ElEsa MPI-R10, MPI-R10-RF Magnetic Measuring System Instruction Manual

Contents

ElEsa MPI-R10, MPI-R10-RF Magnetic Measuring System

Safety Instructions

The product has been designed and manufactured in accordance with the current regulations. The product leaves the factory ready for use and complies with the safety
standards. To maintain the product in this state, it is necessary that it is assembled and used properly, in the closest compliance with this instructions manual and with the following specific safety precautions. Before installing and using the MPI-R10, read carefully this manual, which is intended as an indispensable supplement to the existing documentation (catalogues, data sheets). Morever, all the rules of law must be observed, in regard to accident prevention and environmental protection.

- The use, without complying with the descriptions / specific parameters, (in combination with systems / machines / processes to be controlled), can lead to a malfunction of the product, causing:
- health hazards,
- environmental hazards,
- damage to the product and to its proper functionality.

The device must not be used:

- in explosion hazard areas;
- in medical/life support areas and equipment.

Do not open the equipment and do not tamper with it! Any tampering might have a negative impact on reliability of the device and might be dangerous. Do not attempt any repair. Return any defective equipment to the manufacturer! Any violation of the integrity of the device as delivered will cause the warranty loss. Changes or modifications, not expressly approved by the party responsible for compliance, could void the user's authority to operate the equipment.

Setup/Commissioning
In case of any malfunction (even in case of change in operating conditions), the device must be switched off immediately. Switch off power supply during any installation work on the equipment. Installation and commissioning are allowed by trained and authorised staff only. After correct setup and commissioning, the device is ready for operation.

Maintenance/repair

Switch off the power supply of the equipment before any action. Maintenance should be performed by trained and authorised staff only.

NOTE:

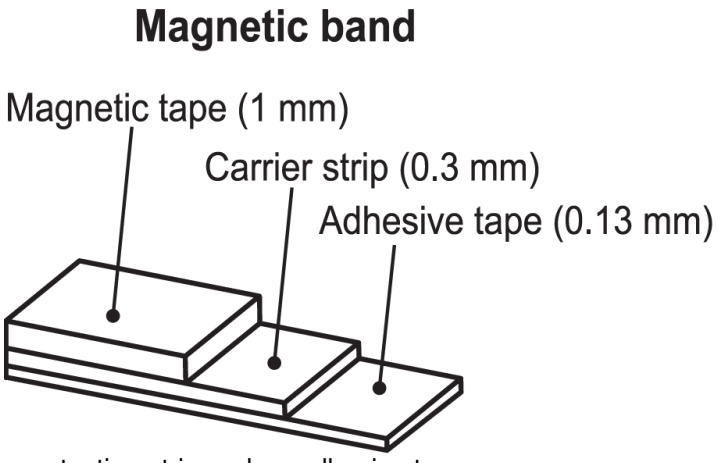
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operating in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy: if not installed and used in accordance with the instructions manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Description

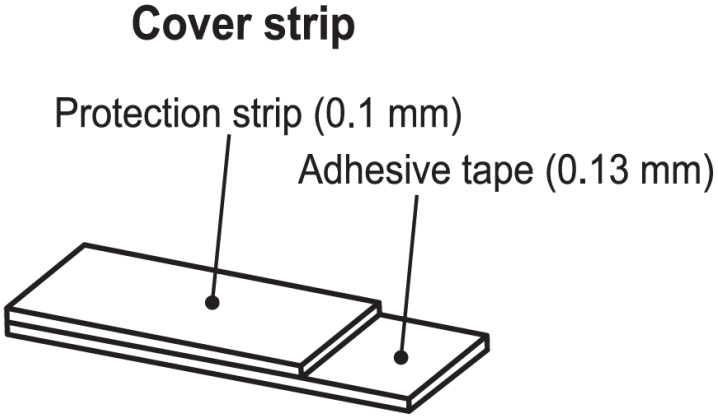
Connected to the dedicated sensor FC-MPI, and combined with the magnetic band M-BAND-10, the MPI-R10 is a complete system for the measurement of linear and angular displacement. Characterized by extremely easy assembly, it allows precise alignment and positioning, reducing time and machining procedures to a minimum.
MPI-R10 main features are:

- Multifunction LCD with 4 function keys.
- Absolute/ incremental mode.
- Programmable offset and targets function.
- Lithium battery powered.
- Protection against accidental polarity inversion.

The sensor cable FC-MPI is made of a metallic enclosure containing the electronic sensor, a multipolar flexible cable and a connector to be plugged into the MPI-R10.
The sensor cable is available in different lengths. The magnetic band M-BAND-10 is made of two separate parts: the magnetic band and the cover strip. The magnetic band is made of a magnetic tape, a carrier strip and an adhesive tape.

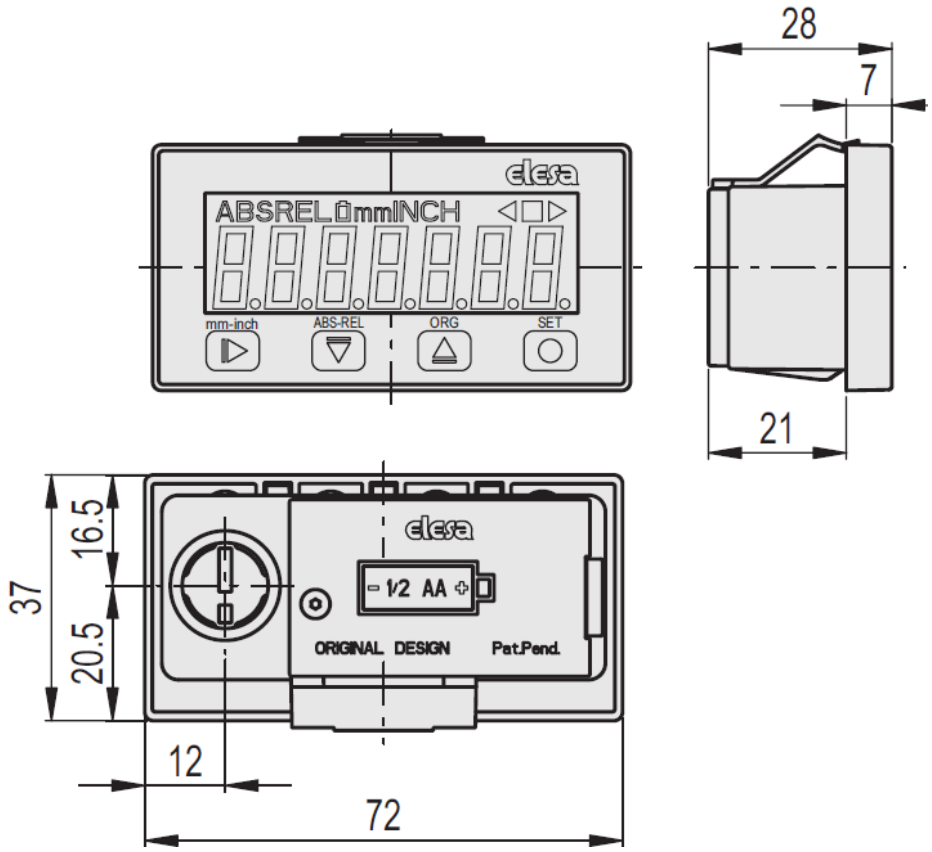


The cover strip is made of a protection strip and an adhesive tape.



Mechanical and electrical characteristics	
Power supply	Lithium battery 1/2AA 3.6 V
Battery life	3 years (2 years for MPI-R10-RF)
Display	7-digit LCD of 12 mm height and special characters
Reading scale	-199999; 999999
Number of decimal digits	programmable
Programmable measuring unit	mm, inches, degrees (angle)
Max operating speed (1)	1 ÷ 5 m/s programmable
Resolution (2)	0.01 mm – 0.001 in – 0.01°
Precision (3)	±0.03mm
Repeatability (4)	0.0002xL mm (L is the measure in mm)
Self-diagnostic	battery check, sensor check, magnetic tape check
Protection class	IP54 or IP67
Operating temperature	0°C ÷ +50°C
Storage temperature	-20°C ÷ +60°C
Relative humidity	max. 95% at 25°C without condensation
Operating environment	Internal use
Altitude	up to 2000 m

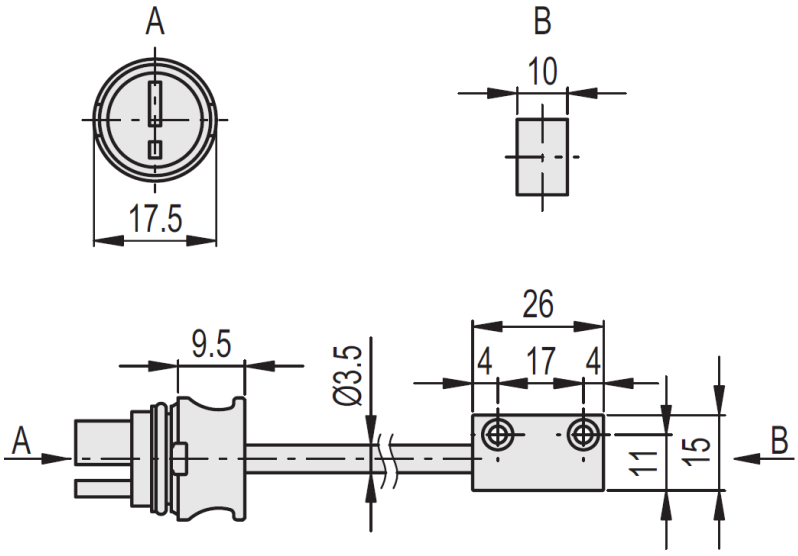
1. The reading speed influences the battery life.
2. Resolution: the smallest change in length that the system is capable of displaying.
3. Precision: the maximum deviation of the value measured by the system from the actual one.
4. Repeat accuracy: the degree of closeness among a series of meas-ures of the same sample, when each single measurement is carried out with the conditions unchanged.



Version – MPI-R10-RF

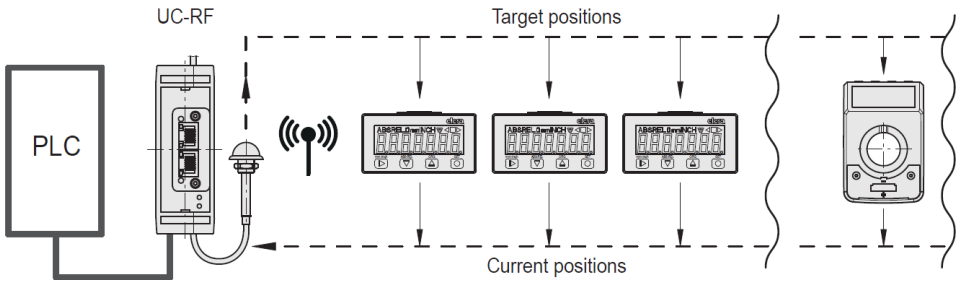
The MPI-R10-RF is compatible with Elesa wireless network that allows magnetic measuring system and indicators to communicate via radio with a PLC. Elesa wireless network is made by the following components:

- One control unit UC-RF
- Max 36 electronic position indicators or magnetic measuring system, such as DD51-E-RF, DD52R-E-RF or MPI-R10-RF.



M-BAND-10 Technical data	
Accuracy class	± 40 µm
Material	magnetic tape: nitrilic rubber
	carrier strip: stainless steel
	cover strip: stainless steel
	acrylic adhesive tape
Width	magnetic band: 10 mm ± 0.20 mm
	cover strip: 10 mm ± 0.20 mm
Thickness	magnetic band: 1.43 ± 0.15 mm
	cover strip: 0.23 mm
Magnetic pole pitch	5 mm
Operating and storage temperature	min -40°C max +100°C
Linear thermic expansion factor	17 x 10-6 / K-1

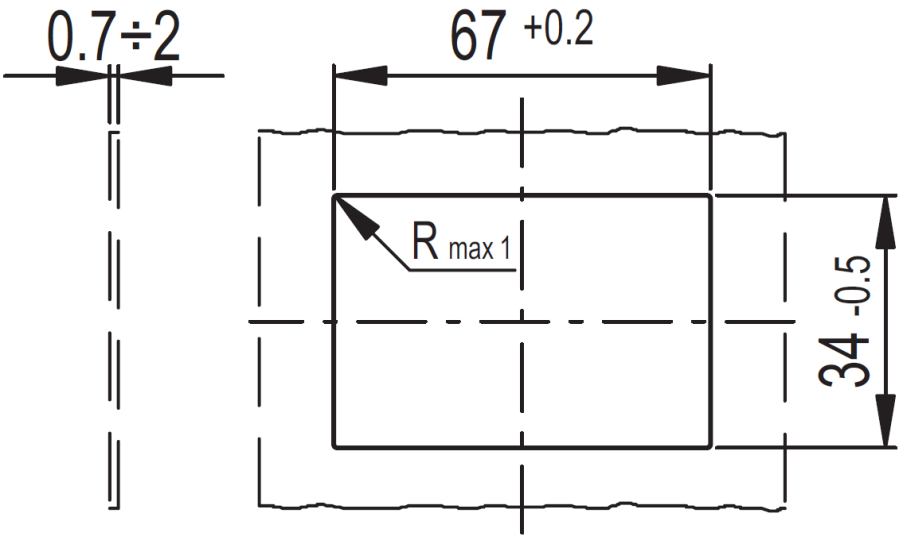
The control unit UC-RF is provided with a standard interface for the most common industrial busses to be connected to the PLC and allows the transmission of the information between the PLC and the MPI-R10-RF magnetic measuring system. The UC-RF exchanges information with the MPI-R10-RF via radio frequency and allows the setting of the target position and the control of the current position of each indicator, directly from the PLC.



Installation

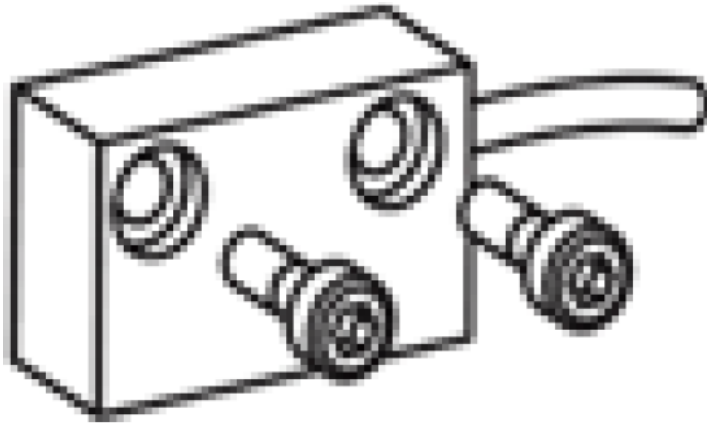
Display installation

1. Drill the panel according to the template dimensions reported.
2. Remove all drilling burrs before fitting the MPI-R10.
3. Fit the lower part of the case into the housing.
4. Press onto the upper part until the case is completely snapped in.



Sensor installation

Fix the magnetic sensor by using M3 screws (not included in the supply). During the installation, use a spacer (max 1 mm is suggested) to grant the parallelism between the sensor and the magnetic band.
The maximum distance between the sensor and the magnetic band, to ensure a correct reading of the displacement, is 1mm.



Magnetic band installation

To mount the magnetic band follow the instructions below:

- Clean the mounting surface carefully.
- Remove the protective film from the adhesive tape of the magnetic band.
- Stick the magnetic band on the mounting surface.
- Clean the surface of the magnetic band carefully.
- Remove the protective film from the adhesive tape of the cover strip.
- Stick the cover strip on the magnetic band. The cover strip must be put on the magnetic band to protect it from possible mechanical damages.
- In case of absence of a seat for the housing of M-BAND-10, secure the ends of the cover strip to prevent unintentional peeling.

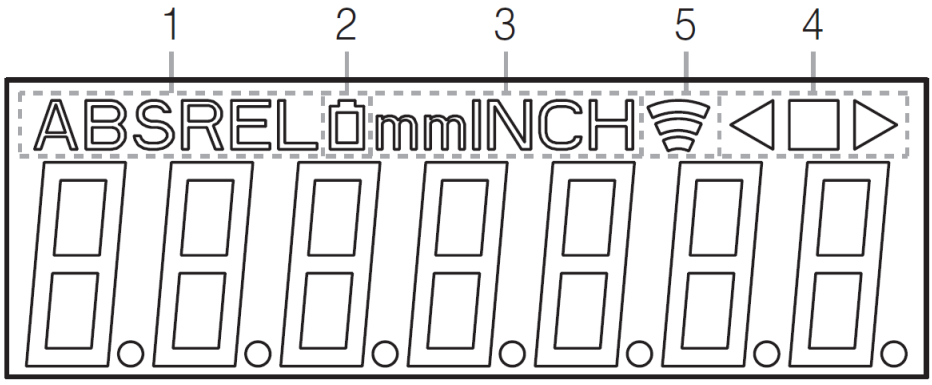
The mounting surface must be flat. Buckles or bumps will lead to measuring inaccuracies. To guarantee an optimal adhesion of the adhesive tapes, the mounting surfaces must be perfectly cleaned, dry and smooth. The following surface roughness is recommended: Ra <= 3,2 N8 (Rz <= 25). To maximize the adhesion install the strip applying pressure. Gluing should preferably be carried out at temperatures between 20 °C to 30 °C and in dry

atmosphere.
WARNING

Once the installation is completed, the calibration procedure must be carried out as shown in cap. 8.5.2.

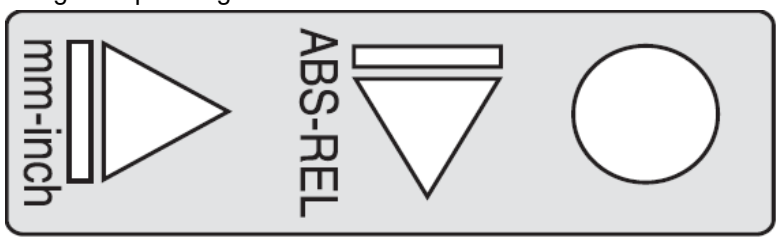
Display

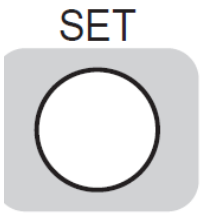
1. Absolute or relative mode indicator
2. Low battery level indicator
3. mm, INCH or degree unit of measure
4. Target position indication
5. RF connection indicator



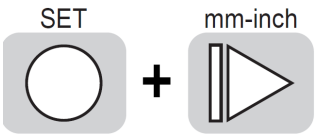
Key functions

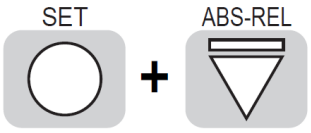
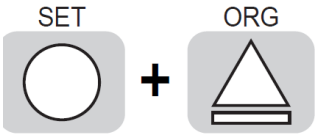
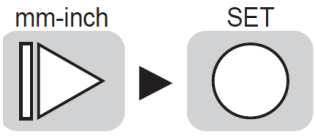
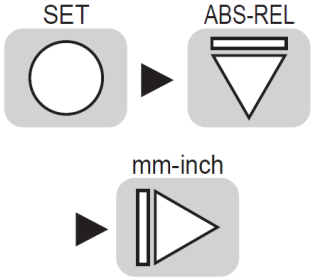
The function of the key changes depending on the mode of the device.



Key Or Key Combination	Operating Mode	Programming Mode
	Keep pressed for 3 sec to enter the programming mode.	Parameter selection/Confirm of parameter change

	Keep the button pressed for 3 sec to set the origin of the measurement. Programmable with one of th e following options (see the ____*0*__ voice of the menu – cap. 8.3): *d_tArG*: when a target is loaded, the display shows the actual absolute position. Pressing the key, the t arget absolute position to reach appears on the dis play. *d_toG0* [DEFAULT]: when a target is loaded the dis play shows the distance to reach the target positio n. Pressing the key, the actual absolute position ap pears on the display. *OFF*: the key is not assigned to any function in the operating mode.	Digit increase / Scroll for para meters bottom-top on the me nu tree
	Select the: *ABS*: absolute measuring mode *REL*: incremental measuring mode It is possible to choose one of the following options (see the __*0*_____ voice of th e menu – cap. 8.3): *ArCLr* [DEFAULT]: switching from *ABS* to *REL* the counter is set to zero. *Ar*: switching from *ABS* to *REL* the counter is not s et to zero. *OFF*: the key is not assigned to any function in the operating mode.	Digit decrease / Scroll for parameters top-bottom on the menu tree
	Press the key to select the unit of measure needed . The options available are: millimeters, inches and degrees. It is possible to choose one of the followi ng options (see the *0*_____ voice of the menu – cap. 8.3): *ALL* [DEFAULT]: selectable units of measure: mm, i nch, degrees *nod EG*: selectable units of measure: mm, inch *OFF*: the key does not allow the unit of measure co nversion	Programming mode exit / Digi t selection

	Programmable with one of the following options (s ee the *0_____ 0* voice of the menu – cap. 8.3): *PrOGOrG* [DEFAULT]: show and set the OriGin pa rameter *PrOGOFS*: show and set the OFFS param eters *OFF*: the key combination is not assigned to any fu nction in the operating mode.	NA

Key Or Key Combinatio n	**Operating Mode**	**Programming Mode**
	Programmable with one of the following options (s ee the *__0___0* voice of the menu – cap. 8.3): *LOA dOrG* [DEFAULT]: the key combination sets the absolute value to the sum of the parameters Origin and Offset. *OFF*: the key combination is not assigned to any fu nction in the operating mode.	NA
	Programmable with one of the following options (s ee the *____0_0* voice of the menu – cap. 8.3): *tAr GEtS*: the keys combination allows to load/program one of the 32 target positions. See 8.4 *OFF* [DEFA ULT]: the key is not assigned to any function in the operating mode	NA
	mm-inch Turn the indicator on hold then SET pres s the key . After the start- up sequence the indicat or is ready to be used (see chap. 4).	NA
		When the reset parameter is selected, press the SET key . At this point, press the ABS-R EL button and then press the key mm-inch ; the display will turn off and the indicator will g o into low power mode of the battery (see chap. 4).

System Switching on/off

Switching on the system

After you have read the section “Safety Instructions”, proceed by switching on the indicator.
To switch the indicator on:

- hold the key
- press the key .

The display will light up and the indicator is ready to be used.

Switching off the system

To switch the system off :

- enter the programming mode,
- select rESEt (see chap. 8.3)
- press
- press
- press

The display will turn off and the indicator will go into low power mode.

Operating mode

Absolute/incremental measuring mode selection
Press the key to select the absolute or incremental measuring mode. The measuring mode selected is shown on the display by the symbols:

- **ABS:** absolute measuring mode.
- **REL:** incremental measuring mode.

It is possible to change the key function by the menu voice __0____ (see chap.8.3). The available options are:

- **ArCLr (default):** when relative measurement is selected, the value is always reset to zero.
- **Ar:** passing from ABS to REL, the relative measurement is not reset to zero.

In this case, the counter is set to zero by pressing

- **OFF:** the key is disabled and does not allow changing the selected measuring mode.

To program the parameters listed above, see chap. 8.3.

Unit of measure selection
Press the key to select the unit of measure.
The options available are millimeters, inches and degrees. The measuring mode selected is shown on the display by the symbols: mm for millimeters, inch for inches and with the ° suffix for degrees. It is possible to change the key function by the menu voice 0_____ .
The available options are:

- **ALL (default):** units of measure that can be selected: mm, inch, degree.
- **nodEG**: units of measure that can be selected: mm, inch.
- **OFF:** the key is disabled and does not allow changing the selected measuring mode.

To program the parameters listed above, see chap. 8.3

Setting the origin

Press the key for three seconds to set the origin of the measurement. Keeping pressed the ORG key for three seconds, the display will show the question Set Org. At this point press the key to confirm or another key to cancel. Confirming the setting of the origin, the display will be reset to zero: this position of the sensor must be considered as the origin of the following measurements.

Setting the absolute reference

After having selected the absolute measuring mode and stopped the sensor in the starting or in the reference position, press the key combination + to set the absolute value to the sum of the values of the parameters Origin (absolute value of reference) and the selected OFFS (compensation value). The value of compensation (OFFSET) allows you to adjust the value shown on the display in such a way that takes into account, for example, wear or tool change. The system allows you to store up to 10 values of compensation.
Pressing the key combination + , the screen will display the last compensation value used (eg OFS 0). It's possible to choose the desired compensation value by pressing the key or , and then pressing the key to confirm.
The screen will display the absolute value equal to the sum of the values of the parameters Origin and OFF Set.
To program the offset values, see parameter OFF Set of cap. 8.3.
It is possible to change the function of the keys combination + choosing one of the available options in the menu voice __0___0
The available options are:
LOAd_OrG: the key combinations allow to choose an offset compensation and to set the origin value
OFF: the keys combination + is not associated to any function in the operating mode.
For programming the parameters listed above see paragraph 8.3

Direct programming of the absolute reference value and compensation values

The keys combination + can be programmed to allow direct access to the programming of the OrIGIn or OFF SEt parameters. It is possible to change the function of the keys combination choosing one of the available options in the menu voice 0_____0 .
The available options are:

- **PrOGOrG:** direct programming of the absolute reference value (OrIGIn parameter).
- **PrOGOFS:** direct programming of the compensation value (OFFSEt parameter).
- **OFF:** the keys combination is not associated to any function in the operating mode.

Targets

MPI-R10 allows to set up to 32 target positions to store relevant machine configuration setting.
To program the targets:

- select tArGEtS in the main menu (see cap 8.3).
- select PrOG_TG (see chap. 8.4).
- select the required memory location (PtrG 01 to PtrG 32).
- press the key to select.
- Follow the instructions in cap. 8.1 to set the required value. To load a target:
- select tArGEtS in the main menu (see cap 8.3).
- select LOAd_TG (see chap. 8.4).
- select the required target value (LtrG 01 to LtrG 32) using the keys ABS-REL and
- press the key to select.

- The value of the selected target is shown.
- Press again to confirm or press to go back to the target selection list.

The keys combination + allows direct access to the programming or loading of targets depending on the value assigned to parameter ___0_0 .
If enabled, the key combination allows to choose between the two following operations:

- **LOAd_tG:** choose one of the 32 available target SET positions, then press to confirm.
- **PrOG_tG:** choose to program one of the 32 available SETtarget positions, then press to start programming.

It is possible to change the function of the keys combination choosing one of the available options in the menu voice ___0_0 .
The available options are:

- **Target:** enable the direct load or program targets functions.
- **OFF:** the keys combination is not linked to any function in the operating mode.

Reaching the target position
When a target is selected by the PLC (version MPI-R10-RF), the device will suggest the direction of movement of the sensor to reach the target by means of the symbols . It is possible to set the FLIP_tG parameter (see chap. 8.2) to adapt the target position indication to the actual sensor configuration. It is possible to set the tolerance of the target as absolute difference from the set value by means of the P_tOLL parameter (see chap. 8.2).
The target position indicators will work, depending from the FLIP_tG and P_tOLL parameters, as in the following table.

	FLIP	**FLIP**
M < T – Toll		
T – Toll <= M < T		
M = T		
T < M < = T + Toll		
M > T + Toll		

- T = set target
- M = measured value
- Toll = tolerance (see P_toll)

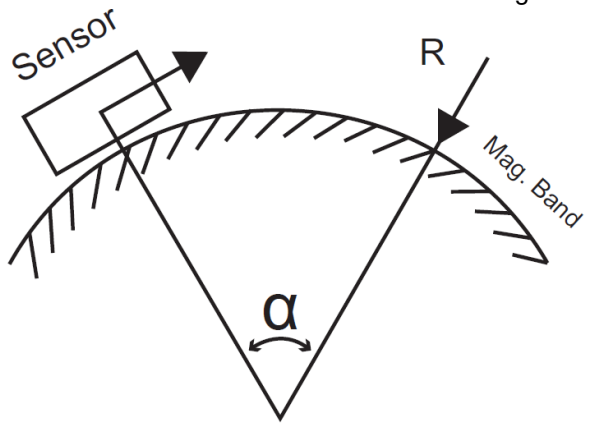
If a target is selected, it is possible to cancel it by pressing the keys combination + and to confirm the StOP_ tG command by pressing the key . To keep the target mm-inch
selection press the key .

Target display mode
Press the key to show the present or the target position depending on the settings of the device.
It is possible to change the function of the key and the target mode choosing one of the available options in the menu voice ____0__ .
The available options are:

- **d_tArG (default):** when a target is loaded, the display shows the actual absolute position and the indication to reach the target as explained before in cap.7.6.1. Pressing ORG
  the key , the set target position is shown.
- **d_to_Go**: when a target is loaded, the display shows the distance to the set target and the indication to reach the target as explained before in cap.7.6.1. If the target is ORG
  not reached, the display blinks. Pressing the key the display shows the actual absolute position.

Target tolerance
Set the value of P_toll parameter to define the tollerance allowed for target (see chap. 8.2 for details).

Angular measurement
MPI-R10 allows to measure angular displacements. To obtain the correct measurement, it is needed to set the parameter “Radius” with the measure of the radius of the arc where the magnetic band is placed.



Version – MPI-R10-RF
Programming the network parameter (nEt id) and the channel parameter (nEt ch)
The system radio network is defined by the following two parameters:

- nEt id: id 00/99
- nEt ch: ch 01/36

These parameters can be configured in the Radio menu of the indicator (see chap. 8.3) and must be set according to the PLC recipe to guarantee a perfect communication between UC-RF and MPI-R10-RF.

Warning
For MPI-R10-RF with firmware release equal to 5.1 or higher, channel 1 is equivalent to channel 4 of the previous version. Consider it when used in old system with UC-RF with firmware release lower than 5.1.

Targets
Using MPI-R10-RF, target positions can be sent from the PLC to the indicators through the control unit. When a target is set, the behaviour is the same as described in cap 7.6.

Programming mode

Press the key for 3 seconds to enter the programming mode. Depending on the setting of PASS parameter (see chap. 8.2), the system may require you to enter a password.
Press the key and to scroll through the list of parameters and select the required one by pressing Press the key to exit the programming mode. The programming mode is automatically dropped after 30 seconds of inactivity.

Programming parameters with numeric values
Press the key mm-inch to select the digit to change. Then use and to respectively decrease or increase the flashing digit. Press the key to confirm the value and go back to the list of parameters. The numeric values of the parameters must be inserted taking into account the selected unit of measure. When a parameter is changed from its stored value, by confirming it, the display will show the message Changed. When exiting from the programming mode, the parameter are stored in the internal memory. If a parameter was changed, the display will show the message Stored.

Device parameters (in alphabetical order)

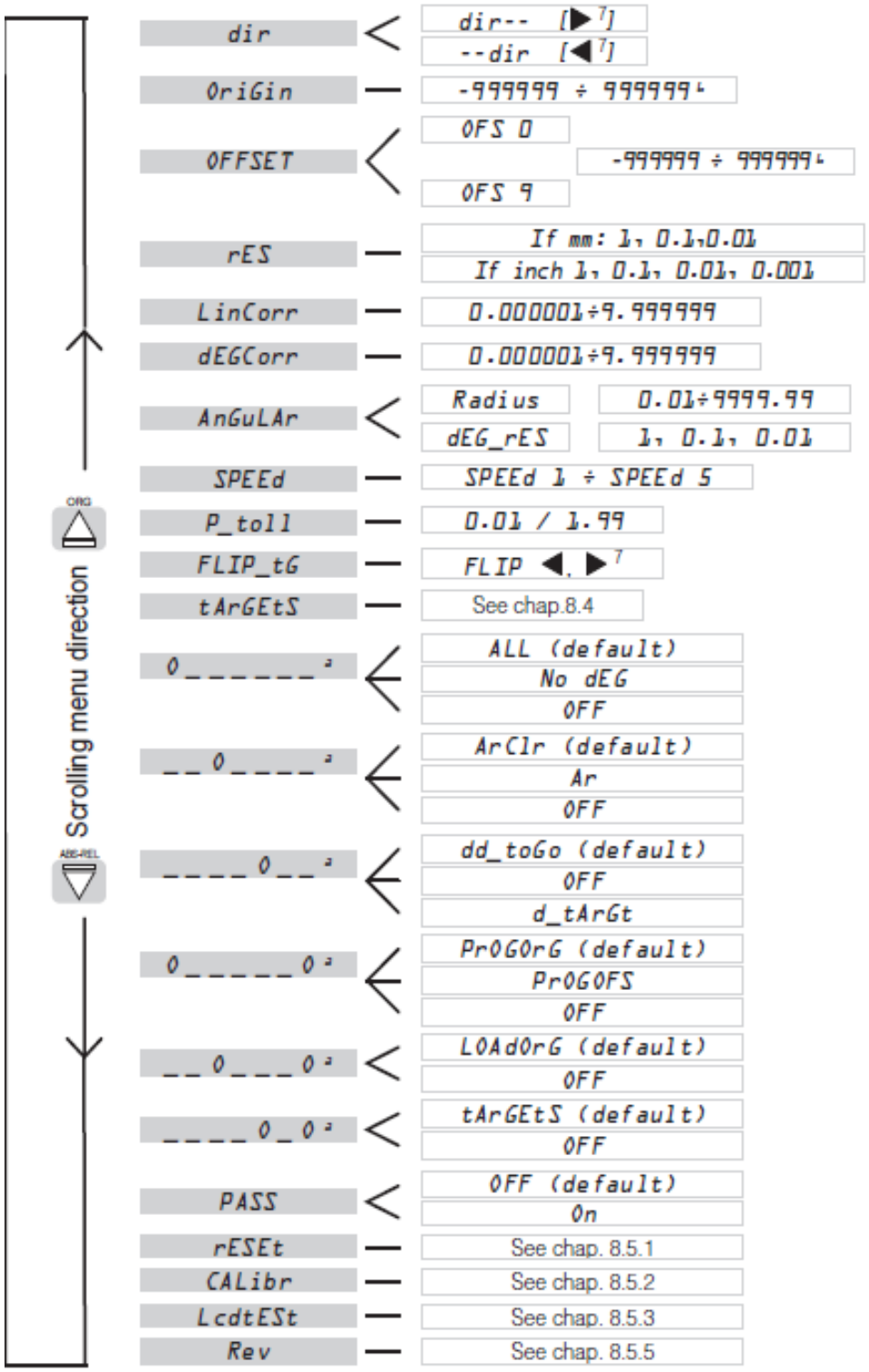
Parameter	Description	Available options	Default
Deg corr	Angular scale correcti on	Programmable value: *0.000001 +/- 9.999999*. *0.00000* cannot be accepted (the c oefficient is automatically set to 1.00000).	*1.000000*
Deg res	Resolution of the angular measurement	The parameter allows to define the resolution of angular measurement. The available options are: *1*; *0.1*; *0.01*	*0.01*
Dir	Measurement directio n Set direction of the positive axis	dir– ( ) —dir ( )	dir– ( )
FLIPp_tG	Arrow to tar- get indicators direction	or The parameter set the direction of the arrow i ndicators when the target is not reached	
Lin corr	Linear scale correctio n	Programmable value: *0.000001 +/- 9.999999*. *0.00000* cannot be accepted (the c oefficient is automatically set to 1.00000).	*1.000000*

Parameter	Description	Available options	Default

Offset	Offset Value	Programmable value *Res = 1:-999999 ÷ 999999* *Res = 0.1:-99999.9 ÷ 99999.9* *Res = 0.01:-9999.99 ÷ 9999.99* *Res =0.001:-999.999 ÷ 999.999* The system allows you to store up to 10 compensation values: *OFS 0 … OFS 9*	*0000.00*
Origin	Reference value	Programmable value Res = 1:-999999 ÷ 999999 Res = 0.1:-99999.9 ÷ 99999.9 Res = 0.01:-9999.99 ÷ 9999.99 Res =0.001:-999.999 ÷ 999.999	*0000.00*
Pass	Password	*ON*: the system requires the password 22011 to enter the programming mode. *OFF* [DEFAULT]: t he system does not require a password to enter t he programming mode.	*OFF*
P toll	Tolerance of target po sition	*0.01÷9.99* The parameter value depends on the unit of measure selected.	*0.10*
Radius	Radius of the circumference where t he reading sensor mo ves	Programmable value: 0.01- 9999.99 The parameter allows to define the radius of the arc where the magnetic band is placed for angula r measurement.	*100.00*
Res	Resolution	The parameter allows defining the resolution of t he measure. The available options are: mm: 1; 0.1; 0.01 inches: 1; 0.1; 0.01; 0.001	mm: 0.01 inches: 0.01
Speed	Reading max speed	Programmable values *1;2;3;4;5* The parameter sets the maximum speed of the movement in m/s that can be correctly read.	*3*

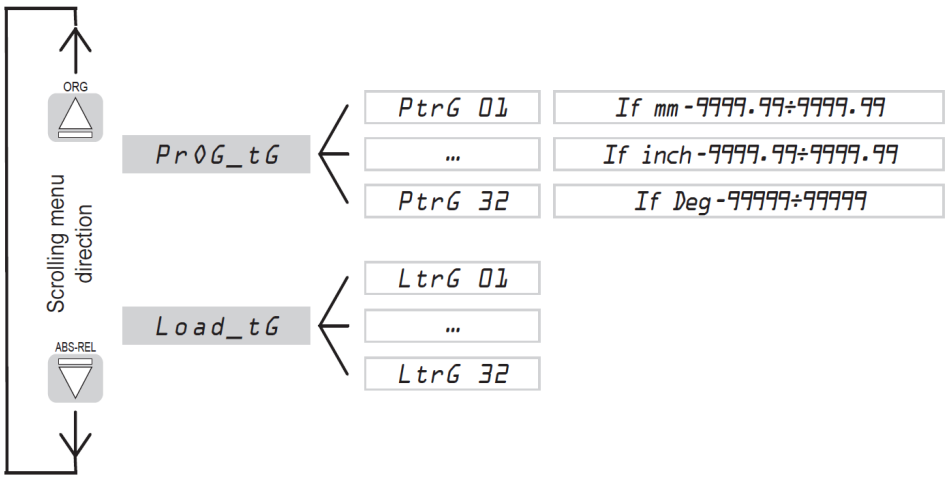
Targets	Target value	Programmable value Res = 1:-999999 ÷ 999999 Res = 0.1:-99999.9 ÷ 99999.9 Res = 0.01:-9999.99 ÷ 9999.99 Res =0.001:-999.999 ÷999.999 The system allows you to store up to 32 compensation values: *LtG01* … *LtG32*. The parameter value depends on the unit of mea sure and resolution set.	*0*

Main menu tree



6 The parameter value depends on the unit of measure and resolution set.
7 The symbols on the display related to the target feature are used.
8 See chap. 5

Target menu tree



Additional features

Reset
To reset the device to its factory setup:

- select the voice RESEt from the main menu (see chap. 8.3).
- elect YES pressing the key
- press the key to confirm.

Calibration
The Calibration voice in the main menu activates the CALIBRATION MODE and the display shows GO. At this point, the user must slowly move the sensor in one direction along the magnetic band. After the GO, a progress bar is displayed that will grow as long the sensor is moved. The procedure is completed when the measurement position is shown again by the display. This operation allows the sensor to be accurately bound to the magnetic tape and has to be done every time after the installation of the sensor.

Test LCD
The LcdtESt voice in the main menu allows to switch on all the display segments.

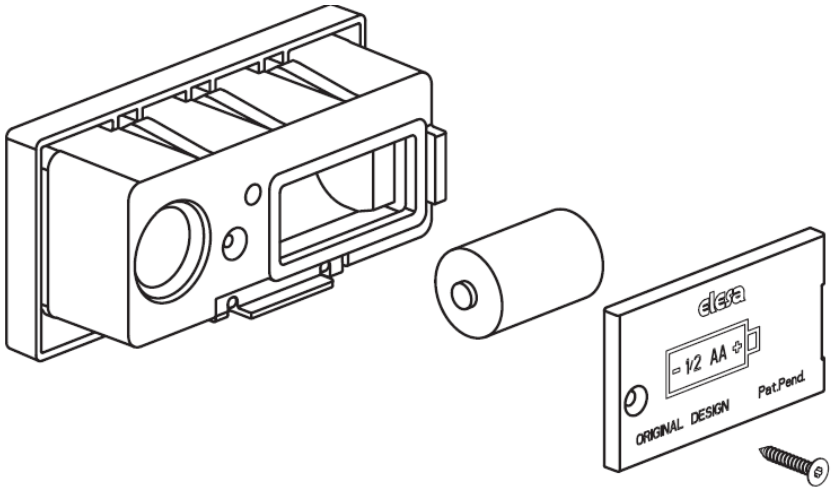
Correction coefficients
To improve the correctness of the measurement, MPI-R10 allows to set two correction factors that take into account the differences between ideal and actual installation of the magnetic band:
Lin Corr: is the ratio between the actual measurement and the value measured by the device in linear measurement.
Ang Corr: is the ratio between the actual measurement and the value measured by the device in angular measurement.
To calculate the correction factor, set it to 1 then read the value measured (M) in a reference point (K). The correction factor will be equal to K/M. Verify that the measurement done in the reference point and/or other known points is correct.

Revision
The release data of the device are shown, starting with the r letter, as last voice in the main menu. These data can be scrolled pressing the key .

- Please note these values and communicate them to Elesa in case of support needed.

Battery replacement

The internal lithium 1/2 AA – 3.6 V battery ensures over 3 years battery life (RF version – 2 years). The symbol is shown on the display when the battery replacement is required. The replacement is made by simply removing the cover on the back. By replacing the battery in less than 5 seconds, all the measurements and settings wil not be lost. If more time is required and the display turns off, the settings of the device have to be set or verified again.



Display messages and troubleshooting

Message on the display	Description	Action
Sensor	The sensor is not connected	Connect the sensor or verify the cable and the co nnector
no tAPE	The magnetic tape is not detected	Verify if the sensor is correctly mounted near the magnetic tape
Speed X	The sensor is moving too fast according to the value of the setting in the Speed parameter. X is the present setting of th e Speed parameter.	Press to go back to the value reading and re-set t he absolute reference.
 Flashing battery symbol	Low Battery	Replace the battery (see chap. 9).

EU DECLARATION OF CONFORMITY {DoC)

COMPANY NAME: Elesa S.p.a.
POSTAL ADDRESS: Via Pompei 29
POSTCODE AND CITY: 20900 Monza
TELEPHONE NUMBER: +39 039 28111
E-MAIL ADDRESS: info@elesa.com
Declare that the DoC is issued under our sole responsibility and belongs to the following product:
PRODUCT: Magnetic measuring system
APPARATUS MODEL: MPI-R10

TRADE MARK: Elesa

The object of the Declaration described above is in conformity with the relevant Union harmonization legislation:
2014/30/EU (EMC): Electromagnetic Compatibility Directive 2011/65/UE (RoHS): Restriction of the use of certain Hazardous Substances in electrical and electronic equipment

The following harmonized standards and technical specifications have been applied:
EN 61326-1 :2013

Documents / Resources

	EIEsa MPI-R10, MPI-R10-RF Magnetic Measuring System [pdf] Instruction Manual MPI-R10, MPI-R10-RF, MPI-R10 MPI-R10-RF Magnetic Measuring System, MPI-R10 Magnetic Measuring System, MPI-R10-RF Magnetic Measuring System, Magnetic Measuring System, Magnetic Measuring

References

- Elesa: components for the mechanical industry