

# INSTRUCTION MANUAL

## for PMS (Portable Tank Measuring System)

### Portable Oil-Water Interface Detector and Temperature Gauging

#### Model T2000-TFC-02 Gas-Tight(Closed) Type

##### Benefits of T2000-TFC-02

- *Portable – one unit used for all tanks*
- *Economical and affordable*
- *Cargo contents validation*
- *High Accuracy & Response Performance*
- *Easy Installation & Operation*
- *Easy Maintenance*
- *Environmental Pollution Prevention*
- *Perfect Isolation of Hazardous Gas*
- *Determines Interface, Ullage and temperature (3 – in – 1)*



MODEL : T2000-TFC-02

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(Model : T2000-TFC-02)

<ATTACHMENT>

\* Technical Service Manual

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## 2. Useful Measuring Jobs on Deck of Tanker and Applicable Rules

Equipment Type	Function	Compliance with
Closed Type Portable Oil/Water Interface Detector ( UTI)	Ullage level	SOLAS 1974,CHAP -2 REGULATION 60 PARAGRAPH 7 IMO, MSC/Circ.551 (IBC BCH CODE)
	Temperature gauging	
	Oil-water interface level	MARPOL 73/78 ANNEX -CHAP - REGULATION 15, (3) (b) IMO RESOLUTION MEPC.5(XIII) ANNEX 4.
Cargo Liquid Sampling Device	Liquid sampling	OCIMF, API STANDARD RESTRICTED WITH CLOSED SAMPLING OF LIQUID SAMPLING
Inert Gas Sampling Hose & Adapter	Oxygen and flammable gas concentration measuring	IMO REQUIREMENT ON TANKER SAFETY AND POLLUTION PREVENTION, 1978-RESOLUTION A.446(XI), 6.6
Pressure Gauge	Inert gas press. gauging	IMO REQUIREMENT ON TANKER SAFETY AND POLLUTION PREVENTION, 1978-RESOLUTION A.446(XI), 6.6(b)
Tank Bottom Liquid and Sediments Checking Device	Tank bottom dryness, & sediment checking	IMO REQUIREMENT ON TANKER SAFETY AND POLLUTION PREVENTION, 1978-RESOLUTION A.446(XI) 4.4.4
Shut On/Off Valve	Vapor lock Installation of portable tank measuring sys.	MARPOL 1973/78 ANNEX I, REGULATION 13b(3) SOLAS 1974,CHAP -2 REGULATION 60, PARAGRAPH 7 (REQUIREMENT OF CLOSED ULLAGE SYSTEM) MARPOL 1973/78 ANNEX I-CHAP II-REGULATION 15, (3) (B) AND SOLAS 1974,CHAP -2 REGULATION 62, PARAGRAPH 17

- IMO MEPC.5(XIII)**  
**ANNEX 4**  
**SPECIFICATION FOR OIL/WATER INTERFACE DETECTORS**

The instrument should be capable of providing a rapid and accurate determination of the oil/water interface in slop tanks and/or tanks where the separation of oil and water is effected and from which it is intended to discharge effluent direct the sea.

- MARPOL 73/78**  
**Chap. - Reg. 15, 3 (b)**

Effective oil/water interface detectors approved by the Administration shall be provided for a rapid and accurate determination of the oil/water interface in slop tanks and shall be available for use in other tanks where the separation of oil and water is effected and from which it is intended to discharge effluent direct to the sea.

### 3. Type of Potable Equipment for IBC BCH CODE

- IBC Code : (International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk)
- IBC Code-Chap. 17-Summary of Minimum Requirements  
Mixtures of noxious liquid substances presenting pollution hazard only and which are provisionally assessed under regulation 3 (4) of Annex II of MARPOL 73/78, may be carried under the requirements of the code applicable to the appropriate position of the entry in this chapter for 'noxious liquids, not otherwise specified'.
- IBC Code-Chap. 13-1.3.1 Gauging
  - 13.1.1 Cargo tanks should be fitted with one of the following types of gauging devices
  - 13.1.2 Gauging devices should be independent of the equipment required under 15.19
  - 13.1.3 Open gauging and restricted gauging should be allowed only where:
    - 1) open venting is allowed by the code; or
    - 2) means are provided for relieving tank pressure before the gauge is operated.
  - 13.1.4 Types of gauging for individual products are shown in column "j" in the table of Chapter 17.

Table of IBC Code- Chapter 13 Instrumentation-13.1 Gauging

Equipment Type	Function
1. OPEN DEVICE	Which makes use of an opening in the tanks and may expose the gauge to the cargo of its vapour. An example of this is the ullage opening.
2. RESTRICTED DEVICE	Which penetrates the tank and which, when in use, permits a small quantity of cargo vapour or liquid to be exposed to the atmosphere. When not in use, the device is completely closed. The design should ensure that no dangerous escape of tank contents (liquid or spray) can take place in opening the device.
3. CLOSED DEVICE	Which penetrates the tank, but which is part of a closed system and keeps tank contents from being released. Examples are the float-type systems, electronic probe, magnetic probe and protected sight glass. Alternatively an indirect device which does not penetrate the tank shell and which is independent of the tank may be used. Examples are weighing of cargo, pipe flow meter.

- BCH Code : (Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk)
- BCH CODE CHAP-III C-Gauging

3.9 General : Cargo tank should be fitted with one of the following types of gauging devices :

Table of BCH Code- Chapter III C-Gauging 3.9 General

Equipment Type	Function
1. OPEN DEVICE	Which makes use of an opening in the tank and may expose the gauge to the cargo or its vapour. An example of this is the ullage opening.
2. RESTRICTED DEVICE	which penetrates the tank and which, when in use, permits a small quantity of cargo vapour or liquid to be exposed to the atmosphere. When not in use, the device is completely closed. The design should ensure that no dangerous escape of tank contents (liquid or spray) can take place in opening the device.
3. CLOSED DEVICE	which penetrates the tank, but which is part of a closed system and keeps tank contents from being released. Examples are the float-type systems, electronic probe, magnetic probe and protected sight-glass.
4. INDIRECT DEVICE	which does not penetrate the tank shell and is independent of the tank. An indirect measurement for determining the amount of cargo is used such as weighing of cargo, pipe flow meter, etc.

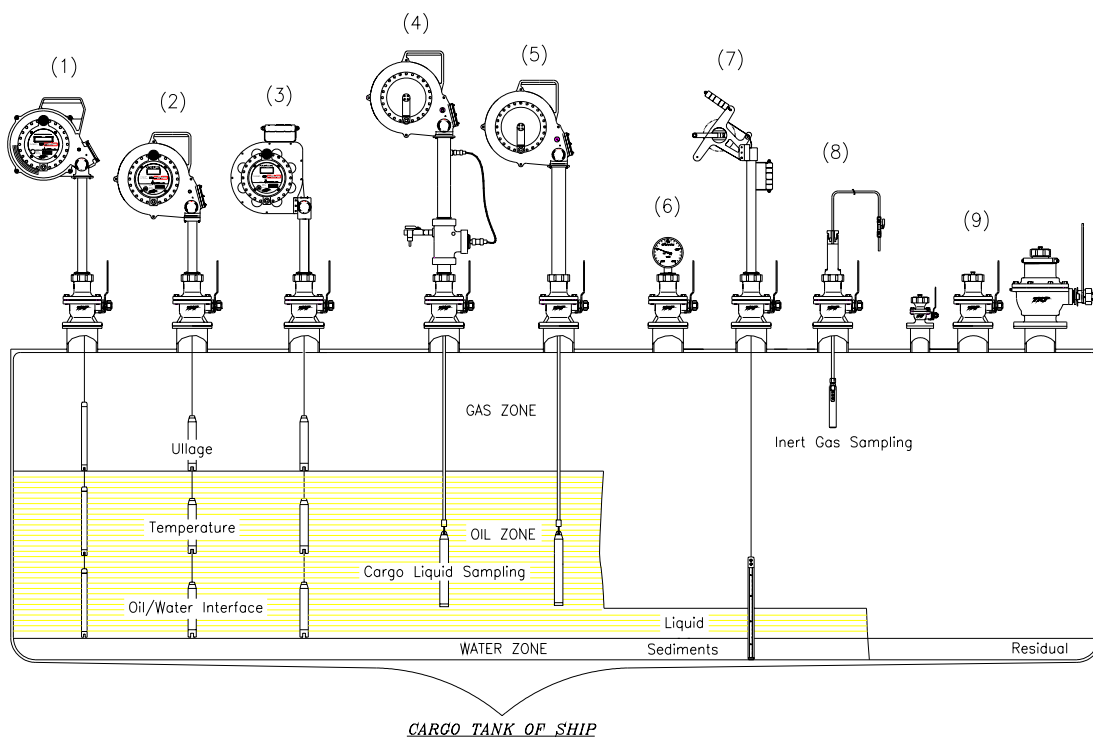
Gauging devices should be independent of the equipment required under 4.1 & 4.2 except for ships constructed prior to 27 September 1982 where the requirements of 4.1 & 4.2 are met by a shutdown valve which operates automatically.

#### 3.10 Gauging for individual substances

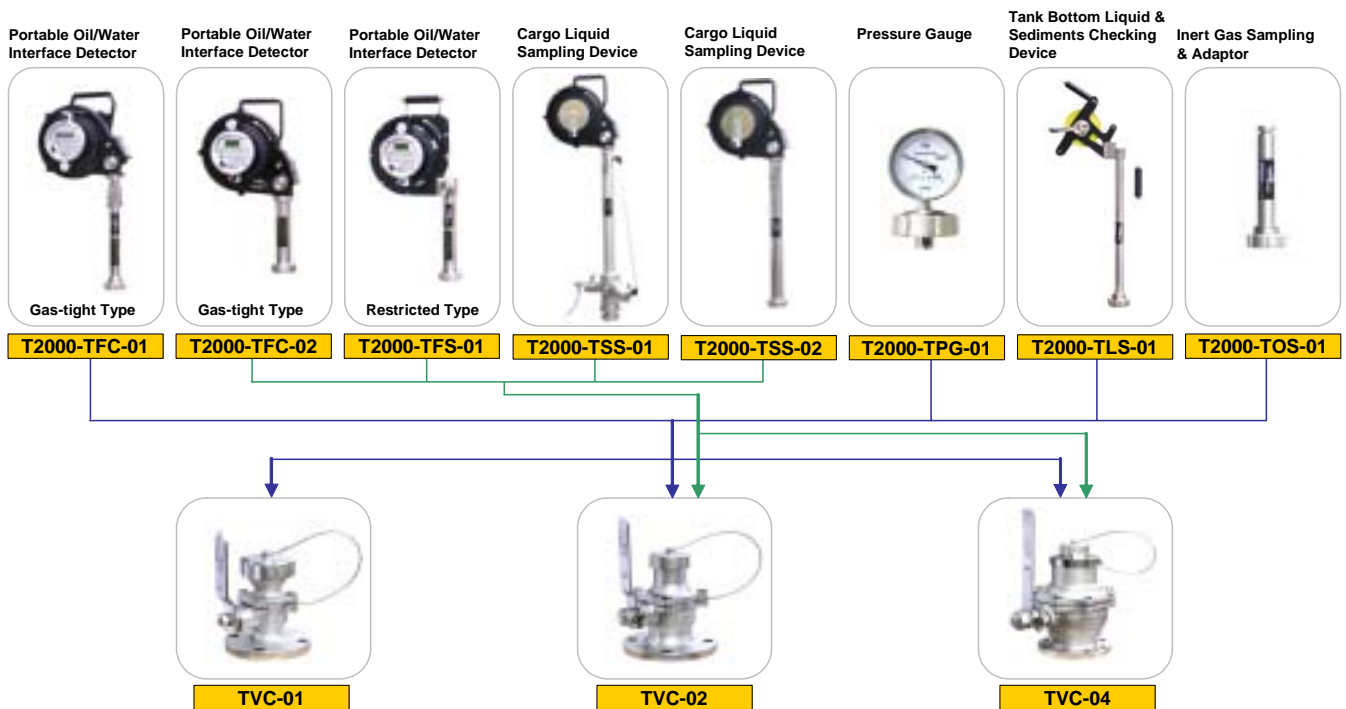
Types of gauging for individual substances are shown in column "j" of the summary of minimum requirements in chapter VI.

## 4. All Kinds of TANKTECH Portable Measuring System

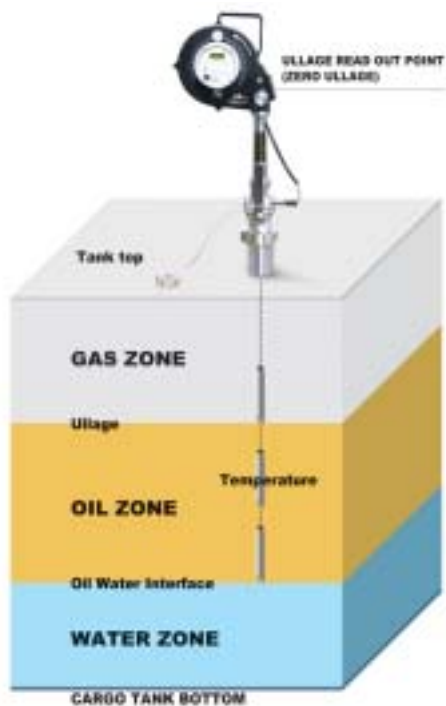
No.	Discription
1	Closed Type Portable Oil/Water Interface Detector for Ullage, Oil/Water Interface & Temperature gauging (MODEL : T2000-TFC-01)
2	Closed Type Portable Oil/Water Interface Detector for Ullage, Oil/Water Interface & Temperature gauging (MODEL : T2000-TFC-02)
3	Restricted type Portable Oil/Water Interface Detector for Ullage, Oil/Water Interface & Temperature gauging (MODEL : T2000-TFS-01)
4	Gas Tight Type Cargo Liquid Sampling Device (MODEL : T2000-TSS-01)
5	Closed Type Cargo Liquid Sampling Device (MODEL : T2000-TSS-02)
6	Inert Gas Press Gauge (MODEL : T2000-TPG-01)
7	Tank Bottom Dryness (Hand Dipping) Checking Device (MODEL : T2000-TLS-01)
8	Inert Gas Sampling Hose & Adaptor (MODEL : T2000-TOS-01)
9	Shut On/Off Valve (Vapor Control Valve) (MODEL : TVC-01, TVC-02, TVC-04)



## 5. Installation Chart for TANKTECH Portable Measuring System



## 6. Three Functions



1. Detection of Ullage
2. Detection of Interface
3. Temperature measurement

## CLOSED TYPE PORTABLE OIL/WATER INTERFACE DETECTOR

### FOR ULLAGE, OIL/WATER INTERFACE, TEMPERATURE GAUGING

## 7. Specification for Portable Oil/Water Interface Detector

### 7-1. General Description

TANKTECH's Portable Oil/Water Interface Detector, T2000 series offer the total solution for management of cargo in tanks. This device can detect and measure the **Ullage**, **Oil/Water Interface** and **Temperature** of cargo at the same time.

### 7-2. Model : T2000-TFC-02

Accuracy of ullage, interface detection	±2 mm
Indication of level divided by ullage and interface	Visible and Audible
Tape length	15M / 30M /40M
Tape graduation	Metric
Tape resolution	1 mm
Diameter of probe	34 mm
Minimum detectable level	8 mm
Ambient temperature range	-20 to 70
Temperature sensor measurement range	-20 to 110
Temperature measurement resolution	0.1
Accuracy over calibration range	±0.1 ( 0 to 60 )
Temperature reading mode	(Celsius) or
LCD display	4-7 Segment
Ball valve coupling (Top mounting of model : TVC-02 )	<b>PF 2-1/4" TAP</b>
Weight	8.1 kg / 30M
Overall dimensions (height x width x thickness)	APP. 585 x 346 x 150 mm
Battery	9 Volt ( <b>MODEL : MN1604</b> )
Intrinsically safe type	<b>Ex ia IIB T4</b>

### 7-3. Material

MODEL : T2000-TFC-02 ( Body ) ----- : Aluminum casting ( JIS – AC4C-T6 )

### 7-4. Coating

IN / OUT SIDE ----- : Epoxy nylon coating  
 COLOR ----- : Black  
 THICKNESS ( IN/OUT SIDE ) ----- : 80mic.



## CLOSED TYPE PORTABLE OIL/WATER INTERFACE DETECTOR FOR ULLAGE, OIL/WATER INTERFACE, TEMPERATURE GAUGING

### 8. Operating Process for Portable Oil/Water Interface Detector

#### 8-1. General description

Thank you for purchasing TANKTECH Portable Tank Measuring equipment.

Our products will make marine cargo tank gauging more efficiently.

Our PMS reflects the three requisites for good management: economical price, user's safety, and environmentally friendly.

Before using our products use, Please carefully read this manual. By doing so, proper handling of the equipment can be ascertained.

#### 8-2. About mark of the manual

This manual is written with [Warning] and [Caution] markings. These are important for a safe operation. These precautions stress the important matter for the prevention of the physical accident and possible damage to the equipment.



**Warning :** When wrong use of equipment may cause body harm to user.



**Caution :** When wrong use of equipment may cause damage to the set.

#### 8-3. Application for model : T2000-TFC-02



**Model : T2000-TFC-02**

#### 8-4. Location & Function of Controls

1. Carrying Handle
2. Tape Reading Window.
3. Cleaning Adaptor : When rewinding the tape from the tank, to clean tape, rotate this wheel clockwise to the arrow indicates "ON". When letting down the probe into the cargo tank, knob show be turned towards the arrow indicating "OFF".
4. Rotating handle & push stopper for measuring and rewinding
5. Tape Reading Point (Ullage Read Out Point)
6. Sounding Tape : Non-corrosive tape scale coated by ETFE
7. Buzzer : Audible & distinguishable sound of Gas, Oil & Water
8. LCD Display
9. Display Panel
10. Power Switch
11. Tape Protection Device
12. Sensor Probe
13. Frame (Storage Barrel)
14. Grounding clamp for static discharge

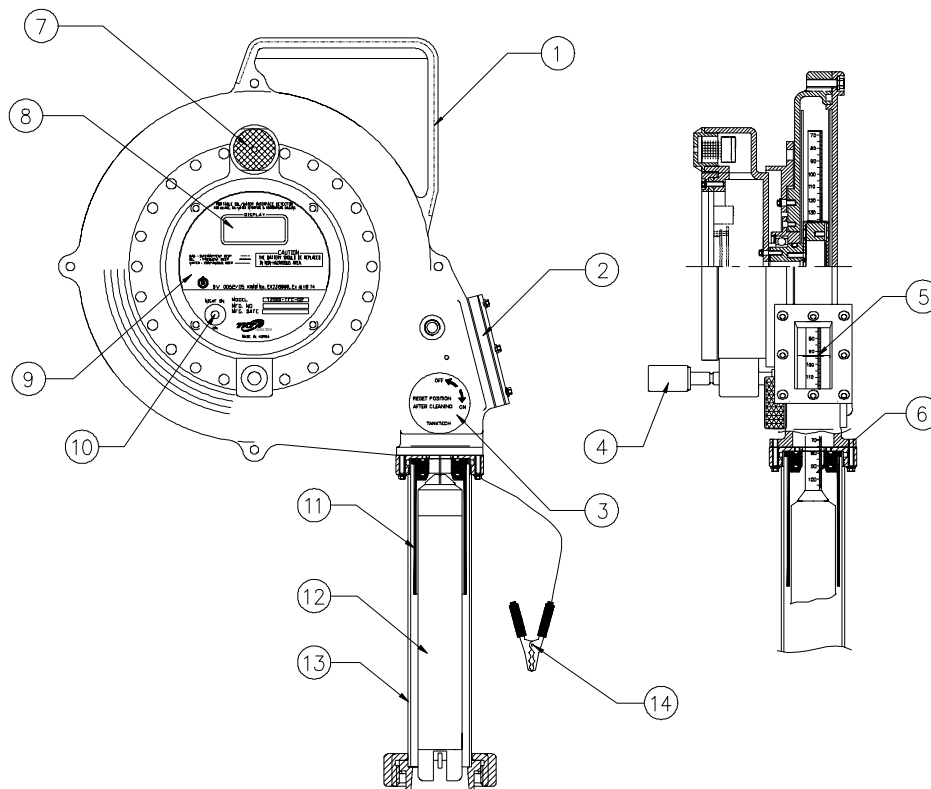


Fig 1. Location & Function

### 8-5. Temperature display mode selector switch.

Also temperature display can be selected from two mode,  $^{\circ}\text{C}$  and  $^{\circ}\text{F}$ , by the inside slide switch. If display mode changing is required, loosen the all screws of front panel and you will find the slide switch.

The temperature display mode should be changed in non-hazardous area.

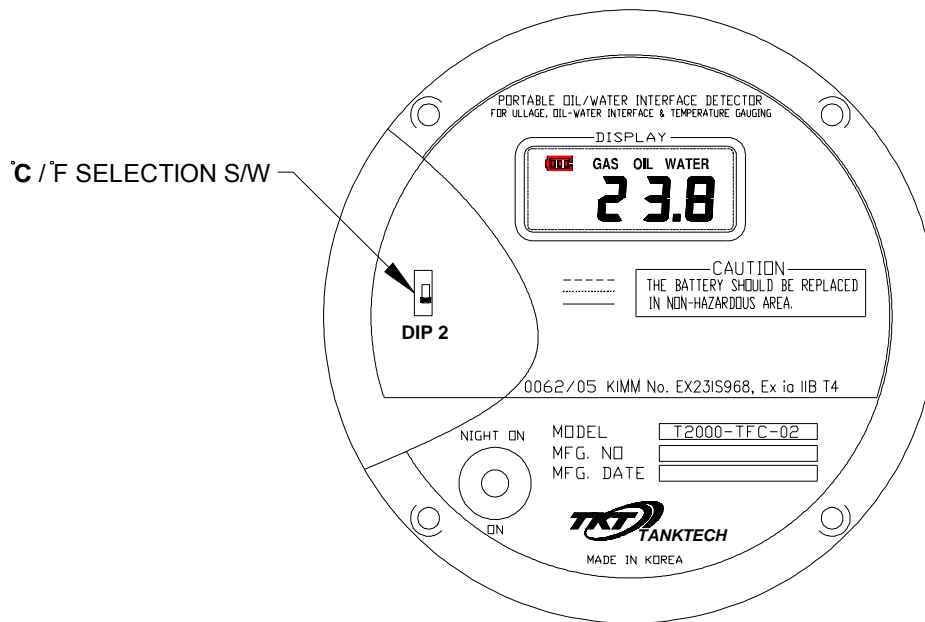


Fig 2. Select S/W for Temperature

### 8-6. Low battery warning.

When the battery is almost used up and it have to be exchanged, a warning is turned on and off repeatedly in left side of first line as Fig 3. For the accurate measurement, it is desirable that the battery is replaced immediately after the warning is displayed.



**The battery should be replaced in non-hazardous area.**

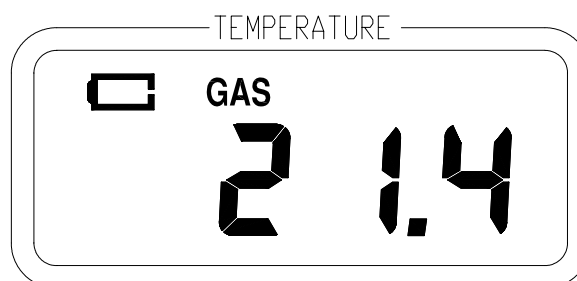


Fig 3. Low battery warning

### 8-7. Tape

The tape of T2000 series consist of steel tape and two electric wires. Also, they are coated with ETFE. This ETFE is a kind of teflon and not corroded by almost all kinds of chemical as well as crude oil.

The electric wires are used for transferring the data acquired by sensors to the display part on the deck. And the electric power for sensors travels to the probe through the steel tape. Also, the steel tape is strong enough to bear the live load of probe. Therefore it has the function as protector of the electric wires from breaking.

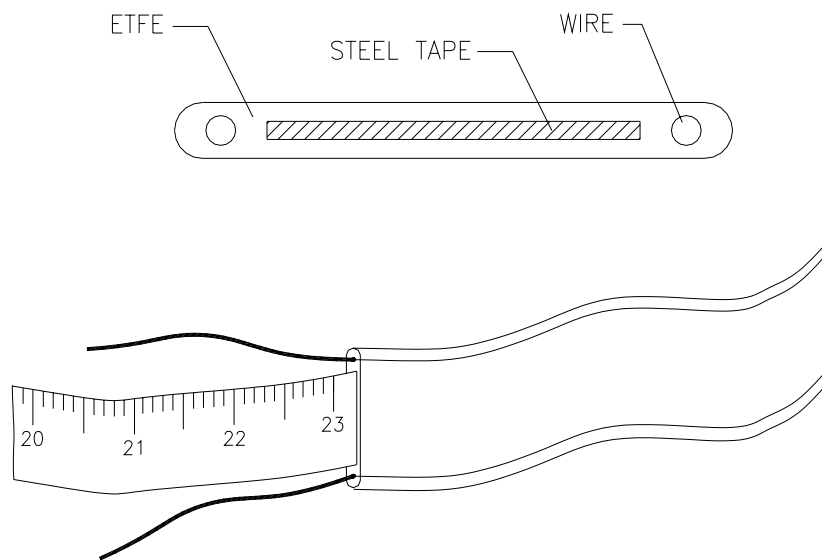


Fig 4. Detail electric wire & Tape

## 8-8. Detection Principles for the accuracy and safety of measurement

### 1. General

Portable oil/water interface detector of TANKTECH is a portable tank measuring Instrument to detect the Ullage, the interface and the temperature. User can know the surrounding environments of the sensor probe and the temperature by the beep and the indication of the LCD.

User is able to measure the depth of the oil tank by the reading of the measuring tape too.

The measurement of the Ullage and the oil/water interface is used the ultrasonic sensor and the conductive bar, the beeps are indicated the surrounding environments of the sensing probe. Measure continuously the oil temperature in tank and indicate the temperature on LCD.

The sources is used the DC 9V alkaline battery.

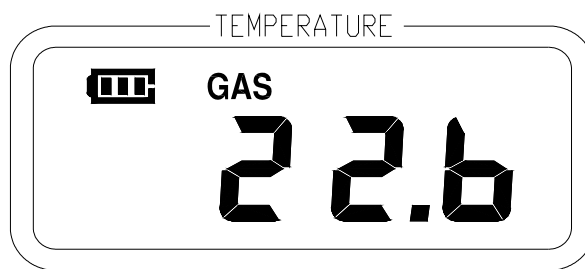


Fig 5. LCD display

### 2. Detection of Ullage

This is the detection method by the difference of ultrasonic receiving signal according to acoustic impedance.

1. Ullage Level (Gas-Oil Boundary) Detection Device : Ultrasonic Sensor
2. Detection : Be determined the output of the receiver sensor, according to the acoustic impedance of the oil and the gas. The medium is between the transmitter and the receiver

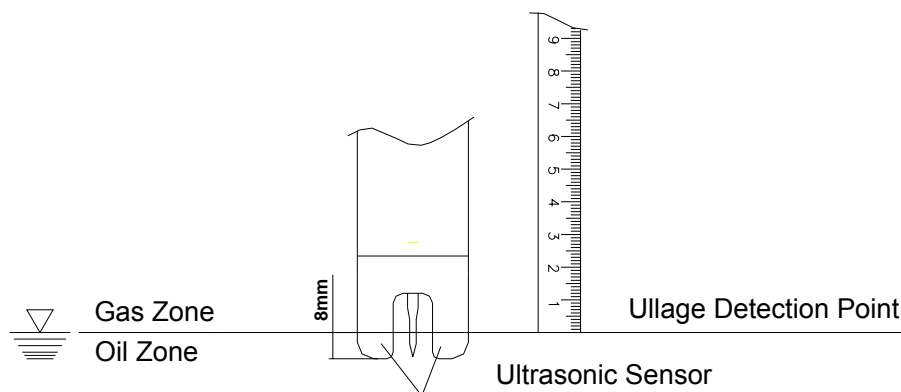


Fig 6. Ullage detection point

## 8-8. Detection Principles for the accuracy and safety of measurement

### 3. Detection of Interface

This is the detection method by the difference of voltage according to conductivity of water.

1. Interface Level (Oil-Water Boundary) Detection device Interface bar and temperature bar
2. Detection : Use to the conductivity of the water

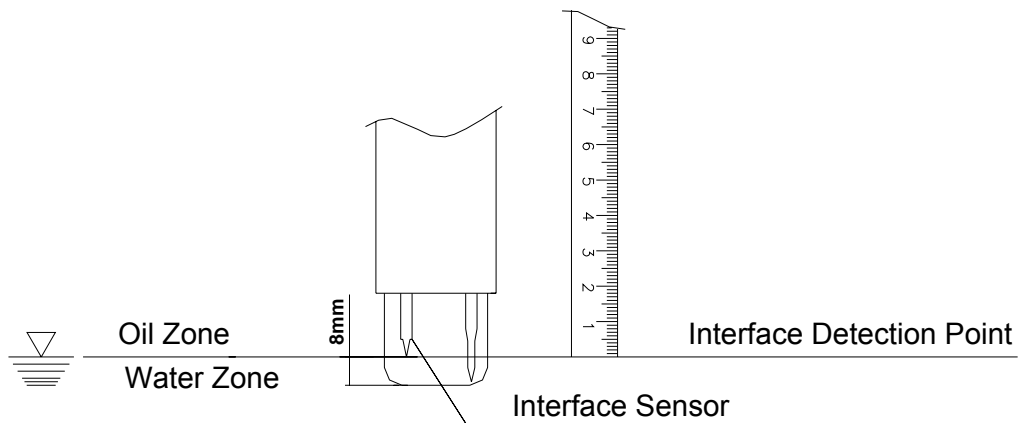


Fig 7. Interface detection point

### 4. Temperature sensor

The PMS tape uses the PT100Ω RTD (Resistance Thermometer Device) instead of the thermistor or semi-conductor thermal sensor. The reason for using RTD is explained below first with a linear change in resistance over temperature.

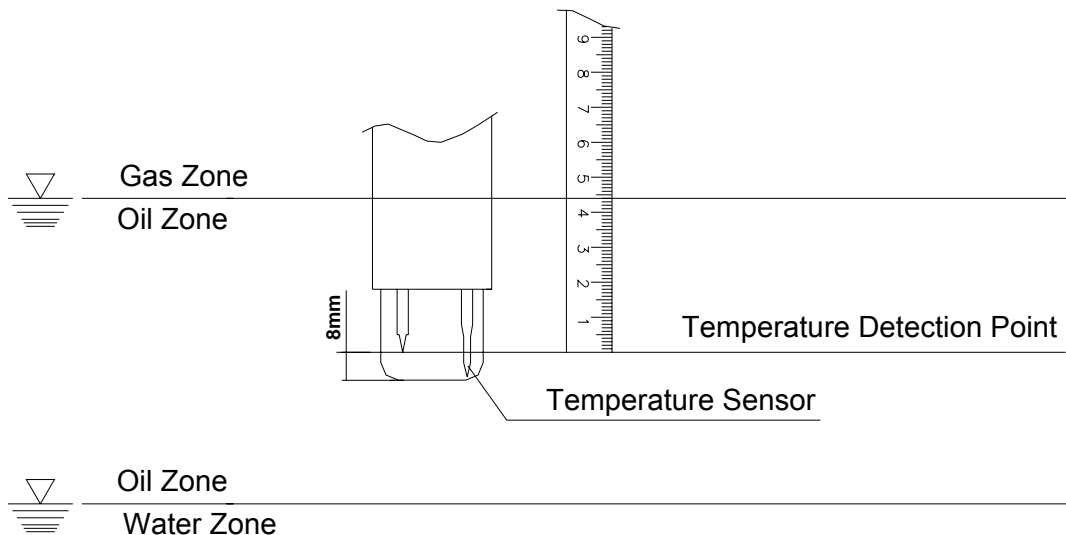
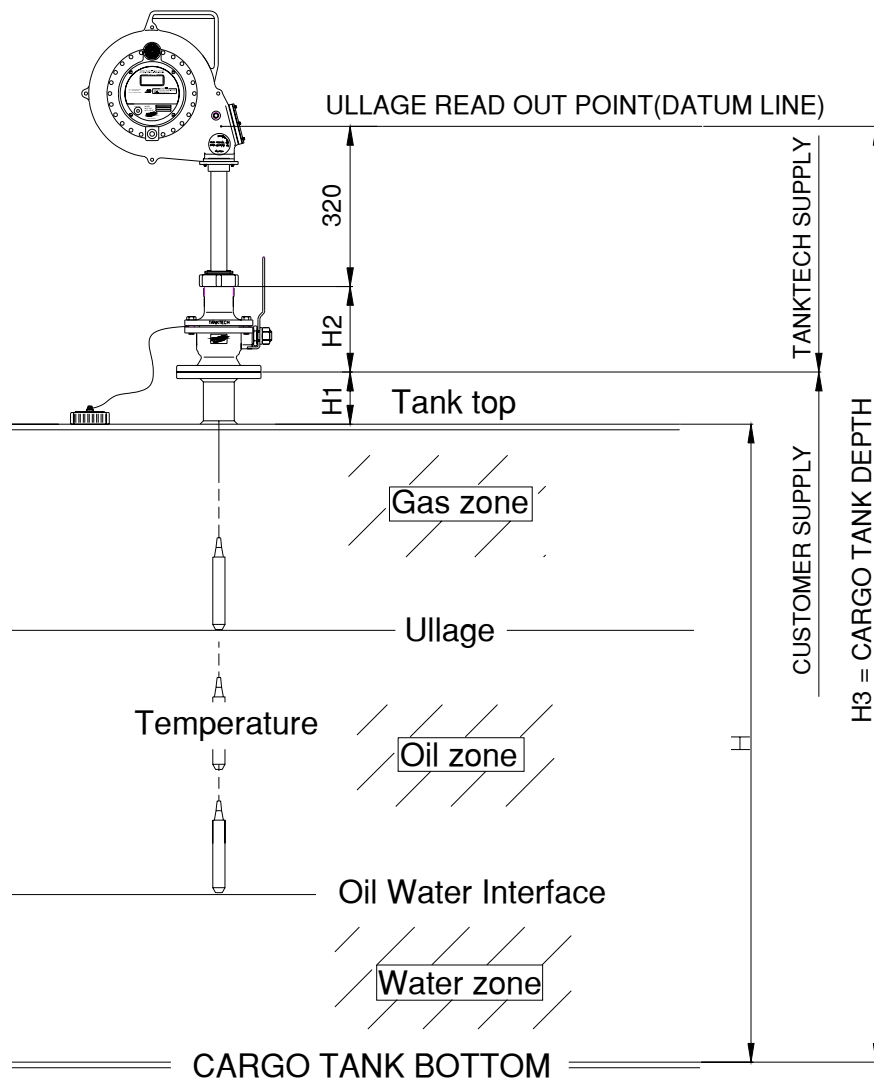


Fig 8. Temperature detection point

## 8-9. Reading Ullage and Interface



DIMENSION					(UNIT : mm)
MODEL	I.D	H1	H2	H3	REMARK
TVC-02	50	*	180	$H3=H+H1+H2+320$	

1. \* FILL OUT BLANK BY CUSTOMER SCOPE
2. DIMENSION H2 IS WITHOUT GASKET(Gasket is Customer Scope)

Fig 9. Reading Ullage & Interface

### 8-10. Installation & Measurement method

Remove the cap of the shut on-off valve, Install the oil/water interface detector at 2" shut on-off valve of TANKTECH CO. LTD.

When sensing part descend by reel, display part emits beep and indicates the surrounding environment of the oil storage tank on the LCD.



**MODEL TVC-02 Shut On/Off valve (Gauging Station) installed on tank top.**

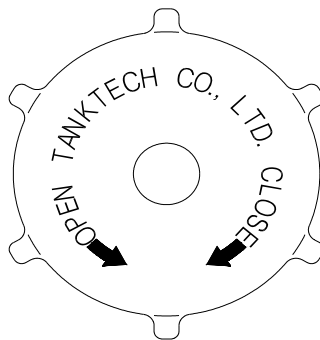


Fig 10. Direction for Open & close of cap

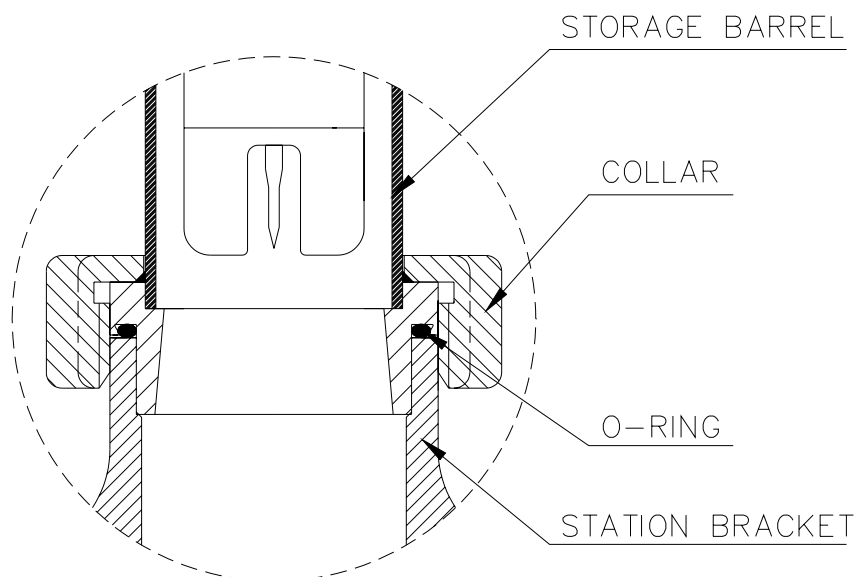


Fig 11. Detail of seal



## 8-10. Installation & Measurement method

1. If user wants to measure the environment of the oil storage tank by equipment, has to ground with the grounding cable at the tank after installation.

Connect the grounding cable at the tank before removing equipment.

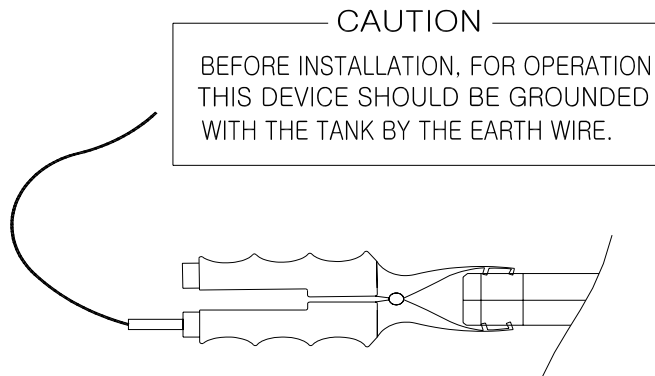


Fig 12. Connect the grounding cable

2. Power switch on, check the initial state of the LCD screen and "BAT" indication.



**Indicated low battery on LCD, change battery only in non-hazardous area.**

Table of Separate zone

	Position of detection	Beep	LCD Indication
Intermittent beep	Gas zone	--- --- ---	GAS
Frequent beep	Oil zone	-----	OIL
Continuous beep	Water zone	-----	WATER

## 8-10. Installation & Measurement method

### \* Measurement of the Ullage and the Oil/Water Interface

3. Toggle switch on, indicate "GAS", the buzzer emits intermittent beeping sound.

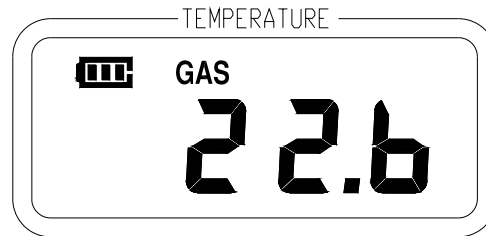


Fig 13. LCD display

4. Pull the Deck Valve lever to open position (in parallel with pipe).

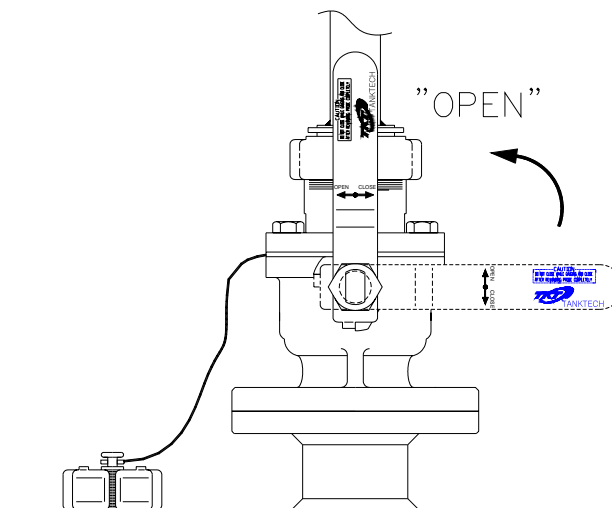


Fig 14. Open handle position

5. Pull the Deck Valve lever to open position (in parallel with pipe).

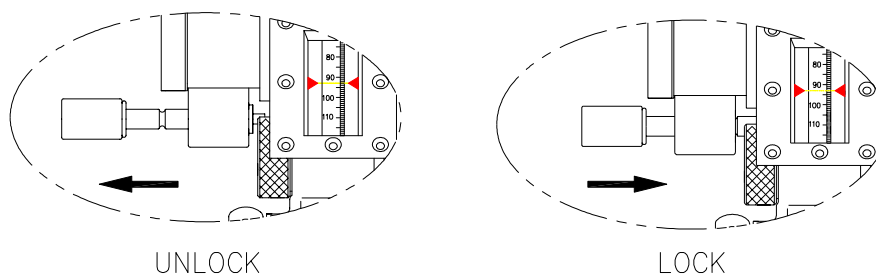


Fig 15. Reel handle breaker

6. Lower the sensor until it touches the cargo. Display will change to "OIL" on LCD and emit frequent beep, start reading the scale through transparent window. The correct reading is above the bar.

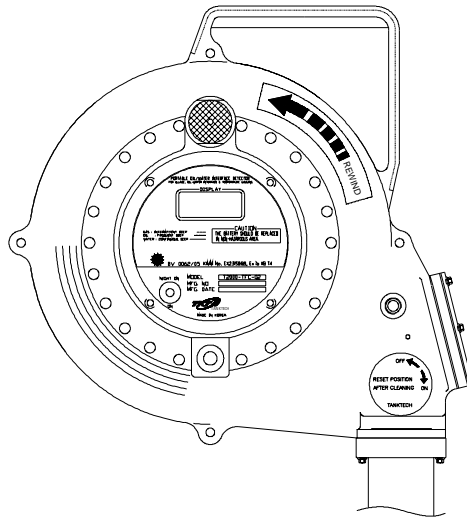


Fig 16. Arrow shows the direction to rewind

7. Pull the tape up and down slightly to determine the exact reading point on the tape.
8. Further down in the slop tank as it senses water, display changes to "WATER" on LCD and buzzer emits continuous beep start reading the scale the transparent window.



**Please read out above line of tape reading bar.**

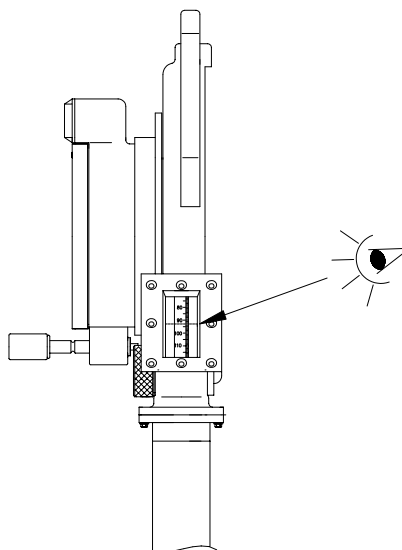


Fig 17. View of Ullage, Interface read out point

**\* Temperature measurement**

9. Temperature measurement is simultaneous and continuous, without the need to switch over.

10. The value is in degree Celsius( ) on LCD as our standard supply. However if user wants the reading to be in degree Fahrenheit( ), he may request for change of temperature mode in the purchase order.

**\* Rewinding work after measurement**

11. Turn the wiper knob to cleaning position indicated by arrow. Wind the reel slowly in anti-clockwise direction. Check cleaning state of measuring tape through transparent window.

**RESET POSITION AFTER CLEANING.**

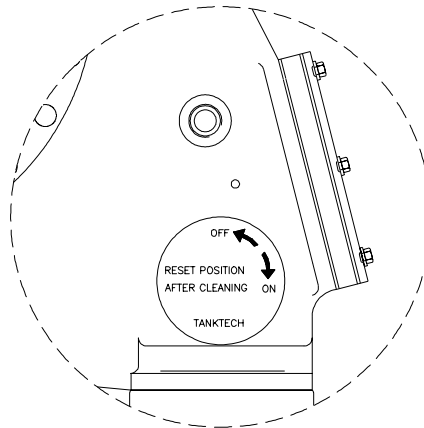


Fig 18. Tape Cleaner

12. Tape protection device from the cut by careless valve closing.

Sensor probe will be inserted to the protection pipe during tape rewinding and this protection device will be completely protected by the tape.

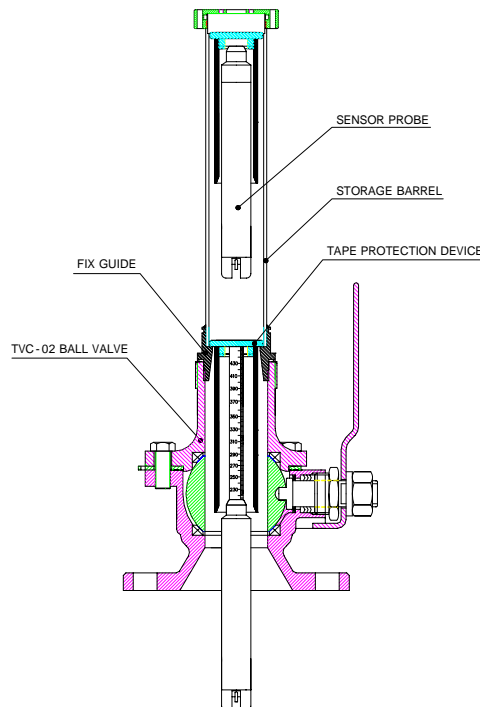


Fig 19. Tape protection device

## CLOSED TYPE PORTABLE OIL/WATER INTERFACE DETECTOR FOR ULLAGE, OIL/WATER INTERFACE, TEMPERATURE GAUGING

### 9. Troubleshooting for Portable Oil/Water Interface Detector

#### SYMPTOMS

##### 1. DEAD SET – No indication on the display, no beeping sound.

- A. Check battery – Voltage above 6V ?
- B. If yes – Check the fuse at Display PCB (Left of the LCD Display).
- C. If fuse is good – Check Power Supply Regulator circuit and shut-circuit the wire and tape (Include probe).
- D. If fuse is blown – Always replace genuine spare parts from TANKTECH. We will not be responsible if alternative parts other than those of our supply are used.

##### 2. DISPLAY is reading Temperature – No beeping sound.

- A. Check buzzer and connecting cables with Ohm meter.
- B. If continuity is OK, check cables and connectors.
- C. If the reading is infinity, check buzzer and replace buzzer.
- D. Check cables and connector.

##### 3. DISPLAY reads “ERROR”.

###### 3.1 CHECK CABLE CONNECTIONS TO THE PROBE

- i. Remove the Red and Yellow cable from the connector at Display PCB.
- ii. Check resistance between Red and Yellow cable with Ohm meter. Reading at ( )KΩ.
- iii. Reverse the Resistance probe (from Meter) and check again the Ohm reading at ( )KΩ.

###### 3.2 If both readings indicate infinity, there is a possibility that the tape is broken.

- 3.2.1 Remove the probe connection.
- 3.2.2 Check continuity between wire at display connector and the probe to verify this assumption.

###### 3.3 If any one of the cables is open circuit (infinity reading), proceed to confirm tape.

- 3.3.1 Check the tape connections from the HUB to confirm that tape is cut.

###### 3.4 If the tape is confirmed cut, proceed to replace the tape. (see tape replacement process).

###### 3.5 If the tape is OK. Proceed to check gland cable connection between connection HUB and display side. Slacken the tape winding to the hub by turning lever clockwise against the ARROW.

###### 3.6 Check the soldered connections inside the HUB: Red, Yellow and Black wires.

- 3.6.1 If the connections are broken, solder the wires as: Red top, Black middle and Yellow bottom (Scale facing).
- 3.6.2 If the wires are wrong, swap positions and test.
- 3.6.3 Replace shrinking tubes (3mm dia. for wires and 13mm dia. for tape) before soldering.

###### 3.7 To remove wire from connector, push the latch pin with jewel screwdriver and pull out wire from plastic connector.

###### 3.8 Use Ohm meter to check continuity between tape wires and connector.

#### **4. DISPLAY IS DIM – BUT ALL OTHER FUNCTIONS ARE OK.**

- 4.1 Check the LCD Contrast Adjustment on the Display PCB.
- 4.2 Warning ! Do not adjust VR1(DISPLAY PCB) – for LOW BAT indication. The VR1 is set with precision Voltage Generator and adjusting without this equipment is not permitted!

#### **5. POOR SENSITIVITY OF CONDUCTIVITY ELECTRODES**

- 5.1 Clean the electrodes with fine sandpaper and alcohol, as it may be coated with alien substance, which causes the reduction of its conductivity reading.  
CAUTION ! Do not use high abrasive tools such as a file to clean.

#### **6. ABNORMAL CHARACTERS APPEAR ON THE LCD SCREEN**

- 6.1 The cause may be due to intense electromagnetic interferences.
  - Turn off the power and wait for 3 seconds to reset the system, then on again.

#### **7. TAPE DOES NOT GO DOWN INTO THE TANK**

- 7.1 There is too much friction between the tape and wiper.
  - ◆ Check the wiper in OFF Position before lowering tape.
  - ◆ Loosen the TEFLON / VITON gland seal located at the top of the Storage Tube to allow more freedom of movement for the tape.