FAGOR

Fagor Automation S. Coop.

NV-10/11
NV-20/21
NV-300/301M

Installation Manual

Manual code: 14460044
Manual version: 0410
Software version: 3.xx

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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.

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 Digital Readout:

NV-10, NV-11, NV-20, NV-21, NV-300M, NV-301M

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" page 10

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.

It is recommended to mount the DRO 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.

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1.4 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:

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 poly-utherane foam on all sides.

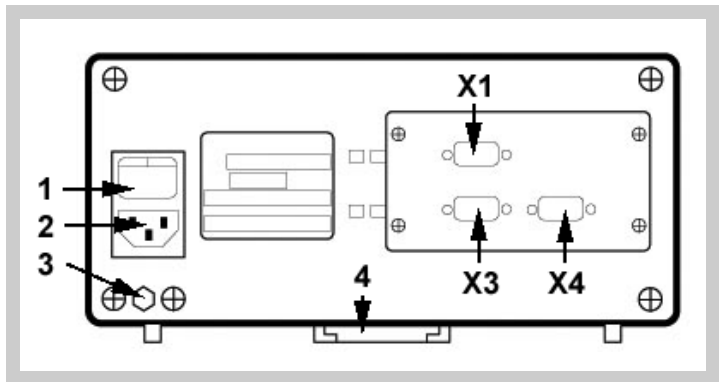Seal the cardboard box with packing tape or industrial staples.

2 Unit description

This DRO is designed for industrial environments, especially for machine tools and measuring machines.

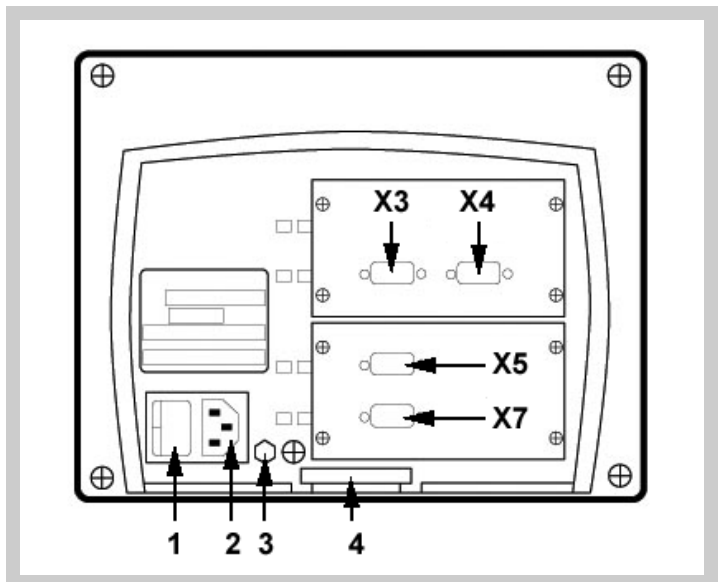It can display the position of one (NV-10 /NV11) or two axes (NV-20 / NV21, NV-300M, NV-301M) of the machine.

2.1 Front panel (see Operation Manual)

2.2 Rear panel

NV-10/11/20/21

NV-300M/301M

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

1. Power switch. When the unit is turned off by this switch, the DRO no longer reads axis position.

   ON
   OFF

   Therefore, it is recommended to use this key at the front panel to turn the display off so the DRO continues keeping track of the axes position when they are moved.

2. Three-prong power connector for AC and ground connection.
3. M6 mm terminal for general machine ground connection.
4. Mounting bracket

Some of the following connectors might not be available depending on specific models:

X1.- (At the NV-10/11/20/21), SUB-D type 9-pin male connector for the RS-232-C (Optional).

X3.- SUB-D HD type 15-pin female connector for 1st axis feedback device.

X4.- SUB-D HD type 15-pin female connector for 2nd axis feedback device. Not available in the NV-10/11 model.

X4.- SUB-D HD type 15-pin female connector for 3rd axis feedback device. Only available at the NV-30M/301M.

X7.- (At the NV-300M/301M) SUB-D type 9-pin male connector for the RS-232-C (Optional).

Dimensions of the NV-300MB/301MB (built-in) model
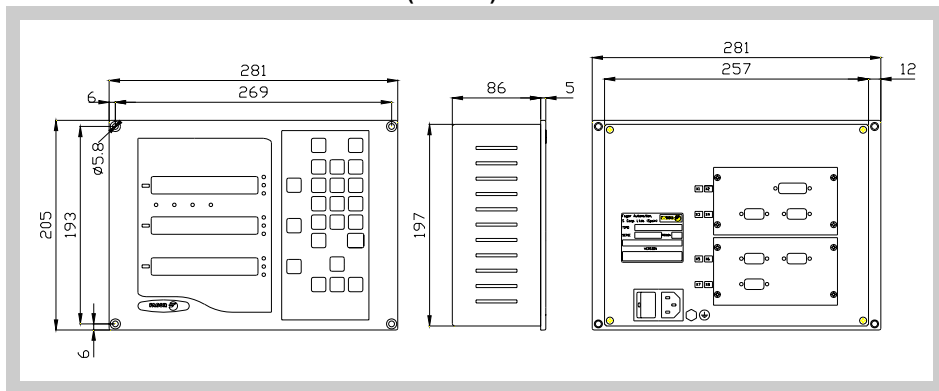
WARNING

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

2.3 General technical characteristics

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

- It withstands power outages of up to 20 milliseconds.

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

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

- The storage temperature inside the DRO 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.

2.4 Connections

The connection for the RS-232 serial line (optional connector X1 for the NV-10/20 and X7 for the NV-300M) is NOT described in this manual; but in a specific supplement.

2.4.1 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. The latter (for the 2nd axis) is not available at the NV10 model.

Characteristics of feedback inputs: X3, X4 and X5:
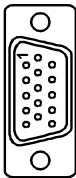
- Power consumption: 250 mA at the +5V input.
- Admits square-wave signal (TTL). (A, B, Io)
- It admits 1Vpp voltage modulated sinewave signals (models NV11/NV21 and NV-301M)
- Maximum frequency: 250 KHz, minimum gap between flanks: 950 nsec.
- Phase shift: 90º ±20º, hysteresis: 0.25 V, Vmax: 7V, maximum input current: 3mA
- High threshold (logic state 1) 2.4V < VIH < 5V
- Low threshold (logic state 0) 0.0V < VIL < 0.55V

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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 at DRO models: NV-11 / NV-21 and NV-301M

2.4.2 Power and machine connection

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 8 mm ^{2}) for this connection.

2.5 Turning the unit on and off

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

The dro runs an autotest and the X axis display shows the text: "FAGOR dro" if everything is OK and the error number if otherwise. See the appendix at the end of this manual.

Turning the uni
 OFF   ⎡ON⎤
 ⎣OFF⎦   If you press the DRO 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 again, on condition that the DRO is getting voltage (plugged in and with the switch on the rear panel on).

NOTE: ⎡ON⎤
 ⎣OFF⎦   If the unit is turned off using the power switch on the back or there is a power outage before having pressed this key, the dro tries to save the position. If it does not have enough time to safe all the data, it will display ERROR 2 when turned back on.

2.6 RS-232 Connection. (Described in a separate supplement)

Since it is an optional feature. It is described in a separate supplement.

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3 Installation parameters

These DROs have a number of installation parameters to configure it for a particular application.

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

- If it affects the axes, the parameter number (PAR??) appears on each axis display and the corresponding axis key must be pressed to modify it.

$\boxed{X}$ • If it is a general parameter and there are more than one axis (NV-20 / NV21), the X display will show the parameter number and the Y/Z its current value. If there is only one axis, its number will appear on the X display and, after pressing , its value.

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

$\boxed{1}$ **to** $\boxed{8}$ • With binary values, it only takes values of 0 or 1 for each digit. The value is changed by pressing the key with the relevant digit between [1] and [8]. Where [1] corresponds to the rightmost digit of the display and [8] to the leftmost digit.

- Numeric values, usually with the corresponding axis resolution, they are entered as regular coordinate preset.

$\boxed{+/-}$ • Options; the value is changed by pressing this key which will make the various options appear in a cyclic way.

To get into parameter editing
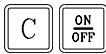
$\boxed{C}$ $\boxed{\frac{ON}{OFF}}$ The dro displays must be on, reading mode and press the following keys:

CODE: 060496 The X axis display shows the word " **COdE** ". **060496**

The displays of the DRO show **PAR00**.
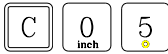
$\boxed{C}$ $\boxed{0}$ $\boxed{5}$ Once in regular display mode, parameter **PAR05** (scaling factor) may also be recalled by pressing this keystroke sequence, so the work mode may be changed without having to go through all the previous steps.

Note: Like PAR05, parameters PAR53, PAR90 and PAR91 can also be accessed directly.

To end editing a parameter, follow one of these steps:

$\boxed{ENTER}$ • Press this key to save the displayed value.

$\boxed{C}$ • Press this key to cancel the modification.

•

To modify a parameter

$\boxed{ENTER}$ Press the [ENTER] key to go on to the next parameter or ---

$\boxed{1/2}$ Press this key to return to the previous one.

To quit the parameter editing mode:

$\boxed{C}$ Press this key.

To go to a particular parameter:

$\boxed{X}$ $\boxed{Y/Z}$ Then, select the axis affecting this parameter.

$\boxed{\text{HOLD}}$ **PAR Nr** $\boxed{\text{ENTER}}$ To go directly to a particular parameter without going through the previous ones, (once in parameter editing mode) press this key sequence.

To recover the factory set default values for the installation parameters:

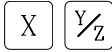$\boxed{0}$ $\boxed{3}$ $\boxed{2}$ $\boxed{1}$ Once in parameter editing mode, **displaying PAR00** on all the displays, press this keystroke sequence. The dots of the first axis will light up.

3.1 Parameters to configure axis position reading and display.

The digits of digital parameters refer to the digits on the axis displays so digit "1" (that can be changed with the [1] key) corresponds to the rightmost digit and "8" to the leftmost digit.

X X X X X X X X   <-- binary code

8 7 6 5 4 3 2 1   <-- keys

PARAMETER	FUNCTION
PAR00	Feedback configuration, different per axis, binary type.
	This parameter sets the specific characteristics of the feedback device (rotary or linear encoder) used to read the axis position.

Digit

8, 7, 6   **Not being used at this time (they must be set to "0")**

5   **Feedback resolution units:**

Linear axis: 0 = mm, 1 = inches

Rotary axis: 0 = degrees, 1 = seconds.

Note: These units refer to feedback pulses not to the position display.

4   **Type of axis:** 0 = **Linear**, 1 = Rotary (NV-11/21/301M)

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3   **Type of feedback** (0 = **incremental**, 1 = absolute)

The connection possibilities are:

X	Y	Z
TTL	TTL	TTL
ABSOLUTE	TTL	TTL
TTL	ABSOLUTE	TTL
ABSOLUTE	ABSOLUTE	ABSOLUTE

The communication with the absolute linear encoder is digital through SSI (Synchronous serial interface). There is a new parameter for connecting future Fagor absolute linear encoders that indicates the number of bits used to transmit the position value.

See also parameter: **PAR95**

2   **Type of feedback signals** (0 = TTL, 1 = 1 Vpp). See table on next page.

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   **Feedback resolution.** Independent for each axis.

Possible values:

    Linear axis: From 0.0001 mm up to 1.0000 mm (0.000005" to 0.03937")
    Rotary axis: From 0.0001° to 1.0000° (from 1 to 999 seconds).
    Absolute feedback: enter the desired resolution.
    Factory setting: 0.0050 mm (5 µm).

Formula to calculate encoder resolution:

$$R = \frac{360}{p \times TTLfactor \times Sfactor} = \frac{360}{p \times PAR02 \times PAR03}$$

Where:

    R = Resolution in degrees
    p = Pulses per turn of the encoder
    TTLfactor = Multiplying factor for TTL signal
    Sfactor = Multiplying factor for sinusoidal signal

Note: Sinewave multiplying factor will be applied on 1 Vpp feedback signals.

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

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

The factory setting is x4 and it is the one used for FAGOR linear encoders.

When using rotary encoders on linear axes, it should be calculating according to the number of pulses of the encoder, leadscrew pitch and the desired resolution as per the formula:

$$p= \frac{P}{RxF}$$

Where:

p = Pulses per turn of the encoder
P = Leadscrew pitch in mm/turn
R = Resolution in mm/pulse
F = Multiplying factor to be applied.

PAR03 **Internal multiplying factor** when using sinusoidal feedback signals or **external multiplying factor** when using distance-coded Io and TTL signals.

Independent for each axis. It is not required when using absolute feedback.

Options: 1, 5, 10, 20, 25, 50.

Factory setting: 1

Feedback parameters

Signal	Model	PAR00 XXXXXXXX	PAR01 mm	PAR02	PAR03	PAR14
TTL	MKT MT CT FT	0000000A	0.005	4	1	00B00000
TTL dif.	MTD	0000000A				
	MX/MOX		0.001		1 / 5	
	MY/MOY		0.005		1 / 10	
	CX/COX					00B00000 / 00B00010
	SX / SOX				1 / 5	
	GX / GOX		0.001			
	FX / FOX				1/25	00B00000 / 00B01010
	LX				1	00B00000
1 Vpp	MP/MOP	0000001A	0.001			
	CP/COP				5	00B00000 / 00B00010
	SP / SOP					
	GP / GOP					
	FP / FOP				25	00B00000 / 00B01010
	LP				10	00B00000
	SA / GA	0000010A	From 0.0001 to 1.0000	-	-	-
11 µA*	MC/MOC	0000001A	0.001	4	5	00B00000 / 00B00010
	CC / COC					00B00000 / 00B01010
	FC / FOC				25	

* With adapters
A = Reading direction (to be selected by the user)
B = Mandatory home search (to be selected by the user)

PAR04 **Axis display.** Independent for each axis.

Digit

8, 7, 6, 5, 4 Not being used at this time (they must be set to "0"),

3 **Turn the axis display off**. 0 = No, 1 = Yes.

2 **Axis display toggle radius/diameter**

0 = no toggle, 1 = toggle

1 **Axis display**. 0 = radius, 1 = diameters.

Note: When a rotary axis, the setting of this parameter will be ignored.

PAR05	**Shrink or scaling factor** independent for each axis.

Numeric value within ±9.999.

A "0" value means that no factor is to be applied. It is not applied when reading with respect to machine reference cero (its LED on) or onto the tool when applying tool compensation (TOOL led on).

The factory setting is "0".

Note: When a rotary axis, the setting of this parameter will be ignored.

PAR07	**Combine the reading of an axis.** Independent for each axis.

It indicates the number of the axis to be added; "0" means none,
1 = X axis, 2=Y, 3=Z. With a minus sign, the reading of the other axis will be subtracted.
Factory setting: "0".

The axis being combined must have the same resolution as the one combined with (PAR01, PAR02, PAR03).

$\boxed{\dfrac{+}{-}}$ **Possible values:** -2 to 2. (NV-20/21), -3 to 3 (NV-300M/301M)

On the NV-20 and NV-21, NV-300M and NV301M models, the X axis display may combine the reading of another axis. In that case, the display of the second axis could be turned off by setting "**PAR04 Bit 3 = 0**". If it is not turned off, the Y/Z axis will display the position of that axis (not combined)

The rest of the parameters of the axis will be considered the same as those of the combination of the axes.

Note: When a rotary axis, the setting of this parameter will be ignored.

PAR08	**Use of alarms**.

Indicates whether the alarms for feedrate, travel limits and feedback will be activated or not.

Digit

8, 7, 6	Not being used at this time (they must be set to "0")
5	**Activate the feedback signal alarm.** 0=No, 1 = Yes.
	NVxx1 models (1 Vpp signals) can detect feedback signal weakness.
4	**Active value of the feedback alarm.** (0=low, 1=high)
3	**Detect feedback alarm provided by the linear encoder.** 0 = No, 1 = Yes.
	Fagor linear encoders do not provide this alarm.
2	**Detect travel limits (PAR12 and PAR13).** When this alarm is activated, the axis value blinks.
	The blinking axis error is cleared by returning the axis within its limits

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1	Detect feedback speed alarm when exceeding 200Khz (60m/min with a resolution of 1µm). Not applicable to a rotary axis.

Possible values: 0 (alarms off) and "1" (alarms on).

Factory-set (default) values: 0

Feedback and feedrate alarms are shown with (. . . . .) at the display.

C	The speed alarm is cleared by pressing this key.

PAR09 **Linear compensation of a machine axis.** Independent for each linear axis.

Numeric value within ±99.999 millimeters per meter.

Factory setting: 0.

Notes: Even when selecting the display in inches, this value MUST ALWAYS BE IN MILLIMETERS.

<div align="center">

1 inch = 25.4 mm

</div>

When a rotary axis, the setting of this parameter will be ignored.

PAR10 **Offset of the reference point** with respect to the reference zero of the scale, independent for each axis.

Usually, the machine reference zero (reference mark of the linear encoder) does not coincide with the absolute zero to be used.

Therefore, when using standard Io's, this parameter must be assigned the value of the distance from the machine zero point to the feedback reference point.

Numeric value in resolution units for each axis.

Factory setting: 0.

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

PAR11 **Miscellaneous, binary.**

Digit

8, 7, 6, 5 Not being used. Must be set to "0".

4 If =0, normal zero setting and coordinate presetting (factory set)

If =1, quick zeroing of the position value displayed on each axis.

3 If =1, allow the selection of the work plane for bolt-hole drilling

2 Type of Machine (0 = Mill, 1 = Lathe). Factory setting: "0"

1 The key affects one axis (= 0) or both (= 1).

If it affects each axis independently, after pressing this key, one must press the axis key.

It may toggle from absolute reading mode to incremental. This parameter determines whether this toggle affects one axis or both (NV20 / NV-300M). **Factory setting: "1".**

PAR12, PAR13	**Travel limit.**
	To set the negative axis travel limit.
	Both parameters admit any value.
	This value will be in mm or inches depending on whether the INCH LED is off or on.
	If PAR08 bit 2 = 1, when the axis exceeds the travel distance between both parameters, the relevant display starts blinking until it is positioned within these limits.

| **PAR14** | **Binary type home search setting.** |
Digit	
8, 7	Not being used at this time (they must be set to "0")
6	If =1, it indicates **mandatory home search on power-up.**
5	**Direction of the distance-coded Io** (0 = Increasing , 1 = Decreasing).
4	1 = **Pitch of the distance-coded Io 100 mm, 0 = 20 mm**
3	1 = **Pitch of the distance-coded Io: 80 mm. 0 = 20 mm**
	NOT BEING USED IN THIS VERSION.
2	**Type of Io of the linear encoder**. (0 = fixed, 1 = distance-coded).
1	If =1,**Linear encoder without I0.** To carry out a home search when the feedback device does not have a reference mark "Io", this parameter must be set to "1".
	Factory setting: "0".

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PAR15   **Multi-point leadscrew error compensation.**

Important: **Before capturing data for an accuracy graph, the axis (axes) must be homed (referenced)** because the compensation will not be applied until they are homed. To use this compensation, it is recommended to set **PAR 14** so as to force a mandatory home search on power-up.
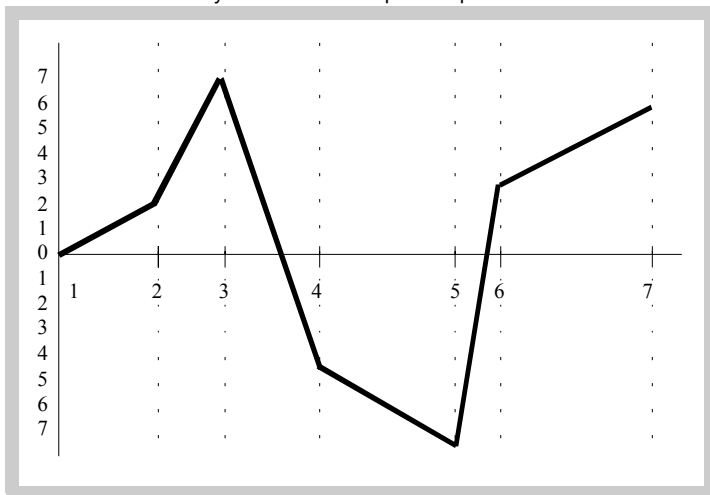
Multi-point leadscrew error compensation table (in mm)

Point Nr.	Position	Error to be compensated
1	0	0
2	200.000	0.002
3	275.250	0.007
4	427.345	-0.005
5	700.500	-0.007
6	760.000	0.003
7	1015.000	0.006

The compensation point must have at least one point with no error (error 0).

$\boxed{X}$ **or** $\boxed{Y/Z}$		Select the desired axis and enter the number of points to be used for the axis, up to 40. Zero means that there is no compensation table for the axis.

POS 1　　Where 1 is the point number to enter.

For NV 20 / 300M

$\boxed{\text{ENTER}}$　Pressing [**ENTER**] displays the position value (X axis display) and the amount of error to be compensated (Y axis display).

Error to be compensated = Master's actual position - displayed position

For the NV 10

$\boxed{\text{ENTER}}$　Pressing [**ENTER**] goes on to editing the position value

$\boxed{\text{ENTER}}$　Press [**ENTER**] to validate and go on to editing the amount of error in the indicated position.

ERROR 1　　Pressing [**ENTER**] goes on to editing the error value.

$\boxed{\text{HOLD}}$　Pressing [**HOLD**] presets on the X axis the current axis position.

$\boxed{C}$　Press this key to exit.

PAR20　　**Determines which axis or axes the hysteresis will be applied on.**

Digit

3, 2, 1　　Apply hysteresis onto the 3rd, 2nd and 1st axis respectively

PAR25　　**Hysteresis distance** desired to avoid the flickering of the displayed position
This value will be in mm or inches depending on whether the INCH LED is off or on.

PAR53　　**Select the number of decimals to be displayed.**

Possible values: 0.0 to 6.6 .

The first digit corresponds to the number of decimals to be displayed in mm and the second digit to the number of decimals in inches.

When selecting a "0" value or a value greater than the number of decimals of **PAR01** it will display the factory set number of decimals.

Note:　It has no effect on rotary axes.

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PAR65	It enables various functions of the dro.
Digit	

8	1= To enter the tool length.
7	1= To enter the tool diameter.
6	1= To compensate for tool radius.
5	1= To directly access parameter PAR05.
4	Not being used at this time. It must be set to "0"
3	1= Enables the bolt-hole feature
2	It enables this key.
1	It enables this key.

PAR95 **Number of bits used to transmit the absolute position value.**

Installing an absolute linear encoder requires a specific feedback board, "NV A" models

3.2 RS-232C communication parameters (optional feature)

PAR90 **RS transmission speed (baudrate).**

Options: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 baud.

PAR 91 **Digit**	**Probe setting.** It indicates the presence of the probe and its active level, binary type.
8, 7, 6, 5	Not being used at this time (they must be set to "0").
4	It indicates the freezing of the display when probing. It updates the position reading when the probe is activated.
3	It indicates the freezing of the display when probing. Probe 0V => hold position.
2	It indicates the negative level of the probe.
1	Enable the probe.

PAR92 **Time constant in milliseconds of the probe bounce filter.**

The probe must be stable at the inactive level for the time period indicated by **PAR92** so it can receive another flank from the probe.

Possible values: From 20 to 255 milliseconds.

4 Appendix

4.1 Error codes

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.

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.

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4.2 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.

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Display ON/OFF	$\boxed{\frac{ON}{OFF}}$
MM/Inches	$\boxed{0}_{inch}$
Fine/coarse resolution	$\boxed{+/-}$
Radius/Diameter	$\boxed{^1/_2}$
Scaling factor (X)	$\boxed{C}$ $\boxed{0}_{inch}$ $\boxed{5}$ $\boxed{X}$ **[Value]** $\boxed{ENTER}$
Incremental/Absolute mode	$\boxed{\nearrow}$
Home reference mode	$\boxed{\llcorner_n}$
Home search (X)	$\boxed{X}$ move (X) axis
Axis preset (X)	$\boxed{X}$ $\boxed{+/-}$ **[Value]** $\boxed{ENTER}$
1/2 axis preset (X)	$\boxed{X}$ $\boxed{+/-}$ **[Value]** $\boxed{^1/_2}$
Cancel	$\boxed{C}$
Zero setting (X)	$\boxed{C}$ $\boxed{X}$

Part centering (X).	$\boxed{^1/_2}$ $\boxed{X}$
Coordinate freeze (X).	$\boxed{HOLD}$ $\boxed{X}$ ... $\boxed{HOLD}$
Middle point (X).	$\boxed{HOLD}$ $\boxed{X}$ ... $\boxed{^1/_2}$
Tool diameter preset	$\boxed{\cdot}_{tool}$ **[Value]** $\boxed{ENTER}$

Tool radius compensation

Cancel Tool Compensation	$\boxed{5}$

Bolt-hole pattern drilling

Center of the circle.
(move the axes to the center)

Select bolt-hole operation $\boxed{\odot}$

RADIUS: [Value] $\boxed{ENTER}$

HOLES: [Number of holes, (2-99)] $\boxed{ENTER}$

ALPHA: [Angle between 1st and last hole] $\boxed{ENTER}$ (0=360º)

DELTA: [Angular distance between holes] $\boxed{ENTER}$

BETA: [Angular position of the 1st hole] $\boxed{ENTER}$
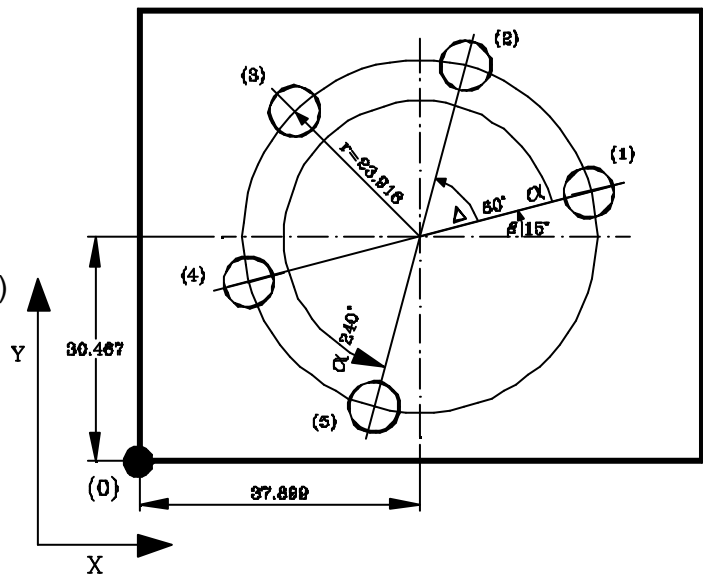
Execution of the bolt-hole drilling operation:

After "HOLE 01", press $\boxed{ENTER}$ and move the axis

To display the current position with respect to the previous hole, press $\boxed{^1/_2}$

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 31	Internal malfunction (Service Dept.)
Error 32	Internal malfunction (Service Dept.)
Error 99	Internal malfunction (Service Dept.)
EEEEEEEE	Maximum position reading or speed exceeded when searching Home

Fagor Automation shall not be held responsible for any mistakes on this sheet and reserves the right to make any modifications without prior notice.

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