FAGOR

Fagor Automation S. Coop.

NC-300M

Installation Manual

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1 CE seal

Warning

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

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

1.1 Declaration of conformity

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

Barrio de San Andrés 19, C.P. 20500, Mondragón -Guipúzcoa (ESPAÑA)

We hereby declare, under our responsibility that the product:

Fagor Positioning NC: NC-300M

meets the following directives:

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

ELECTROMAGNETIC COMPATIBILITY:

EN 50081-2Emission
EN 55011Radiated. Class A, Group 1.
EN 55011Conducted. Class A, Group 1.
EN 50082-2Immunity
EN 61000-4-2Electrostatic discharges.
EN 61000-4-3Radiofrequency Radiated Electromagnetic Fields.
EN 61000-4-4Bursts and fast transients.
EN 61000-4-5Shockwaves
EN 61000-4-6Conducted disturbance induced by radio frequency fields.
EN 61000-4-11Voltage fluctuations and Outages.
ENV 50204 Electromagnetic fields radiated by wireless telephones.
As instructed by the European Community Directives on Low Voltage: 73/23/EEC, (and the 93/68/EEC amendment) on Machine Safety 89/392/EEC and 89/336/EEC on Electromagnetic Compatibility.

In Mondragón, on April 1st, 2000

Fagor Automation, S. Coop. Ltda.
Director Gerente

Fdo.: Julen Busturia

1.2 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 manipulate the inside of the unit

Only personnel authorized by Fagor Automation may manipulate the inside of this unit.

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.

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 limits for temperature and relative humidity indicated in chapter General technical characteristics

Do not work in explosive environments

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

Work environment

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

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It is recommended to mount this unit vertically,

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 coolants, chemical products, blows etc that could damage it. Keep it away from direct sunlight, extremely hot air, high voltage and high current sources as well as from relays, or high electromagnetic fields (about 0.5 m or 20 inches).

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.

1.3 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.

1.4 Material returning terms

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

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.).

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.

Wrap the unit in a polyethylene roll or similar material to protect it.

Pad the unit inside the cardboard box with polyurethane foam on all sides.

Seal the cardboard box with packing tape or industrial staples.
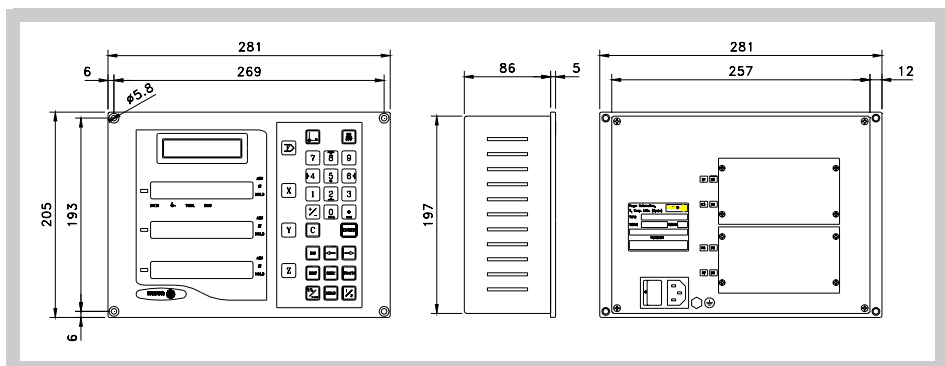
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2 Unit description

The NC-300M is a non-programmable positioning NC designed to be installed on conventional milling machines with a single electronic drive shared by three axes.

2.1 Front panel (see Operation Manual)

2.2 Rear panel
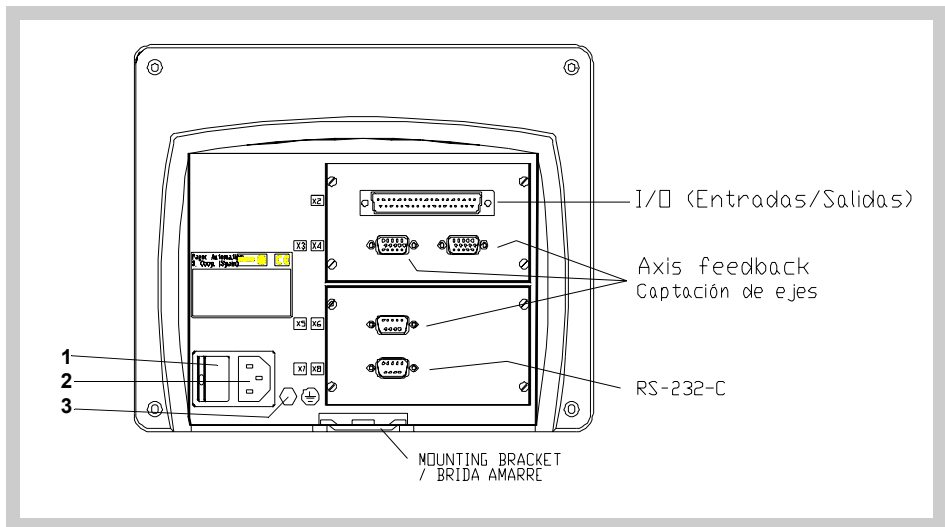
Built-in model (in mm)

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. 37-pin SUB-D type female connector to connect digital and analog inputs and outputs.
X3.-SUB-D HD type 15-pin female connector for the X axis feedback device.
X4.-SUB-D HD type 15-pin female connector for the Y axis feedback device.
X5.-SUB-D HD type 15-pin female connector for the Z axis feedback device.
X7.SUB-D type 9-pin male connector for the RS-232-C.

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 [on/off] key at the keyboard

2.2.1 Precautions to bear in mind in the electrical installation

• Install anti-parallel diodes on electrovalves at 24 Vdc.

• Use shielded cables on the encoder extensions and command signal cables.

• Run the shielded cables away from power supply transformers.

• Run the power cables and the signals cables in separate channels.

• Protect the outputs connected to relays and contactors:
  - RC if they are connected to 110Vac – 220 Vac
  - Anti-parallel diode if they're connected to 24 Vdc.
• Connect to ground the following elements with a 1.5-to-2 mm section cables:

  Outside screw on the rear of the unit.
  From connector X2 Pin 17 - Chassis
  Pin 19 - 0V of the command signal
  Pin 2 and 20 - 0V of the 24V 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 the DRO 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 6 mm ^{2}) for this connection.

2.3 General technical characteristics

Universal Power Supply between 100V AC and 240V AC ±10% at Mains frequency between 45 Hz and 400 Hz or between 120Vdc and 300 Vdc

Power outages of up to 20 milliseconds.

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

The operating temperature inside the unit enclosure must be between 5º C and 45º C (41ºF and 113ºF).

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

Maximum relative humidity: 95% non condensing at 45ºC (113ºF).

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

2.3.1 Connection of the feedback systems

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

Characteristics of feedback inputs: X3, X4 and X5:
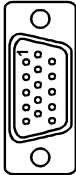
- Power consumption: 250 mA at the +5V input.
- Admits square-wave signal (TTL). (A, B, Io)
- Maximum frequency: 250 KHz, minimum gap between flanks: 950 nsec.
- Phase shift: 90º ±20º, hysteresis: 0.25 V, Vmax: 7V,
  maximum input current: 3mA
- High threshold (logic state 1) 2.4V < VIH < 5V
- Low threshold (logic state 0) 0.0V < VIL < 0.55V

Feedback connection. Connectors X3, X4 and X5

Pin	Signal	Function
1	A	Input for feedback signals
2	/A*	
3	B	
4	/B*	
5	I0	
6	/I0*	
7	Alarm	
8	/Alarm*	
9	+5V	Power supply to feedback devices
10	Not connected	
11	0V	Power supply to feedback devices
12, 13, 14	Not connected	
15	Chassis	Shield

* Only available with differential feedback.

Fagor encoders do not offer an alarm signal.

2.3.2 Characteristics of the inputs / outputs (X2)
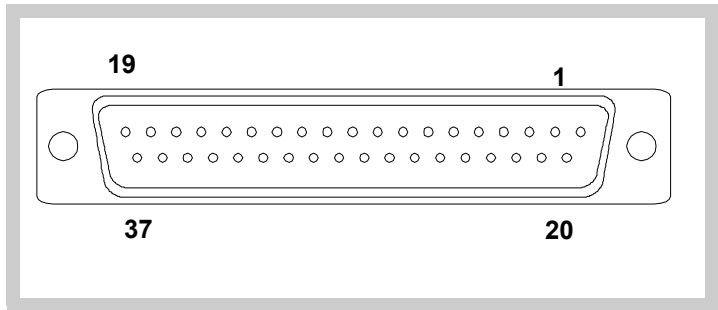
It uses a 37-pin female connector

Characteristics of the signals of connector "X2":

It is powered at +24V (±25%).

Characteristics of the 24V inputs:

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

Main characteristics of the digital outputs (opto-coupled with solid state relay with a normally open contact):

- Maximum AC or DC voltage: 48V
- Maximum load current: 150 mA
- Maximum internal resistance: 240 Ohm
- maximum peak current: 500 mA for 100ms at 25 ºC (77 ºF)
- Circulating current while open: < 1µA
- Leak current (Ileak)   200nA (Vload = 100V)
- Galvanic isolation voltage: 3750V for 1 minute
- Activation time: < 3ms
- Deactivation time: < 3ms

Main characteristics of the analog outputs

- Voltage range: ±10V Resolution:4.88mV
- Maximum current: 10mA Offset:±30mV
- Impedance: 120 Ohm with respect to GND

2.4   Input / output connection
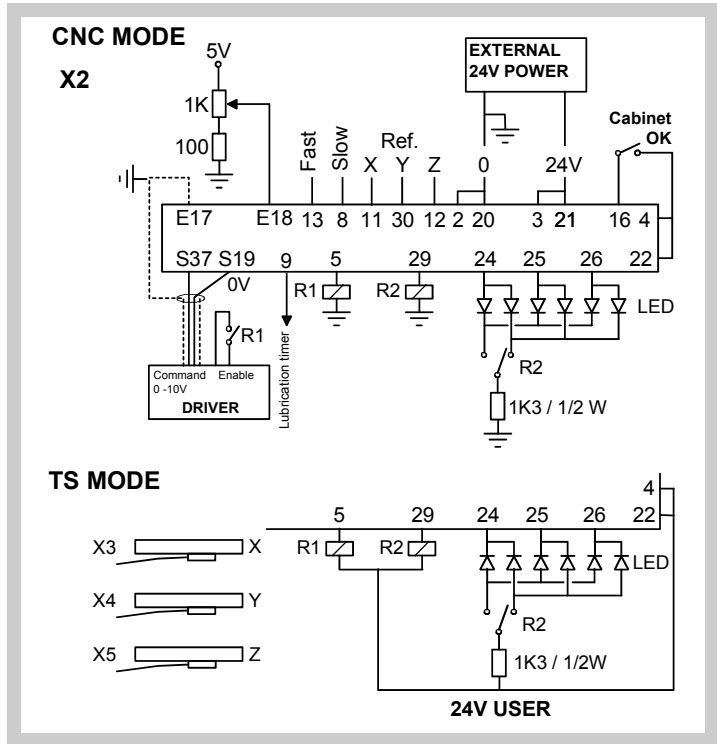
Jumper I18 – O37 and contact R1 to keep the machine running without the NC-300M.

Enable input E16 is only tested when accessing these two modes.

Up to 6 external LED's may be installed to indicate to the operator which AXIS has been SELECTED and its moving DIRECTION that help determine which lever is the correct one to obtain the AUTOMATIC feed of the axis and the proper direction.

The outputs may be adapted to the polarity of the LED's by selecting a jumper in the circuit supported by connector X2 which is accessed by removing the rear plate. (see PAR23).
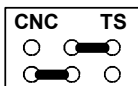
- 24V common.

- 0V common. Installed by default.

3 Installation parameters

The parameters may be saved and restored through the RS-232-C serial line (section 4).

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

- If it affects the axes, press the axis key to modify it.

- If it is a general parameter, it will be displayed on the X axis.

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

There are several kinds of parameters:

- With binary values (1/0), they are displayed on the 8-digit row as 1 through 8 from right to left.

Their state is changed by pressing the pertinent numeric key between [1] and [8].

- Decimal values are used to select the axis and enter the data.

- Options, the value is changed by pressing this key which will make the various options appear in a cyclic way.

[Param Nr.] Certain parameters (PAR11 and PAR50) can be accessed directly.

3.1 Editing installation parameters

Machine parameters PAR11 and PAR50 enable special features of this unit. The machine operator can access them directly.

The rest can only be accessed by installer technicians.

Press [CLEAR]. After 2 seconds, when the displays start blinking, press [ON/OFF]

<param> or also: Press [F] <param> [ENTER].

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

Scroll the table up and down.

The selected parameter starts blinking.

The LCD display shows the parameter number and a short description.

- On the first display if it is a general parameter.

- On the pertinent display if it is an axis parameter.
  In this case, select the axis (X, Y or Z) and edit its new value.

• To go from one parameter to another **saving the changes** :

[ENTER] or [→] • Scroll the table up.

[←] Scroll the table down.

• Pressing the key of another axis saves the value of the previous one and it goes on to editing the new selected axis.

[CLEAR] • Quits the parameter editing mode.

• If once the parameter changing process has started and the new value is not desired, press [CLEAR] to recover the previous one.

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

X X X X X X X

8 7 6 5 4 3 2 1

PARAMETER	FUNCTION
PAR00	Feedback configuration, different per axis, binary type.

This parameter defines the characteristics of the linear encoder of each axis.

Digit

8 Direction of the distance-coded I0 (0 = increasing, 1 = decreasing).

7 Special distance-code I0 pitch, 1 = 100 mm.

6 Type of linear encoder Io (0 = fix pitch, 1 = distance-coded).

5, 4 Not being used at this time. They must be set to zero.

3 Special I0 pitch, 1 = 40 mm.

If bit 7 = 0 and bit 3 = 0 ==> 20 mm

2 Type of feedback signals (0 = TTL).

This bit must be set to "0". The "1" value will be ignored.

1 Counting direction (0 = normal, 1 = reverse)

If an axis count increases or decreases in the opposite direction to the one desired, change the value of this digit.

PAR01 Counting resolution, different for each axis,

Range: From 0.0001mm to 1mm (0.000005" to 0.03937").

Factory setting: 0.0050 (mm).

PAR02 [+/−] TTL multiplication, independent for each axis, options x4, x2, x1 and x0.5.

The factory setting is: x4 for Fagor linear encoders.

PAR03 Internal multiplying factor when using distance-coded I0's and/or sinusoidal feedback signals or external multiplying factor when using distance-coded Io and TTL signals.

Independent for each axis. Options: 1, 5, 10, 20, 25, 50.

Default value: 1

For example, for FAGOR scales: MOX, COX or FOT, set this parameter to 5.

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PAR10	Absolute value imposed on each axis at the end of the home search.
	Factory setting: 0.
	This value will be in mm or inches depending on whether the INCH LED is off or on.
PAR11	Direct access parameter.
Digit	
8 and 7	Not being used at this time. They must be set to zero.
6	If = 1, when turned on, it assumes the ABS display mode.
5	If = 1, when turned on, it assumes the INCH display mode.
4	If = 1, it displays the theoretical position once reached the in-position zone of PAR25.
3	Turn the keyboard buzzer ON (=0) or OFF (=1).
2	Release (=0) or lock (=1) the access to the INCH format.
1	If (=1), the display mode selection, absolute or incremental, affects all 3 axes.
	If (=0), it only affects the selected axis
PAR14	
Digit	
8, 7, 6, 4, 3	Not being used at this time. They must be set to zero.
5	Home search direction on X, Y, Z, 1 = negative direction
2	Home switch being used on X, Y, Z. **0 = Yes**, 1 = No
1	Not being used at this time. They must be set to zero.
PAR21	It indicates the level of the first 8 inputs.
	By default, they are set to "1" indicating that they are activated with 24V.
Digit	**Pin (not being used if not specified)**
8	33
7	14
6	32
5	13 Force fast feed.
4	31
3	12 Z axis home switch, optional [PAR14(2)]
2	30 Y axis home switch.
1	11 X axis home switch.

PAR22   It indicates the level of the next 7 inputs

By default, they are set to "1" indicating that they are activated with 24V.

Digit	Pin (not being used if not specified)
-	-
15	23
14	8 Force slow feed.
13	36
12	35
11	16 External enable.
10	34
9	15

PAR23   It indicates the level of the first 8 outputs (see note of section 2.4).

By default, they are set to "1". When activated, the internal solid state relay closes.

Digit	Pin (not being used if not specified)
8	9 Lubrication timing.
7	27
6	26 Z axis selected
5	7
4	25 Y axis selected
3	6
2	24 X axis selected
1	5 Enable drive

PAR24   It indicates the level of the next 3 outputs.

By default, they are set to "1".

Digit	Pin (not being used if not specified)
16-12	--
11	29 Selected feeding direction.
10	10
9	28

PAR25   It indicates the in-position zone.

By default is 0.01 mm.

PAR26   It indicates the braking distance when decelerating (slow down point) related to a velocity command of 10V (section 5.2).

Range:From 0.0001mm to 99,999.999 mm (0.000005" to 3937").

Recommended value: $\geq$ 3 mm if PAR01 = 1; $\geq$ 5 mm if PAR01 = 5.

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PAR27	It indicates the stopping distance (stop offset).
	Range: From 0.0001mm to 99999.999 mm (0.000005" to 3937").
	Recommended value: from > 0 mm to 0.01 mm.
PAR41	Acceleration time from "0" to maximum speed. It softens abrupt velocity changes.
	Range: 0 – 1 sec. Recommended value = 0.2 sec.
PAR45	Minimum analog voltage imposed at the end of deceleration ramp.
	Range: 0 - 1V
	Recommended value: <0.05.
PAR47	Residual analog voltage imposed at the beginning of positioning moves in EXEC mode.
	Range: 0 - 1V. Recommended value 0.05V.
PAR50	Language selection to display messages on the LCD screen. Direct access.
	0 = English; 1 = Spanish; 2 = German; 3 = French; 4 = Italian;
	5 = Portuguese; 6 = User defined.
PAR52	Load user defined language.
	It requests the access code when accessing this parameter.
	After keying in 5564, this unit is ready to receive the user language file.
PAR63	Graphic symbol shown on the LCD screen for X+, Y+, Z+ (X- Y- Z- assume their inverted symbol).
	Possible symbol codes:
	30 = Left arrow
	29 = Right arrow
	31 = Up arrow
	28 = Down arrow
	Symbols 29/30 and 28/31 are inverted when changing the sign indicator of the axis defined in PAR64 (6, 5, 4). They help identify the proper lever that sets the proper direction. For the same reason, the external 6 indicator LED's may also be kept.

PAR64
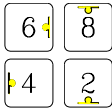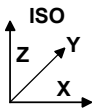
Reverse the coordinate direction indicator (O29) and sign of the tool compensations, length "L" (always active) and radius "R"; with these keys, it does not follow the ISO standard.

8 and 7   Not being used at this time.

6   Z axis, If = 0, O29 active if positive feed.

          If = 1, O29 active if negative feed.

5 and 4   Same as digit "6" for the "Y" and "X" axes respectively.

3   Z axis, If = 0, ISO standard, show "Z – L".

          If = 1, show "Z + L".

2   Y axis, If = 0,   shows "Y + R"

                                shows "Y - R"

          If = 1,   shows "Y - R"

                                shows "Y + R"

1   X axis, If = 0,   shows "X + R"

                                shows "X - R"

          If = 1,   shows "X - R"

                                shows "X + R"

PAR65   It indicates the lubrication time. From 0 to 30,000 seconds.

PAR66   It indicates the time period between lubrications. From 0 to 30,000 seconds.

PAR90   It indicates the RS transmission speed (baudrate).

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

               Factory setting: 9600 baud

                This unit sends and receives data at the speed set by PAR90 and with the following configuration:

               Stop bits: 1

               Data bits: 8

               Parity: None

                Protocol: XON/XOFF

4.1 Saving and restoring parameters

This unit can save data in a peripheral device or PC and later restore them through its RS-232 serial line.

This data is sent out in the following format:

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

Access the PROPERTIES menu of the HYPERTERMINAL applications in Windows and set the same parameters to configure the port:

> Bits per second:9600
> Data bits: 8
> Parity: None
> Stop bits:1
> Flux control: Xon/Xoff

4.1.1 Send parameters

1. Open the HYPERTERMINAL application.
2. Send program from NC-300M.
   [F] <com> <send> [ENTER]

F   **<com>**   **ENTER**
         <send>

3. It is sent as a text file in the format described in section 4.2

   A character ➡ appears on the last line to indicate the end of transmission.

4.1.2 Save parameters as a text file.

1. Drag the mouse to select the whole text including the last character ➡
2. Click the right mouse button to select "COPY".
3. Open a text editor by accessing directly from the bottom tool bar.
   Start, Programs, Accessories, Notepad.
4. Click the right mouse button to select "PASTE".
5. Save in a file chosen by the user.
   File, save as, C, etc. (conventional Windows method).

4.1.3 Restore a file saved in a PC.

Any data may be modified as long as the same format is maintained.

When editing the whole program from a PC, include the last character ➡

F **<com>**
<receive
>   **ENTER**
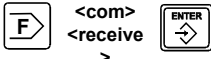
1. Set the NC-300 in receiving mode:
   [F] <com> <receive> [ENTER] It is confirmed with text:
   Communications
   Receive programs
2. Transfer a program from a PC.
   Open the HYPERTERMINAL application.
   Select: "Send" on the top tool bar.
   Select: "Send text file".
   Select the file (Windows resources).
   Select: "Open".
   The text file is sent directly.

4.2 Parameter transmitting formats

The formats of the parameters being transmitted 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.

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5.1 Test mode

There a special test mode to help set up the machine by accessing the inputs and outputs and running various tests.

$\boxed{Y}$ $\boxed{\text{ENTER} \Leftrightarrow}$ While the unit is turned off, keep these keys pressed at the same time and turn it on.

It access the general **TEST** mode.

$\boxed{\leftarrow}$ or $\boxed{\rightarrow}$ Pressing one of these keys rotates through the various options. Wait for a few seconds to confirm the requested option before going on to the next one.

$\boxed{\text{ENTER} \Leftrightarrow}$ It rotates in the up direction

LED All the displays and LED's are lit.

TASTE Keyboard test.

One or two segments of the displays 1 through 5 respond when activating each key.

COUNT Reading (counting).

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

When accessed, it selects the 1st axis - X

$\boxed{Y}$ $\boxed{Z}$ Pressing [Y] selects the 2nd axis – Y.

Pressing [Z] selects the 3rd axis - Z.

I0s Test of the reference signals of the encoders.

The 2nd line shows, with a "0" and "1" and from right to left, the I0 signal level of the encoders of the X, Y and Z axes.

Moving the axis by hand and very slowly, it detects the reference mark usually with a short blink.

PULSES Distance between I0's.

$\boxed{Y}$ $\boxed{Z}$ The first line displays "PULSES 1", pressing [Y] displays "PULSES 2" and pressing [Z] displays "PULSES 3".

Moving the axis manually far enough to detect the reference signal (I0) twice, the 2nd line will show the number of pulses detected.
x PAR01 x PAR02 of each axis.

ALARM Not being used at this time.

SPEED Not being used at this time.

RS-232 RS-232 communication. It shows a "1" if there is no error.

E2PROM Internal memory test

It responds with a "1" if there is no error.

INPUT Input test

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

The 1st line shows, with "0" and "1", the status of inputs (digits) D1 through D8 from right to left.

The 2nd line shows the status of inputs (digits) D9 through D15.

OUTPUT Force outputs

Digital outputs

The 1st line shows, with "0" and "1", the status of the inputs associated with digits D1 through D8 from right to left (see PAR23).

The outputs are activated or reset by pressing their associated keys [1] through [8].

The 2nd line shows the status of the remaining three outputs (see PAR24). They may be neither activated nor reset with their associated key.

Activate/deactivate all the outputs at the same time.

OUT ANA It is possible to impose a value to the analog output O37.

It increases / decreases by 0.01V each time it is pressed.

It offers positive values and then negative that are duplicated or divided by two each time it is pressed.

With [X] or [Y] [imposed value] [ENTER], it selects a particular velocity command.

With [X] or [Y] [0] [ENTER], it resets.

IN ANA The analog input may be tested with the same resources of the previous mode by jumpering O37 and I18:

The Z axis display shows the voltage forced at O37.

The Y axis display shows the same value at I18.

Screen test Alphanumeric

RAM memory It responds with a "1" if there is no error.

DATE Date

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

CHECKSUM (memory)

FAGOR

5.1.1 Direct access to parameters

In order to familiarize with the unit without having to connect the 24V input, a special access has been enabled to machine parameters on power-up.

[CLEAR] **[ENTER]** Turn the unit on while keeping these keys pressed until accessing PAR00 of the parameter table directly.

[→] Go on to PAR22.

[3] **[ENTER]** If parameter PAR22(7) = 0, press this keystroke sequence to force a "0" canceling the external emergency even if emergency input I23 is not connected.

[CLEAR] Exit to the main menu.

5.2 Adjustment of the dynamic response of the axes

Criteria to obtain a good response when positioning the axes with the right accuracy and repeatability:
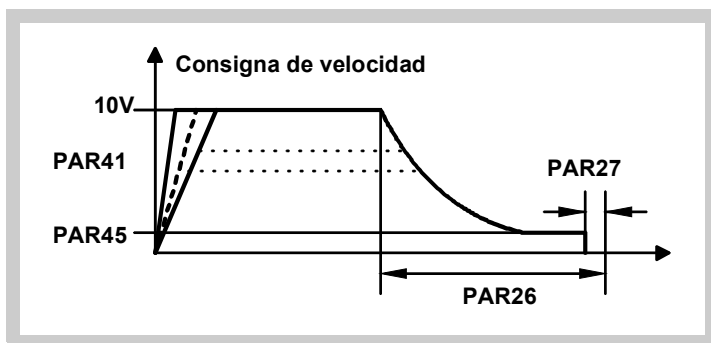
PAR26 It affects the exponential braking response that would be the right one if the maximum feedrate is obtained with 10V of velocity command.

Adjust the drive for those conditions.

PAR27 and PAR45 They affect the final positioning accuracy.

PAR41 It softens any velocity change to limit the acceleration torque without exceeding the peak torque of the servomotor.

6 Appendix

6.1 Error codes

Error FAGOR dro	Description Power outage or turned off with main switch after saving the data.
Error 02	The unit has been turned off without previously pressing [ON/OFF]. It only looses feedback reading (it resets it to zero and the status of the operating modes, inch, abs, radius, etc.).
Error 04	Wrong parameter data
Error 05	Wrong internal configuration
Error 06	Errors in data backup memory (Service Dept.)
Error 07	Emergency input active. Press [CLEAR] or cancel the 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 distance-coded reference mark (Io).
Error 31	Internal malfunction (Service Dept.).
Error 32	Internal malfunction (Service Dept.).
Error 99	Internal malfunction (Service Dept.).
. . . .	Feedback alarm coming from the feedback device (linear or rotary encoder).
1. 4. 3. 6. 5. 7. 2. 5	Feedback speed too high.
EEEEEEEE	Maximum position reading or speed exceeded when searching home.

Error codes

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 this key 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.

If the display of any axis shows all its dots; for example: 1.4.3.6.5.7.2.5. It means that the axis has been moved too fast (>200 KHz or 60 m/min with 1 µm resolution). This error will be displayed if the alarm activation parameter for the axis PAR08(1) = 1

To clear the display, press this key.

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

If the DRO does not come on or goes out while running, check that the voltage and ground outlets are as they should be. If there are OK, disconnect the feedback connectors one by one. If the dro comes on, it means a feedback failure. If the fault persists get in touch with Fagor Automation's Customer Services Department about it.

6.2 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 DRO 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 DRO stand up to:

- • Grease and mineral oils.
- • Alkalis and bleaches.
- • Dissolved Detergents.
- • 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 DRO does not come on press the rear switch for starting, make sure it is properly connected and being supplied with the proper mains voltage.

FAGOR

Fagor Automation S. Coop.

NC-300M

Operating Manual

Manual code: 14460061
Manual version: 0609
Software version: 1.xx

INDEX

1 Description

The NC-300 M has been designed to control the three axes X, Y and Z of conventional milling machines that have the following elements:

• 3 mechanical handwheels for manual movements

• Gear boxes for automatic movements on all 3 axes

• A single electronic MOTOR-DRIVE system, AC or DC shared by all three axes

• 3 linear encoders with TTL signal and resolution between 0.001 and 0.01 mm

This control cannot be programmed, but it allows controlled movements on all three axes. It offers three machining modes that may be selected at the panel:

Manual (DRO) mode with mechanical handwheels

Automatic feed mode forcing the levers

Positioning mode by indicating AXIS and TARGET POSITION and [START]

In these two modes, the feedrate is set with an external dial.

Other resources:

• 10-tool table for radius compensation depending on the machining direction X, Y and length on Z.

• Machine reference zero (home)

• 9 zero offsets (datum points)

• 3 position displaying formats:
  ABSOLUTE, INCREMENTAL or MACHINE REFERENCE (HOME)

1.1 Front panel
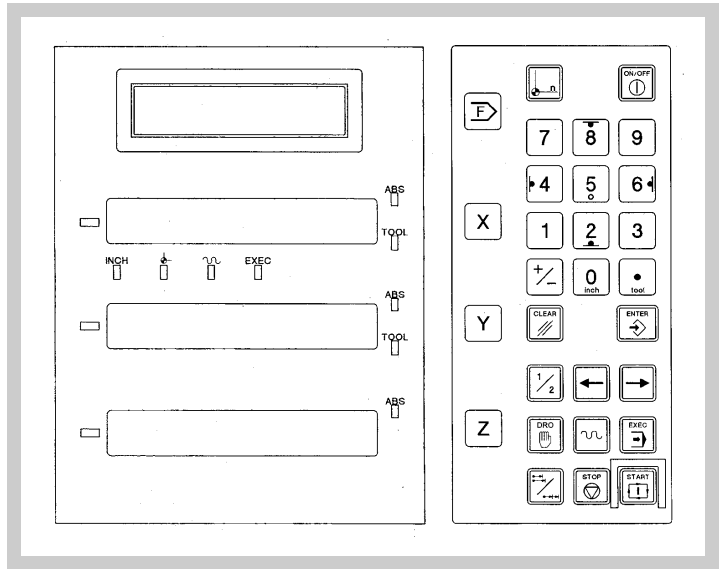
LED	KEY	
INCH	0 inch	Measurement in MM/Inches
⊕	□ n	(n = 0) Machine reference zero (home)
	DRO	DRO mode.
∿	∿	Enables the drive
		Machining in automatic mode
EXEC	EXEC	POSITIONING mode
ABS		Coordinates in ABSOLUTE/INCREMENTAL
TOOL		Axis affected by radius compensation of the selected tool
	tool	Tool table selection
	F	Access to special modes

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X Y Z			Select axis

Turn off the display of the axes.

It keeps reading the position.

Validate data entry.

Cancel data entry.

Access the tool table.
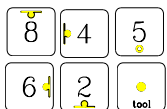
Apply (cancel with [5]) tool radius compensation.

Invert sign or filter the resolution ignoring the 3rd decimal.

Calculate half the value displayed.

Start / interrupt a positioning move.

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2 Start-up

On power-up, once the initial test is successful, it shows the text "FAGOR cnc".

Pressing this key accesses the standard DRO mode.

In this mode, it is possible to set the display format:

• If the machine is not moving, turn the display off to prevent the LED's from wearing out unnecessarily

• MM / INCH conversion

• Turn the last digit off

It is also possible to change certain free-access machine parameters:

PAR50 Language of the help messages of the LCD screen.

PAR11 Operation of the ABS / INC key.
- PAR11.1 = 1, It affects all the axes.

- PAR11.2 = 1, No access to "inch" mode.

- PAR11.3 = 1, Buzzer off.

- PAR11.4 = 1, Displays theoretical coordinates.

- PAR11.5 = 1, Forces inch mode on power-up.

- PAR11.6 = 1, Forces ABS mode on power-up.

2.1 Movement of the axes

The NC 300 M offers 3 machining modes (described next). All the resources described in the following sections are common to all 3 modes:

• **ABS / INC selection**

X   [Value]   • **Preset: X [value] [ENTER]**

• **Tool table selection.**
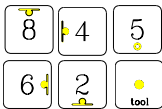
• **Tool radius and length compensation.**

• **Part zeros.**

This symbol appears in several chapters of this manual.

X ⇔ means moving the X axis with a purpose: Search tool-part contact, Machine reference Zero, etc.

X ⇔ 100 means moving the X axis to position X100 in any of the 3 modes:

2.1.1 The 3 operating modes of the NC-300M.

MANUAL (DRO) mode with mechanical handwheels.

It is assumed on power-up.

AUTOMATIC mode.

To select this mode, the gear boxes must be in neutral. Otherwise, it goes into Manual (DRO) mode.

It enables the drive. The motor-drive system is always active at the rpm set with the external dial allowing movements in AUTOMATIC even on several axes simultaneously by forcing the levers.

POSITIONING mode.

Keep the gear boxes in neutral

Machining or positioning sequence on the X axis:

X   [100]   Enables the motor-drive system at a residual feedrate.

Actuating the "AUTOMATIC X" lever in the proposed direction launches the sequence in 4 stages:

1st - Initial feed, 0.2 mm at residual feedrate
2nd - Acceleration up to the feedrate proposed at the dial
3rd - Feed at machining feedrate
4th - Stop with dynamic braking until reaching the target position

2.2 Safety in EXEC mode

Abort exiting to DRO mode.

• When activating a lever of an axis that does not match the proposed one.

• If there are 2 or 3 levers activated in the first stage while testing the initial feedrate.

Stop the feed without aborting the EXEC mode. There are 3 possibilities:

• Pressing this key in any stage.

• If the direction engaged, with a margin of a resolution unit, does not match the proposed final position.

• If the machining direction is reversed by changing the position of the active lever or moving it to the neutral position (it always causes a slight backward movement).

• Resumes the movement.

CAUTION In INC mode, the proposed moving distances are referred to the theoretical coordinate programmed in the previous movement. If it is interrupted causing a STOP, a new movement must not be proposed without previously completing the interrupted movement. To abort without exiting the INC mode, the real coordinate (actual position) reached when interrupted must be preset.

2.3 LCD display

All the modes indicate the active tool and part zeros (datums)

TOOL1, REF1 **Tool 1, origin 1**

The EXEC mode shows additional data:

Programmed coordinate

The display shows the last position proposed:

ABS - X100 Position proposed in ABSOLUTE mode.

INC - X100 + 50 Current position (100) + Proposed increment (50).

X150 When starting the movement, it displays the absolute position.

▲▼ ► ◄ Symbol to indicate the proper lever.

STOP If the axis is stopped

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3 Coordinate origin selection

In order to facilitate the interpretation of machining blueprints, this unit offers several options for displaying axis position.

3.1 Machine reference zero (home), origin "0"

Origin 0.

It is confirmed with the LED
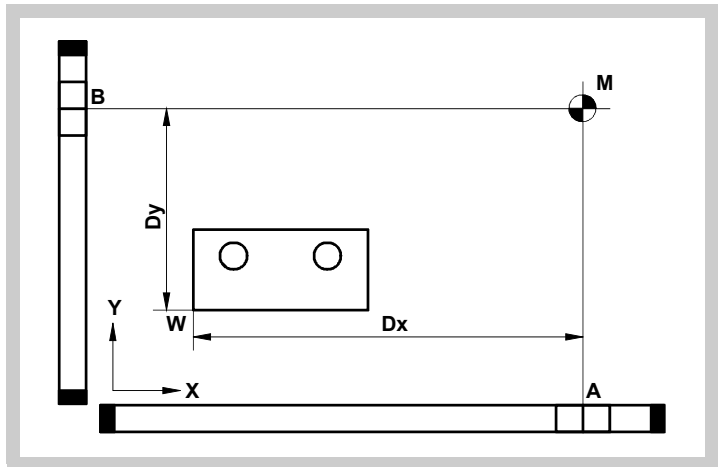
M = Machine Reference Zero (home)
W = Part zero (datum)

Incremental feedback systems have some fixed reference marks A and B that set the machine reference point (home) M.

Having selected the machine reference mode, when the cursor of the linear encoder slides over the A mark on the X axis or over the B mark on the Y axis, this unit sets certain values pre-established by machine parameters. (usually 0.0).

It displays the accumulated reading (count) referred to the machine reference zero (M) which cannot be modified.

Fagor linear encoders have reference marks every 50 mm all along its length. It is important to always select the same reference mark that should be clearly identified with some graphic indication: a sticker, a marker, etc or with home switches installed for this purpose. In that case, it will select the first reference mark found after activating and releasing the home switch **without reversing the moving direction**, as described next.

Sequence to search the machine reference zero (home): (Not in EXEC mode)

⟷   Move the axis to a position near the chosen reference or without associated home switch.

[⊡ n] [**0** inch] [ENTER ⇨]   Access the home search mode .

[X] [Y] or [Z]   Select the axis.

Its associated display stays blinking.

⟷   Move the axis up to the reference mark. It is reached when the preset reference value appears on the screen (usually = 0 or ±R, -L if TOOL is active).

[⊡ n] [**[1] to [9]**] [ENTER ⇨]   Exit this mode.

3.2 Part Zero (datum) setting

[⊡ n] [**[1] to [9]**] [ENTER ⇨]   Origin 1 to 9.
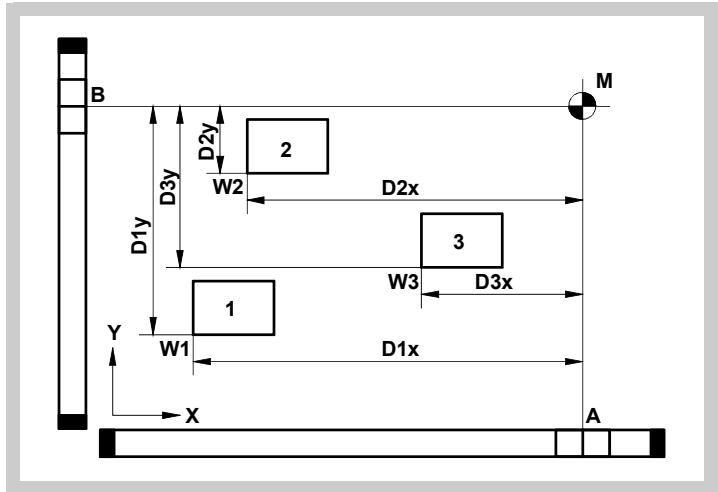
The part zero W may be set in any position of the table. The machining blueprint coordinates are usually referred to W. When selecting the part zero, it displays the accumulated reading referred to W.

With the **NC 300 M** it is possible to work with 9 different datum points (part zeros), from W1 to W9.

The Dx, Dy and Dz values define the offsets between M and W and are saved when this unit is turned off.

If for any reason, the table has been moved while this unit was off, the axes must be homed in order to restore all the zero offsets of the 9 tables as well as the original position readings.

    FAGOR

Sequence to set and select one of the 9 datum points (part zeros).

Force the **ABS** mode on all 3 simultaneous axes (PAR11.1 = 1).

or axis by axis **[ABS/INC] [X], [ABS/INC] [Y], [ABS/INC] [Z]**, if (PAR11.1 = 0)

[1] to [9] Select table from 1 to 9 .

Move the axes until touching the part.

Force "0" on the X, Y or Z axis by keying in: (not in EXEC mode)

[CLEAR] [X] , [CLEAR] [Y] or [CLEAR] [Z]

[Value] **Preset a particular coordinate by keying in:**

{ [X], [Y] or [Z] } [value] [ENTER]

When selecting X, Y or Z, it starts blinking the data entered in the previous preset that will be replaced by the new one.

The absolute position displayed will be referred to part zero of the selected datum point.

3.3 Absolute / incremental display format (Section 5 - Example 1) 1)

To set or change the part zeros, select the ABSOLUTE format.

Once the position has been detected, force any value on X, Y or Z.

The reading will remain in this mode if the **ABS** led is on.

Selecting a new ABS datum point implies losing the previous one.

Sequence to switch to incremental mode:

Change from **ABS** to INC mode on all 3 axes (PAR11.1 = 1).

Change from **ABS** to INC mode only on the X axis (PAR11.1 = 0).

The current position is now the new reference (datum point) in INCREMENTAL mode with the same resources as in the absolute mode to change its value:

Forces a 0 on the X axis (not in EXEC mode).

[Value] Preset a particular value.

When repeating the same value (section 5, example 4, equidistant linear drilling).

Selecting a new INCREMENTAL datum point implies losing the previous one without affecting the reading with respect to part zero that may be restored by switching back to **ABS** mode.

4 Operation with tools

4.1 Loading tool dimensions

The table may save the diameter and length of up to 10 tools (0 to 9).

[tool] [0 to 9] [ENTER]
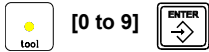
[X] [Value] [ENTER] Indicates the diameter on the X axis display

[Y] [Value] [ENTER] Indicates the length on the Y axis display

[ENTER] Accept. The selected tool is now active.

4.2 Tool compensation
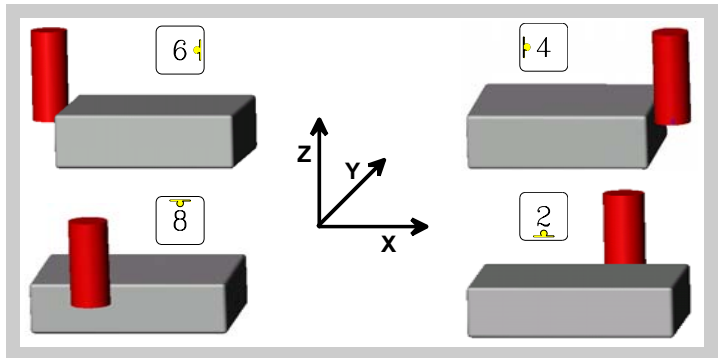
The symbol associated with each key helps in the interpretation of the axis being compensated with the proper sign for the machining direction.

It displays the position of the cutting edge ignoring the position of the tool center.

The Z axis compensation is always active

The TOOL led associated with the X and Y axes indicates "compensation active".

Cancels the compensation

It restores the position of the tool center on the XY axes.

It maintains Z axis compensation.

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4.3 Tool-assisted part zero setting

Load and activate the table with the tool dimensions (section 4.1)
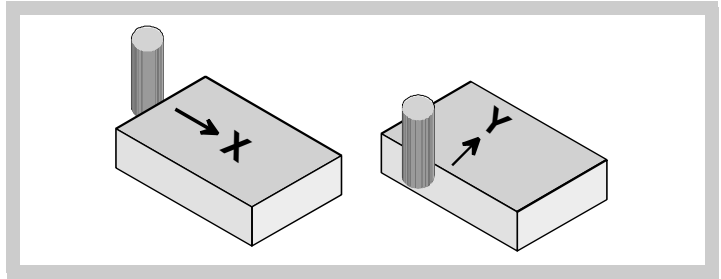
ABS Absolute mode

Move the table in the X+ direction until touching the left side.

It assumes the coordinate direction as per the ISO standard.

`6` Activate X+ compensation

`CLEAR` `X` Preset 0 on contact side, or

`X` **[Value]** `ENTER` Preset value = "reference value of the contact side"

Move the table or the ram in the Y+ direction until touching the front side of the part

`8` Activate Y+ compensation

`CLEAR` `Y` Preset 0 on contact side, or

`Y` **[Value]** `ENTER` Preset value = "reference value of the contact side"

Move the table in the Z- direction until touching the top side

`CLEAR` `Z` Preset 0 on contact side, or

`Z` **[Value]** `ENTER` Preset value = "reference value of the contact side"

4.4 Tool centering between 2 sides

5 — Cancel tool compensation.

ABS — Absolute mode

X ⟺ — Move the X axis until touching on one side

CLEAR **0 inch** — Preset "0"

X ⟺ — Move the X axis until touching on the other side

½ **X** — It displays half the distance between both sides

X ⟺ **0** — Move to X0 to center the tool between both sides

Repeat this sequence on the Y axis to center the tool between 4 sides.

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5 Machining examples

The examples described next are common machining operations with a drill bit or an endmill. The Z axis is always affected by the active tool length compensation, data hard to know unless one has the means to calibrate it.

You should load tool length L=0 on the tables and home the Z axis as described in section 4.1 every time you change the tool.

The examples do not show the Z axis movements.

Example 1 - Linear drilling

It displays the tool center position.

There is no radius compensation

It assumes a drill bit whose diameter D = 10 mm.
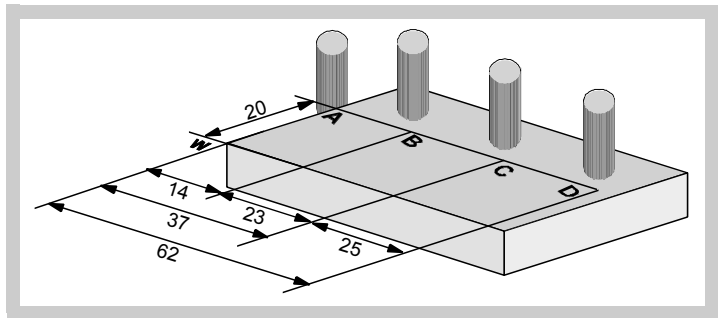
▨ **ABS**		Absolute mode.	
⬛ n	[1] to [9]	⬛ ENTER	Select the part zero (datum point).
		5	Cancel tool compensation.
			Touch the left side, POSITION A
X	+/− 5 ENTER		Preset X -5. It sets part zero
X	⬌	14.000	Move to position B, drill
X	⬌	37.000	Move to position C, drill
X	⬌	62.000	Move to position D, drill.

In INCREMENTAL mode (See section 2.3 LCD display)

The same part zero is supposed to be set and tool compensation is off.

			DRO or ⋀ MODE	EXEC MODE
[DRO] [⋀]		MODE		

X ⟷	0	Move to X0, part zero.	

[⤢] INC		**Incremental mode proposing target position.**	**Incremental mode proposing target position.**

[CLEAR] X	Presetting X0 is redundant.	Do not preset "0".

X ⟷ 14.000	Move to position B, drill.	X 14 [START]

[CLEAR] X	Preset X0.	Do not preset "0".

X ⟷ 23.000	Move to position C, drill.	X 23 [START]

[CLEAR] X	Preset X0.	Do not preset "0".

X ⟷ 25.000	Move to position D, drill.	X 25 [START]

Switching back to **ABS** mode, it displays the position referred to part zero.

The position may be verified with the sum of the steps traveled in incremental mode.

[⤢] INC	**Incremental mode proposing X0**

X [-14] [ENTER]	Preset X -14

⟷ 0	Move to position B, drill.

X [-23] [ENTER]	Preset X -23

⟷ 0	Move to position C, drill.

X [-25] [ENTER]	Preset X -25

⟷ 0	Move to position D, drill.

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Example 2 - Finish flanks of an inside pocket.

Absolute mode with tool radius compensation.

It displays the position of the cutting edge.

1st - Load tool dimensions.

| 6 | 8 |

2nd - Look for part zero W, with compensation (See chapter 4.3).

| | ABS | Absolute mode. |

| 4 | 2 | Apply tool radius compensation. |

| X | ⟺ | 30 | Move X to position A. |

| Y | ⟺ | 10 | Move Y to position A, penetrate in Z. |

| 2 | 6 | Apply tool compensation. |

| X | ⟺ | 90 | Move X to position B. |

| 6 | 8 | Apply tool compensation. |

| Y | ⟺ | 50 | Move Y to position C. |

| 8 | 4 | Apply tool compensation. |

| X | ⟺ | 30 | Move X to position D. |

| 4 | 2 | Apply tool compensation. |

| Y | ⟺ | 10 | Move Y to position A. |
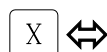
Example 3 - Finishing flanks of a square boss

INCREMENTAL mode with tool radius compensation.

It displays the position of the cutting edge.

1st - Load tool dimensions
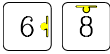
2nd - Look for part zero W, with compensation. (See chapter 4.3).

	DRO or 〜 MODE	EXEC MODE
	Incremental mode	

Keys	Incremental mode	Keys (EXEC)
⧄ INC		
6⌐ 8	Apply tool radius compensation	Apply tool radius compensation
X [-18] ENTER	Preset X -18.	Do not preset.
Y [-10] ENTER	Preset Y -10	Do not preset.
X ⬄ 0	Move X to position A	X [18] START
Y ⬄ 0	Move Y to position A, penetrate in Z.	Y [10] START
8 ⌐4	Apply tool compensation	Apply tool compensation
X [-40] ENTER		Do not preset.
X ⬄ 0	Move X to position B	X [40] START
⌐4 2	Apply tool compensation	Apply tool compensation
Y [-30] ENTER	Preset Y -30	Do not preset.
Y ⬄ 0	Move Y to position C	Y [30] START
2 6⌐	Apply tool compensation	Apply tool compensation
X [40] ENTER	Preset X 40	Do not preset
X ⬄ 0	Move X to position D	X [-40] START
6⌐ 8	Apply tool compensation	Apply tool compensation
Y [30] ENTER	Preset Y 30	Do not preset
Y ⬄ 0	Move Y to position A	Y [-30] START

Example 4   - Grid pattern drilling, 2 identical parts

Part zeros W1 and W2 are supposed to be already set (chapter 3.2).

There is no tool radius compensation
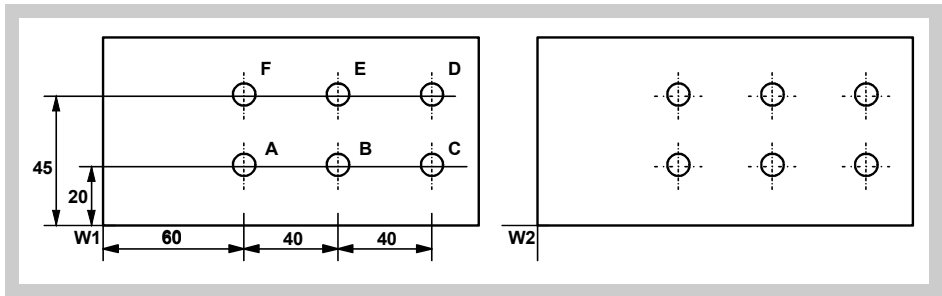
		EXEC MODE
DRO or 〰 **MODE**		

[n] **1** [ENTER]	Select part zero W1	
[⟋] **ABS**	Absolute mode ON BOTH AXES	Absolute mode ON BOTH AXES
[X] ⟷ **60**	Move X to position A	[X] **[60]** [START]
[Y] ⟷ **20**	Move X to A and drill	[Y] **[20]** [START]
[⟋] **INC** [X]	X axis in incremental mode	X axis in incremental mode
[X] **[-40]** [ENTER]	Preset X -40	Do not preset
[Y] ⟷ **0**	Move X to position B and drill	[X] **[40]** [START]

FAGOR

Keys	Description	Alternative
X [ENTER]	Preset X -40 (no need to key in "-40")	Do not preset
X ⬌ 0	Move X to position C and drill	X [START]
[slope] ABS	Not required when keeping ABS in Y	Not required when keeping ABS in Y
Y ⬌ 45	Move Y to position D and drill	Y [45] [START]
[slope] INC X	Not required when keeping INC in X	Not required when keeping INC in X
X [40] [ENTER]	Preset X 40	Do not preset
X ⬌ 0	Move X to position E and drill	X [-40] [START]
X [ENTER]	Preset X 40 (no need to key in "40")	Do not preset
X ⬌ 0	Move X to position F and drill	X [START]
[part zero] 2 [ENTER]	Select part zero W2	Select part zero W2

Repeat same sequence

FAGOR

6 Appendix
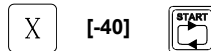
6.1 Error codes

Error	Description
FAGOR dro	**Power outage or turned off with main switch after saving the data.**
Error 02	The unit has been turned off without previously pressing [ON/OFF]. It only looses feedback reading (it resets it to zero and the status of the operating modes, inch, abs, radius, etc.).
Error 04	Wrong parameter data
Error 05	Wrong internal configuration
Error 06	Errors in data backup memory (Service Dept.)
Error 07	Emergency input active. Press [CLEAR] or cancel the 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 distance-coded reference mark (Io).
Error 31	Internal malfunction (Service Dept.).
Error 32	Internal malfunction (Service Dept.).
Error 99	Internal malfunction (Service Dept.).
. . . .	Feedback alarm coming from the feedback device (linear or rotary encoder).
1. 4. 3. 6. 5. 7. 2. 5	Feedback speed too high.
EEEEEEEE	Maximum position reading or speed exceeded when searching home.

Error codes

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 this key 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.

If the display of any axis shows all its dots; for example: 1.4.3.6.5.7.2.5. It means that the axis has been moved too fast (>200 KHz or 60 m/min with 1 μm resolution). This error will be displayed if the alarm activation parameter for the axis PAR08(1) = 1

To clear the display, press this key.

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

If the DRO does not come on or goes out while running, check that the voltage and ground outlets are as they should be. If there are OK, disconnect the feedback connectors one by one. If the dro comes on, it means a feedback failure. If the fault persists get in touch with Fagor Automation's Customer Services Department about it.

6.2 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 DRO 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 DRO stand up to:

- • Grease and mineral oils.
- • Alkalis and bleaches.
- • Dissolved Detergents.
- • 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 DRO 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 :   [ON/OFF]

MM / inches :   [0 inch]

Resolution Fine/Coarse :   [+/-]

MACHINE AND PART ZERO

"Machine zero" mode: [⌐] [0 inch] [ENTER]

[X] [Y] [Z] **and move up to ref mark.**

Select "Part zero": [⌐] **[1 to 9]** [ENTER]

"ABS" mode : [⇥] **(LED "ABS" on)**

"INC" mode : [⇥] **(LED "ABS" off)**

Preset : [X] [Y] [Z] **[Value]** [ENTER]

Force zero: [CLEAR] [X] **or** [Y] **or** [Z]

RESTORE PART ZEROS

Search home (machine zero) if the axes have been moved while the unit was off.

MOVEMENT OF THE AXES

Manual :   [DRO]

Automatic :   [⋀]

   Move : [⇥] **[Value]** [START]

   Stop : [STOP]

TOOL TABLE

Select tool: [• tool] **[0 to 9]** [ENTER]

Diameter D: [X] **[Value]** [ENTER]

Length L: [Y] **[Value]** [ENTER]

Validate: [ENTER]

Compensation:

   [X + D/2] or [X - D/2] : [6] [4]

   [Y + D/2] or [Y - D/2] : [8] [2]

   Cancel X and Y comp. keeping Z - L : [5]

DIRECT ACCESS TO PAR11

[CLEAR] [1] [1] **[Bit number]** [ENTER]

Bit 1 = 1 : "ABS / INC" common to all 3 axes.

Bit 2 = 1 : Disable "inches".

Bit 3 = 1 : Deactivate the buzzer.

Bit 4 = 1 : Display theoretical position.

Bit 5 = 1 : Activate "inches" on power-up.

Bit 6 = 1 : Activate "ABS" mode on power-up.

FAGOR

Fagor Automation S. Coop.