

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)
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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 II -2 REGULATION 60 PARAGRAPH 7 IMO, MSC/Circ.551 (IBC BCH CODE)
	Temperature gauging	
	Oil-water interface level	MARPOL 73/78 ANNEX I -CHAP II - 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 II -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 II -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. -II 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.

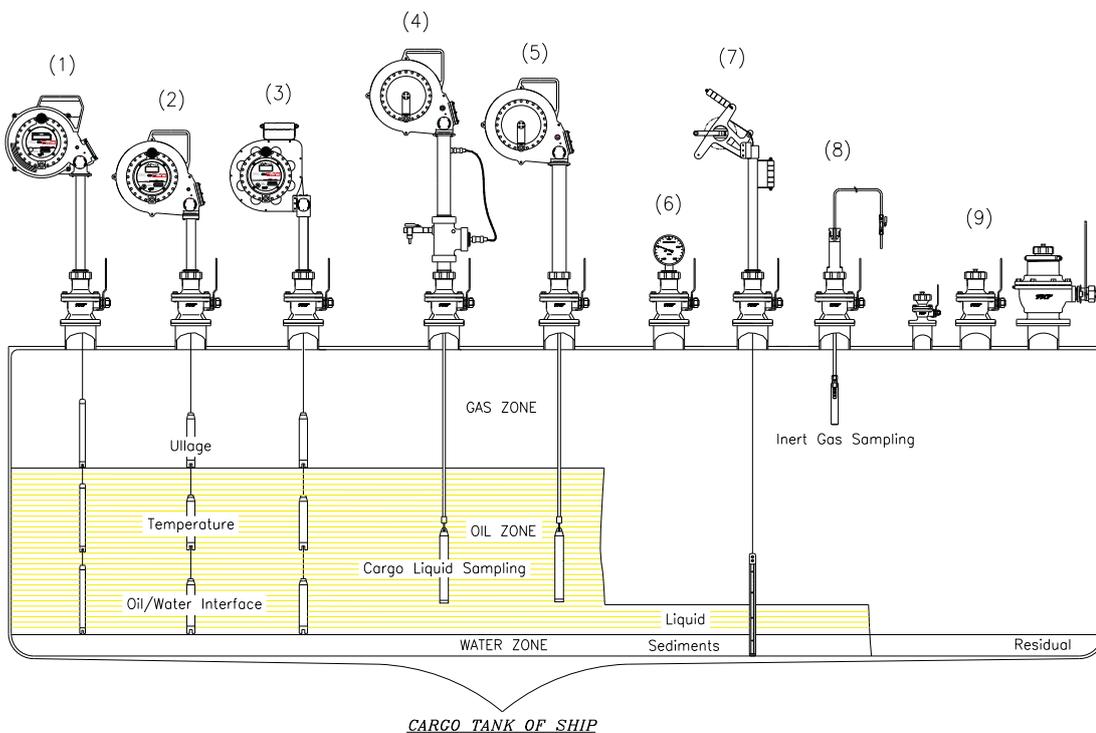
Gauging devices should be independent of the equipment required under 4.1 & 4.2 except for ships constructed prior to 27 September 1982 where the requirements of 4.1 & 4.2 are met by a shutdown valve which operates automatically.

3.10 Gauging for individual substances

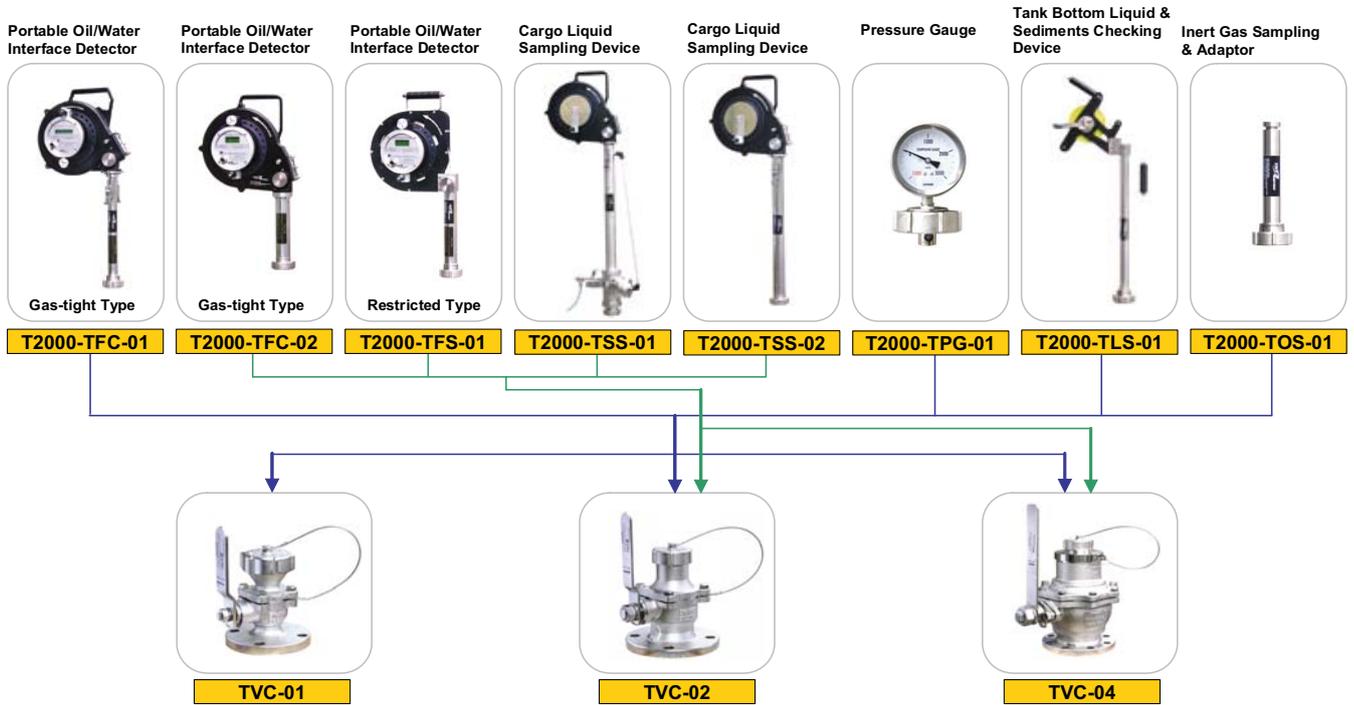
Types of gauging for individual substances are shown in column “j” of the summary of minimum requirements in chapter VI.

4. All Kinds of TANKTECH Portable Measuring System

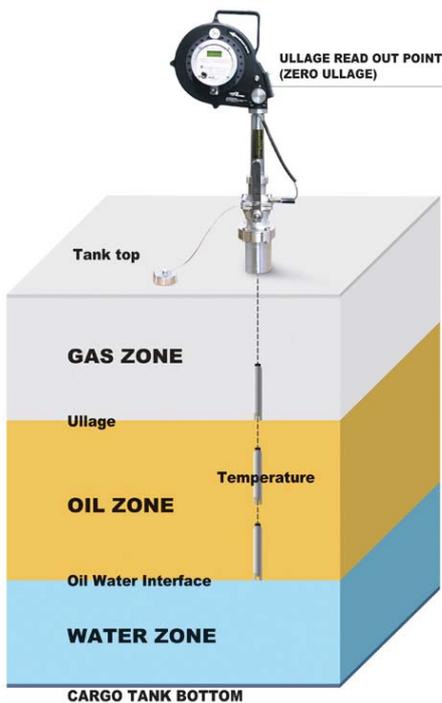
No.	Discription
1	Closed Type Portable Oil/Water Interface Detector for Ullage, Oil/Water Interface & Temperature gauging (MODEL : T2000-TFC-01)
2	Closed Type Portable Oil/Water Interface Detector for Ullage, Oil/Water Interface & Temperature gauging (MODEL : T2000-TFC-02)
3	Restricted type Portable 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°C to 70°C
Temperature sensor measurement range	-20°C to 110°C
Temperature measurement resolution	0.1°C
Accuracy over calibration range	±0.1°C(0°C to 60°C)
Temperature reading mode	°C(Celsius) or °F
LCD display	4-7 Segment
Ball valve coupling (Top mounting of model : TVC-02)	PF 2-1/4" TAP
Weight	8.1 kg / 30M
Overall dimensions (height×width×thickness)	APP. 585×346×150 mm
Battery	9 Volt (MODEL : MN1604)
Intrinsically safe type	Ex ia IIB T4

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

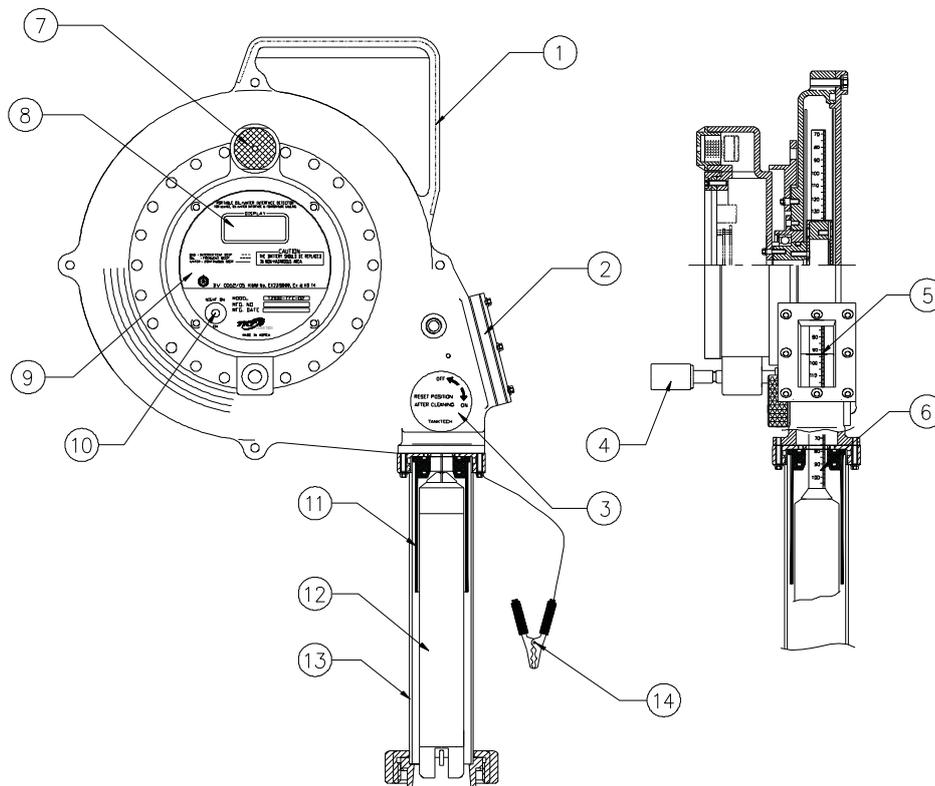


Fig 1. Location & Function

8-5. Temperature display mode selector switch.

Also temperature display can be selected from two mode, °C and °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.

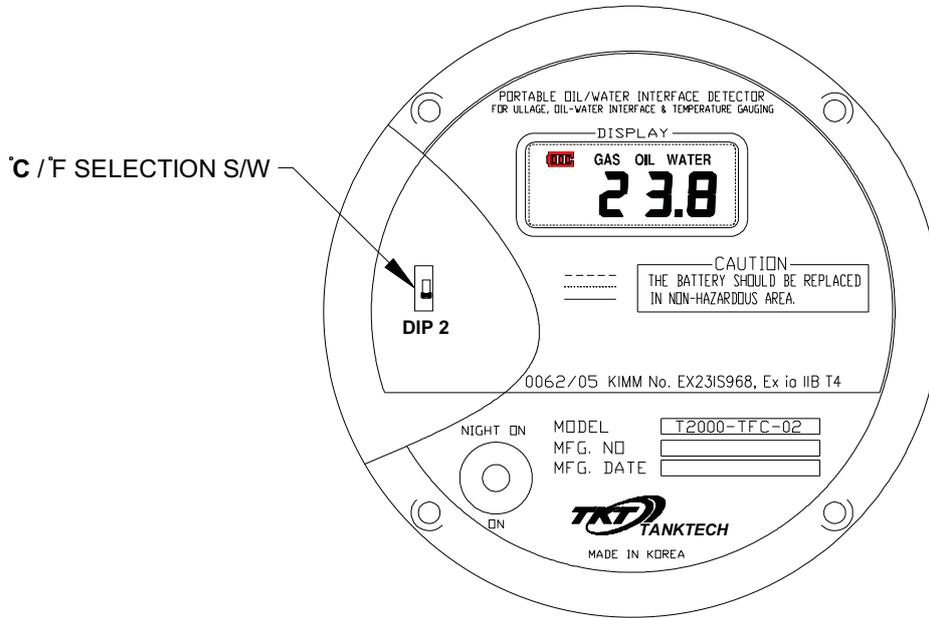


Fig 2. Select S/W for Temperature

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.

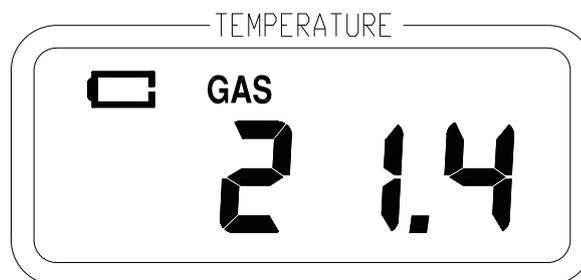


Fig 3. Low battery warning

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.

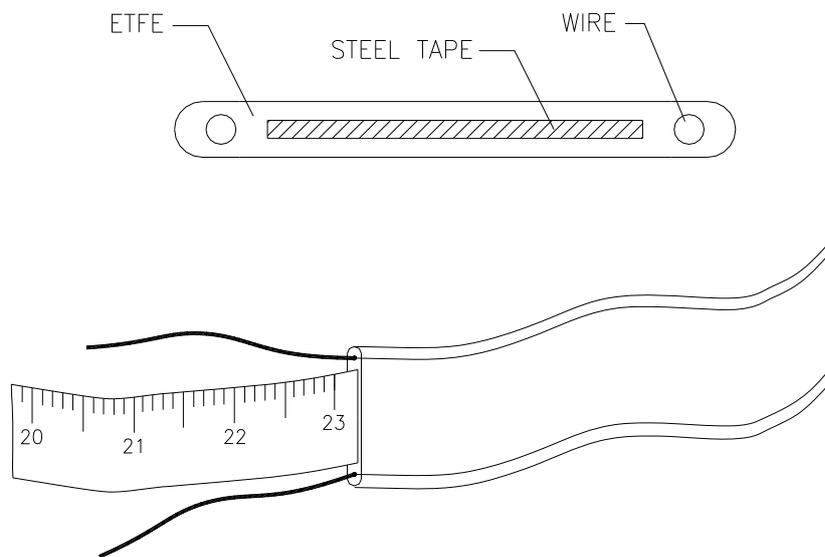


Fig 4. Detail electric wire & Tape

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.

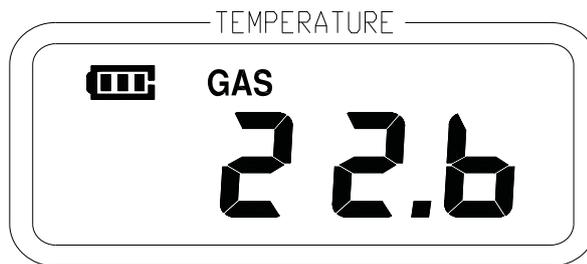


Fig 5. LCD display

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

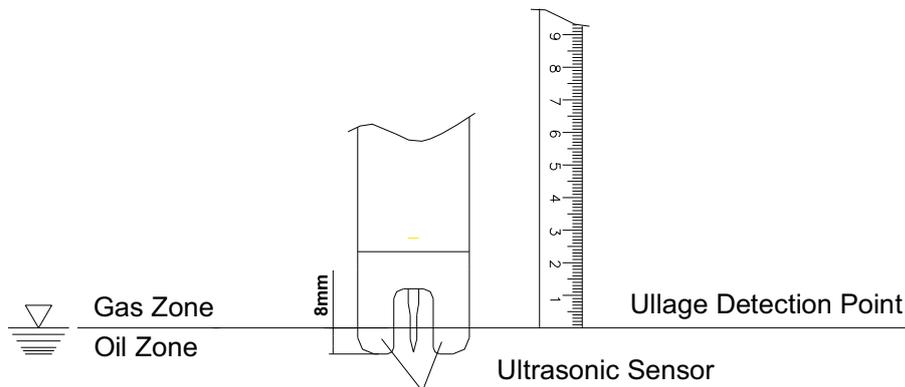


Fig 6. Ullage detection point

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

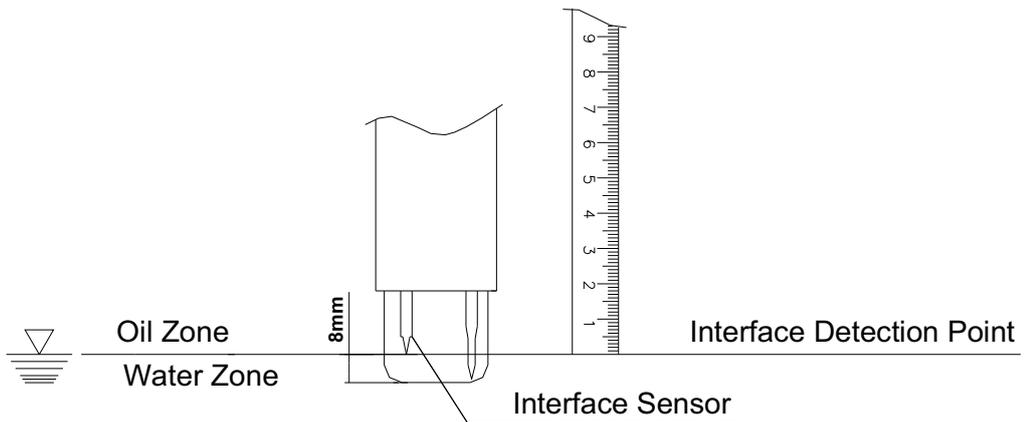


Fig 7. Interface detection point

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.

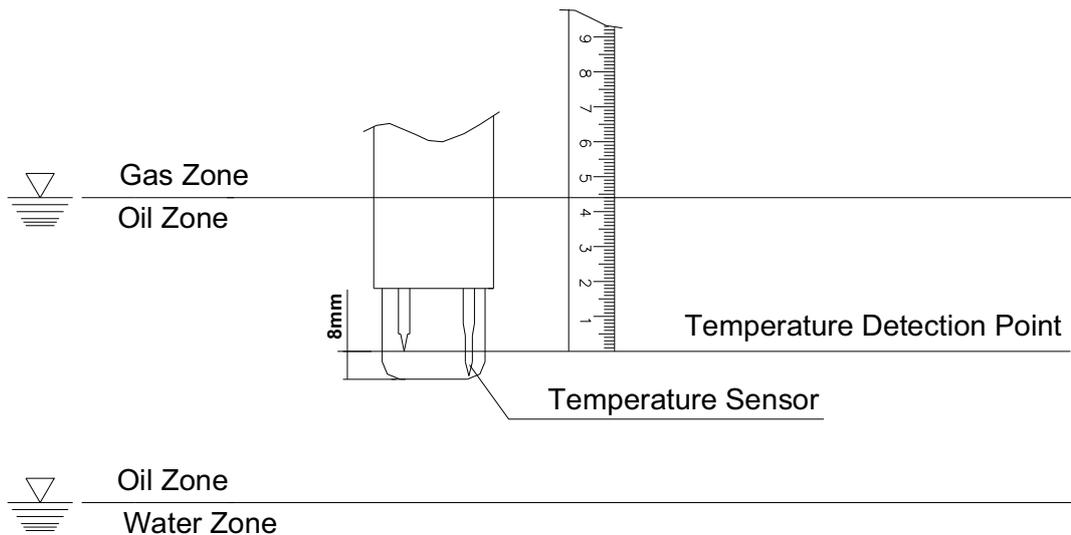
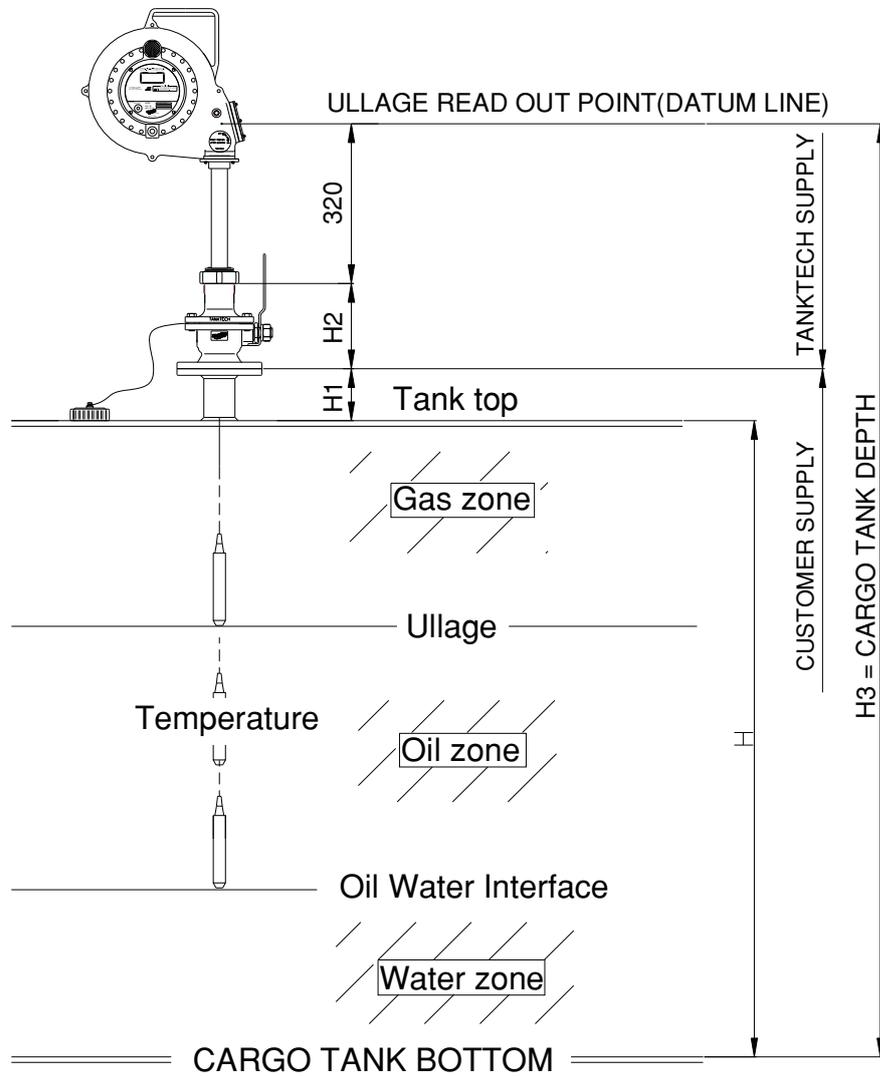


Fig 8. Temperature detection point

8-9. Reading Ullage and Interface



DIMENSION (UNIT : mm)

MODEL	I.D	H1	H2	H3	REMARK
TVC-02	50	*	180	$H3=H+H1+H2+320$	

- * FILL OUT BLANK BY CUSTOMER SCOPE
- 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.**

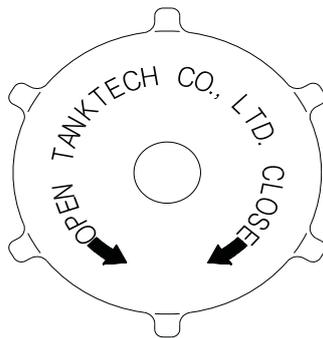


Fig 10. Direction for Open & close of cap

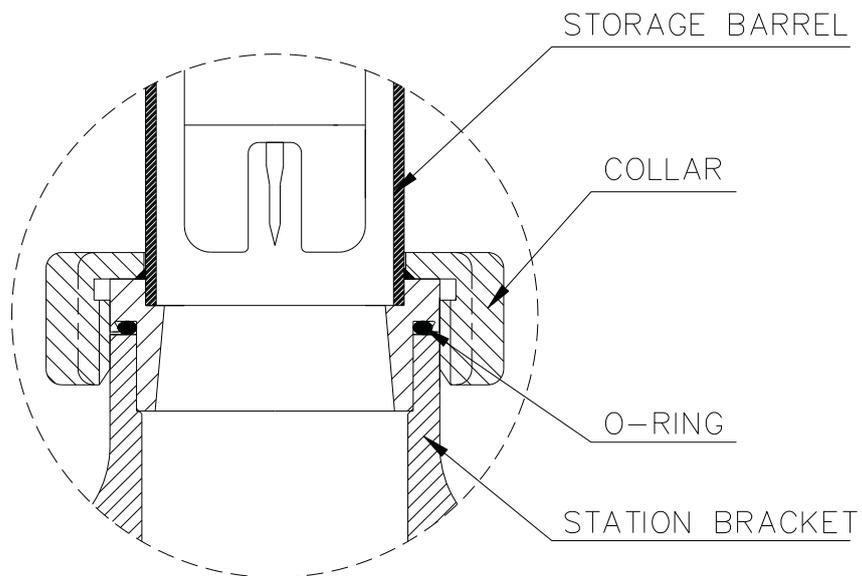


Fig 11. Detail of seal

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.

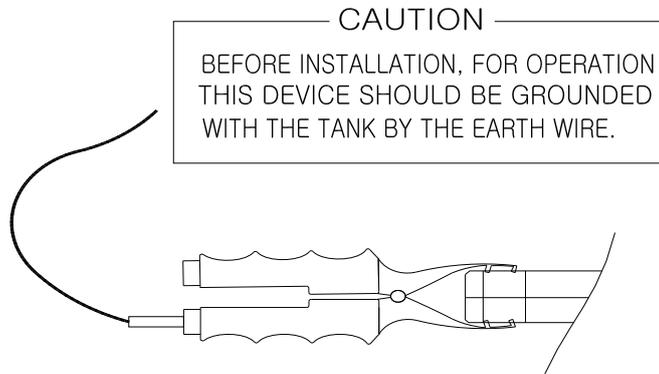


Fig 12. Connect the grounding cable

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.

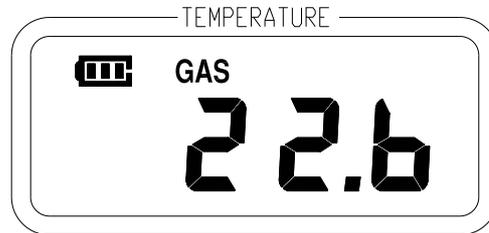


Fig 13. LCD display

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

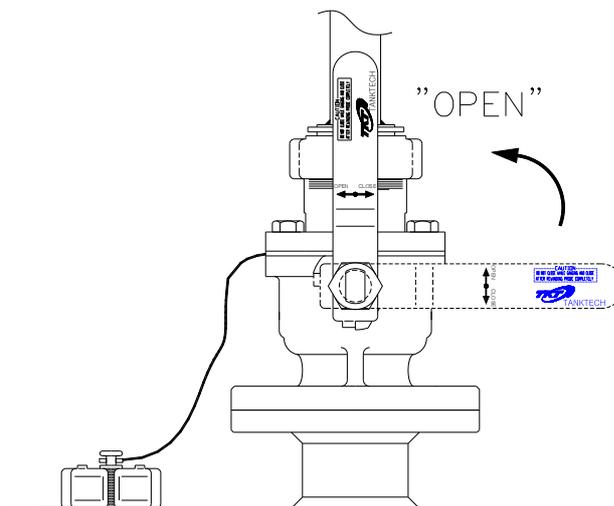


Fig 14. Open handle position

5. Pull the Reel handle breaker then control the Reel.

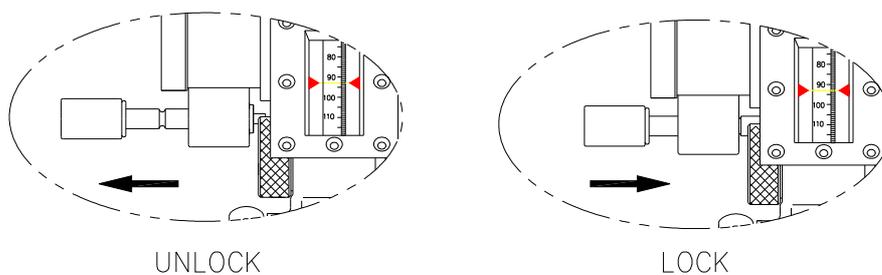


Fig 15. Reel handle breaker

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.

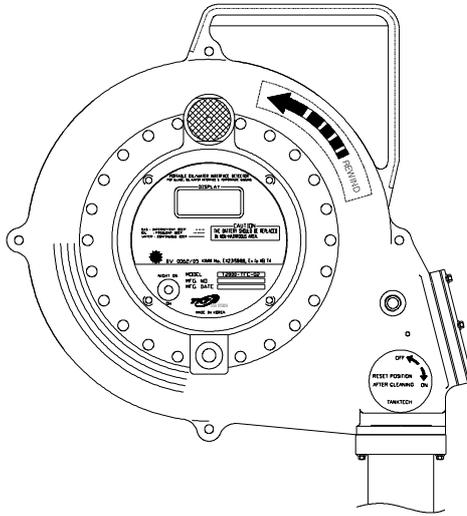


Fig 16. Arrow shows the direction to rewind

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.**

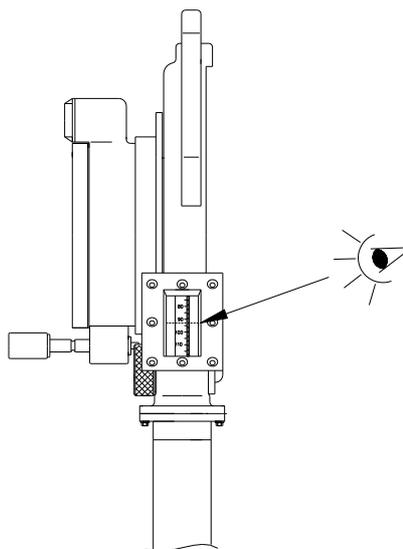


Fig 17. View of Ullage, Interface read out point

*** Temperature measurement**

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

10. The value is in degree Celsius(°C) on LCD as our standard supply. However if user wants the reading to be in degree Fahrenheit(°F), 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.

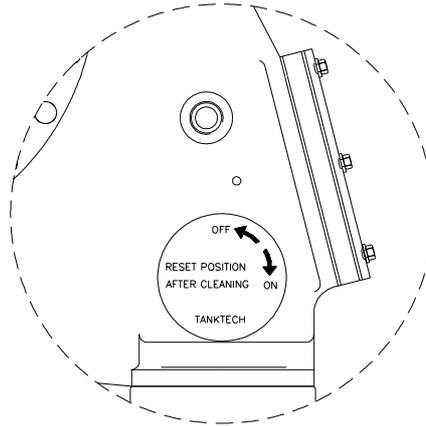


Fig 18. Tape Cleaner

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 completely protect the tape.

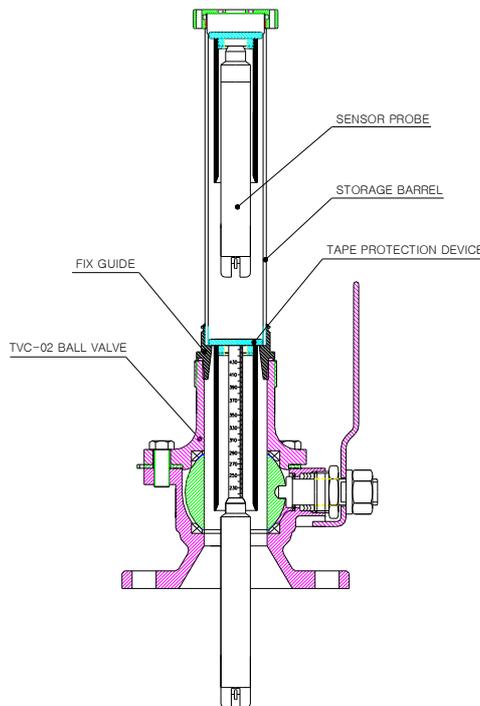


Fig 19. Tape protection device

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 ()K Ω .
- iii. Reverse the Resistance probe (from Meter) and check again the Ohm reading at ()K Ω .

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.



Portable Oil / Water Interface Detector (PMS)

(Technical Service Manual)

- **APPLICABLE RULE** : MARPOL 73/78 Chapter – II Reg.15 (3) (b)
IMO MEPC.5(XIII) Annex 4
- **APPLICABLE MODEL** : T2000-TFC-02 (CLOSED TYPE)
T2000-TFS-01 (RESTRICTED TYPE)

Rev.	Date	Description	Prepared	Checked	Approved
A	09 Mar. 2005	Issued for training	B. C. Park	J. O. Lee	H. Jin

Doc. No.	TKT-PMS-TSM-001	Page	1/15	File	Tech Service PMS.doc
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	Portable Oil / Water Interface Detector Technical Service Manual	2005.03.09
		Rev. A

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Part 1 : Temperature Calibration



Fig. 1 PRECISION DIGITAL THERMOMETER

The equipment required to do a **RACEABLE CALIBRATION** are a Precision Digital Thermometer and a fine tuned controlled temperature water bath.

This thermometer has to be sent to a National Institute for calibration against their higher standard of accuracy, which is what it meant by traceable.

The accuracy of the F250 is 500 ppm or parts per million. The PT100 probe is a 4-wire thermometer of Laboratory grade.

The sensor probe is immersed into the water bath along with the F250 probe.
 The temperature points are at: 20°C, 40°C and 60°C.

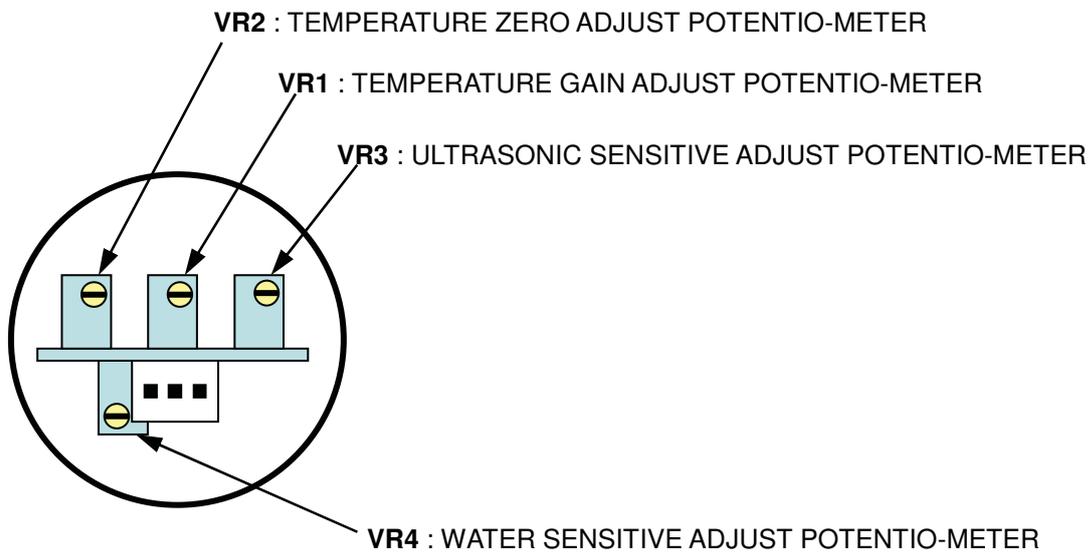


Fig. 2 SENSOR PROBE VIEW FROM THE TOP

This analogue, linear signal is amplified by a LM2904 Op. amp. with the facilities to adjust and offset the zero point and the gain or slope.

Preliminary adjustments are made at two points (20°C and 60°C) before calibration. Therefore the probes are firstly immersed in cold water (lower end of the temperature range) and the ZERO adjustable Potentio-Meter is adjusted to correct the error reading. Secondly, both probes are transferred to a hot water bath at the higher end of the temperature range and the GAIN Potentio-Meter is adjusted to correct the error reading. After the final stage, where the probes are transferred to and from hot to cold water and no corrections are necessary, then the probes are placed in the hot water temperature regulated bath for the full calibration range.

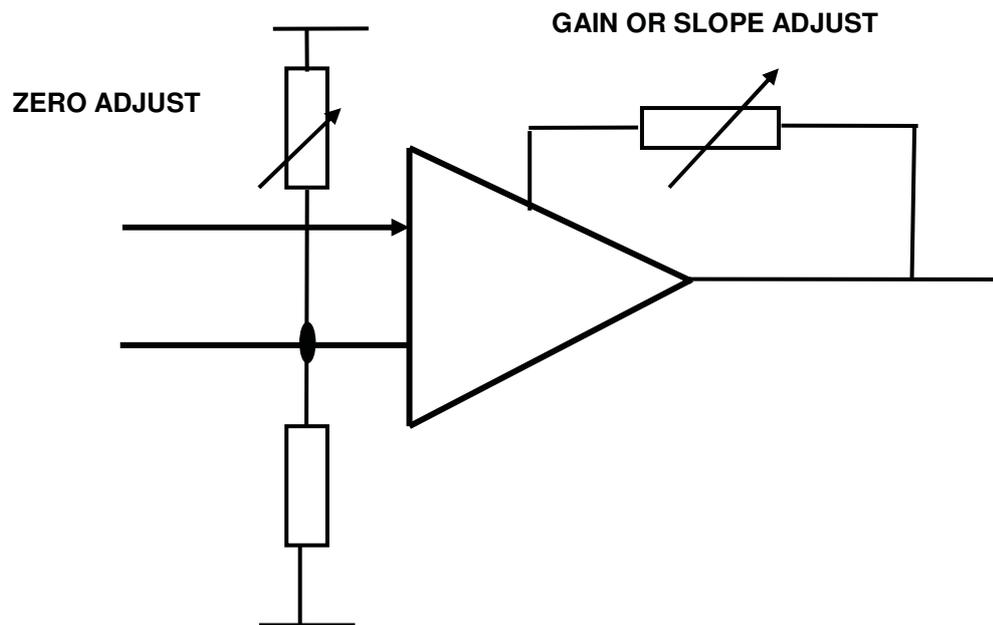


Fig. 3 THE ZERO AND SLOPE ADJUSTABLE RESISTORS

Calibration procedure for 3 points: 20°C, 40°C, and 60°C with temperature regulating water bath, precision thermometer and sensor probe.

(CAUTION !) The immersion depths of both sensor probe and precision thermometer must be the same for a homogeneous reading.

A calibration certificate will be issued after the test and adjustments and the readings error tolerance must be within the specification limits.

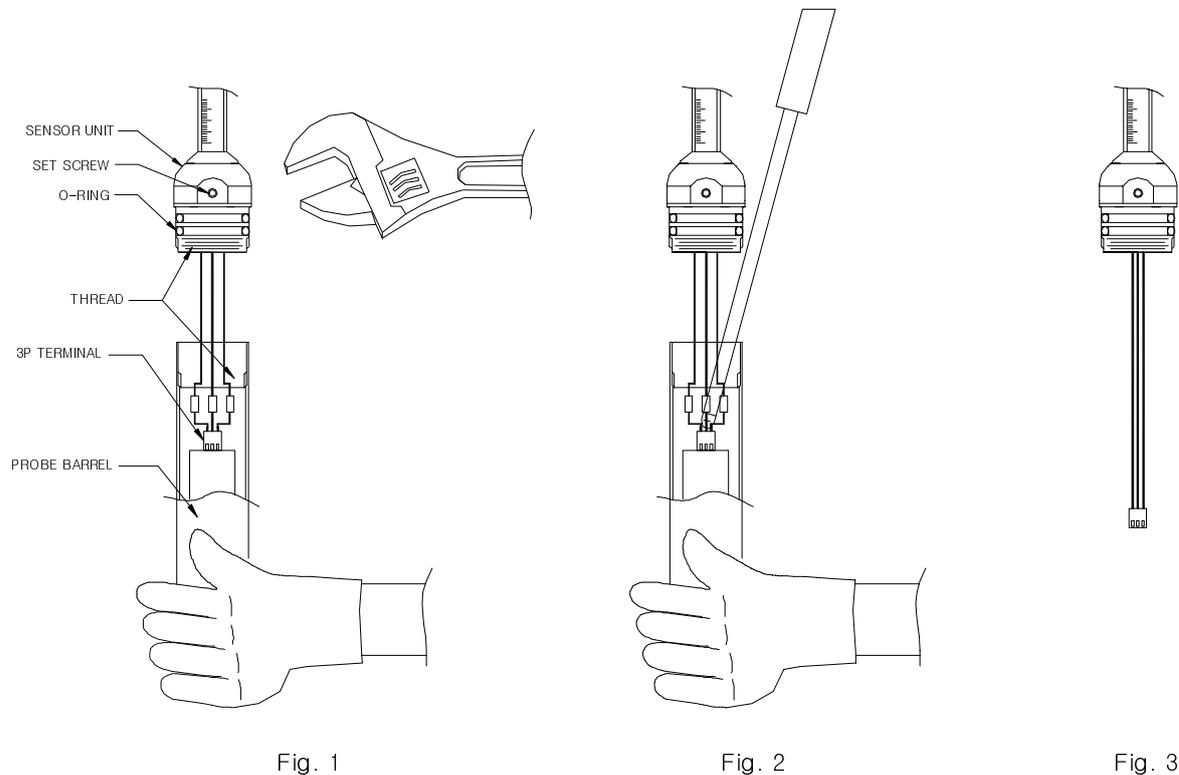


Picture on the left shows the Precision PID Temperature controller water bath for the Calibration Laboratory Standard.

TANKTECH calibrates every single piece of temperature sensor and issue a calibration certificate before dispatching the Tape.

Part 2 : Replacement of sensor probe

1. Disconnection of sensor probe



DISCONNECTION PROCEDURE

1. Carefully separate the sensor unit from the probe barrel with monkey spanner by grapping probe barrel tightly.
In order to unfasten these two items, rotate 2~3 times the sensor unit toward counter-clockwise with monkey spanner. Refer to Fig. 1
(CAUTION !) Do not loose the set screw when separating the sensor unit
2. After separate the sensor unit from probe barrel, three electric wire have to disconnect from the 3P terminal by a small (-) screw driver. Refer to Fig. 2
3. Make be in good shape the 3P Terminal with three electric wires of Sensor Unit.
Refer to Fig. 3

Step	Description	Illustration
1	Carefully separate the sensor unit from the probe barrel with monkey spanner by grapping probe barrel tightly.	
2	After separate the sensor unit from probe barrel, three electric wire have to disconnect from the 3P terminal by a small (-) screw driver.	

2. Reconnection of sensor probe

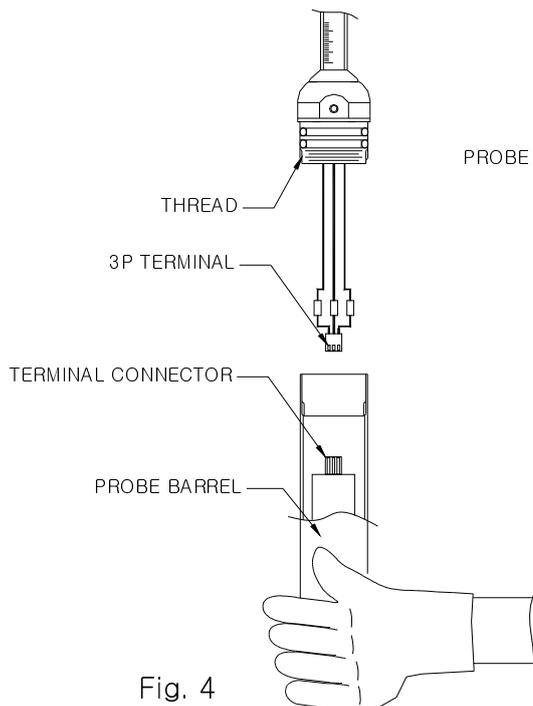


Fig. 4

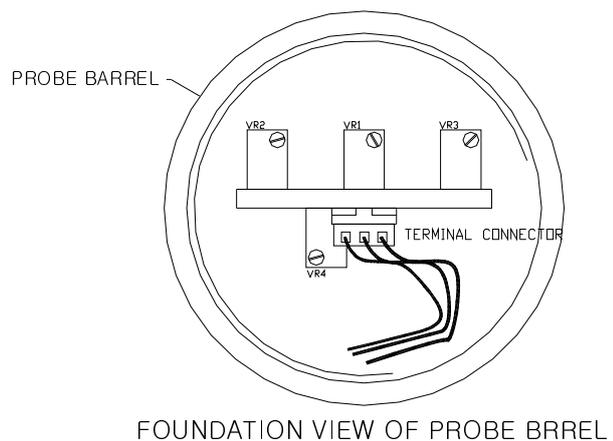


Fig. 5

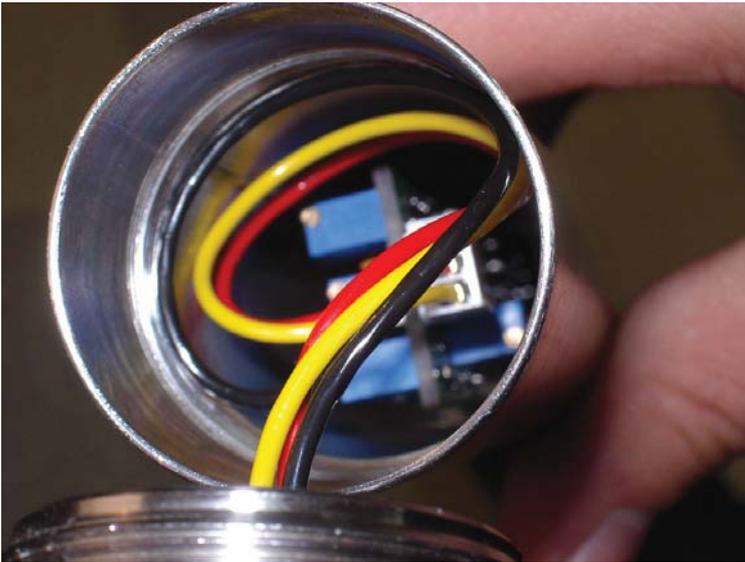
CONNECTION PROCEDURE

1. Connect the 3P Terminal at the sensor unit with the terminal connector at the probe barrel.

Refer to Fig.4

Before assembly it, please coat some heavy grease on the screw thread and O-rings.

2. Make be in good shape the 3 electric wires into spiral at one edge inside barrel as shown on below picture, so that they cannot be damaged by screw thread. Refer to Fig.5



3. Connect the probe barrel to the sensor unit vertically with both hands.
4. To tighten the sensor unit with the probe barrel, please rotate the sensor unit with monkey spanner 2~3 times in clockwise rotation.

Turn 1~2 rounds clockwise first to lessen the cable twisting inside.

(Fig. 1)

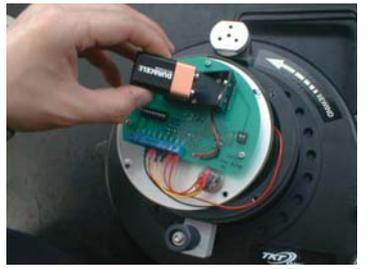
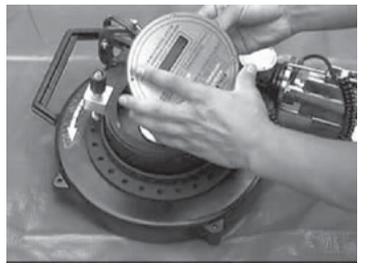
Note> Please do not be tighten over 3 rotations. Wires which located in the probe barrel could be damaged by excessive twist.

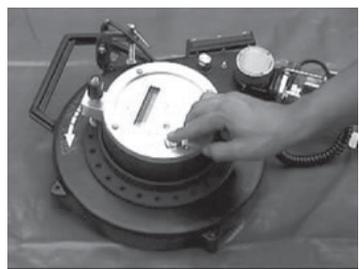
(CAUTION !) Do not let the cable get in between the tape header and the probe threads. Otherwise the header may cut the cable insulations and cause a short circuit.

3. Tool or Kit

Monkey Spanner(12inch), (-)Screw driver, Rubber coated Gloves

Part 3 : Change of battery

Step	Description	Illustration
1	Unfasten four screws from the hub ring by using M4 hex key.	
2	Detach the hub ring from the drum.	
3	Lift carefully the display PCB from the drum	
4	Replace old battery with new one.	
5	Put back the display PCB into its original location.	

Step	Description	Illustration
6	Put back the hub ring with gasket.	
7	Tighten four hex screws with M4 hex key.	
8	Check the PMS by switching on.	

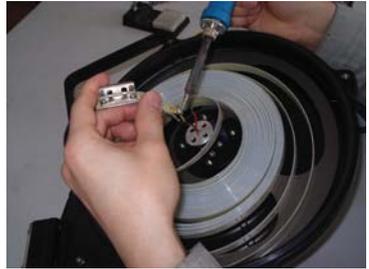
Part 4 : Change of tape

1. Removing the faulty tape

- 1) Preparatory step
 - A. Remove the Storage barrel and them Tape protection device from the Tape body assembly.
 - B. Remove the sensor probe from the connecting head with 19mm monkey spanner.
(CAUTION !) – This procedure has to be done out of the hazardous zones.
- 2) Remove the 4 cover screws with 6 mm Hex key and place screws and washers in a cup.
- 3) Remove the Tape plate screws with “+” screwdriver.
- 4) Release and pull out the faulty tape from the reel, coil the tape outside of the body.
(CAUTION !) – to unwind tape while it is resting on the Display side, to avoid the tape falling off the reel.)
- 5) Remove the bracket screws inside the Hub core.
- 6) Cut open the cable insulations (shrinking tubes) and unsolder the wires from the tape.
- 7) Remove the bracket from the tape with “+” screwdriver and 5.5mm socket wrench.
- 8) Clean up the core from solder wastes and the Hub and associated parts from Silicone Sealant.

< REMOVAL PROCEDURE >

Step	Description	Illustration
1	Unfasten four screws of cover with 6mm hex key.	
2	Unfasten four screws of Tape plate.	
3	Release the tape from the hub core in order to easily remove the tape.	
4	Unfasten screws of the mounting bracket which located in hub core.	
5	Remove the bracket from the tape with socket wrench and (+) driver.	

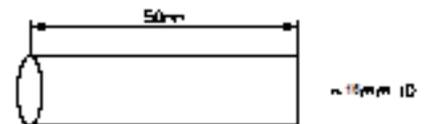
Step	Description	Illustration
6	Unsolder the wires and connections to the tape.	
7	Remove the tape and clean up the core.	

2. Fixing a new tape

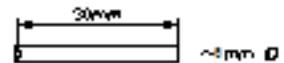
1) Preparatory step

- Place the new tape besides the tape body (*CAUTION! Do not uncoil the tape*).
- CAUTION! Position of the tape should be Header inside and open end outside.
- Remove the wiper assembly (this is optional, as it will be easier to push the new tape in without the wiper getting in the way.)

- Push the tape (Scale side facing window) through the indicator bar, pulley roller and into the Hub core through the slot. Allow about 100 mm lead head.

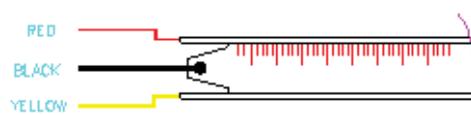


- Splice the tape with 50mm length 13mm dia. shrinking tube before the mounting bracket.



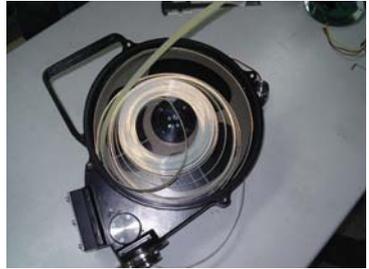
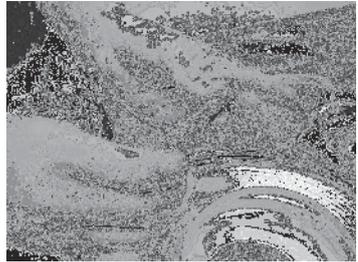
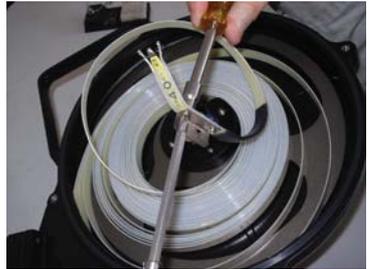
- Sleeve the cables with 3 mm dia. 25mm length shrinking tubes (red color for the red cable and black sleeve for the yellow cable). Short 22mm length, 13mm dia. to the tape end, after the bracket.

- Fix back the mounting bracket onto the tape and apply Silicone Sealant to the nuts and screws.



- 6) Solder the wires to the tape connections. Tape Scale facing: Red wire on top, black in middle and yellow on bottom.
- 7) Shrink the small tubes of the cables and the short larger one over all the joints. Shrink the 50mm length 13mm dia tube at about 40 mm away from the bracket.
- 8) Coil the tape inside the hub and screw the bracket to hub with “+” screwdriver.
- 9) Connect the sensor probe to test the connection integrity. If the connection is right then proceed on to the next step. But if the Display shows “ERROR” then there is communication error, check the connections again.
- 10) Apply silicone sealant to the hub slot and the bracket mounting screws and close the Tape plate, screw with “+” screwdriver.
- 11) Close back the cover of tape body screw with 6mm HEX key.
- 12) Rewind the new tape to the reel.
- 13) Fix back Tape protection device and then Storage barrel.
- 14) Fix back the sensor probe. (CAUTION!)
 - A. Do not twist the cables excessively. Turn head assembly 2 to 3 turns anti-clockwise and screw in clockwise.
 - B. Watch out for the cables that they do not get in between the threads.
 - C. Do not use pipe wrench to grip the sensor probe, as this may cause deep scratch marks on it. Use hand gloves or belt-wrench if needed to.
- 15) Switch on the set to test. If “ERROR” message displayed, remove the sensor probe again to check the connecting cables. If any of the cable insulation is cut, pull out the cable from the connector with mini screwdriver pushing the lock pin and apply shrinking tube (3mm dia.) on it and shrink with cigarette lighter. Push back the cable and test again before screwing in the sensor probe to the header assembly.
- 16) Changing of tape is completed.

< **FIXING PROCEDURE** >

Step	Description	Picture
1	Push new tape (scale facing window) through the bar and slot.	
2	Sleeve in the 50mm length x 13mm dia shrinking tube.	
3	Fix the bracket to the tape. Place shrinking tubes to wires and tape.	
4	Solder wires to tape (Red, black, Yellow scale face)	
5	Shrink the smaller tubes and then the bigger with cigarette lighter.	

Step	Description	Picture
6	Fix back the bracket to the mounting point. Apply silicone sealant.	
7	Cover back the hub cap and guide reel.	
8	Fix back the cover of tape body screw with 6mm HEX key.	
9	Fix back Tape protection device.	
10	Fix back Storage barrel.	