

FAGOR NC-200 PB NC FOR PRESS BRAKES

INSTALLATION MANUAL

Manual version: 0303



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Warning:



Before starting up the DRO, carefully read the instructions of Chapter 2 in the Installation Manual.

The DRO must not be powered-on until verifying that the machine complies with the "89/392/CEE" Directive.

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-200 PB

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 April 1st, 2001

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 DIFFERENT MODELS
(THEY MAY BE SELECTED WITH PAR64)***

A. Controlling only the final position of the bend.

The foot switches and the hydraulic circuit are not controlled by this NC. The intermediate positions of the ram are detected by electrical microswitches.

A1. Same as model "A" with footswitch treatment and outputs for governing the hydraulic valves for the 4 EXECUTION modes.

The rapid approach feed is not managed.

Especially indicated for conventional down-stroke machines.

B. Same as model "A" with a linear encoder or potentiometric scale for decoding the intermediate ram or bed positions affecting the bending approach speed and depth:

With outputs to relays or to a PLC:

STOP - Top dead point overrun

S9 Fast ram approach.

S29 Slow speed controlled by the footswitches.

S28 Ram retraction.

With internal processing: (without external output).

- Going through "Y=sheet thickness" position to withdraw the X axis.
- Bend position reached to start timing the bending process.

C- Control of the actual ram/bed position.

With internal processing of all the intermediate positions.

The footswitches control directly the position of the bending tool, Y axis.

MACHINE MODELS. MOST RELEVANT PARAMETERS

Machine Model	PAR 64 5, 4, 3	Bend confirmation
A	0 0 0	Type 1 and 3
A1	1 0 0	Type 1 and 3
B	0 1 0	Type 1 [PAR 64(8) = 1] and 2 [PAR64(8) = 0]
C	0 0 1	

BEND CONFIRMATION OPTIONS. NEW BLOCK

1.- With contact pressure gage or electronic gage

PAR64 7, 6	Bend confirmation (go to next block)
0 0	Contact pressure gage
	Compatible with potentiometric encoder. B model
1 1	Contact pressure gage and pressure output
	proportional to the required tonnage
0 1	Electronic pressure gage (internal jumper at U4)
	It checks the trigger pressure proportional
	to the required tonnage *

2.- With actual ram position reading

With PAR65(4) = 1 and internal jumper at U4, potentiometric linear encoder.

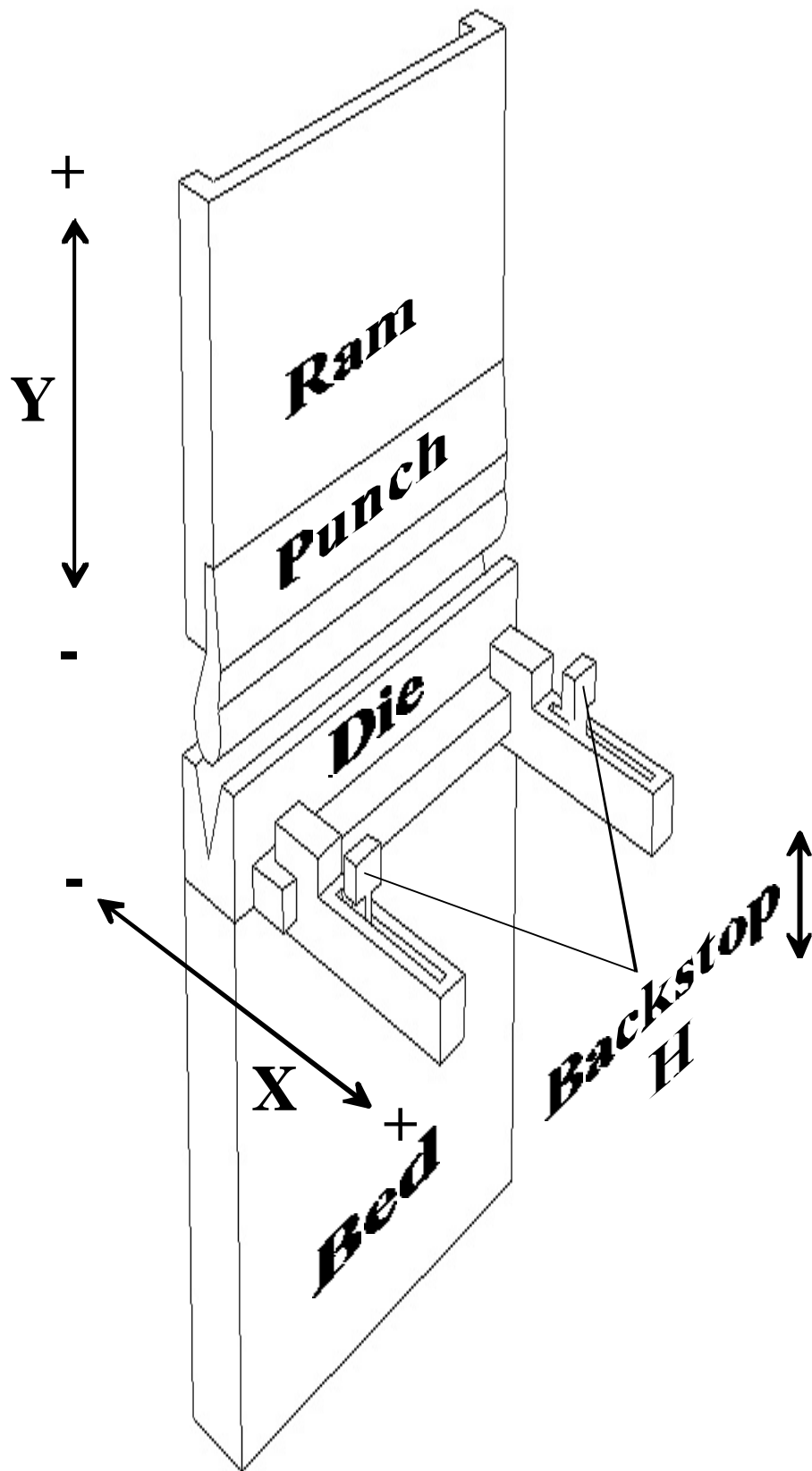
With PAR64(7,6) = (1,1) O18 offers a pressure command proportional to the required tonnage*.

3.- By timing the ram up movement

With PAR51(7) = 1, the top dead point may be modified by programming the ram's up time.

- * The required tonnage is proportional to the opening of the die and the characteristics and dimensions of the sheet metal. The calculation is included when treating each bend.

DIAGRAM OF A TYPICAL PRESS BRAKE

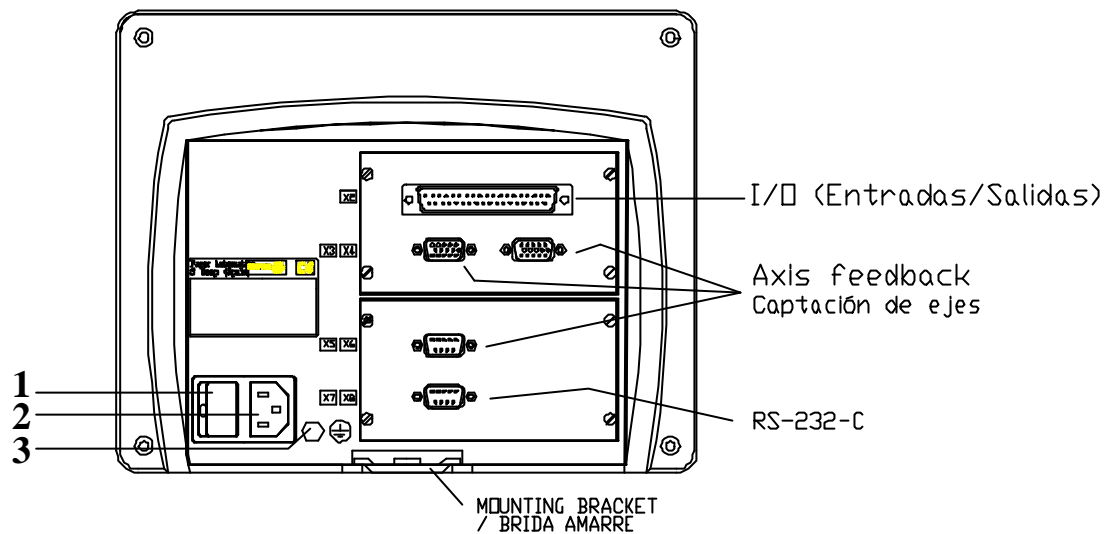


1. UNIT DESCRIPTION

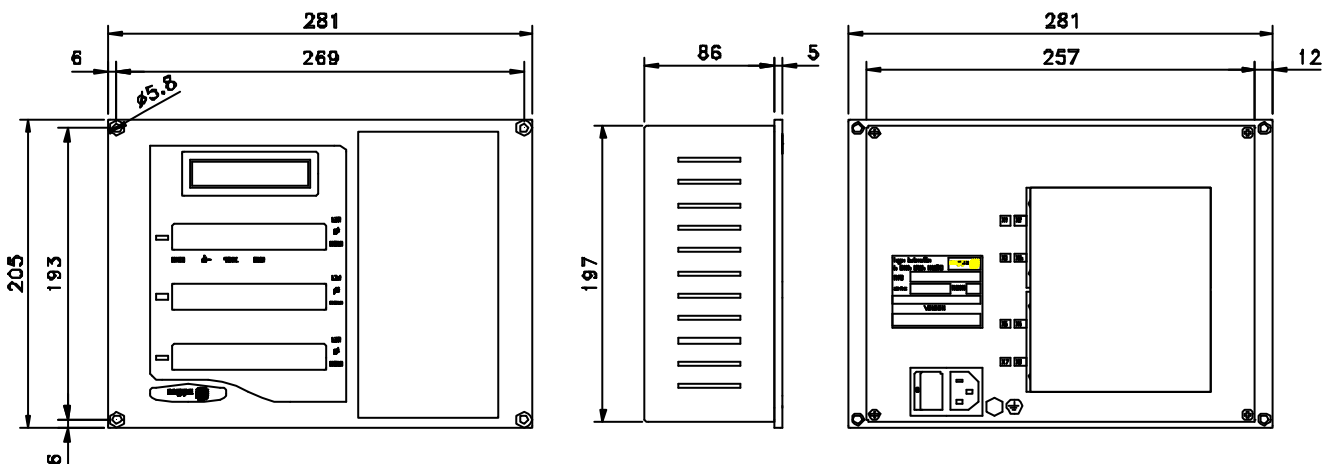
This unit is especially designed to be used on punch presses. It allows displaying the position of the X and Y axes, controlling them as well as the raising device (H), editing and executing part programs etc. The axes may also be moved manually from the dro keyboard or externally with footswitches.

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.


- 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.
- X5.-** SUB-D HD type 15-pin female connector for 2nd axis feedback device. auxiliary Y' axis (only on model "B").
- X7.-** SUB-D type 9 pin male connector for the RS-232-C serial line connection.

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

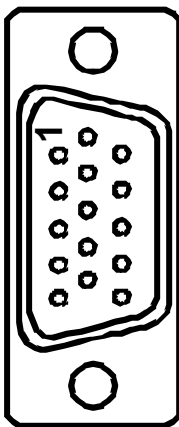
The connection for the RS-232 serial line (optional X1 connector) is not described in this manual; but in a supplement for it.

2.1 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, X4 and X5:

- +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

2.2 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	

2.2.1 PRECAUTIONS FOR THE ELECTRICAL INSTALLATION

- Install diodes in anti-parallel on 24Vdc electro-valves.
- 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 outputs connected to relays and contactors:
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.

2.3 INPUT/OUTPUT CONNECTION (X2).

Pin	I/O	Common signals	Model "A"	Model "A1"	Model "B"	Model "C"
1		Chassis				
2	I	0V External				
3	I	24V External				
4	O	24V User				
5	O	X enable				
6	O	1 = X fast, 0 = X slow				
7	O	X direction				
8	I		Force X-	RETURN footswitch		
9	O		Buzzer		Fast approach	Buzzer
10	O	Height H, 1 = up				
11	I	X limit + (lo X)				
12	I	X- limit				
13	I		New block		Ram up	
14	I	BCD 1 switch				
15	I	Pressure gage				
16	I	External key 1	External key	"BCD 2" EXECUTION mode selector		
17		Chassis				
18	I/O	Pressure or scale input X analog output				
19	I/O	0V Analog.				
20	I	0V External				
21	I	24V External				
22	O	24V User				
23	I	Emergency				
24	O	Y enable				
25	O	1 = Y fast, 0 = Y slow				
26	O	Y direction				
27	O	IN POSITION	MANUAL mode	MAN/EXEC mode	MANUAL mode	MANUAL mode
28	O		Ram retract			Not used
29	O		X, Y in position	Feed ram	Bend slowly	Not used
30	I	Y limit + (lo Y)				
31	I	Y- limit				
32	I		X retract		MANUAL station	
33	I	BCD 2 switch				
34	I	Y disable				
		Semiautomatic				
35	I		External key	Force X- / BEND footswitch		
36	I		External key	"BCD 1" EXECUTION mode		
37	O	Y analog voltage				

2.3.1 INPUT DESCRIPTION.

Section 2.3.3 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 18 may be configured as an analog input with a 0V to +10V range. When installing a linear potentiometer, it should be supplied with the 5V from the digital feedback devices (pin 5 of X3, X4).

PIN	FUNCTION	DESCRIPTION		
11, 12, 30, 31	Limit switches. Hardware	In MANUAL mode, they limit the movement in the corresponding direction. In EXECUTION mode, they abort the program. In HOME SEARCH mode, they respond as home switches in the positive direction		
23	EXTERNAL EMERGENCY	Disables the axes Disables the outputs Displays error 7		
14, 33, 34	5-position BCD selector in MANUAL mode - PAR32	1 - Continuous feed 2, 3, 4 - Incremental feed with the pitch set by PAR 32 5 - Y axis disable in EDITOR / TEACH-IN mode. It only displays it. It allows withdrawing the punch by external means in "C" mode. Semiautomatic in EXECUTION mode		
36, 16	Models A1, B and C			
	"BCD" selector	36	16	
		1 - RUN 1	0	0
		2 - RUN 2	0	1
		3 - SET	1	0
4 - JOG	1	1		
35, 36, 16	Model A External key simulation. PAR 31	Allows duplicating any 3 keys that may be selected - PAR 31		
8, 35	Model A1, B and C footswitch connection	They respond according to the logic defined with the "BCD" selector		
13	Models A, A1, B Next block	If PAR65.1=1, requires previous input at I32 Confirmation of RAM at top dead position. Make sure that I13=1 to begin the home search (A, A1, B)		
32	Models A, A1	Retracts the backstop X if there 's a conflict when bending, conditioned by the editing attribute B in the slow speed stage		
	Model B, C	FAST approach before the bend conditioned to the maneuver safety that requires "busy hands". The change to SLOW is forced at a previous programmable position		
15	Model A, A1, B Pressure sensor section 2.3.4	A - Electrical signal from the pressure sensor A1 - Confirmation that the programmed maximum pressure has been exceeded to begin the delay "D". Not connected. if the machine does not have a pressure sensor.		

2.3.2 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. It is not required on auxiliary relays of less than 20 mA.

The drives are enabled with auxiliary relays (section 5.2).

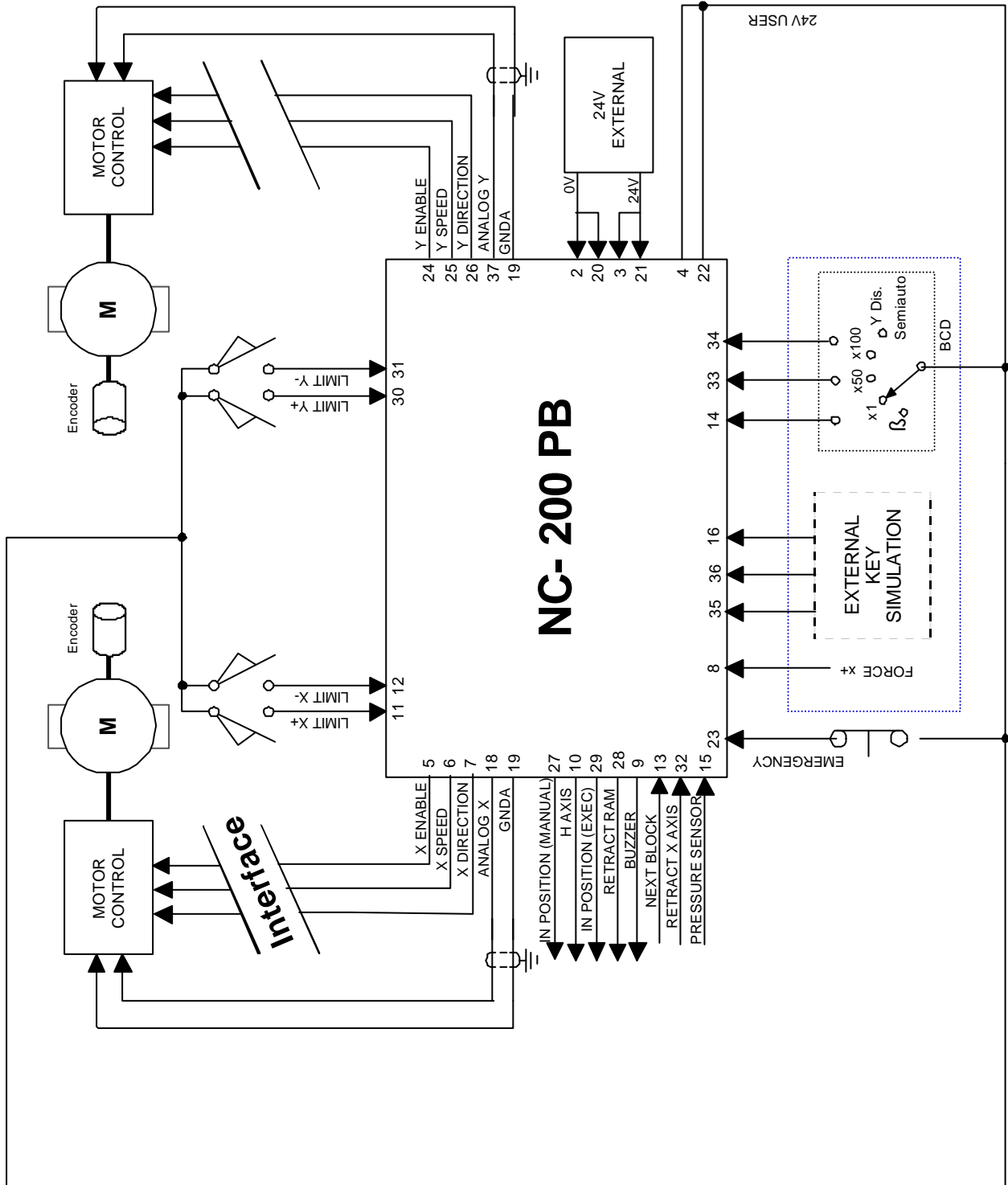
PIN	FUNCTION	DESCRIPTION
5, 6, 7, 24, 25, 26	Axis enable FAST/SLOW DIRECTION PAR46	Enabling drives or frequency inverters for open loop control.
18, 37	Analog voltage outputs. PAR 64, PAR65	To control drives in closed loop drives. When installing a pressure transducer or potentiometric scale, connect it to pin 18 and change the position of the internal jumper.
27	MANUAL mode	MANUAL mode selection confirmation.
10	H output	It activates the auxiliary output to raise the X axis backstop. R axis function, ON /OFF conditioned by the "H" editing attribute.
28	Models A, A1, B Ram retraction. Section 2.3.4	A - Retraction control by trigger time after the pressure gage conditioned by the "D" attribute. A1, B - Forced retraction up to the top dead point. Bending time conditioned by the "D" attribute.
29	Model A Axes in position	Signal to the electrical cabinet to enable the FAST approach buttons or SLOW bend footswitch.
	Model A1 Approach and bending	Single output. The FAST/SLOW change is handled with external resources from the electrical cabinet that manages the FAST buttons and the change switch.
	Model B SLOW approach. Section 2.3.4	At all models, it is reset with : I32 (A, A1) or Y = e (B, C) at the beginning of the bend if attribute B I15 when exceeding the bending pressure
9	Model B Fast movement handling. Ram approach.	It resets in the programmable change position that forces the slow motion output O29.
	Model A, A1, C	Buzzer to warn the operator about "permission to bend"

2.3.3 INPUT/OUTPUT CONNECTION

2.3.3.1 INPUT/OUTPUT CONNECTION. MODEL A

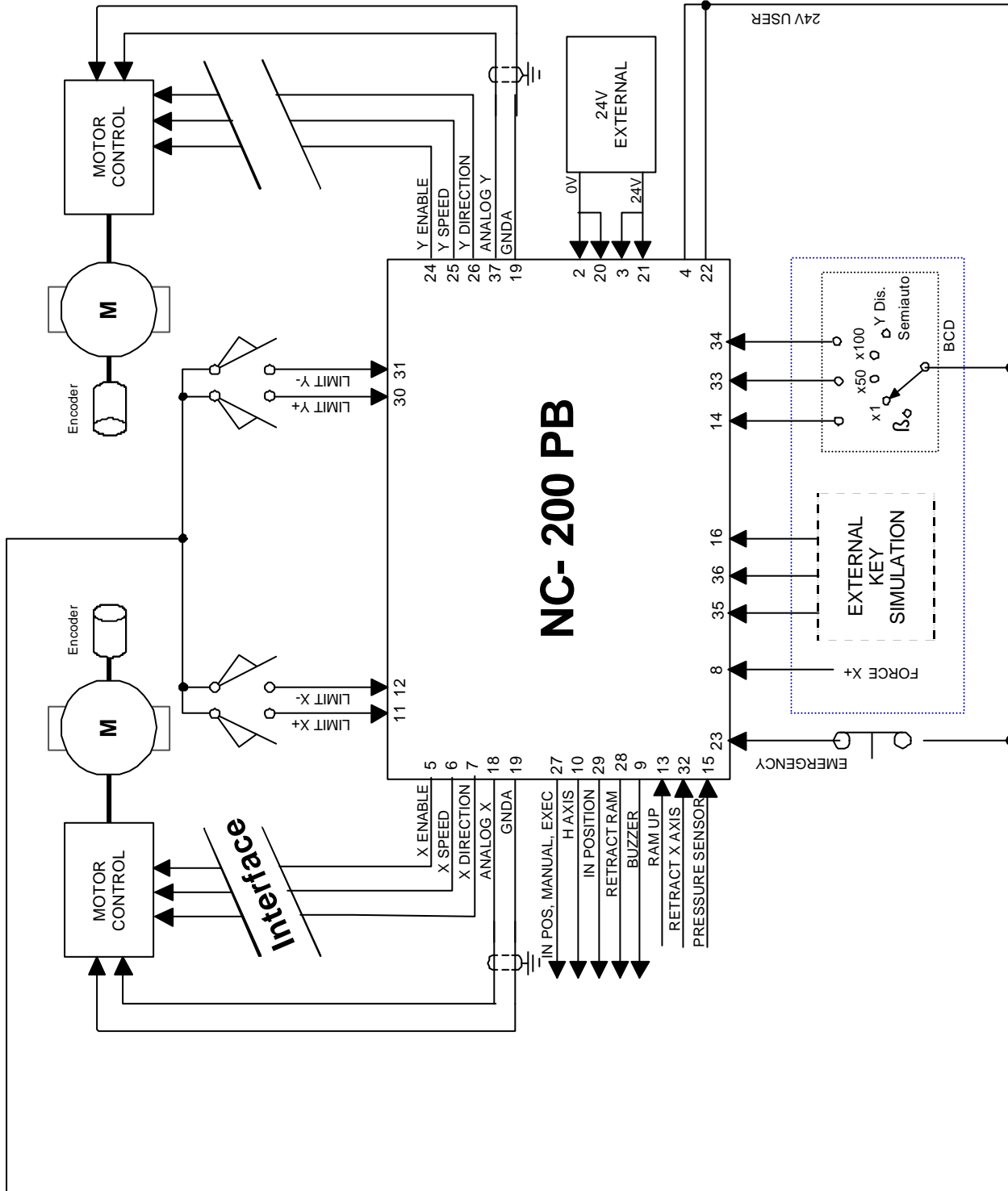
With neither foot switch connection nor ram control outputs.

From the electrical maneuver, it is possible to differentiate the function of the foot switches depending on the work mode. The confirmation of axes IN POSITION is given by O27 in MANUAL and O29 in EXECUTION.



2.3.3.2 INPUT/OUTPUT CONNECTION. MODEL A1

The output for rapid ram approach must be handled externally from the electrical cabinet. The fast ram down movement must be handled with O27 active, both axes in position (MANUAL or EXECUTION).

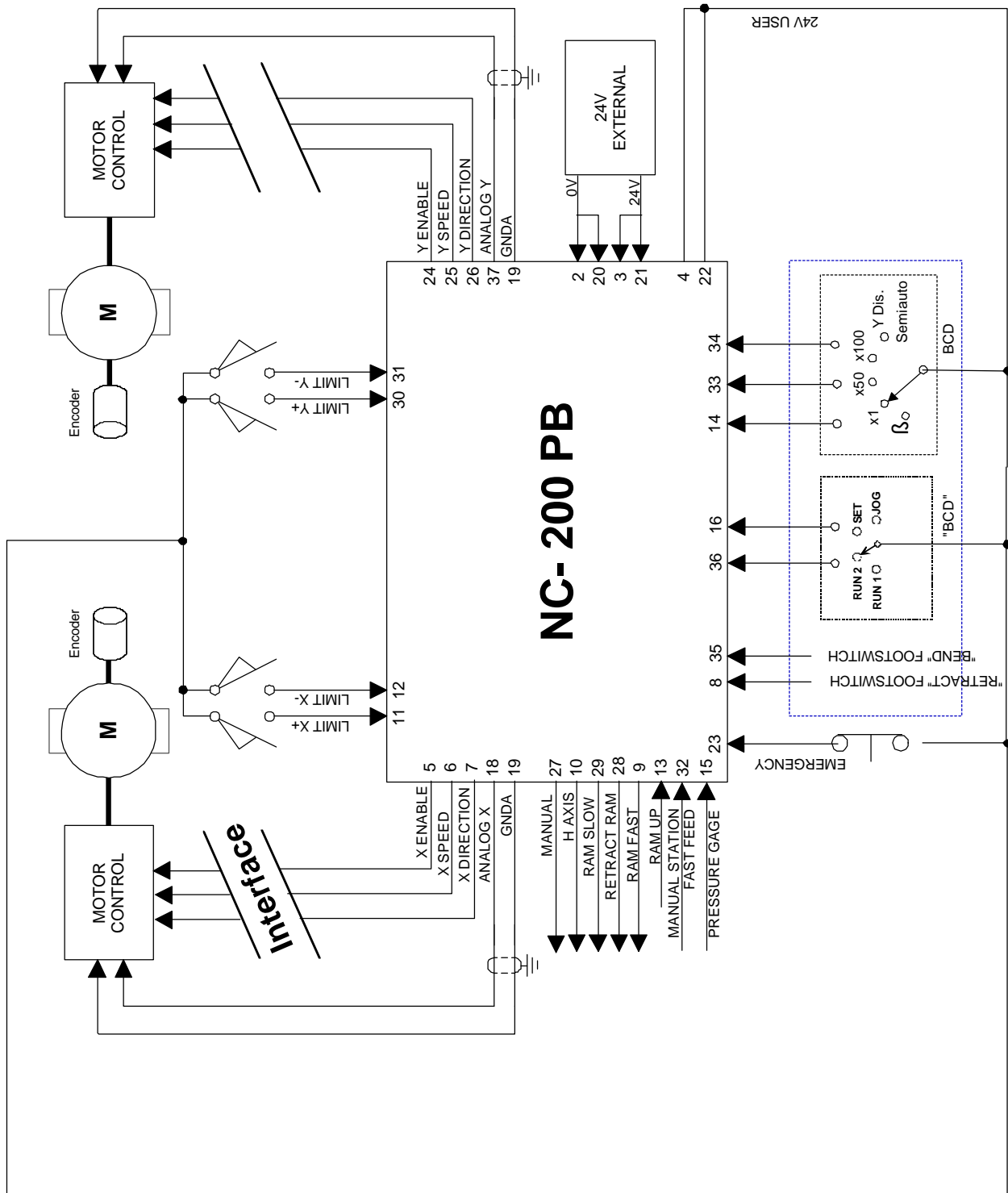


2.3.3.3 INPUT/OUTPUT CONNECTION. MODEL B

With footswitch connection. Manual control and ram controlling outputs.

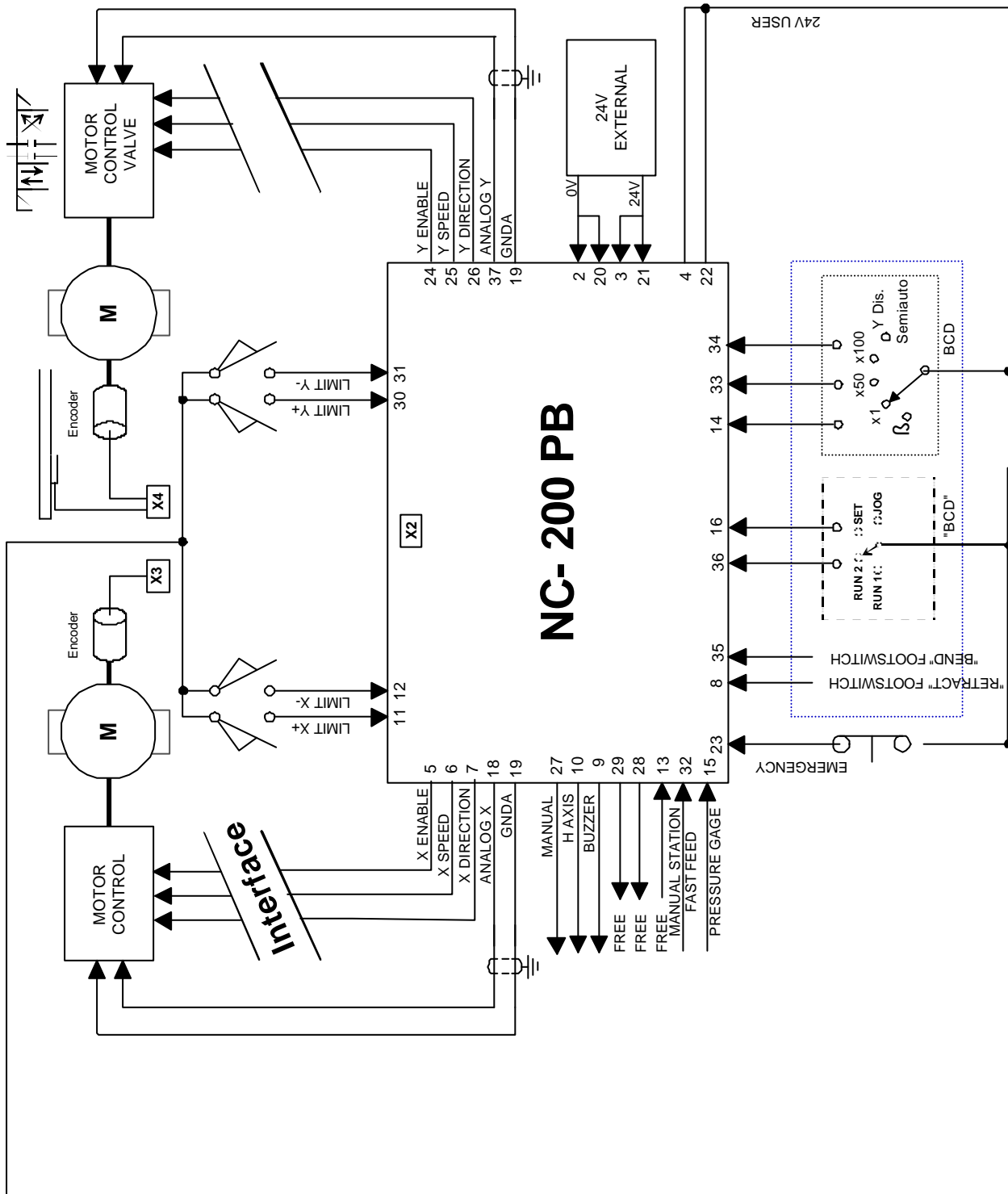
Outputs O9, O28 and O29 only define the ram movement.

Use the electrical maneuver and the safety module to decode and govern the relevant valves.



2.3.3.4 INPUT/OUTPUT CONNECTION. MODEL C

With footswitch connection and manual control.



2.3.4 BLOCK CHANGE SYNCHRONISM. MODELS A, A1,B

There are three ways to synchronize when going from one block to the next at the end of a bend. If a pressure gage* (transducer) is installed, $P64.6 = 1$, the editor offers the possibility to program the trigger pressure proportional to the length of the sheet metal (see next figure).

1. With the transducer connected to input I18 ($P64.7=0$), this positioning dro (NC) compares the active pressure with the one programmed and provokes the sequence for bend timing, ram return and block change.
2. Reserved for special machines using a pressure driven hydraulic system . It outputs a pressure command (O18) and it waits for the command to start bend timing at I15.

A residual command (PAR38) is output during ram approach retraction.

3. With the signal from the pressure gage connected to I15 [$PAR64(6) = 0$].

In all 3 cases:

- . O29 AXES IN POSITION. To enable the action of the foot switch and the ram down movement.

It is kept active during the whole sequence. It is reset if there is a "B" attribute with X axis retraction and while returning the ram.

- . O28 RAM RETURN SIGNAL (Delayed connection)

The delay starts with I15 or when exceeding the voltage threshold at I18 once the rated (nominal) bending pressure has been reached.

It is reset when the ram reaches the top dead point.

- * Recommended pressure-voltage transducer:

GEFRAN MOD TKG-N-3-M- xxxx-M (www.gefran.com)

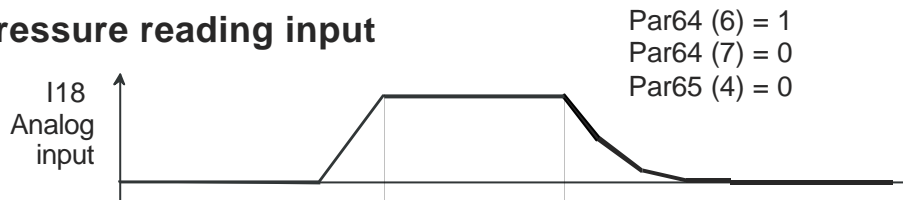
Range up to 500 Bar

Output 0V to 10V

Internal adjustment of bottom of the scale

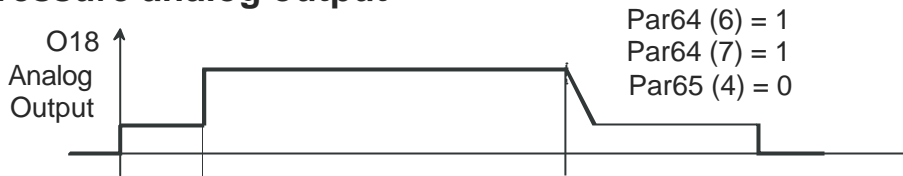
Power supply 15 Vdc - 30 Vdc

1- Pressure reading input



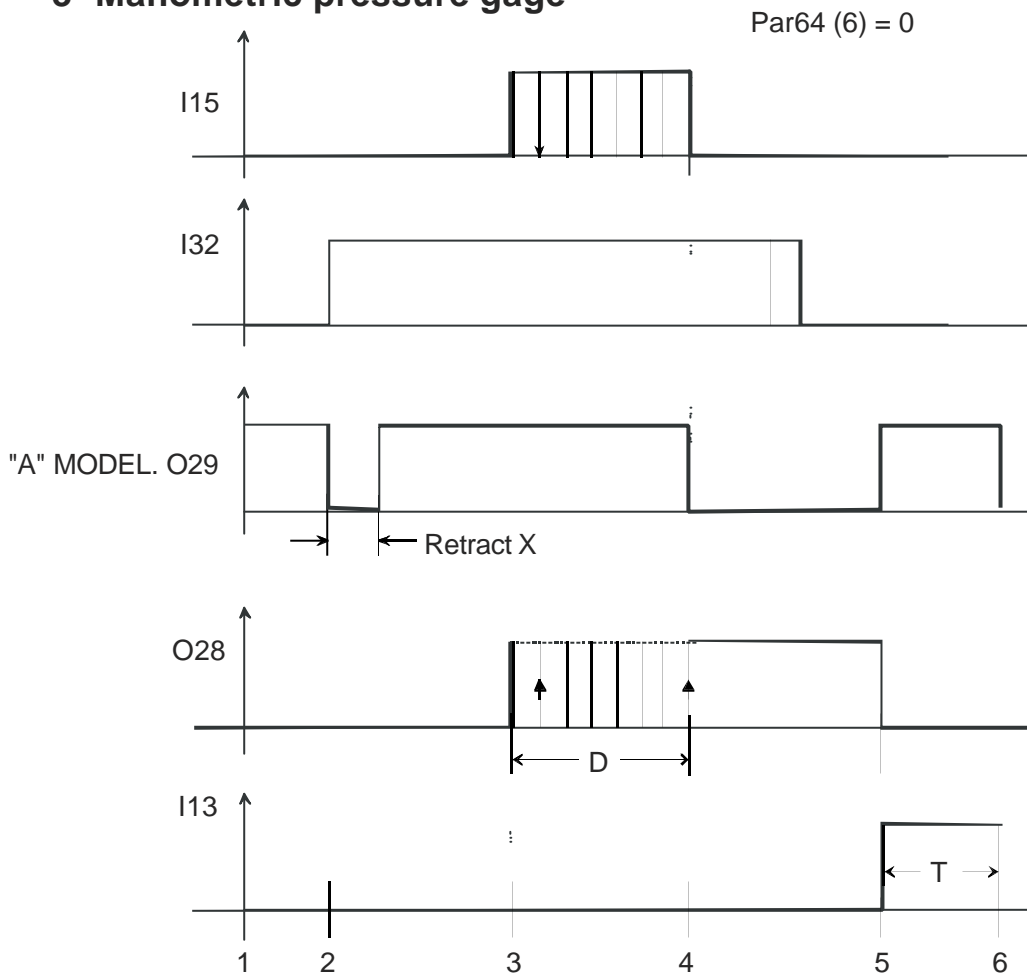
Par64 (6) = 1
 Par64 (7) = 0
 Par65 (4) = 0

2- Pressure analog output



Par64 (6) = 1
 Par64 (7) = 1
 Par65 (4) = 0

3- Manometric pressure gage



Par64 (6) = 0

1. X, Y axes in position.
2. Punch-sheet contact, optional X axis retract (B).
3. Pressure reached, programmable bending time (D).
4. Begin ram return.
5. Top dead point reached.
Go to next block, optional delay (T).
6. New X Y axes positioning.

2.3.4.1 DELAYED RETURN OF THE RAM. MODEL "A"

With pressure sensor signal connected to I15, the programmable delay for RAM UP begins.

When the pressure sensor triggers:

- a. It activates O28 to force the ram to return automatically. It is affected by the timer ($PAR29 + D$). As a precaution, a minimum delay is forced ($PAR29$).
- b. It resets O28 and it goes on to the next block.

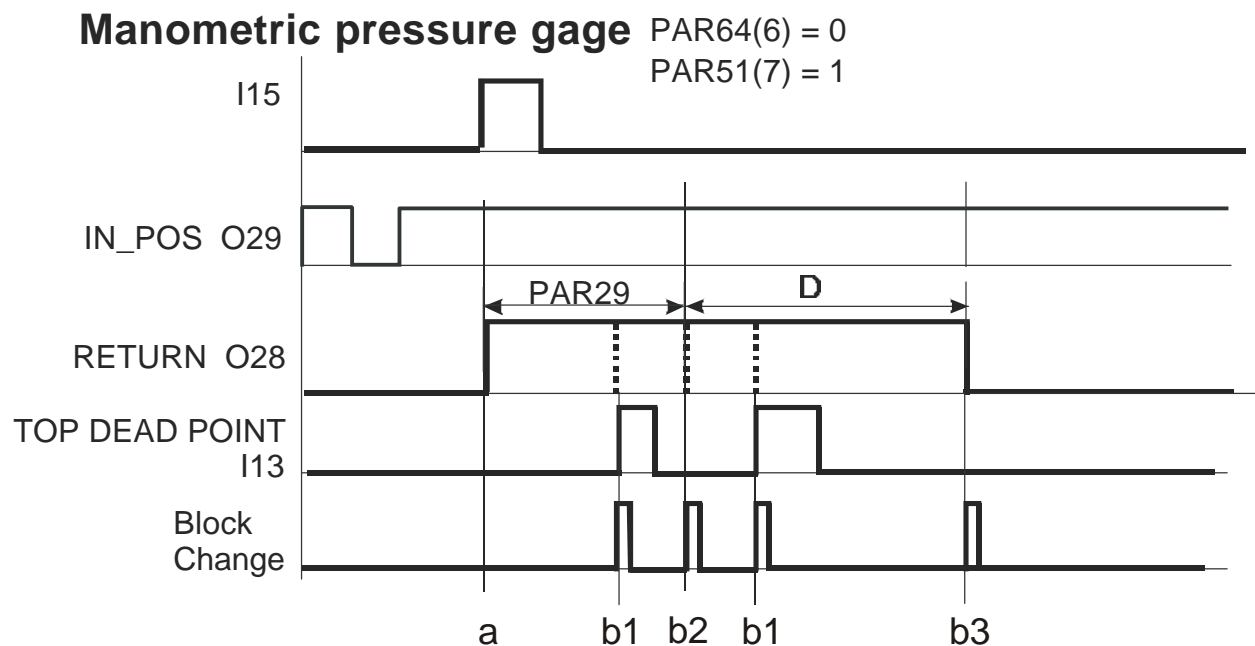
There are three possibilities:

- b1 With a "D" value too high, the ram reaches the top dead point, it activates I13 before the delay is over.
- b2 If $D = 0$, after the $PAR29$ delay.
- b3 If the delay is over ($PAR29 + D$), it forces it to go to the next block without waiting for I13.

In "b1" and "b2" modes, I13 resets the timer and O28.

If it reaches the top dead point, it goes on to the next block.

If $PAR65.1=1$, it requires a previous flank at I32.



2.3.5 BLOCK CHANGE SYNCHRONISM. MODEL B

Description of the diagram according to positions 1 through 6:



1. With X and Y axis already in position, the FAST approach is activated from the MANUAL control station I32 or only SLOW from the "BEND" footswitch (I35).
2. In the change position, Y= PAR33 or programmable, the SLOW speed is activated with the "BEND" footswitch.
3. When pinching the sheet metal, Y = thickness, it resets O29 until the X axis is fully retracted, if attribute B.
4. Reading of the final bend position.

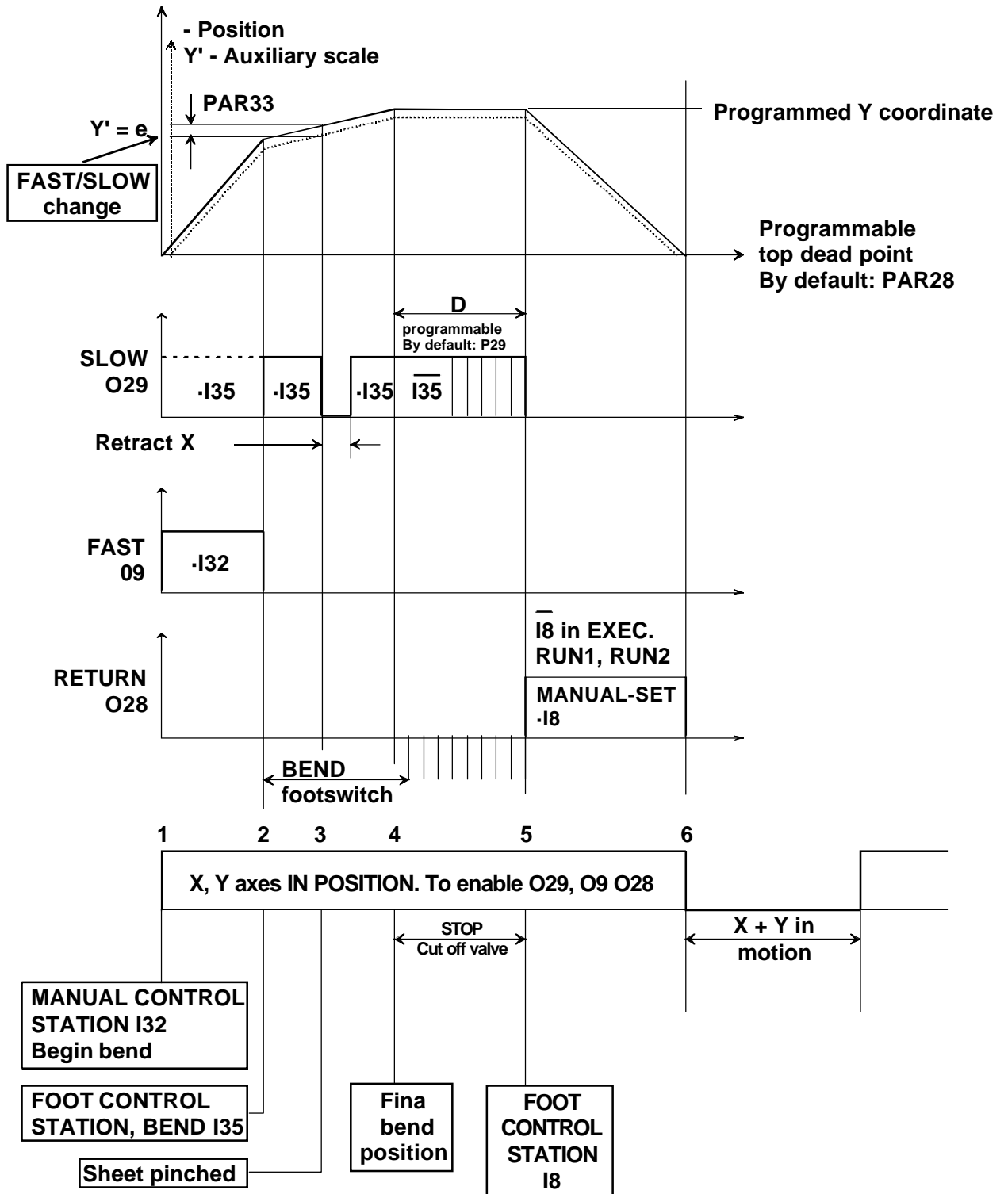
If PAR64(8) = 0, when the programmed depth is reached, it checks if $Y - Y' < PAR25$ of the auxiliary feedback device.

if PAR 64(8) = 1, it waits for the signal from the pressure gage or transducer. It starts timing, attribute D. I8 aborts the timing and forces O28, RETURN.

4. Once the programmed bending depth has been reached, the auxiliary feedback Y' compares the difference $Y - Y' < PAR18$ to begin the bending delay, "D" attribute.
5. After the delay "D" and depending on the selected cycle, it activates the return O28:
If RUN1, RUN2 - Automatic or when interrupting with I8.
If SET- With footswitch I8 (attribute D is ignored).
If JOG - Maintaining I35.
6. When reaching the final dead point, it begins the next block.





2.3.5.1 PRESSURE ANALOG VOLTAGE

- Setting PAR64.6.7 = 1 configures O18 as the analog voltage output for pressure.
- Its value (0V - 10V) is proportional to the requested tonnage indicated on the attributes page (proportional to the length of the sheet metal) of EDITOR mode or on the auxiliary page  <Tool>  of the MANUAL mode.
- It offers a residual value (PAR 38) in the ram approach and return stage.
- It is reset when the ram is kept at rest at the top dead point.






2.4 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  [access code], 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 .

2.4.1 X AXIS HOME SEARCH

PAR14 establishes how the machine reference (home) search is to be carried out. All models perform this home search in the positive direction.

The X axis usually has a travel limit switch: PAR 14 bit 1 = 0 and a rotary encoder. The home searching sequence is as follows:

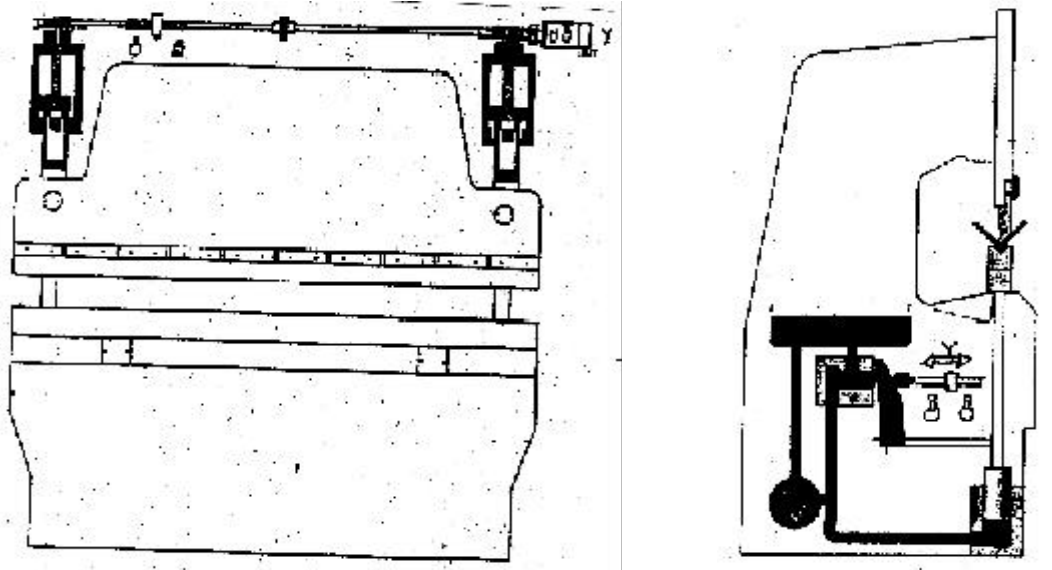
- Set the NC in Home search mode by pressing . The  led will turn on. If the home search for any of the axes is defined as "floating" ($P14.1 = 1$), it requests the password (719200) after pressing .
- Select the  axis. The unit will display the text "START".
- Press .

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 center of the die to the support side of the X axis). See section 2.4.5




2.4.2 Y AXIS REFERENCE (HOME) SEARCH. MODELS A AND A1


Move the sliding cam that activates the travel limit switch of the ram so it reaches the top dead point.



- a- If the machine has travel limit switches, the home search procedure is the same as the one described for the X axis; but it is only enabled if I13 = 1, ram at top dead position.
- b- If the machine does NOT have travel limit switches (which is very common on down stroke models), set PAR14 bit 1 = 1 to indicate that the reference position is floating.






The homing sequence is as follows:

- In MANUAL mode, move the Y axis preferably in the Y+ direction to make sure that the backlash of the rack-and-pinion is properly compensated for.
- With the pressure regulator adjusted to the minimum, actuate the "BEND" footswitch until the ram reaches its final position. Output O27 is active ("A" model) to enable the footswitch.
- Measure the distance between **the support bases of the punch and die**. This distance will be the Yref to be preset.
- Press . The  led will turn on. Select the  axis.
Enter the password (719200).

This unit displays the real position and the axis remains on stand by, (by default, it suggests the PAR10 value). Preset the reference value Yref and press  to assume it. It displays the coordinate ($Y = Y_{ref} - H_{punch} - H_{die}$) compensating the height of the tools that are active. See section 2.4.5


2.4.3 Y AXIS HOME SEARCH. MODEL "B"

Usually, this axis has home switches on UP-STROKE models.

- Position the table or the ram at the far-end position activating the limit switch I13.
- Press . The  led turns on.
- Select the  axis. It displays the word "START".
- Press  to reach the home position.
- Actuate on the "BEND" footswitch until the punch or the die (on up-stroke models) goes to its final position.
 - a) With a linear encoder [PAR 65(4) = 0]:
 - Press  to synchronize the Y axis home value set in PAR10 with that of its associated axis Y'.


- b) With a linear potentiometer [PAR 65(4) = 1]:

It requires two synchronization points for the value of the Y axis with the position of the table in order to obtain the V/mm constant of the potentiometer and set an initial reference value.

1- Press , it displays the value of the potentiometer cursor in volts.

It enables the MANUAL mode.

2- Press 

3- Use  to move the Y axis to the far-end position towards Y-.

Activate the BEND footswitch again until the final position.

Press  again.

Quit by pressing 





2.4.4 Y AXIS HOME SEARCH. MODEL "C"

An up-stroke or down-stroke model "C" has a linear encoder and controls the actual (real) position of the ram using foot switches. It usually has travel limit switches.

If PAR00 bit 6 = 0, has been set for a linear encoder with a regular reference mark (without distance-coded reference marks), the homing procedure is the same as described in section 2.4.2 (a)

If PAR00 bit 6 = 1 has been set for a linear encoder with distance-coded reference marks.

The homing sequence is as follows

- Set the NC in Home search mode by pressing  .
The  led will turn on.
- Select the  axis. The unit will display the text "START".
- Press  .

The axis moves upwards in the positive direction until detecting two consecutive reference marks (I0's) and it displays the reference value set at PAR10.

$$\text{PAR10} = \text{D} - \text{O} + \epsilon$$

Where D = Distance between the support bases between the punch and the die.

O = Offset value indicated on the label of the linear encoder

ϵ = (See the next section 2.4.4)

2.4.5 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.

The floating-home search on the Y axis (PAR14.1 = 1) is a little risky if the home value is wrong and does not match the actual distance between the supporting sides of the punch and die. The software limits set by the OEM may be overshoot.

The Y axis tries to recover a position within the software limits with the risk of exceeding the limits of the worm gear mechanism.

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:

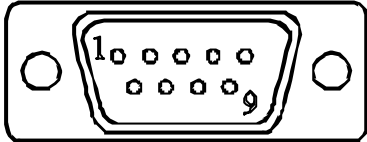
- 1- Set PAR10 with any value and execute a home search for a first rough approach.
Calculate the "ε" difference: $\epsilon = \text{PAR10} - \text{final position reached (+ value)}$
- 2- The final value for PAR10 will be: The requested distance between the support bases between the punch and the die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

2.5 RS-232-C CONNECTION (CONNECTOR X7)

The RS-232-C serial communications line uses a 9-pin male SUB-D type connector.

Parameter PAR90 sets the transmission speed through this line. See section 3.5 in this manual.

The operating mode for this feature is described in chapter 5 of the Operating Manual.

	<u>Pin</u>	<u>Signal</u>	<u>Function</u>
	1	NC	Not connected
	2	RxD	Receive Data
	3	TxD	Transmit Data
	4	NC	Not connected
	5	GND	Ground
	6-9	NC	Not connected

2.6 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 mm²).



2.7 TURNING THE UNIT ON AND 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 shows on the LCD display the text: "Fagor NC-200PB, Press




and the  and  displays show "Fagor dro" if everything is OK and the error




number if otherwise. See the appendix at the end of this manual.

Turning the unit OFF

If you press  this 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 switched off by means of the switch on its rear panel.

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

Notes:

- Before powering this 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 , this 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 by previously pressing .

3. *INSTALLATION PARAMETERS*

These NC's have a number of installation parameters to configure it for a particular application.

These parameters may be saved into a peripheral or uploaded from it through the RS-232-C serial communications line.

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.
- The LCD display will show the description of the parameter and its number.

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.
- Simulated key code, by accessing the corresponding key.



Some parameters may be accessed directly (, [parameter number]) :
PAR28, PAR50, PAR51.

3.1 PARAMETER SETTING

Machine parameters PAR50, PAR51 and PAR90 enable special features of this NC. The user may access them directly.

In initial mode, press  [parameter number] .

The rest can only be accessed by installers and technicians.

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] 



The LCD display will show the parameter number and a short description.

. If it is a general parameter, its value is only shown on the first display.



. If it is an axis parameter, each axis display will show its current value.


In this case, select the axis by pressing its key ( or ) and key in its new value.


- To go to the next parameter **saving the changes**:

Press  or  to go to the next one.

To return to the previous one, press 

- Pressing the key of the other axis ( or ) saves the value of the previous axis and it goes on to edit the new selected axis.

- 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.

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	<p>Feedback configuration, different per axis. Binary type.</p> <p>This parameter sets the specific characteristics of the feedback device (rotary or linear encoder) used to read the axis position.</p>
Digit 8	<p>Direction of the distance-coded Io (0 = Increasing, 1 = Decreasing)</p> <p>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.).</p> <p>When using a rotary encoder or a standard Fagor linear encoder (without "O") for this axis, this bit must be set to "0".</p> <p>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".</p> <p>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".</p>
7	<p>Pitch of the distance-coded Io (0 = 20 mm, 1 = 100 mm)</p> <p>This bit is ignored if bit 6 has been set to "0".</p> <p>When using Fagor M or C series linear encoders, this bit must be "0".</p> <p>When using Fagor F series linear encoders, this bit must be "1".</p>
6	<p>Type of linear scale's Io (0 = Fix, 1 = Coded)</p> <p>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.).</p> <p>When using a rotary encoder or a standard Fagor linear encoder, this bit must be set to "0".</p>

- 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 press brakes:
 X axis retraction in the positive direction.
 Ram up movement 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.
 From 0.000001 to 0.03937 inch
 factory setting: **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 ,
 The factory setting is: **x4** and it is the one used for FAGOR linear encoders (scales).

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

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

Where:

F = is the chosen multiplying factor .

i = Gear ratio. Number of teeth of the Y axis crown on conventional machines.

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

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 $\left[\frac{+}{-} \right]$,

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 0.5µm resolution, eg.: MOY, COY, etc. it must be set to "10".

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

It may be used for adapting any resolution when the encoder is affected by a mechanical gear reduction.

Example:

- Leadscrew pitch: 20 mm
- Gear ratio, $i = 72$ teeth
- Encoder 100 pulses / turn
- PAR2 = 2

$$\text{Resolution} = \frac{20}{100 \cdot 72} = 0.001388888889$$

Set:

$$\text{PAR1} = 0.0013$$

$$\text{PAR2} = \frac{13}{13.88888889} = 0.936 \quad \text{Rounding the 3rd decimal to the least possible error.}$$

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 center of the die to the support side of the X carriage.
 On the Y axis: The distance between the support sides of the punch and the die.
 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 ± 99999.999
 This value will be in mm or inches depending on whether the INCH LED is off or on.
 If PAR08(2)=1 (limit alarms ON), when the axis exceeds this distance, the corresponding axis display starts blinking until it is moved back into the work zone.

PAR13 To set the maximum axis travel limit referred to the value set for PAR10. Range within ± 99999.999
 This value will be in mm or inches depending on whether the INCH LED is off or on.

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 tot 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).

PAR 16 It sets the value of the leadscrew backlash to compensate for.
Backlash compensation requires unidirectional approach (PAR17 = 1 or 2)

Range: ± 99999.999

On the X axis, it is obtained using a simple back-and-forth movement and a dial indicator.

On the Y axis, the worm backlash is negligible and the ram holding nut is ignored because it is always forced in the same direction.

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

X axis: 2 = It will be applied when moving in the positive direction.

1 = Reserved.

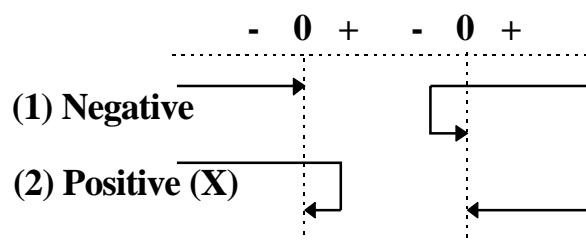
Y axis: 0 = There is no unidirectional approach.

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

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	BCD 2
7	14	BCD
6	32	Retract X axis.
5	13	Go to next block
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	"Return" foot switch.
5	36	External key 3 (A). EXECUTION mode selector
4	35	External key 2 (A). "BEND" foot switch.
3	16	External key 1 (A). EXECUTION mode selector
2	34	Disable the "Y" axis (Teach-in)
1	15	Hands-on palm switches / pressure level.

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	Buzzer. RAPID approach (B)
7	27	Manual mode active
6	26	"Y" axis moving direction
5	7	"X" axis moving direction
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. They must be set to "0".
3	29	Axes in position (A). RAM down.
2	10	"H" output
1	28	Retract RAM.

PAR25 In-position zone.

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

(Model B). On up-stroke machines, it represents the maximum deviation allowed between the Y axis position and that of its associated linear encoder or potentiometer to confirm the end of the bend.



(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.

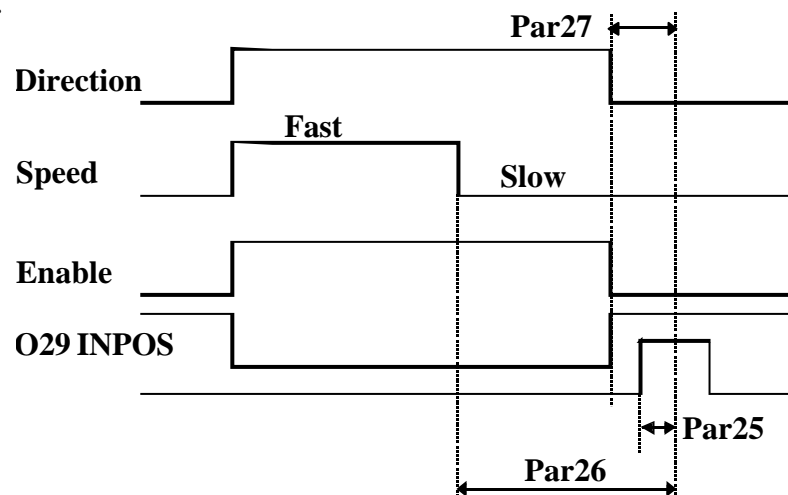
(See time diagram below)

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 5.



PAR28 It may be accessed directly to set the top dead point in MANUAL mode. Default value of the relative distance between the punch and the die to return ram after each bend.

Possible values: From 0.0001mm to 9999.9999 mm
(From 0.000005" to 393.700").

It may be forced from the editor. "B" and "C" models.

PAR29 Default value of the delay of the punch in contact with the sheet metal at the end of the bend.

Possible values: between 0 seconds to 9.9 seconds.

It may be forced from the editor. It is referred to as the "d" attribute.

PAR30 Default value of the delay applied to the X axis movement before the next positioning move.


It may be forced from the editor. "t" attribute.

With electronic pressure gage in MANUAL mode, delay between I13 and pressure acknowledgment.


Possible values: between 0 seconds to 9.9 seconds.

PAR31 (Model "A"). Configuration of the 3 inputs for external key simulation through pins 16, 35 and 36 of 37-pin connector X2.


• **To assign a key to input I16:**

Press  and then the key to be assigned.

• **To assign a key to input I35:**

Press  and then the key to be assigned.

• **To assign a key to input I36:**

Press  and then the key to be assigned.



PAR32 Configuration of the INCREMENTAL MANUAL SWITCH positions (pins 14, 33 and 34 of the 37-pin connector X2) to externally select the jog increments.

Normally, a 5-position BCD switch is used (positions 1 to 5). Position 1 is used for continuous jog, position 5 to disable the "Y" axis and to select the semiautomatic mode (pin 34) and the three in between for incremental movements.

The message screen shows "PAR32.N" where "N" is a value between 0 and 3 related to the switch dial position.

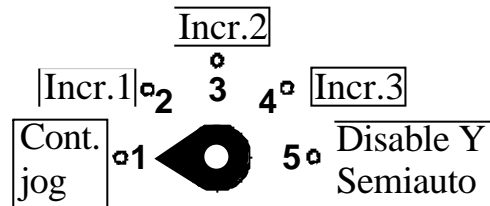
PAR32.0 is reserved as CONTINUOUS JOG mode. It does not affect the resolution.

PAR32.1 to PAR32.3 Value of the INCREMENTAL JOG in multiples of resolution units (according to PAR01).

For example, if the resolution selected in **PAR01** is **5 microns** and with the switch set to position 4 the axis is to be moved 500 microns (0.5 mm) every time   are pushed, PAR32.3 must be assigned the value of 100.

The maximum value is 255 units of resolution.

SWITCH POSITION	BCD VALUE	PIN 14	PIN 33	PIN 34	FUNCTION
1	0	0	0	0	CONTINUOUS JOG
2	1	1	0	0	1st INCREMENTAL POSITION
3	2	0	1	0	2nd INCREMENTAL POSITION
4	3	1	1	0	3rd INCREMENTAL POSITION
5		0	0	1	DISABLE Y / SEMIAUTOMATIC



PAR33 Speed change position. Models B and C.

It sets the relative height between the punch and the top side of the sheet where the speed is to be changed from fast to slow in the down stroke. Possible values: From 0 mm to ±99999.999 mm (From 0" to ±3937").

PAR33 = 0 means that the speed change takes place when the ram touches the sheet.

PAR34 Delay set for the change of homing direction in order to soften the jerk originated when reversing the direction of the movement.

Range: 0 to 9.9 seconds.

PAR35 Indicates the duration of the "in-position" output O29 that enables the "BEND" foot switch.

Possible values: between 0.1 seconds and 9.9 seconds.

If = 0, the signal stays active permanently.

The output is canceled if there is a backwards movement of the X axis in the bending stage and while returning the ram.

PAR36 Configuration of the X axis withdrawal (retract).

0 = Move it in incremental mode in the X+ direction the distance set by PAR37.

1 = Move it in absolute mode the value set by PAR37 .

PAR37 X axis retraction distance (incremental) or position (absolute) when activating the I32 signal of the 37-pin connector X2 on Model "A" or when the punch reaches the "Y=sheet thickness" position on B and C models.

Possible values: From 0 mm to 99999.999 mm (From 0" to 3937").

PAR38 Minimum residual tonnage in the ram approach / retraction stage.
Range: 0 - 99 tons

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 two.

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 5.2).

Possible values: Between 0 and 255.

PAR41 Proportional gain Kv of the position loop in the negative direction if PAR46(5) = 1. Axis controlled in closed loop.
(See section 5.2).

Possible values: Between 0 and 255.

PAR42 Conversion factor of the pressure gage or hydraulic system.

Adjust the bottom of the scale of the transducer to achieve the nominal pressure of the machine with an analog voltage of 10V.

Kp = Tons/volt. Range: Between 0 and 99.9

PAR 43 1st display:

Deformation of the machine structure measured at the punch's contact point when bending at full pressure.

Section 5.3 describes an analytical trial to calculate and load the value automatically.

2nd display:

Deformation of the ram holding device when the ram goes down at full pressure. Analytical method by trial and error carried out without placing the sheet metal and loading all the tonnage on the holding nut.

In MANUAL mode, bending all the way down, use a dial indicator to measure the deviation of the ram in two tries at minimum and maximum pressure.

Range: 0 to 9.9 mm

PAR44 Minimum analog voltage set for movements in the positive direction (only if closed loop). Dynamic improvement with proportional hydraulic valves that usually require a considerable voltage threshold in order to allow a linear response. **Range: Between 0V and 10V**

PAR45 Minimum analog voltage set for movements in the negative direction (only if closed loop). Dynamic improvement with proportional hydraulic valves that usually require a considerable voltage threshold in order to allow a linear response. **Range: Between 0V and 10V**

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 using INVERTERS and the direction output (O7, O26), it may happen that the feedback sign does not match the proper direction. This is solved by swapping the order of the A and B signals of the encoder, pins 1, 3 or the motor turning direction.

1 If = 1, bipolar analog voltage for AC/DC drive.

If = 0, unipolar for inverters governed with bipolar analog voltage.

- PAR47** Analog voltage for slow axis feedrate in the positive direction.
Value range: Between 0 and 10V.
- PAR48** Analog voltage for slow axis feedrate in the negative direction.
Value range: Between 0 and 10V.
- PAR49** Analog voltage for fast axis feedrate in both directions.
Value range: Between 0 and 10V.
- PAR50** Language selection for the messages appearing on the LCD display.
0 = English; 1 = Spanish; 2 = German; 3 = French; 4 = Italian;
5 = Portuguese; 6 = User defined.

PAR51

Digits

- 8 If =1, the EDITOR no longer shows the "attributes" page for machines or programs that do not require those resources.

This unit will assume the attribute values set by parameters PAR29 (d) and PAR30 (t).
- 7 On the "A" model with an electrical signal from the pressure gage, the top dead point may be preset with the "D" variable, timing the ram-up movement. Productivity may be improved when dealing with small parts:

If =1, to activate this feature.

If =0, to deactivate this feature. The block change is only forced when the ram reaches the top dead point, I13=1.
- 6 to 3 Not being used at this time. They all must be set to "0".
- 2 To turn on (=0) or off (=1) the confirmation beep when pressing the keys.
- 1 Program memory lock, 0 = unlocked; 1 = locked.

PAR52 Loading of the user defined language.

When accessing this parameter, the NC requests the password.

After keying 5564, the NC is ready to receive the file containing the user defined language.

PAR64 Press brake model definition
digit

- 8 Exclusive for the "B" model.
Reading of bend position
If = 0, by analyzing the bend position.
If = 1, by confirming with the signal from the pressure gage or transducer.
- 7 If = 0, pin 18 of connector X2 is selected as the analog input for the PRESSURE/VOLTAGE gage or potentiometric scale.

Both options are incompatible.

This operation requires a position change at the selector installed in the circuit of connector X2 which is accessed by removing the rear board: To set pin 18 as analog input, put the jumper towards "U4". Set PAR46.5 and PAR46.3 to "0" to configure the X axis in open loop.

If = 1 and jumper towards "U7", it is set as an analog output.

- 6 Setting of pin 18
If = 0, it is selected as analog output for the X axis.
If = 1, it is selected as an input for the pressure gage or output as a programmable pressure indicator.
The X axis will be controlled in open loop without using the analog output PAR46.5 = 0, PAR46.3 = 0.

5	4	3	Press brake model	Description
0	0	0	A	Only the final bend position is controlled
1	0	0	A1	Same as model A with footswitch handling
0	1	0	B	Same as model A1 with linear encoder for decoded intermediate ram-bed positions
0	0	1	C	Control of actual ram-bed position with footswitch and "busy hands" handling.

- 2 If =0, LCD screen
If =1, VFD screen (blue)
- 1 Not being used at this time. It must be set to "0".

PAR65 Special configurations.

Digit

- 8 to 7 Not being used at this time. They must be set to "0".
- 6 Display of the coordinate after reaching the "in-position" zone.
If = 0, real coordinate, if = 1, theoretical coordinate.
- 5 Not being used at this time. It must be set to "0".
- 4 Only for the "B" model.

If = 0, the feedback device for the ram/table position is a linear encoder.
If = 1, the feedback device for the ram/table position is linear potentiometer.
- 3 Axis positioning mode.

If = 0, The axes move at the same time.

If = 1, The axes move one after the other (1st X and then Y).

Both axes may be positioned with the same inverter using the relevant enable signals to toggle the power connection fine tuning the adjustment of the X axis to avoid rebounds at the final positioning.
- 2 If = 1, the feed towards "X-" will be forced with I35 or I8 (A) (safety regulations for rapid feed).
- 1 If = 1, There is a detector for punch-sheet contact.

Use the "B" attribute to make the X axis retract.

It requires a previous flank at I32 to confirm the change of block with I13.

If = 0, there is no detector. The "B" attribute is ignored.

If the bending sequence is interrupted and the ram returns to the top dead position, I13=1, it provokes the uncontrolled block feed.

PAR90 Indicates the transmission speed of the RS 232 line.

Options: 75, 150, 300, 600, 1200, 2400, 4800 & 9600 baud.

Factory setting: 9600 baud

This NC sends and receive data at the speed set by **PAR90** and with the following configuration:

Stop bits: 1

Data bits: 8

Parity: None

Protocol: XON/XOFF

4. OPERATION WITH THE RS-232-C SERIAL LINE

4.1. SAVING AND RESTORING DATA

With this NC, it is possible to save data into a PC or peripheral device and later restore it by using the RS-232-C serial communications line.










This data is sent out in the following format:

Baudrate as set by PAR90, 8 data bits, 1 stop bit and no parity.

Access the PROPERTIES menu of the Windows application "HYPERTERMINAL" and set the same parameters when configuring the port:

Bits per second:	9600
Data bits:	8
Parity:	None
Stop bit:	1
Handshake:	Xon/Xoff

To access this mode:

- Press 
- Select the "Com" option (communications) of the LCD display by means of the   and press .
- Select: <Send> and press  to send the data out to a PC or peripheral device or select <Receive> and press  to receive data from a PC or peripheral device.
- Select the type of data to transmit **Parameters**, **Program**, **Materials** by means of the   keys and press .

4.2. PARAMETER TRANSMITTING FORMAT

The format of the transmitted parameters are:

For value parameters:	P?? 123.123
For binary parameters:	P?? 10101010
For option parameters:	P?? 0
For axis parameters:	P?? X 123.123 Y 123.123



The number of decimals depends on the selected resolution.

5 *SETUP*

5.1 *TEST MODE*

A special mode has been created in order to make machine setup easier. This mode is accessed from the main menu. Special care must be taken since software and hardware limits are ignored in this mode.

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

- Press 
- Use  to select TEST and press .

This unit requests a password to access this mode: 719200

The message display offers four options that may be selected with  

INPUT- Testing inputs <In>



- The 1st line shows 0's and 1's indicating the status of 8 inputs, 1 through 8 from right to left. See PAR21
- The 2nd line shows the status of inputs I9 through I15.

OUTPUT- Forcing outputs <out>

Digital outputs



- The 1st line shows 0's and 1's indicating 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 key

 to 


- The 2nd line shows the status of the other 3 outputs.

They can be neither activated nor reset.



- The  key activates all the outputs sequentially one after another.
- The  key resets all the outputs.

Analog input / outputs <Ana>

In this mode, it is possible to force a value to the analog outputs in order to move the axes and set reference values in parameters PAR44 through PAR48.

- Select the  or  axis

The enable signal of the relevant axis is activated.

- Every time  or  is pressed, the value is increased or decreased in 0.01 V within a range of $\pm 10V$.

- To force a particular analog voltage, press:  [decimal value] 

To reset the analog voltage, press  or 

If it is a B model and a potentiometric scale has been installed, PAR64.4=1, 65.4 = 1, it can read the analog input at pin 18:

- Select 

While moving the ram or the base, it is possible to compare the maximum/minimum values of the cursor.


<Auto>

It is enabled in automatic mode to fine tune the values of the two parameters involved in the adjustment of the axes:

<Vmin> to adjust the minimum voltage.

- Select the  or  axis

An auxiliary mode is available to operate with the axis in open loop and display the offsets of the drives on the 1st display.


Adjust it until the offset is stabilized at "0" and confirm it by pressing 


- This unit generates an increasing positive voltage (command) to move the axis. This process is interrupted when it accumulates more than 100 feedback pulses and it set PAR44 with the current voltage value.

This process is repeated with an increasing negative voltage for PAR45.

<Kv>  to set the gain with automatic back-and-forth movements.


- Select the  or  axis.


Indicate the coordinate of the positive limit, 

Indicate the coordinate for the negative limit, 

A back-and-forth movement is generated to analyze the dynamic response on reversal movements. If overshooting occurs, the corresponding Kv factor is decreased in 5 units at each reversal until achieving a 1st order system without overshooting in either direction and it sets PAR40 and PAR41 with the corresponding Kv values. It acknowledges the end of this process with two beeps.

Pressing  aborts the active movement and increases Kv in 10 units.

This test may be interrupted by pressing 



Selecting ">" and pressing  offers three options:

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.


PULSES- Testing the number of encoder pulses/turn

When selecting the  axis, the 1st line displays "PULSES 1" and when selecting the  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.








DATE

The 1st line shows the software version and the 2nd line its release date, day, month, year.

To exit to the initial menu, press 

5.1.1 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 keeping the   pressed to access PAR00 of the parameter table.
- Press  [22]  to go to PAR22.
- If parameter PAR22(7) appears set to "0", press   to force a "1". This cancels the external emergency even when the emergency input I23 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.

5.2 AXIS SETTING

To take full advantage of TEACH-IN editing resources and the material-type tables, follow the criteria described here for adjusting the Y axis:

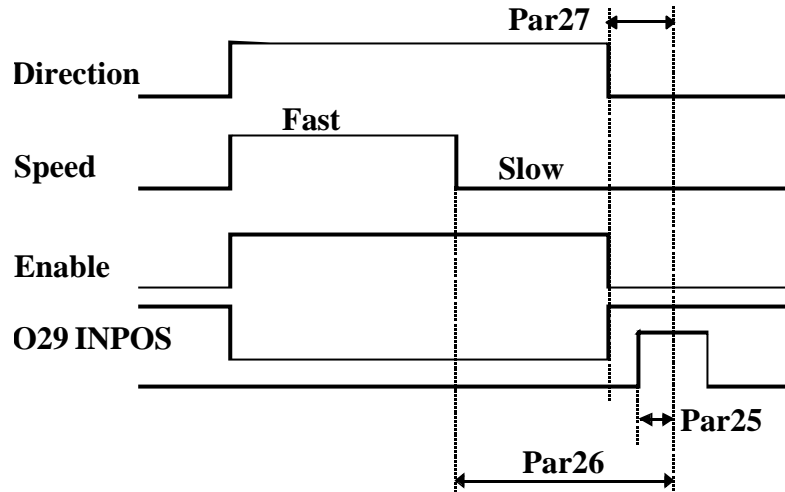
- Try to obtain the best feedback resolution $PAR01 < 0.001$ mm by installing a high resolution encoder (that provides a great number of pulses) at the beginning of the mechanical transmission system, preferably on the motor shaft .
- Force a unidirectional approach. PAR16, PAR17 and PAR18 on the X axis if there is backlash.
- On fast machines, install a d.c. servodrive in closed loop. Section 5.2.4
- On slow machines using INVERTERS in open loop, try reducing the slow speed in order to obtain 2 clearly different ranges (gears) (50/5 Hz) and maximum accuracy (± 0.01 mm).

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.

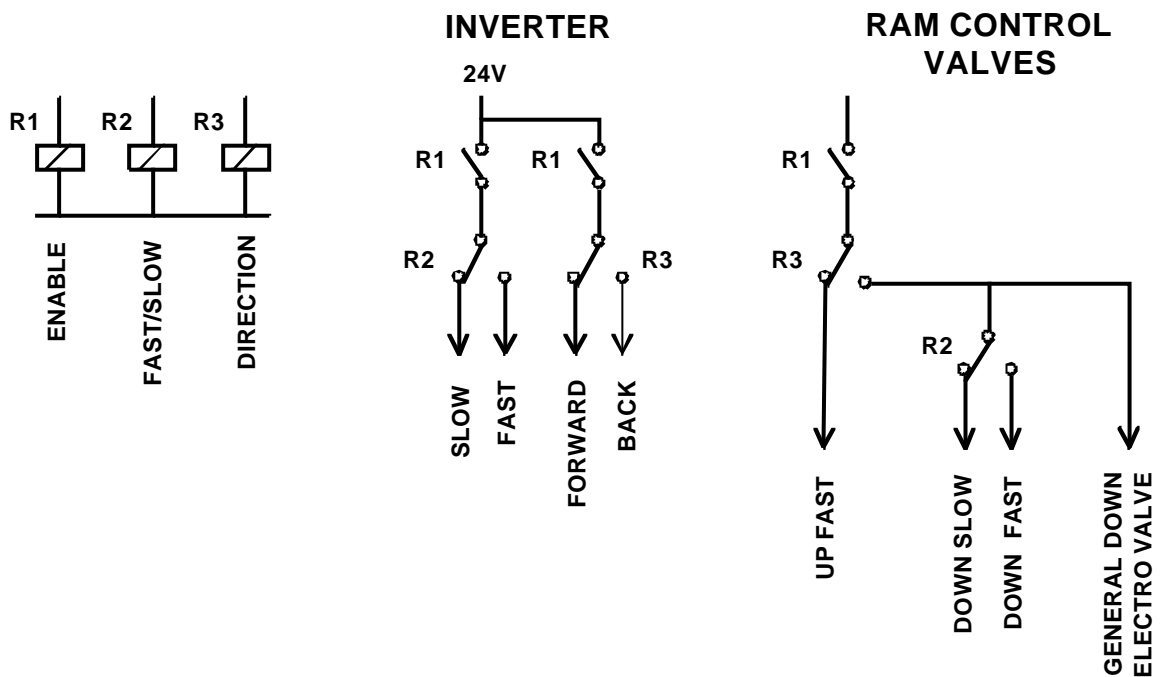
Each one refers to the affected parameters.

5.2.1 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.

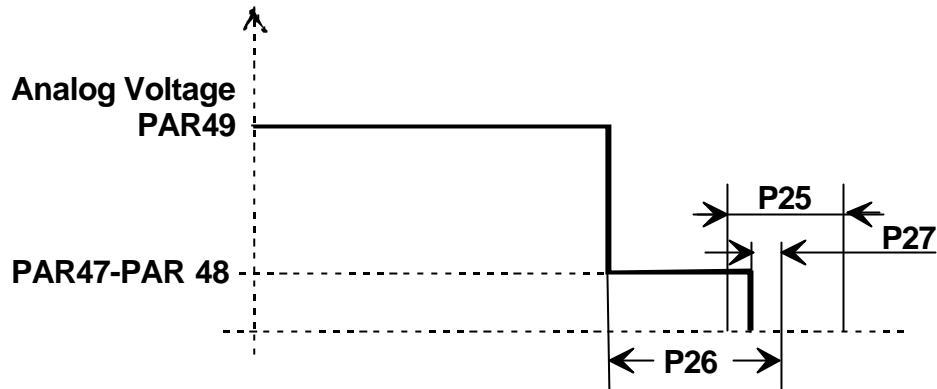


The control of electronic inverters or electro-valves, very common on press brakes, is obtained with simple relay circuits.



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

Method recommended in low range drive systems: unipolar drive [PAR46(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.

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

Method especially developed for the Y axis on "C" type machines with direct control of the ram or table position.

Adjust the offset of the drives to "0"

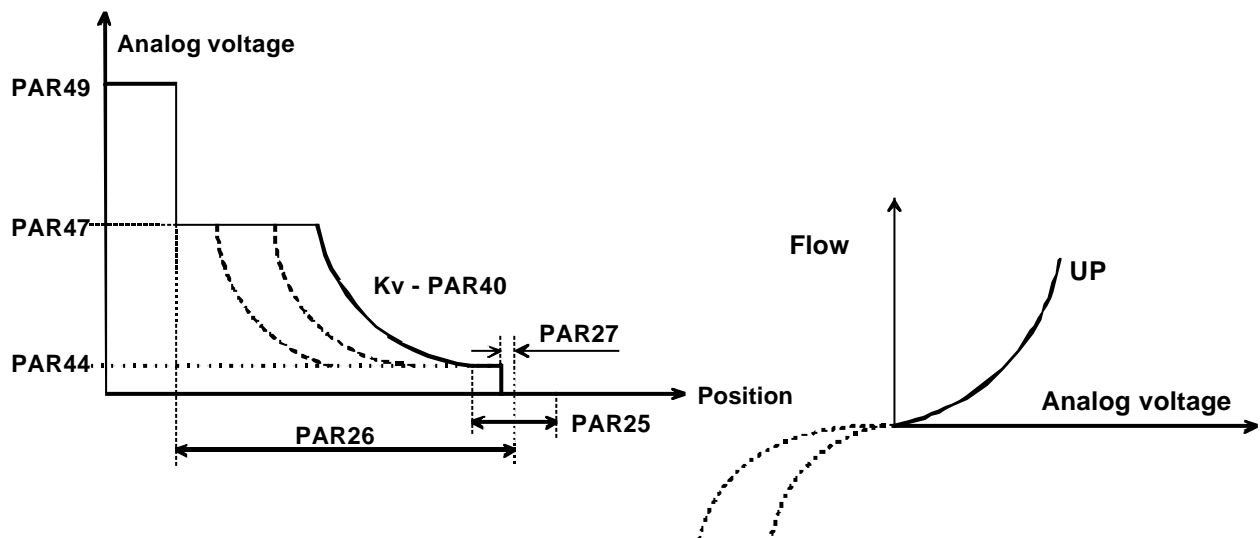


Figure 1 - DRAIN INACTIVE

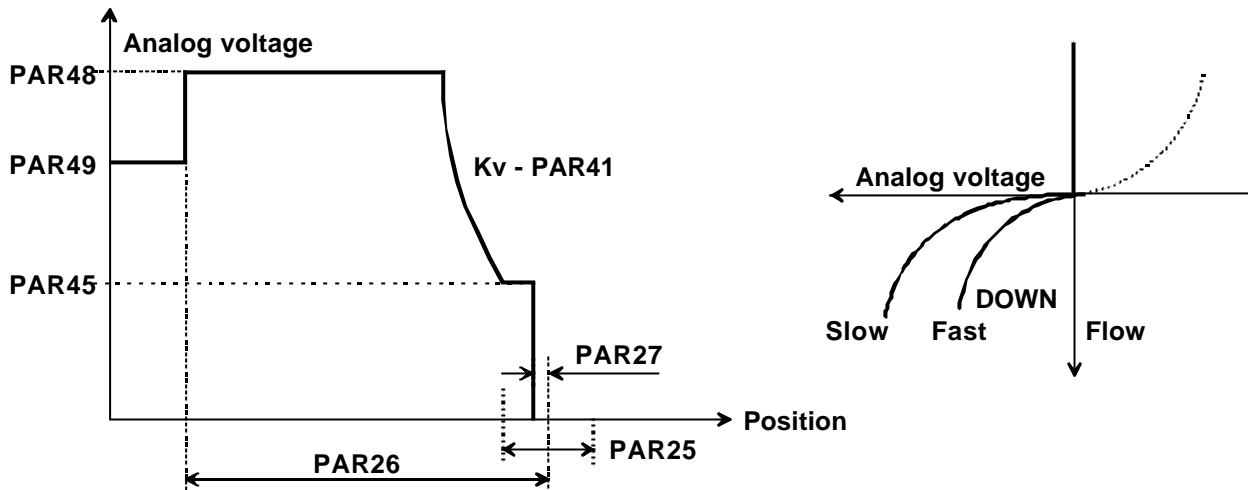


Figure 2 - DRAIN ACTIVE

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-PAR48) and its positions in closed loop. The braking response depends on the value set for Kv (PAR40, PAR41 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.

Parameters PAR40 through PAR49 with very high ranges make it possible to distinguish the up and down response and compensate for any lack of linearity of the hydraulic circuits that activated the drain valves in the slow range of the bending stage.

Figure 1 shows a braking with little dampening with small Kv value.

Figure 2 corresponds to an ideal adjustment of the bending stage that requires special attention in the following parameters:

- PAR45 Minimum analog voltage. Very critical value to achieve a very slow final approach.
- PAR41-PAR19 Adjustment of the dampening degree when switching from slow to minimum speed.
- 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 5.1) are very useful to simplify the adjustment of the axes.

5.2.4 CLOSED LOOP WITH DC/AC SERVODRIVE-MOTOR

Recommendations, most significant parameters:

1- Adjust the drive offset to "0".

2- PAR44 = PAR45 = 0

Servo drives do not require a threshold voltage.

3- PAR47 = PAR48 = 0.05 / 0.1

Decrease the slow speed as much as possible.

4- PAR25 = 0.01.

Position tolerance decreased as much as possible.

5- PAR26 = 2/10 mm

Enough range to access the position window at slow speed.

6- PAR27 = 0.01

7- PAR19 = PAR20 = 7/8, PAR40 = PAR41 = 100/200





Maximum proportional gain while maintaining stability.

5.3 CALCULATION OF STRUCTURE DEFORMATION AT FULL PRESSURE

This trial is reserved to qualified installers and machine manufacturers that can establish the characteristics (length, thickness and resistance) of the sheet-metal that makes it necessary to work at full pressure.



It does not correspond to any of the default materials offered by this NC, create a new table following the procedure described in section 2.3.2 of the operating manual and measure the elasticity factor for 90°, which is the one proposed for this trial, using a narrow format, a scrap is enough, in order not to deform the machine structure (the elasticity tables are obtained by trying with probes that are 50 to 100 mm wide).



In initial mode,



- Select  <mat> 
- <→> 
- <Defor> 

It accesses a mode identical to EDITING.


The initial page defines the tooling that must withstand the maximum pressure of the machine and the proper material to achieve it.


 [Punch number]  [Die number] 


 [Sheet-metal thickness] 


 [Nr of the associated table (0 to 19)] 



Once all the data has been entered, this NC is ready to try the DEFORMATION using the following procedure:

 To access the 2nd page of the editor.


 Select a very typical angle, 90 °.

 To accept the proposed angle. The display shows the “Y” bending depth.

 It displays the text: START

 To reach the “Y” coordinate. Using the foot switches to complete the bend and return the ram to the top position. The  displays shows “000” flashing.

Indicate the real angle which must be greater than the one proposed.

 To calculate the deformation **DY** that corresponds to the difference between the proposed angle and the one obtained.

The resulting value is automatically assigned to machine parameter PAR43 "1st display".

The nominal tonnage is indicated in PAR42 = T nominal/10 with a 0-to-99 range.

On machines with an analog pressure gage, this reference sets the "pressure analog voltage" in Tons/Volt. Analog off-the-shelf Pressure/Volt transducers have a set range and its 10V at full scale rarely coincides with the nominal pressure of the machine.

The GEFRA model, TKN-N-M-xxx-M, offers an internal adjustment of the scale to optimize the linearity between 0V and 10V.

If the full scale is limited to a value $V_{ref} < 10V$, the value of PAR43 must be adapted to a supposed full scale of 10V.


$PAR43 = \text{Actual (real) deformation} * 10/V_{ref}$.

APPENDIX

ERROR CODES


Message	Description
FAGOR dro	Power outage or turned off by main switch after saving the data.
Error 02	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.).
Error 04	Wrong parameter values
Error 05	Wrong internal configuration
Error 06	Errors in data backup memory (Service Dept.)
Error 07	Emergency input active. Press [C] or cancel emergency signal.
Error 08	Wrong software memory or the software has been changed
Error 09	Errors in work memory (Service Dept.)
Error 12	Error while searching a coded marker pulse (lo)
Error 20	Travel limit switch pressed on that axis.
Error 31	Internal malfunction (Service Dept.)
Error 32	Internal malfunction (Service Dept.)
Error 90	Internal malfunction (Service Dept.)
Error 99	Internal malfunction (Service Dept.)
.....	Feedback alarm from the feedback device (scale, encoder, etc) or weak signal.
l.4.3.6.5.7.2.5	Feedback speed too high.
EEEEEEEE	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.

FAGOR NC-200 PB NC FOR PRESS BRAKES

OPERATING MANUAL

Manual version 0303

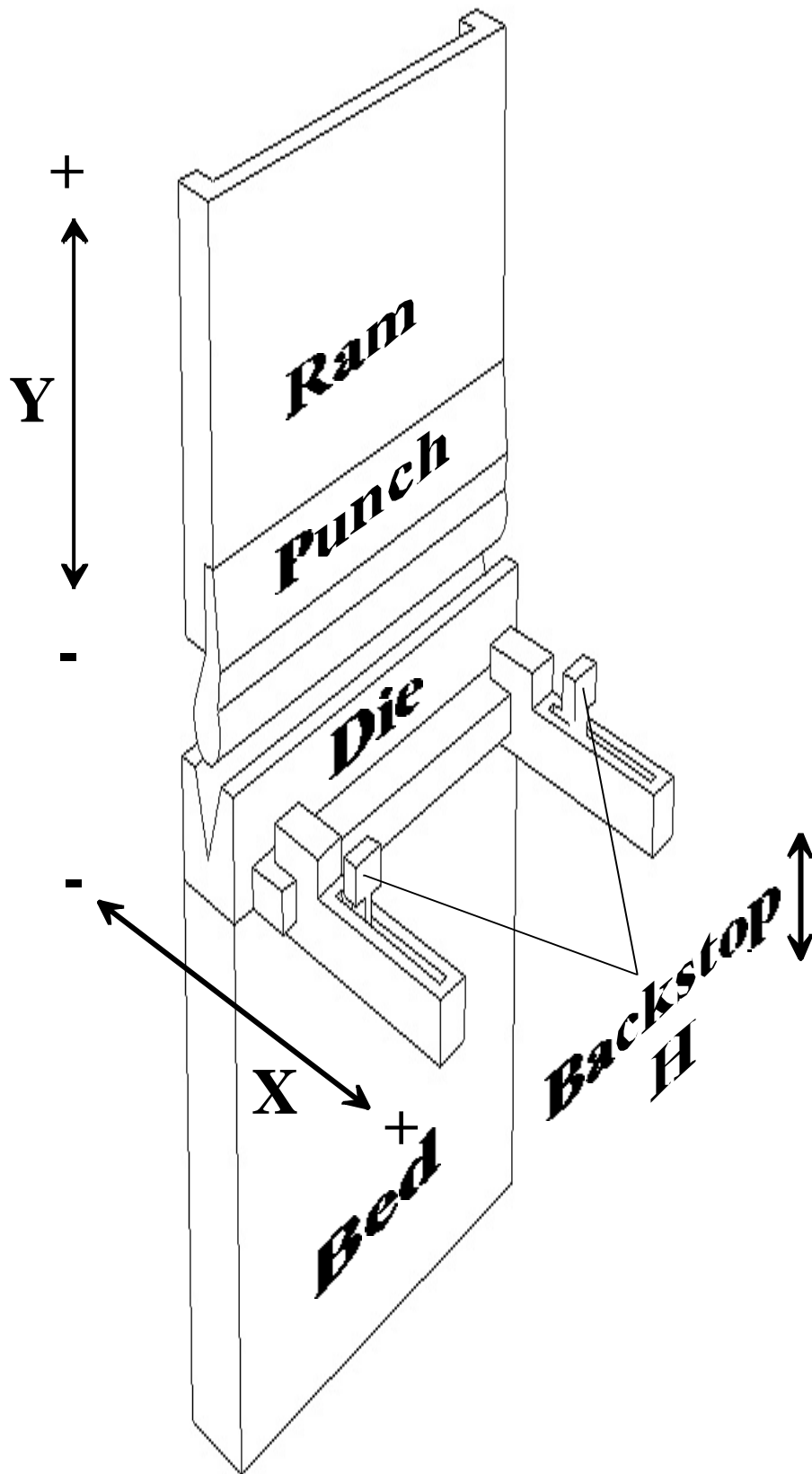


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DIAGRAM OF A TYPICAL PRESS BRAKE



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 MACHINE MODELS

This manual mentions different machine models (A, A1, B, C) that are built quite differently; but they don't differ as much when using the resources of this numerical control whether they are up-stroke or down-stroke models.

The machine manufacturer may do without the switches mentioned in chapters 3 and 5 and propose another design for the pendant.

A. Controlling only the final position of the bend for simple machines that do not require distinguishing 4 execution modes.

The foot switches, the execution modes and the hydraulic circuit are not handled by this unit.

The intermediate positions of the ram cannot be preset.

They are detected with electrical micro-switches.

A1. Same as model A with foot switch control and outputs to control the hydraulic valves handling the 4 EXECUTION modes.

Especially indicated for conventional down-stroke machines.

B. Same as model A1 with a linear feedback, potentiometer or digital to read the actual position of the ram or the table. This allows detecting the intermediate positions that may be selected at the NC:

- Top dead point. FAST/SLOW change position.
- FAST/SLOW change position.
- Sheet metal holding position. End of the bend.

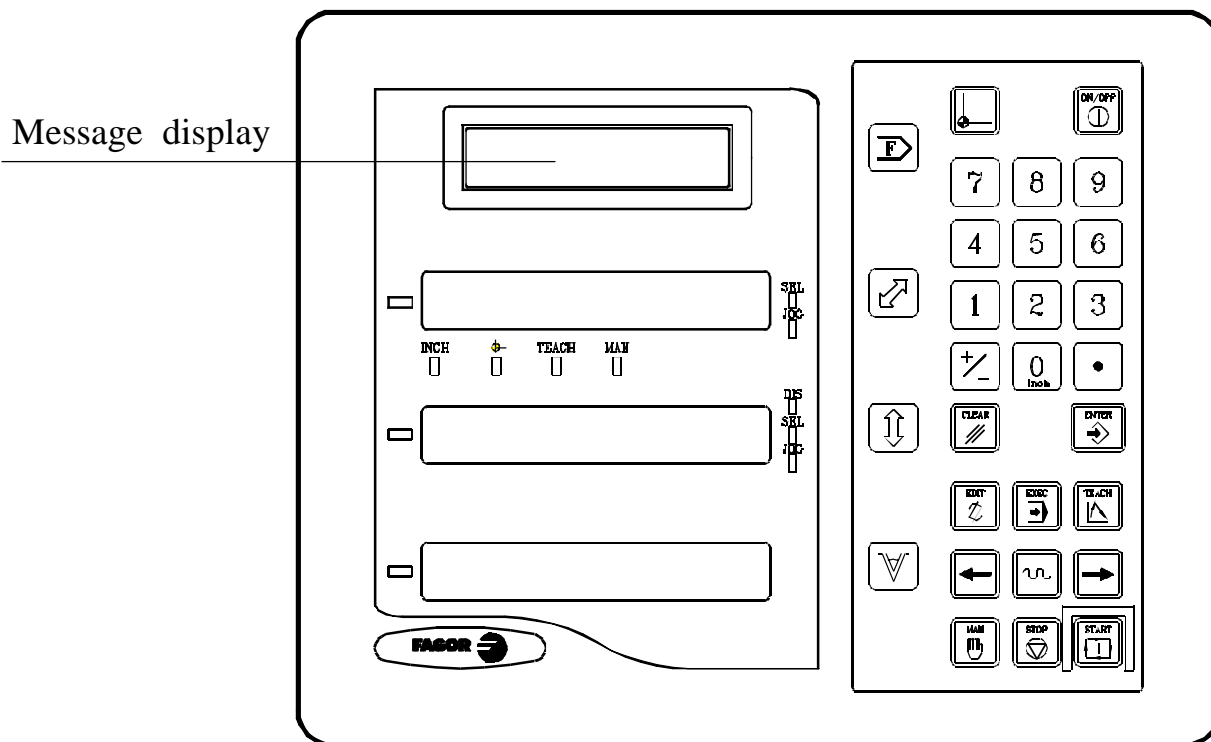
Very useful for up-stroke models.

C. Control of the actual movement of the ram / bed and presetting of intermediate positions.

1. UNIT DESCRIPTION

This NC is especially designed to be used on press brakes. It allows displaying the position of the vertical and horizontal axes as well as executing part programs and also moving the axes manually from this NC's keyboard or by external means.


1.1 FRONT PANEL



The message display offers assistance to facilitate the operating modes of this NC.


When using an LCD screen, its contrast may be adjusted by pressing **3** to decrease it or **9** to increase it.


Each axis display has eight 14.1 mm high LEDs and another one for the minus sign (-).

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



Machine reference search mode which is accessed by selecting the SET mode.

TEACH - TEACH-In mode which is accessed by pressing  when the editing mode is selected (on the screen for coordinate selection).

MAN - Manual mode which is accessed by pressing 

There are two ways to access it:

Models A and B . Using the  key

Model C - By selecting the SET mode.

SEL - Axis selected.

JOG - Not used.

DIS - Y axis disabled (selector switch in position 5).



Select the X and Y axis respectively.



Program the bending angle or the width of the die's "V".



Machine reference zero (home) search.



Turn the display off while keeping track of the axes position at all times. This key must be pressed before turning the unit's power off by the main switch on the back of the unit.



Validate an operation.



Cancel or abort an operation already initiated.



Access the program or tool editing mode.



Access the manual mode.



Access the program execution mode.



Program blocks after moving the axes to the desired position while in editing mode (Teach-in mode).



Move the axes in MANUAL mode in both directions and to move back and forth from one menu option to another.



Move the axes manually at fast feedrate.



Execute and interrupt, respectively, the execution of a program.



Enter data.



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.




Access the special operation modes, parameter setting, communications via RS-232-C, etc.

2. COORDINATE DISPLAY. AUXILIARY MODES


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 LCD screen shows the text:




Fagor NC-200 PB, the 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 of the same.

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).






Notes:


- 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 by previously pressing .

2.1 DISPLAY MODES

Language selection


On this NC, it is possible to select the language used for displaying the help on the LCD screen. To do this:

- Access parameter PAR50 (language) directly by pressing   
- Press  repeatedly until the desired language appears (English, Spanish, French, German, Italian, Portuguese, custom*) and press .


Press  to quit the language selection mode.

"Custom" may be any user defined language. (See section 3.1 PAR52 of the installation manual).

Conversion mm into inches

This NC can displayed the position of the axes in millimeters or inches by pressing  key depending on whether the **INCH** led is off or on respectively.

Turning off the last digit of the X and Y displays

This NC allows a decimal digit to be switched off (coarse resolution) when the resolution is excessive, simply by pressing . For example 0.01 instead of 0.012.



2.2 SELECTION OF TOOLS AND TYPES OF MATERIAL TO BEND


In the initial mode, it is possible to set a particular punch-die set and also the bending pressure as well as the characteristics of a particular material.



This data will only be assumed when machining in MANUAL mode. Section 3.1.



· Press 

· Use  to select <Tool> and press  to access to the selection page:

 [punch number] [·] [die number] and press 

 Requested tonnage. Only for a machine with a hydraulic system actuated with an analog voltage for pressure.

 [Sheet thickness] 

 [Number of associated table (0 to 19)] 

Press  to exit.

This unit assumes the offsets indicated in the tool table. See section 3.3.

· The screen shows the number of the selected tooling.

Punch, die 1.1

· The position shown on the Y axis display corresponds to the relative distance between the edge of the punch and the top side of the die.

The final bend position is always negative.

2.3 TYPE OF MATERIAL

The type of material depends on a number of factors that make it impossible to foresee its behavior in order to calculate the depth "Y" of the punch according to the programmed angle **a**.

This problem is solved using the TEACH-IN editing mode that forces the operator to make several bends by trial and error until obtaining an acceptable result and memorize the "Y" depth associated with the requested angle **a**.

This is a very time-consuming task because it has to be repeated for all the programmed angles. A program stored in memory must be executed with the same tools used in the TEACH-IN process. The width of the die forces its geometry.

Using the elasticity factor associated with each material exceeds the capabilities of a conventional TEACH-IN editor that only requests the depth of the bend:

- It is a programmable parameter that is assumed together with the thickness of the sheet metal in the N0 block of each program.
- It associates certain constants, in a table format, for 8 fixed values multiple of 10 between 50° and 120°.
- It calculates (prorates) the factor corresponding to intermediate angles.
- It is also possible to store in the table 5 special values associated non-multiple of 10 or out of the 50°-to-120° range, if they will be repetitive in future bends with the same material.
- The TEACH-IN editor (section 4.1.2) offers the option to load a new factor for special angles or modify the value stored in the table that matches a typical angle to be corrected.
- This unit has resources to generate the tables for unknown material types and to set corrections based on the original ones to adapt them to materials supposedly very similar to the standard ones offered here and described in later chapters.
- For white sweet sheet metal F114 (resistance < 45 Kg) and maintaining the approximate criteria $A = 8e$, the factor is barely affected by the width of the die. The same program may be executed with different tools with results very similar results as for the mentioned materials and similar punch radii. It will only require a slight correction.

If the A aperture of the die is larger than the one used in the tries, the resulting angle will be slightly greater.

By default, this NC has some initial tables installed which are identified as rigid material that bend without bending radius and that the user must set for each material. Section 2.3.1.

There is a specific way, section 2.3.6 to restore these initial tables.

Certain particular material factors may be used as a reference. They have been tried with the indicated tooling and material, where:

- A = Die opening
- r = Die edge radius
- e = Material thickness
- Punch radius: 1 mm
- Wila type U die.

We suggest $A = 8 \times e$. The die edge radius does not affect significantly the elasticity factor.

Material	Ref.	A	r	e
Sweet iron, shite sheet	1	12	1	1
	2	16	1,5	1,5
	3	20	2	2,5
	4	24	2,5	3
Stainless steel	5	12	1	0,5
	6	16	1,5	1,5
	7	16	1,5	2
Aluminum	8	12	1	1
	9	16	1,5	1,5
	10	20	2	2

Ref	50°	60°	70°	80°	90°	100°	110°	120°
1	812	851	911	946	974	1077	1377	2191
2	870	880	890	830	770	770	750	700
3	845	800	752	750	749	705	627	600
4	1018	1018	995	963	975	987	997	1065
5	748	830	830	895	870	1124	1669	20856
6	864	948	1030	1118	1297	1673	2194	1900
7	1083	1255	1439	1438	1580	3821	-1920	-670
8	2404	2553	2838	3502	4981	32767	-2425	-1230
9	5165	4584	5072	7321	16055	11860	-5519	-2018
10	3498	2920	3081	3107	1782	1756	1539	1448

Dies with a sharp edge in a V shape: $r = 0$, $\alpha = 86^\circ$

Material	A	e	90°	100°	110	120
Inlay sheetmetal	10	0,8	917	800	600	917
Flexible galvanized	12	1	2275	2825	4224	-3971
White sheetmetal	12	1,5	1113	1112	1191	1961
Black sheetmetal	16	2	820	762	825	849
Sweet sheetmetal	25	2,5	789	791	790	945
Chromed	25	3	893	776	680	1350

On machines with an electronic pressure gage, pressure limiting valve or conventional machines, if they compensate the structure deformation, it is necessary to indicate the sheet metal's resistance to traction associated with the active elasticity table. See section 2.3.4.

Sweet sheetmetal's behavior.


- The elasticity factor is limited to the 600-to-2000 range.
For $\alpha = 90^\circ$, the inside bending radius $R = A/6$ approx.
- The elasticity factor correction (section 2.3.3) inversely affects the bending angle. A 15% increase of the index $\alpha = 90^\circ$ decreases approximately 1° .
- Section 4.1.2c describes the TEACH-IN editing method to modify the elasticity factor.
- With a die $A = 20$, a depth increment of 0.1 mm means a correction of 1° .


2.3.1 GENERATE THE WHOLE ELASTICITY FACTOR TABLE FOR A NEW UNKNOWN MATERIAL

Tables 0 through 19 are open to the machine operator. They may be changed with the NC's own resources or uploaded from a PC. They represent each operator's experience.

M0 should be reserved for inflexible materials that do not require bending radius compensation. See example in Section 2.3.2



In order not to deform the structure of the machine, the trials must be carried out with a narrow sheet (between 50 and 100 mm wide).



In initial mode, press 

On the "Materials" menu, select <New> and press 

The EXECUTION mode is accessed in the same way adding a canned cycle that offers a sequence to check the elastic behavior of the new material.


The first page defines the tools:


 [Punch number] [.] [Die number] 


 [Sheet thickness] 


 [number of associated table]  .


Knowing the tool dimensions and the sheetmetal thickness, this NC assumes an M00 factor (rigid material) and has the necessary geometrical data to suggest consecutive trial bends for 8 angles between $\alpha = 120^\circ$ and the minimum α supported by the die selected for the trial, 50° for very closed dies.

Press  to test the 1st angle of 120° :

The  axis displays the sequential trial number, from 1 to 8.

The  axis displays the approximate bending depth to know the trial stage.

- Press  , the Y axis positions at the theoretical depth corresponding to 120° to execute the first bend.

Once executed and when the ram or the base reaches the withdrawal position, go to the new page that requests an angle. Enter the real angle obtained and press  .

- Repeat this sequence until completing the whole table.

After accepting the last angle supported by the chosen die, it calculates the whole table of elasticity factors associated with the angles multiple of 10, thus concluding the trial.

For dies that are very closed or in a "U" shape, it will suggest a minimum angle of 50° and 8 trials will be completed.

Conventional dies in a "V" shape, with $\alpha \geq 85^\circ$, require at least 4 trials 120°, 110°, 100° and 90°


- With a sweet sheet metal, the last trial bends an angle $\alpha < 90$ and it is considered to be finished.
- If with a sour sheet metal, that angle is not achieved, it means that it must be bent almost all the way to the bottom of the die with the chosen tool in order to the punch to force its geometry (shape) thus achieving the 90°. This is typical with fine and very flexible sheets.

Using the "Mat, 1" method described in section 2.3.2, repeat only the trial for the 90° to complete the 4 factors needed.

These factors are stored in the selected table.

Once the proposed Y axis position has been reached, before bending, there are several ways to simplify the trial-and-error stages:

- **Reduce the number tries to avoid angles smaller than 90°.**

Pressing  offers 2 options:

Change factor, < yes >, to ignore the try and go on to the next one.

Repeat the method to ignore the next tries.

< no >, to quit; all the factors of the values already tested will be lost.



- **Indicate the resulting angle, assumed to be known, without actually bending.**

Press  , indicate the angle, 

It suggests the number of the next try.


- **Modify the suggested depth.**

For V-type dies with an angle $\alpha > 88$, the 4th try may force a bend to the bottom of the die that may be incompatible with the material and the selected tools. The resulting angle may be too small if the punch is very acute or a vale forced by the shape of the punch that forces its angle, invalidating the geometric calculation of this NC that always assumes air bending.

Use   to access the depth correction mode. Every push means an increment/decrement of the preset corrector with a range of ± 30 that is shown on the screen next to a LED-bar indicator.

Each correction unit modifies the depth about $A/1000$ mm where A= aperture of the die in mm.

A die whose $A = 20$ mm admits a maximum correction of 0.6 mm. ($30 * 0.020$).

Once the correction has been assigned, pressing  forces a repositioning movement with a previous move to $Y=0$ and a later return to the new position.

The best try will be obtained when reaching an angle slightly smaller than 90° . (85 to 89).

The corrector is reset at the end of the trial. The correction should be applied only on the last angle that forces a bend with an interference at the bottom of the die.

Once their bending limit has been exceeded, the characteristics of the material change. The limit angle depends on the thickness, type of material and punch radius on inflexible materials.

The material type number must be indicated for the 8 suggested angles with sheet metal that should not have been previously bent at greater angles.


This NC offers resources to display the data saved in the tables (section 2.3.3). It is recommended to write down the values of the "a" angle, elasticity factor related to each type of material and the die number used in the trials.



Chapter 7 describes how to save and recall tables through the RS-232 serial line.


2.3.2 GENERATE THE ELASTICITY FACTOR OF A SINGLE ANGLE BY TRIAL AND ERROR OF THE BENDING DEPTH

This method is recommended to determine very accurately a single bending angle by testing an unknown material or an angle way out of the 50°-120° range even if it belongs to a table already tested or the particular 90° angle described in the previous section.

In this trial, the deformation of the machine is not compensated for. It will be carried out with a narrow sheet metal at minimum pressure.



In initial mode, press 



Use  to select <mat> (materials) and press 



On the "Materials" menu, select <1> and press 

The TEACH-IN EDITING (b) mode is accessed in the same way. (Section 4.1.2).


The first page defines the tools and type of material.



 [punch number] [-] [die number] 

 [sheetmetal thickness] 


 [number of associated table (0 to 19)] 


Once all four data have been entered, the NC is ready to start the trial.

Press  (at the "C" model, select "SET" first).

- Press  and key in the **a** value to be tested and press  to make the trial bend. An approximative result will be obtained.
- Using the resources of the continuous or incremental MANUAL mode, COORDINATE+START, fine tune the Y coordinate and repeat the trial.
- Select position 5 of the MANUAL selector switch to disable the Y axis and the "DIS" led will turn on.

Some manufacturers offer resources to move the axis with means external to the NC (typical method on up-stroke machines with a handwheel for manually correcting the leadscrew position).

Once the right angle has been achieved, usually by trial and error, press 

Select <Yes> and press 

Change factor?
Yes<No>

Measure and indicate the obtained angle.

and press 

Change factor?
Angle

The relevant elasticity factor is stored. This procedure may be repeated for several angles until its full capacity is filled: 8 multiples of 10 (from 50° to 120°) + 5 intermediate. When exceeded, it displays the message: "Memory full".

Practical examples:

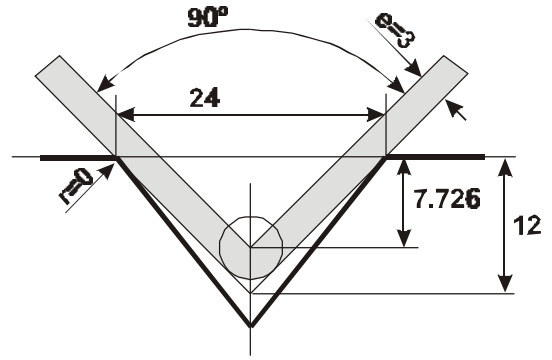
With a factor of M0, the material is supposed to be inflexible without inside bending radius.

a) - With M0, $r = 0$, $e = 0$, $\alpha = 90$,
 $A = 24$

Bending depth $Y = -12$



b) - With M0, $r = 0$, $e = 3$, $\alpha = 90$,
 $A = 24$

Bending depth $Y = -7.726$



2.3.3 ACCESS TO ELASTICITY TABLES


This resource may be used to identify each tried material being possible to read and write the factors from this NC.



Access:  , select <Mat>, <Edit>, 



· The  display indicates the selected table.


By default, "0" is offered. Press:

[Table number (0-19)] ,  to select the table number.

· The  display indicates the reference angles x10 from 50° to 120°, followed by the 5 random angles that may be defined in teach-in mode.


Use   to go back and forth in the angle range.

Using  , [angle] ,  selects a particular value multiple of 10.

· The  display indicates the value of the associated index.





A "0" means that the trial was aborted in an intermediate stage without completing all 8 angles.

Any value within the " ± 500 to ± 32750 " range may be written.

· It is not possible to delete a particular factor associated with the 5 random angles without using the option:  <Mat> <delete> that will affect all the angles of the erased table.

2.3.4 MATERIAL RESISTANCE TABLE

On the initial menu:

- Select:  <mat> 
- < → > 
- <Resis> 

It access the material resistance table where a value in Kg/mm² is associated with the elasticity factor M1 to M19 selected on the program header that will affect the calculation of the bending pressure and the deformation of the machine structure.

- Factor Number (1 to 19) 

It will be shown by the 1st display.

- Associate its resistance in Kg/mm², 

It will be shown by the 2nd display.

Recommended values:

$$Al = 20 \text{ Kg/mm}^2$$

$$\text{Sweet Fe} = 42 - 48 \text{ Kg/mm}^2$$

$$\text{Stainless steel} = 60 - 80 \text{ Kg/mm}^2$$

By default, all the tables are set to 45 Kg/mm²

2.3.5 SAVING AND RECALLING THE MATERIAL-TYPE TABLES THROUGH THE SERIAL LINE RS-232


The material type number is an empirical value (obtained through a custom algorithm) that cannot be interpreted.



Each press brake operator may create his/her own tables and save them using a PC with a communications software like HYPERTERMINAL (available in Windows version) or "Procom" in MS-DOS version.


This method is only recommended when wanting to save the tables of more than 20 materials in computer devices.

The procedure and format are described in chapter 7.

2.3.6 RESTORING INITIAL TABLES

In initial mode, press 


Select <Mat> (Materials) with  and press 

Select <Delete> and press 


- To restore the material type (elasticity factor) for a single material:


Indicate the table number, 1 to 19, displayed on the 3rd display and press 



- To recover all the initial tables:

Indicate Nr. 99 and press 

A dot comes on at the 1st and 2nd display.

Press  again. Two dots are lit.

Press  . 2 dots are lit and it offers two choices (are you sure?).


Use  to select <Yes> and press 

While the tables are being loaded, the message screen shows the message: "Deleting materials...".

Tables 0 through 19 restore the initial values of the master tables of the 8 angles multiple of x10 and cancel the factors of the random 5 angles that could be saved in TEACH-IN mode.

3 OPERATING MODES

3.1 MANUAL /SET MODE

There are two ways to access: Models A & B: With 
Model C: Selecting the "SET" mode.


The MAN led turns on.

This mode also sets the slow Y axis speed below the speed change position (PAR33) at the "B" and "C" models.







The soft limits set by PAR12 and PAR13 cannot be overrun. If the travel limit switches are activated, this unit issues an error message; but it allows moving the axes in the opposite direction to return to the work area.

If PAR16 has been set with leadscrew backlash value, position reading will be ignored when reversing the turning direction. Once the backlash has been made up for, this unit resumes position reading. This is particularly noticeable when using continuous jogging or the Y axis has been enabled and it is moved by external means.

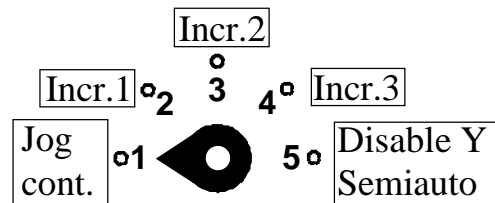
If PAR17 has been set to "1" or "2", when moving the axes in continuous or incremental jog mode, in back and forth movements, this unit assumes the unidirectional approach.

To quit the MANUAL mode, press  or change the switch to a position other than SET at the "C" model.


3.1.1 MANUAL MOVEMENT FROM THE NC KEYBOARD



- Select the axis to be moved with its relevant key  or .
- Press  or  and the axis will start moving in either direction at slow feedrate. To move it fast, press  at the same time and keep it pressed.
- To stop the movement, 1st release the  key and 2nd release SLOW. Otherwise, it keeps moving until reaching the value set by PAR26, braking distance.

Depending on the position of the MANUAL switch, the movement will be continuous or incremental. Positions 1 through 4 (clockwise) in the drawing below.



3.1.2 MOVEMENT WITH THE FOOT SWITCHES. "C" MODEL

In SET mode, actuating upon any foot switch forces the  (Y) axis preset.



In MANUAL mode, using the up and down foot switches is the same as using the   keys that only affect the Y axis.

The foot switches are also operative in INCREMENTAL JOG mode.



3.1.3 MANUAL MOVEMENT TO A PARTICULAR "X" POSITION, "Y" DEPTH OR "a" ANGLE

- Select the MANUAL mode with  or with "SET" at the "C" model.


- Select the axis:


 or  to define the position.

For negative values, press  **after** the coordinate.

  To define the bending angle compensating the active tools and type of material respecting the minimum angle set by the die.

The selected display keeps blinking.

- Request a value and press . The axis will move until it reaches the indicated position.

To interrupt this movement before reaching its target, press .

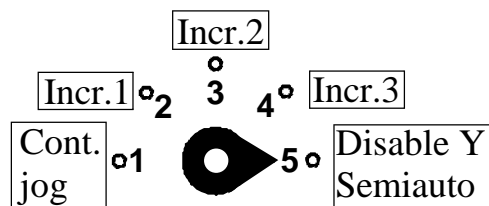
To resume the movement, repeat this process selecting the a new position value.

In MANUAL mode, it always assumes the "SET" type work mode. Two foot switches control the up and down movement of the ram in sensitive mode while they are pressed (A1, B and C models).

Press  to exit.

3.1.4 MANUAL MOVEMENT BY EXTERNAL MEANS

- When disabling the "Y" axis by setting the jog switch in the corresponding position (position 5 in the drawing below), the "DIS" led will turn on and the "Y" axis will be free to be moved by external means. The NC will display the axis position and will watch for its hardware travel limits.



3.2 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.


Move the sliding cam that activates the travel limit switch of the ram so it reaches the top dead point.


3.2.1 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", 1st X, 2nd Y.

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


Press  to force the automatic search.



- b. If the axis does not use home switches, usually on Y, it requests the password (719200) when pressing . It will indicate a value that corresponds with the value of PAR10.



With the pressure regulator adjusted to the minimum actuate on the "BEND" foot switch until the ram reaches its final position.

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 Y coordinate ($Y = Y_{ref} - H_{punch} - H_{die}$) compensating the height of the active tools.

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 access (or quit) code: **719200**.

3.2.2 SEQUENCE FOR AXES WITHOUT MANDATORY HOME SEARCH

In initial mode, press . The  led turns on. Depending on the characteristics of the machine, there are two choices:

- a. If both axes have home switches. This unit displays the word "START" when accessing  freely or accessing  only when the ram is at the top position.

Press .


- b. If any axis does not have a home switch, usually the Y, this unit requests the password **719200** when pressing  and assumes that the values set by the OEM are to be modified. This is only recommended in case of a breakdown or when updating this unit's software version.

For the affected axis, proceed as described in section 3.2.1b


3.2.3 SEQUENCE FOR THE Y AXIS. MODEL B

Proceed as indicated in 3.2.1a. and add the synchronization sequence:


- a.- with a linear encoder.

At the reference position, bend to the bottom until the ram is stopped and press  to balance the reading of the axes Y-Y'.

- b.- With a linear potentiometer.

- 1- Press  and it displays the potentiometer value in volts in MANUAL mode.

- 2- Press 

- 3- Move the "Y" axis with  to the far end position, towards Y-.

Activate the BEND foot switch again up to the final position.

Press  again.


Press  to exit.

3.3 TOOL TABLE LOADING


With this NC, it is possible to load the data of up to 10 sets of punches and dies.






This data refers to the height of the punch (from 0.000 mm and 9999.999 mm), to the height of the die, width of the die, "V" (from 0.000 mm to 9999.999 mm), die angle that limits the bending depth and its edge radius (from 0 to 99.9).


To do this:










- Access the editing mode by pressing 

The screen shows three options:

Select "Punch" and press 

- Choose the tool number using   or keying the number.
- Indicate the punch height:  [value] 
- Press  to exit.


Select "Die" and press 

- Choose the tool number.
- Indicate the die aperture (original value before rounding the corners) with:  [value] 
- Indicate the die height with:  [value] 
- Indicate the die angle with:  [value] 
- Indicate the die edge radius with:  [value] 
- Press  to exit
- Before quitting this mode, it is recommended to check that none of the 9 table positions contains data exceeding the range with a code EEEEEEEE. By default, the whole table contains some initial values:
Hpunch = 0, Hdie = 0, A = 16, r = 1.6 that may be recalled.

3.3.1 RECALL INITIAL TOOL VALUES

While in punch or die editing mode, press the sequence:



The unit will request confirmation of this command. Select <Yes> and press  to restore the initial values.




4 PROGRAMMING


This NC can store up to 200 program blocks.


The program memory may be locked setting installation parameter **PAR51(1)=1**. This way, the program blocks cannot be edited or deleted.

In the initial teach-in stage, it is recommended to work with the simple resources only as a positioning dro without attributes and with a material factor M0 which only compensate for the rounding radius R_{ex} = sheet metal thickness.

Once familiarized with them, it is possible to expand the resources of the material-type tables, program ANGLES with the same capabilities as specific CNC's for press brakes. To access this simple mode (without attributes):

· Press   

· Press  to activate the bit and confirm with 

· Exit by pressing 

Programs edited in conversational mode keep the attributes even when not displayed in EDITOR mode if PAR51.8 has been activated




4.1 PROGRAM EDITING

In a program, it is possible to "Edit" new blocks, "Modify" the data already programmed in the blocks or "Delete" all their contents leaving them free (empty).



4.1.1 EDITING / DELETING AN EXISTING PROGRAM

- Press  to access the block editing mode.

```
Edit
Prg Punch Die
```



- Select "Prg" using the   keys and press 

```
Program Editing
Program .....: 0000
```



- Use the   keys to select the desired program to be modified (they are not stored sequentially).

```
Program Editing
Program .....: 0007
```

- Press 

- Use the   keys to select the option (Edit or Delete).


Program Editing Edit Delete
--






- Select "Delete"  to delete a program from memory.
- Select "Edit"  to modify.

It access the program block N0.


Only some values of the parameters affecting the geometry of the bend may be modified:


- **Die number (with different width).**
- **Elasticity factor (type of material).**
- **Sheet metal thickness.**

When pressing , if the corrector has been stored, it recalculates all the following blocks that have been programmed by indicating the ANGLE in order to adapt them the new parameters of the N0 block and it will confirm that each one of them with two beeps.


- Use the   keys to move to the previous and next blocks respectively. Edit the data of the block using the procedures of the Editing mode described in section 4.1.2 and press   .


Program Nr.	Block Nr.
↓	↓
Editing P0007 N00 Select Tool	



When modifying on the "Attributes" or "Select axis" screen, it may require pressing  two or three times to accept the new value and assume it. The sequence ends with a blinking of the "#" symbol at the upper right hand of the screen and it is confirmed with two beeps.

- To learn how to insert a new block, see section 4.2
- To quit the Editing mode, press .

4.1.2 EDITING A NEW PROGRAM

To edit a new program, pressing  gives access to editing the header of the program (Block N00). The specific data for each bend take two screens pages.


Use the  key to go from one page or one block to the next while validating the data just entered.


Use the   keys to select the page to be displayed; but only on the block being edited (it is not possible to go back to the previous block).

After validating a block, it is not possible to go back to it in order to change a value in it. To do this, finish editing the whole program and then proceed as described in section 4.1.1.

Before accepting a data on the "Y" axis, in all the editing modes, it analyzes the requested bending depth and it cannot be written if it exceeds the width of the die.

The "angle" indicated when loading the tool data serves as a reference to force the safety limit Yminimum.

Editing with the  key indicating the angle as described in this chapter marks the relevant block to recalculate the bending depth "Y" when modifying any data of the header block N0: active die, elasticity factor or sheetmetal thickness.

If programmed with the , depth only, without saving the angle, it is not recalculated when changing the data of block N0. It must be machined with the same die that was chosen in editor mode.



The sheet metal length defined on the attributes page serves as a reference to compensate for structure deformation and to set the best work pressure if the hydraulic system admits an analog voltage for pressure.

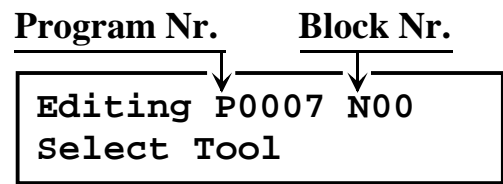
To calculate the proper tonnage, the resistance table (associated with the elasticity table M1 through M19 selected on the program header) must be loaded.


See section 2.3.4.



The program editing procedure is as follows:

1st page. Header / Tool selection page

 Select the "[punch Nr]  [die Nr.]" set to be used.



 Tonnage selected (only with a mechanical pressure gage).

 Sheet metal thickness, press 


 Material type, between 1 and 19, press 

The last two data define the characteristics of the sheet metal and are displayed together on the 3rd display.


Once accepted, press  to go on to...


2nd page. Attributes of 1st block N1

Editing P0000-N01
Attributes

 Key in the number of times that block is to be executed.


If $n = 0$, the block is ignored.

 Auxiliary data.

Each function is represented by its abbreviation on the  display. Each attribute is activated or canceled by pressing its associated key, 1, 2, 3 or 4.

Editing P0000 N01
1T 2H 3B 4D

1 - "t" (timing) . Apply a delay at the beginning of the block before moving the X axis. By default, it shows the time period set by PAR30.


To set another value, press **1** again, key in a value between 0 and 9.9 seconds (shown on the 1st display) and validate it with  .

2 "h" (height). Activate the "H" output.

3 "b" (back). Retract the X axis when the punch presses on the sheet metal according to the conditions set by parameters PAR36, PAR37.

4 "d" (delay). Hold the punch back at the end position once the bend has been completed.

By default, it offers the value set by PAR29.

To force another value, press **4** again, key in a value between 0 and 9.9 seconds (shown on the 1st display) and validate it with  .



Sheet metal length in m.

It serves as a reference to compensate for machine structure deformation. With electronic pressure gage, this same value also affects the bending sequence breaking pressure.



Modelo B: Top dead point.

By default, it offers the value of PAR28; but any other value may be preset.

The values set for the "t" and "d" attributes accessed with the **1** and **4** keys exclude each other. It is assigned to the last attribute from the one it was requested (and shown on the 1st display "t=2" or "d=4"). If one of the two attributes is active, but it is not shown on the 1st display, it assumes the value set by the relevant parameter PAR30 or PAR29.

The attributes are assumed at the beginning of each block before executing the movements of the axes.

In EXECUTION mode, they appear on the screen with the letters: T, H, B, D blinking if they are affecting the bending operation.

The selected tonnage, the resistance, length, thickness of the sheet metal and the opening of the die affect the calculation of the tonnage required for bending and the deformation of the machine.

The correction is NOT dealt with in EDITING mode.

For the same angle, the proposed depth "Y" is the same with any sheet metal length.




Only in EXECUTION mode, it will affect the bending depth always indicating the programmed angle proportional to the theoretical depth.


When indicating a length value = 0, the correction will not be executed.

3rd page. Select X, Y values of 1st block, N1

It offers 3 modes:

a. **Conventional editing:** Presetting numeric values.

- Press  and key in the X position of the bend.
- There are two ways to set the depth of the bend:
 - 1- Pressing  and keying in the final Y position of the bend or---
 - 2- Pressing  and keying in the angle a directly.




When pressing  , this unit analyzes the material type table and calculates the bending depth based on the thickness of the sheet metal and the opening and radius of the die and it stores this value on the Y axis (always negative).

The data for bending depth and angle are displayed at the same time.


b. **Teach-in editing. Storing only the bending depth**

In order not to deform the structure of the machine, the trials must be carried out with a narrow sheet (between 0.1m wide).



The X value is set in the conventional way, by setting a value.

- **On a "C" model.** Select the SET position.
- Press  . The TEACH and MAN leds turn on. By default, the  is selected. ( may be forced only to modify the X axis position).


This unit then offers all the resources of the MANUAL mode for positioning the axes with the following options:


- 1- Key in the position and press 



The selected axis will move to this position.

- 2- Continuous or incremental manual movement using the   keys or the foot switches on the "C" model.

- 3- When selecting position 5 of the MANUAL selector switch, the Y axis is disabled and the "DIS" led turns on. Some manufacturers offer the possibility to move the "Y" axis by external means (not using this NC). This is very common on "A" type up-stroke presses having handwheels.

Once the correct angle has been achieved through trial and error if the material is unknown, press  . It suggests the position reached as the coordinate to be edited; but it admits any correction prior to validating.

Press  to go on to the attributes page.

To exit the Teach-in mode, press  or .

c. Teach-in editing storing the angle with resources to correct the active elasticity table. Only for air bending

Ideal method for materials with known elastic behavior identifiable with a table already tested.



In order not to deform the structure of the machine, the trials must be carried out with a narrow sheet (between 0.1m wide).

The X value is defined using the conventional method.

At the "C" model, select the "SET" position.

- Press  . The TEACH and MAN leds turn on.

It selects the  axis .

- Press  , indicate the bending angle and press 


The "Y" axis reaches the position corresponding to the angle selected for the trial bend.

The characteristics of the material must be close to the selected elasticity factor. An angle close to the one proposed will be obtained.

- Press 


The screen shows the option:

Change factor?

- C1.- <No> 



It accepts the resulting angle that is the same as the one proposed and it is saved without changing the elasticity factor tables.

C2.- <Yes>  . The  display blinks "000".

- Indicate the resulting actual angle with a maximum resolution of 0.1° and press  .

Change the elasticity factor adapting it to the proposed angle. The correction is precise if the real angle differs slightly from the one proposed ($\pm 2^\circ$).



In execution mode, there are ways to force another depth correction that does not modify the edited program. Section 5.3.


Going back with  it is possible to confirm the correction of the "Y" depth corresponding to the suggested angle which will be indicated on the  display with the proper elasticity factor.




The same result is assured in the following blocks having the same angle and edited the conventional way  [angle] .

If at the end of the trial, there are data changed out of the range for the "Y" depth value , the selected table should be erased to restore the initial values. See section 2.3.5. It means that the real angle has not been properly indicated.

If the resulting values are out of range, it forces a safety position $Y = \text{sheetmetal thickness}$.

To store the data, press  . It is confirmed with two beeps and it access the page for selecting the attributes of the next bend, press  .

The end of the program does not require any special instruction. To quit the editing mode, press  . The last block opened when recognizing the block edited last is not stored.

To modify a value, go back to , select the program, move to the desired block using the  key, replace the value and validate it by pressing  (see section 4.1.1).

4.2 INSERTING/DELETING BLOCKS IN A PREVIOUSLY EDITED PROGRAM

Select the previous block as described in section 4.1.1

- Press  .

The LCD screen will show the options to "**Insert**" and "**Delete**".

- With the "**Insert**" option, an empty block is created and inserted after the selected block and the numbers of the next blocks are increased by one.

Note: No block may be inserted after the header block N00.

- The "delete" option eliminates the selected block. The following numbers decrease by 1.


- Block N0 cannot be deleted.

- To delete a whole program, see section 4.1.1.

4.3 DELETING ALL THE PROGRAMS

To delete all the programs, once in "program edit" mode, press the

sequence:   

It requests confirmation Yes/No with 

5 EXECUTION MODES WITH CONTROL FROM THE FOOT SWITCHES AND MANUAL STATION. MODELS A1, B, C

5 stages may be distinguished when executing a block:

1. Previously positioning of the X and Y axes.

Some machines have a specific button that the operator must press to force the X axis approach.

To start the bending sequence, both axes must reach the programmed position. A buzzer may be installed to indicate the order to the operator.

2. RAPID approach.

It is only possible if activated from the manual station.

When reaching the speed change point, it changes to SLOW.

3. Bending from the foot switch station depending on the selected mode. RUN1 and RUN2 are the most common ones.

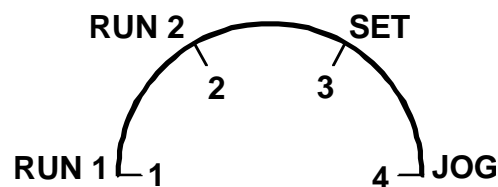
Conditioned by the "B" attribute, the X axis may be forced to return when holding the sheet metal.

4. Delay at the final position at maximum pressure conditioned by the programmable "D" attribute.

5. Return to the top dead point.

In the RUN 1 and RUN 2 modes, the return is automatic once the delay time has elapsed.

At the "C" model with safety pressure gage the bending process is aborted when exceeding the limit value and it returns to the top dead point thus preventing tool damage.



Up to 4 modes may be selected with an external switch. These modes distinguish the way the "BEND" or "RETURN" foot switches respond. The rapid approach controlled from the manual station is not described here.

RUN 1 - CONTINUOUS, STOP WHEN RELEASING THE FOOT SWITCH

- a. Hold the "BEND" foot switch down so the axis starts moving SLOWLY.
- b. Releasing the foot switch interrupts the movement.

Pressing the "RETURN" foot switch, it returns to the top dead point.

- c. Once the position and the bending pressure have been reached, the foot switch may be released. The return is not affected by the status of the foot switch. It is automatic when the bending time has elapsed.
- d. To go on to the next block, release the pedal if it was kept pressed until the top dead point is reached.

RUN 2 - SIMPLE, RETURN TO THE TOP DEAD POINT WHEN RELEASING THE FOOT SWITCH

- a. Hold the "BEND" foot switch down so the axis starts moving SLOWLY.
- b. When releasing the foot switch, it returns to the top dead point.
- c. Once the position and the bending pressure have been reached, the foot switch may be released. The return is not affected by the status of the foot switch. It is automatic when the bending time has elapsed.
- d. To go on to the next block, release the foot switch if it was kept pressed until the top dead point is reached.

SET - IT FORCES THE MANUAL MODE IN THE "C" MODEL BEND ALL DAY DOWN AND RETURN WITH TWO FOOT SWITCHES

It is also assumed in Manual mode, home search and TEACH-IN.

- a. Hold the "BEND" foot switch down so the axis starts moving SLOWLY.
- b. Releasing the foot switch interrupts the movement.

Pressing the "RETURN" foot switch forces the return movement in sensitive mode while it is being pressed.

- c. While the "BEND" foot switch is kept pressed, the cycle is interrupted when both the final position and pressure have been reached.

The return is **not** automatic.

- d. To return to the top dead point, press the "RETURN" foot switch.

The preset bending delay "D" is ignored.

JOG - APPROACH AND RETURN CONTROLLED BY A SINGLE FOOT SWITCH

- a. Holding the "BEND" foot switch pressed, it starts moving SLOWLY.
- b. Releasing it interrupts the movement.

Keeping the "RETURN" foot switch pressed forces the return movement in the sensitive mode.





- c. Once the final position has been reached, keep the "BEND" foot switch pressed to complete the bend and start the return movement.

Releasing the foot switch interrupts the sequence even in the final return movement to the top dead point.

- d. To go on to the next block, release the foot switch after the top dead point is reached.

5.1 PROGRAM EXECUTION

To execute a program:

- Access the "Execution" mode by pressing  .
- Select the desired program by keying its number and pressing  or using the   keys.

Execution Program : 0000



The message screen shows the status of the program:

Program Number: P100

Tools assumed: P1 M1

Block Nr. and Nr. of repetition: N01.02

Active attributes: T H B D

When requesting a new program at the  display, the word "START" appears to indicate that the  key must be pressed to begin the first bend:

1.-  . Position the axes and approach the ram using the manual station.


Feed the sheet metal.

2.- Press the "BEND" foot switch for bending according to the selected EXECUTION mode and the active attributes.



3.- Once the bend is completed, the ram returns to the top dead point.



The sequence for the second bend begins automatically.

The axes position at the coordinate set in the 2nd block repeating the successive bends until the 1st part is completed.

At the end of the last bend, the axes position at the coordinate set in the 1st block without having to press  . It is possible to feed the sheet metal and go on to the 2nd part.

To quit the EXECUTION mode, press  twice.

The block may be interrupted at any stage of the bending operation by pressing  and it may be resumed by pressing .

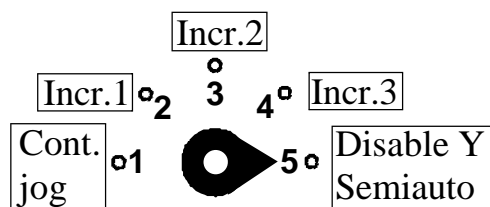
In EXECUTION mode, The  and  axis displays show the actual (real) X Y position.



El 3rd display offers additional information in real time once the punch touches the sheet.

- On the "B" and "C" models, it shows the value of the effective angle on the bending stage.
- On the "A" model, for machines equipped with a pressure gage, it shows the programmed angle and the real effective pressure on the bending stage when touching the sheet metal.

5.2 EXECUTION IN SEMIAUTOMATIC MODE

Having the MANUAL selector in position "5" (semiautomatic), this unit does not execute the next block automatically. The same bend may be repeated over and over again until the selector switch is turned to a position other than "5".



If while in this execution mode, the  key is pressed, the NC will go on to execute the next block. By pressing the  several times, it is possible to select the desired block to be executed in semiautomatic mode or ignore the ones not to be executed.

5.3 "Y" DEPTH CORRECTION WHILE IN CYCLE


This mode may be used to force corrections that affect the bending penetration without altering the edited program:



- All the blocks may be modified, each with a different corrector.
- They are saved when quitting the EXECUTION mode.
- They may be modified as often as you wish in a range of $\pm 6^\circ$.

This method is highly recommended to apply a quick correction for particular angles different in each block. It is handier than the "teach-in" method that changes the elasticity factor. See chapter 6.

The sequence is as follows:

- In EXECUTION mode, select the block to be corrected.

You may advance block by block with the  key without having to execute the bend.


Use  or  to start the corrector modifying sequence.

The screen shows the active corrector (with the index ± 30) corresponding to the block indicated with LED bar information.


- Press  to force the corrector and obtain greater angles.

Press  to obtain smaller angles.

Every time the key is pressed, it increments about 0.2° . The process is completed with 2 options:

1. Press  to validate the new corrector that would affect the next execution of the block.

or

2. Press  to validate the new corrector and force the repositioning with a previous movement to $Y=0$ and return to the new position, thus permitting to bend and verify the correction.

When done, the screen shows the original information again.

6 ***BENDING TECHNIQUE. PRACTICAL RECOMMENDATIONS***

Important factors for bending:

Type of material (elasticity)

The characteristics of the sheet metal are usually unknown and do not stay constant, not even in the same batch of material.

Aluminum, sweet or stainless sheet metal deform in a particular way and, thus, respond to different elasticity table.

Bending method

The elastic deformation values and the analysis of the die's geometry may be considered valid by bending "air" without reaching the bottom of the die.

When bending to the bottom of the die (method used with very flexible sheet metal), the punch forces its shape more than the die thus invalidating the conventional geometric analysis.

Active tooling

The three parameters: opening A , angle α and the die edge radius "r" are essential in geometric analysis and must be dimensioned accurately.

The opening of the die must be measured from the original edges before rounding them and it corresponds with the reference values of the catalogs given by conventional-die makers.

It is a good idea to reserve the 0.0 tooling to display the "Y" coordinate referred to the support sides of the punch and die by loading a value of $H = 0$, no height, on P0.M0 tooling.

There is no strict criteria relating the edge radius "r" to the opening A .

On conventional dies: $r = A/20$. Some manufacturers recommend: $r = A/5$.

Machine behavior

All machines suffer considerable deformation that are supposed to be proportional to the requested tonnage. There are two factors on conventional ones:

- . Their own structure that must counterbalance the force needed to deform the material.
- . The ram holding mechanism that supports the remaining tons. In other words the ones supplied by the hydraulic group - Tons required for bending.

Both deformations affect in opposite directions. The first one opens and the second one closes the throat of the machine. This NC compensates both values.

The automatic correction of the deformation is only treated in EXECUTION mode and is ignored in MANUAL and TEACH-IN modes.

Precautions to bear in mind:

- . The tonnage proposed on the initial page N0 of each program will correspond with the real value selected at the pressure gage that is adjusted according to the instructions of the sample tables offered by all the machines.
- . It is not recommended to change the angle by increasing the work pressure. This NC offers correction systems without unnecessarily having to force the ram holding mechanism.
- . Machines with an electronic pressure transducer adapt the cutting pressure to the tonnage required in each bend without forcing the ram holding mechanism.
- . Machines with hydraulic group governed with an analog voltage for pressure offer just the tonnage required in each sequence and permit extending the bending time under the right conditions for each length and thickness of the sheet metal.

The comparison trials to find out the right elasticity factor are valid if they are carried out under the same conditions as the original ones offered by this NC, obtained with short sheets, between 50 and 100 mm, with the minimum pressure needed not to affect the deformation of the structure.

If a factor has been validated using a scrap, but forcing an unnecessary over -pressure, when executing the program with a wide format will cause an error because the structural deformations of the machine will not be properly compensated.

All these factors are hard to determine. In EXECUTION mode, it is possible to force a corrector associated with each block and it will be saved as data added to the program.

6.1 PRACTICAL GUIDE. RECOMMENDATIONS

1 - Select the active tooling. Section 2.2

By default, it forces the last one used in EXECUTION mode.

2 - Home search

Some machine manufacturers force a home search on power-up usually only on the axes that have a home switch.

To verify the accuracy of the home value set, just request a Y = sheet metal thickness in Manual mode. When bending to that depth, the sheet metal must be secured between the punch and the die. If it is a little loose, fine tune the home value towards ++.


3° - Generate the material elasticity table. Section 2.3.1

This NC offers an analytical way to save the factors of 20 different materials. With V type dies of 88° only the angles resulting from only 4 trials that are proposed for 120°, 110°, 100° and 90° must be validated.

It is a very simple and practical method to foresee the behavior of the sheet metal, it is very close for angles between 90° and 120 and pretty close between 120° and 180°.

Before erasing a table, section 2.3.6 it is a good idea to jot down the factors and the number of the die used in order to restore the values without having to repeat the trial.

4 - Precautions

To permanently save the position of the axes, press  before turning off the machine's main power switch.

If the "Y" axis shows a value out of range EEEEEEEE, check the tool table for any accidental modification or perform a home search.

Depending on the type of work to be carried out, there are different options:

6.2 BENDING IN MANUAL MODE (SECTION 3.1.3)

This method is very useful for sporadic jobs out of the cycle by bending a single angle.

The machine deformation is not compensated. The pressure may be maintained at the end of the bend if, in manual mode, the foot switch keeps the hydraulic group active without attending to the signal from the pressure gage.

6.3 CONVENTIOANL EDITING AND CORRECTIONS IN CYCLE

This method is highly recommended for sweet materials that behave in a uniform way. Method:

1. Try the elasticity table as already described in section 2.3.1 for "New Material".
2. Switch to EDITOR mode and set the same index on the first page, N0. See section 4.1.2

Edit the 3rd page in "a" mode (conventional editing) directly in ANGLE without using the TEACH-IN mode.

3. In EXECUTION mode, correct in cycle. See section 5.3.

If the characteristics of the material or the behavior of the machine change throughout the work day, this correction method makes adapting it easy and reliable.

6.4 PRIOR CORRECTION IN EDITOR MODE

TEACH-IN method confirming the accuracy of the bend before validating the block.

Recommended for the following cases:

- . Materials with an abnormal elasticity progression that do not behave linearly in the full range from 50° to 120°.

They often offer an elastic behavior up to 100° , the fiber has not broken, and another one more uniform with $\alpha < 90$, something typical in aluminum or sheet metal with some kind of superficial treatment.

- . Known materials identified with some elasticity table that must be bent at angles beyond the "50° to 120°" range .

There are different options described in section 4.1.2 of this manual, edit 3rd page:

b- Save only the bending depth.

The angle is not shown.

There is a well known criteria used in the trial-and-error stage, pretty accurate for $\alpha > 120^\circ$ but not so much for $\alpha < 120^\circ$

$$\frac{\Delta \text{ mm}}{\Delta^\circ} = \frac{A}{200}$$

With a die $A=20$, a "Y" increment of 0.1 mm, it means an angle deviation of 1°.

c1-Save the bending angle without changing the selected elasticity table.

It also shows the depth.

c2-Save the angle and change the elasticity table.

7 OPERATION WITH THE RS-232-C SERIAL LINE

7.1 SAVING AND RESTORING DATA

With this NC, it is possible to save data into a PC or peripheral device and later restore it by using the RS-232-C serial communications line.










This data is sent out in the following format:

Baudrate as set by PAR90, 8 data bits, 1 stop bit and no parity.

Access the PROPERTIES menu of the Windows application "HYPERTERMINAL" and set the same parameters when configuring the port:

Bits per second:	9600
Data bits:	8
Parity:	None
Stop bit:	1
Handshake:	Xon/Xoff

To access this mode:

- Press 
- Select the "**Com**" option (communications) of the LCD display by means of the   and press .
- Select: <**Send**> and press  to send the data out to a PC or peripheral device or select <**Receive**> and press  to receive data from a PC or peripheral device.
- Select the type of data to transmit **Parameters**, **Program**, and **Materials** by means of the   keys and press .

7.2 PARAMETER TRANSMITTING FORMAT

The format of the transmitted parameters are:

For value parameters: **P00 123.123**
For binary parameters: **P00 10101010**
For option parameters: **P00 0**
For axis parameters: **P?? X 123.123 Y 123.123**

The number of decimals depends on the selected resolution.

7.3 PROGRAM TRANSMITTING FORMAT

The format is: P000 P0.M0 G0.000 P999.9 X Y A R T H B D U L C

Where:


P0000	Program number.
P0 - D0	Punch number . Die number
M0	Material, elasticity table.
G0.000	Sheet metal thickness
P999.9	Tons. Pressure (LF).
X Y	Bend position
A	Bending angle
R	Number of repetitions of a block
T	Delay (time) between blocks.
H	Auxiliary output H (high)
B	X axis retract before bending (Delay)
D	Punch delay at the end of the bend (Delay)
U	Top dead point (up).
L	Sheet metal length.
C	Corrector assumed in execution.

APPENDIX

ERROR CODES


Message	Description
FAGOR dro	Power outage or turned off by main switch after saving the data.
Error 02	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.).
Error 04	Wrong parameter values
Error 05	Wrong internal configuration
Error 06	Errors in data backup memory (Service Dept.)
Error 07	Emergency input active. Press [C] or cancel emergency signal.
Error 08	Wrong software memory or the software has been changed
Error 09	Errors in work memory (Service Dept.)
Error 12	Error while searching a coded marker pulse (Io)
Error 20	Travel limit switch pressed on that axis.
Error 31	Internal malfunction (Service Dept.)
Error 32	Internal malfunction (Service Dept.)
Error 90	Internal malfunction (Service Dept.)
Error 99	Internal malfunction (Service Dept.)
.....	Feedback alarm from the feedback device (scale, encoder, etc) or weak signal.
1.4.3.6.5.7.2.5	Feedback speed too high.
EEEEEEEE	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 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:

Resolution Fine/Coarse:

HOME SEARCH

Access:

With home switch: or

Floating: or , [719200] [Value]

Exit:

TOOL SELECTION

Access: <tool>

See: Editor, Header page

Confirm:

TOOLS

Table access:

Punch: <Punch>

Die: <Die>

Selection: [N° (1 a 9)] or

Die width: [Value]

Height: [Value]

Angle: [Value]

Edge radius: / Exit:

AXIS MOVEMENT

Access:

Select axis: or

Slow JOG: or

Fast JOG: & or &

Indicate position: or , [Position]

[angle]

Start: / Stop: / Exit:

EDIT

Access: [Prg]

[Prog Nr]

Delete program: <Delete>

Program: <Edit>

Tools: [Punch Nr] [Die Nr]

Manual, tonngge: [Tonnage]

Thickness: [Value]

Elasticity: [1 to 19]

Confirm:

Repetitions:

Attributes: 1 or 2 or 3 or 4

Sheet length: [Value]

Confirm:

X position: [Value]

Y depth: [Value] or

Angle: [Valor]

Confirm block:

Access to previous page:

MODIFICATIONS:

Delete block: <Delete>

Insert: <Inser>

Exit:

* Ignore attributes page: 5 1 8

EXECUTE:

Access: [Program Nr]

1st block: [Foot switch]

Next block:

CORRECTION:

Confirm: / Contrast: / Exit:

Header

* Attributes page

Page of axis position