

# Digital readouts

for milling machines and boring mills

for lathes

for general purpose applications and grinders



# Fagor Automation in permanent evolution

Fagor Automation has been **manufacturing** digital readouts for **over 30 years** and has always kept ahead **launching innovative** products adapted to the actual machining requirements of conventional machines. This catalog is proof of that completing the DRO range with models that provide new and exclusive features.

for **milling machines and boring mills**



for **lathes**



## Best quality and reliability in DRO

- . **Zero setting of the axes**
- . **Preset function**  
For the operator to enter values into the DRO and save them in its memory and recall them when needed.
- . **Direct mm/inch conversion by keyboard**
- . **Absolute, Incremental and I0 reference (home) signals**
- . **Resolutions from 0.1 microns on**
- . **Feedrate and movement alarms**
- . **Axis coupling**  
Parallel axes may be combined so a single axis display shows the addition/subtraction of both axes.
- . **Hysteresis factor**  
To keep the display digits from flickering due to machine vibrations when working at high feedback resolution.
- . **Linear axis sag compensation**  
The linear error caused by the machine may be compensated by parameter.
- . **Calculator function**  
For doing math and trigonometric calculations as well as presetting the result on any axis or using the feedback value to do calculations.
- . **Up to 20 references**  
For parts and/or tools.
- . **Easy setup and diagnosis**  
The DRO detects the characteristics of the feedback system to which it is connected and sets its internal parameters automatically.
- . **Energy saving mode**  
The DRO turns off automatically after being idle for 30 minutes.
- . **Software limits**  
These limits do not cancel the limits already set by the travel limits of the machine, but offer the operator the chance to add other limits between the main ones.
- . **Multi-point compensation**  
A multi-point error is the interpretation of an error between 2 points of the travel; the DRO can compensate up to 100 such error points.
- . **PC communication through a USB adapter**  
For future feature upgrades.

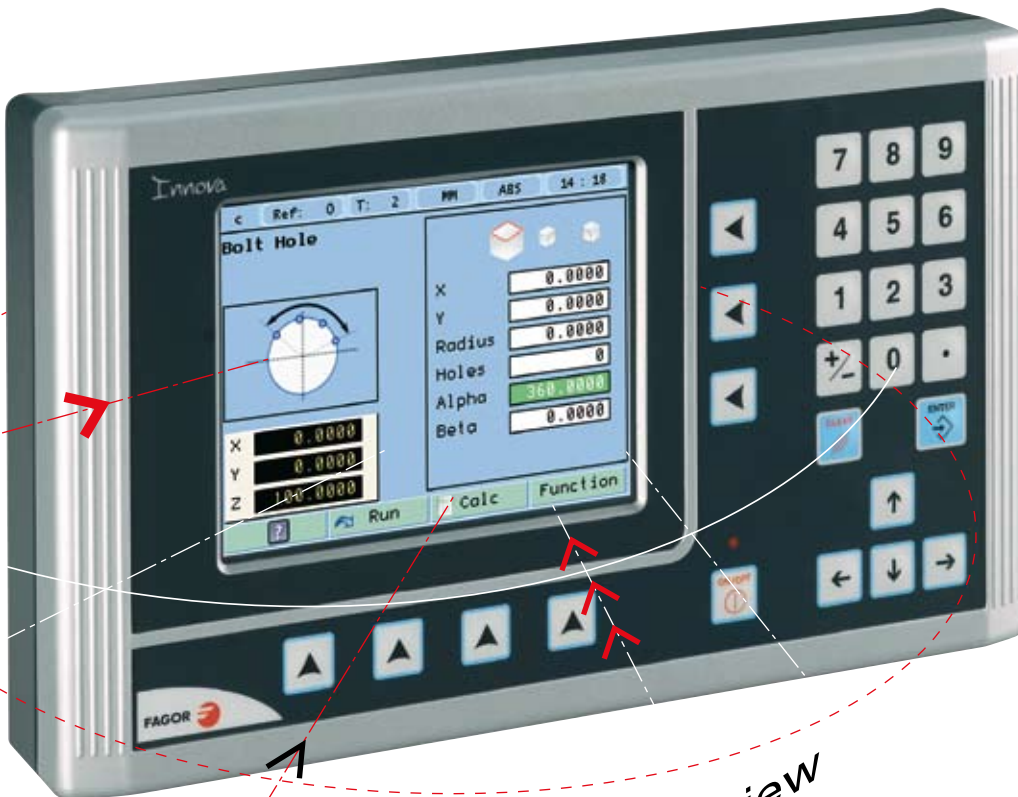
## With tailored solutions

Innova series FAGOR DRO's carry components created, developed and patented by FAGOR. **Highly reliable products that adapt to the customers' particular needs** in order to improve the productivity of milling machines, boring mills, lathes, grinders and general purpose applications among other machines.

for general purpose applications and grinders



## New Innova TrueVision series models



- 5.7" color TFT screen
- 3D graphic assistance for programming and simulation
- Friendly and intuitive operations

*The clearest choice from any point of view*

# FAGOR DRO's and

the combination that

		for milling machines and boring mills				for lathes				for general purpose applications and grinders		
		40i P	40i	30i M	20i M	40i TS	40i	30i T	20i T	40i	20i	10i
<b>feedback</b>	connection to TTL, 1Vpp and SSI encoders	4	3			4	3			3		
	connection to TTL encoders	4	3	3	3	4	3	3	2	3	2	1
	linear axes	•	•	•	•	•	•	•	•	•	•	•
	angular encoders	•	•	•	•	•	•	•	•	•	•	•
	incremental and distance-coded reference marks	•	•	•	•	•	•	•	•	•	•	•
	linear compensation	•	•	•	•	•	•	•	•	•	•	•
	multi-point compensation (points per axis)	100	100	40	40	100	100	40	40	100	40	40
	feedrate alarm	•	•	•	•	•	•	•	•	•	•	•
	travel limit alarm	•	•	•	•	•	•	•	•	•	•	•
<b>display</b>	5.7" color TFT screen	•	•			•	•			•		
	LED display			•	•			•	•		•	•
	number of axes	4	3	3	2	4	3	3	2	3	2	1
	radius or diameter display					•	•	•	•			
	mm/inch conversion	•	•	•	•	•	•	•	•	•	•	•
	fine / coarse resolution			•	•			•	•		•	•
	absolute / incremental /lo	•	•	•	•	•	•	•	•	•	•	•
	"display off" mode	•	•	•	•	•	•	•	•	•	•	•
<b>functions</b>	zero setting of the axes	•	•	•	•	•	•	•	•	•	•	•
	buzzer function	•	•	•	•	•	•	•	•	•		
	number of references	100	100	20	20							
	number of tools	16	16			100	100	20	20			
	axis preset	•	•	•	•	•	•	•	•	•	•	•
	tool compensation	•	•	•	•							
	axis feedrate display	•	•			•	•	•		•		
	calculator	•	•	•	•	•	•	•	•	•		
	easy setup and diagnosis	•	•	•	•	•	•	•	•	•	•	•
<b>cycles</b>	part centering cycles	•	•	•	•							
	bolt hole drilling (with the most recent data saved in memory)	•	•	•	•							
	linear drilling	•	•	•	•							
	grid pattern drilling	•	•									
	<b>go to</b> a particular position	•	•				•			•		
	angle measuring	•	•	•	•							
	taper calculation					•	•	•	•			
	turning					•	•					
	facing					•	•					
	assisted threading ( <b>easy threading</b> )						•					
	on-screen guided help, with graphics	•	•	•	•	•	•			•		
	storage of many part-programs	•										
<b>others</b>	USB connection for copying data	•	•	•	•	•	•	•	•	•	•	•
	auto shut-off after 30-minute idle	•	•	•	•	•	•	•	•	•	•	•
	digital inputs / outputs	4/6				15/11						
	analog inputs / outputs					1/1						

# feedback systems

sets it apart

## With state-of-the-art technology

The DRO offers the user features that make his job easier, but what sets it apart in terms of machining accuracy is the feedback installed on the axes of the machine.

Fagor Automation uses high quality, highly reliable optic technology to manufacture their linear and rotary encoders.

This results in a variety of feedback products that includes the recent absolute linear encoders whose protocols are compatible with the most relevant CNC manufacturers on the market.



## Accuracy certificate

All FAGOR linear feedback systems are subjected a final accuracy test carried out on a computerized measuring bench equipped with a LASER interferometer inside a climate-controlled chamber at a temperature of 20 °C (68 °F).

## Linear encoders for conventional machines

series	design	maximum speed	measuring lengths	accuracy levels
M	small section for installation in limited space	60 m/min	40 mm to 1540 mm	± 10 µm
			40 mm to 1240 mm	± 5 µm
C	wide section	60 m/min	220 mm to 3040 mm	± 10 µm ± 5 µm
F	for great measuring lengths	120 m/min	440 mm to 30 m	± 10 µm

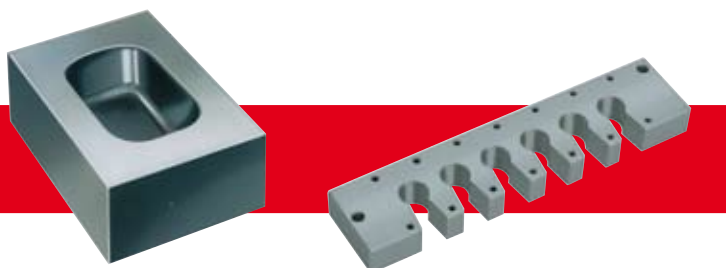


20i M



30i M

For milling machines and boring mills with 2, 3 and 4 axes

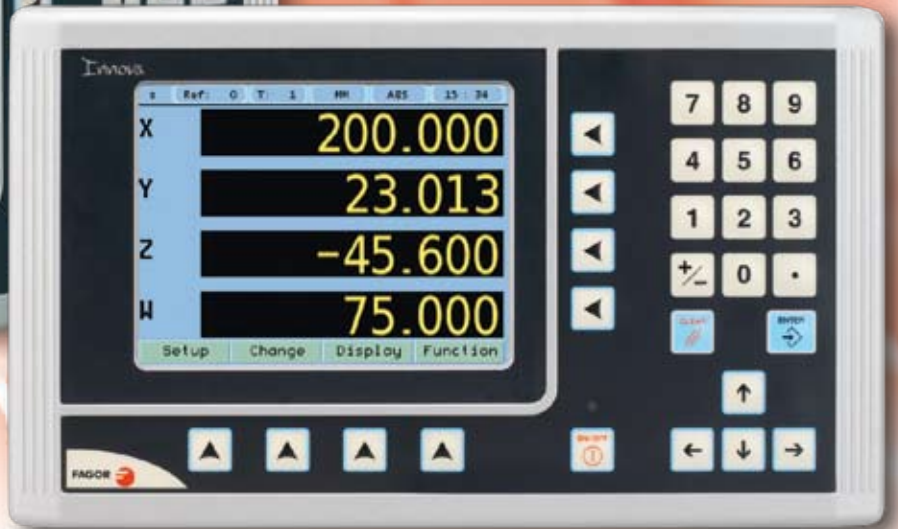


### Most relevant features

- . **Bolt-hole drilling**  
The position of the holes is calculated automatically by entering the values requested by the DRO.
- . **Linear drilling calculation**  
Calculates, memorizes the position and guides through the execution of linear drilling operations at any angle with respect to the axes.
- . **Tool radius compensation**  
The tool radius is added to or subtracted from the position value when milling with a round tool depending on the machining direction.
- . **Part centering**  
Simply touching two points of the part with the tool or with a probe and pressing a key, the DRO calculates the center of the part.
- . **Up to 20 datum points**  
It makes working with several origin points easier and may be used to save tool data and to position holes
- . **Part alignment**  
For measuring angles avoiding part misalignment and correct its inclination until the right position is obtained.
- . **Corner rounding/machining of arcs**  
To be used in simple corner rounding or curved surfaces in a plane defined by two linear axes.



40i



40i P

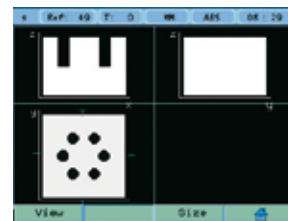
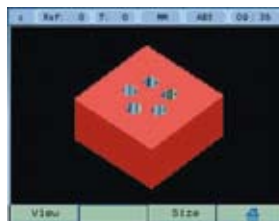


## Innova 40i and 40i P DRO's

Using the TFT screen of the Innova 40i, it is possible to select the X, Y, Z, W plane where the machining will take place, graphically see the steps to follow and simulate the end result in 3D. All that in the intuitive and friendly way that only FAGOR can offer.

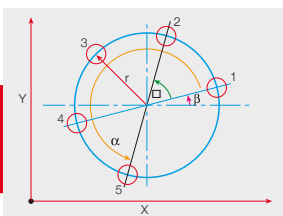
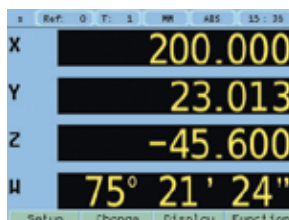
### Graphic programming assistance

- Bolt-hole drilling
- Linear drilling
- Grid pattern drilling
- Angle calculation in the plane

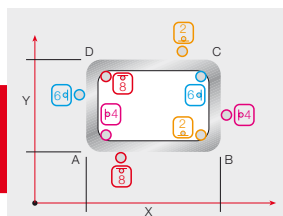


### Specific characteristics of the 40i P

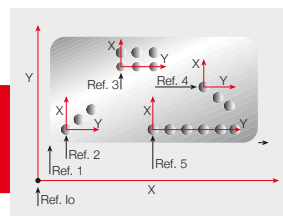
- Up to 4 feedback axes and display on the main screen
- Independent linear and angular feedback, 4-axis display, slope of each axis
- Part-program programming and backup
- Configurable digital inputs / outputs
- Probe



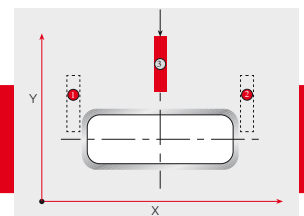
Bolt-hole drilling



Tool radius compensation



Up to 20 datum points



Part centering



## For 2, 3 and 4-axis lathes

### Most relevant features

**. Taper calculation**

The taper of a part may be calculated by entering the value of two points of the travel at the DRO.

**. Z axis coupling**

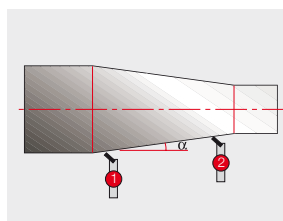
A parallel axis may be coupled with its pair at the same DRO display axis showing the combination of both on the Z axis display.

**. Up to 100 tool references**

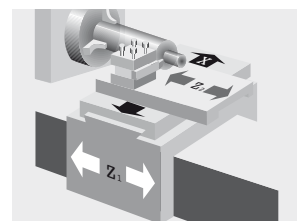
When using more than one tool, each one will have a different origin (offset), these origins may be saved and recalled every time a new tool is changed. At every tool change, it saves a different origin (offset) that may be recalled by the operator.

**. Preset in HOLD mode**

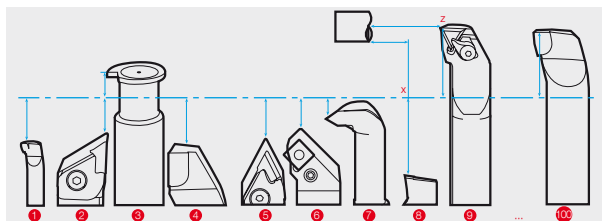
It is possible to preset on the axis the actual diameter value of the machined part (measured with caliper or micrometer).



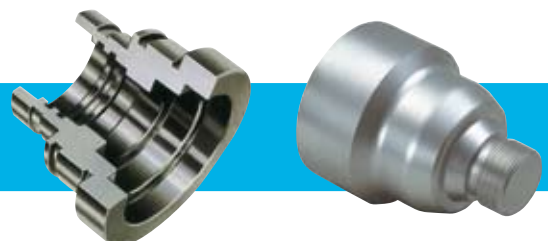
Taper calculation



Z axis coupling



Up to 100 tool references





40i




40i TS



## Innova 40i and 40i TS DRO's

The Innova 40i for lathes offers the operator graphic assistance that no other DRO can offer to program turning operations friendly and intuitively.

### Graphic programming and operating assistance

- . Part taper calculation
- . Axis coupling
- . Easy threading even for mixed threads with leadscrews and threads in different units (mm/inch)

### 40i TS model

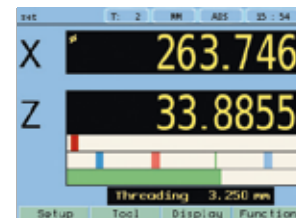
This dro calculates and automatically varies the spindle speed according to the X axis radius while machining; thus providing an optimum part finish, machining time saving and longer tool life.

Its main characteristics:

- . Constant Surface Speed (CSS)
- . Spindle orientation with Teach-in
- . Override (50-150%) of the programmed RPM without interrupting the machining operation
- . Spindle speed control through an external potentiometer
- . Display of real RPM

### And for the machine integrator:

- . Up to 4 spindle speed ranges (gears)
- . Special inputs: Emergency input, analog input for the potentiometer, external push buttons (M3, M4, Stop, etc.)
- . Analog and digital outputs
- . It admits an encoder at the spindle





## For general purpose applications and grinders with 1, 2 and 3 axes

These models provide multi-purpose solutions, because they may be adapted to applications as different as grinders, auxiliary axes, metrology, woodworking machines, etc.

### Most relevant features

- . **Multi-point compensation**  
Its 100 compensation points provide maximum efficiency and guarantee absolute precision. This point-to-point compensation minimizes possible machine errors.
- . **Display of maximum, minimum coordinates and the difference between them (10i)**
- . **Fine or coarse resolution, as needed**
- . **Connection to linear and angular axes**

- . **Software travel limits**  
These limits do not cancel the ones already set by the travel limits of the machine, but offer the operator the chance to add other limits between the main ones.
- . **USB connection**  
USB connection for uploading/downloading data from/to a PC or pendrive.

#### Innova 40i DRO

Also, the Innova 40i offers the operator the advantage of working with a color TFT screen.



## Accessories

### Support arm

- For mill



Model: . ARM 300, 300 mm long  
. ARM 500, 500 mm long

- For lathe



Model: . BSN 09 TORNO (lathe)

### Adapter plate

for built-in model

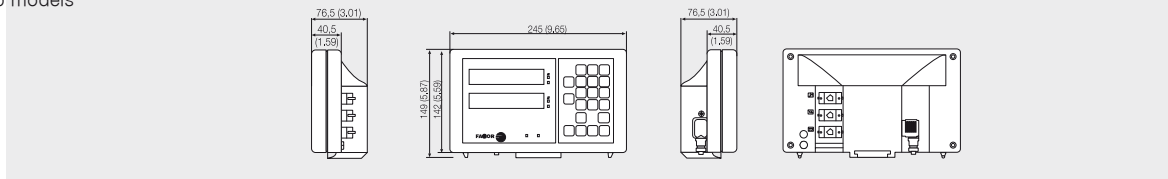


## Operating conditions

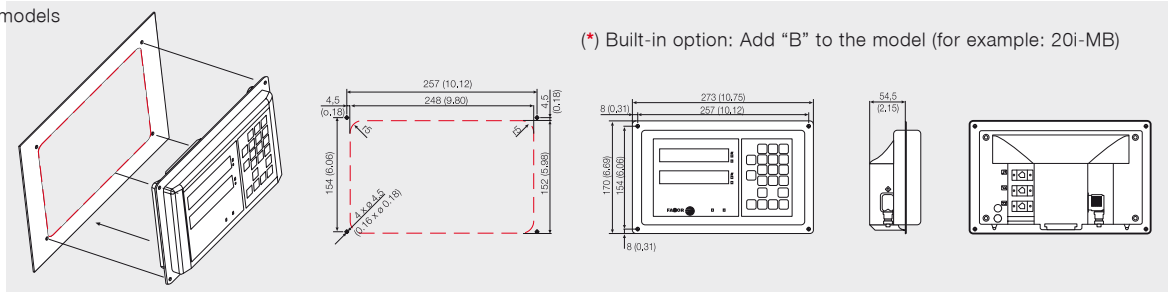
power supply protected against AC mains outage	universal power supply with an input range between 100 V AC and 264 VAC ( $\pm 10\%$ ); Frequency from 45Hz to 400 HZ
operating temperature	from 5 °C to 45 °C (from 41°F to 113 °F)
storage temperature	from -25 °C to 70 °C (from -13 °F to 158 °F)
relative humidity	maximum 95% without condensation at 45 °C (113 °F)
sealing	front panel IP54 and rear panel IP4X (DIN 40050)
product in compliance with safety and electromagnetic compatibility regulations	EN-60204-1, EN-50081-2, EN 55011, EN-55022, EN-55082, EN- 610004-2, 3,4, 5,6,11. EN-V50140, EN-V50141, ENV 50204 and EC directives 73/23/ECC, 89/392/CEE, 89/336/ECC and 73/23/ECC
type of feedback signals	TTL 0-5 VDC $\pm 5\%$ ; differential TTL 0-5 VDC $\pm 5\%$ . Plus, 1 Vpp and SSI on the 40i models
maximum feedback frequency	250 KHz

## Dimensions in mm and inches (models 10i, 20i and 30i)

Tabletop models

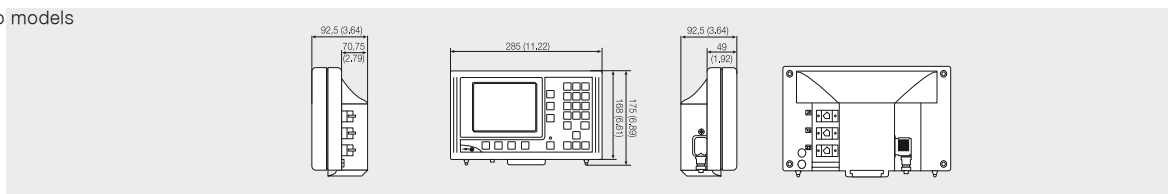


Built-in models

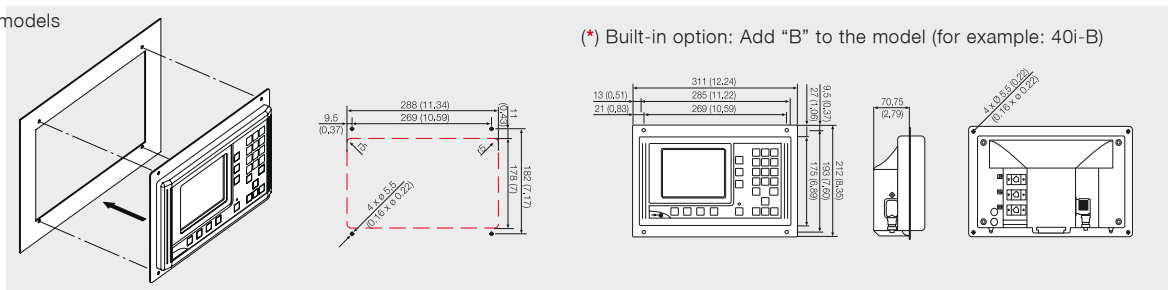


## Dimensions in mm and inches (40i model)

Tabletop models



Built-in models





FAGOR AUTOMATION shall not be responsible for any printing or transcribing errors in the catalog and reserves the right to make changes to the characteristics of its products without prior notice.

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Fagor Automation holds the ISO 9001 Quality System Certificate as well as the CE and UL certificates for its digital readouts.

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