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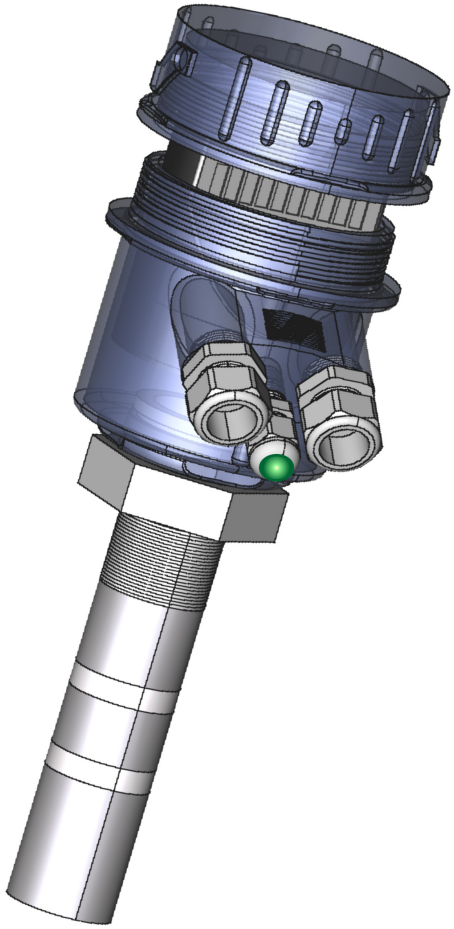
User Manual & Datasheet

Version 2.3



Coat-Endure

Compact Admittance Level Sensor

User Manual & Datasheet

Version 2.3

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Revision History

Revision	Date	Author(s)	Description
1.0	22 Jan,2014	MRK1	created
1.1	22 Feb, 2014	RND1	Connection diagrams udpated
1.2	25 Mar, 2014	RND1	DIP switch position in diagrams updated
2.0	20 Apr, 2014	RND1	Header Correction
2.1	25 Apr, 2014	RND1	Version Control
2.2	10 May, 2014	RND1	Conductive Coat-Endure
2.3	23 April, 2015	RND2	Connection Diagrams updated as per Omni-box insert

1 Introduction

Coat-Endure is a microcontroller based compact coat immune capacitance level limit switch. It is a compact level switch which is suitable for sticky solids, pastes and slurries. The device is specially suited for compact silos and packaging machines where material has a tendency to stick on the probe.

2 Operating Principle

Coat-Endure is an improvement over traditional principle of admittance. The ring type probe has an alternating active and an inactive region, which collectively help the controller to calculate the extent of coating on the probe. In effect, the device is able to identify the differential coating between the sense and the shield by measuring their individual capacitances. As the coating immunity is controlled by the on-board microcontroller, the extent of coating immunity can be set easily.

3 Features

- Universal Power Supply of 18-55 V DC & 90-265 V AC on the same terminal.
- Compact and customizable probe size.
- Passive shielding compensation with adjustable coating immunity.
- Output options: Relay,PNP & Analog.
- High temperature probe suitable for applications up to 200 Deg C.
- Self-diagnosis for probe and electronics.
- Popular with a wide range of materials: low-to-high dielectric conductive materials

4 Dimesional Layout

Dimensional drawing for a probe length of 100 mm is shown in Figure 1. The dimensions shown in Figure 1 can vary depending on the probe length and the mounting arrangment. A dimensional drawing for your order can be made avaliable on request.

5 Technical Specifications

5.1 Electrical Specifications

For electrical specfications please refer to Table 2.

5.2 Mechanical Specifications

Please refer to Table 3 for mechanical specifications.

[1]Mininmum switching time could vary depending on the dielectric constant of the application material

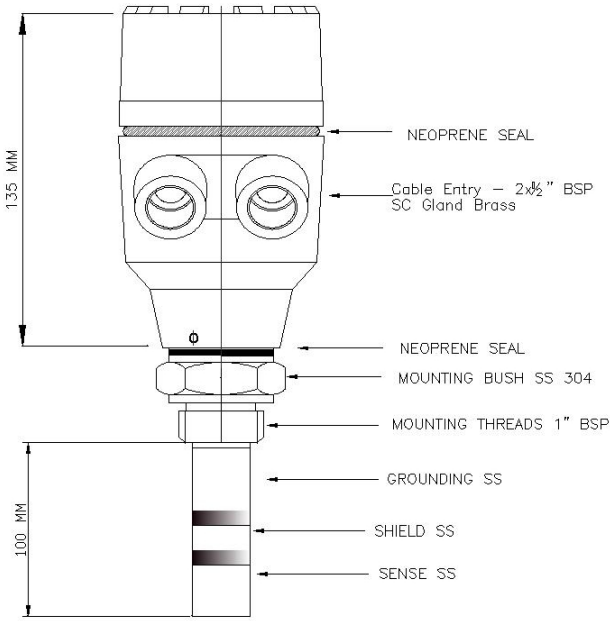


Figure 1: Dimensional Layout: Front View

6 Installation Guidlines

6.1 Procedure for Installation

For quick and easy installation,follow the steps in the order mentioned below:

1. **Testing Electrical Connections:** Before mounting the device on the tank, understand and test the connections outside the tank for at least one piece. For details on connections, refer to Figure 4 before connecting the device to outputs and power supply.
2. **Mouting the Device:** Correct mounting of the instrument is critical to the operation of the instrument. Please refer to **Tank Mounting Installation** to mount the instrument in the tank/silo or hopper. Coat-Endure is designed to work properly in metal-body tanks only, e.g. MS, SS or Aluminium tanks. Performance in plastic tanks might not be satisfactory.
3. **Electrical Connections:** Perform the electrical connections as mentioned earlier in Step 1.
4. **Calibration and Settings:**
   - For non-conductive materials, Coat-Endure can be calibrated in an empty process tank without the application material.
   - If the application material is conductive, Coat-Endure has to be calibrated with the material.

   Time-delay and fail-safe selection should be done afer this stage. Section **Calibration and Settings** covers settings in more detail.

Parameter	Value
Input Power Supply	18-55V DC/90-265V AC (on same terminal)
Output (any one)	• Relay SPDT • Relay DPDT • Open Collector - PNP output • Analog 8/16 mA
Switching	Single-point level switching
Switching Indication	Bi-color LED • Red for Alarm • Green for Normal
Current Consumption	50mA max. at 18V DC with load
Fail safe	Field selectable (min. fail-safe: low, max. fail-safe: high)
Delay Setting	Covered and Uncovered Delays: 1-25 sec [1]
Relay Rating	6 Amps

Table 2: Electrical Specifications

5. **Trial Run:** Perform a trail run of the application process with the application material. In case of errors or unsatisfactory output, refer to Section **Error Indications**.

6. **Finishing the Installation:** Tighten the lid and the cable entries on the instrument so that no moisture seeps into the instrument.

6.2 Tank Mounting Installations

- Coat-Endure is designed to work in metal-body tanks only, e.g. MS, SS or Aluminium tanks. Performance in plastic tanks might not be satisfactory.
- The Coat-Endure probe (see figure 1)can be installed in the vessel in both horizontal (side mounting) and vertical (top mounting) positions. Please refer to Figures 2 and 3.
- To prevent the ingress of moisture and water seepage in side mounting position, the cable entries should always point downwards.
- Weatherproofness of enclosure is guaranteed only if the cover is in place and glands are adequately tightened. Damage due to accidental entry of water can be avoided if the instrument is installed in a rain shade.
- If the ambient temperature is high, the instrument should not be installed to receive direct sunlight. In case such a position of shade is not available, a heat shield should be fitted above the instrument especially if the operating temperature lies between $60°C$ and $80°C$.
- Grounding part (SS material) of the probe should be exposed at least 20mm inside the hopper after threading / nozzle.

Parameter	Value
Housing	Pressure Die Cast: aluminium
Cable Entry	2 x 1/2“ BSP/NPT, PG 13.5
Operating Temprature	$0°C$ to $+60°C$ (Electronics)
High Temperature	• $100°C$ for standard probe • $200°C$ for probe with standoff pipe
Operating Pressure	Up to 10 bar
Mounting	1” BSP / NPT Threaded Flange mouting as per user specification
Dimensions	Refer to GA Drawing
Insulation	Part PTFE / Full PTFE

Table 3: Mechanical Specifcations

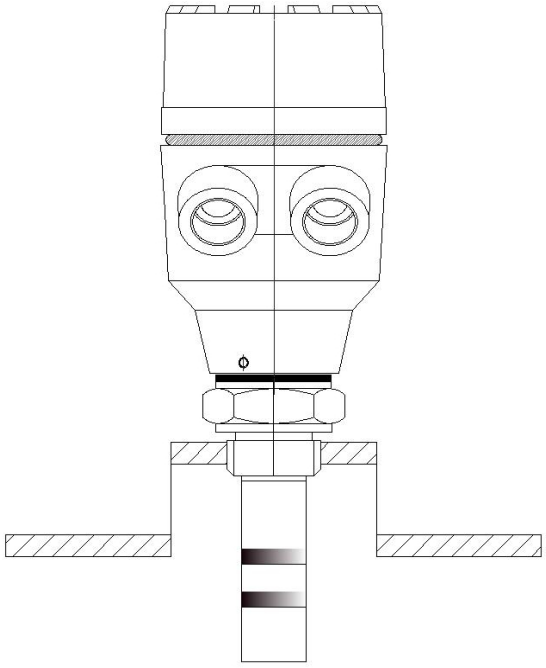


Figure 2: Dimensional Layout - Top Mounting

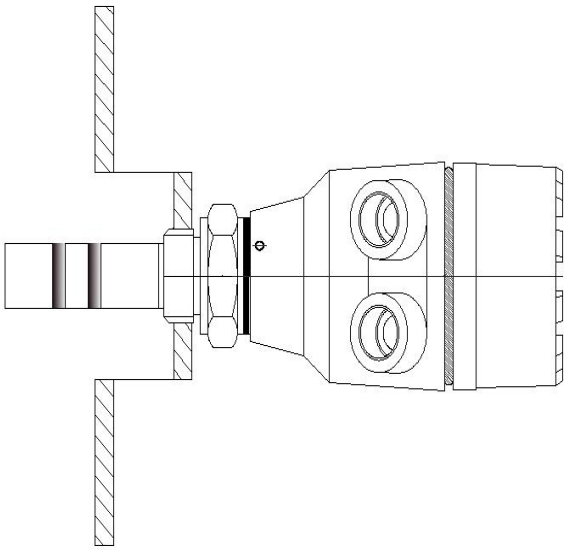


Figure 3: Dimensional Layout - Side Mounting

6.3 Electrical connections

Electrical connections for the instrument will change with the models. Please refer to Figure 4 and the precautions mentioned below before connecting the device.

Precautions for connecting Coat-Endure

- **Power Supply Rating**
  Make sure the power supplied to the instrument is within the specified range mentioned in Table 2.
- **Connect Earth**
  When supplying AC power, please make sure that the grounding screw on the housing and the earth terminal are all connected to the plant's earth.
- **Power Supply Fluctuations & Noise**
  External noise or flucating power supplies could affect performace and shorten the life of the instrument. Use external line suppressors and fuse wires to contain the risk of damage to the circuit.

7 Calibration & Settings

The DIP switches for calibration and settings can be accesed by opening the top aluminium cover. Refer to Figure 5 for information on DIP swtiches Procedure for calibration Coat-Endure depends on the conductivity of the application material:

- **Calibration for non-conductive materials**
  Calibration should be done without the application material. Once calibrated in the empty tank, the device can be used with a wide range of non-conductive materials.
- **Calibration for conductive materials**
  For applications using conductive materials (water, acid based pastes, etc.), Coat-Endure needs to be calibrated with the application material. This will make the instrument specific to the application material i.e. if the application material is changed; calibration should be repeated.

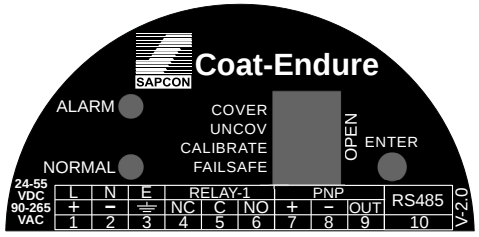


Figure 5: Electrical Top panel

Note: Calibration in air is specfic to the tank, if the tank changes, the instrument needs to be calibrated again.

7.1 Calibration for non-conductive materials

Coat-Endure needs to be calibrated inside the empty process tank (i.e only air, no material). Calibrating the instrument outside the tank can cause malfunctions. Once calibrated inside the empty tank, Coat-Endure can operate with a wide range of application materials without the need of changing its default senstivity settings.

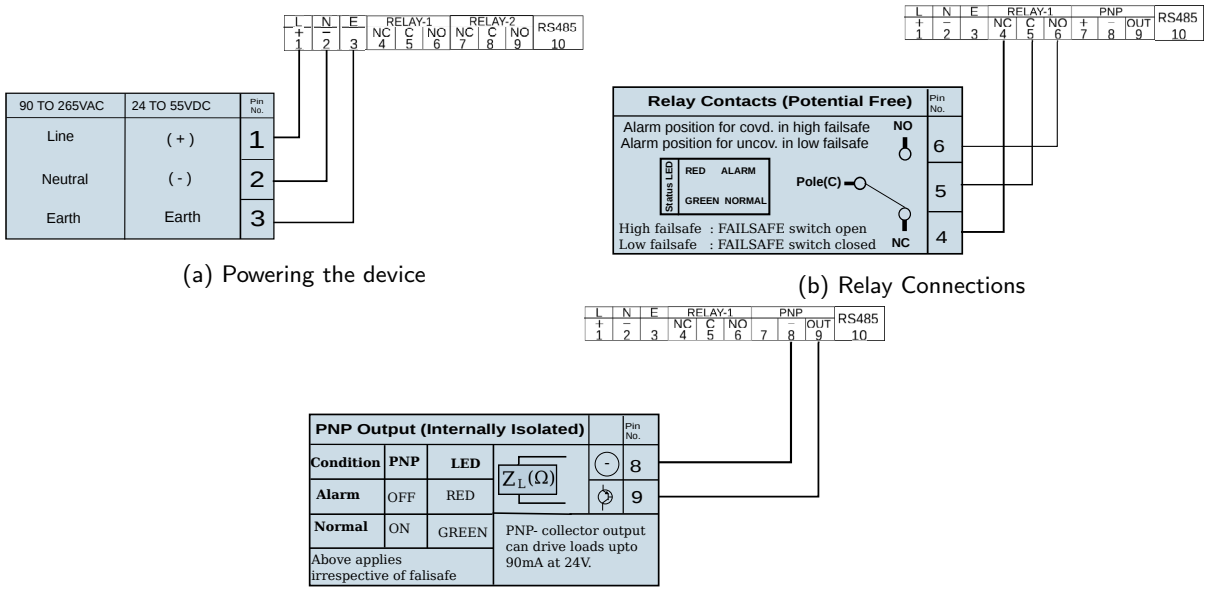
1. Make sure that all DIP switches are in the Open position.
2. To start with the calibration, set the CALIB switch to close position.(Close is opposite of OPEN for DIP switch)
3. Make sure that the Status LED is not blinking. A blinking LED here indicates Error.
4. Then press ENTER, the Status LED will blink once in RED color.
5. Now set the CALIB switch back to OPEN position.
6. Air calibration for Coat-Endure is now complete.

Now, test the calibration by filling in the material or draining it out from the tank. Repeat the filling and draining to confirm proper operation of the device.

Note: For certain application materials, Coat-Endure might need an adjustment to its settings. Refer to Section Sensitivity Adjustment for more details.

7.2 Calibration for conductive materials

Fill the tank with the application material such that the probe is completely covered with the material.



(a) Powering the device

(b) Relay Connections

(c) PNP(isolated) output connections

Figure 4: Electrical Connections

Connection Diagrams for different outputs are mentioned above. As per your model, select a connection diagram and connect the device.

1. Make sure that all DIP switches are in the Open position.
2. To start with the calibration, set the CALIB and COVER switches to close position.(Close is opposite of OPEN for DIP switch)
3. Make sure that the Status LED is not blinking, a blinking LED here indicates Error.
4. Then press ENTER, the Status LED will blink once in RED color.
5. Now set the CALIB and COVER switch back to OPEN position.
6. Calibration for Coat-Endure is now complete.

Now, test the calibration by filling in the material or draining it out from the tank. Repeat the filling and draining to confirm proper operation of the device.

Note: For certain conductive application materials, Coat-Endure might need an adjustment to its settings. Refer to Section Sentivity Adjustment for more details.

7.3 Sensitivity Adjustment

The instrument has 5-point sensitivity level to suit a wider range of application materials. Sensitivity value should be decided with respect to the dielectric constant and coating thickness of the application material. Refer to Table 4 for selecting a suitable value. By default, the sensitivity is set to 3 to suit a wide range of materials. Traverse the following steps to set the sensitivity of Coat-Endure -

1. Select a sensitivity value for the instrument as per Table 4.
2. Set the CALIB switch to CLOSE position.
3. Also switch the UNCV switch to CLOSE position.
4. PRESS and HOLD the ENTER key, the status LED will start blinking.
5. The first blink leaves the sensitivity value unchanged.
6. Start counting from the next blink upto the selected sensitivity value.
7. Set the CALIB and UNCV switches back to OPEN position.
8. Check operation of Coat-Endure by filling in and draining out the material.
9. If the instrument does not switch when covered fully with the material, try again with a higher value of sensitivity.
10. If the instrument switches when covered fully with the material, but does not switch back to normal state when uncovered, try again with a lower sensitivity value.

Factory Reset To reset time delays and sensitivity values to default values, follow the following steps:

Application Material Properties		Sensitivity Value
Dielectric Const.	Coating Thickness	
High	High	$1-3$
Low	High	$3-5$(default)
High	Low	$1-2$
Low	Low	5

Table 4: Switching Sensitivity

1. Set the CALIB, COV and UNCOV switches to CLOSE position
2. PRESS and HOLD the ENTER key until the status LED blinks.
3. Switch the CALIB, COV and UNCOV switches back to OPEN position.
4. This will set the time delay to 0 and the sensitivity level to 3.

7.4 COVER Delay

When material covers the Coat-Endure probe, the changeover of the output can be delayed by a predetermined time. This time is called COVER Delay. Follow the steps mentioned below to set the COVER delay to 2 seconds.

1. To set the cover delay, set the COVER switch to close position.
2. Make sure that the Status LED is not blinking for Error.
3. Then press ENTER and keep it pressed. The Status LED will Blink.
4. Count the blinks of the LED. To Set a delay two seconds, two blinks will be required. After two blinks, release the ENTER key.
5. Delay is entered, but not saved.
6. To save and test the cover delay, set the cover switch back to open position.
7. To test, dip the probe into the material until the switching point is reached.

Coat-Endure will start blinking RED if the switch point is reached. It will blink for the number of seconds for which the cover delay is set. 1 Blink is equal to 1 second during switching. A maximum of 25 seconds can be set.

7.5 UNCOVER Delay

When the material uncovers the Coat-Endure probe, the changeover of the output can be delayed by a predetermined time. This time is called the UNCOVER Delay. Follow the steps mentioned below to set the UNCOVER delay to 2 seconds.

1. To set the uncover delay, set the UNCOV switch to close position.
2. Make sure that the status LED is not blinking for Error. Then press ENTER and keep it pressed.
3. The Status LED will blink. Count the number of blinks of the LED.To Set a delay pf two seconds, two Blinks will be required. After two blinks, release the ENTER key.
4. Uncover Delay is entered, but not saved. To save and test the uncover delay, set the cover switch back to open position.
5. To test, dip the probe into the material until the switching point is achieved.
6. Coat-Endure will start blinking RED if the switch point is reached. It will blink for the number of seconds for which the uncover delay is set.
7. Now, remove the probe from the material until the other switch point is acheived. The Status LED will start blinking GREEN to indicate that the uncover switch point is reached. It will blink for the number of seconds for which the uncover delay is set.

7.6 Fail-safe Selection

In Coat-Endure, fail-safe is applied as soon as its DIP switch is set for the required fail-safe operation.

When fail-safe is set to HIGH (default) - Fail-safe switch is OPEN :

1. Relay ON - When not in contact with the material, LED turns RED.
2. Relay OFF - When in contact with the material, LED turns GREEN.

When fail-safe is set to LOW : The operation is reversed - Fail-safe switch is CLOSED.

1. Relay ON - When in contact with the material, LED turns RED.
2. Relay OFF - When not in contact with the material, LED turns GREEN.

Irrespective of the fail-safe value, the color of the blinking LED when the cover and uncover delays are SET will be:

- RED: Cover Delay
- GREEN: Uncover Delay

7.7 Error Indication

In Coat Endure, errors are indicative of operators mishandling of the instrument. These are provided to ensure proper setting and protection of the instrument.

LED Error Indication	Description	Troubleshooting
RED-GREEN Blinking	Calibration Error	Recalibrate the instrument, make sure that the probe is calibrated in an empty metal-body tank.
RED blinking	Probe short-circuit	Moisture deposition in the probe connector. Clean the connector and use the instrument.
GREEN Blinking	Probe Open	Remove the electronic insert from the housing and check the cable connections of the probe.
3 times GREEN Blinking & one Red Blink	Illegal Key combination	Switch all DIP switches to open position. Use only legal combination of keys.
3 times RED Blinking & one GREEN Blink	Circuit Error	Contact the Customer Support department at Sapcon.

Table 5: Error Indications

Error Indication: On error, the Status LED starts blinking RED and GREEN alternately at a faster rate. Normal LED blinks are always at the rate of 1 blink per second, in either RED or GREEN colour. In some cases, a GREEN or a RED blinking could indicate an error. Refer to Table 5 for a list of errors and their indication.

Nature of error:

1. Incomplete calibration
2. Low capacitance

To avoid errors:

1. Always complete the calibration by putting the CALIB switch back to OPEN position. This can be done within 2 minutes of releasing ENTER for the last time for calibration purpose.
2. Always complete the delay settings by putting the DELAY switches back to OPEN position. This can be done within 2 minutes of releasing the ENTER for DELAY setting purpose.
3. Make sure that only 1 one switch is at the CLOSE position amongst the CALIB, COVER and UNCOV switches .

Fail-safe switch can be OPEN or CLOSE and is not a source of error. Resetting Error:

1. Bring the CALIB, COVER and UNCOV switches to OPEN position.
2. Press the ENTER key.
3. LED alternate color blinking will STOP.

7.8 Maintanence

The electronics of this instrument needs no maintenance. When cleaning and checking the vessel, free the tuning probe from deposits. If the material has a tendency to form a hard sticky deposit, then the instrument must be checked more often. Make sure that the cable ducts and the lid are tightly sealed so that no moisture seeps into the instrument.