

Float & Dial Gauge - FDG

Every Techtrol product should be installed properly, maintained regularly and used within its specified limits to ensure accurate & trouble free performance with extended working life.

1. Introduction

It is mostly used for underground tanks under atmospheric pressure. The gauge comes with a) Analog Indicator and b) Digital Indicator.

a. Analog Indicator –

It consists of a float, clamped to a SS wire rope, the other end of which is wound on a drum, carrying constant torque spring housed in IP66 enclosure, to maintain the rope under tension. Due to change in liquid level, the float rises or falls and rotates the drum. This motion is transmitted through a gear mechanism to a pointer moving over a calibrated dial to display level in meters. Additionally two adjustable switches and or 4-20 mA transmitter can be provided optionally.



Analog Indicator

b. Digital Indicator –

The construction is similar to analog except, constant torque spring is housed in Ex-d enclosure and the gear motion induces a change in variable voltage signal to give 4-20 mA output & digital level indication in %, mm, cm or mtrs. The current output can be further connected to PLC/DCS **through current isolator**.



Digital Indicator

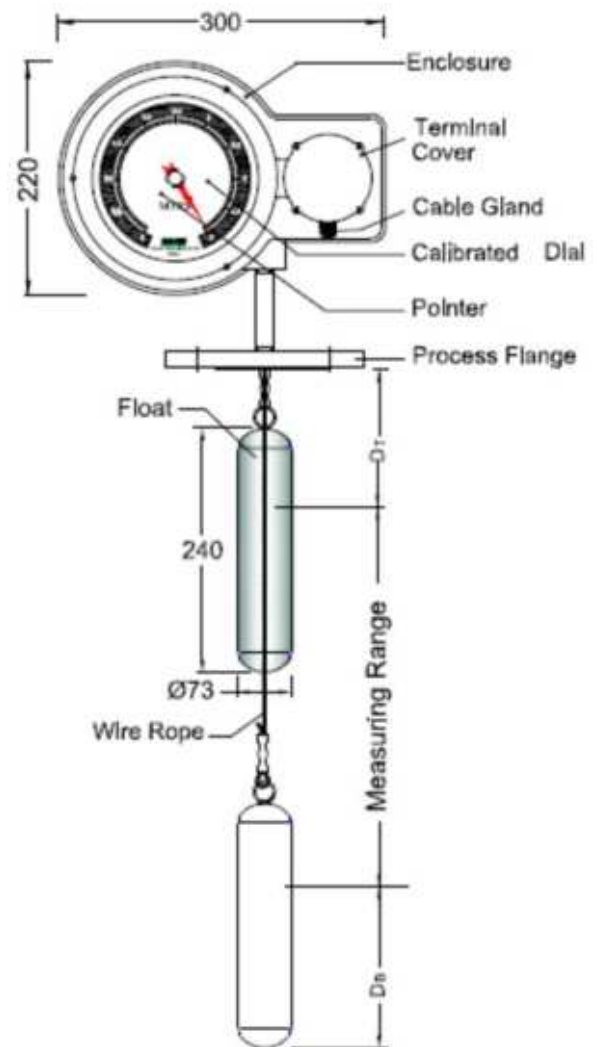
2. Pre- Installation Check

- Ensure that received instrument is in good condition.
- Ensure that the gauge is supplied as per required measuring range and purchase order.

2.1 Checking of FDG with Analog Indication

Fig 1

- Manually pull out the wire rope and ensure that the pointer moves freely on the dial and then release it **very slowly** so that wire rope does not slip out from the pulley and develops kinks.
- Calibration check – the pointer should indicate 'Full Measuring Range' on the dial, when the wire rope is fully wound and float is at its *topmost* position. It should indicate '0', when wire rope is extended up to its measuring range. In case of error, loosen the pointer and bring it at '0' on dial or calibrate for zero.
- Switch operation –Micro switches are set for high and low level of measuring range. Open terminal enclosure and connect continuity tester between P & NO terminals. Slowly pull out the wire rope and observe the continuity (change over) between P & NO at required level set point. (Refer fig 8 for details)
- Transmitter output –**Transmitter o/p is pre calibrated at factory on the basis of tank height & nozzle length specified by the customer.**
- Open the terminal cover and connect 24 VDC supply to +ve & -ve terminals of transmitter card through multimeter in series. (Refer fig 11)
- Observe 20 mA on multimeter when pointer shows full measuring range on dial (tank full condition). Slowly pull out the wire rope till the pointer shows '0' on dial/ display and observe gradual decrease in current. It shows 4 mA when pointer/ display is at '0' (tank empty condition) In case of error, refer procedure described in point 9.2



Analog Indicator

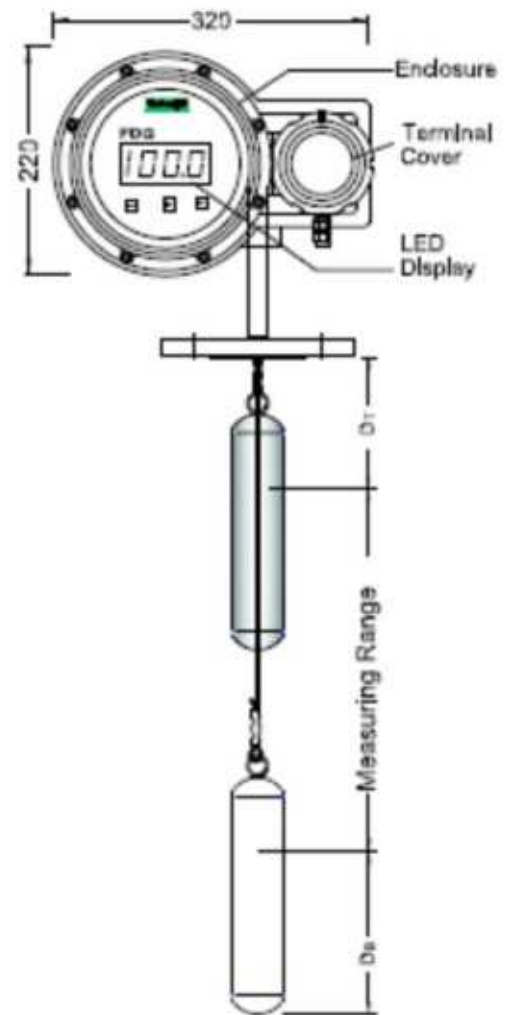


CAUTION : Wire rope should be pulled out and released slowly to ensure that it does not slip out from the pulley.

2.2 Checking of FDG with Digital Indication

Fig 2

- Open the terminal cover and connect 24 VDC supply to +ve & -ve terminals of transmitter card through multimeter in series. (Refer fig 12)
- Observe 20 mA on multimeter and indicator shows full measuring range, when wire rope is fully wound and float is at topmost position. (Tank full condition).
- Slowly pull out the wire rope and observe gradual decrease in current and display readings. It shows 4 mA when indicator shows '0000' (tank empty condition)
- In case of error, refer procedure described in point 9.2 & 11



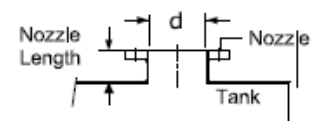
Digital Indicator

3. Precautions before Installation

- Ensure that tank internals do not hinder the float movement.
- Ensure that the float position inside the tank should be such that agitation on it will be minimum.
- Ensure that mounting location of measuring nozzle is away from the inlet to protect the float from damage and faulty readings due to turbulence and at least 500 mm from tanks' inner wall.
- Ensure that process flange of gauge matches with counter flange on the tank.
- Ensure that tank nozzle is perpendicular to tank top and not inclined.
- Ensure nozzle / stillwell 'ID' (d) > float dia to enable insertion of float through nozzle (fig 3). In case, ' d ' < float dia, it should be untied during installation and retied to wire rope from inside of tank.
- Stillwell is recommended for turbulent liquids. While using stillwell, install it on the tank nozzle before mounting of gauge.

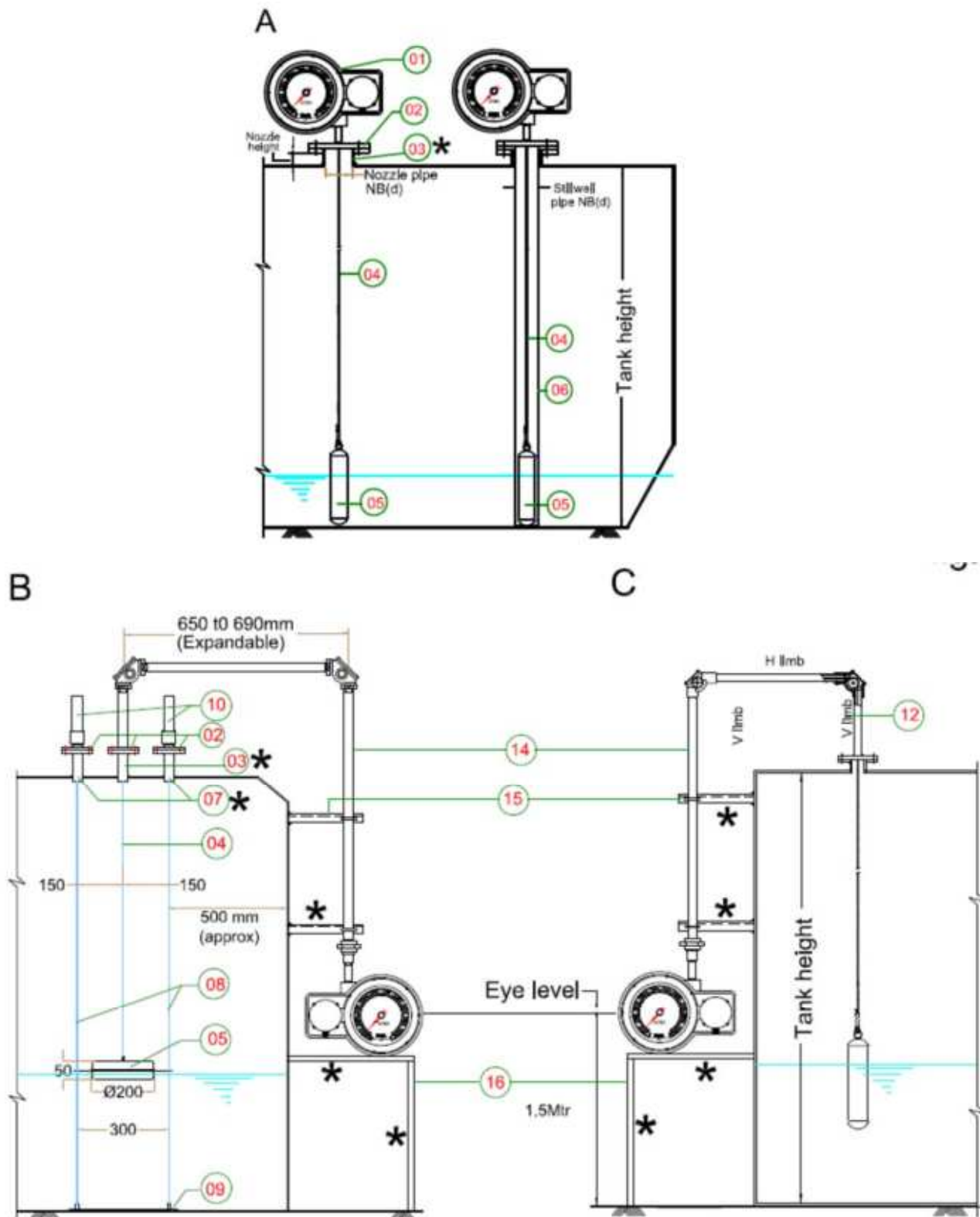
Fig 3

$d >$ Float dia



4. Installation

Fig 4



01: FDG Enclosure, **02:** Process Flange, **03:** Measuring Range, **04:** Float Wire Ropes, **05:** Float, **06:** Stillwell, **07:** Guide Nozzle, **08:** Guide Wires, **09:** Anchor, **10:** Tensioner, **11:** Protection Conduit with Elbow Pulleys, **13:** Vertical Conduit Support, **14:** Conduit Pipes, **15:** Conduit Support, **16:** Gauge Mounting Support, * items in Users Scope

4.1 Top Mounted Installation (fig 4 A)

- Place suitable gasket on tank flange. Hold the gauge in hand along with the float.
- Insert the float through the nozzle, holding the wire rope in hand. **Slowly** allow the float to go down inside the tank.
- Bolt the flanges along with the gasket using nuts & bolts.
- Ensure, when float is at bottom of the tank the gauge should read zero on the dial/display.
- In case the liquid is turbulent, use perforated stillwell. Insert stillwell through the nozzle and then mount the gauge.
- Gauge is **pre-calibrated in factory** for given measuring range and it can be directly taken into operation

Note: *Slowly insert the float through tank nozzle, holding a rope in hand. Do not remove your hold from the float wire otherwise the float will get damaged*

4.2 Side Mounted Installation (fig 4 B & C)

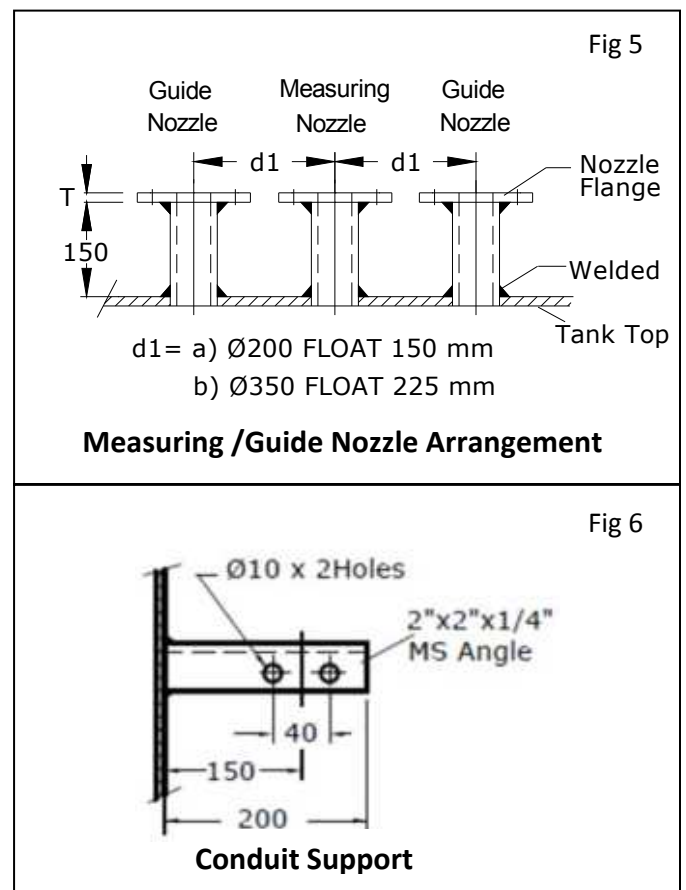
4.2.1 Welding Operation

Welding of Nozzles—

- Locate position of the measuring nozzle at least **500 mm** from the tank inner wall maintaining 650 mm distance from measuring nozzle to conduit pipe and ensure that there is a clearance of min 100 mm between the float & other internal parts (fig 7).
- In case of guided float, in addition to measuring nozzle, locate position of guide nozzles ensuring distance d_1 between them is maintained as per float size (refer figure fig 5).
- Bore the hole and weld nozzles in upright position.

Welding of Conduit & Gauge Support – (fig 6)

- Weld conduit support along the tank length at suitable intervals for conduit pipes.



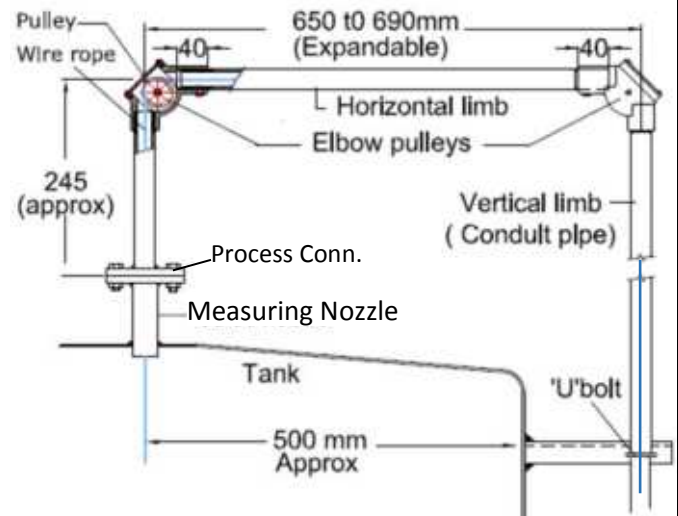
- Weld gauge mounting support at 'eye level' from the ground level.

Anchor Welding (guided float) - Explained in 4.2.3

4.2.2 Fitting of Protection Conduit

Fig 7

- Mount protection conduit and pulley assembly on measuring nozzle.
- Fix process connection on measuring nozzle on the tank.
- Take out the measuring wire rope from the conduit pipes. Hold the wire rope outside pipe.
- Attach protection conduit to conduit support with 'U' bolt.
- Ensure that conduit piping is in plumb with tank wall. Refer figure 4B & C



4.2.3 Fitment of Measuring / Guide Ropes/ Float and Anchor

Measuring Rope Fitting

- Open both the pulley enclosures and insert open end of measuring wire rope from the gauge through vertical limb and pulley enclosure. Unfold the wire rope carefully to avoid any loops / kinks. Now insert it through a horizontal limb of protection conduit and vertical limb and it is then tied to the float knob inside the tank.
- Now check the wire rope for smooth movement of it on both the pulley.

Guide Ropes Fitting (fig 8)

- For guided float, tie one end of guide wire to the spring tension rod.
- Unfold the rope carefully to avoid kinks or loops and pass the end of guide rope inside the tank through guide nozzle.
- Bolt the tensioner flange on guide nozzle flange.
- Repeat this procedure for other guide rope.
- Go inside the tank from manhole, remove the twist of the wires. Now insert the guide rope through the rope guide on the float.
- Fix this free end of guide wire ropes to a knob on the weldable anchor plate or weighted anchor pipe.
- Also fix the measuring rope to float knob.

- Hold the anchor on a support below it. (Take a brick wooden log of 50 mm height as support). Locate the position of bottom anchor plate by lowering a plumb line through the guide nozzles.
- Check all three wires are parallel. Remove spring housing and tighten the tension adjuster nut to provide the guide ropes adequate tension and refit spring housing.
- Remove the support and weld anchor plate to tank bottom in metal tanks. However for non-metal tanks or tanks in service the guide ropes can be weighed down by the anchor pipe filled with sand
- Ensure that gauge pointer reads/ displays `Zero', when float is resting on bottom anchor.
- In case of unguided float, refer figure 4C. The equipment is now ready for use

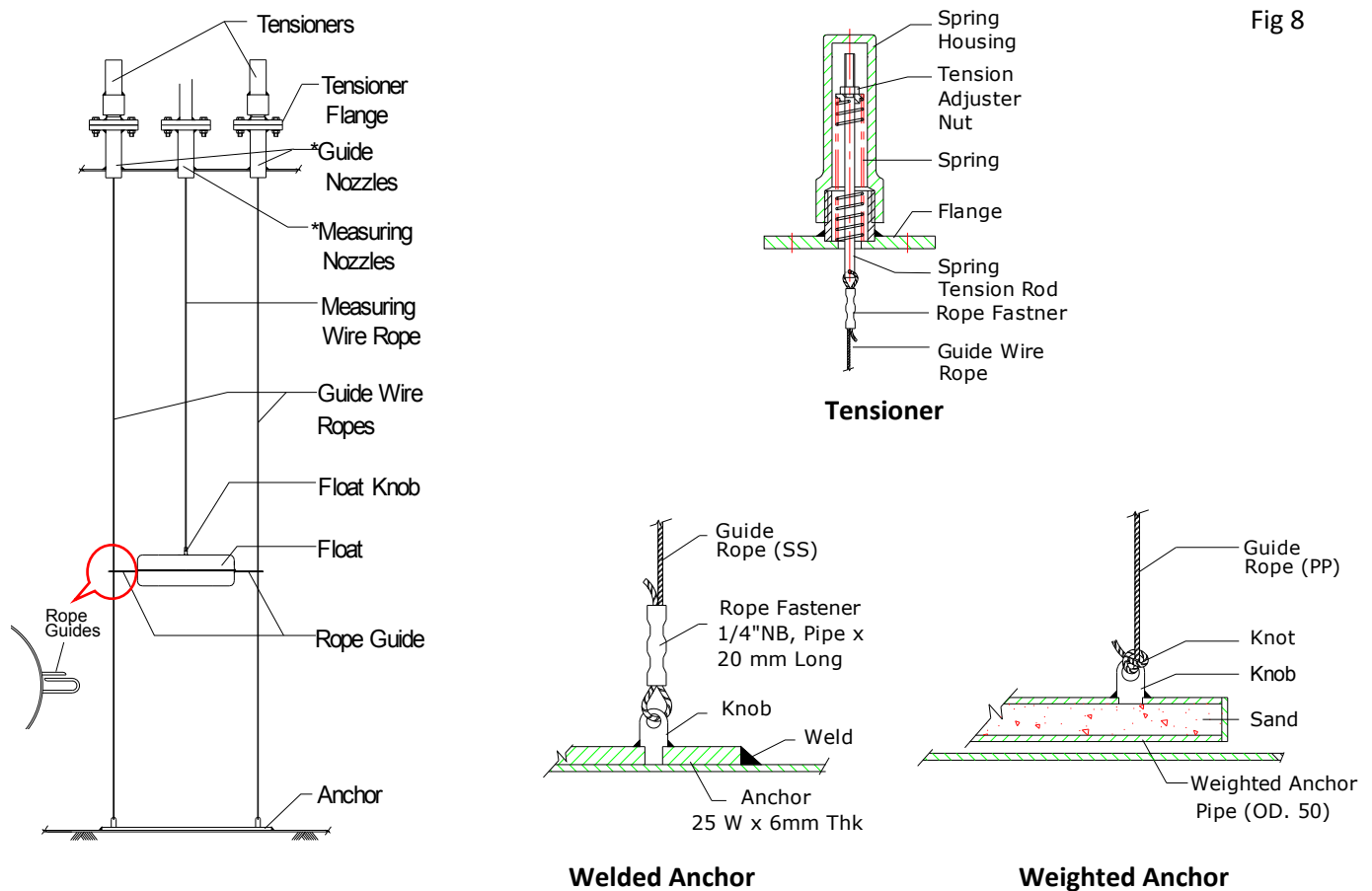


Fig 8

- **Take care not to fold or kink the guide wires.**
- **Both the guide ropes must be stretched vertically parallel to each other.**
- **Ensure proper fastening of guide ropes with bottom anchor. It cannot be easily re-fastened in a filled tank.**

5. Precautions

- Ensure that there is no leakage at process flange by providing gasket.
- Ensure conduit pipe arrangement on the tank is in plumb.
- Before turning on the power supply, ensure all the wiring is correct and completed.
- Ensure IP66 weather proofness by closing enclosure with its gasket.
- **In hazardous locations, open the enclosure cover only after disconnecting the supply.**
- Ensure cables are full tight in cable gland, ensuring no gap in case of analog indicator with switch/ transmitter and gauge with digital indication.
- Ensure operating temp and pressure does not exceed the specified limit.
- Don't disturb trim pots on transmitter card, as they are set for calibrated range and will result in faulty readings.

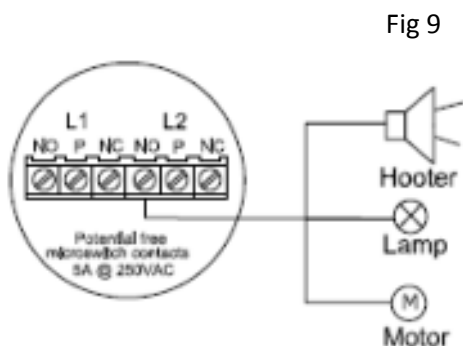
6. Taking Gauge into Operation

- Check that the gauge reads zero when float is at bottom of the tank.
- Fill the tank with liquid, check the reading on the gauge and compare the same with the dip measurement. In case of large error, adjust the level indicating pointer accordingly

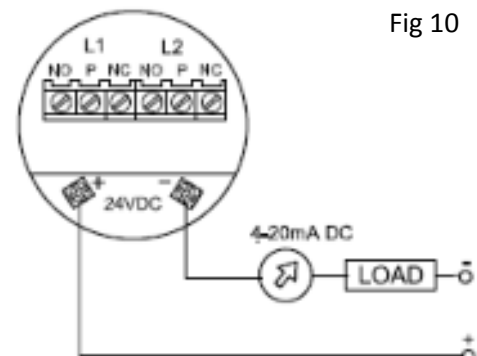
Note: Correct installation of all mounting accessories on the tank is very important for accurate indication of level.

7. Termination and Wiring

- While wiring for switches and transmitter, switch off the power supply.
- In case of transmitter and gauge with digital indicator, ensure correct polarity of 24 VDC
- Ensure that wiring should run away from the high voltage cables, contactors and drive controls.



2 Switches O/P x Analog Indicator



2 Switches + 4-20mA O/P x Analog Indicator

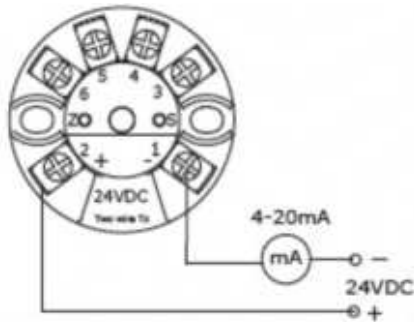


Fig 11

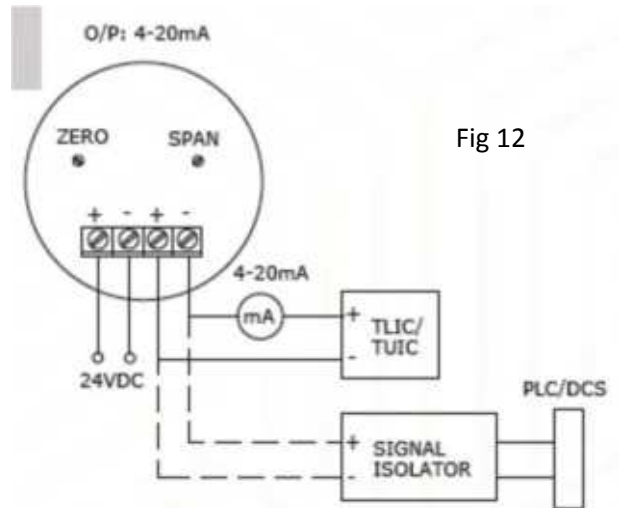


Fig 12

4-20 mA O/P x Analog Indicator

4-20 mA O/P x Digital Indicator

- **4-20 mA output from FDG** - digital indicator, can be directly connected to Techtrol controller TLIC/TUIC, however the o/p is connected to PLC **through signal isolator**.

8. Adjustable Alarm Switches

8.1 Alarm Switches

- Two alarm switches are provided with analog indicator gauge for low and high level alarm.
- Two micro switches are fitted on mounting plate inside the enclosure. Their positions on the mounting plate are **set in factory** to get switching at required set points.
- As the level rises or falls the cam rotates on the plate and operates microswitch lever at set point.

8.2 Resetting of Switches

As such the switches are factory set for required set point, however they can be reset for minor change by adopting following steps as under –

- Remove the FDG from the tank, place it on work table. Extend the wire rope slowly to required length where switch is required to operate and mark the upper point on rope with marker. (Pointer position on dial corresponds to extended wire length).
- Release the wire slowly and remove the dial cover by loosening the screws on it.

- Loosen the pointer with hand and remove the screws on the dial. Take out the dial and find a mounting plate on which micro switches are fitted in slot.
- Loosen the mounting screws (2 threads) of micro switch and now you can move it slightly in the slot as per your requirement.
- Pull out the wire rope upto the mark and observe CAM rotates with gear. Hold the wire rope in hand.
- Move the micro switch in slot such that its lever gets pressed properly by CAM.
- Check the proper operation of switch at set point by pulling the rope in & out and tighten the screws of microswitch.
- Now release the wire rope slowly.
- Recheck the switch operation with continuity tester between P & NO contact at preset point by pulling out the wire rope.

Fig 13

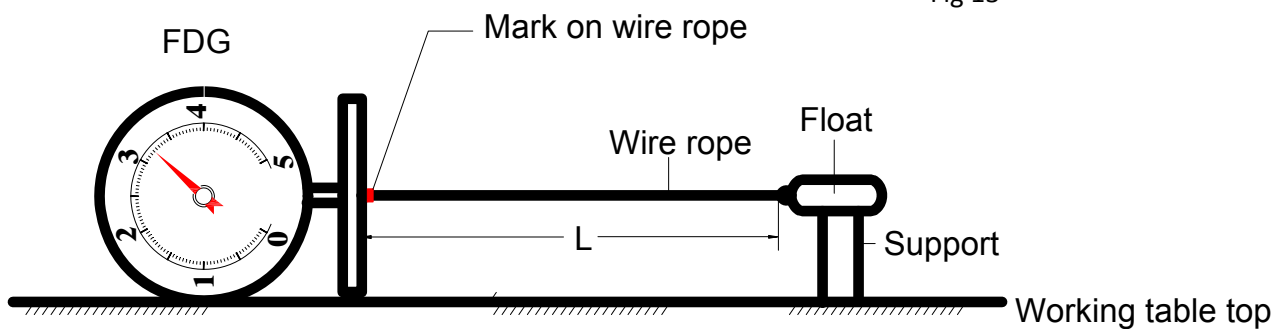


Fig 14

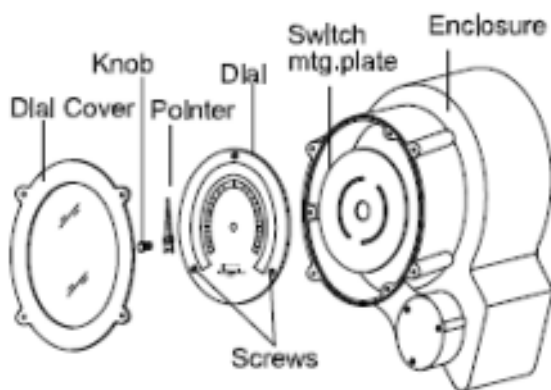
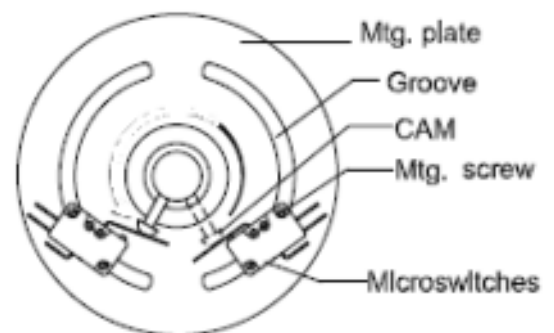


Fig 15



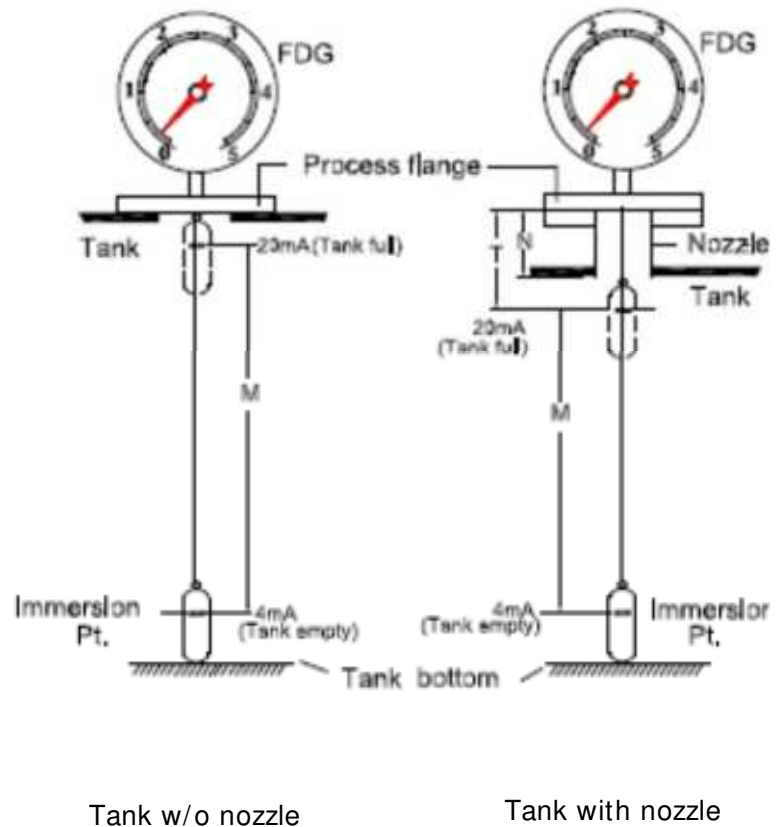
9. Transmitter

FDG with analog indicator is provided with transmitter optionally and FDG with digital indicator comes with 4-20 mA output by default. The transmitter output is factory calibrated for the given measuring range. However the transmitter can be re-calibrated on site if necessary.

9.1 Check Calibration of Transmitter

- Open the terminal enclosure cover, identify 4-20 mA convertor card fitted inside.
- Connect 24 VDC supply to supply terminals with multimeter in series, refer fig 11, 12.
- Empty the tank and observe that the gauge indicates 'Zero' on dial/ display and current output shows 4 mA on multimeter (refer fig. 16)
- Now fill the tank at its full measuring range in question. Observe that the gauge indicates 'Full Measuring Range' on dial/ display and current output shows 20 mA on multimeter
- In case, minor difference is observed in current output, adjust 4 mA with 'Zero' trim pot when tank is empty & 20 mA with 'Span' trim pot when tank is full.

Fig 16



N = Nozzle length,
L = Rope length = measuring range, when N= 0 (w/o nozzle)

9.2 Re-Calibration of Transmitter (fig 17)

- For re-calibration of transmitter, remove the gauge from the tank, place it on working table and connect transmitter to supply and multimeter as shown in fig 11 & 12 for analog and digital indicator respectively.
- Pull out the wire rope for the length = measuring range + nozzle length.

- Ensure pointer indication is zero and current shows 4 mA. In case of error in indication loosen the indicator and adjust the pointer to zero and rotate 'Zero' trimpot minutely to get 4 mA. (Refer pt. 11 to calibrate Zero of digital indicator)
- Now release the rope **slowly** such that rope length = nozzle length. Ensure pointer indication is correct which is equal to measuring range and current shows 20 mA. Set 20 mA with Span trimpot. (Refer pt. 11 to calibrate Span of digital indicator)
- Check intermediate readings for 1/4, 1/2, 3/4th of measuring range showing current output as 8, 12 & 16 mA.

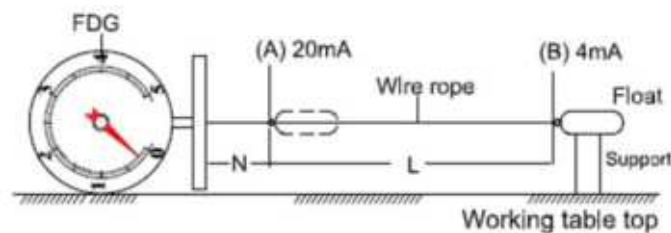


Fig 17

N= Nozzle length, when tank is w/o nozzle N = 0, L= Measuring Range

10. Seal Pot Assembly

- It is provided for fuming liquids to prevent venting of fumes in air.
- Seal pot is supplied in assembled condition with protection conduit assembly (fig 18).
- Once all the installation is complete follow the steps below for seal pot.
- First ensure that drain plug and screw for the pulley on seal pot is tightened properly.
- Open the pulley cover and pour non-volatile liquid (**silicon oil**) in the seal pot completely such that conduit pipe connected to it should also be filled as shown in fig 19 Silicon oil required for seal pot is as under
- Fix the pulley cover on its original position.
- Ensure that there is no leakage of oil from the seal pot.

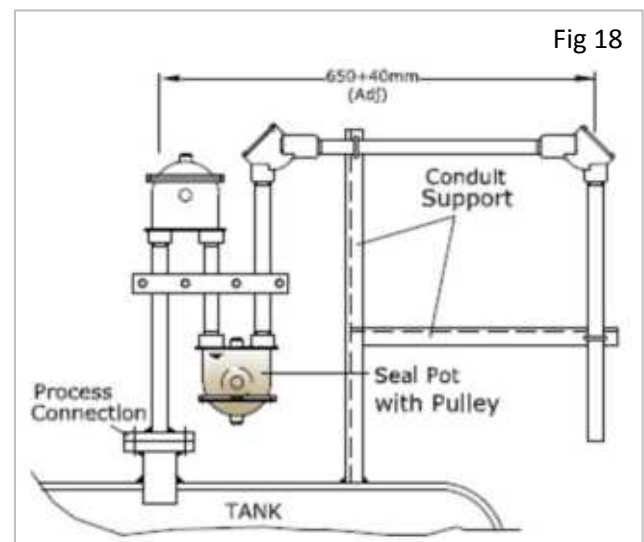


Fig 18

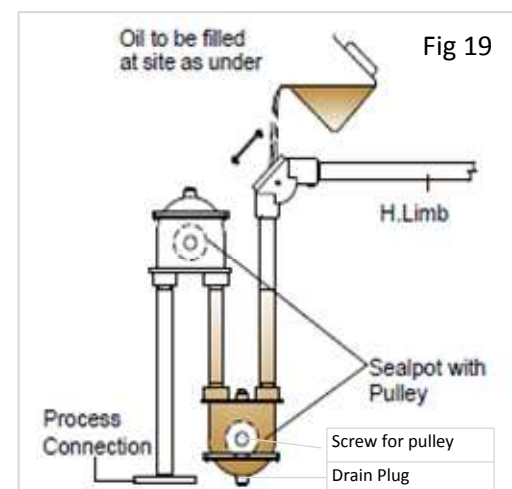


Fig 19

10. Quick Programming Steps

Following programming steps are used to change the measuring range of the digital indicator.

Key Functions :



MODE / DECREMENT KEY : To program / configure data or decrement digit value. Also to enter in next menu.

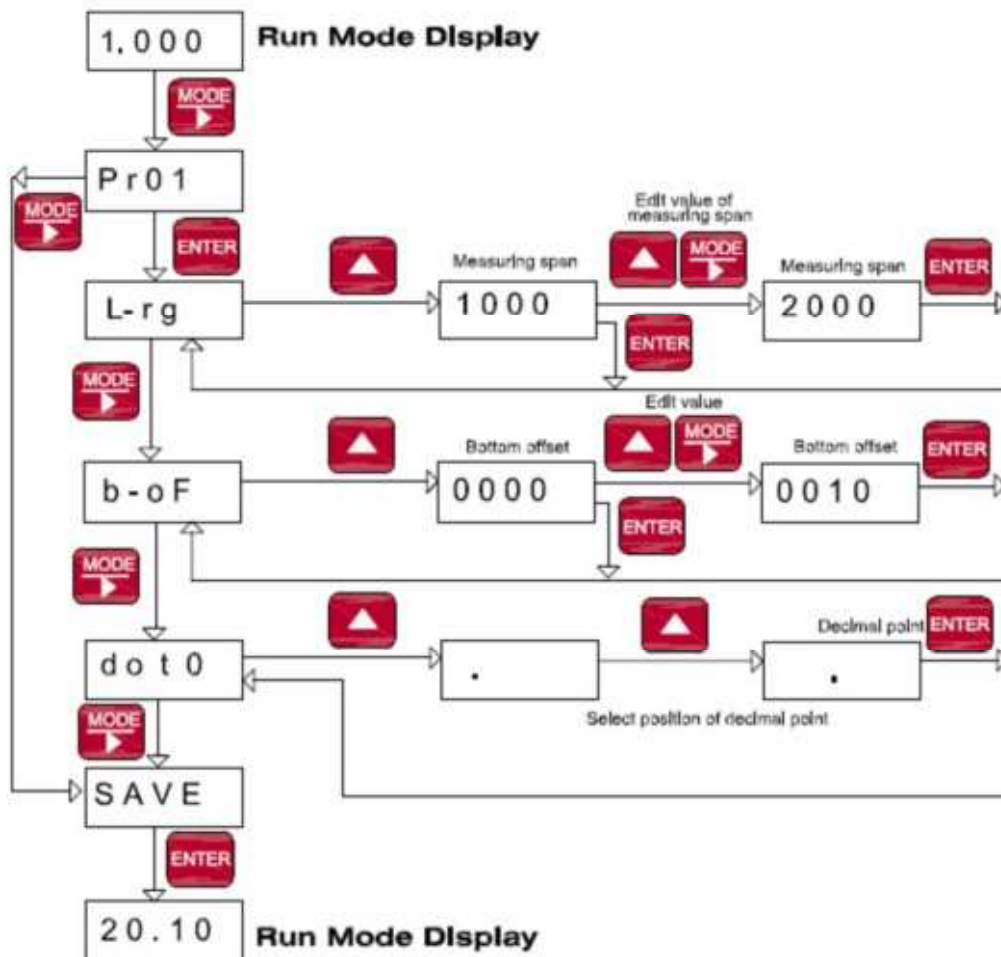


UP (INCREMENT KEY) : To enter in menu or to increment digit value.



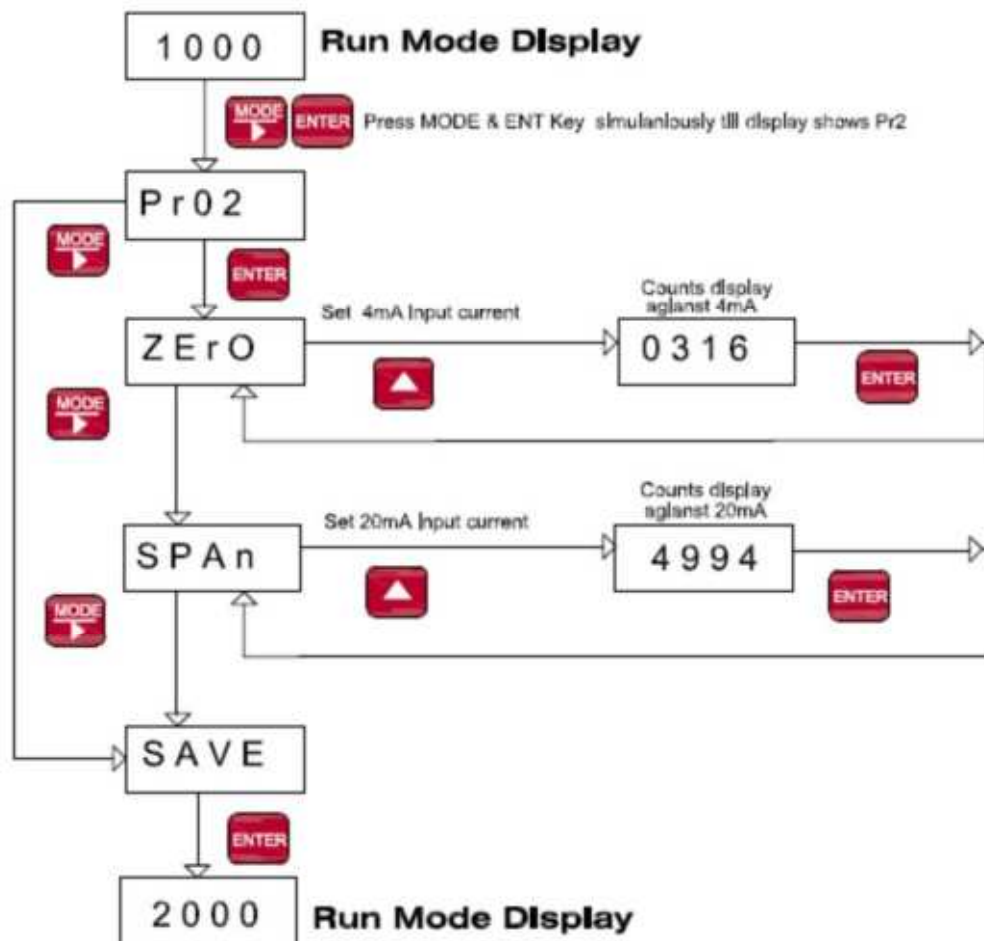
ENTER KEY : To enter parameter.

Programming Flow Chart



11. Quick Calibration Steps

Following programming steps are used to re-calibrate zero and span of digital indicator



11. Periodic Maintenance

- Periodic inspection is necessary to keep your gauge in good working condition.
- During maintenance, switch off the supply and ensure that all terminals are properly tightened.
- Wipe the float to remove sediment particles and visually examine for any damages.
- After maintenance, ensure that switch enclosure cover is fitted with its gasket for 'IP66' weather proofness.
- In hazardous locations, do not open the enclosure cover before disconnecting supply and carry out maintenance to prevent ignition/ explosion

12. Troubleshooting

SL	Problem	Cause	Solution
1	No movement of pointer or no change in indication	<ul style="list-style-type: none"> • Float movement is obstructed due to tank internals • Misalignment of conduit pipes • Float sinks due to low liquid SG < 0.8 • Float punctured 	<ul style="list-style-type: none"> • Check & remove obstructions if any. • Align all the conduit pipes in plumb • Consult factory • Replace float
2	No variation in current output corresponding to dial indication	<ul style="list-style-type: none"> • Loose terminal wiring • Incorrect wiring • Incorrect supply voltage • Loose connection from potentiometer 	<ul style="list-style-type: none"> • Tighten the terminal and ensure no loose connection • Ensure correct polarity • Refer Termination & wiring • Ensure correct supply 24 VDC • Tighten the terminals properly
3.	Switch does not operate	<ul style="list-style-type: none"> • Switch setting is disturbed 	<ul style="list-style-type: none"> • Reset the switch position (refer pt. 8.2)
4.	Current o/p not corresponding to o/p level	<ul style="list-style-type: none"> • Calibration disturbed • Potentiometer wear out • Isolator is not used with digital indicator 	<ul style="list-style-type: none"> • Recalibrate the transmitter (refer pt. 9.2, 13 as applicable) • Consult Factory • Current output should be connected further through isolator

PUNE TECHTROL PVT. LTD

S-18, MIDC Bhosari, Pune: 4110026 India

Ph: +91-20-66342900, ho@punetechtrol.com, www.punetechtrol.com

Works: J-52/7, MIDC, Bhosari, Pune - 411026. India +91-20-67313600