

# **FAGOR NC-10/20 S FOR SHEARS**

**INSTALLATION MANUAL**

**Manual version: 0302**



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<b><u>Warning:</u></b>	
	<p>Before starting up the DRO, carefully read the instructions of Chapter 2 in the Installation Manual.</p> <p>The DRO must not be powered-on until verifying that the machine complies with the "89/392/CEE" Directive.</p>

## **DECLARATION OF CONFORMITY**

**Manufacturer: Fagor Automation, S. Coop.**

**Barrio de San Andrés s/n, C.P. 20500, Mondragón -Guipúzcoa  
(ESPAÑA)**

We hereby declare, under our responsibility that the product:

**NC Fagor NC-10/20 S1**

meets the following directives:

**SAFETY:**

EN 60204-1 Machine safety. Electrical equipment of the machines.

**ELECTROMAGNETIC COMPATIBILITY:**

EN 50081-2 Emission

EN 55011 Radiated. Class A, Group 1.  
EN 55011 Conducted. Class A, Group 1.

EN 50082-2 Immunity

EN 61000-4-2 Electrostatic Discharges.  
EN 61000-4-4 Bursts and fast transients.  
EN 61000-4-5 Power surges  
EN 61000-4-11 Voltage fluctuations and Outages.  
ENV 50140 Radiofrequency Radiated Electromagnetic Fields.  
ENV 50141 Conducted disturbance induced by radio frequency fields.

As instructed by the European Community Directives on Low Voltage: 73/23/EEC, on Machine Safety 89/392/EEC and 89/336/EEC on Electro-magnetic Compatibility.

In Mondragón, on February 1st, 2002

Fagor Automation S. Coop. Ltda.  
Director Gerente

Fdo.: Julen Busturia

## **SAFETY CONDITIONS**

Read the following safety measures in order to prevent damage to personnel, to this product and to those products connected to it.

Fagor Automation shall not be held responsible for any physical or material damage derived from the violation of these basic safety regulations.



### **Do not open this unit**

Only personnel authorized by Fagor Automation may open this unit.



### **Do not handle the connectors with the unit connected to AC power.**

Before handling the connectors (mains, feedback, etc.) make sure that the unit is not connected to AC power.

### **Use proper Mains AC power cables**

To avoid risks, use only the Mains AC cables recommended for this unit.

### **Avoid electrical overloads**

In order to avoid electrical discharges and fire hazards, do not apply electrical voltage outside the range indicated in chapter 2 of this manual

### **Ground connection**

In order to avoid electrical discharges, connect the ground terminals of all the modules to the main ground terminal. Before connecting the inputs and outputs of this unit, make sure that all the grounding connections are properly made.

### **Before powering the unit up, make sure that it is connected to ground**

In order to avoid electrical discharges, make sure that all the grounding connections are properly made.

### **Ambient conditions**

Respect the temperature and humidity ranges specified on the chapter about technical characteristics in this manual (1.3).

### **Do not work in explosive environments**

In order to avoid risks, damage, do not work in explosive environments.

## Working environment

This unit is ready to be used in Industrial Environments complying with the directives and regulations effective in the European Community

## Install the unit in the right place

It is recommended, whenever possible, to instal the DRO so its power switch of the back panel is at a distance between 0.7 m (27.5 inches) and 1.7 m (5.6 ft) off the floor and away from direct sunlight, hot air, coolants, chemical products, blows as well as from relays, or high electromagnetic fields (about 0.5m or 20 inches) that could damage it.

This unit complies with the European directives on electromagnetic compatibility. Nevertheless, it is recommended to keep it away from sources of electromagnetic disturbance such as.

- Powerful loads connected to the same AC power line as this equipment.
- Nearby portable transmitters (Radio-telephones, Ham radio transmitters).
- Nearby radio / TC transmitters.
- Nearby arc welding machines.
- Nearby High Voltage power lines.
- Disturbance generating elements of the machine.
- Etc.

## Safety symbols

### Symbols which may appear on the manual



WARNING. symbol

It has an associated text indicating those actions or operations may hurt people or damage products.

### Symbols that may be carried on the product



WARNING. symbol

It has an associated text indicating those actions or operations may hurt people or damage products.



"ELECTRICAL SHOCK" symbol

It indicates that point may be under electrical voltage



"GROUND PROTECTION" symbol

It indicates that point must be connected to the main ground point of the machine as protection for people and units.

## **WARRANTY TERMS**

### **WARRANTY**

All products manufactured or marketed by Fagor Automation has a warranty period of 12 months from the day they are shipped out of our warehouses.

The mentioned warranty covers repair material and labor costs, at FAGOR facilities, incurred in the repair of the products.

Within the warranty period, Fagor will repair or replace the products verified as being defective.

FAGOR is committed to repairing or replacing its products from the time when the first such product was launched up to 8 years after such product has disappeared from the product catalog.

It is entirely up to FAGOR to determine whether a repair is to be considered under warranty.

### **EXCLUDING CLAUSES**

The repair will take place at our facilities. Therefore, all shipping expenses as well as travelling expenses incurred by technical personnel are NOT under warranty even when the unit is under warranty.

This warranty will be applied so long as the equipment has been installed according to the instructions, it has not been mistreated or damaged by accident or negligence and has been manipulated by personnel authorized by FAGOR.

If once the service call or repair has been completed, the cause of the failure is not to be blamed the FAGOR product, the customer must cover all generated expenses according to current fees.

No other implicit or explicit warranty is covered and FAGOR AUTOMATION shall not be held responsible, under any circumstances, of the damage which could be originated.

### **SERVICE CONTRACTS**

Service and Maintenance Contracts are available for the customer within the warranty period as well as outside of it.

## **MATERIAL RETURNING TERMS**

When returning the DRO, pack it in its original package and with its original packaging material. If not available, pack it as follows:

- 1.- Get a cardboard box whose three inside dimensions are at least 15 cm (6 inches) larger than those of the unit. The cardboard being used to make the box must have a resistance of 170 Kg (375 lb.).
- 2.- When sending it to a Fagor Automation office for repair, attach a label indicating the owner of the unit, person to contact, type of unit, serial number, symptom and a brief description of the problem.
- 3.- Wrap the unit in a polyethylene roll or similar material to protect it.
- 4.- Pad the unit inside the cardboard box with poly-utherane foam on all sides.
- 5.- Seal the cardboard box with packing tape or industrial staples.

### ***DESCRIPTION OF THE VARIOUS MODELS***

This manual mentions different machine models depending on the number of axes controlled. All the models have a parts counter whose display is shared with that of the Y axis position.

<b>SIMPLE</b>	<b>PROGRAMMABLE</b>	
NC 10S1	NC 10S2	1 axis
NC 20S1	NC 20S2	2 axes

The Y axis may be set (PAR65.3 = 1) to only attend to the three fixed positions detected by the limit switches at the 24V INPUTS.

This manual refers to them as NC 20 S1/2\*.

## ***MACHINE DEFINITION. MOST RELEVANT PARAMETERS***

### **1.- PAR65(5)=0, PAR64(3)=1 Cut-off / Shear**

Independent electrovalves to activate clamp / holders and shearing mechanism.

Sequential operation:

- Clamp.
- Option backstop retraction.  
Cut-off / shear.
- Release the foot switch and return.

### **2.- PAR65(5) = 1 Conventional shear**

Single electrovalve.

- Simultaneous action upon sheet holders and shear with optional backstop retraction.
- Release the foot switch and return.

#### **Options:**

#### **a) Interrupt the cut. PAR65(4)**

If = 1, abort when lifting the foot switch.

If = 0, interrupt / resume the cut with the foot switch.

#### **b) Timed end of cut (PAR32)**

#### **c) Auxiliary "Y" axis. "NC-20" model**

Blade gap in swinging shear.

Inclination by swinging the position of the cylinders.

Controls 3 fixed positions without encoder [PAR65(3)].

#### **d) Programmable models: NC-10/20 S2**

Repetitive shearing sequences or with STOP when finishing the batches.

### **3.- PAR64(1) Conventional press brake**

MANUAL and CICLE modes.

X, Y axes positioning, ram-down permission and confirmation with manometric pressure gage.

Modifiable bending time.

Command to return the ram to the top dead point.

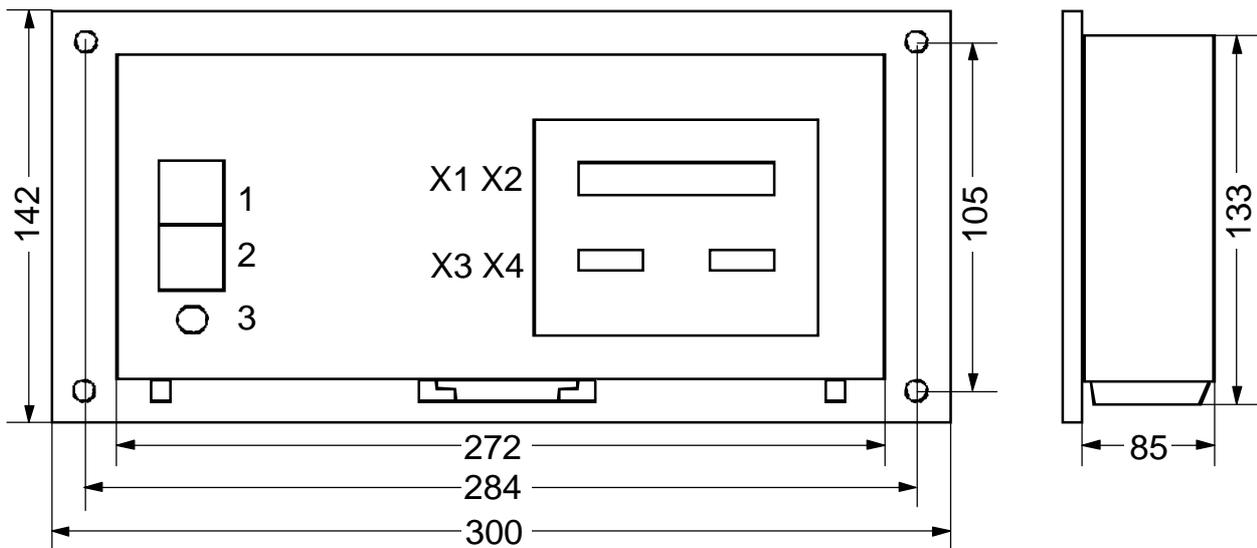
## 1. UNIT DESCRIPTION

This NC is specifically designed to be installed on 1 and 2-axis shears. It allows moving the axes in JOG mode or to a preset position. Through its digital outputs, it can also control auxiliary mechanisms such as sheet holders, pressure valves and shear up and down movements and it has a parts counter.

### 1.1 FRONT PANEL (SEE OPERATION MANUAL)

### 1.2 REAR PANEL

Dimensions of the Built-in model (in mm):



On the back of the unit, the following items may be found:

- 1.- Power switch.
- 2.- Three-prong power connector for AC and ground connection.
- 3.- M6 mm terminal for general machine ground connection.

**X1, X2.-** SUB-D type 37 pin female connector to connect the digital inputs and outputs as well as the analog outputs.

**X3.-** SUB-D HD type 15-pin female connector for X axis feedback device.

**X4.-** SUB-D HD type 15-pin female connector for Y axis feedback device.

**WARNING** Do not handle the connectors while the unit is under power.



Before handling the connectors (mains, feedback, etc.) make sure that the unit is not under power.

It is NOT enough to turn the display off by using the  key at the keyboard.

### **1.3 GENERAL TECHNICAL CHARACTERISTICS**

Universal Power Supply between 100V AC and 240V AC  $\pm 10\%$  at a mains frequency between 45 Hz and 400Hz, between 120Vdc and 300Vdc

Mains frequency of 0 Hz (DC) and from 45 Hz to 400 Hz.

Power outages of up to 20 milliseconds.

10-year memory backup of installation parameter even when the unit is off.

The operating temperature inside the DRO enclosure must be between 5° C and 45° C (41°F and 113°F).

The storage temperature inside the DRO enclosure must be -25° C and +70° C (-13° F and 158° F).

Maximum relative humidity: 95% non condensing at 45°C (113°F).

Front Panel Sealing: IP54 (DIN 40050), Rear panel: IP4X (DIN40050) except for built-in models in which case is: IP20.

## **2. CONNECTIONS AND CHARACTERISTICS**

### **2.1 POWER AND MACHINE CONNECTION**

This NC can be connected to an AC voltage anywhere between 100V AC and 264 V AC  $\pm 10\%$  at a frequency between 45 Hz and 400 Hz. Between 120Vdc and 300Vdc without having to select it depending on the country where they are installed thanks to their universal power supply.

Always mount it vertically so its keyboard is within operator's reach and its digits are easily visible (at operator's eye level).

**Do not connect or disconnect this NC connectors while it is under power.**

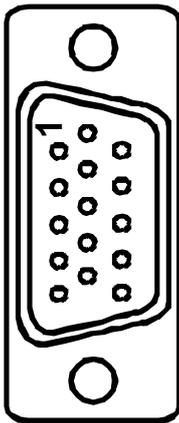
Connect all metallic parts to a common point on the machine tool and it to the general ground point. Use cables of enough gage (no thinner than 8 mm<sup>2</sup>).

## 2.2 CONNECTION OF THE FEEDBACK SYSTEMS

The feedback systems (scales or encoders) are connected via SUB-D HD type 15-pin female connectors: **X3** and **X4**.

### Characteristics of feedback inputs: X3 and X4:

- +5V input consumption: 250 mA
- Admits square-wave signal (TTL). (A, B, Io)
- Maximum frequency: 250 KHz,  
minimum separation between flanks: 950 nsec.
- Phase shift  $90^\circ \pm 20^\circ$ , hysteresis 0.25 V,  $V_{max}$  7V,  
maximum input current: 3 mA.
- High threshold (logic state 1)  $2.4V \leq V_{IH} \leq 5V$
- Low threshold (logic state 0)  $0.0V \leq V_{IL} \leq 0.8V$



Pin	Signal	Function
1	A	Feedback signals
2	/A *	
3	B	
4	/B *	
5	Io	Reference signal
6	/Io *	
7	Alarm	Feedback alarm
8	/Alarm *	
9	+5V	Power for feedback
10	Not connected	Not being used at this time
11	0V	Power for feedback
12	Not connected	Not being used at this time
13	Not connected	Not being used at this time
14	Not connected	Not being used at this time
15	Chassis	Shield

\* For double-ended (differential) feedback

## 2.3 INPUT/OUTPUT CHARACTERISTICS (X2)

A 37-pin female connector is used.

### **Signal characteristics of connector "X2":**

The supply voltage is at +24V ( $\pm 25\%$ ), thus the threshold between a "0" and a "1" will be about +6V.

### **Characteristics of the inputs at 24V :**

- Maximum load current: 100mA
- Minimum DC voltage: 18V
- Maximum DC voltage: 30V

**The main characteristics of the digital outputs are:**  
(optocoupled with solid state relay with a normally open contact)

- Maximum AC or DC voltage: 48V
- Maximum load current: 150 mA
- Maximum internal resistance: 24Ohm
- Maximum peak current: 500mA for 100ms  
at 25°C
- Through current when open:  $\leq 1\mu\text{A}$
- Leak current: 200nA ( $V_{\text{load}}=100\text{V}$ )
- Galvanic isolation voltage: 1500V for 1 minute
- Activation time:  $\leq 3\text{ms}$
- Deactivation time:  $\leq 3\text{ms}$

### **Main characteristics of the analog outputs**

Voltage range:	$\pm 10\text{V}$	Resolution:	4.88mV
Maximum current:	10mA	Offset:	$\pm 30\text{mV}$
Impedance:	120 Ohm referred to GND		

### 2.3.1 PRECAUTIONS FOR THE ELECTRICAL INSTALLATION

- Use shielded extension cables for the encoders and analog signal cables.  
Install the shielded cables far from mains transformers.
- Separate the power cables from the signal cables in different cable hoses.
- Protect the outputs connected to relays, contactors and electrovalves:  
RC if supplied with 110Vac - 220 Vac  
Anti-parallel diode if supplied with 24Vdc
- Ground the following elements with a cable having a section between 1.5 mm and 2 mm:  
External screw on the rear of the unit.  
Connector X2, Pin 17 - Chassis  
Pin 19 - Analog 0V  
Pin 2 and 20 - 0V of the the 24Vdc.

## 2.4 INPUT/OUTPUT CONNECTION (X2).

Pin	I/O	NC-10S1 model	NC-20S1 model
1		Chassis	Chassis
2	I	0V External	0V External
3	I	24V External	24V External
4	O	24V User	24V User
5	O	X Enable	X Enable
6	O	1 = X fast, 0 = X slow	1 = X fast, 0 = X slow
7	O	X direction	X direction
8	I		* Position-1 detector
9	O	Pressure valve	Pressure valve
10	O	Activate sheet holder	Activate sheet holder
11	I	X limit + (lo X)	X limit + (lo X)
12	I	X- limit	X- limit
13	I	Shear up	Shear up
14	I		Sheet contact
15	I		Pressure gage
16	I		* Position-3 detector
17	I	Chassis	Chassis
18	O	X analog output	X analog voltage
19	O	0V Analog.	0V Analog.
20	I	0V External	0V External
21	I	24V Externos	24V Externos
22	O	24V User	24V User
23	I	Emergency	Emergency
24	O		Y enable
25	O		Y speed (* angle -)
26	O		Y direction (* angle +)
27	O	Shear down	Shear down
28	O	Shear up	Shear up
29	O	In position	In position
30	I		Y+ limit (lo Y)
31	I		Y- limit
32	I	Shear down	Shear down
33	I		
34	I		Free Y axis
35	I	Foot switch	Foot switch
36	I		* Position-2 detector
37	O		Y analog voltage

## 2.4.1 INPUT DESCRIPTION.

Section 2.4.3 shows the electrical diagrams for the indicated models. The parameters mentioned there are described in chapter 3 of this manual.

The inputs are active high at 24V (PAR21 and PAR22 = 1...1).

PIN	FUNCTION	DESCRIPTION
11, 12, 30, 31	Hardware travel limits	In MANUAL mode, they limit the movement in the corresponding direction In HOME SEARCH mode, they act as home switches in the positive direction
23	EXTERNAL EMERGENCY	Disables the axes Disables the outputs Displays error 7
34		Y axis disable. It maintains the displayed position
8, 16, 36	Y axis position detectors. NC-20 S1/S2* model	They confirm the fixed positions of the inclination of the shear
35	Foot switch connection	
13	Shear-up switch	Confirms that the shear is at the top position. Make sure that E13 = 1 in order to move the axes and home search sequence
32	Shear-down switch	Causes the shear to return to the top position

When PAR65.3 = 1, the Y axis (knife inclination) only admits 3 positions detected with limit switches recognized at the following inputs:

POS 1, I8: Minimum inclination angle.

POS 2, I36: Medium inclination angle.

POS 3, I16: Maximum inclination angle.

## 2.4.2 OUTPUT DESCRIPTION

If any of the outputs is going to be connected to some highly inductive device, a "1N4000" type diode must be installed in antiparallel.

The drives are enabled with auxiliary relays (section 4.2).

PIN	FUNCTION	DESCRIPTION
5, 6, 7, 24, 25, 26	Axis enable FAST/SLOW DIRECTION PAR46	Enabling of drives and frequency inverters for open loop control.
9	Pressure valve	Simultaneous with O27 OR O28 OR O10 (*OR O25 OR O26)
10	Activate sheet holder	Simultaneous with E35 - Foot switch
18, 37	Analog voltage outputs	To control drives in closed or open loop
27	Shear down	Delay with respect to S10 - PAR31
28	Shear up	End of cut command by: · Lift foot switch · Down time concluded PAR32 · End of travel, I32
29	INPOS section 2.4.4	Axes in position (PAR65.5 = 1 does not inhibit if X axis retraction has been selected when activating the sheet holders. It is released when X reaches the end position.

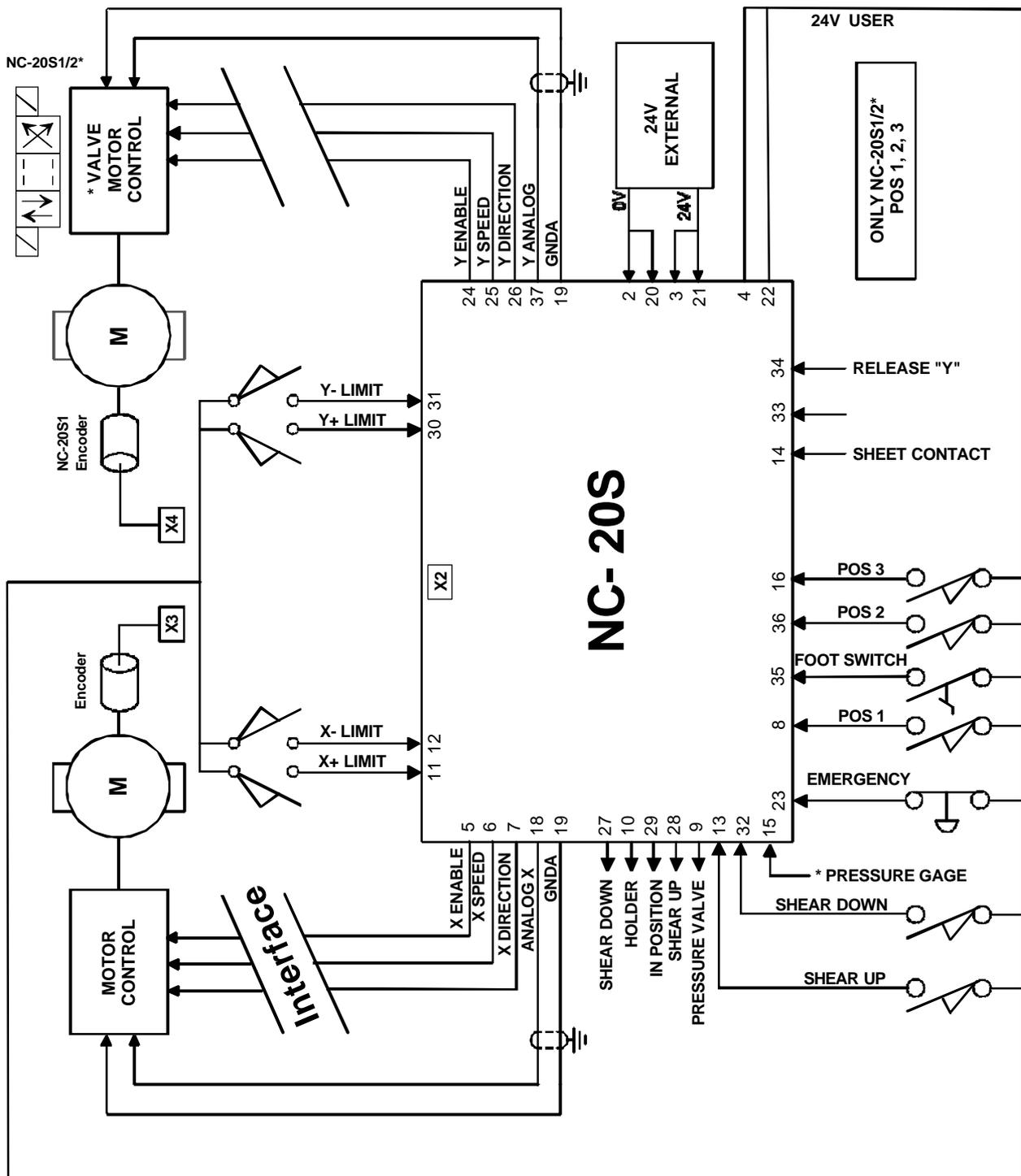
When PAR65.3 = 1 (Section 2.4.1)

O26 is activated if the requested position is higher.

O25 is activated if the requested position is lower.

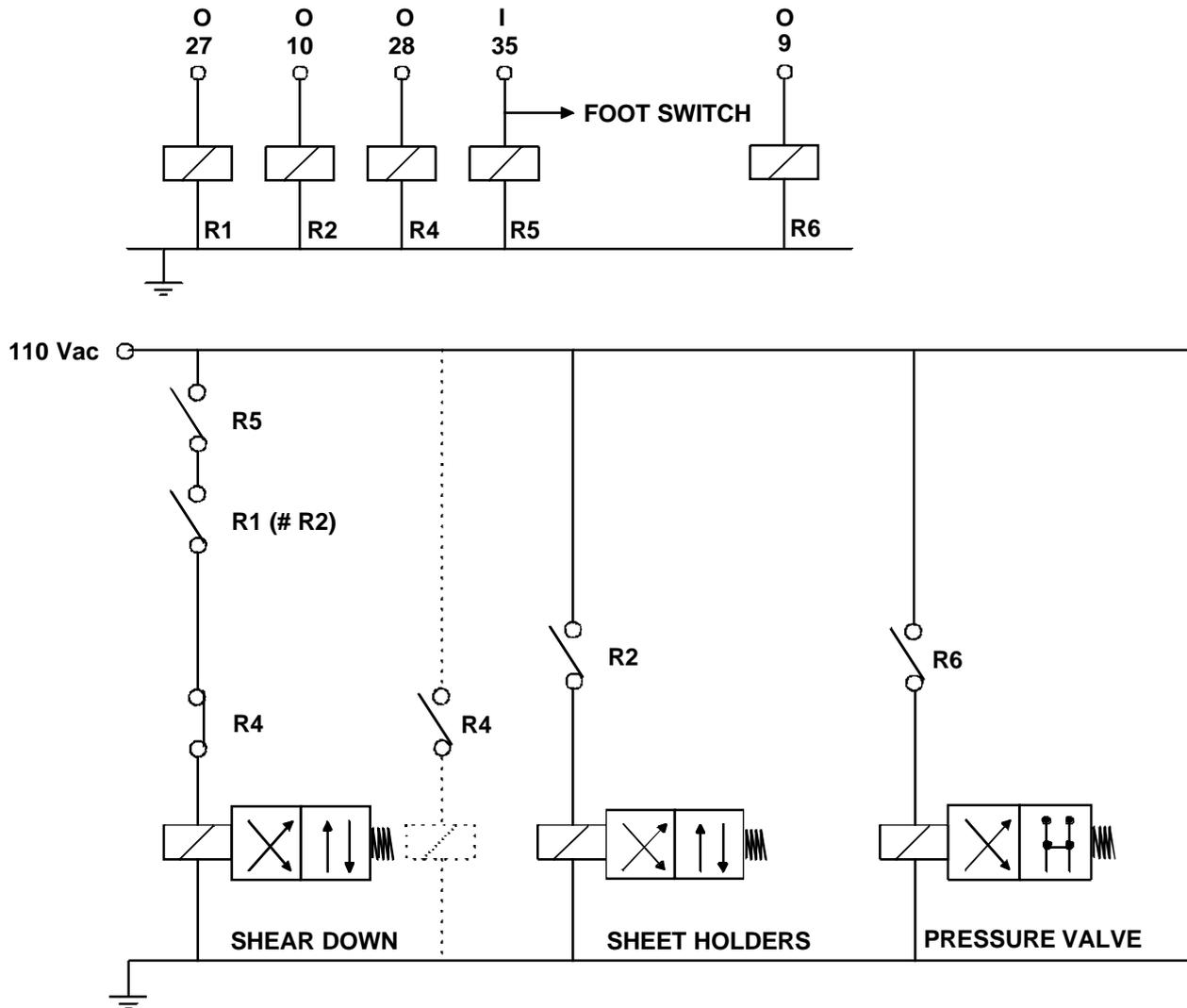
O25 and O26 also activate O9, pressure valve.

## 2.4.3 INPUT/OUTPUT CONNECTION



\* I14 and I15 are exclusive for the SIMPLE PRESS BRAKE model (PAR64.1=1). Shear down controlled by resources external to this NC. (See section 2.4.5)

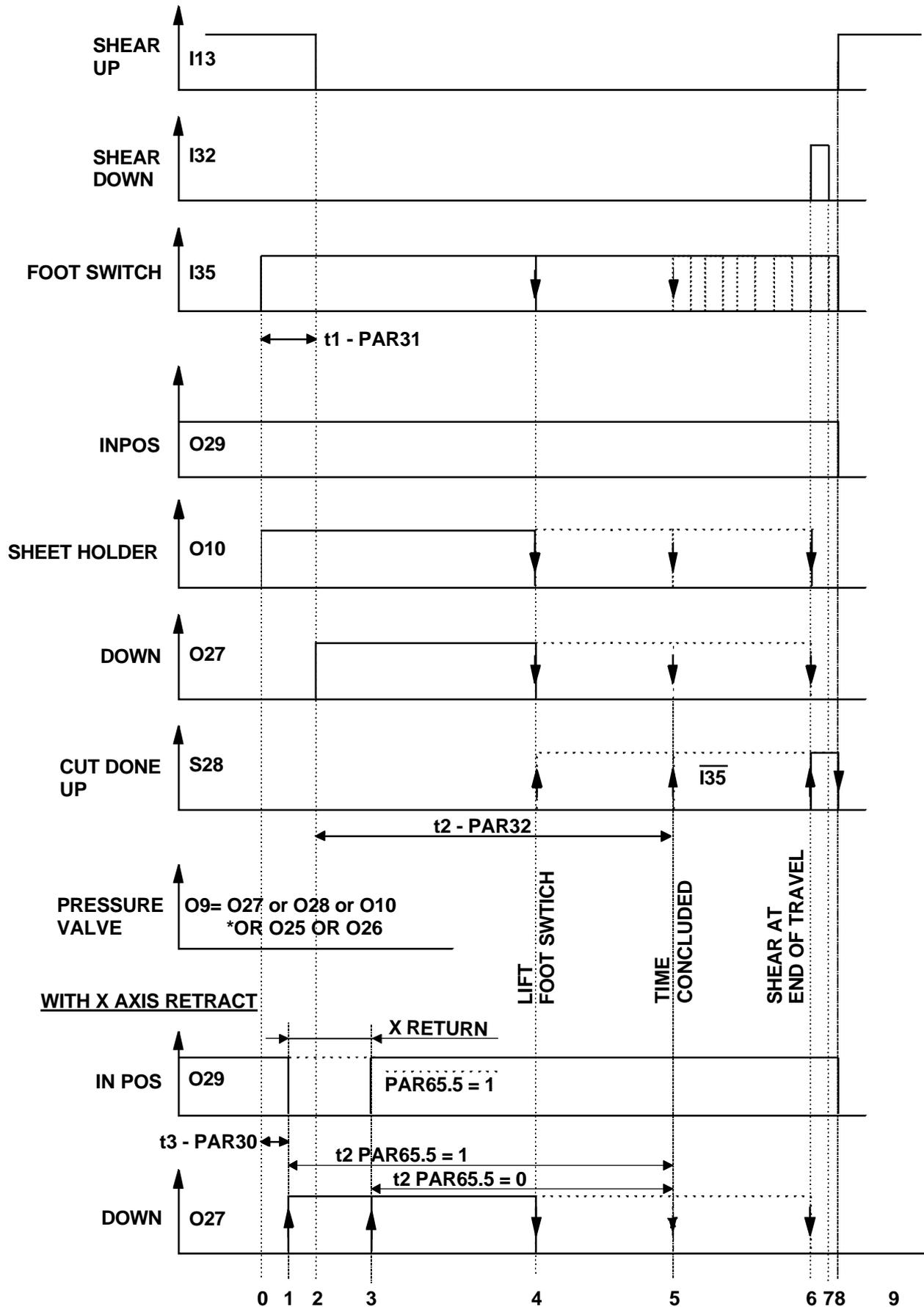
### 2.4.3.1 ELECTRICAL INTERFACE



- # On machines with a single electro-valve, use output O10 (relay R2) as the governing signal, set PAR65.5 = 1, PAR65.4 = 1 and PAR31 = 0.  
A delay may be set between the beginning of the cut, O10 and the retraction of the X axis using PAR30 = 0.1 to 0.5 sec.
- The electrovalve that activates the lowering of the shear is conditioned by a safety chain, some of them redundant. The cut is only allowed with O27 and the foot switch actuated.
- S10, activate sheet holders, is present in the whole cutting sequence.  
It is released during the return of the shear.
- On machines with programmable knife inclination, the lowering of the shear forces a movement of the Y axis encoder (Jumper O29 and I34 to release the Y axis).  
If PAR65.2 = 1, the hardware travel limits are ignored.
- PAR65.4 defines the response of the foot switch in the sensitive or normal mode.

## 2.4.4 SHEAR. TIME DIAGRAM

WITHOUT RETRACTING THE X AXIS when activating the sheet holders



**WITHOUT RETRACTING THE "X" AXIS when activating the sheet holders**

**O29 INPOS**

It is activated on power-up or once both axes are IN POSITION and 

**O10 SHEET HOLDER**

It is activated at the same as the foot switch, "1".

It is deactivated when the shear reaches its top position, "5", "6" or "4".

**O27 SHEAR DOWN**

It is activated with a delay  $t_1 = \text{PAR31}$  with respect to I35, "2".

It is deactivated:

"4" If the foot switch is lifted.

"5" If the time  $t_2 - \text{PAR32}$  has elapsed and the foot switch is lifted.

"6" If the shear reaches its travel limit switch and the foot switch is lifted.

**O28 SHEAR UP**

It is activated in the opposite way of O27:

"4". If the foot switch is lifted before ending the cut.

"5 and 6". Once the cut is done, the shear stays at rest in the lower position.

**The foot switch must be lifted in order to force the return movement.**

It is deactivated when the shear is at the top position (I13), "8".

**O9 PRESSURE VALVE**

Simultaneous with O27 or O28 or S10 and also

Simultaneous with O25 or O26 on model NC-20S1/S2\*

**WITH "X" RETRACT when activating the sheet holders**

**O29** It is activated on power-up or when the axes are in position and when pressing  .

It is deactivated with the delay  $t_3$  ome the sheet holders are actuated (PAR30) and it stays at "0" while the X axis retracts if  $\text{PAR65}(5) = 0$ .

With  $\text{PAR65}(5) = 1$ , it is not reset in the forced retraction stage prior to the cut. It is reset in the next move.

**O27** It is activated in "1" or "3" depending on the setting of PAR65.5.

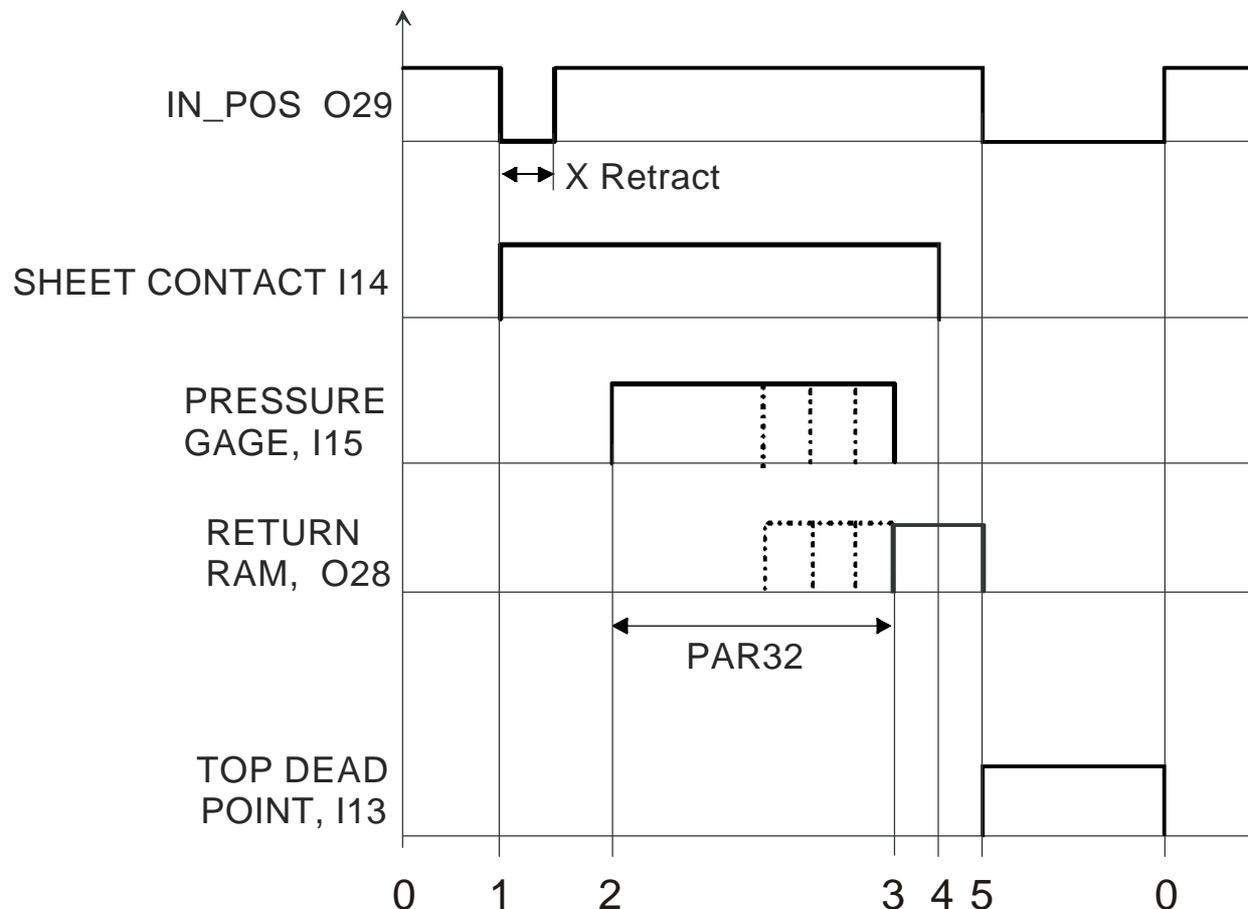
**The emergency input cancels all the outputs.**

**On power-up, it activates O29 and if the shear is not at the top position, it forces O28 and O9 until that position is restored activating I13.**

At the NC-20S1/S2 (\*) model, one of the 3 fixed positions of the Y axis must be selected in order to enable the shear controlling outputs.

If during the shearing process or while the machine is turned off, there has been a deviation of the knife angle and when returning to the top rest position, it does not restore contact with the selected microswitch, an inclination is forced towards the increasing angle until the corresponding microswitch is detected.

## 2.4.5 PRESS BRAKE. TIME DIAGRAM. PAR64(1) = 1..



### Common mode MANUAL or EXECUTION

0 - Axes in position.

O29 is activated to enable the BEND foot switch through the electrical maneuver.

1 - Sheet metal contact detector, I14.

Begin X retraction if  has been selected. O29 is reset.

2 - Pressure reached - I15.

Begin timing (PAR32, direct access parameter).

3 - Output to force the RAM RETURN.

It will have priority over the BEND command, assured by manoeuver.

4 - The ram reaches the top dead point acknowledge with I13.

Begin next positioning move.

5 - Once the ram has reached the top dead point, detected with I13, and the X position has been recovered, it begins the next positioning move.

0 - New INPOS position.

## 2.5 MACHINE REFERENCE (HOME) SEARCH

In this mode, the initial values are preset in a fixed reference position. If PAR14.4 = 1 on any axis, home search is mandatory on that axis every time the machine is turned on.

This unit starts in  mode and suggests homing the X and Y axes directly with . To quit this mode without homing, press   and key in the access/exit code: **719200**

If PAR14.4 = 0, home search is only required on machine setup. At the beginning, the software limits PAR12 and PAR13 should be opened to their maximum values to prevent this NC from forcing uncontrolled movements in order to position the axes within these travel limits.

Should this happen by mistake, the movement may be stopped by pressing . Being PAR14.1 = 1 (Floating home search), if while in this state you press   [719200], the affected axis will show the value: PAR12 + PAR26 as initial value. When pressing the relevant key , , it will suggest the PAR10 value by default with an option to select any other as described in later chapters. Exit by pressing .

### 2.5.1 AXES WITH HOME SWITCHES (PAR14.1=0)

Press   to access the  mode. It only responds with I13 = 1.

· Select the  or  axis. The unit will display the text "START".

· Press .

The Axis moves in the positive direction, backwards, in rapid until reaching the positive travel limit switch causing a stop (PAR34).

Once the switch is pressed, it returns at slow speed until the reference mark (I0) of the rotary encoder is detected. At that point, this unit displays the value set at PAR10 (that will correspond to the real value from the cut line to the support side of the X axis) or the gap of knife on the "Y" axis.

On cut-off type material removing machines, the cut line corresponds with the inside of the blade whose thickness  $e = \text{tool}$ .

If a value has been assigned to the tool variable, it will display the real value of the cut-off format (PAR10-Tool). See section 4.2.4 of the operating manual.

## 2.5.2 AXIS WITHOUT HOME SWITCH

Press   , select the axis and enter the password **719200** to access the  mode.

By default, it indicates the value that matches the one set in PAR10.

- Measure the distance between the support sides of the punch and die and preset that value (**Yref**).
- A wrong value too different from the real one may cause uncontrolled movements of the axis.
- Press  . It displays the selected coordinate
- Exit pressing   . The  led turns off.

If on power-up, you wish to quit the home search mode without actually homing, press   and key in the password (**719200**).

### 2.5.3 PRECAUTIONS WHEN HOME SEARCHING

The software limits set by PAR12 and PAR13 will indicate the real values referred to machine zero and they will correspond to the + and - limits slightly short of the positions of the travel limit switches or hard stops.

As a precaution, make sure that the ram is in the upper area ( $I13 = 1$ ) to make the home search sequence possible.

If the machine has home switches ( $PAR14.1 = 0$ ), the contact point of the micro-switch with the cam should not be too close to the position of the first reference mark (I0) of the encoder. The + limit switch is also the reference input that is deactivated when reversing the movement direction. A certain margin should be kept in order to reach a stable slow feedrate before receiving the reference mark (I0) also overshooting the amount of backlash set at PAR16. Standard clamps allow some rotation of the encoder body to make this adjustment easily.

Once the home search is finished, the axis moves towards X- until it reaches the software travel limit (always less than the hardware limit set by the X+ home switch) until reaching the position =  $PAR13 - PAR26$ .

On open-loop controls, the I0 signal sends a stop command; but there is no assurance that the axis will be held at that position. There is a slight overshooting even when selecting a slow home search speed.

Selecting the reference value for PAR10 takes three steps:

- 1- Set PAR10 with any value and execute a home search for a first rough approach.  
Calculate the "ε" difference:  $\epsilon = PAR10 - \text{final position reached (+ value)}$
- 2- The final value for PAR10 will be:  
"The requested real distance" + ε.
- 3- Set the software travel limits PAR12 and PAR13 referred to PAR10.

### 3. *INSTALLATION PARAMETERS*

These NC's have a number of installation parameters to configure it for a more customized operation.

The format for these parameters depends on whether they are general or particular for each axis.

- If it affects the axes, press the corresponding axis key to modify it.
- If it is a general parameter, the **X** display will show its current value.

There are several kinds of parameters depending on how to set them:

- Binary values (1/0) are displayed in an 8-digit row identified as 1 through 8 from right to left.

Their state changes by pressing their associated number key  to  .

- With decimal values, select the axis and key in the value.
- Options, the value is selected by pressing  which will show the various options in a rollover way.

### 3.1 PARAMETER SETTING

Press and hold  for at least 2 seconds, when the displays start blinking, press .

Key in the access code: **060496** to access the general parameters.

**Once on the menu, to access a particular parameter, press:**

 [Parameter number] 

It shows the parameter number:

- If it is a general type, only at the 1st display.
- If it is axis related, at both displays.

Press  to go to the next parameter and  to go to the previous one.

To change a value:

- Press  or  to select the axis.

It starts blinking.

- Modify the value.
- Selecting the key of the other axis  or , it saves the value of the value of the previous axis.
- Validate by pressing 
- Pressing  will quit the parameter editing mode.
- If while changing the value of a parameter,  is pressed, the unit will ignore the new value and will assume the previous one.
- Certain parameters may be accessed directly:  
(  [parameter number] ): PAR32, PAR37.

Binary values (1/0) are displayed in an 8-digit row identified as 1 through 8 from right to left.

X X X X X X X X  
8 7 6 5 4 3 2 1

**PARA-  
METER**

**FUNCTION**

**PAR00**

Feedback configuration, different per axis. Binary type.

This parameter sets the specific characteristics of the feedback device (rotary or linear encoder) used to read the axis position.

Digit

8

Direction of the distance-coded Io (**0 = Increasing**, 1 = Decreasing)

Fagor offers two types of linear encoders depending on the type of reference marks they use (Io): the standard one with several reference marks every 50 mm and the one with distance-coded reference marks (models with "O", e.g.: MOVX, FOP, etc.).

When using a rotary encoder or a **standard Fagor linear encoder** (without "O") for this axis, **this bit must be set to "0"**.

When using an "M" or "F" series **Fagor linear encoders with distance-coded reference marks** (e.g.: MOVX, FOP) for this axis, **this bit must be set to "0"**.

When using a "C" type linear encoder **with distance-coded reference marks**, (e.g.: COX, COVP) for this axis, this bit must be set to **"1"**.

7

Pitch of the distance-coded Io (**0 = 20 mm**, 1 = 100 mm)

This bit is ignored if bit 6 has been set to "0".

When using Fagor M or C series linear encoders, this bit must be "0".

When using Fagor F series linear encoders, this bit must be "1".

6

Type of linear scale's Io (**0 = Fix**, 1 = Coded)

Fagor offers two types of linear encoders depending on the type of reference marks they use (Io): the standard one with several reference marks every 50 mm and the one with distance-coded reference marks (models with "O" e.g.: MOVC, COS, etc.).

When using a rotary encoder or a standard Fagor linear encoder, this bit must be set to "0".

- 5 Axis units: **0** = mm, 1 = inches  
 These units refer to the feedback and not to the display which may be changed with the  key.
- 4 Not being used at this time. It must be set to "0"
- 3 Not being used at this time. It must be set to "0"
- 2 Type of feedback signals (**0** = TTL)  
 This bit must be set to "0". A value of "1" will be ignored.
- 1 Counting direction (0 = normal, 1 = reverse)  
 Regulation for shears:  
     X axis retracts in the positive direction.  
     knife gap movement "Y" in the positive direction.
- If an axis count increases or decreases in the opposite direction to the one desired, change the value of this digit. It conditions the setting of the sign bit PAR46(2) and the sign of the analog voltage.

**PAR01** Feedback resolution, independent for each axis,

Possible values: from 0.0001 mm to 1 mm.

factory setting: From 0.000001 to 0.03937 inch  
**0.0050 (mm).**

**PAR02** TTL multiplying factor (subdivision). Independent for each axis.

Options: x4, x2, x1 and x0.5.

The selection of these values rotates by pressing .

For linear encoders, choose "x4".

When using an encoder, the resolution is calculated as follows:

$$\text{Resolution (PAR01)} = \frac{\text{Leadscrew pitch (mm/turn)}}{N \times F \times i}$$

Where:

N = Number of encoder lines (pulses / turn).

F = PAR02, is the chosen multiplying factor .

i = Gear ratio.

**PAR03** External multiplying factor (EX E type) when using linear encoders with distance-coded reference marks and TTL feedback signals. Independent for each axis.

**Options: 1, 5, 10, 20, 25, 50.** Factory setting: 1

These values are selected by pressing  $\left[ \begin{array}{c} + \\ \diagdown \\ - \end{array} \right]$

For example:

For **standard Fagor linear encoders** with squarewave signals (without "O" or "P") e.g.: MX, CT, CX, etc. it must be set to "1".

For **Fagor linear encoders with squarewave signals and distance-coded reference marks** (models with "O"), eg.: MOX, COX, etc. it must be set to "5".

For **Fagor linear encoders with squarewave signals and distance-coded reference marks** (models with "O") and 0.5  $\mu\text{m}$  resolution, eg.: MOY, COY, etc. it must be set to "10".

**PAR05** Resolution correction factor. Range: 0 to 9,999

**Example 1:**

"X" axis gear reduction:

- Leadscrew pitch: 5 mm
- Gear ratio,  $i = 3$
- Encoder 100 pulses / turn
- PAR2 = 1

$$\text{Resolution} = \frac{5}{100 \times 3} = 0.016666\dots$$

Select:

$$\text{PAR1} = 0.0166 \text{ mm/pulse}$$

$$\text{PAR5} = \frac{166}{166.6666} = 0.996$$

**PAR08** Feedback alarm enable. On if = 1 and Off if = 0.

Digit

3 Detects the feedback alarm provided by the encoder through pins 7 and 8.

Fagor models DO NOT provide this signal.

rest Not being used at this time. They must be set to "0".

**PAR10** Absolute value set on each axis at the end of the home search.

On press brakes, it coincides with (see section 2.4):

On the X axis: the distance from the cut line to the X back gage.

On the Y axis: The knife gap distance / inclination.

Factory setting: **0**.

This value will be in mm or inches depending on whether the INCH LED is off or on.

**PAR12** To set the minimum axis travel limit referred to the value set for PAR10. Range within  $\pm 99999.999$

This value will be in mm or inches depending on whether the INCH LED is off or on.

**PAR13** To set the maximum axis travel limit referred to the value set for PAR10. Range within  $\pm 99999.999$

This value will be in mm or inches depending on whether the INCH LED is off or on.

The real travel is limited to PAR13-PAR25-PAR16 x PAR18

**PAR 14** It sets how the machine reference search (I0) will be carried out .

Digit

8, 7, 6, 5 Not being used at this time. They must be set to "0".

4 If =1, mandatory home search on power-up.

3 If =1, The whole home search is carried out at slow speed.

2 If = 1, it does not use a home switch.

Home search begins slowly in the negative direction. It ends when detecting the 1st marker pulse (home signal) of the encoder.

- 1 If = 0, The selected axis moves in rapid in the positive direction up to home switch and returns at slow speed until detecting the home pulse.  
If = 1, the home position is floating.

When pressing   , it requests the password (**719200**) to access to the selection of the "X" or "Y" axis.

**PAR 16** It sets the value of the leadscrew backlash to compensate for.

To compensate for the backlash, it must be set it for unidirectional approach (PAR17 = 2).

Range:  $\pm 99999.999$

It is obtained empirically with a simple back-and-forth movement using a dial indicator.

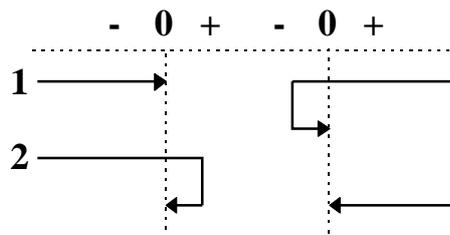
**PAR 17** It sets how the leadscrew backlash compensation will be applied with unidirectional approach. Rotate with 

0 = There is no unidirectional approach.

It forces to "0" any value selected in PAR16.

1 = It will be applied after moving in the negative direction (reserved).

X axis, 2 = It will be applied after moving in the positive direction, after the retraction movement of the backstop.



**PAR18** It indicates the multiplying factor applied onto leadscrew backlash, PAR16, in order to calculate the overshooting distance in unidirectional approach. In order to assure that the return will be done at slow speed, set  $P26 > P16 \times P18$

Possible values: 1 to 255

**PAR19** Indicates the reduction factor of the Kv gain. It affects exponentially in base 2.

For example: PAR19 = 3 means a reduction factor of  $2^3 = 8$ .  
Possible values: between 0 and 20. Recommended value: 10

**PAR21** Indicates the active level of the first 8 inputs.  
By default, they are set to "1" meaning that they are activated with 24V.

Digit	Pin	
8	33	
7	14	
6	32	Shear down
5	13	Shear up
4	31	Y axis negative travel limit
3	12	X axis negative travel limit
2	30	Y axis positive travel limit
1	11	X axis positive travel limit

**PAR22** Indicates the active level of the next 7 inputs.  
By default, they are set to "1" meaning that they are activated with 24V.

Digit	Pin	
8		Not being used at this time. It must be set to "0".
7	23	Emergency.
6	8	Knife position 1.
5	36	Knife position 2.
4	35	Foot switch.
3	16	Knife position 3.
2	34	Disable the "Y" axis.
1	15	

**PAR23** Indicates the active level of the first 8 outputs.  
By default, they are set to "1" meaning that when activated, they provide 24V.

Digit	Pin	
8	9	Pressure valve.
7	27	Shear down
6	26	"Y" axis moving direction (* Increase knife angle)
5	7	"X" axis moving direction (* Decrease knife angle)
4	25	"Y" axis fast movement
3	6	"X" axis fast movement
2	24	"Y" axis enable
1	5	"X" axis enable

**PAR24** Indicates the active level of the next 3 outputs.  
By default, they are set to "1".

Digit	Pin	
8-4		Not being used at this time.
3	29	In position.
2	10	Activate sheet holders
1	28	Shear up.

**PAR25** In-position zone.

It is the distance before and behind the point where the axis is considered to have reached its target position.

(See the following time diagram)

Possible values: From 0.0001mm to 99999.999 mm  
(From 0.000005" to 3937").

Recommended value: between 0.02 mm and 0.05 mm

**PAR26** Indicates the braking distance (slowdown point)

By default, this unit sets P26=P27 if P26<P27

(See the following time diagram)

Possible values: From 0.0001mm to 99999.999 mm  
(From 0.000005" to 3937").

Recommended value: between 1 and 5 mm.

**PAR27** Indicates the stopping distance (stop offset).

It does not admit PAR27 = 0.

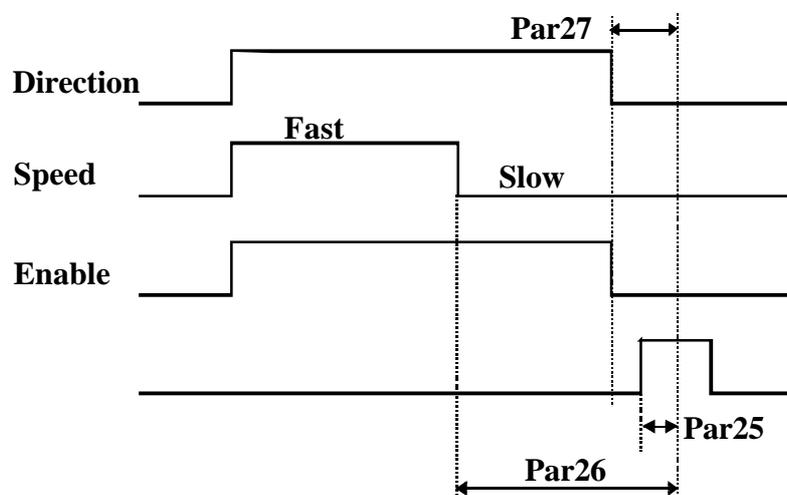
(See time diagram below)

Possible values: From 0.0001mm to 99999.999 mm  
(From 0.000005" to 3937").

Recommended value: between > 0 mm and 0.5 mm

The description of Par27 continues on the next page.

PAR27 and PAR47 **must be** coordinated in order to ensure that the known final position is within the in-position zone (PAR25). See chapter 4.



**PAR30** Delay between output O10 (activate sheet holders) and the retraction of the X axis. Range 0 to 9.9 seconds.

**PAR31** Delay between I35 (foot switch) and output O27 (shear down). Range: 0 to 9.9 seconds.

Set to "0" if PAR65.5 = 1

**PAR32** It may be accessed directly (    )

Time for the shear to come down. Range: 0 to 9.9 seconds.

**PAR34** Delay when reversing the homing direction in order to make it smoother. Range: 0 to 9.9 seconds.

**PAR37** Incremental distance for X axis retraction in the positive direction if the option of "cutting with a previous X axis retraction" has been defined. Range: 0 mm to 99999.999 mm (0" to 3937").

We recommend: PAR37 < PAR26

It may be accessed directly: (    )

**PAR39** Analog voltage centering. Back-and-forth movement for balancing the sign of the analog voltages.

Measure the analog voltages of this unit in both directions in any of the ranges (fast or slow). Calculate the difference and divide by 2.

Try different values of multiples of 5 mV to obtain the best balance.

For example: 6.135 and -6.120 => (0.015 difference)/2 = **0.007**

Round it off to the closest value: **0.005** or **0.010**

**PAR40** Proportional gain Kv of the position loop in the positive direction if PAR46(5) = 1. Axis controlled in closed loop.  
(See section 4.2). Possible values: Between 0 and 255.

**PAR46** Axis control.

Digit

8, 7, 6

Not being used at this time. They must be set to "0".

5

If =1, axis controlled in closed loop (the enable is maintained within the in-position zone)

If =0, "Axis controlled in open loop". The enable is canceled when reaching the in-position zone. It is restored if the axis gets out of position.

4

Not being used at this time. It must be set to "0".

3

Use analog voltage for feedrate.

- 2 Sign of the positive movement. Change it if the axis does not get in position.
- When installing INVERTERS, using the direction output (O7, O26) it may happen that the feedback direction does not match the proper moving direction. This is solved by swapping the A and B encoder signals, pins 1 and 3 or the turning direction of the motor.
- 1 If =1, Bipolar voltage for DC/AC drive.  
If =0, Unipolar for inverters governed with an analog voltage
- PAR47** Analog voltage for slow axis feedrate in the positive direction.  
Value range: Between 0 and 10V.
- PAR49** Analog voltage for fast axis feedrate in both directions.  
Value range: Between 0 and 10V.
- PAR51** Special configurations.  
Digit
- 8 to 2 Not being used at this time. They must be set to "0".
- 1 Program memory locking.  
If = 0, unlocked. If = 1, locked.
- PAR64** Press brake / cut-off mode selection.  
Digit
- 8 to 4 Not being used at this time. They must be set to zero.
- 3 If = 1, it is set in CUT-OFF mode.
- Free access to the  key to indicate the thickness of the knife. See section 4.2.4 of the operation manual.
- 2 Reserved. It must be set to zero.
- 1 If = 1, it is set as SIMPLE PRESS BRAKE. The bending sequence is confirmed with the signal from the pressure gage at I15, the dwell PAR32 and ram withdrawal O28. See section 2.4.5.

**PAR65** Special configurations.

Digit

- 8 Not being used at this time. They must be set to "0".
- 7 If = 0, The X return is enabled only when the shear reaches the top position.  
If = 1, the shear goes up and the X backstop returns at the same time.  
(The cut is not allowed with the foot switch in sensitive mode, PAR65.4=0).
- 6 Display a position once the "in-position" zone has been reached.  
If = 1, theoretical position. If = 0, real position.
- 5 If =1, when forcing the backstop retraction before the cut, the DOWN output (O27) is kept enabled during the movement towards X+ without forcing the backstop to reach the end position to allow the cut.  
If =0, it is activated only if the X retraction is completed.  
See section 2.4.4
- 4 If =1, operation in normal mode.  
Releasing the foot switch aborts the cutting sequence, the sheet holders are released and the shear is forced to return.  
If =0, sensitive mode.  
Releasing and activating the foot switch causes an up and down movement of the shear without releasing the sheet holders.
- 3 If =1, the Y axis position is detected with 3 microswitches that recognize one of the 3 selectable fixed positions.  
Outputs O25 and O26 are enabled to govern the 3-position valve that controls the inclination of the knife.
- 2 If = 1, ignore Y axis hardware travel limits in the shearing stage.  
It may be used when the lowering of the shear drags the feedback and mechanism of the Y axis out of its travel limits.
- 1 If = 1, on power-up, it assumes X axis retraction when the activating the sheet holders. See PAR37.

## 4 *SETUP*

### 4.1 *TEST MODE*

A special mode has been created in order to access the inputs and outputs as well as running several tests.

Be particularly careful in this mode because neither software nor hardware travel limits are monitored.

While the unit is turned off, Press and hold the **7** **3** keys and turn it on. This accesses the general TEST mode.

Pressing  or  scrolls through the following test options. Wait for a few seconds to confirm the requested option before going on to the next one.

#### 1. **LED**

All displays and LED's are lit.

#### 2. **TASTE** - Keyboard test.

One or two segments of displays 1 through 5 respond to each key press.

#### 3. **COUNT** - Feedback reading.

It shows the feedback reading (count) accumulated on each axis.

When accessed, it selects the 1st axis - X

Pressing **Y** selects the 2nd axis - Y.

#### 4. **I0s.** Testing of the encoder I0's

The 2nd line shows 0's and 1's indicating the level of the encoder I0's for the X and Y axis from right to left.

Moving the axis slowly by hand, the I0 will be detected with a short blinking.

#### 5. **PULSES.** Testing the number of encoder pulses/turn

The 1st line displays "PULSES 1" and when selecting the **Y** axis, it displays "PULSES 2".

Moving the axis by hand far enough to detect the I0 signal twice, the 2nd line will show the number of pulses per turn x PAR01 x PAR02.

#### 6. **ALARM**

If a feedback alarm is activated (pin 7 of X3, X4) it will be reflected in the second display row.

## 7. SPEED - Feedrate.

When accessed, it selects the "X" axis.

Press  to toggle the axis selection.

Moving the encoder, the 2nd display shows the maximum feedrate reached (in m/min).

## 8. E2PROM - Internal memory test

It responds with a "1" if there are no errors.

## 9. INPUT- Testing inputs

Section 3.1, PAR21 through PAR24 describes the relationship between the display digit and the number of the connector pin to be tested.

- The 1st line shows 0's and 1's indicating the status of inputs I1 through I8 from right to left.
- The 2nd line shows the status of inputs I9 through I15.

## 10. OUTPUT- Forcing outputs

Digital outputs

- The 1st line shows with "0" and "1" the status of the outputs associated with digits 1 through 8 from right to left (see PAR23).

The outputs are activated or reset by pressing their associated keys:

through

- The 2nd line shows the status of the other three outputs (see PAR24). They can neither be activated nor reset.
- Pressing  activates all 11 outputs sequentially one after another.
- Pressing  resets all of them.

## 11. OUT ANA

It is possible to force a value at the analog outputs.

 ,  select the "X" or the "Y" axis respectively.

 offers positive values and then negative values that increase every time this key is pressed.

 or  [value]  presets that particular analog voltage value.

 or    resets it.

## 12. DATE

The first row shows the software version and the 2nd one its validation date, day, month and year.

## 13. CHECKSUM - (memory test)

### 4.1.1 DIRECT ACCESS TO THE PARAMETERS

In order to get better acquainted with the operation of this unit without having to connect the 24V input, there is a special way to access the installation parameters on power-up:

- Turn the unit on while pressing   at the same time until PAR00 of the parameter table is directly accessed.
- Press     to go to PAR22.
- If parameter PAR22(7) displays "0", press   to force a "1". This cancels the external emergency even when the emergency input I23 is not connected.
- To access the modes described in the operating manual, the shear must be at the top position with input I13 activated.

To simulate this state:

Press     and   to force a "0" and recognize I13 that is not connected.

- Exit to the main menu by pressing  .

Safety regulations dictate to connect the emergency input with a "1" level at 24V.

The emergency button interrupts the connection causing the machine to stop.

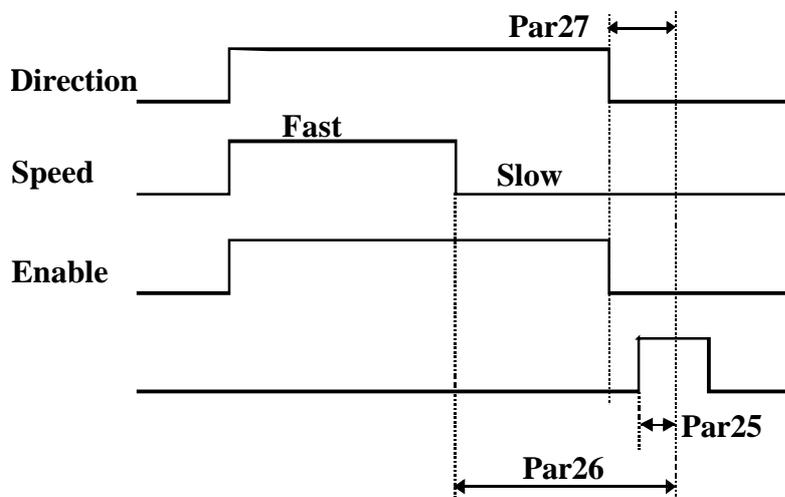
## 4.2 AXIS SETTING

These sections describe the most common criteria to achieve a good response when positioning the axes with the proper accuracy and repeatability in the three ways to close the loop.

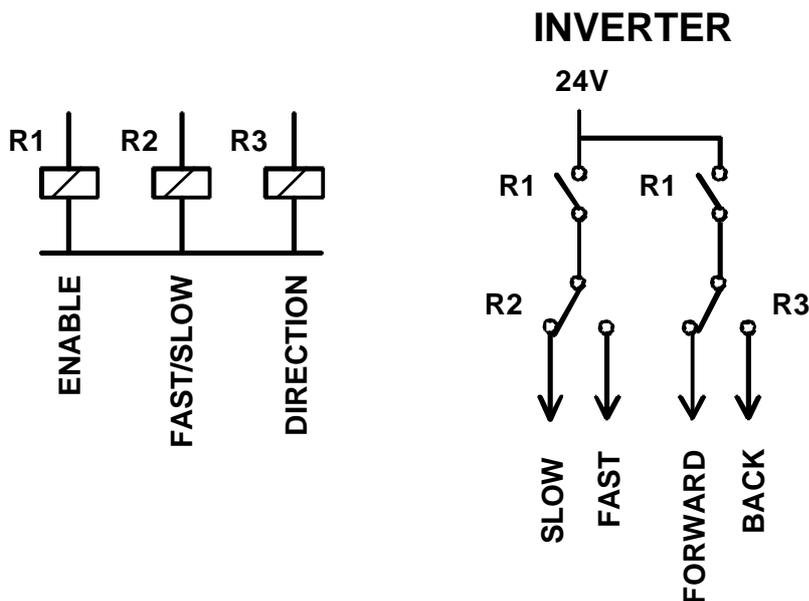
Each one refers to the affected parameters.

### 4.2.1 OPEN LOOP WITHOUT ANALOG VOLTAGE OUTPUT. $P46(3)=0, P46(5)=0$

Method recommended in drive systems with one or two speed ranges activated with three digital outputs: ENABLE, FAST/SLOW, DIRECTION.

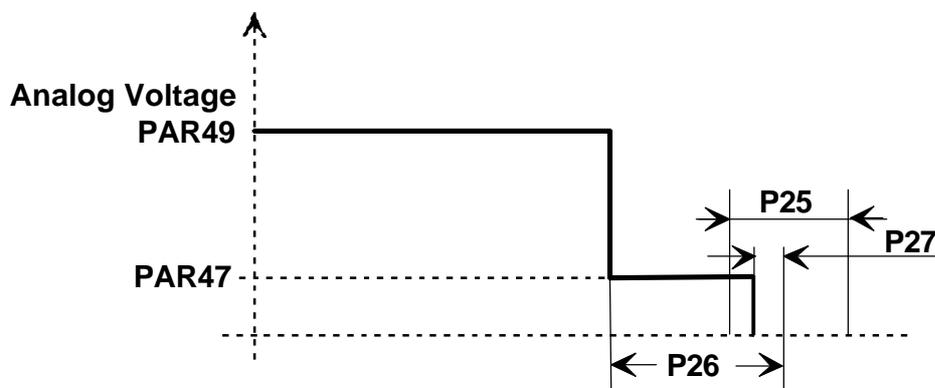


The control of electronic inverters or electrovalves, very common on press brakes, is obtained with simple relay circuits.



## 4.2.2 OPEN LOOP WITH ANALOG VOLTAGE OUTPUT. PAR46(3)=1, PAR46(5)=0

Method recommended in low range drive systems: unipolar drive [PAR45(1)=0], proportional valves, etc.

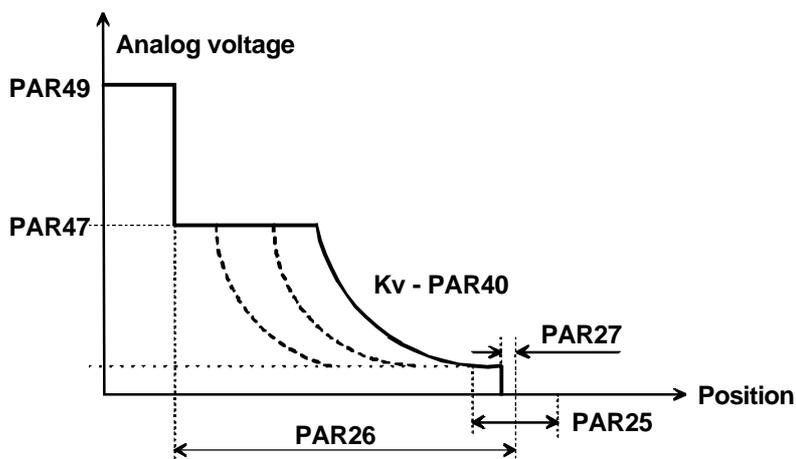


PAR27 sets the distance before the end point where the analog voltage is canceled. On drive systems with good braking response, the drive may be kept active delaying the releasing of the enable relay. Just connect a capacitor in parallel with the relay. Forcing PAR27 with small values may result in a sudden braking and a later release when the axis reaches the end point.

If the axis is forced to get out of the in-position zone, the enable signal and the analog voltage for the slow speed are activated to restore the programmed coordinate.

## 4.2.3 CLOSED LOOP. PAR 46(3)=1, PAR46(5)=1

Method especially developed for AC/DC drives or servo-valves.



The fast approach movements are carried out in open loop with the analog voltage set in PAR49. PAR26 sets the anticipation distance for the slow speed (PAR47) and its positions in closed loop. The braking response depends on the value set for Kv (PAR40 and PAR19) being more sudden at greater Kv gain values.

The minimum analog voltage PAR44, PAR45 is adjusted to reach the threshold voltage of proportional valves.

Especially involved parameters:

PAR40-PAR19      Adjustment of the dampening degree when switching from slow to STOP.

PAR27              Prior distance to force a "0" analog voltage.

The analog voltage may be analyzed at the oscilloscope.

Best positioning is achieved by minimizing the time the minimum voltage PAR45 is on. This voltage corresponds to the sudden lowering from the value of PAR48 to that of PAR45.

The resources of the TEST mode, section 4.1(11), are very useful to simplify the adjustment of the axes.

If an axis does not stay stable in the rest position, adjust the offset to cancel the drift caused by the drive.

Too large Kv gain values make the system unstable.

Low Kv gain values do not provide proper positioning accuracy and repeatability.

**Recommendations, most significant parameters:**

1- Adjust the drive offset to "0".

2- PAR47 = PAR48 = 0.05 / 0.1

Decrease the slow speed as much as possible.

3- PAR25 = 0.01.

Position tolerance decreased as much as possible.

4- PAR26 = 2/10 mm

Enough range to access the position window at slow speed.

5- PAR27 = 0.01

6- PARP19 = 7/8, PAR40 = 100/200

Maximum proportional gain while maintaining stability.

## *APPENDIX*

### *ERROR CODES*

<b>Message</b>	<b>Description</b>
<b>FAGOR dro</b>	Power outage or turned off by main switch after saving the data.
<b>Error 02</b>	Power outage or turned off by main switch without having saved the data. The unit has been turned off without previously pushing the [ON/OFF] key. It will only lose the position count (will be reset to zero) and the status of the operating modes (inch, abs, etc.).
<b>Error 04</b>	Wrong parameter values
<b>Error 05</b>	Wrong internal configuration
<b>Error 06</b>	Errors in data backup memory (Service Dept.)
<b>Error 07</b>	Emergency input active. Press [C] or cancel emergency signal.
<b>Error 08</b>	Wrong software memory or the software has been changed
<b>Error 09</b>	Errors in work memory (Service Dept.)
<b>Error 12</b>	Error while searching a coded marker pulse (lo)
<b>Error 20</b>	Travel limit switch pressed on that axis.
<b>Error 31</b>	Internal malfunction (Service Dept.)
<b>Error 32</b>	Internal malfunction (Service Dept.)
<b>Error 90</b>	Internal malfunction (Service Dept.)
<b>Error 99</b>	Internal malfunction (Service Dept.)
.....	Feedback alarm from the feedback device (scale, encoder, etc) or weak signal.
<b>I.4.3.6.5.7.2.5</b>	Feedback speed too high.
<b>EEEEEEEE</b>	Maximum position reading or speed exceeded when searching Home

If any message other than the first two from the table were to come up, the equipment should be switched off and on again until one of the first two are seen.

After pressing  to access the counting mode, check the parameters.

If any of the errors shown as (Service Department) are often repeated, ask Fagor Automation's Customer Services Department about this.

The feedback alarm error will appear if the bit of the corresponding alarm activating parameter for the axis has been set to "1" **PAR08(1) = 1**.

In either case, to clear the display, press .

**If the axis value is flashing**, this means that one of the travel limits established by machine parameter has been exceeded. This error will be displayed if the alarm activation parameter for the axis **PAR08(2) = 1**. **All outputs are deactivated**

If the NC does not come on or goes out while running, check that the voltage and ground outlets are as they should be. If an axis does not count, disconnect the feedback connectors one by one. If the NC comes on, it indicates a fault in the feedback device. If the fault persists get in touch with Fagor Automation's Customer Services Department about it.

## ***MAINTENANCE***

### **Cleaning:**

An accumulation of dirt in the equipment can act as a screen preventing proper dissipation of the heat generated by the internal electronic circuits with the consequent danger of overheating and NC fault.

Accumulated dirt can also, in some cases, provide a conductive path for electricity which could give rise to faults in the internal circuits of the equipment, especially in high humidity conditions.

To clean the equipment nonabrasive dish-washing detergents are recommended (in liquid, never powder form) or 75% isotropic alcohol with a clean cloth. **DO NOT USE** aggressive solvents, (benzol, acetones, etc.) which could damage the materials the equipment is made with.

Do not use high pressure compressed air to clean the item as this could give rise to an accumulation of charges which in turn lead to electrostatic discharges.

The plastics used in the front panel of the NC stand up to:

1. Grease and mineral oils.
2. Alkalis and bleaches.
3. Dissolved Detergents.
4. Alcohol

Avoid the effect of solvents such as ChlorohyNCcarbons, Benzol, Esters and Ethers because these could damage the plastics with which the front of the equipment is made.

### **Preventive Inspection**

If the NC does not come on press the rear switch for starting, make sure it is properly connected and being supplied with the proper mains voltage.

# **FAGOR NC-10/20 S FOR SHEARS**

**OPERATING MANUAL**

**Manual version 0302**



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## ***INTRODUCTION***

Throughout this manual, certain installation parameters are referred to which affect the description of certain NC functions.

These parameters have been set by the installer and may not be modified by the operator.

These parameters are described in the installation manual supplied with this unit.

## ***DESCRIPTION OF THE VARIOUS MODELS***

This manual mentions different machine models depending on the number of axes controlled. All the models have a parts counter whose display is shared with that of the Y axis position.

<b>SIMPLE</b>	<b>PROGRAMMABLE</b>	
NC 10S1	NC 10S2	1 axis
NC 20S1	NC 20S2	2 axes

The Y axis may be set (PAR65.3 = 1) to only attend to the three fixed positions detected by the limit switches at the 24V INPUTS.

This manual refers to them as NC 20 S1/2\*.

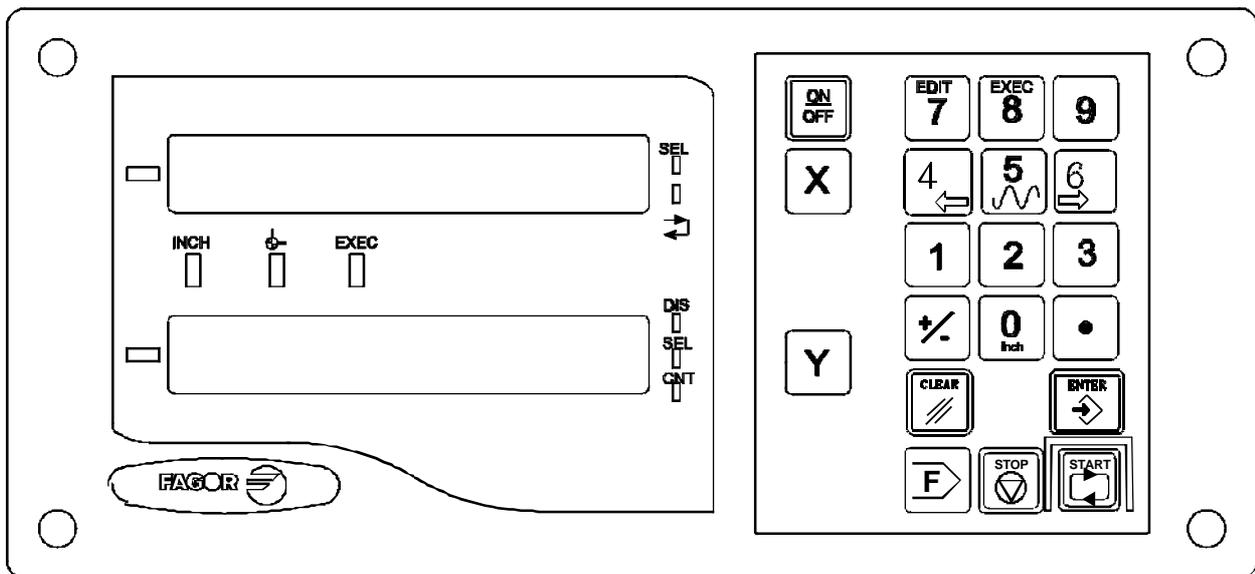
## 1. UNIT DESCRIPTION

This NC is specifically designed to be installed on shears. It allows positioning the horizontal axis "X" and the knife gap /inclination "Y". It can also activate other mechanisms that cause the cutting sequence:

- Shear control by setting the shear-down time.
- Control of the elements that hold the sheet down.
- Optional X axis back gage when activating the sheet holders.

It also has a parts counter.

### 1.1 FRONT PANEL



#### LED description:

**INCH-** Inch mode selection. To access it or quit it, press 

 Machine reference search mode.

It is accessed by pressing  **X** or  **Y**

Press  to exit this mode.

**EXEC -** Execution mode.

**SEL -** Axis selected.

**DIS -** Y axis disabled.

**CNT-** Parts counter.

 X axis retraction before the cut.

## **Keypad description:**

  Axis selection.

 Turns the display off while reading the position of the axes.

This key should be pressed before turning the unit off with power switch on the rear of the unit.

 Validate an operation.

 Cancel or abort an operation already started.

  Jog the axes in both directions.

 Jog the axes in rapid.

 Select the EDITOR mode.

 Select the EXECUTION mode.

  Execute and interrupt, respectively, a positioning move.

Data entry.

 Change the sign of the value being entered and to eliminate the last digit of the X and Y axes.

 Toggle between metric and inch display.

 Auxiliary key to access special functions.

## 2. ***TURNING THE UNIT ON / OFF***

### **Turning the unit ON**

The unit is turned on by actuating on the power switch of the rear panel

This NC runs a self-test and its 1st and 2nd displays show "Fagor cnc". Press



and if there is an error, the displays will show the error number if otherwise.

See the appendix at the end of this manual.

### **Turning the unit OFF**

If you press  key the NC turns off the displays while maintaining the power supply to the feedback systems and goes on reading the position of the axes at all times. This is not the case when the equipment is turned off by means of the switch on the rear panel.

To reset the displays, just press this key again as long as that the NC is getting voltage (plugged in and with the switch on the rear panel on).

### **Precautions:**

- Before powering the NC down with the switch on the rear panel or disconnecting it from mains, it is a good idea to press the  key in order to store the current position of the axes permanently.
- If the unit is powered down with its rear panel switch or there is a power outage without previously having pressed , the NC will keep the last position of the axes for at least 30 minutes.
- The unit will display ERROR 2 when powered back up if the position reading was lost when turned off while the axes were moving or after the accidental backup period has expired without having saved the current position.

### **Imposed safety**

**On power-up, once the emergency input is enabled, if the shear is in an intermediate position, it is forced to return to the top position.**

The NC-20S1/S2\* model must have one of the 3 fixed positions of the Y axis selected to enable the shear controlling outputs.

If during the shearing process or while the machine is turned off, there has been a deviation of the knife angle and when returning to the top rest position, it does not restore contact with the selected microswitch, an inclination is forced towards the increasing angle until the corresponding microswitch is detected.

## **3. POSITIONING OF THE AXES**

### **3.1 SAFETY**

- The axes may only be moved if the shear is at the top position.
- Software travel limits set by PAR12 and PAR13 may not be overrun.
- If for any anomalous reason, the travel limits are activated, this NC issues ERROR 20.

In MANUAL mode, it inhibits the feed, but it allows movements in the opposite direction to return to the work zone.

In EXECUTION mode, it aborts it and goes into MANUAL mode.

The return movements of the X+ and Y+ axes may be defined with unidirectional approach to compensate for mechanical backlash (PAR16, PAR17).

### 3.2 JOGGING WITH THE KEYBOARD

- While the shear is up, select the axis by pressing  or .
-  to access the JOG mode.
- Press  or  and the axis will start moving slowly in either direction. To move fast, hold down the  key at the same time.
- To stop the movement: 1st release  and then release the slow movement. Otherwise, it will keep moving until the value set by PAR26 is reached.
-  or  to exit.

#### Model NC 20 S1/S2(\*)

- With the shear up, select the Y axis.
- Press  to access the JOG mode.
- Pressing  activates the control valve towards the increasing inclination limited by the top angle microswitch.
- Pressing  activates the control valve towards the decreasing inclination limited by the bottom angle microswitch.

#### 3.2.1 MOVEMENT TO A PRESET POSITION

- Select the axis by pressing  or .
- Indicate a position value. The selected display starts blinking.
- Press . The axis will move to the indicated position.

To stop this movement before reaching its destination, press .

To resume the movement again, repeat this procedure by selecting the same position again.

-  to exit.

#### 3.2.2 MOVEMENT TO A FIXED POSITION (NC-20 S1/2\*)

- Select the Y axis.
- Indicate one of the 3 fixed positions 1, 2 or 3.
- Press  to reach the requested position.
-  or  aborts the movement already in progress.
- It resumes selecting 1, 2 or 3 again and pressing .
- During the movement of the Y axis, cutting is inhibited.

## 4. ENABLING SHEAR MOVEMENT

Once the axes are in position, press . To activate the cutting enable and enable the footswitch, the "SEL" led of the selected axis must be off.

### 4.1 SAFETY

The travel of the shear may be set freely up to the bottom limit switch or controlled with a timer (section 4.2.3).

In normal operating mode, releasing the foot switch aborts the cutting sequence. The sheet holders are released and the shear returns to the top position.

PAR65.4 = 0 sets the sensitive mode.

Releasing and pressing the foot switch before completing the cut, forces an intermittent up and down movement of the shear without releasing the sheet holders.

Once the cut is completed, the shear is kept at rest in the lower position.

The foot switch must be released to force the return movement.

### 4.2 OPTIONS, ACCESS MODES

#### 4.2.1 PARTS COUNTER

Press  

The "Y" axis display shows the accumulated number of parts.

The counter increases in one unit when the cutting sequence is completed: Actuate the foot switch and shear down and up.

To show the "Y" position again, press  

The parts counter stays active.

To reset the accumulated count, press  

When turning the unit off, the parts counter is deactivated.

On NC-10S1/2 and NC-20S1/2\* models, the counter is always active.

#### 4.2.2 "X" AXIS RETRACTS WHEN ACTUATING THE SHEET HOLDERS.

Press   to activate and   to deactivate.

It displays the corresponding text "ON" or "OFF" for a second and it is indicated with the  led.

If PAR65.1 = 1, it assumes the "ON" option on power-up.

If PAR65.1 = 0, it assumes the "OFF" option on power-up.

If the starting position is in the actual travel limit, the cut will not be allowed if  has been selected.

The retraction distance may be changed by pressing    selecting a value (usually < 2 mm) and confirming by pressing .

### 4.2.3 SELECTING THE SHEAR-DOWN TIME

- Press    to access machine parameter PAR32.
- Select a value up to 9.9 seconds and confirm it with .
- Select "0" to ignore the timer.

### 4.2.4. CUTTING THICKNESS COMPENSATION ON THE X AXIS

This feature is only useful on material removing cut-off machines.

In the initial mode, press .

The 1er display shows the text: "tool".

Indicate the thickness of the blade and press .

The real position of the X axis will be affected and it will correspond with:  
"Programmed X value + blade thickness" .

## 5. MACHINE REFERENCE (HOME) SEARCH

If machine parameter PAR14.4 = 1, the home search is mandatory on one or both axes on power-up. Whenever any axis has been moved while the NC was turned off, the axis that has been moved must be homed.

Parameter PAR14.1 distinguishes the sequence depending on whether home switches or used or not.

### 5.1 SEQUENCE FOR AXES WITH MANDATORY HOME SEARCH ON POWER-UP

On power-up, pressing  activates the  mode.

- a. If the axis has a home switch, this unit displays the word: "START".

**If it is the Y axis, make sure that the shear is at the top position touching the home switch.**

Press  to force the automatic search, 1st "X", then "Y".

- b. If the axis does not use home switches, it will indicate a value that corresponds with the value of PAR10.

Measure the distance from the cutting line, o inside of the blade, to the "X" backstop or the gap /misalignment of the blade if it is the Y axis and preset that value.

A wrong value too different from the real one, that could force a position beyond the software limits, may cause uncontrolled movements of the axis.

Press . It displays the selected coordinate

Exit pressing  . The  led turns off.

If on power-up, you wish to quit the home search mode without actually homing, press   and key in the password (**719200**).

## 5.2 SEQUENCE FOR AXES WITHOUT MANDATORY HOME SEARCH

Press   to access the  mode.

Press  or  to select:

- If the axis has a home switch, the display shows the word "START".

Press .

- If the axis does not have a home switch, it requests the password , **719200**  
Use the method described in section 5.1.b.

## 6 PROGRAMMING. ONLY FOR NC 10/20 S2 MODELS

Storage capacity for 10 programs of up to 10 blocks.

The memory may be locked with PAR51.1 = 1 to prevent the programs from being edited, modified or deleted.

### 6.1 PROGRAM EDITING

This mode may be used to edit, modify or add blocks at the end of a program.

It is not possible to insert intermediate blocks or delete single blocks.

Each block takes 2 screens: 1st- axis position and 2nd- repetitions (999 maximum).

A blinking display indicates that it is waiting for a value to be loaded and will not be validated until it is confirmed with . Pressing  before  restores the previous data ignoring the one just edited.

- In initial mode, press 
- Select the program number between 0 and 9 and . The default value (0) is displayed blinking.

This begins the editing of the 1st screen of block N0.

- Press , load the 1st value and confirm with 
- If the unit is an "NC 20 S2" model, press , load 1st value and confirm with 
- Press  to validate both data.

This access the 2nd screen "rEP". The default value (1) blinks.

Set the number of repetitions with 3 options that distinguish how they will be executed:

- A "0" value in an intermediate block in order to ignore it (not executed)
- A positive value in all blocks y they are to be executed in the conventional way. When done with the repetitions of the last block, the foot switch is disabled.

It returns to N0 and the execution resumes only by pressing .

- Negative value to set it as a final block and set a continuous execution mode. When finishing this block, it returns to the beginning of the program and it executes block N0 to repeat the execution.

Press  to edit the next block.

The end of the program does not require any special instruction. It is validated by pressing 

The final block, opened when the last one is acknowledged, is not stored.

Pressing  or  scroll up or down to display / modify the lines of the edited program.

When done editing, press 

To quit the EDITOR mode, press  again.

## 6.2 DELETING A PROGRAM

- Press   . It displays the text: DELETE. By default, it blinks program P0.
- Indicate the program number between 0 and 9 and press  to delete it.

## 7 EXECUTION. ONLY FOR NC 10/S0 S2 MODELS

In initial mode, press  . The "EXEC" LED comes on.

Select the program number between 0 and 9. By default, it blinks "0", and press



When requesting a new program, or repeating one that has positive repetitions, the Y axis shows the word START to indicate that  must be pressed to start the execution.

- Press  to position the axes.

It displays: The block number and the X axis position on the 1st display

The total number of cuts and the ones pending on the 2nd display (if the counter is active).

The foot switch is enabled to go on with the execution of the program, the block transition and the parts counter are synchronized when the shear reaches the top position.

The foot switch is disabled at the end of the execution if the number of repetitions of the last block is positive. It is reset with  .

Pressing  displays, for 2 seconds, the number of accumulated executions.

If a block has a negative **rPT**, it forces a jump to block N0 to repeat the execution of the same program indefinitely. The "EXEC" LED blinks while executing the first block.

If a block is edited with **rPT** = 0, it will be ignored, (not executed).

- Pressing  forces the feed and lets selecting a particular block number or ignore the ones that you don't wish to execute.
- Pressing  interrupts the program in progress.

If the axes are moving, they will stop and the outputs will be reset.

- Pressing  resumes the EXECUTION mode.
- To quit the EXECUTION mode, press  ; it will show the text: "ABORT, P-" for 2 seconds and it returns to the initial menu.

## *APPENDIX*

### *ERROR CODES*

<b>Message</b>	<b>Description</b>
<b>FAGOR dro</b>	Power outage or turned off by main switch after saving the data.
<b>Error 02</b>	Power outage or turned off by main switch without having saved the data. The unit has been turned off without previously pushing the [ON/OFF] key. It will only lose the position count (will be reset to zero) and the status of the operating modes (inch, abs, etc.).
<b>Error 04</b>	Wrong parameter values
<b>Error 05</b>	Wrong internal configuration
<b>Error 06</b>	Errors in data backup memory (Service Dept.)
<b>Error 07</b>	Emergency input active. Press [C] or cancel emergency signal.
<b>Error 08</b>	Wrong software memory or the software has been changed
<b>Error 09</b>	Errors in work memory (Service Dept.)
<b>Error 12</b>	Error while searching a coded marker pulse (Io)
<b>Error 20</b>	Travel limit switch pressed on that axis.
<b>Error 31</b>	Internal malfunction (Service Dept.)
<b>Error 32</b>	Internal malfunction (Service Dept.)
<b>Error 90</b>	Internal malfunction (Service Dept.)
<b>Error 99</b>	Internal malfunction (Service Dept.)
.....	Feedback alarm from the feedback device (scale, encoder, etc) or weak signal.
<b>I.4.3.6.5.7.2.5</b>	Feedback speed too high.
<b>EEEEEEEE</b>	Maximum position reading or speed exceeded when searching Home

If any message other than the first two from the table were to come up, the equipment should be switched off and on again until one of the first two are seen.

After pressing  to access the counting mode, check the parameters.

If any of the errors shown as (Service Department) are often repeated, ask Fagor Automation's Customer Services Department about this.

The feedback alarm error will appear if the bit of the corresponding alarm activating parameter for the axis has been set to "1" **PAR08(1) = 1**.

In either case, to clear the display, press .

**If the axis value is flashing**, this means that one of the travel limits established by machine parameter has been exceeded. This error will be displayed if the alarm activation parameter for the axis **PAR08(2) = 1**. **All outputs are deactivated**

If the NC does not come on or goes out while running, check that the voltage and ground outlets are as they should be. If an axis does not count, disconnect the feedback connectors one by one. If the NC comes on, it indicates a fault in the feedback device. If the fault persists get in touch with Fagor Automation's Customer Services Department about it.

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Avoid the effect of solvents such as Chlorohydrocarbons, Benzol, Esters and Ethers because these could damage the plastics with which the front of the equipment is made.

### **Preventive Inspection**

If the NC does not come on press the rear switch for starting, make sure it is properly connected and being supplied with the proper mains voltage.

**GENERAL**

Display ON/OFF: 

MM/Inches: 

Fine/Coarse resolution: 

**JOG**

Select axis:  or 

Select JOG: 

Slow JOG:  or 

Fast JOG:  and   
 and 

Quit JOG:  or 

Indicate position:  or  , [Posit. value]

Start: 

Stop: 

Quit:  or  , 

**EDITOR**

Access:  [Prog Nr] 

Program:

1st page:  [Value]  

 [Value] 

2nd page: [rEP] [± Nr] 

End:  

Delete:   [Nr] 

Rep +: Complete the batch. Restart with 

Rep -: Return to 1st block. Go on with foot switch.

**HOME SEARCH**

Access:  

With home switch:  or  

Floating:  ó  , [719200] [Value] 

Quit:  

**SHEAR MOVEMENT**

Access: "SEL" LED's off.

Counter: yes/no  

Reset:  

X retract: yes/no  

By time:    [t] 

Ignore time:     

X retract:    [2 mm] 

**EXECUTION**

Access:  [Prog Nr] 

1st block:  [footswitch]

Next block: 

Cycle counter:  (Displayed for 2 seconds)

Quit: 

Note: The cut counter cannot be activated from the EXECUTION mode.