PES-305 SEALED EDDY CURRENT PROXIMITY SENSOR

User's Manual

Safety Information

The following manual contains information and warnings that must be observed and followed in order to keep instruments in good condition and insure safe operation.

Safety and Electrical Symbols

	Warning - Danger - Identifies conditions or practices that could cause physical harm or damage the measuring chain and other equipment to which it is connected.
	Caution - Identifies conditions or practices that could result in a permanent loss of data.
	Important Information - Must be read and followed.
	Shield connection location.

Safety Precautions

Warning - Danger Caution
• **To use the described sensors correctly and safely, read and follow all safety instructions or warnings displayed throughout this manual;** • **This product is intended to be used by qualified operators and maintenance personnel who are familiar with the safety precautions required to avoid possible injury. Carefully read and follow all installation information before using this product;** • **Install and use this product only as specified in this manual or the protection provided by this instrument might be impaired;** • **When in doubt that safety protection has been impaired, make this product inoperative and secure it against any unintended operation;**

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TABLE OF CONTENTS

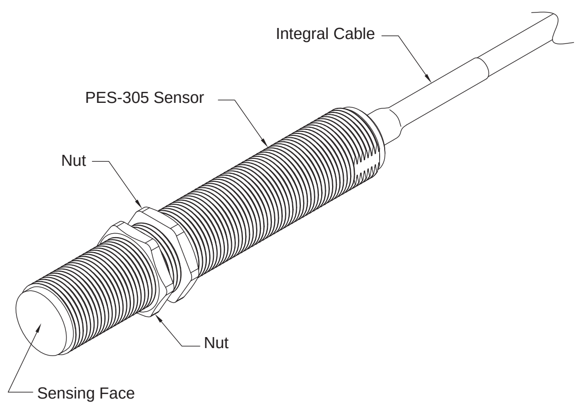
1. OVERVIEW OF THE PES-305 PROXIMITY SENSOR

1.1 Description

PES-305 proximity sensors are designed for measuring the relative distance between the sensor's sensing face and metallic target surfaces. Its housing is sealed to sustain pressure up to 10 Bars *[150 PSI]* when submerged in oil, with a submersible integral cable.

The PES-305 covers a 0 to 5 mm *[0 to 197 mils]* measuring range.

PES-305 Sensor



1.2 Main Unit Interventions

- Sensor holder must be bolted or welded at the appropriate location;
- The sensor's integral and extension cable must be routed and protected from the sensor to the acquisition unit.

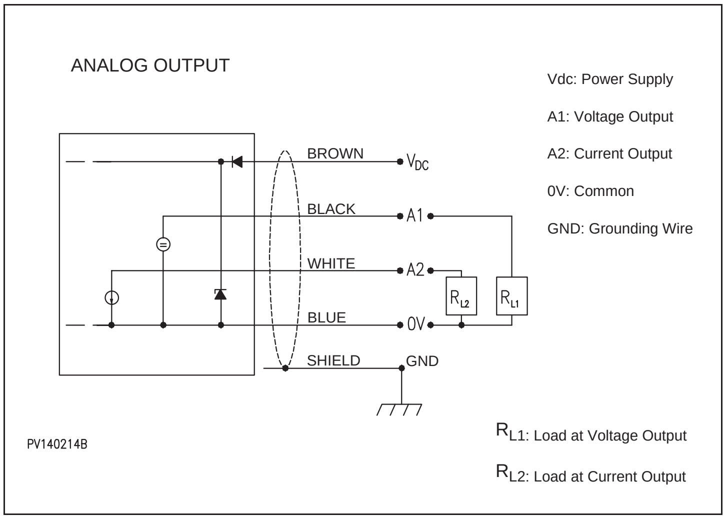
Caution
• Instructions for sensor installation and connection must be thoroughly followed to ensure a safe and proper operation; • In order to complete the commissioning, VibroSystM must be contacted when Section 2.2 (Assessing the actual sensitivity) is reached.

2. OPERATING THE PES-305 PROXIMITY SENSOR

2.1 Connecting the PES-305 Sensor

Connect the sensor as displayed in the following wiring diagram:

Wiring Diagram



Important Information

- The integral cable shield **IS NOT** connected to the sensor's metallic casing body. It must always be grounded on the instrumentation side.

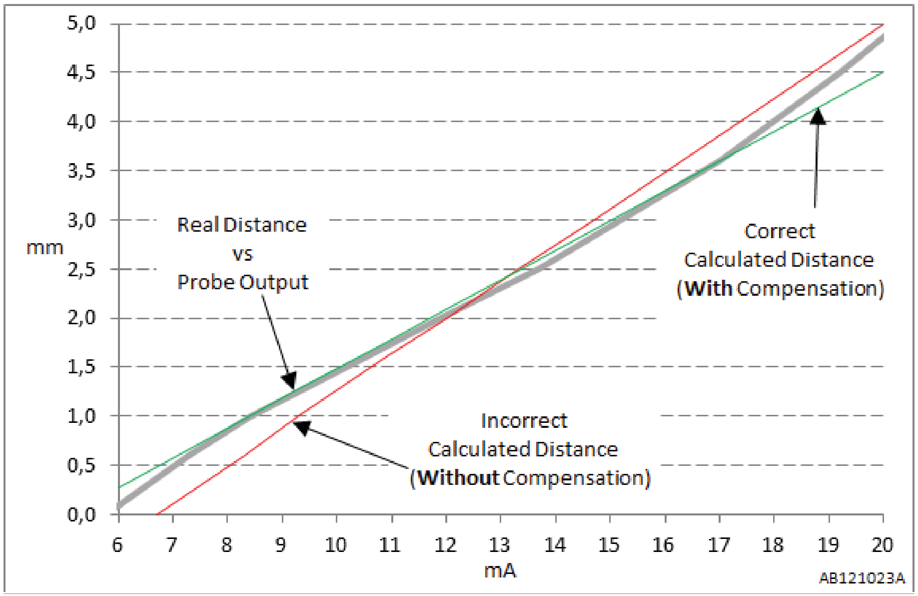
2.2 Assessing the Actual Sensitivity

PES-305 proximity sensors are calibrated to produce a linearized output based on an FE360 steel target. Because the sensitivity of eddy-current sensors is affected by the nature of the material used as a target, the actual sensitivity must be experimentally determined.

Important Information

- Failure to correctly assess and compensate the sensitivity will result in incorrect measurement results as displayed in the illustration below.

PES-305 Calculated Distance vs Sensor Current Output



Important Information
• Step 1 must be completed BEFORE installing the sensor. Steps 2, 3, and 4 must be completed AFTER installing the sensor; • In the examples below, calculations are in metric format. All distances can also be measured in inches with the resulting values used in the same formulas.

Step 1 - Measuring Current Output (I_{out}) and Corresponding Distance

To assess the sensor's actual sensitivity, physical distance and current measurements must first be taken using a target made of the **same material** as the real target. Minimum dimensions for the target are: 50mm x 50mm x 2mm *[2″ x 2″ x 1/16″]*.

Proceed as follows:

Fill the table with measurements (distance vs current), equally distributed on the full current scale. Add **non- metallic** spacers between the sensor's tip and the target until I_{out} max. is approximately reached. Note down the current value and the distance (total thickness of spacers) in the table. Gradually remove spacers to approximately reach the next I_{out} level and again, write down the current value and distance. Repeat until the table is filled. The last I_{out} value is measured without spacers (0mm), with the sensor's tip placed directly against the target.

Recorded Distance Values vs I_{out} for PES-305

Ideal level of I_{out} (mA)	**20**	**16.3**	**13.3**	**10.9**	**6.7**
Measured I_{out} (mA)					
Measured distance (mm)					**0**

Example of Recorded Distance Values vs I_{out} for PES-305

		$I_{out\,B}$	I_{op} approx.	$I_{out\,A}$	
Measured I_{out} (mA)	*20.3*	*17*	*13.7*	*10.5*	*5.8*
Measured distance (mm)	*5*	*3.6*	*2.5*	*1.6*	**0**
		d_B		d_A	

Step 2 - Taking a Measurement with the Sensor Installed

With the sensor now installed, take a measurement and note the real operating current ($\mathbf{I_{op}}$).

Important Information
• For best results, the sensor should be installed at a distance corresponding to the middle of the measuring range when the target is stationary (unit stopped).

Example with PES-305: $\mathbf{I_{op}}$= 13.7 mA

Step 3 - Calculating the Sensitivity

Select two points in the table, on either side of the value closest to $\mathbf{I_{op}}$. These two points (A & B) will be used to define the linear equation. The selected points should be at equal distance from $\mathbf{I_{op}}$ (ideally, point A at $\mathbf{I_{op}}$ - 2.5 mA, and point B at $\mathbf{I_{op}}$ + 2.5 mA).

If $\mathbf{I_{op}}$ = 13.7 mA:

Point A: $\mathbf{I_{op}}$ - 2.5 mA= 11.2 mA (closest correspondence in the table: $\mathbf{I_{out\,A}}$ = 10.5 mA, $\mathbf{d_A}$ = 1.6 mm)

Point B: $\mathbf{I_{op}}$ + 2.5 mA= 16.2 mA (closest correspondence in the table: $\mathbf{I_{out\,B}}$ = 17 mA, $\mathbf{d_B}$ = 3.6 mm)

a) Calculate «**m**» (the sensitivity or gain), using selected points A and B.

$$m = \frac{d_B - d_A}{I_{outB} - I_{outA}}$$

Example for PES-305:

$$m = \frac{3.6 - 1.6}{17 - 10.5} = \frac{2}{6.5}$$

= 0.308

b) Calculate «**b**» (the y-intercept) of the linear equation, using calculated «**m**», measured current $\mathbf{I_{out}}$ and measured distance «**d**» corresponding to point A, or point B.

$$b = d - (m \times I_{out})$$

Example for PES-305 (with point B):

b = 3.6 - (0.308 x 17)

= -1.636 mm

c) The equation to calculate the compensated distance corresponding to the sensor's current output is:

$$d_C = (m \times I_{out}) + b$$

Where:

$\mathbf{d_C}$ is the calculated distance (in mm)

d) Verify the «**m**» and «**b**» calculated values by applying the following formula on the measured value between the **A** and **B** coordinates:

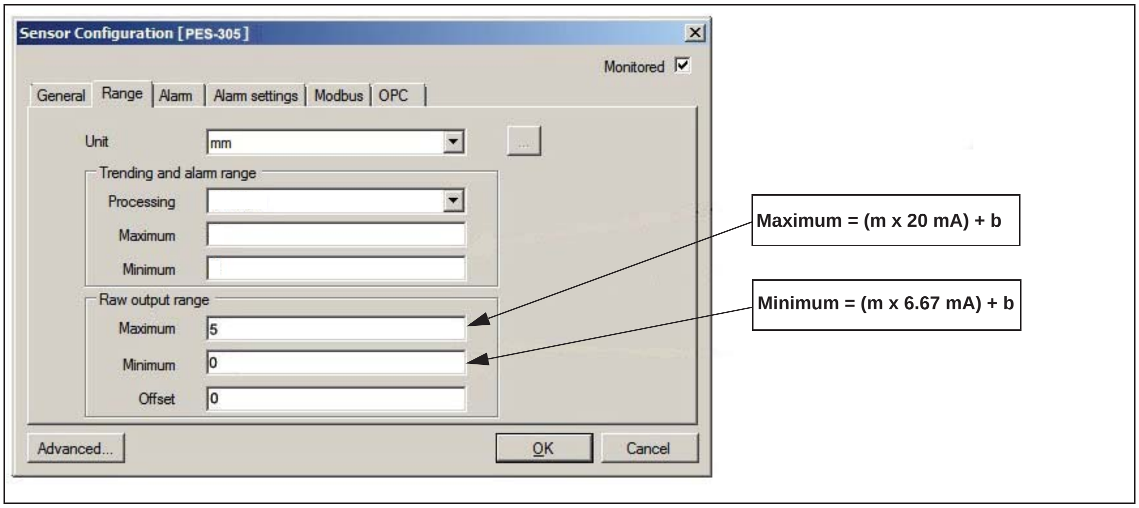
for $\mathbf{I_{out}}$ = 13.7 mA, verify that $\mathbf{d_C}$ = 2.5 mm (± 5% of range):

d_C = (0.308 x 13.7) - 1.636 = **2.58 mm**

Step 4 - Adjustment Through the ZOOM Configuration Software

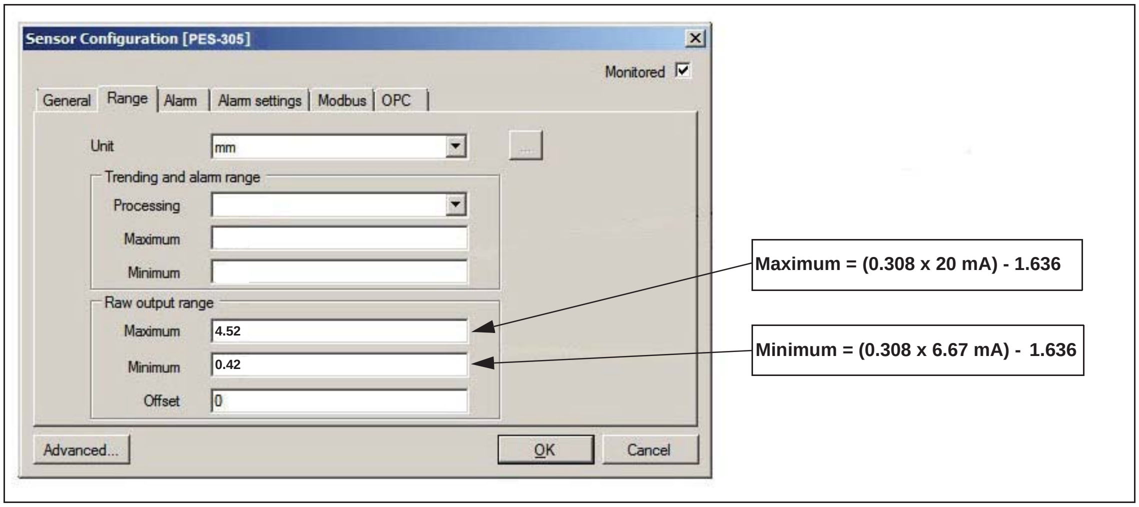
Proceed with the final adjustment through the ZOOM Configuration software. Select **Sensor Configuration**, and in the **Range** tab of the dialog window, enter the **Maximum** and **Minimum** values of the **Raw output range**.

Formulas for Adjustment of the Raw Output Range



Note: In the **Trending and alarm range** section, the Maximum and Minimum values must be within the limits of the **Raw output range**.

Example with Calculated Values



3. SENSOR INSTALLATION INFORMATION

3.1 Positioning the Sensors

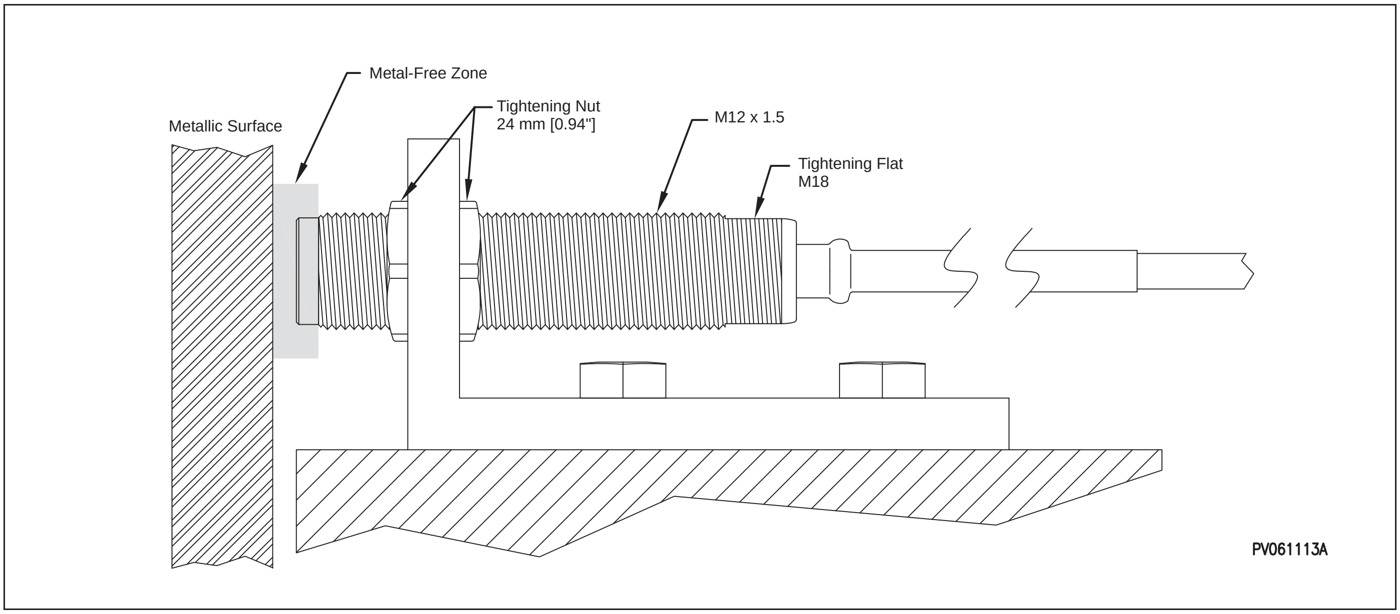
Caution
• The PES-305 sensor must be properly connected with its cable well protected to avoid any sort of mechanical damage.

Before determining where to install the sensor, consider the following:

- The sensor's surface must face the target;
- The maximum cable length (integral cable + extension) must be considered. From the sensor to the acquisition unit, the maximum distance is 300 m *[984 ft]* for the current output, and 100 m *[328 ft]* for the voltage output.

Important Information
• VibroSystM recommends relying on the services of a trained technician for supervising the installation of these proximity sensors and finalizing the ZOOM Software configuration.

3.2 Typical Installation



4. GENERAL SPECIFICATIONS

Operation

• Measurement Type	Non-Contact Proximity, Eddy Current
• Measuring Range*	0 to 5 mm *[0 to 197 mils]*
• Outputs*	6.67 to 20 mA 1.67 to 10 V
• Sensitivity*	2.67 mA/mm *[67.7 µA/mil]* 1.67 V/mm *[42.3 mV/mil]*
• Accuracy**	± 10%
• Repeatability	± 5%
• Bandwidth	0 to 1000 Hz (-3dB)
• Load at Current Output	500 Ω max.
• Load at Voltage Output	10 kΩ min.
• Temperature Drift	< 10%
• Short Circuit Protection	Built-In
• Certification	GOST Russia - Pattern Approval Certificate for Measuring Instruments

Power Requirements

• Voltage	15 to 30 Vdc
• Consumption	30 mA max.
• Voltage Reversal Protection	Built-In
• Warm-Up Time	5 Minutes

Connection

• Integral Cable	
Type	4-Wire x 0.34 mm^2 *[22 AWG]* Shielded
Outer Jacket Material	PUR (Polyurethane)
Outer Jacket Diameter	5.9 mm *[0.232 in]*
Length	30 m *[98.4 ft]*
Min. Bending Radius	60 mm *[2.36 in]*
• Max. Cable Length (Integral + Extension)	
For Current Output	300 m *[984 ft]*
For Voltage Output	100 m *[328 ft]*

Environment

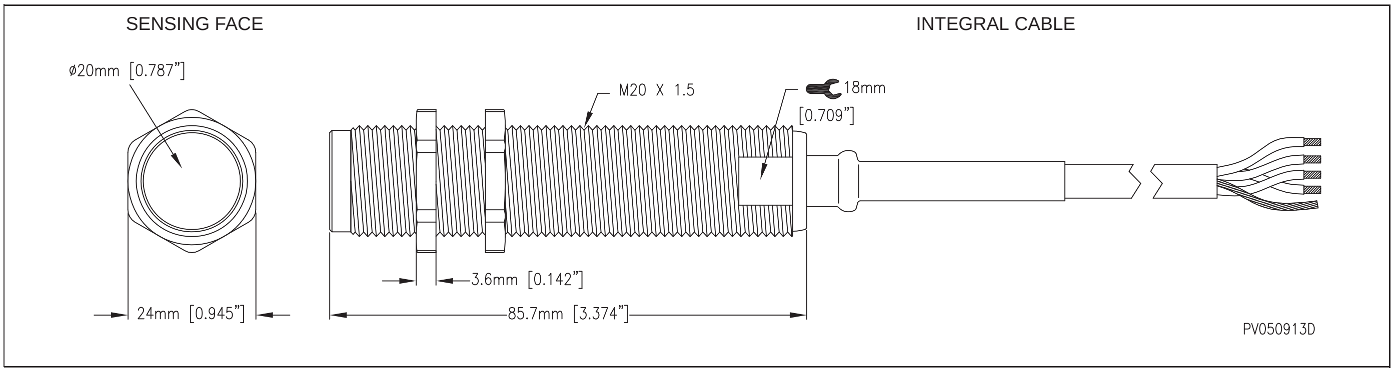
• Temperature Range	
Operating	0 to 70°C *[32 to 158°F]*
Storage	-25 to 70°C *[-13 to 158°F]*
• Max. Submersible Pressure	10 Bar *[150 PSI]*
• Protection Rating	IP69

Physical Characteristics

• Sensor Body	Chrome-Plated Brass
• Sensing Face	Polyamide-imide

Dimensions

**Target material: FE360 steel*
***With appropriate correction factor*



5. TEMPLATE FOR RECORDING DISTANCE VALUES VS I_{out}

Unit no.: ________ Sensor S/N: ______________________ Position: _______________________

Measured I_{out} (mA)					
Measured distance (mm)					**0**

Unit no.: ________ Sensor S/N: ______________________ Position: _______________________

Measured I_{out} (mA)					
Measured distance (mm)					**0**

Unit no.: ________ Sensor S/N: ______________________ Position: _______________________

Measured I_{out} (mA)					
Measured distance (mm)					**0**

Unit no.: ________ Sensor S/N: ______________________ Position: _______________________

Measured I_{out} (mA)					
Measured distance (mm)					**0**

Unit no.: ________ Sensor S/N: ______________________ Position: _______________________

Measured I_{out} (mA)					
Measured distance (mm)					**0**

Unit no.: ________ Sensor S/N: ______________________ Position: _______________________

Measured I_{out} (mA)					
Measured distance (mm)					**0**