Innova 40i TS / 40i TS-B

Installation / Operation Manual
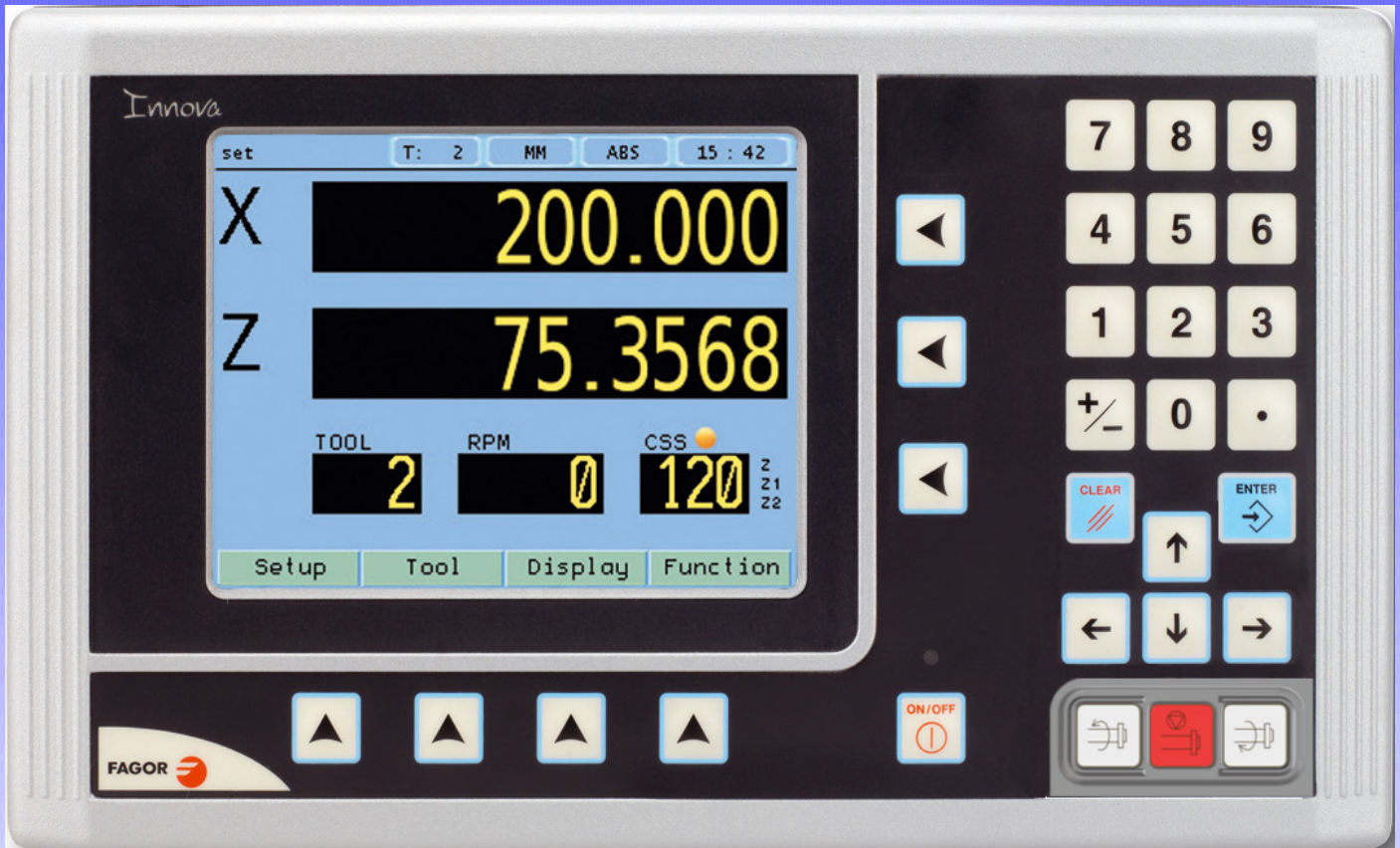
FAGOR

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

Spindle keys

Keys to open droplist buttons of the
FUNCTION BAR

Power-off button

Power indicator LED
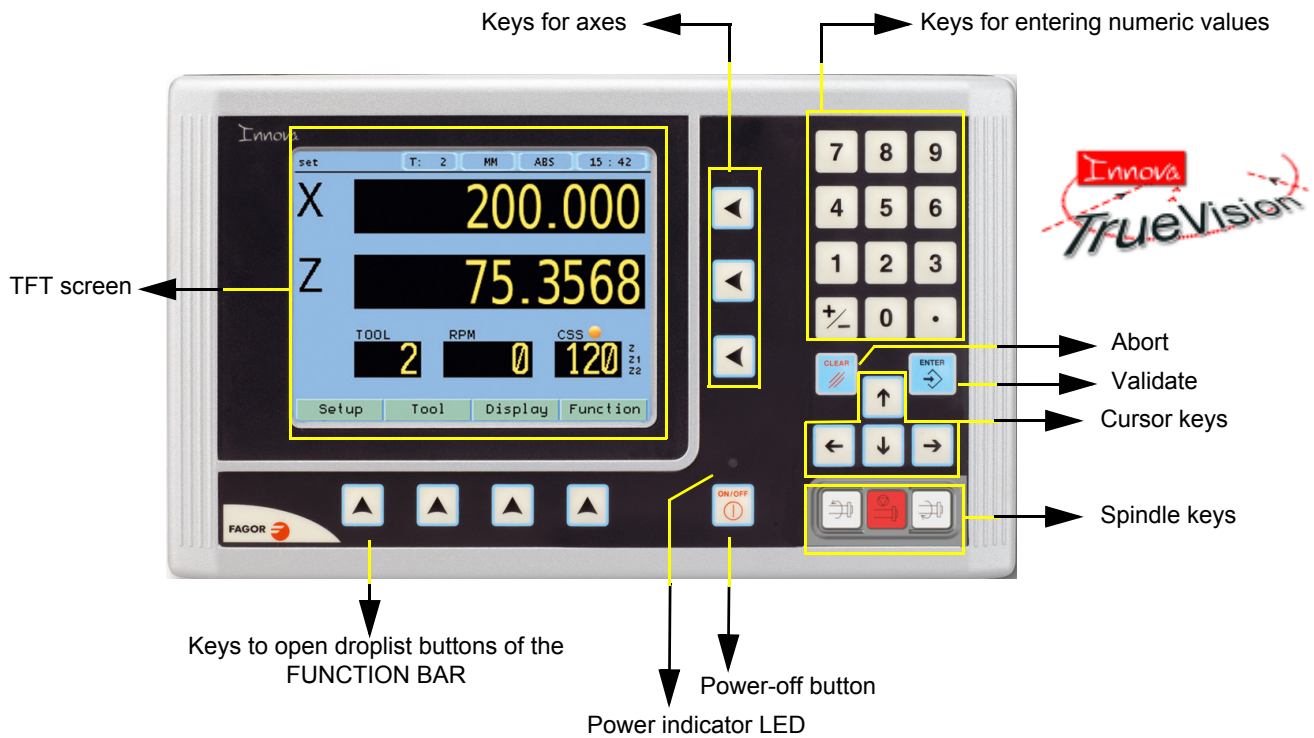
1.2 Turning the unit on and off

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:
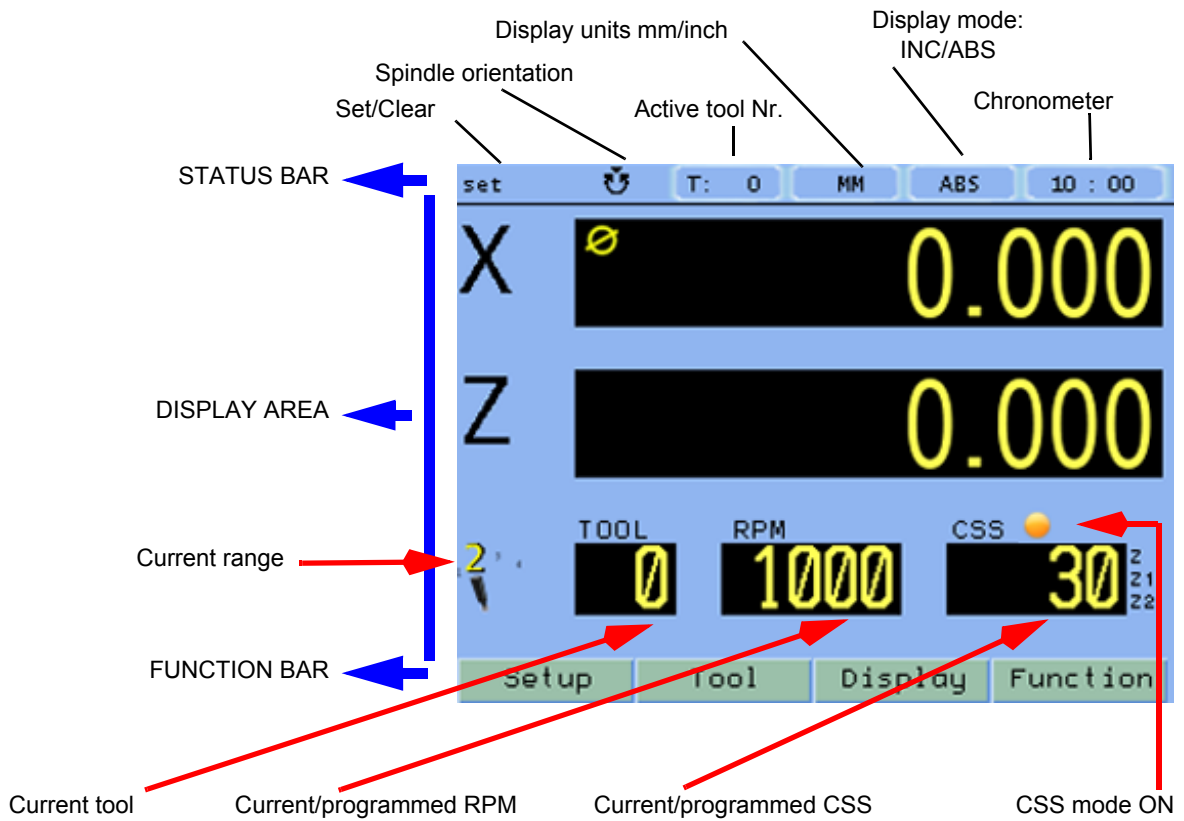
When the spindle is off, the RPM and CSS displays show the programmed values.

When the spindle is ON and there is an encoder on the spindle, the RPM and CSS displays will show the current value; but if there is no encoder, they will show their theoretical values.

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

TOOL
- Set tool Nr.
  - Teach-in
  - Tool table

DISPLAY
- inc/abs
- mm/inch
- rad/diam
- Set/Clear

FUNCTION
- RPM
- CSS
- Angle measurement
- Turning
- Calculator
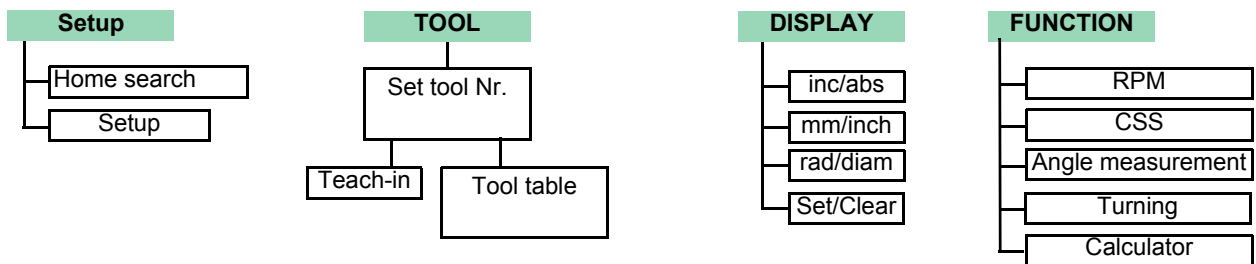
2 DRO operation

2.1 Display modes.

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

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 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 ⌀ sign.

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

2.1.3 inc / abs

Display	inc/abs

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

2.1.3.1 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.
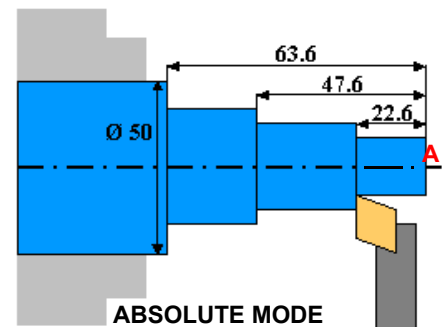
2.1.3.2 Incremental mode:

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.
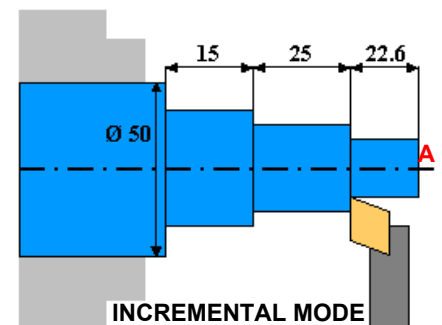
2.2 Set/Clear

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).
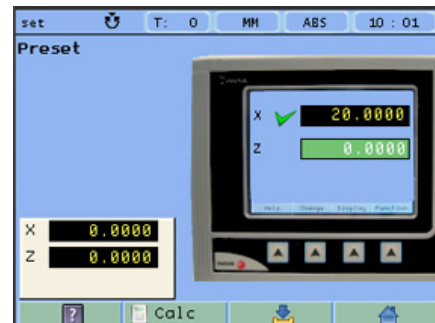
2.2.2 In "Clear" mode (indicated with a "C" on the upper status bar)

◁ 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.

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" on page 21**).
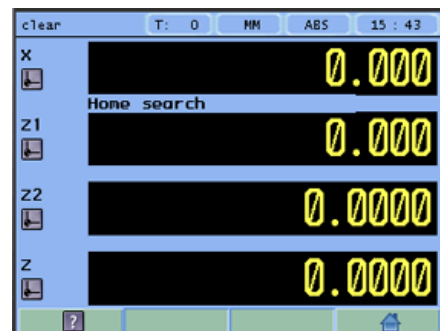
2.4 Tool:

Each tool will remember the RPM and CSS values programmed by the user.

When the tool number is changed, the saved values will be set as current. If the spindle is turning , it will stop before setting the new values.
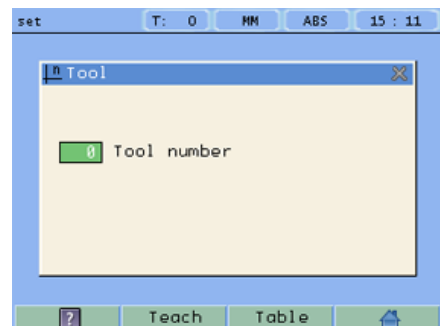
2.4.0.1 Tool setting:

Teach

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

2.4.0.2 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

Teach tool

	Hold	
	Hold	

X	200.0024	Tool	0
Z	0.0000	X	0.0000
		Z	0.0000
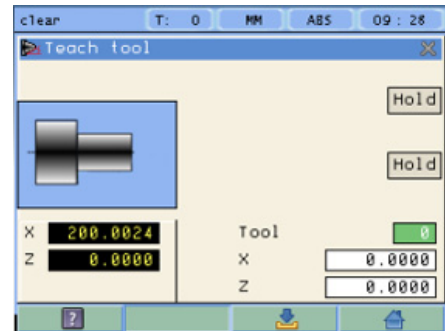
2.4.0.3 Setting the tool by touching a part of unknown diameter:

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

Press **HOLD** for both axes.

Remove the part and measure it.

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.

2.4.1 View tool table:

Tool **Table**

View tool offset table.

clear	T: 0	MM	ABS	09 : 29

Tool

Tool	x⌀	z
0	0.0000	0.0000
1	0.0000	0.0000
2	0.0000	0.0000
3	0.0000	0.0000

2.5   Machine control

This unit offers the possibility to control the spindle as well as the inputs and outputs required for it.

2.5.1   Spindle Control

The Start Stop keys control the machine spindle.

Start spindle in m3.

Start spindle in m4.

Stop the spindle.

Note:

If the spindle is already turning, the m3 and m4 keys will speed up or slow down the spindle.

When starting or stopping the spindle, the machine will follow the programmed acceleration time.

The external JOG keys, M3 and M4, will work in the same way as the DRO keys.

2.5.1.1   Potentiometer Control

The spindle speed can be changed manually using an external potentiometer.

The potentiometer mode will turn on when the digital input called "Potentiometer on/off" is activated (the icon indicates that the potentiometer mode is active). Then, the analog input will be assumed as spindle velocity command. When exiting the potentiometer 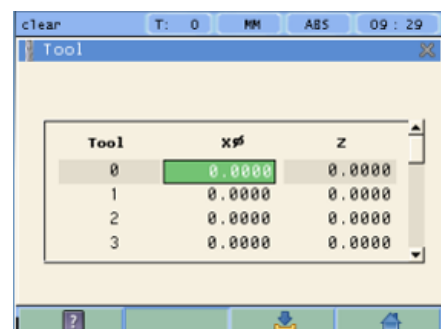mode by deactivating the digital input "Potentiometer on/off" and after stopping the spindle, the DRO will return to its previous state, either RPM mode or CSS mode.

2.5.2   Range (gear) change.

When selecting a work range other than the current one, the DRO waits for the user to change to the indicated range (gear).

When using automatic range (gear) detection, the range cannot be edited at the DRO, just change the range and accept the confirmation of the change at the DRO.

The current range value will be read through inputs DM41, DM42, DM43, DM44. The exact combination of inputs DM41...DM44 for each range may be set by parameter.

If it detects that the gear has been changed while machining, the spindle stops immediately and it cannot be restarted until the range change is confirmed at the DRO.

The DRO generates digital outputs in order to be able use an automatic gear change.

Outputs M41, M42, M43 and M44 indicate the range (gear) to change to (M41 indicates Gear 1, M42 indicates Gear 2, etc.), then, the STROBE signal to command the gear changer to act. It is also possible to wait for the "M-done" signal as confirmation for the DRO that the gear change process is completed successfully.
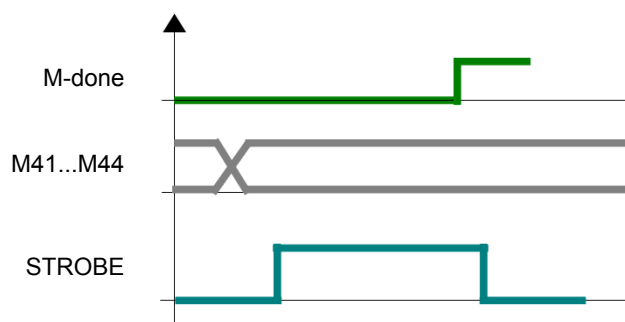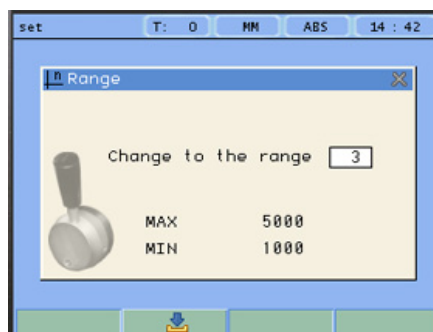
2.5.3 Control of maximum spindle speed

Maximum spindle speed may be limited by an external device connected to inputs DT1, DT2, DT3 and DT4. A rotary selector switch may be used, binary, bcd, gray, etc. Or an intelligent device for safety.

It is possible to edit the RPM values for each combination of inputs DT1 to DT4.

The speed indicated by these inputs will be assumed as the maximum allowed at all times, even in potentiometer mode.

2.5.4 Spindle orientation

For stopping the spindle in an angular position set by the user. It requires an encoder on the spindle.

How to preset the spindle orientation point.

While the spindle is stopped, access the following screen.

OFF   Turn spindle orientation off

ON   Turn spindle orientation on
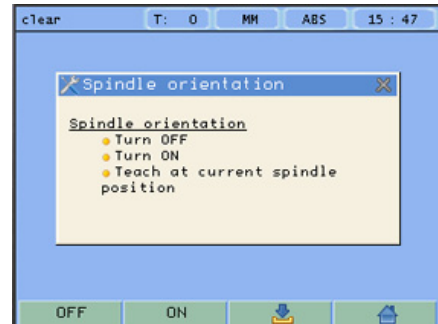
It takes the value of the current spindle position as the preset position to stop the spindle.

The icon shows that the spindle orientation mode is ON.
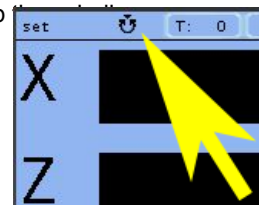
How to orient the spindle

While in spindle orientation mode, it will stop at the position preset earlier.

Force a stop.

Pressing STOP twice aborts spindle orientation and the spindle stops.

2.5.5 Emergency input

The emergency input will stop the spindle immediately and disable all the digital outputs.

2.6 Special functions.

Function   It gives access to the specific lathe functions.
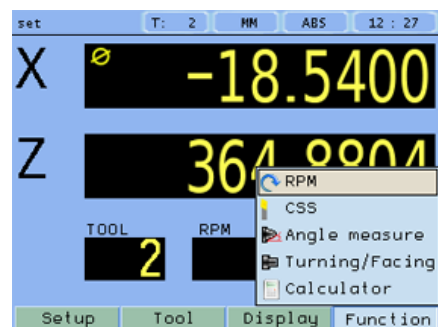
2.6.1 Set RPM

Function	RPM

For setting the RPM value for the current tool.

RPM: Desired value in revolutions per minute

Range: Gear range position

Validate the programmed values

Exit without changing values

Note:

The preset value must be between the minimum and the maximum rpm for the selected range (gear).

Setting the RPM value turns the CSS mode OFF.
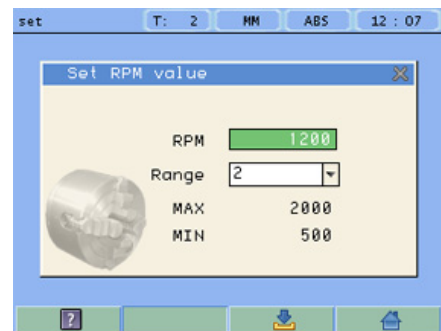
2.6.2 Set Constant Surface Speed, CSS

Function	CSS

For setting the Constant Surface Speed value for the current tool.

CSS: Constant surface speed in m/min or ft/min.

Max RPM: Maximum working RPM value

Range: Gear range position

Disable the CSS mode

Validate the programmed values

Exit without changing values

Note:

When CSS mode is ON, the CSS display of the main window will show a yellow light.

If the X axis value is changed by clearing it or by presetting a new value, the spindle will stop for safety.
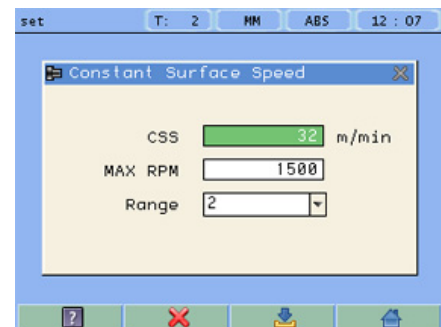
2.6.3 Angle measurement.

Function	Angle measurement

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

Touch the first point and press Enter.

Touch the second point and press Enter.

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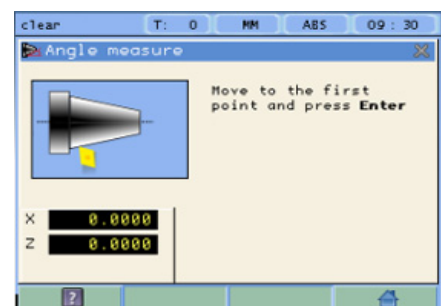
2.6.4 Turning function.

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.

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.
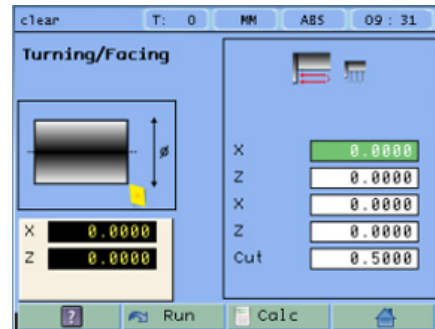
Run

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

Go on to the next execution step.

Total number of steps.

Current step Nr.

2.6.5 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 $1/x$ $\sqrt{}$
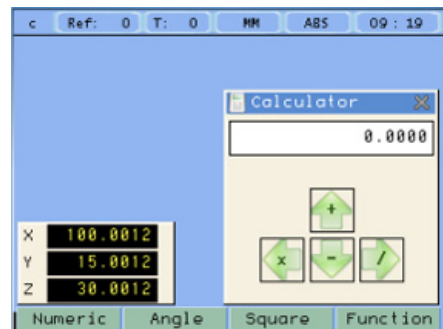
Function

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.

3 DRO installation

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

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 TS-**B**

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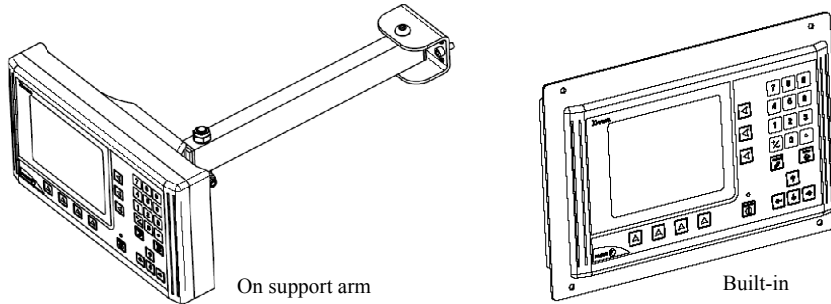
Dimensions of the DRO and the window to insert it into.

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.
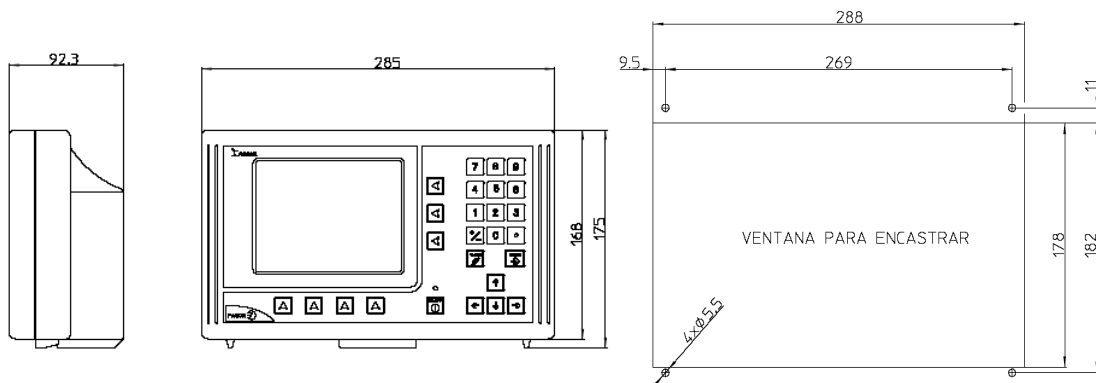
3.3 Rear panel

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.

X2.-SUB-D HD type 15-pin female connector for 2nd axis feedback device.

X3.-SUB-D HD type 15-pin female connector for the third axis feedback device.

X4.-SUB-D HD type 15-pin female connector for 4th axis (spindle) feedback device.
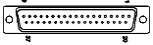
* 37-pin connector for inputs and outputs.

*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.

ETL file number:

Cert. to CSA
STD C22.2 No.142

Conforms to
UL STD 508

INTERTEK
ETL
c LISTED US
CM
3168680

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: 750 kHz

-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   Input/output connection 37-pin connector

Characteristics of the analog input:

Voltage range: ±10V

Impedance > 10 kOhm

Maximum unshielded cable length: 75mm

Characteristics of the analog output:

Voltage range: ±10V

Minimum impedance of the input to which it is connected: 10 kOhm

Maximum unshielded cable length: 75mm

We recommend using shielded cables joining the shield to the connector housing at each end.

Characteristics of the digital inputs:

Rated voltage: +24 V DC

Maximum voltage: +30 V DC

Minimum voltage: +18V DC

High threshold voltage (logic state 1): > +18V.

Low threshold voltage (logic state 0): < +5V

Typical consumption of each input: 5mA

Maximum consumption of each input: 7mA

Characteristics of the digital outputs:

Rated voltage: 24 V AC or DC

Maximum voltage: 47 V AC or DC.Protection against over-voltage

Maximum load current: 100mA Protection against over-current

Activation time: <3ms

Deactivation time: <3ms

PIN	I/O	Signal	PIN	I/O	Signal
1		Chassis			
2	I	0V external	20	I	0V external
3	I	24V external	21	I	24V external
4	S	24V user	22	S	24V user
5	S	M3	23	I	Jog [+]
6	S	M41	24	S	M4
7	S	M43	25	S	M42
8	I	Jog [-]	26	S	M44
9	S		27	S	M STROBE
10	S		28	S	
11	I	Detect MAX RPM 1	29	S	
12	I	Detect MAX RPM 3	30	I	Detect MAX RPM 2
13	I	Emergency	31	I	Detect MAX RPM4
14	I	Jog - M3	32	I	M-done
15	I	Detect M41	33	I	Jog - M4
16	I	Detect M43	34	I	Detect M42
17		Chassis	35	I	Detect M44
18	I	Analog potentiometer	36	I	Potentiometer On/Off
19	I/O	0V analog	37	S	Spindle command

3.5.2.1 Connection diagram
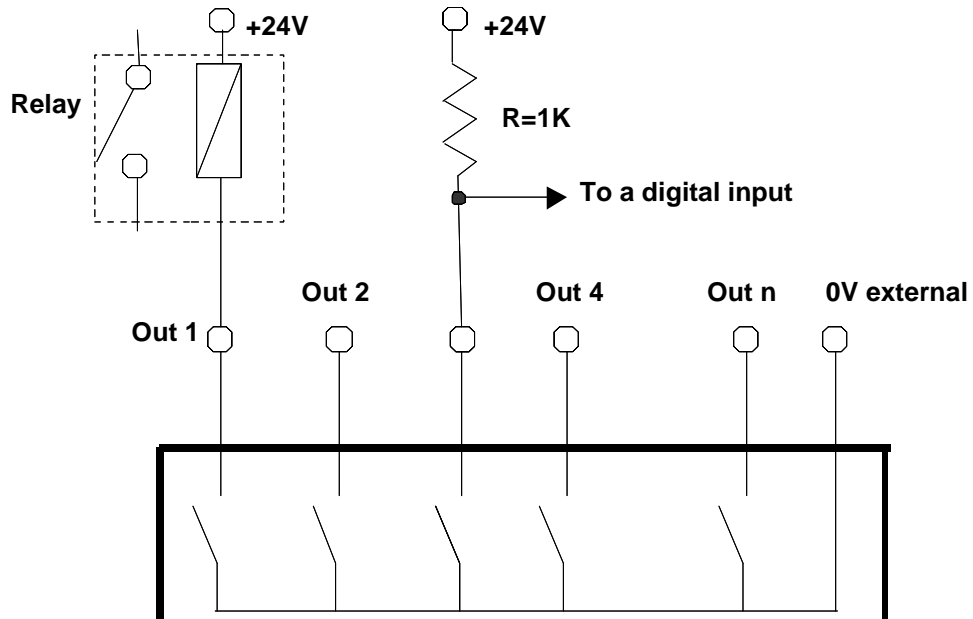
3.5.2.2 Connection example
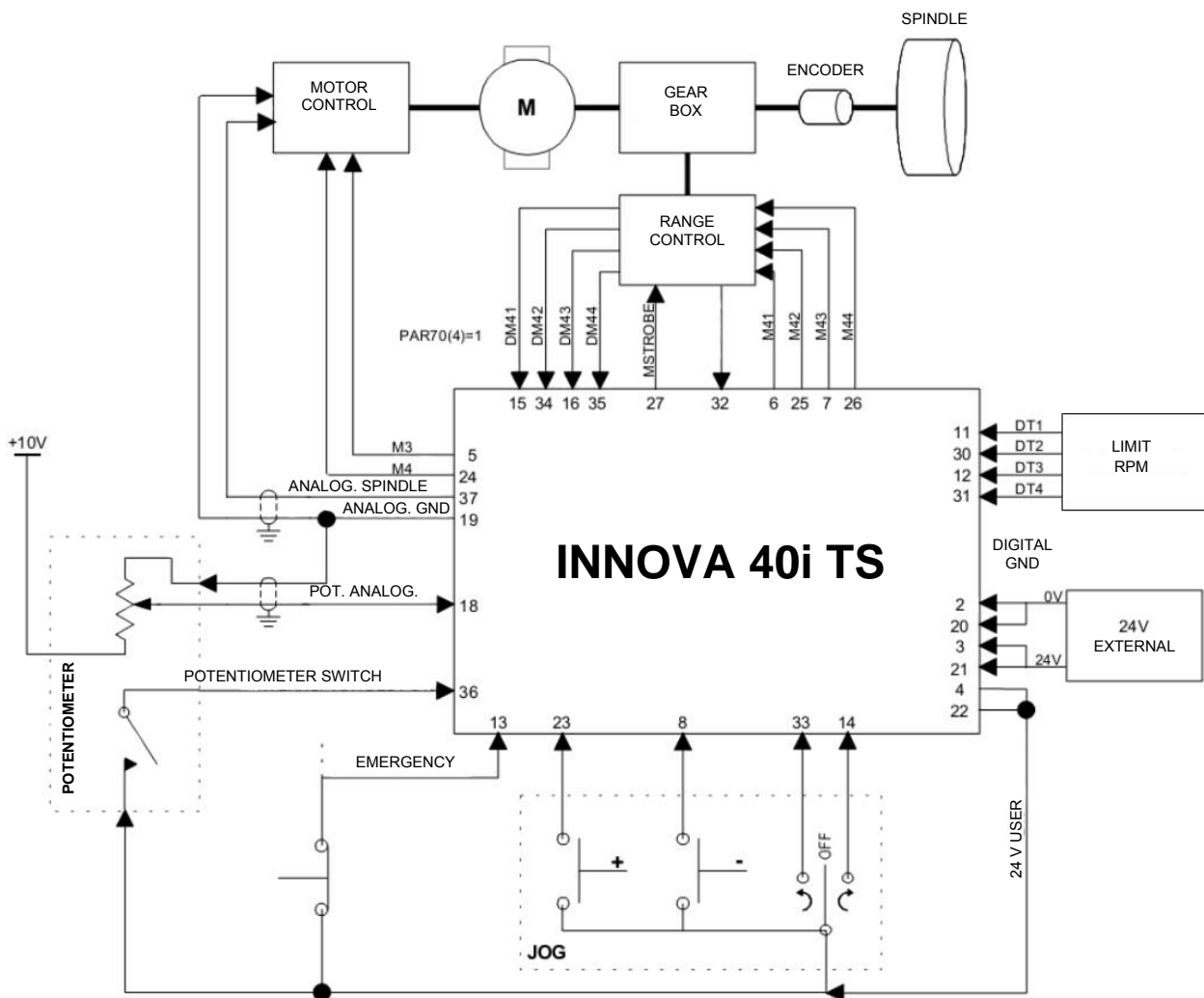
3.5.3   Power and machine connection

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 │   │ Machine Control│
  │(type, axes,│   │ (encoders) │   │(linear,      │   │                │
  │  alarms)   │   │            │   │ multi-point) │   │                │
  └────────────┘   └────────────┘   └──────────────┘   └────────────────┘
```
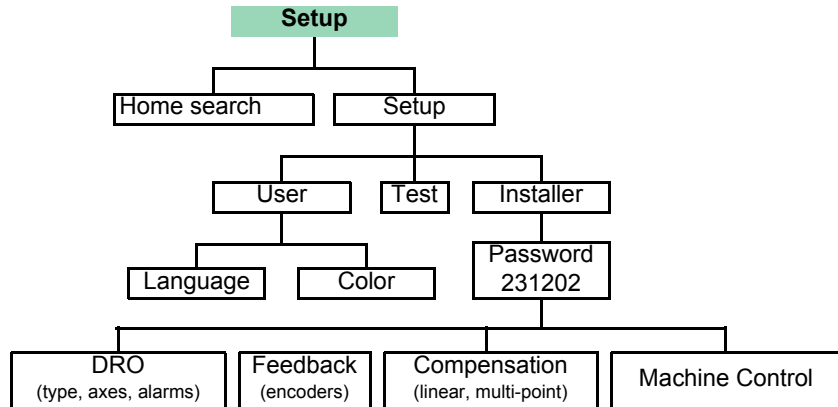
Setup   **Setup**

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**   **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.

Enter the password: **231202**

This window offers the following options:

DRO, feedback, error compensation and machine control.
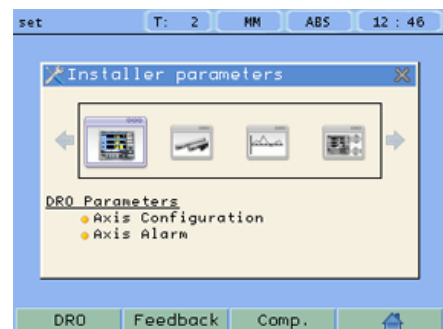
3.6.3.1 Parameter backup into USB memory

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**   **Installer parameters**   **DRO**

It configures the DRO for each type of machine: Number of axes, default units, etc.

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

1- Type of machine: In this case, it is set for lathe.

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

   This model sets 4 axes. The fourth one is the spindle.

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.

Axes option:

Setup	Setup	Installer parameters	DRO	Axes

These parameters must be set for each axis.

Note: To select the spindle axis (the 4th axis), press the 3rd axis key twice.
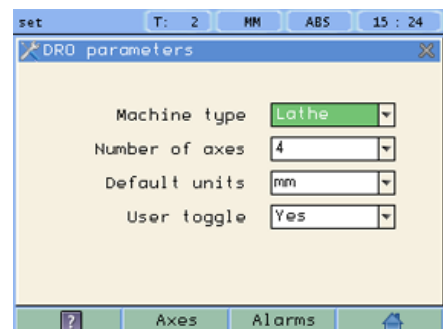
1- Combine axes: It is possible to add/subtract any axis to/from another axis. The factory setting is NO.

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.

5- Default value: Measurement in radius or diameter. Only available for the X axis.

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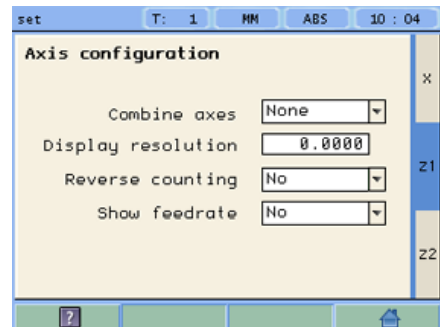
Alarms option:

Setup	Setup	Installer parameters	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.

3.6.3.3 Feedback:

Setup	Setup	Installer parameters	Feedback	FAGOR
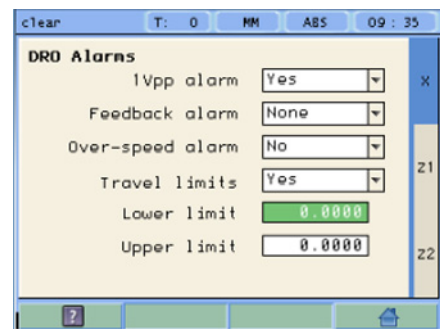
Selecting Fagor feedback knowing the name or model of the linear encoder.

◁ 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	Installer parameters	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 and the *leadscrew pitch* in mm, inches
or turns per inch.

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

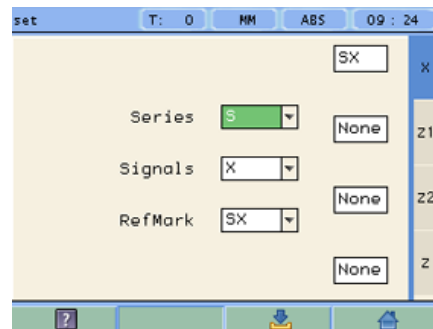   **2.1- TTL**: It requests the resolution of the linear encoder or Nr of pulses of the encoder.

    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:

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

$$1 \text{ µm} = \frac{20 \text{ µm}}{4 * 5}$$

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.

Feedback properties

Axis type	Linear
Encoder signals	SSI
Resolution	0.0001
Number of bits	32

Reference

Setup	Setup	Installer parameters	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.

Reference marks

User Offset	0.0000
Homing on start up	No
Type	Normal

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.

Reference marks

User Offset	0.0000
Homing on start up	No
Type	Coded
	20
Extern. Multiply	1

20
40
100

1
5
10
20
25
50

* 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	Installer parameters	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).

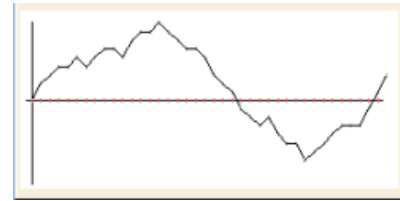Different options are offered when the Function button is pressed:

| Function | Exit |

To exit the screen saving the data.

| Function | Draw Graph |

Draws a graph with the points 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.

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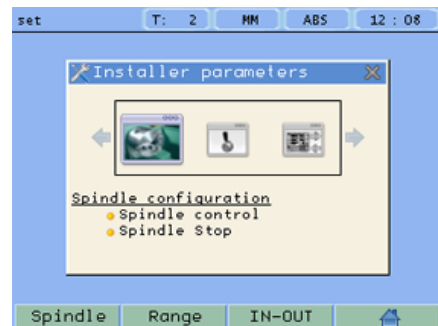
Pressing **Test** again offers the chance to run different tests that are very useful for troubleshooting the DRO itself or the encoder.

The Test mode is for the installer only and the access is protected with the password: **231202**

3.6.5   Machine Control

| Setup | Setup | Installer parameters | Machine Control |

For setting the spindle control parameters, inputs and outputs.

3.6.5.1 Spindle Configuration

Setup	Setup	Installer parameters	Machine Control	Setup Spindle

For setting the values for spindle control.

Spindle encoder. Defines whether the machine has an encoder connected to the spindle or not.

Spindle control: When selecting closed loop, the DRO will try to follow the programmed rpm.
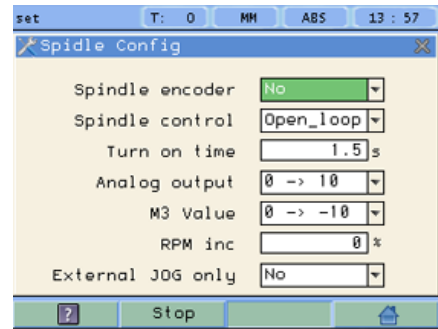
Acceleration time: Time required by the analog signal to go from 0V to 10V. It is limited to 7 seconds.

Analog output: Depending on the drive, unipolar from 0V to 10V or bipolar from -10V to +10V.

M3 value: Analog command value for M3 rotation.

RPM inc: The value for RPM UP and DOWN keys.

External JOG only: Disables the M3 and M4 keys of the DRO, the external JOG can only be used to start the spindle.

3.6.5.2 Spindle orientation

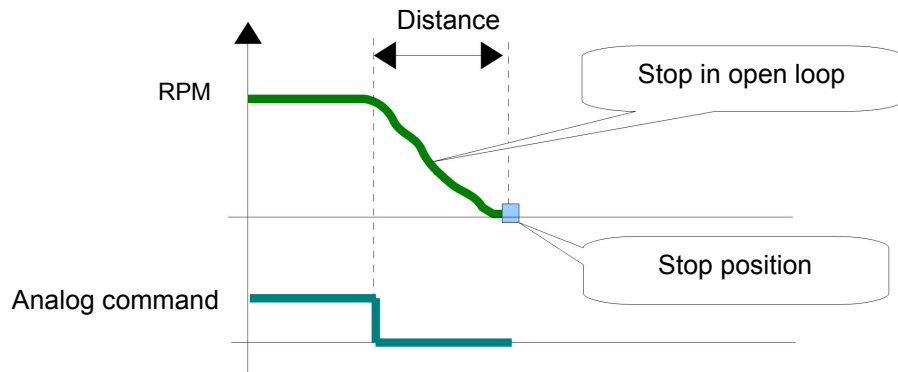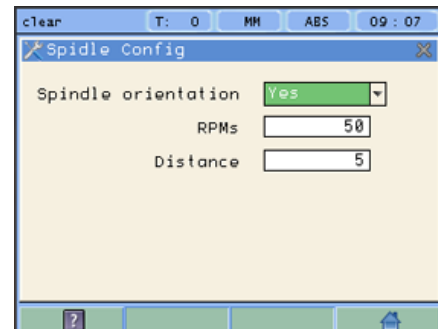| Setup	Setup	Installer parameters	Machine Control	Setup Spindle	Stop

In order to be able to stop the spindle in a particular position, the system must have an encoder mounted on the spindle.

Spindle orientation: It turns that option on or off

RPM: RPM during spindle orientation.

Distance: Angular anticipation distance to stop the spindle.

3.6.5.3 Range configuration

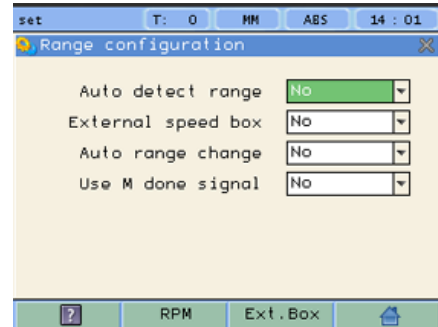| Setup	Setup	Param. Instal.	Machine Control	Range

It sets the values for range control

Automatic range (gear) detection: For safety, the DRO will control the current range by reading the digital inputs.

External speed box: For safety, an external box or selector that indicates to the DRO the maximum RPM allowed.

Automatic range (gear) change. The gear change can be done automatically.

M-done signal: For safety, wait for the M-done signal before considering that the gear change is completed and moving the spindle.

3.6.5.4 RPM table for each range

Setup	Setup	Param. Instal.	Machine Control	Range	RPM

For setting the gear range to control the spindle speed.

Automatic range (gear) configuration: It reads the correct position of the gear lever through its digital inputs.

Range: Gear range position

Min: Minimum rpm value that may be preset for this range.

Max: RPM value for an analog signal of 10V.

Comp: Compensation for the analog signal. Useful to adjust the machine when working in open loop.
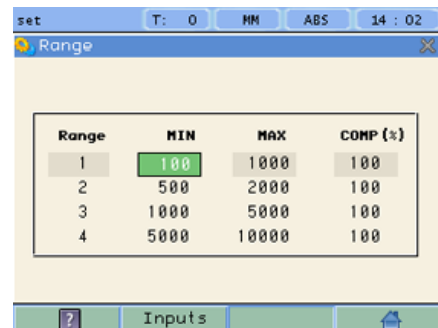
3.6.5.5 Gear (range) detection inputs

Setup	Setup	Param. Instal.	Machine Control	Range	RPM	Inputs

To set the value of the inputs for each range.

3.6.5.6 Active level configuration

Setup	Setup	Param. Instal.	Machine Control	Inputs/Outputs

For setting the active level for the digital inputs.

| set | | T: 0 | MM | ABS | 09:09 |

Inputs

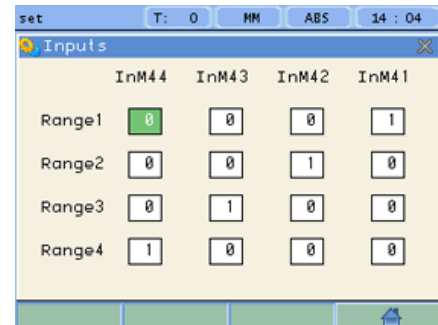| Pin	Name	Level
33	M4	0
14	M3	0
13	Emergency	0
23	Speed_up	0
8	Slow_down	0
36	Pot	0
15	Detect M41	0
34	Detect M42	0
16	Detect M43	0
35	Detect M44	0

| ? | Output | + | ⌂ |

| + |

Pressing this key displays the following screen:

| set | | T: 0 | MM | ABS | 09:11 |

Inputs

Pin	Name	Level
11	Ext.Box_in1	0
30	Ext.Box_in2	0
12	Ext.Box_in3	0
31	Ext.Box_in4	0
32	M Done	0

| ? | | | ⌂ |

Setup	Setup	Param. Instal.	Machine Control	Outputs

For setting the active level for the digital outputs.

| set | | T: 0 | MM | ABS | 09:11 |

Outputs

Pin	Name	Level
24	M4	0
5	M3	0
6	M41	0
25	M42	0
7	M43	0
26	M44	0
32	M Strobe	0

| ? | | | ⌂ |

3.6.5.7 External device or box for speed limitation

Setup	Setup	Param. Instal.	Machine Control	Range	External box

Inputs DT1, DT2, DT3 and DT4 may be used to set up to 16 different levels. Edit the table with the maximum RPM that indicate each level.

| set | | T: 0 | MM | ABS | 09:08 |

External speed box

DT1,2,3,4	RPM
0	250
1	500
2	1000
3	1200

4 Appendix

4.1 UL seal

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:

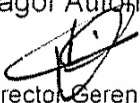#### 4.2.1.1 Electromagnetic compatibility:

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.