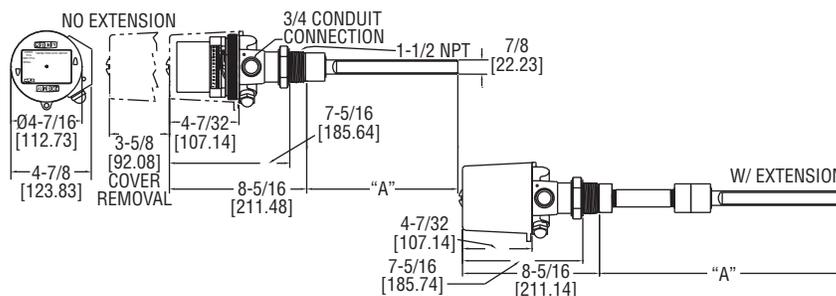




## Series TFLS Tuning Fork Level Switch

Specifications – Perfect for Sensing Low Bulk Density or Low Dielectric Materials



EXTENSION LENGTH	DIM "A"
NONE	9-1/4 (234.95)
6 IN	15-1/4 (387.35)
12 IN	21-1/4 (539.75)
18 IN	27-1/4 (692.15)
24 IN	33-1/4 (844.55)
36 IN	45-1/4 (1149.35)
48 IN	57-1/4 (1454.15)

Series TFLS tuning fork level switch is ideal for level control of powders and fine grained solids, especially those with a low bulk density. Featured in the TFLS is user-selectable fail-safe operation of the contacts. Unit is not affected by vibration from conveying systems, motors, or the movement of material. It can be mounted in any position and is available with factory built extensions for mounting on the top of the storage vessel.

Series TFLS is easy to use with no calibration required and with no mechanical moving parts there is no routine maintenance required. The TFLS is unaffected by the dielectric constant of the sensed material making it superior to a capacitance level switch for applications where the dielectric constant is too low, where there is more than one material being used in one vessel, and when material moisture content can change. The level switch is also good for applications when the bulk density is too low for a rotating paddle level switch. It can also detect granular material submerged in liquids of low viscosity, for example sand, gravel, or polyester chips in water.

### FEATURES

- **No Calibration Required**
- **Vibrating Fork Design:** Great for low bulk density and low dielectric constant products. Will detect products down to 1.8 lb/cu ft (30 g/l).
- **Universal Power Supply:** One model works from 90 to 265 VAC and 24 VDC.
- **Adjustable Sensitivity:** Can be set to ignore lighter bulk density products and only detect heavier products, such as sand in water.
- **Status Indication:** External LED status indicator, and internal indicators for normal and alarm status.
- **Failsafe Setting:** Output switch can be set for Normally Open or Normally Closed condition on loss of power.
- **Time Delay:** Prevent false alarms from material surges.

### SPECIFICATIONS

- **Service:** Dry powder or bulk materials compatible with wetted materials. Can detect bulk materials submerged in liquid.
- **Sensitivity:** Minimum bulk density of 1.8 lb/ft<sup>3</sup> (30 g/l), maximum particle size 0.4 in (10 mm).
- **Wetted Materials:** 316 SS.
- **Temperature Limits:** Ambient: -4 to 140°F (-20 to 60°C); Process: -4 to 176°F (-20 to 80°C).
- **Pressure Limit:** 145 psig (10 bar).
- **Power Requirement:** 90 to 265 VAC, 50/60 Hz; 24 VDC.
- **Power Consumption:** 4 VA.
- **Enclosure:** Aluminum, powder coated.
- **Enclosure Rating:** Weatherproof, NEMA 4X.
- **Switch Type:** SPDT.
- **Electrical Rating:** 5A @ 230 VAC.
- **Electric Connections:** Screw terminals.
- **Conduit Connection:** 3/4" female NPT.
- **Process Connection:** 1-1/2" male NPT.
- **Weight:** 5.5 lb (2.5 kg).
- **Indication Lights:** External: red LED; Internal: green and red LED's.
- **Sensing Delay:** (Maximum) covered probe: 2 seconds; uncovered probe: 3 to 7 seconds.
- **Time Delay:** Separate settings for covering and uncovering the probe. Adjustable from 2 to 20 seconds.

**MODEL CHART**

<b>Example</b>	TFLS	W	1	1	EC	1	048	MT	TFLS-W11EC1-048-MT
<b>Series</b>	TFLS								Tuning Fork Level Switch
<b>Enclosure</b>		W							Weatherproof
<b>Switch</b>			1						SPDT rated 5A @ 120/240 VAC
<b>Power Supply</b>				1					24 VDC, 90-265 VAC
<b>Probe Type</b>					SR EC ES				Standard Rod Extension Carbon Steel Extension 316 SS
<b>Process Connection</b>						1			1-1/2" NPT male
<b>Probe Length</b>							XXX		Insertion length in inches (Only for probe type E)
<b>Options</b>								MT SS	M25 conduit connection 316 SS Enclosure

**OPERATING PRINCIPLE**

The TFLS incorporates a piezoelectric crystal that vibrates the fork at its natural frequency, 85 Hz. When the fork comes in contact with material the vibration is dampened and the switch changes state. As the fork becomes free of material the switch changes back to its normal state.

**INSTALLATION**

**Unpacking**

Remove the TFLS from the shipping carton and inspect for damage. If damage is found, notify the carrier immediately.

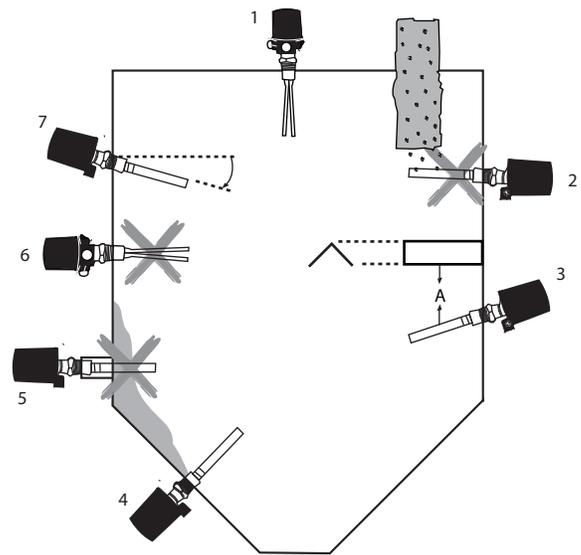
**Mounting Location**

The TFLS is rated for industrial environments with few restrictions, however certain considerations must be made to ensure for optimal sensing and extended operational life.

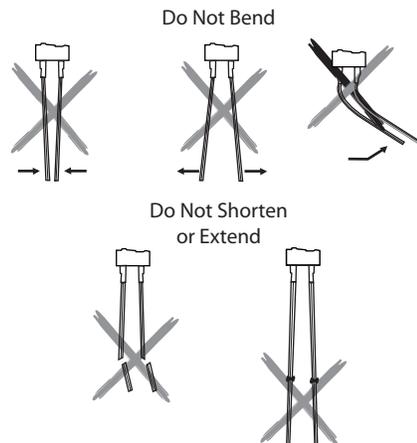
- The process temperature and ambient temperature must be with- in the specified limits for the instrument.
- It is recommended to use a suitable material to protect and seal the process threads such as TFE tape.
- Position the tines using a wrench on the hexagonal flats above the process connection. Do not position by turning the housing.
- The probe must be located away from tank inlets or chutes where material may fall on the probe during filling or emptying (Figure 1, No. 2). If this is not possible a baffle may be installed above the probe to protect it from falling material (Figure 1, No. 3). The baffle must be installed a minimum of 8" (200 cm), see dimension A in Figure 1, above the probe so that material will not become packed between the probe and the baffle.
- For mounting horizontally install with conduit entry facing down so condensate does not enter the enclosure.
- For mounting horizontally position the tines vertically, narrow edges up, so that material flows freely through them. The TFLS is designed so that if the conduit opening is pointed down the tines will be in the proper orientation. No. 6 in Figure 1 shows incorrect mounting, No. 7 correct mounting.
- For mounting horizontally with materials that may stick to the tines it is recommended to mount the probe angled down so that material slides off easily (Figure 1, No. 7).
- The tines should not be bent, shortened, lengthened, or altered in any way (See Figure 2).
- For top mounting the tines can be mounted in any position (Figure 1, No. 1).
- When using mounting nozzles, make sure the length is proper so that the tines extend far enough into the vessel to vibrate free of material buildup on the vessel wall. Also make sure the nozzle

does not extend further than necessary into the vessel (Figure 1, No. 5).

**Figure 1: Installation Guide**



**Figure 2: Fork Protection**



**Wiring**

Warning: Always install or service this device with the power off and where required install a disconnect lockout.

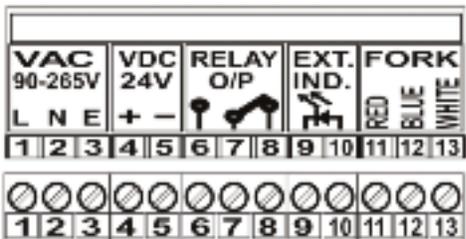
Caution: For power line connections use NEC Class 1 wiring rated 60°/75°C. Use 12 to 20 AWG copper only for line and load connections. Strip the wires 1/4”.

Note: Installation must be made in accordance with National Electric Code and local codes and regulations. When fishing wire through the conduit connection do not allow the wire to touch or press on components on the boards. Damage to the circuitry may result.

The TFLS has a 3/4” NPT female conduit connection. The conduit connection must be made such that condensation is not allowed to enter the housing. If nonmetallic conduit is used, the protective ground may be connected to the external ground connection screw.

Strip 1/4” of insulation from wires. Connect the power wires to terminals 4 and 5 if powered by 24 VDC and terminals 1, 2, and 3 if powered by 90 to 265 VAC. Only one type of power supply may be used at a time, do not connect both AC and DC power simultaneously. Connect control lines to the relay contact terminals 6, 7, and 8. See Figure 3 for terminals layout.

**Figure 3: Terminals**



**CONTROLS AND INDICATORS (See Figure 4)**

**Sensitivity Potentiometer** — This control sets the sensitivity for different types of material.

**Time Delay Potentiometers** — These controls select the delay times from 2 to 20 seconds from the detection of a level change to the output. There is one setting for the probe getting covered by material and one setting for the probe becoming uncovered by material.

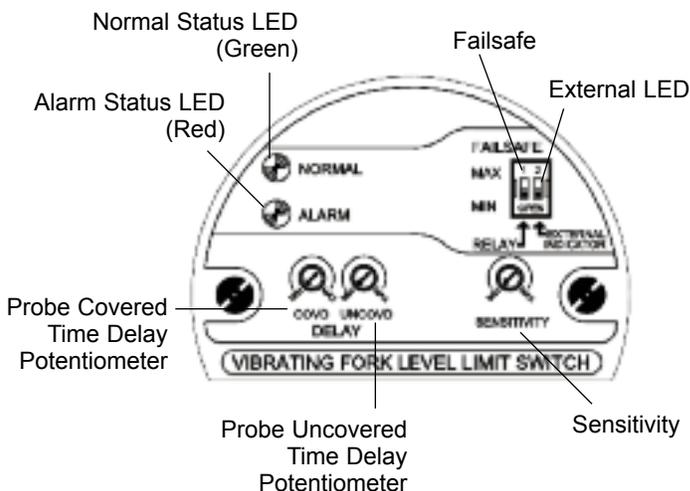
**Dip Switch** — This two section switch selects the external LED status and failsafe mode.

**Normal LED** — Green. This LED is illuminated when the unit is powered and the fork does not sense any material.

**Alarm LED** — Red. This LED is illuminated when the relay is powered by the fork sensing material. It is affected by the delay setting.

**External LED** — Red. This external LED is illuminated in conjunction with the fork being covered or uncovered.

**Figure 4: Switches and LED's**



**SETUP AND CALIBRATION**

**1. Fail Safe Mode Selection:** The relay will always be off when the power fails. In this case the contacts identified as normally open will be open. The fail safe switch selects whether the normally open contacts are open or closed when the probe is uncovered. There are two options for the failsafe condition that are selected by the RELAY DIP switch (See Figure 4). Selecting MAX will force the relay contacts to be open when the probe is uncovered and the NORMAL green LED to be on. Selecting MIN will energize the relay (closed) when the probe is uncovered and the ALARM red LED to be on.

**2. External LED Selection:** The red external LED indicates material sensing status. There are two options for the LED condition that are selected by the EXTERNAL INDICATOR DIP switch (See Figure 4). Selecting MAX will make the LED illuminate when the probe is uncovered. Selecting MIN will make the LED illuminate when the probe is covered.

**3. Sensitivity Selection:** The sensitivity selection adjusts the fork sensitivity to material bulk density. The more dense the material, the lower the sensitivity needed. After installing the probe and making all electrical connections, set the Fail Safe Selection switch to the MAX position. Set both the CVD and UNCOVD time delays to their minimum by rotating them counter-clockwise to the end position. Rotate the SENSITIVITY potentiometer counter-clockwise to its end position (See Figure 4). If there is no material in the tank then the green LED will be illuminated. Fill the tank so that the fork tines are covered by material. If the green LED turns off and the red LED turns on then no adjustments are necessary. If the green LED stays on then rotate the sensitivity potentiometer clockwise to the point where the green LED goes out and the red LED comes on. Setting is completed.

**4. Time Delay Selection:** The time delay is the programmed time between when the probe senses the presence or absence of material and when the relay changes state. A time delay is good for applications that could have false or rapid pulsing of level indications from sloshing or agitated material. Choose a delay setting appropriate for the specific application. There are two potentiometers for adjusting the delay time. The potentiometer labeled COVD sets the delay time between when the probe is covered and when the switch changes state. The potentiometer labeled UNCOVD sets the delay time between when the probe becomes uncovered and when the switch reverts back to its normal state (See Figure 4). Adjust the time delay potentiometers by turning them fully counter-clockwise to their end position. This setting is no delay. To then set a delay time turn the potentiometer clockwise to the desired time setting. The delay can be set anywhere from 2 to 20 seconds.

**TROUBLE SHOOTING**

If the instrument fails first check that the wiring connections are correct and that the set up is correct for the application. Next, check to see if the tines vibrate when free of material.

**MAINTENANCE**

Upon final installation of the Series TFLS Tuning Fork Level Switch, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series TFLS is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

Condition	Relay Status	Probable Cause
Probe Covered Red LED Off Green LED Off	Terminals 6 & 7 Open Relay De-energized	No power supplied
Probe Covered Red LED On Green LED Off	Terminals 6 & 7 Open Relay De-energized	Voltage too low Material too light Material has formed cavities Vibration of vessel wall at 85 Hz
Probe Uncovered Red LED Off Green LED On	Terminals 6 & 7 Closed Relay Energized	Heavy material deposit on fork Fork Damaged Vibration of vessel wall at 85 Hz