Innova 40i P / 40i P-B

Installation / Operation Manual

FAGOR

Fagor Automation S. Coop.

INDEX

IMPORTANT NOTE

Some of the features described in this manual may not be available in this version.

Consult with the Fagor Automation branch office nearest you.

1 DRO description

1.1 Front plate:

Keys for axes

Keys for entering numeric values

TFT screen

Abort

Validate

Cursor keys

Keys to open droplist buttons of the FUNCTION BAR

Power indicator LED

Power-off button
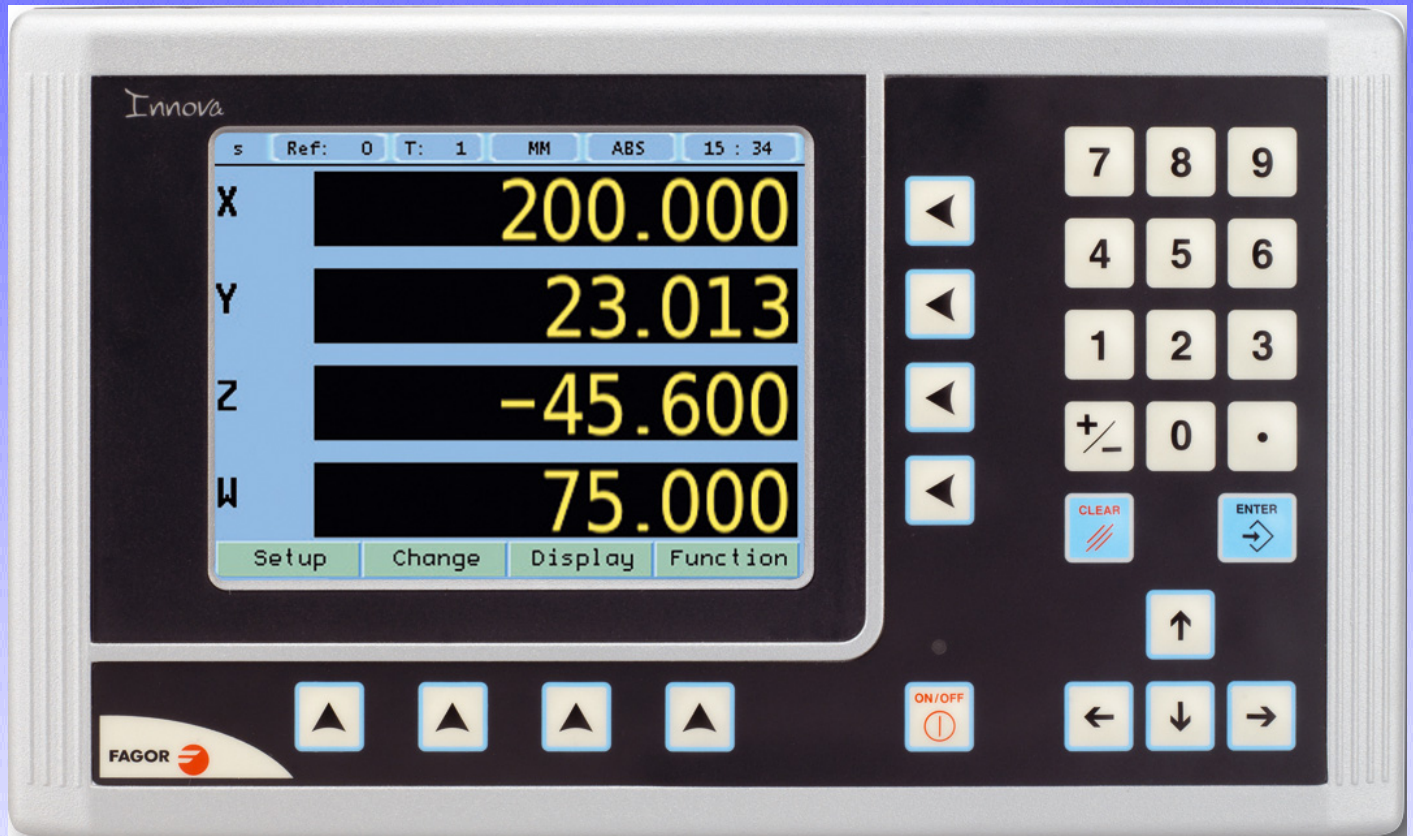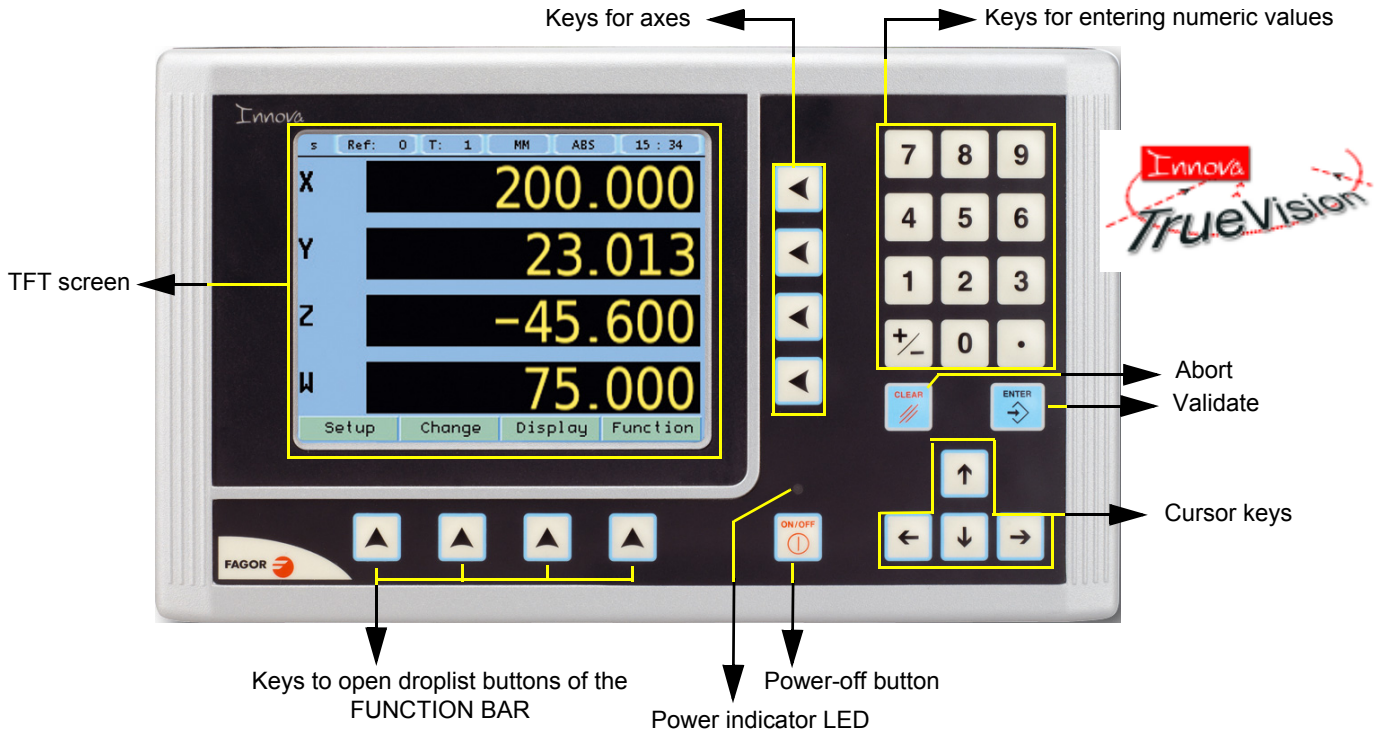
1.2 Turning the unit on and off

It turns on automatically when applying voltage or after pressing the on/off key.

On power-up, an initial screen comes up for a few seconds and then the work screen is displayed.

Turns the DRO on or off.

1.3 Main screen description:
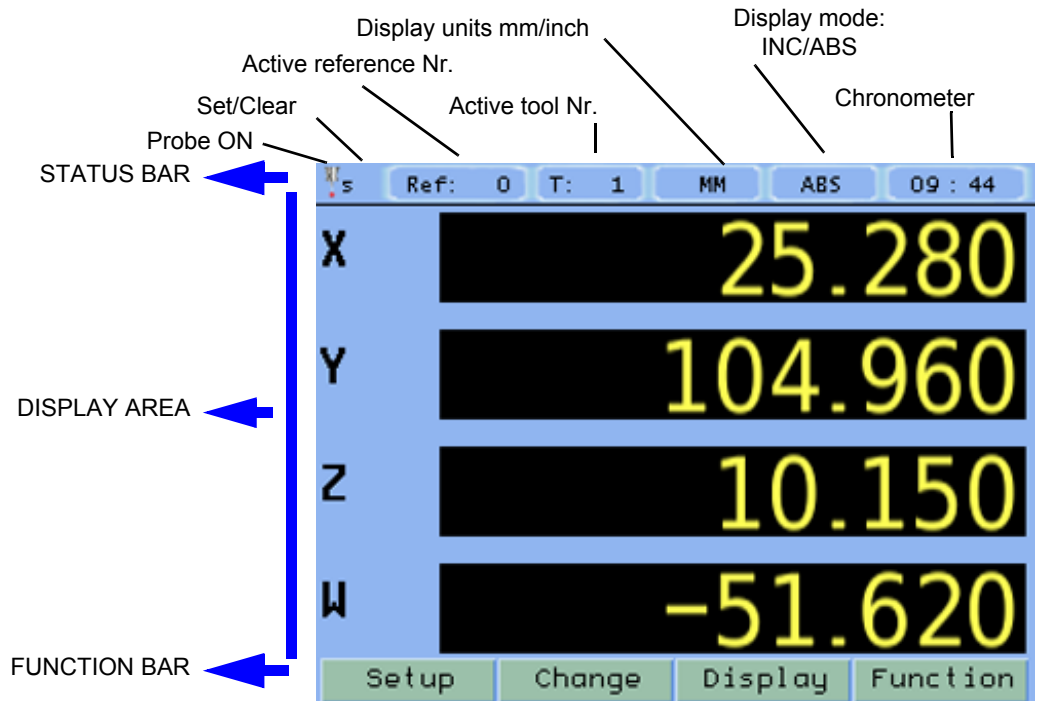
1.4 Function bar

The function bar gives access to the various functions offered by the DRO.

1.4.1 Access to functions:

Setup
Home search
Setup

CHANGE	
Reference	Tool
Part datum	Tool setting
Part center	Tool table

DISPLAY
INC/ABS
mm/inch
Set/Clear
Deg/DMS
Rad/Diam

FUNCTION
Bolt-hole drilling
Linear drilling
Grid pattern drilling
Go to
Cycles
Programs
Calculator
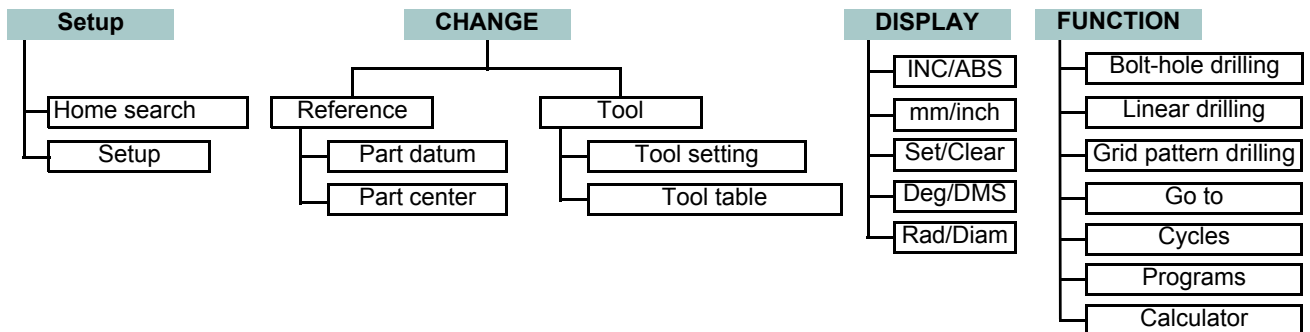
2 DRO operation

2.1 Display modes.

Display

2.1.1 mm / inch

Display	mm / inch

Toggle units between mm and inches.

This toggle is possible if the installer parameters have been set as toggle .

2.1.2 inc / abs

Display	inc / abs

c	Ref: 0	T: 0	MM	ABS	12 : 26
				INC	

Toggle between incremental and absolute feedback reading (counting).

The status bar shows the currently active feedback reading mode.

2.1.2.1 Absolute mode:

The coordinates (position values) are referred to part zero.

The example on the right would be carried out as follows:

(B) [14.000]   Move the axis until the display reads [14.000] (B position) and drill the hole.

(C) [37.000]   Move the axis until the display reads [37,000] (C position) and drill the hole.

(D) [62.000]   Move the axis until the display reads [62,000] (D position) and drill the hole.
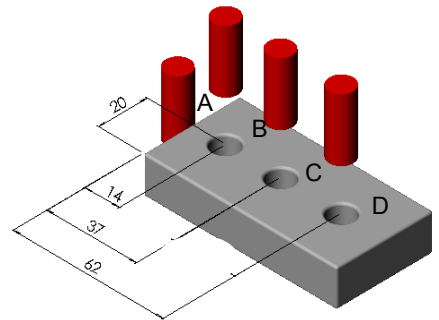
2.1.2.2 Incremental mode:

The coordinate is referred to the previous point where the axis display has been set to zero.

The example on the right would be carried out as follows starting at point A:

(B) [14.000]   Move the axis until the display reads [14.000] (B position) and drill the hole.

Set the X axis to zero.

(C)[23.000]   Move the axis until the display reads [23,000] (C position) and drill the hole.

Sets the X axis to zero.

(D) [25.000]   Move the axis until the display reads [25,000] (D position) and drill the hole.
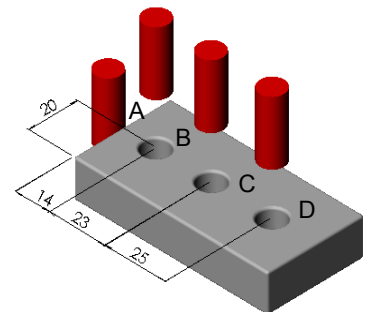
2.1.2.3 Degrees / Degrees-Minutes-Seconds

Display	Deg / DMS

1   Toggles the axis display units between degrees and degrees, minutes, seconds.

2.1.3 Rad / Diam

Display	Rad / Diam

Toggles the X axis display between radius and diameter

2.2 Set/Clear

Display	Set/Clear

There are two ways (modes) to set a value (Set) on the display or zero it (Clear).

2.2.1 In "Set" mode (indicated with an "S" on the upper status bar):

◁ Value ENTER ➔   To preset a value for an axis.

CLEAR ◁   To zero the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis).
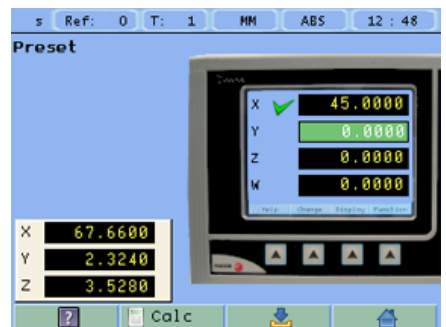
2.2.2 In "Clear" mode (indicated with a "C" on the upper status bar)

◁   Set the display to zero.

To preset a value:

ENTER ➔ ◁ Value ENTER ➔

And validate the data by pressing this key.

Or ignore it by pressing this key.

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2.3   Machine reference (home) search:

Setup	Home search

Select axis. A red bar appears on that axis display indicating that it is waiting for a reference pulse.

Move the selected axis until the DRO detects the reference mark.

A green checkmark appears next to the axis display when the reference mark is properly detected (homed) and the axis display will show the position value preset in parameter "user offset", (see **Reference**).

This icon indicates that the axis must be homed.
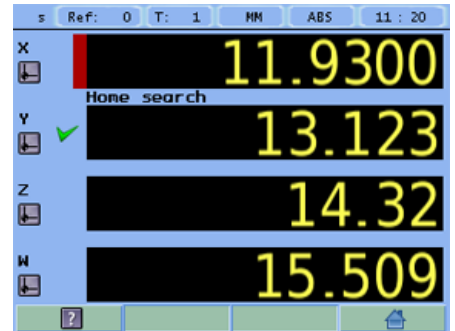
Note: When all the required axes are homed, the DRO automatically leaves the home search mode.

2.4   Tools and references:

2.4.1   Tools:

Change	Tool

Change to set tool (diameter and length).

It offers a 15-tool table.
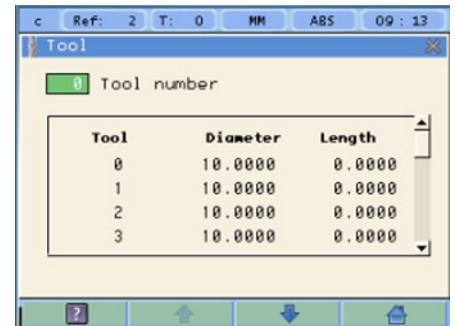
2.4.1.1   Tool change:

Tool Nr. [ENTER] It becomes the current tool.

2.4.1.2   Set a new tool in the table:

[↑] [↓]   Select the tool number you wish to set.

[ENTER]   Enter the diameter of the tool. Press Enter.

[ENTER]   Enter the length of the tool. Press Enter.

2.4.1.3 Tool compensation:

This DRO offers a function for compensating tool radius depending on the machining direction.
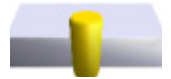
⇧ ENTER ➔   Tool compensation on /off in this direction:

⇩ ENTER ➔   Tool compensation on /off in this direction:

⇐ ENTER ➔   Tool compensation on /off in this direction:

⇒ ENTER ➔   Tool compensation on /off in this direction:

When machining pockets, tool radius compensation is activated in two axes at the same time.

⇒ ⇧ ENTER ➔   Tool compensation on /off for this corner of the pocket:

⇐ ⇧ ENTER ➔   Tool compensation on /off for this corner of the pocket:

⇐ ⇩ ENTER ➔   Tool compensation on /off for this corner of the pocket:

⇒ ⇩ ENTER ➔   Tool compensation on /off for this corner of the pocket:

2.4.2 Reference:

| Change | Reference |

Change part reference (datum), set a new one or **search the center of the part.**

There are 100 references or datum points that may be set for the part when using absolute coordinates (0-99).

1/2   Assistant for searching the center of the part by touching on two sides.

Origin   Assistant for setting the part zero (datum point).

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2.4.2.1 Changing the reference:

Change	Reference

Changing from one reference to another.

Tool Nr. [ENTER]   It changes to the selected reference.

2.4.2.2 Setting part zero (datum) as instructed by the assistant:

Change	Reference	Origin

Setting part zero requires measuring at least 2 points. One point on each of the sides to be homed. The third point is optional and is used for setting the datum point (origin) of the vertical axis.

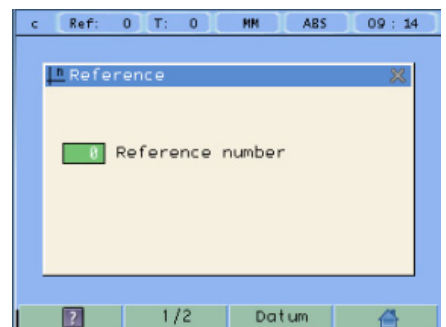**Probe**   It activates the probe mode. If the probe has been set, it may be used to touch the desired sides of the part. Probe dimensions, length and diameter, must be entered as if they were those of a tool.

  Set or change the tool. It will compensate for the radius of the tool being used.
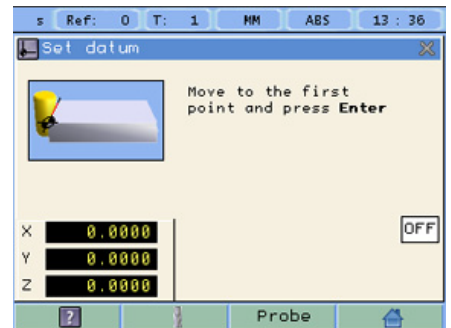
[Z axis]   Activate Z axis homing.

Optional:

· Activate the probe mode if the probe has been configured and it is being used.

· Select the Z axis to set the datum point on the vertical axis.

Sequence to follow:

  Set or change the tool.

Move the tool to the first side until it touches the part.

[ENTER]   Press Enter.

Move the tool to the second side until it touches the part.

[ENTER]   Press Enter.

If the vertical axis is activated, move the tool to the top side until it touches it.

[ENTER]   Press Enter.

1	2
3	4
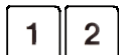
Select the corner where the part zero (datum) will be set.
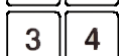
Notes:

When using a probe, there is no need to press Enter, just touch a point on the desired side.

In order to ensure that tool or probe radius compensation is done correctly, the sides of the part to be referenced, must be aligned with the axes of the machine as much as possible.
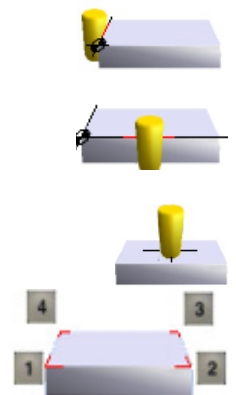
2.4.2.3 Setting part zero (datum) without using the assistant:

Change	Reference

Set a datum point at a corner other than the 3rd quadrant.

Compensate for tool radius on the X axis.

Touch with the tool on the side indicated in the figure.

Set the X axis to zero.

Compensate for tool radius on the Y axis.

Touch with the tool on the side indicated in the figure.

Set the Y axis to zero.
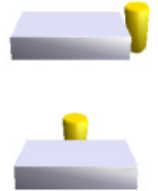
2.4.2.4 Search for the center of a part:

Change	Reference	1/2

Set or change the tool.

Probe It activates the probe mode. If the probe has been set, it may be used to touch the desired sides of the part.

Move the tool to the first point.

Press ENTER.

Move the tool to the second point.

Press the key of the axis whose center you're trying to find.

The display of the axis whose center you're searching shows a value that is half the distance moved in that axis. Move this axis to zero. The tool is now located at the center.

Note: This mode may be accessed directly by pressing this key.
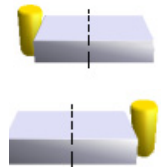
2.5   Special functions.

Function It gives access to the specific milling functions.

2.5.1   Cycles.

The DRO allows storing 99 cycles, numbered from 1 to 99. The cycles may be executed, deleted or edited at will.

The screen shows the data of the selected cycle so it can be identified easily.

Deletes the selected cycle.

To edit the values of the selected cycle.

Run Execute (run) the cycle.

The cycles that may be programmed are:

· Bolt-hole drilling

· Linear drilling

· Grid pattern drilling

· Go to:
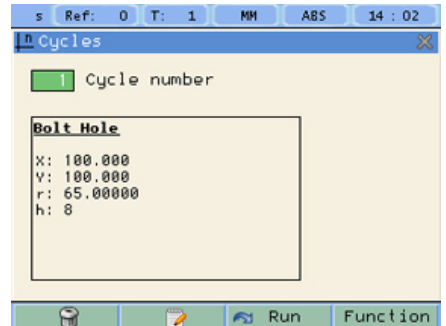
2.5.1.1   Options for each cycle.

Exit cycle editing.

Show graphics. See **"Simulation / execution special modes:" (page 14)**.

Save cycle data in a cycle number so it can be edited or executed later on.
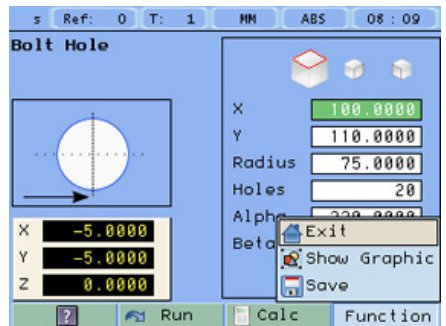
2.5.1.2 Bolt-hole drilling.

Function	Bolt-hole drilling

It allows up to 99 holes to be drilled in a bolt-hole pattern in different planes (XY, XZ, YZ) without having to calculate the coordinates (X Y) of each hole, by simply keying in some basic data.
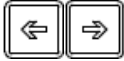
Select **plane**.

X, Y: Coordinates of the center of the circle where the holes will be drilled referred to the active reference zero.

Radius of the circle where the holes will be drilled.

Number of holes.

Alpha: Total angle between the first and last hole of the circle.

Beta: Position of the first hole.
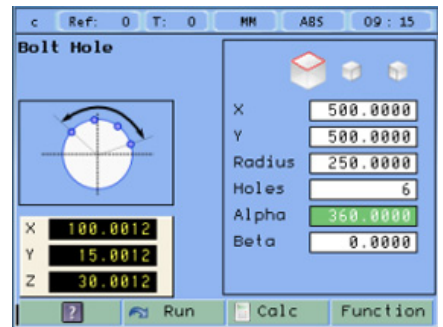
2.5.1.3 Linear drilling.

Function	Linear drilling

It allows up to 99 holes to be drilled in line in different planes (XY, XZ, YZ) without having to calculate the coordinates (X Y) of each hole, by simply keying in some basic data.
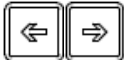
Select **plane**.

X, Y: Position of the first hole.

Distance between holes.

Number of holes.

Alpha: Inclination of the line of holes.
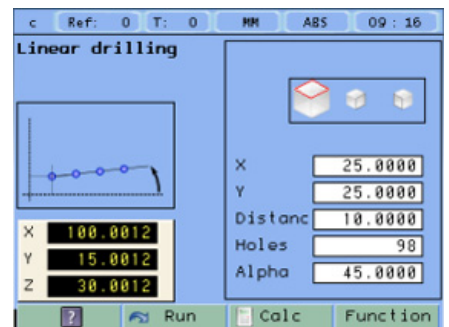
2.5.1.4 Grid pattern drilling.

Function	Grid pattern drilling.

It allows up to 99**holes to be drilled in grid or frame pattern** in different planes (XY, XZ, YZ) without having to calculate the coordinates (X Y) of each hole, by simply keying in some basic data.

Select **plane**.

Type: *Grid* (a matrix of holes) or *frame* (holes in the perimeter of a frame).

X, Y: Position of the first hole.

Inc 1: Gap between the holes of the grid along the X axis.

Inc 2: Gap between the holes of the grid along the Y axis.

Alpha: Inclination of the matrix of holes.

N 1: Nr of holes along the X axis.

N 2: Nr of holes along the Y axis.
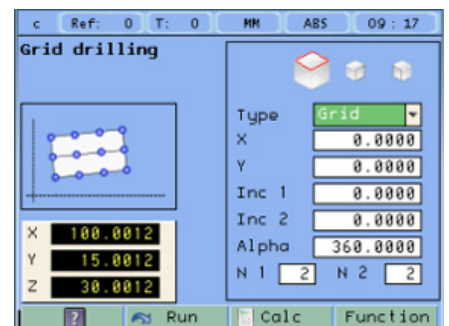
2.5.1.5 Go to:

Function	Go to

This function is the alternative to the most commonly used positioning method consisting in presetting an incremental zero at a point and moving the axis until the display shows the desired coordinate. The **Go to** function may be used to do the same in the opposite direction, you enter the coordinates of the target point and the DRO screen shows these values with the negative sign. The operator must move the axes to zero. The advantage of using this method is that the operator does not have to memorize the target coordinates, he simply has to move the axes to zero.

When presetting a value on an axis, press **ENTER** to go on to the next axis and validate the data just entered.

2.5.2 Programs.

Various cycles may be joined one after another making a program. The programs may be executed, deleted or edited at will.

Cycle number 0 indicates the end of the program.

Deletes the selected cycle.

Inserts an empty cycle in the current position.

Run Executes the current program.
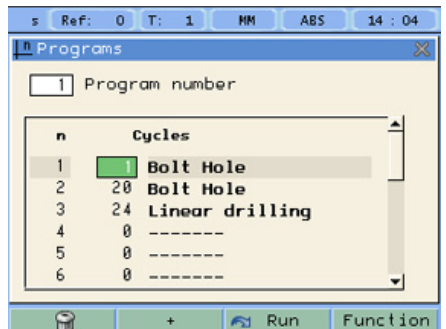
2.5.2.1 Execute programs

It will execute the various cycles up to an empty cycle or invalid cycle (with the 0 number).

The screen shows information about the program and the current cycle:

· current step of the program / Number of steps

· Cycle number and type.

Go back one cycle.

Advance one cycle.

Run Execute the current cycle.
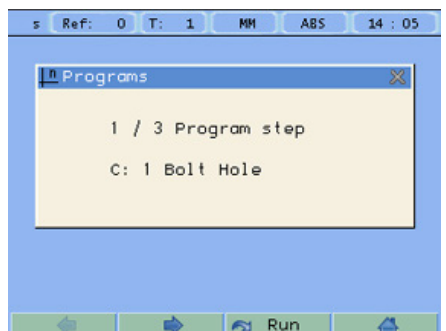
2.5.3 Calculator function

Function	Calculator

It may be used to carry out mathematical and trigonometric operations as well as preset the desired axis with the result of the calculation or import the displayed coordinate values into the calculator to carry out math operations.

Different types of calculators may be selected at the function bar: Arithmetic, trigonometric and for square functions.

Numeric — Numeric calculator. Functions: **+ - x /**

Trigonom — Trigonometric calculator. Functions: **Sin, Cos, Tan.**

Square — Functions: $x^2 \quad 1/x \quad \sqrt{}$

Function

To **Exit** the calculator **Set** an axis with the result or **Insert** a value into the calculator.

Exit — Exit the calculator.

Set — Set one of the axis with the result of the calculator. To do this, access the calculator by pressing the Calc button of the function bar on the **Preset** screen.

Insert — Enter the value of an axis, PI or 2PI into the calculator.
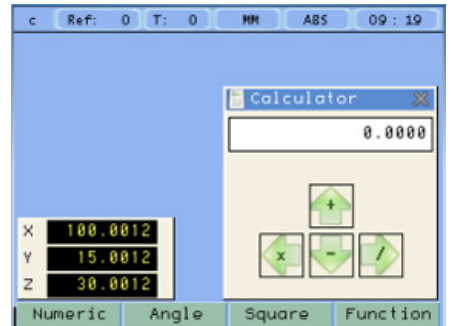
2.5.4 Simulation / execution special modes:

After completing the data that define a drilling cycle, you can execute the cycle or simulate it to verify that data entered is correct.

2.5.4.1 Cycle simulation:

Function	Bolt-hole drilling	Function	Show Graph
	Linear drilling		
	Grid pattern drilling		

The simulation may be seen in the following modes: *tool movement*, *views and sections* or *3D*.

View	Tool movement
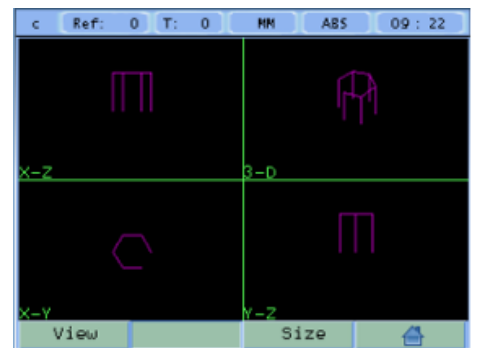
Tool movement

View	Engineering Drawing
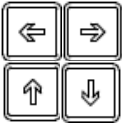
Consists of a top view and two sections with a mobile partition by pressing the arrow keys.
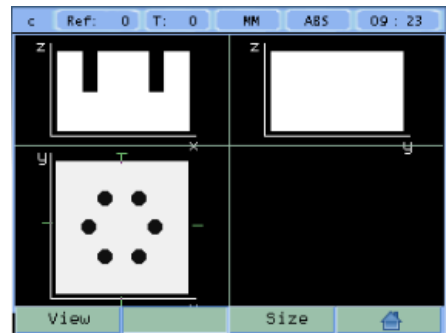
View	3D
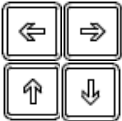
The 3D graphic may be rotated using the arrow keys.
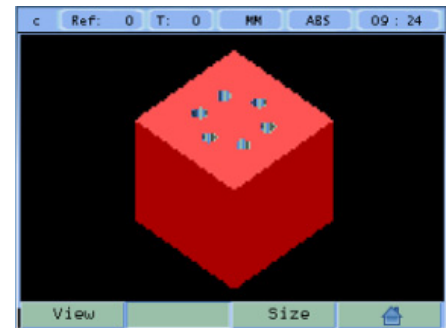
Size

Opens the window for entering the actual (real) part dimensions. Viewing the simulation in real mode requires entering the real X, Y, Z dimensions of the part.

2D views

3D solid

2.5.4.2 Cycle execution:

Run

Pressing the **Run** key, the DRO shows the distance the axes must move to position at the first hole. Move the axes to zero. .

The status bar indicates the number of the current hole and the total number of holes programmed in the cycle.

03 /   06

→ Total number of holes programmed.
→ Current hole Nr.

Once positioned at the drilling point, touch the surface with the tool. Press the Z axis key. The Z axis display reads zero.

Press Enter. A window opens for entering the hole depth. Press Enter to validate. The entered depth value is shown on the Z axis display.

Move the Z axis until its display reads zero. This way, the hole is drilled with the indicated depth.

Press this key to show the coordinates of the next drilling position (hole).

Repeat these steps until all the holes of the circle are drilled.
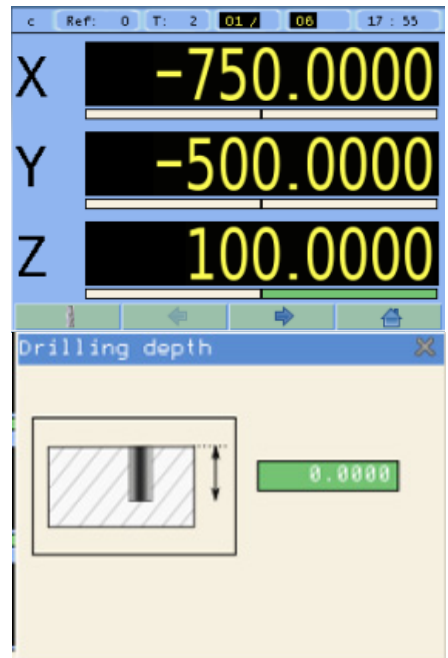
2.5.5 Probe:

The probe stores the data about the probed points in a USB memory. The probing data may be read and processed at a PC.

The file containing the probed points is: **FAGOR/DRO/PROBE/probe.csv**

The format of the generated file is "**csv**" (comma separated values) and may be easily imported into a spreadsheet.

From the left column to the right, the values correspond to the 1st, 2nd, 3rd and 4th axis respectively:

For example:

> 100.000 , 132.035 , 0.435, -124.500
>
> 133.005 , 132.035 , 0.435, -140.005
>
> 870.020 , 132.435 , 0.435, -145.755
>
> 133.870 , 132.035 , 0.435, -140.500
>
> 191.890 , 205.545 , 10.540, 40.500

2.5.5.1 Turn the probe ON and OFF.

Connect a USB memory to the DRO and wait for 4 seconds for the DRO to configure the memory.

To turn the probe mode ON.

The icon shows that the probe mode is ON. The data captured by the probe is saved in the file.

The probe MUST be turned OFF properly before extracting the USB memory so as not to lose any probing data.

To turn the probe mode OFF.

Note: Do not unplug the USB memory until the DRO completes the safe extraction sequence.
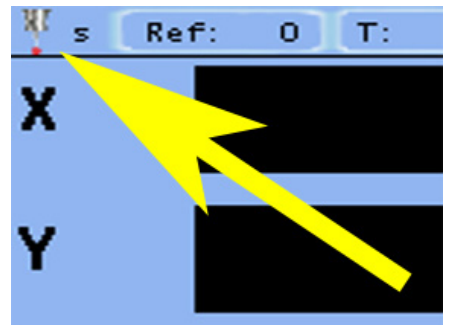
3 DRO installation

There are two ways to mount the Innova 40i M:

1- Mounted on the support arm.

2- Built-in model.

3.1 Mounting on the support arm.

The DRO may be mounted at the desired height and may be oriented at will.

The DRO is mounted on to the support arm using two set-screws.

3.2 Mounting of the built-in model.

The DRO is ready to be built into an operator panel or pendant. The name of this model is special, a **B** has been added at the end of the product name.

Example: INNOVA 40i M **-B**

On support arm

Built-in
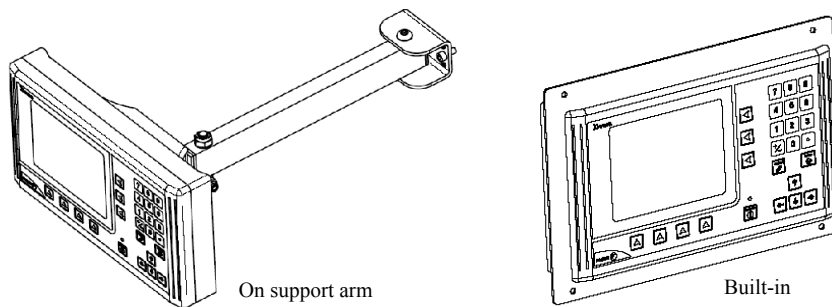
Dimensions of the DRO and the window to insert it into.

The first figure shows the DRO dimensions. The second figure shows the dimensions of the hole needed in the enclosure of the machine to built this model into.

VENTANA PARA ENCASTRAR
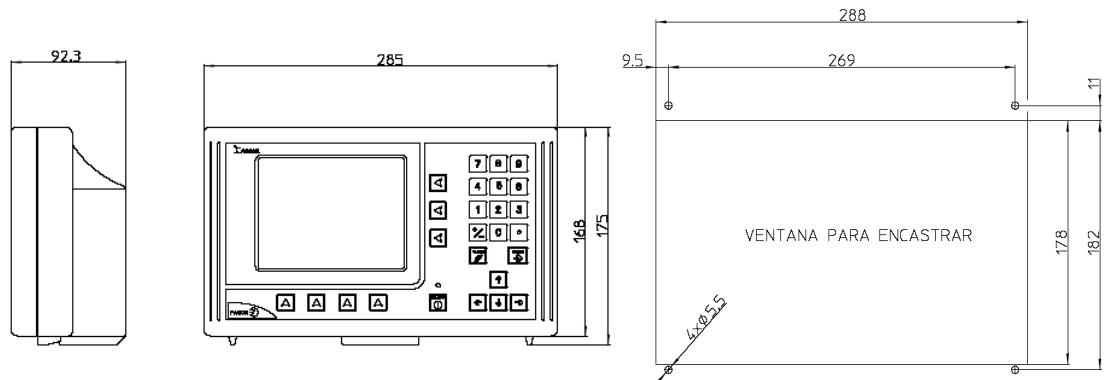
3.3   Rear panel

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

* Three-prong power connector for AC and ground connection.

* M6 mm terminal, for general machine ground connection.

* Mounting bracket.

* Feedback connectors:

X1.-SUB-D HD type 15-pin female connector for 1st axis feedback device (scale or encoder).

X2.-SUB-D HD type 15-pin female connector for 2nd axis feedback device (scale or encoder).

X3.-SUB-D HD type 15-pin female connector for 3rd axis feedback device (scale or encoder).

X4.-SUB-D HD type 15-pin female connector for 4th axis feedback device (scale or encoder).

X5.-SUB-D type 9-pin female connector for the probe.

*USB connector.

UL seal

In order to comply with UL standards, this unit must be connected in the final application using a listed detachable cord set (BLEZ) with a molded three-prong plug and a suitable fitting to be connected to the equipment, rated minimum 300 V AC. The cord type shall be SO, SJO or STO. Suitable Strain Relief means must be provided in the cord set to assure the connection of the plug and the fitting.

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

3.4   General technical characteristics

Universal Power Supply between 100V AC and 240V AC ±10% at mains frequency between 45 Hz and 400 Hz between 120V DC and 300 V DC. It withstands power outages of up to 20 milliseconds.

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

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

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

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

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

3.5   Connections
3.5.1   Connection of the feedback systems

The feedback systems (linear or rotary encoders) are connected via SUB-D HD type 15-pin female connectors: X1 through X4.

Characteristics of feedback inputs: X1, X2, X3 and X4:
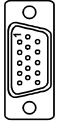
-Maximum feedback consumption: 250 mA at the +5V input.

-Admits square-wave signal (TTL).

-It admits voltage modulated 1 Vpp sinusoidal signal.

-**It admits SSI communication** for absolute encoders.

-Maximum frequency: 250 KHz, minimum gap between flanks: 950 nsec.

-Phase shift: 90º ±20º, hysteresis: 0.25 V, Vmax: 7V, maximum input current: 3mA

- High threshold (logic state 1): 2.4 V < VIH< 5 V

- Low threshold (logic state 0): 0.0 V < VIL< 0.55 V

Feedback connection. Connectors X1, X2, X3 and X4

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

3.5.2   Probe connection (connector X5)

Either a 5 V or a 24 V probe may be connected.
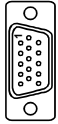
Characteristics of probe inputs X5:

5V probe input

Typical value 0,25 mA. ? Vin = 5 V.

High threshold (logic state 1) VIH: From +2.4 V DC on.

Low threshold (logic state 0) VIL: Below +0.9 V DC.

Maximum nominal voltage Vimax = +15 V DC.

24 V probe input

Typical value 0,30 mA. ? Vin = 24 V.

High threshold (logic state 1) VIH: From +12.5 V DC on.

Low threshold (logic state 0) VIL: Below +4 V DC.

Maximum nominal voltage Vimax = +35 V DC.

Probe connection. Connector X5

PIN	SIGNAL	DESCRIPTION
1	CHASSIS	Ground connection
2	+5Vout	+5V output
3	PROBE_5	+5V Probe input
4	PROBE_24	+24V Probe input
5	GNDVOUT	GND output.
6	5Vout	5V output
7	---	---
8	---	---
9	GNDVOUT	GND output.

The unit has two probe inputs (5 V DC and 24 V DC) at connector X5.

Depending on the connection being used, it is possible to choose whether it is activated by the up flank or by the down flank of the probe (see section **DRO:**).

Probe with a normally-open-contact output.

```
                    +Vcc
                     ○

         ○─────┐   ○
              ╱│▄│    ○  PIN3  Vcc=+5V TTL
         ○───╱─┘ └─┤      PIN4  Vcc=+24Vcc
                    ○──○  PIN3  
                 ○  PIN5   0V
                ▯▯▯
```

Acts with an up flank.
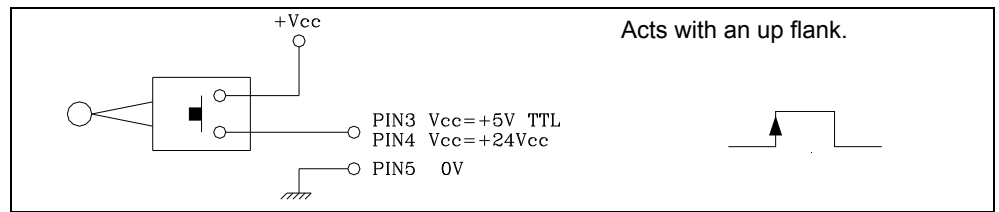
Probe with a normally-closed-contact output.
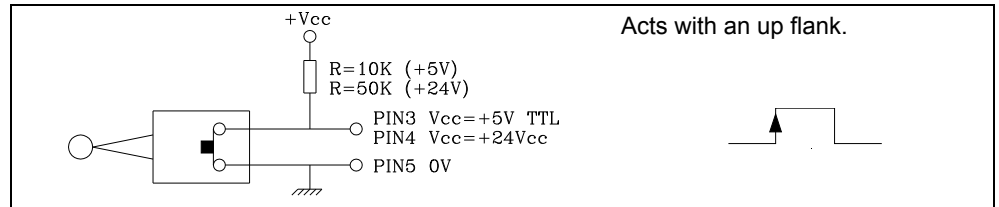
```
                      +Vcc
                       ○
                       ▯  R=10K (+5V)
                       ▯  R=50K (+24V)
         ○─────┐    ○    ○  PIN3  Vcc=+5V TTL
              ╱│▄│          PIN4  Vcc=+24Vcc
         ○───╱─┘ └─┤    ○  PIN5  0V
                  ▯▯▯
```

Acts with an up flank.

Interface with an open-collector output. Connection to +5 V.

```
                      +5V
                       ○
                       ▯  1K5
         ○──▨▨──┐     ○
                │◁│   ○  PIN3  Vcc=+5V
         ○──────┘ ▯▯▯ ○  PIN5  0V
```

Acts with a down flank.

Interface with an open-collector output. Connection to +24 V.

```
                     +24V
                      ○
                      ▯  12K
         ○──▨▨──┐    ○  PIN4  Vcc=+24V
               │◁│   
         ○─────┘▯▯▯  ○  PIN5  0V
```

Acts with a down flank.
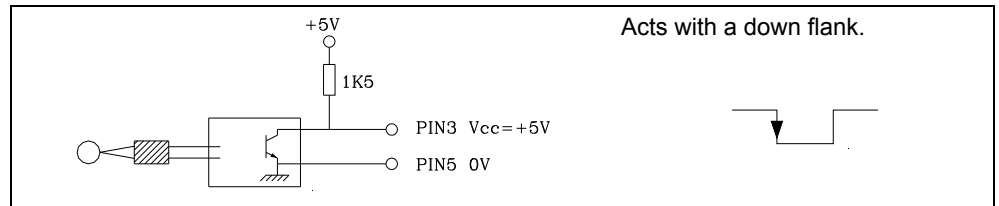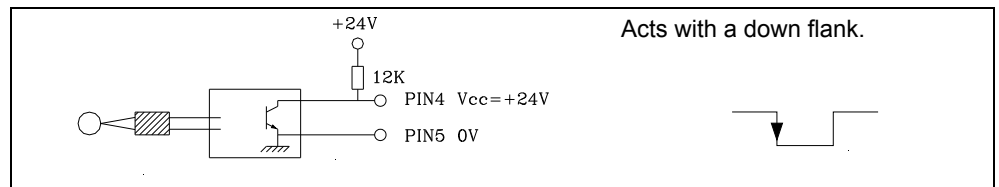
Interface with a PUSH-PULL output.

```
                    +Vcc
                     ○
         ○──▨▨──┐   ○    ○  PIN3  Vcc=+5V TTL
              │◁│          PIN4  Vcc=+24Vcc
         ○────┘▯▯▯  ○  PIN5  0V)
```

The active flank depends on the interface used
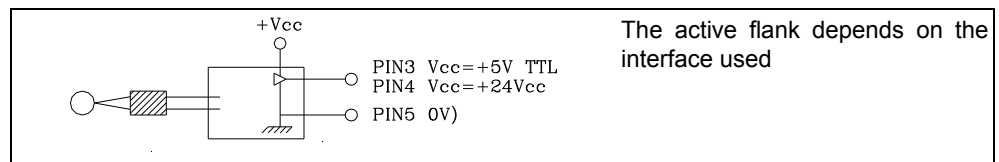
3.5.3   Power and machine connection

Always mount it vertically so its keyboard is within operator's reach and its digits are easily visible (at operator's eye level).

Do not connect or disconnect the DRO connectors while it is under power.

Connect all metallic parts to a common point on the machine tool and it to the general ground point. Use cables of enough gage (no thinner than 8 mm ^{2}) for this connection.

3.6 Installation parameters

3.6.1 Accessing installation parameters

```
                              ┌─────────┐
                              │  Setup  │
                              └────┬────┘
                      ┌────────────┴────────────┐
               ┌──────┴──────┐            ┌──────┴──────┐
               │ Home search │            │   Setup     │
               └─────────────┘            └──────┬──────┘
                              ┌──────────────────┼──────────────┐
                       ┌──────┴──────┐     ┌──────┴──┐     ┌──────┴──────┐
                       │    User     │     │  Test   │     │  Installer  │
                       └──────┬──────┘     └─────────┘     └──────┬──────┘
                  ┌───────────┴──────┐                     ┌──────┴──────┐
           ┌──────┴──────┐    ┌──────┴──────┐              │  Password   │
           │  Language   │    │   Color     │              │   231202    │
           └─────────────┘    └─────────────┘              └──────┬──────┘
                              ┌───────────────────────────────────┼───────────────────────┐
                       ┌──────┴──────────┐          ┌──────────────┴──────┐     ┌───────────┴──────────────┐
                       │      DRO        │          │     Feedback        │     │     Compensation         │
                       │(type, axes, alarms)│       │    (encoders)       │     │  (linear, multi-point)   │
                       └─────────────────┘          └─────────────────────┘     └──────────────────────────┘
```

Setup   **Setup**

Gives access to setting installation and user parameters and to the test mode.

The parameter setup is divided into three parts:

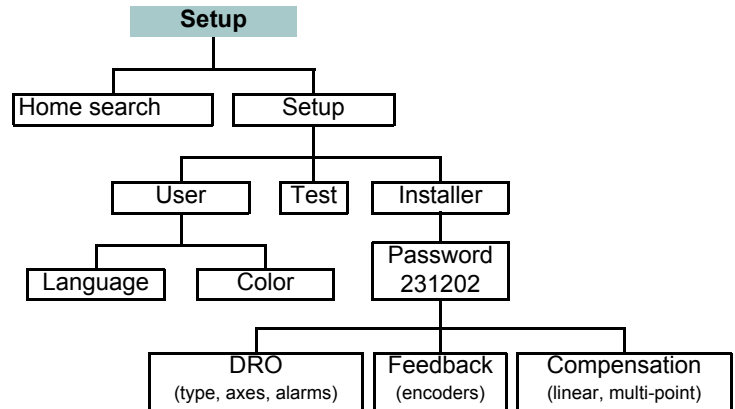**User**   **1- USER PARAMETERS:** Parameters that may be modified by the user: *change the language, set the clock* and *set the screen color*.

Install   **2- INSTALLER PARAMETERS:** Parameters that must be set when installing the DRO for the first time, when replacing an encoder or when doing a repair. They are parameters related to the machine, feedback and to the DRO itself.

Test   **3- TEST MODE:** To check the various status of different elements of the DRO, such as screen, keyboard, etc.

For the installer only. Accessing the test mode requires a password:

Password: 231202

3.6.2 User parameters:

Setup   **Setup**   **User**

Parameters that may be modified by the user: *change the language, set the clock* and *set the screen color*.

3.6.2.1 Language

Use the cursor keys to select the language.

Press Enter.

3.6.2.2 Screen color

ColorSet

Use the cursor keys to change the colors for the background, for the numbers, for the box, etc.

The *default* box shows the three preset options:

1- *Default:* Blue background with yellow numbers.

2- *Color 1:* Black background with yellow numbers.

3- *Color 2:* Green background, white box and green numbers.
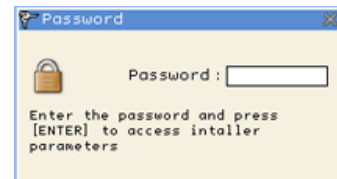
3.6.3 Installer parameters.

Setup	Setup	Install

Parameters that must be set when installing the DRO for the first time, when replacing an encoder or when doing a repair. They are parameters related to the machine, feedback and to the DRO itself.

Enter the password: 231202

3.6.3.1 Parameter backup into USB memory.

If a USB memory is connected, it is possible to save and recover:

- DRO parameters

- Multi-point compensdation tables

- User programs

3.6.3.2 DRO:

Setup	Setup	Install	DRO

It configures the DRO for each type of machine: Number of axes, type of machine (mill, lathe, etc.).

Pressing this button opens the window shown on the right. The following items are set in it:

1- Type of machine: Mill.

2- Number of axes to display: 1, 2 or 3.

3- Default units: mm or inches.

4- Toggled by the user: Yes or NO. If set to "YES", to change the units, select the **mm/inch** option from the **Display** drop list while the DRO is showing the main screen.

5- Configure the probe. It may be configured as inactive, active low (0V) or active high (5V or 24V depending on type of connection).
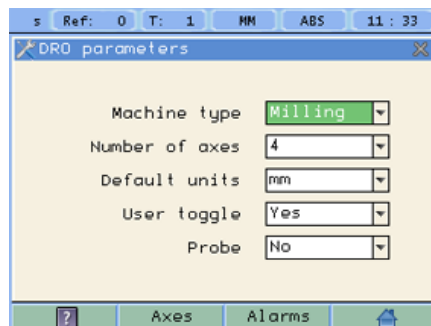
Axes option:

Setup	Setup	Install	DRO	Axes

These parameters must be set for each axis.

1- Combine axes: It is possible to add/subtract any axis to/from another axis. The factory setting is NO.

Rotary axes cannot be combined.

2- Display resolution: It is the resolution of the DRO. It makes it possible to display the position with a coarser resolution than that of the feedback device, although the actual internal calculation is done with the finest resolution.

Factory setting: 0.0000. It means that the display resolution is the encoder resolution.

3- Reverse the feedback reading (pulse counting) direction: Yes or NO. Factory setting: NO.

4- Display feedrate: Axis feed rate, both in mill and lathe modes. When activating this option ("YES"), the screens shows a window indicating the feed rate of each axis.

The units will be m/min or inches/min depending on whether MM or INCH is active.

5- Hide axis. Hides the axis and does not display its value.
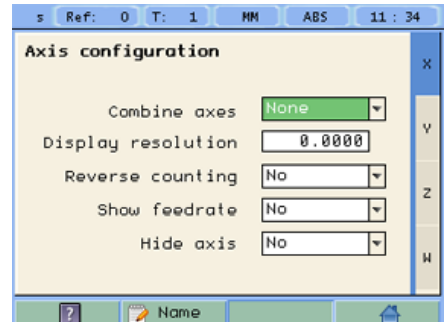
Name

The names of the axes may also be changed instead of calling them X, Y or Z.

Alarms option:

Setup	Setup	Install	DRO	Alarms

Turn on/off the various types of alarms.

These alarms must be set for each axis. The following screen is displayed:

1- 1 Vpp alarm: The DRO checks the amplitude and phase shift of 1 Vpp signals. An alarm is displayed when any of the signals gets out of the set limits.

2- Feedback alarm: Feedback alarm provided by TTL angular encoders. It may be active low (TTL O) or active high (TTL 1).

3- Feed rate overrun alarm: When set to YES, an alarm is issued over 200 kHz.

4- Travel limits: Setting it to YES activates two more fields (boxes) for entering the travel limits. A warning appears on the screen when overrunning these limits.

3.6.3.3 Feedback:

Setup	Setup	Install	Feedback	FAGOR
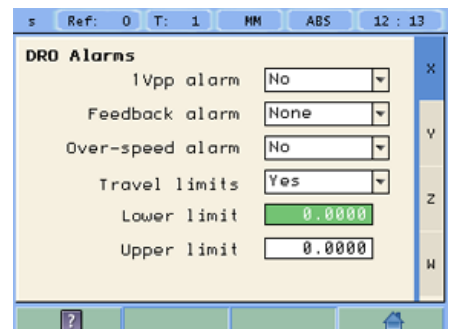
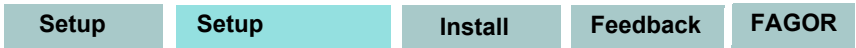## Selecting Fagor feedback knowing the name or model of the linear encoder.
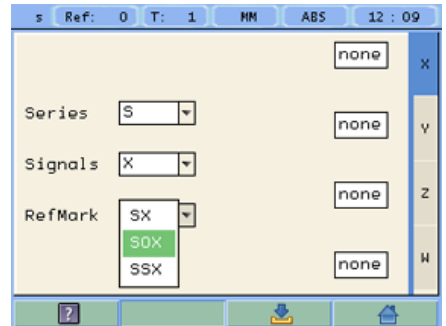

Select axis.

Select type of linear encoder, type of signal and type of reference pulse.

To validate the data for that axis.

Custom feedback selection:

Setup	Setup	Install	Feedback

Use this screen to set the characteristics of the encoder.

They are parameters for each axis.

The sections to be set are:

1- Type of axis: Linear or rotary.

    1.1- LINEAR: It requests the *resolution of the linear encoder.*

    1.2- ROTARY: It requests the *number of pulses / turn* of the encoder.

2- Type of encoder signal: TTL, 1 Vpp or SSI.

It requests the number of pulses/turn of the encoder and the number of turns the encoder must make for the machine to consider a 360° movement (mechanical gear ratio).
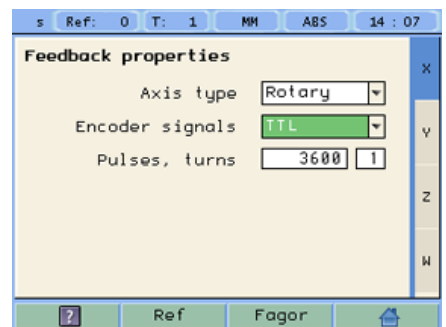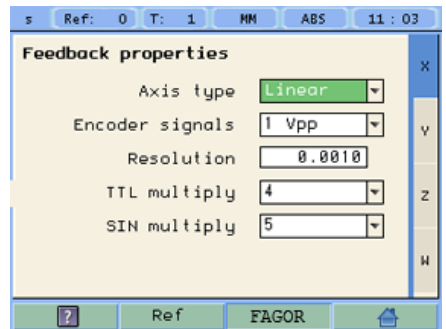
    2.1- TTL: It requests the resolution of the linear encoder or Nr of pulses of the encoder.

    The following table shows the resolutions of FAGOR TTL linear encoders.

Model	Resolution
MT/MKT, MTD, CT & FT	0,005 mm
MX/MKX, CX, SX, GX, FX, LX, MOX, COX, SOX, GOX, FOX & LOX	0,001 mm
SY, SOY, SSY, GY, GOY & GSY	0.0005 mm
SW, SOW, SSW, GW, GOW & GSW	0.0001 mm

2.2- 1Vpp: The **TTL MULTIPLICATION** and **SINUSOIDAL MULTIPLICATION** boxes are activated.

* **TTL multiplication.** Options: 0.5, 1, 2, 4. The factory setting is 4 and it is the one normally used with FAGOR linear encoders.

* **Sinusoidal multiplication.** Options: 1, 5, 10, 20, 25, 50. One or the other is used depending on the resolution to be obtained if the feedback signal is **1Vpp** or **TTL** with **distance-coded** reference marks.

Example: We wish to install a FAGOR GP linear encoder (1 Vpp and 20-micron-pitch graduated glass) with **1 micron** resolution

:

Therefore, a **1-micron resolution**, would require a **sinusoidal multiplying factor of 5**.

If the feedback signal is TTL with NO distance-coded reference marks, like GX, FT, SY etc. the value for this parameter will be "1".

$$\text{Resolution} = \frac{\text{Graduation pitch (20, 40 or 100 μm)}}{\text{TTL multiplier} * \text{Sinusoidal multiplier}}$$

$$1\ \mu m = \frac{20\ \mu m}{4 * 5}$$

2.3- SSI: It is the protocol used to communicate with absolute encoders. This protocol is configured with the following parameters:

* *Resolution:* Only requested if the axis is linear. The resolution to be used with FAGOR absolute linear encoders is 0.0001 mm.

Number of bits: It sets the digital communication between the encoder and the DRO. The factory setting and the one used with absolute linear encoders are 32 bits.
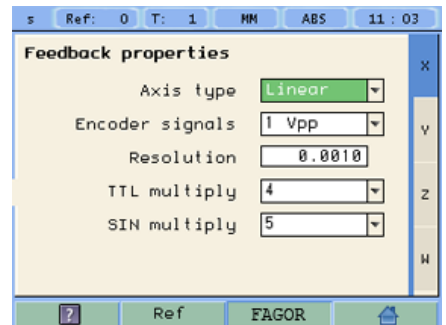
Reference

Setup	Setup	Install	Feedback	Reference

This window sets the parameters related to home search and the type of reference mark of the encoder. This configuration must be set for each axis.

* **User offset:** Offset of the reference point with respect to the reference zero of the feedback device, independent for each axis.

Usually, the machine reference zero (reference mark of the linear encoder) does not coincide with the absolute zero to be used. Therefore, this parameter must be assigned the value of the distance from the machine zero point to the feedback reference point.

Factory setting: 0.

This value will be in mm or inches depending on whether the DRO units have been set in "mm" or "INCH".
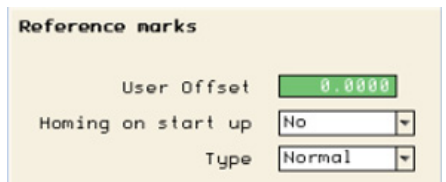
* Mandatory Home search. When set to **YES**, every time the DRO is turned on, it forces a home search. It is recommended to set it to **YES** when the DRO uses positioning error compensation because if the compensated axis is not homed, the compensation will not be applied.

* Type: It sets the reference system of the linear encoder: NONE, NORMAL (INCREMENTAL) or DISTANCE-CODED.

When selecting DISTANCE-CODED, you must set the engraving pitch of the linear encoder (20 µm, 40 µm or 100 µm) and the external multiplying factor (1, 5, 10, 25 or 50).

Exit and save data.

3.6.3.4 Compensation:

Setup	Setup	Install	Comp.

Choose the type of compensation to be used.

1- NONE.

2- LINEAR.

Choose LINEAR from the list, press Enter to validate it.

Edit   Press Edit to enter the compensation value. The following window is opened:

Even when working in inches, this value must always be in mm.

Enter the linear compensation value and press Enter.

3- MULTI POINT.

Choose MULTI-POINT from the list and press Enter to validate it.

Important   **Before capturing data for an accuracy graph, a home search must be carried out** because the compensation will not be applied until the home search is done. To use this compensation, it is recommended to force a home search on power-up.

Edit   Pressing the Edit button displays a table with 105 points and their corresponding error values.

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

There is no need to use all the points. The compensation point must have at least one point with no error (error 0).

Different options are offered when the Function button is pressed:
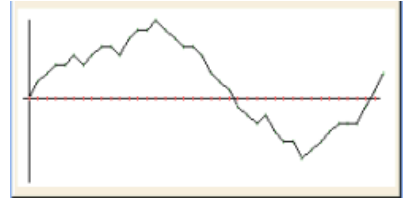
* Exit:

Function	Exit	To exit the screen saving the data.

* Draw Graph:

Function	Draw Graph

Draws a graph with the po ints and errors entered. It is recommended to check the graph to detect possible mistakes made when entering data.

Note: The maximum slope for the compensation graph is ±0.8 mm/m.

3.6.4 Test mode.

It may be used to know system information such as software version, hardware version, software burning date, etc.

Pressing the **Test** key displays the software and hardware versions, software recording date, checksum, error history, etc.

Pressing **Test** again offers the chan ce to run different tests that are very useful for troubleshooting the DRO itself or the encoder.

The Test mode is for the installer only and the access is protected with a password.

Password: 231202

4 Appendix

4.1 UL seal

see **"Rear panel" (page 18).**

4.2 CE seal

⚠️ *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.

4.2.1 Declaration of conformity

Manufacturer:Fagor Automation, S. Coop.

Barrio de San Andrés 19,

20500, Mondragón -Guipúzcoa- (SPAIN)

We hereby declare, under our responsibility that the product this manual refers to

Note. Some additional characters may follow the references to the models indicated in this manual. All of them comply with the following regulations:
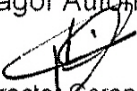
4.2.1.1 Electromagnetic compatibility:

EN 61000-6-2:2005 Standard on immunity in industrial environments

EN 61000-6-4:2007 Standard on emission in industrial environments

According to the European Directive: 2004/108/CE on electromagnetic compatibility.

In Mondragón, September 1st, 2009

Fagor Automation, S. Coop.

Director Gerente
Pedro Ruiz de Aguirre

4.2.2 Safety conditions

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

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

Do not manipulate the inside of the unit

⚠️ Only personnel authorized by Fagor Automation may open this unit.

Do not handle the connectors while the unit is under power.

⚠️ Before handling the connectors (mains, feedback, etc.) make sure that the unit is not under power.

Use proper Mains AC power cables.

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

Avoid electrical overloads

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

Ground connection

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

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

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

Ambient conditions

Respect the limits for temperature and relative humidity indicated in chapter

Do not work in explosive environments

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

Work environment

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

Install this DRO vertically so its power switch of the back panel is at a distance between 0.7 m (27.5 inches) and 1.7 m (5.6 ft) off the floor and away from coolants, chemical products, blows etc that could damage it. Keep it away from direct sunlight, extremely hot air, high voltage and high current sources as well as from relays, or high electromagnetic fields (about 0.5 m or 20 inches).

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

- Powerful loads connected to the same AC power line as this equipment.

-Nearby portable transmitters (Radio-telephones, Ham radio transmitters).

-Nearby radio / TC transmitters.

-Nearby arc welding machines.

-Nearby High Voltage power lines.

-Disturbance generating elements of the machine.

-Etc.

Safety symbols

Symbols which may appear on the manual

WARNING symbol

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

Symbols that may be carried on the product

WARNING symbol

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

"Electrical shock" symbol.

It indicates that point may be under electrical voltage.

"Ground Protection" symbol.

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

4.2.3   Warranty terms

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

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

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

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

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

EXCLUDING CLAUSES

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

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

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

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

SERVICE CONTRACTS

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

4.2.4 Material returning terms

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

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

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

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

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

Seal the cardboard box with packing tape or industrial staples.

Maintenance

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

Accumulated dirt can also, in some cases, provide a conductive path for electricity which could give rise to faults in the internal circuits of the equipment, especially in high humidity conditions.

To clean the equipment nonabrasive dish-washing detergents are recommended (in liquid, never powder form) or 75% isotropic alcohol with a clean cloth. DO NOT USE aggressive solvents, (benzol, acetones, etc.) which could damage the materials the equipment is made with.

Do not use high pressure compressed air to clean the item as this could give rise to an accumulation of charges which in turn lead to electrostatic discharges.

The plastics used in the front panel of the DRO stand up to: Grease and mineral oil, alkalis and bleaches, dissolved detergents and alcohol.

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

Preventive Inspection

If the DRO does not come on press the rear switch for starting, make sure it is properly connected and being supplied with the proper mains voltage.

FAGOR

Fagor Automation S. Coop.