FAGOR DRO

NV-300G
NV-301G

INSTALLATION MANUAL

Man: 9910 Soft: 1.xx

INDEX

Warning:

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

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

DECLARATION OF CONFORMITY

Manufacturer: Fagor Automation, S. Coop.

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

We hereby declare, under our resposibility that the product:

Digital Readout (DRO) Fagor: NV-300G / NV-301G

meets the following directives:

SAFETY:

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

ELECTROMAGNETIC COMPATIBILITY:

EN 50081-2	Emission
EN 55011	Radiated. Class A, Group 1.
EN 55011	Conducted. Class A, Group 1.
EN 50082-2	Immunity
EN 61000-4-2	Electrostatic Discharges.
EN 61000-4-3	Radiofrequency Radiated Electromagnetic Fields
EN 61000-4-4	Bursts and fast transients.
EN 61000-4-5	Power surges
EN 61000-4-6	Conducted disturbance induced by radio frequency fields.
EN 61000-4-11	Voltage 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, 1996

Fagor Automation, S. Coop. Ltda.
Director Gerente

Fdo.: Julen Busturia

SAFETY CONDITIONS

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

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

Do not access the inside of the unit

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

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

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

Use proper Mains AC power cables

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

Avoid electrical overloads

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

Ground connection

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

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

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

Ambient conditions

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

Do not work in explosive environments

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

Working environment

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

Install the unit in the right place

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

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

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

Safety symbols

Symbols which may appear on the manual

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

Symbols that may be carried on the product

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

"ELECTRICAL SHOCK" symbol
It indicates that point may be under electrical voltage

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

WARRANTY TERMS

WARRANTY

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

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

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

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

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

EXCLUDING CLAUSES

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

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

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

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

SERVICE CONTRACTS

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

MATERIAL RETURNING TERMS

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

1.- Get a cardboard box whose three inside dimensions are at least 15 cm (6 inches) larger than those of the unit. The cardboard being used to make the box must have a resistance of 170 Kg (375 lb.).

2.- When sending it to a Fagor Automation office for repair, attach a label indicating the owner of the unit, person to contact, type of unit, serial number, symptom and a brief description of the problem.

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

4.- Pad the unit inside the cardboard box with poly-utherane foam on all sides.

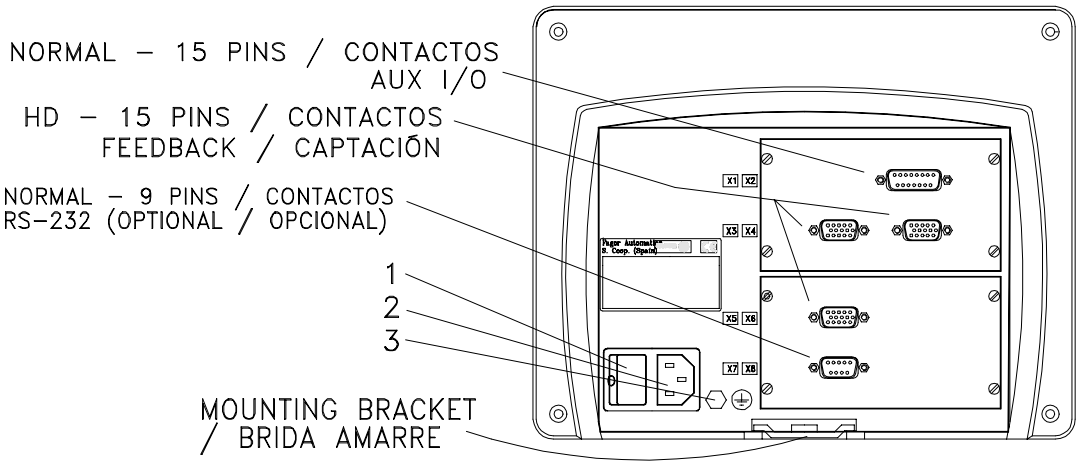
5.- Seal the cardboard box with packing tape or industrial staples.

1. UNIT DESCRIPTION

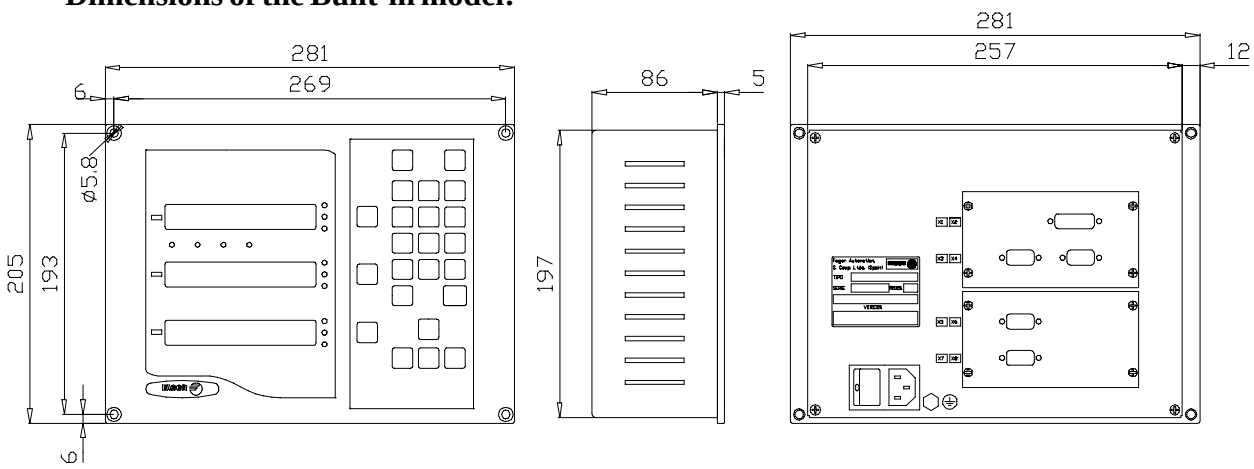
This DRO is designed for industrial environments, especially for machine tools and measuring machines.
It can display the position of one two or three axes of the machine and control up to four digital inputs and six digital outputs

1.1 FRONT PANEL (SEE OPERATION MANUAL)

1.2 REAR PANEL



Dimensions of the Built-in model:



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. Therefore, it is recommended to use the ON/OFF 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.

X2.- SUB-D type 15 pin female connector for input/output connection

X3.- SUB-D HD type 15-pin female connector for 1st axis feedback device (scale or encoder).

X4.- SUB-D HD type 15-pin female connector for 2nd axis feedback device (scale or encoder).

X5.- SUB-D HD type 15-pin female connector for 3rd axis feedback device (scale or encoder).

X7.- SUB-D type 9 pin male connector for the RS-232-C serial line connection.

WARNING

Do not handle the connectors while the unit is under power.
Before handling the connectors (mains, feedback, etc.) make sure that the unit is not under power.
It is NOT enough to turn the display off by using the 

key at the keyboard.

1.3 GENERAL TECHNICAL CHARACTERISTICS

Universal Power Supply between 100V AC and 240V AC +10% -15%

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

Power outages of up to 20 milliseconds.

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

The operating temperature inside the DRO enclosure must be between 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. CONNECTIONS

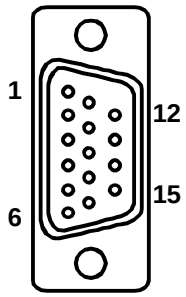
The connection for the RS-232 serial line (optional X7 connector) is not described in this manual; but in a supplement for it.

2.1 CONNECTION OF THE FEEDBACK SYSTEMS

The feedback systems (scales or encoders) are connected via SUB-D HD type 15-pin female connectors: **X3, X4** and **X5**.

Characteristics of feedback inputs: X3, X4 and X5:

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



Pin	Signal	Function
1	A	Feedback signals
2	/A*	
3	B	
4	/B*	
5	I0	Reference signal
6	/Io*	
7	Alarm	Feedback alarm
8	/Alarm*	
9	+5V	Power to feedback device
10	Not connected	Unused
11	0V	Power to feedback device
12	Not connected	Unused
13	Not connected	Unused
14	Not connected	Unused
15	Chassis	Shield

* Available only at the NV-301G model DRO

2.2 INPUTS / OUTPUTS (CONNECTOR X2)

2.2.1 CHARACTERISTICS OF THE I/O SIGNALS (X2)

Four general purpose opto-isolated inputs. The operating voltage for these inputs may be chosen between 5V and 24V. The +24V power supply voltage must be between 0 and 24V (±25%). The on/off threshold is around +2.4V.

Characteristics of the inputs at 24V :

- Maximum load current: 100mA
- Minimum voltage: 18Vdc
- Maximum voltage: 30Vdc

Characteristics of the inputs at 5V :

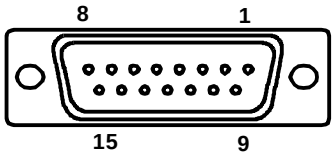
- Maximum load current: 100mA
- Minimum DC voltage: 3.75V
- Maximum DC voltage: 6.25V

Six outputs, opto-isolated with solid state relay with a normally open contact.
The main characteristics are:

- Maximum AC or DC voltage: 40V
- Maximum load current: 225mA
- Maximum internal resistance: 5ê
- Maximum peak current: 2.5A for 100ms at 25ºC
- Through current when open: ≤ 1µA
- Galvanic isolation voltage: 1500V for 1 minute
- Activation time: ≤ 3ms
- Deactivation time: ≤ 3ms

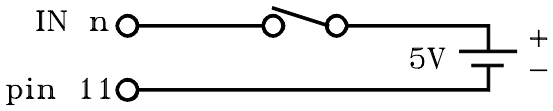
2.2 INPUT / OUTPUT CONNECTION (X2)

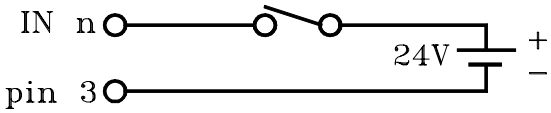
This DRO offers an additional SUB-D type 15-pin female connector "X2" to connect:



- 4 Inputs

They may be activated at 5V or at 24V.





- E1 to zero the diamond axis display.

- E2 and E3 to zero the vertical and cross axes respectively.
  These inputs must be activated one at a time and they must be kept activated for at least 50 ms in order to be acknowledged.

  When activating any of these signals, the display of the corresponding axis will be set to zero and any other zeroing signal will be ignored until the first one is deactivated.

  PAR20(4) determines whether input E2 sets the display of the vertical axis to 0 (if =0) or it is preset with the coordinate for end of machining (if =1).

- E4 to count the spark-out passes if PAR20(8)=1.

PAR21 determines whether the inputs are active high (1) or low (0). Each input has its own digit assigned to it in that parameter.

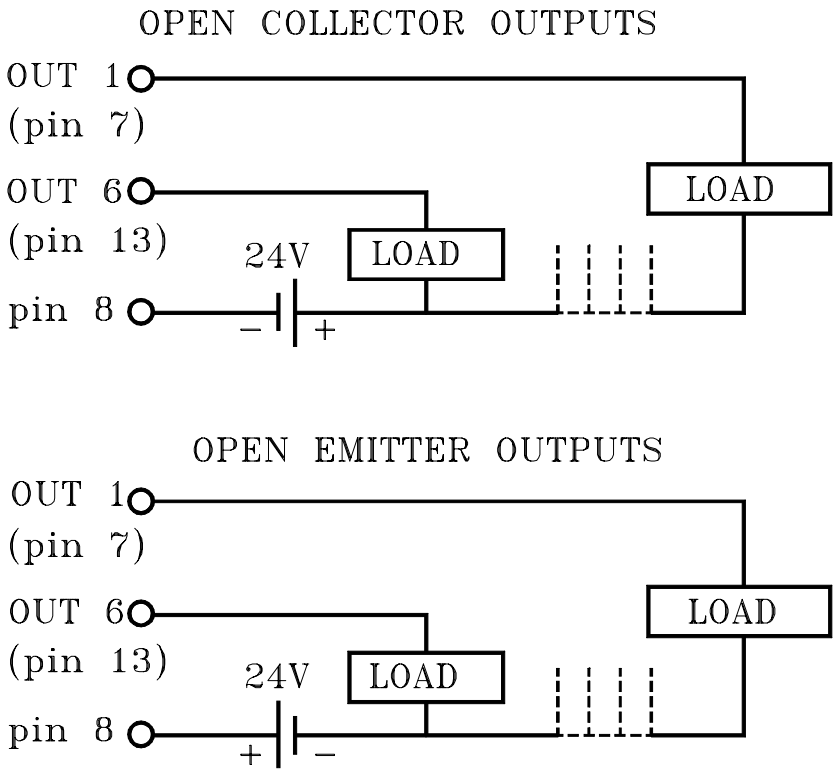
- 6 Outputs:

- S1 and S2 to indicate the beginning and end of the machining operation.
- S3 to indicate that the position to start the wheel dressing operation has been reached if PAR20(7)=1.
- S4 as end of spark-out signal if PAR20(8)=1
- S5 and S6 to control the least and most positive limits of the cross axis if PAR20(5)=1

PAR23 determines whether the outputs are active high (1) or low (0). Each output has its own digit assigned in that parameter.

Note .- If any of the outputs is going to be connected to an inductive device, a 1N4000 type diode must be placed in anti-parallel.

Pin	Signal	Pin	Signal
1	Input E1 (Set diamond axis to zero)	9	Input E2. Set vertical axis to zero or preset it with any value dependingon PAR20(4).
2	Input E3 (Set cross axis to zero)	10	Input E4 (count spark-out passes)
3	GND for 24V inputs	11	GND for 5V inputs
4	Not connected	12	Not connected
5	Output S5. At "-" limit of cross axis	13	Output S6. At "+" limit of cross axis
6	Output S3 (in wheel dressing position)	14	Output S4 (spark-out completed)
7	Output S1 (reached starting position for the finishing operation)	15	Output S2 (reached end of the finishing operation)
8	Contact common to all outputs		



2.2.3 POWER AND MACHINE CONNECTION

These DROs can be connected to an AC voltage anywhere between 100V AC and 264 V AC +10% -15% with a frequency between 45 Hz and 400 Hz without having to select it depending on the country where they are installed thanks to their universal power supply.

Always mount it vertically so its keyboard is within operator's reach and its digits are easily visible (at operator's eye level).
Do not connect or disconnect 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).

2.3 TURNING THE UNIT ON AND OFF

Turning the unit ON

The unit is turned on by actuating on the power switch of the rear panel
The DRO runs a self-test and 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 unit OFF

If you press ON / OFF 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 key again, on condition that the DRO is getting voltage (plugged in and with the switch on the rear panel on).

NOTES:

- Before powering the DRO down with the switch on the rear panel or disconnecting it from mains, it is a good idea to press the ON / OFF key in order to store the current position of the axes **permanently**.

- If the unit is powered down with its rear panel switch or there is a power outage without previously having pressed ON / OFF, **the DRO will keep the last position of the axes for at least 30 minutes.**

- The unit will display ERROR 2 when powered back up if the position reading was lost when turned off while the axes were moving or after the maximum accidental backup period has expired without having saved the current position by previously pressing ON / OFF .

2.4 GRINDER FUNCTIONS

This dro behaves as a 2-axis NC in open loop and sets the typical surface grinding sequence through its digital outputs.

The operator defines the cycle functions at the dro keyboard and the installer designs the auxiliary keyboard to control the machine. A typical operation managed by a PLC must consider the following items:

- Manual mode selector for JOG movements.
- In AUTOMATIC mode, cycle selector:
  . Vertical only machining.
  . Continuous cross axis movement.
  . Intermittent cross axis movement.
- Potentiometer to indicate ROUGHING/FINISHING pass depending on outputs S1 and S2.
- Control of the CROSS AXIS depending on outputs S5 and S6 with:
  . START and STOP push buttons.
  . Joy stick for continuous feed.
  . Potentiometer to indicate the feedrate in continuous mode.
  . Potentiometer to indicate the increment in intermittent mode.
- Control of the TABLE through external limit switches and push buttons.
- Interpret and count number of wheel dressing passes distinguishing between having and not having cross axis movement.
- Auxiliary devices for: lubrication, hydraulics, wheel holder, lubrication of the magnetized table, etc.

In order to achieve penetrations of the vertical axis of around 0.001mm to 0.01 mm, it is recommended to excite the vertical driver with two analog levels, fast and slow and adjust the depth with timers.

Once the position is reached, the driver is disabled in order to avoid drifting.

A dynamo type handwheel should also be installed. In manual mode, very slow movements of the vertical axis can be achieved and they are very useful to detect any backlash in the gear box for finishing operations outside the cycle.

EXAMPLE OF A PLC MANOUEVER

Status	S1	S2	S3	S4	S5	S6	PLC management
External START command							(The starting position is set in manual mode). If there is a batch of parts, the withdrawal coordinate must be the same as the one to begin the machining operations.
Begin ROUGHING							Infeed roughing passes. Usually with a timer and external potentiometer.
Begin FINISHING	ON						Infeed finishing passes. Usually with an internal timer and fixed pass.
End position reached		ON					Cancel feeds.
End of SPARK-OUT				ON			End grinding operation. Withdraw the table and take the wheel up to safety position.
Cross + limit reached						ON	Reverse cross movement towards negative limit.
Cross - limit reached					ON		Reverse cross movement towards positive limit.
Begin WHEEL DRESSING			ON				Begin wheel dressing operation withdrawing the table and moving the diamond back and forth..
Recover coordinate after wheel dressing.			OFF				Depending on the values set by PAR27 and PAR28, resume the grinding operations after the dressing operation.
STOP	OFF	OFF	OFF	OFF			When reaching the withdrawal position, all outputs are reset. It waits for a new START command.

- **Spark-out:**
  This function is only available if PAR20(8)=1 to set and count the number of spark-out passes after the final finishing position in the vertical axis has been reached (S2 active).
  These passes are counted through input E4 and when the last pass is completed, it activates the output signal S4.

- **Wheel dressing:**
  This operation may be performed either automatically or manually.
  The parameters involved in this operation are:
  - PAR7 of the vertical axis for combining or not the reading of the diamond axis with that of the vertical axis.
  - PAR20(7,6) To choose automatic or manual wheel dressing.
  - PAR27. If greater than "0", indicates the duration of the automatic wheel dressing signal S3, if PAR28=0.
  - PAR28 indicates the percentage of the amount dressed which the vertical axis must go down before deactivating the dressing signal.
    Refer to chapter 3 of this manual for further detail on these parameters.
  - As the initial position of the vertical axis to establish the machining depth between two dressing operations, the DRO assumes the current position of the vertical axis at the time when the value is entered or when presetting or zeroing the axis.
  - The dressing operation begins when as much material has been removed as the entered distance and finishes when:
    · A time period (set by parameter PAR27 in seconds) has expired.
    or
    · When recovering a percentage (set by parameter PAR28) of the position prior to dressing.

- **Hysteresis:**
  In order to prevent the output signals as well as the position display to flicker in short oscillatory motions, a hysteresis zone (PAR 25) may be set in such a way that the displayed position and the output signal state will remained stationary within until the axis position exceeds this zone.

- **Anticipation signal:**
  PAR26 compensates for possible overshooting in the vertical axis due to inertia in open-loop movements. To do this, an anticipation distance may be set to activate the signals before reaching the programmed position.

3. PARAMETER SETTING

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

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

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

. If it is a general parameter and there are more than one axis, the first axis display will show the parameter number and the second one its current value.

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

· With binary values. The value of each digit toggles between "0" and "1" when pressing its corresponding key from [1] to [8] where [1] corresponds to the rightmost digit and [8] to the leftmost one.

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

· Options, the value is changed by pressing [+/-] which will make the various options appear in a cyclic way.

To go into parameter editing:

- **While the unit is on and in normal display mode,** press [CLEAR] [ON / OFF] .

  The first axis display shows the word "**CodE**". Then key in: **060496**

  Then, select the axis affected by this parameter.

Once in regular display mode, parameter **PAR05** (scaling factor) may also be recalled by pressing CLEAR 0 inch 5 , as well as **PAR25** (hysteresis) by pressing CLEAR 2 5 so the work mode may be changed without having to go through all the parameters previous to the desired one.

To end editing a parameter, follow <u>one</u> of these steps:

. Press ENTER , to save the displayed value.

. Press CLEAR to cancel the change and recover the previous value or---

. Press **the other axis key** (if it is an axis parameter) to save the display value and go on to the editing it for the other axis selected.

To modify a parameter, press ENTER to go on to the next one or ↑ to return to the previous one. Then, select the axis affecting this parameter.

To quit the parameter editing mode:

Press CLEAR

To restore the default values for the installation parameters:

While displaying parameter **PAR00**, press: 0 inch 3 2 1

To go directly to a particular parameter without going through the previous ones, (once in parameter editing mode), press ↑ [parameter Nr.] ENTER.

3.1 PARAMETERS TO CONFIGURE AXIS COUNT AND DISPLAY

PARA-METER **FUNCTION**

PAR00 Feedback configuration, different for each axis. Binary type.

Digit

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

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

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

5 Feedback resolution units (0 = millimeters, 1= inches)

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

3 Differential feedback signals (**0 = No**, 1 = Yes)
The NV-300G model cannot be set to "1" (Yes).

2 Type of feedback signals (**0 = TTL**, 1 = 1 Vpp)
The NV-300G model cannot be set to "1" (Vpp).

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: from 0.1µm up to 1 mm. (0.000005" to 0.03937").
Default value: **5** (µm).

PAR02 TTL multiplying factor (subdivision). Independent for each axis.
Options: x4, x2, x1 and x0.5.

The selection of these values rotates by pressing 

The default value is: **x4** and it is the one used for FAGOR scales. When using encoders, it should be calculating according to the number of pulses of the encoder, leadscrew pitch and the desired resolution as per the formula:

$$\text{Encoder (lines/turn)} = \frac{\text{Leadscrew pitch (mm/turn)}}{\text{Resolution (mm/pulse)} \times F}$$

Where "xF" would be the multiplying factor to be applied.

PAR03 Internal multiplying factor when using distance-coded feedback devices and/or sinewave feedback signals (NV-301G) or external multiplying factor when using distance-coded feedback devices and TTL feedback 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.

PAR05 Scaling or shrink factor. Independent for each axis, numeric value within ±9,999.

A "0" value means that no factor is to be applied. It is applied onto the coordinates to be displayed after compensating for table sag. It is **not** applied when reading with respect to machine reference zero (led on).

The default value is: "**0**".

PAR06 Display the axis or not.. Independent for each axis:
Possible values: "0 = Yes" and "1=No". The default value is: "**0**".

It is possible to "turn off" the display of an axis which is not being used.

The selection of these values rotates by pressing 

When NOT installing a feedback device on the diamond or its axis is not to be displayed because it is coupled with the vertical axis, this parameter may be set to "1".

PAR07 Combine the reading of an axis. Independent for each axis.
Possible values: -4 a 4. **Default value: "0".**
Indicates the number of the axis to be combined; **0** means not to combine any other axis. 1 = first axis (diamond), 2=vertical axis, 3=Cross axis, 4=Not used. With the negative sign, the other axis' count will be subtracted.

The selection of these values rotate by pressing 

To enable automatic wheel dressing compensation, the vertical axis must be combined with the diamond axis.
Therefore, PAR07 of the vertical axis must be set to "1" or "-1" depending on the direction of the reading of the diamond axis.

The resolution of the axis to be combined will be considered the same as that of the axis resulting from the combination of the axes.

PAR08 Indicates whether the feedback alarms will be used or not.

Digit	
8, 7, 6	Not being used at this time. Must be set to "0".
5	The NV301G detects the amplitude of the feedback signals.
4	Feedback alarm contact active level (0=low, 1=high)
3	Detect the feedback alarm supplied by the transducer.
2	Detect software travel limits (PAR12 and PAR13).
1	Detect speed alarms.

Possible values 0 (alarm OFF) and "1" (alarms ON).

Default value: **0**

Refer also to the error codes in the appendix of this manual.

PAR09 Table sag compensation, per linear axis.
Numeric value within ±99.999 millimeters per meter.
Default value: **0**.

Notes:

- Even when selecting the display in inches, this value **MUST ALWAYS BE IN MILLIMETERS.**
- Remember that 1 inch = 25.4 mm

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

Numeric value in resolution units for each axis.
Default value: 0.

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

PAR12 To set the negative axis travel limit.
Possible values: between -99999.999 and 0.

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

When the axis exceeds this distance, the corresponding axis display starts blinking until it is moved back into the work zone.

PAR13 To set the positive axis travel limit.
Possible values: between 0 and 99999.999

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

When the axis exceeds this distance, the corresponding axis display starts blinking until it is moved back into the work zone.

PAR 14 To carry out the home search when the feedback device does NOT have reference marks "Io" (for example, FAGOR MKT scales), this parameter must be set to "1". **Default value = "0".**

PAR 16 To compensate for leadscrew backlash. It indicates the value in millimeters or inches, according to PAR00(5), to compensate for in each reversal of movement.

Notes:

- This parameter has no effect when using linear feedback devices (scales).
- On the vertical axis, the backlash does not affect the kinetics of the machine, but it is important to compensate for any play at typical worm gears.

3.2 GRINDING PARAMETERS

PAR20 Contains information on the operating modes. With its corresponding digits to "1" it means:

Digit

8 Indicates whether the spark-out signal is to be used or not.

7 Indicates whether the automatic wheel dressing signal is to be used or not.

6 Indicates whether the wheel dressing compensation will be manual or not.

5 Indicates whether the cross axis limits will be monitored or not.. If "0". It is assumed that the axis has limit switches for this purpose.

4 Indicates whether the axis reading is set to "0" (if=0) or the End-of-job is preset (if=1), instead, when activating the corresponding axis input.

3 Activate hysteresis and minimum coordinate on the cross axis

2 Activate hysteresis and minimum coordinate on the vertical axis

1 Activate hysteresis and minimum coordinate on the diamond axis

Default value: 0

Refer to the parameter configuration examples in the next section.

PAR21 Indicates whether the inputs are active high (1) or low (0). Only the first four digits to the right are used.

PAR23 Indicates whether the outputs are active high (1) or low (0). Only the first six digits to the right are used.

PAR21 Indicates the active level for the inputs. Only the first four digits are used. A "0" indicates that the input is active low (0V).

PAR23 Indicates the active level for the outputs. Only the first six digits are used. A "1" indicates that the output is active high (5V or 24V).

PAR25 Determines the hysteresis zone desired to avoid the flickering of the displayed coordinates and output signals. This value will be in mm or inches depending on whether the INCH LED is off or on.

PAR26 Contains the anticipation distance (up to 0.9999 mm or 0.03937 inch) before reaching the preset position. This value will be in mm or inches depending on whether the "INCH" LED is off or on. The axis will be considered to have reached the preset position when it is positioned at a distance smaller than PAR26 from it.

PAR27 If ">0", it indicates the time period the automatic dressing signal S3 is on (between 0.1 and 9.9 seconds).

PAR28 It indicates what percentage of the dressed amount must the vertical axis go down before deactivating the dressing signal when PAR27=0.

Note: If both PAR27 and PAR28 are given values, the value of PAR27 will be ignored and only that of PAR28 will be taken into account.

3.2.1 EXAMPLES OF PARAMETER SETTINGS

Configuration	Parameter	Function
Manual dressing without feedback. Cross axis limits not monitored. Neither automatic dressing nor spark-out.	Par06[1] = 1 Par20 =01000010 Par21 = 00001111 Par23 = 11111111 Par25 = 0.0050 Par26 = 0.0010 Par27 = 0 Par28 = 0	- Do not display diamond axis - Hysteresis on vertical, manual dressing - Inputs active high - Outputs active high - Hysteresis: 5 µm - Signal anticipation: 1 µm - Not used - Not used
Automatic dressing without feedback. No spark-out	Par06[1] = 1 Par20 =01110010 Par07(2) = 0 Par21 = 00001111 Par23 = 11011111 Par25 = 0.0050 Par26 = 0.0010 Par27 = 0.5 Par28 = 0	- Do not display diamond axis - Hysteresis on vertical, automatic dressing with manual compensation. Cross axis limit monitoring. - Inputs active high. - Outputs active high, except upper limit of cross axis. - Hysteresis: 5 µm - Signal anticipation: 1 µm - Duration of dressing signal: 500 ms - Not used
Automatic dressing with feedback	Par06[1] = 0 Par20 =10110010 Par07(2) = 1 or -1 Par21 = 00001111 Par23 = 11011111 Par25 = 0.0050 Par26 = 0.0010 Par27 = 0.0 Par28 = 75	- Display diamond axis - Hysteresis on vertical, spark-out, automatic dressing, cross axis limit monitoring. - Inputs active high. - Outputs active high, except upper limit of cross axis. - Hysteresis: 5 µm - Signal anticipation: 1 µm - Not used - Duration of dressing signal until going down 75% of dressed amount.

APPENDIX

ERROR CODES

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

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

After pressing 

to access the counting mode, check the parameters.

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

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

In either case, to clear the display, press 

.

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

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 an axis does not count, disconnect the feedback connectors one by one. If the DRO comes on, it indicates a fault in the feedback device. If the fault persists get in touch with Fagor Automation's Customer Services Department about it.

PARAMETER TABLE

	Diamond axis		Vertical axis		Cross axis	
Parameter	Default value	Current value	Default value	Current value	value	value
PAR00	0000_0000		0000_0000		0000_0000	
PAR01	0.00		0.00		0.00	
PAR02	4		4		4	
PAR03	1		1		1	
PAR05	0		0		0	
PAR06	0		0		0	
PAR07	0		0		0	
PAR08	0000_0000		0000_0000		0000_0000	
PAR09	0		0		0	
PAR10	0		0		0	
PAR12	-9999.999		-9999.999		-9999.999	
PAR13	9999.999		9999.999		9999.999	
PAR14	0		0		0	
PAR16	0		0		0	
PAR20	0000_0000		0000_0000		0000_0000	
PAR21	0000_0000		0000_0000		0000_0000	
PAR23	1111_1111		1111_1111		1111_1111	
PAR25	0		0		0	
PAR26	0.01		0.01		0.01	
PAR27	0.5		0.5		0.5	
PAR28	0		0		0	

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:

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

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

Preventive Inspection

If the 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 DRO

NV-300G
NV-301G

OPERATION MANUAL

Man: 9910 Soft: 1.xx

INDEX

INTRODUCTION

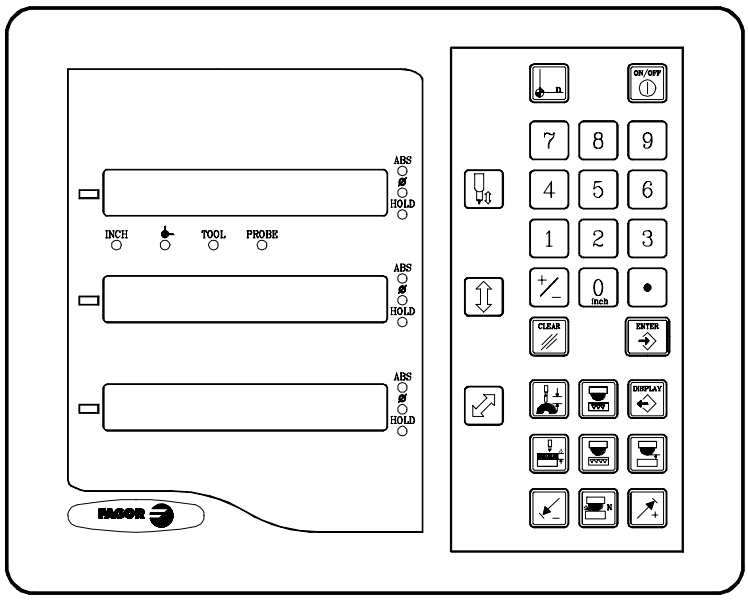
Throughout this manual, certain installation parameters are referred to which affect the description of certain DRO functions.

These parameters have been set by the installer and may be modified by the operator.

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

1. UNIT DESCRIPTION

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



It can display the position of one two or three axes of the machine and control up to four digital inputs and six digital outputs.

1.1 FRONT PANEL

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

INCH- This lamp stays on when working in inches and off when doing it in millimeters. To access it or quit it, press [0 inch]

This lamp stays on during machine reference search . To access it or quit it, press [n]

[⇕] [⇕] [⇗] Keys for selecting the diamond axis, the vertical axis and the cross axis respectively.

[n] Is used for carrying out the home (reference) search.

[ON / OFF] is used to turn the display off while still reading the position of the axes.

This key must be pressed before turning the unit off with the power switch on the back of this unit.

ALPHANUMERIC KEYPAD: Is used to enter the data desired for the various operations.

Is used to change the sign of the value being entered and to toggle between fine and coarse resolution.

Is used to validate an operation.

Is used to cancel or quit an operation already initiated.

Is used to indicate and compensate the amount of dressing of the wheel. It has no effect if the DRO controls the dressing operation with an auxiliary encoder.

Is used to enter the grinding depth between two consecutive dressing operations. It has no effect if the DRO does NOT control the wheel dressing.

Is used to enter the number of spark-out passes to be carried out. It has no effect if the DRO does NOT control the spark-out.

Is used to switch between the various display modes.

Is used to indicate the wheel withdrawal position after the grinding operation.

Is used to indicate the starting position of the finishing operation.

Is used to indicate the end-of-job position.

Are used to set the limits of the cross axis.

2. COORDINATE DISPLAY

2.1 DISPLAY MODES

Turning the unit ON

The unit is turned on by actuating on the power switch of the rear panel
The DRO runs a self-test and 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 unit OFF

If you press ON / OFF key the DRO switches 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 the rear panel of the same.

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

NOTES:

- Before powering the DRO down with the switch on the rear panel or disconnecting it from mains, it is a good idea to press the ON / OFF key in order to store the current position of the axes **permanently**.

- If the unit is powered down with its rear panel switch or there is a power outage without previously having pressed ON / OFF, **the DRO will keep the last position of the axes for at least 30 minutes.**

- The unit will display ERROR 2 when powered back up if the position reading was lost when turned off while the axes were moving or after the maximum accidental backup period has expired without having saved the current position by previously pressing ON / OFF .

Conversion mm into inches

These DROs let the position of the axes be displayed in millimeters or inches by pressing 0 inch key depending on whether the **INCH** led is off or on respectively.

Fine / coarse resolution

These DROs allow the last decimal digit to be switched off (coarse resolution) for cases in which fine resolution is excessive, simply by pressing +/- key.

2.2 POSITION OF THE AXES

This DRO offers the following display modes which can be accessed by pressing 

.

The three axis displays will show respectively:

1. Normal display of the current position of the axes.

2. . The current roughing (Rough) or finishing stage (Fine). **(ROUGH...Er)**
   . End-of-job position (E).
   . Current wheel position (r).

3. . The current roughing (Rough) or finishing stage (Fine). **(FINE...Ed)**
   . End-of-job position (E).
   . Distance (d) to the End position.

4. . The current roughing (Rough) or finishing stage (Fine). **(FINE...dr)**
   . Distance (d) to the End position.
   . Current wheel position (r).

Once the End-of-job position has been reached, if the DRO has been set to control the spark-out passes, display modes 2, 3 and 4 show: **(Nxx...Er)**
(Nxx...Ed)
(Nxx...dr)

Where **(Nxx)** indicates the number of spark-out passes left.

The hysteresis avoids the continuous blinking of the digits of the displays due to small oscillations of the axes.

2.3 READING REFERRED TO MACHINE REFERENCE ZERO

A DRO displays the present coordinate of one or several axes.

Coordinate means the distance from one point or position with respect to another chosen as reference.

In **reference zero** ( ), when led is on, the distance from the present position of the axis to home (**Io**) chosen in the feedback system (scale or encoder) is displayed. To access this mode use key.

2.3.1 MACHINE REFERENCE SELECTION AND SEARCH

Though it is not absolutely necessary for a large number of applications we recommend fixing a reference point (home) for each axis using the reference marks (Io) of its feedback system, whether this is a scale or an encoder in order to be able to save the coordinates with respect to that zero and recover them after having disconnected the equipment or for any other reason.

Standard FAGOR scales have a fixed reference mark (Io) every 50 mm along their travel.

FAGOR also offers scales with a coded Io every 20 mm or every 100 mm (depending on the model) with which all you have to do is move the axis at most 20 mm or 100 mm from the present position in order to "find" the exact position of the axis with respect to home.

When this mode is selected, the DRO waits to receive this pulse (Io) to re-establish all its previous coordinates.

For this reason when fixed Io (not coded) scales are used, one first has to choose an approximate reference zone, for example about half way along the axis travel, take the axis up to said zone and carry out the search for the Io ( ) reference mark of the scale (or encoder).

After said (Io) mark has been "found", following the steps described below, this axis zone is marked with a pen or sticker in order to go back to this in later searches, recommended after having disconnected (not just turning off the display by pressing ON/OFF)

These DROs keep the coordinates of each axis with respect to Machine Reference Zero in their internal memory for 10 years even after cutting off their mains power supply, for example, by means of the switch on the rear panel. This means that when it is necessary to reference the axes again, when the Io (home) mark is "found" these values are recovered.

The home search sequence is as follows:

- Move the axis to the approximate reference zone (roughly).
  <u>This step is only for fixed Io scales (not distance coded)</u>
- Put the DRO in home mode by pressing the  to turn the  led on.
- Select the axis to be referenced by pressing its key ( for example) Zeros to the left of the axis display will appear.
- Move the axis until the Io reference pulse is detected, that is, when the zeros on the left hand side of the display for the axis being referenced disappear.

  When the reference pulse is received, the DRO presets this point with the value assigned to that axis by installation parameter. This value is (factory set) default “0”. At the same time it recovers the relative coordinates from this previously set zero point .
- Press  again to switch off the  led and thus quit the home mode.

Bear in mind that in reference mode, no other operation besides home searching and axis position display are possible.

2.3.2 HOME PRESET FOR FEEDBACK WITHOUT REFERENCE MARKS

When using feedback devices not having reference marks (FAGOR MKT scales, for example) and the DRO has been set accordingly, it is possible to preset a value for Machine Reference Zero (home) in that mode ( LED on). To do this:

- Select the axis to be homed by pressing its key ( for example).
- The DRO blinks the value set by the manufacturer. If this value is the desired one, just press  . To set it to zero, instead, press   (for the vertical axis, for example).

3. OPERATION MODES

Before starting the job, the following values must be set:

- The limit switches for the cross axis (optional).
- The starting position for the machining operation on the vertical axis.
- The starting position for the finishing operation on the vertical axis.
- The end position for the finishing operation (end-of-job, usually zero).
- The wheel withdrawal position on the vertical axis.
- The number of spark-out passes (optional).
- The machining depth between two consecutive dressings (optional).
- The dressing compensation (optional).

In Machine Reference Mode, the machining signals are canceled.

3.1 CROSS LIMITS PRESETTING

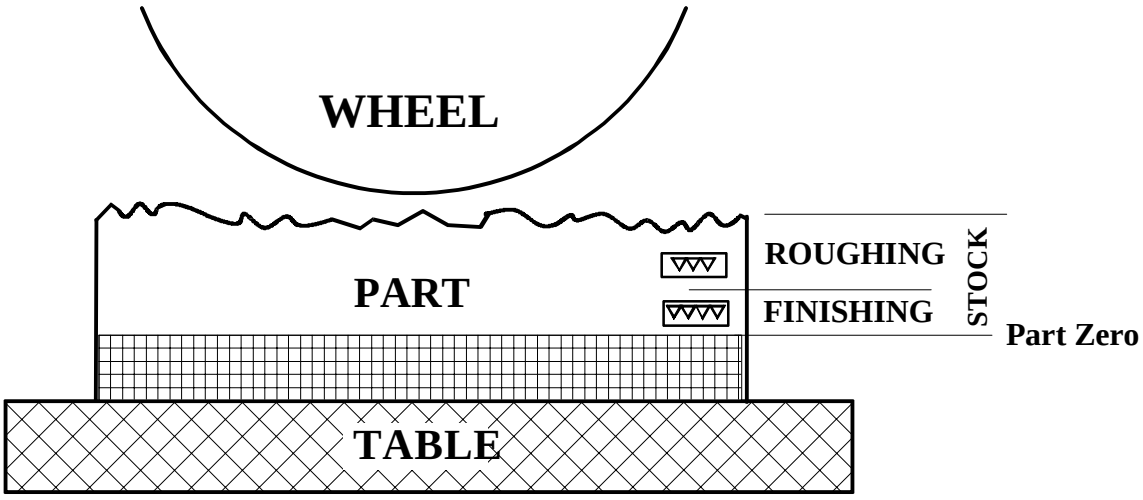
The cross limits may be preset in two ways:

-By pressing  , keying its value and then pressing either  or  for the most negative and most positive limit respectively.

Or also:

-Taking the cross axis to the limit position and pressing either  or  for the most negative and most positive limit respectively.

NOTE: These operations cannot be carried out if the DRO is set NOT to control (or monitor, rather) the limits of the cross axis.



3.2 STARTING POSITION FOR THE GRINDING OPERATION

This is the position where the roughing operation starts.

To set it, move the vertical axis manually until touching the top surface of the part. Once touched, the amount of stock to be removed may be preset.

To do that, press [⇕] key in the position where the grinding operation begins and press [ENTER] to validate the data.

3.3 STARTING POSITION FOR THE FINISHING OPERATION

This position indicates the end of the roughing operation and the beginning of the finishing operation.

To set this position: Press [ ] [beginning of the finishing operation] [ENTER] .

3.4 END POSITION

Indicates the end-of-job position.

To set this position: Press [ ] [end position (0)] [ENTER] .

3.5 WHEEL WITHDRAWAL POSITION

This position is the one the wheel goes back to when the part is fully machined.

To set this position: Press  [position] 

.

3.6 DISTANCE BETWEEN DRESSINGS

This function is available if the DRO has been set for **automatic wheel dressing**.
It is used to indicate when the wheel is to be dressed automatically.
To enter the distance between two consecutive dressing operations:

 [distance] 

.

- If "0" is preset, this operation is not carried out.

3.7 SPARK-OUT

This function is available is the DRO has been set for it. It is possible to preset the number of spark-out passes to be carried out when the vertical axis reaches the position preset as end-of-job.

To do this: Press:  [number of passes] 

When the vertical axis reaches the end position, by pressing 

, the DRO shows the number of spark-out passes left (e.g. N10) and it counts down every time it runs a pass.

NOTE: If "0" is preset on the table surface, the positions preset as beginning of the machining operation, beginning of the finishing operation, end-of-job and the wheel withdrawal position are referred to that origin.

3.8 WHEEL DRESSING COMPENSATION

When having a feedback device mounted onto the diamond, it is possible to directly compensate the dressed amount by adding the reading of the axes on the vertical axis.

When not having a feedback device on the diamond, the dressed amount can be compensated for manually.
To enter the amount of compensation:

Press  [compensation value, with sign] 

.

3.8.1 MANUAL WHEEL DRESSING

In manual dressing, after moving the auxiliary lever and pressing  , the DRo shows the compensation value previously set, press  to apply this value or key in a new one and press  , the value will be added to or subtracted from the position of the vertical axis depending on the sign.

To clear the dressing compensation value, press  

This keystroke sequence:

- Deletes the dressing value and the position value.
- Counts down all the dressings carried out from the last preset.

This can also be cleared when presetting or setting the vertical axis to zero.

3.8.2 AUTOMATIC DRESSING WITHOUT AUTOMATIC COMPENSATION

In automatic wheel dressing without automatic compensation, every time an automatic dressing operation is carried out caused by an output of the DRO, the value of the compensation will be automatically added to or subtracted from the reading of the vertical axis.

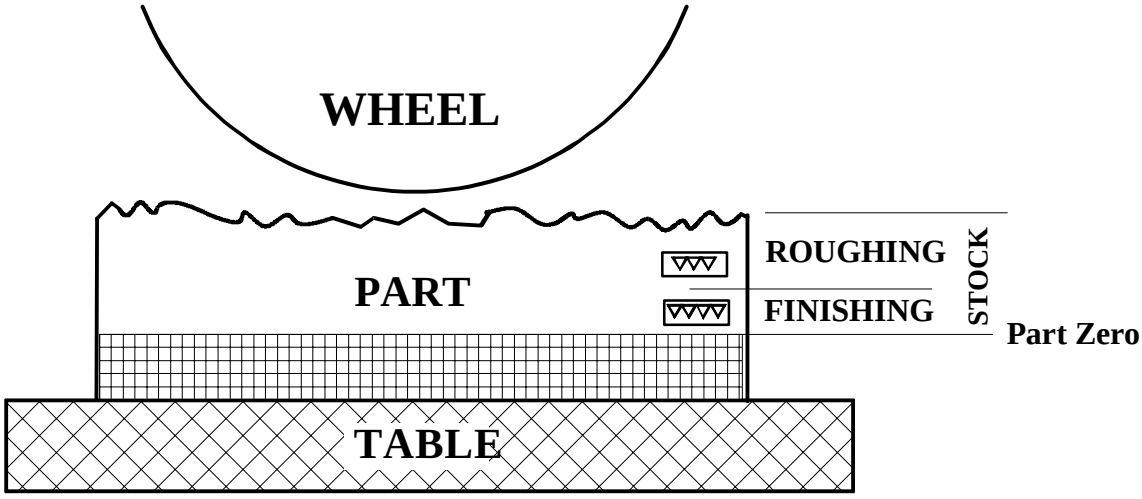
This feature is **ONLY** available if the DRO is set for **automatic wheel dressing without automatic compensation,** PAR20(7)=1, PAR07=0 y for **manual wheel dressing**, PAR20(6)=1

3.9 SCALING FACTOR

With this DRO, it is possible to apply a scaling factor between ±9.999 by simply keying in (for the cross axis, for example):     [factor] 

The DRO will then show the axis position resulting from multiplying its real position by the 'value' of the scaling factor while not in "machine reference mode".

3.10. GRINDING EXAMPLE



Sequence	Operation
	Move the vertical axis until touching the top of the part with the wheel. When working with a batch, take into account the possible dispersion and consider it as the highest one.
... ENTER	Enter the amount stock to be ground. When working with a batch, this operation is only carried out on the first part.
... ENTER	Enter the finishing stock..
... ENTER	Enter the "end-of-job" position, in this example: zero.
... ENTER	Enter the wheel withdrawal position. When working with a batch, it must be the same as the residual stock.
... ENTER	Enter the machining depth between consecutive dressingss.
... ENTER	Enter the number of spark-out passes.
	Move the cross axis to the most negative position on the part (wheel forth).
	Indicate that it is the lower limit.
	Move the cross axis to the most positive position of the part (wheel back).
	Indicate that it is the upper limit.
	Press the start button at the machine (not at the dro) to start first roughing operation.

APPENDIX

ERROR CODES

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

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

After pressing 

to access the counting mode, check the parameters.

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

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

In either case, to clear the display, press 

.

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

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 an axis does not count, disconnect the feedback connectors one by one. If the DRO comes on, it indicates a fault in the feedback device. If the fault persists get in touch with Fagor Automation's Customer Services Department about it.

MAINTENANCE

Cleaning:

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

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

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

Preventive Inspection

If the 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.

- QUICK REFERENCE - NV-300G / NV-301G - *(REF: 9812-E)*

Display on / off

MM/Inches

Fine / Coarse resolution

Scaling factor **[Value]**

Machine Reference Zero mode

Machine Reference search (vert.) **move axis**

Cancel

Axis reading to zero (vertical axis)

Limits setting **- Move axis to "+" limit**

- Move axis to "-" limit

Stock preset **[Value]**

Finishing stock preset **[Value]**

End of job preset **[Value]**

Wheel withdrawal preset **[Value]**

Depth between dressings **[Value]**

Spark-out passes **[Nr of passes]**

Manual dressing compensation **[Value]**

(This value is added to or subracted from the vertical axis count)

Display modes for vertical axis:

1. Standard display of current position of all axes.

2. . Current stage: roughing (**Rough**) or finishing (Fine). ..... **(ROUGH...Er)**
   . End position (**E**).
   . Current wheel position (**r**).

3. . Current stage: roughing (Rough) or finishing (**Fine**). ..... **(FINE...Ed)**
   . End position (**E**).
   . Distance (**d**) left to the end position.

4. . Current stage: roughing (Rough) or finishing (**Fine**). ..... **FINE...dr)**
   . Distance (**d**) left to the end position.
   . Current wheel position (**r**).

When reaching the end position, modes 2, 3 and 4 would show: **(Nxx...Er), (Nxx...Ed)** or **(Nxx...dr)** where (**Nxx**) means Number of spark-out passes left.

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
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Error 31	Internal malfunction (Service Dept.)
Error 32	Internal malfunction (Service Dept.)
Error 99	Internal malfunction (Service Dept.)
. . . . . .	Feedback alarm supplied by the feedback device (scale, encoder, etc).
l.4.3.6.5.7.2.5	Feedback speed too high.
EEEEEEEE	Maximum position reading or speed exceeded when searching Home

Fagor Automation S. Coop. (Spain)