

	<b>TECHNICAL PRODUCT DOCUMENTATION</b>	EP5 - 1824
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**ANGULAR ENCODER  
TYPES:  
EPO – 02 – 01 – 2  
EPO – 03 – 01 – 2**

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## 1. SAFETY INSTRUCTIONS

### 1.1 Application range

The Angular Encoder (EPO) is designed for position measurement in automatic control, regulation and measurement installations.

Other applications should be consulted with the Manufacturer.



The Manufacturer doesn't bear responsibility for any damages which result from using the encoder in the way not according to application. The risk is only on the user's side. Element of proper using of the device is also usage to recommendations given in the present Instruction Manual.

### 1.2 Instructions and warnings

In case of not observing the instructions and warnings by a user, serious body injuries and/or serious material damages may arise. The servicing staff has to be adequately instructed and acquainted with all the safety instructions and warnings.

For reliable and safe transducer operation, the proper transport, storage, assembly, starting and maintenance instructions have to be ensured.

Important remarks of safety in this Technical Product Documentation were marked by the below pictograms:

	<p><b>This sign means: Pointer.</b></p> <p>„Pointer” indicates an operation or any process important for proper functioning of device. Material damages might arise if a user doesn't keep the instructions.</p>
	<p><b>This sign means: Warning.</b></p> <p>„Warning ” indicates on action or any process, which might be dangerous for the operating staff or make serious material damages in case of incorrect operation.</p>

## 2. SCOPE OF THE TECHNICAL PRODUCT DOCUMENTATION

The scope of this Documentation is the Angular Encoder (EPO) designed for position measurement in the control, regulation and measurement systems. The device converts change of the encoder axis rotation angle into standardized current signal 4-20 mA. Measurement of angle is realized by means of Hall effect device. The angular encoders made on the basis of contemporary technologies which guarantee high stability and long-term life of conversion circuit. the EPO-02 and EPO-03 unit are made on the basis of digital circuit applications.

### 3. PRODUCT MARKING AND ORDERING

The Angular Encoder is marked with the following type EPO-01, EPO-02, EPO-03.

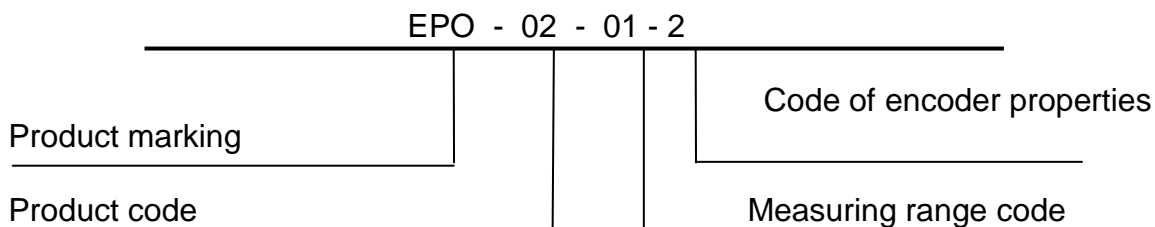


Fig. 1. Product marking (meaning of the particular code places).

The detailed data concerning the Product marking and the way of encoder Ordering are shown in table no. 1.

**Markings used in the text of the present Instruction Manual:**

**EPO-02 → denotes the product type EPO-02-01-2**

**EPO-03 → denotes the product type EPO-03-01-2**

**Tab.1. Product marking and short description of the particular options**

<b>EPO – 02-</b>	Angular Encoder (digital, Hall effect device)
<b>EPO – 03-</b>	Angular Encoder (digital, Hall effect device)

CODE 1	TRANSDUCER MEASURING RANGE	
	EPO – 02	EPO – 03
<b>01</b>	0 ÷ 360°	0 ÷ 360°

CODE 2	TRANSDUCER PROPERTIES	
	EPO – 02	EPO – 03
<b>2</b>	marine life period, practically unlimited, transducer axis: 6mm	marine life period, practically unlimited, transducer axis: 6mm

<b>EPO – 02 – 01 – 2</b>	<b>Exemplary way of ordering</b>
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#### Examples:

**EPO – 02 – 01 – 2**

**– Angular Encoder  
(digital, Hall effect device), life period practically  
unlimited, transducer axis: 6 mm and measuring range:  
0 ÷ 360°.**

## 4. DESIGN AND PRINCIPLE OF OPERATION

### 4.1. EPO – 02, EPO – 03

The Angular Digital Encoder consists of the Hall effect sensor (EPO-02 and EPO-03) and electronic circuit based on microprocessor technique. The used sensor (potentiometer, or Hall effect sensor) changes a measured angle into voltage signal which is transformed in the analogue-digital converter (AD) into digital form.

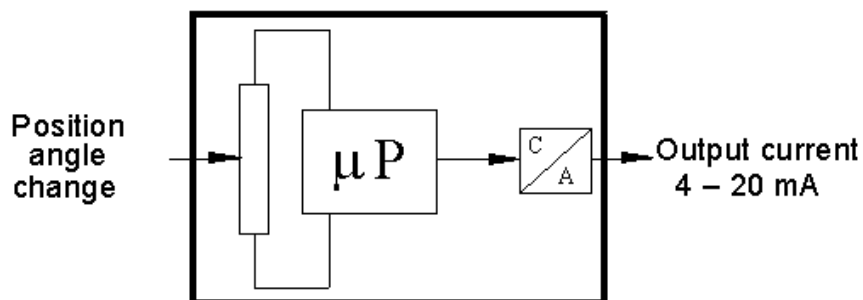


Fig. 4.1. Block diagram of EPO-02 and EPO-03 encoders

Block diagram of encoder is presented in fig. 4.1. Operation of EPO encoder is controlled by microprocessor circuit, according to algorithm stored at the stage of transducer production.

In order to enable the user to communicate with the transducer (**readout of parameters and their change**), one applied the keyboard unit consisting of the two pushbuttons and liquid crystal display type LCD (EPO-03) or diodes LED (EPO-02). After taking of position measurement and making of necessary calculations, microprocessor drives the output digital-analogue converter (DA). This circuit displays the expected value of output current which indicates the measured position value. It also has a possibility of selecting the beginning and end of measuring range. Adjustment of these parameters is totally independent. The EPO encoder is powered in two-wire technique with DC voltage.

## 5. TECHNICAL DATA

**Tab. 2.**

Parameter / Type	EPO-02-	EPO-03-
Two-wire power supply	12÷36V DC *	
Power consumption	≤ 1 VA	
Measuring range	0÷360°	
Setting of range	20÷100%	
Output signal	4÷20mA	
Characteristics of conversion	linear, dependent of the transducer axis rotation angle	
Load resistance	0÷R <sub>max</sub> ≤ 1kΩ    R <sub>max</sub> =(U <sub>z</sub> -12V)/20mA	
Conversion error for FSO	≤ 0,3%	
Hysteresis for FSO**	≤ 0,2%	
Operating temperature	-40÷80°C	-25÷80°C
Ambient temperature effect for FSO**	≤ ± 0,15%/10°C	
Load resistance change effect	≤ 0,1%	
Power supply voltage effect	≤ 0,1%	
Resistance to vibrations	5G	
Mechanical life time	depending on the selected sensor (Tab. 1)	
Casing protection degree	IP-65	
Relative humidity	30÷95%	
Display	diodes LED	4-digit LCD + mA, %, °
Mass	≈200g	
External dimensions	Ø49x31mm	

\* the wires “+” and “-“ have got the connection from the PE protective earthing terminal, through transils of 63 V voltage.

\*\* FSO – for maximum range.

## 6. ASSEMBLING AND START-UP

### 6.1. Mechanical Assembling

The encoder is to be mounted at the measuring point which fulfils the technical conditions placed in the **table 2**.

One should pay special attention to setting of the potentiometer axis the beginning of measuring range so that the initial setting would correspond to minimum value. In case of EPO-03 and EPO-02 the setting of axis beginning can be arbitrary.

## 6.2. Electrical Assembling

In order to connect the angular encoder wire (EPO-xx-xx-x) to the measuring-supply connector (fig. 6.1.) one should do the following:

- One should connect the opposite ends of the cable wires to measuring circuit containing the DC voltage source of 12÷36 V and necessary devices for measurement, regulation and signalling. For cooperation with the angular encoder (EPO-xx-xx-x), one recommends usage of mains power supply unit type ZS-30, produced by APLISENS. Total resistance of this circuit cannot exceed the encoder load resistance, given in the Technical Data (table 2).



**In order to ensure safe usage of encoders: EPO-02, EPO-03 one should connect the encoder screen wire with the PE terminal.**

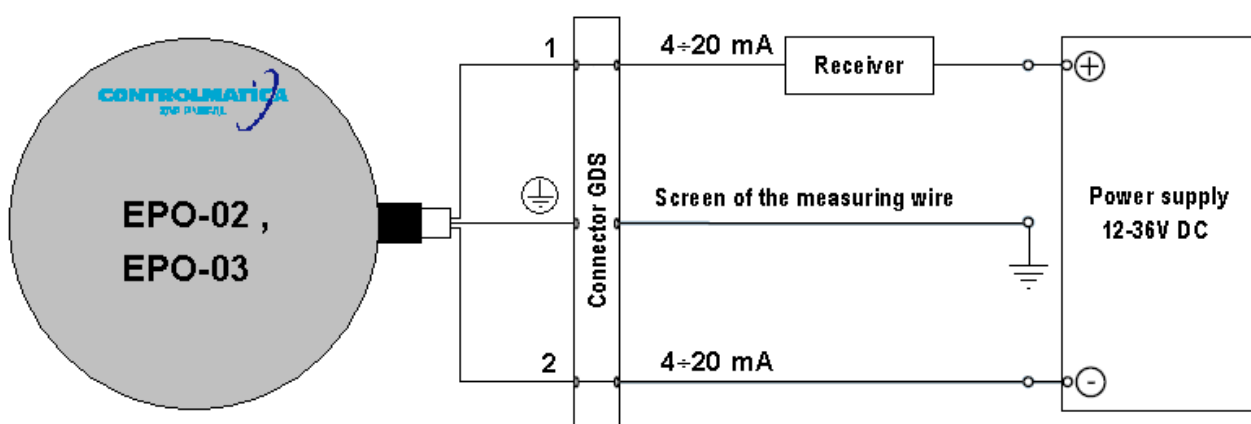


Fig. 6.1. Application diagram for the EPO – 02, EPO – 03 - marine encoder

## 6.3. Start-up

The encoder (EPO-xx-xx-x) does not have its own switch, switching-on of measuring circuit power supply source causes the encoder start-up. After the power supply is switched on, the EPO-02, EPO-03 encoder will show on its display a value of actual angle (in units being set), while at the output it will indicate the current proportional to the angle being set (EPO-xx-xx-x).



**As the standard, the encoder is factory set to maximum measuring range, and for encoders EPO-03- the angle value is displayed in units [°].**

## 7. Service

### 7.1 EPO-02

The communication interface serves for communication with the converter. In the standard version it is the set of two push-buttons and four LED diodes on the front panel of the converter. This system allows for adjustment of zero and range of the converter as well as setting the inverse mode or normal mode output signals characteristics, which determine, with the selected direction of position angle change of the converter axis, an increase of the output signal (fig. 7.1.).

### 7.1.1. Setting of measuring range and output signal characteristics:

7.1.1.1. Settings of sense of output signal consist in simultaneous press of the (+/-) & ENTER push-buttons during approx. 2 s. Then the proper LED diode will shine and show the sense of output signal characteristics set: [L] – inverse mode, [P] – normal mode, repeated press of the push-buttons will result in setting the reverse sense of output signal.

#### 7.1.1.2. Setting of measuring range:

- Connect the electric system acc. to the diagram on the drawing 6.1 with the output current measurement,
- Rotating by the converter axis, set up the converter axis in the position from which the current signal is to increase,
- Setting the initial value requires pressing of the push-button (+/-) during approx. 4s – then the diode **[ZERO]** will shine and the **4mA** current is set,
- Connect the converter mechanically with the gear driving the converter axis,
- Reset the drive up to the final value required by a User,
- Setting of the final value requires to press the ENTER push-button during approx. 4s – then the diode **[ZAKRES]** will shine and the **20mA** current is set,
- During the drive resetting check the initial and the final values set.

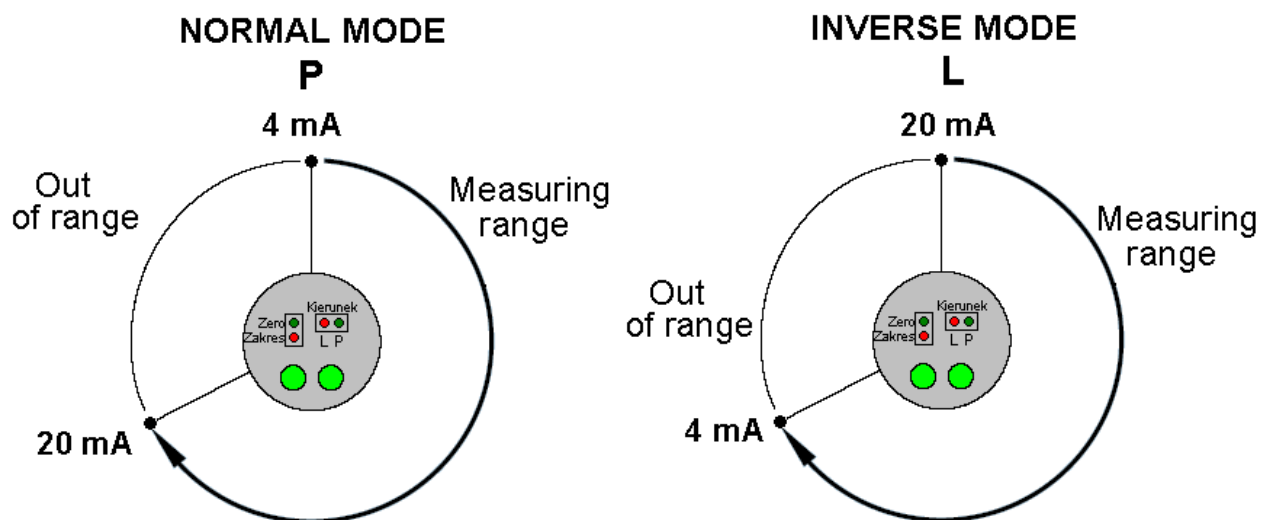


Fig. 7.1. Sense of rotation of the EPO-02 encoder (view from the interface side).

## 7.2 EPO-03

### 7.2.1. Keyboard

Communication interface with the LCD-type display is designed for service and communication with encoder. The standard version is the set of two pushbuttons and 4-digit LCD display mounted on the front panel of encoder.

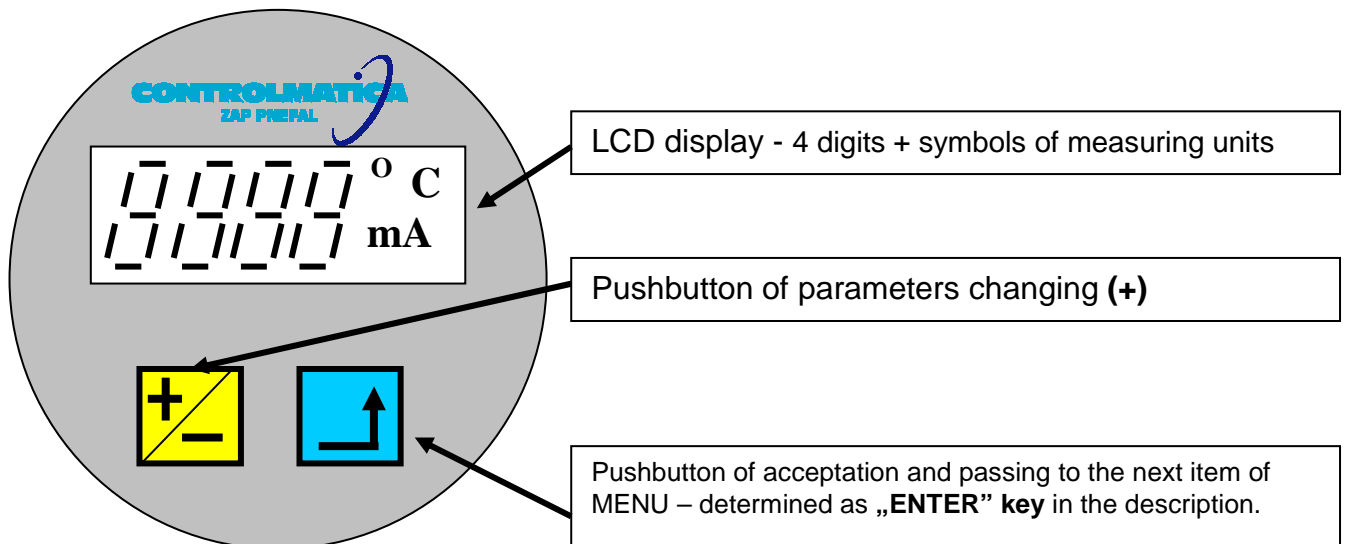


Fig. 7.2. View of the encoder front panel, with description of functions

### 7.2.2. Quantities which are set in the encoder MENU

- Rotation sense,
- Beginning of the measuring range,
- End of the measuring range,
- Characteristics of the output signal,
- Values of the operation cycles divider, with simultaneous cancelling of the current status of the counter,
- Measuring units.

### 7.2.3. MENU

The encoder operates in two modes (browsing and editing).

7.2.3.1. Browsing mode – allows to read out the parameter of the encoder, without changing of its settings. Displaying of the next parameters is possible after subsequent pressing of pushbutton **ENTER**. This parameter is displayed alternatively: mnemotechnical parameter name and parameter value (with frequency of 1Hz). In case when one does NOT press **ENTER** pushbutton, the encoder will automatically exit from **MENU** of browsing mode after ca. 10 s. Entry into Browsing Mode requires pressing of any pushbutton (+/-) or **ENTER** for time of approx. 1 s.

### 7.2.3.2. Displayed messages:

- Readout of setting the rotation direction –  $\boxed{P\_}\boxed{\_}\boxed{\_}\boxed{\_}$  right or  $\boxed{L\_}\boxed{\_}\boxed{\_}\boxed{\_}$  – left,
- Readout of setting the encoder range beginning  $\boxed{0d\_}\boxed{\_}\boxed{\_}\boxed{+}$
- Readout of setting of encoder range end  $\boxed{\_}\boxed{\_}\boxed{d0}$
- Readout of setting the characteristics of output signal:  $\boxed{4\_}\boxed{20}$  - normal conversion,  $\boxed{20\_}\boxed{4}$  - inverse conversion,
- Readout of setting the divider for number of cycles  $\boxed{n\_}\boxed{\_}\boxed{\_}\boxed{\_}$  ,
- Readout of cycles number done by encoder  $\boxed{n|}\boxed{\_}\boxed{\_}\boxed{\_}$  , calculated number of cycles counted by the encoder is equal to:

$$\underline{\text{number of cycles}} = n \times n1$$

- The end of Browsing Mode  $\boxed{End}\boxed{\_}$  .

### 7.2.3.3. Operation mode „**EDITING**”

-enables changing of the encoder configuration. Changes made in this Mode cause the output signal from the encoder during their setting. Depending on the exit way from this Mode (approving the changes or not), the encoder will accept the new settings or returns to the previous configuration.



**The user's actions in this encoder operation mode must be conscious. They must be preceded by detailed acquainting with the below information.**

- **The entry to “EDITING” mode:**

- The entry to programming mode requires simultaneous pressing of pushbuttons (+/-) & ENTER for time period of ca. 5 secs.
- Pressing of pushbuttons (+/-) & ENTER shows on the display a message Ed1 E, after approx. 5 secs this message Ed1 E will be replaced by the message Ed4 informing about converting the encoder into Mode of parameters editing.
- After the pushbuttons (+/-) & ENTER are released, a message EP0 will appear on the display.
- These messages describing the parameter being set and parameter value are displayed in turns, with frequency of ca. 1Hz.
- Pressing the pushbutton ENTER one will enter the MENU to the parameter being set, change in parameters values should be done with the use of pushbutton (+/-) after pressing (+/-) there occurs incrementation of parameter value.
- Passing to setting of a next parameter will appear after pressing of pushbutton ENTER.
- Setting of the rotation direction P--- right or L--- left (see fig. 7.2). Change in the rotation direction does not change the places of 4mA point position, but it causes that current value increases to the right or left from 4mA point.
- Setting of the encoder beginning range 0d-- : set the encoder axis to initial value (it is displayed in degrees) alternatively with message 0d-- and confirm the settings by pressing the pushbutton (+/-) - confirmation of data receiving is displaying of message YES. After this operation the transducer will indicate current of 4 mA.
- Setting of the encoder final range: --d0 set the encoder axis to final value (it is displayed in degrees) alternatively with message --d0 and confirm the settings by pressing the pushbutton (+/-) - confirmation of data receiving is displaying of message YES. After this operation the encoder will indicate current of 20 mA.
- Setting of the output signal characteristics type char - one can select normal mode 4-20 (range beginning is at the point of 4 mA, range end at the point of 20 mA), or inverse 20-4 (range beginning is at the point of 20 mA, range end at the point of 4 mA). Change in this parameter changes the places of 4 and 20 mA point position on the characteristics of conversion (see fig. 7.3).
- Entering of divider of cycle number done by the encoder n---, value *n* divides the number of cycles done. Value of cycle divider is set up by means of pushbutton (+/-), which changes the digit value (from 0 to 9 in the loop), pushbutton ENTER changes the position of digit being set. The divider can be an integer from the range of 1÷9999. Entering 0 causes setting of divider value equal

to 1. The divided number of cycles is summed up and entered into the ERAM memory approx. every 1 [hour].

- Setting of units  which are to be shown on the display (mA, %, °).

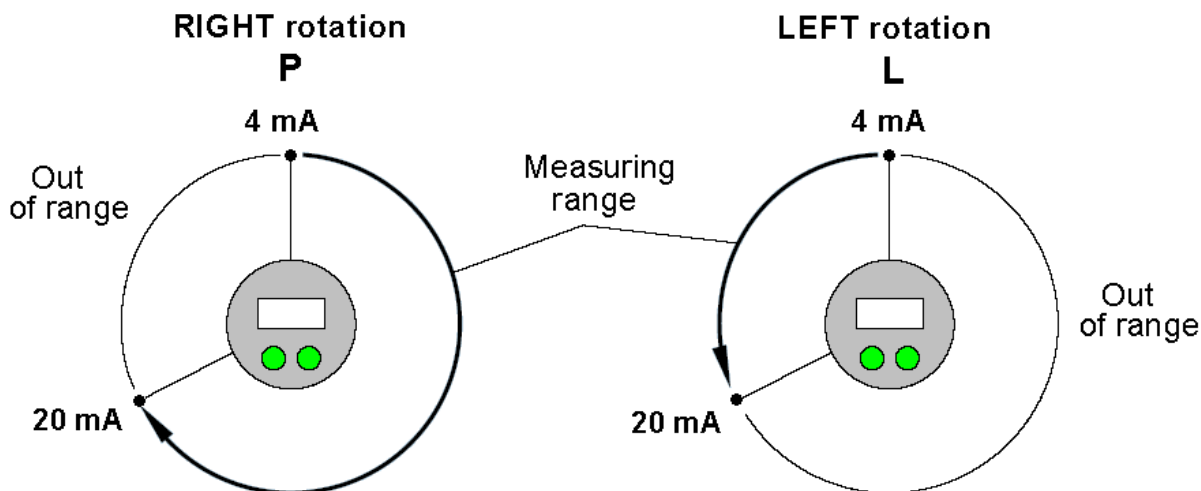


Fig. 7.3. Sense of EPO-03 ecoder rotation (view from the side of LCD display)

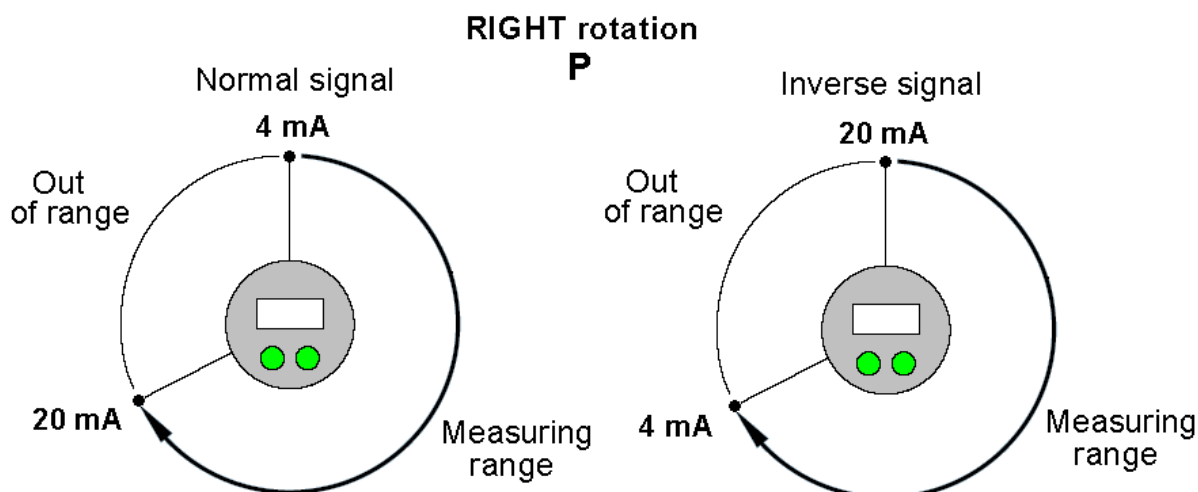


Fig. 7.4. Type of EPO-03 encoder output signal (view from the side of LCD display)  
RIGHT rotation

The saving data being set into the ERAM memory is reported by the message  – saving requires the conscious selection. Saving of the set parameters requires Pressing the pushbutton (+/-) causes approving of the entry which is confirmed by the displayed message . Releasing of the pushbutton (+/-) will cause automatic saving and exiting from MENU.



**In case when the entry is NOT accepted for saving in ERAM memory, as above, the changes which were made will be lost, and encoder will exit the MENU loop „SAVING OF DATA” automatically after time of approx. 2 minutes.**

### 7.3. General Instructions



It is recommended to tightly turn the encoder nut down each time after making of any settings in the encoder.

## 8. MAINTENANCE

Angular encoder: (EPO-xx-xx-x) does not require continuous service and maintenance.

## 9. CONDITIONS OF STORAGE AND TRANSPORT

The angular encoder is packed in polyethylene foil bag and cardboard box during the storage and transport. No vibrations and shocks are allowed during transporting.

The product is to be transported only in factory packing.

The product is to be stored in original packing, in closed rooms, free from media causing corrosion. Storage temperature range from -25°C to +50°C, at relative humidity less than 95%.

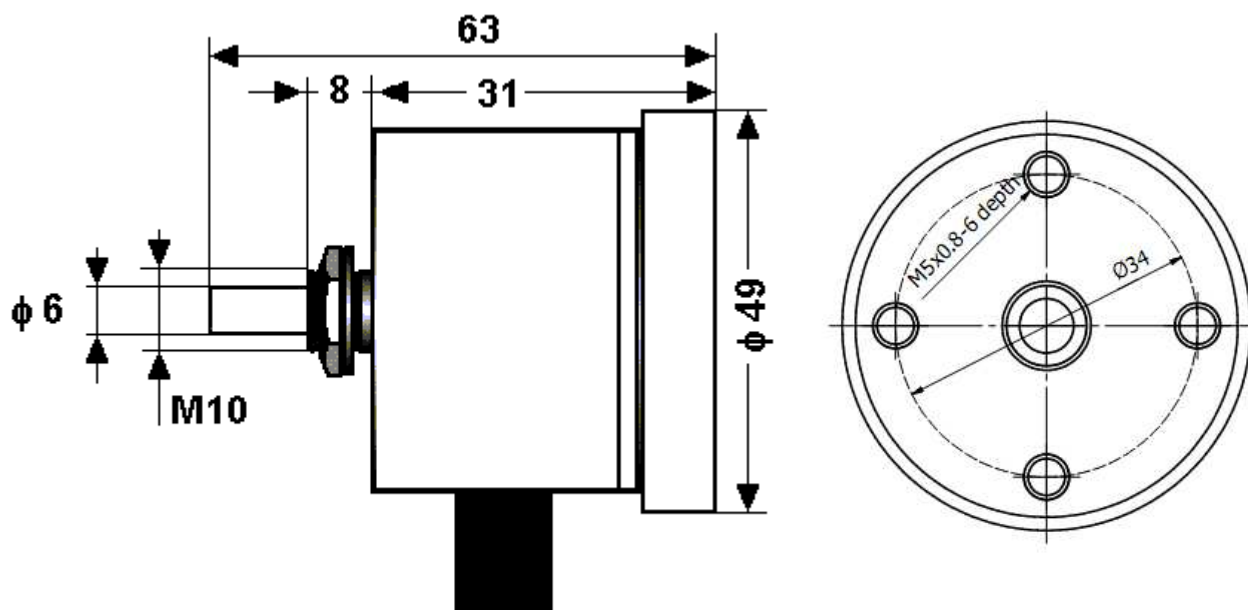
## 10. COMPLETENESS OF DELIVERY

The complete delivery consists of:

1. encoder is delivered in a cardboard box,
2. 'Technical Product Documentation' which among others contains:
  - dimensioned drawings,
  - declaration of compliance,
  - Guarantee Card.

## 11. CONDITIONS OF GUARANTEE

The conditions of guarantee are additionally determined in the Guarantee Card enclosed to each product, which is obligatory in the **Controlmatica ZAP-PNEFAL Works**.

**12. Dimensioned drawings of angular encoders****12.1. EPO – 02, EPO – 03 – marine encoder:****CONTROLMATICA ZAP-PNEFAL Sp. z o.o.**

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