GB

Xilog³MMI

Cod.0000502281

RoutoLink

for Bore-Milling Machines manufactured

by the SCM Group

USER AND

PROGRAMMING GUIDE

V. 6.3 - Novembre 2001

SCM GROUP

This manual has been designed to provide information relative to the use of Bore-Milling machines manufactured by the SCM Group.

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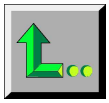
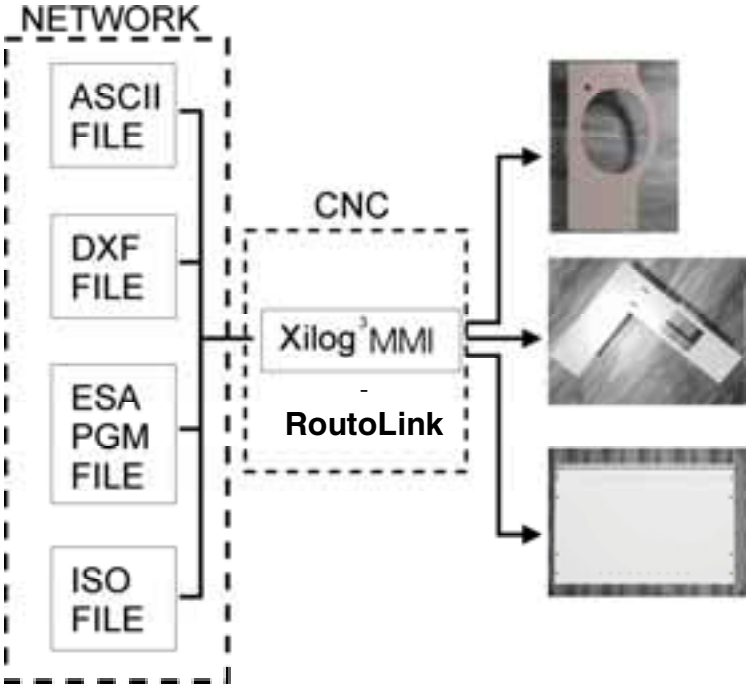
1. TABLE OF CONTENTS



14. SUPPLEMENTARY NOTES TO THE MANUAL AND “CORRECTIONS”

2. GENERAL

Xilog³MMI - RoutoLink is a Graphic User Interface present on the machine used to manage and set the machine into action. *Xilog³MMI - RoutoLink* allows simple and immediate interaction between the operator and the activities of the machine.
Xilog³MMI - RoutoLink can also be installed on a standard office PC, and its graphic interface helps the operator during all the stages of creation of a **program** (intended as the programming of the machining to be executed on a panel): from writing the program, to its graphic simulation, from file management (supported also in a networked installation) to customisation of the development environment.
This means that it is now possible to create and execute **mix** of programs, that is a sequential list of programs whose execution is managed and organised by the operator interface based both on the programmed sequence and on the characteristics of the working table of the machine, so as to reduce to a minimum the execution times.
The mix (consisting of a sequence of instructions containing the name and the header of each program) may be built also using a Bar Code Reader or a remote computer connected to the *Xilog³MMI - RoutoLink* interface via the serial port of the computer.
The *Xilog³MMI - RoutoLink* program management can be schematised as follows:



2.1 MODES AND WINDOWS ORGANISATION

The *Xilog³MMI - RoutoLink* Graphic User Interface (GUI) is organised to provide the operator with a developing environment characterised by various modes (such as for instance MANUAL, AUTOMATIC, PROGRAM EDITOR, etc.) each represented by one or more windows on the screen, in Microsoft® Windows* style.
Each status is characterised by specific functions more or less related to the movement of the machine (e.g. while the PROGRAM EDITOR status is used to write programs, the MDI status is used to issue positioning instructions to the machine).
Each window has one specific function, as indicated below:

- provides data, values or position readings;
- allows the selection of an element from a list:
- allows the entry of data
- activates the functions specific to the current status.

The operator can enter data, issue instructions or select items from a list either by using the keys on the control (i.e. the PC) or directly using a mouse.
The single video keyboard, always present at the bottom of the screen, allows access to the various modes of the interface and changes with the current active mode. The video keyboard keys can be pressed either by pressing the corresponding function keys on the physical keyboard of the control or the PC, or by clicking on them with the left mouse button.
The top part of the screen (the mode windows), always provides the following information: Name of current mode, the condition of the physical keyboard, date and time, the current configuration of the interface, the status of the NC and the condition of the machine.
The interface gives messages to the operator also via *message boxes* that pop up whenever necessary. The message boxes are colour-coded according to their meaning:

- ERROR, FAULT, STOP (password request): red;
- WAIT, INFORMATION: blue;
- DATA ENTRY: green;
- AMBIGUITY: yellow.

One of the main characteristics of *Xilog³MMI - RoutoLink* is that it is able to continue the operational management of the machine also when it is in non-operative modes (e.g. PROGRAM EDITOR). For instance, it is possible to access the AUTOMATIC PROGRAM mode, enable the machine to the

* Windows is a trademark of Microsoft™ Corp.

automatic execution of one or more programs, load the panels on the work table and press the **"START"** push-button. Now, while the machine proceeds with the work, it is possible to leave the "AUTOMATIC PROGRAM" mode and write a program in the "PROGRAM EDITOR" mode. The operator will be shown all information relative to the current machining operation (such as for instance a fault message), both by the display of graphic images in the Mode window, and by showing *message boxes*.

2.1.1 GRAPHIC HELP MODE

The *Xilog³MMI - RoutoLink* GUI is organised so as to present the operator, in each mode, a graphic representation of the programs that are created or executed on the machine to reduce possible errors to a minimum. In addition, to have the maximum number of graphic information in all modes, *Xilog³MMI - RoutoLink* provides a GRAPHIC HELP mode, which is enabled by pressing once the **[F11]** key. An icon in the mode window identical to the icon on the [F11] key shows that the GRAPHIC HELP mode is active. To leave the GRAPHIC HELP mode, press [F11] again.
For example, the PROGRAM EDITOR in normal mode is a TEXT EDITOR (where the program steps are represented by textual instructions). In GRAPHIC HELP mode, however, it shows a graphic simulation on a panel of the machining generated by the instruction.

2.1.2 'NO EDIT' Selector

On the boring/milling machine control panel there is a key type selector which allows the operator to enable/disable the possibility of saving permanently the data contained in a program (see MIX or PGM Editor), the software configuration (see CFG Editor file) or the tooling (see TLG Editor file).
With this function disabled, it is still possible to access the above Editors, but no changes made to any open documents can be saved (access for display purposes only).

2.2 SYSTEM REQUIREMENTS

The *Xilog³MMI - RoutoLink* user interface can be installed on a compatible IBM® Personal Computer having at least the following minimum characteristics:

- CPU Intel® Pentium® or better;
- minimum 32 Mb Ram;

- Floppy Disk Drive 3”1/2 1.44 Mb;
- Hard disk minimum 250 Mb;
- 2 serial ports;
- 1 parallel port;
- VGA or SVGA graphic adapter;
- Colour monitor with a resolution of at least 640x480 dpi;

and running the following operating systems[†]:

- Microsoft® Windows 95;
- Microsoft® Windows 98.

CAUTION

THE CURRENT SESSION OF THE SYSTEM MUST BE CLOSED BEFORE THE MACHINE IS SWITCHED OFF.

2.3 INSTALLATION

The procedure for a correct installation of the *Xilog³MMI - RoutoLink* program is the following:

- Turn on the computer (or the machine);
- Launch Windows;
- Insert the Installation disk in drive A of the computer;
- Select RUN from the FILE menu of the Program Manager;
- Type:
  A:install;
- Press the **[Enter]** key and wait for the window of the installation program to appear on screen;
- Use the *mouse* or the **[Tab]** key to select the required installation:

P.C.
If the computer is not connected to the N.C. (office computer);

CNC NET

[†] Windows 95, Windows 98 are trademarks of Microsoft™ Corp.

for the display on the machine;

CNC COM1, CNC COM2
if you want to connect the N.C. to a computer other than the display on the machine. COM1 and COM2 refer to the serial ports 1 and 2 of the computer to be connected to the N.C..

NOTE

CNC COM1 AND CNC COM2 ARE TO BE USED ONLY IN EMERGENCIES (MALFUNCTIONING OF PCNUM, FIPO CARD, ETC...)
REFER TO: PROCEDURE FOR INTERFACING PERSONAL COMPUTER AND CNC.

- Enter the complete name of the directory where you want to install the program (no action is required to install the program in the default directory C:\XILOG3);
- Press the **[Enter]** key
- Follow the instructions given by the installation program and wait for the complete installation (the gauge must read 100%).

The installation program will automatically generate a new Windows Group called *Xilog³MMI - RoutoLink* (if not present already) which contains the icon of the installed program.

NOTE

If PROGRAM MANAGER is not present, a folder with the *Xilog³MMI - RoutoLink* icon cannot be created. In this case, although this particular condition generates an error, the installation is to be considered complete.

To execute *Xilog³MMI - RoutoLink*:

- Turn the computer (or the machine) OFF;
- Plug the dongle into the parallel port of the computer;

- Turn the computer (or the machine) ON;
- Launch Windows;
- Select VGA video resolution;
- If the *Xilog³MMI - RoutoLink* icon has been created during installation, double-click on the icon. Otherwise follow the instructions provided on the manual of the operating system. The executable file **xilog3.exe** is contained in the directory.....\XILOG3\WINEXE.

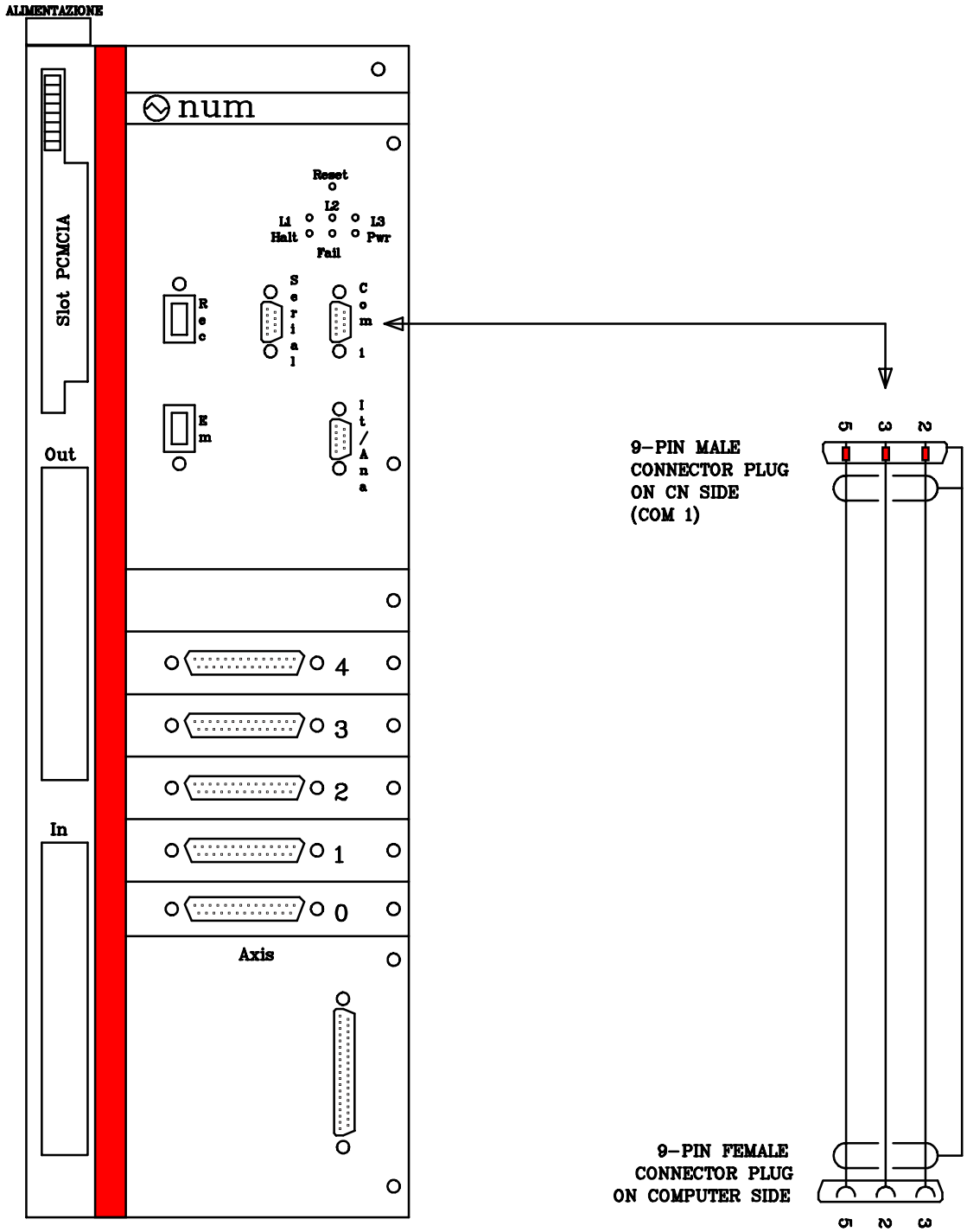
To change the current language proceed as follows:

- Launch *Xilog³MMI - RoutoLink*;
- From the BASE MENU press **[F8] =>** SERVICES page;
- Press **[F5] =>** INTERNATIONALISATION;
- Select the flag of the required country by pressing the **[F7]** repeatedly as necessary.

2.4 PROCEDURE FOR INTERFACING PERSONAL COMPUTER WITH CNC NUM

In case of emergency caused by the malfunction of the FIPO card or of the PC NUM, it is possible to connect the office computer to the N.C..
This connection is carried out between the serial port COM1 of the N.C. (the only port available) and one of the two serial ports COM1 or COM2 of the external computer. This port must be selected during the installation of *Xilog³MMI - RoutoLink* (see INSTALLATION).

2.4.1 WIRING AND CONNECTION OF SERIAL CABLE



3. CONFIGURATION

There are two types of *Xilog³MMI - RoutoLink* configuration files, both with the extension .*CFG*, and contained in the directory.....\XILOG3\CFG:

- **machine configuration files**;
- **software configuration files**.

The parameters contained in the machine configuration files have been set by the manufacturer of the machine.
The parameters of the software configuration file will have to be set by the user according to his requirements.
Only in the rarest occasion (e.g. customisation of the working table of the machine, or set-up of a different mode of execution of a program) the user is forced to modify the parameters set by the manufacturer.

CAUTION

Serious malfunctions may result from changing the machine configuration files!

The parameter editor is accessed from the BASE MENU, by pressing first the **[F8]** key to access the SERVICE environment, and then the **[F4]** key.
The program will present a list of parameters that can be selected using the **[🡻]** and **[🡹]** keys.

3.1 SOFTWARE CONFIGURATION

The files containing the parameters relative to the Graphic User Interface and its use are:

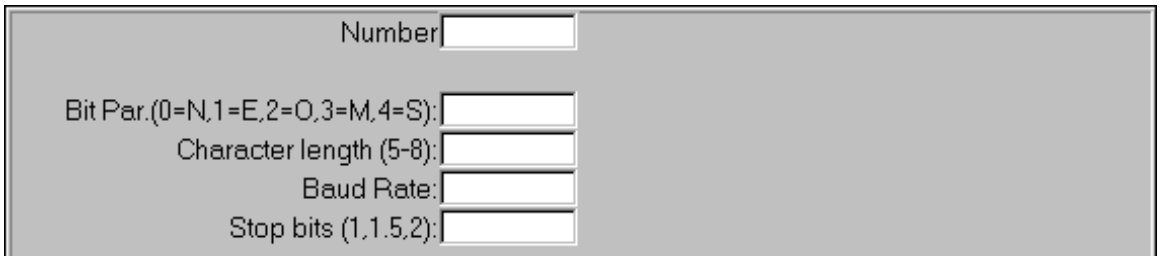
- **COUNTRY.CFG** describes the available languages and unit of measurement;
- **RS232.CFG** Configures the serial ports;
- **BCR.CFG** Contains BCR data;
- **CAD.CFG** Contains data for the import of DXF files

- **PASSWD.CFG** Activates and configures password access to the various environments.

The **COUNTRY.CFG** file is managed automatically by the GUI and must not be modified.
The correct set-up of the files **RS232.CFG** and **BCR.CFG** is essential to ensure the good reception of data from the serial ports of the computer, especially if the BCR is used to load programs.

3.1.1 RS232.CFG

Allows the configuration of the serial ports of the control (or the computer) to a maximum of 4.



Number:

Number of the serial port: 1=COM1, 2=COM2, 3=COM3, 4=COM4.
For further information on the serial ports, refer to the manual of the numerical control or the computer.

Parity Bit (0=N,1=E,2=O,3=M,4=S):

Value of the parity bit. If the length of the data is less than 8 bit, the eighth bit can be used to check the parity. This field can be set to one of the following values:

- **0**: NONE, no check;
- **1**: EVEN;
- **2**: ODD;
- **3**: MARK, always active;
- **4**: SPACE, always inactive.

Character Length (5-8):

Number of bits that make up a character.

Baud rate:

To set the Baud Rate, its value must be provided directly, or the corresponding indicator given in the table below must be supplied:

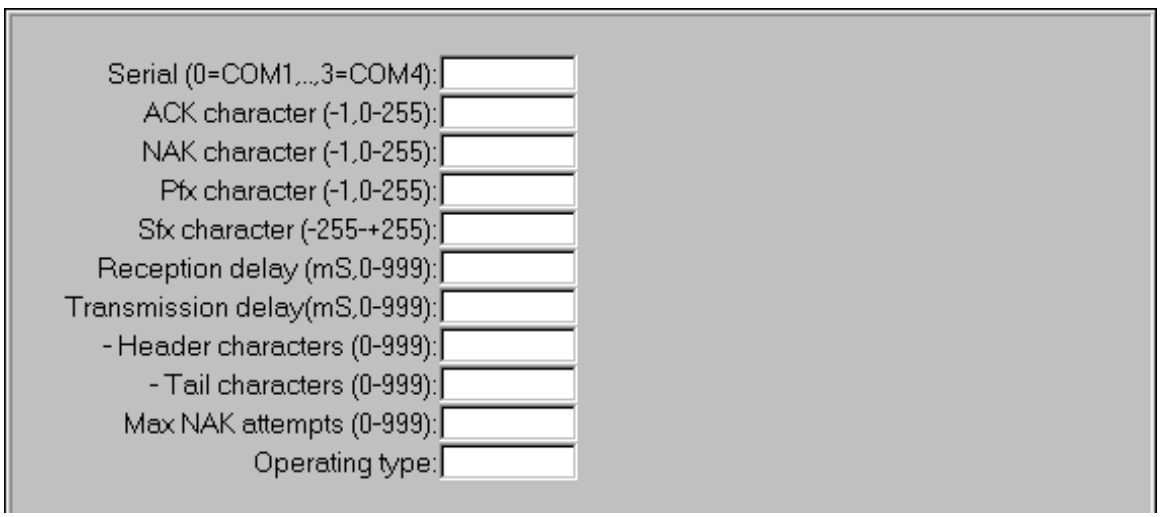
Index	Baud Rate
2	110
5	300
6	600
7	1200
10	2400
12	4800
14	9600
15	19200
16	38400
19	14400
20	56000
21	128000
22	256000

Stop bits (1,1.5,2):

Number of bits at the end of a character which identify the finish of it.

3.1.2 BCR.CFG

The **BCR.CFG** contains the configuration information for the transmission and reception of data from the Bar Code Reader and/or Remote Computer.



Serial:

Number of the serial port to which the BCR or the remote computer is connected: 1=COM1, 2=COM2, 3=COM3, 4=COM4.

CAUTION

The serial port selected must not be the one to which the mouse is connected.

ACK character:

Value of the character sent to the BCR to confirm the correct reception of the data. Any value between -1 and 255 can be set, but it must be different from the NAK character (if both are not set to -1). If this value is set to -1 no ACK character will be sent to the BCR.

NAK character:

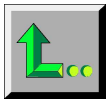
Value of the character sent to the BCR to indicate the incorrect reception of the data. Any value between -1 and 255 can be set, but it must be different from the ACK character (if both are not set to -1). If this value is set to -1 no NAK character will be sent to the BCR.

Prefix character (Pfx):

Value of the first buffer character received by the BCR. Any value between -1 and 225 can be set. Set this value to -1 to indicate that the text read by the BCR starts with the first character of the buffer.

Suffix character (Sfx):

Any value between -255 and 255 can be set. If the value is greater than or equal to zero, the suffix character represents the termination value of the received character buffer. In this case, it must be different from the prefix character.
If this value is negative, it will represent the number of characters that make up the buffer (including the prefix, if different from -1). The difference between the value entered, minus the total number of header and tail flush characters must not be greater than the maximum number of characters of the text.

Reception delay:

Maximum buffer reception time period (from 0 to 999 milliseconds).

Transmission delay:

Delay (between 0 and 999 milliseconds) to be inserted between the reception of the last buffer character and the issue of the ACK/NAK to the BCR.

Header flush characters:

Number of header characters to be flushed at the beginning of the buffer (from 0 to 999), including the prefix, if any.

Tail flush characters:

Number of tail characters to be flushed at the end of the buffer (from 0 to 999), including the suffix, if any.

Number of NAK attempts:

Maximum number of consecutive NAK transmissions (from 0 to 999) to account for disturbances.

Operating type:

if the setting is 0:
the programs read sequentially by the BCR are placed in a queue in order of reading and make up a real MIX of programs (i.e. a sequence of MIX steps similar to that created by the MIX editor is produced). This MIX is executed in sequential count-down mode.

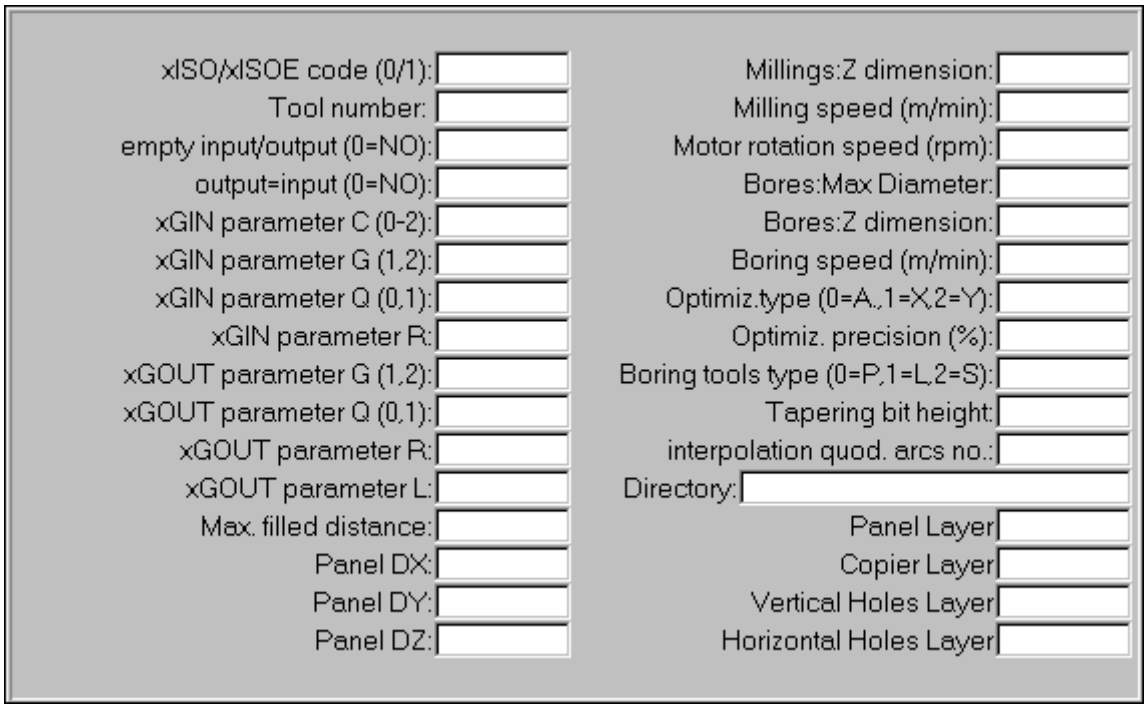
If the setting is 1:
The program read by the BCR is inserted in all the empty fields of the machine. If there are no empty fields, the program is placed in a queue in all the fields (annulling any previous queue) and loaded as soon as a place becomes free.
If the machine is fitted with automatic suction cups (TVS) this mode cannot be enabled.

(see EXECUTING A MIX, BAR CODE READER-REMOTE COMPUTER)

3.1.3 CAD.CFG

CAD.CFG contains the standard parameters used when importing a DXF file. Importing a DXF file entails the translation of the information contained in it, identifying spatial geometries, into program steps. Each geometry is translated in a sequence of operative instructions, which begins with the automatic entry into profile GIN (or xGIN), and the beginning of profile G0 (or xG0), and ends with the automatic exit from profile command GOUT (or xGOUT).
(see PANEL PROGRAMMING and IMPORTING A DXF FILE).

First configuration page



xISO/xISOE Code:

If set to 0, the geometries are imported as a sequence of textual instructions. If set to 1, graphic instructions are generated.
(see PANEL PROGRAMMING).

Tool Number:

Number of the standard tool used to execute all profiles and all borings not generated by the optimiser.

Empty ENTRY/EXIT:

If set to 1, all the automatic entry into profile and automatic exit from profile instructions are generated without parameters. If set to 0, the parameters indicated in the following fields (from **xGIN parameter C** to **xGOUT parameter L**) are issued with these instructions.

ENTRY=EXIT:

If set to 1, the automatic entry into profile instruction is set to the same parameters of the automatic exit from profile instruction. Otherwise, the relative values set in the following fields will be used.

XGIN: parameters C,G,Q,R:

See PROGRAMMING A PANEL, INSTRUCTION LIST, GIN and XGIN – automatic entry in profile.

XGOUT: parameters G,Q,R,L:

See PROGRAMMING A PANEL, INSTRUCTION LIST, GOUT and XGOUT – automatic exit from profile.

Max. connection distance:

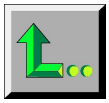
This value identifies the maximum distance (on the plane) between the extremities of two distinct graphic elements so that they can be connected if requested by the operator (see IMPORTING DXF FILES).

Panel DX, DY, DZ:

Standard panel size (if not indicated in the source DXF file header).

Z value for milling:

Value of the **Z** field for all the milling and boring instructions (other than those generated by the optimiser) which are generated by the program. The milling depth may be modified in PROGRAM EDITOR only after having imported the DXF file.
This quantity can be modified inside the «IMPORTING A DXF FILE» environment, and also after importing the DXF file into the PROGRAM EDITOR.



Milling and motor speed:

Value (in metres per minute the first and in RPM the second) taken by the corresponding fields in milling instructions.
(see PANEL PROGRAMMING).

Boring Max. diameter:

Value, in millimetres, that discriminates the DXF instruction CIRCLE which, when imported, produce geometries which are translated as boring instructions. Boring instructions are generated from CIRCLE instructions with a diameter smaller or equal to the value set in this field.

Boring Z value:

Standard depth of imported borings. (In the IMPORTING DXF FILE environment it is possible to set different boring depths for each boring.)

CAUTION

For best results in the automatic boring optimisation, the boring depth must be set manually. The boring depth must be set manually in any case when the required Z value is not the standard value.

Boring speed:

Value (in metres/minute) taken by the corresponding field in boring instructions.
(see PANEL PROGRAMMING).

Optimisation Type:

Value identifying the method followed by the boring optimisation algorithm (see BORING OPTIMISER)

- **0** = ABSOLUTE: minimises the path of the boring head following the diagonal;
- **1** = AXIS X: minimises the path of the boring head following first axis X and then axis Y.
- **2** = AXIS Y: minimises the path of the boring head following first axis Y and then axis X.

Optimisation accuracy:

Percentage expressing the accuracy of the optimisation algorithm. (See BORING OPTIMISER.)

Boring Bit Type:

Value defining the type of boring bits used during boring:

- **0** = FLAT BIT;
- **1** = LANCE;
- **2** = TAPER BIT;

The BORING OPTIMISER will generate the boring instructions using the tools (configured in the **tooling** file of the machine) having the required characteristics.

Taper height:

Bit taper height. To be programmed only if the previous field is set to 2.

Interpolation quod. arcs number:

If there are any «ELLIPSE» type elements in the DXF file, this value represents the number of arcs per quadrant (geometrical) produced by the algorithm of the ellipse interpolation. The larger this number, the more accurate the curve interpolation will be.

Directory:

Name of the directory where the configuration files and external tooling files needed to C.A.D. can be found. If not programmed, these files are not generated.

Panel Layer:

Indicate the overall dimensions of the rough panel from which the finished panel will be cut.
In the DXF file the layer name must be followed by the character "_" and by a number which represents the size of the panel in Z.
This layer, in the DXF file, must contain 4 lines joined to form the rectangle of the panel.

If the parameter **"panel layer"** is not programmed, the panel sizes programmed in the parameters **"Panel DX, DY, DZ"** are valid.

Example:

Panel layer:
- S

in DXF file:
- S_25 defines a panel 25 mm thick (S_25_5 defines a panel 25.5 mm thick);
- the "LINE" elements of this layer only define the panel dimensions in X and Y and are not interpreted as linear millings.

Pantograph Layer:

Indicate the profile to be cut from the rough panel.
In this case you do not need to specify a numeric parameter as lines, arches and circles are converted into millings. WARNING: all geometric elements not belonging to other layers are considered elements of this layer.
The milling and boring depth is determined by the parameter **"Z Millings (0=CFG,1=THK,2=ELEV)"**.

Horizontal Holes Layer:

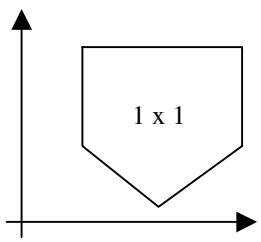
Horizontal holes are defined by the instructions **"BR"** or **"XBR"**.
In the DXF file the layer name must end in a number which corresponds to the distance from the centre of the hole to the work table (under side of panel).

Example:

Horizontal Holes Layer:
- HO

In the DXF file:
- HO20_5 defines a horizontal hole with its centre 20.5 mm from the work table (se parameter **"H"** of instruction **"BR"**);

To program these holes characterise DXF file (through C.A.D.) as follows:
1. Input the drawing of a point with closed lines and unitary sides (1 x 1) in block named "HORIZ" :



2. Create a definition block of a horizontal hole (for example “HO20” if the panel layer is “HO”, see the example above)
3. Insert the block HORIZ in the layer (HO20) specifying:
   - scale in X -> enter the hole diameter;
   - scale in Y -> enter the hole depth;
   - rotation -> on the basis of the side of insertion.

Vertical Holes Layer:

These define the vertical boring as an alternative to the standard based on programming the parameter **“Boring Maximum Diameter ”** which refers to all the “CIRCLES” present in the DXF file. If programmed, the vertical boring layer establishes that only the circles in this layer are interpreted as vertical holes, their diameter is the diameter of the circle programmed in the DXF file.
In the DXF file the layer name must be followed by the character “_” and by a number representing the dimension in Z of the holes (in relation to the panel surface) belonging to the layer. If you drill a different diameter you have more layers.

Example:

Vertical Holes Layer:
- Z

In the DXF file:
- Z_10 represents holes 10 mm deep;
- Z_10_5 represents holes 10.5 mm deep;
- Z_20 contains holes 20 mm deep.

Second configuration page

Z Holes (0=CFG,1=THK,2=ELEV):

This establishes how to read the depth (or Z quota) of the boring imported from the DXF file:

“Z Holes (0=CFG,1=THK,2=ELEV)”	**Depth**
0	Programmed in the parameter **“Dimension Z Boring”**

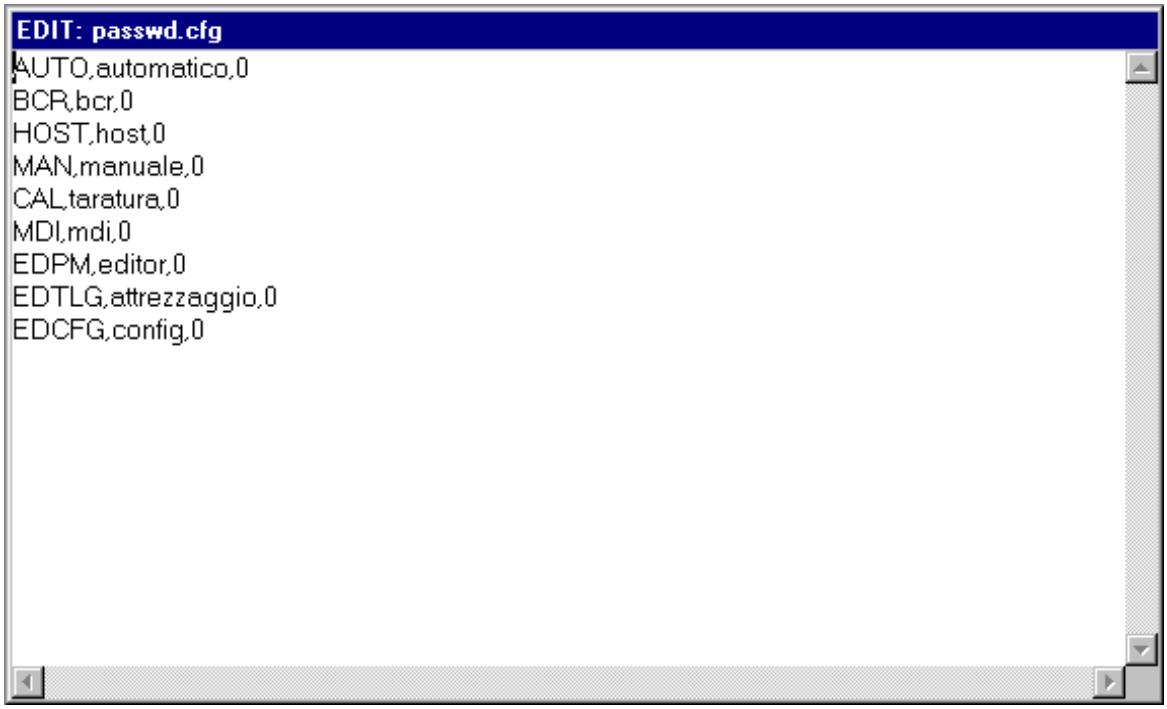
1	programmed in the DXF file as "THICKNESS" of the geometry, corresponds to the quota Z of each individual edge of the geometric elements.
2	Programmed in the DXF file as "ELEV" of the geometry, definable with C.A.D. using the relevant control described in the C.A.D manual.

Z Millings (0=CFG,1=THK,2=ELEV):

This parameter has the same meaning as the parameter **"Z Holes (0=CFG,1=THK,2=ELEV)"** but refers to the millings imported from the DXF file. In this case the standard thickness reading (corresponding to the value 0 of this parameter) is that programmed in the field "**Dimension Z Milling"**.
If programmed this parameter disables manual milling depth setting in the environment of importing from the DXF file. In this case it is not even possible to set a different entrance point on a closed profile.

3.1.4 PASSWD.CFG

This file may be edited only after entering the password provided by the machine tool manufacturer.



It is possible to associate a password to each interface mode (except for BCR and HOST which are not currently supported). The associated password is the character string following the comma after the interface mode identifier.
If a line ends with 1, access to the corresponding mode is granted only after entering the correct password.

4. MACHINE MOVEMENT

From the BASIC MENU mode it is possible to access three operating environments which allow the issue of direct instructions and command the movement of the machine. These are:

- CALIBRATION
- MANUAL
- MDI

The current position of the axes can be monitored from all three environments. A window is always present for displaying any error messages.

4.1 CALIBRATION

To calibrate the machine, access the CALIBRATION mode by pressing the **[F5]** key from the BASIC MENU. If the machine has not been calibrated, the status window will display an icon identical to the one of the **[F5]** key, marked by a cross.
In the CALIBRATION mode, the calibration cycle will start by pressing the green **"START"** button on the control panel of the machine. To stop the cycle at any time, press the **"HOLD"** button located next to the "START" button.
If the calibration cycle cannot be completed for some reason (and the "Machine Not Calibrated" icon is shown in the status window), repeat the calibration cycle.
The **(+)** key located on the control panel of the machine commands the calibration of a single axis. The active axis is shown in green in the dimension window (present in this mode).
If the control panel of the machine is fitted with one, the axes can be selected with the axis selector. Otherwise, use the **[F5]** or **[↑]** keys to select the previous axis in the axis dimension list. Use the **[F6]** or **[↓]** key to select the following axis.
If the machine has not been calibrated, it is not possible to access the AUTOMATIC PROGRAM mode and the AUTOMATIC MIX mode.

NOTE

Execute this function every time you turn the control ON.

4.2 MANUAL MODE

In manual mode, the machine is totally controlled by the operator. Using the controls located on the panel, the operator can move the selected axis **incrementally**. To access the MANUAL mode, press **[F4]** from the BASIC MENU.
In this mode, the current axis is highlighted (in the encoder position window) by a green background. If configured, also the auxiliary axis of the boring unit is displayed.
If the control panel of the machine is fitted with one, the axes can be selected with the axis selector. Otherwise, use the **[F5]** or **[↑]** keys to select the previous axis in the axis dimension list. Use the **[F6]** or **[↓]** key to select the following axis.
The **(+)** key of the control panel of the machine moves the selected axis forward (towards higher values). The **(-)** key moves the axis backwards (towards smaller values). The mode of movement of the axis varies according to the JOG value set. This value, displayed in the status window, may be:

- indefinite (JOG): the axis moves as long as the key is kept pressed;
- 1, 10, 100, 500, 1000, 10000: the axis moves as far as the number of thousandths of millimetres indicated.

The value of JOG can be changed sequentially using **[F7]**.
The speed potentiometer can be used to set the displacement speed of the axes.

The control is switched to manual mode also when the corresponding key located on the control panel of the machine is turned. In this case, if the current mode is an operative mode (such as for instance the AUTOMATIC PROGRAM mode), and if the machine is not currently executing a program, the interface switches automatically to the MANUAL mode.

4.3 MANUAL DATA INPUT

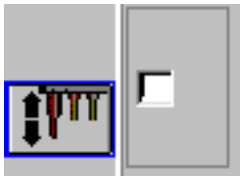
In this mode, which can be accessed from the BASIC MENU with function key **[F6]**, you can control the machine directly by entering positioning values, or *ISO* language instructions (ISO is the language of the Numerical Control).
The instruction entered must be confirmed with the **[Enter]** key (or the **[Shift]**+**[F2]** key) and may be executed by pressing **(START)** on the control panel of the machine.

Using function keys **[F3]** and **[F4]** you can access the Manual I/O Tests of the boring and milling units and the Manual I/O Tests of the tool change, in circular mode;
The manual tests enable direct control of the machine boring and milling units, such as the fixed boring unit and the electro-spindle and the Tool Change (without having to set the ISO instruction related to the required control) by selecting one of the predefined options using the arrow keys **[<-]**, **[->]**,**[🡻]**, **[🡹]**; the control is confirmed and carried out in the same way as an ISO control.
The key **[F5]**, allowing access to TOOL CHANGE MANAGEMENT is enabled only if the additional tool change (T type) has been configured.

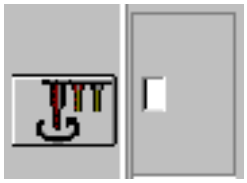
4.3.1 MANUAL TESTS OF BORING AND MILLING UNITS

Press the function key **[F3]** in sequence to access the manual test page for all machine boring and milling heads, programmed in the file "PHEADS.CFG". The configuration pages are in function of the head configuration parameters which can be: controlled by a three phase motor or a frequency converter; fixed or with "VECTOR" or by pneumatic rotation.

4.3.1.1 Fixed boring head



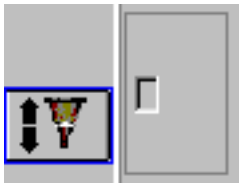
SELECTING INDIVIDUAL SPINDLE
The number of the desired spindle must be inserted in the picture opposite. Possible nos. are: from 01 to 96 depending on the configuration of the boring machine present in *Xilog³-Routolink*; see file SPINDLES.CFG.



SWITCHING SPINDLES ON/OFF.
IN THE CASE OF A BORING MACHINE WITH **EVER** STEP-STEP DRIVE, USING THIS ICON THE SPINDLES ARE ONLY SWITCHED ON.
ENTER THE STATE CHOSEN FOR THE ACTION PREVIOUSLY ENABLED IN THE PICTURE OPPOSITE:
VALORE = 0 (OFF) BORER UP AND SPINDLES OFF
VALORE = 1 (ON) BORER DOWN AND SPINDLES ON

If one or more spindles of the borer fixed unit are controlled by a frequency converter, the spindle ON/OFF key is like the one for the electro-spindle. There are also controls to invert the rotation direction and speed setting (see**"Electro-spindle"**).

4.3.1.2 Electro-spindles

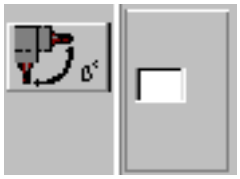


HEAD DOWN / HEAD UP
THE PICTURE OPPOSITE IS NOT USED; PRESS THE SOFT KEY, TO MOVE THE HEAD FIRST DOWN AND THEN UP AGAIN.

SPINDLE ON/OFF
IN THE PICTURE OPPOSITE YOU CAN ENTER THE ENABLE STATE CHOSEN:
VALUE = 0 ENABLE OFF
VALUE = 1 ENABLE ON

STARTING SPINDLE CLOCKWISE / STARTING SPINDLE ANTI-CLOCKWISE
IN THE PICTURE ALONGSIDE, ENTER THE STATE CHOSEN FOR THE ACTION PREVIOUSLY ENABLED:
VALUE = 0 STARTING CLOCKWISE
VALUE = 1 STARTING ANTI-CLOCKWISE

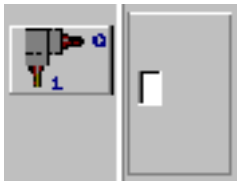
DESIRED SPEED FOR ELECTRO-SPINDLE
THE DESIRED SPEED IS ENTERED IN THE PICTURE ALONGSIDE, ENTER A TWO FIGURE NUMBER (BETWEEN 0 AND 99) THIS WILL THEN BE MULTIPLIED INTERNALLY BY 1000 ; EXAMPLE :
FOR S18000 , ENTER = 18



ONLY FOR ELECTRO-SPINDLES WITH VECTOR
VECTOR MOVEMENT CODE
ENTER THE DESIRED NUMBER IN THE PICTURE OPPOSITE, PRESS THE TO ACTIVATE THE TRANSMISSION AND THE MOVEMENT
ENTER A THREE FIGURE NUMBER FOR THE ANGLE DESIRED (IN DEGREES)

4.3.1.3 special units (UNIVERSAL,BLADE,LOCK CUTTING)

There are the same controls as for the electro-spindle (see **"Electro-spindles"**) apart from those for setting the required speed, these are not present if the unit is run by a three-phase MOTOR or VECTOR only if the unit is driven by pneumatic rotation the controls are as follows:

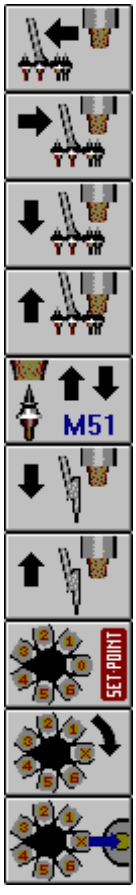


ONLY FOR PNEUMATIC ROTATION UNITS
ROTATION IN POSITION 0°
ROTATION IN POSITION 90° OR 180° OR 270° (according to the configuration of the unit in “PHEADS.CFG”)
ENTER THE STATE CHOSEN FOR THE ACTION PREVIOUSLY ENABLED IN THE PICTURE OPPOSITE::
VALUE = 0 (ROTATION IN POSITION 0°)
VALUE = 1 (ROTATION IN POSITION 90° OR 180° OR 270°)

4.3.2 TOOL CHANGE TEST

Press function key **[F4]** in sequence to access the manual test page for all the machine magazines configured in the file “STOREPOS.CFG”.

4.3.2.1 D – RAPID magazine



move tool magazine to home position

move tool magazine towards spindle

tool magazine down

tool magazine up

enables unlocking and locking of spindle tool

tool magazine excluser down

tool magazine excluser up

search origin of tool magazine

rotating tool magazine by one position

start tool chjange cycle

Memorising no. Tools in spindle

ONLY WITH TOOLROOM, arm Y RAPID tool change from centre towards TOOLROOM

ONLY WITH TOOLROOM, arm Y RAPID tool change from TOOLROOM towards centre

ONLY FOR PNEUMATIC HOOD, hood up

ONLY FOR PNEUMATIC HOOD, hood down position 1

ONLY FOR PNEUMATIC HOOD, hood down position 2

ONLY FOR PNEUMATIC HOOD, hood down position 3

ONLY FOR PNEUMATIC HOOD, hood down position 4

ONLY FOR POWER DRIVEN HOOD, pneumatic actuator down connected to hood bellows

ONLY FOR POWER DRIVEN HOOD, pneumatic actuator up connected to hood bellows

ONLY FOR POWER DRIVEN HOOD, search origin

ONLY FOR POWER DRIVEN HOOD, electric position control of pneumatic actuator limit switch stop

4.3.2.2 T – TOOLROOM magazine

TOOLROOM down

TOOLROOM up

TOOLROOM towards RAPID

TOOLROOM away from RAPID

Locking tools in TOOLROOM

Unlocking tools in TOOLROOM

4.3.3 MANAGEMENT OF ADDITIONAL TOOL CHANGE

If the machine has the additional tool change Tool Room type (T) and the XILOG3.CFG "**Special Machine"** parameter is configured to the value 1, the management of the tools and their magazine locations may be carried out in this environment.
The table (representing this environment) features a series of fields arranged in a circular fashion for the magazine stations on the machine.
The table is divided into two parts: the first, on the left, represents the main circular magazine; the second on the right represents a single magazine rack on the supplementary Tool Room magazine. If the supplementary magazine is made up of more than one rack, the [F8] key allows you to pass from one rack to another (in the right hand side of the table).
The table may be used:

- To set a starting condition of the tools in the magazines (pertaining to the loading of tools in their magazine locations)
- to program loading and unloading cycles of tools from the magazines (when the most frequently used tools have to be kept on the machine rotating magazine in order to speed up a series of machining operations)

In the first case, the table can be found in the *Positioning* condition of the tools in the magazines (see in DESCRIPTION OF STATUS AND FUNCTIONS, TOOL CHANGE MANAGEMENT TABLE). The machine user must set the number of tools about to be loaded manually in a given position of the magazine. The tool setting operation is facilitated by a list of tools available for any given magazine location represented by their name E*n*, plus any multiple heads characterised by the symbol A*n* (see «TOOLING», «SUPPLEMENTARY TOOL CHANGE» and "DESCRIPTION OF STATUS AND FUNCTIONS", "TOOL CHANGE MANAGEMENT TABLE").
In this condition the same tool number cannot be associated to two different magazine locations and there should be two free locations at least in the ADDITIONAL magazine. After confirmation of the table (by means of **[F6]**) **the actual situation of the tools in the machine must correspond to the condition set in the table itself.** Upon completion, the *Load/Unload* condition is enabled.

In the second case, the status is that of *Load/Unload:* the user can program loading and unloading operations of the tools from the magazine. The tools in the rotating magazine can only be unloaded and those of the additional

magazine can only be loaded; the load and unload programming must follow the rules set either by the number of magazine locations or by the “dimD” parameter, (see in DESCRIPTION OF STATUS AND FUNCTIONS, TOOL CHANGE MANAGEMENT TABLE).
In this case, confirming the table (with **[F6]**) enables the machine to do the actual tool change. At this stage the user must wait for the Load/Unload cycle to be completed.

At first, it is recommended to carry out the following operations in order to position the tools in the side magazine manually:

1 start positioning with **[F4]**;
2 fill the rotating magazine and configure the table regarding the magazine itself with the loaded tools;
3 confirm the situation with **[F6]**;
4 program a complete unloading of the rotating magazine;
5 confirm with **[F6]** and wait for the Unloading cycle to be completed;
6 press **[F5]** and continue from operation **2** onwards until all tools are positioned in the additional magazine.

5. TOOLING FILE

The tooling file contains all the parameters of all the tools available on the machine.
Xilog³MMI - RoutoLink supports various tooling files (having the extension *.TLG*). The characteristics of the tools actually installed on the machine must correspond to the characteristics described in the **active (current) tooling** file at all times. The name of the current tooling file is always shown at the top right of the status window. The standard tooling of the machine, which correspond to the standard current tooling file, is the **DEF** file, which must always reside in the main tooling directory .....\XILOG3\TLG.
The TOOLING CONFIGURATION mode allows to create, edit, delete and copy tooling files. It is possible to select the current tooling by highlighting it in the file list and pressing **[F7]**.

The TOOLING EDITING MODE can be accessed from the BASIC MENU by pressing first **[F8]** to access SERVICES, and then **[F3]**. The TOOLING CONFIGURATION mode is displayed. From this mode you can select an existing file from the list with the **[↓]** and **[↑]** keys or create a new one by entering its name. Press **[ENTER]** or **[F2]** to edit the file.

NOTE

The characteristics of the tools mounted on the machine must match with the characteristics described in the current tooling file at all times.
A tooling file can be made active only if it is contained in the main directory.
During the execution of a program, the file set in the program must correspond with the active file.

5.1 CONFIGURING THE TOOLS

Two types of tools are configured in the tooling file:

- fixed tools;
- magazine (or external) tools.

The fixed tools are the ones mounted on the boring head of the machine (if a boring unit is present).
The external tools are those located in the magazine of the machine (or mounted on the UNIVERSAL unit, if present).
The tooling file allows the definition of up to **96** fixed tools and **96** external tools. The first **96** tools, numbered **1** to **96**, represent the **fixed** tools. The remaining **96** tools, numbered from **E1** to **E96** are the **external** tools.
The fixed tool *n* corresponds to the tool mounted on spindle *n* of the boring head. The parameters that configure the spindles of the boring head have been already specified by the machine manufacturer in the SPINDLES.CFG file (see MACHINE PARAMETERS). It is not possible to configure fixed tool *n* if spindle *n* has not been configured already (the HEAD GRAPHIC window in the PROGRAM EDITOR environment shows a graphic representation of the boring head and its spindles).
Based on their Type, both fixed and external tools can be classified into 5 categories:

- tools type **P** (boring bit);
- tools type **F** (fluted mill);
- tools type **D** (disc mill);
- tools type **T** (tracer);
- tools type **S** (special tool);

In the case of fixed tools, the Type field is present in the configuration file SPINDLES.CFG and it has already been programmed by the machine manufacturer.
In the case of external tools, the Type field, present in the tooling file, must be set according to the specific requirements of the operator.
Tool *n* (from 1 to 96 and from E1 to E96) is considered configured when its Type field has been defined. *Xilog³MMI - RoutoLink* considers valid (and interprets their tooling characteristics, whatever they may be) all configured tools.
The structure of the tooling file editor varies according to the class and the Type of tools to be configured.
In the case of fixed tools, the editor consists of a column of editable fields on the left of the screen (called main fields), arranged according to the Type of the tool.
External tools require also a second group of fields on the right of the screen (secondary fields), which do not change regardless of the Type of tool.

The main fields of a given Type of fixed tools are the same for the same Type of external tools.

NOTE

The tools of an aggregate must be configured individually. If the type of tool is set, the tool is considered present on the machine and all the other parameters must be entered.

5.1.1 MAIN FIELDS FOR FIXED TOOLS

Tool number:

Number of tools from 1 to 96 and from E1 to E96.

G0/B speed (m/m)

If the tool is used during boring, this is the default value for execution of the hole (only if not programmed in the V field, see instructions B and BR).
If the tool is used during milling, this is the speed at which the tool enters the wood (only if greater than zero; otherwise the entry speed is the same as the feed speed).
The G0/G0R V field is the piece feed speed (see: G0 instructions).

Maximum speed (m/m)

Only applies if the tool is used during milling.
If it is greater than zero, it is the same as the tool's maximum feed speed.

Standard speed (m/m)

Only applies if the tool is used during milling.
If it is greater than zero, it is the same as the tool's standard feed speed (unless programmed in the G0 V field).
Cannot be greater than “Maximum speed”.

N.B.:

these fields are only used if their value is greater than zero; in this case, they operate as follows:

- **Boring without V parameter**: the lower value of "**G0/B speed"** and "Maximum speed" is used.
- **Boring with V parameter**: the lower value of "**V"** and "Maximum speed" is used.
- **Routing without V parameter in the (x)G0/(x)G0R**: to feed the piece the lower value of "**G0/B speed"** and "Maximum speed" is used.
- **Routing without V parameter in the instructions following G0/G0R**: to feed the piece the lower value of "Standard speed**"** and "Maximum speed" is used.
- **Routing with V parameter in the (x)G0/(x)G0R:** to feed the piece the lower value of "**V"** and "Maximum speed" is used.
- **Routing with V parameter in the instructions following G0/G0R**: to feed the piece the lower value of "**V"** and "Maximum speed" is used.

Standard Rotation:

it is not to be programmed for tools numbered 1 to 96.
For external tools, (E1 – E96) it corresponds to the rotation speed of the spindle during machining phase of a profile, if unspecified in the S field of milling and boring instructions.

Maximum Rotation:

It is not to be programmed for tools numbered 1 to 96.
For external tools, (E1 – E96) it corresponds to the speed of the spindle set during milling and boring phase only if inferior to the speed programmed in the S field.

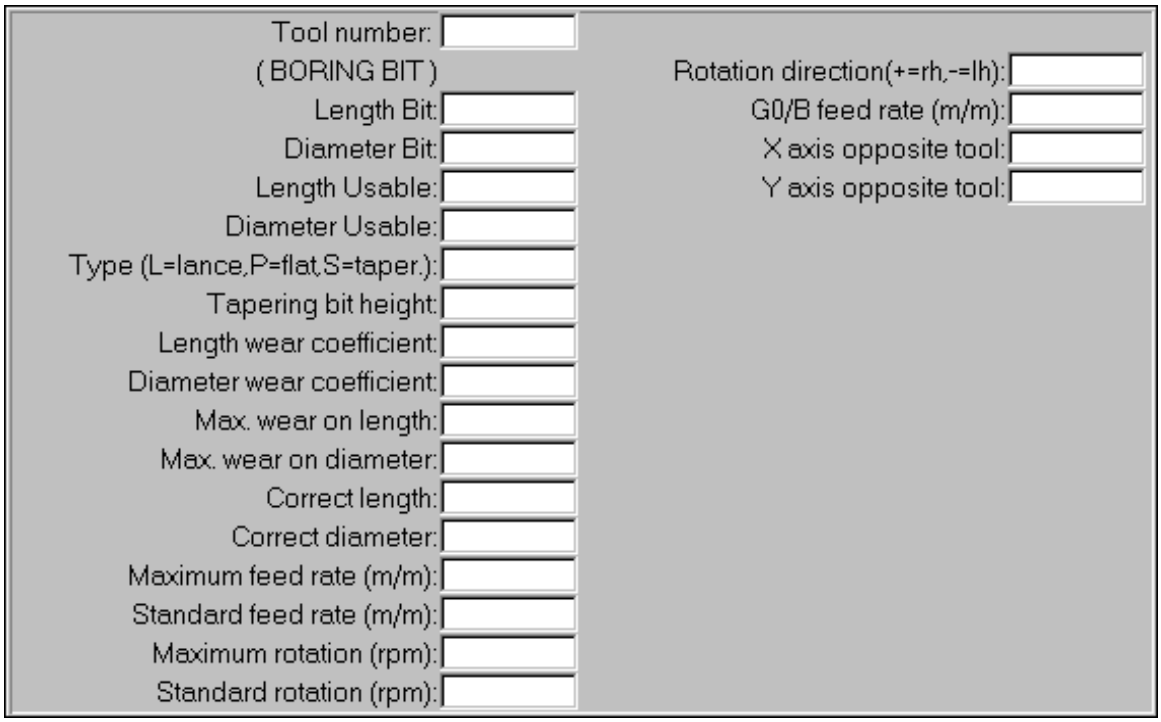
Direction of Rotation:

it is not to be programmed for tools numbered 1 to 96.
1. For external tools, (E1 – E96) it corresponds to the direction of rotation of the electric spindle.

Opposite tool in X and Opposite tool in Y:

Contain the number of the tool to be used in case of mirror machining in X and mirror machining in Y.

5.1.1.1 TOOL TYPE P (BORING BIT)



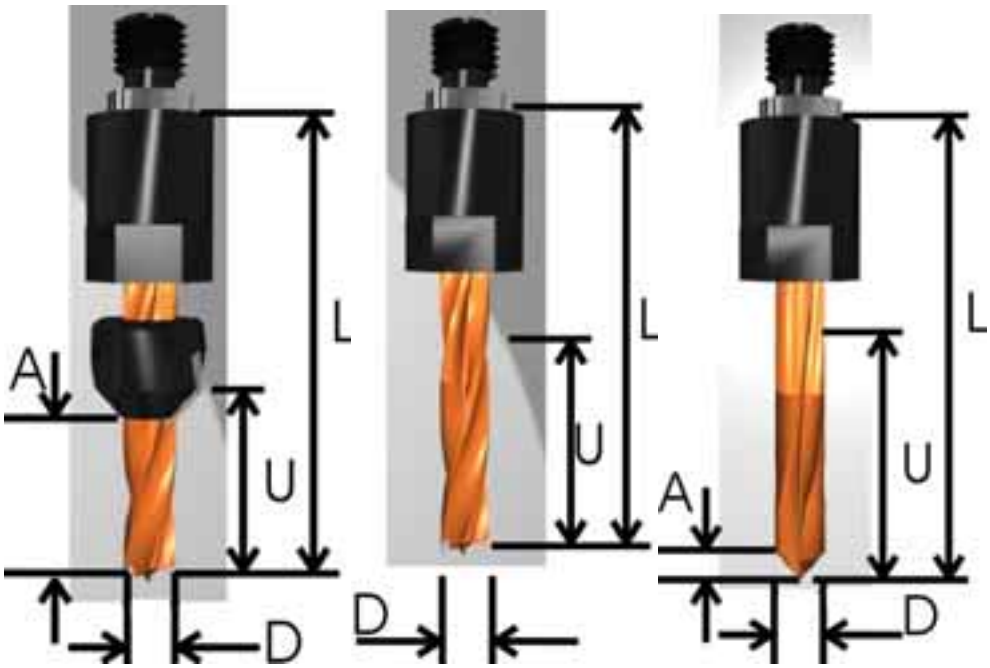
Bit Length, Useable length:

For fixed tools, as in fig. 1; for external tools, see fig.2 considering the milling tool as a boring bit.

Bit diameter, Useable diameter:

For fixed tools, the “Useable diameter” must coincide with the diameter of the boring bit or it must be equal to 0. In the latter case the diameter of the bit counts.
In the case of external tools the «Bit diameter» is the size (the diameter) of the bit while the «Useable diameter» is the bore diameter. If the «Useable diameter» is programmed with a value of 0, the «Bit diameter» also represents the bore diameter.

TAPER BIT **FLAT BIT** **LANCE BIT**



L = length;
D = diameter;
U = useable length;
A = tapering bit height.

Figure 1

Type (L,P,S):

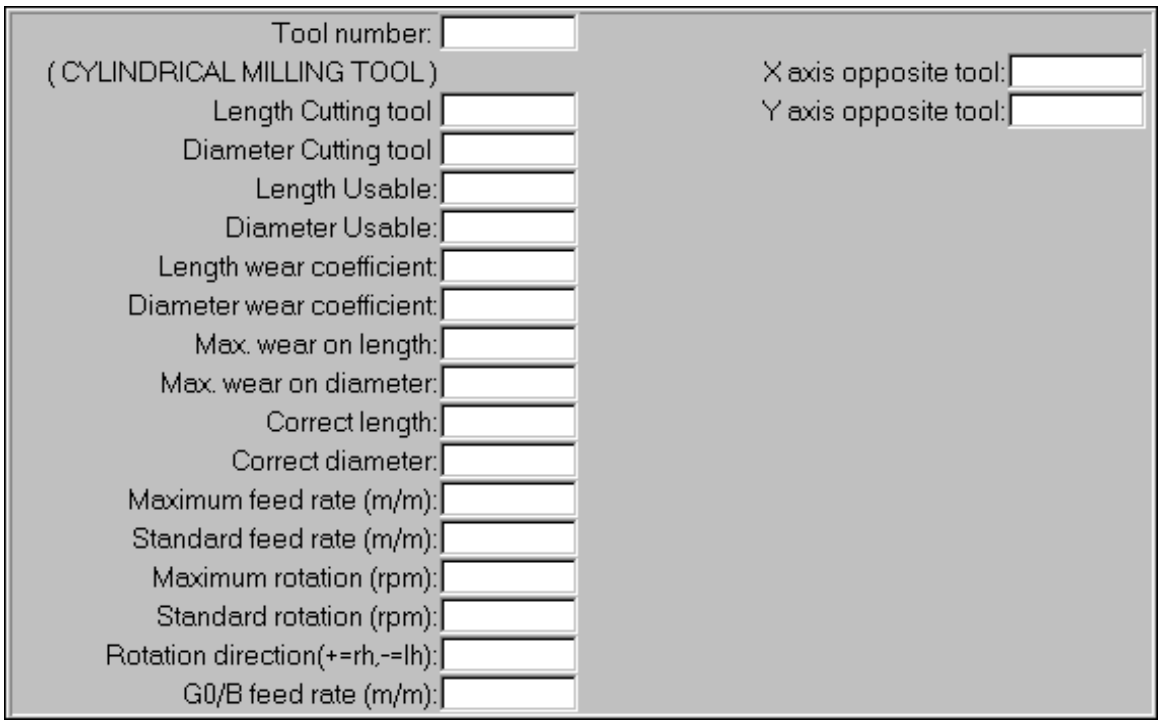
represents the type of bit (see figure 1):

- Empty: unspecified;
- **L** lance;
- **P** flat bit;
- **S** taper bit.

Taper height:

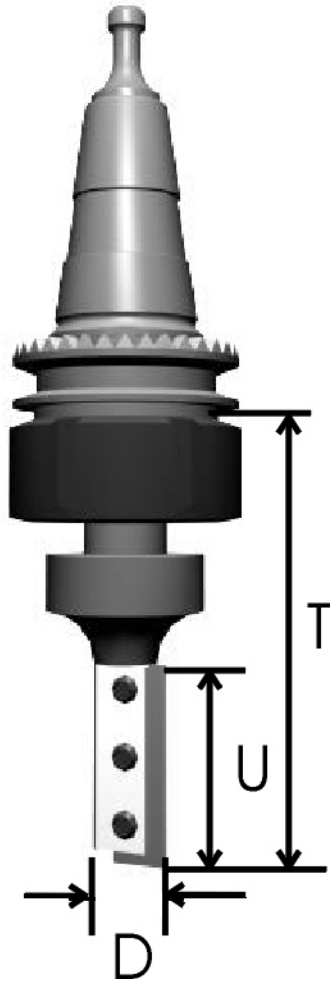
To be set only if the bit is tapered. It represents the height of the taper part of the bit (see figure 1).

5.1.1.2 TOOL TYPE F (FLUTED MILL)



Cutting tool length, Useable length:

For a mill mounted onto the fixed head, see flat bit in figure 1 whereas for an external mill, see in figure 2.



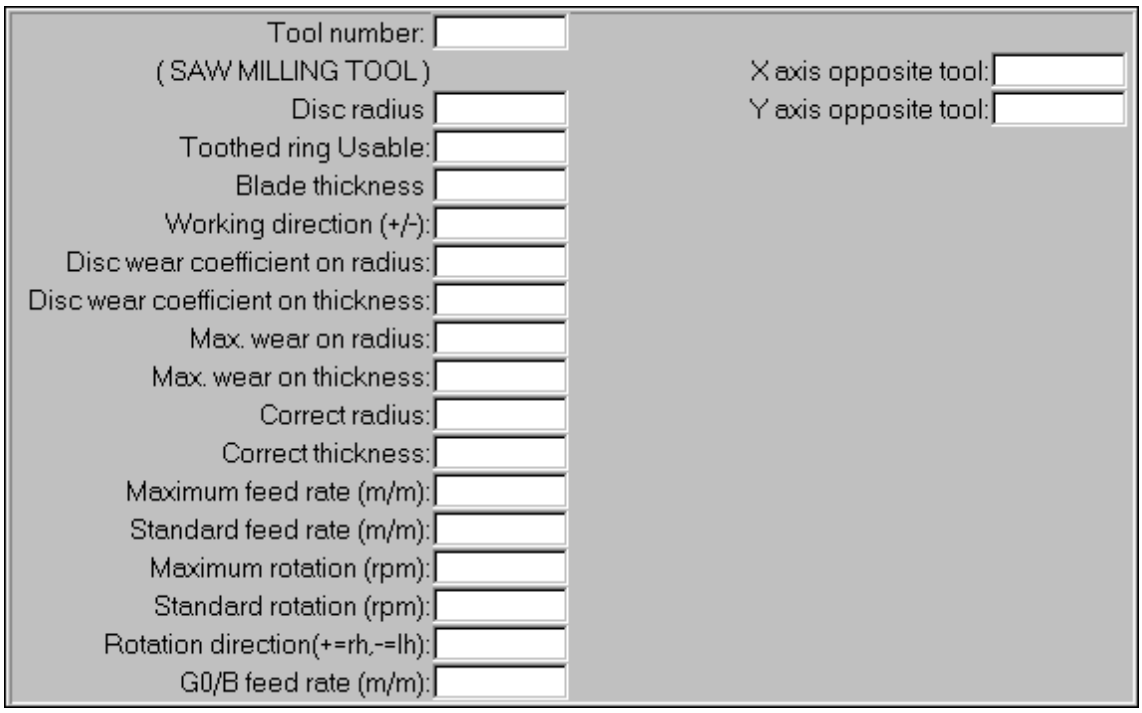
L = length;
D = diameter;
U = useable length;

Figure 2

Cutting Tool diameter, Useable diameter:

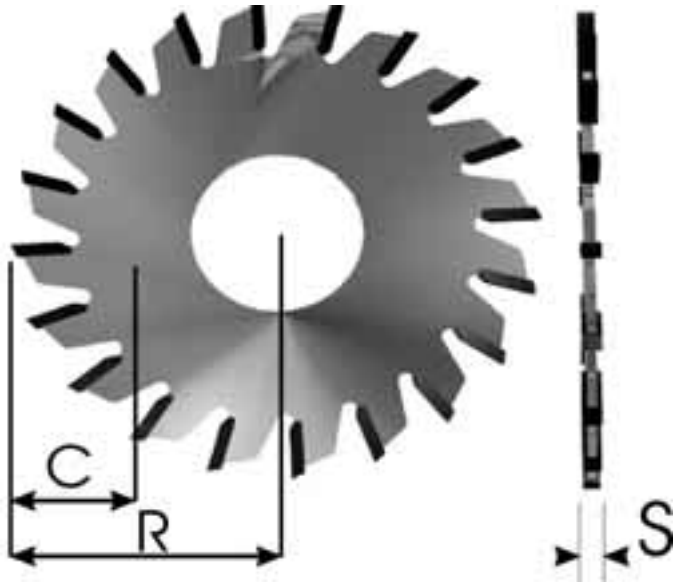
For fixed tools the «Useable diameter» must be the same as the diameter of the milling tool or it must be equal to 0. In the latter case the diameter of the milling tool counts.
In the case of external tools the «Milling tool diameter» is the size (the diameter) of the milling tool and the «Useable diameter» is the diameter of the mill. If the «Useable diameter» is programmed with a value of 0, the «Milling tool diameter» also represents the machining diameter.

5.1.1.3 TOOL TYPE D (DISK MILL)



Disc radius, Useable toothed ring, blade thickness:

As per figure 3.



R = disk radius;
C = useable toothed ring;
S = blade thickness;

Figure 3

Working direction:

Working direction of disk:

+ feed direction;
- counter feed direction.

Direction of rotation (of spindle):

It must be programmed so that the mill, when turning, moves the blades against the wood.

+ Right hand (clockwise);
- Left hand (counter clockwise)

5.1.1.4 FIELDS OF SIGNIFICANCE FOR THE BORING OPTMIZER

Only type **P (BORING BIT)** tools are considered by the boring optimization algorithm.

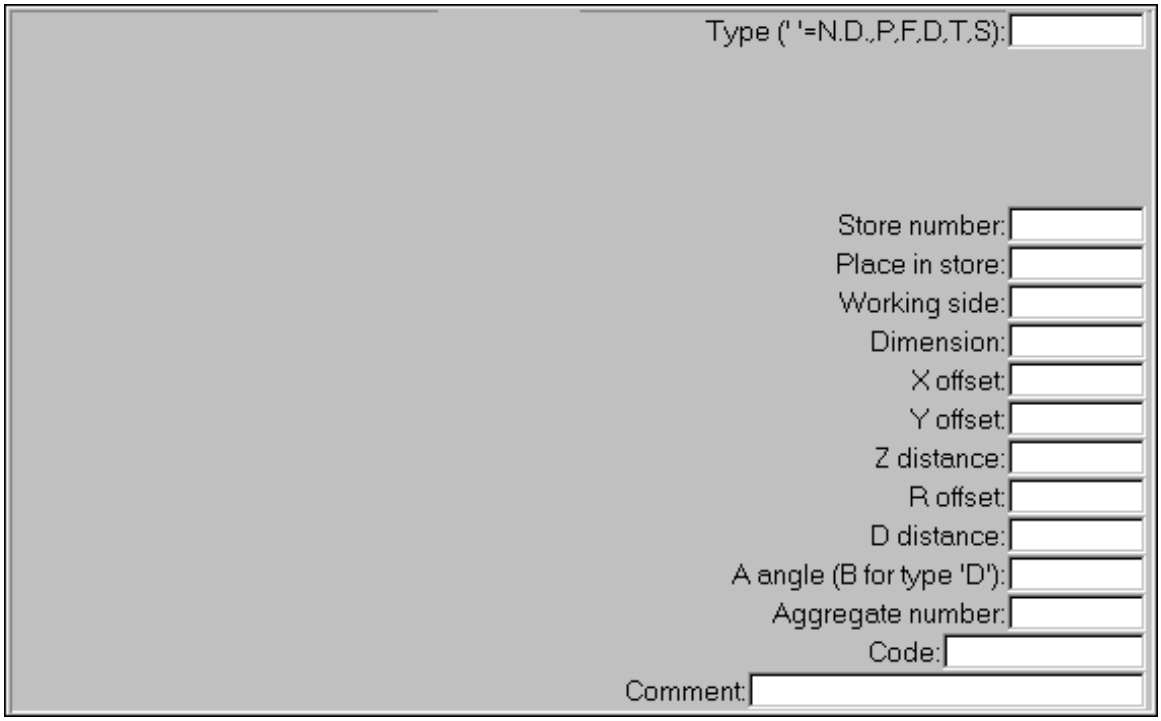
Since it is carried out in a single operation (with just one instruction), a series of borings must consist of elements having the same depth, the same execution speed and the same work face.
To generate an instruction comprising this series of borings, the optimizer proceeds as follows:

- it only considers the bits mounted on the spindles active in the set work face;
- it disables all bits having **Useable Length** less than the set depth;
- it only analyses tools having the same **Bit Length**.

In order to be capable of performing a given boring, a bit must meet the following conditions:

- the **Bit Diameter** must coincide with the boring diameter (remember that in case of fixed tools, the **Useable Diameter** is the same as the **Bit Diameter**);
- the bit **Type (L=Lance, P=Flat, S=Taper)** must be the same as that set for the boring. A boring set with a given Type cannot be executed by a bit the **Type** field for which is not programmed.
- The **Taper height** of the tool must be the same as that of the boring, if the hole has been programmed tapered and with taper other than zero.

5.1.2 EXTERNAL TOOLS



Tool Type:

- 'empty tool not defined;
- **P** boring bit;
- **F** fluted mill;
- **D** disc mill;
- **T** feeler;
- **S** currently not used.

Store number (Magazine number):

Number of the magazine containing the tool. This is the number of the magazine configured in the PHEADS CFG file. Set to 0 if the machine has one magazine only.

Place in Store (Magazine location):

Position of the tool in the magazine (from 1 to the maximum number of locations in the magazine).

Working Side (Work face):

0 The tool can work on all five faces.
1 face 1;
2 face 2;
3 face 3;
4 face 4;
5 face 5.

If the VECTOR is mounted on the electrospindle, all tools working on side face can be programmed with Face=0

Aggregate number:

If the tool belongs to an aggregate, this field indicates the number of the aggregate. Otherwise it can be left blank.

WARNING

Only for TOOLROOM type magazines, and if all fields "T3(0=NO)" of the type D – RAPID magazine even posts are programmed (in file "STOREPOS.CFG") with the value –1, the value –2 means that this tool is automatically considered as type 2 (dimD=2). It will therefore not be automatically unloaded from the RAPID.

Code:

Code of tool, if any, 11 characters long maximum.
This code also identifies a BMP file containing the photograph of the tool. The photograph of the tool in bitmap format corresponding to the file "*NOMEDELCODICEUTENSILE.BMP*", copied in the directory **XILOG3\TLGBMP**, is displayed in the HEADS GRAPHIC environment together with the characteristics of the tool (to display press function key **[F6],** see HEADS GRAPHIC).

Comment:

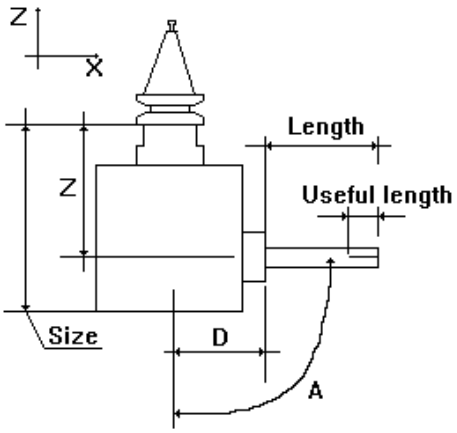
Free comment, if any, composed of 40 characters maximum.

Dimensions, Offset X, Offset Y, Distance Z, Offset R, Distance D, Angle A for tools type 'P' or 'F' (boring bits and fluted mills):

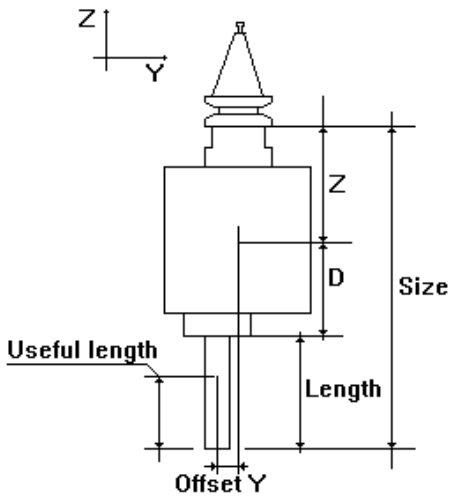
Axis **A** = 0 (VECTOR)

Size > 0, Distance Z > 0, Distance D > 0

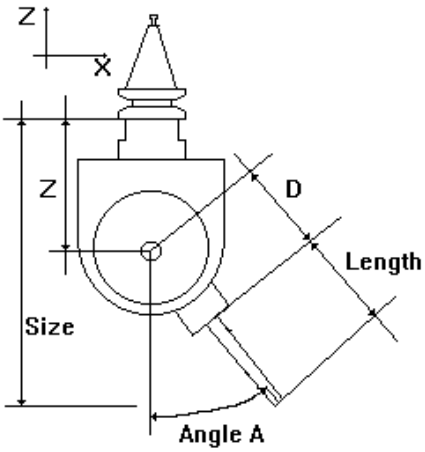
Case angle A=90 deg



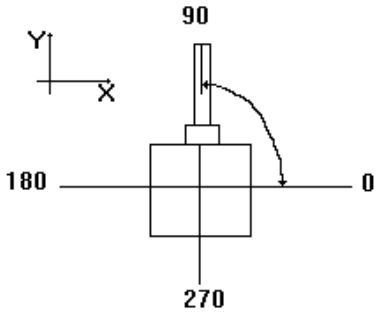
Case angle A=0 deg



Case 0 < A < 90

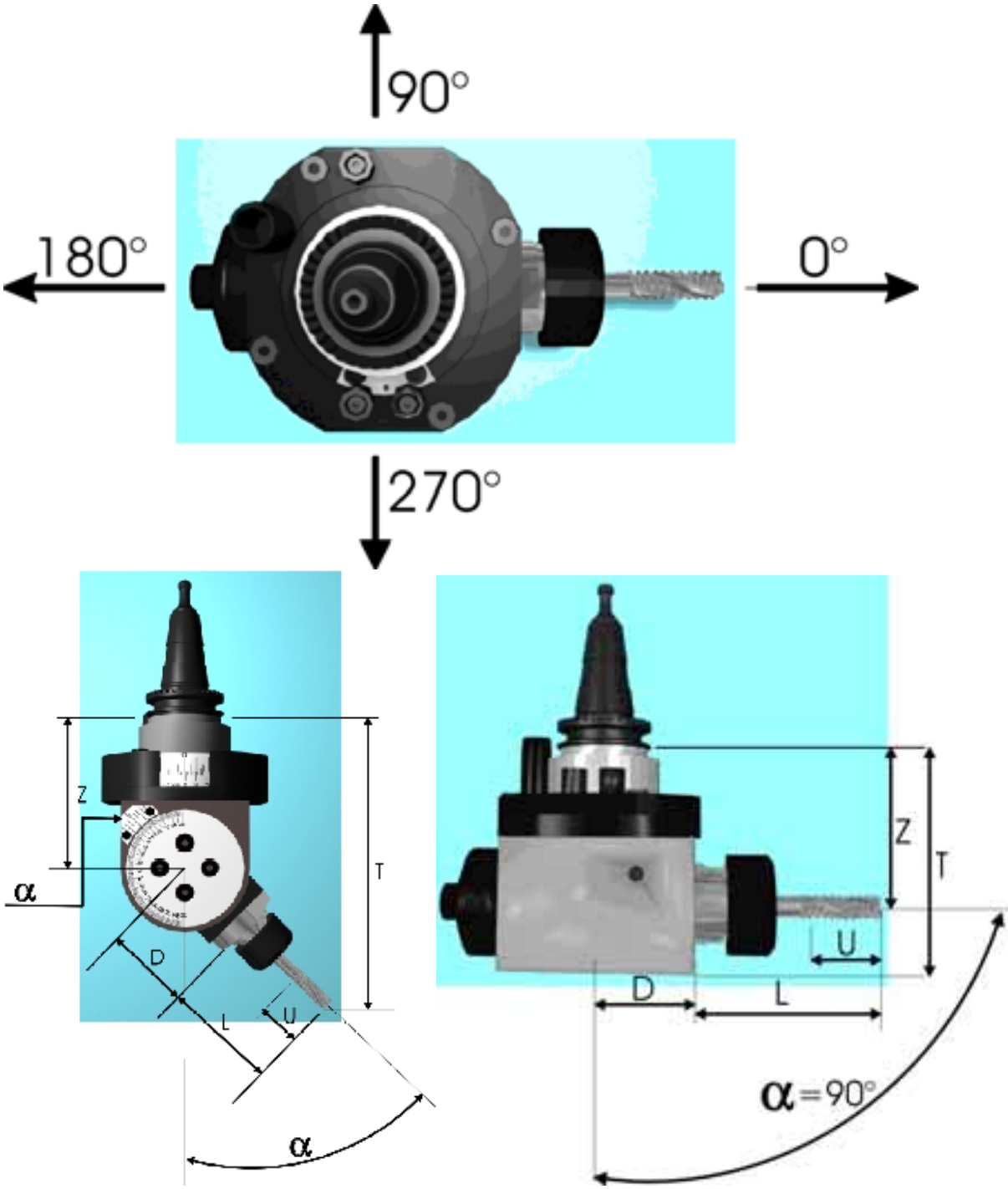


Offset R [0 <= R < 360)



Offsets X and Y are currently not supported and must be set to 0.
Distances D, Z and the overall Dimensions must be set with positive values.

Configuration of external tools type P or F:



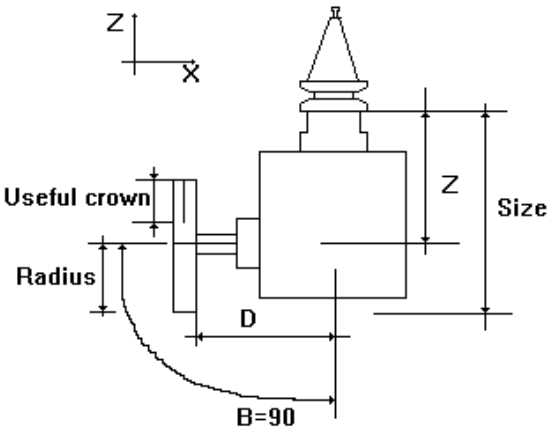
L = length
U = useable length
T = dimensions
α = angle A

Dimensions, Offset X, Offset Y, Distance Z, Offset R, Distance D, Angle B for tools type 'D' (disc mills):

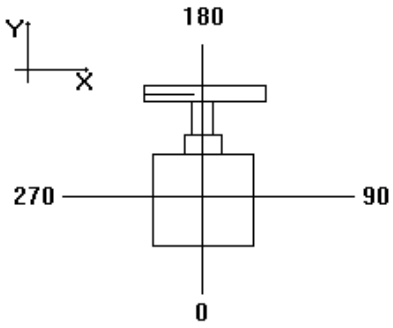
Axis **A** = 0 (VECTOR)

Size > 0, Distance Z > 0, Distance D > 0

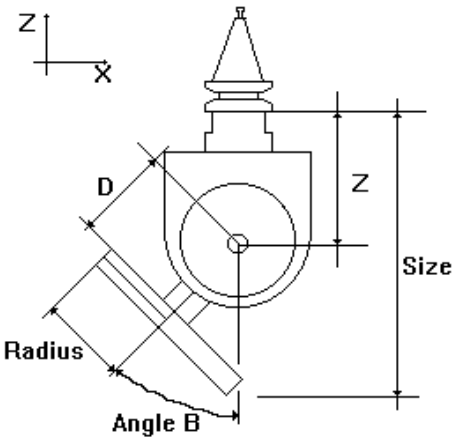
Case angle B=90 deg



Offset R [0 <= R < 360]

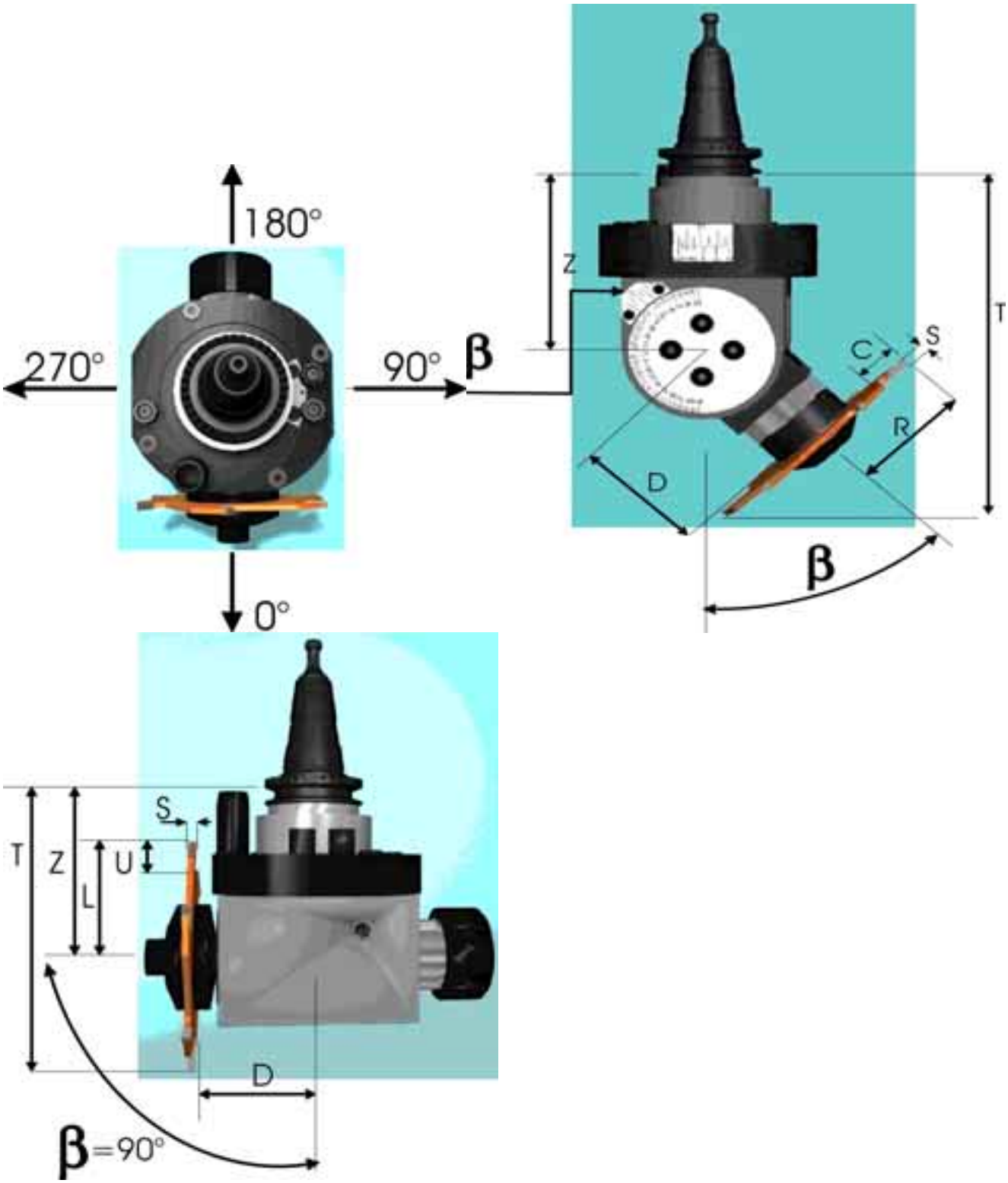


Case 0 < B < 90



Distances D, Z and the overall Dimensions must be set with positive values.

Configuration of external tool type D:



L = disk radius
U = useable toothed ring
T = dimensions
S = blade thickness
β = angle B

5.2 ADDITIONAL TOOL CHANGE

If the machine features additional Tool Room (T) type tool change (and the XILOG3.CFG **"Special Machine"** parameter is configured to 1), the management of the tools and their magazine locations are completely automatic and therefore the fields **"Magazine Number"** and **"Magazine location"** of the external tool configuration should not be programmed. The **«Aggregate no.»** field**,** if programmed with a value between 1 and 96, means that specific tool is considered (together with all the other tools having the same aggregate number) as belonging to a single head. This head is represented by the symbol A*n* with *n* ranging from 1 to 96 in the supplementary tool change control table in the «MDI» environment (see «MACHINE MOVEMENT», »SUPPLEMENTARY TOOL CHANGE»). After programming the tooling file data, tools must be loaded in the machine magazines by means of the tool change management table, in the M.D.I. environment (see in MACHINE MOVEMENT). Upon completion, the system will update the two parameters of tooling file mentioned above automatically and they will remain valid while the machine is being used. This way it is possible to program and manage more than one tooling file: when enabling a different tooling file used previously, the system will automatically configure all data saved in the file (and therefore the tool change management table now shows the old configuration) but the user must actually reset this condition by manually positioning the tools in the magazine of the machine as indicated in the configuration.

5.3 BLADE UNIT ON EVER BORING MACHINES

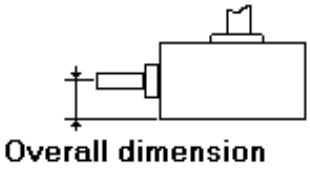
If the machine is equipped with a EVER boring unit and if it is equipped with a blade that can work in X or Y, a spindle with "**offset R**" = 180 / 0 setting for machining along X and a spindle with "**offset R**" = 90 / 270 setting for machining along Y should be configured in SPINDLES.CFG.
The " **PLC Enabling**" field should be set to **zero**.
The X,Y,Z offsets refer to spindle 1 and should be read on the centre of rotation of the head and on the centre of the blade.

5.4 UNIVERSAL UNIT

If the machine is equipped with a UNIVERSAL UNIT, tools number E80 to E83 are reserved to the pneumatic UNIVERSAL UNIT.
The configuration of the tools mounted on the UNIVERSAL UNIT is similar to the configuration of external tools. Take into account, however:

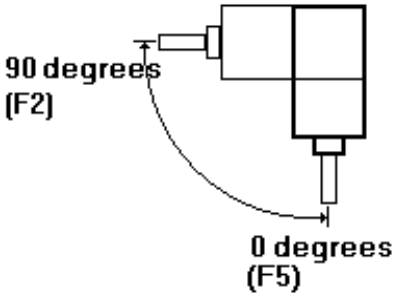
- Angle A (or B for tools type 'D') is 90 degrees;

- The dimension is as shown in the figure below:



The tools must be configured according to the type of UNIVERSAL UNIT actually installed on the machine.

5.4.1 Pneumatic rotation 0 - 90

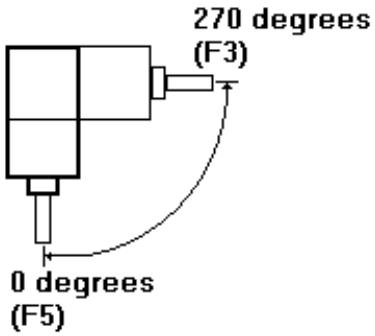


In this case a single tool is installed on the UNIVERSAL UNIT.
In the file PHEADS.CFG, the **"+ limit st. Vector"** field relative to the UNIVERSAL UNIT (corresponding to head number 4) must be set to -90 (see MACHINE PARAMETERS).
Two different tools must be configured, with different work sides and specific offsets.

- **E80**, containing all the characteristics of the tool when the UNIVERSAL UNIT is in its idle position (0 degrees);

- **E82**, corresponding to the tool working with the UNIVERSAL UNIT turned 90 degrees.

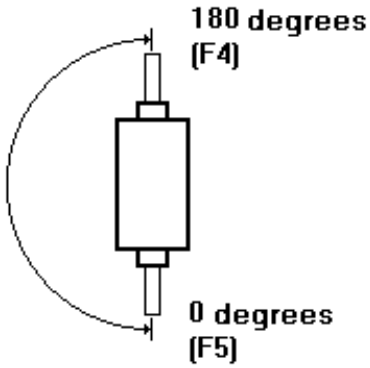
5.4.2 Pneumatic rotation 0 - 270



Similar to the 0-90 case, a single tool is installed on the UNIVERSAL UNIT.
In the file PHEADS.CFG, the **"+ limit st. Vector"** field relative to the UNIVERSAL UNIT (corresponding to head number 4) must be set to -270 (see MACHINE PARAMETERS).
Two different tools must be configured, with different work sides and specific offsets.

- **E80**, containing all the characteristics of the tool when the UNIVERSAL UNIT is in its idle position (0 degrees);
- **E82**, corresponding to the tool working with the UNIVERSAL UNIT turned 270 degrees.

5.4.3 Pneumatic rotation 0 - 180



In this case, two tools are mounted on the UNIVERSAL UNIT.
In the file PHEADS.CFG, the **"+ limit st. Vector"** field relative to the UNIVERSAL UNIT (corresponding to head number 4) must be set to -180 (see MACHINE PARAMETERS).

Four different tools must be configured, with different work sides and specific offsets.
The following convention is applied: When the UNIVERSAL UNIT is in its idle position (0 degrees), the first tool is the one facing the operator, while the second is the opposite one.

- **E80**, containing all the characteristics of the first tool when the UNIVERSAL UNIT is in its idle position (0 degrees);
- **E83**, containing the second tool configuration when the UNIVERSAL UNIT is in its idle position (0 degrees);
- **E82**, corresponding to the first tool working with the UNIVERSAL UNIT turned 180 degrees.
- **E81**, containing the configuration of the second tool working with the UNIVERSAL UNIT turned 180 degrees.

5.4.4 Motorised Rotation (Vector)

In this case a single tool is installed on the UNIVERSAL UNIT.
In the file PHEADS.CFG, the **"+ limit st. Vector"** field relative to the UNIVERSAL UNIT (corresponding to head number 4) must be set to or above **zero.** (see MACHINE PARAMETERS).
The tool installed can be associated to any configuration from E1 to E96.

5.5 OTHER SECONDARY GROUPS

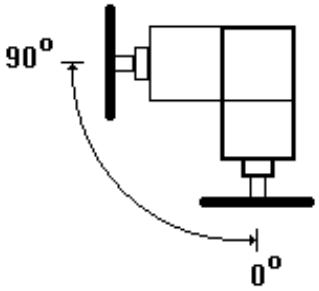
5.5.1 SAW UNIT

The SAW UNIT can be configured in any «PHEADS.CFG» position between 4 and 11.
The SAW UNIT is configured by entering 6 in the **"Actuator"** field; The configuration of the tools mounted on the SAW UNIT is similar to the configuration of external tools.

5.5.1.1 No rotation

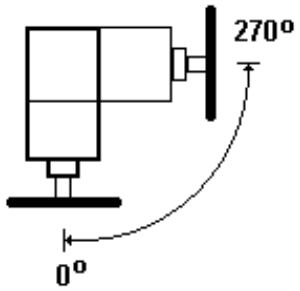
In the file "PHEADS.CFG", the **"+ limit st. Vector"** field relative to the SAW UNIT must be set to –1; The tool installed can be associated to any configuration from E1 to E96.

5.5.1.2 Pneumatic rotation 0 - 90



In the file "PHEADS.CFG", the **"+ limit st. Vector"** field relative to the SAW UNIT must be set to –90; two different tools between E1 and E96 must be configured with the convention that the odd numbered tools make the unit rotate, the even ones do not.

5.5.1.3 Pneumatic rotation 0 - 270



In the file PHEADS.CFG, the **"+ limit st. Vector"** field relative to the SAW UNIT must be set to –270 two different tools between E1 and E96 must be configured with the convention that the odd numbered tools make the unit rotate, the even ones do not.

5.5.1.4 Motorised Rotation (Vector)

In the file PHEADS.CFG, the **"+ limit st. Vector"** field relative to the SAW UNIT must be set to or above **zero.** (see "MACHINE PARAMETERS").
The tool installed can be associated to any configuration from E1 to E96.

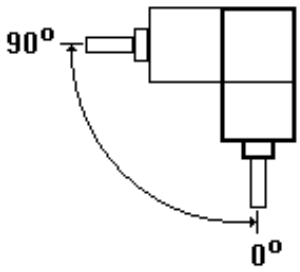
5.5.2 LOCK MORTISING UNIT

The LOCK MORTISING unit can be configured in any position of «PHEADS.CFG» between 4 and 11.
The LOCK MORTISING unit is configured by entering 5 in the **«Actuator»** field of «PHEADS.CFG» and can accommodate one (in the *single overhanging* unit) or two tools (in the *double overhanging* unit); The configuration of the tools mounted on the LOCK MORTISING UNIT is similar to the configuration of external tools.

5.5.2.1 No rotation

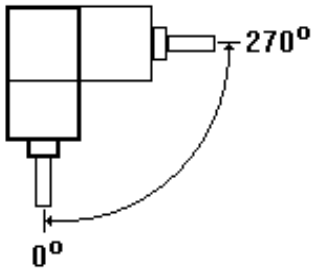
In the file "PHEADS.CFG", the **"+ limit st. Vector"** field relative to the LOCK MORTISING UNIT must be set to –1; the tools installed can be associated to any configuration from E1 to E96.

5.5.2.2 Pneumatic rotation 0 - 90



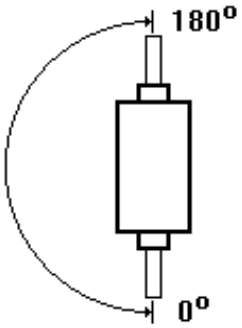
In the file "PHEADS.CFG", the **"+ limit st. Vector"** field must be set to –90; two (in the *single overhanging* unit) or four different tools (in the *double overhanging* unit) must be selected between E1 and E96 with the convention that the odd numbered tools make the unit rotate, the even ones do not.

5.5.2.3 Pneumatic rotation 0 - 270



In the file "PHEADS.CFG", the **"+ limit st. Vector"** field must be set to –270; two (in the *single overhanging* unit) or four different tools (in the *double overhanging* unit) must be selected between E1 and E96 with the convention that the odd numbered tools make the unit rotate, the even ones do not.

5.5.2.4 Pneumatic rotation 0 - 180



In the file "PHEADS.CFG", the **"+ limit st. Vector"** field must be set to –180; two (in the *single overhanging* unit) or four different tools (in the *double overhanging* unit) must be selected between E1 and E96 with the convention that the odd numbered tools make the unit rotate, the even ones do not.

5.5.2.5 Motorised Rotation (Vector)

In the file PHEADS.CFG, the **"+ limit st. Vector"** field must be set to or above **zero.** (see "MACHINE PARAMETERS"). The tools installed can be associated to any configuration from E1 to E96.

5.5.3 VERTICAL UNIT

The VERTICAL unit can be configured in any «PHEADS.CFG» position between 4 and 11.
The VERTICAL unit is configured by entering 7 in the **«Actuator»** field of «PHEADS.CFG»; the configuration of the tools mounted on the VERTICAL UNIT is similar to the configuration of external tools. The tools installed can be associated to any configuration from E1 to E96.

5.5.4 BORER ON INDEPENDENT AXIS

To configure the borer on independent axis write 1 in the number 1 head (borer) **"Actuator"** field "PHEADS.CFG" .

5.6 REFERENCING THE TOOLS IN A PROGRAM

During programming, the field containing the tool number (field T if the instruction supports it) with a number *m* that identifies univocally the configured tool *n* according to the following rule:

- 1 <= *m* <= 96 fixed tool *n* = *m*;
- *m* = *h*+*k*, 100 <= *h* <= 900, 01 <= *k* <= 96 electrosp. *h*/100, external tool *n* = E*k*.

In the case of boring operation with fixed tools, it is also possible to set a multiple operation. By programming more tools at the same time, (separated by a blank space or a coma, if the numbers are not contiguous, by a dash if they are in sequence) boring operation takes place with a unique downward movement of the boring head of the machine. In the case, the X,Y and Z positions set with boring instructions refer to the hole made by the first tool of the programmed list. The following holes are shifted in X,Y, Z with respect to the first hole equivalent to the offset in X,Y,Z of the programmed tools with respect to the first tool of the list.

5.6.1 EXAMPLES

T = 3 fixed tool 3 of boring head;
T = 101 external tool 1, E1 on main electrospindle 1;
T = 280 tool E80 on the UNIVERSAL UNIT;
T = 5 2 1 tools 5,2 e 1 of the boring head, in a unique downward

movement;
T = 1 – 4 tools 1,2,3,4 of the boring head, in a unique downward movement;

6. PROGRAMMING A PANEL

The programme is a sequence of instructions describing a machining cycle of the panel. It is saved in a binary file in the main PGM format and is translated into ISO language when it is executed by the machine.
The instructions available to the user for programming machining on a panel belong to two different classes:

- **Basic** instruction (or **text**);
- **Extended** instructions (or **graphics**).

The Basic Language (consisting of basic instructions) is the main language of the *Xilog³MMI - RoutoLink* operator interface and contains the essential programming instructions.
The Extended Language was born both to facilitate programming and to give the operator the possibility to extend the programming language by creating true new instructions called *fixed cycles (or macro,* see in PARAMETRIC PROGRAMMING AND FIXED CYCLES).
The Extended Language consists of basic operational instructions extended by five standard fields (relating to setting modal data) and of all *fixed cycles* present in the memory. The management of programs written in extended language is entirely assisted: from the graphic help of the Graphic Editor to the immediate graphic display of the piece during its programming (see GRAPHIC EDITOR and GRAPHIC GUIDE).
The instructions can be classified (according to their function inside a program) as follows:

- header;
- operative instructions;
- modal instructions;
- subprogram management instructions;
- program flow management instructions;
- work table programming instructions;
- programming help instructions.

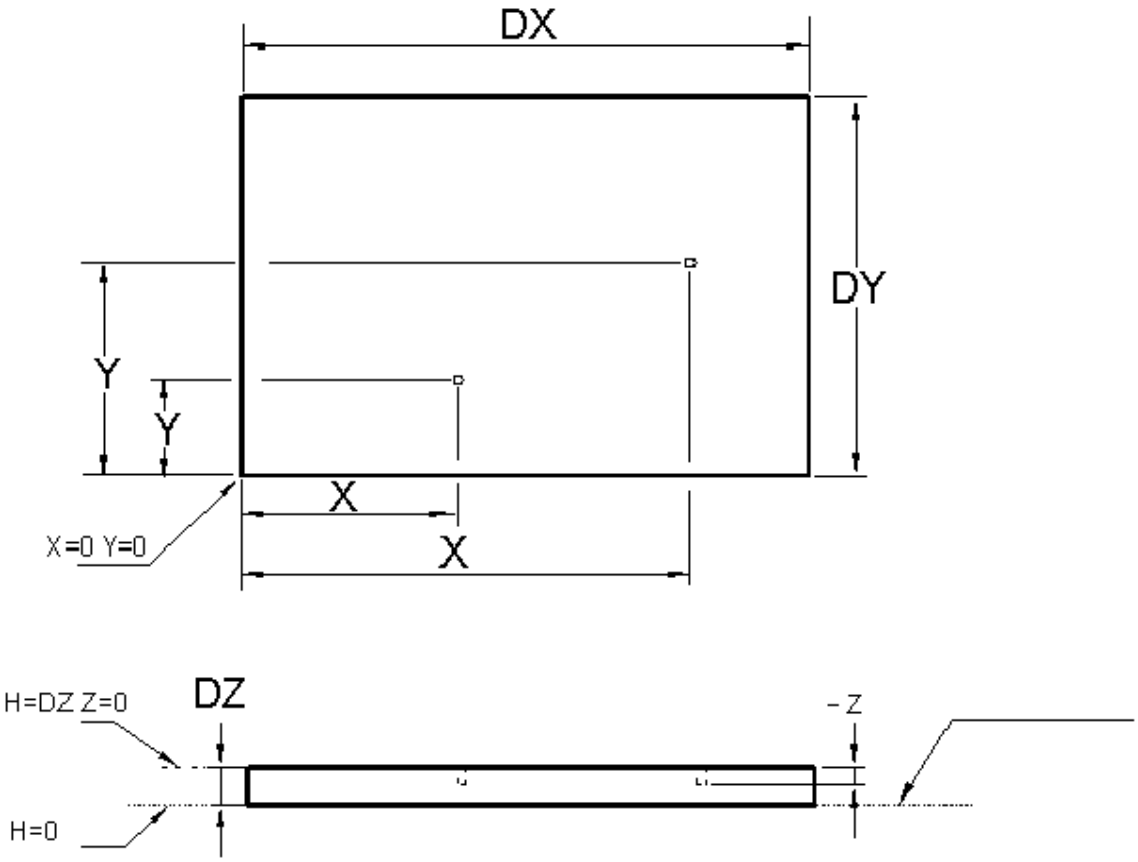
6.1 HEADER

It contains the main data relating to both the panel and the running of the piece program on the machine.

- H header;

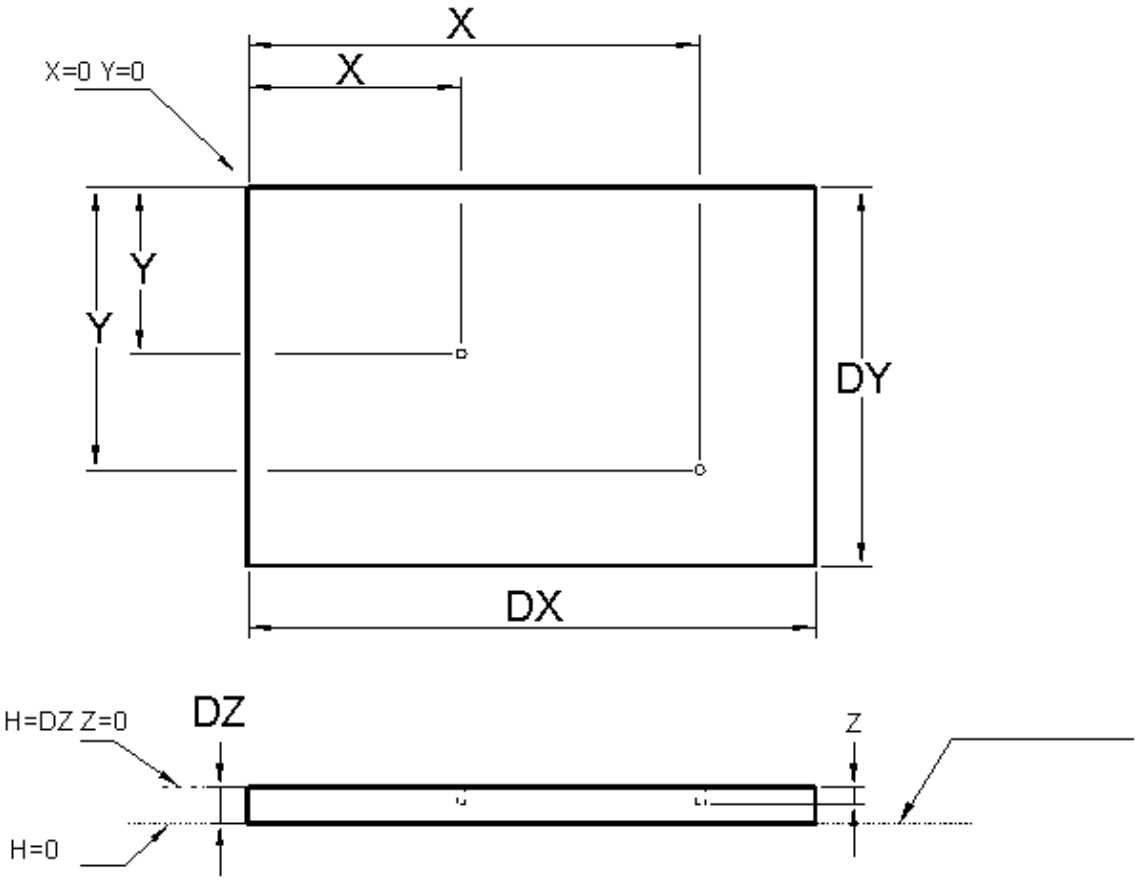
It must be programmed and no instructions can given beforehand.

If the *Programming Origin* parameter in the XILOG3.CFG file are set to 0 (*RoutoLink* configuration), then the following references apply:



The panel reference (X=0, Y=0) is taken in the low left part.
The position on the panel (or work table) is given by the pair of values at the X,Y,Z axis (<0) increases in the arrow direction and decreases in opposite direction until it becomes positive if over zero.

If the *Programming Origin* parameter in the XILOG3.CFG file are set to 1 (*Xilog³MMI* configuration), then the following references apply:



The panel reference (X=0, Y=0) is taken in the up left part.
The position on the panel (or work table) is given by the pair of values at the X,Y,Z axis increases in the arrow direction and decreases in opposite direction until it becomes negative if over zero.

DX stands for panel length along the X. Axis.
DY stands for panel length along the Y Axis.
DZ stands for panel thickness along the Z Axis.

WARNING

The panel dimension in Z is used to optimise translation of head between machining on different faces. For this reason the DZ field must be compiled with the effective maximum overall dimensions of the piece in Z, otherwise the heads and the piece may collide.

6.2 MODAL INSTRUCTIONS

Modal instructions can be written several times inside a program but the setting of a subsequent modal instruction cancels the previous one. These modify the meaning of the X, Y and Z present in all operative instructions following the call of the modal instruction. For example, setting a different work face means that the X, Y, Z readings of all subsequent operative instructions refer to the origin of the new set face. Modal instructions are:

(basic)

- O shift of machining origin;
- F machining face;
- C tool correction;
- IX set incremental machining in X;
- IY set incremental machining in Y;
- SX set mirror (specular) machining in X;
- SY set mirror (specular) machining in Y;
- PL inclined plane;
- SET system parameter declaration;
- REF defining the dimensions of a subpanel

(extended)

- xO shift of extended machining origin;
- xPL inclined plane.

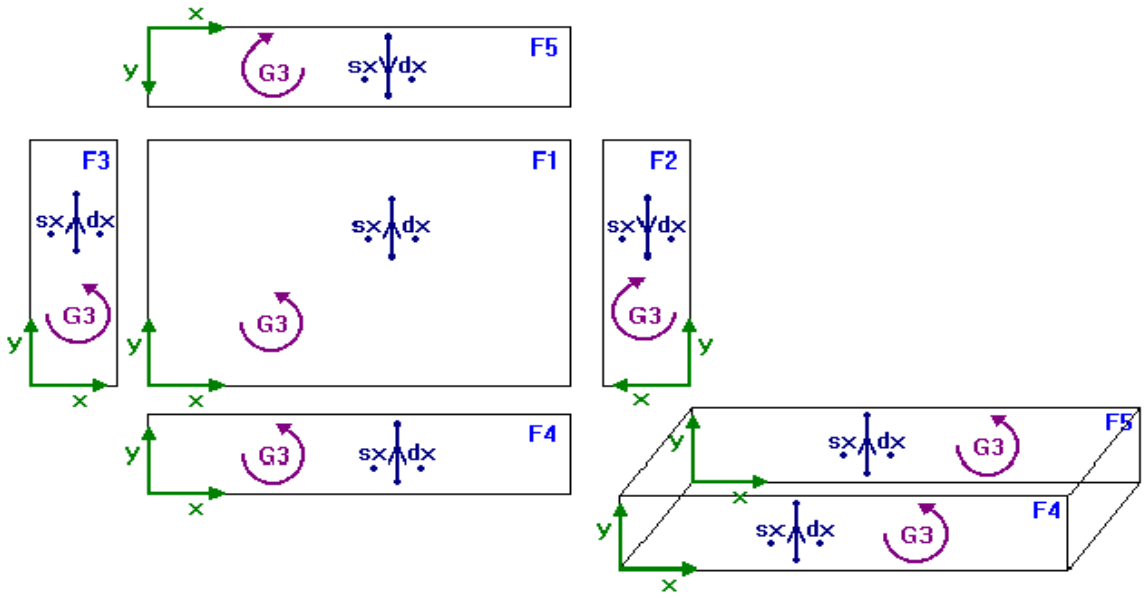
The PL, xPL instructions and the face F change instruction cancel each other.
In the operative instructions of the extended language, which do not correspond to an intermediate machining operation of a profile, the possibility to set modal data of work face, tool radius correction, incremental and specular machining operations is integrated in the instructions themselves under the form of five standard fields described later on.

6.2.1 F - Work surface

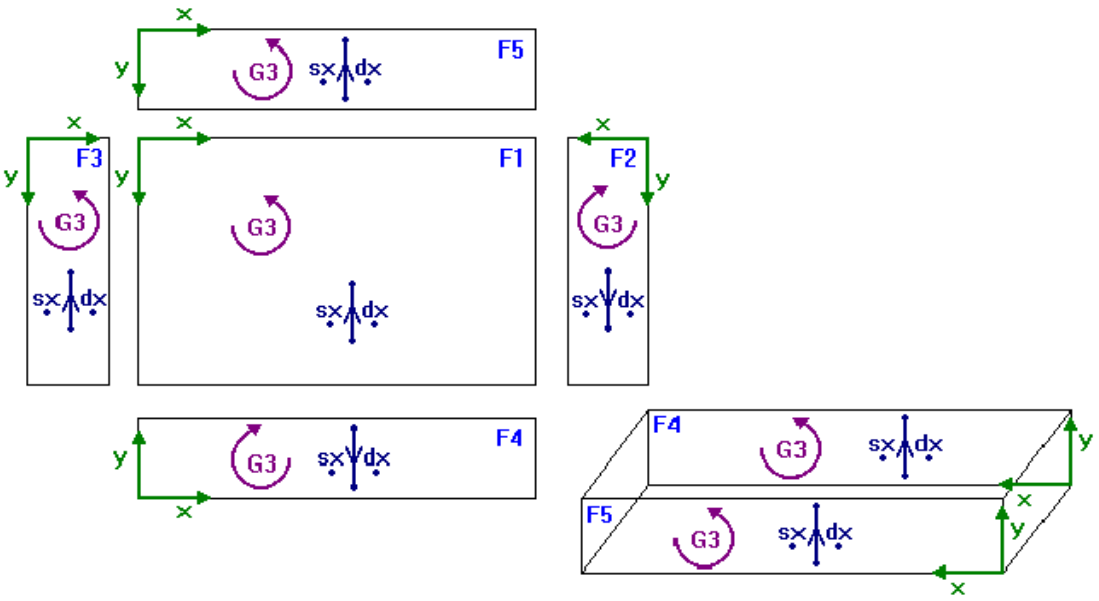
Enables the programming of a given work face; its value is identical to that found at the F instruction of the basic language:

1 upper face
2 right hand face
3 left hand face
4 front face
5 rear face

If the *Programming Origin* parameter in the XILOG3.CFG file are set to 0 (*RoutoLink* configuration), then the following references apply:



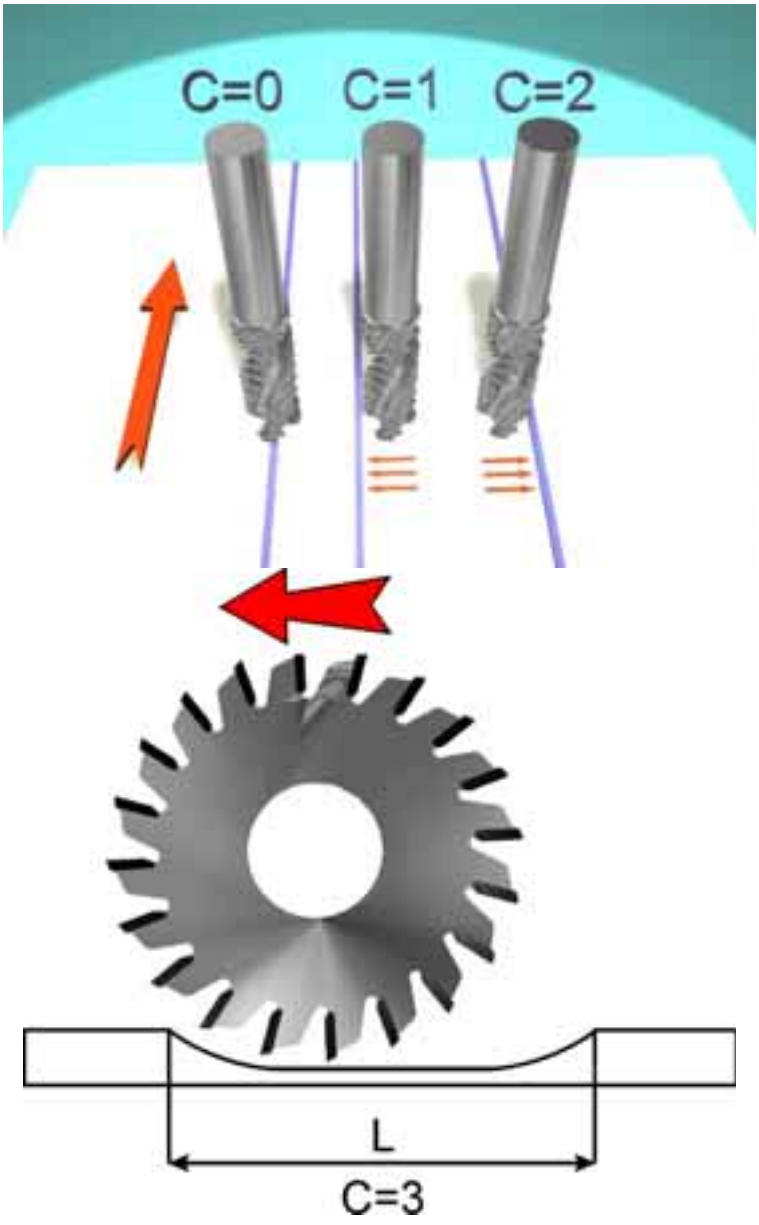
If the *Programming Origin* parameter in the XILOG3.CFG file are set to 1 (*Xilog³MMI* configuration), then the following references apply:



6.2.2 C - tool radius correction

This value applies to milling operations and modifies the tool route in proportion to its radius; it is similar to the C instruction of the basic language and can equal:

- 0 no correction
- 1 right correction
- 2 left correction
- 3 depth correction
- 13 o 31 correction 1 + correction 3
- 23 o 32 correction 2 + correction 3



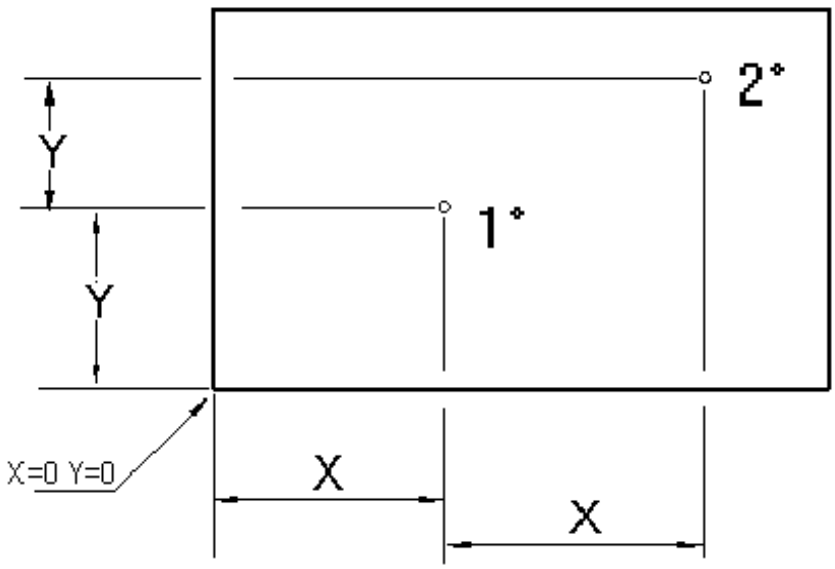
6.2.3 K – incremental

When incremental programming is enabled, the reading enabled as incremental (X or Y or both), programmed in an operative instruction, no longer refers to positioning with respect to the origin of the panel but to a shift of the value that the reading itself had undergone after carrying out the previous operative instruction.

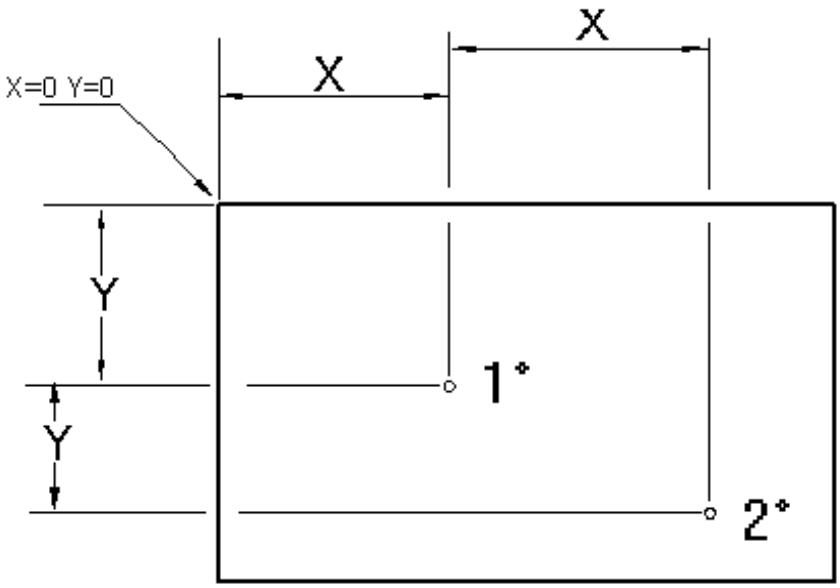
0 no incremental
1 incremental in X, corresponding to instruction IX=1 in basic language
2 incremental in Y, corresponding to instruction IY=1 in basic language
3 incremental in X and Y, corresponding to the sequence of the two instructions IX=1 and IY=1 in basic language.

The next figures shows the incremental condition in X and Y on the second machining operation.

If the *Programming Origin* parameter in the XILOG3.CFG file are set to 0 (*RoutoLink* configuration), then the following references apply:



If the *Programming Origin* parameter in the XILOG3.CFG file are set to 1 (*Xilog³MMI* configuration), then the following references apply:



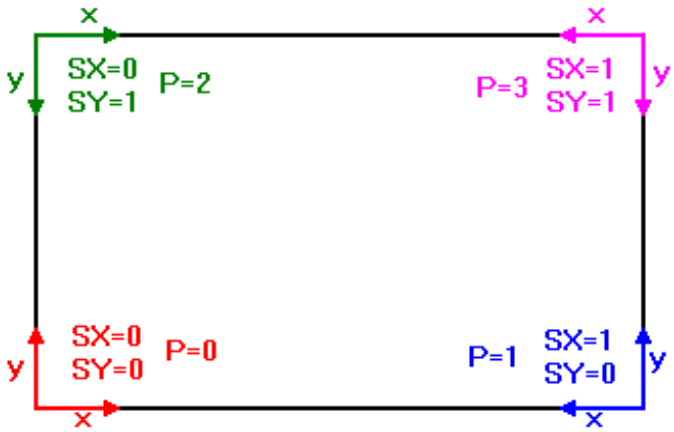
6.2.4 P – reference origin

It enables the specular machining with an eventual inversion of the direction of round millings. It can assume the following values:

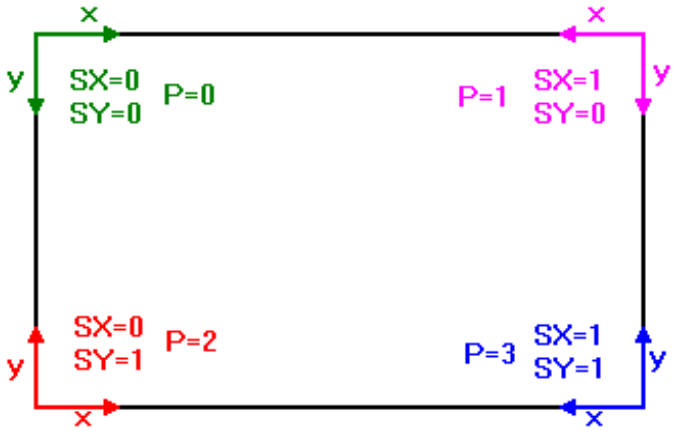
0 no specular
1 specular in X, corresponding to instruction SX=1 in basic language
2 specular in Y, corresponding to instruction SY=1 in basic language
3 specular in X and Y, corresponding to the sequence of the two instructions SX=1 e SY=1, in basic language
11 as 1 reversing the direction of arcs of circle, corresponding to instruction SX=1 M=1 in basic language
21 as 2 reversing the direction of arcs of circle , G2 <-> G3, corresponding to instruction SY=1 M=1 in basic language
31 as 3 reversing the direction of arcs of , G2 <-> G3, corresponding to the sequence of the two instructions SX=1 M=1 e SY=1 M=1 in basic language.

The next figure show the new reference points of the X and Y readings with the enabled specular:

If the *Programming Origin* parameter in the XILOG3.CFG file are set to 0 (*RoutoLink* configuration), then the following references apply:



If the *Programming Origin* parameter in the XILOG3.CFG file are set to 1 (*Xilog³MMI* configuration), then the following references apply:



6.2.5 ; - comment

It can be programmed with any sequence of ASCII characters helping the programmer write the program and corresponds to the comment instruction programming (*o;) in basic language.

6.3 OPERATIVE INSTRUCTIONS

They are instructions defining the actual machining operations of the piece. When running the program, each of these instructions can correspond to either a single movement or a set of movements of the operating unit of the machine.

For example, in the case of boring, the operating head of the machine carries out the operation in various pre-set phases. The operative instructions are:

(basic instructions, textual)

- B boring;
- BO optimised boring;
- BR slanted boring;
- G0 milling start;
- G1 linear milling;
- G2 clockwise circular milling;
- G3 counter-clockwise circular milling;
- G5 milling tangent to previous section;
- ATP circular milling tangent to the previous segment;
- G0R begin milling with tool slanted;
- G1R linear milling with tool slanted;
- G2R clockwise circular milling with tool slanted;
- G3R anticlockwise circular milling with tool slanted;
- G5R milling tangent to previous section with slanted tools;
- ATPR circular milling tang. to previous segment with tools slanted;
- N null operation;
- GIN automatic entry into profile;
- GOUT automatic exit from profile;
- GREP repetition of a profile;
- ISO ISO instruction;
- GSET defining the characteristics of a profile;

(extended instructions, graphic)

- xB extended boring;
- xBO extended optimised boring;
- xBR extended inclined boring;
- xG0 extended milling start;
- xL2P linear milling by 2 points;
- xA2P circular milling, knowing 2 points;
- xA3P circular milling for three mills.
- xAR circular milling, knowing radius;
- xAR2 circular milling with a given radius 2;
- xG5 extended milling tangent to previous milling;
- xATP circular milling tangent to previous section;
- xSP linear milling by 3 points (or broken line);
- xLR rounding milling between segments;
- xLU connection milling between segments;
- xRAT linear milling and tangent circular milling;
- xTAR circular milling and tangent linear milling;
- xEA arc_of_ellipse milling;

- xG0R start milling with slanted tool;
- xG1R linear milling with slanted tool;
- xG2R clockwise circular milling with slanted tool;
- xG3R counter-clockwise milling with slanted tool;
- xG5R extended milling tangent to previous section with slanted tools;
- xATPR extended circular milling tangent to previous linear section with slanted tools
- xN extended null operation;
- xGIN automatic entry to the profile;
- xGOUT automatic exit from profile;
- xGREP repetition of a profile;
- xGSET defining the characteristics of a profile.

6.4 SUBPROGRAM MANAGEMENT INSTRUCTIONS

They allow to recall inside a program another program previously set. It is possible to pass new parameters to the latter by means of the parametric programming (see PARAMETRIC PROGRAMMING AND FIXED CYCLES and PARAMETRIC PASSAGE TO SUBPROGRAMS ANS FIXED CYCLES).
These are:

(basic)

- S subprogram call;
- SO optimised call of a subprogram;
- PAR parameter setting;

(extended)

- xS extended subprogram call;
- PAR parameter declaration (through parameter table);

6.5 PROGRAM FLOW MANAGEMENT INSTRUCTIONS

By setting these instructions, the programmer can modify the program flow on the basis of the values acting as variables inside the program itself. The “IF” type control instructions can check the result of an expression and so take the program at a pre-set point identified by a “.” tag. The control instructions can check compound expressions composed of constant values as well as variables (defined by “L” instruction), Parameters (defined by PAR instruction) and Alias (defined by “D”).
All extended language instructions (including fixed cycles) present a field defined by “IF=” in which it is possible to program an expression that will be

able to distinguish whether the condition is true or not and if it is true it will be carried out otherwise it will be ignored. (see in PARAMETRIC PROGRAMMING AND FIXED CYCLES and GRAPHIC EDITOR).
The program flow management instructions are:

(basic)

- . label;
- GOTO unconditional jump;
- L assign the value of an expression to a variable;
- IF GOTO conditional jump;
- IF THEN conditional execution;
- ELSE alternative conditional execution;
- FI conditional execution end;
- DO begin cycle;
- REPEAT repeat cycle;
- IF REPEAT conditional repeat cycle;
- EXIT exit cycle;
- IF EXIT conditional exit cycle;
- OD end cycle;
- PAR parameter setting;
- D Alias declaration;

(extended)

- PAR parameter declaration (through parameter table);
- D Alias declaration (through parameter table);

6.6 INSTRUCTIONS FOR SENDING MESSAGES TO THE OPERATOR

These instructions enable messages to be sent to the operator while the piece is being machined:

(basic)

- MSG sending a message

(extended)

- XMSG sending a message

6.7 WORK TABLE PROGRAMMING INSTRUCTIONS

These instructions are to program the position of the supports of the machine with respect to the origin of the panel. When the program is running, the operator can view a graphic display of how and where to position the supports according to their actual previous programming. These are:

(basic only)

- VT open suction cup table;
- VROW suction cup table row;
- ENDVT close suction cup table;

In the graphic editor work top programming is entirely assisted graphically.
The suction cup table, if any, must always be at the end of the program.

6.8 PROGRAMMING HELP INSTRUCTIONS

These instructions are to program the position of the supports of the machine with respect to the origin of the panel. In addition, they display or memorize diagnostic messages during graphic display of the program. When the program is running, the operator can view a graphic display of how and where to position the supports according to their actual previous programming. These are:

(basic only)

- * - ; comment;
- PRINT to display a message;
- TRACE to memorize a message.

In the graphic editor work top programming is entirely assisted graphically.
The suction cup table, if any, must always be at the end of the program.

NOTE

The Header is a required instruction and must not be preceded by any other instruction.
The suction cup table, if present, must always be located at the end of the program.
Incorrect programming of machining with slanted tools may cause damages to the structure of the machine. It is advisable that a SIMULATION of this type of operation be executed first.

6.9 FORMAT OF PROGRAMS

The *Xilog³MMI - RoutoLink* operator interface supports the following programs:

- PGM;
- XXL;
- DXF;
- CNC;
- PGE.

6.9.1 PGM

This is the standard format of the programs developed in PROGRAM EDITOR. The files with the PGM extension are binary files, and include a descriptive bitmap which is built at the time of memorisation. PGM's are immediately recognisable by the descriptive bitmap displayed on the right of the screen.

6.9.2 XXL

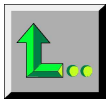
This is the *ASCII* format of the programs developed in PROGRAM EDITOR. These programs can be edited with any text editor.

6.9.3 DXF

These are the *ASCII* programs generated by external *CAD* packages. They can be imported to the PGM format.

6.9.4 CNC

These are *ISO* programs. They may be edited using any external ASCII editor and can be imported to the PGM format for execution on the machine only if they do not contain jump instructions.
ISO programs can be controlled directly on some types of machine with NUM®, as described in the chapter DIRECT CONTROL OF ISO PROGRAMS.



6.9.5 PGE

These are the programs in the old binary format. This format can be imported in PGM format or in XXL format.

6.10 PARAMETRIC PROGRAMMING AND FIXED CYCLES

6.10.1 VARIABLES

In programs, subprograms and fixed cycles, up to a maximum of 256 variables can be set.
Variables are objects used to contain numerical values. These values may be absolute numbers, or the result of an arithmetic or logical expression. The range of values that can be memorised is from 1.7E-308 to 1.7E+308.
Each variable must be assigned an univocal name, selected according to the following rules:

- must not be longer than 15 characters;
- it can contain letters (upper and/or lower case), numbers and the character '_' (underscore);
- the first character cannot be a number.

Some variables are reserved and can be used to read the dimensions of the piece, the work area, and represent *pi* (these variables cannot be written):

- DX dimension in X
- DY dimension in Y
- DZ dimension in Z
- FLD work area :
  1=A, 2=B, 3=C, 4=D
  12=AB, 21=BA, .., 41=DA
  101=E, 102=F, 103=G, 104=H
  112=EF, 121=FE, ..., 141=HE
  201=I, 202=J, 203=K, 204=L
  212=IJ, 221=JI, ..., 241=LI
  301=M, 302=N, 303=O, 304=P
  312=MN, 321=NM, ..., 341=PM
  900 = area 00, 901 = area 01
  910 = area 10, 911 = area 11
- PI pi

The values are assigned to the variables with the assign instruction L (let), using the syntax:

L <variable name > = <expression>

CAUTION

A variable that it hasn't been set equals 0 if used in expressions, "undefined" if used as reading.

Examples:

L V1 = 6000
L Diameter = 18
L Radius = Diameter/2

6.10.2 EXPRESSIONS

Expressions are rules for reading the value of the operands and calculating new values by the application of operators.
Operands may be fixed values (numbers) and names of variables. The operators are the conventional operators, plus many others to facilitate the construction of arithmetic and logical expressions.
Arithmetic expressions provide a numerical result. Logical expressions give a *True* or *False* logical result. *Xilog³MMI - RoutoLink* considers the value 0 (zero) as False, and any other value as True. *Xilog³MMI - RoutoLink* evaluates the value 1 for True.
The rules for the composition of the expressions group the operators into priority classes. Unary operators have maximum priority, then in the order, multiplication, addition, comparison and logical.

6.10.2.1 Operators and Priority Rules

The table below contains the list of the operators grouped by priority. The lines separate the levels. The maximum priority is at the top.

Max. priority

-	Minus (unary)
+	Plus (unary)
DEF	parameter/variable definition control (0= not defined,1= defined)
NDEF	parameter/variable definition control (0= defined, not defined)
ABS	Absolute value
ACOS	Arc cosine
ASIN	Arc sine
ATAN	Arc tangent
COS	Cosine
SIN	Sine
TAN	Tangent
RD	Rounds a number down, to the nearest integer
RU	Rounds a number up, to the nearest integer
EXP	Exponent
LN	Natural logarithm
LOG	Base-10 logarithm
SQR	Square root
TLRAD	Max. tool radius
TLURAD	Useful tool radius
TLLEN	Tool length
TLULEN	Useful tool length
TLROT	Direction of rotation of tool (0=no rotation, 1=+, 2=-)
TLOPPSTX	Opposite tool in X
TLOPPSTY	Opposite tool in Y
TLSERIES	Tool series (0=none, 1=X, 2=Y)
OPROG	Reserved
FCKP(1)	repositions the value of the active face (F=1 o 2 o 3 o 4 o 5)
FCKP(2)	repositions the programmed C correction (0=no,1,2,3,13,23,31,32) (which can differ from the active one if the former is programmed at mid-profile)
FCKP(3)	repositions the value of active K incremental (0=no, 1=X, 2=Y, 3=X+Y)
FCKP(4)	repositions the value of active P specular (0=no, 1=X, 2=Y, 3=X+Y, 10=G2G3, 11=X+G2G3, 12=Y+G2G3, 13=X+Y+G2G3)
TMAC	Reserved

TOOL indicates the data from the tooling file specified in current program:

TOOL(n, 1)	repositions the type (0=N.D., 1=P, 2=F, 3=D, 4=T, 5=S) of tool n (n=1,..,96,101,..,196,..,801,..,896)
TOOL(n, 2)	repositions subtype (0=N.P., 1=L, 2=P, 3=S)
TOOL(n, 3)	repositions magazine number
TOOL(n, 4)	repositions magazine type
TOOL(n, 5)	repositions magazine location
TOOL(n, 6)	repositions number of opposite tool in X
TOOL(n, 7)	repositions number of opposite tool in Y
TOOL(n, 8)	repositions series (0=N.D., 1=axis X, 2=axis Y)
TOOL(n, 9)	repositions radius

TOOL(n, 10) repositions useable radius
TOOL(n, 11) repositions the length/blade radius
TOOL(n, 12) repositions useable length
TOOL(n, 13) repositions rotation direction (0=N.D., 1=+, 2=-)
TOOL(n, 14) repositions work direction (0=N.D., 1=+, 2=-)
TOOL(n, 15) repositions aggregate number
TOOL(n, 16) repositions work face (0=all,1=F1,..,5=F5)
TOOL(n, 17) repositions tapering bit height
TOOL(n, 18) repositions standard rotation speed
TOOL(n, 19) repositions maximum rotation speed
TOOL(n, 20) repositions standard speed
TOOL(n, 21) repositions maximum speed
TOOL(n, 22) repositions G0/B speed
TOOL(n, 23) repositions offset X
TOOL(n, 24) repositions offset Y
TOOL(n, 25) repositions offset Z
TOOL(n, 26) repositions offset D
TOOL(n, 27) repositions offset R
TOOL(n, 28) repositions angle A (B for Disk type)
TOOL(n, 29) repositions dimensions
TOOL(n, 30) repositions wear coefficient in length
TOOL(n, 31) repositions wear coefficient in diameter
TOOL(n, 32) repositions maximum wear in length
TOOL(n, 33) repositions maximum wear in diameter
STRCMP(s1,s2) compares s1 string with s2 string (only for fixed cycles). Repositions: -1 if s1 < s2; 0 if s1=s2; 1 if s1 > s2. s1 and s2 can be immediate strings between double quotes or the parent variable pN
FIELD(a,1) repositions specular value X of work field a (values allowed for a are all those which can assume the variable FLD)
FIELD(a,2) repositions specular value Y of work field a
FIELD(a,3) repositions transverse number of work field a
FIELD(a,4) repositions first transverse number of work field a
FIELD(a,5) repositions X original value in work field a
FIELD(a,6) repositions Y original value in work field a
FIELD(a,7) repositions Z original value in work field a
FIELD(a,8) repositions dimension X in work field a
FIELD(a,9) repositions dimension Y in work field a

^	Tool selection (fixed cycles only)
**	Power
*	Multiplication
/	Division
MOD	Remainder from division (module)

+	Sum
-	Subtraction
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
=	Equal to
<>	Not equal to
NOT	Logical Not
AND	Logical And
OR	Logical Or
XOR	Logical Xor

Less priority

It is possible to overrule the evaluation order by placing the expression within parenthesis. An expression enclosed by a parenthesis is evaluated independently of the operator before and after it.

Examples:

```
L FOOT = 300
L HEAD = 200
L SHOULDER = 200
L CENTRE = 50
L L1 = DY-(SHOULDER*2)-CENTRE
L L1 = L1/2
L R1 = CENTRE*SIN 45
L R2 = (DY/2)-(SHOULDER+CENTRE+R1)
L L2 = DX-FOOT-HEAD-R2-R1
L L4 = L1-CENTRE
L L3 = L2-L4
```

6.10.3 FLOW CONTROL

Some instructions allow you to control the flow of the program. These instructions are:

.	label
GOTO	unconditional jump
IF	conditional jump

Examples:

```
L CoordX=100
L StepX=32
L Turns=2
.OtherTurn
IF Turns <= 0 GOTO End
B X=CoordX Y=200 T=1,2,3
L CoordX=CoordX+StepX
L Turns = Turns-1
GOTO OtherTurn
.End
```

6.10.4 FIXED CYCLES

A **Fixed Cycle** is a special type of *subprogram* whose name becomes a recognised programming instruction.
An example of Fixed Cycle (internal) is the boring instruction B that, although performing a series of complex functions, is seen by the programmer as a single command.
The Fixed Cycles are shown in the list of instructions together with the description, the shortcut, and the bitmap.

6.10.4.1 Programming Fixed Cycles

A Fixed Cycle is an ASCII file with the extension **.xxl.** The name of the file must contain only letters and/or numbers. Fixed Cycles are created and edited outside the *Xilog³MMI - RoutoLink* environment using any ASCII editor. Then the cycle is first compiled using XISO.EXE, specifying which bitmap is to be used (see MIMIC).
A file with **PGM** extension is thus obtained representing the actual fixed cycle (i.e., “HINGE.PGM”).
Programming a Fixed Cycle follows the same rules applied for programming a normal program, including the possibility of calling other subprograms or Fixed Cycles. Nevertheless some restrictions apply, described later on:

Header

The fields **DX**, **DY** and **DZ** must be set to zero, while field /, normally indicating the tooling, must have the following format:

"<shortcut>,<parameters>,<description index>,<description>"

<shortcut> is a pair of characters used for quickly selecting the Fixed Cycle from the general instruction list. The first character must be a number between 5 and 9, and the second character must be a letter of the alphabet.

<parameters> is the list of the parameters of the Fixed Cycle (see 4.1.1.1).

<description index> must be set to zero.

<description> is the string describing the Fixed Cycle.

Examples:

H DX0 DY0 DZ0 *MM /"9p,XYZDT,0,DOOR TYPE 08"

Fixed Cycle Parameters

The parameters are information that the user must pass to the Fixed Cycle so that it can perform the required function.
The parameters are to be selected among those contained in the following list. Some have a set meaning, which must be maintained, others are free, but may have a recommended meaning.

X	free (co-ordinate X)
Y	free (co-ordinate Y)
Z	free (co-ordinate Z)
A	angle of rotation
H	free (co-ordinate H)
E	free (hood position)
I	free (co-ordinate I)
J	free (co-ordinate J)
V	forward speed
S	spindle rotation speed
T	tool list
F	machining face
C	tool correction
K	incremental
P	panel reference
Q	free (quadrant)
R	free (repeats)
x	free (final position X, step in X, ...)
y	free (final position Y, step in Y, ...)
a	free

B	free (angle, ...)
r	free (radius, ...)
D	free (diameter, out of work range, ...)
s	free (step, ...)
l	free (length, ...)
G	free (direction of circular milling, direction of multiple tool, ...)
L	free (length, ...)
N	subprogram name

The parameters may be indicated in any order. If, when a Fixed Cycle is called, no value is assigned to a parameter, this takes the value provided by the Fixed Cycle.

Using the parameters

From within the Fixed Cycle, it is possible to read the value of the parameters using the reserved variables pX, pY, pZ, pA, pH, pE, pI, pJ, pV, pS, pT, pF, pC pK, pP, pQ, pR, px, py, pa, pB, pr, pD, ps, pl, pG, pL, pN, called **p variables**.
All p variables (except pT) may also be used in expressions, as long as their status has been defined, otherwise the result is not evaluated.
To know the status of a p variable, you can use the **NDEF** operator, which returns *True* (1) if the variable has not been defined, and *False* (0) otherwise.

Examples:

```
H DX0 DY0 DZ0 *MM /"9p,XYZDT,0,DOOR TYPE 08"
L FOOT=100 ;the foot to use if the value of parameter X has not been specified
IF NDEF pX GOTO TESTpY
L FOOT=pX ;foot passed as value of parameter X
.TESTpY
        ...
```

Special Variables

Some special read only variables are available for use in Fixed Cycles. These variables, which may be used also in expressions, are:

X	current X co-ordinate
Y	current Y co-ordinate
Z	current Z co-ordinate
C	current radius correction
Cp	programmed radius correction
F	current face

Examples:

```
L oldF = F
L curC = C
L QY = Y+32
B X=X Y=QY Z=Z
```

Special instructions

Some special instructions are available in Fixed Cycles:

```
PRINT “message”          displays the message
C=<variable>       assigns the radius correction type
F=<variable>             assigns the face
```

Examples:

```
F=oldF
C=curC

IF NOT NDEF pX GOTO Beginning
PRINT “value of parameter X missing”
GOTO End
.Beginning
        ...
.End
```

Tool management and ^ operator

In the Fixed Cycles the programmer can use a special variable T that contains the current tools. Using the ^ operator, is possible to:

1. cancel the tools in T
2. add a tool to T
3. copy pT and T to normal variables that will acquire the meaning of tool variables;
4. copy pT and the tool variables to T
5. read the number of tools in pT or in the tool variables
6. read one at the time all the tools in pT or in the tool variables

Cancelling current tools

To cancel the current tools, add the value zero to T.

Examples:

```
L T = T+0
```

Adding a current tool

To add a current tool, add to T the number of the tool.

Examples:

```
L T = T+6
L T = T+101
```

Copying tools

To copy tools, follow the ^ operator with -2.

Examples:

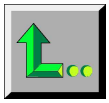
```
L CopyOfT = T^-2          ;copies the current tools

L CopyOfpT = pT^-2        ;copies pT

L T = T + 0
L T = CopyOfT^-2          ;assigns a tool variable to T

L T = T + 0
L T = CopyOfpT^-2

L T = T + 0
L T = pT^-2               ;assigns pT to T
```

Reading the number of the tools

To read the number of the tools, follow the ^ operator with -1.

Examples:

```
L NumTool = pT^-1
L NumT = CopyOfT^-1
```



Reading individual tools

To read the individual tools, follow the ^ operator with the position of the required tool (beginning with 0).

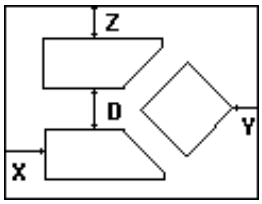
Examples:

```
L FirstTool = pT^0
L SecTool = CopyOfT^1
L ToolPos = 3
L NextTool = pT^ToolPos
```

6.10.4.2 Mimic window

The mimic is a picture describing graphically the fixed cycle and the meaning of its parameters.
The mimic must be a BMP file (i.e. drawn with Paintbrush) size 120 x 90 pixels.

Example:



6.10.4.3 Compiling the Fixed Cycles

Once written, Fixed Cycles must be translated into the *Xilog³MMI - RoutoLink* format; to do so, you must use the DOS program XISO.EXE using the following syntax:

XISO <name of fixed cycle> <any parameter>

The parameters are codes, preceded by the symbol -, used to guide the translation process according to the following rules:

-l	generates a list (.LST) containing any error
-f<bmp>	adds the mimic <bmp> to the Fixed Cycle

If no errors are detected, the Fixed Cycle is translated and a file with the extension .PGM is generated.

Examples:

XISO door.xxl
XISO door.xxl -fdoor.bmp -l

6.10.4.4 Decompiling Fixed Cycles

To convert a Fixed Cycle from the PGM format back to the ASCII XXL format, use the DOS program XISO.EXE, with the following syntax:

XISO <filename.PGM> -x

Examples:

XISO door.pgm -x

6.10.4.5 Making a Fixed Cycle active

To integrate correctly the fixed cycle in the programming environment, it is necessary to define a group of fixed cycles to which it must belong. For example, the XB , XBO and XBR system fixed cycles belong to the milling group. To define a group of fixed cycles and enable the fixed cycle as its element, follow these instructions:

- Close *Xilog³MMI - RoutoLink*;
- Create a subdirectory of the main directory….\XILOG3\FXC, whose name must not contain any extension (i.e., “DOOR”)
- Constitute a BMP file (or bitmap) sized 32 x 32 pixels, containing the mimic of the group and having the same name as the directory (i.e., “DOOR.BMP”)
- Copy the PGM file representing the fixed cycle previously generated (such as, for instance, “HINGE.PGM”) in the directory relating to group it belongs to. (i.e. …..\XILOG3\FXC\DOOR)
- Reopen *Xilog³MMI - RoutoLink*

In the directory generated which, for instance, can identify a particular machining operation thanks to its name and its bitmap, it is possible to copy more fixed cycles which could represent all the elements composing that particular machining operation.

WARNING

In case of update of the software to a 04x or better version, the fixed cycles previously programmed under the directory …..\XILOG3\FXC are automatically copied in the USER group. This group is represented by the following bitmap (see in GRAPHIC EDITOR):

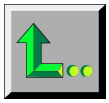
Content of directory …\FXC\PRIVATE must not be modified.

6.10.4.6 Example of Fixed Cycle

```
H DX0 DY0 DZ0 *MM /"9p,XYZDT,0,DOOR TYPE 08"
; Parametric door
        ; pX=FOOT
        ; pY=HEAD
        ; pZ=SHOULDER
        ; pD=CENTRE FRAME
        ; pT=TOOLS

L V1=6000                       ;cutting feed speed
L V2=5000                       ;moulding feed speed
L V3=8000                       ;window feed speed
L V4=8000                       ;square feed speed


;Checks that the input parameters are OK
IF NOT NDEF pX GOTO TESTpY
PRINT "Value of foot (X) missing"
GOTO END
.TESTpY
IF NOT NDEF pY GOTO TESTpZ
PRINT "Value of head(Y) missing"
```

```
GOTO END
.TESTpZ
IF NOT NDEF pZ GOTO TESTpD
PRINT "Value of shoulder (Z) missing"
GOTO END
.TESTpD
IF NOT NDEF pD GOTO TESTpT
PRINT "Value of centre frame (D) missing"
GOTO END
.TESTpT
IF NOT NDEF pT GOTO BEGIN
PRINT "Tools (T) missing"
GOTO END

.BEGIN                                  ;Start work
L FOOT = pX
L HEAD = pY
L SHOULDER= pZ
L CENTRE= pD

L numT=pT^-1                            ;extracts number of programmed tools
L T=T+0                                 ;resets current tools
L T=T+pT^0                              ;activates tool number 1

.CUTTING
L Z1=-(DZ+2)                            ;depth of straight cut
C=1                                     ;straight cut
GIN G=1 R=2 Q=0
G0 X=0 Y=DY Z=Z1 V=V1                   ;the tool has already been activated
G1 Y=0
GOUT G=1 R=2 Q=0

IF numT < 2 GOTO MOULDING
L T=T+0                                 ;resets current tools
L T=T+pT^1                              ;activates tool number 2

.MOULDING
L Z2=-DZ                                ;depth of moulding
C=1                                     ;moulding
GIN G=1 R=2 Q=0
G0 X=0 Y=0 Z=Z2 V=V2                    ;the tool has already been activated
G1 X=DX
G1 Y=DY
G1 X=0
GOUT G=1 R=2 Q=0
```

```
L L1=DY-(SHOULDER*2)-CENTRE
L L1=L1/2                                ;short side
L R1=CENTRE*SIN 45
L R2=(DY/2)-(SHOULDER+CENTRE+R1)         ;semidiagonal of square
L L2=DX-FOOT-HEAD-R2-R1
L L4=L1-CENTRE
L L3=L2-L4

IF numT < 3 GOTO WINDOW1
L T=T+0                                  ;resets current tools
L T=T+pT^2                               ;activates tool number 3

.WINDOW1
L Z3=-(DZ+2)                             ;machining window 1
O X=FOOT Y=SHOULDER Z=0
C=2
GIN G=2 R=3 Q=1
G0 X=200 Y=L1 Z=Z3 V=V3                  ;the tool has already been activated
G1 X=0
G1 Y=0
G1 X=L2
G1 Y=CENTRE
G1 X=L3 Y=L1
G1 X=200
GOUT G=2 R=3 Q=1 L=5

.WINDOW2
L O2=SHOULDER+L1+CENTRE                  ;machining window 2
O X=FOOT Y=O2 Z=0
C=2
GIN G=2 R=3 Q=1
G0 X=200 Y=0 Z=Z3 V=V3                   ;the tool has already been activated
G1 X=L3
G1 X=L2 Y=L4
G1 Y=L1
G1 X=0
G1 Y=0
G1 X=200
GOUT G=2 R=3 Q=1 L=5

L YO=DY/2                                ;origin square
L XO=DX-HEAD-R2
L LQ=R2/SIN 45
L LQ2=LQ/2
L LQ2M=-LQ2
O X=XO Y=YO Z=0
```



```
ROT X=0 Y=0 A=-135

C=1                                   ;machining square
GIN G=2 R=2 Q=1
G0 X=LQ2M Y=0 Z=Z3 V=V4               ;the tool has already been activated
G1 Y=LQ2
G1 X=LQ2
G1 Y=LQ2M
G1 X=LQ2M
G1 Y=0
GOUT G=2 R=2 Q=1 L=5

C=0                                   ;exit
ROT X=0 Y=0 A=0
O X=0 Y=0 Z=0

.END
```

6.10.5 PASSING PARAMETERS TO SUBPROGRAMS AND FIXED CYCLES

There are two ways of passing a set of parameters from a main program to a subprogram or to a fixed cycle.

The first is based on the programming of a sequence of **PAR** instructions (up to a maximum of 16) inside the subprogram (see PAR instruction in INSTRUCTION LIST).
If, when calling the subprogram (in main program), the name of the parameters defined inside the subprogram (they can be composed of numbers or letters, to a maximum of 15 characters) is not known, the values set using the syntax:

PAR1=*value1* PAR2=*value2* ,.., PAR16=*value16*

are passed to the parameters inside the subprogram. The value defined by PAR1 is associated to the first parameter of the subprogram, the value defined by PAR2 is associated to the second parameter and so on.
Otherwise, in case the names of the parameters of the subprogram are know, the parameters can be programmed directly with their names. For example, if in the subprogram DOOR.PGM the parameter has been programmed:

PAR length = 3

The call:

S /DOOR length=10

Will execute the subprogram DOOR.PGM with the length parameter set to 10.
The same applies to all the nesting levels of the subprograms (or fixed cycles); i.e. it applies to a call to a subprogram from inside another subprogram, etc.

The second method is based on the programming of overall variables
All the variables set in the main program before a call to a subprogram (or a fixed cycle) can be recalled within the subprogram (or fixed cycle) itself. In the subprogram (or fixed cycle), these variables can be handled as local variables (those set internally), with the difference that they are automatically initialised with the value they had in the main program. In the subprogram, any modification of the value of the overall variables is only effective until the system exits from the subprogram.
Here again, the method applies to all the nesting levels of subprograms (or fixed cycles): a local variable of a subprogram becomes overall for all its subprograms, and so on.
The overall variables at the highest levels are those set in the **environment variables file**. The name of this file, which is a program only containing settings of variables (see instruction L in the INSTRUCTION LIST chapter), must be stated in the heading (H) of a program.

CAUTION

When using an overall variable, always make sure that it has been set at a higher level. Otherwise, this variable equals 0 if used in expressions, "undefined" if used as reading.

As an alternative to programming a subprogram to which values are passed in the two modes described above, it is possible to program a fixed cycle, using the passage of standard parameters for fixed cycles (see FIXED CYCLES).

6.11 SAMPLE PROGRAMS

Disk 4 (Utilities) of *Xilog³MMI - RoutoLink* contains (in the PGM directory) some programming examples. To edit these programs proceed as follows:
After installing *Xilog³MMI - RoutoLink*, access the TOOLING LIST mode. Insert disk 4 into drive A, select unit A and access directory TLG. Copy the tooling files to the main directory.....\XILOG3\TLG following the instructions given in the manual (see PROGRAM LIST and TOOLING LIST). Select the main drive (usually C) and check that the file is listed. Similarly, access PROGRAM LIST, copy the programs (contained in drive A in the directory PGM) to the directory

.....\XILOG3\PGM. Check that the programs are shown in the list and press **[F2]**. If GRAPHIC GUIDE is not enabled, press **[F11]**.

CAUTION

All programs, fixed cycles and machine configurations on the *Xilog³MMI - RoutoLink* disk 4 (Utilities) are supplied as guidelines only. Under no circumstances must the files on disk 4 be installed on the machine, since they may lead to SERIOUS MALFUNCTIONS. The machine manufacturer declines all liability for all consequences which may derive from use of the programs, fixed cycles, toolings and configurations on *the Xilog³MMI - RoutoLink* disk 4 (Utilities).

6.12 PRINTING PROGRAMS

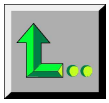
The PROGRAM LIST window which appears when selecting a program includes a command to print the program current highlighted (the command is ignored if more programs are selected). Programs can be printed in XXL, PGM, DXF e CNC formats.
If the printer is not connected at the control, you can print a file in PGM format by exporting it first in the XXL format.
Then it is necessary to copy the XXL file to a floppy disk in drive A:
Once you have the file on disk, you can print it using your office PC as any other standard ASCII text file.

6.13 IMPORTING A DXF FILE

Xilog³MMI - RoutoLink is able to read a DXF file (in the 12,13,14,LT formats) and interpret it as a series of processes on the panel.
A DXF file is imported in two phases.
The first involves a profile procedure which takes place in the import environment and comprises: the joining of unconnected sections (*auto-join*), the deletion of geometric elements, any boring settings, profile path inversion, changing the point of entry for a profile, changes in the profile machining mode (Depth Z, tooling and tool used, milling speed V and spindle rotation speed S), detachment of open curves, offset settings and changes to the reference system, changes in the order of geometrical generation. This phase allows all

the geometries present in the source file to be made available to the *Xilog³MMI - RoutoLink* programming environment in the form of a program. (See DXF PROGRAM IMPORT ENVIRONMENT).
The second phase, which takes place in the actual *Xilog³MMI - RoutoLink* program Editing environment, consists of more detailed programming of the previously imported machining operations. The programmer can reset the new milling depths, the correct movement speeds, any settings and/or disabling of automatic inputs/outputs and, where necessary, the enabling of machining operations to correct the tool radius. For these operations (which are part of standard panel programming), the user must possess a thorough knowledge of the characteristics of the tools used, which sizes, machining directions, rotational directions, maximum speed etc. (See TOOLING, PROGRAMMING A PANEL, PROGRAMS EDITOR).

The geometries programmed using C.A.D. are imported in the form of two-dimensional processes, all on a single face. The face can be selected in the import environment. If the user wishes the processes on more than one face to be contained in a single program, after importing the processes on each single face individually he simply recalls the programs obtained from the import (as subprograms) in a single main program.
The geometries are imported as text or graphic instructions included between the profile start instructions (GIN and GO) and the profile end instruction (GOUT). The profile start and end instructions are all generated identical (in the mode set in the CAD.CFG file) and all with the same parameters (read from the CAD.CFG file). If the GIN and GOUT instructions are empty (with no parameters), the automatic entries/exits have not been enabled in the CAD.CFG file. All profiles other than borings are generated with the same tool number and the same depth, set in the CAD.CFG file. Any settings different from the original ones can be reprogrammed profile by profile by means of a graphic window which can be accessed by pressing **[F3]**, and can be later modified after importation, in the program editor.
The geometries can be classified by type by programming the new fields referring to the LAYER. In this case depending on which LAYER it belongs to, the DXF instructions correspond to a clearly defined type of machining.
For example a rectangular geometry belongs to the “PANEL LAYER“ this only determines the panel dimensions and is not interpreted as a cutting mill measurement. See in CONFIGURATION, CAD.CFG, how to program the LAYERS and what type of machining can be defined by using the LAYERS.
Only if the “LAYERS” are not used can the borings be programmed under the form of *CIRCLE* instructions with a diameter smaller than that pre-set. Unless specifically set as "single borings", all borings are subjected to the optimization algorithm, which generates the optimised boring instructions on the basis of the chosen tooling file and the boring parameters (see Boring Optimizer). If the selected tooling file does not contain bits capable of performing some of the programmed borings it is possible to modify the boring parameters (such as the depth and diameter) or the borings can be set as "single".

Before importing the DXF file it is necessary to check (or personalise to requirements) the programming of the CAD-CFG file containing the standard parameters useful for the import procedure (see CONFIGURATION).
The DXF file import environment is accessed automatically by asking to copy (or rename) a program from DXF format to PGM or XXL format (see PROGRAMS ARCHIVE).
Once this environment has been accessed, the user must set (or confirm if present):

- the dimensions of the panel (which, if present in DXF, are read by the source file; otherwise, they are taken from the CAD.CFG file);
- any offset of the geometries in relation to the origin (to ensure that processing of the panel is shifted to the correct position);
- a scale factor (which does not affect the diameter of any borings present);
- the work face;
- the minimum diameter threshold below which CIRCLE instructions are to be considered as borings.
- the tooling file (.TLG) from which a list of configured tools is obtained.

The **[F7]** key can be used to modify all these values except the last, which only has to be set the first time.
All the geometries read from the DXF file are shown on the panel in yellow; the current profile is highlighted in blue and the current entity belonging to it in red.
The bottom of the screen shows the following information from left to right: the panel dimensions, the length of the current section (or entity), the work side, and the X and Y values of the final point of the current entity (represented by a square). The **[<-]** and **[->]** keys can be used to scroll through the profiles, and the user may scroll through the current profile using the **[↑]** and **[↓]** keys. If the **[↑]** key has no effect, this means that the current entity is the first in the profile. If the **[↓]** key has no effect, the end of the profile has been reached. This feature, together with the highlighting of the end point of the current entity, is useful in establishing the direction in which a profile is executed.
Click the mouse to select the profile to be processed.
Bearing in mind that the **[F3]** and **[F5]** functions are only effective on the current profile, the operations to be carried out for correct import of a DXF file are the following:

1. press **[F5]** to delete all entities which do not correspond to panel processing steps (such as forms, position indications and various external lines).
2. Delete any overlapping or intersecting profile entities which might lead to an error in interpretation of the geometries.
3. Delete any entries/exits if the automatic entries and exits are to be used (only enabled in tool radius compensation mode).

4. Carry out an auto-join (using the **[F4]** key), grouping together all adjacent entities in a single profile.
5. set the direction of the profiles (except for the CIRCLE type profiles, using key **[F6]**);
6. set the entry point for each profile (where different from the imported entry point) or, if the current profile is a boring, set the boring parameters (key **[F3]**). In case of a profile, the offset is equal to the distance between the new point of entry and the initial point of the current entity. Again by pressing **[F3]** it is possible to edit the depth Z, the tool and the milling speed V and the spindle rotation speed S to be used for a given profile.
7. Arrange the profiles in a fixed sequence. When the **[ENTER]** key is pressed on the current profile, this profile will be generated in the position corresponding to the number of times the [ENTER] key has been pressed since the beginning of the arrangement process. When the user exits from the function, the latest order is confirmed.
8. Use the **[F2]** key to import. (If the DXF file contains borings, the name of the tooling file is requested).

If the operation is concluded correctly, the system accesses the environment for editing the PGM thus obtained, and programming of the panel has to be completed (see second phase, described above).

6.13.1 Importable DXF sections

The following sections are recognised:

- **HEADER**
- **TABLES**
- **ENTITIES**
- **BLOCKS** only for horizontal boring by layers

The following entities are imported:

- **LINE**
- **ARC**
- **CIRCLE**
- **POLYLINE**
- **ELLIPSE**
- **LWPOLYLINE (RECTANGLE, POLYGON)**
- **INSERT** only for horizontal boring by layers

The **$EXTMIN** and **$EXTMAX** values in the **HEADER** section establish the working range on the basis of which the drawing of the processes on the panel

is made. If the DXF file does not contain these values, there is no guarantee that the geometries will be displayed correctly.

All the geometries produced by CAD except for those listed above are ignored by the DXF importer.

NOTE

The DXF file must always contain the **HEADER** section.
For more information to see C.A.D. user guide

6.14 INSTRUCTION LIST

In all graphic instructions (names starting with x) the field IF= is enabled where you can program an expression. The instruction in question is executed only if the expression has been verified (see in PROGRAM FLOW MANAGEMENT INSTRUCTIONS and PARAMETRIC PROGRAMMING). A detailed list of all instructions in PGM language follows.

6.14.1 H - header

Describes the panel.

DX size X of panel
DY size Y of panel
DZ size Z of panel
- work area on which the program is to be executed. The permitted values are A, B, C, D, AB, BA, CD, DC, AD, DA.

/ name of tooling-up configuration file
C machining type. The permitted values are 0 for normal machining and 1 for uninterrupted machining.
T enable / disable lifters (if present) and the lights laser for positioning piece (if present)

Field T	Lifter	laser lights
0	No	No
1	Yes	No
10	No	Yes
11	Yes	Yes

R number of identical panels to produce (max. 9999).

* unit of measurement. Permitted values are MM (millimetres) and IN (inches). If this field is omitted, the default unit is that specified in the machine parameters.

name of environment variables file

BX size X of any additional shim or block located under the panel

BY size Y of any additional shim or block located under the panel

BZ size Z of any additional shim or block located under the panel

V activates / deactivates the clamping of the piece and the position control of the automatic suction cups, if present, according to the table below:

Field V	Blocking	Automatic Suction Cups Control
blank	Yes, using the system configured in XILOG3.CFG.. If both vacuum and pressure switches are mounted, the vacuum switches are used	Yes
0	Mechanic	No
1	Mechanic	Yes
10	Yes, using the vacuum switches	No
20	Yes, using the pressure switches	No
11	Yes, using the vacuum switches	Yes
21	Yes, using the pressure switches	Yes
30	Yes, using pressure and vacuum switches	No
31	Yes, using pressure and vacuum switches	Yes

Examples:

H DX1000 DY500 DZ20 -AB R10 *MM /DEF

WARNING!

The panel dimension in Z is used to optimise translation of head between machining on different faces. For this reason DZ field must be compiled with the effective maximum overall dimensions of the piece in Z, otherwise the heads and the piece may collide.

6.14.2 BO e XBO – optimised boring

This executes one or more holes using the boring optimization algorithm. All BO instructions programmed in succession are placed in the same optimization session; a program may contain more than one block of BO instructions.

X	X co-ordinate of the first hole
Y	Y co-ordinate of the first hole
Z	hole depth
D	hole diameter
N	hole type (P=flat, L=lance, S=taper)
L	taper height (only if N=S)
V	boring speed
G	number of chip discharge steps
R	number of repetitions of the programmed holes
x	X step for repetitions
y	Y step for repetitions

Examples:

For *Xilog³MMI* configuration:
BO X250 Y185 Z10 D8 N=P V4
For *RoutoLink* configuration:
BO X250 Y185 Z-10 D8 N=P V4

6.14.3 B and xB - boring

Executes one or more borings.

X	co-ordinate X of the first boring
Y	co-ordinate Y of the first boring
Z	depth of the borings
E	position of hood
V	boring speed
S	rotation speed of tool, in revolutions per minute
T	tool list. In case of more than one tool, co-ordinates X, Y refer to the first tool listed
G	number of steps for shavings discharge
D	out-of-work range value
R	**(XB only)** number of repetitions of programmed borings
x	**(XB only)** step in X of the repetitions
y	**(XB only)** step in Y of the repetitions

Q **(XB only)** repetition of the borings according to the specular in X/Y (0=No, 1=SX, 2=SY, 3=SXSY)
G nr. of steps for the boring

Examples:

For *Xilog³MMI* configuration:
B X250 Y185 *Z*10 V4 T16 17 18 19
xB F1 X250 Y185 *Z*10 V4 R2 x32 y32 T16 17 18 19
For *RoutoLink* configuration:
B X250 Y185 *Z*-10 V4 T16 17 18 19
xB F1 X250 Y185 *Z*-10 V4 R2 x32 y32 T16 17 18 19

6.14.4 BR and xBR - slanted boring

Allows you to make one or more borings at an angle other than 90° with respect to the working table.
BR is always referred to side 1. The current work side must always be side 1. (F=1)

X co-ordinate X of the first boring
Y co-ordinate Y of the first boring
Z depth of the borings
H height of boring from the working table (position of the tool from the working table of the machine. Defaults to DZ)
A angle of rotation of the boring (0-360)
E position of hood
V boring speed
S rotation speed of tool, in revolutions per minute
T tool list. In case of more than one tool, co-ordinates X, Y refer to the first tool listed
G number of steps for shavings discharge
D out-of-work range value
Q if equal to 0, the angle A is algebraically added to the tool offset R. If equal to 1, the angle A replaces the tool offset R.

Examples:

For *Xilog³MMI* configuration:
BR X100 Y300 *Z*10 H9 V3 S12 T101
For *RoutoLink* configuration:
BR X100 Y300 *Z*-10 H9 V3 S12 T101

NOTE

Incorrect programming of machining with slanted tools may cause damages to the structure of the machine. It is advisable that a SIMULATION of this type of operation be executed first.

6.14.5 G0 and XG0 - milling start

Defines the beginning point of a profile.

X	co-ordinate X of profile beginning
Y	co-ordinate Y of profile beginning
Z	depth of profile beginning
E	position of hood
V	piece feed speed
S	rotation speed of tool, in revolutions per minute
T	tool
D	out-of-work range value
N	profile name (see GREP)

Examples:

For *Xilog³MMI* configuration:

G0 X50 Y75 *Z*5 V3 N="example" S12000 T101
xG0 X50 Y75 *Z*5 V3 S12000 T101

For *RoutoLink* configuration:

G0 X50 Y75 *Z*-5 V3 N="example" S12000 T101
xG0 X50 Y75 *Z*-5 V3 S12000 T101

6.14.6 G1 - linear milling

Defines a line segment.

X	co-ordinate X of segment end
Y	co-ordinate Y of segment end
Z	depth of segment end
V	milling speed

Examples:

For *Xilog³MMI* configuration:
G1 X150 Y230 *Z*11.5 V5
For *RoutoLink* configuration:
G1 X150 Y230 *Z*-11.5 V5

6.14.7 G2 - clockwise circular milling

Defines a clockwise arc of a circle (from axis Y to axis X of the reference system).
In alternative to the definition of the centre, it is possible to define the radius of the arc according to the following convention:
if the radius is positive, the centre falls to the left of the imaginary line going from the beginning to the end point of the arc, otherwise, the centre falls to the right of this line.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Z depth of arc end
V milling speed
I co-ordinate X of centre of arc
J co-ordinate Y of centre of arc
r radius of arc

Examples:

For *Xilog³MMI* configuration:
G2 X50 Y75 *Z*5 I55 J160 V3
G2 X50 Y75 *Z*5 r-20 V3
For *RoutoLink* configuration:
G2 X50 Y75 *Z*-5 I55 J160 V3
G2 X50 Y75 *Z*-5 r-20 V3

6.14.8 G3 - counter-clockwise circular milling

Defines a counter-clockwise arc of a circle (from axis X to axis Y of the reference system).

In alternative to the definition of the centre, it is possible to define the radius of the arc according to the following convention:
if the radius is positive, the centre falls to the left of the imaginary line going from the beginning to the end point of the arc, otherwise, the centre falls to the right of this line.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Z depth of arc end
V milling speed
I co-ordinate X of centre of arc
J co-ordinate Y of centre of arc
r radius of arc

Examples:

For *Xilog³MMI* configuration:
G3 X54 Y91 *Z*5 I12.5 J223 V3
G3 X54 Y91 *Z*5 r30 V3
For *RoutoLink* configuration:
G3 X54 Y91 *Z*-5 I12.5 J223 V3
G3 X54 Y91 *Z*-5 r30 V3

6.14.9 G5 and XG5 - section tangent to previous section

Defines a milling section tangent to the previous one.

X co-ordinate X of end of milling (only if G=2 or G=3)
Y co-ordinate Y of end of milling (only if G=2 or G=3)
Z depth of end of milling
V milling speed
G type of tangent (1 = Segment in the direction of the path of previous section, -1 = Segment in the opposite direction of the path of previous section, 2 = clockwise circular milling, 3 = counter-clockwise circular milling)
L Length of segment (only if G=1 or G=-1)

In the case of **XG5**, the X, Y, G, L parameters are required.

Examples:
G5 G=1 L=100 V1
XG5 X300 Y200 G3 V1

6.14.10 ATP and XATP - arc tangent to previous section

Defines an arc of a circle tangent to the previous section, which must be a line segment or another arc of a circle.

X co-ordinate X of the end of the arc
Y co-ordinate Y of the end of the arc
Zend of the arc depth
V milling speed
G direction of path along arc (2=clockwise, 3=counter-clockwise)

in the case of **XATP**, parameters X, Y, G are required.

Examples:

ATP X54 Y91 G3 V1
xATP X300 Y200 G3 V1

6.14.11 G0R, XG0R - begin milling with slanted tool

Begins a milling operation with a tool slanted on a plane which is not square with the surfaces of the panel.
G0R is always referred to side 1. The current work side must always be side 1. (F=1)

X co-ordinate X of profile beginning
Y co-ordinate Y of profile beginning
Z depth of profile beginning
E position of hood
V piece feed speed
S rotation speed of tool, in revolutions per minute
T tool
D out-of-work range value
N profile name (see GREP or xGREP)
H height of machining from the working table (position of the tool from the working table of the machine. Defaults to DZ).
A angle of rotation of the milling operation (0-360)
IC **(only G0R)** entry side (0,1,2)
I **(only XG0R)** entry side (0,1,2)
define the meaning of the parameter A according to the following table:

Field IC	Field A

0 Value A=0 indicates the tool entry direction projected on face 1, and parallel to X positive semi axis of the face reference system.
Values of A other than 0 provoke a phase angle displacement of the tool direction.
The angular position of the tool is kept constant during machining.

1 Value A=0 indicates that the rotation axis of the tool projected on face 1 is normal to the programmed direction; the tool enters the profile from the right.
Values of A other than 0 provoke a phase angle displacement of the tool direction.
The angular position of the tool is interpolated during machining.

2 Value A=0 indicates that the rotation axis of the tool projected on face 1 is normal to the programmed direction; the tool enters the profile from the left.
Values of A other than 0 provoke a phase angle displacement of the tool direction.
The angular position of the tool is interpolated during machining.

3 The value A = 0 indicates a direction of the tool entry trajectory, projected on face 1, parallel to the programmed trajectory.
Values of A other than 0 cause an angular error in the tool direction.
The angular tool position is kept fixed throughout the processing operation.

4 The value A = 0 indicates a direction of the tool entry trajectory, projected on face 1, parallel to the programmed trajectory.
Values of A other than 0 cause an angular error in the tool direction.
The angular tool position is interpolated throughout the processing operation.

Examples:

For *Xilog³MMI* configuration:

G0R X0 Y100 *Z*5 H9 IC1 A45 S12 N="test" T101
For *RoutoLink* configuration:
G0R X0 Y100 *Z*-5 H9 IC1 A45 S12 N="test" T101

NOTE

Incorrect programming of machining with slanted tools may cause damages to the structure of the machine. It is advisable that a SIMULATION of this type of operation be executed first.

6.14.12 G1R, XG1R - linear milling with slanted tool

Allows you to perform a linear milling operation on a plane which is not square with the surfaces of the panel. It must be effected with slanted tools. It always refers to side 1. (F=1).

This instruction must be preceded by a begin milling with slanted tool or by another milling instruction with slanted tool.

X co-ordinate X of segment end
Y co-ordinate Y of segment end
Z depth of segment end
H height of end point of machining from working table.
V milling speed

Examples:

For *Xilog³MMI* configuration:
G1R X150 Y230 *Z*11.5 H9 V5
For *RoutoLink* configuration:
G1R X150 Y230 *Z*-11.5 H9 V5

6.14.13 G2R, XG2R - clockwise circular milling with slanted tool

Defines a circular milling segment (or arc of circle) on a plane which is not square to the surfaces of the panel, with a

clockwise motion (from axis Y to axis X of the reference system).
In alternative to the definition of the centre, it is possible to define the radius of the arc according to the following convention:
if the radius is positive, the centre falls to the left of the imaginary line going from the beginning to the end point of the arc, otherwise, the centre falls to the right of this line.

This instruction must be preceded by a begin milling with slanted tool or by another milling instruction with slanted tool.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Z depth of arc end
H height of end point of machining from working table.
V milling speed
I co-ordinate X of centre of arc
J co-ordinate Y of centre of arc
r radius of arc

Examples:

For *Xilog³MMI* configuration:
G2 X50 Y75 *Z*5 I55 J160 H9 V3
G2 X50 Y75 *Z*5 r-20 H9 V3
For *RoutoLink* configuration:
G2 X50 Y75 *Z*-5 I55 J160 H9 V3
G2 X50 Y75 *Z*-5 r-20 H9 V3

6.14.14 G3R, XG3R - counter-clockwise circular milling with slanted tool

Defines a circular milling segment (or arc of circle) on a plane which is not square to the surfaces of the panel, with a counter-clockwise motion (from axis X to axis Y of the reference system).
In alternative to the definition of the centre, it is possible to define the radius of the arc according to the following convention:
if the radius is positive, the centre falls to the left of the imaginary line going from the beginning to the end point of the arc, otherwise, the centre falls to the right of this line.

This instruction must be preceded by a begin milling with slanted tool or by another milling instruction with slanted tool.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Z depth of arc end
H height of end point of machining from working table.
V milling speed
I co-ordinate X of centre of arc
J co-ordinate Y of centre of arc
r radius of arc

Examples:

For *Xilog³MMI* configuration:
G3 X50 Y75 *Z*5 I55 J160 H9 V3
G3 X50 Y75 *Z*5 r-20 H9 V3
For *RoutoLink* configuration:
G3 X50 Y75 *Z*-5 I55 J160 H9 V3
G3 X50 Y75 *Z*-5 r-20 H9 V3

6.14.15 G5R e XG5R - section tangent to previous section with slanted tool

Defines a section of milling tangent to previous section with slanted tool

X co-ordinate X of end of milling (only if G=2 or G=3)
Y co-ordinate Y of end of milling (only if G=2 or G=3)
Z depth of end of milling
H height of final point of machining
From work top (measurement to which tool must be lowered in reference to the machine work top).
V milling speed
G type of tangent (1 = Segment in the direction of the path of previous section, -1 = Segment in the opposite direction of the path of previous section, 2 = clockwise circular milling, 3 = counter-clockwise circular milling
L Length of segment (only if G=1 or G=-1)

In case of **XG5R**, the X, Y, H, G, L parameters are required.

Examples:
G5R G=1 L=100 V1 H10

XG5R X300 Y200 G3 V1 H10

6.14.16 ATPR, XATPR - arc tangent to previous segment with slanted tool

Defines a circular milling segment on a plane which is not square to the surfaces of the panel. The programmed arc is tangent to the previous segment, which must be a line segment or an arc of a circle.

This instruction must be preceded by a begin milling with slanted tool or by another milling instruction with slanted tool.

X co-ordinate X of the end of the arc
Y co-ordinate Y of the end of the arc
Z end of the arc depth
H height of end point of machining from working table.
V milling speed
G direction of path along arc
(2=clockwise, 3=counter-clockwise)

Examples:

ATPR X54 Y91 G3 V1

6.14.17 GFIL, XGFIL – connection between millings

Makes a circular connecting milling between the milling programmed before this instruction and the one programmed after this instruction.. This instruction connects any linear or circular milling to any other linear or circular milling.
The fields are as follows:

r radius of connecting arc
V milling speed

Examples:

G1 X=200 Y=100
GFIL r=200
G2 Y=200 r=50

6.14.18 GCHA, XGCHA – rounding between millings

Makes a circular rounding milling between the milling programmed before this instruction and the one programmed after it. The previous and following rounding instruction can be any linear milling.
The fields are as follows:

I	length of the first section to be rounded
L	length of the second section to be rounded
V	milling speed

Examples:

G1 X=200 Y=100
GCHA I=50 L=50
G1 Y=200

6.14.19 GIN and XGIN - automatic entry into profile

Defines a line or an arc of a circle tangent to the profile at the entry point.
It has effect if programmed before a profile start instruction (GO or XGO).

G	type of entry: 1 = line, 2 = arc (arc is valid only if tool radius compensation is enabled)
R	tool radius multiplication factor (default=2)
Q	type of approach: 0 = at position, 1 = downstroke

Examples:

GIN G1 R2 Q0
xGIN G1 R2 Q0

Entry with blade in tangent line (G=1) is enabled.

WARNING

The automatic entry is not enabled if: C=3 or C=31 or C=32.
If C=0 and G=2, the entry direction of the arc is determined by the sign of R

6.14.20 GOUT and xGOUT - automatic exit from profile

Defines a line or an arc of a circle tangent to the profile at the exit point.
It has effect if programmed after the last instruction of the profile.

G type of exit: 1 = line, 2 = arc (arc is valid only if tool radius compensation is enabled)
R tool radius multiplication factor (default=2)
Q type of disengagement: 0 = at position, 1 = downstroke
L profile overlap

Example:

```
GOUT G1 R2 L30 Q0
XGOUT G1 R2 L30 Q0
```

Entry with blade in tangent line (G=1) is enabled.
If the value of L is set to –1, overlapping operation occurs all along the last profile section; if L is set to –2, overlapping occurs al along the last profile section and also the panel exits perpendicularly (as per instruction N) ignoring the value of parameter Q.

WARNING

Automatic exit is not enabled if: C=3 or C=31 or C=32.
If C=0 and G=2, the arc entry direction is determined under the sign of R.

6.14.21 GREP and xGREP - profile repeat

Repeats a profile.

X co-ordinate X of the beginning point of the profile, or offset X of the profile (see Q).
Y co-ordinate Y of the beginning point of the profile, or offset X of the profile (see Q).
Z offset of profile in depth Z.
Q 0 = X,Y absolute values, 1 = offset

G	reverse direction (0=NO,1=YES)
V	milling speed
S	rotation speed of tool, in revolutions per minute
D	out-of-work value
N	name of profile (see field N of instruction G0 and XG0)
T	tool
A	**(XGREP only)** angle of rotation (the rotation takes place around point X,Y only if X and Y are set and Q=0)
x	**(only XGREP)** reading X of rotation centre
y	**(solo XGREP)** reading Y of rotation centre

Example:

GREP N="sample" G1 V2000 T102 Q1 X100 Y0
xGREP N="sample" G1 V2000 T102 Q1 X100 Y0

6.14.22 N and XN - null operation

Turns the rotation off and moves the electrospindles to their idle position.

X	position of head on axis X
Y	position of head on axis Y
V	displacement speed
S	tool rotation speed expressed rpm
T	number of external tool

Values X and Y are referred to machine zero. The tool indicated in field T is collected from the tool magazine.

Examples:

N X1500 Y0 V8
XN X1500 Y0 V8

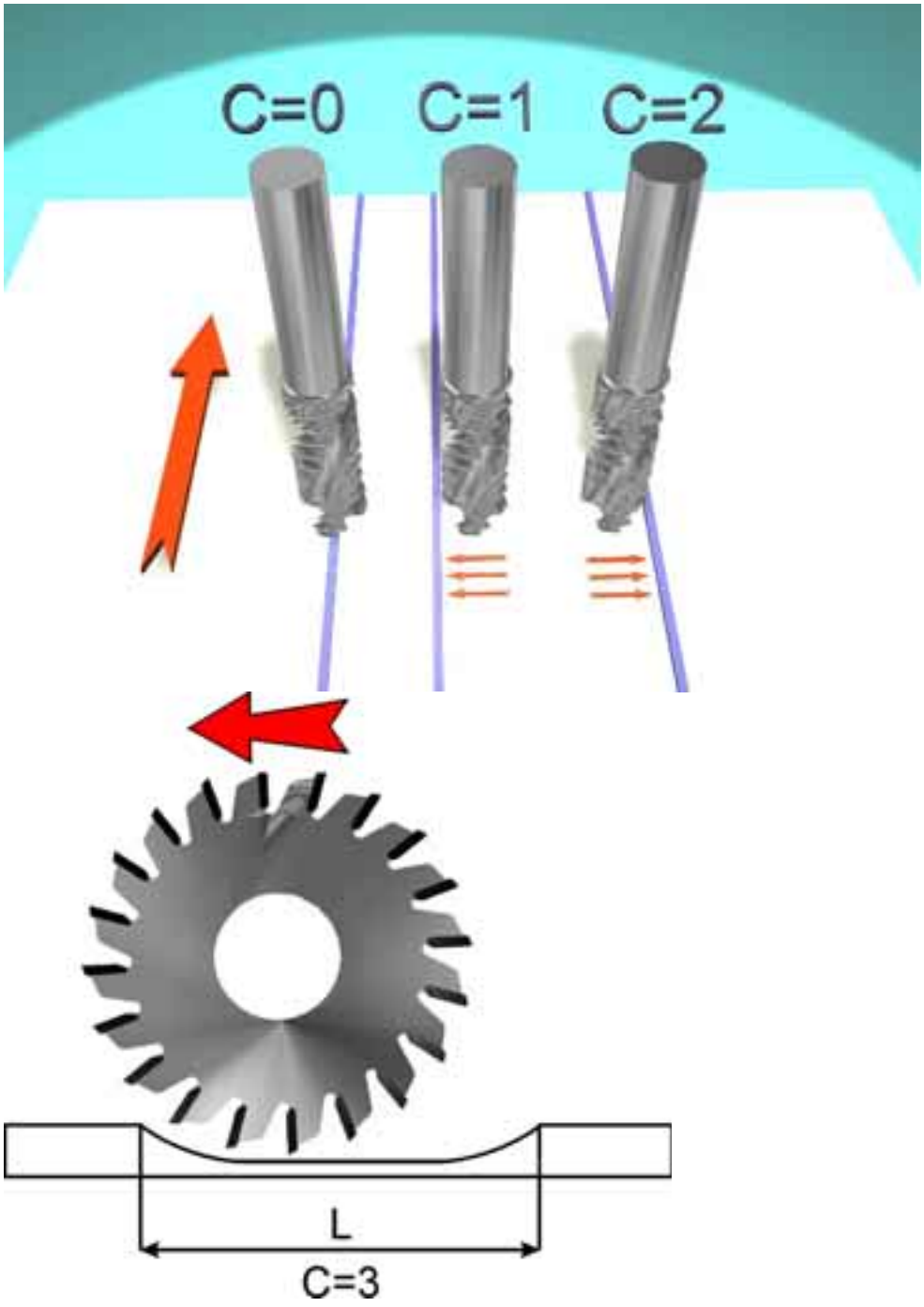
6.14.23 C - tool correction

Enables the correction of the path of the spindle based on the characteristics of the milling tool mounted. If the mill is of the fluted-type, the correction is equal to the radius; if the mill is of the disk type, the correction is equal to half the thickness of the blade.

S machining allowance

The permitted values for C are:

0 no correction
1 right correction
2 left correction
3 depth correction



Examples:

C0
C1
C2

6.14.24 PL and XPL - inclined plane

Enables the inclined plane absolute condition.

X co-ordinate X of the origin of the plane (referred to the origin of the panel)
Y co-ordinate Y of the origin of the plane (referred to the origin of the panel)
Z co-ordinate Z of the origin of the plane (in relation to panel base)
Q angle of rotation around axis Z
R angle of rotation around axis X

Angles Q and R are applied to the base cartesian triad, depending on the type of machine and program origin (data t be found in file XILOG3.CFG); the new traid must be positioned so that the direction of the Z axis corresponds to the direction in which the tool works and the direction set for that type of machine.
An instruction PL/xPL is cancelled by:

- another instruction PL/xPL; if all parameters have a value of zero face 1 is reset;
- the retrieval of a standard face.

WARNING!

When machining inclined surfaces, make sure that they are programmed correctly and efficiently, otherwise they may damage the machine.

Example:

```
PL X0 Y0 Z0 Q45 R90
xPL X0 YO Z0 Q45 R90
```

6.14.25 F - machining face

Defines the active machining face. The permitted values are:

1 upper face

2 right hand face
3 left hand face
4 front face
5 rear face

Examples:
F1
F3

6.14.26 ISO - ISO instruction

Used to program an instruction in the ISO language of the numerical control used. The instructions are placed between double quotation marks and may be followed by a list of parameters separated by at least one space (the structure and meaning of the parameters are described in the paragraph on the instruction PRINT).
No syntax check is performed on the instruction and no graphic display is associated to it.

Examples:
ISO “GX1000Y740F6000”
ISO “M71”
ISO “M?d” 110+ Hood

6.14.27 SET - system parameter

This instruction allows changing some of the system parameters set by the machine tool manufacturer. The syntax is the same as the one of instruction L, with the difference that the variable name must be selected from a group of specific names. These names are:

- **ZFAST** changes the contact position
- **SIZEFLD** changes the size in Z of the piece
- **AUTOTOOL** enables/disables overlapping tool change
- **NOPF45** enables/disables the insertion of an instruction N between subsequent borings in faces 4 and 5.
- **STANDBY** causes a temporary stop of the machining:
  0 = no stop
  1 = stop without the possibility of releasing the piece
  2 = stop with the possibility of releasing the piece
- **PRU** allows the press to be used:

0 = press up
1 = press down

- **USAW** modal, allows a movement of the blade *s* to be defined, -0.5mm <= *s* <= 0.5mm, orthogonal to the programmed linear trajectory. This is only applied to machining with a blade for linear milling with the same X,Y co-ordinates as the previous linear milling.

WARNING!

If the instruction SET USAW is programmed, always check that all the linear millings with blade, carried out on another linear milling with the same X and Y co-ordinates as the previous, (corresponding to all the linear millings "in place"), are programmed OUT OF PANEL DIMENSIONS !

Three new system parameters have been implemented for the SET instruction.
The first two set up optimization of the **BO** instructions. The value of these parameters does not change until they are set again.
The last parameter allows setting of a scale factor for all the processes in a program.

- **BOTYPE** optimization type;
- **BOPERC** optimization percentage (see **BORING OPTIMIZER**);
- **SCALE** setting of a scale factor for the program. Must be set before operating instructions and cannot be repeated.

Examples:

```
SET ZFAST = 18
SET AUTOTOOL = 0
SET STANDBY = 1
```

6.14.28 xL2P - segment by two points

Defines a line segment.

X co-ordinate X of segment end
Y co-ordinate Y of segment end
Z depth of segment end
A angle of rotation
V milling speed
B angle of segment referred to axis X
L length of segment

The following combinations are valid:
1. position X (Y=last set value)
2. position Y (X=last set value)
3. position X and position Y
4. angle B and one of the two positions X and Y
5. angle B and length L

Examples:

For *Xilog³MMI* configuration:
xL2P X100 Y100 *Z*5 V3
xL2P B45 X50 *Z*5 V3
xL2P B45 L300 *Z*5 V3
For *RoutoLink* configuration:
xL2P X100 Y100 *Z*-5 V3
xL2P B45 X50 *Z*-5 V3
xL2P B45 L300 *Z*-5 V3

6.14.29 xSP - segments by three points (broken line)

Defines two line segments.

X co-ordinate X of end of second segment
Y co-ordinate Y of end of second segment
Zdepth of end of second segment
A angle of rotation
V milling speed
B angle of first segment referred to axis X
D angle of second segment referred to axis X

Parameters X, Y, B, D are required.

Examples:

For *Xilog³MMI* configuration:

xSP X50 Y75 *Z*5 B35 D45
For *RoutoLink* configuration:
xSP X50 Y75 *Z*-5 B35 D45

6.14.30 xA2P - arc by two points

Defines an arc of a circle with two points known.

X	co-ordinate X of end of arc
Y	co-ordinate Y of end of arc
Z	depth of end of arc
A	angle of rotation
V	milling speed
I	co-ordinate X of centre of circle
J	co-ordinate Y of centre of circle
B	angle of arc
G	direction (2=clockwise, 3=counter-clockwise)
L	length of arc (1=smaller, 2=greater)

Parameters I, J, G are required. Specify either angle B, or at least one of final co-ordinates X, Y and length L.

Examples:
xA2P X300 I100 J300 G2 L1

6.14.31 XA3P - arc by three points

Defines an arc of circle giving three points. The depth of intermediate point can be different from end point.

X	co-ordinate X of end of arc
Y	co-ordinate Y of end of arc
Z	depth of end of arc
x	co-ordinate X intermediate
y	co-ordinate Y intermediate
H	intermediate depth
A	rotation angle
V	milling speed

Parameters X, Y, B, D are required.

Examples:

For *Xilog³MMI* configuration:
XA3P X300 Y0 Z10 x150 y150 H5
For *RoutoLink* configuration:
XA3P X300 Y0 Z-10 x150 y150 H5

6.14.32 xAR - arc with known radius

Defines an arc of a circle from its radius.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Zdepth of end of arc
A angle of rotation
V milling speed
r radius
G path direction (2=clockwise, 3=counter-clockwise)

Parameters X, Y, r, G are required. The value for radius r may be positive or negative. If positive, the centre is on the left of the imaginary line joining the beginning point with the end point of the arc. If negative, the centre is on the right.

Examples:
xAR X300 Y300 r150 G3

6.14.33 XAR2 - arc with radius 2

Defines an arc of circle with known radius.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Z depth of end of arc
A rotation angle
V milling speed
r radius
G direction of path (2=clockwise, 3=counter-clockwise)

The parameters X, Y, r, G are required; the radius r can take positive and negative values. If it is positive, it is always

considered as the shortest radius, if it is negative, it is always considered as the longest radius.

Examples:

XAR2 X300 Y300 r150 G3

6.14.34 xLR - rounding between segments

Defines a rounding between two line segments.

X co-ordinate X of end of second segment
Y co-ordinate Y of end of second segment
A angle of rotation
V milling speed
x co-ordinate X of the common vertex
y co-ordinate Y of the common vertex
L length of the rounding on the first segment
l length of the rounding on the second segment

Parameters X, Y, x, y are required. At least one of lengths l, L must be indicated.

Examples:

xLR X500 Y100 x200 y500 l100

6.14.35 xLU - connection between segments

Defines a circular connection between two line segments.

X co-ordinate X of end of second segment
Y co-ordinate Y of end of second segment
Zdepth of end of second segment
A angle of rotation
V milling speed
r radius of the connection (arc of circle)
x co-ordinate X of the common vertex
y co-ordinate Y of the common vertex

Parameters X, Y, r, x, y are required.

Examples:

xLU X500 Y100 x200 y500 r20

6.14.36 xRAT - segment plus tangent arc

Defines a line segment and an arc of a circle tangent to it.

X co-ordinate X of end of arc
Y co-ordinate Y of end of arc
Z depth of end of arc
A angle of rotation
V milling speed
r radius
B angle of segment referred to axis X

Parameters X, Y, r, B are required.

Examples:
xRAT X300 Y500 r150 B45

6.14.37 xTAR - arc plus tangent segment

Defines an arc of a circle and a line segment tangent to it.

X co-ordinate X of end of segment
Y co-ordinate Y of end of segment
Z depth of end of segment
A angle of rotation
V milling speed
r radius
B angle of segment referred to axis X

Parameters X, Y, r, B are required.

Examples:
xTAR X400 Y500 r100 B45

6.14.38 TA, XTA - feeling

Feeling is used to detect any irregularity or roughness in the panels and therefore enables them to be corrected

X co-ordinated X of the point to feel referring to the current side (from 1 to 5)
Y co-ordinated Y of the point to feel referring to the current side (from 1 to 5)
T tool

After detecting the difference (D) between the real panel dimensions and the theoretical dimensions, the feeler changes the numerical control in relation to the side on which it was carried out:

- Face 1: D is algebraically added to dimension Z of panel (DZ)
- Face 2: is algebraically added to dimension X of panel (DX)
- Face 3: is algebraically added to offset X of panel (BX)
- Face 4: if the face is opposite the stop, is algebraically added to dimension Y of panel (DY); otherwise, D is algebraically added to offset Y of panel (BY)

Face 5: same rule as Face 4

By touching the panel once or a number of times you can generally determine variations in its dimensions from those (theoretical) specified in instructions H. The new dimensions (real) are memorised in the variables @DX, @DY and @DZ which can be used in the parametric; the real dimensions are automatically used when the machining operations are programmed with specular instructions SX and SY; more than one face can be touched before machining.

Examples:

```
H DX1000 DY800 DZ20 –A /DEF
F 2
TA X10 Y400 T91
F 3
TA X10 Y500 T91
F 1
B X100 Y400 Z8 T2
B X = @DX – 50 Y500 Z8 T2
SX 1
B X200 T1
```

6.14.39 xEA - arc of ellipse

Defines an arc of ellipse **generating also the milling start instruction.**

X	co-ordinate X of centre of ellipse
Y	co-ordinate Y of centre of ellipse
Z	milling depth
V	milling speed
S	rotation speed of tool, in revolutions per minute
G	direction of execution of arc (2=Clockwise, 3=Counter-clockwise)
Q	number of arcs of circle to be used to approximate the ellipse per quadrant.
R	angle with axis X of initial point
B	angle with axis X of final point
I	length of smaller semi-axis
L	length of larger semi-axis
A	angle of rotation in relation to the centre
T	tool
E	position of suction hood

Parameters X, Y, R, B, I, L, G are required.

Examples:

xEA X200 Y300 Q5 G2 V1 R135 B35 I50 L100

6.14.40 IX - incremental in x

Enables incremental programming along direction X. The permitted values are:

0	disables incremental programming in X
1	enables incremental programming in X

Examples:

IX1
IX0

6.14.41 IY - incremental in Y

Enables incremental programming along direction Y. The permitted values are:

0 disables incremental programming in Y
1 enables incremental programming in Y

Examples:
IY1
IY0

6.14.42 SX - specular in X

Changes the reference in X moving it to the upper right corner of the panel. The permitted values are:

0 restores the normal reference in X
1 moves to the upper right the reference in X

M reverses the direction of round millings.
The permitted values are 0 to not invert and 1 to invert

Examples:
SX1
SX1 M1
SX0
SX0 M0

6.14.43 SY - specular in Y

Changes the reference in Y moving it to the lower left corner of the panel. The permitted values are:

0 restores the normal reference in Y
1 moves to the lower left the reference in Y

M reverses the direction of round millings. The permitted values are 0 not to invert and 1 to invert

Examples:
SY1

SY1 M1
SY0
SY0 M0

6.14.44 O and xO - move panel origin

Moves the origin of the panel to the programmed position. All the following instructions will refer to the new origin.

X origin in X
Y origin in Y
Z origin in Z
f if programmed with the number of one face (1-5), it enables the instruction only for the origin of the set face

Examples:
O X200 Y150 Z0
XO X200 Y150 Z0

6.14.45 S and xS - subprogram call

Calls a normal existing program as a subprogram.

/ **(only S)** name of (sub)program
N= **(only XS)** name of (sub)program
X origin in X of subprogram
Y origin in Y of subprogram
Zorigin in Z of subprogram
A angle of rotation of subprogram
PAR1= value of first parameter (if required)
...
PARn= value of n^{th} parameter (if required)

Examples:
xS N=demo X100 Y50 Z0 A45
xS N=star X80 Y45 PAR1=1000 PAR2=12
xS N=demo X100 Y50 Z0 A45
xS N=star X80 Y45 PAR1=1000 PAR2=12

If X,Y,Z are not programmed, the current values shall be applied (for Z the last work position is used).

6.14.46 PAR - parameter setting

Defines a parameter, optionally assigning to it a default value. There can be more than one parameter, but they all have to be located immediately after the header.
The value of a parameter may be modified by the instruction (S), to call a subprogram.
its fields are:

“” description of parameter.

The parameter description appears in the parameter insertion table of the GRAPHIC EDITOR and during loading of the program in AUTOMATIC PROGRAM.
The description, useful to the programmer, will not influence the value of the parameter.

Examples:

```
PAR NumberSides=3
PAR MotorRPM=15000
PAR Step
```

6.14.47 D - alias declaration

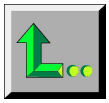
Defines a variable by means of an expression composed of numeric, parameter and alias constants.
Each alias can be defined once, immediately after the definition of parameters.
The alias of the program appear in the parameter insertion table of the GRAPHIC EDITOR and are useful to programming the execution conditions of extended instructions and fixed cycles. (See in PARAMETRIC PROGRAMMING AND FIXED CYCLES).

Examples:

```
D OKFRESA = 3
```

6.14.48 . - Label

A label is used to identify a target location in the program where to jump by means of an IF or a GOTO instruction.



Examples:

.JUMPHERE
.loop
.End

6.14.49 GOTO - unconditional jump

Used to modify the flow of a program, resuming its execution from a label.

Examples:

GOTO loop

6.14.50 L - assign

Assigns the value of an expression to a variable.

Examples:

L VAR1 = DX / 2
L VAR2 = (VAR1 - DY) * 2

6.14.51 IF GOTO - conditional jump

Used to check if a condition is true or false and modify the flow of the program accordingly, continuing its execution from a label.

Examples:

IF DX = 600 GOTO JUMPHERE
IF NOT ((VAR1 < 10) OR (VAR2 >= 27)) GOTO End

6.14.52 IF THEN - conditional execution

Allows you to check a condition and, if the condition is true, to execute the following instructions until the end cycle instruction FI (required) or the ELSE instruction (if present).

Example:

```
IF A > B THEN
        OK=1
FI
```

6.14.53 ELSE - alternative to conditional execution

Allows you to execute the subsequent instructions until the end cycle instruction, if the condition expressed in the IF THEN instruction has not been found true. The ELSE instruction must be located between the IF THEN instruction and the FI instruction. It always refers to the innermost IF THEN conditional execution instruction.

Example:

```
IF A > B THEN
        OK = 1
ELSE
        OK = 0
FI
```

6.14.54 FI - end conditional instruction

Ends the innermost IF THEN [ELSE] conditional execution instruction.

Example:

```
IF A > B THEN ; conditional execution 1
        IF OK = 0 THEN ; conditional execution 2
            OK = 1
        ELSE ; alternative to 2
            OK = 0
        FI ; end of 2
ELSE ; alternative to 1
        OK = 0
FI ; end of 1
```

6.14.55 DO - begin cycle

Begins a cycle.

N name of cycle

Examples:

```
DO  N=1 ; begins cycle 1
DO ; begins cycle 2
```

6.14.56 OD - end cycle

Ends the innermost DO cycle.

Example:

```
DO N=ALPHA
    DO N=BETA
    OD ; end cycle BETA
OD ; end cycle ALPHA
```

6.14.57 REPEAT - repeat a cycle

Repeats a cycle beginning with the instruction immediately after the instruction DO.

N name of cycle

The instruction REPEAT refers to the cycle described by parameter N. If no names are specified, it repeats the innermost cycle.

Example:

```
DO N=ALPHA
    DO N=BETA
        REPEAT ; repeats cycle BETA
    OD ; end cycle BETA
    REPEAT N=ALPHA ; repeat cycle ALPHA
OD ; end cycle ALPHA
```

6.14.58 IF REPEAT - conditional repeat of a cycle

Repeats a cycle beginning with the instruction immediately after the instruction DO if the specified condition has been found true.

N name of cycle

The instruction IF REPEAT refers to the cycle described by parameter N. If no names are specified, it repeats the innermost cycle.

Example:

```
DO N=ALPHA
    DO N=BETA
        IF NOT A REPEAT ; repeats cycle BETA
    OD ; end cycle BETA
    IF A > B REPEAT N=ALPHA ; repeats cycle ALPHA
OD ; end cycle ALPHA
```

6.14.59 EXIT - exit a cycle

Exits cycle DO.

N name of cycle

The instruction EXIT refers to the cycle specified by parameter N. If no names have been specified, it exits the innermost cycle. The program continues with the instruction immediately following the cycle end instruction OD.

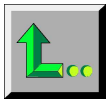
Example:

```
DO N=ALPHA
    DO  ; cycle BETA
        EXIT ;exits cycle BETA
    OD ; ends cycle BETA
    EXIT N=ALPHA ;exits cycle ALPHA
OD ; ends cycle ALPHA
```

6.14.60 IF EXIT - conditional exit from a cycle

Allows you to evaluate a condition and, if found true, exit the cycle. In this case, the program continues from the instruction immediately after the end cycle instruction OD.

N name of cycle



The IF EXIT instruction refers to the cycle specified by parameter N, If no names have been specified, it exits the innermost cycle.

Example:

```
DO N=ALPHA
    DO  ; cycle BETA
        IF A > B EXIT N=ALPHA ;exit cycle ALPHA
        IF A <= B EXIT ;exit cycle BETA
    OD ; end cycle BETA
OD ; end cycle ALPHA
```

6.14.61 VT - open suction cup table

Signals the beginning of the table describing the position of panel supports and suction cups.

Examples:

```
VT
```

6.14.62 VROW - program line for crossbeam suction cups

Defines the position of a panel support and its suction cups. The suction cup program table must contain a VROW instruction for each programmable support (the correspondence is positional).

E	enables the support (0=No, 1 =Yes)
X	co-ordinate X of the support
Y	co-ordinate Y of the suction cups, separated by commas

Examples:

```
VROW E1 X100 Y30,200,400,480
```

6.14.63 ENDVT - end of suction cup programming

Signals the end of the table describing the position of panel supports and suction cups.

Examples:

```
ENDVT
```

6.14.64 * e ; - comment

A comment is a line of text that begins with the character **;** or with the character *****. Comments beginning with **;** can also be placed at the end of instruction lines.

Examples:

```
* PLACE JIGS IN TABLES 1 AND 3
; Calculation of sine of angle alpha
H DX1000 DY500 DZ20 -A /DEF  ; cabinet door
```

6.14.65 PRINT – displaying a message

Allows a diagnostic message to be displayed; after display any further interpretation of the program is blocked.
The instruction consists of a string between double apexes, sometimes followed by a list of parameters separated by at least one space.
The parameters are associated in the position mode to print formats in the message; and so the programmer must be careful to enter a format for each parameter.
A print format starts with a question mark (?); when «PRINT» meets the first format (from left to right) it converts the value of the first parameter after the message and inserts it into the message in place of the format; the second format determines the conversion of the second parameter and so on.
Any parameters in excess of the format are ignored; any formats in excess of the parameters are ignored too.
A print format must have one of the following forms, each of which is assigned a type of display of the corresponding parameter:

- **?x** a hexadecimal number between 0000 and FFFF;
- **?d** a whole decimal number between –32768 and 32767;

- **?u** a whole decimal number between 0 and 65535;
- **?D** a whole decimal number between -2147483648 and 2147483647;
- **?U** a whole decimal number between 0 and 4294967295;
- **?f** a number between 1.7E-308 and 1.7E+308 displayed in the form **[-] dddd.dddd**;
- **?e** a number between 1.7E-308 and 1.7E+308 displayed in the form **[-] d.ddd and [+/-] ddd**;
- **?g** a number between 1.7E-308 and 1.7E+308 displayed in the format **?f** or **?e** which gives the most compact display;
- **?c** character;
- **?s** string of characters.

If a question mark is followed by a character that does not identify any print format, that character is displayed; and so to display a question mark the form ?? must be used.

Examples

PRINT " Incorrect Q value "
PRINT " Incorrect ?d of Q value " QVAL

6.14.66 TRACE – memorising a message

Allows a message to be written in a dedicated file; after writing it, the program interpretation continues as normal. The instruction consists of a string between double apexes, sometimes followed by a list of parameters separated by at least one space.
The parameters are associated in the position mode to print formats in the message.
The print formats are the same as those for the «PRINT» instruction.
The «TRACE» instruction is only effective in the editor when the piece design has been completed; therefore, it has no effect during program memorisation or during the various automatic mode phases.

Examples

TRACE «At line?d Q equals ?f» QVAL line

6.14.67 MSG and xMSG – message to operator during operation

The messages to the operator contain information sent to the operator while the peice is being machined.

"<string>"	message
SBY	type of standby to carry out
INP	name of variable for input value

An MSG without parameters cancels the previous message.
A request to input data can be associated to every message (parameter INP).
After a message is sent the piece program may carry on or stop waiting for the operator to input required data and/or press start cycle pushbutton.
The standby indication (parameter SBY at 1 or 2) stops the piece program waiting for the cycle start pushbutton to be pressed. When data is requested the piece program stops simulating the indication SBY=1.
The instructions MSG are treated individually and displayed with logic according to the type:

MSG without INPUT
The message is displayed in blue in the message window. When there is a standby the message is cancelled by pressing start-cycle pushbutton; otherwise, the message is cancelled when a new MSG arrives, in both cases the message is cancelled by RESET.

MSG with INPUT
The message is displayed in blue in the message window and an icon is displayed to indicate the need to input data. To access the folder to input data press the relevant pushbutton in automatic mode.
The message is cancelled when the start-cycle pushbutton is pressed and when a RESET is accepted.

Examples:

```
…
MSG "Wait completion of unload cycle"
…
MSG
…
MSG "Remove rejects and press start-cycle!" SBY=1
```

```
…
L ADX = 0
L ASX = 90
MSG “Input right cutting angle” INP=ADX
MSG “ Input left cutting angle” ” INP=ASX
IF ADX > 90 THEN
    …
FI
…
L Min = 0
L Max = 4
L Cuffia = 0
MSG “Position of hood (from ?d to ?d)” Min Max INP=Hood
IF Cuffia >=Min AND Cuffia <= Max THEN
    ISO “M?d” 110+Cuffia
ELSE
    PRINT “Position Hood=?d error!” Hood
FI
```

6.14.68 GSET and xGSET – definition of the characteristics of a profile

The instruction GSET describes some new characteristics of a profile retrieved with GREP or next xGREP.

V advancement speed
Ttools
B type of profile

All instruction parameters are optional.
The type of profile B associates the characteristics of GSET to the tool or process active at the moment of interpreting the geometry.

B=1 run to be routed.
B=2 run to be planed.

GSET instructions must be input before any G movement instructions. G movement instructions influenced by a GSET assume new characteristics during a repetition of the profile with GREP or xGREP.
GSET instructions are only enabled if the specified tool is equal to that specified in GREP or if the identifier of the type of profile is represented by the active tool during the repetition of the profile.

Examples:

1. GSET has no effect when the specified tool in GREP is not 101

```
….
G0   X..Y.. Z.. V=1 S E T=101 N=”Prof”
G1   X.. Y.. Z.. V=5
GSET V=10 T=101
G1   X.. Y.. Z.. V=6
….
GREP V=2 T=102 N=”Prof”
….
```

2. GSET is significant when the specified tool in GREP coincides with that of GSET

```
….
G0   X.. Y.. Z.. V=1 S E T=101 N=”Prof”
G1   X.. Y.. Z.. V=5
GSET V=10 T=102
G1   X.. Y.. Z.. V=6
….
GREP V=2 T=102 N=”Prof”
….
```

3. GSET only has an effect if the tool E2 is a cutter

```
….
G0   X.. Y.. Z.. V=1 S E T=101 N=”Prof”
G1   X.. Y.. Z.. V=5
GSET V=10 B=1
G1   X.. Y.. Z.. V=6
….
GREP V=2 T=102 N=”Prof”
….
```

4. GSET only has an effect if the tool E2 is a cutter (due to presence of B=1)

```
….
G0   X.. Y.. Z.. V=1 S E T=101 N=”Prof”
G1   X.. Y.. Z.. V=5
GSET V=10 T=101 B=1
G1   X.. Y.. Z.. V=6
….
GREP V=2 T=102 N=”Prof”
….
```

As the profile can be repeated more than once, more than one GSET can be specified before a G movement instructions.
The repetition in progress determined by GSET associated with the movement instructions G.

If GSET is redundant, the last one is taken into consideration.

5.

```
….
G0   X.. Y.. Z.. V=1 S E T=101 D N=”Prof”
G1   X.. Y.. Z.. V=5
GSET V=10 T=102
GSET V=15 T=103
G1   X.. Y.. Z.. V=6
….
GREP V=2 T=102 N=”Prof”      ;Has an effect only if GSET with T=102
GREP V=2 T=103 N=”Prof”      ;Has an effect only if GSET with T=103
….
```

6.

```
….
G0   X.. Y.. Z.. V=1 S E T=101 D N=”Prof”
G1   X.. Y.. Z.. V=5
GSET V=10 T=102
GSET V=15 T=103
GSET V=20 B=1
G1   X.. Y.. Z.. V=6
….
GREP V=2 T=102 N=”Prof”      ; ;if E2 and E3 are cutters the
instruction GSET
GREP V=2 T=103 N=”Prof”      ; with B=1 the previous GSET are
invalidated
….
```

6.14.69 SO – subprogram optimised call

The instructions SO enable the retrieval of a subprogram associating it to a work zone, while the work is being carried out the real dimensions of the piece are maintained and therefore the position of the face.

/	name of subprogram
DX	dimension in X of panel
DY	dimension in Y of panel
DZ	dimension in Z of panel
-	area of work to which (A, B, C, D, AB, BA, CD, DC, AD, DA) must be associated
BX	dimension in X of a shim positioned under the panel
BY	dimension in Y of a shim positioned under the panel
BZ	dimension in Z of a shim positioned under the panel

At the exclusion of the subprogram name, all the other parameters are optional, if present the optional parameters replace those programs corresponding to the subprogram header.

WARNING!

The SO can only be retreived inside the main program, it is not possible to input SO instructions by using the graphic editor.

SO instructions define the charactristics of a panel which becomes a subpanel of the main panel defined in the main program header. The latter defines the total machining characteristics (including locking pieces), and dimensions DX, DY and DZ, these specifications must include the subpanels.

WARNING!

The panel dimension in Z is used to optimise translation of head between machining on different sides. For this reason DZ field must be compiled with the effective maximum overall dimensions of the piece in Z, otherwise the heads and the piece may collide.

SO machining starts from the stop in the SO specified work area.
For programs containing SO instructions, the tool change optimisation may be requested as described in the paragraph PROGRAM OPTIMISATION. The optimisation consists of reorganising the machining with the aim of minimising the number of tool changes between one machining operation and another.

WARNING!

The optimisation of the tool change only has an effect on the SO instructions in the main program.

Example:

Program which carries out the same machining (Test) on two panels positioned in area A and two in area B.

H DX=2000 DY=1000 DZ=30 –AB /DEF BX=0 BY=0 BZ=0

```
;
S0 /Test DX=500 DY=300 DZ=10 –A BX=0 BY=0 BZ=0
S0 /Test DX=300 DY=100 DZ=10 –A BX=0 BY=500 BZ=0
;
S0 /Test DX=500 DY=300 DZ=10 –B BX=0 BY=0 BZ=0
S0 /Test DX=300 DY=100 DZ=10 –B BX=0 BY=500 BZ=0
```

6.14.70 REF – defining a new reference

REF instructions change the characteristics of the panel defined in the program header, therefore subsequent machining refers to the new characteristics.

DX	dimension in X of panel
DY	dimension in Y of panel
DZ	dimension in Z of panel
-	work area associated with (A, B, C, D, AB, BA, CD, DC, AD, DA)
BX	dimension in X of a shim positioned under the panel
BY	dimension in Y of a shim positioned under the panel
BZ	dimension in Z of a shim positioned under the panel

All parameters are optional, if present, these replace the corresponding ones programmed in the program header.
An REF without parameters resets all the characteristics specified in the program header.

WARNING

The panel dimension in Z is used to optimise translation of head between machining on different faces. For this reason DZ field must be compiled with the effective maximum overall dimensions of the piece in Z, otherwise the heads and the piece may collide.

WARNING!

REF instructions cannot be input using the graphic editor.

Machining carried out following an REF instruction start from the stop in the work area specified in the REF.

Example:

```
H DX=2000 DY=1000 DZ=30 –AB /DEF BX=0 BY=0 BZ=0
;
G0 X=0 Y=0 Z=DZ+3 N=Test1 T101
G1 X=500
G1 Y=300
G1 X=0
G1 Y=0
;
REF DX=500 DY=300 DZ=10 –A BX=0 BY=500 BZ=0
GREP N=Test1
```

7. EXECUTING PROGRAMS

To execute a machining cycle on a panel (program) you need to access the "AUTOMATIC PROGRAM" window. You can access this window by pressing **[F2]** from the "BASIC MENU" only if the machine has been calibrated.
If no programs have been loaded for execution on the machine, the "PROGRAM LIST" window is displayed, where you can select and load the required program by pressing **[Enter]**.
Xilog³MMI - RoutoLink will now ask you to confirm the header of the program. You can now change any setting of the program that does not correspond to your requirements. For instance, you can set a different work area or a different number of repeats. The key **[F5]** can also modify the values of parameters set inside the program. The parameters changed at this time and those entered in any empty field are not memorised in the original program which will retain the original header.
After confirming the parameters with the **[Enter]** key, you continue with the automatic translation of the program to the ISO language. This stage is signalled by a window showing the graphic representation of the panel. If this procedure is not stopped, the interface will then display the "AUTOMATIC PROGRAM" window.
From this window you can monitor the position of the axes. A mimic of the fields of the machine is shown containing the headers of the loaded programs. The field mimic also indicates the stops which the panel must be pushed against.
In addition, if GRAPHIC HELP has been enabled, the graphic of the program highlighted by a yellow border will be shown in the field mimic. If GRAPHIC HELP has not been enabled, the screen will show an alarm window.

WARNING

If the numerical control is NUM the tool corrector D1 is reserved for *Xilog³MMI - RoutoLink*.

7.1 FIELD STATUS

The colour of the panel in the field mimic indicates its operative condition on the machine table.

- **WHITE**
  panel not clamped;
- **BLUE**
  panel clamped;
- **LIGHT BLUE**
  cycle reserved;
- **GREEN**
  cycle running;
- **RED**
  alarm.

7.2 FIELD ASSOCIATION

The field mimic highlights the associations of the areas. For instance, if the machine has two work areas, A and B, and if a program has been loaded on the double area BA, the field window is completely occupied by a single panel.
The possibility of associating the field in an homogeneous or non homogeneous manner is determined by the "HOMOGENEOUS MIX (0=NO, 1=YES)" in the machine configuration file XILOG3.CFG. If this parameter is 1, only homogeneous associations are possible. In this case, if the machine has 4 work areas (A, B, C, D) the following mutually exclusive associations are possible:

- individual areas: A, B, C, D;
- paired areas: AB,BA,CD,DC;
- single area: AD,DA.

Otherwise, if the parameter is set to 0, all combinations are possible as long as there are no overlapping areas. In this case, for instance, the combination A, B, DC would be possible. The combination A, B, DA would instead not be possible.

The values 00, 01, 10 and 11 are also valid. In this case, the area is calculated automatically on the basis of the DX dimension of the tool (which establishes the combination) and the following convention:
first figure: 0 = area not specular in X (programmed with SX=0), 1 = area specular in X (programmed with SX=1);
second figure: 0 = area not specular in Y (programmed with SY=0), 1 = area specular in Y (programmed with SY=1).
The SX and SY values of each area are programmed in the FIELDS-CFG configuration file.

7.3 OPERATING MODES

The different operating modes can be selected by pressing at the same time modal keys **[F7]** and **[F8]**. The selected mode is indicated in the status window. The icon shown on the screen indicates that mode associated to the key with the same icon is active.

- NORMAL no key pressed;
- SIMULATED program test without movement of axes;
- SINGLE step-by-step execution. The CYCLE START key must be pressed to execute each step.

7.4 INPUTTING MESSAGE DATA WITH INPUT REQUEST

Press keys **[Shift]+[F6]** to access data input folder; confirm value input by pressing **[F6]** or **[Enter]** keys.
An icon will flash to show that data must be input, any data input when the icon is not flashing will have no effect.

7.5 DISPLAYING PROGRAM BLOCKS

Press keys **[Shift]+[F8]** to access PGM instruction display and ISO block currently being used. The current face and type of tool radius correction are also displayed in the PGM section. The G and M active functions are also displayed in the ISO section.

WARNING

The blocks display is only available on some machines with NUM® control.

In each section you see two instructions or blocks, the current one below and the previous one above.
Due to the speed with which an instruction is carried out it is possible to miss some instructions passing in the current block folder.
To see a new display starting from blank folders, disable and then enable the block display again, while the program is being run.

7.6 STARTING AND ENDING A CYCLE

To start a cycle, press the **"START"** push-button relative to the machine field associated to the program area (indicated in the header).
If the area has not been associated, the **"START"** push-buttons of each individual area are active.
The execution cycle can be stopped at any time by pressing the **"HOLD"** push-button located on the control panel of the machine.
If the **"START"** push-button of an area is pressed while the machine is executing a cycle on an another area, the area of the **"START"** push-button will be reserved for machining.
To cancel all reservations, use function key **[F1]** send a RESET command.
At the end of the execution of a cycle, the number of repeats is decremented by one and, if it is 0, the corresponding program graphic representation is deleted from the field mimic. To re-execute a program that has completed all set repeats, re-load it with function **[F2]**.

7.7 MANAGEMENT OF TVS TABLE

Xilog³MMI - RoutoLink is able to manage the automatic suction cups/cross-bars (TVS) independently by means of a PLC serial line.
To set TVS management, two parameters included in the **XILOG3.CFG** setup file must be compiled:

1. the **"Table (0=Mul.,1=Vt.M,2=Vt.A)"** parameter must be set at 2 ;

2. the **"Automatic Suction Cup COM N. "** parameter must be set at:
   - -1 to disable all controls;
   - 0 to enable control by means of PC COM1;
   - 1 to enable control by means of PC COM2.
   - 2 to enable control by means of the PC's COM3;
   - 3 to enable control by means of the PC's COM4;

Using control by means of COMx allows the user to position the suction cups of one working area while the machine is executing the piece of another area; *Xilog³MMI – RoutoLink* sends the position values to the suction cups of an area when the program for that area is loaded, while it checks that all the suction cups of an area are in position whenever the relative program start button is pressed.
If one of the following errors occurs during production:

NCI(61-0)…

NCI(62-0)…
NCI(63-0)…
NCI(64-0)…
NCI(65-0)…
NCI(66-0)…
NCI(67-0)…
NCI(68-0)…
NCI(69-0)…
NCI(70-0)…
NCI(71-0)…
NCI(73-0)…,

execution has to be aborted by pressing **[F4]** after eliminating the error message with **[F6]**; otherwise, communication with the suction cups will not be restored.

7.8 CONTROL OF WORK TABLE BY LASER LIGHT

Xilog³MMI - RoutoLink is able to control positioning of cross beams and suction cups by means of one or more laser lights fitted to the machine (where available).
Each light is configured in «PHEADS.CFG» by choosing any position between 12 and 96; the fields to be programmed are:

- **" Actuator "** must be 4;
- **" Setting 0"** the light offset in relation to the reference head (X and Y only);
- **" Setting 1"** offset of sight from suction cups (only X and Y);
- **" Motor Number "** programmed with the laser light order number.

The correct method of positioning the cross beams and suction cups is that the user, before loading any program on the work area, accesses the WORK TABLE DISPLAY environment (using key **[F6]** and makes sure the yellow frame, in the field synoptic, highlights the loaded program).
In the WORK TABLE DISPLAY environment, pressing the **«START»** button (on the machine control panel) enables the machine to project the laser light at the point the cross beam and suction cup are to be put as shown in the graphic representation. After having positioned the cross beam and/or the suction cup manually, the **«START»** button must be pressed again to obtain the position for the next cross beam and/or suction cup, continuing in this way to the last suction cup programmed. In this phase, the panel representing the loaded program in the field synoptic turns orange.

Once the last suction cup programmed has been positioned, exit the WORK TABLE DISPLAY environment in order to execute the program as described in CYCLE START AND FINISH».

7.9 CONTROL OF WORK TABLE BY SPECIAL HEAD

Xilog³MMI - RoutoLink is able to control positioning of cross beams and suction cups by means of a special head (where available). This feature is enabled by setting the **«Automatic suctions cups COM no.»** field to 6 in the «XILOG3.CFG» file.
The positioning procedure is exactly the same as described in the previous paragraph.

8. PROGRAMMING A MIX

A MIX is a sequence of instructions formed by the name and the header of a program.
The format of a mix step instruction is:

/	program name
DX	size X of panel
DY	size Y of panel
DZ	size Z of panel
-	work area on which the program is to be executed. The permitted values are A, B, C, D, AB, BA, CD, DC, AD, DA.
/	name of tool-up configuration file
C	machining type. The permitted values are 0 for normal machining and 1 for uninterrupted machining.
T	enable / disable lifters (if present) and laser lights to position piece (if present)

Field T	Lifters	Laser lights
0	No	No
1	Yes	No
10	No	Yes
11	Yes	Yes

R	number of identical panels to produce (max. 9999).
*	unit of measurement. Permitted values are MM (millimetres) and IN (inches). If this field is omitted, the default unit is that specified in the machine parameters.
#	name of environment variables file
BX	size X of any additional shim or block located under the panel
BY	size Y of any additional shim or block located under the panel
BZ	size Z of any additional shim or block located under the panel
V	activates / deactivates the clamping of the piece and the position control of the automatic suction cups, if present, according to the table below:

Field V	Blocking	Automatic Suction Cups Control
blank	Yes, using the system configured in XILOG3.CFG. If both vacuum and	Yes

	pressure switches are mounted, the vacuum switches are used	
0	Mechanic	No
1	Mechanic	Yes
10	Yes, using the vacuum switches	No
20	Yes, using the pressure switches	No
11	Yes, using the vacuum switches	Yes
21	Yes, using the pressure switches	Yes
30	Yes, using pressure and vacuum switches	No
31	Yes, using pressure and vacuum switches	Yes

Examples:

P /test DX1000 DY500 DZ20 -AB R10 *MM /DEF

8.1 MIX FORMAT

The *Xilog³MMI - RoutoLink* GUI support the following mix formats:

- MIX;
- XXL;
- FRZ.

8.1.1 MIX

This is the standard format of the program lists developed in MIX EDITOR.

8.1.2 XXL

This is the *ASCII* format of the programs developed in MIX EDITOR. These programs can be edited with any text editor.

8.1.3 FRZ

This is the format of MIXes that have been interrupted during their execution in AUTOMATIC MIX. These MIXes can be edited by any text editor.

8.2 PRINTING MIXES

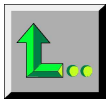
The MIX LIST window appears when selecting a mix and shows the print function key of the mix currently selected (in this case any multiple selection is ignored). You can print the mixes in XXL, PGM formats.
If the printer is not connected at control, you can print a file in PGM format by exporting it first in XXL format.
Then it is necessary to copy the XXL file to a floppy disk in drive A:
Once you have the file on disk, you can print it using your office PC like any other standard ASCII text file.

9. EXECUTING A MIX

The MIX execution environment can be accessed from the “BASIC MENU” window with function key **[F3]**. The operative modes are identical to those of the “AUTOMATIC PROGRAM” window. In this case, however, the translation of the mix programs is carried out automatically without a graphic representation. Any changes to the parameters contained in the headers of the programs that form the mix are read directly from the parameters set in the MIX steps.
The programs of a MIX can be executed in the following manners:

- RECURSIVE
- RECURSIVE COUNT-DOWN;
- SEQUENTIAL COUNT-DOWN;

In addition, there are two different procedures for execution from BCR/SERIAL LINE identified by the "Operating type" parameter configured in the BCR.CFG file (see CONFIGURATION).
In case of execution from BCR / SERIAL LINE, to enable a reading session from the serial line, press the **[F2]** keys and select the reference directory for the programs. If the “operating type” is set to 0, MIX Type selection allows the name read by the BCR to be interpreted as the name of a MIX. In this case, all the steps of the selected MIX are added to the end of the MIX in execution, in sequence.
To close the reception session, press **[F2]** again. It is always possible, during the execution of a MIX, to open and close a reception session several times. A green bar code icon in the status window shows that a reception session from BCR or SERIAL LINE is active.
In all cases other than execution from BCR/SERIAL LINE with operating type set as 1, when execution of a MIX is interrupted (with **[F4]** key), you can memorise the INTERRUPTED MIX as a file with the extension **FRZ**. The MIX LIST window can be enabled to show and execute INTERRUPTED MIX files (or **FRZ**) with the option *“Type:”* and selecting INTERRUPTED MIX from the list displayed.

WARNING!

If the numerical control is NUM the tool corrector D1 is reserved for *Xilog³MMI - RoutoLink*.

9.1 RECURSIVE EXECUTION

Allows you to execute a MIX indefinitely until an interruption is requested. Each MIX step (from the first to the last) is executed once sequentially. At the end of the MIX, the cycle resumes by executing the first program again, and so forth.

9.2 RECURSIVE COUNT-DOWN EXECUTION

This method is similar to the RECURSIVE EXECUTION except for the fact that, in this case, the number of repeats of each individual MIX step is also taken into account. At the end of the execution of a MIX step, its repeat number is decremented by one and, when the repeat number becomes zero, the MIX step is removed from the MIX.

9.3 SEQUENTIAL COUNT-DOWN EXECUTION

In this mode, the MIX steps are executed sequentially from the first to the last as many times as indicated in the repeat number for the corresponding step. The MIX is ended with the execution of its last step.

9.4 BAR CODE READER - REMOTE COMPUTER

This mode is linked to the "Operating type" parameter configured in the BCR.CFG file (see CONFIGURATION).

1. If the "Operating type" is set as 0, the programs read sequentially by the BCR are arranged in order of reading and make up a MIX of programs (in other words, a sequence of MIX steps similar to that edited in the MIX editor is produced). This MIX is executed in sequential count-down mode.

2. In mode 1, on reception of the name of the file to be executed the file is loaded on all the points of origin available in the machine, bearing in mind the combinations of the programmed fields (AB, CD, AD, etc.), or established by the DX dimensions of the piece (field programmed 00, 01, 10 or 11). The number of repetitions is not considered and the program remains active until replaced. Reception of a new file name replaces the previous one on the free points of origin; origins are considered free if there is no clamped panel present, if no reservation is present or if execution is not in progress. If there are no free points of origin, the file is placed in the queue and replaces the previous file once an origin becomes free. It is not possible to place more than one program in standby, so further readings replace the file previously in the queue state.

After enabling the reception from the serial line with the **[F2]** key, MIX steps may be entered using the BCR or the HOST COMPUTER connected to the serial line itself.

WARNING:

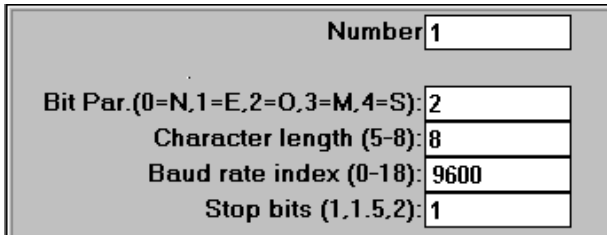
Ensure that the parameters for the serial ports and the BCR in the configuration files **rs232.cfg** and **bcr.cfg**, are correct and match the characteristics of the BCR.

9.4.1 Example

For a serial Scanner with the following configuration:

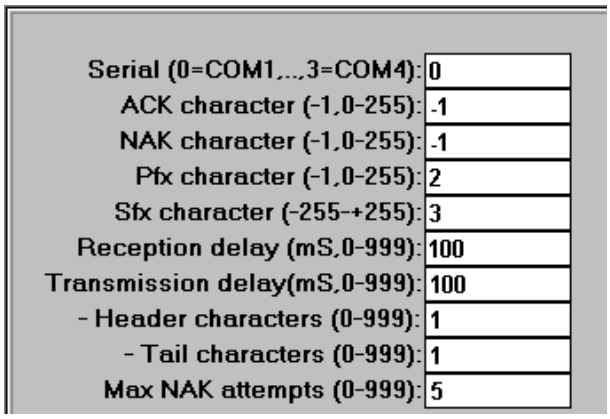
- COM 1
- BAUD RATE 9600
- PARITY ODD
- STOP BITS 1
- DATA BITS 8

The **rs232.cfg** file must be programmed as follows:



First hypothesis:

The scanner automatically adds the **STX** character (2) at the beginning of the label and the **ETX** character (3) at the end.
The **bcr.cfg** file must be configured as follows:

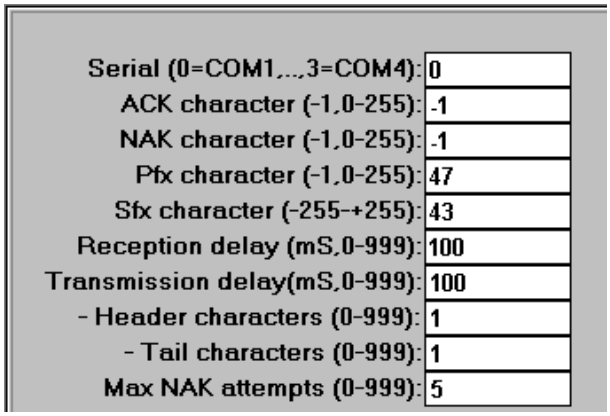


The label will be of the type:

TEST –A R2 DX1000 DY500

Second hypothesis :

The prefix and suffix characters are **/** (47) and **+** (43) respectively, and form part of the label.
The **bcr.cfg** file must be configured as follows:



The label will be of the (CODE 39) type:

/TEST –A R2 DX1000 DY500+

CAUTION

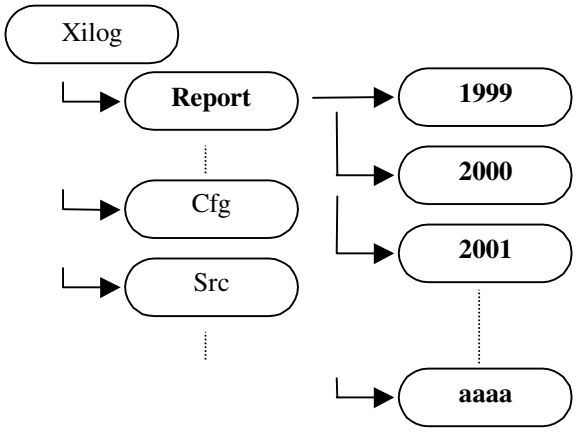
The scanner must be enabled to operate in RS232 mode.
The scanner must not activate any hardware control (CTS/RTS) or any software control (XON/XOFF).
The scanner must not insert any pause between the start of one character and the next.

10. THE REPORT FILE

The Report file is a text type file (ASCII), which contains information to do with the use and exploitation of the machine on which the *Xilog³MMI - RoutoLink* program is being run. There are two types of Report file: one for production (in the **PRODUCTION** Report) and the other regarding the way the machine works during production (in the **DIAGNOSTIC** Report).

10.1 File System Organisation

The files containing this information are organised in the following way (see figure below) : starting with the Xilog directory in the *Xilog³MMI - RoutoLink* packet, there is the Report sub-directory (created when the software is first installed), which contains a directory for each Report year the machine is used (created when the software is running). A Report file is created and saved within each year/directory containing the information for the individual daily use: as there are two types of Report, for each day the machine is used, there will be two files created in each year directory.



The format of the file name to be saved is based on the following criteria:

Daily PRODUCTION Report for day/month/year ⇒ *yyyymmdd.pro* file (ASCII file)

Daily DIAGNOSTIC Report for day/month/year ⇒ *yyyymmdd.dia* file (ASCII file)

For example if the machine is used on 30 June 1999, at the end of the day in the Report\1999 directory, there will be two new files : *19990630.pro* and *19990630.dia* .

10.2 PRODUCTION Report

The report will list a series of information to do with the productive life of the machine which, if we wished to express this in a table, would look like the following :

Area	Progr. PGM	Dimensions	Start Hour	Stop Hour	eff.T	tot.T	Quantity	Average T	Description
A	Pippo.pgm	1000x800x18.2	8:30	10:30	1:00	2:00	5	0:12	…
CD	pluto.pgm	800x500x20	8:40	10:00	0:50	1:20	2	0:25	…
B	Pippo.pgm	1000x800x18.2	8:50	10:50	1:00	2:00	5	0:12	…
…	…	…	…	…	…	…	…	…	…

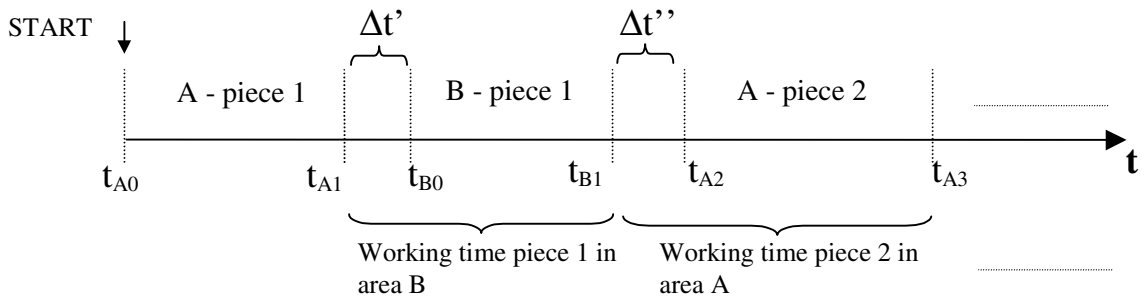
The different fields have the following meanings:

~ **Area** : : is the area occupied by the wood panel on which the PGM program is carried out.

- **Progr. PGM** : is the name of the file which contains the Xilog machining instructions for the piece in question. This information together with the **Area** information gives a univocal description of the piece being processed. In the example above *pippo.pgm* could be the program to work on a door: in area A it produces a right hand door while in area B it produces a left hand door (A and B are mirrored) and the operator could give each process a different code.
- **Dimensions** : dimensions of the wood panel to be processed, length x width x height (dX x dY x dZ).
- **Start time** : is the time machining started expressed in hours:minutes:seconds. This is timed from the moment the head leaves the rest position or has just finished working on a piece from a different job.
- **Finish time** : is the time all working stops on all pieces (see **Quantity** field) needing to be processed.
- **eff**. **T**: is the total actual working time taken by the machining head for the job in hand.
- **Tot. T** : is the machine overall working time for the job in hand.
- **Quantity** : the number of pieces to be processed during the job.
- **Average Time** : the average time between the actual total **effT** divided by the **Quantity**, expressed as before in hours:minutes:seconds..

- **Description** : each PGM file contains in the first instruction of program Header, a text field which gives a summarised description of the program. This information is to be written in the column.

There now follows a description of how to calculate the time machining starts, but above all the time it finishes and the **effT** and **totT** times. the problem is how to ascribe the total working time to the various machining operations which can be carried out on the machine. Certain operations can in fact be *concurrent*, that is to say more than one PGM program can be run on the same machine: there are indeed different work areas and these can be occupied by a single PGM (and relative panel), used in pairs or all four used together.
If we therefore run the file pippo.pgm in areas A and B and each of these has to process 5 pieces at the same time (or rather the heads have been reserved by both areas), the working time graph for that head will be as follows :



In which the following quantities are identified :

t_{A0} = pippo.pgm **Start time** in area A;
t_{B0} = pippo.pgm **Start time** in area B;

Once machining has started in A, the **Start time** (t_{A0}) field is known and in that precise instant the chronometer starts in order to calculate the working time in A: at that moment t_{A1} is stopped because, once the first piece is completed, control passes to the head in B and so the chronometer is stopped until t_{B1}, the moment the second piece in A starts, it is then started again until t_{A3} and so on until all the pieces in area A have been completed. The same procedure applies to the machining operations in B.

This means that when processing a piece, the time interval Δt (time taken for the machining head to move from one area to another) is ascribed to the machining of the following piece, and so:

$$\textbf{Ttot(A)} = (t_{A1} - t_{A0}) + [\Delta t'' + (t_{A3} - t_{A2})] + \ldots + [\Delta t^n + (t_{An} - t_{An-1})]$$

$$\textbf{Ttot(B)} = [\Delta t' + (t_{B1} - t_{A1})] + \ldots + [\Delta t^n + (t_{Bn} - t_{Bn-1})]$$

Therefore, the less distance between the working areas, the less actual working time wasted due to the head moving from the area where it has just finished working to the next where it has to start another operation.

With reference to the graph above, the **effT** value means the **effective** working time the machining head is in use (for example) for the machining operation pippo.PGM in area A :

$$\textbf{Teff(A)} = (t_{A1} - t_{A0}) + (t_{A3} - t_{A2}) + \ldots + (t_{An} - t_{An-1})$$

$$\textbf{Teff(B)} = (t_{B1} - t_{B0}) + \ldots + (t_{Bn} - t_{Bn-1})$$

It therefore represents the total working time, as if the head had been assigned to just one work area.

As well as the above lines, the Production Report also contains one more line (as a file, at the head of the file itself) with a summary of the information contained in the other lines (the totals line):
Eff. Time Total: is the total effective machine time calculated as the sum of all **effTs** for all jobs carried out during the day;
Total no. of Panels : is the total number of the panels completed during the day.

After the total line there is a line containing the name of the operator who has carried out the work. To set the operator's name press **[Shift]+[F8]** in the SERVICES Menu to access input window. The maximum number of characters accepted is 16.

10.3 Internal format of the PRODUCTION report

The internal file format is of the text (ASCII) type with the extension *.pro*. The different lines that go to make up the table in the example shown previously will be entered in the following way:

// Totals line
(Total time),(Total no. of panels)CRLF

// Declaration of current operator
#OP,(Name Operator – max 16 characters)

// Job 1
(Area),(Progr. PGM),(Descr.),(Dimensions),(Start time),(Finish time),(effT),(totT),(Quantity),(Av. Time)CRLF

// Job 2
(Area),(Progr. PGM),(Descr.),(Dimensions),(Start time),(Finish time), (effT),(totT),(Quantity),(Av. Time)CRLF

// Job 3

(Area),(Progr. PGM),(Descr.),(Dimensions),(Start time),(Finish time), (effT),(totT),(Quantity),(Av. Time)CRLF

// Job n
(Area),(Progr. PGM),(Descr.),(Dimensions),(Start time),(Finish time), (effT),(totT),(Quantity),(Av. Time)CRLF

With the individual line which will be made up of :

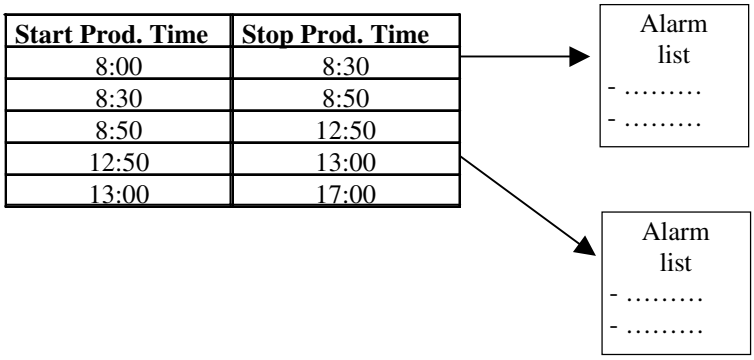
hh,mm,ss,(Total no. of panels) CRLF
(Area),(Progr.PGM),(Desc.),dX,dY,dZ,hh,mm,ss,hh,mm,ss,hh,mm,ss,(Quantity),hh,mm,ss,cc CRLF
....

Sizes of the individual fields :

Field	**Max. no. char**	**Example**
(Total time)	2,2,2	hh,mm,ss
(Total no. of panels)	5	(max 65567 pieces)
(Area)	2	AD
(Progr. PGM)	256	(long file name in Windows 95)
(Description)	256	(general string)
(Dimensions)	8,8,8	XXXX.XXX,YYYY.YYY,ZZZZ.ZZZ
(Start time)	2,2,2	hh,mm,ss
(Finish time)	2,2,2	hh,mm,ss
(effT)	2,2,2	hh,mm,ss
(totT)	2,2,2	hh,mm,ss
(Quantity)	5	(max 65567 pieces)
(Average time)	2,2,2,2	hh,mm,ss,cc (for greater precision also 100ths of a second «cc»)

10.3.1 DIAGNOSTIC REPORT

The Report will show a series of data regarding the way the machine works during use, set out in the following way:



10.3.2 INTERNAL FORMAT OF THE DIAGNOSTIC REPORT

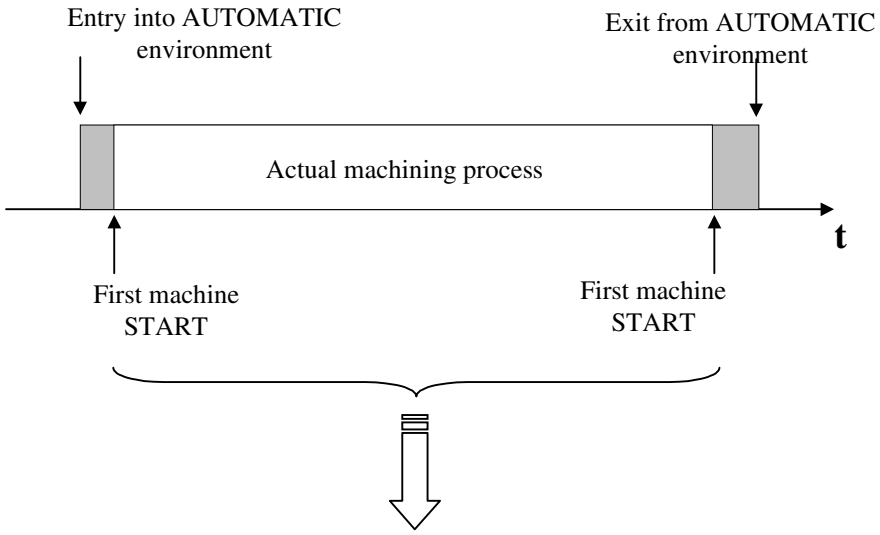
The internal file format is of the text (ASCII) type with the extension *.dia*. The different lines that go to make up the table in the example shown previously will be entered in the following way:

START PROD,(Time Event),(Name Operator)CRLF	// Start production from operator …
STOP PROD,(Time Event)CRLF	// Stop production
START ALRM, (Time Event)CRLF	// Alarm
ALRM, (alarm 1 description)CRLF	
ALRM, (alarm 2 description)CRLF	
….	
ALRM, (alarm n description)CRLF	
STOP ALRM,(Time Event)CRLF	// Stop Alarm : resume normal production
START PROD,(Time Event),(Name Operator)CRLF	// Start production from operator …
…..	
STOP PROD,(Time Event)CRLF	// Stop production

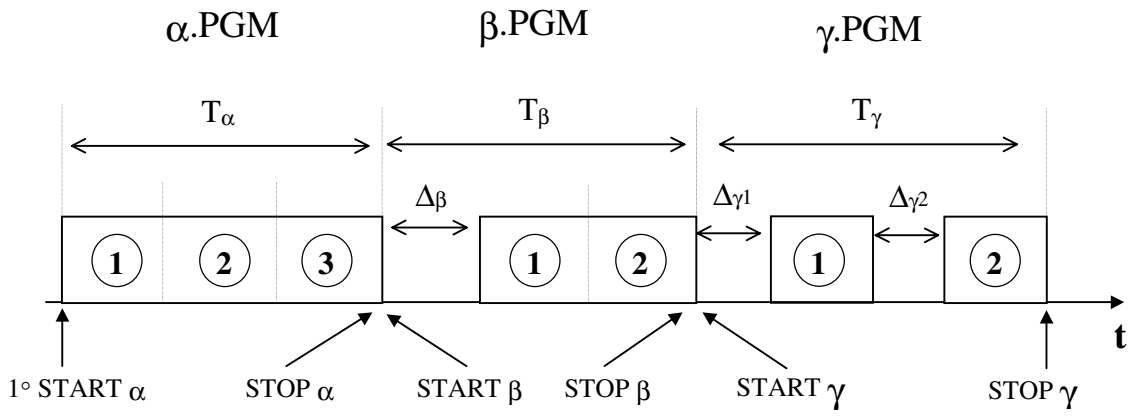
With fields **(Time ..)** in the form «hh,mm,ss» while the field **(alarm N description)** is a string with a maximum of 256 characters and the field (Operator Name) is a string with a maximum of 16 characters).

10.4 Temporal comparison between DIAGNOSTIC Report and PRODUCTION Report

DIAGNOSTIC Report



PRODUCTION Report



Imagining a hypothetical job made up of three PGM files (α.PGM, β.PGM, γ.PGM), we can calculate the typical time intervals of the two Reports created: (N.B. : we have assumed there are no reservations between the three PGMs, if we were to consider these, the various cubes of the three PGMs would be mixed up together and we would refer to the previous considerations);

$effT_{\alpha} = T_{\alpha}$; $effT_{\beta} = T_{\beta} - \Delta_{\beta}$; $effT_{\gamma} = T_{\gamma} - \Delta_{\gamma 1} - \Delta_{\gamma 2}$;

of which :

totT $= T_{\alpha} + T_{\beta} + T_{\gamma}$; **effT.tot.** $= effT_{\alpha} + effT_{\beta} + effT_{\gamma}$;

11. DESCRIPTION OF STATUS AND FUNCTIONS

The top part of the screen always shows a status window, which provides the following information:

- NC status;
- interface status (also called development environment);
- physical keyboard status;
- date and time.

The lower part of the screen contains the keyboard, which takes the functional characteristics required by the current environment.

11.1 THE KEYBOARD

The graphic keyboard includes a row of 10 primary keys (lower part of the keyboard) and a row of 10 secondary keys (upper part).
The primary keys are associated to the **[F2]** .. **[F11]** function keys of the physical keyboard. The secondary keys are associated to the combination of the **[Shift]** key together with the function keys of the physical keyboard (from **[Shift]**+**[F2]** to **[Shift]**+**[F11]**).
The **[ESC]** key causes the exit from the current status.
The **[F1]** key sends a RESET command to the NC.
The **[F12]** inverts the main keys with the secondary keys.
The graphic keyboard is divided into two areas: The first area, formed by the first 12 keys on the left (6 primary and 6 secondary keys), depends on the development environment; the second, formed by the remaining 8 keys (4 primary and 4 secondary keys), is the same for all environments.

11.2 COMMON FUNCTIONS FOR ALL ENVIRONMENTS

The common functions are accessed through the common keys on the keyboard. These keys are:

- **[F9]** ALARMS display;
- **[Shift]**+ **[F9]** display of the PLC variables and Inputs/Outputs. This function is useful for testing the machine and during tele-assistance.
- **[F10]** display of this quick Guide;

- **[Shift]**+ **[F10]** CALCULATOR;
- **[F11]** GRAPHIC GUIDE.
- **[Shift]**+ **[F11]** exit.

11.2.1 ALARMS DISPLAY

The last 30 alarms are displayed with their date and time.
The possible operations are:

- **[F4]** exit;
- **[F6]** if the alarm help is enabled, this opens the viewer selected and displays the help related to the error code the cursor is currently pointing to in the table;
- **[F8]** display active and passive alarms;
- **[F9]** display active alarms (default);

11.2.2 CALCULATOR

Displays a scientific calculator.
If in any given environment the cursor is located on an editable field that can receive only numerical data, the calculator display shows the value present in that field. Press **[F6]** to paste the value in the display of the calculator to the editable field where the cursor is located.
In addition to the keys on the physical keyboard, the following functions are also available (where X is the value shown by the display of the calculator and Y is the value stored in the memory of the calculator):

- **[S]** Sine of X;
- **[A]** Arc sine of X;
- **[C]** Cosine of X;
- **[O]** Arc cosine of X;
- **[T]** Tangent of X;
- **[N]** Arc tangent of X;
- **[P]** X = pi π;
- **[R]** square root of X;
- **[F2]** X = X^3;
- **[Shift]**+**[F2]** X = X^2;
- **[F3]** X = Y^X;
- **[Shift]**+**[F3]** X = X^Y;
- **[F7]** change sign of X;
- **[Shift]**+**[F7]** X = 1 / X;

- **[F8]** recall memory: X = Y;
- **[Shift]+[F8]** store X: Y = X;
- **[F9]** subtract X from value in memory: Y = Y - X;
- **[Shift]+[F9]** add X to value in memory: Y = Y + X;
- **[F10]** clear all: X = 0 e Y = 0;
- **[Shift]+[F10]** clear memory: Y = 0.

11.2.3 GRAPHIC GUIDE

The GRAPHIC GUIDE mode key enables this condition in all environments. An icon in the status window signals if the Graphic Guide is enabled.

11.3 BASIC MENU

From the basic menu, the following environments can be accessed:

- **[F2]** AUTOMATIC PROGRAMS;
- **[F3]** AUTOMATIC MIX;
- **[F4]** MANUAL;
- **[F5]** CALIBRATION;
- **[F6]** MANUAL DATA INPUT;
- **[F7]** PROGRAM EDITOR;
- **[Shift]** + **[F7]** MIX EDITOR;
- **[F8]** SERVICES;
- **[Shift]** + **[F11]** EXIT from BASIC MENU;

11.3.1 OTHER ACTIVE KEYS

- **[Ctrl]+[End]** exits the BASIC MENU.

NOTE:

Leaving the BASIC MENU is the same as leaving the interface!

11.4 AUTOMATIC PROGRAMS

If programs have never been loaded (to be executed on the machine), the interface will show a PROGRAM LIST, from which you can select one with the **[F2]** key.
Otherwise, the interface will show the encoder positions, the mimic panel of the work area, the active alarms.
The mimic panel of the work areas indicates the programs loaded. Each graphic area, if not empty, will have a different colour indicating the machining progress on the relative area. A cursor indicates one of the areas.
When the GRAPHIC GUIDE is active, the interface will show the graphic representation of the machining operation corresponding to the program highlighted in the area mimic window.
After having loaded one or more programs, it is possible to leave this environment to access other non-operative environments (such as for instance PROGRAM EDITOR).
In addition to the controls on the control board of the machine, the active functions are:

- **[F2]** loads another program;
- **[Shift]+[F3]** continuously enables display of the axis positions as follows:
    1. only current positions in machine co-ordinates (standard);
    2. current positions together with delta and tracking error in piece co-ordinates;
    3. current positions together with delta and tracking error in machine co-ordinates;
    4. only current positions in piece co-ordinates;
- **[F3]** modifies the repeats of the program highlighted in the area mimic screen;
- **[F4]** aborts the current execution;
- **[F5]** displays the trace being worked (ANIMATION);
- **[F6]** displays the graphic of the work table for the program highlighted in the mimic window of the work areas;
- **[F7]** enables simulated execution mode;
- **[F8]** enables step-by-step execution.

11.4.1 OTHER ACTIVE KEYS

- **[<-]** and **[->]** highlight another area on the mimic screen.

11.4.2 ANIMATION

Traces the machining of the current program on the panel graphic.
At present, only machining on the upper face of the panel can be followed.
The current graphic can be erased with **[F6]**.

11.4.3 WORK TABLE DISPLAY

Shows the correct positioning of the panel on the work table of the machine.
If the work table consists of crossbeams and suction cups, it is possible to measure the programmed physical co-ordinates of each suction cup (and corresponding crossbeam) in relation to the origin of the supports. One of the suction cups, the corresponding crossbeam, and the relevant co-ordinates are always highlighted.
The following functions are available:

- **[F5]** highlights the previous suction cup;
- **[F6]** highlights the next suction cup;
- **[F7]** selects the previous crossbeam;
- **[F8]** selects the next crossbeam

If the work table is of the multifunction-type, graphic is not available.

11.5 AUTOMATIC MIX

Allows the execution of a previously defined sequence of programs (the MIX) and enables the execution of programs read from the BCR, or transferred through the RS232 serial line.
If BCR/SERIAL LINE is selected, new programs to be executed may be added to the end of the sequence via BCR or serial line.
The choice of the execution mode is offered when this environment is accessed; for every setting except BCR/SERIAL LINE, once the selection has been made the MIX ARCHIVE is presented, allowing a MIX to be selected using **[F2]**.
For BCR / SERIAL LINE EXECUTION, the read session from the serial line is enabled by pressing the keys **[F2]** and selecting the reference directory for the programs. Press **[F2]** again to close the current receive session. Within the execution of a mix, you can open (and close) a receive session more than one time. The presence of a green bar-code icon in the status window indicates that the reception from BCR or SERIAL LINE is active.

The arrangement of the windows on the screen and the functions available (including GRAPHIC GUIDE) are similar to the AUTOMATIC PROGRAMS environment, with the following exceptions:

- **[F2]** opens/closes a BCR receive session;
- **[F3]** MIX DISPLAY AND EDIT environment.

When you interrupt the execution of a MIX (with the **[F4]** key), the INTERRUPTED MIX may be saved as a file with the **FRZ** extension. When the MIX LIST is displayed, INTERRUPTED MIXes (or **FRZ**) can be executed by enabling the display of **FRZ** files with the "*Type:* " command, and selecting INTERRUPTED MIX from the options in the list.

11.5.1 MIX DISPLAY AND EDIT

The complete MIX is shown, allowing the following operations:

- **[F3]** edits the number of repeats for the MIX step highlighted;
- **[F5]** deletes the MIX step highlighted by the cursor;
- **[Shift]+[F11]** exits.

11.6 MANUAL

Allows the movement of the individual axes.
Except for the mimic window of the work area, this environment has the same windows of the AUTOMATIC PROGRAMS environment.
The selected axis is indicated in the corresponding window. (If configured, also the auxiliary axis of the boring unit is displayed).
In addition to the controls on the control board of the machine, the active functions are:

- **[F3]** continuously enables display of the axis positions as follows:
  1. only current positions in machine co-ordinates (standard);
  2. current positions together with delta and tracking error in piece co-ordinates;
  3. current positions together with delta and tracking error in machine co-ordinates;
  4. only current positions in piece co-ordinates;

- **[F5]** selects previous axis (only if the machine has no axis selector);
- **[F6]** selects next axis (only if the machine has no axis selector);
- **[F7]** changes the jog value.

11.6.1 OTHER ACTIVE KEYS

- **[↓]** and **[↑]** associated to **[F5]** and **[F6]**.

11.7 CALIBRATION

Allows you to perform a complete calibration of the machine, or a calibration of individual axes.
The windows displayed here are the same present in the MANUAL environment.
To perform a complete calibration, use the **(START)** key . Use instead the **(+)** key to calibrate the selected axis only.
The following functions are enabled:

- **[F3]** continuously enables display of the axis positions as follows:
  1. only current positions in machine co-ordinates (standard);
  2. current positions together with delta and tracking error in piece co-ordinates;
  3. current positions together with delta and tracking error in machine co-ordinates;
  4. only current positions in piece co-ordinates;
- **[F5]** selects previous axis (only if the machine has no axis selector);
- **[F6]** selects next axis (only if the machine has no axis selector);

11.7.1 OTHER ACTIVE KEYS

- **[↓]** and **[↑]** associated to **[F5]** and **[F6]**.

11.8 MANUAL DATA INPUT

You can control the machine directly by entering instructions in *ISO* language. After typing in the instruction confirm it with the **[Enter]** key (or the **[Shift]**+**[F2]** key). To execute the instruction use the **(START)** button on the control panel of the machine.
The windows displayed in MANUAL DATA INPUT are the same displayed in AUTOMATIC PROGRAMS, except for the mimic panel of the work area, which is replaced by the operating window.

The following functions are enabled:

- **[F2]** positioning co-ordinates / ISO instruction;
- **[Shift]+[F3]** continuously enables display of the axis positions as follows:
    1. only current positions in machine co-ordinates (standard);
    2. current positions together with delta and tracking error in piece co-ordinates;
    3. current positions together with delta and tracking error in machine co-ordinates;
    4. only current positions in piece co-ordinates;
- **[F3]** Boring unit I/O test
- **[F4]** Tool change I/O test;
- **[F5]** TOOL CHANGE MANAGEMENT TABLE (Only if additional tool change has been configured).
- **[F7]** Positioning Fast Speed;
- **[F8]** Parking position.

The I/O Tests enable the Units and Tool Change to be controlled directly, without entering an ISO instruction for the required command, by selecting one of the predefined options using the arrow keys **[<-]**, **[->]**,**[🡻]**, **[🡹]**. The command is confirmed and executed just like an ISO command.

Borer
Before power up extract at least one fuse otherwise it will not come on, to shut down, disable power up.

Electrospindles
The correct control sequence is, Enable, Number of revs, On, Cw/Ccw. When there is no enable the other comands have no effect. To shut down select Off, which only has effect when there is an enable.

11.8.1 OTHER ACTIVE KEYS

- **[<-]** and **[->]** move along the string within the current editable field;
- **[Del]** deletes the character on the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string;
- **[End]** moves the cursor to the end of the string;
- **[Enter]** associated to **[Shift]+[F2]**.
- **[<-I]** deletes the character to the left of the cursor.

11.8.2 TOOL CHANGE MANAGEMENT TABLE

This environment is accessible only if the additional tool change has been configured (if the machine features additional tool change) and it allows to manage the magazines of the machine together with external tools positioned in them (see in MACHINE MOVEMENT, TOOL CHANGE MANAGEMENT)
The configurations of the machine magazines are displayed and include:

- Magazine location (uneditable),
- Tool number (can be edited or selected from a list),
- Loading/Unloading operation required (can be edited or selected from a list),
- overall side dimension «dimD» (represented graphically by the tool icon),
- Number of tool loaded onto the electro-spindle, on the last line of the table regarding rotating tool change.

The tools go from E1 to E96 and correspond to those configured in the active tooling file, In addition, all tools configured with the same aggregate number (and therefore belonging to a single head) are represented by A*n* where *n* ranges from 1 to 96 and is the number programmed in the **«Aggregate no.»** field of the tool data tables. (see in “TOOLING FILES”, ” SUPPLEMENTARY TOOL CHANGE ”).
The “C/S” (load7unload) operations are:

> “C” represents the request of loading operation of the tool programmed in the field “tool” in the magazine location “Location”.
> “S” represents the request of unloading operation of the tool programmed in the field “tool” in the magazine location “Location”.
> “=” indicates that the tool programmed in the field “tool” has actually been positioned in the magazine location “Location”.

The overall side dimension “dimD” is function of the maximum diameter of the tool and is set to (see in TOOLING FILE):

- 1 for a maximum diameter inferior or equal to 20 mm;
- 2 for a maximum diameter greater than 20 mm and inferior or equal to 160 mm, and if the tool does not present an angular offset (the **Offset Z** parameter of the tooling file equals 0);
- 3 for a maximum diameter greater than 160 mm and if the tool has an angular offset (and therefore the **offset Z** parameter of the tooling file is greater than 0).

The fields of the table scroll by pressing the **[Tab] key**.
The table can be presented in two different conditions:

- *Positioning*;
- *Loading/Unloading.*

In *Positioning* mode where an initial configuration must be done (e.g. when all the magazines of the machine are empty) the fields “tool” are enabled and the “Load/Unload” fields are disabled. The user may select from a list the number of a tool to be loaded manually in a certain position of the magazine. Each position has its own list of tools available based on the physical conditions of the magazines and of the tools themselves.

- The even-numbered magazine locations (excluding number 10) may only contain tools of “dimD” equal to 2;
- The odd-numbered magazine locations may only contain tools of dimension “dimD” equal to 1;
- The number 10 magazine location may contain tools of dimension “dimD” equal to either 2 or 3;

In the *Load/Unload* status, the user can programme loading and unloading operations of tools from the magazines. The tools of the rotating magazine can only be unloaded and those of the additional magazine can only be loaded; loading and unloading programming must follow the rules set by the number of magazine locations and the rules governed by
“dimD”, described above.
In this case, confirming the table (with **[F6]** key) enables the actual tool change.

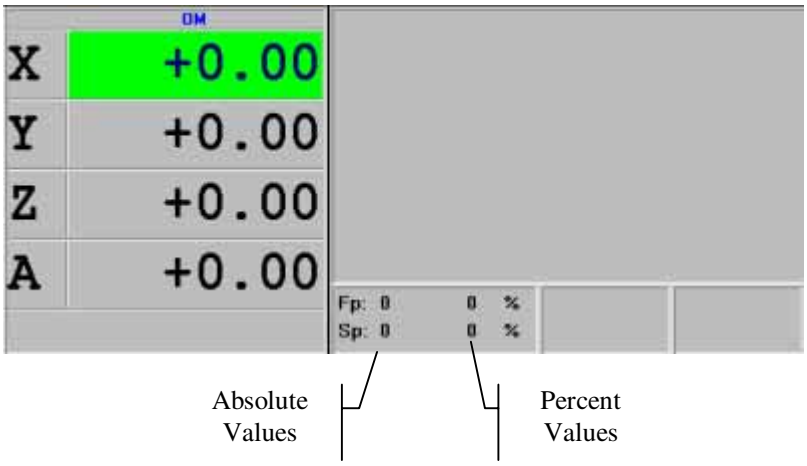
The following functions are enabled:

- **[F3]** HEADER GRAPHIC;
- **[F4]** sets table contents to zero and enables the status of manual *Positioning* of the tools in the magazines;
- **[F5]** allows to continue the manual *Positioning* of the tools in the magazines maintaining the data previously entered;

- **[F6]** confirms the data programmed in table and if the status is that *Positioning*, it enables the automatic load/unload mode of the tools from the magazines.

11.9 F and V SPEED DISPLAY

In the **AUTOMATIC PGM** (F2), **AUTOMATIC MIX** (F3), **MANUAL** (F4), **CALIBRATION** (F5) and **MDI-ISO** (F6) environments, the current feed rates of the machining head F ($^{m}/_{min}$), the spindle speed S (rpm) and the current F and S percentages have been displayed , calculated in relation to the maximum value of the two speeds.
These four items of data are shown in the window to the right of the axis position display window.



11.10 PROGRAM EDITOR (PROGRAM LIST)

Work programs are sequences of instructions describing the work to be executed on the panel.
The PROGRAM EDITOR environment displays a list of the programs that can be used to select the program to edit.
The selected work directory and/or disk drive (if any) are automatically memorised by the system as work directory and/or drive.
In this environment you can process the following types of programs:

- **PGM**

This is the standard format of the programs developed in the PROGRAM EDITOR. The following operations are possible:

  - edit;

- delete;
- copy;
- rename;
- MM/INCH conversion;
- export to XXL format.

- **XXL**

This is the ASCII format of the programs developed in the PROGRAM EDITOR. These programs can be edited with any text editor. The following operations are possible:

- delete;
- copy;
- rename;
- import to PGM format

- **DXF**

This is the format of ASCII programs generated by external CADs.
The following operations are possible:

- delete;
- copy;
- rename;
- import to XXL format
- import to PGM format

- **CNC**

These are *ISO* programs
The following operations are possible:

- delete;
- copy;
- rename;
- import to XXL format
- import to PGM format

- **PGE**

These are the programs in the old binary format.
The following operations are possible:

- delete;
- copy;
- rename;
- import to XXL format
- import to PGM format

At least one program is always highlighted in the programs list. All the operations (valid for the programs) enabled in this environment refer to this program.
In addition, more than one program can be highlighted simultaneously in order to speed up deletion of a program, or copying of a program with shift to another directory. When more than one program is highlighted in the programs list,


editing and import/export operations are not enabled. Multiple program selection is possible in different ways:

- using the *mouse,* keeping the left button pressed by scrolling through the programs list;
- with the **[Shift]** key, keeping the key pressed while scrolling through the list using the **[🡻]** and **[🡹]** keys;
- with the spacer bar, pressing it in correspondence with the program desired.

After selecting a program in one of the three ways described above, any program highlighted by the cursor which has not been selected as described is not considered to have been selected.
Multiple program import/export function is enabled.

The following functions are available:

- **[Shift]+[F2]** confirms the operation on the current control. (e.g.: if pressed on the name of a directory, it displays the files and the directories contained in it. If pressed while the focus is on the file list, it behaves like **[F2]**).
- **[F2]** edits the selected program;
- **[F3]** copies the selected program (or import/export);
- **[F4]** renames the selected program (or import/export);
- **[Shift]+[F5]** prints the program selected (single)
- **[F5]** deletes the selected program or directory;
- **[F6]** makes a new directory;
- **[F7]** MIX editor environment;
- **[F8]** conversion MM/INCH.

11.10.1 OTHER ACTIVE KEYS

- **[<-]** and **[->]** move along the string within the current editable field;
- **[🡻]** and **[🡹]** scroll the current list.
- **[Del]** deletes the character on the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string if the current control is an editable field, otherwise, it moves the cursor to the top of the current list;

- **[End]** moves the cursor to the end of the string if the current control is an editable field, otherwise, it moves the cursor to the end of the current list;
- **[<-l]** deletes the character to the left of the cursor;
- **[Enter]** associated to **[Shift]+[F2]**.

11.10.2 DXF PROGRAM IMPORT ENVIRONMENT

This environment is accessed when copying (or renaming) a program from the DXF format to either the PGM or XXL formats.
All the geometries present in the source file are drawn in this environment. The current profile is highlighted in blue, and its current entity in red. You can scroll the profiles with the **[<-]** and **[->]** keys, and you can scroll inside the current profile with the **[🡻]** and **[🡹]** keys**]**.

NOTE:

The DXF file must always contain the **HEADER** section.
For more information to see C.A.D. user guide.

The following operations can be performed:

- **[F2]** imports the work:
  the code is generated following the information programmed in the CAD.CFG file.
  If there are borings, the name of the tool-up file is requested;
- **[F3]** sets up entry on profile.
  If the current geometry is a boring,
  information on the boring is requested.
  Otherwise, the offset of the entry point in relation to the initial point of the current entity is requested.
  If the geometry is not closed, it is broken.
- **[Shift]+[F3]** redraws the graphic.
- **[F4]** groups in a single profile all the entities having the extremities closer than the corresponding parameter (as programmed in the CAD.CFG file) (*auto join*);

- **[Shift]+[F4]** allows you to operate on the reference system;
- **[F5]** deletes the current geometry (or boring);
- **[Shift]+[F5]** highlights the previous entity on the current geometry;
- **[F6]** reverses the direction of travel of the current geometry;
- **[Shift]+[F6]** highlights the next entity on the current geometry
- **[F7]** allows you to set new dimensions for the panel, a different work side, and new graphic parameters;
- **[Shift]+[F7]** highlights the geometry before the current one;
- **[F8]** enables the geometry generation order;
- **[Shift]+[F8]** highlights the geometry after the current one;

11.11 PROGRAM EDITOR

After selecting the program (in PGM format), you access the proper editing environment.
The program editor consists of:

- TEXT EDITOR (with GRAPHIC GUIDE disabled);
- GRAPHIC EDITOR (with GRAPHIC GUIDE enabled).

Each of these environments can be in three different modes:

1. *Modify*;
2. *Enter*;
3. *Error*.

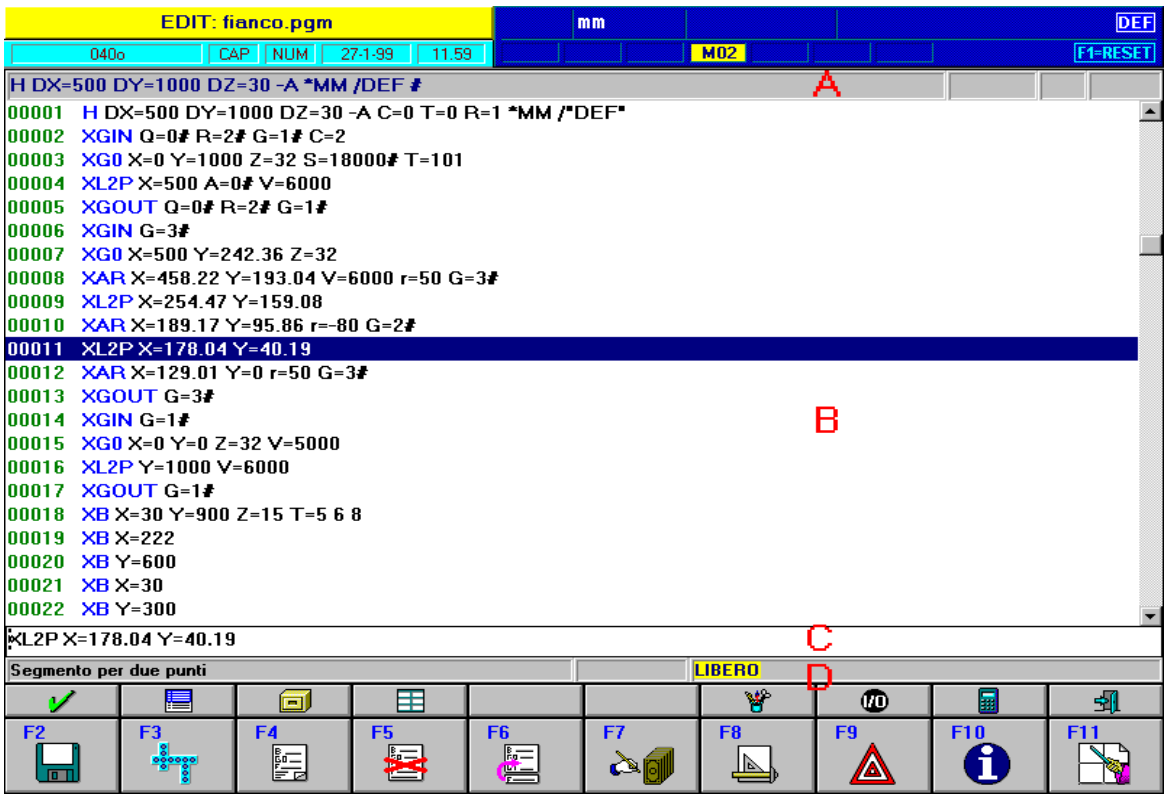
The Editor is in *Modify* status when you want to edit a pre-existing program.
In this status you can scroll the program and all EDITOR functions are enabled.
In the *Enter* mode new program steps can be inserted.
If the program is new, the control switches automatically to the *Enter* status and the programming of the program Header is set.
Error mode occurs when an erroneous instruction is confirmed. In this case, in TEXT EDITOR, the control requires the correction of the current instruction and prevents going to another instruction; whereas in the GRAPHIC EDITOR the *Error* mode corresponds to a block of graphic viewing and the automatic graphic update is disabled.
You can always go from the *Modify* status to the *Enter* status and vice versa, but in TEXT EDITOR, this is only possible when the *Error* mode is not active.

11.11.1 TEXT EDITOR

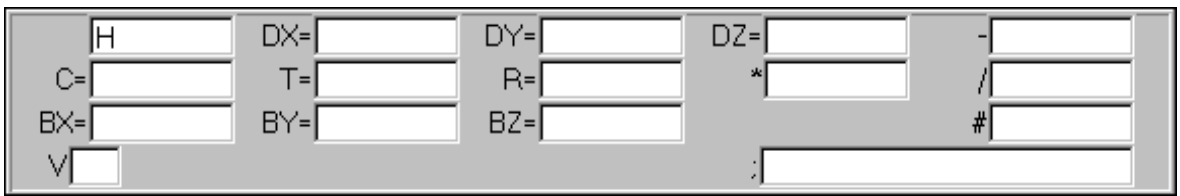
The TEXT EDITOR can in turn be:

- *FREE EDITOR*;
- *GUIDED EDITOR*.

In TEXT EDITOR, when not in *Error* mode, it is always possible to switch from FREE EDITOR to GUIDED EDITOR and viceversa.
The program editor (in text format) uses four windows on screen (*A*, *B*, *C*, *D*) arranged as shown below:



Window *A* always shows the HEADER of the program.
Window *B* is a scrolling window, displaying the program steps.
Window *C* is where you edit the current program steps.
Window *D* contains both the on-line help and the status of the editor.
Window *C* is managed according to the current text editor *(FREE EDITOR / GUIDED EDITOR)*
If the *FREE EDITOR* has been selected, field *C* is a single editable field.
In *GUIDED EDITOR* instead, each individual field of the instruction can be edited:



When in *Modify* mode, as you scroll the program steps in window *B* with the **[🡻]** and **[🡹]** keys, the highlighted instruction is also shown in window *C*, allowing you to edit it.
Press either **[Shift]**+**[F2]** or **[Enter]** to confirm the instruction in field *C*.
If you request the display of the next instruction when you are positioned on the last instruction, the control toggles automatically to *Enter* mode.
When not in *Error* mode, it is always possible to switch between the *Modify* and *Enter* modes.
When in *Enter* mode, confirming a text edited in window *C* causes the addition of the new instruction to the program.
In this mode, when the **[Ctrl]** and **[⇑]** keys are pressed simultaneously an instruction identical to the one which precedes the current position is inserted.
The following functions are available:

- **[F2]** saves the program;
- **[Ctrl]**+**[F2]** save with name;
- **[Shift]**+**[F2]** confirms instruction or value in the editable field;
- **[F3]** HEAD GRAPHICS;
- **[Shift]**+**[F3]** enables/disables *BLOCKS* functions;
- **[F4]** INSTRUCTION LIST (only in *Enter* mode);
- **[Shift]**+**[F4]** PROGRAM LIST (In *Enter* mode it allows to select one or more subprograms to be entered);
- **[F5]** deletes current instruction;
- **[Shift]**+**[F5]** selects/deselects *GUIDED EDITOR*;
- **[F6]** selects/deselects new instruction enter mode;
- **[F7]** MIX EDITOR;
- **[Shift]**+**[F7]** UNDO (currently not available);
- **[F8]** GRAPHIC DISPLAY;
- **[Shift]**+**[F8]** selects assisted programming environment:
    1. BORING OPTIMISATION;
    2. SUCTION CUPS / MULTIFUNCTION TABLE EDITOR
    3. PROGRAM OPTIMISER

WARNING

Inside an editable field, you are always in character entry mode.
When in *Modify* mode, the contents of field *C* which is not confirmed are lost.
All keys have the Repeat function enabled.
The Header of the program cannot be deleted.

11.11.1.1 Other active keys

- **[Ctrl]+[Home]** positions the editor at the beginning of the program
- **[Ctrl]+[End]** positions the editor at the end of the program;
- **[<-]** and **[->]** allow you to move on the string within the current editable field;
- **[Tab]** and **[Shift]**+**[Tab]** move the cursor onto the editable fields one after the other;
- **[Del]** deletes the character to the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string;
- **[End]** moves the cursor to the end of the string;
- **[PgUp]** moves to the previous page of the program;
- **[PgDown]** moves to the following page;
- **[<-|]** deletes the character to the left of the cursor;
- **[Enter]** confirms the entire instruction.

11.11.1.2 BLOCKS

Another TEXT EDITOR operating mode is the *BLOCKS* mode, accessed using **[Shift]+[F3],** where several lines of the program can be selected simultaneously for the *CUT*, *COPY* and *PASTE* (or *MERGE*) functions. In this mode, the *FIND* and *REPLACE* functions for strings are also enabled. The **[Enter]** key or **[Shift]+[F2]** enables and disables the multiple selection (of a block of program lines). The *MERGE* function is useful when copying a block of lines of one program into another program; after selecting and copying (using **[F4]**) the block concerned, the user can simply access editing of the program desired (after saving the old program, if necessary) in the *BLOCKS* mode. After locating the cursor in the desired point, he then just presses **[F6]** (PASTE).
In the *BLOCKS* mode, the functions described below replace those of the *FREE* (and *GUIDED*) EDITOR:

- **[Shift]**+**[F2]** start/end of multiple selection;
- **[F3]** CUT the block (or the line) selected;
- **[F4]** COPY the block (or the line) selected;
- **[F5]** DELETE the block (or the line) selected;
- **[F6]** PASTE the block (or the line) selected;
- **[F8]** FIND a string, from current position down;

- **[Shift]+[F8]** REPLACE a string from current position down;

11.11.1.3 Instruction List

The Instruction List allows you to select an instruction from a list of all permitted instructions (including Graphic Language instructions).
Each instruction has a shortcut (consisting of the first two characters of the line in the list) for faster selection.
The following operations can be performed:

- **[F4]** cancels;
- **[F6]** confirms the selected instruction;

OTHER ACTIVE KEYS

- **[↓]** and **[↑]** scroll the list;
- **[0]-[9]** and **[a]-[z]** allow you to select the instruction having as a shortcut the two characters entered.

11.11.1.4 Graphic display

Provides a graphic display of the work programmed. The current program step is highlighted on the graphic. Passing works are also highlighted with a different colour. The following functions are available:

- **[Shift]+[F2]** ZOOM -. This enables the ZOOM OUT function in the standard graphic display, if some parts of the machining go beyond the margins of the window this enables the whole operation to be seen;
- **[F2]** Zoom +. In display ZOOM OUT resets standard graphics;
- **[F3]** redraws;
- **[F4]** stop, to interrupt endless loops;
- **[F5]** previous step;
- **[F6]** next step;
- **[F7]** graphic display of individual faces;
- **[Shift]+[F7]** enables/disables centre tool trace in radius correction;

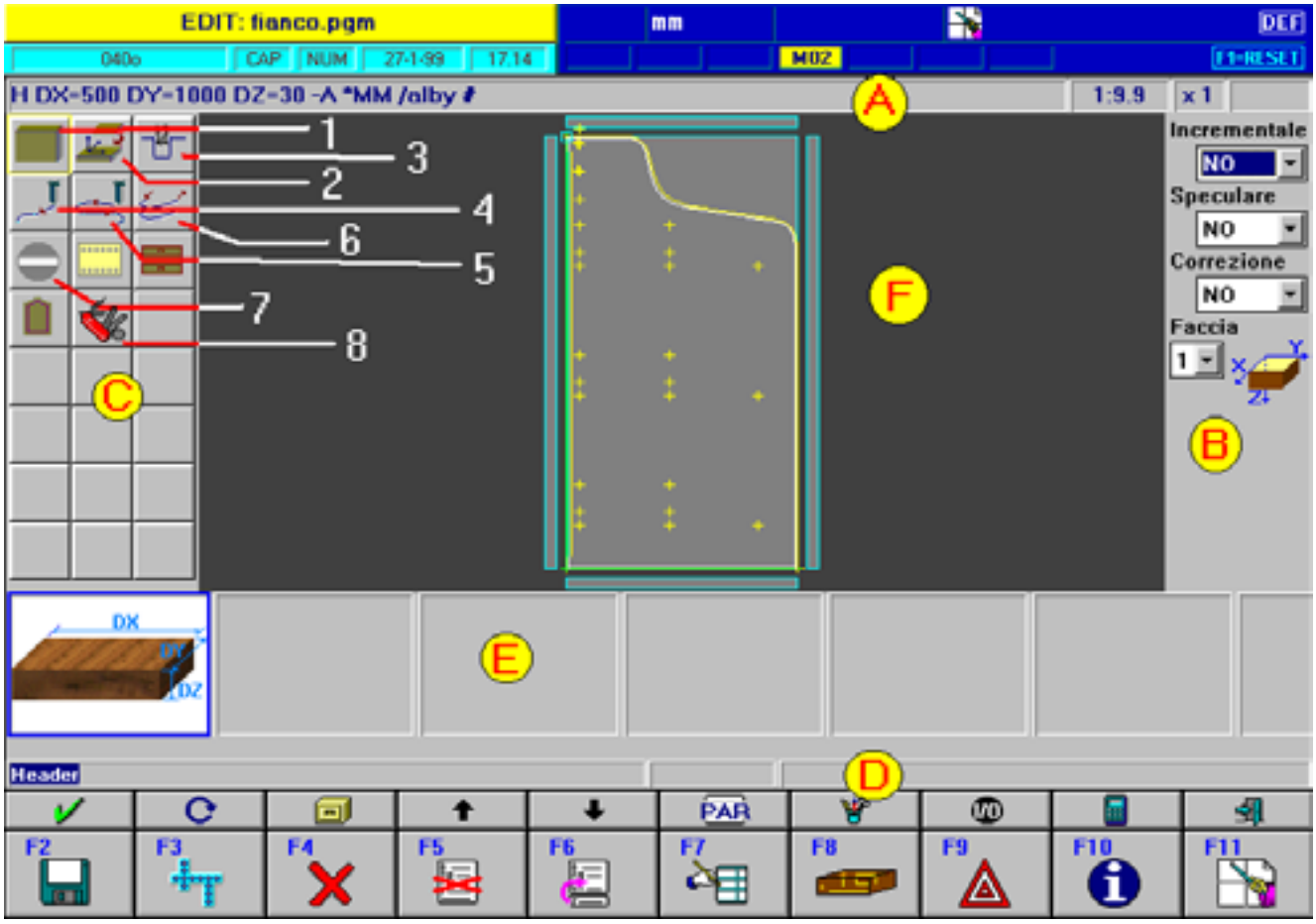
- **[F8]** graphic display of projections on side faces (Only if the graphic is relative to one of the individual faces.)

OTHER ACTIVE KEYS

- **[↓]** and **[↑]** associated to **[F5]** and **[F6]**

11.11.2 GRAPHIC EDITOR

The graphic version of the program editor uses six screen windows (*A*, *B*, *C*, *D*, *E*, *F*) arranged as shown below:



Window *A* is similar to that of *TEXT EDITOR* and also presents, from left to right: the scale value of panel graphic (in window F); the percentage of current

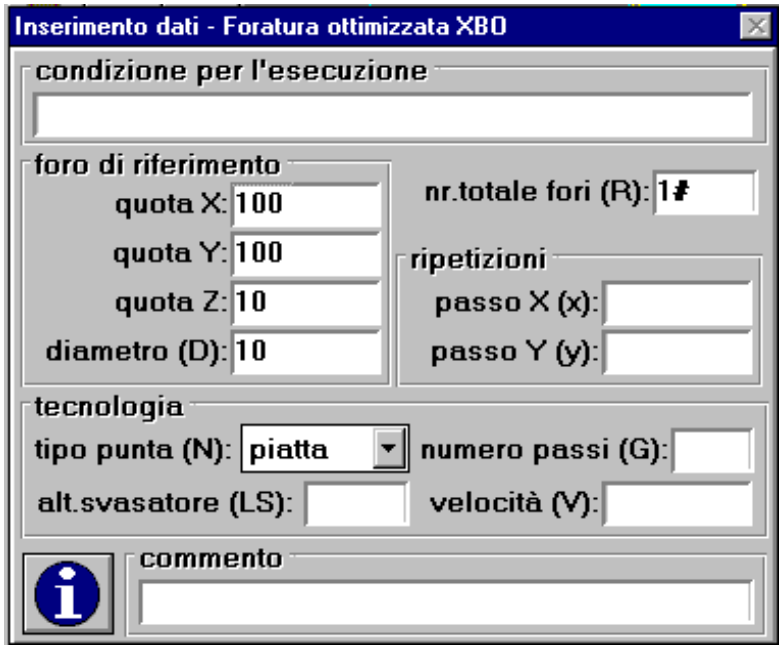
zoom, always relating to the panel graphic; if active, the graphic viewing mode of the side faces (with or without projections of the machining operations on the other faces).
Window *B* highlights the current values of modal programming data (corresponding to modal fields that are common to all extended language instructions). These are: the current work face F; the incremental K in X or Y with an inversion of the path direction of the arcs G (G2 <-> G3); the specular P in X or Y; the correction of tool radius C , right hand, left hand or in depth. (see in PANEL PROGRAMMING and PARAMETRIC PROGRAMMING AND FIXED CYCLES).
Window *C* contains the bitmap describing all the **groups** of instructions available in this editor:

- **1** Program header (H);
- **2** Modal functions and special functions (XO, XS, XPL);
- **3** Boring instructions (XB, XBR, XBO);
- **4** Simple milling instructions (XG0, XL2P, XA2P, XAR, XAR2, XG5, XATP, XG0R, XG1R, XG2R, XG3R, XG5R, XATPR, XN);
- **5** Complex milling functions (XA3P, XSP, XLR, XLU, XRAT, XTAR, XEA);
- **6** Profile Operations (XGIN, XGOUT, XGREP);
- **7** Reserved instructions (that are all the “text” instructions, not editable in the graphic editor);
- **8** Fixed cycles (or macro) user imported by an update of the interface in the 04xx or better version.
- **9** Fixed cycles (or macro) user imported by an update of the interface in the 04xx or better version.

All the other bitmap (if any, o reserved if empty) refer to fixed cycles (or macro) dedicated to operator’s special needs. r
Window *D* is similar to that of TEXT EDITOR.
Window *E* contains all mimics of the instructions belonging to the group highlighted in yellow in window C, and presents the selected instruction in a blue frame. Together with window C, it represents the list of all instructions available in this editor.
Window *F* presents the graphic of the whole program with the machining operation corresponding to the current instruction being highlighted in red.

The programs edited with the graphic editor make an exclusive use of a graphic language which is a subgroup of the text programming language (see in PANEL PROGRAMMING); Anyway All the other instructions (of the text language itself) are interpreted but it is not possible to modify them or enter new ones. Each instruction of graphic type (including the fixed cycles) belong to a precise group (see in FIXED CYCLE ACTIVATION).
In the *Modify* mode, when you scroll the program with the keys **[🡻]** e **[🡹]**, the windows B, C, E and F are automatically updated with the data relating to the current instruction. In particular in window B you can read and modify modal

data only if the current instruction is graphic: after modifying one of these parameters, press **[Enter]** again to make the new condition effective.
In this Editor, contrarily to the TEXT EDITOR, the data insertion table only appears on request through the **[F7]** key function**,** and each instruction in extended language has its own table presenting a complete description of the data to program. Two of the fields are common to all instructions: Condition for execution, which corresponds to the field "IF=" in the TEXT EDITOR and the Comment field which corresponds to the "," field (see in PANEL



PROGRAMMING). For example, the data insertion table for optimised boring reads as follows:
The keyboard and the *mouse* are used to enter data. The keys is **[Shift]**+**[F5] and [Shift]**+**[F6]** allow to scroll the program even with the tables highlighted. **[Enter]** is used to confirm entered data.
The *Enter* status may be accessed (only if the data entry table is displayed) by pressing the key **[F6]** or directly with the *mouse* by selecting firstly a group of instructions from window C, then an instruction from window E. In the first case, the keys**[↓]** and **[↑]** allow to select a different group of instructions (in window C) and the keys **[<-]** and **[->]** allow to scroll the various instructions belonging to the highlighted group; the table is activated by pressing **[F7]**. Whereas selecting with the mouse directly activates the data entry table.
In the *Enter* mode you can modify one of the modal parameters displayed on window B by simply entering new data before selecting a table (even before entering in Enter mode without confirming the change) and confirm only once when all data have been entered in the table relative to the new instruction.

In the *Error* status, (if during programming there was an error), the symbol BLK appears on window B. This symbol is used to warn the programmer that window F will not be updated until refresh key (**[Shift]+[F3]**) has not been pressed. In this case, the programmer is led to correct the error or terminate the operations that have caused the error.
Access to the list of parameters and alias of the program (useful to programming the Conditions for executing the instructions, see in PANEL PROGRAMMING, PARAMETRIC PROGRAMMING AND FIXED CYCLES, instruction PAR and instruction D) can be simply made by recalling the parameter table by pressing **Shift]+[F7]**. If the Editor is not in the *Enter* status, you can still modify the values of the parameters, cancel parameters (with key **[Del]**) or enter new ones (with **[Tab]** key) to scroll the fields and **[Enter]** to confirm the entry.

The available functions are:

- **[F2]** memorises the program on disk;
- **[Ctrl]**+**[F2]** save with name;
- **[Shift]**+**[F2]** validates the data entered for the current instruction, indicating the corresponding graphic segments;
- **[F3]** HEAD GRAPHICS;
- **[Shift]**+**[F3]** refresh;
- **[F4]** stops endless loops;
- **[Shift]**+**[F4]** PROGRAM LIST (which, in *enter* mode, is used to select one or more subprograms to be inserted);
- **[F5]** deletes current instruction. This is eliminated and the next one (if present) is displayed. The graphic display is updated to reflect the new situation.
- **[Shift]**+**[F5]** displays the instruction before the current instruction, showing the corresponding graphic segments. If the current instruction is the first instruction, this key has no effect;
- **[F6]** Enables/Disables *Enter* mode. Graphic display remains unchanged; if the current instruction is the last one, the key has no effect; The graphic representation remains unchanged;
- **[Shift]**+**[F6]** displays the instruction after the current instruction, showing the corresponding graphic segments. If the current instruction is the last instruction, the EDITOR switches to *Enter* mode automatically;
- **[F7]** Enables/disables the data entry table;
- **[Shift]**+**[F7]** Enables the table of parameters and alias;
- **[F8]** Circular selection of graphic viewing modes

of single faces with projections;

- **[Shift]+[F8]** selects assisted programming environment:
  1. BORING OPTIMISATION;
  2. SUCTION CUPS / MULTIFUNCTION TABLE EDITOR
  3. PROGRAM OPTIMISATION.

WARNING:

When in *Modify* mode, the contents of table which are not confirmed are lost.
Inside an editable field, you are always in character entry mode.
All keys have the Repeat function enabled.
The Header of the program cannot be deleted.

11.11.2.1 Other active keys

- **[Ctrl]+[Home]** positions the Editor at the beginning of the program;
- **[Ctrl]+[End]** positions the editor at the end of the program;
- **[Ctrl]+[+]** enables the Zoom function;
- **[Ctrl]+[-]** disables the Zoom function;
- **[<-]** and **[->]** allow you to move on the string within the current editable field;
- **[Tab]** and **[Shift]+[Tab]** move the cursor to the editable fields one after the other;
- **[Del]** deletes the character to the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string;
- **[End]** moves the cursor to the end of the string;
- **[<-|]** deletes the character to the left of the cursor;
- **[Enter]** in *modify* confirms the instruction programmed; in *entry* it confirms the table if present, otherwise it displays the table of instructions used for entry.

11.11.3 HEADS GRAPHICS

Provides a graphic representation of the operating heads together with the faces on which the individual tools can operate. A typical panel is shown, with the number of the tools drawn on the corresponding faces. In addition, the interface displays the installed tool relative to the currently selected tool number.
The active functions are listed below:

- **[↓]** and **[↑]** move the selection to the previous/following tool
  alternatively, you can select the tool directly by entering its number in the corresponding field and pressing the **[Enter]** or the **[Shift]**+**[F2]** keys;
- **[F2]** selects the current tool;
- **[F3]** allows you to highlight all the tools having specific characteristics. A window is opened where you can enter the *Length/Radius* and/or *Diameter/Thickness* to be searched. At the end of the search, the tools found with the required characteristics remain highlighted;
- **[F4]** cancels a previous search and/or manual selection, and deselects the tools;
- **[F5]** repositions the selected tools in the relative field of the instruction currently being edited;
- **[F10]** displays the tooling information for the selected tool. The fields vary according to the case.

The information is read from the current tool-up file.

11.11.4 BORING OPTIMISER

The Boring Optimiser is meant to assist the programming of a series of borings. Its purpose is that of generating boring instructions and choose, based on the current tooling configuration, which and how many bits to use in order to reduce to a minimum the number of strokes, and minimise the total displacement of the boring head.
All the programming lines generated by the optimiser can be modified by the programmer, and are marked by a comment at the end, identifying their position in the sequence.
The optimiser can be used both in TEXT and in GRAPHIC EDITOR mode.
It consists of a full-screen table on which the borings to be optimised are to be programmed. All the fields in the table are modal fields.
The parameters of the table are:

1. R row number (may not be modified);
2. X X co-ord. of the boring, or of the first boring of a row of borings;
3. Y Y co-ord. of the boring, or of the first boring of a row of borings;
4. Z depth of the boring or of all borings on the same row;
5. PX distance in X between a boring and the next;
6. PY distance in Y between a boring and the next;
7. F face on which an operation is to be performed;
8. T tool type (lance, flat, taper);
9. D diameter of boring/s;
10. LS length of taper;
11. N number of borings to be made beginning from the set co-ordinates;
12. SX SX =1: row of borings made specularly to X (referred to the DX edge of the panel);
13. SY SY=1: row of borings made specularly to Y (as above);
14. V boring speed.

The operations that can be performed are:

- **[F2]** optimises and confirms;
- **[Shift]+[F2]** confirms the programmed value;
- **[F3]** deletes one line;
- **[F4]** deletes all the lines between the first line and the current line;
- **[F5]** deletes all the lines from the current line to the last line;
- **[F6]** inserts a line.

When programming a piece, the Boring Optimiser can be recalled more than once. The last values set and confirmed are memorised in a file and are suggested again when the optimiser is called again.
If you press the **[F2]** key before the generation of the code, you can select one of the following optimisation methods (relative to the optimisation of the boring head path only):

1. axis X - axis Y the shortest route is searched following first an horizontal route and then a vertical route;
2. axis Y - axis X the shortest route is searched following first a vertical route and then an horizontal route;
3. diagonal the search is carried out along a diagonal route.

The **[F5]** key can also be used to set a precision percentage for the analysis of the best stroke condition. The higher the precision, the less is the number of strokes (and therefore instructions) produced by the optimiser, but the

optimisation algorithm takes a longer time. Even a percentage below 50% results in a good level of optimisation in an acceptable time.

11.11.4.1 Other active keys

- **[<-]** and **[->]** **[🡻]** , **[🡹]** scroll the table;

11.11.5 GRAPHIC PROGRAMMING OF CROSSBEAMS AND SUCTION CUPS

(Only if the work table of the machine is formed by crossbeams and suction cups)
This environment displays a graphic representation of the panel support of the machine, together with the corresponding crossbeams and suction cups, while the panel being machined is drawn in the programmed area
The home positions of crossbeams and suction cups are read from the configuration file SUPPORTS.CFG. One crossbeam and one corresponding suction cup always appear highlighted.
The following operations can be performed:

- **[F2]** confirms the programming and exits;
- **[Shift]+[F2]** confirms the values set in the editable fields;
- **[F3]** enables / disables Zoom function;
- **[F4]** stops any endless loops that may occur when drawing the machined panel;
- **[Shift]+[F4]** (only for TVS) self-tutorial readings of crossbeams and suction cups(as positioned in the machine);
- **[F5]** selects the previous suction cup;
- **[Shift]+[F5]** moves up the selected suction cup;
- **[F6]** selects the next suction cup;
- **[Shift]+[F6]** moves down the selected suction cup;
- **[F7]** selects the previous crossbeam;
- **[Shift]+[F7]** moves left the selected crossbeam;
- **[F8]** selects the next crossbeam;
- **[Shift]+[F8]** moves right the selected crossbeam.

Alternatively, it is possible to program positioning movements by specifying the positions in the corresponding editable fields and confirming them with the **[Enter]** key. It is also possible to modify directly the displacement step shown in field *S* (in mm). Fields *X* and *Y* represent the position of the current suction cup,

referred to the origin of the piece. *X* and *Y* are affected by specular programming, but not by incremental programming.

In Text Editor, confirming the programming of supports and suction cups is equivalent to the generation of the following instructions:

- VT
- series of VROW
- ENDVT

In Graphic Editor these instructions are not visible, but the set programming remains active.

11.11.5.1 Other active keys

- **[<-]** and **[->]** move the crossbeams;
- **[🡻]** , **[🡹]** move the suction cups;
- **[Tab]** and **[Shift]**+**[Tab]** move the cursor recursively through all editable fields;
- **[Del]** deletes the character to the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string.
- **[End]** moves the cursor to the end of the string;
- **[<-I]** deletes the character to the left of the cursor;
- **[Enter]** associated to **[Shift]+[F2]**.

11.11.6 PROGRAM OPTIMISATION

The following functions are available:

- **[F4]** get out of program optimiser

[F6] confirm data input

Two modes of program optimisation are available in this environment they can be used simultaneously and are opened by PGM Editor:

- SEQUENTIAL Optimisation: this reorganises the order of machining in the program so that operations requiring the same tool follow one another.

TOOL CHANGE Optimisation: this reorganises the order of machining in the program in order to minimise the number of tool changes between one machining and another; **only effects SO instructions in the program.**

Both optimisation methods can be carried out, SEQUENTIAL optimisation is carried out first followed by TOOL CHANGE.
The method of optimisation is chosen in the relative *checkbox* in the window. Using the field *Name File Optimised*, you can choose the file name (max 8 characters, without extension) containing the result of the optimisation chosen.
Press the confirm key to start up the required optimisation session.
The optimised file is catalogued in the current directory under the specified name and can be edited and run as a normal program.

11.11.6.1 OPTIMISING TOOL CHANGE

Tool change optimisation changes the order of machining in order to minimise the numbr of tool changes required between one machining operation and another.

WARNING!
The tool change optimisation only effects SO instructions in the main program.

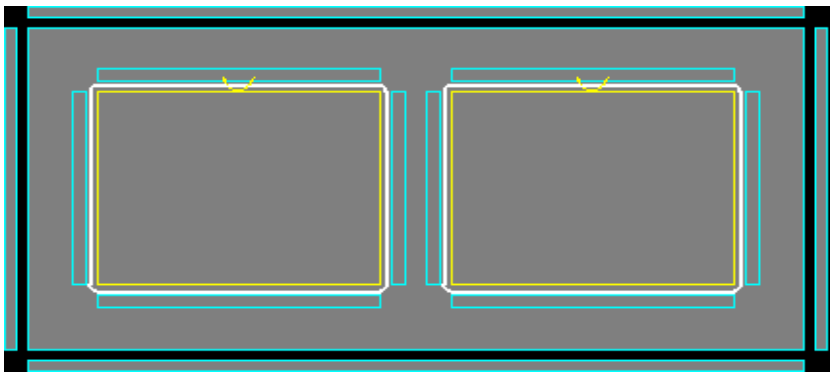
Example:

The TEST_1 program carries out the trimming of a panel in two stags, roughing using tool E1 and finishing with tool E2.

```
H DX=400 DY=300 DZ=20 -A C=0 T=0 R=1 *MM /"def"
; Roughing
C =2
GIN G=2
G0 X=DX/2 Y=0 N="PROF" T=101
G1 X=DX
G1 Y=DY
G1 X=0
G1 Y=0
G1 X=DX/2
GOUT
; Finishing
GREP N="PROF" T=102
```

The MAIN_1 program retrieves TEST_1 program for trimming two distinct panels.

```
H DX=1100 DY=500 DZ=20 -A C=0 T=0 R=1 *MM /"def"
SO /"test_1" BX=100 BY=100
SO /"test_1" BX=600 BY=100
```



Without optimisation, the MAIN_1 program machines the left hand panel first with tool E1 and then with E2. It then machine the right hand panel first with tool E1 and then with E2. A total of 4 tool changes are required (3 if in E1 is already on the spindle at the start).
By requesting just the tool change optimisation the program is generated

```
H DX=1100 DY=500 DZ=20 -A C=0 T=0 R=1 *MM /"def"
;Frame 0 - Block 0 - Tool 101
REF DX=400 DY=300 DZ=20 FLD=A BX=100 BY=100 BZ=0
O X=0 Y=0 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 T=101 N="PROF"
G1 X=400 Y=0 Z=0
G1 X=400 Y=300 Z=0
G1 X=0 Y=300 Z=0
G1 X=0 Y=0 Z=0
G1 X=200 Y=0 Z=0
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 0 - Tool 101
REF DX=400 DY=300 DZ=20 FLD=A BX=600 BY=100 BZ=0
O X=0 Y=0 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 T=101 N="PROF"
G1 X=400 Y=0 Z=0
G1 X=400 Y=300 Z=0
G1 X=0 Y=300 Z=0
G1 X=0 Y=0 Z=0
G1 X=200 Y=0 Z=0
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 1 - Tool 102
REF DX=400 DY=300 DZ=20 FLD=A BX=600 BY=100 BZ=0
O X=0 Y=0 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 V=1000 S=18000 T=102 N="PROF"
G1 X=400 Y=0 Z=0 V=1000
G1 X=400 Y=300 Z=0 V=1000
G1 X=0 Y=300 Z=0 V=1000
G1 X=0 Y=0 Z=0 V=1000
G1 X=200 Y=0 Z=0 V=1000
```

```
GOUT G=2 R=2 Q=0 L=0
;Frame 0 - Block 1 - Tool 102
REF DX=400 DY=300 DZ=20 FLD=A BX=100 BY=100 BZ=0
O X=0 Y=0 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 V=1000 S=18000 T=102 N="PROF"
G1 X=400 Y=0 Z=0 V=1000
G1 X=400 Y=300 Z=0 V=1000
G1 X=0 Y=300 Z=0 V=1000
G1 X=0 Y=0 Z=0 V=1000
G1 X=200 Y=0 Z=0 V=1000
GOUT G=2 R=2 Q=0 L=0
```

The optimised program carries out the machine in the following sequence:

1. Roughing left panel with tool E1
2. Roughing right panel with tool E1
3. Finishing right panel with tool E2
4. Finishing left panel with tool E2

requiring a total of 2 tool changes (1 if E1 is already on the spindle at the start); this process also obtains secondary optimisation of head transfer.

11.11.6.2 SEQUENTIAL OPTIMISATION

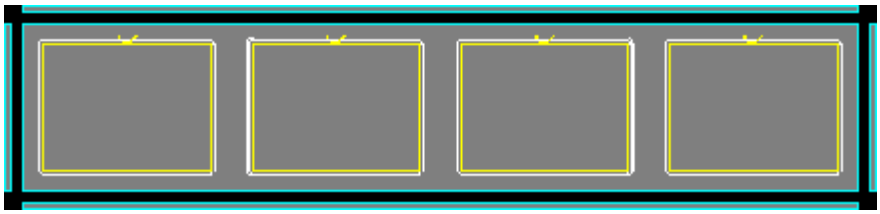
Sequential optimisation reorganises the machining order in the program so that operations using the same tool follow on from each other.

Example:

The program TEST_2 carries out the trimming of a certain number of panels (4 in the example) in two stages: roughing using tool E1 and finishing using tool E2.

```
H DX=2000 DY=400 DZ=20 -AB C=0 T=0 R=1 *MM /"def"
PAR Num =4
PAR OffsetY =0 " "
L MyDX =400
L MyDY =300
L Cnt  =0
DO
   O X=50+500*Cnt Y=50+OffsetY
   ; Roughing
   C =2
   GIN G=2#
   G0 X=MyDX/2 Y=0 N="PROF" T=101
   G1 X=MyDX
   G1 Y=MyDY
   G1 X=0
   G1 Y=0
```

```
   G1 X=MyDX/2
   GOUT
   ; Finishing
   GREP N="PROF" T=102
   ;
   L Cnt =Cnt+1
   IF Cnt=Num EXIT
OD
```



If carried out without optimisation TEST_2 program machines the panels from left to right using for each panel first tool E1 and then E2; requiring a total of 8 tool changes (7 if E1 is already in the spindle at the start).
Br requesting only the sequential optimisation obtains the generation of the program.

```
H DX=2000 DY=400 DZ=20 -AB C=0 T=0 R=1 *MM /"def"
;Frame 1 - Block 1 - Tool 101
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=50 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 T=101 N="PROF"
G1 X=400 Y=0 Z=0
G1 X=400 Y=300 Z=0
G1 X=0 Y=300 Z=0
G1 X=0 Y=0 Z=0
G1 X=200 Y=0 Z=0
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 3 - Tool 101
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=550 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 T=101 N="PROF"
G1 X=400 Y=0 Z=0
G1 X=400 Y=300 Z=0
G1 X=0 Y=300 Z=0
G1 X=0 Y=0 Z=0
G1 X=200 Y=0 Z=0
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 5 - Tool 101
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=1050 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 T=101 N="PROF"
G1 X=400 Y=0 Z=0
G1 X=400 Y=300 Z=0
G1 X=0 Y=300 Z=0
G1 X=0 Y=0 Z=0
G1 X=200 Y=0 Z=0
```

```
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 7 - Tool 101
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=1550 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 T=101 N="PROF"
G1 X=400 Y=0 Z=0
G1 X=400 Y=300 Z=0
G1 X=0 Y=300 Z=0
G1 X=0 Y=0 Z=0
G1 X=200 Y=0 Z=0
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 2 - Tool 102
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=50 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 V=1000 S=18000 T=102 N="PROF"
G1 X=400 Y=0 Z=0 V=1000
G1 X=400 Y=300 Z=0 V=1000
G1 X=0 Y=300 Z=0 V=1000
G1 X=0 Y=0 Z=0 V=1000
G1 X=200 Y=0 Z=0 V=1000
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 4 - Tool 102
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=550 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 V=1000 S=18000 T=102 N="PROF"
G1 X=400 Y=0 Z=0 V=1000
G1 X=400 Y=300 Z=0 V=1000
G1 X=0 Y=300 Z=0 V=1000
G1 X=0 Y=0 Z=0 V=1000
G1 X=200 Y=0 Z=0 V=1000
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 6 - Tool 102
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=1050 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 V=1000 S=18000 T=102 N="PROF"
G1 X=400 Y=0 Z=0 V=1000
G1 X=400 Y=300 Z=0 V=1000
G1 X=0 Y=300 Z=0 V=1000
G1 X=0 Y=0 Z=0 V=1000
G1 X=200 Y=0 Z=0 V=1000
GOUT G=2 R=2 Q=0 L=0
;Frame 1 - Block 8 - Tool 102
REF DX=2000 DY=400 DZ=20 FLD=AB BX=0 BY=0 BZ=0
O X=1550 Y=50 Z=0
C=2 S=0
GIN G=2 R=2 Q=0
G0 X=200 Y=0 Z=0 V=1000 S=18000 T=102 N="PROF"
G1 X=400 Y=0 Z=0 V=1000
G1 X=400 Y=300 Z=0 V=1000
G1 X=0 Y=300 Z=0 V=1000
G1 X=0 Y=0 Z=0 V=1000
G1 X=200 Y=0 Z=0 V=1000
```

```
GOUT G=2 R=2 Q=0 L=0
```

The optimised program carries out the machining in the following sequence:

1. Roughing all panels from left to right with tool E1
2. Finishing all panels from left to right with tool E2

Requiring a total of 2 tool changes (1 if E1 is already in the spindle at the start).

11.11.6.3 TOOL CHANGE AND SEQUENTIAL OPTIMISATION

Tool change and sequential optimisations can be combined to obtain the advantages of both.

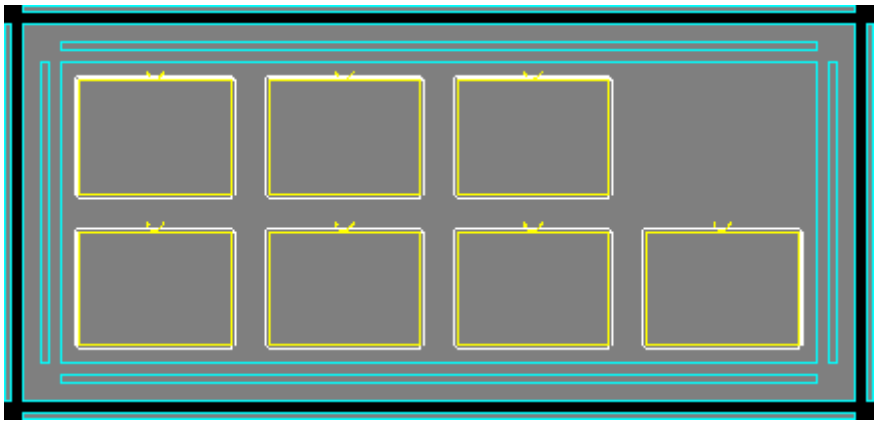
WARNING!

Tool change optimisation only has an effect on SO instructions in the main program.
When carrying out combined optimisation, start with the sequential and then tool change.

Example:

The MAIN_2 program retrieves TEST_2 program to trim two rows of panels.

```
H DX=2200 DY=1000 DZ=20 -AB C=0 T=0 R=1 *MM /"def"
SO /"test_2" DX=2000 DY=800 BX=100 BY=100 Num=3
SO /"test_2" DX=2000 DY=800 BX=100 BY=100 OffsetY=400
```



By requesting both methods of optimisation (sequential and tool change) you obtain the generation of an optimised program (not illustrated here) which first carries out the roughing of all panels with tool E1 and then finishes all panels with tool E2 also optimising head transfer.

11.12 MIX EDITOR (MIX LIST)

MIXes are sequences of instructions, each representing a program.
A MIX LIST is identical to a PROGRAM LIST, except for the types of program that can be processed, which in this case are:

- **MIX**
  This is the standard format of the program lists developed in MIX EDITOR. The functions available are:
  - edit;
  - delete;
  - copy;
  - rename;
  - export to XXL format.
- **FRZ**
  This is the format of MIXes that have been interrupted during their execution in AUTOMATIC MIX. The functions available are:
  - delete;
  - copy;
  - rename;
- **XXL**
  This is the *ASCII* format of the programs developed in MIX EDITOR. These programs can be edited with any text editor. The functions available are:
  - delete;
  - copy;
  - rename;
  - import to MIX format.

The functions available are the same as those in the PROGRAM ARCHIVE with the exception of the following : **[F7]** allows access to the PROGRAM editor environment. If the currently selected line contains a parametric type PGM program , by pressing **[Shift]**+**[F7]** a table opens containing the list of program parameters, showing, for each parameter, its default value, a comment and

description. The table also contains a column which can be edited which is for defining the parameter values when the program is called up by the MIX.

11.13 MIX EDITOR

The functions provided by this environment closely resemble the functions in PGM EDITOR.
The functions available here are:

- **[F2]** Saves the program on disk;
- **[Shift]+[F2]** Confirms the instruction;
- **[F3]** Selects a MIX step from the PGM LIST;
- **[Shift]+[F3]** enables/disables *BLOCKS* functions;
- **[F4]** INSTRUCTION LIST (only in *Enter* mode);
- **[Shift]+[F4]** MIX LIST;
- **[F5]** deletes current instruction;
- **[Shift]+[F5]** selects / deselects the *GUIDED EDITOR*;
- **[F6]** selects/deselects new instruction enter mode;
- **[F7]** PGM; EDITOR
- **[Shift]+[F7]** opens the parameter table for the currently selected PGM.

Multiple selection of mix steps from the PROGRAMS ARCHIVE (key **[F3]**) is enabled.

11.13.1.1 OTHER ACTIVE KEYS

- **[<-]** and **[->]** allow you to move on the string within the current editable field;
- **[Tab]** , **[Shift]+[Tab]** move the cursor recursively through all editable fields
- **[Del]** deletes the character to the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string;
- **[End]** moves the cursor to the end of the string;
- **[PgUp]** moves to the previous page of the program;
- **[PgDown]** moves to the next page of the program;
- **[<-|]** deletes the character to the left of the cursor;
- **[Enter]** confirms the entry of the edited value in the current field. If the field is the last, it confirms the entire instruction.

11.14 SERVICES

The functions available are:

- **[Shift]+[F2]** RESTORE function;
- **[F2]** BACKUP function;
- **[F3]** TOOL-UP CONFIGURATION EDITOR;
- **[F4]** PARAMETER EDITOR;
- **[F5]** LANGUAGE AND UNIT OF MEASUREMENT;
- **[F6]** DATE AND TIME;
- **[F7]** FORMATS FLOPPY DISK;
- **[F8]** Report Editor.
- **[Shift]+[F8]** Setting operator name.

11.15 BACKUP AND RESTORE FUNCTIONS

The BACKUP function (**[F2]**) allows the user to make a copy on disk or tape (or on the network) of all the files contained in the *Xilog³MMI - RoutoLink* main directories. The backup function includes all the files contained in all the subdirectories of the main directories, except in the case of configuration files.
The main directories are:

- PGM for the programs;
- MIX for the mixes;
- TLG for the toolings;
- CFG for the configuration files.

The user may choose whether to perform a selective Backup (for example, of the programs only) or a complete Backup.
If the floppy disk unit is selected, it is not possible to make a BACKUP copy of the files which exceed the capacity of the floppy disk. This is because the files are copied onto the selected disk unit without being compressed. When the space available on the disk runs out, the user is prompted to insert a new disk in the BACKUP unit.

The RESTORE function (**[Shift]**+**[F2**]) allows the files previously saved in a BACKUP session to be returned to the hard disk.
If the floppy disk unit is selected, since the disks are not automatically catalogued, the user must take care to insert all the disks containing the BACKUP copy, one at a time (regardless of order) when carrying out the RESTORE procedure. When the RESTORE procedure has been completed on each disk, the system prompts the user to insert a new disk (if the file is not yet complete).

11.16 SETTING TIME AND DATE

Allows the system time and date to be changed. As well as these, the number of hours for which the application *Xilog³MMI-RoutoLink* has been used is also displayed .
If the N. C. is NUM®, and if enabled, there is also a section showing the date the N. C. battery was changed.
If this section is present, after changing the N.C. battery, insert the date in the various fields.

11.17 FORMATTING A FLOPPY DISK

In the Windows 95‡ operating system, the formatting window is the standard one of the MS-DOS® system, and so once the operation is complete, the window has to be closed using the mouse or by pressing the **[Alt]** and **[F4]** keys simultaneously.

11.18 PARAMETER EDITOR

The following configuration files can be edited:

(main file)
- XILOG3.CFG contains general data;

(software configuration files)
- BCR.CFG contains the data of the BCR;
- CAD.CFG contains data necessary to the DXF import configuration environment.
- COUNTRY.CFG describes the available languages and units of measurement.
- PASSWD.CFG activates and configures the access passwords to the various environments;
- RS232.CFG configures the serial ports;

(machine parameters files)
- AXIS.CFG configures groups of parameters in the C.N;
- FIELDS.CFG configures the work fields of the machine;
- GENDATA.CFG contains the general data of the machine;
- PARAMS.CFG contains all the parameters of the numerical control;
- PHEADS.CFG configures the operating heads;

‡ MS-DOS and Windows 95 are registered trademarks of Microsoft™ Corp.

- SPINDLES.CFG configures the spindles of the boring unit;
- STOREPOS.CFG describes the tool magazines;
- XZONE.CFG configures the X zone of the machine;
- YZONE.CFG configures the Y zone of the machine;
- SUPPORTS.CFG configures crossbeams and suction cups (if installed)
- VACUUM.CFG offset of suction cups (automatic version only)

The files COUNTRY.CFG, PASSWD.CFG, PARAMS.CFG and VACUUM.CFG can be edited with a FREE EDITOR. For all other files, a TABLE EDITOR is available.

- **[F5]** Prints selected configuration file

WARNING
Changing the configurations set by the manufacturer may cause serious malfunctions to the machine!

11.18.1 FREE EDITOR

This is a text editor that accepts all inputs from the keyboards and allows selection, cut and paste of edited areas with the mouse.
To enter a new line, press **[Ctrl]**+**[Enter]**.
The following functions are available:

- **[F2]** saves the information;
- **[F3]** cuts the area selected with the mouse;
- **[F4]** copies the area selected with the mouse;
- **[F6]** pastes the area selected with the mouse.

11.18.2 TABLE EDITOR

This editor shows a series of editable fields containing the data for the current element. The first field contains the number or the name of the element (for example, in FIELDS.CFG, the elements are the machine fields and their names are *A, B, C,* and *D)*. Each element can have more than one page.

Files GENDATA.CFG and XILOG3.CFG have a single element and one page only.
Each single page for each single element must be saved.
The functions available are:

- **[F2]** saves the current table;
- **[F4]** resets all fields of the current table:
- **[F5]** displays the information relative to the previous tool;
- **[F6]** displays the information relative to the next tool;
- **[F7]** displays the previous page (if there is one);
- **[F8]** displays the next page (if there is one);

11.18.2.1 Other active keys

- **[<-]** and **[->]** allow you to move within the field;
- **[🡻]** , **[🡹]** associated to **[F5]** and **[F6]**;
- **[PgUp]** and **[PgDown]** associated to **[F7]** and **[F8]**;
- **[Tab]** and **[Shift]**+**[Tab]** move the cursor recursively through all editable fields;
- **[Del]** deletes the character to the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string.
- **[End]** moves the cursor to the end of the string;
- **[<-I]** deletes the character to the left of the cursor;

11.19 TOOLING EDITOR (TOOLING LIST)

The program shows a list of tooling files from which you can select one for editing. The procedure and the functions available from **[F2]** and **[F6]** are similar to the PROGRAM LIST. If the required file does not exist, you must confirm the creation of a new file before you can access the editing environment proper. Press **[F7]** to make the selected file the current tooling file.

11.20 TOOLING EDITOR

The editor appears as a series of editable fields, containing information for the current tool. The first field contains the number of the tool. There are two classes of tools:

- fixed tools, numbered 1 to 96 (the ones fitted on the machine boring head);
- magazine (or external) tools, numbered E1 to E96.

The structure of the editor varies according to the type of tool that you want to configure. As to fixed tools, if the interface does not allow for editing the parameters of a tool, this means that the spindle relative to that tool is not present.
As to external tools, press **[Enter]** or **[Shift]**+**[F2]** after entering the type descriptor in the relevant field, to display the required tool type table (which are: P = Boring bit, F = Flute mill, D = disk mill).
It is necessary to save the information for each individual tool.
To display the information for other tools, enter the number of the required tool in the relevant field and press **[Enter]** or **[Shift]**+**[F2]**.

The available functions are:

- **[F2]** saves the current table;
- **[F3]** HEADS GRAPHIC;
- **[F4]** resets all the fields of the current table;
- **[F5]** displays the data for the previous tool;
- **[F6]** displays the data for the next tool;
- **[F7]** copy the parameters of another tool.

11.20.1 OTHER ACTIVE KEYS

- **[<-]** and **[->]** allow you to move within the field;
- **[🡻]** , **[🡹]** associated to **[F5]** and **[F6]**;
- **[Tab]** and **[Shift]**+**[Tab]** move the cursor recursively through all editable fields;
- **Del]** deletes the character to the right of the cursor;
- **[Home]** moves the cursor to the beginning of the string.
- **[End]** moves the cursor to the end of the string;
- **[<-I]** deletes the character to the left of the cursor;

11.21 REPORT EDITOR

This function can be used to display in a table the information contained in the files with .DIA and .PRO extensions, containing respectively the diagnostic and production reports. These files are edited during the automatic mode machining (AUTOMATIC MIX or AUTOMATIC PGM) of *Xilog³MMI - RoutoLink*, for a more detailed account of the rules used to compile them and for a better understanding of the meaning of the data they contain, see the chapter headed 'THE REPORT FILE'.

On entering this environment the classic open file window is seen which, by default, allows .PRO type files to be opened inside the «Xilog\Report\yyyy» directory where «yyyy» is the current year and represents the sub directory where the report files are created and saved.

Having chosen a file, this is opened and converted from the ASCII internal file format into a table to give a better display of the information contained in the file. Each column of the table therefore represents a single piece of data from the open report.

The functions available are the following:

- **[F4]** o **[ESC]** close the Report Editing environment and return to the SERVICES MENU;
- **[F5]** print the report currently open;
- **[F6]** open a new report file;

11.22 INPUTTING OPERATOR NAME

The name of the operator who will carry out the operation can be input using this function. A maximum of number of 16 characters can be used. The name will be used during the production of the diagnostic and production reports. When Xilog³/RoutoLink is loaded (machine power-up) the operator name is cancelled.

12. MACHINE PARAMETERS

To access the Parameter Editor from the **MAIN MENU,** press first the **[F8]** key to access the **SERVICES** page, and then the **[F4]** key. A list of parameters is displayed for selection with the up and down arrow keys (**[↓] [↑]**):

- **AXIS.CFG** configures groups of parameters in the C.N;
- **XILOG3.CFG** contains the main general data;
- **FIELDS.CFG** configures the work fields of the machine;
- **GENDATA.CFG** contains additional general data for the machine;
- **PARAMS.CFG** contains all the parameters of the numerical control;
- **PHEADS.CFG** configures the operating heads;
- **SPINDLES.CFG** configures the spindles of the boring unit;
- **SUPPORTS.CFG** configures cross beams and suction cups.
- **STOREPOS.CFG** describes the tool magazines;
- **XZONE.CFG** configures the X zone of the machine;
- **YZONE.CFG** configures the Y zone of the machine;
- **VACUUM.CFG** offset of crossbeams and suction cups. This parameter is to be entered if the supports calibration is not correct (TVS only).

Press **[Enter]** or **[F6]** to edit the selected file.

PLEASE NOTE

All the parameters which express offsets or positions are always expressed in millimetres (even when the control is set to inches).
With the exception of «PHEADS.CFG» and «SPINDLES.CFG», all the parameters which express general offsets refer to the machine parameters origin; this origin is set by the machine constructor and is found at the («**machine_0-O X Offset**»,« **machine_0-O Y Offset**»,« **machine_0-O Z Offset**») position programmed in «XILOG3.CFG»:
All the offsets contained in «SPINDLES.CFG» refer to boring spindle n. 1 (and so this spindle must have all offsets to zero).
All the offsets contained in «PHEADS.CFG» refer to the main head (and so this head must have all offsets to zero); the main head is defined by the machine constructor in the «**Reference head no. (1-9)**» parameter of «XILOG3.CFG».

12.1 AXIS.CFG

Contains a series of Numerical Control parameters divided into sections. Certain sections and parameters described below may not be present as the structure of the sections and parameters depends on the machine type.

12.1.1 AXIS X, AXIS Y, AXIS Z

These sections contain the parameters for the linear axes X, Y and Z.

Minimum Limit (micron), Maximum Limit (micron):

Defines the axis travel limits. Used to limit software travel in the measurement space.

Sizing Measure (micron):

Used to set the measurement origin (ORPOM) of an axis within or outside the travel limits.

Maximum Speed (mm/min):

Used to define the maximum axis traverse rates.

Standard Acceler. (mm/s^2), Jog Acceleration (mm/s^2):

Used to define the maximum permissible accelerations for each of the axes.

Pursuit Error (micron):

Defines the maximum permissible following error for each axis.

Servo system loop gain:

Defines the coefficient used by the CNC to calculate the reference supplied to the servo-drive according to the following error.

MULTI, DIVI:

Adapts the measurement supplied by the position encoder to the internal CNC measurement.

Reversal clearance (micron):

Used to correct positioning errors due to backlash.

Locking window (micron):

A distinction is made between two cases:
For stopping an axis at the end of movement, defines the following error threshold below which the CNC considers the movement to be finished.
At the end of a block including function G9, defines the following error threshold below which the CNC considers the movement in the block to be finished.

Dynamic movement control:

Used each sample (RTC in P50) to compare the real speed of an axis with its theoretical speed deduced from the following error.

12.1.2 AXIS A, AXIS B, AXIS C

These sections contain the parameters for the rotating (or goniometric) axes A,B and C.

Minimum Limit (1/10000deg), Maximum Limit (1/10000deg):

see “AXIS X”.

Sizing Measure (1/10000deg):

see “AXIS X”.

Maximum Speed (deg/min):

see “AXIS X”.

Standard Acceler. (deg/s^2), Jog Acceleration (deg/s^2):

see “AXIS X”.

Pursuit Error (1/10000deg):

see “AXIS X”.

Servo system loop gain:

see “AXIS X”.

MULTI, DIVI:

see “AXIS X”.

Reversal clearance (1/10000deg):

see “AXIS X”.

Locking window (1/10000deg):

see “AXIS X”.

Dynamic movement control:

see “AXIS X”.

12.1.3 AXIS F

Minimum Limit (micron):

End of travel – of the boring machine Y axis (see in «AXISX»).

Maximum Limit (micron):

End of travel – of the boring machine Y axis (see in «AXISX»).

12.1.4 GEN1

Measured axes:

Used to declare the measured axes of the machine and check for the presence of spindle and handwheel interfaces.
The bit position gives the physical axis address. The bit is a 1 to declare the axis as measured.

Servo control.-interpol. axes:

Used to declare servo-controlled and interpolated axes.
The bit position gives the physical axis address.

Axis measurement direction:

Used to define the direction of axis measurement.
The bit position gives the physical axis address.
If the bit is a zero, the encoder for the corresponding axis is mounted in the forward direction (the «measurement step» supplied by the encoder increases as the tool moves in the positive direction of the axis).
If the bit is a 1, the axis encoder is reverse-mounted (the measurement decreases as the tool moves in the positive direction).

Homing direction:

Defines the direction from which the datum switch is approached in homing mode.
Inhibits the switch status test on axes which do not have a datum switch.

Direction axis speed reference:

Used to reverse the direction of the axis speed reference sent to the axis servo-drive.
The bit position gives the physical axis address.
If the bit is a 1, a positive speed reference applied to the servo-drive results in a negative movement of the axis.

Servo loop time constant:

Defines the position servo-loop time constant.

Displayed Axes:

Defines the axes displayed on the INFO and AXIS pages.

Axis-unit combination:

Used to associate the symbolic axis names with the physical addresses and groups.

Programme recall, Programme:

Used to assign a subroutine number to a miscellaneous M function.

12.1.5 GEN2

Baud Rate Com1 CNC:

Sets the line assigned to the PLC link.

Check axis limit switches:

Enables (if set to 1) / Disables (if set to 0) control of the axis end of travel switches when the machining operations are displayed graphically, in the program editor.

G9:

Enables (if set to 1) / Disables (if set to 0) the generation of a «G9» instruction in the ISO file. «G9» represents exact stop at the end of the block before connecting to the next block.

12.1.6 HOOD

Configures the extractor hood.

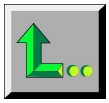
Position Z1,.., Position Z8:

Containing the suction hood strokes.
Each stroke is considered as a offset on the Z axis between the point where the hood projects most and the corrected base of a fixing cone installed on the electric spindle; up to eight strokes can be specified and the list is considered to have finished on the first stroke with value zero.
If the hood position is not specifically stated (Field E) in the instructions which use the electric spindle, the position corresponding to the most suitable stroke, in relation to the usable length of the tool, is automatically enabled (only for Face 1).

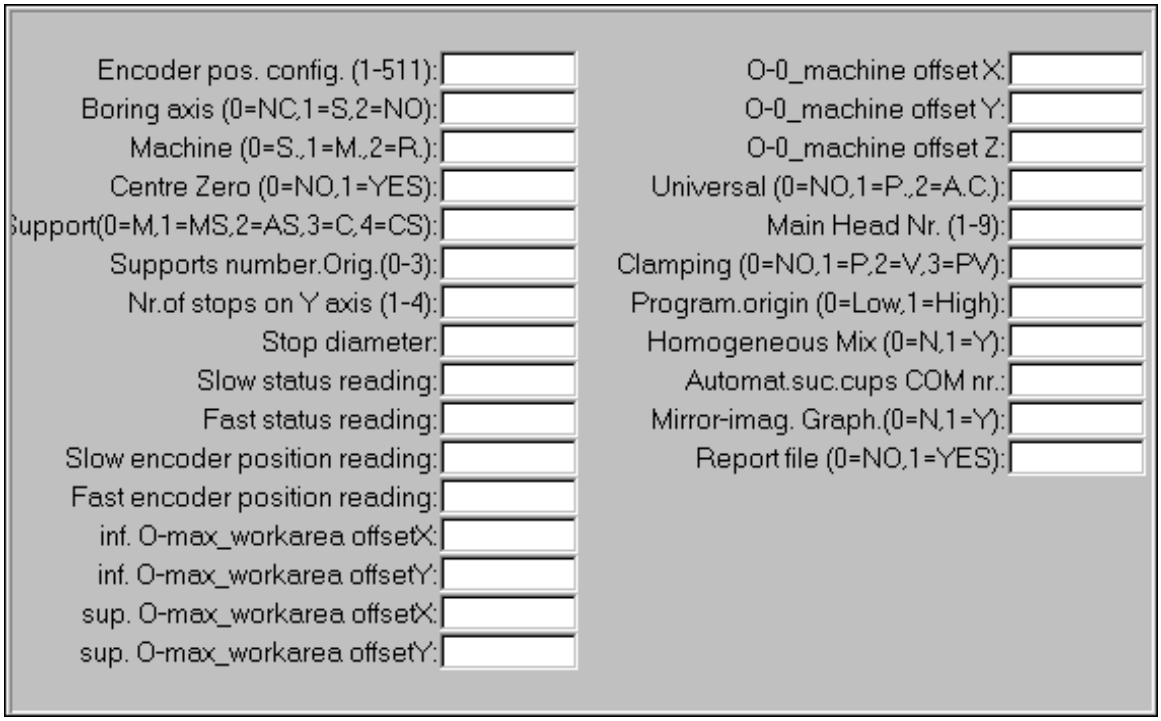
Axis:

Defines the type of hood:

- 0 discrete axis;
- 1 continual axis.



12.2 XILOG3.CFG



Encoder pos. config.:

is an integer obtained from the binary format and determines which axis position is shown in the relative windows:

bit = 1 axis present;
bit = 0 axis not present.

	C	B	A	W	V	U	Z	Y	X	
short (16 bit)	0	0	0	0	0	0	0	1	1	= **71**
	0	0	0	0	0	0	1	1	1	= **263**

In the *Xilog³MMI* configuration the system interprets the presence of axis A with the presence of the VECTOR. In the *RoutoLink* version the presence of axis C with the presence of the VECTOR

Boring axis (0=NC,1=S,2=NO):

configures the type of axis that commands the fixed boring unit:

0. N.C. axis
1. independent axis controlled serially (on the «EVER» model boring machine);
2. machine with no fixed boring unit.

Machine (0=S,1=M,2=R):

is a code (protected) to identify the machine constructor:

- 0 = Scm;
- 1 = Morbidelli;
- 2 = Routech.

Centre zero (0=NO,1=YES, 12=SI with 2 real areas):

- 0 = A machine without a central zero and therefore with 2 stops along the X axis which identify 2 x «Number of Y axis stops» work fields (or areas) configured (in the «FIELDS.CFG» file);
- 1= A machine with a central zero and therefore with 4 stops along the X axis which identify 4 x «Number of Y axis stops» work fields (or areas) configured (in the «FIELDS.CFG»file).
- 12= machine with a central zero and therefore 4 stops along the X axis but with only 2 work fields.

NOTE

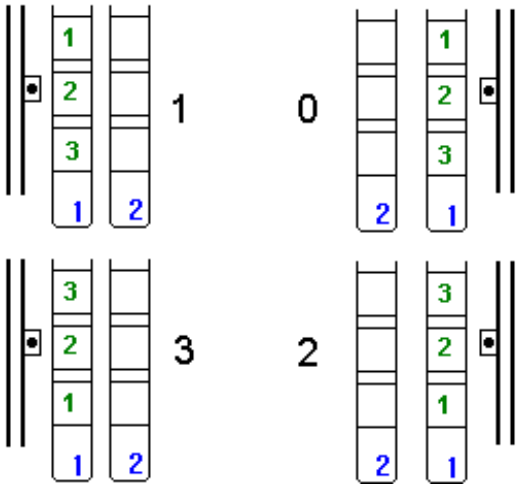
On machines with a single work area (area A), the «**Central zero**» parameter should be programmed with a 0 value and all the fields relative to area B in the «FIELDS.CFG» file should be set to zero.

Table:

- 0 = Multifunction;
- 1 = Manual Suction Cups;
- 2 = TVS (Automatic Suction Cups).
- 3 = manual Clamps;
- 4 = manual Suction cups and manual Clamps.

Supports number. origin (0-3):

To be programmed only if the work table is composed of cross beams and suction cups (or clamps), identifies the starting point for numbering the supports according to the following pattern:



Number of stops on Y axis (1-4):

This parameter corresponds with the number of stops along the machine Y axis and, together with the «**Central zero**» parameter, identifies the total number of fields (or areas) configured (as described in «Central zero». See «Field» in «FIELDS.CFG»).

Stop diameter:

Represents the diameter in millimetres of the machine end stops.

Slow status reading, Fast status reading:

These represent a period of time (in milliseconds) within which a reading of the machine status is guaranteed by the N.C.
The *default* setting is a quick reading while a slow reading is enabled when a program is translated into ISO (to execute it) and also when the operator enters the program or mix edit environment.

Slow encoder position reading, Fast encoder position reading:

These represent a period of time (in milliseconds) within which a reading of the encoder positions is guaranteed by the N.C.
The *default* setting is a slow reading while a quick reading is enabled when the ANIMATION environment is accessed.

Inf. O-max_workarea offsetX, Inf. O-max_workarea offsetY, Sup. O-max_workarea offsetX, Sup. O-max_workarea offsetY:

These define the four corners of a rectangle comprising the whole machine work area. The graphic display of the machine table (in the «TABLES AND SUCTION CUPS EDITOR» environment) shows all the characteristics configured (such as: stops, tables, suction cups, clamps), which lie within this rectangle.

O-0_machine Offset X, O-0_machine OffsetY, O-0_machine OffsetZ:

These represent the machine parameter origin offsets in relation to the machine zero setting.

Universal:

This configures any UNIVERSAL type units which may be present on the machine:

- 0 = not present;
- P = pneumatic (door, window config.),
- NC axis = (axis B).

Main head nr. (1-9):

Represents the head number (configured in «PHEADS.CFG») which has no offsets in relation to the machine parameters zero.

Clamping:

Describes the type of clamping controlled by the machine.
NO = manual, P = pressure switches, V = vacuum switches, PV = both.

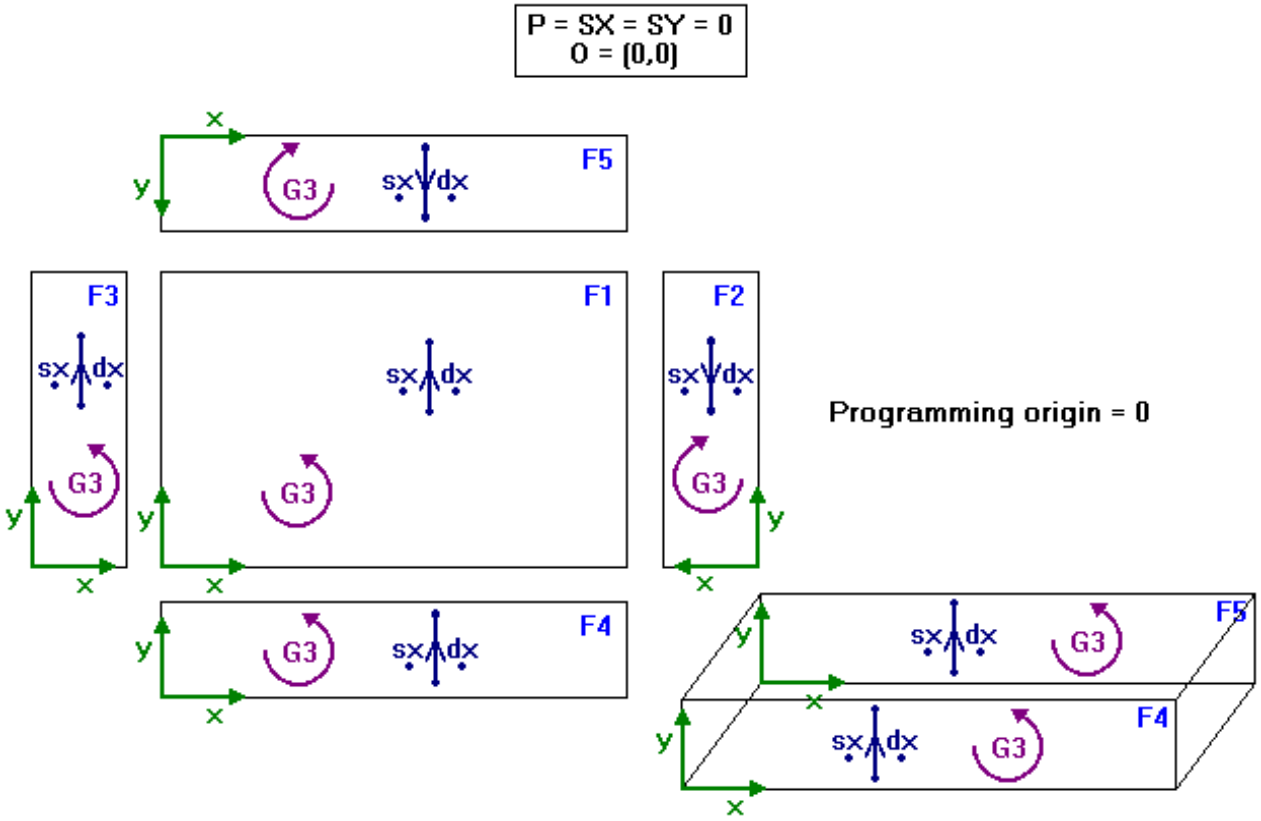
Programming Origin:

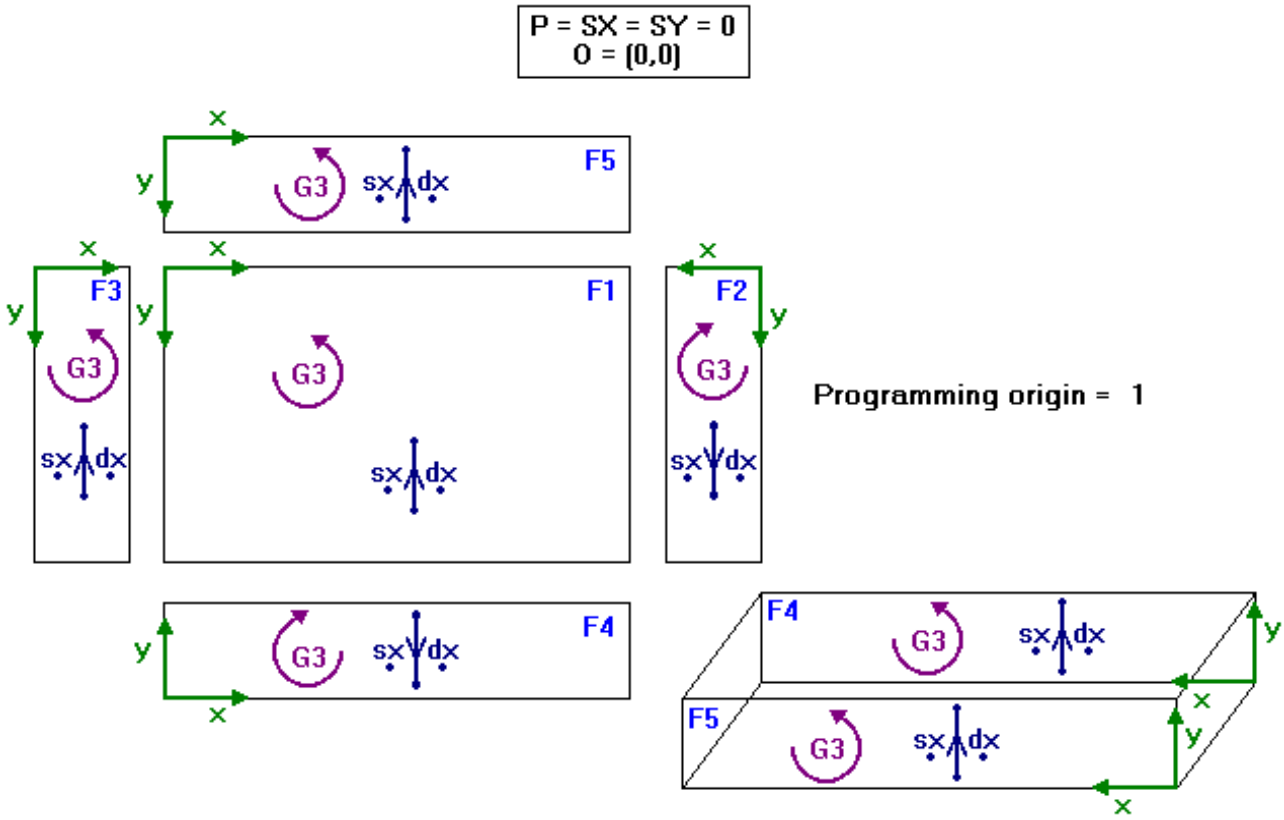
If panel is positioned on the working table opposite to the operator (if rear machine stops are activated, in the *Xilog³MMI* configuration), the value set must be 1; otherwise (if front machine stops are activated, in the *Routolink* configuration) the value set must be 0;

NOTE

It is possible that the programs done with a high programming origin are not compatible with the programs with a low origin and viceversa.

The following figures shows the characteristics of the two different programming origins.





Homogeneous Mix (0=NO,1=YES):

A value of 1 enables the control for automatic execution of the mix composed by programs with non-homogeneous work areas. For example one program can be run on double area AB with a different one on single area A (not at the same time).
If this parameter is 0, in the loading phase of a mix, the presence of one or more programs with non-homogenous work areas is signalled as an error.

Automatic suction cup COM. N.:

Defines the type of piece positioning on the machine table:

-1 manual with no control at all;
0 automatic by COM1 (only for TVS);
1 automatic by COM2 (only for TVS);
2 automatic by COM3 (only for TVS);
3 automatic by COM4 (only for TVS);

4 automatic by laser light[§];
5 reserved for external laser;
6 automatic by special tool;
7 automatic by PLC;

Mirror-image graphics editor (0=NO 1=YES).:

If this is set at 1, in graphic display and in the graphics editor, the panel graphics reflect the specular nature of the field programmed in the header.
If it is set at 0, the process graphics are always presented in non specular form, regardless of the field programmed in the program heading.

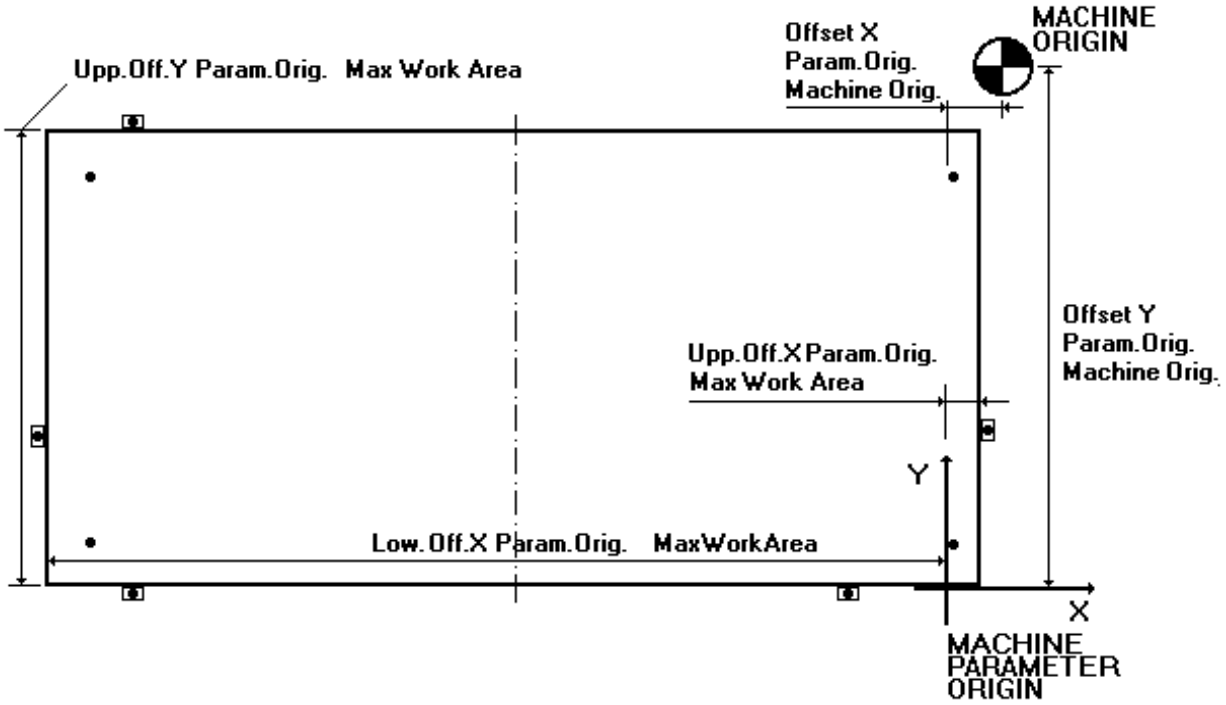
Report file (0=NO,1=SI):

1= Enables / 0= Disables production of the report file.

[§] In this case it is also necessary to configure a position in «PHEADS.CFG» for each light present.

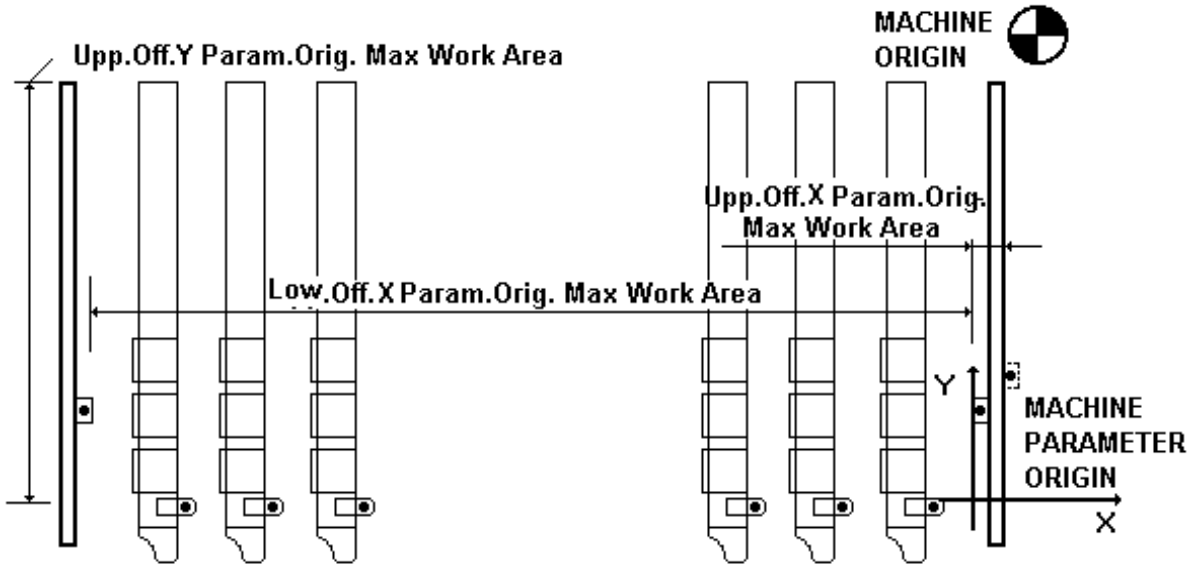
12.2.1 EXAMPLES

"RECORD" MULTIFUNCTION TABLE WITH 2 WORK AREAS



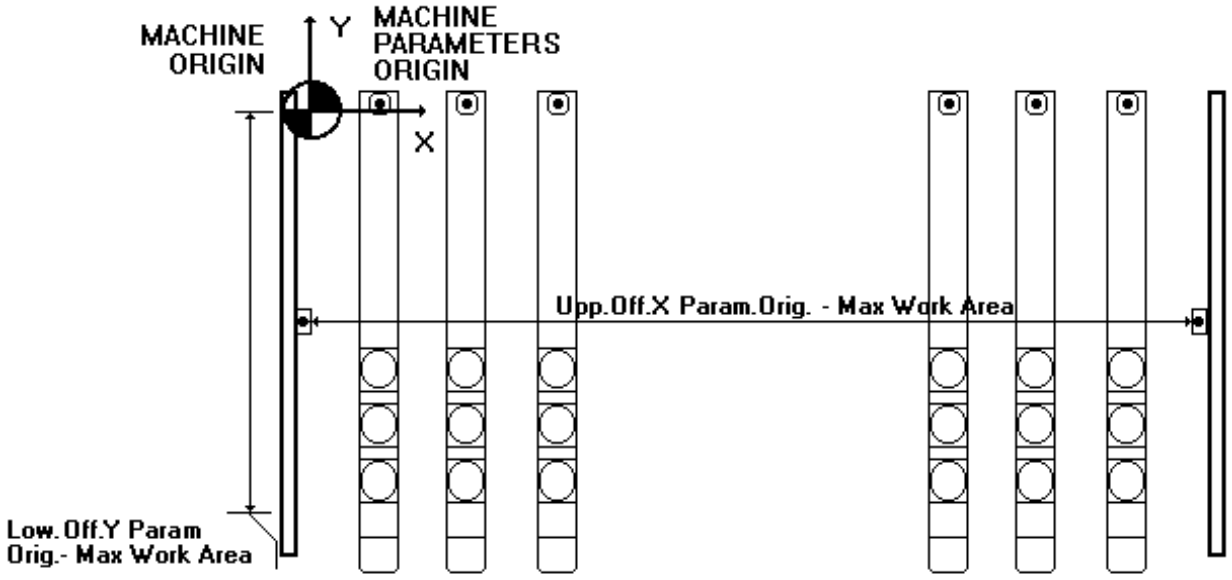
Low. Off. Y Param.Orig. - Max Work Area = 0.

"RECORD" SUPPORTS TABLE (TVS) WITH 2 WORK AREAS



Low. Off. Y Param.Orig. - Max Work Area = 0.

"AUTHOR" SUPPORTS TABLE WITH 2 WORK AREAS



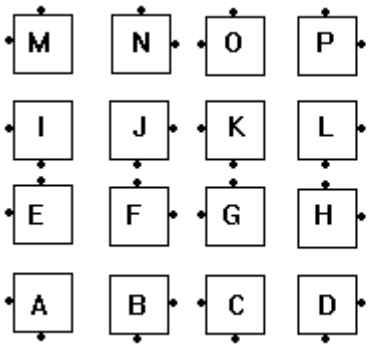
Upp. Off. Y Param. Orig.-Max Work Area = Low. Off. X Param.Orig. - Max Work Area = 0.

12.3 FIELDS.CFG

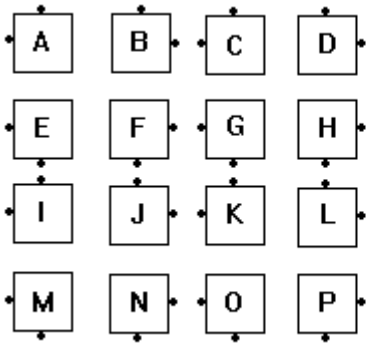
Field:	
X origin:	
Y origin:	
Z origin:	
X mirror image:	
Y mirror image:	
Number of cross elements:	
Number of first cross element:	
X dimension of field:	
Y dimension of field:	

Field:

name of field: A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P.
The fields of the machine must meet the following conditions:



Programmation Origin = 0



Programmation Origin = 1

The fields that can be programmed are:

- only the fields from A to D (A - D);
- the fields A - D and the fields E - H;
- the fields A - D and the fields I - J;
- the fields A - D , the fields E - F and the fields I - J ;
- all the fields.

Origin X, Origin Y, Origin Z:

Origin of the field from the edge of the stops
Origin Z may be used to permanently account for a fixed overlay on the table (overcups for instance).

Mirror X, Mirror Y:

Mirror X = 1 (or mirror Y =1) means that, during execution, the mirror machining is performed in X (or in Y)

Number of crossbeams, Number of first crossbeam:

In case of a multifunction table, the information in the crossbeam fields is not significant.
Otherwise they represent the number of crossbeams in the area and the number of the crossbeam closest to the stop of the area, respectively.

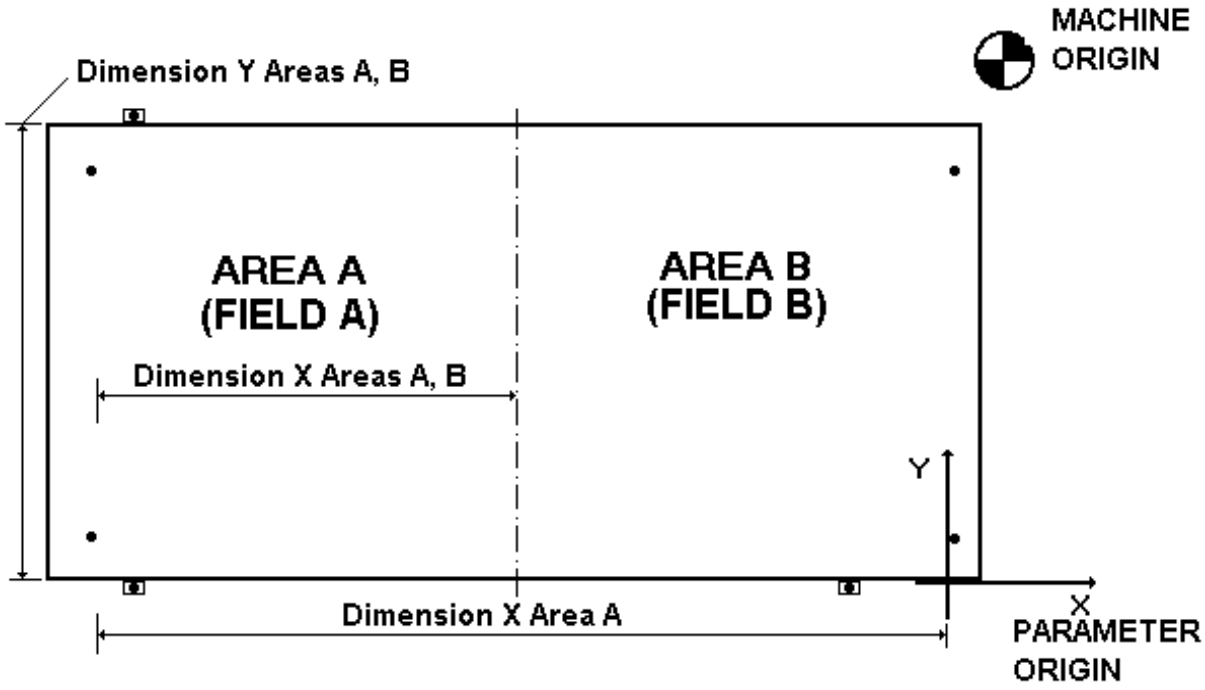
X dimension of field, Y dimension of field:

Max. dimensions in millimetres of the work area

NOTE
The field is not valid if both the X and the Y dimensions are not programmed.

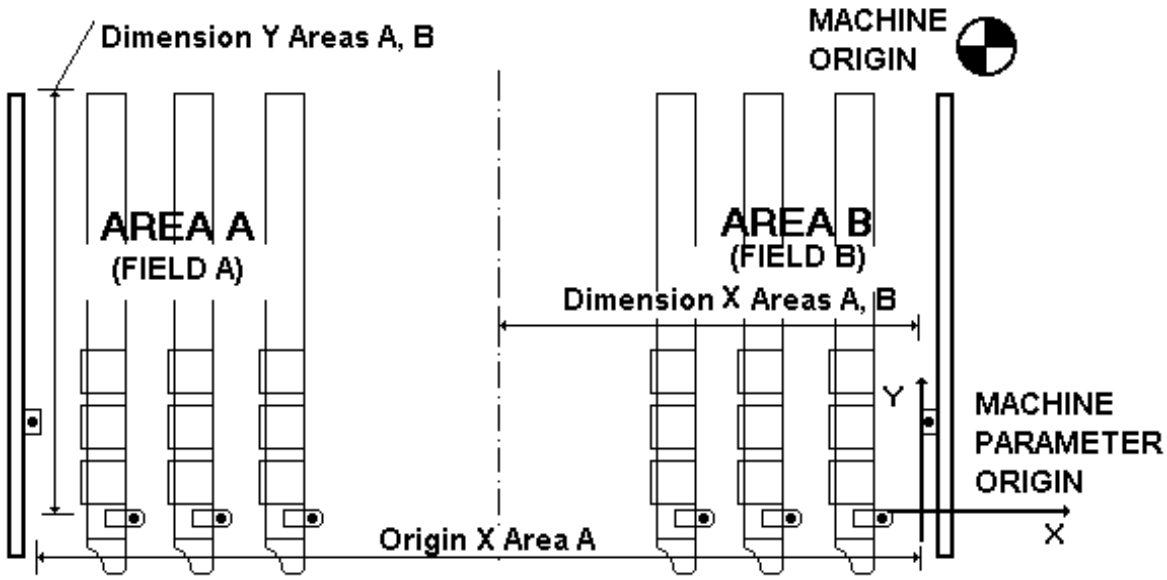
12.3.1 EXAMPLES

"RECORD" MULTIFUNCTIONAL TABLE WITH 2 WORK AREAS



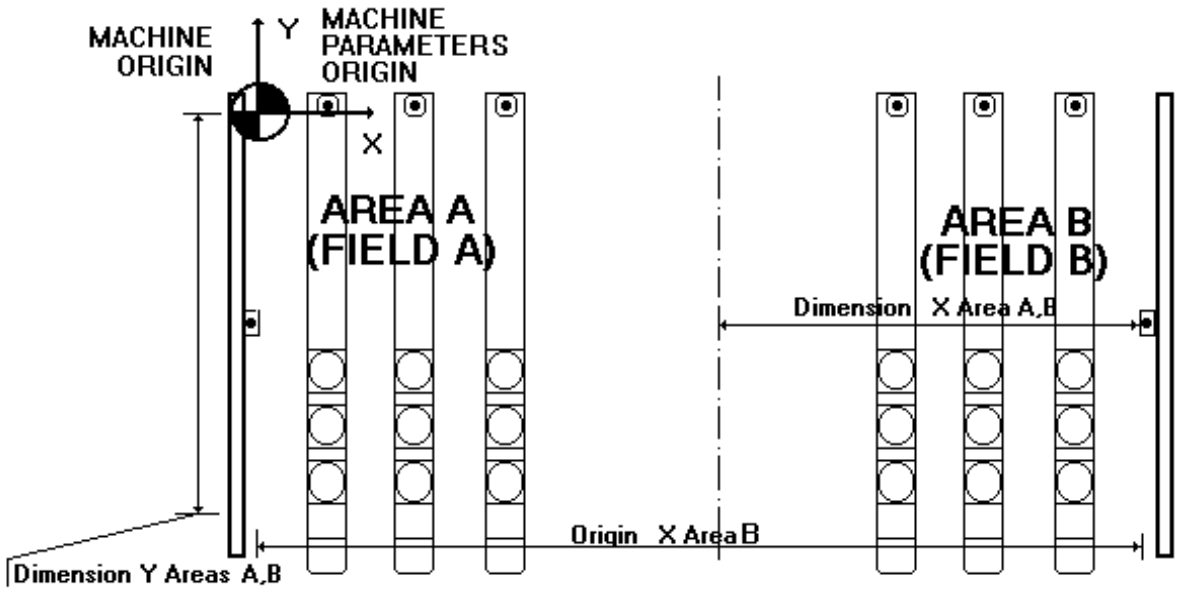
Origin Y area A = Origin X area B = Origin Y area B = 0;
Mirror X area A = Mirror Y area A = Mirror Y area B = 0;
Mirror X area B = 1;

"RECORD" SUPPORTS TABLE (TVS) WITH 2 WORK AREAS



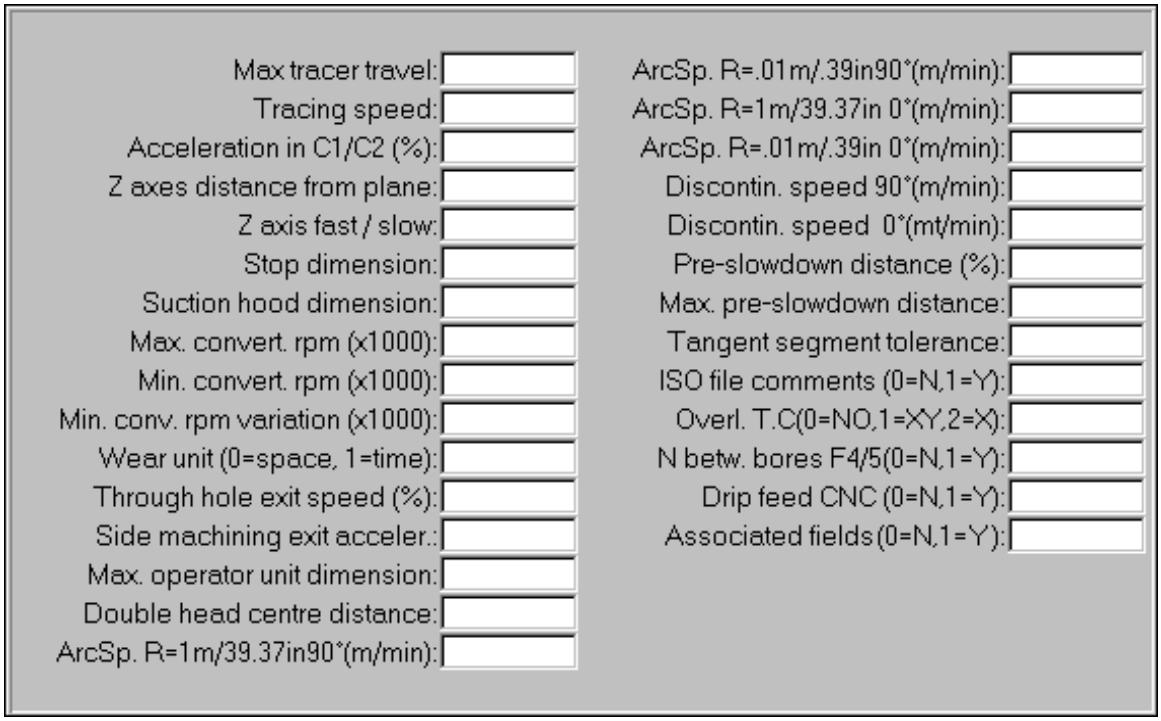
Origin Y area A = Origin X area B = Origin Y area B = 0;
Mirror X area A = Mirror Y area A = Mirror Y area B = 0;
Mirror X area B = 1;

"AUTHOR" SUPPORTS TABLE WITH 2 WORK AREAS



Origin X area A = Origin Y area A = Origin Y area B = 0;

12.4 GENDATA.CFG



Max. tracer stroke:

To be programmed only if the machine has a tracer (otherwise must be 0).
Max. extension of the stroke of the tracer when searching the piece after coming near it.

Tracing speed:

To be programmed only if the machine has a tracer (otherwise must be 0).
Piece search speed during tracing

Acceleration in C1/C2 (%):

On the *Routolink* version this parameter is not controlled (and its value must be 0).
If this field is programmed, the dynamic acceleration is enabled for all milling instructions.

Distance axis Z from table:

Absolute value of distance between work table and the edge of the adapter on the electro-spindle.

Fast/slow axis Z:

Out-of-work position (absolute value)

Stop size:

Height of stops (in Z).

Suction hood height:

Height of suction hoods (in Z).

Max. converter, Min. converter, Min. converter variation:

On the *Routolink* version these parameters are not controlled (and their values must be 0).
Maximum and minimum rotation speed of spindles powered by a static converter. The last parameter is the minimum variation threshold of the spindles powered by a static converter.

Wear unit (0=sp,1=tm):

Tool wear calculation mode. 0 based on space (1 metre of machining), 1 based on time (1 minute of work).

Through (hole) boring exit speed:

Percentage of the programmed boring speed.

Side machining exit acceleration:

On the *Routolink* version this parameter is not controlled (and its value must be 0).
Percentage of the exit acceleration for non-vertical machining.

Max. size of working unit:

On the *Routolink* version this parameter is not controlled (and its value must be 0).
Max. overall size of the working unit intended as the distance Z between the largest location on the same and the reference for the offsets of the spindles on the head.

Twin head centre distance:

On the *Routolink* version this parameter is not controlled (and its value must be 0).
Fixed distance Y between each spindle of the main head and the corresponding spindle on the twin head.

S. arcs R=..m/..in 90/0 degs (m/min):

On the *Routolink* version these parameters are not controlled (and their values must be 0).
Maximum displacement speed of the axes during the execution of arc milling with a radius of one metre (39.37 inches) and 0.01 metres (0.39 inches), to ensure optimum machining.
The first pair of speeds is applied for arcs forming an angle greater than or equal to 90 degrees.
The second pair is used for arcs forming angles between 0 and 90 degrees (ends included).

Direction change speed 90/0 degs (m/min):

On the *Routolink* version these parameters are not controlled (and their values must be 0).
These are the maximum displacement speeds of the axes before a change of direction (on the current profile) that can ensure optimum machining.
In the first case (Dir. change 90 degs) the set value is applied when the angle between the new and the old routes is greater than or equal to 90 degrees.
In the second case (Dr change 0 degs) the set value is applied when the machining paths are not tangent.
The speed values set are applied only if different from 0.

Slowdown distance (%), max. slowdown dist.:

On the *Routolink* version this parameter is not controlled (and its value must be 0).
These are the slowdown distances (percentage and maximum in mm) that

define the section of profile before a change of direction of the profile. The speed of execution of this segment is a function of the values set in these parameters.
The percentage slowdown distance is considered only if it is less than the maximum slowdown distance. Otherwise only the maximum programmed slowdown distance is considered.

Tangent segments tolerance (degrees):

On the *Routolink* version this parameter is not controlled (and its value must be 0).
Defines the tolerance within which two profile segments are considered to be tangent. No slowdown speed is applied to tangent segments.

ISO file comments:

If this parameter is set to 1, comments are inserted in the ISO file obtained by the translation of a program. If this parameter is set to 0, the ISO file is generated without comments.

Overlapping tool change:

Set to 1 to enable the machine to change the tool during the execution of other operations.

Generation N between borings F4/5:

If this parameter is set to 1, null instructions (N) are generated between the boring instructions of sides 4 and 5.

Drip feed CNC:

Governs the execution mode of programs written entirely in ISO.
Set to 1 to enable through mode. In through mode, the ISO file must not contain jump instructions; in the non-through mode there must be enough memory available in the N.C. to contain the program.
The parameter value has no effect if the controller is ECS.

Associated Fields (0=NO,1=YES):

0	If, in the Automatic Programs and Automatic Mix modes, you do not want two or more programs to be loaded together with overlapping work areas


	(as in previous versions).
1	New Automatic Programs and Automatic Mix modes. Allows two programs to be loaded at the same time which have a multiple and mirrored work area between them. If the machine has automatic suction cups (TVS) this mode cannot be enabled.

Max diameter tool type 1:

Only for machines with TOOL ROOM, this is the max. diameter allowed for a tool classified type 1 (see CHANGING SUPPLEMENTARY TOOLS).

Max diameter tool type 2:

Only for machines with TOOL ROOM, this is the max. diameter allowed for a tool classified type 2 (see CHANGING SUPPLEMENTARY TOOLS).

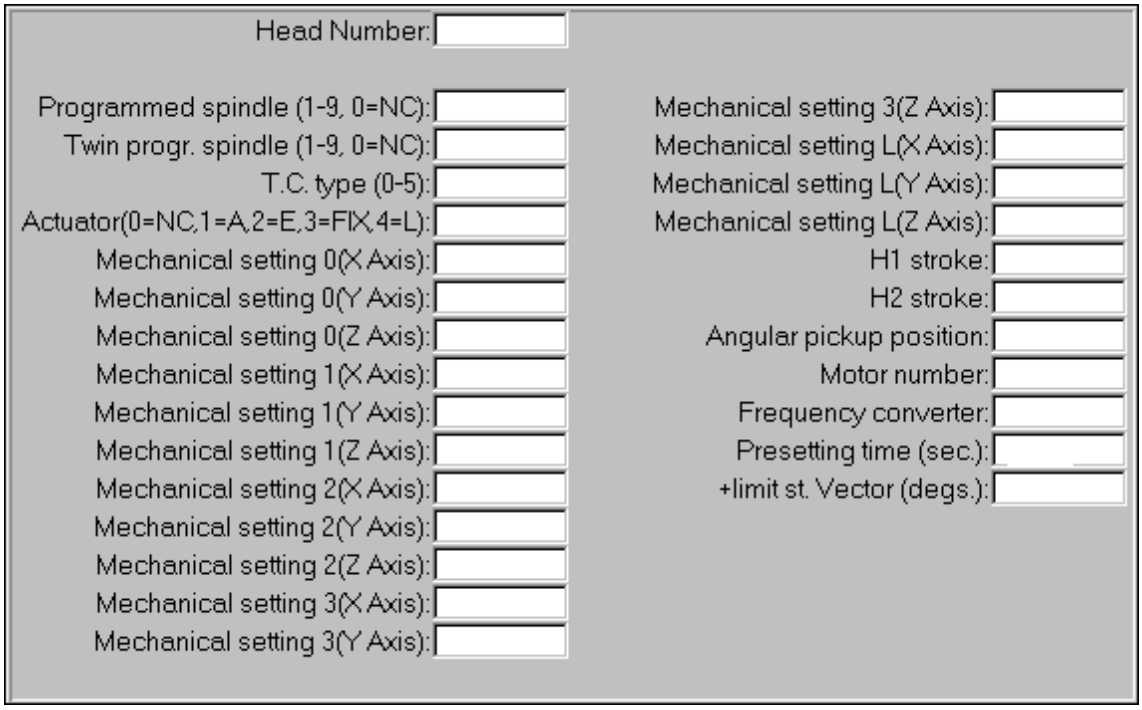
Max diameter tool type 3:

Only for machines with TOOL ROOM, this is the max. diameter allowed for a tool classified type 3 (see CHANGING SUPPLEMENTARY TOOLS). If any tools have a greater maximum value than that allowed, no kind of control or machining must be carried out as it could cause a mechanical fault.

BO Tollerance:

The Z offset of the boring machine spindles are configured in the file SPINDLES.CFG; spindles of the same type and diameter but different Z offset are compatible to the optimisation operated by BO/xBO if the difference in Z comes within the tolerance BO; otherwise they are not compatible.

12.5 PHEADS.CFG



Head number:

Head number 1 is the boring head.
Head number 2 is for a second boring head (if applicable).
Head number 3 is the main electro-spindle.
Head number 4 is reserved to the UNIVERSAL unit (if installed on the machine).
Numbers 5 to 96 are assigned to programming additional secondary heads (such as, for example, laser heads). In any case the operational heads must be assigned numbers between 5 and 11.

Programmed spindle, Twin programmed spindle:

The values from 1 to 9 indicate that the spindle configured is an operational head and is therefore able to load a tool and to carry out machining. The value 0 indicates a secondary head.
In the programming phase, the activation of tool *n* in spindle number *m* corresponds with the value *m* x 100 + *n* (see «TOOLING»,»REFERENCE TO TOOLS IN PROGRAM»).
The «twin» parameter should be programmed only if the machine is fitted with a «twin» unit.

T.C. Type[ξ]:

It can assume the following values:

- 0 manual tool change;
- 1 RAPID automatic tool change;
- 2 tool change with manual clamping;
- 3 RANDOM automatic tool change;
- 4 CHAIN automatic tool change;
- 5 LINEAR automatic tool change.

Actuator:

it can assume the following values:

- 0 non-configured type;
- 1 A/C axis type;
- 2 external axis type;
- 3 fixed type;
- 4 laser light type.

Setting 0 – L (Axis X), Setting 0 – L (Axis Y), Setting 0 – L (Axis Z):

The offsets of the head relative to the Machine Parameters origin assuming that the main head (programmed in the «**Reference head no.**» parameter in «XILOG3.CFG») is positioned at the actual origin (or rather with all offsets cancelled).
Setting 1 parameters are to be programmed only if the head has 2 working positions (e.g. for the UNIVERSAL unit: Setting 0 = Upper position; Setting 1 = Lower position). If the head is provided with Vector the values for Axes X and Y are taken on the rotation centre.
All the other settings need to be programmed only for those units which have a work position number greater than two.

H1 stroke, H2 stroke:

Only to be programmed on machines which have a tool change shuttle, these parameters configure respectively the Z stroke of the shuttle (H1) and the height of the magazine from the work table (H2).

[ξ] on some machines you must set a three figure number xyy where x is the type of c.u. and yy number of the associated tool room..

Angular pickup position:

The angle which the VECTOR must take up before the tool change.

Motor number:

To be programmed with a value from 1 to 9 if the unit is an «operational» head (or rather with the parameter **«programmed spindle»** other than zero) without the frequency converter, this parameter corresponds with the motor number to be activated in the work phase.

Frequency converter:

To be programmed with a value from 1 to 9 if the unit is an 'operating' head (or rather with the parameter **«programmed spindle»** other than zero) with the frequency converter, this parameter corresponds with the converter number to be activated in the work phase
If the machine only has the main electrospindle this parameter must be set to 1 for head no.3.

Presetting time (sec):

Waiting time for the first head before starting its down stroke in Z.

+ limit st. Vector (degrees):

The Vector field, if present, must always be greater than or equal to zero. It corresponds to the Offset of the Vector axis; otherwise the Vector value must be -1.
In case of the pneumatic** UNIVERSAL, the Vector field configures the type of rotation and is programmed according to the following table:

- -90 if Rotation 0 – 90;
- -180 if Rotation 0 – 180;
- -270 if Rotation 0 – 270;
- -1 no rotation

Masked tool change:

Value 1 for the main head enables the machine tool change (always relative to main electro-spindle), during other machining operations, only use heads configured with this parameter 1.

** And of the other secondary pneumatic units

Safe cylinder diameter:

Expresses the maximum diameter of the tools and angular drive heads that can be rotated with the head fully up.
A tool or head within the safe cylinder diameter is rotated in the work position with the head fully up. Otherwise the the rotation takes place with the head down, as long as safety conditions are fulfilled.
If the parameter is set at a value lower than or equal to zero, the rotation is with head down as long as safety conditions are fulfilled.

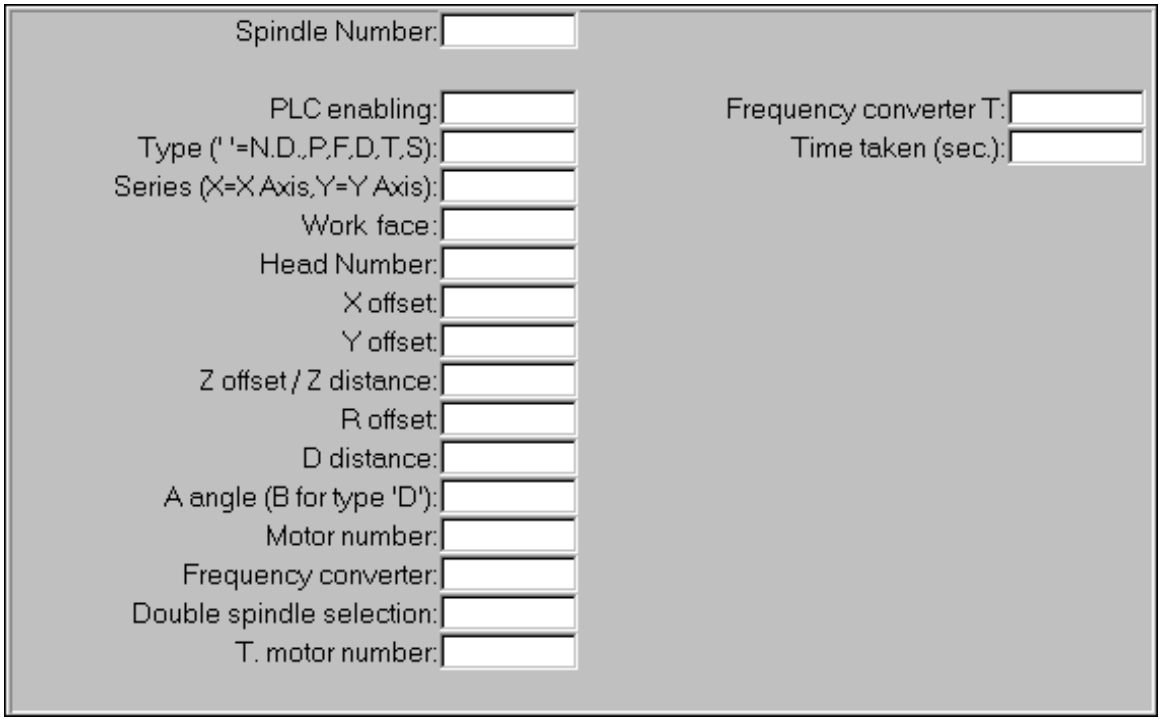
Limit switch + axis Y (mm):

Expresses the maximum quota the head can reach along the Y axis without colliding with the bumpers.
The anti collision check is only carried out if the parameter is set at a value different from zero more limiting than limit switch + mechanical of axis Y.

Limit switch - axis Y (mm):

Expresses the minimum quota the head can reach along the Y axis without colliding with the bumpers.
The anti collision check is only carried out if the parameter is set at a value different from zero more limiting than limit switch + mechanical of axis Y.

12.6 SPINDLES.CFG



Spindle number:

The spindles of the fixed boring head are numbered **1** to **96.**
Spindle 1 must always be programmed and is the reference spindle to all other programmed spindles.
The programmed spindles are all the spindles (on the fixed boring head) that have a non-empty Type field.
In the tooling files it is possible to configure the tools for the programmed spindles only. The programmed spindles are displayed in the boring head graphic display together with the characteristics of the tools installed on them (in Program Editor.)

PLC Enabling :

Number of the PLC output associated to the spindle.

Type:

Programmable types are:

P boring bit;
F fluted mill;
D disk mill;
T tracer;
S special tool.

Generally speaking, all fixed head spindles are type P.

Series (X=Axis X, Y=Axis Y):

To be programmed only if the spindle is to be associated to a series in X or Y.

Work face:

Number of the side on which the tool mounted on the spindle works. It can have the following values: 1, 2, 3, 4, 5.

Head number:

Number of the head which the spindle belongs to (see «PHEADS.CFG»).

X Offset, Y Offset, Z Offset / Z Distance:

Unlike other configuration files, the fields of the offsets of each spindle must be programmed with values which are not referred to the machine parameter origin, but refer instead to spindle no.1. Spindle no. 1 shall have all offsets set to 0.
The **«Z Offset / Distance Z»** parameter takes on the meaning of Z offset for spindles which work on the side faces and Z Distance in the case of configuration with a blade.

R Offset, D Distance, A angle (B for type 'D'):

These correspond with blade type tool configuration parameters fitted to the fixed unit (see «TOOLING»,» D TYPE TOOL»).

Motor number:

To be programmed with a value from 1 to 9 only if the boring machine has more than one motor, this value corresponds with the number of the motor to be activated in the work phase.

Frequency converter:

To be programmed with a value from 1 to 9 only if the boring machine has more than one frequency converter, this value corresponds with the number of the converter to be activated in the work phase.

Double spindle selection, T. Motor number, T. Frequency converter:

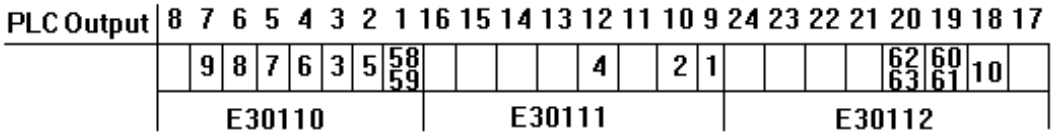
These parameters refer to the «twin» head and do not need to be programmed if no head of this type is configured.

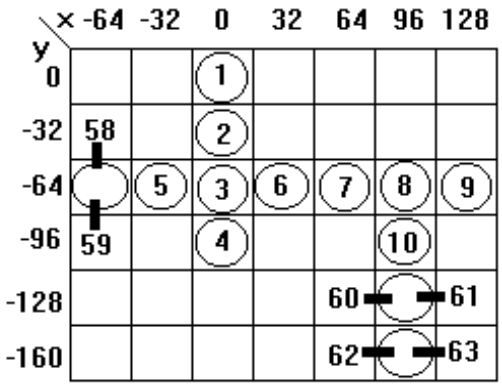
Time taken (sec):

Represents the head delay before making its down stroke in Z.

12.6.1 EXAMPLES

13-spindle boring machine:

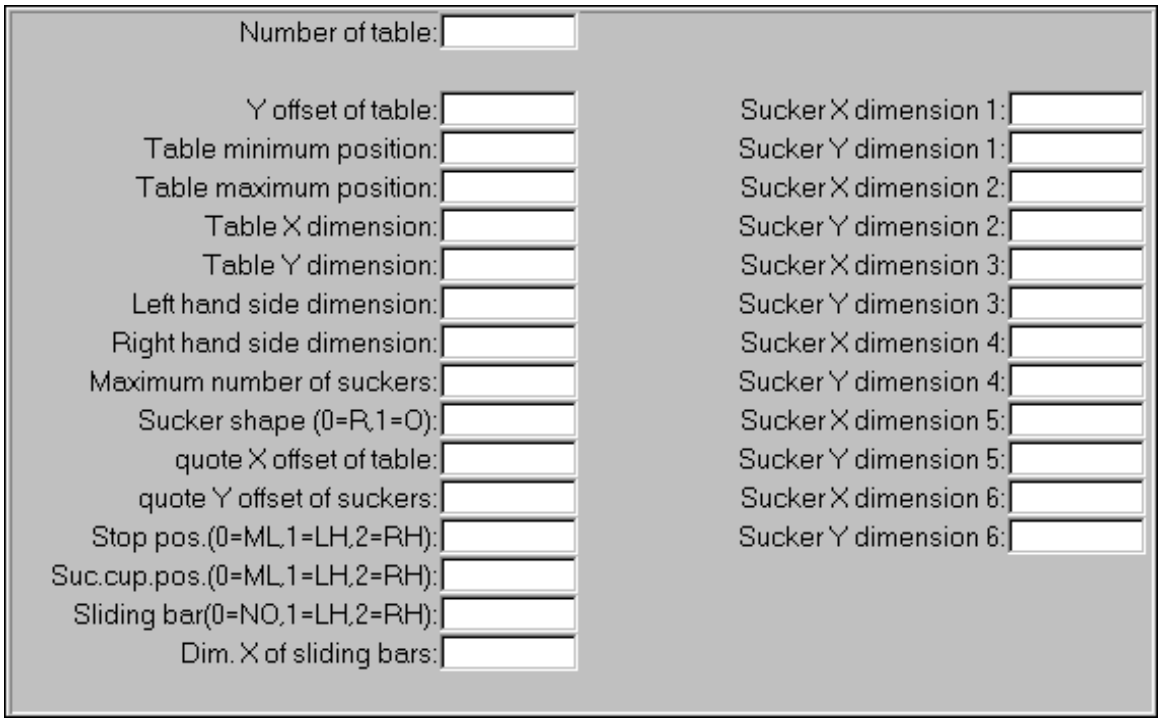




12.7 SUPPORTS.CFG

To program only if the machine table consists of suction cups (or clamps) and crossbeams.
Up to 16 crossbeams (or tables) can be configured, each with a maximum of 6 suction cups.
The field Origin_num_supp. in file **xilog3.cfg**, set to 3, means that the crossbeam 1 (or table 1) is the first to the left, and suction cup 1 is the first from the bottom.
All the positions and offsets relative to the cross beams and suction cups refer to their centres.

First configuration page

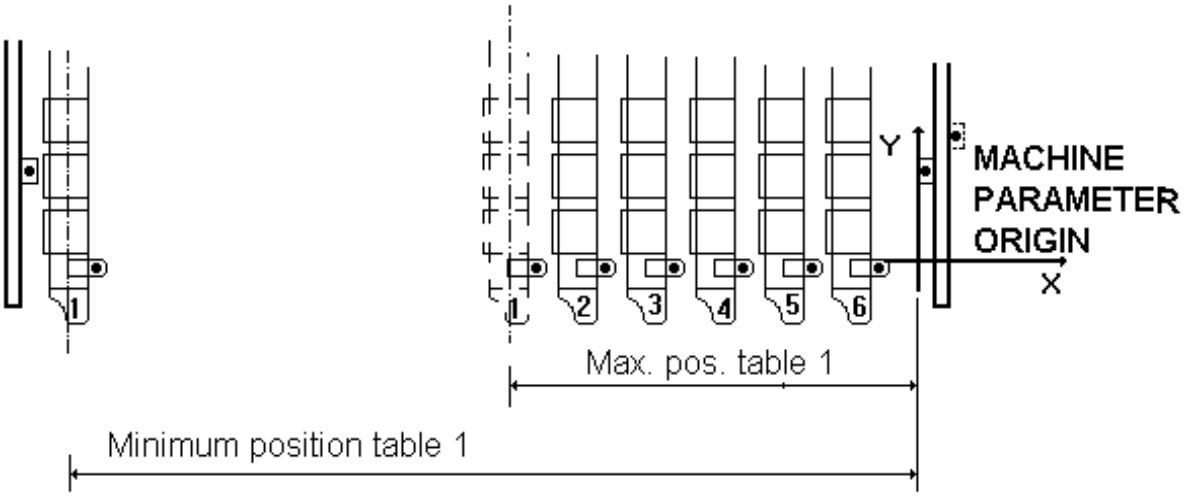


Y Offset of table:

Offset in Y of the cross beam in relation to the machine work table.

Table minimum/maximum position:

"RECORD"



"AUTHOR"

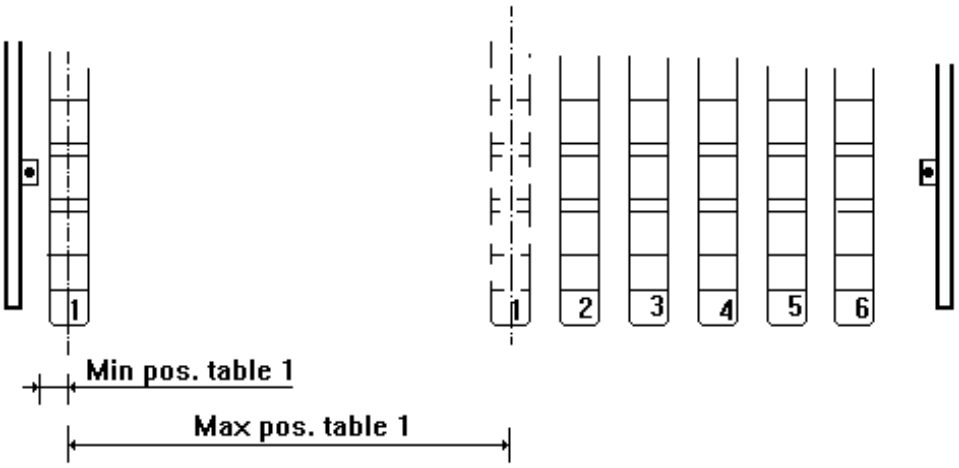


Table X dimension, Table Y dimension:

Width and length of base cross beam (excluding suction cups, lifting bars etc.).

Dimension X LH side, Dimension X RH side:

The sum of these values is the total size in X of the crossbeam (including the lift bar, the stop and the suction cups or clamps).

Maximum number of suckers:

Number of suction cups present on cross beam. If only clamps are present this parameter must be set to zero.

Sucker shape (0=R,1=O):

- 0 rectangular suction cups;
- 1 oval suction cups.

Quote X offset of table:

A value which is algebraically added to the physical work table positioning (in reference to the machine parameters origin) when, after having loaded a program to be executed, a request is made to display the machine work table together with the positions of the programmed cross beams. If the machine has a millimetre rule for positioning the supports, this offset should be programmed in such a way that the cross beam index on the rule shows the same position as the one displayed on the control.

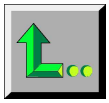
Quote Y offset of suckers:

A value which is algebraically added to the physical work table suction cup positioning (referred to the machine parameters origin) when, after having loaded a program to be executed, a request is made to display the machine work table together with the positions of the programmed suction cups. If the cross beam is fitted with a millimetre rule for positioning the suction cups, this offset should be programmed in such a way that the suction cup indexes on the rule show the same positions as those displayed on the control.

Stop position (0=C,1=SX,2=DX):

position of the end stop(s) on the cross beam:

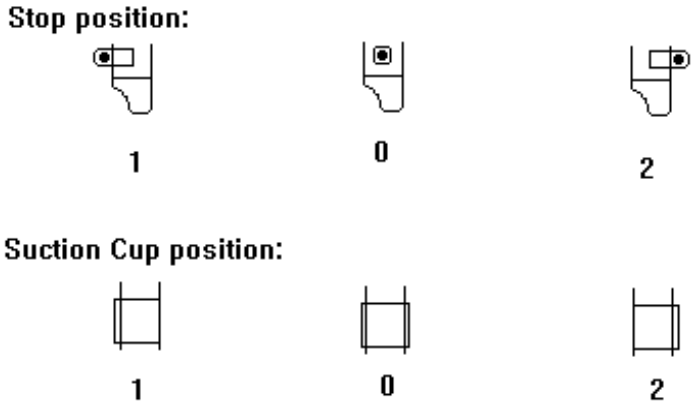
- 0 centre;
- 1 to the left;
- 2 to the right.



Suction cups position (0=C,1=SX,2=DX):

position of the suction cups on the cross beam:

- 0 central;
- 1 to the left;
- 2 to the right.



Slide bars:

1= left; 2 = right; 0 = none.

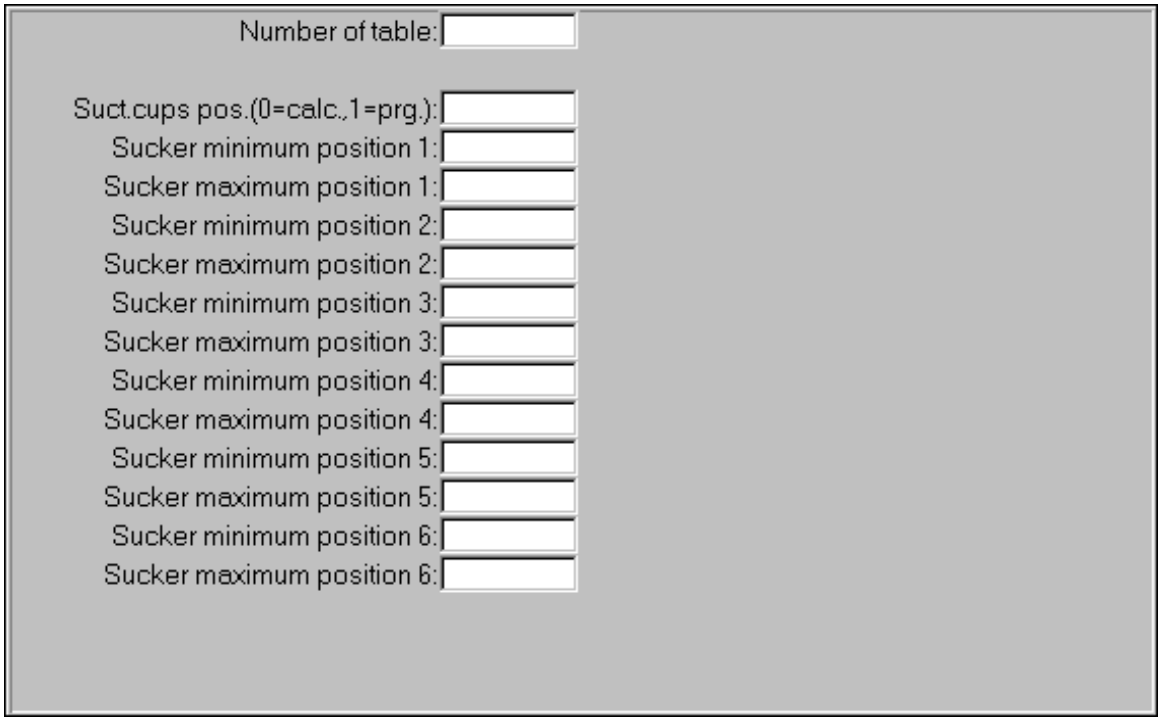
Size X of slide bar:

Width of slide bar.

Size X suction cup, Size Y suction cup:

The size in Y of the suction cup.
The dimension in Y also represents the size of the suction cup.

Second configuration page



Suction cups position (0=calc.,1=progr.):

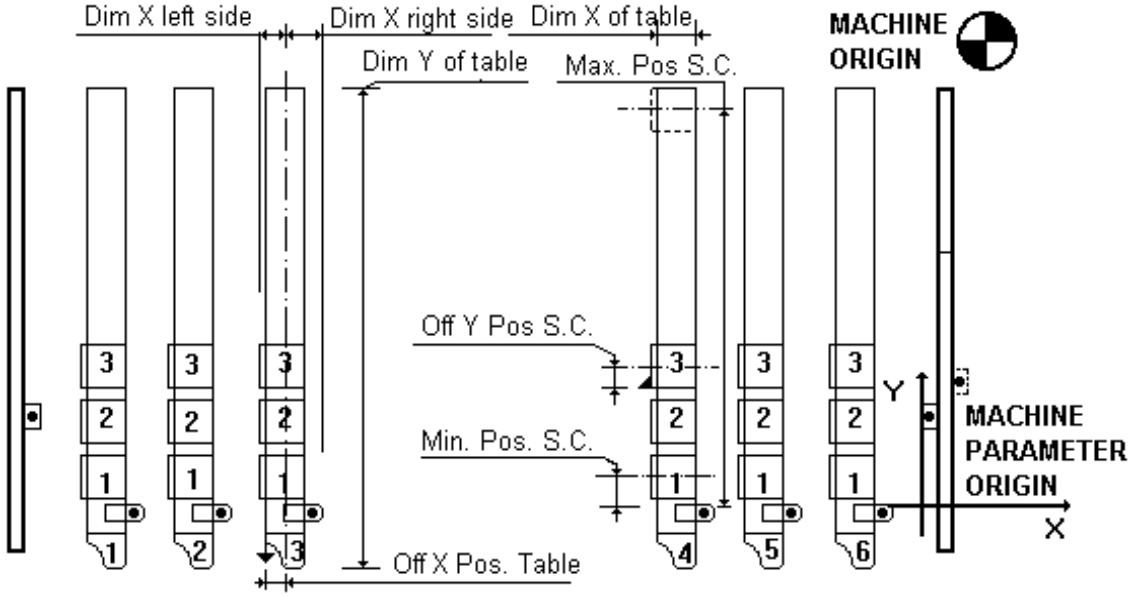
A value of 0 shows that for all suction cups on the cross beam the same minimum and maximum positions are applicable programmed in the fields «**Suction cup 1 minimum position**» and «**Suction cup 1 maximum position**».
A value of 1 allows a minimum and maximum position to be programmed (in the fields following this one) for each individual suction cup on the cross beam.

Suckers minimum/maximum position:

Minimum and maximum suction cup movements. These are interpreted on the basis of the parameter described above.

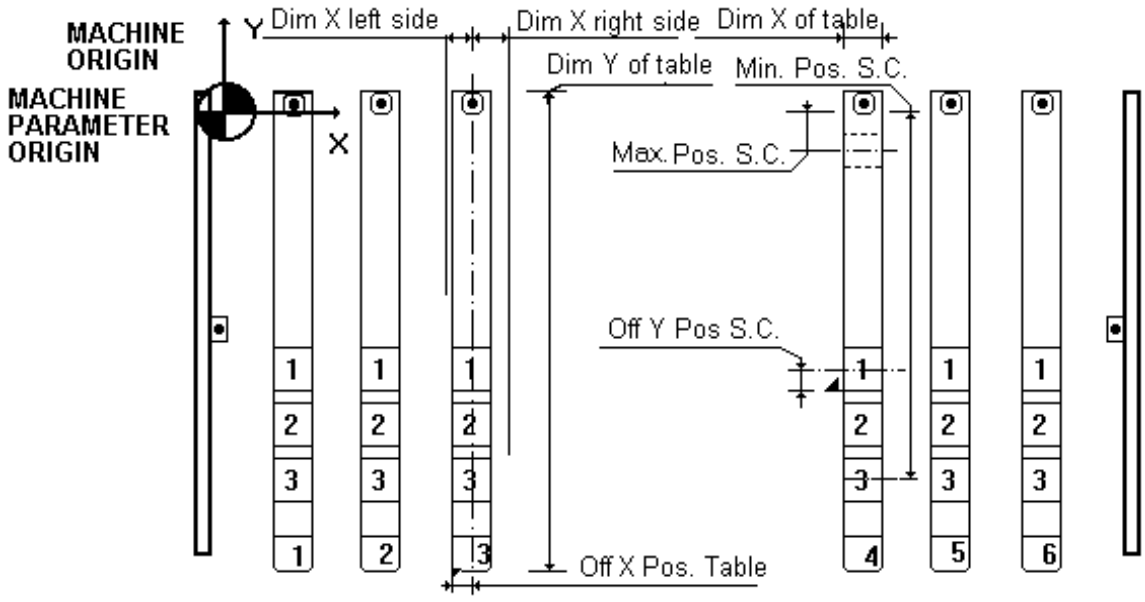
12.7.1 EXAMPLES

"RECORD" WITH 6 TABLES AND 3 SUCTION CUPS PER TABLE



Max number of suction cups = 3.

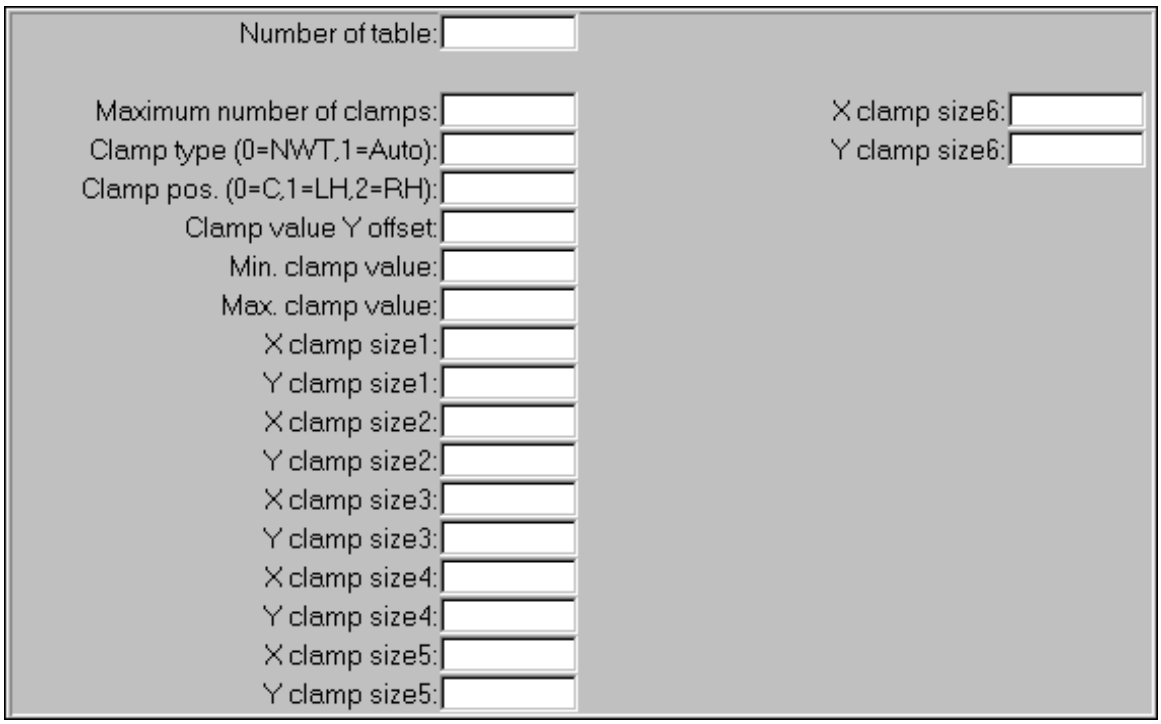
"AUTHOR" WITH 6 TABLES AND 3 SUCTION CUPS PER TABLE



Max number of suction cups = 3.

12.8 CLAMPS.CFG

To be programmed only if the machine is fitted with clamps to hold the piece.



All the positions and offsets relative to the clamps and suction cups refer to their centres.

Maximum number of clamps:

The number of clamps present on the cross beam.

Clamps type (0=NWT,1=Auto):

type of clamps fitted to cross beams:

- 0 clamps tightened manually (NWT type);
- 1 automatic clamps.

The automatic clamp comprises the whole front clamping system plus the whole rear clamping system.

Clamps position (0=C,1=LH,2=RH):

Configures the position of the clamps on the cross beam:

- 0 central;
- 1 to the left;
- 2 to the right.

Clamps value Y offset:

see «**Suction cup Y offset position**» in «SUPPORTS.CFG».

Min clamps value, Max clamps value:

These are the minimum and maximum clamp movement positions.
In the case of automatic clamps, these positions are taken from the centre of the two front and rear systems in relation to the machine parameters origin.

X clamps size, Y clamps size:

These correspond with the clamp sizes. The automatic clamp sizes include the total sizes of the both front and rear systems.

12.9 STOREPOS.CFG

Magazine number:

from 0 to 31.

Type:

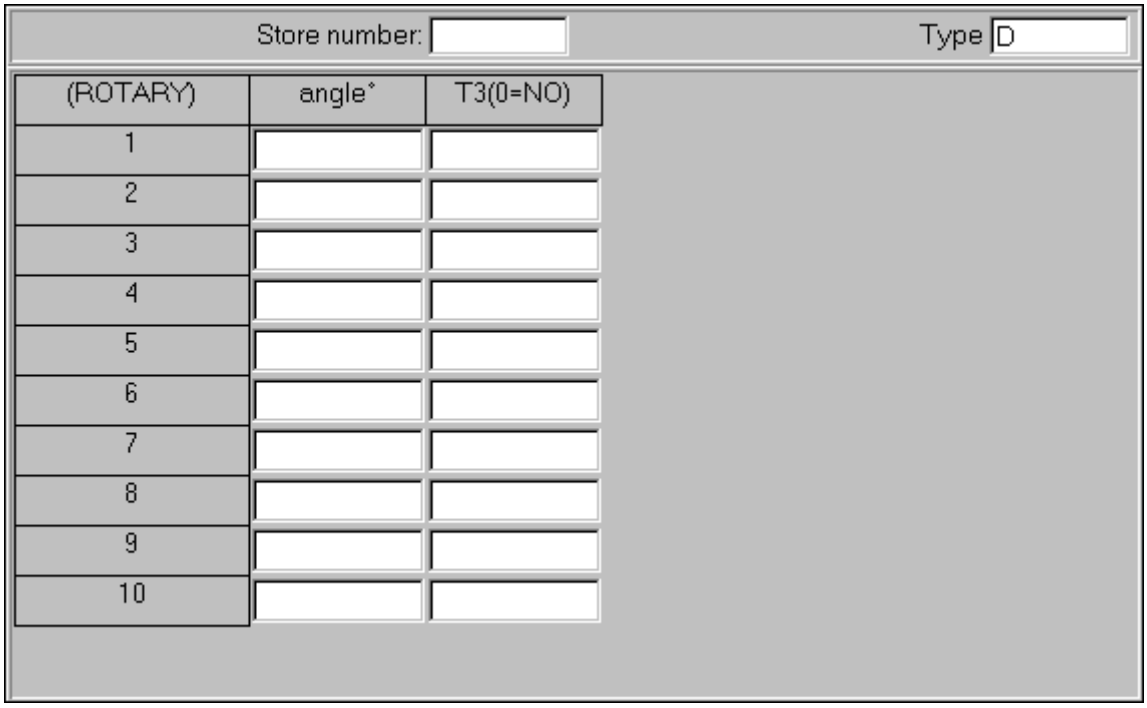
Type of magazine: R,D = rotary, C = chain, L = linear, P=random, M=manual, T=tool room.

12.9.1 Rotating Magazine - R

Angle (degrees):

Is the angle of magazine post corresponding to the number indicated in first column.
-1 or a value lower than the last one programmed means that the previous position is the last one configured.

12.9.2 Rotating magazine – D



Angle (degrees):

Is the angle of magazine post corresponding to the number indicated in first column.
-1 or a value lower than the last one programmed means that the previous position is the last one configured.

T3 (0=NO):

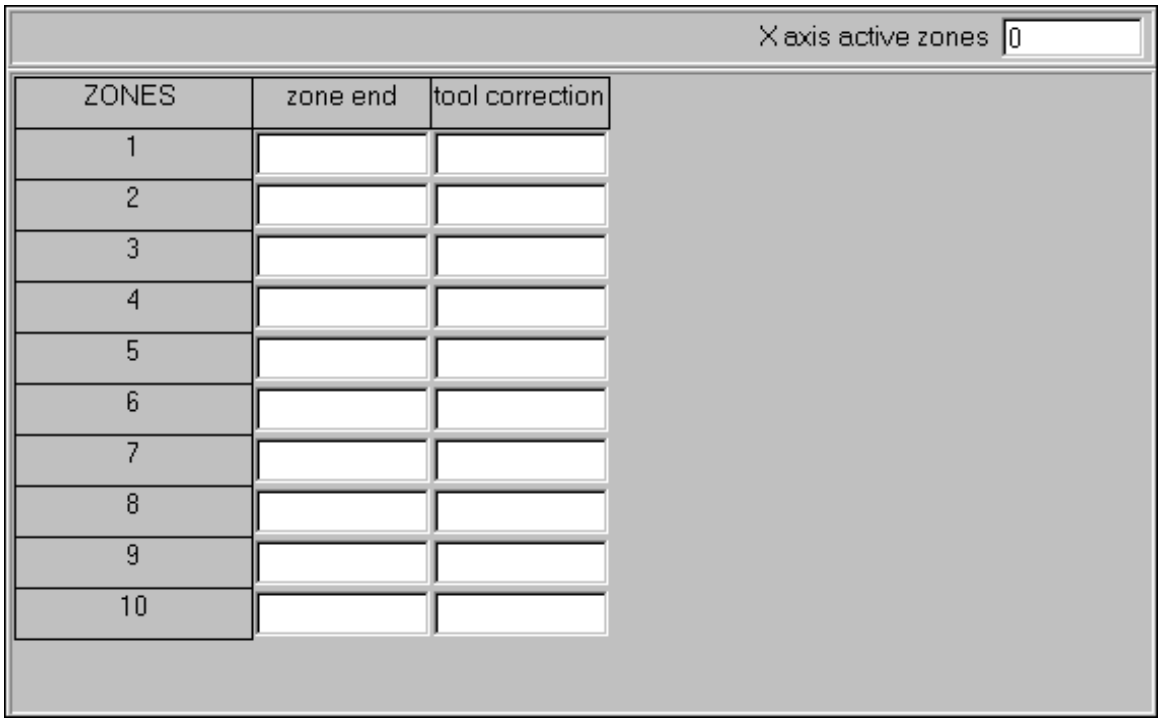
If programmed with value 1, the magazine post can load more tools with angular drive. If the machine is equipped with a TOOL ROOM, these tools are type 3. Only if the even posts are programmed with the value –1, setting the value –2 in the field **"Number aggregate"** of a given tool means that tool is automatically considered to be type 2 (dimD=2). It will therefore not be automatically unloaded by the RAPID.

12.9.3 Other magazines

X, Y, Z :

For non-rotary magazines, these correspond with the tool positions within the magazine.
-1 or a value less than the last one programmed indicates that the previous position is the last configured position.

12.10 XZONE.CFG, YZONE.CFG



Active zones axis X (or axis Y):

Number of single areas forming the general working area of the machine (along axis X if XZONE.CFG, along axis Y if YZONE.CFG).

Zones:

Area number.

Zone end:

Last position of the area (position X for XZONE.CFG, position Y for YZONE.CFG).

Correction:

Correction value applied to the axis following the detection of mechanical errors on the axis itself.

12.11 NCI.CFG

NCI.CFG is an ASCII file which, for *Xilog³/RoutoLink* 5.0 and later versions, must be filled in to configure the M codes (and other information) for the various heads and units on the machine.
The file has a general section and a number of special sections for the number of machining heads; the general information is identified by key words with the $GEN_ prefix; the information in the special sections is identified by key words with the $Hxx_ prefix, where xx is the number of the corresponding head in the PHEADS.CFG file; every key word opens a block of one or more M codes; the block ends with the $ character.
The key words not required may be omitted; phrases within braces are comments and have no effect on the code.
Xilog³/RoutoLink 5.x creates a minimal NCI.CFG file if it is not found in the configuration file directory; the minimal file is sufficient for updating versions previous to 5.0 bit is not generally sufficient for version 5.0 and later machines.

12.11.1 General section

The key words permitted in the general section *RoutoLink* are as follows:

- GEN_INIT program initialisation (from 053)
- GEN_END program end (from 053)
- GEN_PRU new presser enabling (from D60)
- GEN_PGMLOG “pgm.log” file enabling (from D60)
- $GEN_LASERAON$ laser area A ON
- $GEN_LASERAOFF$ laser area A OFF
- $GEN_LASERBON$ laser area B ON
- $GEN_LASERBOFF$ laser area B OFF
- GEN_NWTOPT NWT optimising enabling (from D60)
- $GEN_MAXTOOLRAD$ maximum tool radius permitted

- $GEN_RAPID01RAD$ Rapid radius
- $GEN_TRTIMETRX$ transfer in X between Tool Room tables time
- $GEN_TRxxSETPOINT$ tool room xx set-point (from 01 to 04)
- $GEN_TRxxSELPLACE$ tool room xx position selection
- $GEN_TRxxDOWN$ tool room xx downstroke
- GEN_TRxxUP tool room xx upstroke
- GEN_TRxxIN tool room xx to rapid (from 053)
- $GEN_TRxxOUT$ tool room xx away from rapid (from 053)
- $GEN_TRxxLOCKED$ tool room xx tool block
- $GEN_TRxxUNLOCKED$ tool room xx tool release
- $GEN_TRxxPACK$ Tool Room xx table
- $GEN_TRPACKyyRAD$ Tool Room yy table radius
- $GEN_TRPACKyyTIMEUP$ Tool Room yy table upstroke time
- $GEN_TRPACKyyTIMEDN$ Tool Room yy table downstroke time Room
- $GEN_TRPACKyyTIMEROT$ Tool Room yy table step rotation time

12.11.2 Special sections

The key words permitted in the special sections *RoutoLink* are as follows:

- Hxx_VECTOR xx head: code for vector axis around Z; add N if the vector is not Interpolating
- $Hxx_SETVECTOR$ xx head: positioning codes for non-interpolating Z vector
- $Hxx_XVECTOR$ xx head: code for vector axis around X; add N if the vector is not Interpolating
- $Hxx_XSETVECTOR$ xx head: positioning codes for non-interpolating X vector
- $Hxx_XFCVECTOR$ xx head: + limit switch for X vector
  $Hxx_YVECTOR$ xx head: code for vector axis around Y; add N if the vector is not Interpolating
- $Hxx_YSETVECTOR$ xx head: positioning codes for non-interpolating Y vector
- $Hxx_YFCVECTOR$ xx head: + limit switch for Y vector
- Hxx_WAITCU xx head: tool change end wait
- Hxx_UP xx head: upstroke
- Hxx_DOWN xx head: downstroke
- Hxx_ROTCW xx head: Clockwise rotation enabling
- Hxx_ROTCCW xx head: Counter-Clockwise rotation enabling
- Hxx_NOROT xx head: rotation disabling

- Hxx_POS0 xx head: work position 1
- Hxx_POS1 xx head: work position 2
- $Hxx_SETHOOD$ xx head: hood position codes
- $Hxx_DOWNHOOD$ xx head: power-driven hood downstroke (from 053)
- Hxx_UPHOOD xx head: power-driven hood upstroke (from 053)
- $Hxx_POMHOOD$ xx head: power-driven hood origin search (from 053)
- $Hxx_BATHOOD$ xx head: power-driven hood positioning at stop (from 053)

12.11.3 Examples - *RoutoLink*

General section

{General info – Laser area A}
$GEN_LASERAON
M141
$
$GEN_LASERAOFF
M143$
{General info - Tool Room 1}
$GEN_TR01SETPOINT
M14
$
$GEN_TR01DOWN
M136
$
$GEN_TR01UP
M135
$
$GEN_TR01LOCKED
M124
$
$GEN_TR01UNLOCKED
M125
$
{General info - Tool Room 2}
$GEN_TR02SETPOINT
M14
$

```
$GEN_TR02DOWN
M136
$
$GEN_TR02UP
M135
$
$GEN_TR02LOCKED
M124
$
$GEN_TR02UNLOCKED
M126
$
{General info - Tool Room 3}
$GEN_TR03SETPOINT
M14
$
$GEN_TR03DOWN
M138
$
$GEN_TR03UP
M137
$
$GEN_TR03LOCKED
M124
$
$GEN_TR03UNLOCKED
M127
$
{General info - Tool Room 4}
$GEN_TR04SETPOINT
M14
$
$GEN_TR04DOWN
M138
$
$GEN_TR04UP
M137
$
$GEN_TR04LOCKED
M124
$
$GEN_TR04UNLOCKED
M128
$
```

Head 1, EVER router

{Head 01 – EVER Router}
$H01_UP
M91
$
$H01_DOWN
M92
$
$H01_ROTCW
M88
$
$H01_ROTCCW
M88
$
$H01_NOROT
M89
$

Head 2, EVER blade

{Head 02 - Ever blade}
$H02_UP
M91
$
$H02_DOWN
M92
$
$H02_ROTCW
M21
$
$H02_ROTCCW
M21
$
$H02_NOROT
M50M78M81M79
$
$H02_POS0
M71
M25
$
$H02_POS1
M71
M26
$

Head 3, main spindle with interpolating Z vector

```
{Head 03 - Main spindle}
$H03_VECTOR
C
$
$H03_WAITCU
M189
$
$H03_ROTCW
M64M3M23S%ld
$
$H03_ROTCCW
M64M3M24S%ld
$
$H03_NOROT
M50
$
```

Head 4, old pneumatic Universal

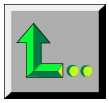
```
{Head 04 – old pneumatic Universal}
$H04_UPM81
$
$H04_DOWN
M71
$
$H04_ROTCW
M65M3S%ldM21
$
$H04_ROTCCW
M65M3S%ldM21
$
$H04_NOROT
M50
$
$H04_POS0
M25
$
$H04_POS1
M26
$
```

Head 5, slotter unit with non-interpolating B vector

```
{Head 05 - Slotter unit}
$H05_VECTOR
BN
$
$H05_SETVECTOR
V=2000 B=%.2fM150
$
$H05_UP
M81
$
$H05_DOWN
M71
$
$H05_ROTCW
M65M3S%ldM21
$
$H05_ROTCCW
M65M3S%ldM21$
$H05_NOROT
M50
$
```

Head 6, pneumatic blade unit

```
{Head 06 - Blade unit}
$H06_UP
M82
$
$H06_DOWN
M72
$
$H06_POS0
M35
$
$H06_POS1
M36
$
```



13 DIRECT CONTROL OF ISO PROGRAMS

Some machines fitted with NUM® control also have direct control of ISO programs.
An ISO program is a file with the extension CNC which can be freely edited and graphically displayed; this function is demanded by Numeric Control and therefore only operative when Numeric Control is connected.
The names of CNC files must be chosen according to NUM® convention where every name has a maximum of 5 figures followed by a 0 (zero).

WARNING!

Direct control of ISO programs is only available on some types of machine fitted with NUM® control.

13.1 PROGRAM EDITING

The list of ISO programs can be accessed from the program archive selecting the CNC type. Once you have chosen the program press **[F2]** or use the mouse to enter in editor. The editor is a normal text editor with standard functions (cut, copy, paste); the keys enabled on the keyboard are::

[F2]	save
[F3]	text graphic
[Shift]+[F4]	program archive
[F7]	editor mix
[F8]	graphic display
[F9]	alarm display
[Shift]+[F9]	I/O display
[F10]	help
[Shift]+[F10]	calculator
[F11]	graphic guide (only operates on status bar icon o)
[Shift]+[F11]	exit

13.1.1 PROGRAM EDITING: GRAPHIC DISPLAY

Press key [F8] of ISO program Editor to activate graphic display of program currently in use (supplied by NUM®).

WARNING!

The graphic display of ISO program is demanded by Numeric Control and is only available with Numeric Control connected. The mouse is not operative in graphic display mode.

The program (for example 1110.CNC) is transferred into the Numeric Control memory and the graphic display is activated, the screen is as shown in Figure 1.

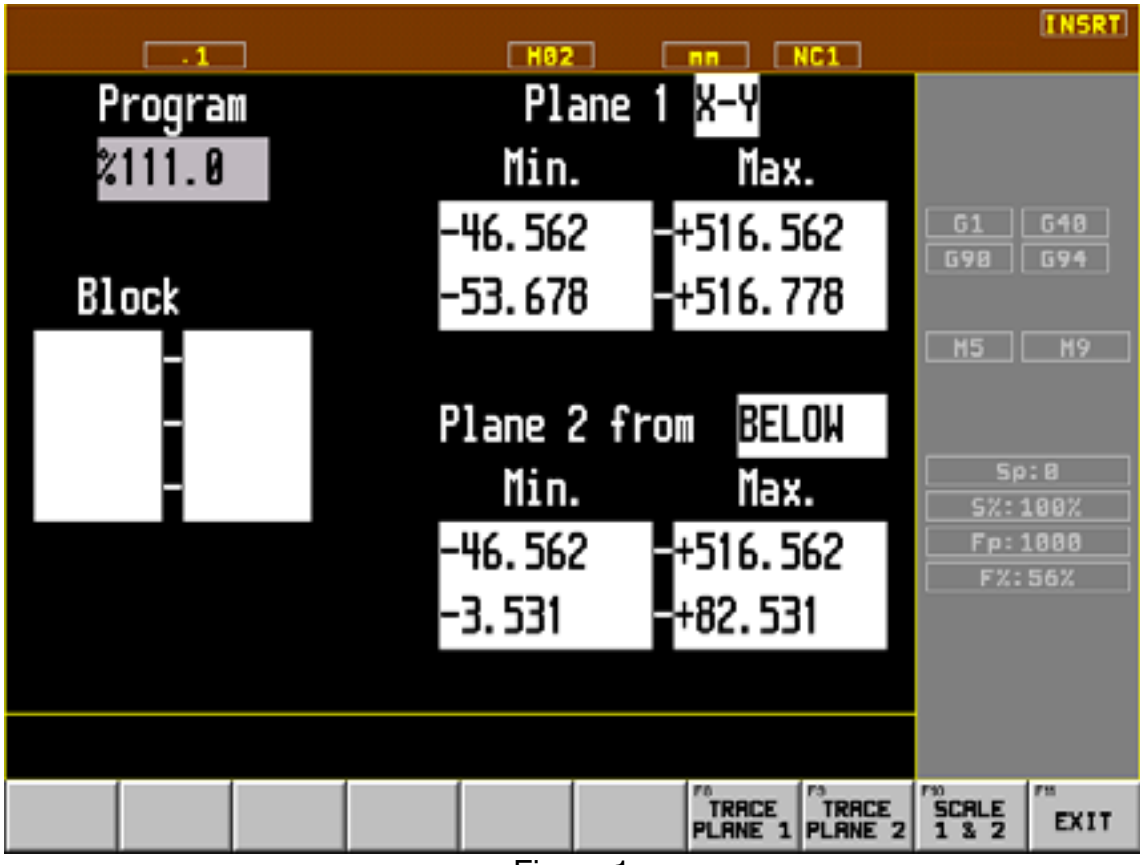


Figure 1

The fields are compiled automatically, each of them can be changed manually as follows:

1. Select a different program to display by compiling the field **Program** and confirm by pressing the **[Enter]** key.
2. Select the first and last blocks of the sequences to display compiling the fields **Block** confirm by pressing the **[Enter]** key.
3. Select the first display plane compiling the field **Plane 1** confirm by pressing the **[Enter]** key; the planes allowed are X-Y (default), Y-Z and Z-X.
4. Select the second display plane compiling the field **Plane 2** confirm by pressing the **[Enter]** key; the values allowed are, Left, Right, Above and Below (default).
5. Input the framing values manually (fields **Min** and **Max**) of planes 1 and 2.

To obtain the graphic drawing of the piece select the trace of the plane by pressing **[F8]** for plane 1 or **[F9]** for Plane 2; the screen will be as in Figure 2.

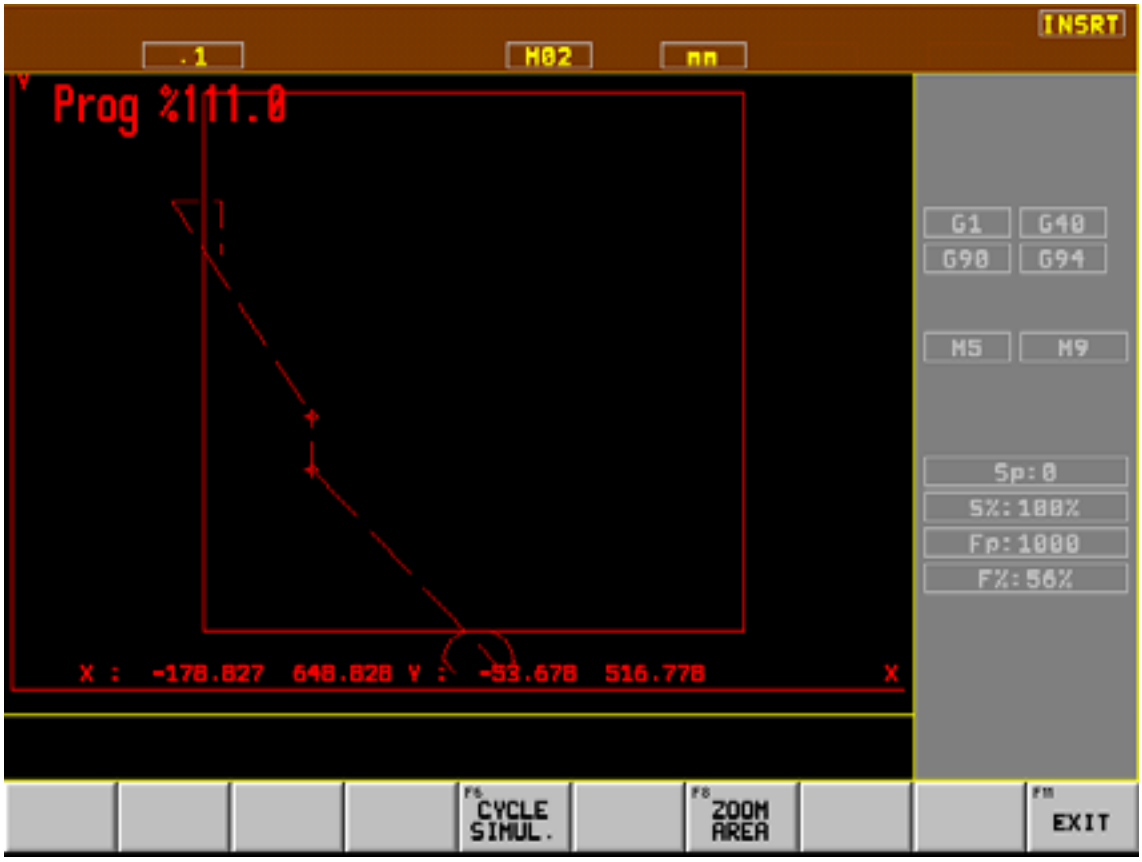


Figure 2

Press key **[F8]** to enlarge a detail of the trace (ZOOM), as illustrated in Figure 3; in this window it is possible to:

1. Enlarge or reduce the area of a detail you want to see by pressing keys and .

2. Move the window containing the detail by pressing the arrow keys on the keyboard.
3. Enlarge by pressing **[F8]**.
4. Confirm enlargement carried out by pressing **[F9].**
5. Cancel enlargement in progress by pressing **[F10]**.
6. Exit Zoom mode by pressing **[F11]**.

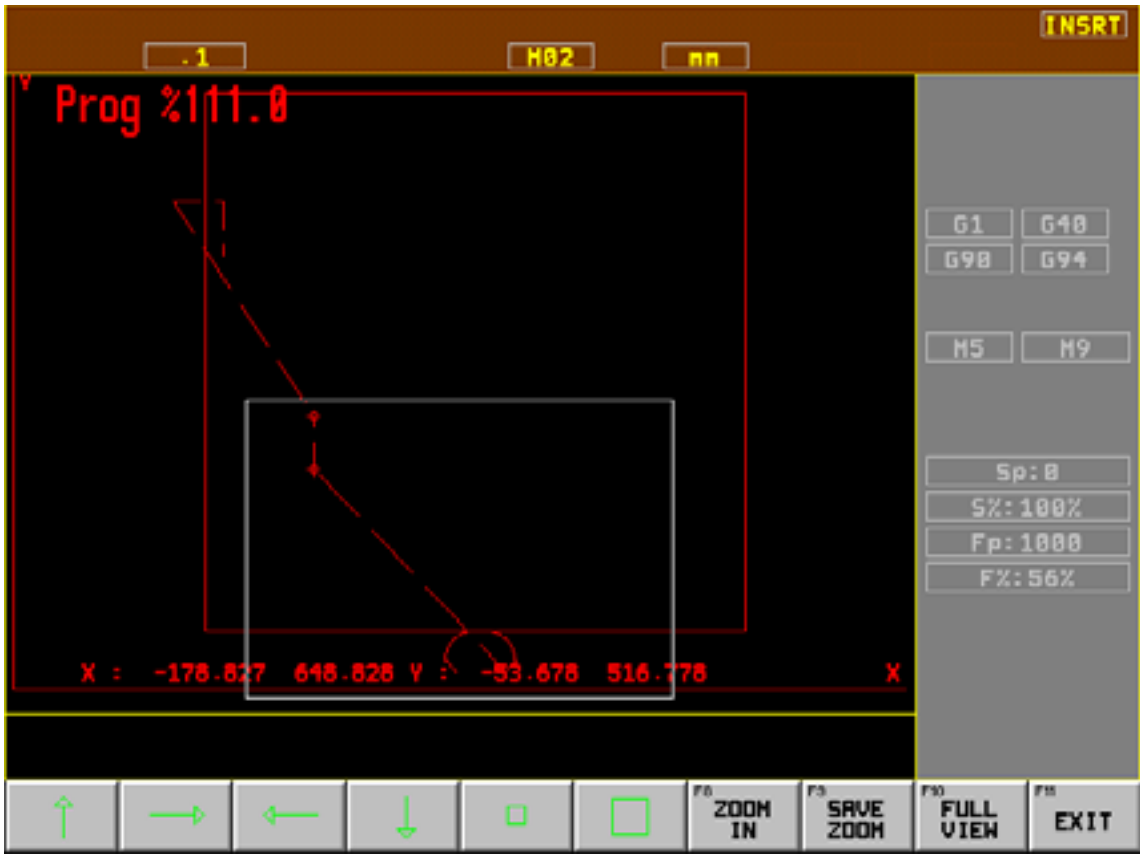


Figure 3

Press **[F6]** of the window illustrated in Figure 2 to access the machining simulation, this enables you to check that the program is running as planned (dimension of piece and operation flow); the function menu is illustrated in Figure 4; the following are possible:

Figure 4

1. Select continuous mode by pressing **[F3]**.
2. Select sequential mode by pressing **[F4]**.
3. Carryout machining simulation (run program up to M02 in continuos mode, or of a block sequential mode) by pressing **[F6]**.

4. Suspend development of simulation by pressing **[F5]**; to restart the simulation press **[F6]**.
5. To zero set simulation press **[F7]**.
6. Interrupt or restart the tool trajectory trace by pressing **[F8]**.
7. Interrupt or restart display of current point co-ordinates by pressing **[F9]**.
8. To Exit simulation press **[F11]**.

Machining simulation is as shown in Figure 5.

Figure 5

The development of the simulation is similar to the actual functioning of Numeric Control but is carried out outside machining, the programmed interventions (M00, M12, data input etc.) are not taken onto consideration during simulation, external parameters E are4 not altered in simulation.

13.2 EDITING MIX

In the mixes the programs can be retrieved with extension CNC. In this case the only significant parameters are work area and number of pieces.

13.3 AUTOMATIC PROGRAMS

The list of ISO programs is accessed from the “Program archive”. Having chosen the program required select the CNC type and enter the “Change Header” table showing all empty fields, apart from the work area which has the value A and the piece number with the value 1. When confirmed, the program is displayed in the synoptic area waiting for the START pushbutton to be pressed.
While a program is running any messages for the operator are displayed in blue in the message window. If a message requires a value to be input access the data input folder, set the data and press **[F6] or [Enter]**.

WARNING

If a message requires the operator to input a value there is no icon displayed to indicate that data must be input**.**

13.4 AUTOMATIC MIX

Running programs with the extension CNC is the same as described for “Automatic programs” and can be operated in all modes including bar code reading. When they are not specified in the mix step or label the work area and the piece number are positioned respectively at A and 1.

13.5 SUBPROGRAMS

Any program retrieved from an ISO program must be loaded in the Numeric Control memory. The list of ISO programs can be accessed from the “Program Archive” and ”Program Editor” by selecting CNC. To manipulate programs in the Numeric Control memory use the following keys:

[Shift]+[F3] lists programs present in the Numeric Control memory

[Shift+[F4] copies programs selected by the PC from the Numeric Control memory

13.5.1 [Shift]+[F3]

The “Program Archive” is used to list the programs in the Numeric Control memory; in this case the keyboard will only have the cancellation key F5, apart from normal system keys.
The programs highlighted can be cancelled from the Numeric Control memory using F5.

13.5.2 [Shift]+[F4]

Each highlighted program is copied in the Numeric Control memory, overwriting any programs present with the same number.

13.5.3 Note

The name of a file used as a subprogram must correspond in the CNC memory to the name by which the file is retrieved.
Example:

File 7770.CNC

```
…
G77 H8086
…
M2
```

Before running or displaying program 7770.CNC graphically load the subprogram %8086.0 in the CNC memory; for this create and transfer the file **80860.CNC**.

13.6 BAR CODES

Details of how to run ISO programs by reading a bar code are described in the chapter REMOTE CALCULATOR BAR CODE READER.
The label must contain the program name (complete with .CNC extension) followed by any parameters; the program name must be separated from the parameters by the character; (semi-colon); each parameter must be separated from the others by the character; (semi-colon).
Examples:

TEST.CNC
TEST.CNC ; L0=1000 ; L1=800 ; L2=30

ENCLOSED A – UNIVERSAL UNIT (on RD220) WITH ROTATION AXIS PARALLEL TO MACHINE Y AXIS.

Unit Configuration:

XILOG3.CFG
Set the “Universal” parameter = 0.

PHEADS.CFG (head 4)
Set the “Actuator” parameter = 5.

Measure the distance along X between the main spindle centre of rotation and the axis of rotation of the unit spindle in the horizontal position, as illustrated in Fig. 1 and set the “Position 0 X” parameter using said value, observing the sign.

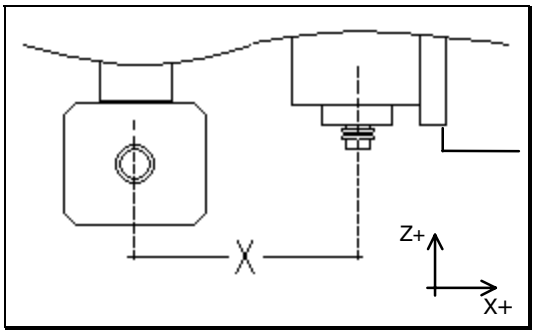


Fig. 1

Measure the distance along Y between the main spindle centre of rotation and the axis of rotation of the unit spindle in the vertical position, as illustrated in Fig. 2 and set the “Position 0 Y” parameter using said value, observing the sign.

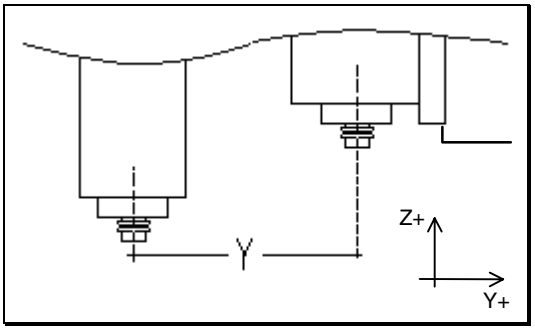


Fig. 2

Measure the distance along Z between the reference point for tool measurement of the main spindle and the axis of rotation of the unit spindle in the lowered-horizontal position, as illustrated in Fig. 3 and set the “Position 0 Z” parameter using said value, observing the sign.

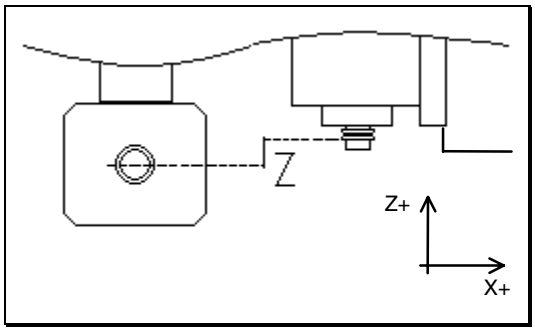


Fig. 3

Set the “Vector Degrees” parameter = 0.

NCI.CFG
Edit the file with a common text Editor and add the following section if not already present:

{Tilting-Axis Lock Cutting Unit}
{Start Section}
$H04_XVECTOR
B
$
$H04_XFCVECTOR
43
$
$H04_UP
M81
$
$H04_DOWN
M71
$
$H04_ROTCW
M65M3S%ld
M21
$
$H04_ROTCCW
M65M3S%ld
M21
$
$H04_NOROT

M50
$
{End Section}

Creating Unit Tooling:

Edit any tool between **E1** and **E96** which is a CUTTER or BIT.
Set the tool length as the distance between the unit reference plane and the tip of the cutter to be controlled (see Fig. 4).

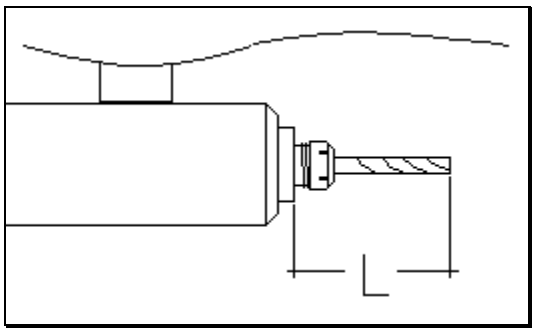


Fig. 4

Set the tool diameter, working length, working diameter, feed speed (maximum and standard), rpm (maximum and standard) and G0/B speed parameters as indicated in the RoutoLink manual.

Set the “Dimension” parameter as the distance between the tool axis of rotation and the maximum dimension Z of the unit in the horizontal position (Fig.5).
Set the “distance Z” parameter = 0.
Set the “Offset R” parameter with the angle of the tool on the XY plane when the unit is at 0° rotation (see the Angle Head section in the RoutoLink manual).
Set the “distance D” parameter as the distance between the unit centre of rotation and the reference plane for measurement of the unit tool length (Fig. 5).

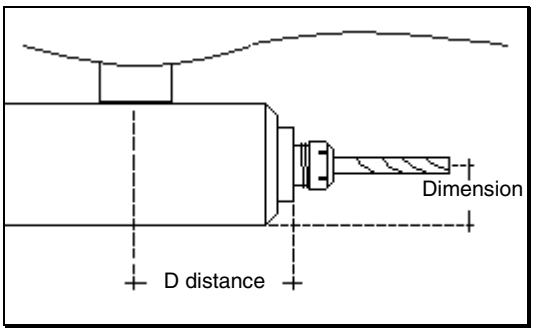


Fig. 5

Set the “Angle A” parameter with the angle of the tool to the vertical axis when the unit is at 0° rotation.

Programming the Unit:

To program the unit in question, use the standard programming procedures with the RoutoLink interface, remembering to enter the unit tilting instruction as follows:

XAXROT R=110 N=”B” ;Positioning unit **B** tool at 110° to the vertical plane.

BR X=800 Y=50 Z=-10 A=270 Q=1 T=201 ;Angled boring instruction with boring angle of 270° on the XY plane with tool **E1** of head **2**.

The angle programmed in XAXROT must always be positive.

To change the angle of machining relative to the vertical plane, enter the **XAXROT** instruction again and repeat the machining. This is not necessary if the angle does not have to change.

You cannot change the unit angle of rotation once the profile is started, since the **XAXROT** instruction envisages unit positioning only before machining starts and not unit interpolation during machining

Example:

CORRECT

XAXROT R=90 N=”B”
G0R X=0 Y=0 Z=-10 A=90 H=20 N="profile" T=201
G1R X=100

CORRECT

XAXROT R=110 N=”B ”
G0R X=0 Y=0 Z=0 A=90 H=20 N="profile" T=201
G1R X=100 Z=-10

INCORREC

XAXROT R=90 N=”B ’
G1R X=0 Z=-20
G1R X=100

You can machine all the faces of the panel (using the unit), correct the tool radius or center the tool, using the normal B,XG0,XL2p instructions, etc.,

specifying the face required. You can also machine compatible angled planes using the XPL X... Y... Z.. instructions etc... (see RoutoLink manual).
In these cases, you do not have to position the tilting axis with the XAXROT command since the Xilog3 compiler will use the angle compatible with the work plane selected:

XPL X=0 Y=10 Z=0 Q=0 R=90 ;Enabling of a plane parallel to face 4 of the panel.

XG0 X=100 Y=20 Z=-10 T=201 N=”profile” C=2
XL2P X=300

To repeat the profile just created by changing the work plane, you can use the **XGREP** instruction, specifying the name of the profile:

XPL X=0 Y=0 Z=0 Q=0 R=80 ;Enabling of a plane parallel to face 4 of the panel.
XGREP N=”profile” T=202 ;Repetition of the profile on an angled plane with tool 202.

ENCLOSED B – PROGRAMMING "DUOMATIC" CLAMPS

Selection of hold-down using the DUOMATIC clamps must be made at the start of the program before the workpiece hold-down request (M28/M39/M58).
It is selected using the usual E30xxx parameters:

E30001 (Selects the type of workpiece hold-down to be used for zone 1).
E30002 (Selects the type of workpiece hold-down to be used for zone 2).
(Also see Diagnostic and M Code manual, supplied with the machine)

In particular: **E30001 =11 : DAB (Duomatic zone AB)**
E30002 =11 : DCD (Duomatic zone CD)

1 The correct programming of the **"V"** parameter inside the RoutoLink PGM program Header allows automatic setting of the values for **E30001** and **E30002** in accordance with the vacuum zone (A, B, C, D etc.) selected:

V=5x (Selects the DUOMATIC clamps)

Example:
(H DX=… DY=… DZ=… -A C=0 T=0 R=99 … V=5x)
E30001=11
…
M28

Example:
(H DX=… DY=… DZ=… -B C=0 T=0 R=99 … V=5x)
E30001=11
…
M38

At the start of the program, before the workpiece hold-down request (M28/M38/M58), you must also select which DUOMATIC clamps are to be used to start work [front (operator side in Y direction), rear (side opposite operator in Y direction) r both].

E30059 (Selects the front/rear/both CLAMPS DUOMATIC zone 1)
E30060 (Selects the front/rear/both CLAMPS DUOMATIC zone 2)

E30059 = 1 : Front clamps zone 1 E30060 = 1 : Front clamps zone 2
= 2 : Rear clamps zone 1 = 2 : Rear clamps zone 2
= 3 : Both clamps zone 1 = 3 : Both clamps zone 2

2 The correct programming of the **"V"** parameter allows automatic setting of these values for the zone involved.

V=50 (no effect)
V=51 (Selects front DUOMATIC clamps)
V=52 (Selects rear DUOMATIC clamps)
V=53 (Selects front and rear DUOMATIC clamps)

Example:
(H DX=… DY=… DZ=… -CD C=0 T=0 R=99 … V=51)
E30002=11
E30060=1
…
M58

Example:
(H DX=… DY=… DZ=… -AB C=0 T=0 R=99 … V=53)
E30001=11
E30059=3
…
M58

At any point of the program, you can then exchange (during machining) the front and rear clamps using the code:
M193 (exchange front and rear clamps)
(Also see Diagnostic and M Code manual, supplied with the machine)

3 Routolink has a special macro-instruction which can carry out this operation directly from the program (XISO instruction):

DUOMATIC G=0 (exchange front and rear clamps)

Example:
(H DX=… DY=… DZ=… -AB C=0 T=0 R=99 … V=53)
E30001=11
E30059=3
…
M58

…
…
(DUOMATIC G=0)
M193

At any point of the program, you can decide to release the front or rear clamps if the **V=53** option (both) has been selected.

E30059 (Selects the front/rear CLAMPS DUOMATIC zone 1)
E30060 (Selects the front/rear CLAMPS DUOMATIC zone 2)
M194 (overrides the clamps selected)

E30059 = 4 : Front clamps
= 5 : Rear clamps

E30060 = 4 : Front clamps
= 5 : Rear clamps

N.B. Once the front clamps have been released, you can no longer release the rear clamps and vice versa or decide to re-apply hold-down with both clamps.

4 The instruction referred to above can be used to carry out this operation directly from the program (XISO instruction):

DUOMATIC G=1 (overrides front clamps)
DUOMATIC G=2 (overrides rear clamps)

Example:
(H DX=… DY=… DZ=… -AB C=0 T=0 R=99 … V=53)
E30001=11
E30059=3
…
M58
…
…
(DUOMATIC G=1)
E30059=4
M194

ANNEX C - QUESTIONNAIRE

The SCM Group has always dedicated the utmost attention to customers' needs, in order to improve the performance of its products.
For this purpose, you are kindly requested **to fill in the questionnaire below and send it by telefax to the *Xilog³MMI – RoutoLink* DOCUMENTATION SERVICE - FAX. N.: +39 – (0)541700282**.

For further advice and suggestions, please do not hesitate to contact the following **E-mail** address:

xilog3 @ woodwork.it

Thank you for your co-operation.

PLEASE FILL IN AND RETURN TO THE *XILOG³MMI – RoutoLink*
DOCUMENTATION SERVICE -FAX N.: +39 – (0)541700282

Company Name:……..

Machine type:……..……..…..…..……Software version:……..…..……

FUNCTIONALITY

Level of satisfaction (Low=1;High=10):	**1 - 2**	**3 - 4**	**5 - 6**	**7 - 8**	**9 - 10**
Execution of processes	○	○	○	○	○
Control of feed system	○	○	○	○	○
Programming environment	○	○	○	○	○
Graphic programming environment	○	○	○	○	○
Programming language	○	○	○	○	○
File management (programs,mixes,toolings)	○	○	○	○	○
Import of geometries from C.A.D. (DXF)	○	○	○	○	○
Flexibility (P.C.)	○	○	○	○	○

GRAPHIC PRESENTATION

Level of satisfaction (Low=1;High=10):	**1 - 2**	**3 - 4**	**5 - 6**	**7 - 8**	**9 - 10**
Ease of use	○	○	○	○	○
Availability and visibility of information	○	○	○	○	○
Window lay-out	○	○	○	○	○
Functionality of commands	○	○	○	○	○
Functionality of keyboard	○	○	○	○	○
Functionality of mouse	○	○	○	○	○
Graphic and geometric help	○	○	○	○	○

INSTRUCTIONS

Level of satisfaction (Low=1;High=10):	**1 - 2**	**3 - 4**	**5 - 6**	**7 - 8**	**9 - 10**
Training courses	○	○	○	○	○
Manual	○	○	○	○	○
In-line help	○	○	○	○	○

GENERAL

Do you consider the use of the mouse on the machine simple ?	YES	NO
Should the graphics reflect the Windows® style to a greater extent ?	YES	NO
Are you familiar with other, similar interfaces ?	YES	NO

If so, which, and what is your comparative assessment ? …….
……..…….

SUGGESTIONS:……..……..……..……..……
……..……..

14. SUPPLEMENTARY NOTES TO THE MANUAL AND "CORRECTIONS"

This section includes a set of notes, explanations and corrections useful for a better understanding of important aspects.

14.1 SAFE CYLINDER DIAMETER

If the parameter is set to zero, rotation always occurs with the head raised. If it is set to –1, rotation always occurs with the head lowered.

14.2 XL2P – segment through two points

Up to the previous version, an XL2P instruction with the length L setting but not the angle B incorrectly assumed an angle B equalling 90 degrees. It now assumes an angle B equalling 0.
Correction of this problem means that those programs which specified the length L but not the angle B no longer function. Said programs must be modified by setting the value of angle B to 90.

14.3 N and XN – null operation

Meaning of field S:
- If not programmed or if value is 0 the spindles are switched off.
- If programmed with value 1 the spindles remain on.

Meaning of field Q:
- If not programmed or if value is 0, dimensions X and Y refer to the machine zero.
- If programmed with value 1, dimensions X and Y refer to the panel zero.

14.4 APPROACHING MACHINING

On some machines the head which must perform the initial machining on the panel descends before or during movement. The dimension Z to which the head moves is defined **exclusively** according to the panel Z dimension (value of program title field DZ). Therefore, the size of any panels present on the other machining areas is not considered.
If there is any danger of collision with the other panels, before the program initial machining insert one or more N or XN instructions, which control the movement in safety.
The same procedure applies for subsequent machining, if the heads must move over other panels.

14.5 MOVEMENT ABOVE PANEL

The movements of the heads as they approach the starting point of the subsequent machining are optimised according to the tools/assemblies and the panel Z dimension.
If there is no safety dimension to which the head can move above the panel with the tools/assemblies mounted, a “No safety dimension above workpiece” error message is issued.

14.5.1 UNRECOVERABLE CASES

In the following cases the “No safety dimension above workpiece” error cannot be recovered:

1. If movement is possible with the pneumatic head raised:
   - BR or XBR with tool configured on face 0
   - TA or XTA on face 1
   - B or XB on inclined worktable

2. If movement is not even possible with the pneumatic head raised:
   - BR or XBR with tool configured on face 0
   - TA or XTA
   - B or XB on inclined worktable

The other cases may be recovered using the SET DONTCARE instruction.

14.5.2 SET DONTCARE

The SET DONTCARE=1 instruction prevents Xilog³/RoutoLink from issuing the "No safety dimension above workpiece" message for the following machining.
The instruction is only effective in recoverable cases and only on the following machining. There must not be any other instructions between SET DONTCARE=1 and the machining.
You can use the SET DONTCARE=1 instruction to take responsibility for direct control of the movements (by means of N or XN), so as to prevent collisions with the panels and guarantee that any Vector rotations occur outside the workpiece.

14.6 PGM PROGRAM MANAGEMENT

14.6.1 EDITING

You can edit and graphically display programs with up to approximately 32700 lines.

14.6.2 RUN PROGRAMS

You can run all editable programs which produce a maximum of around 65500 operating instructions.

Operating instructions: H, REF, F, BR, B, N, TA, G0, G1, G2, G3, SET, MSG, ISO, VT, VROW, ENDVT, G0R, G1R, G2R, G3R.
If necessary, the limit of around 65500 operating instructions may be extended; however, modification is not recommended since system performance may be compromised.

14.7 RUN MIXES

If you modify a Mix or the programs or sub-programs retrieved by the Mix while it is running, this may result is serious malfunctions. In contract, you can safely modify other Mixes, programs or sub-programs which are not involved in the Mix currently running.

14.8 ISO PROGRAM DIRECT MANAGEMENT

14.8.1 EDITING

- You can edit and graphically display programs containing up to 65000 characters. For larger programs, use an external editor, outside Xilog³/RoutoLink.
- Programs below the size limit can only be graphically displayed if the Numeric Control memory has enough space to hold them. Moreover, any sub-programs must be transferred to the Numeric Control memory in advance.

14.8.2 RUN PROGRAM

The limit of around 65000 characters does not apply when running programs. However, the following considerations apply:

- If the program to be run contains jumps, you must set the “CNC transient mode” parameter of file GENDATA.CFG to 0. In such cases, the program will only run if the Numeric Control memory has enough space to hold it. Moreover, any sub-programs must be transferred to the Numeric Control memory in advance.
- If the program to be run does not contain jumps, set the “CNC transient mode” parameter of file GENDATA.CFG to 1. In such cases, the program is transferred to the Numeric Control in blocks. Therefore, the only limit on its size is the space available on the hard disk of the Personal Computer. However, any sub-programs must be transferred to the Numeric Control memory in advance.

14.8.3 M02

In CNC programs all M02 blocks must be preceded by a M201 block. When the M201 block is missing, the program continues to function correctly but at the end the work area colour stays green and the piece counter does not decrease. In this situation press the F1 key (Reset) to inform Xilog³/Routolink that the program is finished.
If you are working with an old CNC program, edit it and manually write the required M201 code.

14.8.4 M20

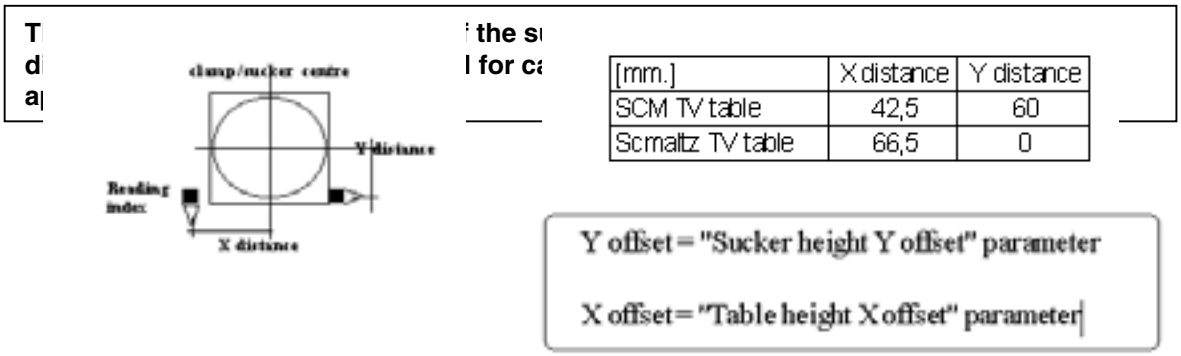
The presence of code M20 instead of M2 (in pendulum machining) means that machining does not have to end in pass mode, therefore, gaining time during the passage from one machining area (e.g.: area A) to another (e.g.: Area B). If using an old CNC program, edit it and manually enter the desired M20 code (from version 6.3).

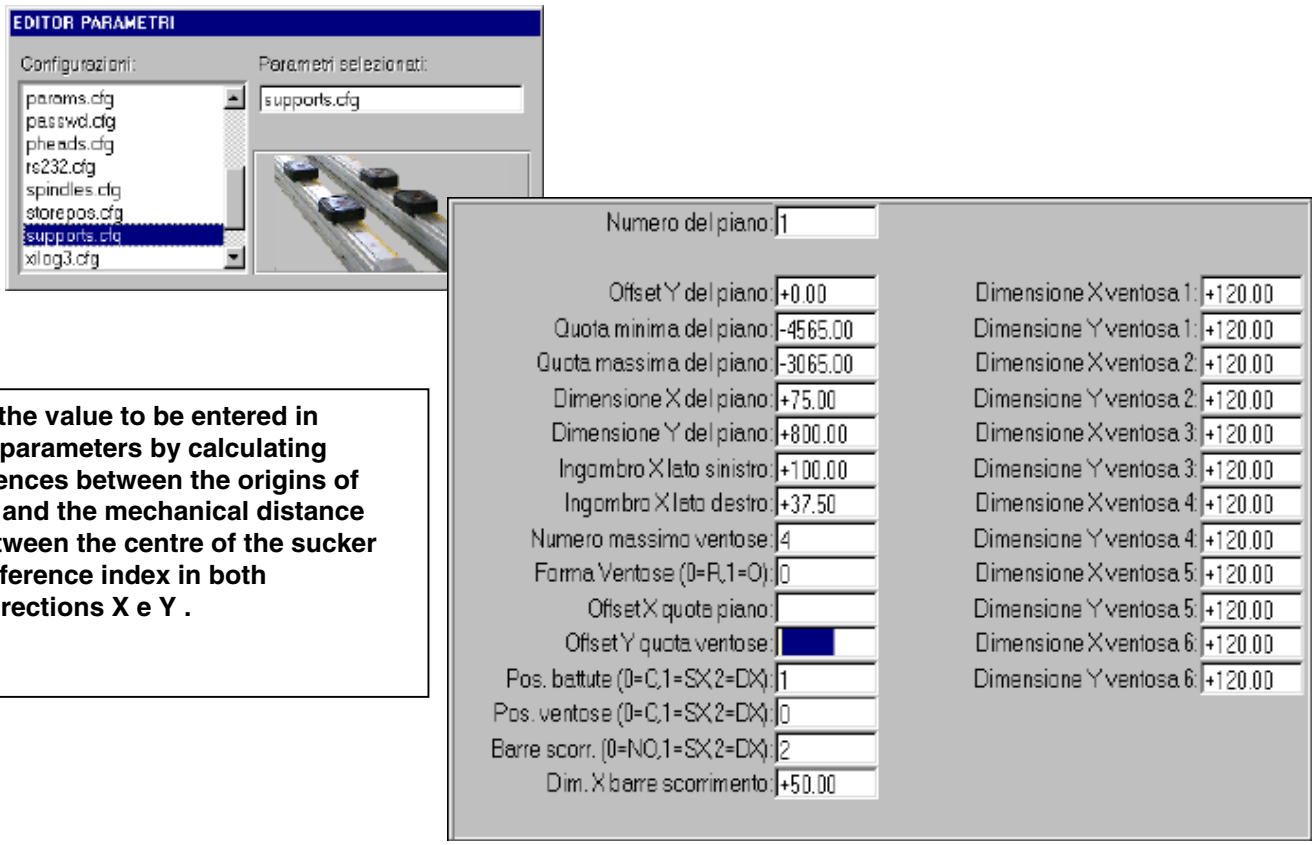
14.9 How to use and program SEPRI height DISPLAYERS/INDICATORS.

To use these devices a number of settings must be made in the Routolink configuration files:

File "**supports.cfg**"

-Set the metric ruler height indicator offset values in relation to the centre of the clamp/sucker.





Calculate the value to be entered in the offset parameters by calculating the differences between the origins of Routolink and the mechanical distance values between the centre of the sucker and the reference index in both X and Y directions X e Y .

File "**Xilog3.cfg**"

- Set the type of positioning management for the elements on the table (manual)
- Set the serial line used and select the transmission protocol.

As in AUTOSET functioning, the following parameters must be set :

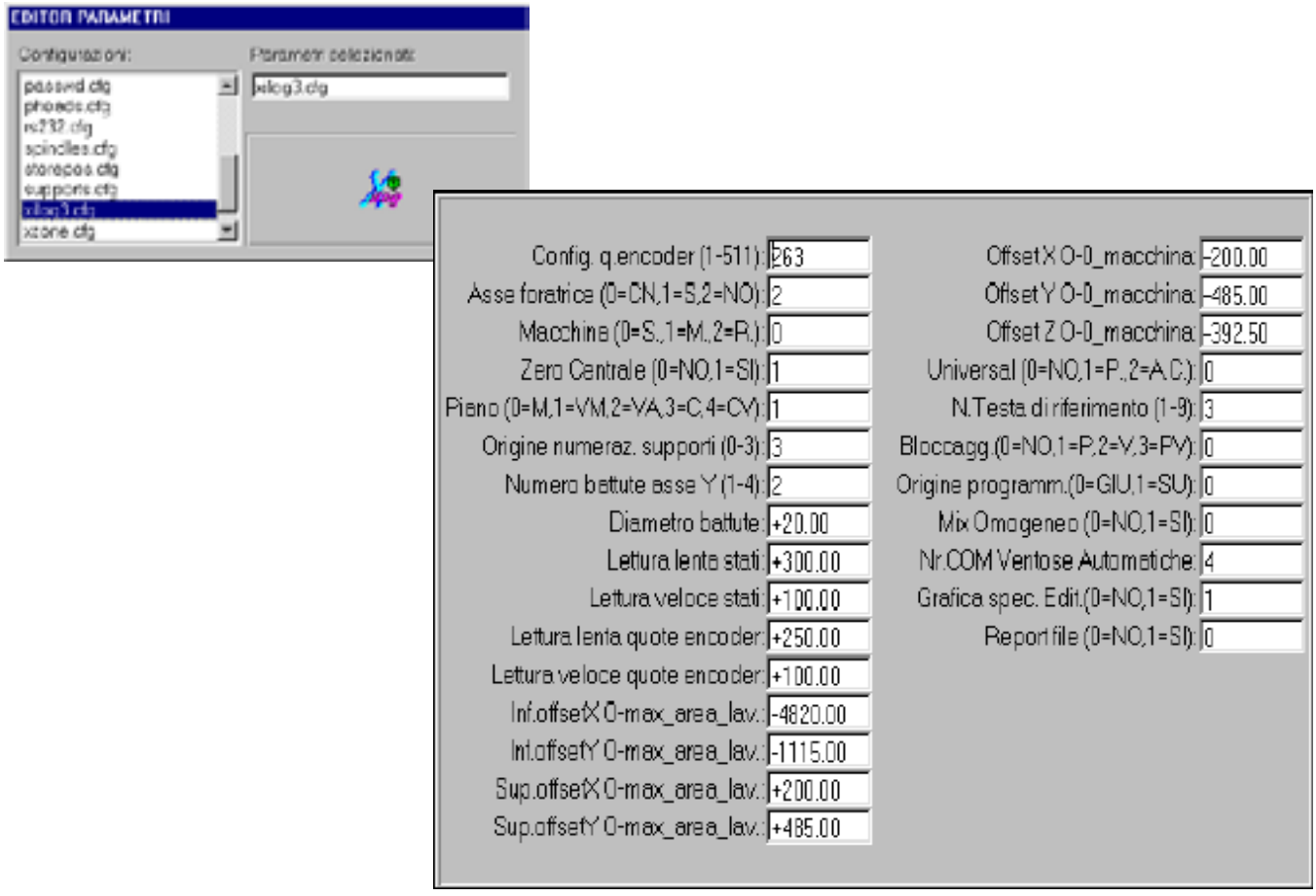
For TVS table graphic programming, see AUTOSET: (Routolink manual)
- section 7.7 (TVS table management)
- section 11.11.5 (cross bar and sucker graphic programming)

This function is only included from the 6.1 version onwards.

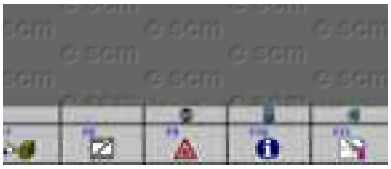
Parameter: "TABLE" = 1
(positioning the blocking elements on the table manually)

parameter: “NR.COM. AutomaticSuckers” = (COM management selection)

forVIS SEPRI	**10 (COM1)**	**forVIS LIKA-SIKO**	**20 (COM1)**
	11 (COM2)		**21 (COM2)**
	12 (COM3)		**22 (COM3)**
	13 (COM4)		**23 (COM4)**



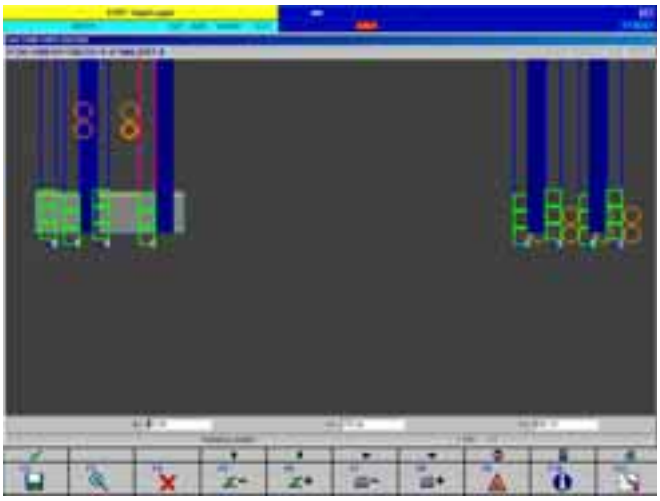
14.10 Procedure to use the positioning of the bars and the vacuum cups on the RD130 STV and RD240 TV.

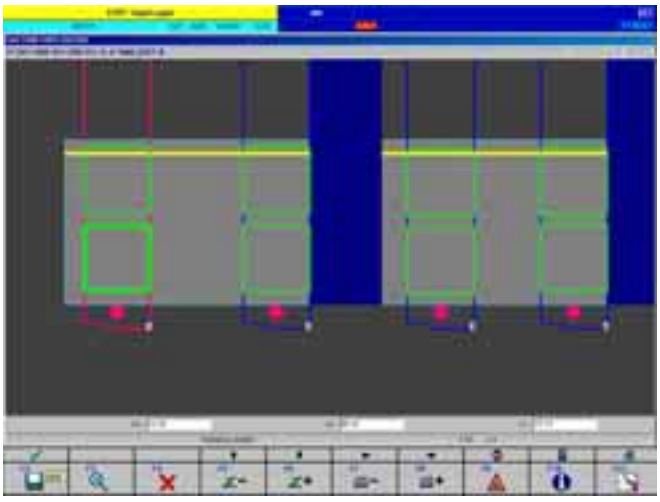


Select the program that you desired to perform (shift+F2)

Select the assisted programmation (shift+F8)

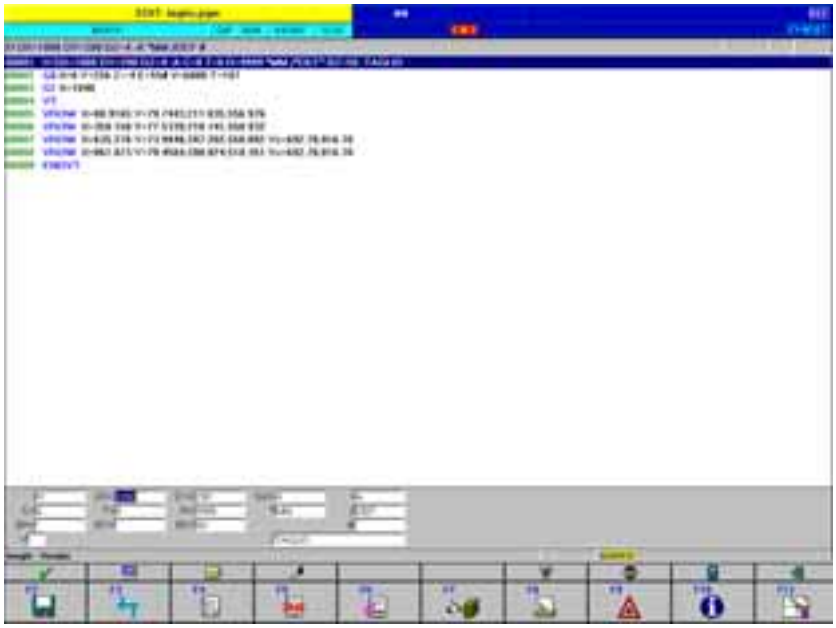
Select the "Suction Cups Editor (F6)



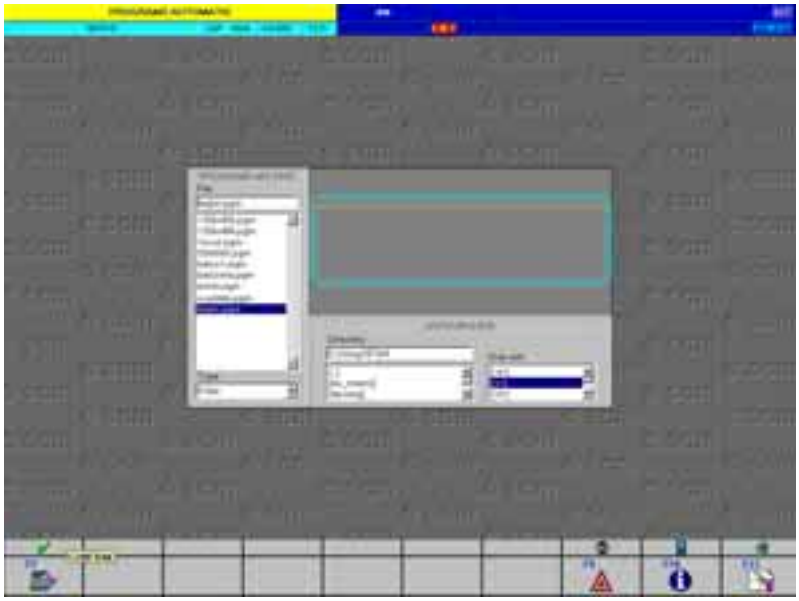


Positioning the bars and the suction cups under the piece, with the pointer of the mouse + the key SX.

If necessary to help zooming the interested zone (F3).



You can be verified in the program the selected cooordinates



Select the program in automatic mode.

Set the field V=11 (fields A,). After the start of the program, the quote will be trasmitted to the visualizer SEPRI on the bar.

Press the key “SEL”, until the letter “H” will appear.

Move the bar until the index marks on the bar, indicate the value on the SEPRI visualizator.

Press the key "SEL", until the letter "1" will appear.

Move the vacuum cups until the cups-body , indicate the value on the SEPRI visualizator.

Repeat the same procedure for all vacuum cups and bar used.

14.11 CNC NUM JERK function : use and programming .

IMPORTANT NOTICE FOR USERS:

In order to optimise machine use in the various machining stages, a special software function has been enabled (called JERK), which can vary the machine response (and, therefore, its dynamic behaviour) according to the workpiece being machined.

In particular, the **expert user** is given the possibility of optimising the machine response, altering its dynamics according to the desired speed-precision compromise.

The operator can set the Jerk function adjustment **"level"**, to favour one above the other, or select a neutral situation which takes into account both requirements.

We refer to **expert users**, since use of this function requires in-depth knowledge of the various machining requirements and programming tools (involves manual program editing, ability to read the ISO list, or XISO if Routolink is present, and familiarity with list editing tools).

Those who do not want to, or do not feel able to, make these changes can simply forget this function, leaving the default values set by SCM Group S.p.A., which still guarantee a great compromise between finishing and roughing requirements, without having to make adjustments every time.

[**JERK** = a software function for gradual application of machine acceleration, adjusting its development. Allows considerable reductions in down times and acceleration times, with significant savings in terms of the total time required for workpiece machining, with less stress on the machine. The results which can be obtained are linked to the type of workpiece being machined and are more obvious the more significant are the rapid movement phases (G0) and acceleration and deceleration. For example, the maximum gain is in boring cycles, whilst the minimum gain is in routing only cycles with slow consecutive movements (G1)]

JERK LEVEL MACRO ACTIVATION BY THE OPERATOR:

To make the above-mentioned adjustment, retrieve the following ISO instruction line from the part-program, in which you must specify the desired value for "XXX" parameters.

Only tests and experience will tell which is the correct value to use for each program.

The program line in question may be repeated several times in the same program, each time you feel that this is necessary.

At present, this optimisation is not controlled by the post-processors distributed by SCM Group S.p.A., therefore, selection of the position in which to enter the programming line in the program is entirely the operator's responsibility. Use manual program editing.

If unsure, leave the default value!

G120EJxxx (use this instruction line to retrieve the system ISO program %10120 and request "JERK" activation)

Where: "XXX" = JERK adjustment value
[minimum value which can be set = 60] .

If the Routolink operator interface is present (**starting from version 6.3**) , the correct instruction, according to Routolink syntax, is:

SET JERK=XXX (use this instruction line to retrieve the system ISO program %10120 and request "JERK" activation)

You MUST enter the instruction before "G0" for approaching the workpiece for start of machining.

RECOMMENDED VALUES:

"XXX" =	60	BORING
"XXX" =	90	ROUGHING
"XXX" >=	160	FINISHING

where, from one machine to another, the typical values detected by SCM Group S.p.a. are:

RECORD series, range	100-121-130	"XXX" >=	**180**	**FINISHING**
RECORD series, range 240		"XXX" >=	**180-200**	**FINISHING**
RECORD series, range 260		"XXX" >=	**260**	**FINISHING**
ERGON series		"XXX" >=	**90**	**FINISHING**

"XXX" = value varies from one machine to the next according to SCM Group S.p.a. standard NEUTRAL MACHINE (DEFAULT)

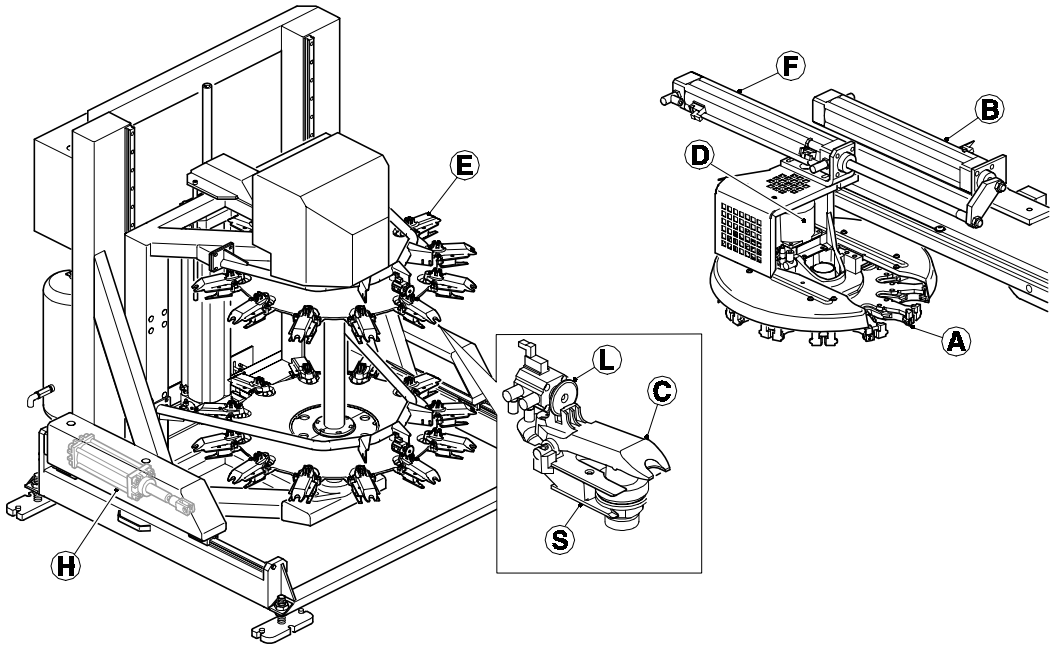
"XXX" = 0 RESET DEFAULT VALUES in a program in which they were previously deliberately changed (a "RESET" from the CNC also restores the DEFAULT conditions)

IMPORTANT : DO NOT EDIT OR DELETE !!!

program **%11000** (SCM Group S.p.a. file reserved for machine configuration)
program **%10120** (SCM Group S.p.a. file reserved for Jerk enabling)

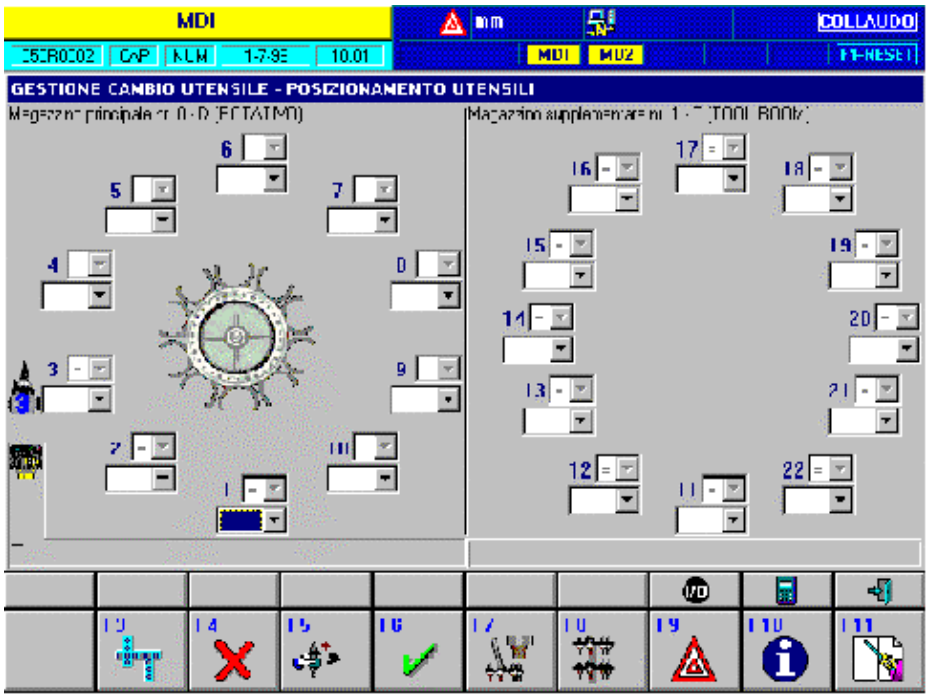
14.12 Using and Programming the Tool Room.

(Correction to section 4.3.3: ADDITIONAL TOOL CHANGER MANAGEMENT)



If the machine has the additional tool change Tool Room type (T) and the XILOG3.CFG "**Special Machine"** parameter is configured to the value 1, the management of the tools and their magazine locations may be carried out in this environment.

The table (representing this environment) features a series of fields arranged in a circular fashion for the magazine stations on the machine.
The table is divided into two parts: the first, on the left, represents the main circular magazine; the second on the right represents a single magazine rack on the supplementary Tool Room magazine. If the supplementary magazine is made up of more than one rack, the [F8] key allows you to pass from one rack to another (in the right hand side of the table).



The table may be used to set a starting condition of the tools in the magazines (pertaining to the loading of tools in their magazine locations)

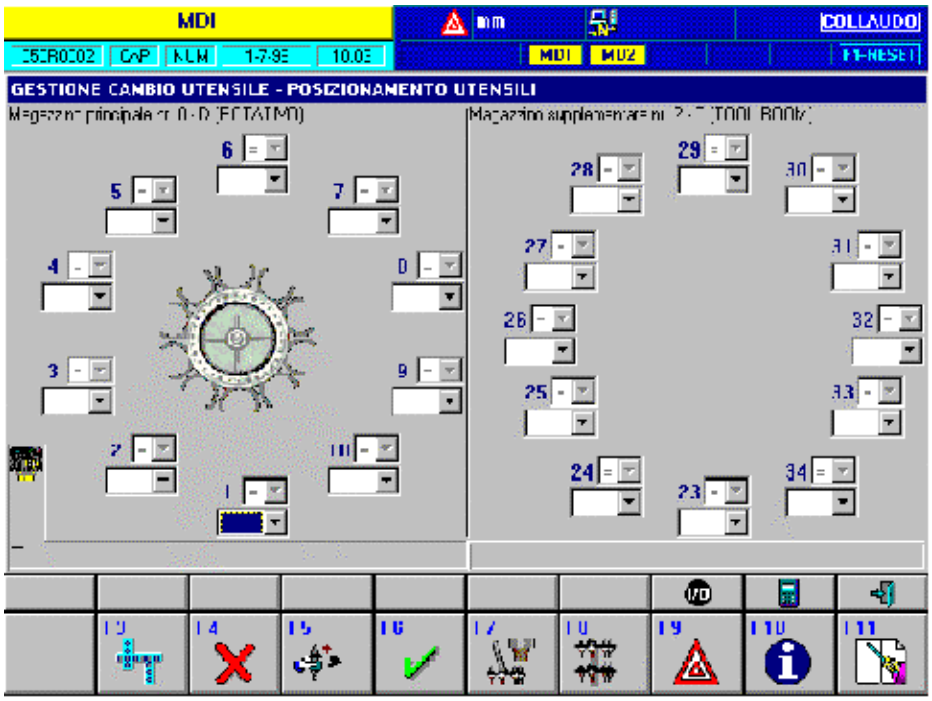
In the first case, the table can be found in the *Positioning* condition of the tools in the magazines (see in DESCRIPTION OF STATUS AND FUNCTIONS, TOOL CHANGE MANAGEMENT TABLE). The machine user must set the number of tools about to be loaded manually in a given position of the magazine. The tool setting operation is facilitated by a list of tools available for any given magazine location represented by their name E*n*, plus any multiple heads characterised by the symbol A*n* (see «TOOLING», «SUPPLEMENTARY TOOL CHANGE» and “DESCRIPTION OF STATUS AND FUNCTIONS”, “TOOL CHANGE MANAGEMENT TABLE”).

In this condition the same tool number cannot be associated to two different magazine locations and there should be two free locations at least in the ADDITIONAL magazine.

After confirmation of the table (by means of **[F6]**) **the actual situation of the tools in the machine must correspond to the condition set in the table itself.**

In the second case, the status is that of *Load/Unload:* the user can program loading and unloading operations of the tools from the magazine. The tools in the rotating magazine can only be unloaded and those of the additional magazine can only be loaded; the load and unload programming must follow the rules set either by the number of magazine locations or by the “dimD” parameter, (see in DESCRIPTION OF STATUS AND FUNCTIONS, TOOL CHANGE MANAGEMENT TABLE).

In this case, confirming the table (with **[F6]**) enables the machine to do the actual tool change. At this stage the user must wait for the Load/Unload cycle to be completed.



To delete the tool table, use function key F4.

Deletion of a tool table must be confirmed using function key F6.

To enable table editing, press function key F5.

At this point you can if you wish load new tools to the table using the Tool Location field. Click on any Tool Location to open the window showing the tools that can be loaded into that location (previously configured in the tooling stage: see Routolink manual). .

When you have finished editing the table, save the changes using function key F6.

Press the ESC key to return to the previous page and then to MDI mode.

TOOL CHANGE OPTIMISER

MODULE

The software is an integral part of the SCM Routolink interface for controlling CNC routers and borers.

It can be installed, as Routolink module, only on machines equipped with Tool Room.

Main features

1) Before performing a machining cycle, the software that all the tools required for the work to be done are present on the machine (on the spindle, on the Rapid or on Tool Room) .

2) It removes any obstacles that might prevent a tool from being fitted on any of the grippers on the Rapid.

The new system incorporates various rules for preventing collision between the tools on the Rapid and on Tool Room. This means any tool can be placed on any gripper of the Rapid.

3) It automatically fills the Rapid with all the tool required for the machining cycle to be carried out. If the Rapid cannot contain all the tools required, automatic filling is carried out two or more times.

Operating mode

The tool change program can operate both in Automatic and in MDI modes.

Tooling the magazines (A) and (E)

All the tools available must be loaded manually into the magazines in completely Random manner until all the locations are filled. Check each tool to ensure that it does bot collide with the adjacent tools.

Note. Remember that the Routolink tool table must exactly reflect the arrangement of the tools in the magazines (A) and (E).
Do not load any tool manually onto the electro-spindle.

When the first part program starts, the Optimiser Module automatically transfers to the Rapid as many of the tools to be used as possible.

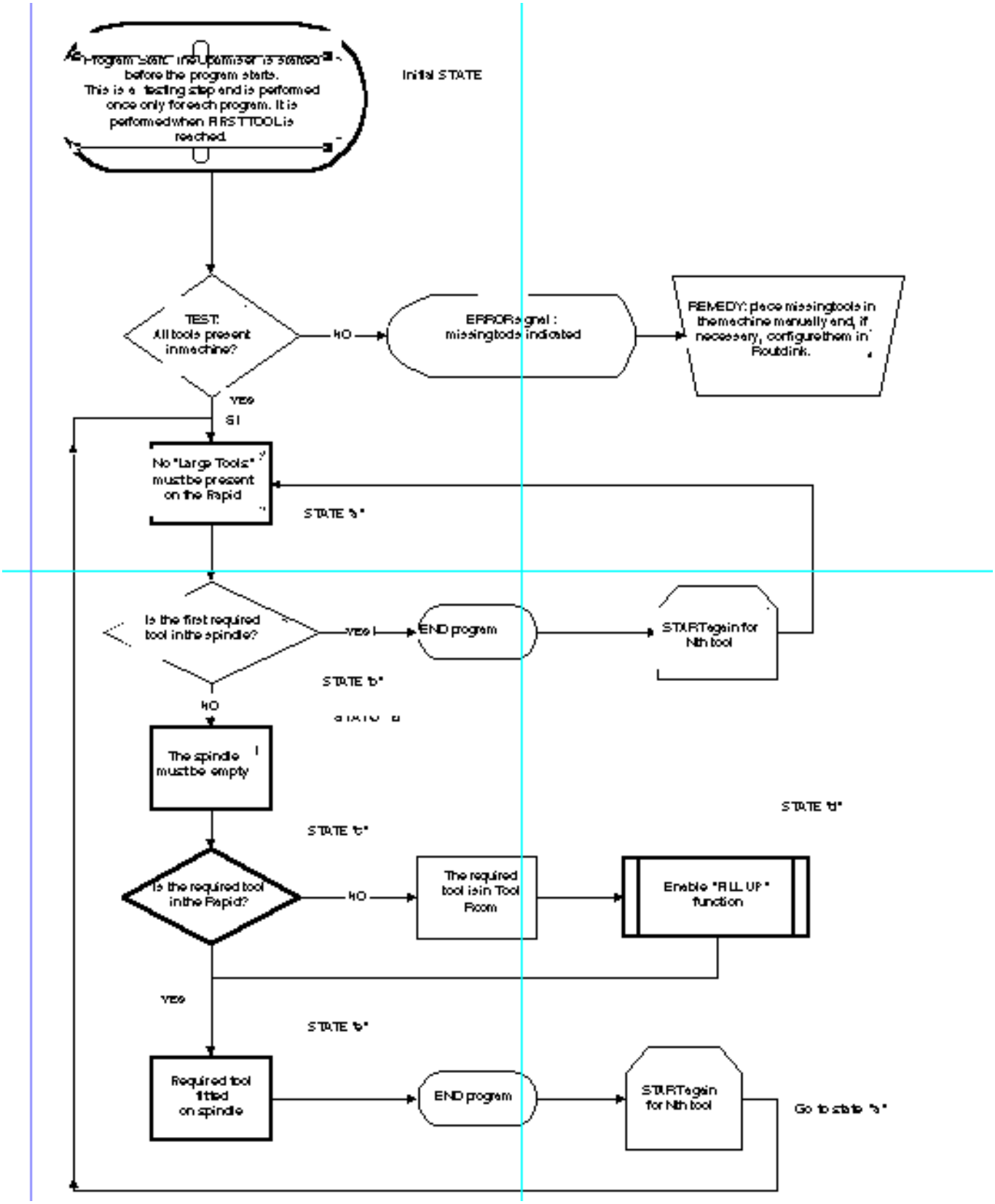
If the part program requires more tools than the Rapid can contain, the Optimiser Module unloads those that are no longer necessary and loads the remaining tools required.

The procedure automatically controls, the exchange of tools between the magazine (A) and the magazine (E) according to size (see RoutolinkNCI.cfg file).

Tool data are defined during tooling (see the Routolink manual for details). Assigning a length and a radius to a tool automatically classifies the tool according to the rules described above.

N.B. **1) The table must be updated each time a tool is moved manually.**
2) The table entries must always match the tools mounted on the magazine in order to prevent tool collisions during machining.

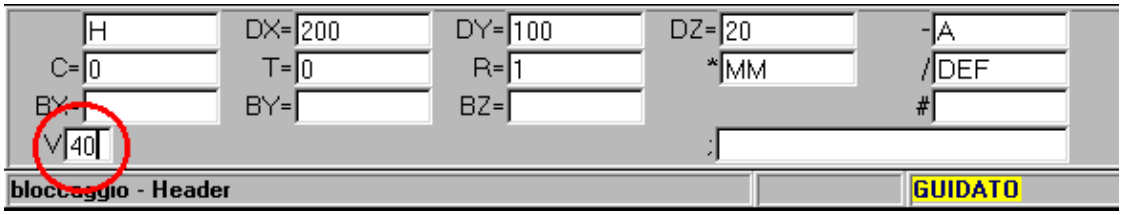
OPTIMISER MODULE FLOW CHART



14.13 Customer tooling management.

Before switching the tooling ON or OFF, you must ensure that the starting condition on all zones of the work table is the home position.
You can carry out pendulum machining, but you cannot manage the tooling together with other locking systems.

With Routolink:



To switch tooling management ON, enter V= 40 in the locking field.

In ISO:

2 ZONE MANAGEMENT

E30001=1 Zone A

E30002=1 Zone B

- M191 = Tooling ON
- M190 = Tooling OFF

These codes must be followed by the normal vacuum request codes.

4 ZONE MANAGEMENT

E30001=1 Zone A

E30001=2 Zone B

E30001=3 Zone AB or BA

E30002=1 Zone C
E30002=2 Zone D
E30002=3 Zone CD or DC

- M191 = Tooling ON

- M190 = Tooling OFF

These codes must be followed by the normal vacuum request codes.

14.14Additions to file “NCI.cfg” .

The following lines are additions to the description in section 12.11

Main section:

```
$GEN_MAXTOOLLEN      maximum length allowed on rapid
```