

PUNE TECHTROL PVT LTD

Instruction and Maintenance Manual for Displacer Torque Tube Level Transmitter - DTT

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1. About the manual

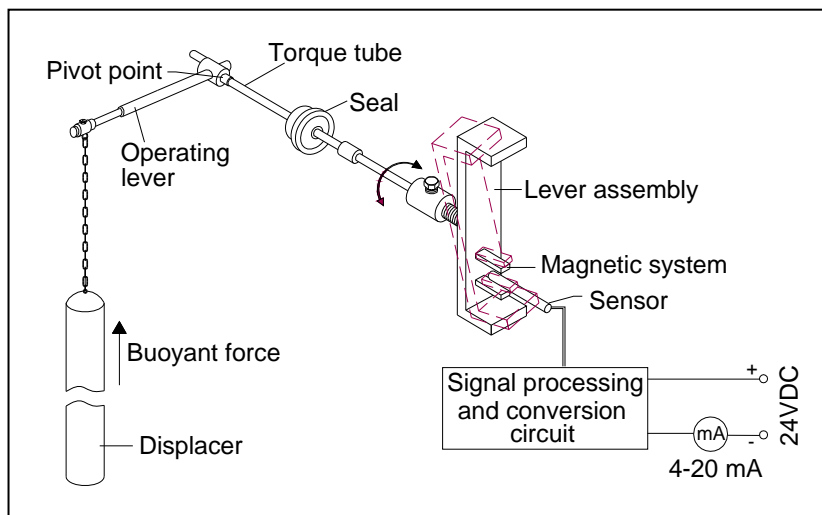
This manual has been prepared as an aid and guide for personnel involved in installation or maintenance. All instructions must be read and understood thoroughly before attempting any installation, operation or maintenance.

2. Introduction

It is an accurate and smart transmitter, for level and interface level measurement of liquids.

It consists of a displacer suspended from one end of an operating lever, the other end of the lever is connected to a torque tube, which in turn is connected to a bar fixture attached to a compression spring. The enclosure houses a sensor and signal processing electronics. This assembly is mounted in an external cage for side mounting. The rise in liquid level reduces the resultant weight of displacer due to increase in buoyant force which causes operating lever to twist the torque tube in clockwise, resulting in reduced torque force on the sensor through a bar fixture. Vice versa a fall in liquid level increases the torque force on the sensor. This change in torque force is proportional to change in buoyant force and is converted into 4-20mA output.

Figure 1 - Construction



4.

Inspection

Please check that the supplied gauge is as per required specifications and it is not damaged in transit.

The user should confirm that:

- (a) The displacer transmitter model no and serial no. stamped on the nameplate conforms to the description on the user's purchase order.
- (b) The operating conditions described in the purchase order agree with the actual operating conditions at the installation site.
- (b) The materials of construction of the transmitter are compatible with both the contained media and surrounding atmosphere in the specific application.

5. Storage and handling

- (a) Transmitter should be stored with its original packing in proper place / rack
- (b) It should be protected from rapid temperature changes.
- (c) Take care not to bend the operating lever while handling the transmitter.

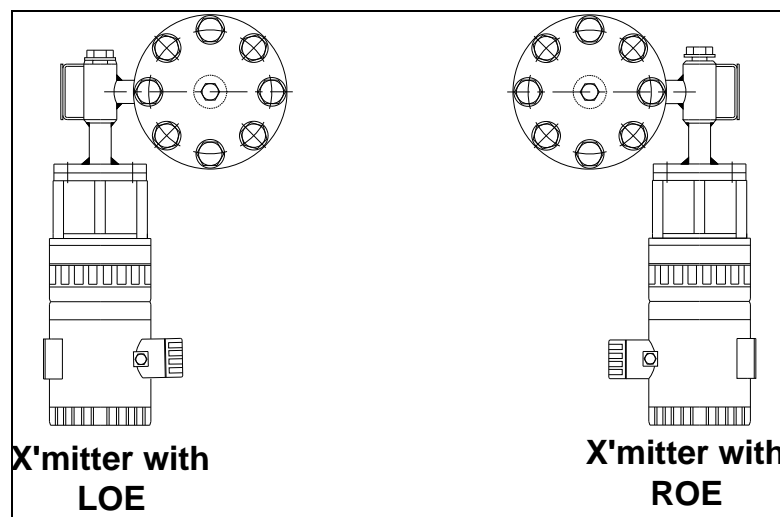
A bent lever will affect smooth working of transmitter

6. Precautions for installation

- 1) Identify suitable location on the tank with minimum vibrations.
- 2) To meet type of protection IP66 requirement, a correct installation of the cable glands and all O-rings has to be ensured.
- 3) Protect transmitters against direct and extreme sun and/or heat exposure. Ensure that the transmitter electronics is maintained at ambient temperature below 60°C.
- 4) Mounting of transmitter should be away from electromagnetic and electrostatic interference.
- 5) Use correct displacer (displacer length = measuring length) corresponding to Transmitter electronics as each displacer's size is designed and calibrated according to measuring range.

- 6) Ensure the weather proofness by closing the enclosure cover with its gasket and cable should be full tight ensuring no gap between cable gland ID and cable OD.
- 7) During placement of transmitter, ensure its correct **enclosure orientation**.
i.e. transmitter enclosure oriented towards **left (LOE)** and enclosure oriented towards **right (ROE)** as shown below.

Figure 2 Top View



WARNING

- **Instruction manual should be read & understood before installation of gauge.**
- **Installation should be carried out by qualified & experienced personnel. It is strongly recommended that two people work together at this stage, particularly when installing the instrument on the vessel.**
- **Take care not to bend the operating lever at any stage of installation. A bent lever will prevent transmitter from working.**
- **Tank /vessel must be relieved of all pressure or vacuum and allowed to reach ambient temperature prior to installation.**

7. Installation

Displacer transmitter is mounted **internally** (fig 4) or **externally** either on left or right side of the tank. (fig 5)

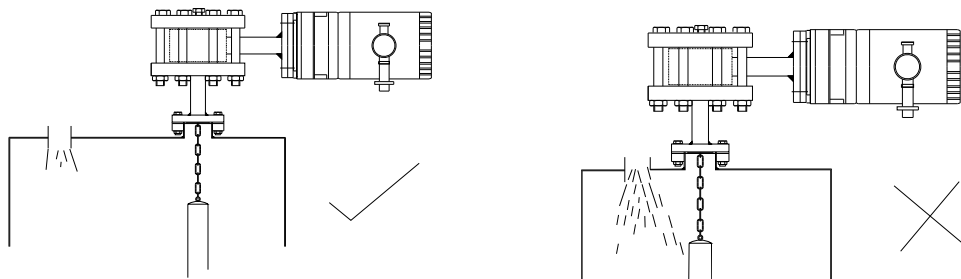
7.1 Internal Mounting -

Transmitter is supplied without cage with X'mitter flange or mounting directly on tank nozzle flange. Perforated still well is recommended for tanks with liquid turbulence.

Pl. ensure –

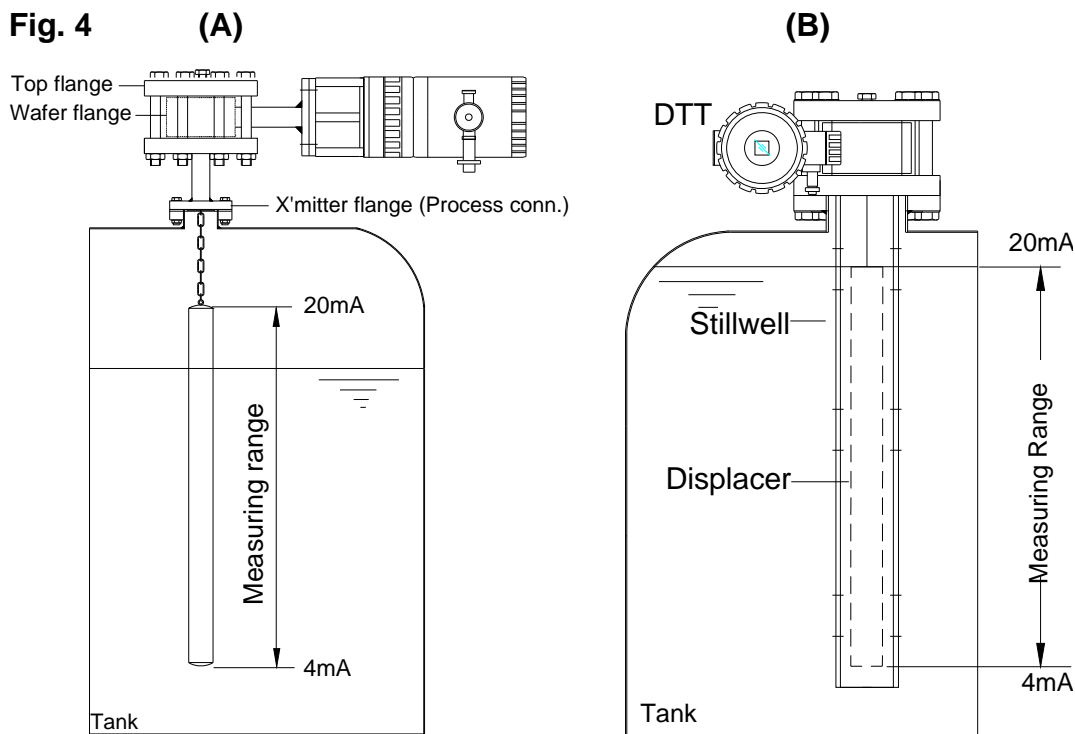
- 1) Be sure that tank internals does not restrict displacer movement during operation.
- 2) Transmitter should be mounted vertically in plumb for undisturbed movement of displacer and correct output.
- 3) Stillwell fig 4 B - If there is a high degree of agitation in the vessel, such that the displacer element could be caused to swing or bounce, then a stillwell should be installed in the vessel. Ensure that the stilling tube has an internal diameter large enough to allow free movement of the displacer element, and that a vent hole is drilled at the top to prevent air-locks. The tube must be installed vertically so that the displacer element does not touch the tube at any point.
- 3) Transmitter is mounted at a safe distance from liquid inlet and outlet.

Fig. 3



7.2 Mounting steps –

1. Place suitable gasket on the tank nozzle flange.
2. Transmitter can be mounted on the vessel in two ways -
 - 2 a. If the overhead space on the tank is sufficient - smaller range displacer is hanged on the hook before bolting and then lower full assy of transmitter enclosure along with displacer in the tank and place transmitter flange on tanks nozzle flange.
 - 2 b. In case, overhead space on tank is not sufficient - displacer with longer length is lowered partly in the tank first and hold it with proper arrangement. Be sure that it does not get dropped in the tank. Now lower the x'mitter enclosure on the nozzle flange and hang displacer on the hook coming out from x'mitter flange and place it on tanks' nozzle flange.



- 2c. In case, overhead space on tank is not sufficient - Lower the x'mitter enclosure and place it on the nozzle flange and displacer can be mounted thru manhole.

3. Align the holes of transmitter and nozzle flange & insert bolts through the

holes and fasten it with nuts. Use **torque wrench** in zigzag manner in several steps.

7.3 External mounting

External mounting is provided with two installation options 1) Side-side process connection (fig 5) or 2) side - bottom process connection (fig 6)

In left side tank mounting, the x'mitter enclosure should be oriented towards the left (**LOE**) and process connection for tank mounting on right or rear. In right side tank mounting, the x'mitter enclosure should be oriented towards the right (**ROE**) and process connection for tank mounting on left or rear.

Pl. ensure –

1. The chamber should be mounted as close to the vessel as possible with minimum pipe length.
2. External mounting should be provided with separate isolation valves on the tank for safety and easy removal of transmitter for repairs & maintenance .
3. Be sure that cage must be installed vertical in upright position and bolted with appropriate gaskets and bolts.

Fig. 5

X'mitter with side- bottom process connection.

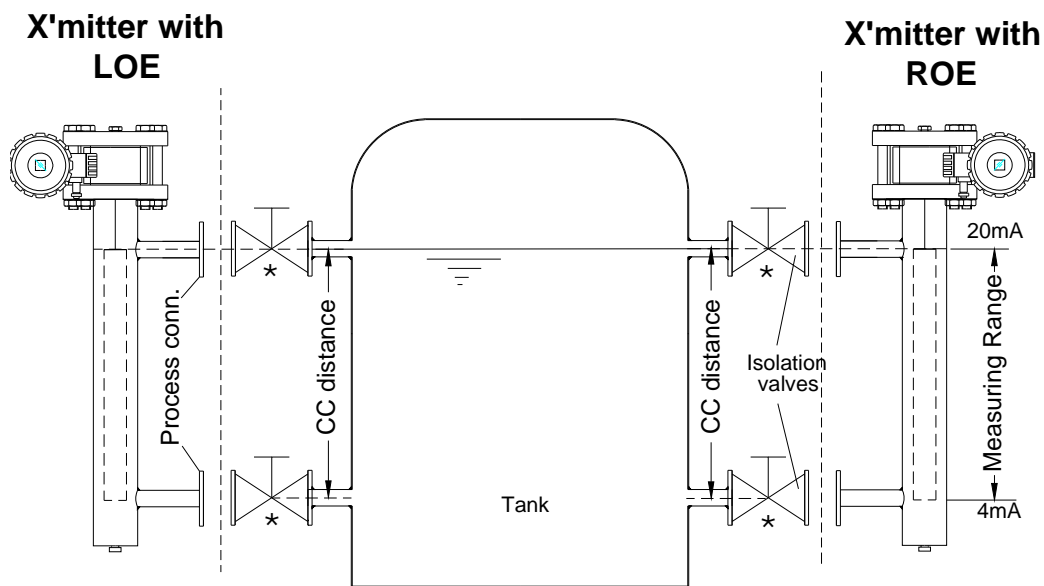
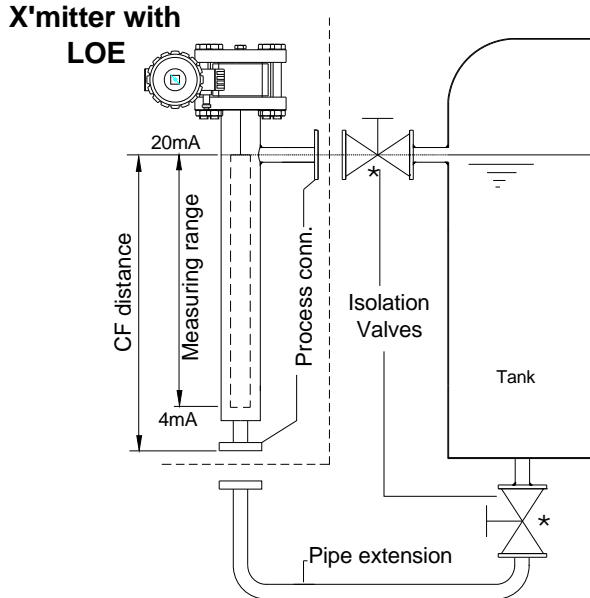


Fig 6

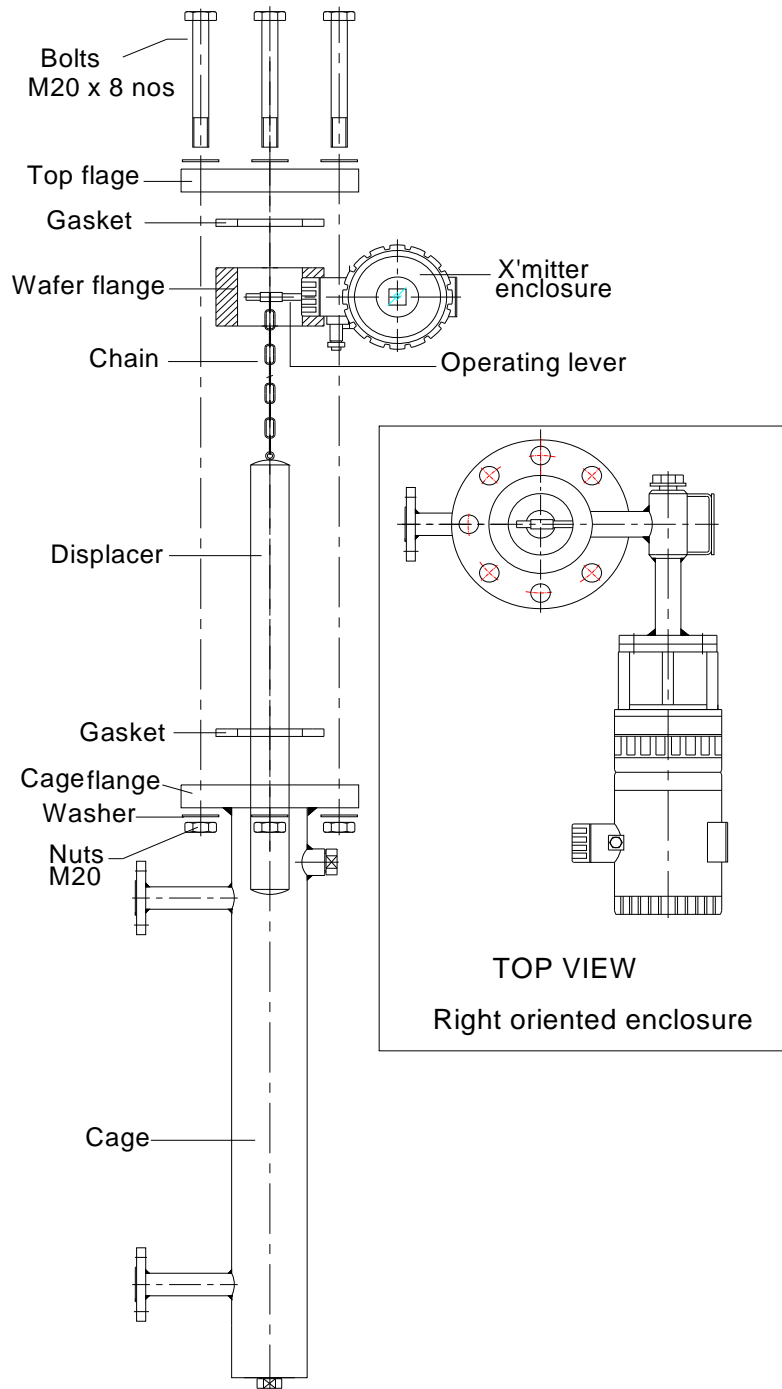
X'mitter with side- bottom process connection.



Follow the steps given below & fig 7 to mount transmitter on cage.

1. Place the gasket on vessel / cage flange.
2. Lower the displacer inside the vessel/ cage.
3. Hold the wafer flange along with electronic transmitter in hand and place it on vessel/ cage flange.
4. Tilt the wafer flange from one side and hang displacer on the groove of operating lever.
5. Place gasket on wafer flange and then top flange on it such that holes on top flange and cage flange are aligned.
6. Insert bolts through both flange holes and secure it by screwing nuts on it.
7. Before tightening the bolts further, ensure that gaskets and wafer flange together with cage flange & top flange are aligned and properly placed.
8. Tighten the nuts in crosswise with torque wrench in several steps.

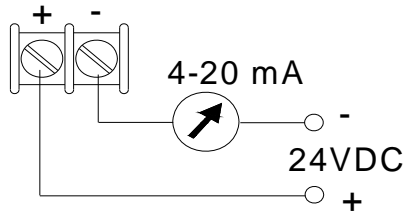
7.4 Mounting of transmitter on external cage
Fig 7



8. Termination and wiring

1. While wiring power supply should be strictly off.
2. Connect supply 24 VDC to terminals with correct polarity fig. 8
3. Wiring should run away from **high voltage cables, contactors & drives.**

Fig 8



9. Operation and calibration of transmitter



CAUTION

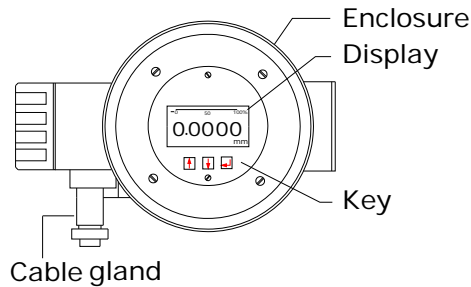
Tank /vessel must be relieved of all pressure or vacuum and allowed to reach ambient temperature prior to installation.

After completing proper installation of displacer and wiring, transmitter is ready to use. It is programmed and calibrated in factory for the measured range with dry weight, however it is required to be calibrated on the vessel with liquid.

1. Connect transmitter to power supply as shown in fig 8
2. Empty the vessel and refer the **programming** steps to edit & check programmed data and calibration of output.
3. To change unit in off line – Press 'Increment' key once display indication will toggle between Temp & PV. Again press same key second time, display indicates % of PV, Press the same key for third & display toggles between % & mm value of PV. Again press the same key fourth time it shows PV

10. Programming of transmitter

fig. 9



10.1 Display module (fig. 9)

1. Main display shows value of liquid level upto 5 digits with selected measuring unit near it.
2. On top side of display it is graphical representation of level from 0 to 100 %.
3. Three keys **Confirm/Shift, Increment and Decrement** are at bottom side and on key M on the top.

10.2 Key Functions –

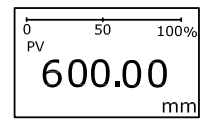
←	to enter into program to shift next digit to confirm edited value
↑	to go to next menu once you enter in program to increment digit or toggle
↓	to decrement digit

Transmitter is programmed and calibrated using front keys on display module. Once you learn modification of digit, it is easy program further. Many steps are repeated in programming menu.

Once you enter the password and go into programming menu, you can directly go to a required menu by using 'Increment' key.

Programming Steps

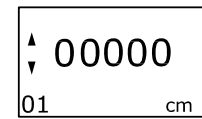
Run Display



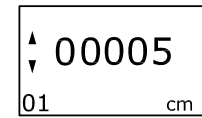
(Fig - 1a)

Menu - 01 Enter Password

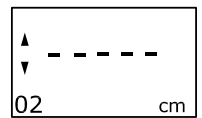
1. Press \leftarrow key for few sec seconds till display appears as shown in adjacent figure -1b
2. Press \leftarrow key and first digit on display starts flickering
3. Using \uparrow , \downarrow , \leftarrow keys, enter password as 00005
4. Press \leftarrow after modification of last digit.
5. Press \leftarrow to confirm.(fig-1c)
6. Press \uparrow to go to next menu 2 (fig -1d)



(Fig - 1b)



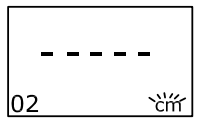
(Fig - 1c)



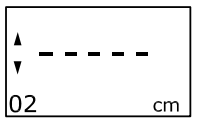
(Fig - 1d)

Menu - 02 Unit Selection

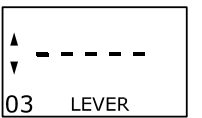
1. Press \leftarrow key , unit at left bottom starts blinking. (fig-2a)
2. Press \uparrow \downarrow key to scroll through units cm,mm,ft,m & in
5. Press \leftarrow to confirm.(fig- 2b)
6. Press \uparrow to go to next menu 3. (fig -2c)



(Fig - 2a)



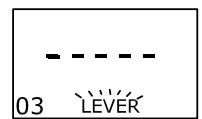
(Fig - 2b)



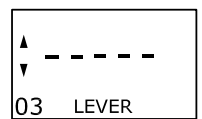
(Fig - 2c)

Menu - 03 Measurement Type

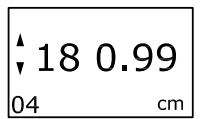
1. Press \leftarrow key , measurement type at bottom starts blinking. (fig-3a)
2. Press \uparrow \downarrow key to scroll through measurement types LEVER (Level), INTEA (Interface), DENSI (Density)
5. Press \leftarrow to confirm.(fig- 3b)
6. Press \uparrow to go to next menu 4. (fig -3c)



(Fig - 3a)



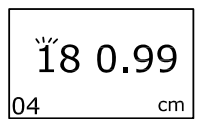
(Fig - 3b)



(Fig - 3c)

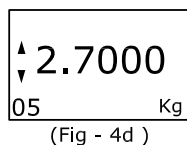
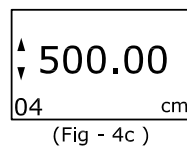
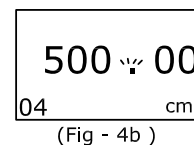
Menu - 04 Displacer Length

1. Press \leftarrow key , first digit starts blinking. (fig-4a)



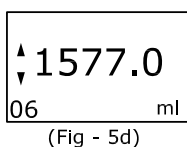
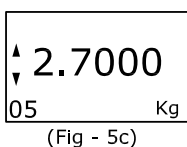
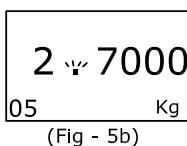
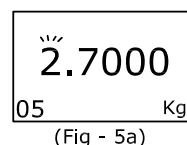
(Fig - 4a)

2. Using ↑, ↓ & ← keys, edit the value
4. After modification of last digit, press ← and decimal point starts blinking. (fig-4b)
5. Press ↑ key to shift decimal point to right
6. Press ← key to confirm. (fig - 4c)
6. Press ↑ key to go to next menu 5 (fig -4d)



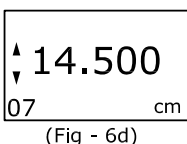
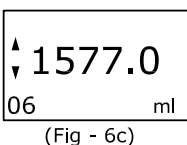
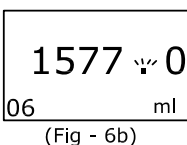
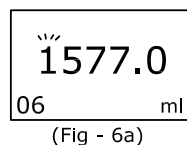
Menu - 05 Displacer weight

1. Press ← key, first digit starts blinking. (fig-5a)
2. Using ↑, ↓ & ← keys, edit the value
4. After modification of last digit, press ← and decimal point starts blinking. (fig-5b)
5. Press ↑ key to shift decimal point to right
6. Press ← key to confirm. (fig -5c)
6. Press ↑ key to go to next menu 6 (fig -5d)



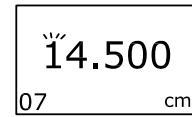
Menu - 06 Volume of Displacer

1. Press ← key, first digit starts blinking. (fig-6a)
2. Using ↑, ↓ & ← keys, edit the value
4. After modification of last digit, press ← and decimal point starts blinking. (fig-6b)
5. Press ↑ key to shift decimal point to right
6. Press ← key to confirm. (fig -6c)
6. Press ↑ key to go to next menu 7 (fig -6d)



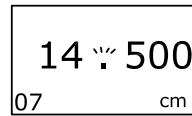
Menu - 07 Torque Tube Arm Length

1. Press \leftarrow key , first digit starts blinking. (fig-7a)
2. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig-7b)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig -7c)
6. Press \uparrow key to go to next menu 8 (fig -7d)



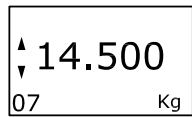
14.500
07 cm

(Fig - 7a)



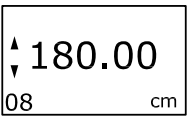
14.500
07 cm

(Fig - 7b)



14.500
07 Kg

(Fig - 7c)

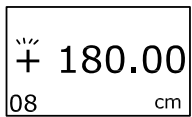


180.00
08 cm

(Fig - 7d)

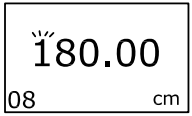
Menu - 08 Torque Tube Arm Length

1. Press \leftarrow key , see '+' sign flickers. Sign can be changed(toggled) to '-' using \uparrow key. To enter positive integer, select '+' (fig -8a)
2. Press \leftarrow key and first digit of number starts flickering (fig -8b)
3. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig-8e)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig -8d)
6. Press \uparrow key to go to next menu 9 (fig -8e)



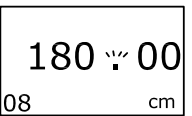
+180.00
08 cm

(Fig - 8a)



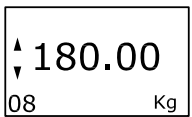
180.00
08 cm

(Fig - 8b)



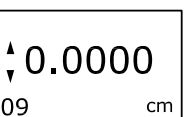
180.00
08 cm

(Fig - 8c)



180.00
08 Kg

(Fig - 8d)




0.0000
09 cm

(Fig - 8e)

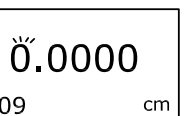
Menu - 09 Lower Limit of Measurement

1. Press \leftarrow key , see '+' sign flickers.(fig -9a) Sign can be changed(toggled) to '-' using \uparrow key. To enter positive integer, select '+' (fig -9b)
2. Press \leftarrow key and first digit of number starts flickering
3. Using \uparrow , \downarrow & \leftarrow keys, edit the value



+0.0000
09 cm

(Fig - 9a)



0.0000
09 cm

(Fig - 9b)

4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig-9c)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig -9d)
7. Press \uparrow key to go to next menu 10 (fig -9e)

0.0000
09 cm

(Fig - 9c)

0.0000
09 cm

(Fig - 9d)

15.000
10 s

(Fig - 9e)

Menu - 10 Set Damping

1. Press \leftarrow key , first digit starts blinking. (fig-10a)
2. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig- 10b)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig - 10c)
6. Press \uparrow key to go to next menu 11 (fig -10d)

15.000
10 s

(Fig - 10a)

15.000
10 s

(Fig - 10b)

15.000
10 s

(Fig - 10c)

0.9000
11 SGU

(Fig - 10d)

Menu - 11 Set Gravity of Light Medium

1. Press \leftarrow key , first digit starts blinking. (fig-11a)
2. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig- 11b)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig - 11c)
6. Press \uparrow key to go to next menu 12 (fig -11d)

0.9000
11 SGU

(Fig - 11a)

0.9000
11 SGU

(Fig - 11b)

0.9000
11 SGU

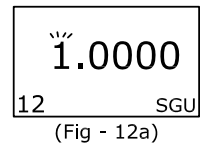
(Fig - 11c)

1.000
12 SGU

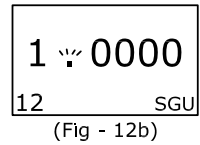
(Fig - 11d)

Menu - 12 Set Gravity of Heavy Medium

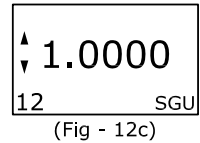
1. Press \leftarrow key , first digit starts blinking. (fig-12a)
2. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig- 12b)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig - 12c)
6. Press \uparrow key to go to next menu 13 (fig -12d)



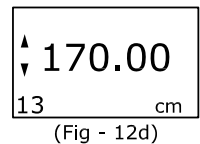
1.0000
12 SGU
(Fig - 12a)



1.0000
12 SGU
(Fig - 12b)



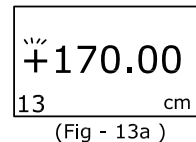
1.0000
12 SGU
(Fig - 12c)



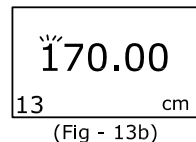
170.00
13 cm
(Fig - 12d)

Menu - 13 Upper Limit Alarm

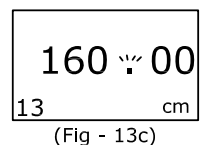
1. Press \leftarrow key , see '+' sign flickers. Sign can be changed(toggled) to '-' using \uparrow key. To enter positive integer, select '+' (fig -13a)
2. Press \leftarrow key and first digit of number starts flickering (fig - 13b)
3. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig-13c)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key to confirm. (fig -13d)
6. Press \uparrow key to go to next menu 14 (fig -13e)



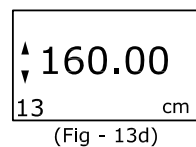
+170.00
13 cm
(Fig - 13a)



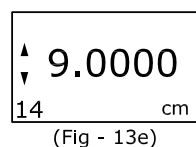
170.00
13 cm
(Fig - 13b)



160.00
13 cm
(Fig - 13c)



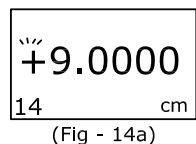
160.00
13 cm
(Fig - 13d)



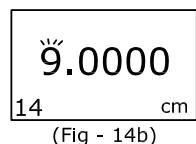
9.0000
14 cm
(Fig - 13e)

Menu - 14 Lower Limit Alarm

1. Press \leftarrow key , see '+' sign flickers. Sign can be changed(toggled) to '-' using \uparrow key. To enter positive integer, select '+' (fig -14a)
2. Press \leftarrow key and first digit of number starts flickering (fig -14b)

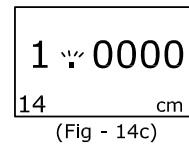


+9.0000
14 cm
(Fig - 14a)

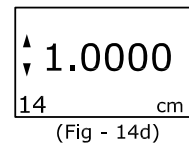


9.0000
14 cm
(Fig - 14b)

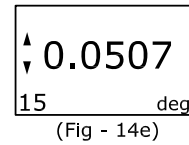
3. Using ↑, ↓ & ← keys, edit the value
4. After modification of last digit, press ← and decimal point starts blinking. (fig- 14c)
5. Press ↑ key to shift decimal point to right
6. Press ← key to confirm. (fig - 14d)
7. Press ↑ key to go to next menu 15 (fig -14e)



(Fig - 14c)



(Fig - 14d)

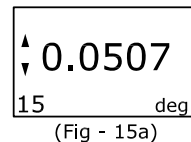


(Fig - 14e)

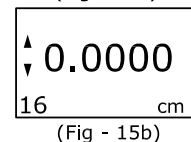
Menu - 15 Set coupling Point

Option is locked for editing

1. Press ↑ key to move to next menu 16. (fig-15b)



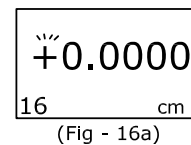
(Fig - 15a)



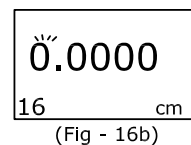
(Fig - 15b)

Menu - 16 Calibration of low limit

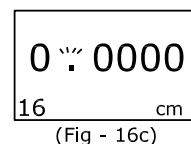
1. Press ← key, see '+' sign flickers. Sign can be changed(toggled) to '-' using ↑ key. To enter positive integer, select '+' (fig -16a)
2. Press ← key and first digit of number starts flickering (fig - 16b)
3. Using ↑, ↓ & ← keys, edit the value
4. After modification of last digit, press ← and decimal point starts blinking. (fig-16e)
5. Press ↑ key to shift decimal point to right
6. Press ← key, observe 'c-ok' flickering at right bottom (fig 16 e) and after few sec the value is confirmed.
6. Press ↑ key to go to next menu 17 (fig -16f)



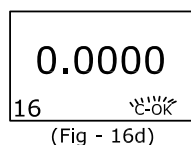
(Fig - 16a)



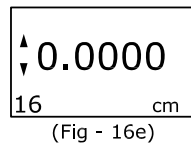
(Fig - 16b)



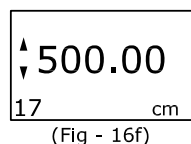
(Fig - 16c)



(Fig - 16d)



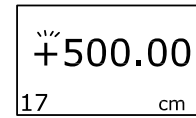
(Fig - 16e)



(Fig - 16f)

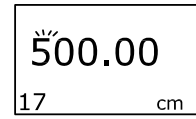
Menu - 17 Calibration of Upper Limit

1. Press \leftarrow key , see '+' sign flickers. Sign can be changed(toggled) to '-' using \uparrow key. To enter positive integer, select '+' (fig -17a)
2. Press \leftarrow key and first digit of number starts flickering (fig - 17b)
3. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig-17c)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key , observe 'c-ok' flickering at right bottom (fig 17e) and after few sec the value is confirmed.
6. Press \uparrow key to go to next menu 18 (fig -17f)



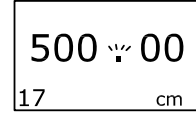
17 \pm 500.00 cm

(Fig - 17a)



17 500.00 cm

(Fig - 17b)



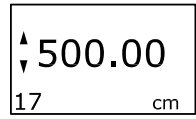
17 500.00 cm

(Fig - 17c)



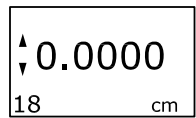
17 500.00 c-ok

(Fig - 17d)



17 \uparrow 500.00 cm

(Fig - 17e)

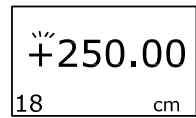


18 \uparrow 0.0000 cm

(Fig - 17f)

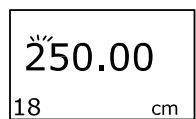
Menu - 18 Fine Adjustment

1. Press \leftarrow key , see '+' sign flickers. (fig 18a). Sign can be changed (toggled) to '-' using \uparrow key. To enter positive integer, select '+' (fig -18b)
2. Press \leftarrow key and first digit of number starts flickering (fig - 18c)
3. Using \uparrow , \downarrow & \leftarrow keys, edit the value
4. After modification of last digit, press \leftarrow and decimal point starts blinking. (fig-18d)
5. Press \uparrow key to shift decimal point to right
6. Press \leftarrow key , to confirm
7. Press \uparrow key to go to next menu 19 (fig -18e)



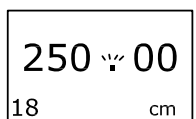
18 \pm 250.00 cm

(Fig - 18a)



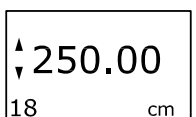
18 250.00 cm

(Fig - 18b)



18 250.00 cm

(Fig - 18c)



18 \uparrow 250.00 cm

(Fig - 18d)



19 ----- SAVE

(Fig - 18e)



19 ----- SAVE

(Fig - 19a)

Menu - 19 Save Program

1. Press \leftarrow key , observe 'SAVE' flickering at right bottom. (To cancel you can press key and option CANCEL appears)
2. Press \leftarrow key to save.

11. Maintenance



C A U T I O N

Maintenance should be carried out only when the tank/ vessel has reached to ambient temperature, relieved of all pressure or vacuum and drained of all fluids.

1. Check for any leakages near gasket, change it if necessary & re-tighten the bolts.
2. Check displacer for scaling on it and clean it.
3. Check for loose electrical connections and retighten them.
4. Take care when removing the instrument from any vessel. The assembly must be kept vertical when removing from the vessel to prevent damage to the lever assembly.

12. Troubleshooting

SI	Defect	Causes	Solution
1	No display and no current output.	<ol style="list-style-type: none"> 1. Loose terminal connection 2. Incorrect wiring 3. In correct supply voltage 	<ol style="list-style-type: none"> 1. Tighten loose terminals 2. Refer wiring diagram and ensure correct polarity 3. Check & ensure supply is 24VDC
2	Improper output	<ol style="list-style-type: none"> 1. Incorrect mounting of x'mitter 2. In correct programming 3. Sp. Gr is different than what is programmed. 4. Wrong calibration 5. Torque tube sensor setting is disturbed 6. Process residue build up on the displacer or dents on displacer may change weight and calibration 	<ol style="list-style-type: none"> 1. Check & ensure correct mounting vertically in plumb and there is no hindrance to displacer movement in vessel/ cage 2. Check & ensure that all parameters are programmed with correct values 3. Re-enter the correct value of sp gr. 4. Recalibrate, refer programming for calibration 5. Consult factory. 6. Check & clean displacer or replace new displacer and recalibrate the transmitter.

3	Output is out of range (>21mA or < 3.8mA)	<ol style="list-style-type: none"> 1. Incorrect mounting of x'mitter 2. Wrong calibration 3. Torque tube sensor setting is disturbed 	<ol style="list-style-type: none"> 1. Check & ensure correct mounting vertically in plumb and there is no hindrance to displacer movement in cage. 2. Recalibrate, refer programming for calibration 3. Consult factory.
4	Output is continuously varying	<ol style="list-style-type: none"> 1. Turbulence in liquid 2. Programmed damping value is very low 3. Torque tube sensor setting is disturbed 	<ol style="list-style-type: none"> 1. Use Stillwell for top mtg x'mitter to dampen the turbulence. 2. Reprogram Menu 5 and increase the damping value. 3. Consult factory.

