FAGOR DRO

NV-300E
NV-301E

INSTALLATION MANUAL

Man: 9910 Soft: 2.xx

ADDENDUM «010528» for the following version-9910 manuals:

NV-xx	**code: 14460000**
NV-xxx-M	**code: 14460001**
NV-xxx-E	**code: 14460003**

1. An anti-bouncing control for the probe signal.
   The probe signal must stay stable, inactive, for at least 100 milliseconds in order to accept another probe pulse.

2. A probe operation error has been corrected.
   When the probe is active (it has touched a point), if a value was preset, this preset would be applied to the exact point where the probe was activated even if the axis was at another position at the time of the preset.

3. The resolution parameter for a rotary axis PAR 01 may have any value between 0.0001 and 1.0000.
   This allows reading the position of rotary axes having a mechanical reduction or multiplication device providing an unusual number of pulses per revolution (360º). For example: 1200, 1250, 3000, 3200, 9600, etc.

   In general, any resolution value (360º / Nr of pulses) that may be given with 4 decimals.

4. When pressing the **[1]** key, the display of rotary axes toggles between **degrees** and **degrees-minutes-seconds**.

5. Improved bolt-hole drilling cycle.
   Now, to access the cycle, it is no longer necessary to press [ENTER] after the bolt-hole selecting key..
   While executing, press ENTER to go to the next hole. If pressed in the last hole, it will roll on to the first hole so as for tapping the holes just drilled, etc. Press [CLEAR] to exit the cycle.
   The data are stored in such a way that the next time the bolt-hole cycle is accessed, it will offer by default the data of the cycle previously executed. The data is lost when the unit is turned off because they are in RAM memory.

6. A new parameter is now available to limit the access to certain characteristics of the dro.

   PAR 65
   Bit 1 -> Allow fine/coarse resolution key
   Bit 2 -> Allow [HOLD] key
   Bit 3 -> Allow bolt-hole key
   Bit 4 -> Allow [stand-by] key. S1-S6 outputs
   Bit 5 -> Allow direct access to PAR05
   Bit 6 -> Allow tool radius compensation keys
   Bit 7-> Allow selecting an electrode diameter
   Bit 8-> Allow presetting the electrode length

   By default, they will all be set to 1, thus allowing all the options. The machine manufacturer may limit the user's access according to his criteria.

7. A new feature to control maximums and minimums is now available.

   When the DRO is set as NV10 or NV11, the [7] key will be used to switch between Min, Max and Normal display.

   Min. mode: It displays the minimum position reached by the axis.

ADDENDUM "021001" FOR MANUAL: ***ADENDA "021001" PARA MANUAL:***		**MANV-10/20, CODE: 14460000 VERSION: 9910** **MANV-300M, CODE: 14460001 VERSION: 9910** **MANV-300E, CODE: 14460003 VERSION: 9910**
FAGOR dro models: ***Visualizadores FAGOR:***	**NV-10/20** ***NV-300M*** ***NV-300E***	**New software version: 2.4** ***Nueva versión Software: 2.4***

ENGLISH

NEW FEATURES

1.1 The DRO model NV-E can now work while its displays are off.

Pressing the [ON/OFF] key turns the displays off and does not display the position, but it keeps working as well as the outputs that control the electrode penetration levels. Pressing [ON/OFF] again, the DRO turns the displays back on. This feature is activated by setting PAR11 bit 5 = 1

1.2 Feature to make it easier to enter EDM levels.

In order to make data entry easier and error free, the following sequence has been implemented.

Pn [number] → to edit the coordinate of the desired penetration step

END

This means that all the penetration coordinates from the one indicated by [number] (this number included), will be set to the END value of the EDM cycle.

1.3 Feature to be able to work with the DRO without having access to its keyboard.

For when the DRO is out of the operator's reach or inside a protection enclosure.

On power-up, the DRO stays displaying FAGOR DRO waiting for the [CLEAR] key to be pressed in order to start working.

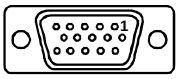
If "PAR11 bit 4 = 1", while the DRO is displaying FAGOR DRO on power-up, the DRO may be set ready to work by either pressing the [CLEAR] key or applying a leading edge (up flank) at one of the inputs used to set the axis to zero.

ERRORS IN MANUAL REF: 9910

Installation Manual:

· Pages 10 and 12:
They indicate that the mains voltage may range between 100v AC and 240v AC **+10%,-15%**. The actual range is between 100v AC and 240v AC **±10%.**

· Page 20 → The [CLEAR] is not correct. It should be: 

· Page 11→ The figure for the 15-pin SUB-D HD connector is wrong. The right one is: 

· Page 8 → It indicates that a key is used to display **half** the real count of the axis instead of **double** the real count.

Operating Manual:

· Page 3 → It indicates that a key is used to display **half** the real count of the axis instead of **double** the real count.

· Page 23 → The [CLEAR] is not correct. It should be: 

INDEX

INTRODUCTION

Attention:

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-300E / NV-301E

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 manipulate the inside of the unit

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

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

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

Use proper Mains AC power cables

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

Avoid electrical overloads

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

Ground connection

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

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

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

Ambient conditions

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

Do not work in explosive environments

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

Working environment

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

Install the unit in the right place

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

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

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

Safety symbols

Symbols which may appear on the manual

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

Symbols that may be carried on the product

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

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

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

WARRANTY TERMS

WARRANTY

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

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

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

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

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

EXCLUDING CLAUSES

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

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

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

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

SERVICE CONTRACTS

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

MATERIAL RETURNING TERMS

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

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

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

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

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

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

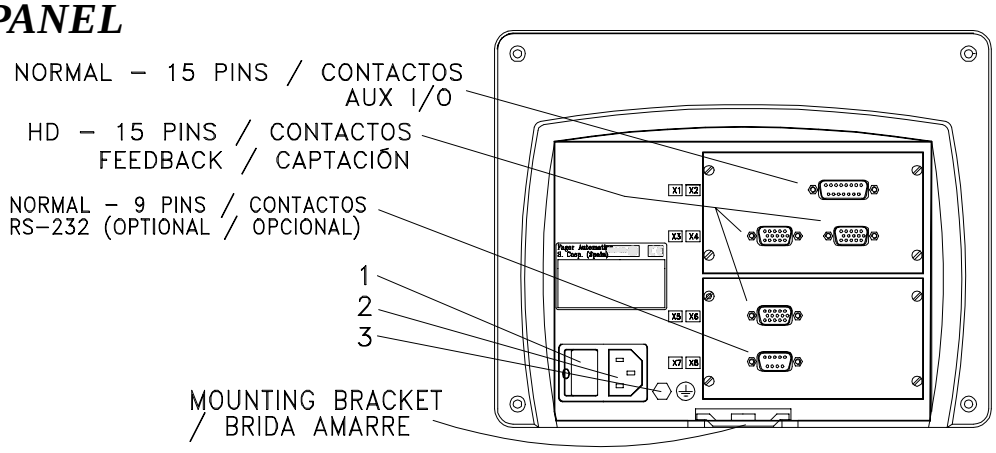
1. UNIT DESCRIPTION

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

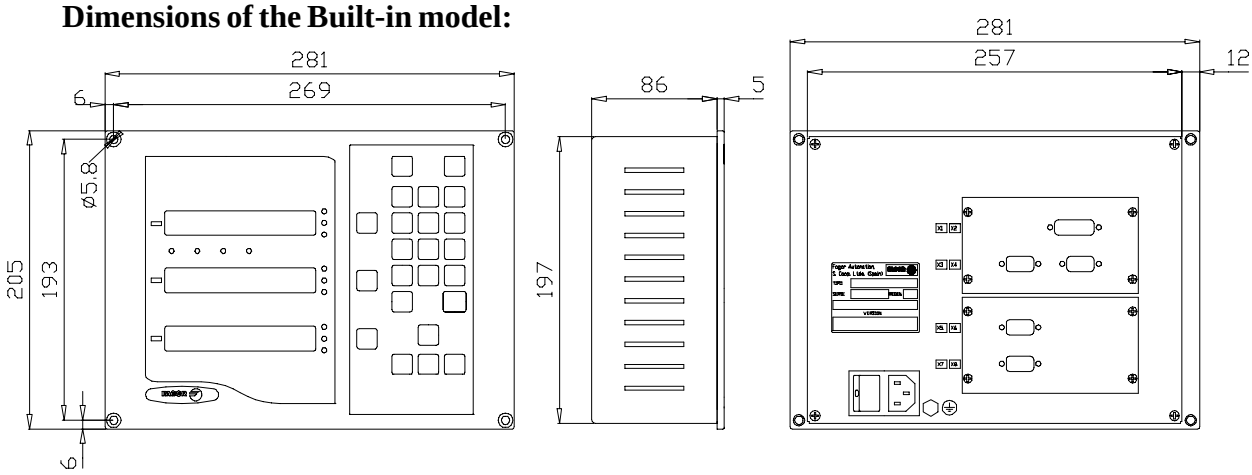
It can display the position of one two or three axes of the machine and control up to four digital inputs and six digital outputs

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 ON/OFF 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 between 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

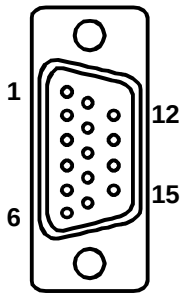
The connection for the RS-232 serial line (optional X7 connector) is not described in this manual; but in a supplement for it.

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:

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



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

* Available only at the NV-301E model DRO

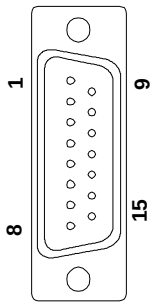
2.2 INPUT / OUTPUT CONNECTION (X2)

This DRO offers an additional SUB-D type 15-pin female connector "X2" to connect up to four digital inputs and six digital outputs.

Characteristics of the signals at connector "X2":

Four 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.

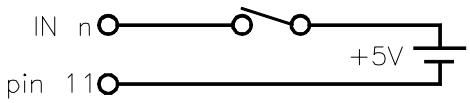
It also has four digital inputs, which can be activated at 5 V or 24 V. E1 to E3 can be used for zeroing the axes (E1 for X, E2 for Y and E3 for Z) and E4 as the Emergency input
ng When used as Emergency Input (E4). If activate, the output signals will become inactive. They can also be used to reset the reading of the axes (E1 for the X axis, E2 for the Y axis, E3 for the Z axis).



Pin	Signal	Pin	Signal
1	Input 1 (zero X)	9	Input 2 (zero Y)
2	Input 3 (zero Z)	10	Input 4 (Emergency)
3	GND for 24V inputs	11	GND for 5V inputs
4	Not connected	12	Not connected
5	Output 5 (P4/UP2 or BCD STROBE)	13	Output 6 (End)
6	Output 3 (P2 or BCD digit 3)	14	Output 4 (P3/UP1 or BCD digit 4)
7	Output 1 (home or BCD digit 1)	15	Output 2 (P1 or BCD digit 2)
8	Contact common to all outputs		

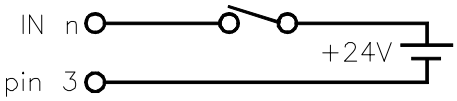
Characteristics of the inputs at 5V :

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



Characteristics of the inputs at 24V :

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

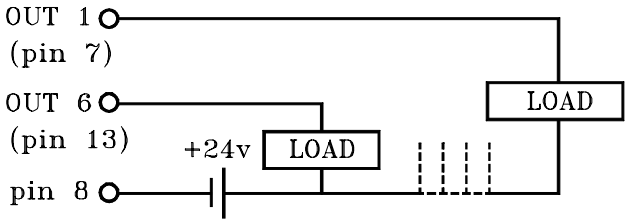


Six outputs, opto-isolated with solid state relay with a normally open contact.

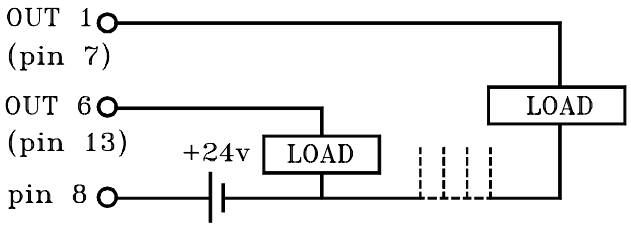
The main characteristics are:

- Maximum AC or DC voltage:	48V
- Maximum load current:	150mA
- Maximum internal resistance:	24ê
- Maximum peak current:	500mA for 100ms at 25ºC
- Through current when open:	≤ 1µA
- Leak current (Ileak):	200nA (Vload =100)
- Galvanic isolation voltage:	3750V for 1 minute
- Activation time:	≤ 3ms
- Deactivation time:	≤ 3ms

Open collector output connection:



Open emitter output connection:



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.

2.2.1 USAGE OF OUTPUT SIGNALS

The EDM process can control up to six or eleven depth levels depending on whether the discrete mode is selected (if PAR20(7)=0, which activates a digital relay output) or the BCD mode is selected (with four BCD outputs plus a strobe signal if PAR20(7)=1) respectively depending on the position reached.

If PAR20(7)=0, each EDM level may be independently associated with each one of the display axis. If PAR20(7)=1, The 11 EDM levels (Home, End and 9 intermediate) can only be preset for the Z axis.

If the machine does not control all the EDM levels, the unused ones can be cancelled as to not being able to change its position or activate its corresponding output.

During the EDM process, the signals may be left inactive in order to replace or calibrate the electrode.

- **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.

- **Cleaning cycle:**
  If PAR20(6)=0, two of the outputs may be used to control the cleaning cycle for the electrode. To do this, just set two distances: the first one called UP1 (PAR3) which will control output signal S4 and the other one UP2 (PAR4) which will control output signal S5.
  When the DRO detects a direction change on the electrode axis and once the set distance is reached (measured from the END coordinate) it will activate the corresponding signal.

Using discrete signals. PAR20(7)=0:

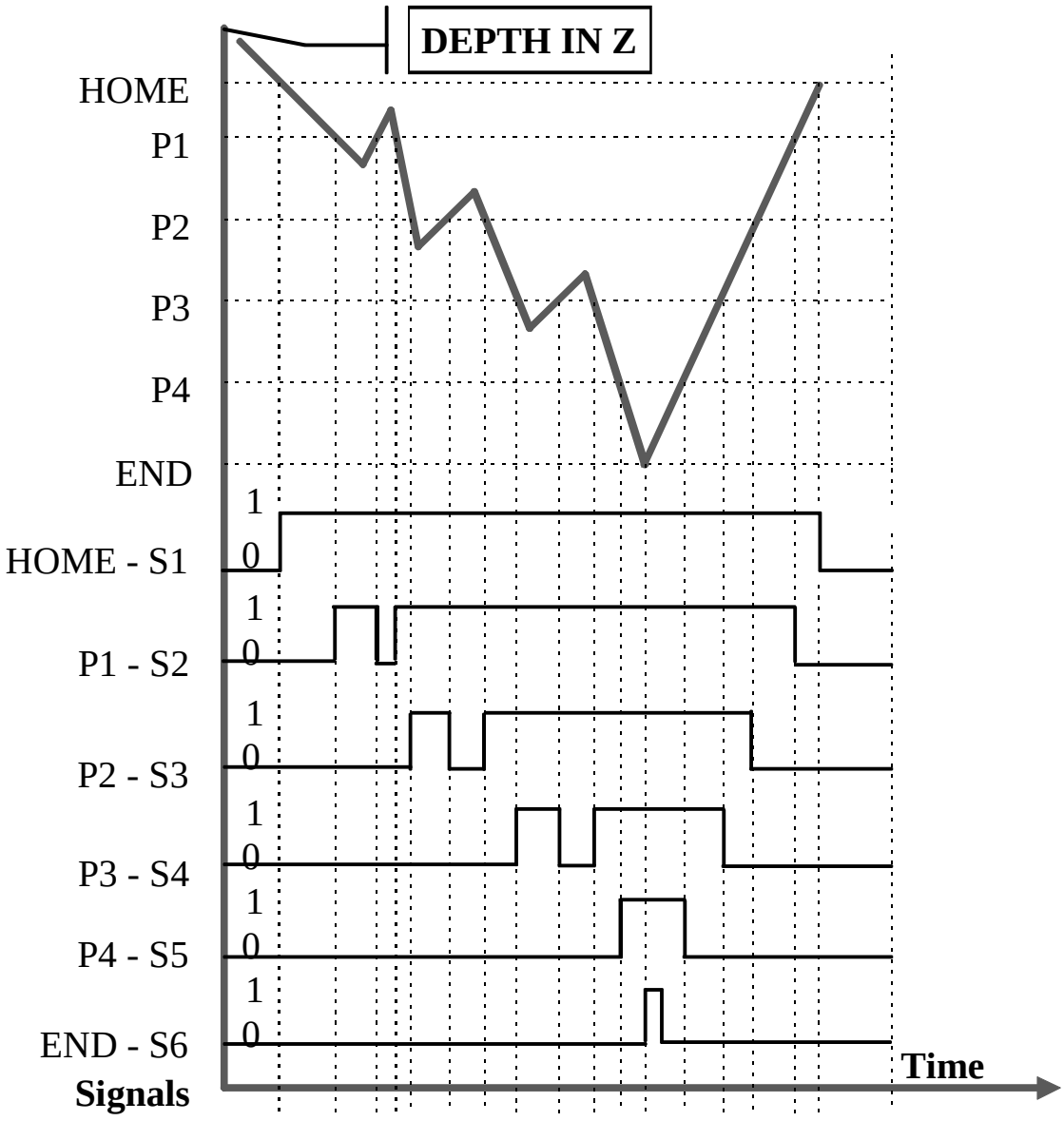
The diagram below shows the states of the six outputs depending on the depth along Z.

In this mode, up to 4 intermediate levels may be preset (from P1 to P4 between HOME and END) by means of the [Pn↑] key.

Important notes:

- **Signals S1 through S6 indicate the level currently reached.**
- **The unused levels MUST BE PRESET with the same value as the "END" coordinate.**
- **If PAR20(5)=1, the outputs are maintained until reaching HOME.**

With PAR20(5)=0



Using BCD output signals:

The diagram below shows the states of the six outputs depending on the depth along Z when using them in BCD format (Binary Coded Decimal) by setting PAR20(7) to "1".

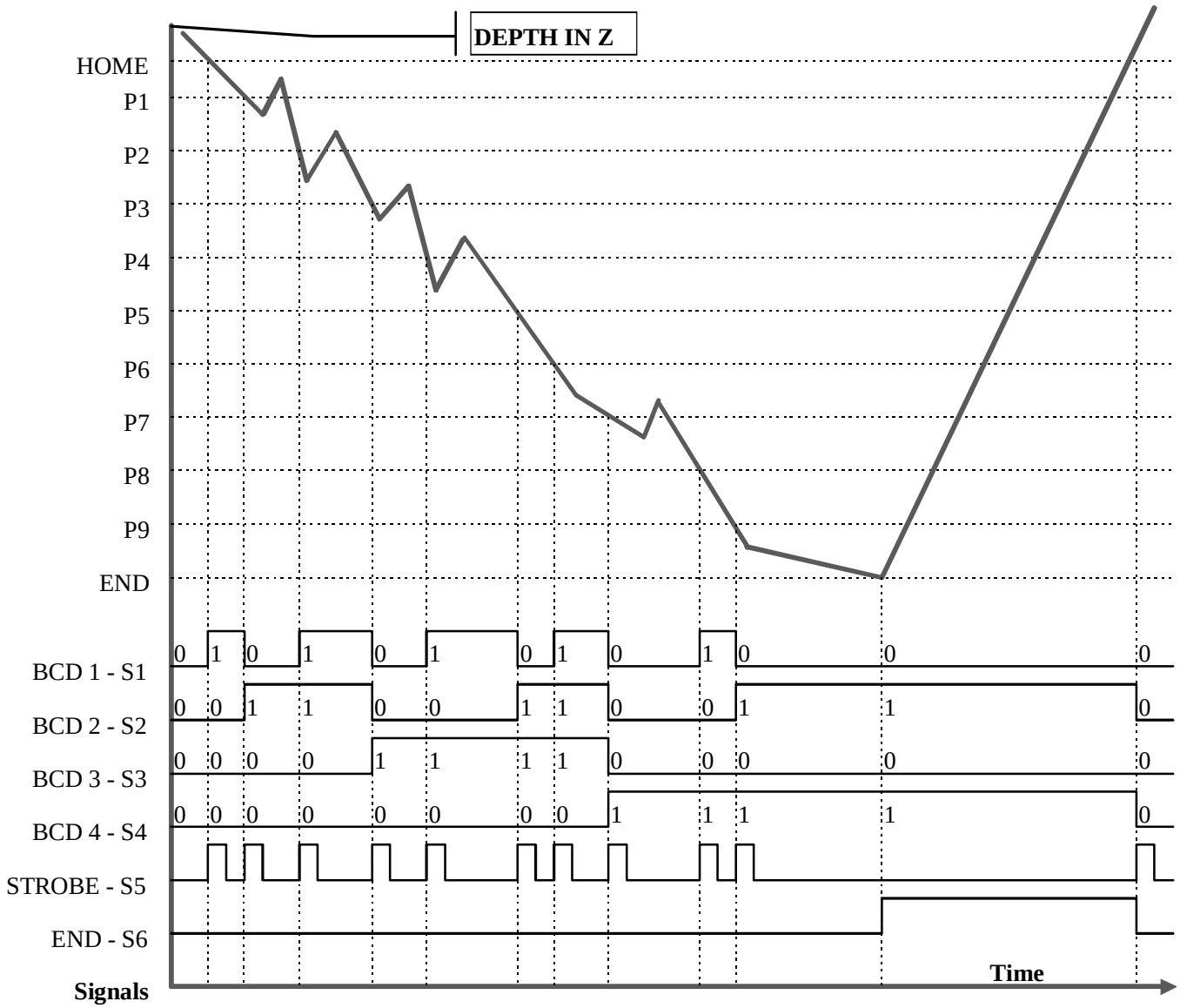
The duration of the STROBE signal is set between 0.1 and 9.9 seconds by means of parameter PAR27.

In this mode, up to 9 intermediate levels may be preset (from P1 to P9 between HOME and END) by means of the [Pn] key.

Important notes:

- The BCD signals indicate the NEXT level to be reached.

- The unused levels MUST BE PRESET with the same value as the "END" coordinate.



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).

2.4 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 on the X axis display 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 accidental backup period has expired without having saved the current position by previously pressing ON OFF .

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 **X** display will show the parameter number and the **Y** its current value; if there is only one axis, its number will appear on the **X** display and, after pressing [X], its 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 edit a parameter,
While the DRO display is on and in counting mode, press [C] [ON/OFF].

The X axis display shows the word "**COdE**". Then key in: **060496**

Go to the parameter to be modified and, then, select the axis affected by this parameter.

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

Once in regular display mode, parameter **PAR05** (scaling factor) may also be recalled by pressing [C] [0 inch] [5], as well as **PAR25** (hysteresis) by pressing [C] [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 [C] to cancel the change and recover the previous value or---

. Press **the other axis key** (if it affects the axes) 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 [1/2] to return to the previous one. Then, select the axis affecting this parameter.

To quit the parameter editing mode:

Press [C]

To recover the factory set factory settings for the installation parameters:

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

3.1 PARAMETERS TO CONFIGURE AXIS COUNT AND DISPLAY

The digits of digital parameters refer to the digits on the axis displays so digit "1" corresponds to the rightmost digit and "8" to the leftmost digit.

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

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 = Fix**, 1 = Coded)

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

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

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

2 Type of feedback signals (**0 = TTL**, 1 = 1 Vpp)
The NV-300E 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 1mm (0.000005" to 0.03937")
Factory setting: **5** (µm).

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

The selection of these values rotates by pressing [+/-]

The factory setting is: **x4** and it is the one used for FAGOR 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:

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

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

PAR03 Internal multiplying factor when using semi-absolute feedback devices (coded Io) and sinewave feedback signals (NV-301E) or external multiplying factor when using semi-absolute feedback devices (coded Io) and sinewave feedback signals. Independent for each axis.
Options: 1, 5, 10, 20, 25, 50. **Factory setting: 1**

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

PAR04 Radius or Diameter. Independent for each axis.
Possible values: 0 (radius), 1 (diameter) and 2 (commutated). The first case is regular count, the second one is double count and the third one is toggle between radius and diameter by pressing [1/2]. The selection of these values rotates by pressing [+/-]

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 cero (led on) or onto the tool when applying tool compensation (**TOOL** led on).

The factory setting is: "**0**".

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

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

The selection of these values rotates by pressing +/-

The factory setting is: "**0**".

PAR07 Combine the reading of an axis. Independent for each axis.
Possible values: -4 a 4. Factory setting: "**0**".
Indicates the number of the axis to be combined; **0** means not to combine any other axis, 1 = X axis, 2 = Y, 3 = Z, 4 = W. With the negative sign, the other axis' count will be subtracted. With the negative sign, the other axis' count will be subtracted.

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

The selection of these values rotate by pressing +/-

PAR08 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. Must be set to "0".

5 Detect feedback signal weaknesson NV301E models.

4 Value for the feedback alarm contact (0=low, 1=high)

3 Detect feedback alarm provided by the scale.

2 Detect travel limits (PAR12 and PAR13).

1 Detect feedback speed alarma.

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

Factory values: **0**

See also error codes in the appendix of this manual.

PAR09 Table sag compensation, per 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.**
- 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.

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

Factory setting: **0**.

PAR11 MiscMellaneous, binary.

Digit

8, 7, 6, 5, 4, 3, 2 Not being used. Must be set to "0".

1 The  key is used for toggling between absolute and incremental reading modes. This parameter determines whether this toggle affects the axes separately (=0) or all of them at the same time (=1).

If it affects the axes separately (=0), after pressing  one must press the axis key.
Factory setting: "**1**"

PAR12 To set the negative axis travel limit. If PAR08(2)=1
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 from home, the corresponding axis display starts blinking until it is moved back into the work zone.

PAR13 To set the positive axis travel limit. If PAR08(2)=1
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 from home, 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".
This way it is possible to preset a home value in Machine Reference mode. **Factory setting = "0".**

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

Digit

8 Not being used at this time. Must be set to "0".

7 Indicates whether the outputs are used in discrete mode (0) or in BCD mode (1). When setting this bit to "1", up to 9 intermediate levels can be entered (P1 to P9 between HOME and END) for the Z axis instead of just 4 by means of the P_n key. (See pages 10 and 11 of this manual).

6 If = 0, Outputs S4 and S5 are used for levels P3 and P4.
If = 1, Outputs S4 and S5 are used for the cleaning cycle.
Note: if PAR20(7)=1, the cleaning cycle is not available, PAR20(6)=0.

5 If = 0, it indicates that the outputs are not affected by the status of the S1 (home).
This means that if a level is exceeded in reverse, its corresponding signal is deactivated (See diagram on page 10).

If = 1, All outputs go low when S1 =0.
Note: if PAR20(7)=1, it forces PAR20(5)=1. The Home signal (BCD 0000) sets the rest of the outputs to zero. (See diagram on page 11).

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

3 Activate hysteresis and minimum coordinate on the 3rd axis (Z)

2 Activate hysteresis and minimum coordinate on the 2nd axis (Y)

1 Activate hysteresis and minimum coordinate on the 1st axis (X)

PAR21 Indicates the active level for the inputs. Only the first four digits are used where the first one corresponds to "E1" and the last one to "E4". A "0" indicates that the input is active low (0V).

E1, E2 and E3 are used to zero the reading of the X, Y and Z axes respectively and E4 as Emergency signal.

PAR23 Indicates the active level for the outputs. Only the first six digits are used where the first one corresponds to output "S1" and the last one to "S6". A "1" indicates that the output is active high (5V or 24V).

It must be borne in mind that the outputs are activated when the axis position is equal to or more negative than the preset value and they go high "1" or low "0" depending on the setting of machine parameter PAR23.

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 Determines the anticipation distance (up to 0.9999 mm or 0.03937 inches) to activate the signal before reaching the set position. This value will be in mm or inches depending on whether the INCH LED is off or on.

PAR27 Value for the duration of the STROBE signal when using output signals in BCD mode: PAR20(7)=1. Values between 0.1 and 9.9 sec.

PAR30* to **PAR35*** These parameters set the axis number controlling its corresponding signal. PAR30 corresponds to S1 .... PAR35 to S6. It admits values from "0" to "3" where "0" means that the signal is not being used, 1 = X, 2 = Y, 3 = Z.

PAR40* to **PAR45*** They set the signal activating positions (levels) of the axes indicated by PAR30 through PAR35. The PAR40 coordinate is used to activate signal "S1", ... and the PAR45 coordinate to activate "S6".

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

* Parameters PAR30 thru PAR45 are not displayed if PAR20(7)=1 because only the Z axis is used to control the outputs and the activation levels.

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 fromthe feedback device (scale, encoder, etc) or weak signal.
l.4.3.6.5.7.2.5	Feedback speed too high.
EEEEEEEE	Maximum position reading or speed exceeded when searching Home

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

After pressing 

to access the counting mode, check the parameters.

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

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

In either case, to clear the display, press 

.

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

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.

FAGOR DRO

NV-300E
NV-301E

OPERATION MANUAL

Man: 9910 Soft: 2.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.

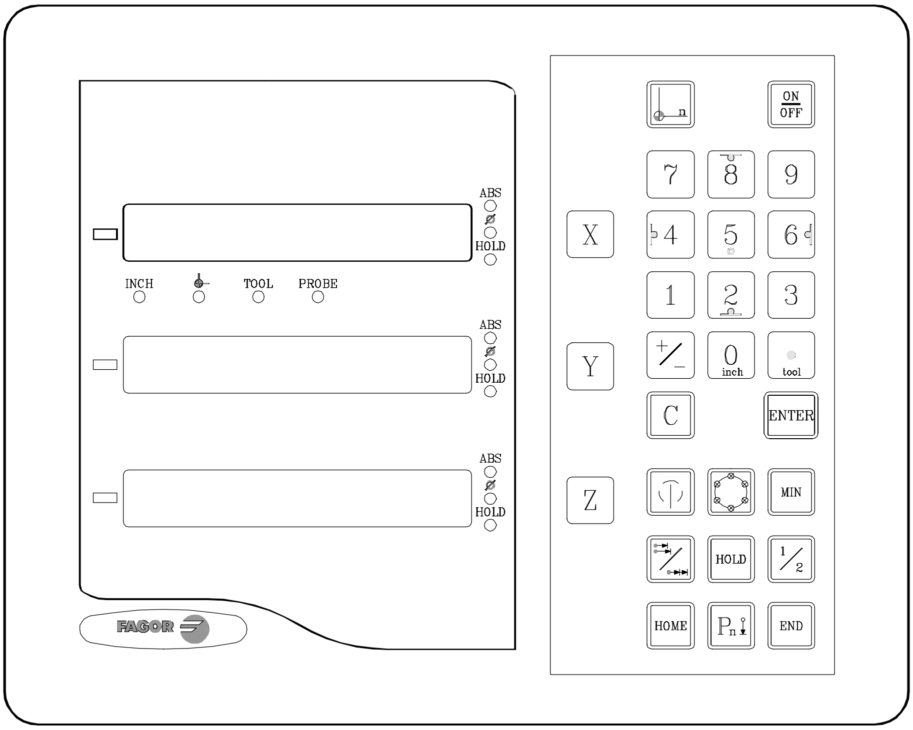
These parameters are described in the installation manual supplied with this unit.

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 (-).

ABS-This lamp stays on when operating in absolute mode and off when in incremental mode. To access or quit this mode, use the key.

Φ- This lamp stays on when operating in diameter mode. In this mode, the DRO displays twice the actual axis movement. To access it or quit it, use the key (if allowed by PAR04)

HOLD- This lamp comes on when "freezing" the axis position by pressing HOLD and the axis key.

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 in machine reference mode. To access it or quit it, press [n].

TOOL- This lamp stays on when working with tool compensation.

"PROBE" This lamp goes on when selecting the optional "probe" mode.

[X] [Y] [Z] Keys to select the first the second and third axis respectively.

[n] Is used to access or quit themachine reference mode.

[I/C] Is used for rotating from the incremental to the absolute mode and vice versa

[ON OFF] Is used to turn the display off while keeping track of the axes position at all times. This key must be pressed before turning the unit's power off by the main switch on the back of the unit.

[ENTER] Is used to validate an operation.

[C] Is used to cancel or abort an operation already initiated.

[1/2] Is used to display half the actual axis movement.

[8] [4] [5] [6] [2] [tool] These are dual purpose keys and are used for entering values and applying tool compensation

[+/-] Is used to change the sign of the entered value or change from fine to coarse resolution and vice versa.

[HOLD] Is used for “freezing” the display of the feedback even though the axis moves.

[ ] Is used for bolt-hole pattern machining.

Is used for activating and deactivating outputs, When the outputs are inactive, the Z axis display blinks the text "Outs OFF" very second.

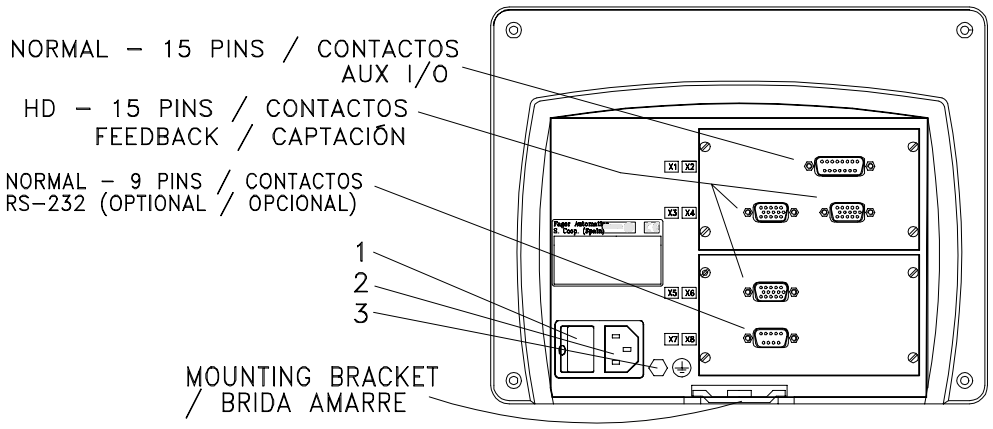
MIN Is used to toggle between the minimum position reached and the actual position with hysteresis on the selected axes (PAR20 digits 1 to 3). It has no effect if the first three digits of PAR20 are set to "0".

HOME Is used to enter the coordinate of the beginning of the EDM operation. It has no effect if PAR30 is set to "0".

Pn Is used to enter the intermediate levels of the EDM operation. After pressing this key, the DRO shows the letter "P". Then, the digit corresponding to the desired intermediate level (1 to 4) must be pressed. It has no effect if the corresponding PAR31-to-PAR34 is set to "0".

END Is used to enter the coordinate of the end of the EDM operation. It has no effect if PAR35 is set to "0".

1.2 REAR PANEL (SEE INSTALLATION MANUAL)



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 on the X axis display 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 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 a decimal digit to be switched off (coarse resolution) for cases in which fine resolution is excessive, simply by pressing [+/-] key.

Radius / Diameter:

When these models are used for measuring radius or diameter, one can display twice the real displacement of the axis (diameter) by pressing [1/2]. Led Φ will go on or off to indicate the double or real counting mode respectively.

Notes:

- This key works in this way if the installation parameter **PAR04** of the axis has been preset as "**2**" **(**Commutated).

- If this parameter is preset as "**0**" (radius), this key will not affect the DRO reading and will always show the **real** displacement of the axis.

- If this parameter is preset as "1" (diameter), this key will not affect the DRO reading and **twice** the real displacement of the axis will always be shown.

2.2 INCREMENTAL, ABSOLUTE AND WITH RESPECT TO MACHINE ZERO

A coordinate 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.

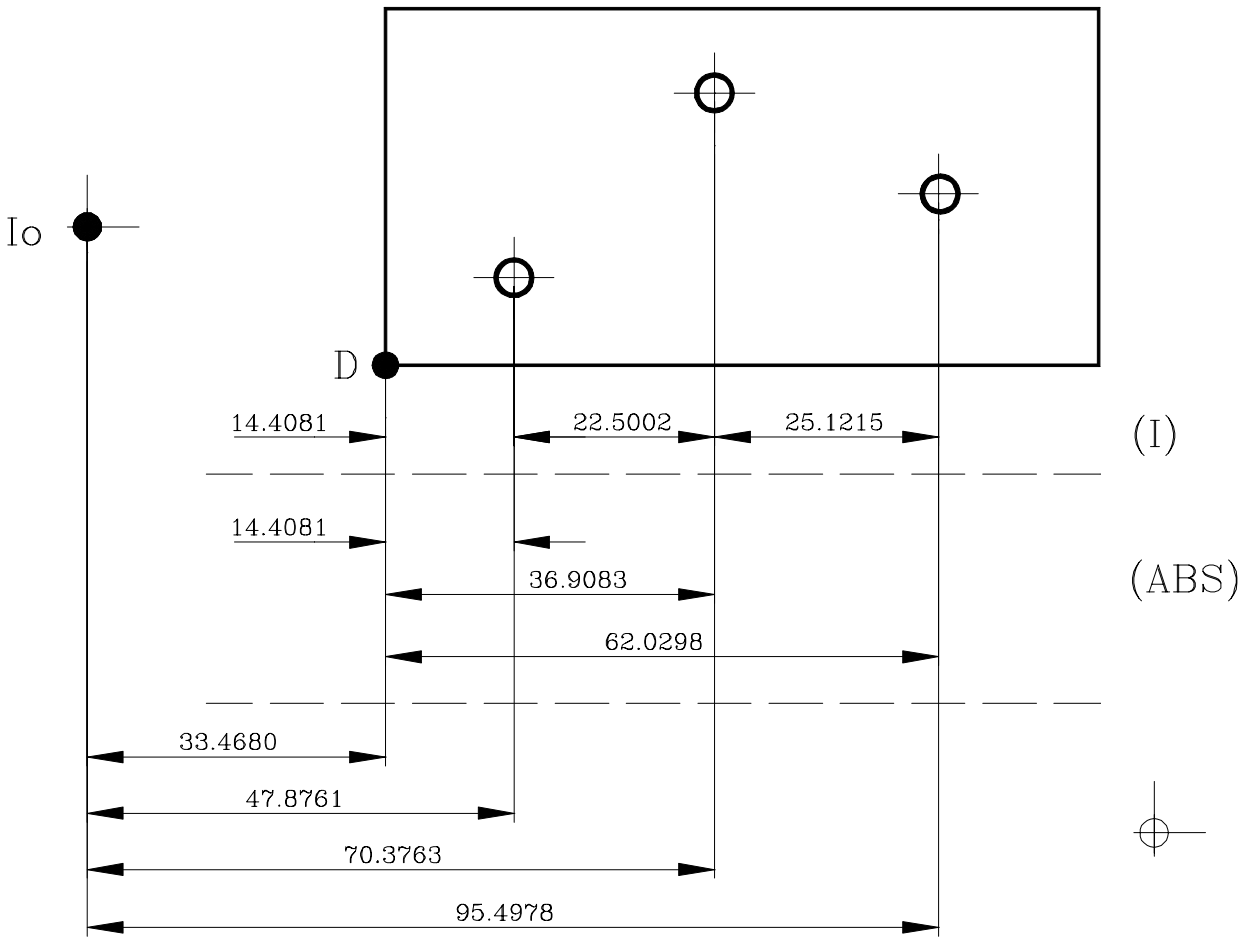
These DROs can display the position of the axes in incremental or absolute mode or referring to home.

The lower figure displays the coordinates of an axis which would appear in the different modes:

- In **Incremental** (I), when the **ABS** and leds are off the distance from the present position of the axis to the previous position is displayed.
- In **Absolute** (ABS), when the **ABS** led is on and the is off, the distance from the present position of the axis to part zero (**D**) is displayed.
- 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.

To change from one of these display modes to another, press until the relevant led goes on or off as described earlier.

It could occur that the installation parameter **PAR11(1)** has been set to **"0"** for key to independently affect each axis so that one axis can display its position in incremental mode whilst the other does this in absolute. In this case, to change the display mode for a particular axis, press sequence: X for "X", Y for "Y" and Z for "Z".



2.3 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 keep the respective zeros (part and incremental) and recover these 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 reestablish all its previous absolute and incremental references (part zero and incremental zero).

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 **"switched off"** the machine, as will be shown later on).

These DROs keep the relative distance from home () to part zero (**ABS** on) and incremental zero (**ABS** off) for each axis 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" said absolute and incremental zero 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 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 (X 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 the installation parameter **PAR10** for this axis. This value is (factory set) default “0”. At the same time it recovers the relative distance from this home to the previously fixed part zero (ABS) and incremental.

- 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.

<u>HOME PRESET IF THE FEEDBACK SYSTEM HAS NO REFERENCE MARK. PAR14=1.</u>

When using feedback devices without reference marks (FAGOR MKT scales, for example) the PAR14 of each axis may be set to "1".

This way, it is possible to preset a "machine reference zero" (home) value in that mode ( LED on). When pressing the axis key, the DRO displays the value of PAR10. To use this value, just press ENTER .

To set it to zero, press C and, then, the axis key.

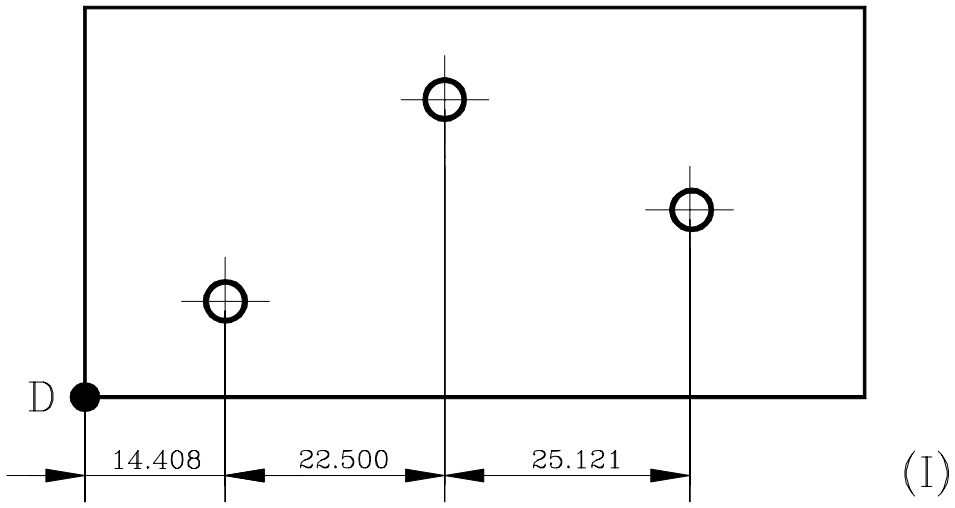
2.4 AXIS COORDINATE PRESET

To reset the axis display, just press: sequence: [C] [X] for "X", [C] [Y] for "Y" and [C] [Z] for "Z".

Using the lower figure, let us imagine we wish to make a part in which three holes have to be made with the coordinates stated. It is clear that the blue-print will only reflect the incremental coordinates (I) or the absolute ones (ABS) referring to the part zero (point D in the figure) although the DRO also shows them with respect to home (Io).

After referencing the axes, as was described in the previous section, we can make this part in incremental or absolute mode according to whether we chose a type of dimensions (I) or (ABS) of the blue-print.

<u>In incremental mode:</u>



- Press [ABS] until the **ABS** led go out and the key [ ] for switching off the led.

- Move the axis up to corner "D" to set this as part zero.

- **At this point, one can proceed in two ways.**
  - Preset the axis with zero value by pressing [C] [X]
  - Move the axis towards the first hole until the DRO reads: **14.408.**
  - Move the axis towards the second hole until the DRO reads: **22.500**
  - And so on up to the third hole.

or...

- Preset the axis with value **-14.408** by pressing: [X] [+/-] **14. 408** [ENTER] to validate it

  In case of a mistake, press [C] to cancel this and leave it as it was.

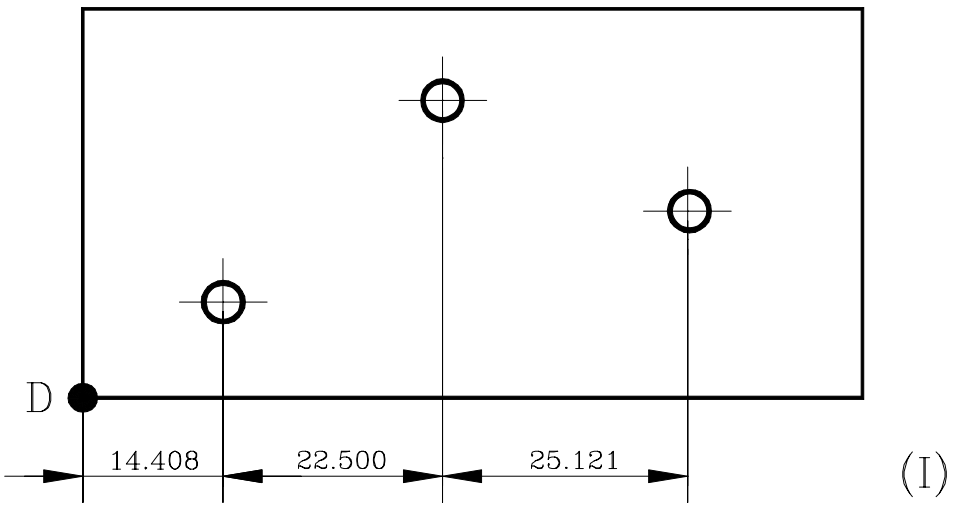
- Move the axis towards the first hole until the DRO reads: **0.000.**

  This last method turns out to be more practical as after selecting the destination coordinate one only has to remember to move the axis until the DRO reads zero.

- After making this hole, one can go to the next position, after having preset the next coordinate **(-22.500)**, by moving the axis until the display reads **0.000.**

- And so on successively until all the holes are made.

Note: By pressing [ABS] until the **"ABS"** LED lights up, the DRO will show the axis real position with respect to part zero "D"



In absolute mode:

- Press [⁄] until the **ABS** led comes on.
- To preset part zero, one of these methods can be used:
- Place the axis (electrode center) exactly over "D" and press: [C] [X]

  or
- Touch one of the sides of the part with an electrode of known diameter (for example 25.076) and press: [X] [+/-] (to enter this with the opposite sign) **25.076** [1/2]

  The DRO will thus indicate that the electrode center is: **-12.538** mm from Part zero. By moving the axis until the DRO reads 000.000, the center of the electrode will be placed exactly over point "D" or Part zero.

In this mode one can also work from coordinate to zero as in the incremental mode, thus having two parallel incremental counting systems, but this IS NOT RECOMMENDED as it is more practical to use absolute counting with respect to a fixed part zero "D" and another incremental one with respect to a mobile zero (previous position).

At any time, by pressing key [⁄] , the DRO will display the present position with respect to the previous zero (ABS and ⌞ leds off), to part zero (**ABS** led on) or with respect to home (⌞ led on).

3. EDM MODE

If there is an axis with hysteresis control (PAR20), when pressing [MIN], It is possible to toggle between continuously displaying the electrode axis position, with hysteresis and displaying only the lowest position reached. The X axis display will show, for a few seconds, a message indicating the selected display mode (normal -none-, hysteresis -hyst- or minimum -min- coordinate).

Depending on how installation parameter PAR20(7) has been set, it is possible to control up 4 intermediate levels (if=0) or nine for the Z axis only (if=1) by activating either a relay digital output depending on the level reached (if =0) or BCD outputs (if =1).

The value for each level may be changed even during the EDM operation directly from the keyboard:

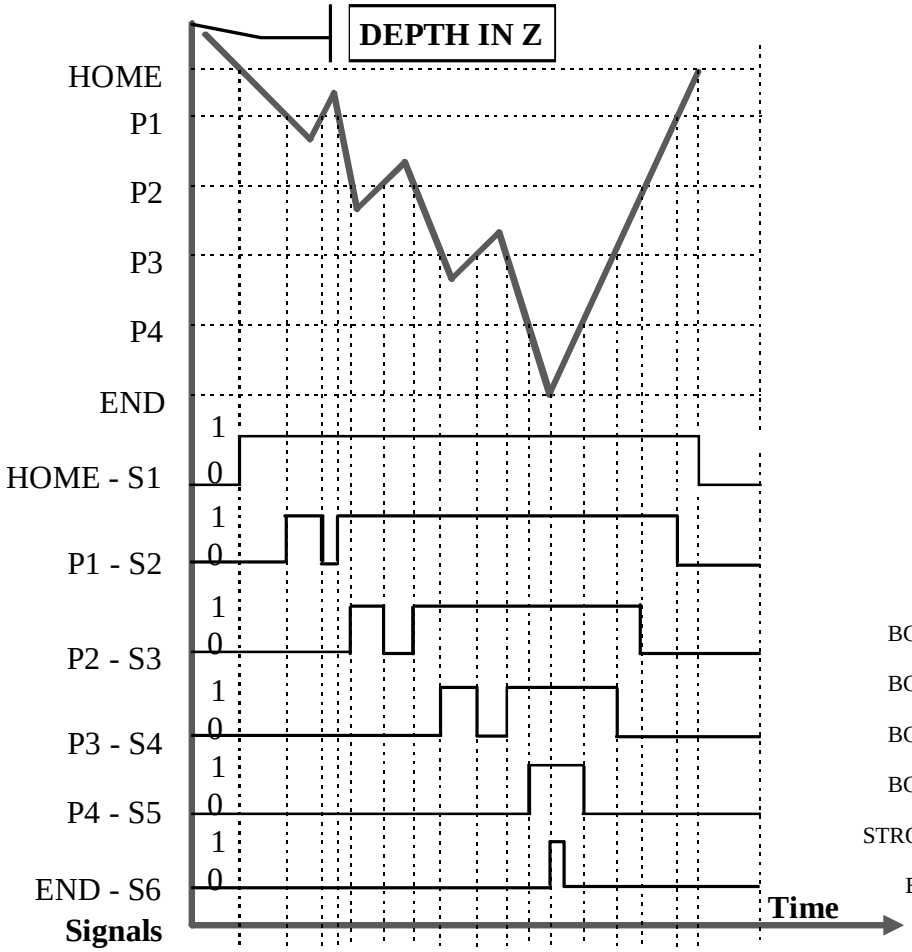
- **To enter the home coordinate:** Press [HOME] coordinate [ENTER]
- **To enter the end coordinate**: Press [END] coordinate [ENTER]
- **To change the intermediate coordinates**:
  - Press [Pn], the DRO willdisplay the letter "P".
  - Press the key corresponding to the level to be changed: [1] through [4].
  - Key in the desired intermediate coordinate value. Press [ENTER]

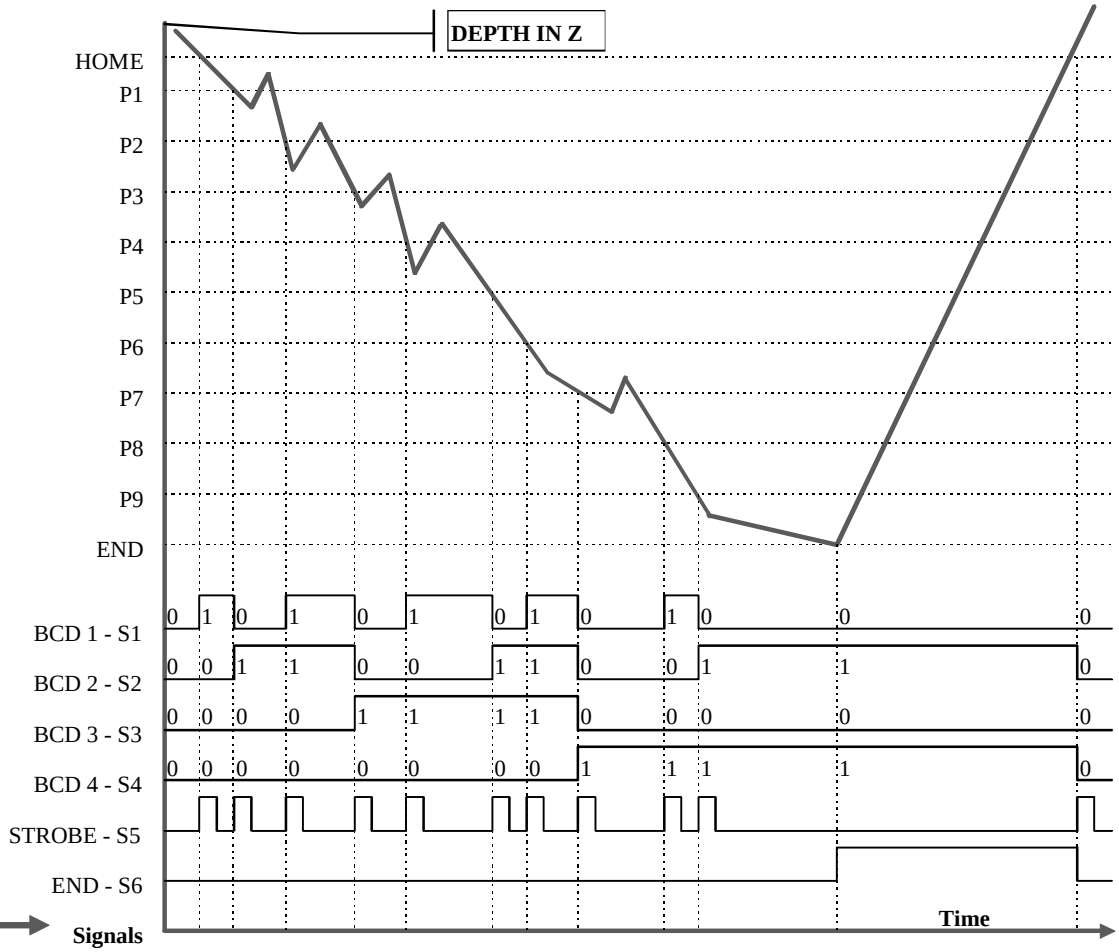
3.1 DIAGRAM. FOR DISCRETE SIGNALS IF PAR20(7)=0. FOR BCD SIGNALS IF PAR20(7)=1.

Important notes:

- **Discrete** signals S1 through S6 indicate the level **currently** reached.
- The **BCD** signals indicate the **NEXT** level to be reached.
- The unused levels MUST BE PRESET with the same value as the "END" coordinate.

With PAR20(5)=0



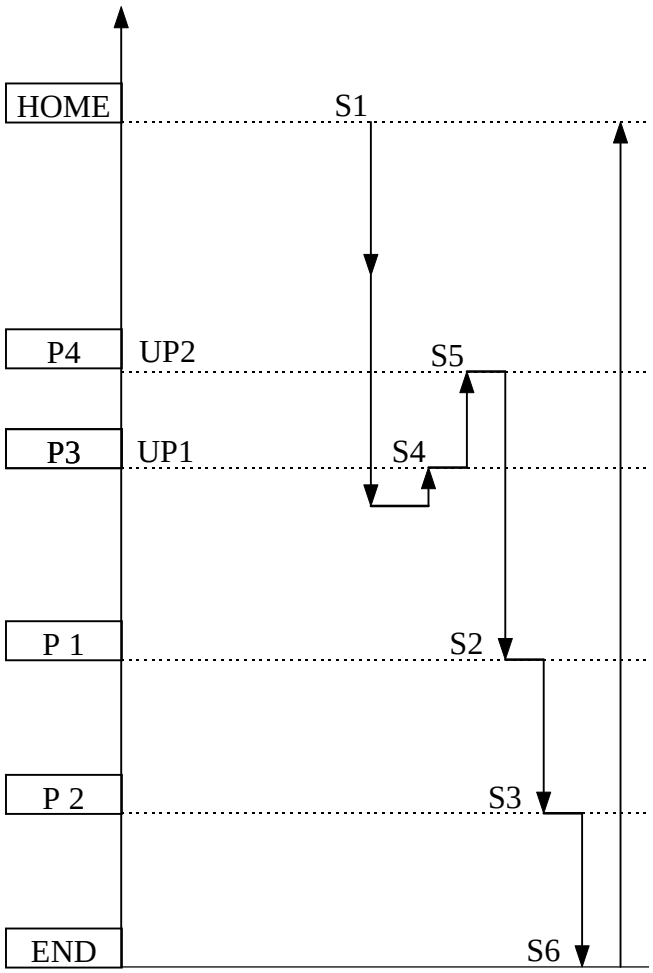


- **Cleaning cycle** [only available if PAR20(7)=0**:**

If PAR20(6) has been set to "1" indicating that there is a cleaning cycle, level P3 will be used to raise the electrode (UP1) activating output S4 and P4 to lower it (UP2) activating output S5.

When the DRO detects a direction change on the electrode axis and once the distance programmed in P3 has been reached (measured from the minimum position reached), the corresponding signal will be activated.

These levels may be set and modified during the EDM process.



P3 and P4 must have positive values.

Many cleaning cycles may take place at different points during the edm operation.

- **Chapter 4.4 of this manual describes how to preset the electrode length and radius.**

- **To deactivate / reactivate the outputs:**

During the EDM process, the output signals may be deactivated so no electrode calibration or replacement can be performed.
To do this:

- Press [⏻] and the Z axis display will blink the text: "**Outs OFF**".
- Press [⏻] again to activate them back.

Note: When activating the Emergency input, all the outputs will be deactivated.

4. SPECIAL OPERATIONS

4.1 SCALING FACTOR

With this DRO, it is possible to apply a scaling factor between 0 and 9.999 for applications such as mold making by simply keying in (for the X axis, for example):

[C] [0 inch] [5] [X] 'value' [ENTER].

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

4.2 PART CENTERING

This feature is available when <u>none</u> of the axes have installation parameter PAR04 set to "2" (commutated**).**

Part centering can be done in two ways:

<u>Method 1:</u>

- Set the DRO in incremental mode by pressing key [ABS] until the **ABS** and leds go out.
  If this led does not light up, press key [n]

- Touch one side of the part with the electrode.
- Reset the counting by pressing [C] [X] for "X" axis (for example)

- Take the electrode to the other side of the part and touch this with it.

- Press [1/2] [X] for "X" axis (for example) The DRO will display **half** of the distance covered by the electrode.

  Consequently, as the axes withdraw until the displays read **0.0000**, the electrode can be placed exactly at the center of the part.

To cancel this operation after starting, press [C]

Method 2 Coordinate freeze "HOLD"

- Set the DRO in incremental mode by pressing key [⇄] until the **ABS** and leds go out.

  If this led does not light up, press key [n]

- Touch one side of the part with the electrode.
- Freeze the counting for the axis by pressing [HOLD] [X] for "X" axis. (for example).

- Take the electrode to the other side of the part and touch this with it.
- Press [1/2] . The DRO will display **half** of the distance covered by the electrode.

  Consequently, as the axes withdraw until the displays read **0.0000** the electrode can be placed exactly at the center of the part.

To cancel this operation after starting, press [C]

4.3 COORDINATE FREEZE (HOLD)

It enables “freezing” the display of the counter whilst inside it goes on reading the real position of the axis. This comes about when it is necessary to change the electrode and preset the dimension of the new one.

For example, to change an electrode at any known point of the part:

- Press key [HOLD] [X] and the display counting said axis “freezes” at the present value.

- Press key of other axis if you wish to also “freeze” the display of this axis.

- The electrode to be replaced withdraws and the new one takes its position.

- The new electrode is led to the “freezing” point and the part is touched at said point.

- Press [HOLD] and the counting “defreezes” starting to count from the previously “frozen” value.

  If [1/2] is pressed, instead, the DRO will assume half the distance travelled since [HOLD] was pressed. This is possible when "freezing" only one axis

4.4 OPERATING WITH ELECTRODE COMPENSATION

4.4.1 ENTERING ELECTRODE DIAMETER AND LENGTH

- Electrode length and radius compensation may be changed during the EDM process:
- Press [tool]. The DRO blinks the diameter value (Y axis).
- To change the diameter, press [Y] 'new diameter' [ENTER]
- To change the length, press [Z] [+/-] 'new length' [ENTER]

  The new length value will be **added to or subtracted from** the current Z

  position value.

NOTE: Although the axes may have different resolutions, the diameter of the electrode is requested with a resolution of one tenth of a micron. (0.0001 mm) or 0.00005" when working in inches ('INCH' LED on).

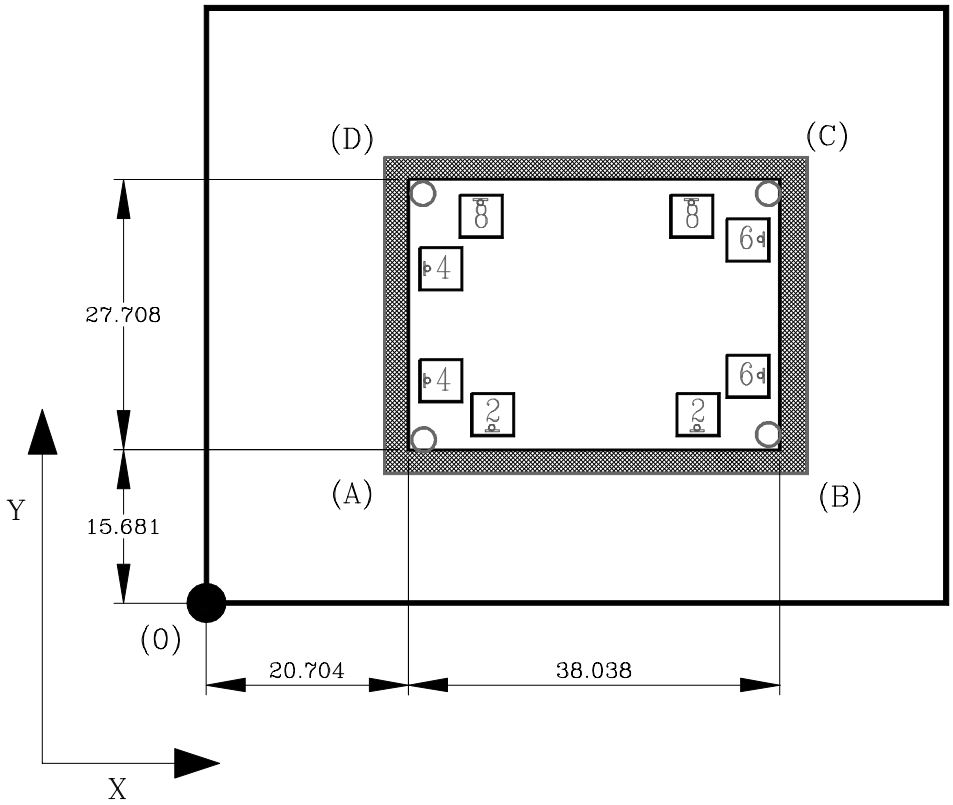
4.4.2 EXAMPLE OF HOW TO WORK WITH TOOL COMPENSATION

The following illustration displays the typical application of tool compensation to make both an internal and external pocket.

Tool compensation is applied by pressing either of keys [8] [4] [6] or [2] and canceled by pressing [5]

After presetting the electrode diameter, as was described in the previous section, it is advisable to know how to apply the compensation before making said movement.

- Inside pocket -



After having preset part zero (0) and keyed in the diameter of the mill to be used and before making the next movement, there has to be analysis of which side the electrode is going to "attack" from.

In the previous figure, let us suppose that we have an 8 mm diameter mill working in incremental mode (**ABS** and leds off).

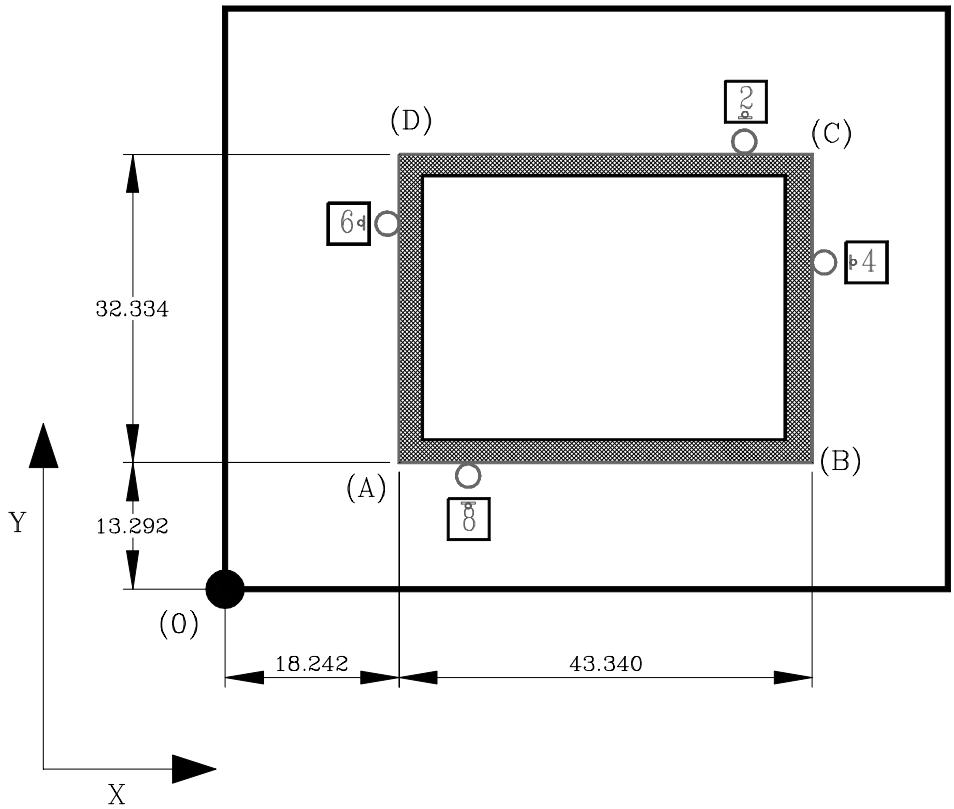
- With the mill at point (0); to go to point (A):
  preset value [X] **-20.704** [ENTER] and [Y] **-15.681** [ENTER]
- On pressing [4] and [2] the DRO will display the value **-24.704** for X and **-19.681** for Y due to the compensation of the electrode radius. On moving both axes to **"0.000"**, the mill will take up a position at point "A".

- After positioning at point "A", to go to point "B" the following values will be preset: **-38.038** for X and "**0.000**" for Y.

  By pressing [6] and [2] the DRO will display values: **-30.038** for X and "**0.000**" for Y. In this case key [2] does not have to be pressed as one does not have to change the compensation for Y; but it is a good idea to do so simply as sound working practice.

- And so on successively for the other points of the figure using the symbolic keys shown on it.

- Outside pocket -



After having preset part zero (0) and keyed in the diameter of the mill to be used and before making the next movement, there has to be analysis of which side the electrode is to "attack" from.

In the top figure, let us suppose that there is an 8 mm diameter mill working in incremental mode (**ABS** and leds off).

- With the mill at point (0); to go to point (A):
  preset value [X] **-18.242** [ENTER] and [Y] **-13.292** [ENTER]

- By pressing [6] and [8] the DRO will display value **-14.242** for **X** and **-9.292** for **Y** and due to the compensation of the electrode radius. By moving both axes to "**0.000**", the mill will take position at point "A".

- After reaching point "A", to go to point "B" preset values:
  -43.340 for X and "**0.000**" for Y.
  By pressing [4] and [8] the DRO will display values: **-51.340** for X and "**0.000**" for Y. In this case it is not needed to press key [8] as the compensation in Y does not have to be changed; but it is a good idea to do so as sound working practice.

- And so on successively for the remaining points of the figure using the symbolic keys shown on it.

4.4 BOLT-HOLE PATTERN EDM

It allows up to 99 holes to be made in a bolt-hole without having to calculate the coordinates (X Y) of each hole, by simply keying in the following basic data (in the example):

CENTER **Coordinate** of the center of the bolt-hole (X = 37.899, and = 30.467)

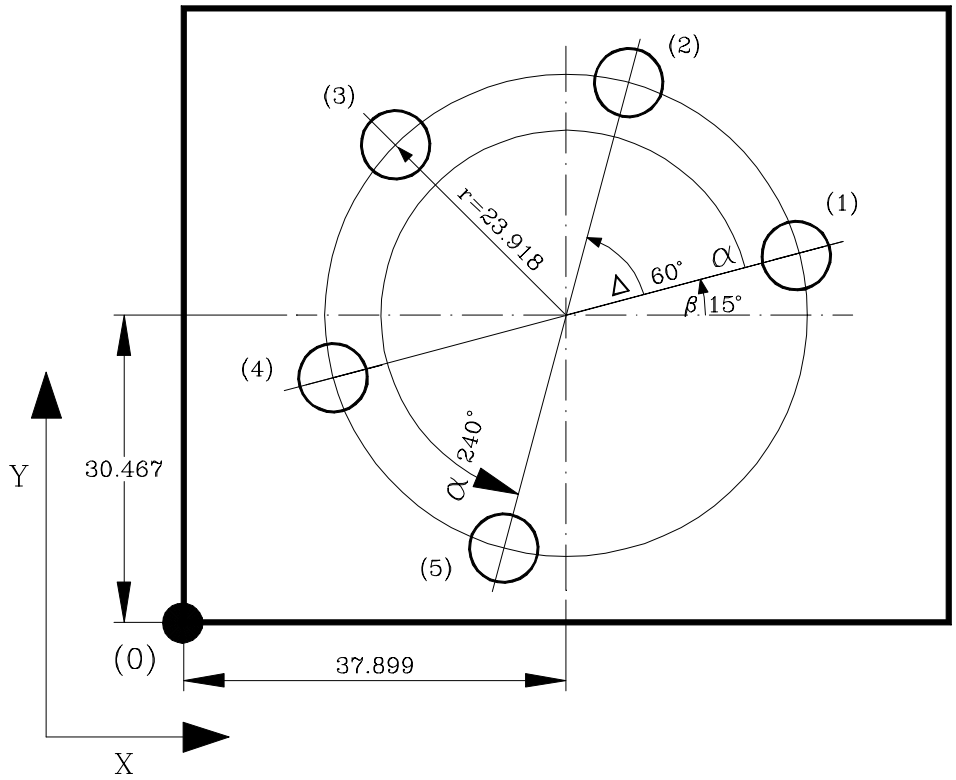
RADIUS **r,** RADIUS of the bolt-hole (23.918)

HOLES **N,** or Nr. of HOLES to be made (5)

ALPHA **α,** total angle between the first and last hole (240º).

DELTA Δ, angular distance between holes (60º). Only requested when HOLES = 0.

bEtA **β,** position of the first hole (15º).



To make this part:

Entering data:

1- Move the electrode to the center of the circle **before** selecting the bolt-hole operation

2- Select the bolt-hole operation by pressing [ ] [ENTER] after which, the display "X" displays the word "**RAdIUS**" and the display "Y" flashing zeros waiting for the required value to be entered (in this case: **23.918**) with up to 3 decimals in mm and up to 5 in inches.

Then press [ENTER]

If a wrong value were keyed in before pressing , press [ENTER], press [C] and key in the right data.

3.- The DRO displays the word "**HOLES**" in the display "X" and two flashing zeros on the "Y" side waiting for the number of holes to be entered (in this case **5**).

Press [ENTER] to go to the following field. If a wrong value were keyed in before pressing [ENTER] press [C] and enter the right data.

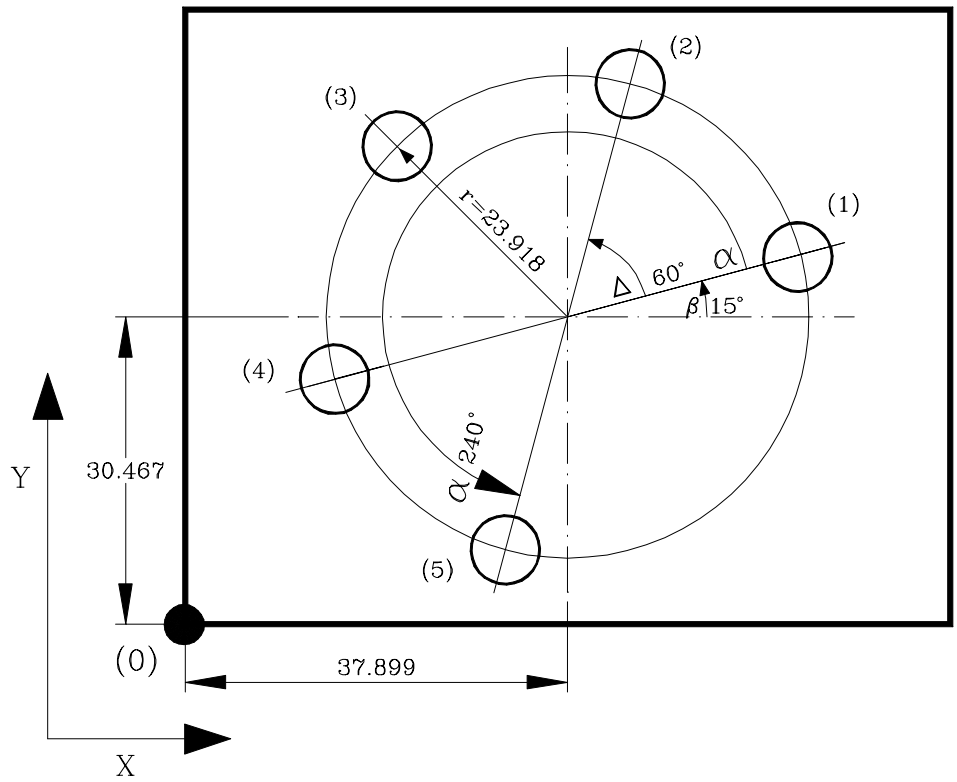
4.- The DRO displays the word "**ALPHA**" in display "X" and three flashing zeros in "Y" waiting for the degrees separating the last hole from the first to be entered (in this case **240º**). Press [ENTER] to go to the next field.

If a wrong value were keyed in before pressing , press [ENTER] , press [C] and key in the right data.

5.- **Only** if "00" had been entered in the field "**HOLES**"), (pressing only [ENTER] , the DRO will display the field "**dEltA**" in display "X" and three flashing zeros waiting for the angular increment between two holes to be entered (in this case **60º**). Otherwise, this field would be skipped, going on to the next one.

6.- The DRO displays the word "**bEtA**" in the display "X" and three flashing zeros in the "Y" waiting for the angular position of the first hole to be entered (in this case **15º**). Press [ENTER] to go to the next field.

If a wrong value were keyed in before pressing [ENTER] , press [C] and key in the right data.



Execution of bolt-hole pattern EDM operation

After entering this data, the DRO displays the text "**HOLE 01**" in the display "X" switching off the "Y".

- After pressing [ENTER], the coordinates of the first hole will be displayed: **X: -23.105 Y: -6.190**

- The axes will move until the displays read **X 0.000 and 0.000**
- Press [ENTER] again for the coordinates of the second hole "**HOLE 02**" to be displayed: **X: 16.915 Y: -16.915**

  If so wished, Press [1/2] to display the current position with respect to the previous hole.

- The axes move until the displays read **X 0.000 and 0.000**

And so on until all the holes are completed (all 5).

Notes: It is recommended to **define the hysteresis or the display of the minimum position reached,** PAR20 (1) to (3) **only for the electrode axis** (Z) because the result may be affected by it.

When machining in this cycle, neither the intermediate levels nor the electrode may be changed.

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 fromthe feedback device (scale, encoder, etc) or weak signal.
l.4.3.6.5.7.2.5	Feedback speed too high.
EEEEEEEE	Maximum position reading or speed exceeded when searching Home

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

After pressing 

to access the counting mode, check the parameters.

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

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

In either case, to clear the display, press 

.

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

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-300E / NV-301E - (REF: 0898-E)

Display ON/OFF [ON/OFF]

MM/Inches [0 inch]

Fine/coarse resolution [+/-]

Radius/Diameter [1/2]

Scaling factor (X) [C] [0 inch] [5] [X] **[Value]** [ENTER]

Incremental/Absolute mode [ ]

Home reference mode [ ]

Home search (X) [X] move (X) axis

Axis preset (X) [X] [+/-] **[Value]** [ENTER]

1/2 axis preset (X) [X] [+/-] **[Value]** [1/2]

Cancel [C]

Zero setting (X) [C] [X]

Part centering (X). [1/2] [X]

Coordinate freeze (X). [HOLD] [X] ... [HOLD]

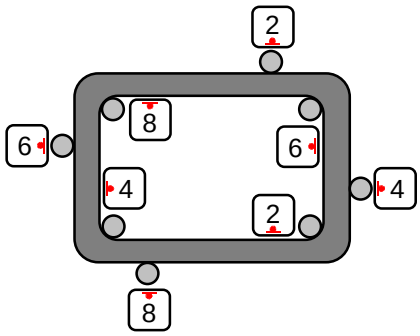
Middle point (X). [HOLD] [X] ... [1/2]

Electrode diameter preset [tool] [Y] **[Value]** [ENTER]

Electrode length change [tool] [Z] [+/-] **[Value]** [ENTER]

The new length is added to (or subtracted from) the current position reading.

Tool radius compensation



Cancel Tool Radius Compensation [5]

Bolt-hole pattern drilling

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

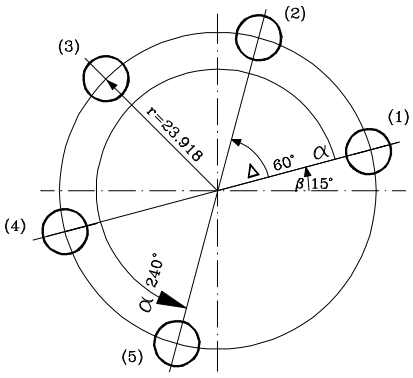
Select bolt-hole operation [ ]

[ENTER]

RADIUS: [Value] [ENTER]

HOLES:

[Number of holes, (2-99)] [ENTER]



ALPHA: [Angle between 1st and last hole] [ENTER] (0=360º)

DELTA: [Angular distance between holes] [ENTER]

BETA: [Angular position of the 1st hole] [ENTER]

Execution of the bolt-hole drilling operation:

After "HOLE 01", press [ENTER] and move the axis

To display the current position with respect to the previous hole, press [1/2]

EDM MODE

Enter HOME coordinate:

[HOME] **[value]** [ENTER]

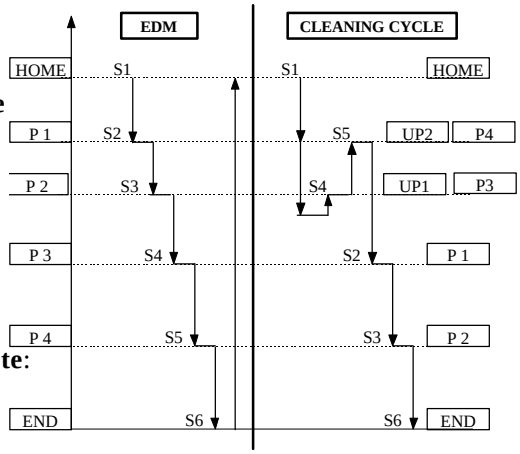
Change intermediate levels:

[Pn] [1] to [4].

[value] [ENTER]

Enter END coordinate:

[END] **[value]** [ENTER]



Cleaning cycle (if available at the machine):

For UP1: [Pn] [3] For UP2: [Pn] [4]

Message	Description
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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

Fagor Automation S. Coop. (Spain)