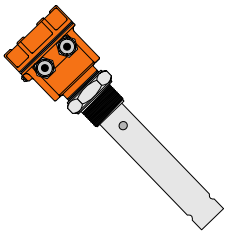
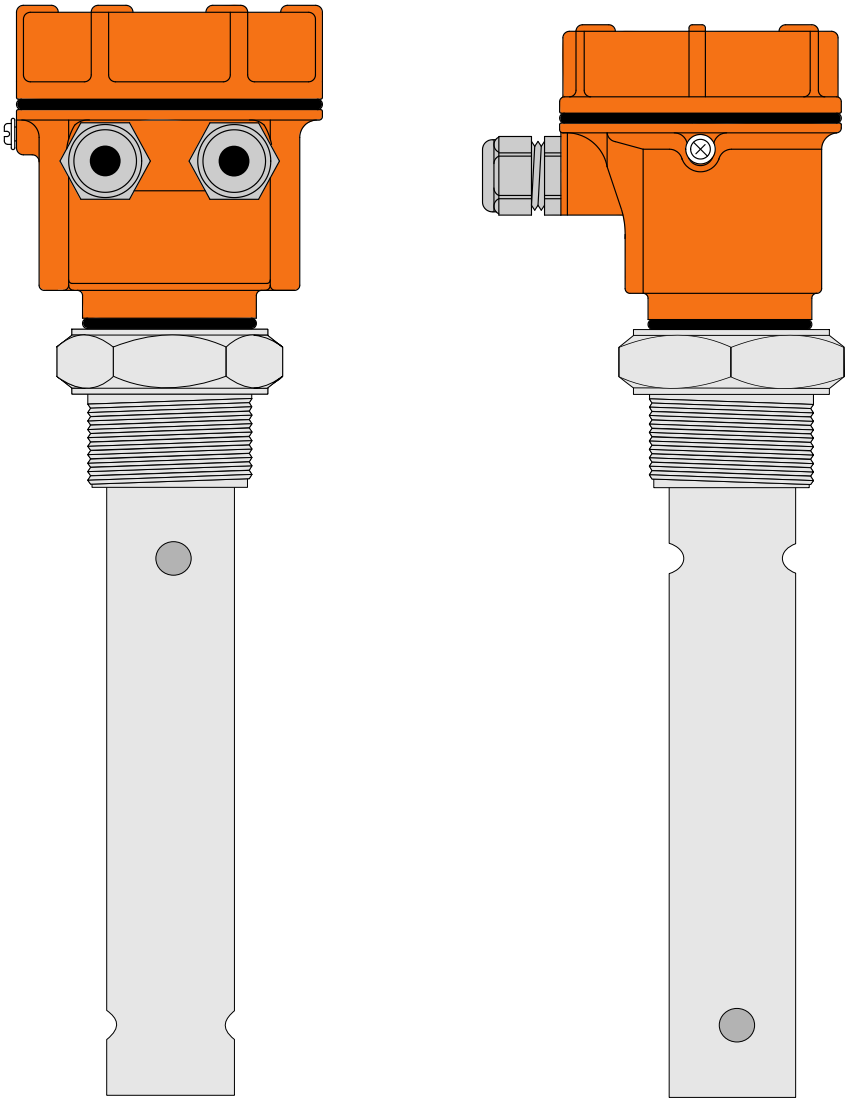


TLC:
Capacitance Type Level Transmitter for Liquids

Trumen®
sensing matters

Instruction Manual



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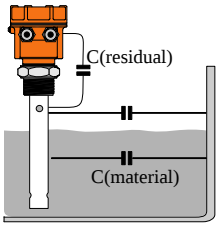
Customer Support

Phone: +91-731-656 2425
email: sales@trumen.in
email: support@trumen.in
web:www.trumen.in

Operating Principle

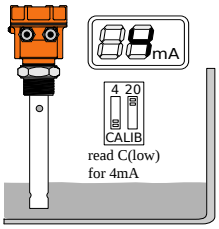


The probe forms a capacitance with the metalic tank-wall.
The capacitance is sum of three capacitance:-

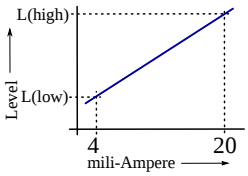
C(air)=ε(air) x P x (H-L)
C(material)=ε(material) x P x L
C(residual) is due to device itself.

Where ε(air) is the dielectric constant of air ≈1.
ε(material) is dielectric constant of material.
P is the constant of probe and installation, H is the active length of probe and L is the level of material.

Capacitance to level translation is performed with the aid of on-site calibration also called "wet-calibration".



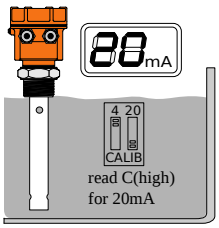
The device stores a low level capacitance as level for 4mA and high level capacitance as level for 20mA as defined by the user.



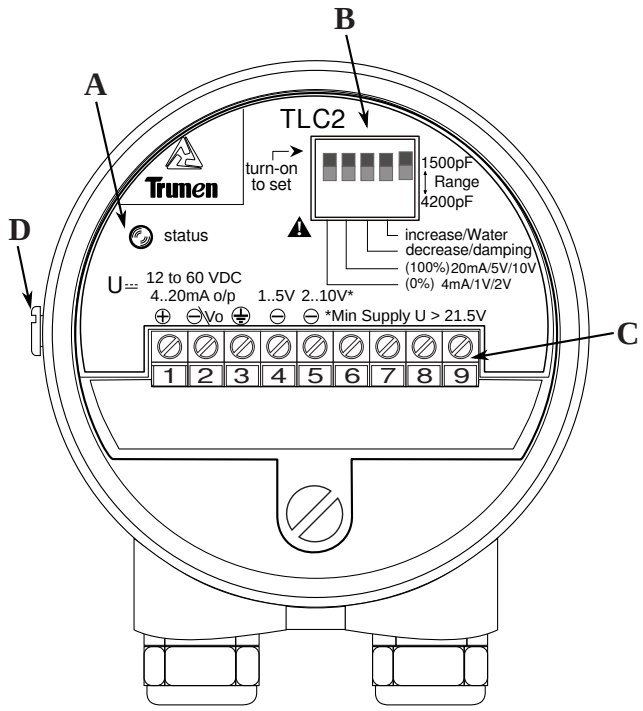
Using these values and following equation

$$L(high)\ L(low) = \frac{C(high)\ C(low)}{P \times \{\varepsilon(material)\ \varepsilon(air)\}}$$

device creates a chart of level to 4-20mA translation.



Introduction - TLC2



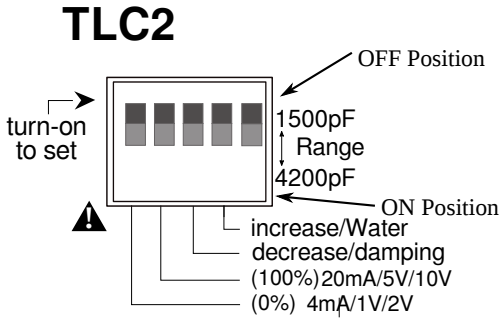
controls & indicators

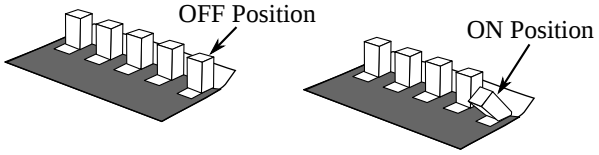
A	Process indicating LED status
B	Calibration & configuration switches
C	Connecting terminals
D	External Earthing Terminal

connection terminals

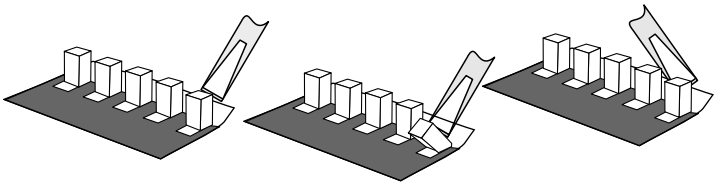
1	+ of DC of 4-20mA Loop
2	- of DC of 4-20mA Loop Supply: 12 to 60 VDC
3	Earth terminal for safety
4	Reference for 1 to 5V Output at terminal no.2
5	Reference for 2 to 10V Output at terminal no.2
6 to 9	Not Used

configuration switches





Example of Switch in On and Off Positions



Using small screw-driver tip to turn-ON and OFF

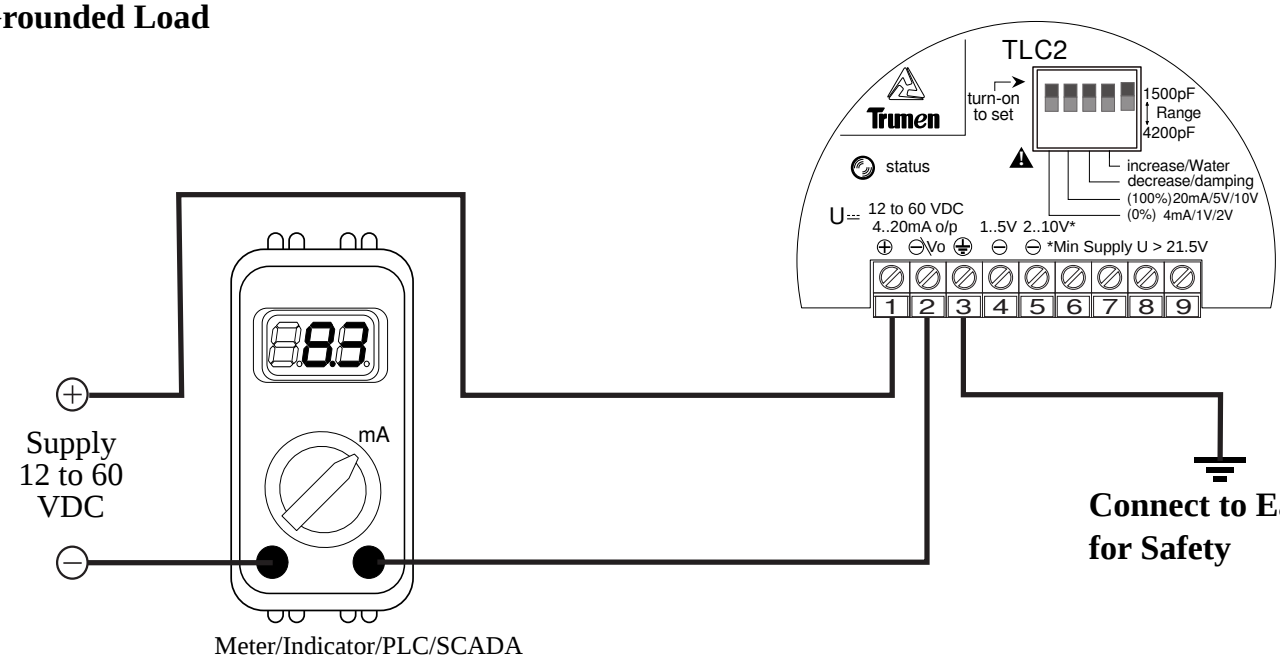
1	4mA or 0% calibration switch: This switch calibrates 0% or 4mA level and it also trims 4.0mA value in association with switch 3 (decrease) and 4 (increase)
2	20mA or 100% calibration switch: This switch calibrates 100% or 20mA level and it also trims 20.0mA value in association with switch 3 (decrease) and 4 (increase)
3	Digital Trim (decrease) Switch
4	Digital Trim (increase) Switch Switch#4 also act as diagnostic switch
5	Range Switch select for 1500pF to 4200pF

Shown on the left is typical ON and OFF positions of the DIP switches.

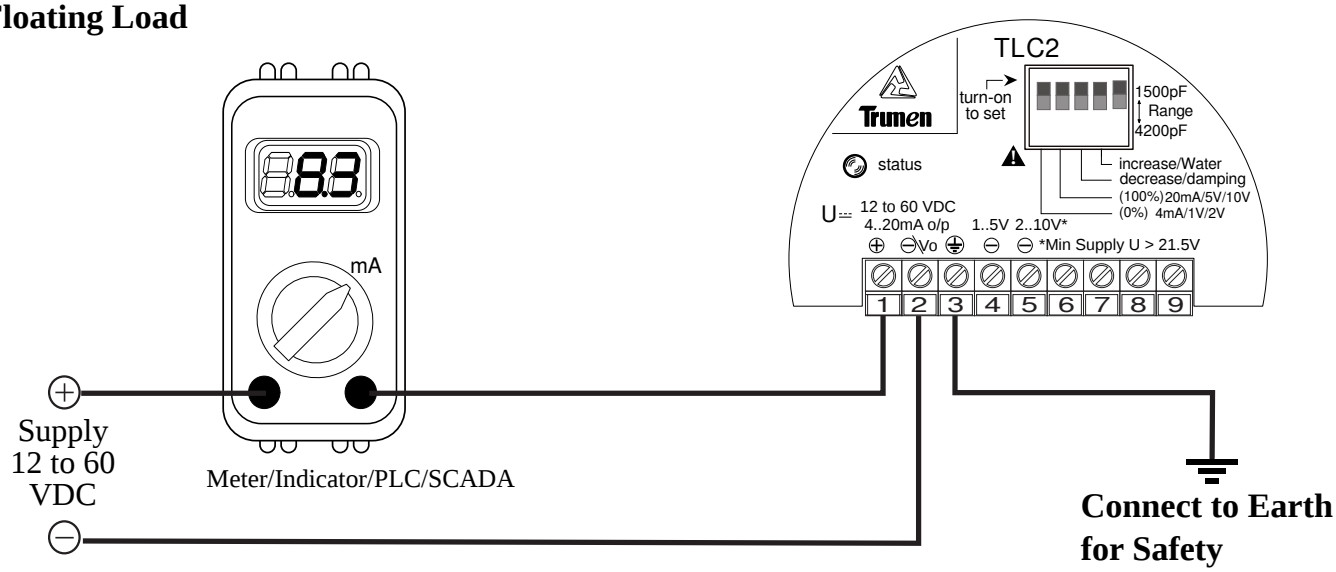
Always use a small screw driver to turn ON/OFF the switches using pen and other method may damage the switches.

Connection Diagrams - TLC2

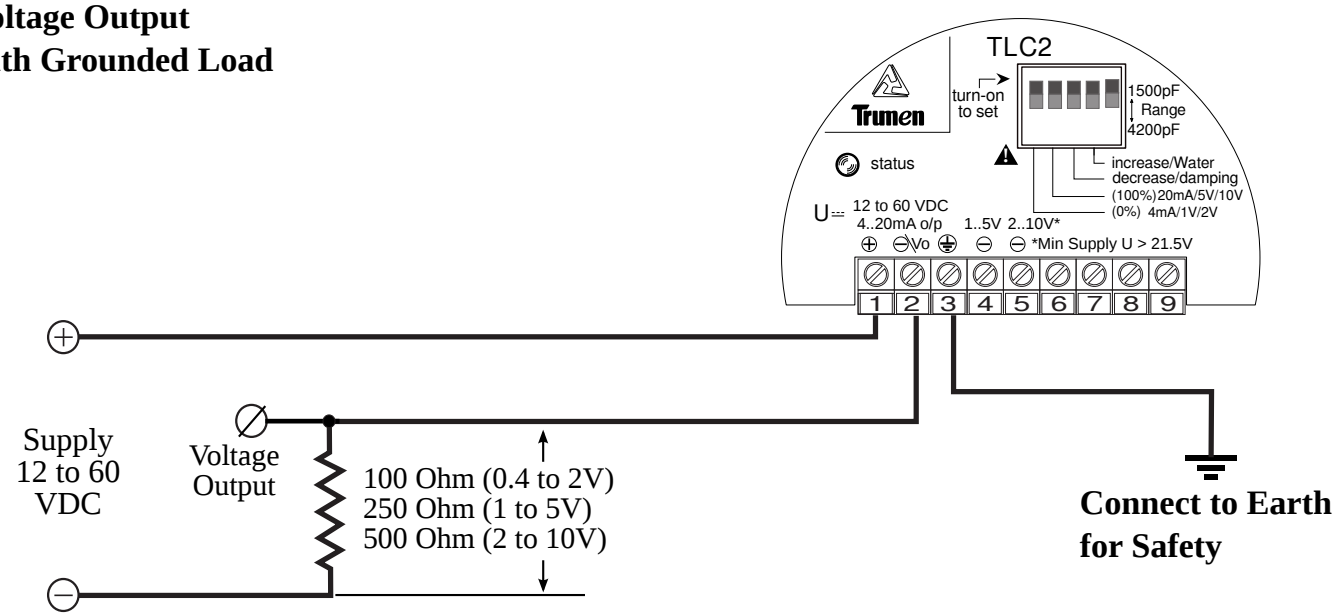
1. Grounded Load



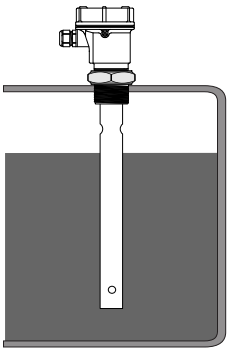
2. Floating Load

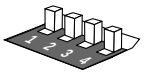


3. Voltage Output with Grounded Load

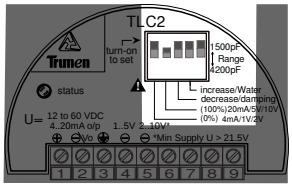


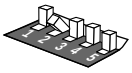
Full calibration (100% or 20mA Calibration)





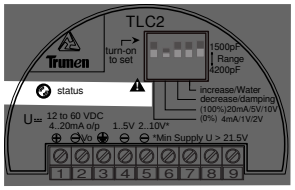
Switches1,2,3 & 4 must be OFF (#5 is as per range). Fill the material to the desired level

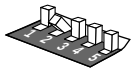




status

LED must be blinking once per 2 sec (No Error). MiliAmmeter must be connected in series with the device



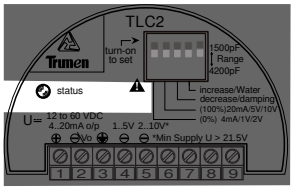


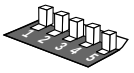
Turn ON Switch# 2

Make sure that switch 1, 3, 4 & 5 are OFF (as shown above).

status

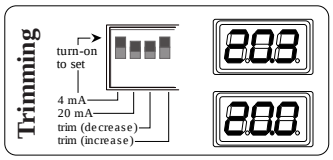
LED will blink faster (not as faster as Error blink). During this time the switch can be put back if accidently turned ON. LED will start blinking three times then off, successively. mA meter will show 4mA

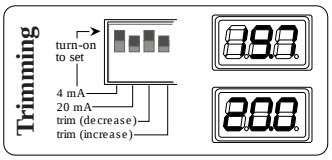




Wait till mA meter shows 20mA. Turn-off switch# 2, 20mA level or 100% level is calibrated.

Trimming (100% or 20mA)

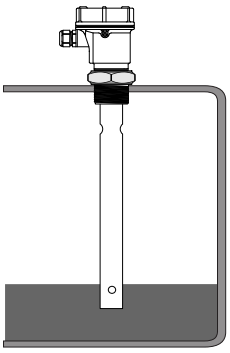




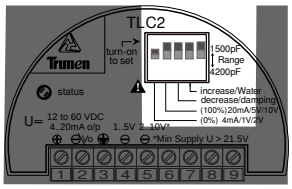
Trimming can be done. If 20mA reading in mili-ammeter is lesser or more then 20mA. Use the trim-switches
(switch# 3 to decrease, say 20.3 mA to 20.0)
(switch# 4 to increase, say 19.7 mA to 20.0).

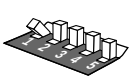
For trimming 100% (20mA)
a) Turn switch 3/4 (decrease/increase) ON
b) Turn 20mA switch ON
(this sequence is important).
and watch the mili-ammeter till correct trimming of 20mA is done. Immediately
a) Turn switch 3/4 (decrease/increase) OFF
b) Turn 20mA switch OFF (sequentially).

Empty calibration (0% or 4ma Calibration)



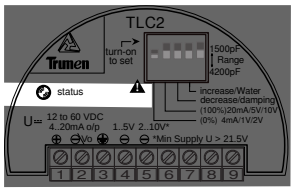
Switches1,2,3 & 4 must be OFF (#5 is as per range). Empty the material to the desired level.





status

LED must be blinking once per 2 sec (No Error). MiliAmmeter must be connected in series with the device

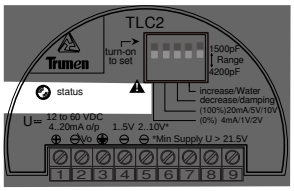


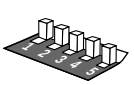
Turn ON Switch# 1

Make sure that switch 2, 3, 4 & 5 are OFF (as shown above)

status

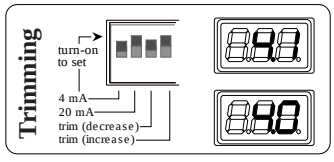
LED will blink faster (not as faster as Error blink). During this time the switch can be put back if accidently turned ON. LED will start blinking three times then off, successively. mA meter will show 20mA

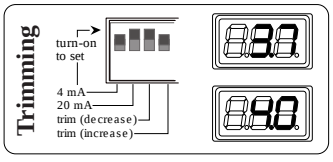




Wait till mA meter shows 4mA. Turn-off switch# 1, 4mA level or 0% level is calibrated.

Trimming (0% or 4mA)



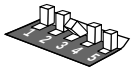


Trimming can be done. If 4mA reading in mili-ammeter is lesser or more than 4mA Use the trim-switches
(switch# 3 to decrease, say 4.1 mA to 4.0)
(switch# 4 to increase, say 3.7 mA to 4.0)

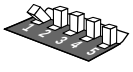
For trimming 0% (4mA)
a) Turn switch 3/4 (decrease/increase) ON
b) Turn 4mA switch ON
(this sequence is important).
and watch the mili-ammeter till correct trimming of 4mA is done. Immediately
a) Turn switch 3/4 (decrease/increase) OFF
b) Turn 4mA switch OFF (sequentially).

Damping(response time)

1. Turn switch 3 ON (switch no. 1, 2 & 4 should be off)
2. LED will blink rapidly, then it will turn OFF.
3. Once LED is OFF, turn switch 1 ON, LED will turn ON.
4. Turn switch 1 OFF, LED will turn OFF. damping is set to 1 sec.
5. Repeat operation 3 and 4 for as many seconds of damping required, to finish seting, turn all switches OFF.



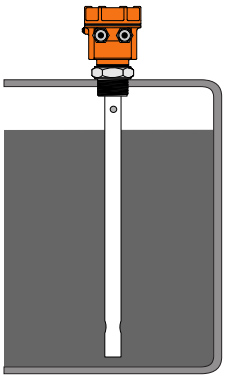
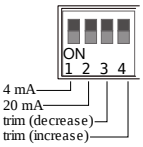
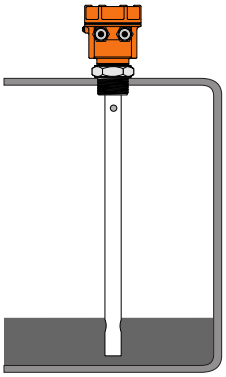
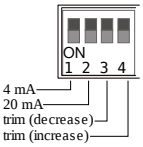
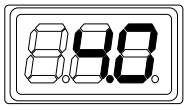
Turn switch 3 ON



Turn switch 1 ON

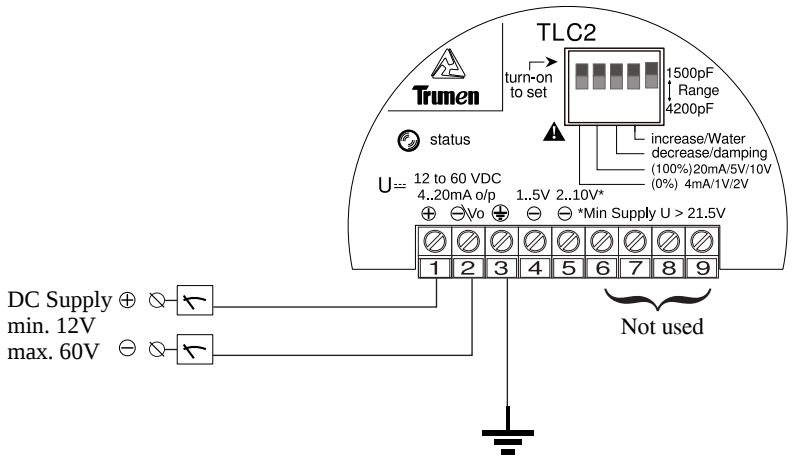
Operation Matrix - TLC2

This model is best suitable for continuous current level measurement.

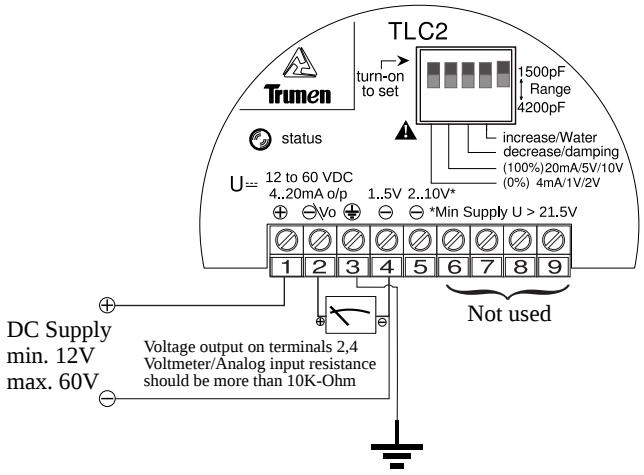
Material & Installation	Switching Operation	Calibration Switches	Current Output and LED indication
20mA or 100% Level 	When the material in tank is at 100%. All switches are OFF. LED will blink faster mA meter will show 4mA. Wait till mA meter shows 20mA.		 LED will blink faster  Current meter shows 20mA.
4mA or 0% Level 	When the material in tank is at 0%. All switches are OFF. LED will blink faster mA meter will show 20mA. Wait till mA meter shows 4mA.		 LED will blink faster  Current meter shows 4mA.

Power Supply

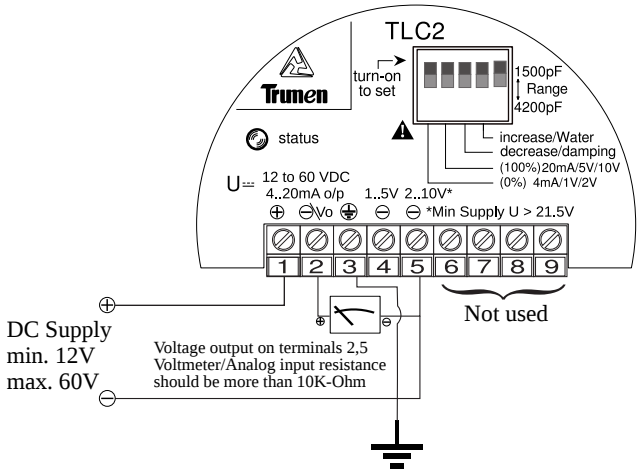
electrical connections TLC2



electrical connections TLC2-(1-5V) Voltage Output



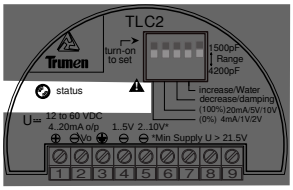
electrical connections TLC2-(2-10V) Voltage Output



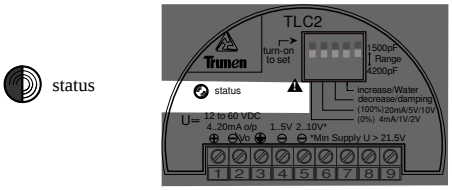
Proper connection to supply earth terminal (3) and the external earth terminal (screw) is must.

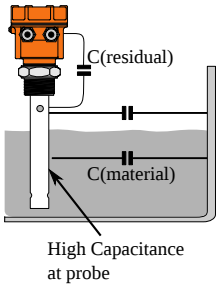
Status LED Indications

1. Blinking once per two seconds : No Error



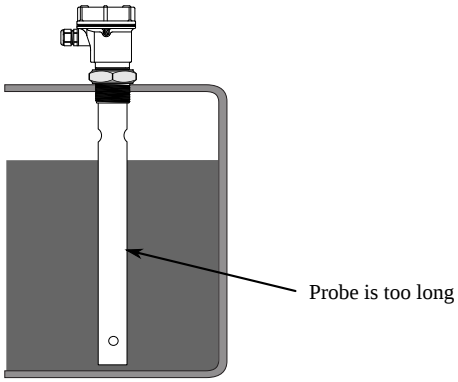
2. Blinking rapidly rapidly : Too High Capacitance at probe



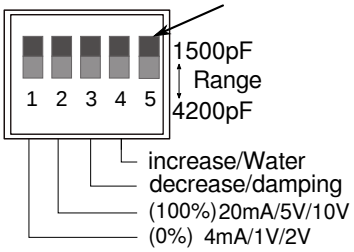


3. Due to Probe insulation failure in conductive liquid

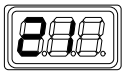
4. Probe too long for TLC2 device in conductive liquid.



5. change the range from 1500pF to 4200pF using switch# 5



Error is indicated by 21mA on output.



Technical Specification

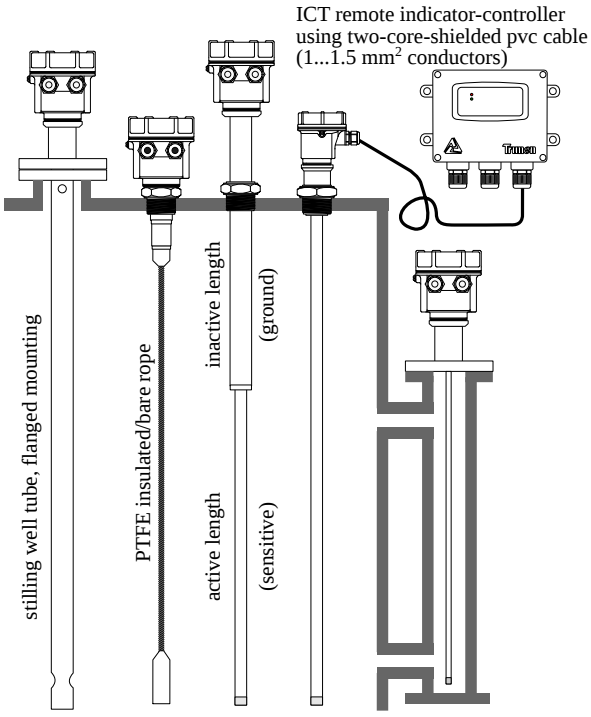
Features

1. Fast Switching Response
2. High temperature endurable probes
3. Single sensor allows pump-control & multi-point switching
4. Easy calibration with or without material
5. Remote electronics with std 10 meters cable length
6. External indication LED available
7. Threaded , Flanged Mountings & TC
8. Electronic Inserts support all requirements
9. Ingress protection : IP 68/65 (as per IS-13947)
10. Ex-proof (Ex d T6 IP-66 IIC)
    - Flameproof as per IS/IEC 60079-1:2007
    - Weatherproof (IP-66) as per IS/IEC 60529:2001
    - Suitable for Gas Group : IIC
    - Suitable for Zone 1 & 2 atmospheres
12. Compact size
13. Rigid rod / flexible rope versions
14. No potentiometers - hassle free calibration compensation against material build-up

Applications

1. Free flowing homogeneous liquids like oil, raw water, WFI, DM/DI water etc
2. Suitable for top mounting
3. Process temperature max. 200°C
4. Process pressure max. 20 bar

Typical Mountings



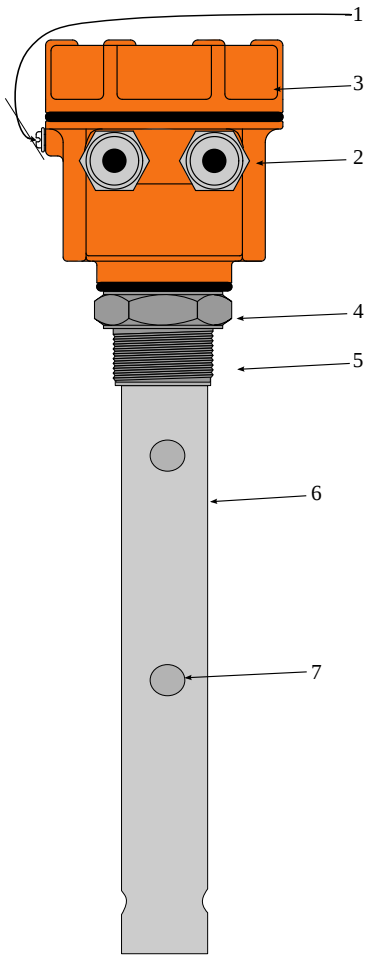
Specifications

EIL	Integral Electronics Two-wire Loop Powered
Supply	15-60 VDC
Output	4-20mA Loop powered, Error output 21mA
Loop Resistance	maximum 475 Ohm @ 24VDC supply
EIV	Integral Electronics Three/Four wire (negative common)
Supply	15-60 VDC
Output	Field Configurable : 0% => 0V/1V (2V for 100%=>10V), 100% => 5V/10V
Load Resistance	minimum 10K Ohm
EIM	Integral Electronics Three/Four wire (negative common)
Supply	15-60 VDC
Interface/Output	ModBus-RTU / complementry 0-5V output suitable for > 20K Ohm Calibration/configuration available through ModBus as well as without using DIP switches
ICT specifications	ICT provides numerical LED indicator, control logic with relay outputs and re-transmission over galvanically isolated 4-20mA output
ICT Power Supply	SA : 80-260VAC, 50/60Hz for AC version SD : 16 to 32VDC for DC version
ICT RSx Relay Rating	SPDT 5 A each @ 24VDC or 220VAC (3 SPDT relays in IP65, max 6 SPDT relays in IP40 metal sheet enclosure)
ICT RKx Relay Rating	Contactors with 2NO/2NC rated at (1, 2 or 3 contactors, only in IP40 metal sheet enclosure)
ICT Isolated Loop Supply	24V +/- 4V Suitable for maximum 25mA load
ICT re-Transmission	4-20mA, Error@21mA, galvanically isolated loop powered section for use with either integrated ICT Isolated Loop Supply or any external DC supply within range 16 to 50VDC
ICT to TLC cable	Shileded 2 Core PVC cable with 1 to 1.5 mm^2 conductors cross section
Min. Dielectric Constant	1.8 (non-hygroscopic)
Ambient Temp.	-20°C ... 70°C (-4°F ... 158 °F)
Process Temp.	-20°C ... 100°C (-4°F ... 212 °F)
Extended Process Temperature	PTFE Insulation: -30 °C ... 250 °C (-22 °F ... 482 °F) Ceramic Insulation: -30 °C ... 600 °C (-22°F ... 1,112 °F) (extensions & heat sinks required)
Process Pressure	absolute / max. 15 bar (for ceramic insulation : 1 atm)
Wetted Parts	SS-304, SS-316, SS-316L, PTFE, part ceramic
Process Connection	TC / NPT / BSP 1", 1¼", 1½", 2" etc Flanged : ANSI/JIS/DIN/ASA/custom
Probe Insertion Length:	Rigid Rod : 50mm to 3,000mm Flexible Rope : 100mm to 20,000mm

Specifications are subject to change without prior notice

Do's and Don'ts

Installation Precaution



1. Always connect the "Earth" to the external "Earthing" screw

2. Tighten the cable entries & glands properly

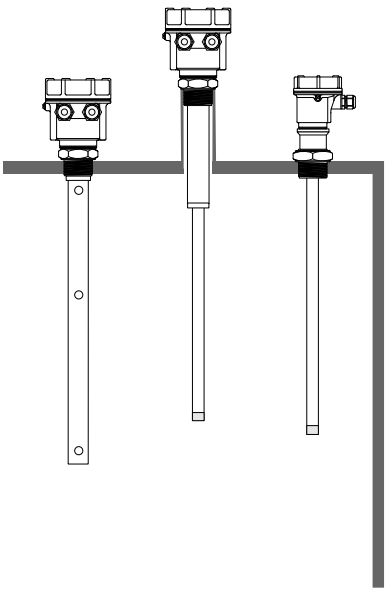
3. Secure the top aluminium cover at its place properly once the electrical connections and other settings are completed

4. Always tighten the process connection using proper wrench never try to tight by rotating the aluminium housing

5. Make sure process connection is same as that in hopper/tank

6. Transmitter probe should never be:-
6.1 Bent
6.2 Held from thin part
6.3 Cut or machined in any way
6.4 Extended by welding or machining

7. Airvent hole should be clear from material and other dust particles



8. Nozzles should never be longer than the probe

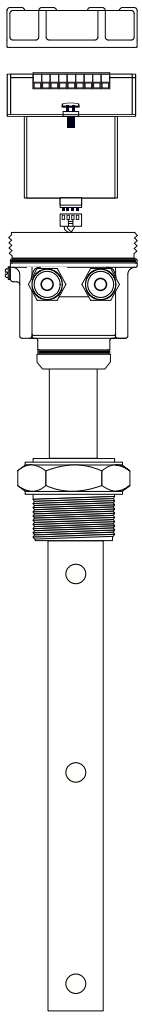
9. Never climb either by gripping or stepping over either the probe or its aluminium housing

10. Obeserve other safety precautions as required at the place of application

Troubleshooting

Indication	Probable cause	Work-around	Solution
All LEDs are OFF Even proper voltage is avialable	Power section of sensor electronic insert is failed		Sensor electronic insert is needed to be replaced.
After calibration current meter showing 21mA and first three LEDs are glowing dim	Sense and earth part of probe are shorted Wrong calibration done at same level	Check if probe sense part are shorted with ground / PTFE insulation is break and conductive liquid are entered into it	Recalibrate at different level or replace the probe if shorted.
Calibration and settings are all OK but mA reading abruptly change or chatters continuously	Power supply carrying extra noise and capacitance amplifier picking the noise Ground is not properly connected	Make necessary arrangements to filter the noise in power-line before being fed to the device Provide an exclusive earthing to terminal# 3, capacitance enclosure earthing screw and capacitance probe process connection (device mounting screw or flange)	Device contains sufficient filtering of power supply noise inside, but sometimes external earth is needed to make filters sink the extra power supply noise back to earth, connect proper ground.

Maintenance and Spares



Top Cover

Electronic Insert
connection terminals
electronic insert fixing screw

4-way male connector for sensor (probe)
4-way female connector from sensor (probe)

Device enclosure
Cable glands

Thermal spacer (where needed)

Process connection

Stilling well tube

Shown on the left are various parts of TLC capacitance level switch. Separatable parts are

1. Electronic insert in short called 'electronics'
2. Probe + Enclosure + Cover + Glands collectively called 'mechanical'

For maintenance issues involving replacement of 'electronics', just a single fixing screw is needed to be released.

Lift the electronics slowly by holding electronics with one hand and mechanical with other, as wires are connected using rigid 4-way connectors to it.

Disconnect 4-way connector by holding electronics with one hand and female of connector by other hand, while the rest of the device is at rest.

Connect the new replaced sensor. 4-way connector is unidirectional and only connects in proper direction.

Set the electronics properly to its position.

Match the mounting screw hole of electronics with that of enclosure and fix the screw.

For mechanical issues please send the entire device back to Trumen.