Innova 40i / 40i-B

Installation / Operation Manual

Manual code: 14460086 Manual version: 1501 Software version: 2.50





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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:



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 Accessing functions in MILL mode



1.4.2 Accessing functions in LATHE mode



2 DRO operation in MILL mode

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

AB
ABS

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) [37.00] 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 To preset a value for an axis.
Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either preset a 0 value using the previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either previous keystroke sequence or use this other sequence (clear + axis). Image: Selent process of the axis, either process
2.2.2 In "Clear" mode (indicated with a "C" on the upper status bar)
Set the display to zero.
To preset a value:
And validate the data by pressing this key.
Or ignore it by pressing this key.

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

Change

2.4.1 Tools:

Change Tool

Change to or set tool (diameter and length). It offers a 15-tool table.

c Ref: 2 1	F: 0 MM	ABS 09:13
Tool		×
🔲 Tool n	umber	
Tool	Diameter	Length
0	10.0000	0.0000
1	10.0000	0.0000
2	10.0000	0.0000
3	10.0000	0.0000
<u> </u>		•
?	1	-

2.4.1.1 Tool change

Tool Nr

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 the diameter of the tool. Press 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.



2.4.2.1 Changing the reference

Change

Reference

Changing from one reference to another.



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.

It activates the probe mode. If the probe has been set, it may Probe 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:

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

Press Enter.

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



Press Enter.



2

3

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

Select the corner where the part zero (datum) will be set.

Notes:

Press Enter.

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





2.4.2.4 Searching the center of a part



Move the tool to the first point.

 \triangleleft

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.





Special functions 2.5

Function It gives access to the specific milling functions.

2.5.1 **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.

2.5.2 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.

2.5.3 Grid pattern drilling

Function Grid pattern drilling.

It allows up to 99holes 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.





c Ref: O T: O	MM ABS 09:16
Linear drilling	
	98
0000	× 25.0000
	Y 25.0000
X 100.0012	Distanc 10.0000
Y 15,8812	Holes 98
Z 30.0012	Alpha 45.0000
? 🔊 Run	Calc Function

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.

2.5.4 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.

2.5.5 Calculator function

Function

Square

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.

Functions: $x^2 = 1/x = \sqrt{-1}$

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.



2.5.6 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.

2.5.6.1 Cycle simulation



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

Consists of a top view and two sections with a mobile partition

View	Tool movement
View	Engineering Drawing

3D

by pressing the arrow keys.



Tool movement



2D views

Size

¢

¢

Ŷ

View

⇒

⇒

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.

The 3D graphic may be rotated using the arrow keys.



3D solid



2.5.6.2 Cycle execution

Select particular hole.



2.5.7 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.

When using the USB-RS232 adapter, the probe data will be sent to the PC in the same format.

RS232 communication parameters:

Baudrate:9600 BaudNumber of bits:8Stop bits:1Parity:none

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

> 100.000 , 132.035 , 0.435 133.005 , 132.035 , 0.435 870.020 , 132.435 , 0.435 133.870 , 132.035 , 0.435 191.890 , 205.545 , 10.540

2.5.7.1 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 operation in LATHE mode

3.1 Display modes

3.1.1 2/3 axes

Display

2/3 axes



Toggle the reading of the second axis between Z (Z1 + Z2), Z1 or Z2, when the DRO has been set for 3-axis lathe.

When it has been set by parameter to only display the Z axis, this key toggles between displaying 2 axes (X, Z) and displaying 3 axes (X, Z1, Z2).

3.1.2 mm / inch

Display mm/inch

Toggle units between mm and inches.

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

3.1.3 rad/diam

Display rad/diam

Toggle between radius mode and diameter mode. It only affects the X axis.

In **diameter mode**, the X axis display shows twice the actual distance traveled by the tool. When this mode is active, the X axis display shows the \emptyset sign.

In radius mode, the X axis display shows the actual distance traveled.

3.1.4 inc / abs

Toggle between incremental and absolute feedback reading (counting). The status bar shows the currently active mode.

3.1.4.1 Absolute mode

In this mode, the coordinates (position values) are referred to part zero.

Example on the right:

Set the DRO in absolute mode.

Set part zero (datum).

Run several passes moving the Z axis from "0" to "63.6" until obtaining the desired diameter.

Run several passes moving the Z axis from "0" to "47.6" until obtaining the desired diameter.

Run several passes moving the Z axis from "**0**" to "**22.6**" until obtaining the desired diameter.





3.1.4.2 Incremental mode

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

Set the dro in incremental mode.

Set a floating zero (Z=0) at point A.

Preset the value "**22.6**" for the Z axis. Run several passes moving the Z axis from "0" to "63.6" until obtaining the desired diameter.



Clear Z axis.

Preset the value "**25**" for the Z axis. Run several passes moving the Z axis from "0" to "63.6" until obtaining the desired diameter.



Clear Z axis.

Preset the value "15" for the Z axis. Run several passes moving the Z axis from "0" to "63.6" until obtaining the desired diameter.

3.2 Tool

Set or change the tool.

Up to 100 tool offsets may be defined at this DRO, from *tool 0* to tool 99. The unit stores in its internal memory the relative offsets of all the tools with respect to that of tool "0". (master tool).

Therefore, if *tool 0* has been preset in ABS mode (on X and Z) and, then, the rest of the tools, it will suffice to just preset the *master tool* (tool 0) again (on Z) for the new part. The DRO will then automatically recalculate all the offsets of the rest of the tools without having to preset them for each part.

Teach	Assistant for setting new tool offsets.
Table	Access to the tool table.



3.2.1 Tool setting



When going into Teach mode, if the DRO was in INC mode, it switches to ABS mode.



3.2.1.1 Setting the tool by touching a part of known diameter



Enter tool number. Press Enter.

Move the X axis until the tool touches the part. Preset the part diameter.

Move the Z axis until the tool touches the part. Preset the value for the Z axis.



Press button to validate.

clear	T:	0	MM	ABS	09:28
🄈 Teach	tool				×
					Hold
					Hold
× 200.	8824		Tool		0
Z 🛛 😗 .	0000		×		0.0000
			z		0.0000
?	1	1			4

3.2.1.2 Setting the tool by touching a part of unknown diameter

When the part must be removed to measure its dimensions, use the HOLD function.



Enter tool number. Press Enter.

Move the X axis until the tool touches the part.

Move the Z axis until the tool touches the part.

Hold

Remove the part and measure it.

Press HOLD for both axes.

Preset the X axis with the measured diameter value.

Preset the value for the Z axis.

Press button to validate.



These tool presets are kept in memory even when the unit is powered off up to a maximum of 10 years.

Notes: The presets done with any tool in incremental mode change the part zero for all the tools.

If a tool offset has been preset in Z_1 , Z_2 or Z (Z1 + Z2) mode, that tool must be used in the same mode (Z_1 , Z_2 or Z) when using it to machine the part.

The tool offsets are referred to the machine zero found at the time. When turning the DRO on, it is necessary to find the same reference mark.

3.2.2 View tool table



cle	ar	T: 0	MM	ABS	09:29	
	ſool					×
1						1
	Tool		XØ	z		
	0		0.0000	0.	0000	1
	1		0.0000	0.	0000	
	2		0.0000	0.	0000	
	3		0.0000	0.	0000	
ſ						1
	?			₽	4	



3.3 Special functions

Function It gives access to the specific lathe functions.

3.3.1 Angle measurement

Function

Angle measurement

It may be used to calculate the angle or taper of a part by touching two points.



Touch the second point and press Enter.

It shows the calculated angle in *degrees* and *degrees* - *minutes* - *seconds*.



3.3.2 Turning function

Function

Turning

Assistant for defining a turning cycle after having entered the following data:



X: Starting diameter. Move the X axis until the tool touches the part. Press X axis button to enter the position value on the X axis. If the part diameter is known, its value may be entered directly. Press Enter. The next field (box) is activated.

Z: Initial Z axis value. Place the tool touching the part on the Z axis. Preset a value and press the button for the Z axis to enter the value of the Z axis display. Press Enter. The next field (box) is activated.

Execute turning cycle. Move the axes until both axis displays read zero.



X: Enter final diameter. Press Enter.

Z: Enter Z axis final value. Press Enter. Press Enter.

Cut: Enter cutting pass in mm. The DRO will use this value also as the safety distance to withdraw after each pass.

Run

Go on to the next execution step.







3.3.3 Threading function

Function Threading

This function helps you making threads of various pitches on a lathe. This function is only available on machines that have an encoder on the leadscrew. Refer to section **4.6.5** "Threading" on page **35** to see how to install the encoder and set the relevant parameters.

set

3.3.3.1 Threading Procedure

Pitch It is the thread pitch in mm or threads per inch (tpi).

Cancel threading



Execute Threading cycle It will display the threading screen.



Pito	:h	mm 🔻 3.000	*
6			

MM

ABS

T: 1

09:48

Main screen

3 bars will now appear on the screen.

The top LED bar is for the linear scale feedback that's attached to Z axis. The middle LED bars are for the encoder feedback that's attached to the leadscrew. The bottom bar shows the distance to go.

Setup

When beginning to work, depending on the encoder position, sometimes it is impossible to engage the axis. So, with the machine stopped, move the Z axis position just to get one rectangle close to the other (one of the colored rectangle on the right side of the red one) and engage the machine.





÷

Now using the DRO keys [< -] [->], move the red rectangle just to see it over the other colored rectangle and then press Enter.

Z axis feedback Encoder feedback of leadscrew Distance to go bar



IMPORTANT

The LED bars need to move from right to left.

If they are not, reverse polarity as described on page: 36



- The operator has the chance to clutch the axis every time the rectangles are aligned one of top of the other. If the operation has been properly done, the green bar will be at 100 %.
- For finishing the thread, we do recommend engaging the machine in the same color as the previous cycle, to improve the final result of the thread.

Distance-to-go bar (DTG): As the Z axis feedback and the encoder feedback LED bars approach each other, the white bar will increase size. When the DTG turns fully green, the LED bars should be aligned and ready to engage lever.

3.3.4 Calculator function

Function Calculator

See section: 2.5.5 "Calculator function" on page 12



4 DRO installation

There are two ways to mount the Innova 40i:

- 1- Mounted on the support arm.
- 2- Built-in model.

4.1 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.

4.2 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 -B



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.





4.3 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).

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



0(:...)0

*USB connector.



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.



ETL file number:



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



4.4 General technical characteristics

- Universal Power Supply between 100V AC and 240V AC ±10 % at Mains frequency between 45 Hz and 400 Hz. Between 120 V DC and 300 V DC. Maximum power consumed 25 VA. 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 5 °C and 45 °C (41 °F and 113 °F).
- The storage temperature inside the DRO enclosure must be -25 °C and +70 °C (-13 °F and 158 °F).
- Maximum relative humidity: 95 % non condensing at 45 °C (113 °F).
- Front Panel Sealing: IP54 (DIN 40050), Rear panel: IP4X (DIN40050) except for built-in models in which case is: IP20.



4.5 Connections

4.5.1 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 X3.

Characteristics of feedback inputs: X1, X2 and X3:

-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: 90° ±20°, 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 and X3

Pin	Signal 1Vpp/ TTL	Signal SSI	Function
1	А	-	
2	/A	-	
3	В	-	Input for foodback signals
4	/B	-	input for reedback signals
5	10	Data	
6	/10	/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	Cha	Issis	Shield



4.5.2 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 **4.6.3.2 DRO en la página 29**).



Probe with a normally-open-contact output.



Probe with a normally-closed-contact output.



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



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



Interface with a PUSH-PULL output.



4.5.3 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.



4.6 Installation parameters

4.6.1 Accessing installation parameters



Setup	Setup	() () () () () () () () () () () () () (
	Gives access to setti the test mode.	ng installation and user parameters and to	XSetup X
	The parameter setup	is divided into three parts:	
User	1- USER PARAMET	ERS: Parameters that may be modified by	* 🏠 💥 🧠 🔹
	the screen color.		
Install	2- INSTALLER PAR when installing the I encoder or when do to the machine, feed	CAMETERS: Parameters that must be set DRO for the first time, when replacing an ing a repair. They are parameters related back and to the DRO itself.	<u>User Parameters</u> • Display Adjust • Tool Bar • Language
Test	3- TEST MODE: To etc.	check the various status of different element	s of the DRO, such as screen, keyboard
	Can the installer cal	A according the test mede requires a passive	a wal .

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

Password: 231202

4.6.2 User parameters



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

4.6.2.1 Language



Use the cursor keys to select the language.

Press Enter.



4.6.2.2 Screen color

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

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.

4.6.3 Installer parameters



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

4.6.3.1 Parameter backup into USB memory

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

- DRO parameters
- Multi-point compensation tables
- User programs

4.6.3.2 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 or lathe.

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.

s Ref: 0 T: 1 MM ABS 11:33 ∛DRO paramete Machine type × Number of axes 4 Ŧ Default units mm -User toggle Yes Ŧ No Ŧ Probe Alarms Axes

parameters

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

6- Display Z only. The main window will only show the X and Z axes. Pressing the third axis selection key, the display will toggle between displaying 2 axes and displaying 3 axes.



3rd

FAGOR

Axes option	1				
Setup	Setup	Install	DRO	Axes	
These parameter	ers must be set for e	each axis.			
1- Combine ax from another ax	(es : It is possible t is. The factory setti	o add/subtract a ng is NO.	any axis to/	set Axis config	
Rotary axes car	not be combined.			incip coming	
2- Display reso it possible to dis that of the fer calculation is do Factory setting: the encoder res	Jution: It is the reso splay the position wi edback device, all one with the finest re 0.0000. It means t colution.	olution of the DR ith a coarser res though the act esolution. hat the display r	O. It makes olution than ual internal esolution is	Combine axes None Display resolution 0.1 Reverse counting No Show feedrate No	
3- Reverse direction: Yes	the feedback re or NO. Factory setti	ading (pulse	counting)	?	
4-Display Feed screens shows	Irate: Axis feed rate a window indicating	e, both in mill and I the feed rate of	l lathe modes each axis.	. When active	
The units will be	e m/min or inches/m	in depending on	whether MM	or INCH is a	
The names of the	ne axes may also be	e changed instea	ad of calling th	nem 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 0) 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.

clean T: 0 MM ABS 09	: 35
DRO Alorns	
1Vpp alarm Yes 🔻	×
Feedback alarm None 🔻	
Over-speed alarm No	
Travel limits Yes 🔻	21
Lower limit 0.0000	
Upper limit 0.0000	z2
	}



4.6.3.3 Feed	dback							
Setup	Setup	Install	Feedback	FAGOR				
Selecting Fa	agor feedback kn	owing the na	ame or mod	el of the l	inear encoder.			
	Select axis.				s [Ref: 0] [T: 1]	MM AB	5 10 : 43	
	Select type of linear reference pulse.	encoder, type	e of signal an	d type of			SOP	×
2	To validate the data for	or that axis.			Series	S 🔻		
					Signals	P 🔻	none	Y
					RefMark	SOP 🔻		
							none	z

Custom feedback selection:



1.2- ROTARY: 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).For SSI, the number of bits per turn (maximum number of bits = 23)

s Ref: 0 T: 1 MM ABS 10:3	86
Feedback properties	
Axis type 🛛 Linear 💌	×
Encoder signals 1 Vpp 👻	
Resolution 0.0001	Ŷ
TTL multiply 4	
SIN multiply 50 💌	
	z
? Ref Fagor 🐣	

2



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

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:

Resolution = TTL multiplier * Sinusoidal multiplier

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

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".

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.

s Ref:	0][T: 1)(•	IM ABS	10 : 3	6
Feedback	propert	ies			
	Axis	type	Linear	T	×
Enco	der sign	nals	1 Vpp	v	
	Resolut	tion	0.0	001	Ŷ
TTL multiply 4					
SIN multiply 50 🔻					
					z
		_	-		
?	Ref		Fagor		

	Reference							
Setup	Setup	Install	Feedback	Reference				
	This window sets the the type of reference must be set for each	parameters re mark of the e axis.	Reference marks					
	* User offset: Offset reference zero of the axis.	of the referen feedback dev	ce point with vice, indeper	respect to the ident for each	Homing on start up No V Type Normal V			
	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 b assigned the value of the distance from the machine zero point to the feedback reference point.							
	Factory setting: 0.							
	This value will be in m	nm or inches d	epending on	whether the DF	RO 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 NONE, NORMAL (IN	e homing system of the linear encoder: NCREMENTAL) 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. 25							
4.6.3.4 Co	mpensation							
Setup	Setup	Install	Comp					
	Choose the type of co 1- NONE.	ompensation to	o be used.					

Important	Before c	apturing of	data for	an ac	curacy	y graph,	a home	c'	lear	T: 0 H	M AB	5)(0	9
	search m	must be carried out because the compensation will						•	Multi Poi	int Error Com	t Error Compensation		
	compensa	ation it is r	ecomme	nne sear	force	a home	search on		Point	Position	Er	ror	1
	power-up.		000111110		10100	a nomo			1	0.0000	0.0	000 -	1
	The maxi	imum amo	unt of e	error that	at mav	/ be con	npensated		3	0.0000 0.0000	0.0	888 888	
	correspon	ids to a slo	$rac{1}{2}$ of ± 3	mm/m.	it may		iponoatoa		4	0.0000	0.0	888	
									6	0.0000	0.0	888	
									7	0.0000	0.0	000	
Edit	Pressing	Pressing the Edit button displays a table		able w	vith 105 p	th 105 points and		8	0.0000	0.0	888 -	J	
	their corresponding error values.					/ Help		*	Fun	iC			
	Error to displayed	be comp position	ensated	= Mas	ster's	actual p	osition -						
	There is n (error 0).	io need to i	use all th	ne points	. The c	compensa	ation point	mu	ist have	at least one	point w	ith n	0
	Different o	options are	offered v	when the	e Funct	tion butto	n is presse	ed:					
	* Exit:												
Function	Exit	To ex	it the scr	reen sav	ing the	e data.							
	* Draw Gi	raph:								\sim			
Function	Draw G	aph							\sim	× \			
	Draws a	graph w	ith the	points	and	errors e	ntered. It	is	;		\sim		

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



Test

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 chance 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



z1

Z2

tion

error

4.6.5 Threading

4.6.5.1 Installation Instructions

To install the threading feature onto a lathe you will first have to attach an encoder to the end of the ballscrew/ leadscrew.

First off you will need to locate the end of the ballscrew/leadscrew.

You will need to expose the end of the ballscrew/leadscrew so that you can attach the encoder to it.

To attach the encoder to the ballscrew/ leadscrew you will need some sort of shaft extruding off of it.

Here is an example of a shaft that was made to connect to the encoder.

Note: AF Coupling will be connecting the shaft to the encoder.)

You will have to make up a bracket to secure the encoder onto the machine.

Here is an example of a bracket made up to mount to the machine.

The encoder and AF Coupling are attached to the bracket as another example.

Connect the shaft to the AF Coupling.

Align and mount the encoder bracket onto the machine.

Make sure everything is tight, aligned and secure.

Attach the cable to the encoder and the DRO.

After mounting all of the hardware correctly, the next step is set the software parameters.





3x120*







Accessories included with encoder

SxM4 (cu.)









4.6.5.2 Parameters for the threading function

In Feedback properties set Z2 as Rotary axis type (Z2 reads the pulses of the encoder connected to the leadscrew in the lathe). Then, follow the instructions on the screen to complete the configuration of Z2: number of pulses of the encoder and the leadscrew pitch of the lathe in millimeters or inches.

Access the DRO, AXIS and FEEDBACK parameters as described in the previous sections and set them as follows: Machine type: Lathe Number of axes: 3 Default units: mm or inches.	Clear T: 0 MM ABS 09:33 CDR0 parameters Machine type Lathe V Number of axes 3 V Default units mm V User togale Yes V
Type of axis: Rotary. Number of pulses: Depends on encoder. Pitch: Depends on leadscrew/ballscrew. In millimeters (mm) or threads per inch (tpi).	Image: Contract of the set
	22 2 Ref
Note: If the polarity of the Z axis linear encoder needs to be	set T: 1 MM ABS 10:04
reversed, follow steps below for Z1.	Axis configuration
Change Reverse Counting to Yes.	×
It will ask you if you want to save parameters. Press Yes.	Combine axes None * Display resolution 0.0000 Reverse counting Yes * Show feedrate No * Z2

?

5 Appendix

5.1 UL seal

see "Rear panel" (page 23).

5.2 CE seal



<u>Warning</u>

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.

5.2.1 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:

5.2.1.1 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.



Pedro Ruiz de Aguirre

5.2.2 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.

5.2.3 Warranty terms

WARRANT All products manufactured or marketed by Fagor Automation has a warranty period of 12 months from the Y 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.



5.2.4 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 AUTOMATION S. COOP. B^a San Andrés Nº 19 Apdo de correos 144 20500 Arrasate/Mondragón - Spain - Web: www.fagorautomation.com Email: info@fagorautomation.es Tel.: (34) 943 719200 Fax: (34) 943 791712



Fagor Automation S. Coop.

Fagor shall not be held responsible for any printing or transcribing errors in this manual and reserves the right to make any modifications to the characteristics of their products without prior notice.

