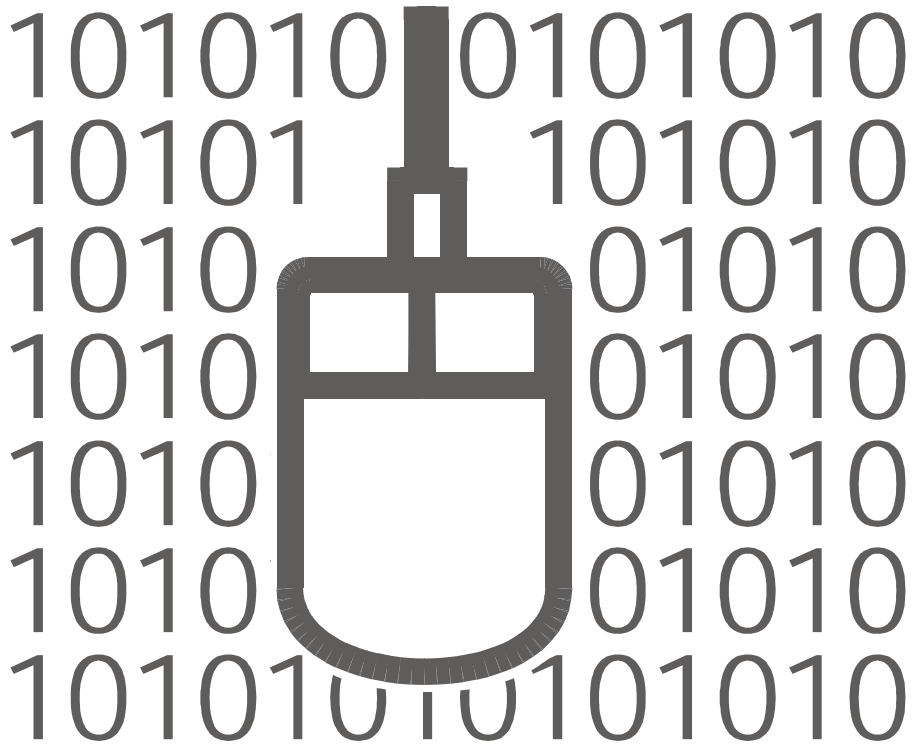
COMIL

Comil Applications

for WRT

Software

Software User's Manual



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The document is supplied with the machine. It must be kept in a safe, easily accessible place known to those responsible for running or maintaining the machine. Furthermore, this manual must be used with care throughout the machine useful life and must be handed over to the new owner should the machine be sold.

Table of contents

Introduction

The software can be used with a numerical control (NC) or with a personal computer (PC) connected to a NC. The PC software is optional, and will be supplied separately only when requested by the customer.

Field of application and purpose of this manual

This manual describes the normal operations and procedures required to create programs that can be run using the software. The manual is aimed at users of the machine to which the software is connected. Before reading this manual, please consult the machine User's Manual and related Annexes, in order to obtain a thorough knowledge of the machine and how to operate it safely.

Documents supplied with the machine

The following is a list of the main documents supplied with the machine:

- **Machine User's Manual**; contains basic information on the use and maintenance of the machine.
- **Software User's Manual**; contains information about the operations and procedures required to run the programs executable with the software connected to the machine.
- **Spare parts catalogue**; used to search and/or order spare parts.
  If the machine comes with the "InDocs" (Interactive Reference Documentation for User)" CD-rom, the spare parts catalogue will only be supplied if specifically requested.
- **Annexes**; contain information about any special parts of the machine. In order not to miss any important information, each Enclosure must be consulted together with the document to which it refers.
- **InDocs (Interactive Reference Documentation for User) CD-rom**; used to search and/or order spare parts and to consult the following documents:
  - Machine user's manual;
  - Software user's manual;
  - Pneumatic system diagrams.
- **Electric system diagrams**; describe the machine electric system and are aimed at technicians specially prepared for problem solving.
- **Pneumatic system diagrams**; describe the machine pneumatic system and are aimed at technicians in charge of problem solving.
- **EC Declaration of conformity**; certifies that the machine complies with the directives indicated.
  It is only issued for machines sold in EEC countries and in countries where Directive 98/37 is applied.

- **Documentation for special devices**; contains information about any special parts of the machine.

Warning signs

Paragraphs that should not be overlooked are highlighted and preceded by the symbols described and illustrated below:

Paragraphs marked with this symbol indicate an imminent danger, and the contents must therefore be taken into careful account in order to prevent a serious accident.

Paragraphs marked with this symbol indicate procedures to be used and actions to be taken to avoid any damage to goods and property.

This symbol is used to indicate points of particular importance that must not be overlooked.

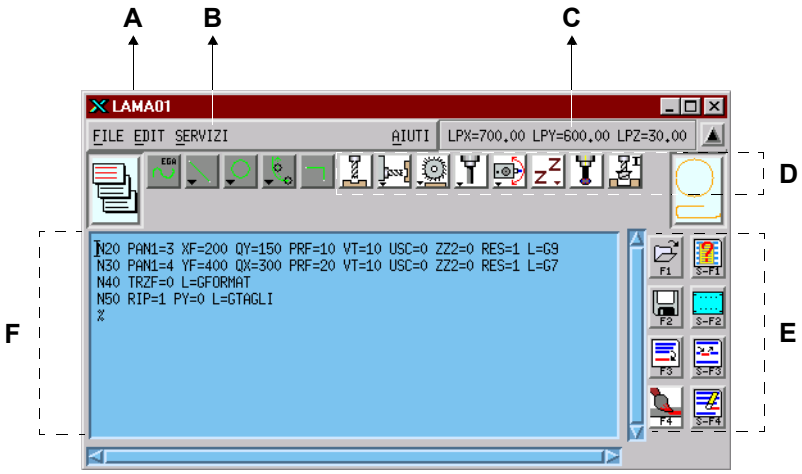
Warnings

Before using the machine, read the safety information provided in the MACHINE USER'S MANUAL.

1 Assisted Editor

1.1 User interface

The Editor application software is used to create programs for machining pieces (see figure below).



A Program name

B Menu bar

C Panel dimensions

D Toolbar.

E Command fields.

F Central area displaying the instructions (CNI-ISO language) that form the program.

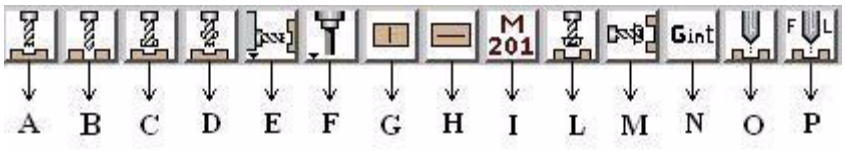
1.1.1 Menu bar

The menu bar contains items that can be used to open sub-menus. Left-clicking with the mouse on a menu will open a drop-down menu that can be used to choose an option linked to a specific operation.

The items in the menu bar are: FILE, EDIT and SERVICES. For more information, see the “XNC Instruction Manual”.

1.1.2 Toolbar

The toolbar contains the Assisted Editor icons that can be configured. These icons are used to activate the TOOLS to execute machining programs.



A displays a window for programming standard vertical boring.

B displays a window for programming vertical through boring.

C displays a window for programming vertical boring with large bore bits.

D displays a window for programming countersunk vertical boring.

E displays the toolbar sub-row for horizontal boring.

F displays the toolbar sub-row for machining operations with electrospindle.

G displays a window for programming milling with the blade along the Y-axis.

H displays a window for programming milling with the blade along the X-axis.

I displays a window for programming a change in the work origin.

L displays a window for programming inserting tools vertically.

M displays a window for programming inserting tools horizontally.

N displays a window for programming an interference position between the two centres in X.

O displays a window for programming applying glue.

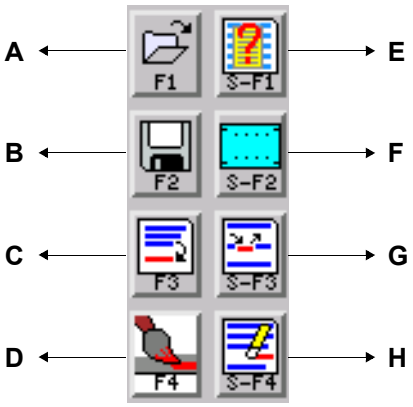
P displays a window for programming milling with glue.

This toolbar is a limit situation. In fact, all machines can have as toolbar a sub-set of those indicated, according to the real possibilities of the product.

1.1.3 Control Fields

These are marked buttons (icons) which are found in both dialogue boxes and applications. Each control field has a function that is associated to an application or to the window to which it belongs. Control fields are used to speed up CONTROL management operations without it being necessary to open menus and choose the required options.

Example of application data fields.



A Used to create or to open a program.

B Used to save a program.

C Used to copy a program row.

D Used to open a graphic dialogue box.

E Used to edit a program row.

F Used to open the BORING EDITOR window for boring operation optimisation.

G Used to search and replace a string.

H Used to delete a whole string.

Example of the most commonly found control fields inside the dialogue boxes:

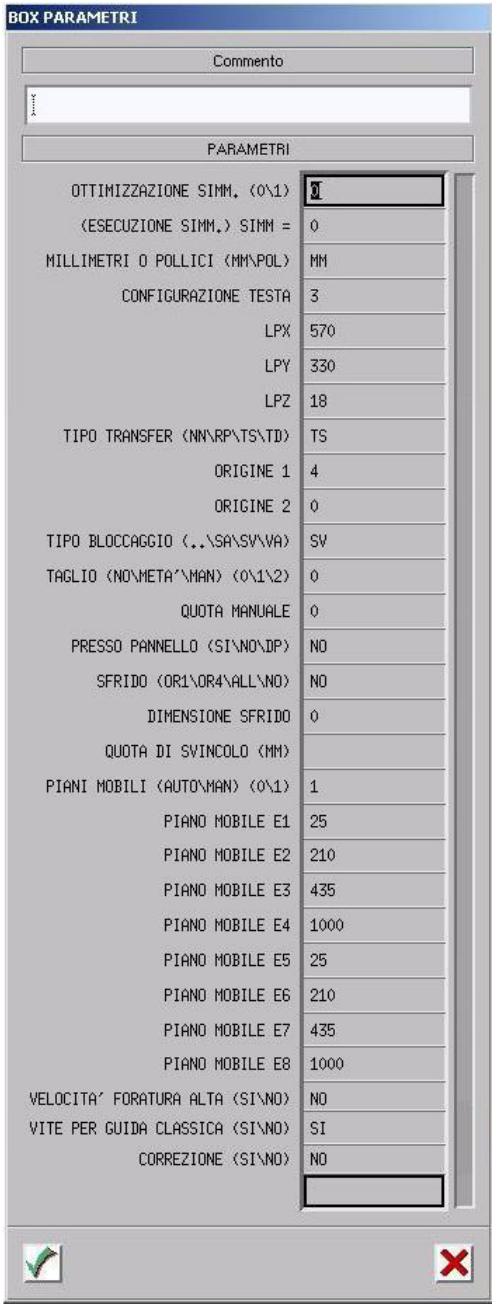
A CONFIRM.

B CANCEL.

Selecting CONFIRM accepts the settings for the data inside the dialogue box, while selecting CANCEL revokes the settings and closes the dialogue box.

1.2 Dialogue box

Dialogue boxes are boxes with a grey background, which allow data to be read and/or set. Find below an example of a dialogue box; however, each line of product will actually have a sub-set.



2 Programming machining operations

2.1 Creating the program

Programs are created by creating a file that contains a group of instructions to be given to the machine in order to make it execute a processing operation.

1. To create a program, select the menu File and the Open option; or click the left mouse button on the icon provided on the left, in the command buttons. Type the program name into the bottom section (**A**) of the **File Selection** dialogue box, then press the CONFIRM control field (**B**).

2. The **Parameter Box** dialogue box will open. In this box some of the parameters of a work program can be defined. It opens automatically each time a new program is created or it can be recalled using the Parameter option from the File menu in the EDITOR application.
Set the following data fields:

Symmetric Optimisation:	symmetric program carried out on the X axis as well
Symmetric Execution:	the program physically executed on the machine will be normal if this field is 0, or symmetrical if it is 1.
Millimetres or inches (MM\IN):	unit of measurement: type in MM (for millimetres) or IN (for inches).
Head configuration:	the configuration number of the operating section.
LPX :	size of the piece along the X-axis (length).
LPY :	size of the piece along the Y-axis (width).
LPZ:	piece thickness.

Transfer type (NN\RP\TS\TD):	type of panel locking: NN: the piece will not be locked on any origin TS: the piece will only be locked on the origin indicated by the OR1 parameter. TD: the piece will first be locked on the origin indicated in the OR1 parameter, and then on the one indicated in OR2. RP: the piece will be locked on the origins indicated in OR1 and OR2 alternately (odd on OR1, even on OR2). (Can be used only on FT)
Origin 1 (OR1):	First work origin. If 0, it will not be considered.
Origin 2 (OR2):	First work origin. If 0, it will not be considered.
Locking type (..\SA\SV\VA):	type of panel locking SA: pushers only SV: with suction cups only VA: suction cups and pushers
Cut (NO\HALF\MAN):	it is possible to indicate that some machining operations should be carried out on the first work origin (OR1) and others on the second one (OR2) by inserting a cutting on the panel. 0: no cutting 1: all machining operations with X-coordinate below half the panel will be carried out on the first work origin (OR1); any other, on the second origin (OR2). 2: all machining operations with X-coordinate below the position indicated in the STAV parameter will be carried out on the first work origin (OR1); any other, on the second origin (OR2).
Manual position:	cutting position for manual cutting
Panel pressing (Y\N\DP):	panel pressing to improve the accuracy of machining operations. Y: pressing only close to the work origin. N: no pressing. DP: panel pressed at both the head and the end.
Waste (OR1\OR4\ALL\NO):	cutting and collecting waste (Available only in FT1300 with tool changer and waste disposal device). OR1: only on the first work origin. OR4: only on the second work origin. ALL: on all work origins. NO: no operation of this kind.
Waste dimension:	dimension of the waste to be carried out. Waste involves removing a corner of the panel with cathetus dimensions equal to those indicated below using an electrospindle. (Available only in FT1300 with tool changer and waste disposal device)

Moving tables (AUTO\MAN):	Type of positioning for moving tables. AUTO: the position of moving tables is automatically assigned, without taking into account through machining and potential interferences. MAN: the positions of moving tables are manually set by the operator in the following parameters. If a datum is omitted, it is automatically calculated.
Moving table E1, …, E8:	position of the moving table (Available only in FT1300 with moving tables).
High boring speed (Y\N):	during regular vertical boring, the panel enters at half its working speed. This function can be deleted by selecting "Y" in this parameter.
Screw for classic guide (Y\N):	for classic guides, it may be sometimes necessary the presence of the safety screw (if the specific unit is present). This can be done by selecting "Y" in this parameter. (Available only in KT/IT with the magazine of the classic guides with safety screw.).
Correction (Y\N):	for the machine, for inserting tools, boring operations are carried out on the work origin with stop at the end of the panel. By selecting “Y” in this parameter all machining operations will be duly corrected. (Available only in KT/IT.)

Piece locking operations are carried out automatically and without any intervention on the part of the operator, if an automatic machine, that is, a machine that is set to work in line with other machines, is used.

*The information in the **Parameter box** of a program created with a software previous to the XNC 2.0.0.0 version must be modified as it is not compatible with the information specified above. To ensure correct program operation, the LPZ filed data must be entered manually. If you do not wish to introduce any changes but only execute the program, it is not necessary to open the **Parameter Box**.*

3. Confirm by selecting the CONFIRM command field.
4. Enter all of the machining operations desired by means of the icons on the Toolbars. The central area of the EDITOR application displays all of the strings in CNI-ISO language. Each string represents a type of machining and the whole of these strings forms a work program.
5. Use the SAVE control field to save each type of machining operation (see the section entitled 1.1.3 “Control Fields”).

2.2 Opening, changing and saving a program

1. To open an existing program, select the File menu followed by the Open option, or use the mouse to left-click on the relevant control button icon.
2. Scroll the cursor through the **File Selection** dialogue box and position it on the file to be opened. Press the ENTER key from the keyboard to confirm the selection.

3. To edit the program strings (in CNI-ISO language) displayed in the central area of the application, proceed as follows:

   Delete a program row: scroll the cursor onto the row and select the DELETE ROW control button. The string will immediately be deleted.

   Copy a program row: scroll the cursor onto the row and select the COPY ROW control button. The string will immediately be copied below the string displayed.

   Modify a program row: scroll the cursor onto the row and select the MODIFY ROW control button. The window for editing program strings will open.

   Search and replace a program row: This is used to find and replace rows. Scroll the cursor onto the row and select the FIND/REPLACE. control button:

   - In “Find string”: type the string you wish to find
   - In “Replace string”: type the new string that is to replace the one found
   - click on the Find field to find the string
   - click on the Find\Repl. field to find the string and replace it with the new one.

4. To save a new program or a program that has been edited, use the SAVE FILE control field. To save an existing program under a different name, select the File menu, followed by the Save As option. The **File Selection window will open**. Type in the name and confirm it with the CONFIRM control field.

2.3 Deleting and renaming the program

1. Use the cursor to select the File menu, followed by the Open option, or click on the relevant icon, which is situated on the left among the control buttons.
2. To delete a file, position the cursor on the file to be deleted and use the mouse to left-click on the  control field. Select the DELETE button. When the request to confirm the deletion appears, click on the CONFIRM control field.
3. To rename a file, position the cursor on the file to be renamed and use the mouse to left-click on the  control field. Select the RENAME button. Type in the new name and confirm it with the CONFIRM control field.

2.4 Programming non-optimised boring

“Non optimised” boring may be carried out using the spindles of the boring unit or the electrospindle. To program a non-optimised boring operation, it is necessary to enter the boring data and to select the required spindle.

Vertical boring

This type of machining operation is carried out using the boring unit spindles.

In order to open the window of boring operations, left-click to select the G99 (G98, G97 or G96) VERTICAL BORING tool. Program the following fields:

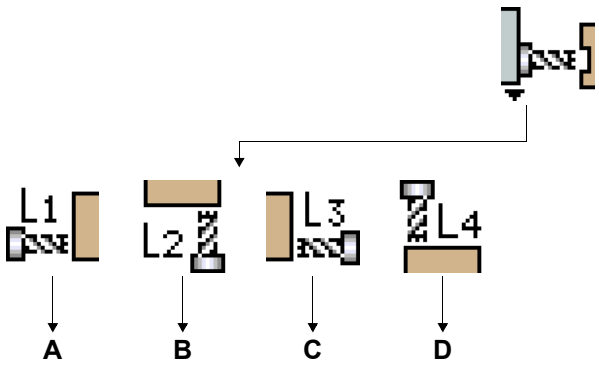
- **X:** bore X-coordinate
- **Y:** Y-coordinate of the bore to be carried out with head 1
- **PRZ:** depth of bores carried out with head 1
- **T:** spindles to be used from head 1
- **V:** Y-coordinate of the bore to be carried out with head 2
- **PRW:** depth of bores carried out with head 2
- **T:** spindles to be used from head 2
- **VF:** boring speed. If omitted, the speed of the bit present in the machine data is considered.
- **PRF:** only one depth for both heads can be indicated without specifying if it is PRZ or PRW.

Use the mouse to left-click on the CONFIRM control field to confirm.

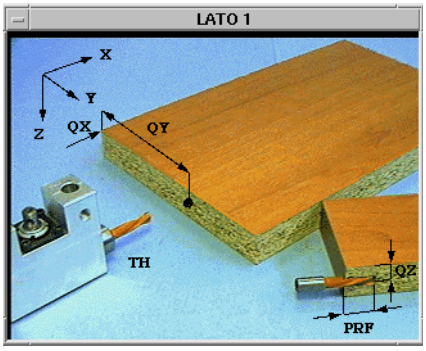
Horizontal boring

This type of machining operation is carried out using the boring unit spindles.

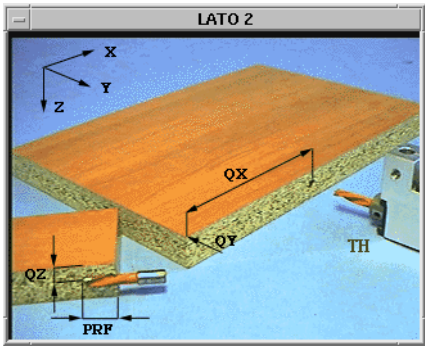
To program the side on which to make a horizontal bore, use the left-hand button of the mouse to select the HORIZONTAL BORING tool. The following icons will be displayed.



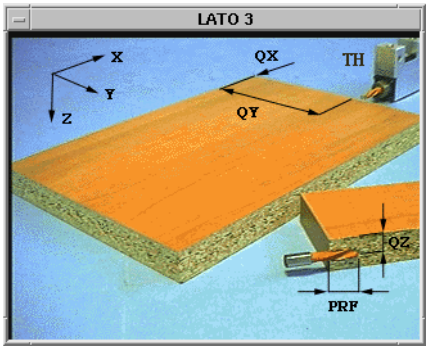
A Allows bores to be made on side 1 of the piece.



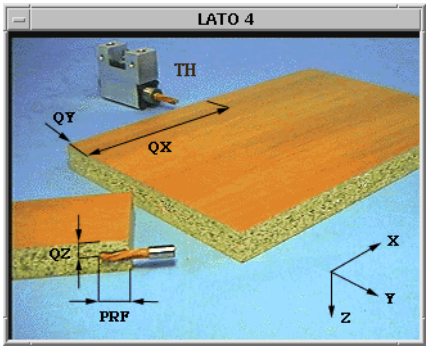
B Allows bores to be made on side 2 of the piece.



C Allows bores to be made on side 3 of the piece.



D Allows bores to be made on side 4 of the piece.



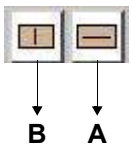
Select the required icon and enter the following data into the window that will open:

- **QX:** bore X-coordinate
- **QY:** bore Y-coordinate with head 1
- **QZ:** bore Z-coordinate with head 1, starting from the top surface of the piece
- **TH:** number of horizontal spindles of head 1 that must carry out the boring operations
- **QV:** bore Y-coordinate with head 2
- **QW:** bore Z-coordinate with head 2, starting from the top surface of the piece
- **TH:** number of horizontal spindles of head 2 that must carry out the boring operations
- **PRF:** bore depth value
- **VF:** value of spindle entrance speed. If omitted, the speed of the bit present in the machine data is considered.

Use the mouse to left-click on the CONFIRM control field to confirm.

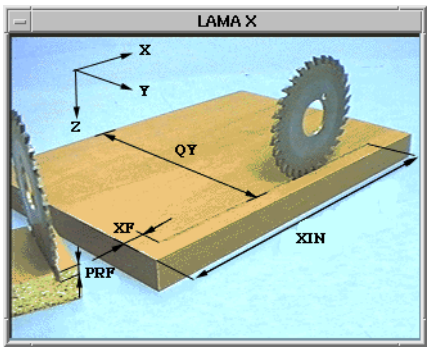
2.5 Setting generic blade cutting operations

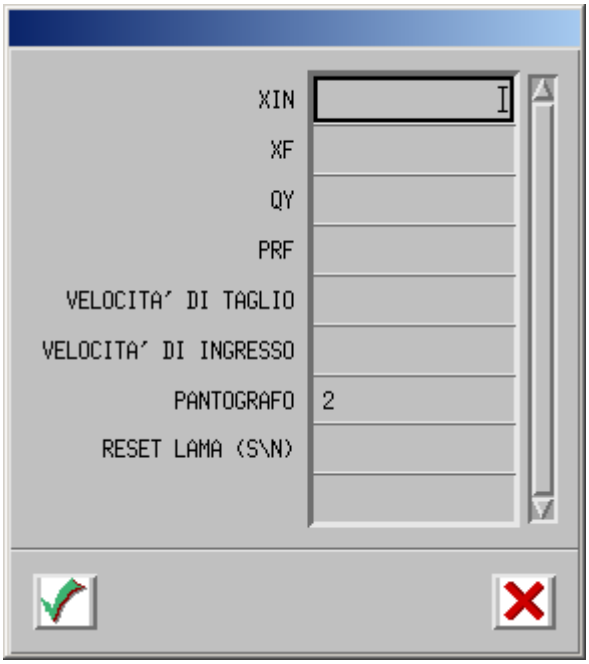
This type of operation is used to program milling operations using a milling tool or an electrospindle.



Horizontal cutting with blade

Selecting the icon for BLADE X (ref. A) will cause a horizontal cut to be made.



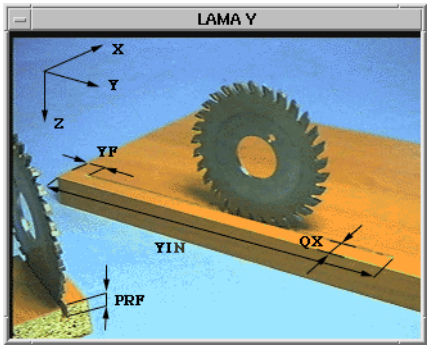


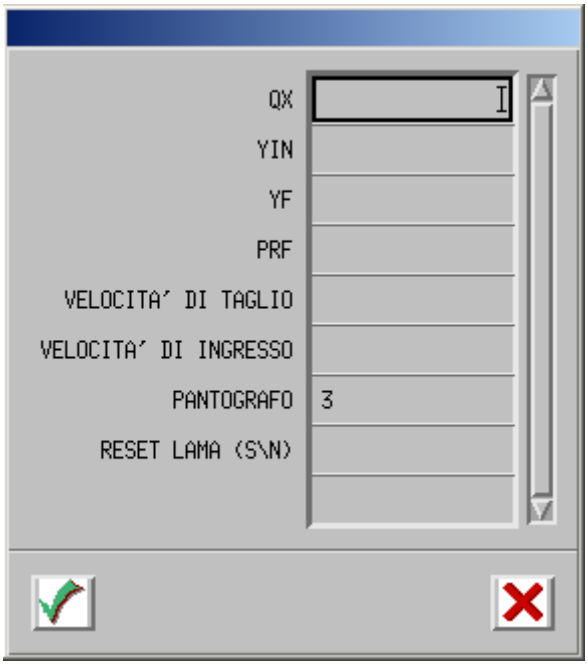
- **XIN:** coordinate of the starting point X for machining operations. This is the point at which the blade must start to cut.
- **XF:** coordinate of the end point X for machining operations. Point at which the blade must finish cutting.
- **QY:** machining Y-coordinate
- **PRF:** cut depth value
- **VELT:** value of the blade advance speed
- **VELF:** speed value of the blade entering the panel
- **PAN:** milling tool on which the blade that will make the cut is fitted.
- **RES (Y\N):**
  - Y indicates that the blade, once machining has finished, will leave the piece and stop.

- N indicates that the blade, once machining has finished, will leave the piece but without stopping. At this point another cut with the blade can be made.

Vertical cutting with blade

Selecting the icon for BLADE Y (ref. B) will cause a vertical cut to be made.





To program these two machining operations, open the required window and enter the following data fields:

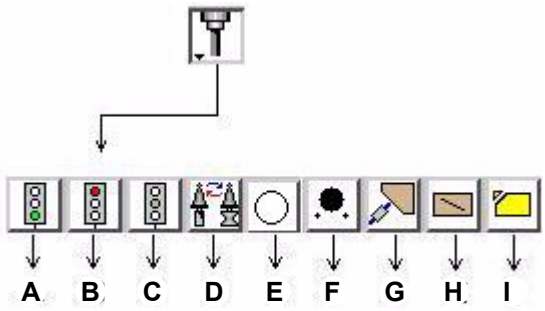
- **QX:** X-coordinate for the machining operation
- **YIN:** coordinate of the starting point Y for machining operations. This is the point at which the blade must start to cut.
- **YF:** coordinate of the end point Y for machining operations. Point at which the blade must finish cutting.
- **PRF:** cut depth value
- **VELT:** value of the blade advance speed

- **VELF:** speed value of the blade entering the panel
- **PAN:** milling tool on which the blade that will make the cut is fitted.
- **RES (Y\N):**
  - Y indicates that the blade, once machining has finished, will leave the piece and stop.
  - N indicates that the blade, once machining has finished, will leave the piece but without stopping. At this point another cut with the blade can be made.

Use the mouse to left-click on the CONFIRM control field to confirm.

2.6 Setting electrospindle machining operations

To set machining operations that use the electrospindle, use the mouse to left-click on the ROUTING tool. The following sub-row of icons will be displayed.



A Start machining (green light)

B Halt machining (orange light)

C Finish machining (red light)

D Tool changing

E Circle

F Hinge Bore

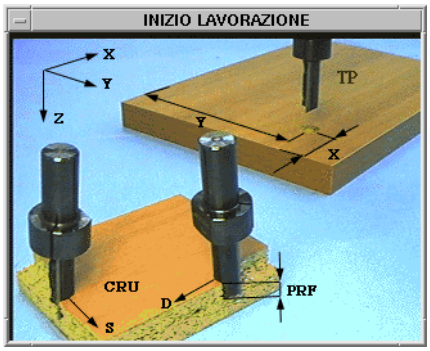
G Horizontal boring with aggregate

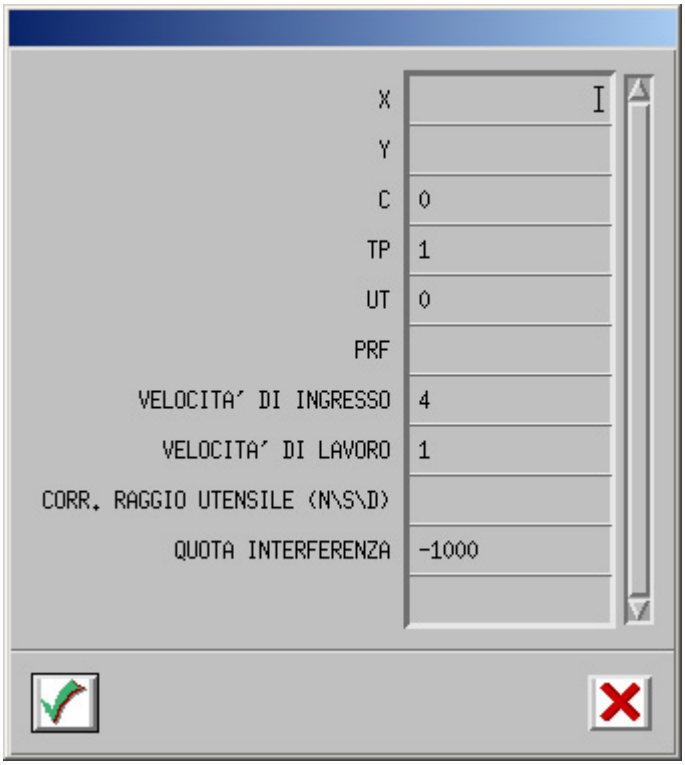
H Milling with blade aggregate

I Waste

Start Machining

Select the icon WORK BEGIN, PON (ref. A on page 18) to set the data relating to the start of the machining operation:.





- **X:** coordinate of the starting point X for machining
- **Y:** coordinate of the starting point Y for machining
- **C:** C-axis position
- **TP:** number of the electrospindle that will be used for machining
- **UT:** number of the spindle of the aggregate that will be used for machining
- **PRF:** machining depth value
- **VF:** speed value of the aggregate entering the panel
- **VELE:** value of the aggregate advance speed

- **CRU(N\S\D):**
  - N: the programmed machining path is defined from the centre of the milling tool.
  - S: the programmed path is defined by the left-hand part of the milling tool, seen from behind compared to the forward feed direction (the milling tool adjusts itself by moving to its right compared with case N).
  - D: the programmed path is defined by the right-hand part of the milling tool, seen from behind compared to the forward feed direction (the milling tool adjust itself by moving to its left compared with case N).
- **INT:** minimum value in X that will be reached from centre 2 or maximum value in X that will be reached from centre 1. In this way an interference position with a different centre is defined.

Use the mouse to left-click on the CONFIRM control field to confirm.

Machining Halt

Selecting the icon for OUT OF PANEL, PSU (ref. B on page 18), will automatically create the program line L=PSU.

End of Machining

Selecting the icon WORK END, POFF (ref. C on page 18), will automatically create the program line L=POFF.

Tool changing

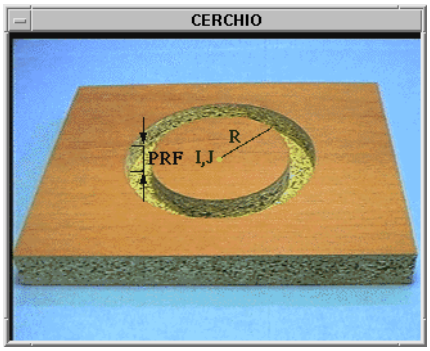
By selecting the icon for TOOL CHANGING, PCUA (ref. D on page 18), the data related to tool changing can be set.

- **PAN:** number of the electrospindle in which the tool changing will be carried out
- **UT:** name of the tool to be fitted on the electrospindle. If NULL, only the tool fitted at that moment is unloaded.

Use the mouse to left-click on the CONFIRM control field to confirm.

Circle

By selecting the icon for CIRCLE, PCER (ref. E on page 18), the data related to the circle can be set.

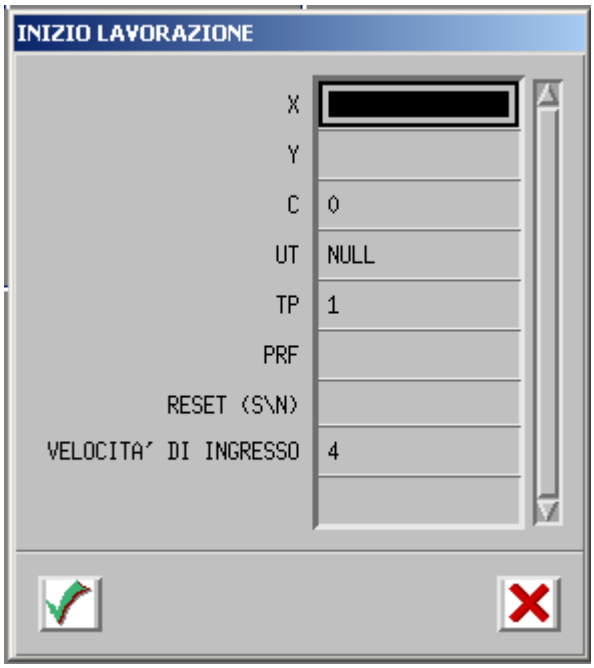


- **RAG:** ray value
- **CEN_X:** X-coordinate at the centre of the circumference
- **CEN_Y:** Y-coordinate at the centre of the circumference
- **F:** advance speed in interpolation
- **VF:** entrance speed in the panel
- **PRF:** machining depth
- **STOPPAN (Y\N):**
  - Yes: the electrospindle stops once the machining operation has finished**.**
  - No: the electrospindle continues moving after the machining operation has finished.

Use the mouse to left-click on the CONFIRM control field to confirm.

Hinge Bore

By selecting the icon for the HINGE BORE, PCERN (ref. F on page 18), the data related to the hinge bore can be set.

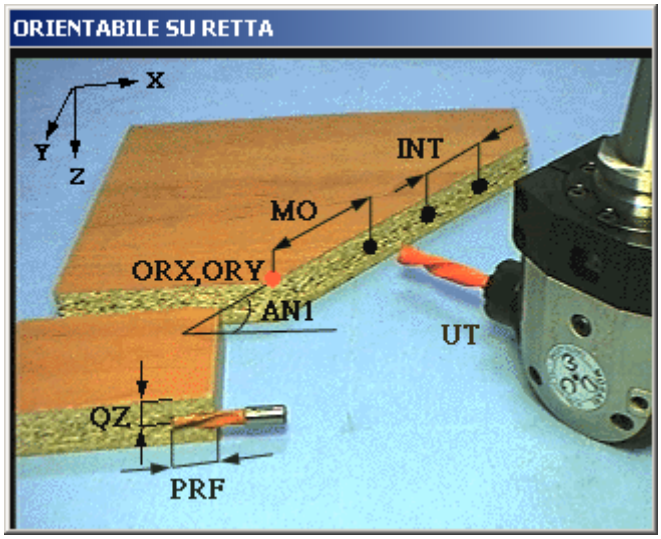


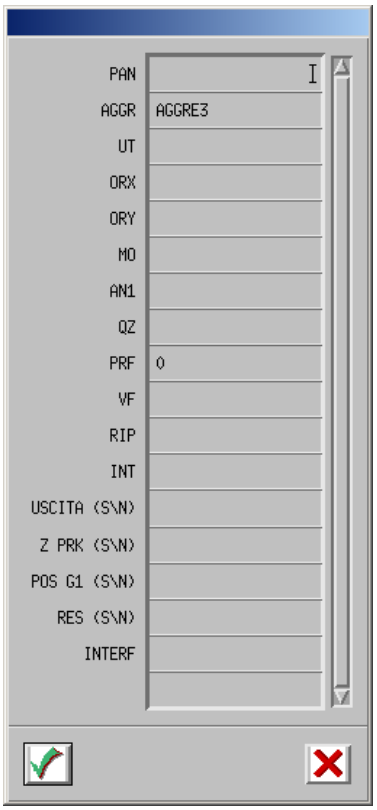
- **X:** X-coordinate of the hinge bore
- **Y:** Y-coordinate of the hinge bore
- **C:** C-axis orientation
- **UT:** name of the aggregate that must be fitted on the electrospindle to carry out the hinge bore.
- **TP:** number of the electrospindle that will carry out the machining operation
- **PRF:** hinge bore depth
- **RESET (Y\N):**
  - Yes: the electrospindle stops once the machining operation has finished
  - No: the electrospindle continues moving after the machining operation has finished.
- **VF:** entrance speed in the panel.

Use the mouse to left-click on the CONFIRM control field to confirm.

Horizontal boring with aggregate

By selecting the icon for HORIZONTAL BORING WITH AGGREGATE, G100 (ref. G on page 18), the data related to the horizontal boring with aggregate can be set.





- **PAN:** number of the electrospindle on which the machining tool will be fitted.
- **AGGR:** name of the aggregate that will be fitted on the electrospindle.
- **UT:** number of the spindle of the aggregate that will carry out the machining operation

- **ORX:** X-coordinate of the starting point of the inclined straight line
- **ORY:** Y-coordinate of the starting point of the inclined straight line
- **MO:** distance of the first bore on the inclined straight line
- **AN1:** inclination of the straight line (warning: AN1 is the angle formed between the straight line tangent to the profile and the X-axis and it increases for clockwise rotations).
- **QZ:** Z-coordinate of the bore, starting from the top surface of the piece.
- **PRF:** bore depth
- **VF:** value of the milling tool entrance speed
- **RIP:** number of bore repetitions
- **INT:** distance between centres for repeated bores
- **USC (Y\N):**
  - Y = the tool bores and exits.
  - N: the tool remains in the piece to carry out further boring steps.
- **Z PRK (Y\N):**
  - Y: once the machining has finished, the Z-axis will be sent to a parking position.
  - N: once the machining has finished, the Z-axis will remain where it is.
- **POS G1 (Y\N):**
  - Y: before machining starts, the first positioning will be carried out in G1.
  - N: before machining starts, the first positioning will be carried out in G0.
- **RES (Y\N):**
  - Y: the tool bores and exits, the motor shuts off and the Z-axis is sent to a parking position.
  - N = the tool bores and exits, but the motor does not shut off.
- **INTERF:** minimum position at which the X axis will be transferred during machining for the centre 1 and maximum position for the centre 2.

Use the mouse to left-click on the CONFIRM control field to confirm.

Here are some simplified examples.

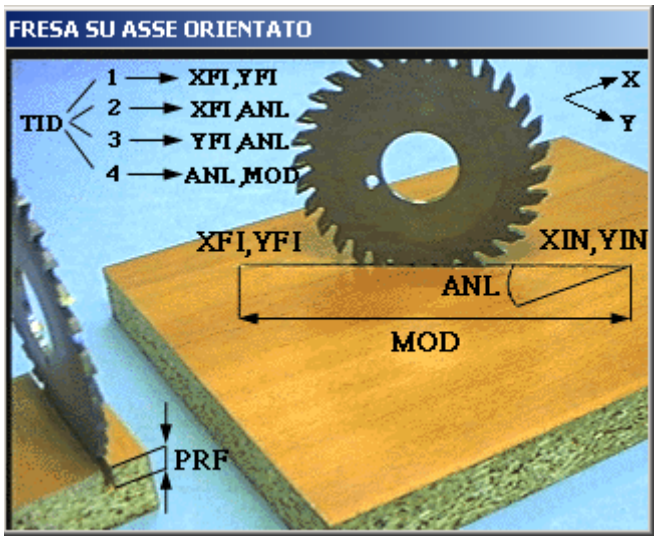
- Bores side 1, reference corner 1:
  N20 PAN=1 ST1="AGGRE3" UT=2 ORX=0 ORY=0 MO=100 AN1=90 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=64 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Bores side 1, reference corner 2:
  N30 PAN=1 ST1="AGGRE3" UT=2 ORX=0 ORY=LPY MO=-50 AN1=90 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Bores side 2, reference corner 2:
  N40 PAN=1 ST1="AGGRE3" UT=2 ORX=0 ORY=LPY MO=100 AN1=0 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=100 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Bores side 2, reference corner 3:
  N50 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX ORY=LPY MO=-100 AN1=0 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-50 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100

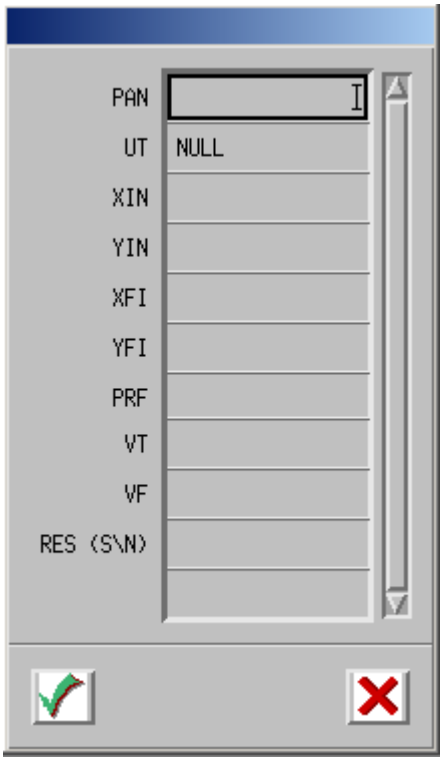
- Bores side 3, reference corner 3:
  N60 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX ORY=LPY MO=50 AN1=270 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=50 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Bores side 3, reference corner 4:
  N70 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX ORY=0 MO=-50 AN1=270 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-32 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Bores side 4, reference corner 4:
  N80 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX ORY=0 MO=50 AN1=180 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=32 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Bores side 4, reference corner 1:
  N90 PAN=1 ST1="AGGRE3" UT=2 ORX=0 ORY=0 MO=-100 AN1=180 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-100 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Corner 1:
  N100 PAN=1 ST1="AGGRE3" UT=2 ORX=100 ORY=0 MO=10 AN1=135 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
  N110 PAN=1 ST1="AGGRE3" UT=2 ORX=0 ORY=100 MO=-10 AN1=135 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Corner 2:
  N120 PAN=1 ST1="AGGRE3" UT=2 ORX=0 ORY=LPY-100 MO=10 AN1=45 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
  N130 PAN=1 ST1="AGGRE3" UT=2 ORX=100 ORY=LPY MO=-10 AN1=45 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Corner 3:
  N140 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX-100 ORY=LPY MO=10 AN1=-45 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
  N150 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX ORY=LPY-100 MO=-10 AN1=-45 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Corner 4:
  N160 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX ORY=100 MO=10 AN1=225 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
  N170 PAN=1 ST1="AGGRE3" UT=2 ORX=LPX-100 ORY=0 MO=-10 AN1=225 QZ=LPZ/2 PRF=20 VF=2 RIP=3 INT=-16 INTF=-1000 USC=0 PUNS=0 GUNO=0 RES=1 Z=PRK L=G100
- Series of bores with variable distance between centres:
  N20 PAN=1 ST1="AGGRE3" UT=2 ORX=453 ORY=LPY MO=-32 AN1=45 QZ=LPZ/2 PRF=18 VF=2 RIP=1 INT=0 USC=0 PUNS=1 GUNO=0 RES=0 INTF=-1000 Z=PRK L=G100 N30 PAN=1 ST1="AGGRE3" UT=2 ORX=453 ORY=LPY MO=-64 AN1=45 QZ=LPZ/2 PRF=28 VF=2 RIP=1 INT=0 USC=0 PUNS=1 GUNO=1 RES=0 INTF=-1000 L=G100 N40 PAN=1 ST1="AGGRE3" UT=2 ORX=453 ORY=LPY MO=-192 AN1=45 QZ=LPZ/2 PRF=18 VF=2 RIP=2 INT=-224 USC=0 PUNS=1 GUNO=1 RES=0 INTF=-1000 L=G100 N50 PAN=1 ST1="AGGRE3" UT=2 ORX=453 ORY=LPY MO=-544 AN1=45 QZ=LPZ/2 PRF=28 VF=2 RIP=1 INT=0 USC=0 PUNS=1 GUNO=1 RES=0 INTF=-1000 L=G100 N60 PAN=1

ST1="AGGRE3" UT=2 ORX=453 ORY=LPY MO=-576 AN1=45 QZ=LPZ/2 PRF=18 VF=2 RIP=1 INT=0 USC=0 PUNS=0 GUNO=1 RES=1 INTF=-1000 L=G100

Milling with blade aggregate

By selecting the icon for MILLING WITH BLADE AGGREGATE, G102 (ref. H on page 18), the data related to milling with blade aggregate can be set.





- **PAN:** number of the electrospindle on which the machining tool will be fitted.
- **UT:** name of the aggregate that will be fitted on the electrospindle
- **XIN:** initial X-coordinate for machining
- **XFI:** final X-coordinate for machining
- **YIN:** initial Y-coordinate for machining
- **YFI:** final Y-coordinate for machining
- **PRF:** milling depth
- **VF:** value of the milling tool entrance speed
- **VT:** value of the milling tool advance speed
- **RES (Y\N):**
  - Y: the tool bores and exits, the motor shuts off and the Z-axis is sent to a parking position.
  - N = the tool bores and exits, but the motor does not shut off.

Use the mouse to left-click on the CONFIRM control field to confirm.

Waste

By selecting the icon for WASTE, PSFRIDO (ref. I on page 18), the data related to the waste can be set. Some data are already stored in the PARAMETER BOX to carry out this machining operation: waste dimension and origin on which it should be carried out.

- **TP:** number of the electrospindle on which the machining tool will be fitted.
- **UT:** name of the aggregate that will be fitted on the electrospindle
- **VF:** value of the milling tool entrance speed

Use the mouse to left-click on the CONFIRM control field to confirm.

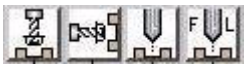
2.7 Suspending the program

M201 – Suspension for translation to a mirror origin 

Suspends machining operations after commanding the axes to the park position. The piece is released in order to be locked again into position on the mirror origin. Machining on this origin is not mirrored compared to that carried out at the origin on which the piece was initially locked. The mirror origin is selected according to the type of machine. In an insider FT the origin is indicated in the PARAMETER BOX as the second work origin; in an insider KT or IT, the second work origin is selected by the PLC according to the dimensions of the piece and the work table. In an insider FT, machining can only be carried out if the piece dimension in X is over half the dimension of the work table. In this case, the origin change will only take place when both centres are ready to do so. The program line L=G201 will be automatically generated.

2.8 General insertions

This type of machining operation allows programming different kinds of insertions.



Insertions of vertical tools

By selecting the icon for VERTICAL INSERTION, GINS, the data related to the insertion can be set.

- **QX:** X-coordinate for insertion
- **QY:** Y-coordinate for insertion for head 1
- **TY:** spindles of head 1 to be used for insertion
- **QV:** Y-coordinate for insertion for head 2
- **TV:** spindles of head 2 to be used for insertion

Whereas, by selecting the icon for GUIDE INSERTION, GLOADER, the data related to the insertion can be set.

- **QX:** X-coordinate for insertion
- **QY:** Y-coordinate for insertion for head 1
- **TY:** spindles of head 1 to be used for insertion

Use the mouse to left-click on the CONFIRM control field to confirm.

Insertions of horizontal tools

By selecting the icon for HORIZONTAL INSERTION, GINS_O, the data related to the insertion can be set.

- **PLAT:** side where to carry out the insertion
- **SPIG:** reference corner for the following coordinates
- **QX:** X-coordinate for insertion
- **QY:** Y-coordinate for insertion
- **QZ:** Z-coordinate for insertion
- **TH:** spindles to be used for insertion

Use the mouse to left-click on the CONFIRM control field to confirm.

Glue insertion

By selecting the icon for GLUE INSERTION, GCOLLA, the data related to the insertion can be set.

- **QX:** X-coordinate for insertion
- **QY:** Y-coordinate for insertion for head 1
- **TY:** spindles of head 1 to be used for insertion
- **QV:** Y-coordinate for insertion for head 2
- **TV:** spindles of head 2 to be used for insertion

Use the mouse to left-click on the CONFIRM control field to confirm.

Milling operation with glue

By selecting the icon for GLUE MILLING, GFRES, the data related to the continuous glue jet can be set.

- **XIN:** initial X-coordinate of milling with glue
- **XF:** final X-coordinate of milling with glue
- **QY:** Y-coordinate for insertion for head 1
- **TY:** spindles of head 1 to be used for insertion
- **QV:** Y-coordinate for insertion for head 2
- **TV:** spindles of head 2 to be used for insertion
- **VT:** advance speed for milling with glue.

Use the mouse to left-click on the CONFIRM control field to confirm.

2.9 Interference management

With this type of machining it is possible to indicate to the PLC the maximum position in X that centre 1 will reach or the minimum position for centre 2. 

- **MAND:** spindle to which the following position refers
- **XT:** interference position in X.

3 Running the program

3.1 Information on running mode

Running the program is the final step in the operation that allows actual machining of the piece to be carried out.
The software allows both single programs and work lists to be run.

3.2 Running the program

Programs are run in "automatic" mode, since each one is run from beginning to end by means of a single initial consent, which is given by the operator.

1. Display the QUOTE application (See the “XNC Instruction Manual”).
2. Select the field AUTOMATIC;
3. Select the Windows menu and the Program option or press the F1 key on the keyboard.
4. Use the cursor to scroll through the list in the Program Selection window and select the required program, which will become black. Press the ENTER key on the keyboard to confirm the selection.
5. The name of the program will be displayed at the bottom of the application;
6. Press the START key to begin machining.

3.3 Executing the work list

A work list is a table used to set out a list of programs for machining a predefined quantity of pieces.

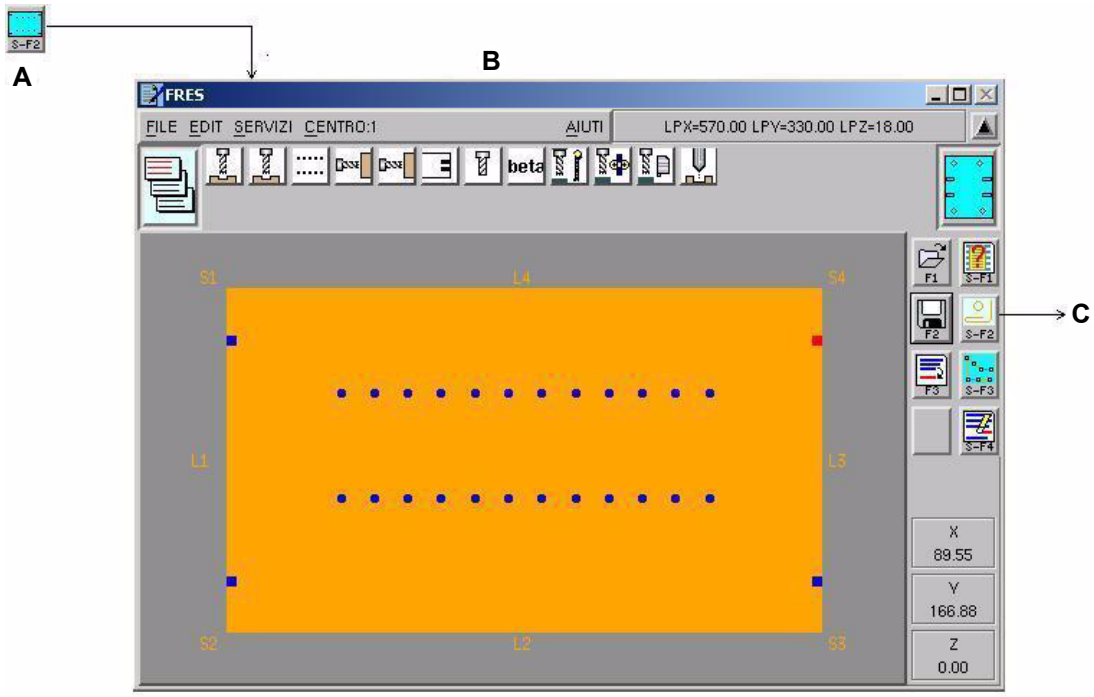
1. Display the QUOTE application (See the “XNC Instruction Manual”).
2. Select the AUTOMATIC field;
3. Select the Windows menu and the Work list option or press the F2 key on the keyboard.
4. Use the cursor to scroll through the list in the Selecting Work list window and select the required work list. Press the ENTER key on the keyboard to confirm the selection. Before starting machining operations, it is possible to add new programs to the list by pressing the F1 key on the keyboard or by selecting the File menu followed by the Program option. Double click with the mouse on the required program file in the PROGRAM SELECTION window and the program will automatically be added to the work list.

5. The name of the work list will be displayed at the bottom of the application;
6. Press the START key to begin machining.

4 Setting optimised boring operations

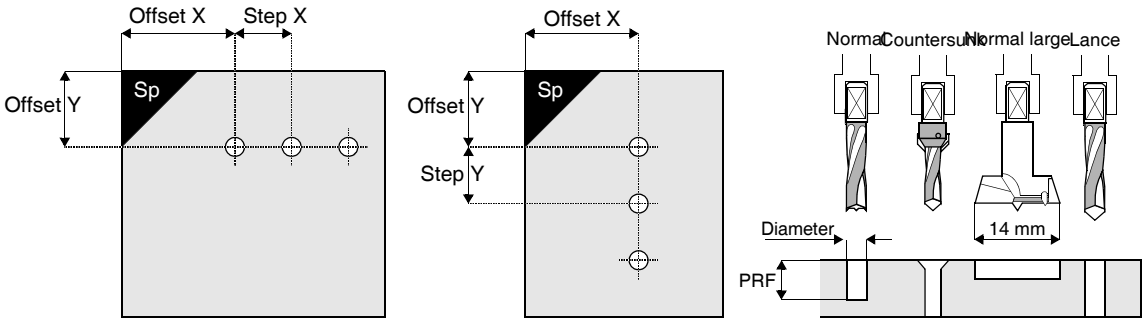
"Optimised" boring operations are carried out using the boring unit spindles. To program this type of operation it is necessary to enter the data (diameter, bit type, etc.) required by the NC to optimise machining times. The NC will automatically find the suitable tools and also study the most suitable path for quick and correct machining.

When the command S-F2 (**A**) is selected with the mouse in the ASSISTED EDITOR application, the EDIT BORES (**B**) application will be displayed. Using this application it is possible to optimise boring procedures for the required piece. To return to the ASSISTED EDITOR application, use the mouse to left-click on the CONTOURS, S-F2 (**C**) icon.



4.1 Vertical boring

- Selecting the  tool will open the dialogue box in which to enter the following data:
  - **CORNER**: number of the reference corner.
  - **OFFSET X**: initial boring coordinate along the X-axis.
  - **OFFSET Y:** initial boring coordinate along the Y-axis.
  - **DEPTH**: bore depth.
  - **DIAMETER**: bore diameter.
  - **HOLE TYPE**: type of boring tool (1 for normal, normal large or countersunk bit; 2 for lance-type bit).
  - **INSERTION TYPE**: type of element to be inserted.
  - **REPEATS**: number of boring repeats.
  - **STEP X**: distance, along X-axis, between the centres of one bore and the next during repeat operations.
  - **STEP Y**: distance, along Y-axis, between the centres of one bore and the next during repeat operations.
- Confirm by clicking with the left mouse button on the CONFIRM command field.



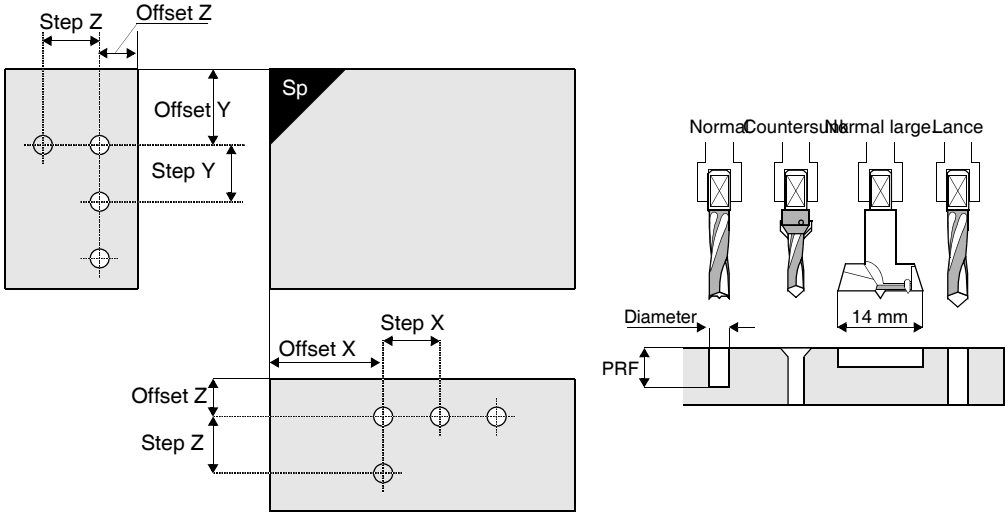
Apart from the vertical boring, given the bore diameter and type, it is possible to carry out such operations by indicating the name of the bit to be used.

- **CORNER:** number of the reference corner
- **OFFSET X:** initial boring coordinate along the X-axis
- **OFFSET Y:** initial boring coordinate along the Y-axis
- **NAME:** name of the bit for machining
- **DEPTH:** bore depth
- **REPEATS:** number of boring repeats
- **STEP X:** distance, along X-axis, between the centres of one bore and the next during repeat operations
- **STEP Y:** distance, along Y-axis, between the centres of one bore and the next during repeat operations

- Use the mouse to left-click on the CONFIRM control field to confirm.

4.2 Horizontal boring

- Selecting the  tool will open the dialogue box in which to enter the following data:
  - **CORNER**: number of the reference corner.
  - **SIDE**: number of the reference side.
  - **OFFSET X**: initial boring coordinate along the X-axis.
  - **OFFSET Y:** initial boring coordinate along the Y-axis.
  - **OFFSET Z**: bore coordinate along the Z-axis.
  - **DEPTH**: bore depth.
  - **DIAMETER**: bore diameter.
  - **HOLE TYPE**: type of boring tool (1 for normal, normal large or countersunk bit; 2 for lance-type bit).
  - **INSERTION TYPE**: type of element to be inserted.
  - **REPEATS**: number of boring repeats.
  - **STEP X**: distance, along X-axis, between the centres of one bore and the next.
  - **STEP Y**: distance, along Y-axis, between the centres of one bore and the next.
  - **STEP Z**: distance, along Z-axis, between the centres of one bore and the next.
- Confirm by clicking with the left mouse button on the CONFIRM command field.



Apart from the horizontal boring, given the bore diameter and type, it is possible to carry out such operations by indicating the name of the bit to be used.

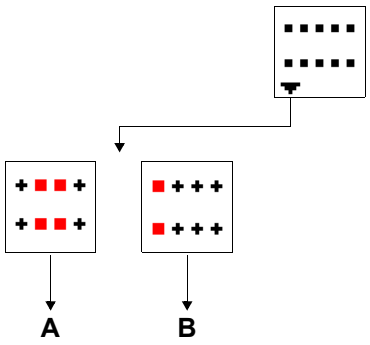
- **CORNER:** number of the reference corner
- **SIDE:** number of the reference side
- **OFFSET X:** initial boring coordinate along the X-axis
- **OFFSET Y:** initial boring coordinate along the Y-axis
- **OFFSET Z:** initial boring coordinate along the Z-axis
- **NAME:** name of the bit for machining
- **DEPTH:** bore depth

- **REPEATS:** number of boring repeats
- **STEP X:** distance, along X-axis, between the centres of one bore and the next during repeat operations
- **STEP Y:** distance, along Y-axis, between the centres of one bore and the next during repeat operations
- **STEP Z:** distance, along Z-axis, between the centre of one bore and the next during repeat operations

■ Use the mouse to left-click on the CONFIRM control field to confirm.

4.3 Vertical boring: System 32

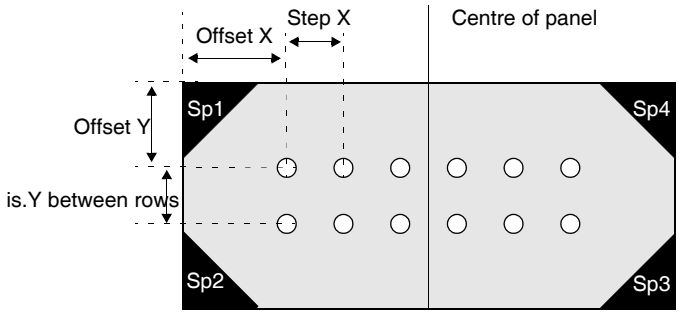
Selecting the SYSTEM 32 tool will display a sub-row of icons that are required to set two types of System boring:



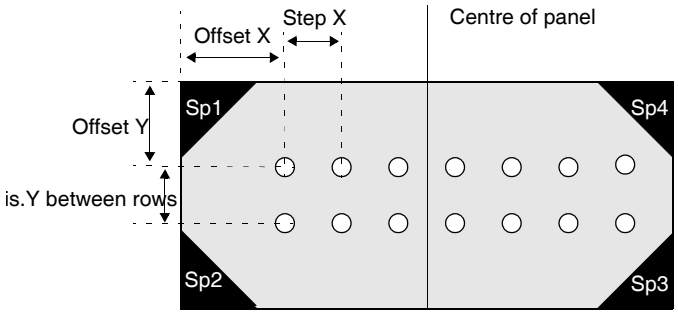
■ To make a series of vertical bores in two rows of which the co-ordinates of the starting point are known, use the mouse to left-click on the "**A**" icon. This will open the CENTRE CORRECTED SYSTEM 32 dialogue box. The number of bores will automatically be calculated and set out at the centre of the piece in the direction of the X-axis.

- **CORNER**: number of the reference corner.
- **OFFSET X**: bore X-coordinate.
- **OFFSET Y**: bore Y-coordinate.
- **DISTANCE BETWEEN THE TWO ROWS OF HOLES**: distance along Y.
- **DEPTH**: bore depth.
- **DIAMETER**: bore diameter
- **HOLE TYPE**: type of boring tool (1 for flat, hinged or countersunk bit; 2 for through bit).
- **STEP X**: distance, along the X axis, between the centres of one bore and the next during repeat operations.

- Confirm by clicking with the left mouse button on the CONFIRM commend field.

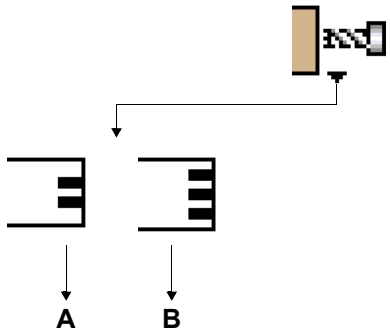


- To make a series of vertical bores in two rows, use the mouse to left-click on the "**B**" icon. This will open the SYSTEM 32 WITH FIXED BEGINNING VALUE dialogue box. The number of bores will automatically be calculated and set out with reference to the selected corner, with a fixed initial value in the direction of the X-axis.
  - **CORNER**: number of the reference corner.
  - **OFFSET X**: initial boring coordinate along the X-axis.
  - **OFFSET Y**: **:**initial boring coordinate along the Y-axis.
  - **DISTANCE BETWEEN THE TWO ROWS OF HOLES**: distance along Y.
  - **DEPTH**: bore depth.
  - **DIAMETER**: bore diameter.
  - **HOLE TYPE**: type of boring tool (1 for normal, normal large or countersunk bit; 2 for lance-type bit).
  - **STEP X**: distance, along the X axis, between the centres of one bore and the next during repeat operations.
- Confirm by clicking with the left mouse button on the CONFIRM command field.

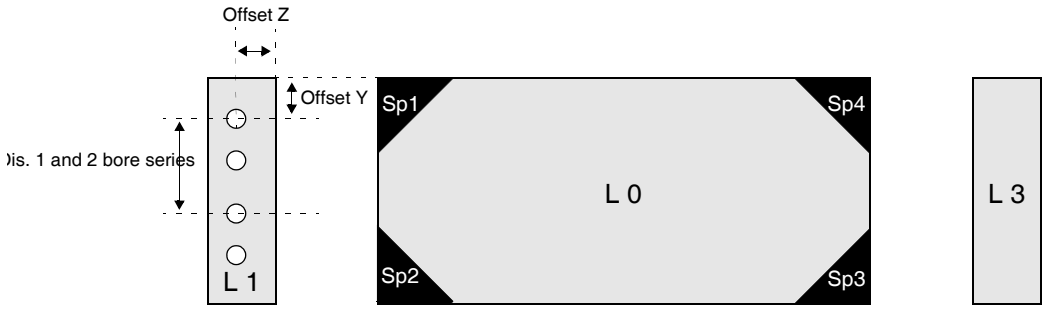


4.4 Series of Horizontal Bores

Selecting the SERIES OF HORIZONTAL HOLES tool will display a sub-row of icons to set two types of horizontal boring.



- To machine a SERIES OF 2 HORIZONTAL HOLES, use the mouse to left-click on the "**A**" icon. Program the following data:
  - **CORNER**: number of the reference corner.
  - **SIDE**: number of the reference side.
  - **OFFSET Y**: bore Y-coordinate.
  - **OFFSET Z**: bore Z-coordinate.
  - **DISTANCE BETWEEN 1 AND 2 SERIES OF HOLES**: distance along the Y-axis between the first and the second series of three bores.
  - **DISTANCE BETWEEN 2 AND 3 SERIES OF HOLES**: distance along the Y-axis between the second and the third series of three bores.
  - **DEPTH**: bore depth.
  - **DIAMETER**: bore diameter.
  - **HOLE TYPE**: type of boring tool (1 for flat, hinged or countersunk bit; 2 for through bit).
  - **STEP Y**: distance, along Y-axis, between the centres of one bore and the next during repeat operations.
- Confirm by clicking with the left mouse button on the CONFIRM command field.



- To machine a SERIES OF 3 HORIZONTAL HOLES, use the mouse to left-click on the "**B**" icon Program the following data:
  - **CORNER**: number of the reference corner.
  - **SIDE**: reference side.

- **OFFSET Y**: bore Y-coordinate.
- **OFFSET Z**: bore Z-coordinate.
- **DISTANCE BETWEEN 1 AND 2 SERIES OF HOLES**: distance along the Y-axis between the first and the second series of three bores.
- **DISTANCE BETWEEN 2 AND 3 SERIES OF HOLES**: distance along the Y-axis between the second and third series of three bores.
- **DEPTH**: bore depth.
- **DIAMETER**: bore diameter.
- **HOLE TYPE**: type of boring tool (1 for flat, hinged or countersunk bit; 2 for through bit).
- **STEP Y**: distance, along Y-axis, between the centres of one bore and the next during repeat operations.

■ Confirm by clicking with the left mouse button on the CONFIRM command field.

4.5 Insertions

It is possible to make different types of insertions according to the object to be inserted, but the parameters to be indicated are always the same. For machines that bore and insert, this macro also allows both things to be carried out with only one operation.

For horizontal insertions, indicate the following:

- **CORNER:** number of the reference corner
- **SIDE:** number of the reference side
- **OFFSET X:** initial boring/ insertion coordinate along the X-axis
- **OFFSET Y:** initial boring/ insertion coordinate along the Y-axis
- **OFFSET Z:** initial boring/ insertion coordinate along the Z-axis
- **NAME:** name of the bit to carry out insertion operation
- **DEPTH:** bore depth
- **DIAMETER:** diameter of the bit for boring
- **HOLE TYPE:** type of bit to be used for boring
- **REPEATS:** number of boring repeats
- **STEP X:** distance, along X-axis, between the centres of one bore and the next during repeat operations
- **STEP Y:** distance, along Y-axis, between the centres of one bore and the next during repeat operations
- **STEP Z:** distance, along Z-axis, between the centre of one bore and the next during repeat operations

■ Use the mouse to left-click on the CONFIRM control field to confirm.

For vertical insertions, indicate the following:

- **CORNER:** number of the reference corner
- **OFFSET X:** initial boring/ insertion coordinate along the X-axis
- **OFFSET Y:** initial boring/ insertion coordinate along the Y-axis

- **NAME:** name of the bit to carry out insertion operation
- **DEPTH:** bore depth
- **DIAMETER:** diameter of the bit for boring
- **HOLE TYPE:** type of bit to be used for boring
- **REPEATS:** number of boring repeats
- **STEP X:** distance, along X-axis, between the centres of one bore and the next during repeat operations
- **STEP Y:** distance, along Y-axis, between the centres of one bore and the next during repeat operations

■ Use the mouse to left-click on the CONFIRM control field to confirm.

Some times there may be a macro as in the case of guides insertion, where it is impossible to carry out repeats along the Y-axis. In this case, the "**STEP Y** " field is not present. Furthermore, when the machine is programmed for insertions only, the following fields are not present: **DEPTH, DIAMETER, HOLE TYPE.**

5 Line multicentre machines

Line machines are multicentre machines; that is, machines with more than one machining centre. There are usually three centres: two are "operative" processing centres (centres 1 and 2), while one is the "logical" centre (centre 3), which sets up the machine for processing. All sections of a program (profiling, boring, etc.) are organised per centre. The logical centre is the first to run a program and it communicates the necessary information - locking type required for the piece, the machining origin, etc. - to the PLC. Programming the logical centre is essential for the correct operation of the machine. The logical centre is programmed by means of the Parameter Box, which is displayed every time a new program is created. It can also be called up using the PARAMETERS option in the FILE menu of the AP Editor.

5.1 Operation modes

This paragraph describes the working modes by which a panel can be clamped and machined.

Filling mode

The filling mode allows for simultaneous machining of two identical pieces where each "operative" centre executes all the machining operations of the piece. For this reason the only type of panel which can be machined in this mode is a medium-short panel (panel occupying only one station).

Single tandem mode

The single tandem mode foresees that a piece is always machined on the same origin, which must be specified. If the piece is medium-short, it is machined by the centre associated with the stop at which it has been locked into position. If it is long, it is machined by both centres at the same time.

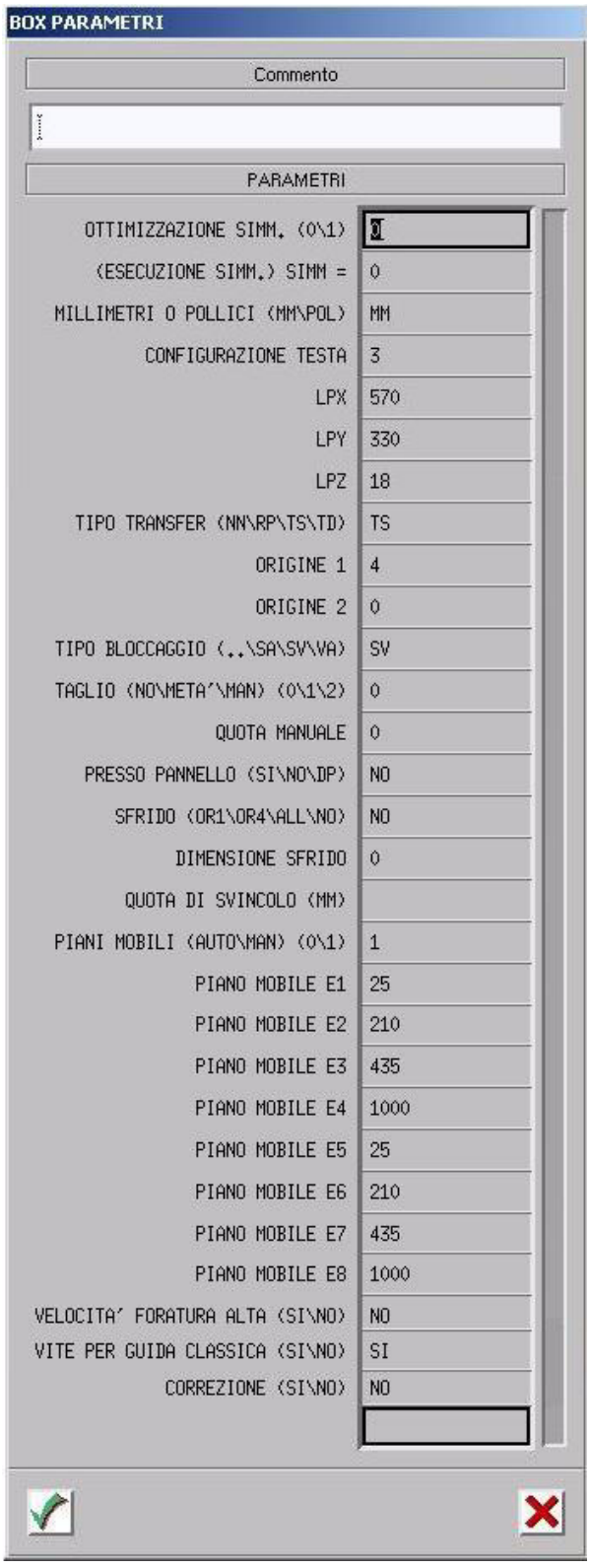
Double tandem mode

The double tandem mode foresees that a piece is machined and locked into place in two parts. The piece is locked into place and machined on the first required origin. After machining is completed, it is released and transferred to the second required origin.

5.2 Parameter Box

The Parameter box is displayed as shown in Figure 1.

Figure 1: Parameter Box



The parameters which may be defined are described below:

Symmetric Optimisation:	symmetric program carried out on the X axis as well
Symmetric Execution:	the program physically executed on the machine will be normal if this field is 0, or symmetrical if it is 1.
Millimetres or inches (MM\IN):	unit of measurement; type in MM (for millimetres) or IN (for inches).
Head configuration:	the configuration number of the operating section.
LPX:	size of the piece along the X axis (length).
LPY:	size of the piece along the Y axis (width).
LPZ:	thickness of the piece.
Transfer type (NN\RP\TS\TD):	type of panel locking: NN: the piece will not be locked on any origin TS: the piece will only be locked on the origin indicated by the OR1 parameter. TD: the piece will first be locked on the origin indicated in the OR1 parameter, and then on the one indicated in OR2. RP: the piece will be locked on the origins indicated in OR1 and OR2 alternately (odd on OR1, even on OR2). (Can be used only on FT)
Origin 1 (OR1):	First work origin. If 0, it will not be considered.
Origin 2 (OR2):	First work origin. If 0, it will not be considered.
Locking type (..\SA\SV\VA):	type of panel locking SA: pushers only SV: with suction cups only VA: suction cups and pushers
Cut (NO\HALF\MAN):	it is possible to indicate that some machining operations should be carried out on the first work origin (OR1) and others on the second one (OR2) by inserting a cutting on the panel. 0: no cutting 1: all machining operations with X-coordinate below half the panel will be carried out on the first work origin (OR1); any other, on the second origin (OR2). 2: all machining operations with X-coordinate below the position indicated in the STAV parameter will be carried out on the first work origin (OR1); any other, on the second origin (OR2).
Manual position:	cutting position for manual cutting
Panel pressing (Y\N\DP):	panel pressing to improve the accuracy of machining operations. Y: pressing only close to the work origin. N: no pressing. DP: panel pressed at both the head and the end.

Waste (OR1\OR4\ALL\NO):	cutting and collecting waste (Available only in FT1300 with tool changer and waste disposal device). OR1: only on the first work origin. OR4: only on the second work origin. ALL: on all work origins. NO: no operation of this kind.
Waste dimension:	dimension of the waste to be carried out. Waste involves removing a corner of the panel with cathetus dimensions equal to those indicated below using an electrospindle. (Available only in FT1300 with tool changer and waste disposal device).
Moving tables (AUTO\MAN):	Type of positioning for moving tables. AUTO: the position of moving tables is automatically assigned, without taking into account through machining and potential interferences. MAN: the positions of moving tables are manually set by the operator in the following parameters. If a datum is omitted, it is automatically calculated.
Moving table E1, …, E8:	position of the moving table (Available only in FT1300 with moving tables).
High boring speed (Y\N):	during regular vertical boring, the panel enters at half its working speed. This function can be deleted by selecting "Y" in this parameter.
Screw for classic guide (Y\N):	for classic guides, it may be sometimes necessary the presence of the safety screw (if the specific unit is present). This can be done by selecting "Y" in this parameter. (Available only in KT/IT with the magazine of the classic guides with safety screw.).
Correction (Y\N):	for the machine, for inserting tools, boring operations are carried out on the work origin with stop at the end of the panel. By selecting “Y” in this parameter all machining operations will be duly corrected. (Available only in KT/IT.)

5.3 Dynamic control of interference between the work centres

The basic problem when creating programs that contain interpolations is that of preventing an interpolation from being suspended by the control, because the centre that is completing it is moving towards interference with the other centre. This suspension could damage the piece due to the overheating of the tool, which will continue to rotate inside the piece while the axes are idle. In order to solve this problem, all machining operations must specify which is their interference position. For centre 1, it is the maximum position the axis will reach during the machining, while for centre 2, it is the minimum position. In this way, when the position is specified, it is possible to check that such position does not interfere with the interference position of the other centre. If there are no interference problems, the centre continues machining. Otherwise, it will wait for the other centre to finish the operation already started, and will eventually move if it becomes an obstacle. In case both centres want to move along the interference direction and one of them has

to move away, centre 2 will go on and centre 1 will move away to leave space. Before positioning the axes, all machining operations should include the following line:

N20 ST8=SS XT=QX L=GINT,

where SS is the spindle used (T22, TH1, TP3, etc.) and QX is the interference position.

This operation is always automatically carried out for all the operations carried out in optimised mode. Two different situations can be found when profiling. For boring and milling (G7, G9), for making hinge bore (PCERN) or cutting waste (PSFRIDO) or for milling with a blade aggregate, nothing has to be done because the interference position is automatically calculated within the cycle. When milling or horizontal boring with aggregate, it is necessary to specify the macro interference position by using a specific parameter. For further information see chapter 2.

For specific instructions on how to add a line when profiling for interference control, in case it is absolutely necessary, refer to section 2.9.

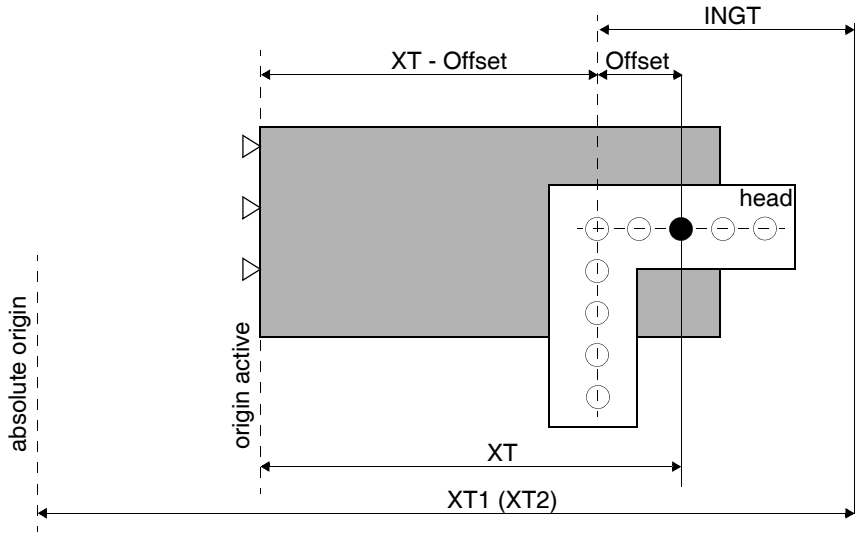
5.3.1 Limit calculation

Within the GINT cycle the limit positions are calculated using the following formulae:

XT1 = XORI + (XT - Spindle Offset) + Head Dimensions on X+ centre 1;
XT2 = XORI + (XT - Spindle Offset) - Head Dimensions on X - centre 2.

If the active origin is origin 1, *XORI* = Calibrator Origin 1; if the active origin is origin 2, *XORI* = Calibrator Origin 2 - LPX. The parameter *XT* is the limit declared through the dialogue window of the GIN cycle. The *Spindle Offset* is read from the relevant CALIBRATOR table of the machine data on the basis of the name inserted in the SPINDLE field of the GIN dialogue window. The *Head Dimension* is read from the HEAD table on the basis of the centre.

Figure 2: Limit calculation.



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