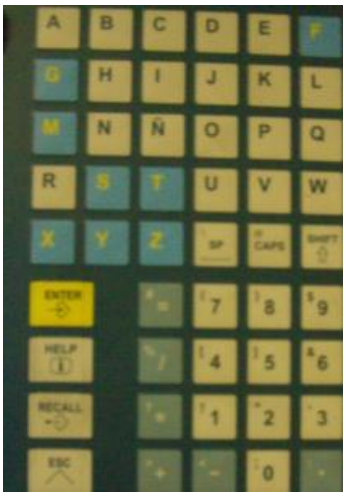
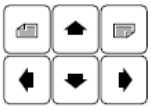


Figure 3

-  Keys that permit moving forwards or backwards, page to page or line to line, the habituated information in the screen, as well as moving the cursor along the same screen.
- [INS] permit select the insertion mode or substitution.
- [CL][CLEAR] permit deletes the character on the one which is positioning the cursor or introduces the last one if the cursor is found at the end of the line.

- [F1] to [F7] Soft keys or keys of function that permit select the different options of habituated operation in the monitor.

Figure 4

- [HELP] permit accedes to the system of help in any mode of operation.
- [MAIN MENU] It accedes directly to the main menu of the CNC.

Figure 5

- [ESC] Turn to the screen or the previous option.

Figure 6

- [RECALL] In a conversational manner it assigns the value of a dimension to the field selected.
- [ENTER] used to validate the commands of the CNC and PLC generated in the window of edition.

Figure 7

- [RESET] serve to initialize the history of the program in execution, by assigning it the definite values using machine parameter. The program must be stopped in order for stopped the CNC accepts this key.

Moreover exist the following special sequences of the keyboard:

[SHIFT] + [RESET] The result of this sequence of keys is the same as if you switch off and on the CNC. This option must use after modifying the CNC machine parameters so that be effective.

[SHIFT]+ [CL] With this sequence of keys disappear the display of the CRT screen. Switch off the screen, but it doesn't lose information. It is an option to increase the life of the screen as well as for the economy of energy. To recover your states normal is necessary to push any key. If while the screen is out, it is produced an error or receives a message of PLC or CNC, the screen will recover its normal state.

[SHIFT] + [NEXT PAGE] It permits visualizing on the right side of the screen the position of the axis and the state of the program in the course. It can be used in any mode of operation. To recover the previous display it is necessary to push the same sequence of keys.

1.3. DISTRIBUTION OF THE PANEL OF COMMAND

In the function of the utility that has the different parts can consider that the panel of command of the CNC finds divided into the following form:

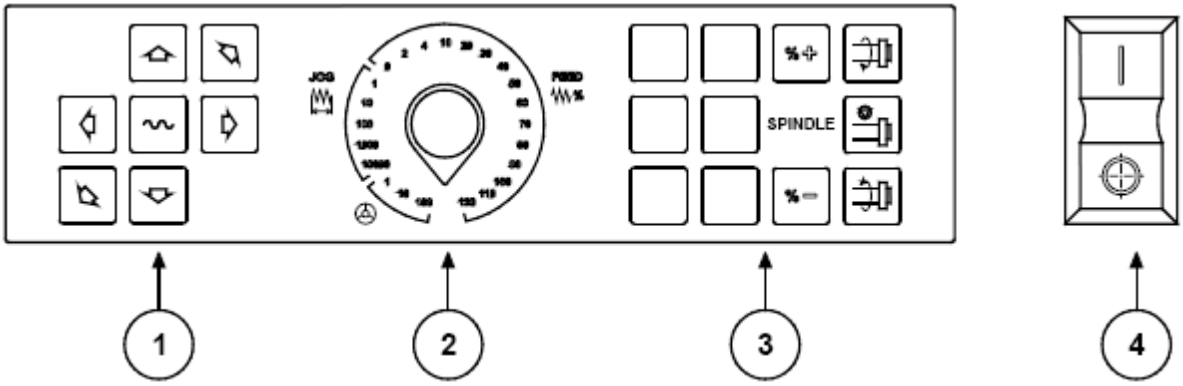


Figure 8

- Keyboard for the manual movement of the axis.

- Selective change-over switch with the following functions:
  Selecting the factor of multiplication of the number of impulses of the electronic wheel (1.10 or 100).
  Selecting the incremental value of the movement of the axis in "JOG" mode.
  Modifying the programmed advance of the axis between 0% and 120%.

- This Keyboard permits control of the axis of the side wheels and the wheels; if the acquired machine disposes of them.
- Keyboard for START and STOP of the block or programs to execute.

2. OPERATION

After switching on the CNC or after performing the sequence of SHIFT+ RESET keys, the main window of the monitor will appear on page 0 (in it figures the logotype, dates and hour).

The screen will show the main menu of the CNC, can the different manners are selected of operation using the soft keys. (F1 to F7).

The options it will show the CNC main menu after the ignition, after playing the sequence of SHIFT RESET keys or after playing the "MAIN MENU" key are:

- **EXECUTE** permits the execution of program pieces in automatic or block-to-block.
- **SIMULATE** permit the simulation of program piece in several manners.
- **EDIT** permits the edition of already existing programs.
- **JOG** permit controls manually the movements of the machine using the keys of the direction of the panel of command. ↑, ↓, ←, →...
- **TABLES** permit manipulation of the CNC tables related to the piece programs (correctors, tools, warehouse of tools and variable or global or local parameters).
- **UTILITIES** permit the manipulation of programs (copy, delete, rename,).
- **STATUS** Sample the state of the CNC and the DNC communication routes. Also, it permits the activation and deactivation of the communication of PC with a DNC path.
- **PLC** permits operation with the PLC (edit the program, monitoring, alter the state of your variables, it accedes to the page of messages or active errors,)
- **PERSONALIZE** permit using an editing graphic change creates screens defined for the user, that afterwards can be activated from the PLC, used in the programs of PERSONALIZE or presented in the moment of the switch on (page 0).

- **MACHINE PARAMETERS** permit personalizes the machine parameters to fit the CNC to the machine.

- **DIAGNOSIS** carries out a test of the CNC.

  The CNC allows, while executing or simulating a piece program, to accede to any other mode of operation without stopping the execution of the program. Thus, it can edit a program while executing or simulating another. It does not allow editing the program that is executing or stimulating, nor executing or simulating two programs piece at the same time.

Figure 9

Figure 10

3. MOVEMENT OF THE MACHINE IN JOGMODE

This mode of operation will be used to move the machine manually.

Enter the "JOG mode" from the main screen (press the key "MAIN MENU" to enter). Press the key "JOG". It can verify that it finds in it by observing that in the area of screen 1 (defined on page 3) puts JOG.

At this time on this screen, you will see the following options:

- REFERENCE SEARCH (key F1): This function, normally, must not be used for the operator. This option exchanges the whole system of reference of global coordinates of the machine for those that have been designed.

Figure 11

- PRESET (Key F2): It is used to fix the local zeros of the machine, that is, the point that you take as reference for our piece in short. After pressing one time PRESET, you will have available the options x (key F1), y (key F2) and z (key F3). To fix a zero in one of this axis, press the one that you need, type the value of the point you are about to take as reference (using the numeric keyboard) and then press the key "ENTER". Carry out these steps with each of the desired axes. On the screen, it will appear now the value that has been introduced to each axis.

Figure 12

Figure 13

- MILLIMETER/INCH (Key F7): to change the units
- MDI (Key F4): (it is explained on page 14)
- Being in JOG mode can move the machine by employing the keys of the numeric control ↑, ↓, ←, →... or the keypad.

  Using the selector we can select the factor of multiplication of the number of impulses with which you want that it moves or indicate that it moves in incremental form.

Figure 14

3.1. Immediate mode (Key F4)

The machine allows a movement to a desired coordinate always concerning the machine's origin, with or without the activation of the cutting tool.

It permits you to carry out our movements in a JOG way, without the need of using the page of the CNC or of the buttons in order that moves.

You can accede the key F4 in the JOG mode. One time selected, introduce the value of the point to the one that want that moves and it plays the green key to begin the movement. Using the selector we select the value of the impulses or the increments such as explained in the JOG mode.

Example: We want to move the machine to the x200, y300, and z0 positions.

*This coordinate is related to a point of our reference, which it has previously fixed or will fix, using the preset option.

- We fix the point of reference (fix the zeros):

  From the main screen (MAIN MENU), press JOG (Key F4), PRESET (Key F2), X (Key F1) introduces the value 0 and plays ENTER, and (Key F2) introduce the value 0 and it plays ENTER (if we have the Z axis carries out the same this that with e X and Y).

Figure 15

- Insert the data for the movement in IMMEDIATE:

  Now already we have to fix our system of reference. Following we press the ESC key, select MDI, and introduce for screen: X200 Y300 Z0.

- Move the potentiometer of speed to the minimum.

- Press the green button and we fit the potentiometer to the desired speed. The machine will be moved until reaching to a suitable position.

4. MOVEMENT OF THE MACHINE IN AUTOMATIC MODE

4.1. Execute

For the correct execution of the cuts in automatic mode, it is necessary to carry out preset (such as it is explained on page 8) before the start-up of the program.

From the main menu, select EXECUTE (Key F1).

The arrow of the control will be needed to select different programs stored in memory until putting us in the desired. Then press ENTER and you will visualize in the screen the code of the

program. Following we can begin the program if pulse on the key at the beginning of the cycle (green button).

Figure 16

Before beginning it recommends putting the value of the potentiometer in the zero value, to avoid any mistakes in the cutting of GRP if some error introduces previously in the zeros of the machine, the speed or some other parameter. Press on time the green key and increase the value of the potentiometer. If you see that all proceed as foreseen, fix the potentiometer to the desired value.

Figure 17

While executing the cycle, in the screen the x position is visualized as X, Y, Z following dimensions that you want to achieve, and the X, Y, Z set in the machine.

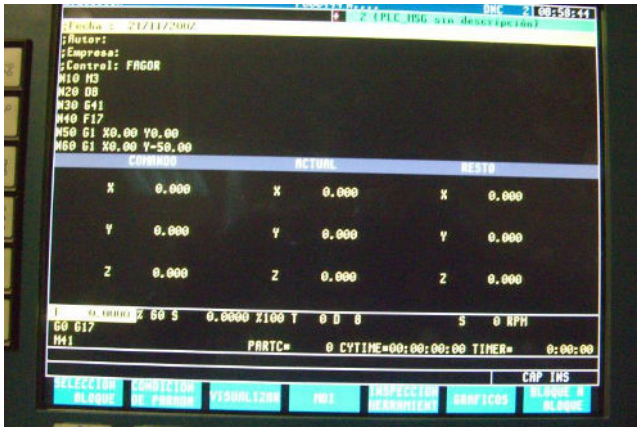


Figure 18

If during the execution of the program, you want to stop the machine momentarily, you must pulse the red button and when you want to re-start, the green button. The machine will follow the program from the position in which was stopped (as long as the machine is not moved for the operator in JOG mode). If you want to start the cycle from the beginning and not from the position in which we pause the program you must play RESET before pressing the green to begin again.

A very useful option before starting the cut program is to visualize the contour of the piece to sketch. You can see it by selecting from the main menu SIMULATE (Key F2). Selects with the arrow the desired program and press ENTER, THEORICAL PATH (Key F1), GRAPHICS (Key F6), CLEAR SCREEN (Key F6) (so you delete possible previous graph that could remain loaded on screen), then press the green key to start the simulation, and finally once the simulation is finished press DISPLAY AREA (Key F2) and OPTIMUM AREA (Key F4).

Being on the screen of the graph you may start the program by pressing the green key, and you will be able to see on the screen the drawing with the carried-out part and the remaining part.

You can reach this screen at any moment when it is executing a program. From the EXECUTION menu, press GRAPHICS (Key F6), and to see well the piece plays DISPLAY AREA and OPTIMUM AREA.

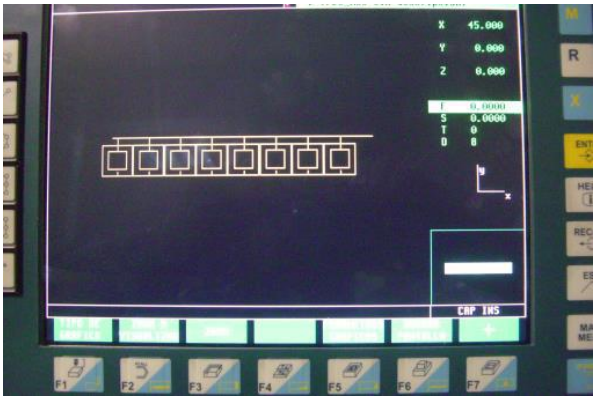


Figure 19

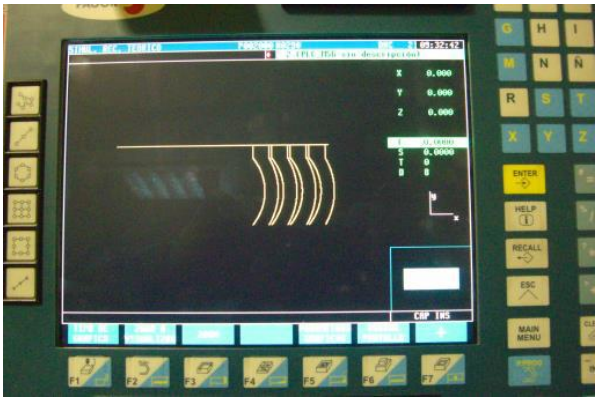


Figure 20

Example.: Execution of the P000001 program called "PROGRAM 1"

- From the main screen (MAIN MENU), press EXECUTE (Key F1). Using the arrow of the CNC keyboard move us to the different programs loaded in memory until finding the program of P000001 name with PROGRAM1

description and press ENTER (on screen will appear the code of the program and the state). Press the green key to start the execution.

4.2. Simulate

From the main menu, select SIMULATE (Key F2).

The arrow of the control will move us to the different programs stored in memory until putting us in the desired, play ENTER and you can visualize in screen the code of the program.

Following we can begin the simulation of the program if press the key at the beginning of the cycle (green button).

*This action is the same as EXECUTE, but with the difference that the machine does move, simply simulates by the CNC.

4.2.1. Edit

Using this option, you can edit new lines of piece program RAM memory of the CNC.

The code for the CNC is generated in an automatic way for the GRANICAD program, but from the CNC is possible to create programs new or modify the existing ones.

From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard to move for the different programs loaded in memory until putting us on the desired program.

The available options are:

Figure 21

Figure 22

4.2.1.1. Edit

Allows to edit new lines in the selected program.

Example: In a program of the memory, P000001 called PROGRAM 1, you want to introduce the order to go to the X0 Y0 position after the N40 number instruction

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard move to the different programs loaded in memory until finding the program of P000001 name with PROGRAM1 description and press ENTER.
- With the arrow of the keyboard scrolls through the instructions, position the number instruction N40 and press EDIT (Key F1), press CNC LANGUAGE (Key F1) and write using the ALPHANUMERIC characters N41 X0Y0. Then press ENTER to validate. You will see that under the N40 line already appears the newly introduced instruction.

*The number of lines introduced N41 can be between N40 and N50. It is a good practice to introduce N10, N20, and N30… to leave 10 intermediate positions to add possible forgetful instructions.

4.2.1.2. Modify

It permit modifies a line of a program.

Example: In a program of the memory, P000001 called PROGRAM1, you want modify the N40 number instruction (exchange N40 F12, by N40 F14)

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard move to the different programs loaded in memory until finding the program of P000001 name with PROGRAM1 description and press ENTER
- With the arrow of the keyboard scroll through the instructions, position the number instruction N40 and press MODIFY (Key F2). Modify using the alphanumeric characters and press ENTER to validate. You will see that in the N40 line already appears the corrected instruction.

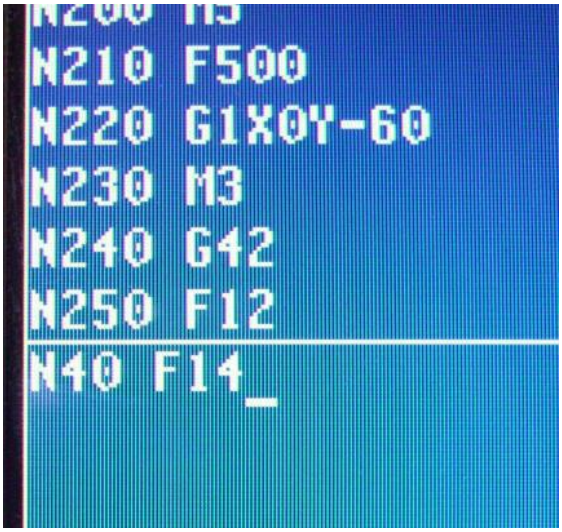


Figure 23

Example.: Modifying the parameters of the "TABLAS" program:

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard to move us to the different programs loaded in memory until finding the program with TABLAS description and it plays ENTER.

- With the arrow of the keyboard scroll the lines of the program, find the line you want to modify and play it MODIFY (Key F2) write using the alphanumeric| characters the parameters to modify and press ENTER to validate.

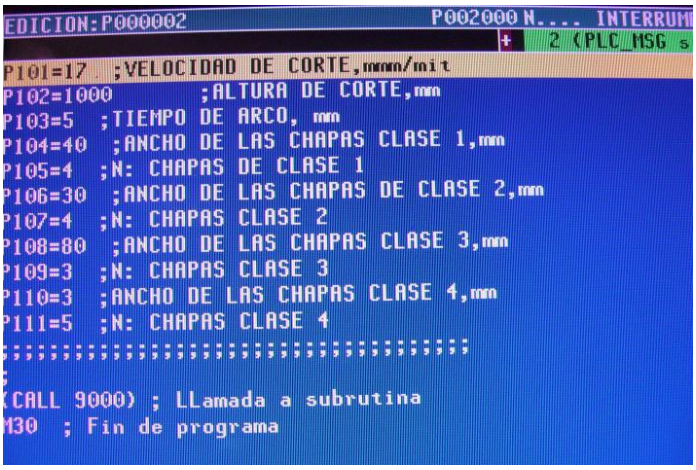


Figure 24

4.2.1.3. Find

Permit searches for a sequence of characters in a program.

Example.: In a program of the memory, P000001 called PROGRAM1, search for the G41 sequence

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard scroll through the different programs loaded in memory until finding the program of P000001 name with PROGRAM1 description and press ENTER.
- Press FIND (Key F3), press TEXT (Key F5) and write using the alphanumeric characters G41 and press FINAL TEXT (Key F6). It underlines us in the program in yellow the where place appears. Press BEGINING (Key F1) to get out of the new to the previous screen.

4.2.1.4. Delete Block

Permit deletes a block or group of blocks in a program.

Example.: In a program of the memory, P000001 called PROGRAM1, you want to delete from the N40 line to the N60 line

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard scroll the different programs loaded in memory until finding P000001 named as PROGRAM1 and press ENTER.
- Press DELETE BLOCK (Key F5), with the arrow on the keyboard scroll through the different instructions and instruction 40 and press INITIAL BLOCK (Key F1), move using the arrow until finding the N60 instruction and press FINAL BLOCK

4.2.1.5. Move Block

Permit moves a block or group of blocks in a program.

*The way to work with this instruction is equivalent to a DELETE BLOCK.

*TO THE FOLLOWING FUNCTIONS YOU MUST PUSH + KEY (F7).

4.2.1.6. Copy Block

Permit copies of a block or group of blocks in other positions of a program.

*The way to work with this instruction is equivalent to DELETE BLOCK or MOVE BLOCK.

4.2.1.7. Copy to Program

Permit copies of a block or group of blocks in another different program.

Example.: In a program of the memory, P000001 called PROGRAM1, you want the block goes from the N30 instruction to the N60 in the P400 program.

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard move us to the different programs loaded in memory until putting us on the program of P000001 named PROGRAM1 and press ENTER.
- Press + (Key F7), it plays COPY T plays OGRAM (Key F2).
- With the alphanumeric keyboard we indicate the number of programs to the one that want to copy (400) and press ENTER.
- Move with the arrow until putting finding the N30 instruction and press INI BLOCK (Key F1), move with the arrow until selecting the N60 instruction and press FINAL BLOCK (Key F1). Already we have copied the block in the suitable program.

4.2.1.8. Include Program

To include the content of another program in the program that is to find selected.

Example.: Putting the content of the P000001 program called PROGRAM1, in the P000002 program.

- From the main screen (MAIN MENU), press EDIT (Key F3), using the arrow of the CNC keyboard scroll the programs loaded in memory until selecting the program of P000002 name with the name PROGRAM2 and press ENTER.
- Press + (Key F7), it play INCLUDE PROGRAM (Key F3).
- With the alphanumeric keyboard indicate the number of programs that you want to include and press ENTER.
- Press INI OPERATION (Key F1). Already you have copied the P000001 program into the P000002 program.

4.3. Utilities

This mode of operation allows access to the programs in the RAM memory of the CNC and the external devices through the USB port.

4.3.1. Directory

Permit to access the directory of programs of the RAM and external devices (USB port). Also, it is possible to access a directory of stored subroutines in the RAM.

Example.: Access to a program called "PROGRAM1" that has been generated with the GraniCad and has been saved in a USB memory.

- From the main screen (MAIN MENU), press UTILITIES (Key F6), DIRECTORY (Key F1), USB (Key F2), and PROGRAMS (Key F1) using the arrow of the CNC keyboard scroll the different programs loaded in the USB memory until putting us on the program of PROGRAM1 name. Then using the keys F1 to F7 you can return to the directory, copy, delete and exchange the date pulsing on them in a similar way to the alone already explained in the manual.

4.3.2. Copy

Permit carries out copies of programs in the same directory or between directories of different devices.

To carry out the copy you must:

1. Press COPY (Key F2)
2. Search and select where is the program or programs that they want to copy.
3. Search and select the number of programs that wants to copy.

   Select the program with the arrow or type your number and play ENTER.
4. If you want to copy several programs play "TO THE END" or "UNTIL". In the case of "UNTIL" it indicates the number of the last program that you want to copy.
5. Press the “EN” |soft key|.
6. Indicates in which it wants to make the copy.
7. When copying a unique program you can select another different number for the program to destine.
8. Press ENTER.

   If a program with the same number exists, the CNC will show a message of notice. Moreover, if these programs are in the CNC execution it will show a message indicating that is not able to perform the task.

It does not permit the disposal of two subroutines with the same name in the RAM.

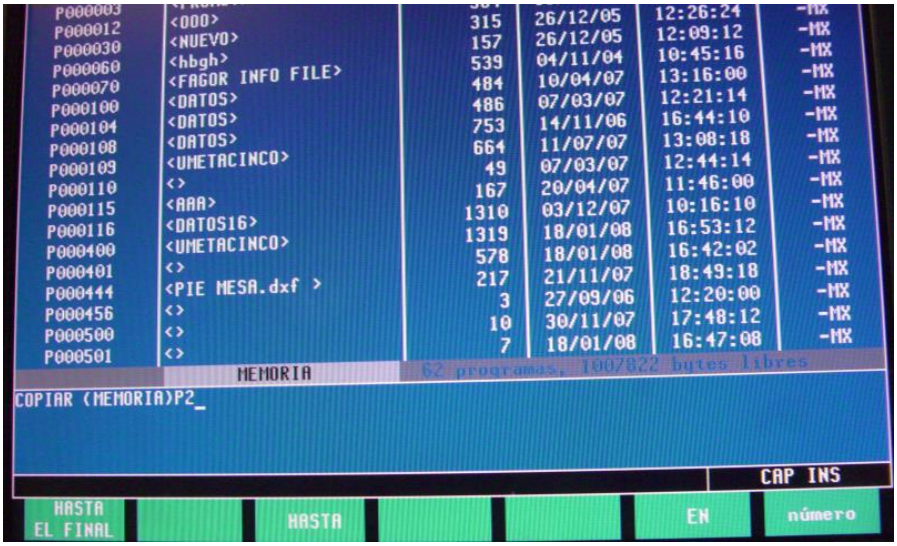


Figure 25

4.3.3. Delete

Permit carries out copies of programs in the same directory or between directories of different devices.

They can delete programs in the RAM memory of the CNC or external devices.

To delete a program you must:

1. Press “DELETE” (Key F3)
2. Indicate where is the program or programs that they want to delete.
3. Indicate the number of programs that wants to delete.

   Select the program with the arrow and it plays ENTER, or it types your number.
4. If you want to delete several programs play the "TO THE END" or "UNTIL ", in the case of "UNTIL" indicates the number of the last program that you want to delete.
5. Press ENTER.

4.3.4. Rename

Permit assigns a new name or a new comment to a stored program in the CNC RAM.

To rename a program you must:

1. Press "RENAME" (Keys F4).
2. Indicate where is the program or programs that they want to rename.
3. Select the program with the arrow and play ENTER.
4. Play the NEW NUMBER or NEW COMMENT |soft key|
5. Introduce the new number or the new comment and press ENTER
   If you exist a program with the same number, the CNC will show a message of notice and will allow you to modify the command.

4.3.5. Change date

Permit modifies the date and the hour of the system.

It shows the date in day month /year format (12/04/1998) that forms up the CNC for your possible substitution. After the substitution it, must play the key ENTER to validate it. If it does not want to exchange it plays the key ESC.

Following you will show the hour in hours/minutes/seconds format (08/30/00) that forms up the CNC for your possible substitution. After the substitution, it must play the key ENTER to validate it. If it does not want to exchange it plays the key ESC.

5. IMPORTANT COMMAMDS BY CN

The commands in ISO language, basic for the realization of the programs are:

- M 003: Activation of the turn of the wire.
- M 005: Deactivation of the turn of the wire.
- M 002, M030: End of program.

- D 001, D002, D003, …: Wire diameter.
- F 100: Speed of advance(F100, F 300)
- G 000: Lineal displacement to quick speed.
- G 001: Lineal displacement to speed programmed previously
- G 002: Turn in a clockwise sense to speed programmed.
- G 003: Turn in anti-clockwise is sense to speed programming.
- G04+K: temporization. Introduction of the timeout in the cut.

NOTE: It is necessary to use a timeout when:

- Change a straight trajectory to another straight.
- Change of a curved trajectory to a straight.
- NO use timeouts when changing from curved trajectory to curve, because you can mark the stone.

G04 K200 [cents. of second]

- G 040: Cancel the correction of radius.
- G 041: Correction of radius to the left of the profile to mechanize
- G 042: Correction of radius on the right-hand side.
- G70: Indications of measures in inches
- G71: indications of measures in mm
- G92: relative piece zero: G92 X0 Y0 ENTER + CYCLE. Is used when having repetitions.

Examples:

Example 1: programming of a square of 50x50 (mm):

N10 M3	M3 starts the wire
N20 D8	D8 defines a wire diameter of 8mm
N30 G41	G41 corrects the radius of the tool to the left
N40 G01 X0 Y0	G01 carries out a lineal displacement to the programmed speed, and X0 Y0 moves the machine to position 0.0.
N45 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N50 G01 X50 Y0	G01 carries out a lineal displacement to the programmed speed, and X50 Y0 moves the machine to position 50.0.
N55 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N60 G01 X50 Y-50	G01 carries out a lineal displacement to the programmed speed, X50 and, 50 moves the machine to position 50, 50.
N65 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N70 G01 X0 Y-50	G01 carries out a lineal displacement to the programmed speed, X0 and, 50 moves the machine to the position 0, 50.
N75 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N80 G01 X0 Y0	G01 carries out a lineal displacement to the programmed speed, and X0 Y0 moves the machine to position 0.0.

N85 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N90 G40	G40 annuls the correction of the radius.
N100 M5	M5 stop the wire
N110 M30	M30 end the program

The N10 instructions to N110 simply indicate the number of lines of the program.

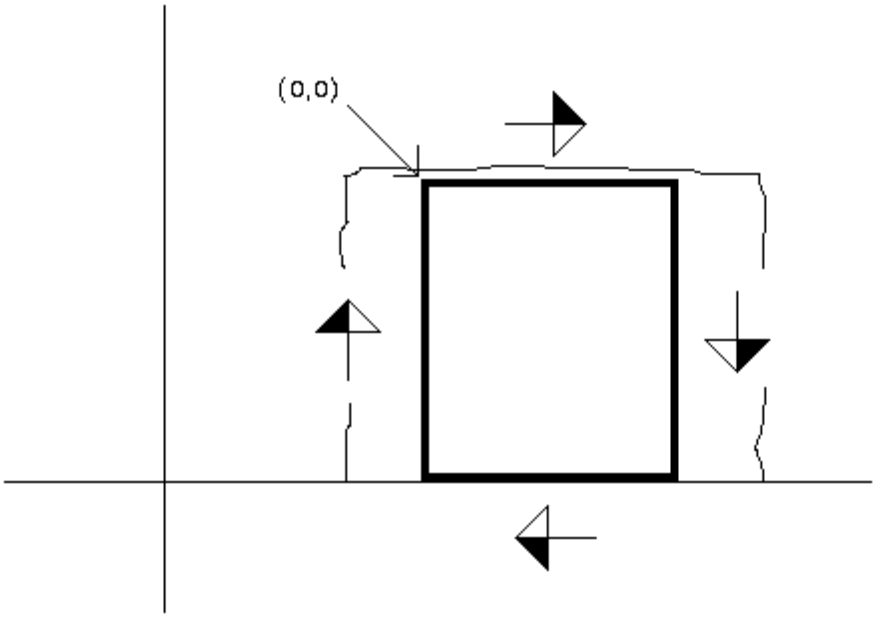


Figure 26

Example 2: programming of a cornice:

N10 M3	M3 starts the wire.
N20 D8	D8 defines a wire diameter of 8mm.
N30 G41	G41 corrects the radius of the tool to the left.
N40 G01 X0 Y0	G01 carries out a lineal displacement to the programmed speed, and X0 Y0 moves the machine he position 0.0.

N45 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N50 G01 X50 Y0	G01 carries out a lineal displacement to the programmed speed, and X50 Y0 moves the machine to position 50.0.
N55 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N60 G03 X100 Y-50 R50	G03 carries out an arc in an anti-clockwise sense to the speed programmed, X100 and, 50 the final position of the arc is 100, 50, R50 the radius of the arc is 50.
N70 G02 X150 Y-100 R50	G02 carries out an arc in an hourly sense to the speed programmed, X150 and, 100 the final position of the arc is 150, 100, R50 the radius of the arc is 50.
N80 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N90 G01 X200 Y-100	G01 carries out a lineal displacement to the programmed speed, X200 and, 100 moves the machine to position 200,100.
N100 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N110 G01 X200 Y-150	G01 carries out a lineal displacement to the programmed speed, X200 and, 150 moves the machine to position 200, 150.
N120 G04 K60000	G04 K60000 introduces a timeout of 60000 hundred seconds.
N130 G40	G40 annuls the correction of the radius.
N140 M5 ;	M5 stops the wire.
N150 M30	M30 end the program.

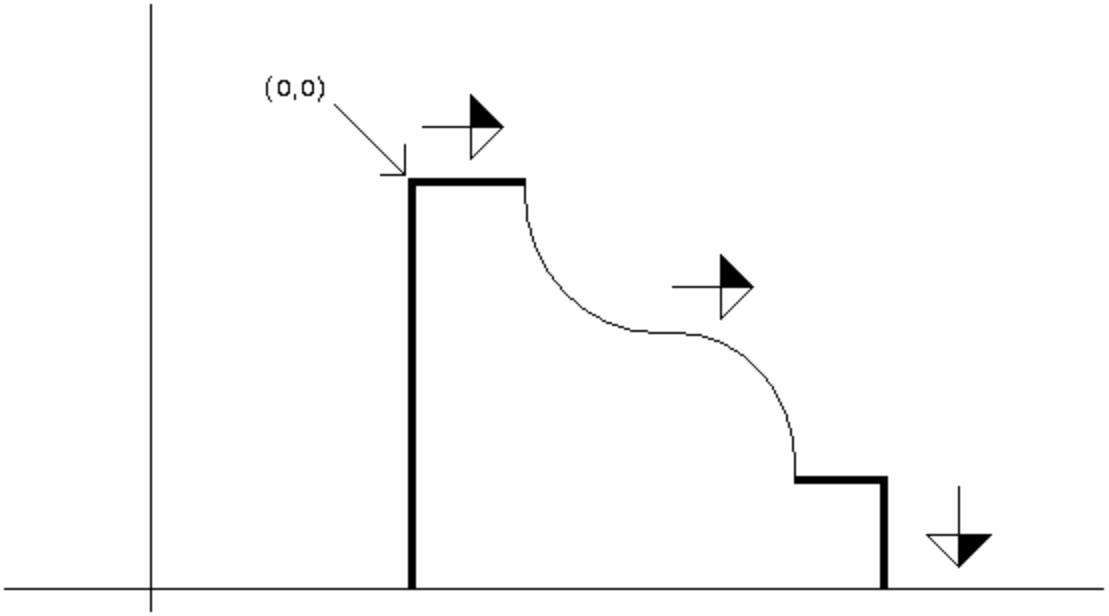


Figure 27

6. LINEAL MOVEMENTS AND FUNCTION AUXILIARIES

6.1. Function G01. Linear Interpolation

Displacement of the wire online straight to the advance programmed previously, or programmed in the same block, of the CNC program.

Maintenance of the machine as well as a registry of follow-up of this board are compulsory for honouring the guarantee contract given by GRANI ROC Company. Likewise, it is also compulsory to fill out the maintenance chart to fulfil the guarantee contract.

Formats:

- Cartesian coordinates: G01 X value Z value or G1 X value Z value;
- Polar coordinates: G01 R value Q value or G1 R value Q value.

G01 is incompatible with G00, G02, G03...

This function uses for straight cuts and you can program as G01 or G1.

6.2. Function G00. Quick Positioning

The G00 function is used to program the displacement of the online straight to the available speed.

Formats:

- Cartesian coordinates:

G00 X value Z value or

G0 X value Z value or

Value Z value x g.

- Polar coordinates:

G00 R-value Q value or

G0 R-value Q value or

Value Q value r g.

This function is used to program previous movements of the wire in which it is out of the stone. For example:

- Approach of the wire immediately start of the cut.
- Exit the wire of the piece.
- Step of the wire for already cut areas.
- G00 is an incompatible function with G01, G02, G03...
- It can program as G00, G0 or well G.

7. F: SPEED OF ADVANCE

7.1. F: Speed of Advance

The speed of advance is the speed with which the diamond-like wire moves, that is, the speed of cut in cm/h.

The speed of advance is represented by the F. letter

F [Value speed].

One time programmed a certain F, the machine will execute all movements of cut with this speed until programming a different speed.

If no programs any F and also the control has not an active advance, the control gives a message of error " there is not F selected " or takes as advance F0.

8. M: AUXILIARY FUNCTIONS

8.1. M Functions

The auxiliary functions are used to define the functioning of the machine, such as the sense of turn, stop of the turn, and end of the program.

In a block in which program these function, the control executes them in the first place and, if it is several auxiliary functions, these are executed in the order in which is written.

For example in the block:

N100 G00 X20 Z5 F0.2 M03 M08.

The order of execution of the functions is the following:

1. The control executes M03 and after M08.
2. Executes the G00 movement, positioning the tool in the coordinate X20 Z5.

3. Finally, the control loads the conditions of cut F0.2

In an only block is possible to program until 7 auxiliary functions (function M) as long as being incompatible among themselves.

The auxiliary functions are classified into 3 groups:

- Related to the CNC program.
- Related with the turn of the wire.
- Related to the functioning of the machine.

8.2. Related with the program

8.2.1. Function M02: End of the program

In the block in which is written this function, the control considers executing the program, although after exist other writings blocks. The control moreover carries out a RESET, all functions that it is activated during the execution of the CNC program will be cancelled and it is activated by default or initially.

8.2.2. Function M30: End of the program and return to the position of the initial block

The reader of blocks of the control is put in the first block of the program, it lists to return to execute the program when the operator decides. In the program of the fixed income example, when the control executes the N170 block produces a stop of the machine and selects the N10 block, prepared to execute the program again. Accordingly, the N180 block never executes.

The M30 function is normally to finish a CNC program.

```
N10 G54
N20 D02
N30 G00 X0 Y0
N40 G01 X20 AND 30
…
N150 G00 X60
N160 Z100
N170 M30
N180 G00 X10 Z-2
```

8.2.3. Related with the turn of the wire

8.2.3.1. Function M03: Turn of the wire

The control when reading this function draws the wire towards the right or clockwise sense.

8.2.3.2. Function M05: Stop of the turn of the wire

These functions are incompatible among themselves.

9. EXAMPLES OF SOME BASIC USUAL OPERATIONS

9.1. STRAIGH CUT IN A BLOCK IN IMMEDIATE MODE

We suppose that we want to cut a block which has a height of 1.50 Ms.

- We approximate the block in JOG mode until the initial position of the cut.

From the Principal JOG (Key F4) menu and we move the machine with the keypad or the commands of the panel until the desired position.

- One time in the initial position, we make a preset to fix the reference of the machine.

In the JOG menu, press PRESET (Key F2); and following X (Key F1) 0 ENTER, and (Key F2) 0 ENTER, Z (Key F3) 0 ENTER.

Figure 28

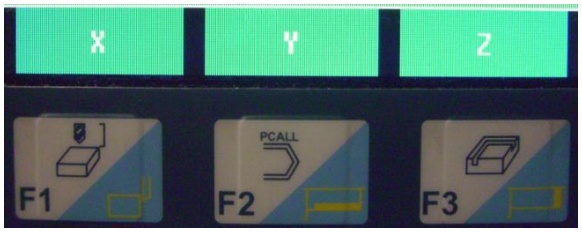


Figure 29

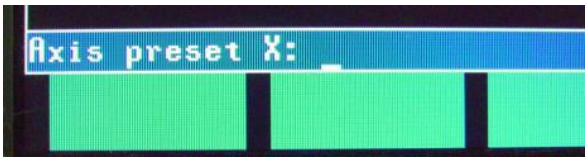


Figure 30

Figure 31

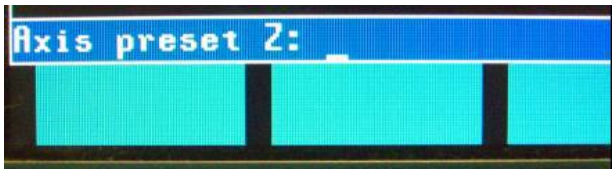


Figure 32

- We accede to the immediate mode and we indicate that the wire goes down stopping 1, 50m, that it is the height of our block.

From the main menu, press JOG (Key F4), and MDI (Key F4) and it writes using the keyboard G1 Y-1500 F17 M3, enters

(G1: Lineal movement to the programmed speed)

(Y-1500: Descent of 1500mm)

(F17: Speed of gone down in cut to 17mm/|min| = 100 cm/h)

(M3: Starting the wire)

To start the cut press the green button.

One time executed the cut will play the red button to stop the wire. We will play RESET if we want to stop the code.

*It is convenient to put the potentiometer in the minimum value before starting the cut to avoid it damages the stone in the case of error when introducing the parameters, one time initiate and after verifying that all is correct will be fitted until the desired value.

9.2. HORIZONTAL CUT IN IMMEDIATE MODE

We suppose that we want to cut in horizontal a block which has a width of 1.50 m.

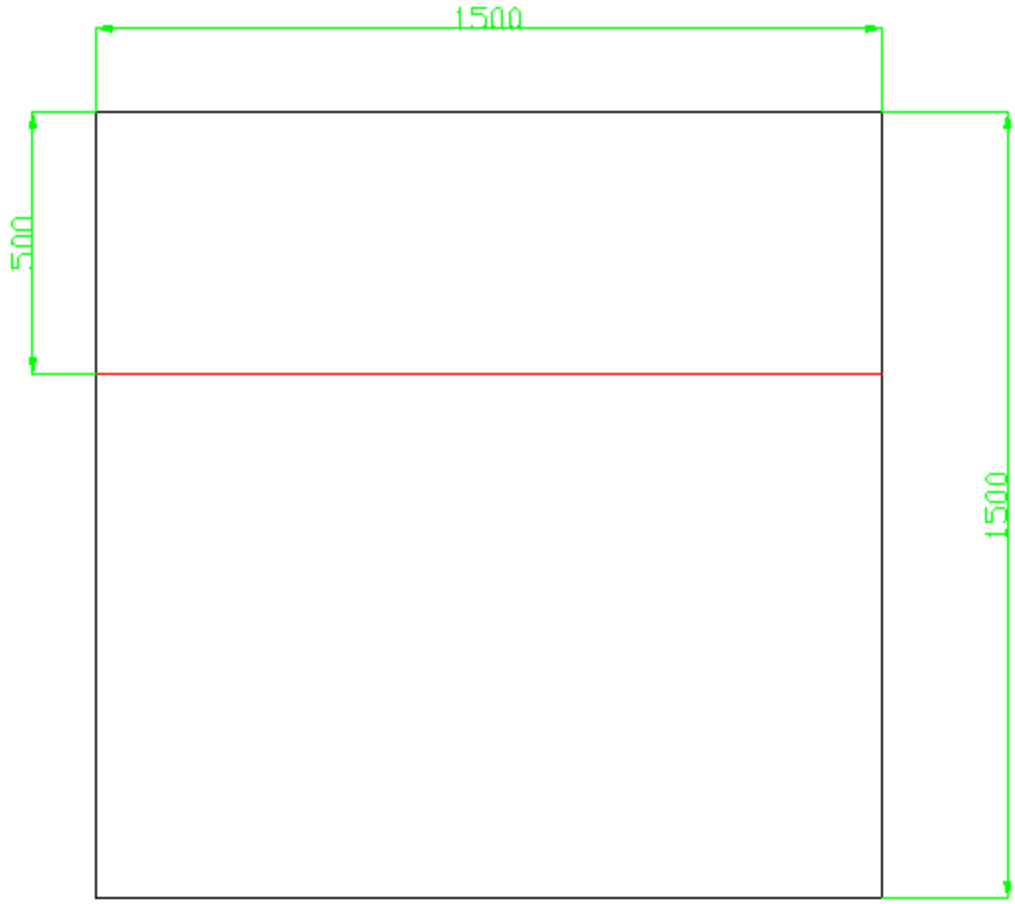


Figure 33

- We approximate the block in JOG mode until the initial position of the cut.

From the Principal JOG (Key F4) menu and we move the machine with the button maker or the commands of the panel until the desired position.

- One time in the position of start-up, we make a preset to fix the reference of the machine.

In the JOG menu, press PRESET (Key F2); and following X (Key F1) 0 ENTER, and (Key F2) 0 ENTER, Z (Key F3) 0 ENTER.

Figure 34

Figure 35

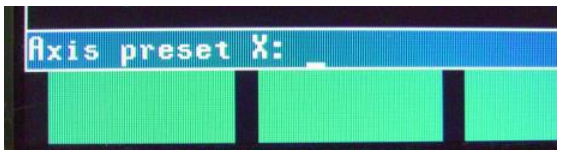


Figure 36

Figure 37

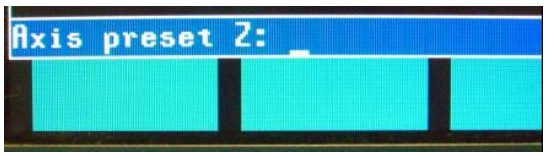


Figure 38

- We accede to the immediate mode and we indicate that the wire goes down stopping 1, 40m, that it is the height of our block.

From the Principal menu, press JOG (Key F4), MDI (Key F4) and it writes using the keyboard G1 X1500 F17 M3, ENTER.

(G1: Lineal movement to the programmed speed)

(X1500: Horizontal movement of 1500mm)

(F17: Speed of gone down in cut to 17mm/|min| = 100 cm/h)

(M3: Starting the wire)

To start the cut press the green button.

One time executed the cut will play the red button to stop the wire. We will play RESET if we want to stop the code.

*It is convenient to put the potentiometer in the minimum value before starting the cut to avoid it damages the stone in the case of error when introducing the parameters, one time initiate and after verifying that all is correct will be fitted until the desired value.

9.3. CUT IN DIAGONAL OF A BLOCK

We suppose that we want to carry out a cut-in diagonal in a block it has a height of 1.50 m, such as shown oneself to be in the following figure.

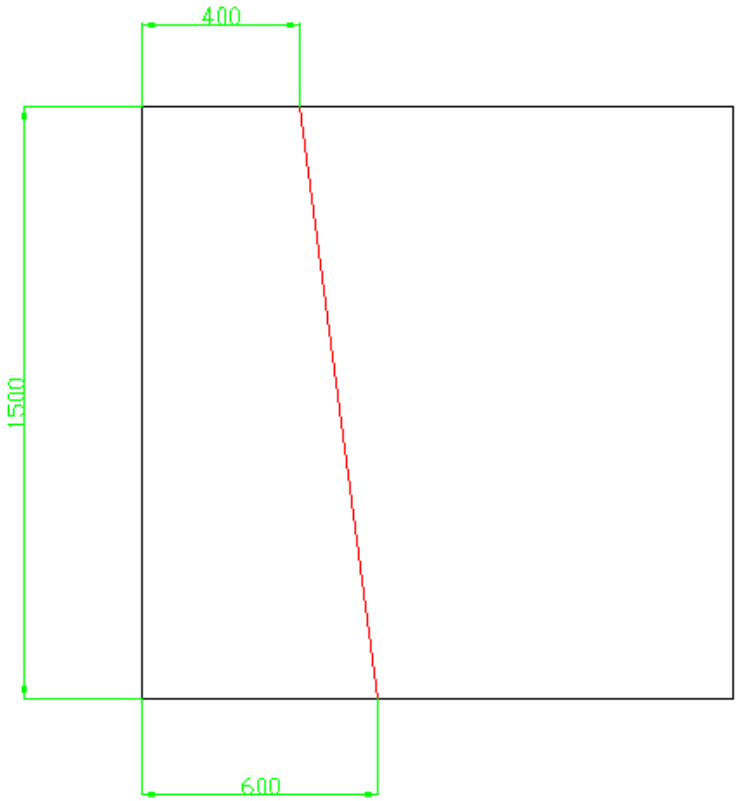


Figure 39

- We approximate the block in JOG mode until the point of start-up of cut.

From the Principal JOG (Key F4) menu and we move the machine with the button maker or the commands of the panel until the initial position.

- One time in the position of start-up, we make a preset to fix the reference of the machine.

In the JOG menu, press PRESET (Key F2); and following X (Key F1) 0 ENTER, and (Key F2) 0 ENTER, Z (Key F3) 0 ENTER.

Figure 40

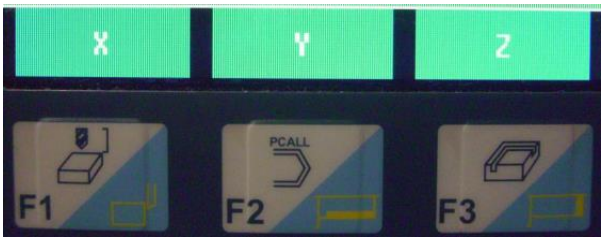


Figure 41

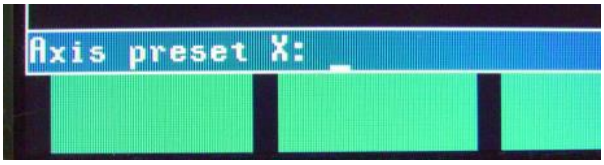


Figure 42

Figure 43

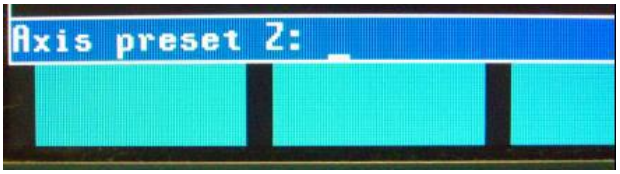


Figure 44

- We accede to the immediate mode and it indicates that the wire goes down stopping, by unlacing in x 200.

(Initially, it finds in a coordinate in x of 400 and the final full stop is in a coordinated x of 600, 600-400=200) and in 1500. From the Principal menu, press JOG (Key F4), and MDI (Key F4) and write using the keyboard G1 X200 ENTER, Y-1500 F17 M3, ENTER.

(G1: Lineal movement to the programmed speed)

(Y-1500: Descent of 1500mm)

(F17: Speed of gone down in cut to 17mm/|min| = 100 cm/h)

(M3: Starting the wire)

To start the cut press the green button.

One time executed the cut will play the red button to stop the wire. We will play RESET if we want to stop the push code.

*It is convenient to put the potentiometer in the minimum value before starting the cut to avoid it damages the stone in the case of error when introducing the parameters, one time initiate and after verifying that all is correct will be fitted until the desired value.

Example: We suppose that we want to carry out a cut in diagonal in a block which has a height of 1.50 m, such as it shows oneself to be in the following figure.

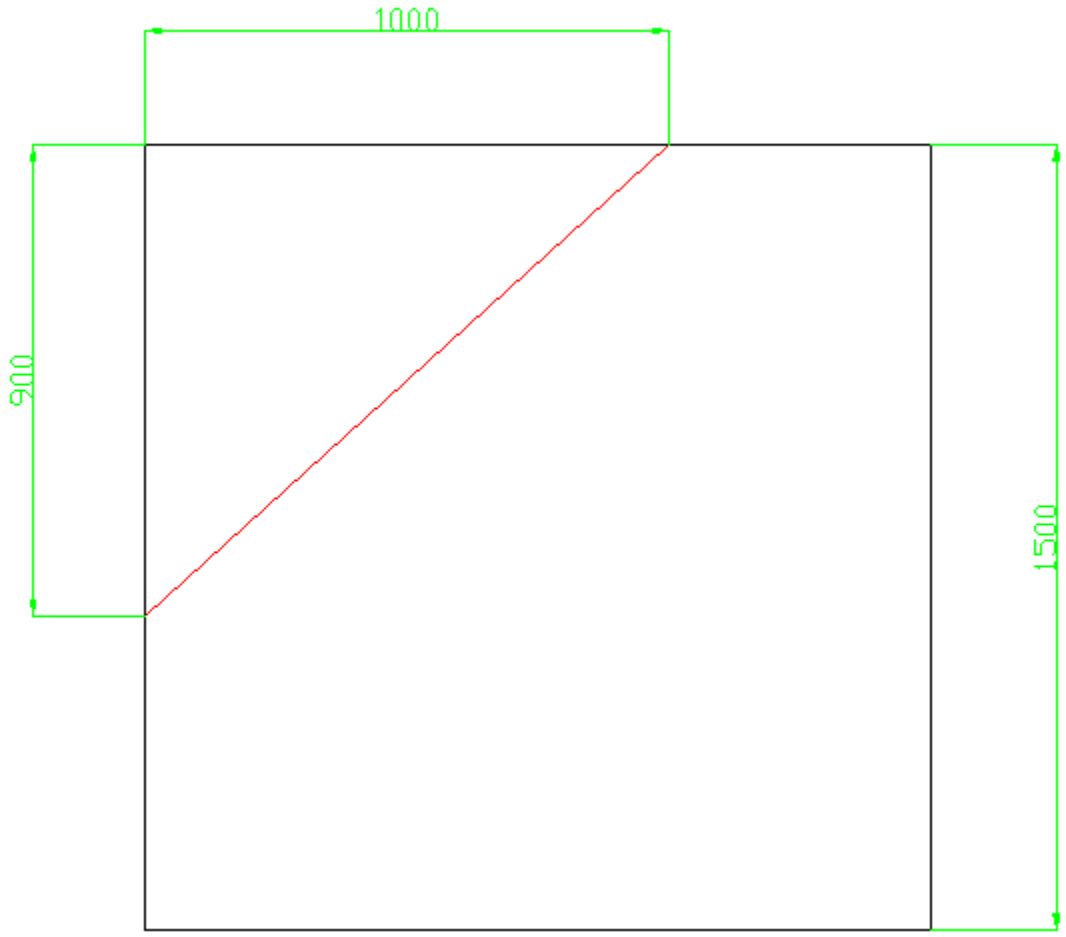


Figure 45

- We approximate the block in JOG mode until the point of start-up of cut

From the Principal JOG (Key F4) menu and we move the machine with the button maker or the commands of the panel until the initial position.

- One time in the position of start-up, we make a preset to fix the reference of the machine.

In the JOG menu, press PRESET (Key F2); and following X (Key F1) 0 ENTER, and (Key F2) 0 ENTER, Z (Key F3) 0 ENTER.

Figure 46

Figure 47

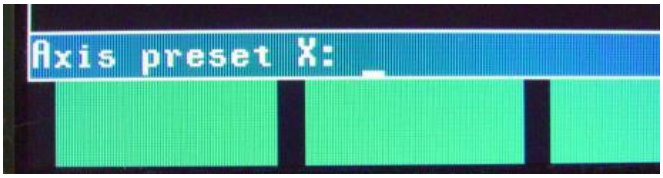


Figure 48

Figure 49

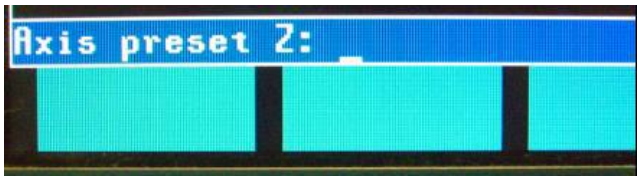


Figure 50

- We accede to the immediate mode and it indicates that the wire goes down stopping, by unlacing in x, 1000 and in and, 900. From the Principal menu, press JOG (Key F4), MDI (Key F4) and it write using the keyboard G1 X, 1000 and, 900 F17 M3, ENTER.

(G1: Lineal movement to the programmed speed)

(X-1000: Displacement in horizontal of -1000mm)

(Y-900: Descent of 900mm)

(F17: Speed of gone down in cut to 17mm/|min| = 100 cm/h)

(M3: Starting the wire)

To start the cut press the green button.

One time executed the cut will play the red button to stop the wire. We will play RESET if we want to stop the code.

*It is convenient to put the potentiometer in the minimum value before starting the cut to avoid it damages the stone in the case of error when introducing the parameters, one time initiate and after verifying that all is correct will be fitted until the desired value.

9.4. CUT OF TABLES

We suppose that want to obtain 10 tables of 25mm and 3 tables of 40mm, of a block of stone of 1500mm in height.

It is possible two cases:

1. If the block has been previously cleaner and it places the machine in a JOG way to the opportune distance unwillingly in the first descent of the machine already obtains a table.

2. If the block is not clean.

   *According to is a case or other will affect us in the number of slabs.

   - Go to the table program that previously has been loaded in the CNC for the GRANI ROC technicians.

   From the main menu, press EDIT (Key F3), with the arrow of the control we move for the different amounts of wine laid in vats for ageing programs until putting on the one name is “TABLAS” and it plays ENTER.

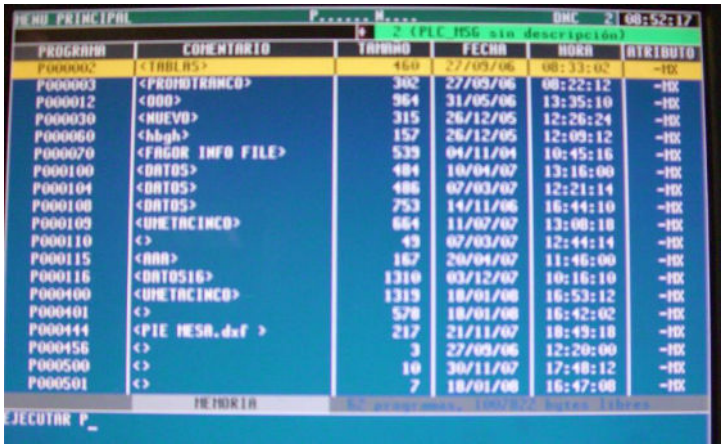


Figure 51

- We fix the parameters of the cut.

1. SPEED OF CUT

   We situate ourselves on the first line to fix the speed of cut that for this example will establish it in 17 mm/min. Play MODIFY (Key F2). With the arrow of the control move us on the line of edition and it exchanges the previously established value for 17. Play ENTER to validate.

2. HEIGHT OF CUT

   We situated on the second row to fix the height of the cut that for our example will be 1600. (Consider that the machine is positioned to 100mm, in this way the 1600mm of descent of cut, instead of the 1500mm that is the height of the block). It plays MODIFY (Key F2). With the arrow of the control move us on the line of edition and it exchanges the previously established value for 1500. Play ENTER to validate.

3. TIME OF ARC

   We situated on the third row to fix the time of arc that for our example will be 300 seconds. It plays MODIFY (Key F2). With the arrow of the control move us on the line of edition and it exchanges the previously established value for 300. Play ENTER to validate.

4. WIDTH OF THE SLAPS CLAS 1

We situate on the fourth row to fix the width of the slabs class 1 that for our example will be 25mm. It plays MODIFY (Key F2). With the arrow of the control move us on the line of edition and it exchanges the previously established value for 25. Play ENTER to validate.

5. Nº of SLAPS CLAS 1

   We situate the five rows to fix the number of clatter class 1 that for our example will be 10.

   It plays MODIFY (Key F2). With the arrow of the control move us on the line of edition and it exchanges the previously established value for 10. Play ENTER to validate.

   *As reflected before have two possible cases, the block is previously cleaned and placed the machine manually in the appropriate place or that is cleaned. In the case that the block is not cleaned will be to indicate here a unit more than those who want to obtain it. For our example, it is considered that the block is clean and the machine has been positioned manually at a distance of the extreme of the 10mm block (width of slab class 1).

6. WIDTH OF THE SLAPS CLAS 2.

   We situate on the fourth row to fix the width of the distinguished sheets 2 that for our example will be 40mm.

   It plays MODIFY (Key F2). With the arrow of the control move us on the line of edition and it exchanges the previously established value for 40. Play ENTER to validate.

7. Nº of SLAPS CLAS 2.

   We situate the five rows to fix the number of clatter class 1 that for our example will be 3.

   It plays MODIFY (Key F2). The arrow of the control moves us on the line of edition and it exchanges the previously established value for 3. Play ENTER to validate.

8. The successive lines of the width of the sheet of Nº of slabs stopped with the zero value, as long as our single example has two types of different sheets.

9. DIAMETER OF THE WIRE

We situate ourselves on the line of the diameter of the wire, which for our example is considered 11mm. It plays MODIFY (Key F2). The arrow of the control moves us on the line of edition and it exchanges the value previously established by 11mm.

Once we have modified the parameters of the table program, and after we positioned the machine previously in JOG mode, press EXECUTE (Key F1) from the Principal menu, situate us on the table program and it plays ENTER.

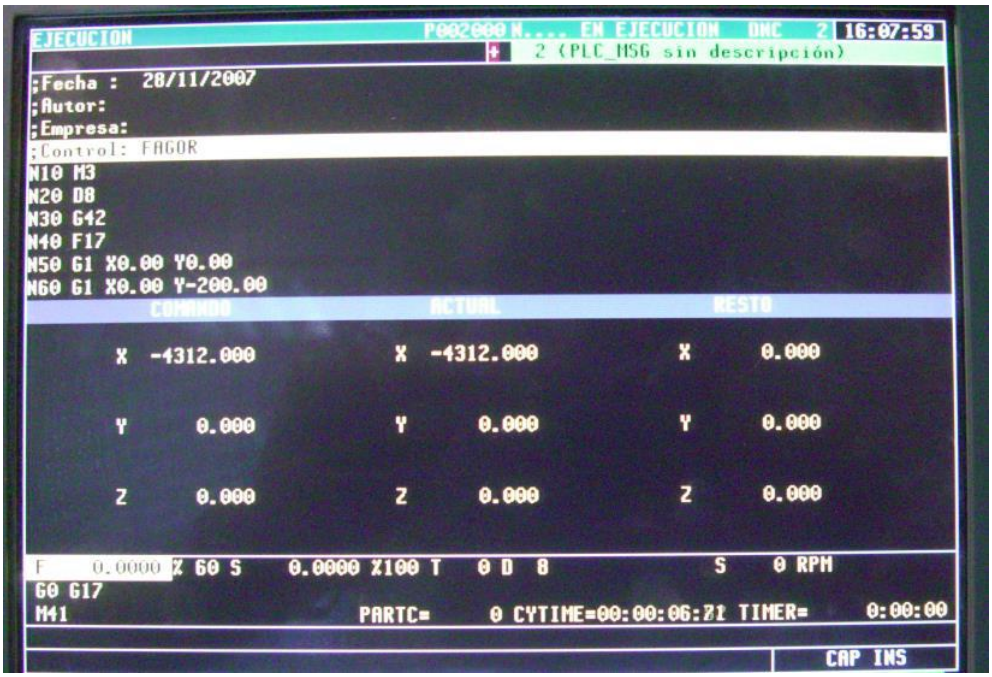


Figure 52

To start your execution it plays the green button.

9.5. ARC CUT IN A BLOCK

We suppose that we want to cut an arc to f=17 in such a block and as it shows oneself to be in the following figure.

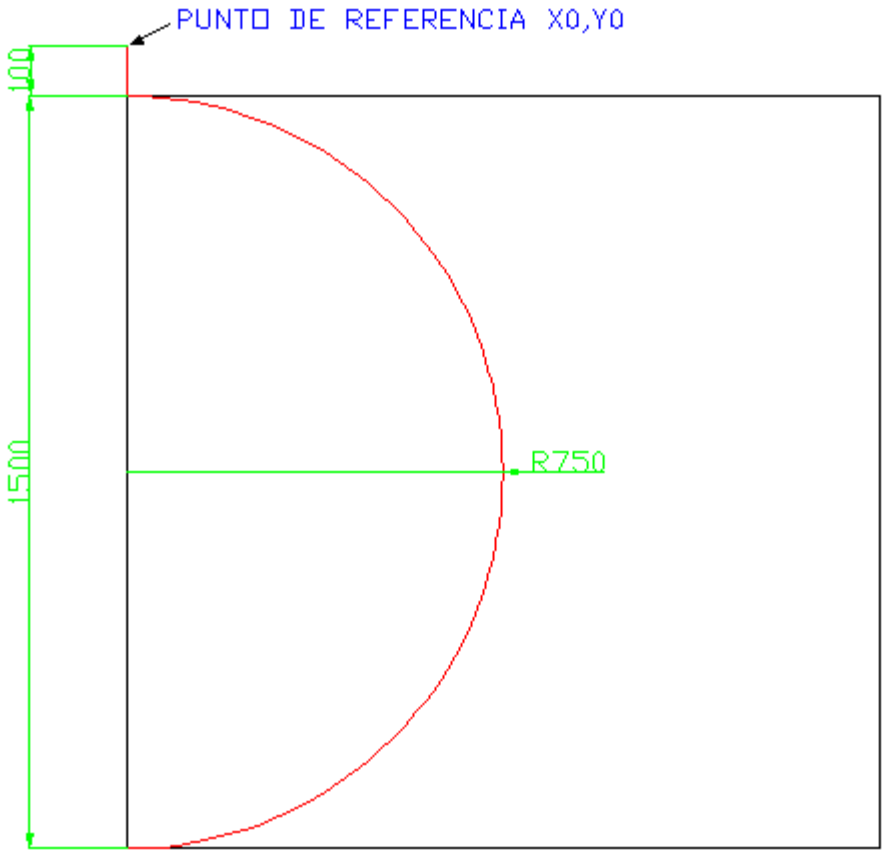


Figure 53

- We approximate the block in JOG mode until the point of reference.

From the Principal JOG (Key F4) menu and we move the machine with the button maker or the commands of the panel until the initial position.

- One time in the position of reference, we make a preset to fix the reference of the machine.

In the JOG menu, press PRESET (Key F2); and following X (Key F1) 0 ENTER, and (Key F2) 0 ENTER, Z (Key F3) 0 ENTER.

Figure 54

Figure 55

Figure 56

Figure 57

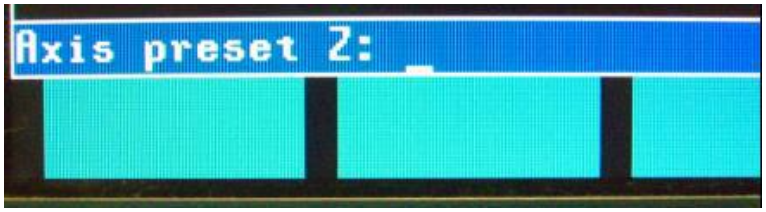


Figure 58

- We do that the wire carries out the descent of closeness to the stone of 100mm.

From the main menu, press JOG (Key F4), and MDI (Key F4), and write G01 (instruction for online straight movement for the speed programmed), Y-100 (descent of closeness of 100mm), F17 (speed of desired cut) M3 (start the wire). Press the green button (the machine will carry out the descent).

- We instruct the arc without having played the red button to stop the wire).

In the immediate mode (MDI) write G02 (instruction for a turn in an hourly sense to the speed programmed), X0 (coordinate of final x), Y-1500 (coordinate of and final), I750 (coordinated of x of the centre of the arc), and J750 (coordinate of and of the centre of the arc) F17 (speed of desired cut).

Press the green button (the machine will carry out the cut of the arc). One time executed the cut will play the red button to stop the wire. We will play RESET if we want to stop.

We suppose that we want to carry out an in-form cut of arc to f=17 in such a block and as it shows oneself to be in the following figure.

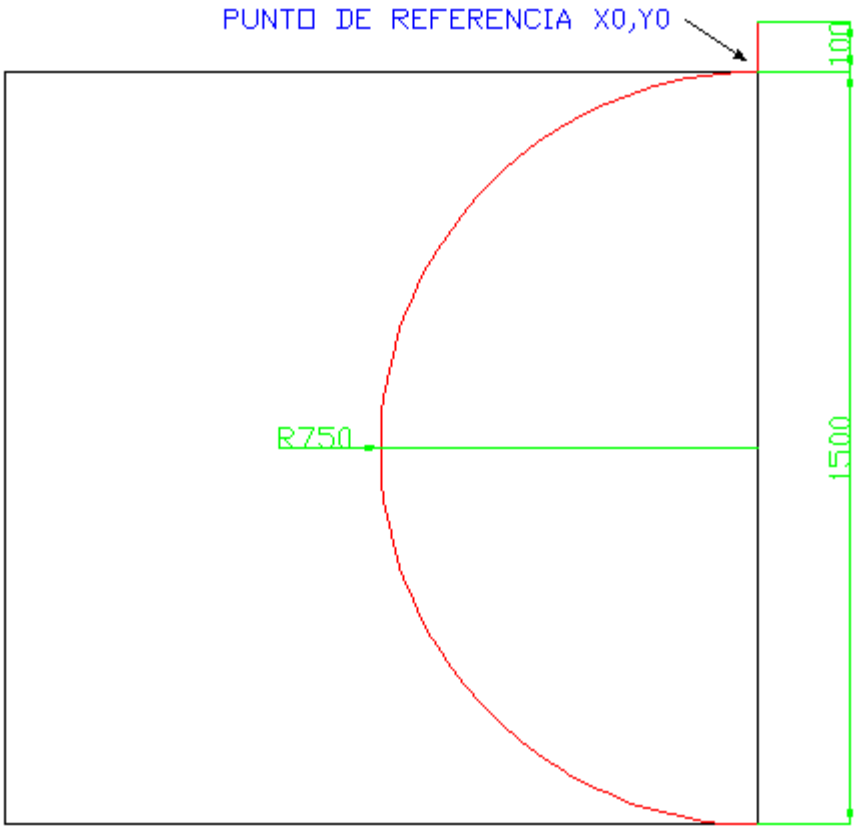


Figure 59

- We approximate the block in JOG mode until the point of reference.

From the Principal JOG (Key F4) menu and we move the machine with the button maker or the commands of the panel until the initial position.

- One time in the position of reference, we make a preset to fix the reference of the machine.

In the JOG menu, press PRESET (Key F2); and following X (Key F1) 0 ENTER, and (Key F2) 0 ENTER, Z (Key F3) 0 ENTER.

Figure 58

Figure 59

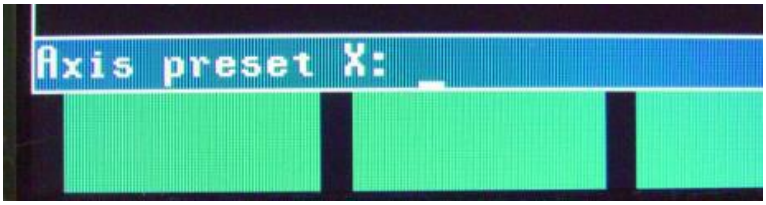


Figure 60

Figure 61

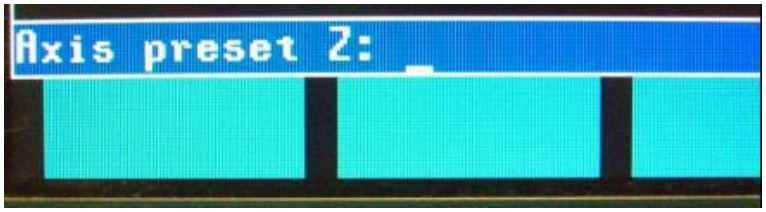


Figure 62

- We do that the wire carries out the descent of closeness to the stone of 100mm.

From the main menu, press JOG (Key F4), and MDI (Key F4), and write G01(instruction for online straight movement for the speed programmed), Y-100 (descent of closeness of 100mm), F17 (speed of desired cut)M3(start the wire).

Press the green button. (The machine will carry out the descent with the broke wire)

- We instruct the arc (without having played the red button to stop the wire).

In the immediate mode (MDI) write G03 (instruction for turning in an anti-clockwise sense to the speed programmed), X0 (coordinate of final x), and, 1500 (coordinate of and final), I, 750 (coordinated of x of the centre of the arc), J-750 (coordinate of and of the centre of the arc) F17 (speed of desired cut).

Press the green button. (The machine will carry out the cut of the arc).

One time executed the cut will play the red button to stop the wire. We will play RESET if we want to stop.

10. POSSIBLE PROBLEMS THAT THEY CAN APPEAR

10.1. Extracting the machine when you have touched the end limit switch

(It is only necessary if the machine disposes of the button of extracts).

1. To play without releasing the "EXTRA AXES" button.
2. Playing the "REARM" button (the machine remains rearmed).
3. To play MAIN MENU or ESC.
4. To move the machine manually to the correct position.
5. Release the "EXTRACURSOS" button.

10.2. Program interrupted during the execution (message in screen)

If during the execution, the electric supply is interrupted and restarts the numeric control

The control does not lose the coordinates of the point in which it remained.

To continue with the execution of the program we can process it in 2 different ways:

The 1ª form to do the following:

At the point in which had stopped have to do the following steps:

Press SIMULATE (Key F2), select the program that we were executing by moving us with the arrow and playing ENTER when are on it.

Press the key you G, M, S, T FUNCTIONS (Key F3).

Press the key STOP CONDITION (Key F2).

Press the BLOCK SELECTION (Key F2) and we select the line previous to see who was executed, and one time selected play ENTER and follow the key CICLO.

- Press MAIN MENU.
- Press EXECUTE (Key F1), and we select the program that-were executing by moving us with the arrow and playing ENTER when are on it.
- Press the key CICLO (green button) and the machine will follow by executing the program.

The 2ª way is the following:

- Press EXECUTE (Key F1); we select the program that we were executing by moving with the arrow and playing ENTER when are on it.
- Press MDI and we write the parameters with those who were working on our program until the moment of the interruption. Serve as an example the following:
  - D8: Introduce the straight diameter with which was stopping. Press the green button to validate.
  - G41: Introduce the correction of the wire. In this example, we have a weight that worked with the correction to the left of the profile. Press the green button to validate.
  - F17: Introduce the speed of descent that had our program. Press the green button to validate.
- Always finally press M3 to start the wire
- Onetime press ESCAPE and it SELECT BLOCK (it finds in the EXECUTION menu of the program that was carried out). Using the arrow we put on the line of code following the last that know that it had executed before going out the numeric control. One time on it Press ENTER.
- Press the green button and the machine will follow by executing the program.

10.3. Cancel the arch time

So much in the simulation as in the execution, the CNC keeps in mind the arch time. Not to have the "as soon as" in the simulation, is necessary to place the character "/" in front of each line in advance of G04 wait. So only the control will have you as soon as in the execution.

- G04 k90000 (timeout: simulation and execution);
- G04 K90000 (timeout: execution).

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