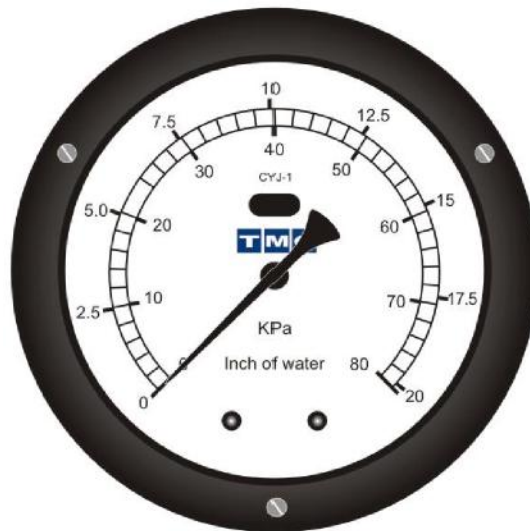




T e s t · M e a s u r e · C o n t r o l

**DUAL BELLOWS
DIFFERENTIAL PRESSURE GAUGE
MODEL: LI-CYJ-1**

**User's Manual
Version 1, Dec 2008**



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1.0 Introduction

The LI -CYJ-1 is a differential pressure indicator used to measure differential pressure of liquid level or flow. Typical applications include the measurement of the level in Cryogenic tanks holding liquid oxygen, liquid nitrogen, liquid carbon dioxide, liquid argon and similar liquefied gases. In addition, the level of virtually any liquid contained in any form of tank or container can be measured using this indicator. When measuring the level of liquid in a vessel, the pressure gauge is connected in such a way as to display changes in the differential pressure caused by changes in the height of the liquid in the vessel. When measuring the flow rate, the unit is connected between a low pressure and a high pressure side of the system being measured.

2.0 Design and operation

The Model LI-CYJ-1 differential pressure indicator consists of a differential pressure measuring unit ("DPMU") coupled to an indicator/case assembly which includes a 6-inch scale and a mechanical pointer that rotates across that scale on a 270 degree arc to provide an indication of the measured variable.

DPMU

The DPMU is comprised of two opposing bellows assemblies - one low-pressure and the other high-pressure – each of which is enclosed in a pressure housing and, along with over-range valves, a temperature compensator, and a torque tube assembly, mounted and sealed on a center plate. The bellows and center plate are filled with a non-compressible fluid. The torque tube assembly transmits the motion of the bellows to an external indicator assembly. The measurement range of the indicator is set by a combination of springs which are attached to the bellows and controlled by adjustment of the indicator mechanism. The temperature compensation device is attached to the high pressure bellows to minimize the effect of temperature on the performance of the gauge. The tank being measured is connected to the high and low bellows through the connection fittings on the pressure housing.

The internal volume under the bellows and inside the center plate of the DPMU is filled with a non-compressible fluid (the "fill fluid") which allows the bellows to move in response to the applied differential pressure without damage to the bellows. As the bellows move the fill fluid flows from the high pressure bellows to the low pressure bellows thru an internal passage in the center plate. If the differential pressure rating of the DPMU is exceeded an internal overpressure valve seals the fluid passage and traps fluid in the bellows to prevent damage or

shift in calibration. The trapped fluid under the bellows stops the bellows movement and allows very high pressures to be applied without any damage to the bellows. A variety of fill fluids are available for any application including inert fluids suitable for applications involving measurement of oxygen.

The sealed torque tube assembly, connected to a shaft coupling the two bellows, transmits the position of the bellows through the center plate to the indicator/case assembly through rotation of the torque tube shaft. The torque tube shaft rotates approximately 9 degrees. It is connected to a pointer and meter movement assembly through a linkage which causes the pointer to rotate 270 degrees in response to the torque tube shaft rotation.

The indicator/case assembly includes a scale plate with markings corresponding to variable being measured. Standard and custom scale plates are available to meet any need.

The temperature compensation device, connected outside the high-pressure bellows, keeps the temperature shift of the differential pressure readings to the minimum within the working temperature range.

All TMC indicators are calibrated and tested before shipment and are ready for installation when received.

Immediately upon receipt, unpack the unit and inspect for any damage that may have occurred during transport.



If the unit is packaged with a notation that it has been cleaned for Oxygen service handle the unit appropriately and carefully and do not allow any oils or contamination to enter the pressure ports.

The indicator includes dual pressure port connections (top and bottom) on both the high and low pressure housings. The high pressure side is located on the right side of the instrument when facing the scale plate of the indicator and the low pressure connection is on the left. The standard port size is $\frac{1}{4}$ " FNPT, however, many other port sizes are available at customer request. If in doubt, check the TMC Smart Part Numbering Guide which will indicate the connection fittings for each unit shipped. Ensure that the high and low pressure ports are properly connected. Unused ports can be plugged or plumbed for use as vents or drains depending on whether a liquid or gas is being measured.

It is recommended that installation utilize a 3-valve manifold or independent high, low, and balance valve configuration between the process connections and the indicator as indicated in Figure 1. A 3-valve configuration will allow the unit to be placed into service without unnecessary risk of over-range exposure and will also facilitate taking the unit out of service and re-setting the indicator zero reading after re-placing the unit into service.

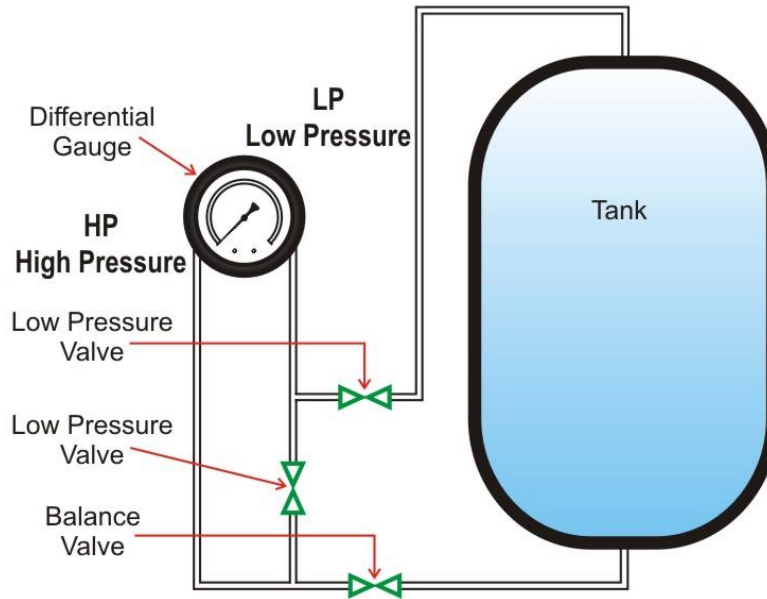


Figure 1. 3-Valve method of connecting the indicator and the storage tank.

Install the unit using the wall/pipe mount bracket per the drawing shown in Figure 2 (a) and 2(b). If the indicator is to be panel mounted, use the drawing shown in Figure 3 for dimensional reference.

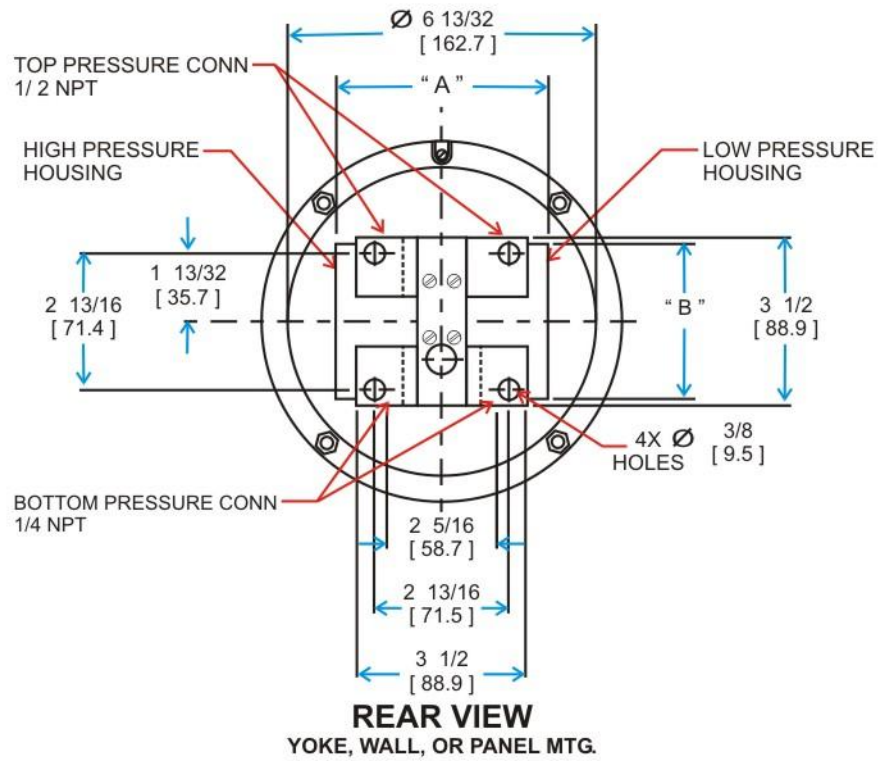


Figure 2 (a) Rear View – Wall and Pipe Mount.

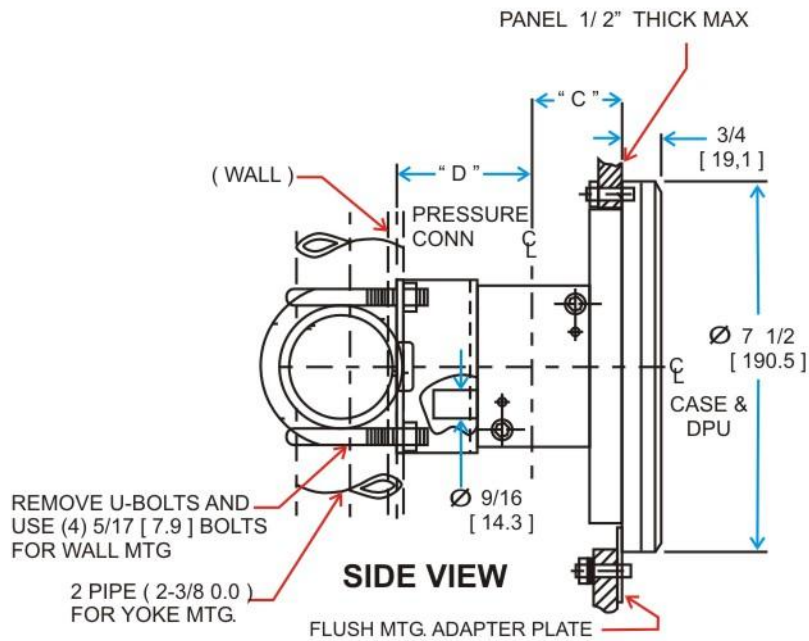
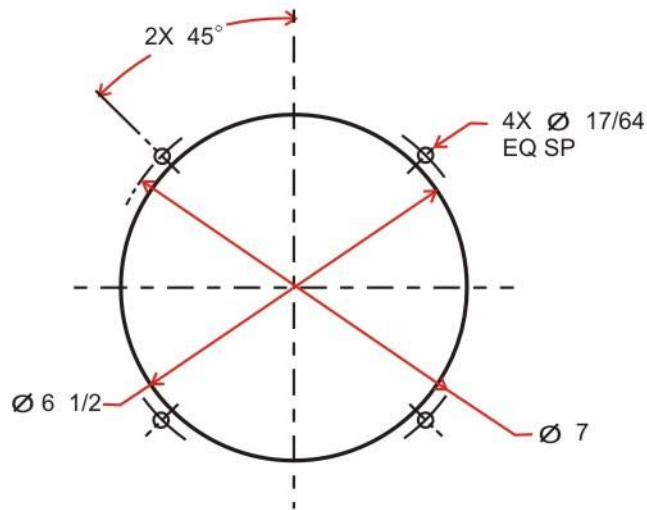


Figure 2(b): Side View: Wall and Pipe Mount.

The indicator zero may have to be adjusted prior to use. This can be done before or after mounting. If it is done before mounting be sure the indicator is orientated the same as it will be in the final mounting configuration. Mounting orientation can affect the indicator zero position. Follow the instructions in Section 4 to adjust the indicator zero.



PANEL MOUNTING CUTOUT

Figure 3

3.0 Placing the indicator in service

When placing the indicator in service:

- Start with the Low Pressure, High Pressure and Balance valves closed
- Open the Balance Valve
- Open the High Pressure Valve
- Close the Balance Valve
- Open the Low Pressure Valve

4.0 Zero position adjustment

For the most accurate measurement, it may be necessary to adjust the zero position of the pointer. This can be done prior to or after installation of the indicator. If zero position adjustment is made prior to installation it is important to ensure that the orientation of the indicator while the adjustment is being performed is the same as it will be in the actual installation. The recommended indicator position when performing the adjustment is to have the scale plate vertical, i.e., perpendicular to the horizontal plane (see Figure 5).

Zero adjustment can be done with no pressure applied or under static pressure with the same pressure applied to both the high and low pressure ports. If the unit has been installed with a 3-valve manifold or individual valves this can be done by performing the following steps.

- Close the Low Pressure Valve
- Open the Balance Valve

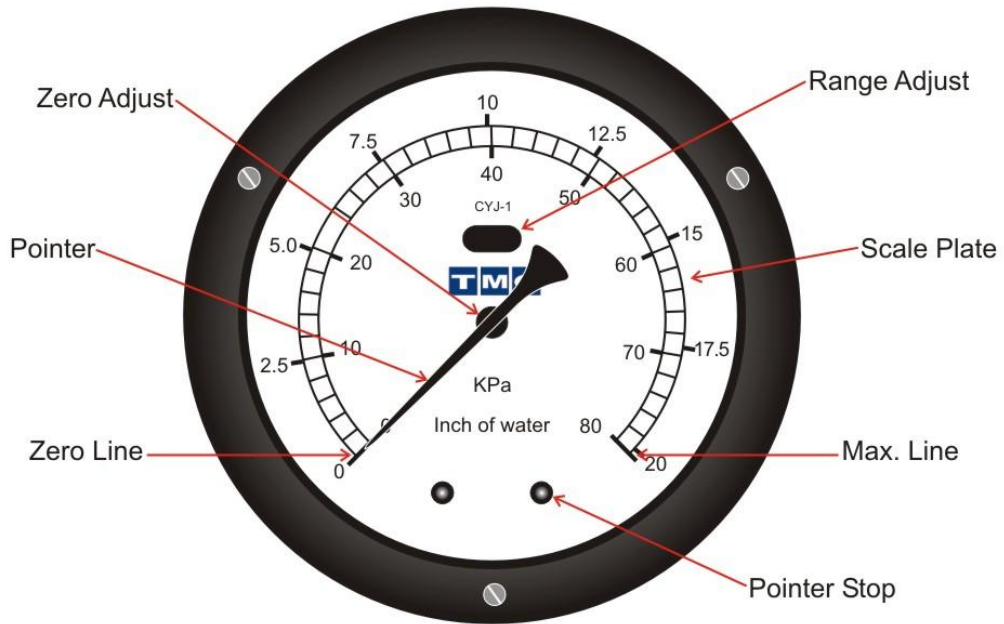
This applies the high side static pressure to both the high and low pressure ports for zero adjustment under static pressure conditions.

To return the unit to service performs the following steps after the zero adjustment has been completed.

- Close the Balance Valve
- Open the Low Pressure Valve

To perform the actual zero adjustment, you should complete the following steps.

- Remove the 3 screws that hold the bezel and lens to the indicator case.
- Remove the bezel, lens and lens gasket from the unit.
- Tap the scale plate with the fingers of one had 3-4 times to allow the pointer to find its minimum friction position.
- Set the pointer zero position by holding the hub and rotating (sliding) the pointer on the hub to align it with the zero mark as shown in Figure 4
- Use a $\frac{1}{4}$ " wrench (or a flat blade screwdriver if the hub does not include a hex nut) to hold the hub in place with one hand while carefully rotating the pointer to the zero position using the fingers of the other hand.
- Check the zero position and repeat the procedure as necessary to accurately align the pointer with the zero scale mark.



FRONT VIEW

Figure 4

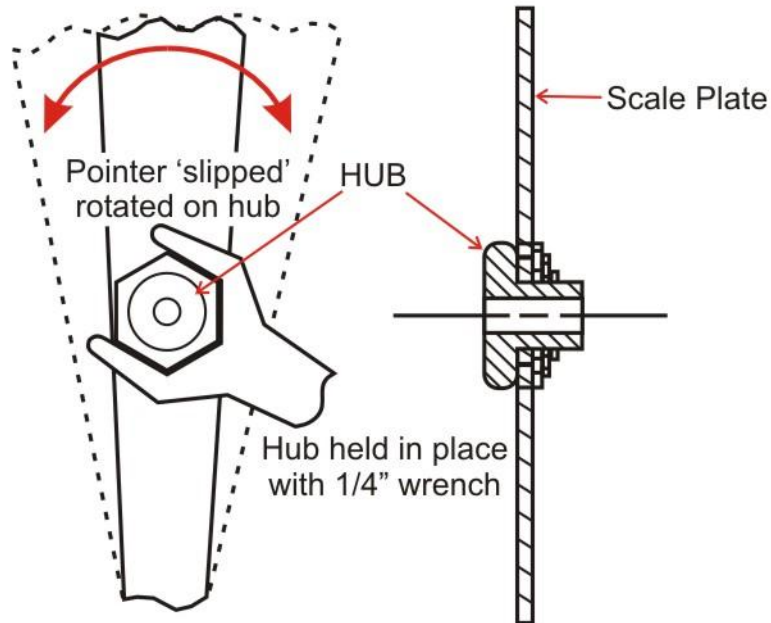


Figure 5. Zero Adjustment.

The range of the instrument can be adjusted by using a 2 mm wrench to rotate the Rand-Adjustment Screw (see Figure 6) that is accessible through the slot in the scale plate. Only a small range adjustment can be performed using this procedure. If an adjustment greater than a percent or so is required than a complete recalibration may be necessary. Please follow the instructions on the TMC web site for complete recalibration or return the unit for recalibration.

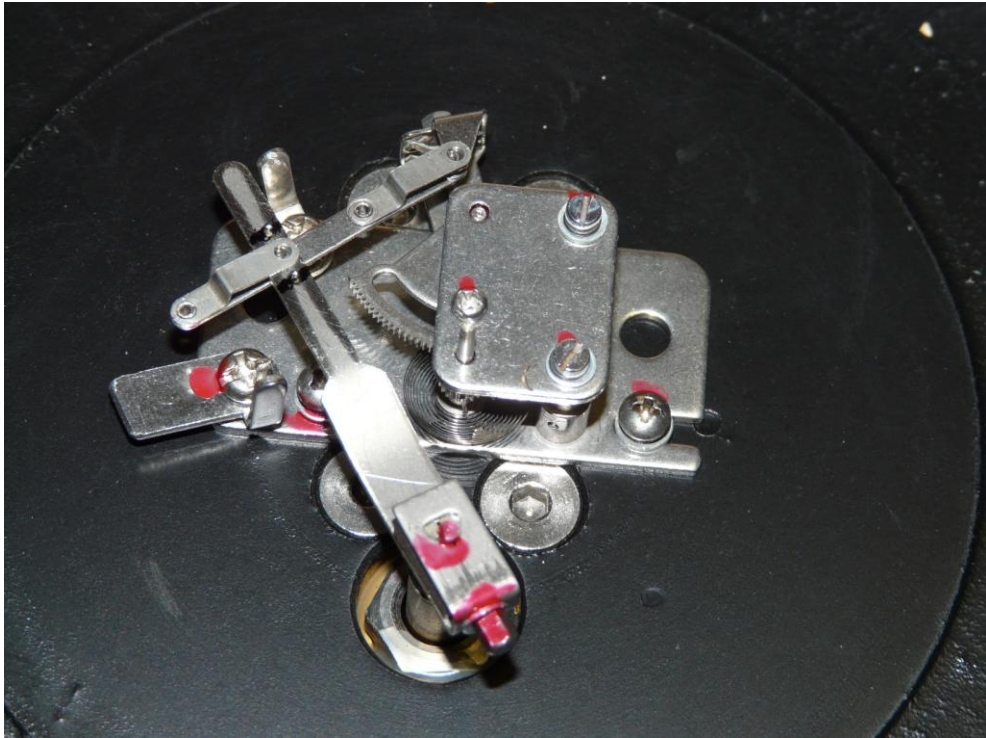


Figure 6. Range Adjustment Assembly.

5.0 Parts diagram

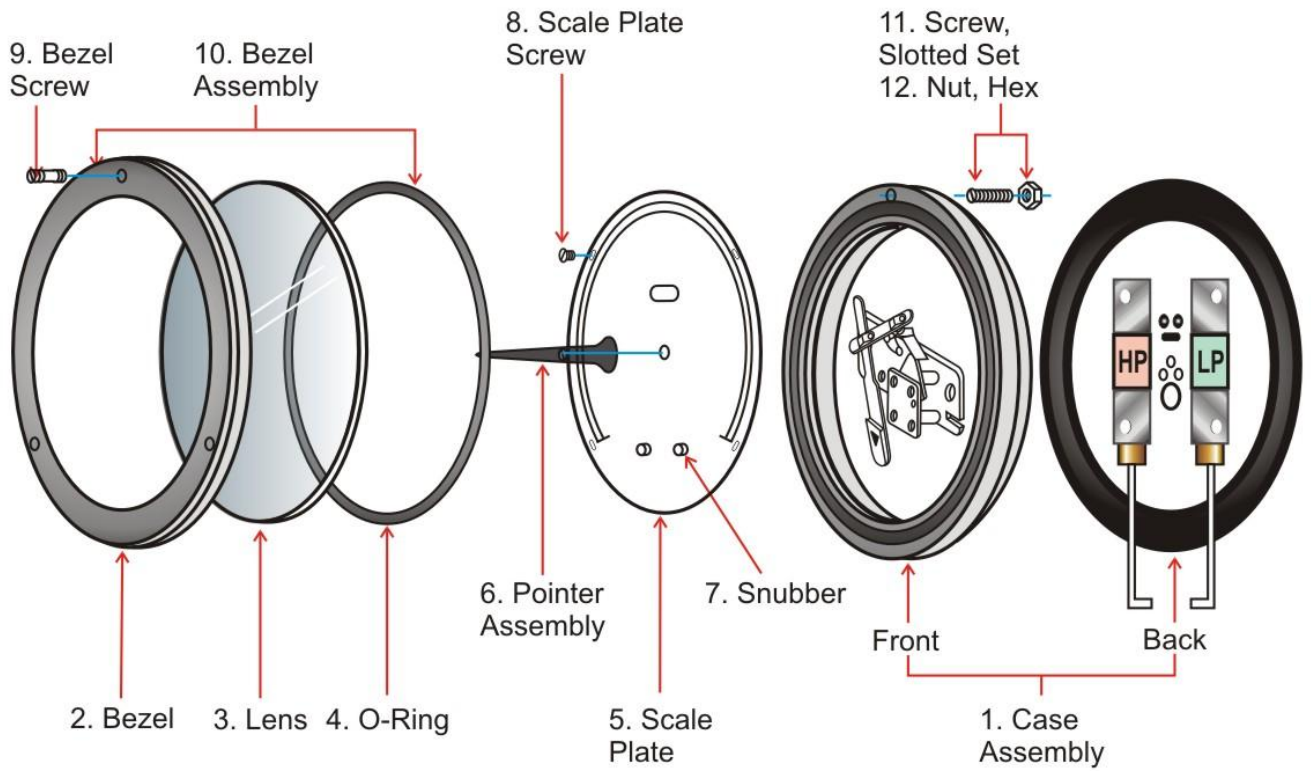


Figure 7: Parts diagram.

Item	Description	Part Number	Qty
1	Case Assembly (includes DPMU and meter movement)		1
2	Bezel (Part Of Item #10)		1
3	Lens (Part Of Item #10)		1
4	O-Ring (Part Of Item #10)		1
5	Scale Plate		3
6	Pointer Assembly White		1
	Black		
7	Snubber		2
8	Scale Plate Screw		4
9	Bezel Screw		4
10	Bezel Assembly		
11	Screw Slotted Set		1
12	Nut, Hex		

6.0 Technical specifications

Accuracy level	1.5%
Nominal working pressure	2.5MPa
Measurement rang	0~15kPa(0~1500 mm WC) 0~20kPa(0~2000 mm WC) 0~25kPa(0~2500 mm WC) 0~30kPa(0~3000 mm WC) 0~50kPa(0~5000 mm WC) 0~75kPa(0~7500 mm WC)
Atmospheric pressure	86kPa - 1 06kPa
Temperature	-40 to +70~
Relative humidity	5% to 95%
Lens	
O-rings (wetted)	
Dial size:	152 mm (6.0 inches)
Overall dimensions:	190x135mm (7.5 x 5.3 inches)
Weight	3.2kg (7.04 lbs)

7.0 Storage

Unopened units should be stored in an indoor environment where the temperature is between 0 and ± 40 degree **Celsius?** and where the humidity does not exceed 80%. Corrosive gas and other harsh environments should be avoided.

If a meter has been stored or has gone unused for more than five years, the unit should be subject to an evaluation by a qualified technician before being placed in service.

8.0 Service after sales

TMC Products Inc. commits to provide professional, high-quality service to all of our customers. We welcome your questions, comments and feedback on our products. If you have any questions or difficulties with the installation and operation of our products, please contact us and we will offer technical support as quickly as possible.

9.0 Warranty

TMC Products Inc warrants that at the time of shipment the products manufactured by TMC Products Inc. and sold hereunder will be free from defects in material and workmanship and will conform to the specifications furnished by or approved by TMC products Inc.

TMC Products will repair or furnish a replacement for, but not install, any product for which a warranty claim is filed within three (3) years of shipment from TMC Products Inc and which, following test and examination by TMC Products Inc proves defective within the above warranty. If Buyer believes any product is defective under this warranty, Buyer shall notify TMC Products immediately.

No product will be accepted for return or replacement without the written authorization of TMC Products Inc. Upon such authorization, and in accordance with instructions by TMC Products Inc., the product will be returned shipping charges prepaid by Buyer. Replacement made under this warranty will be shipped prepaid.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER EXPRESSED OR IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

Components manufactured by any supplier other than TMC Products shall bear only the warranty made by the manufacturer of that product, and TMC Products Inc assumes no responsibility for the performance or reliability of the unit as a whole.

In no event shall TMC Products be liable for indirect, incidental, or consequential damages nor shall the liability of TMC Products arising in connection with any products sold hereunder (whether such liability arises from a claim based on contract, warrant, tort, or otherwise) exceed the actual amount paid by Buyer to TMC Products Inc. for the products delivered hereunder.

The warranty does not extend to any product manufactured by or for TMC Products Inc. which has been subjected to misuse, neglect, accident, improper installation or is used in violation of instructions furnished by TMC Products Inc.

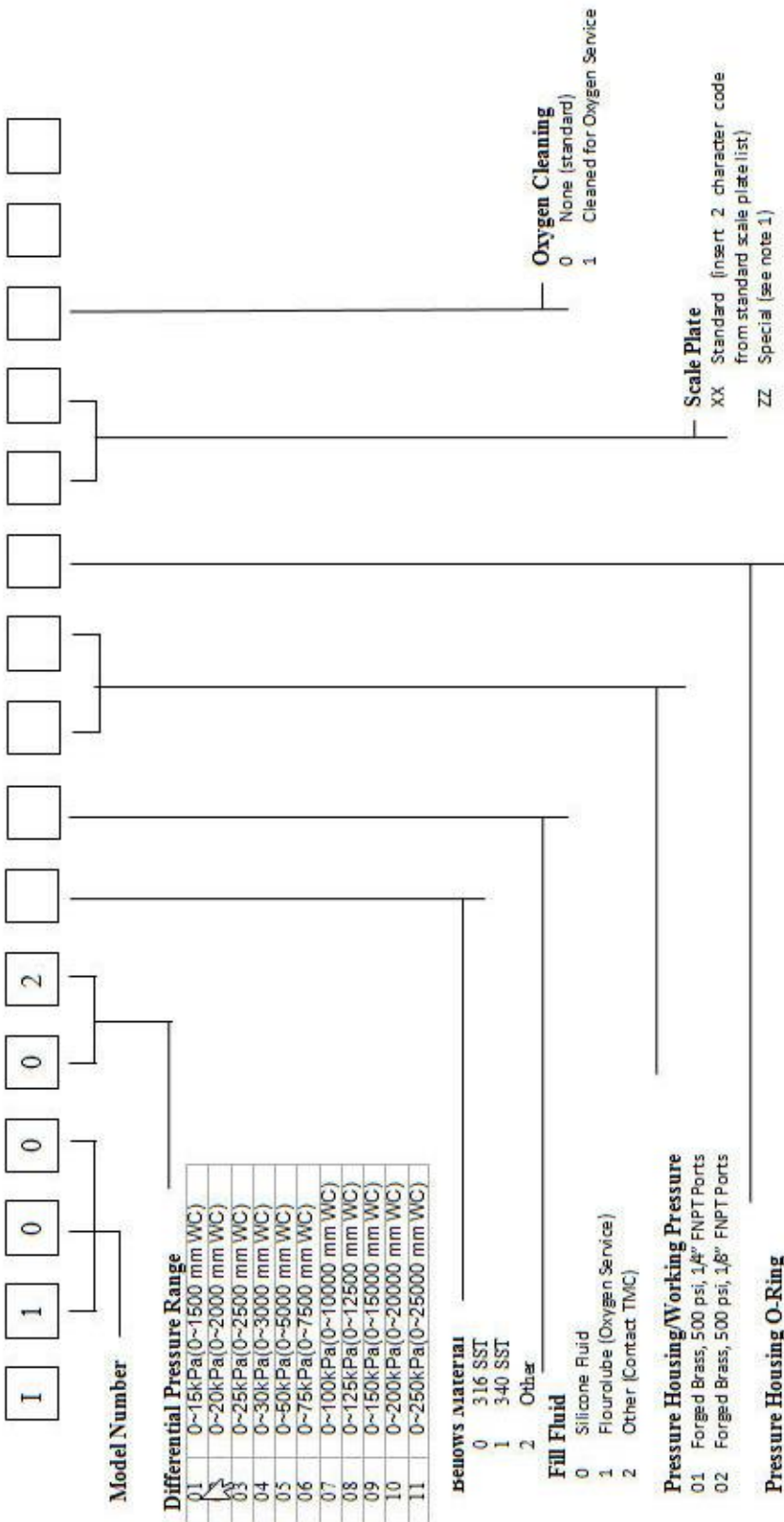
The warranty does not extend to or apply to any unit which has been repaired or altered ant any place other than at a TMC Products Inc. authorized service location by persons not expressly approved by TMC Products Inc.

Disclaimer:

TMC Products Inc makes no warranty of any kind with regard to these manual, materials referenced to, attached to or provided with, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. TMC Products Inc. shall not be liable for errors contained in this manual, including materials attached to or referenced herein, or provided with, or for incidental or consequential damages in connection with furnishing, performance, or use of this information,. The information contained in this manual (along with referenced, attached or provided materials) is subject to change without notice. The contents of this manual and all attached/provided/referenced materials may be revised without prior notice.

10.0 TMC Smart Part Number/Ordering Guide

In order to make the ordering process as smooth as possible for our customers, TMC Products Inc. has implemented a Smart Part ordering system that allows our customers to build their own specific indicators by specifying in the order precisely what components and specifications they wish in their indicator. Use the handy chart below as a guide for creating application specific indicator



Note 2. Please provide the following information:

• Linear or Square Root Scale	• Scale Units (KPa, PSI, Gal/Min, etc.)
• Single or Dual Scale	• Number of Graduations
• Scale Range (0-100, etc.)	• White on Black or Black on White