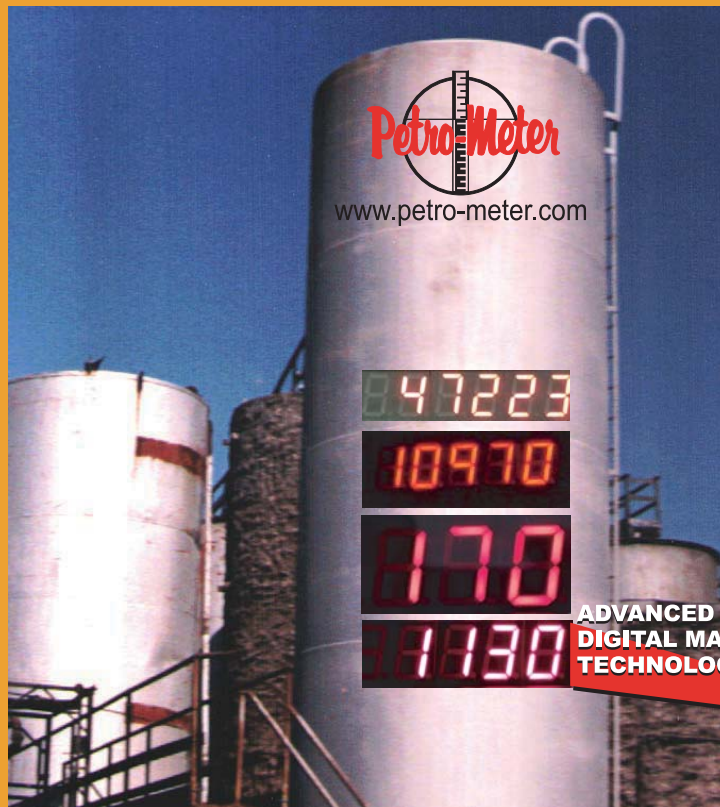


PETRO-METER CORPORATION

LINDENHURST, NEW YORK

OPERATING AND INSTALLATION INSTRUCTIONS

SERIES 5700-PT1 DIGITAL TANK GAUGE SYSTEM



ADVANCED
DIGITAL MANOMETER
TECHNOLOGY

PROUDLY MADE IN U.S.A



MULTI-TANK DIGITAL GAUGE SYSTEM

5700-PT1



www.petro-meter.com

Petro-Meter Corporation is a leading manufacturer of remote fuel tank gauging systems and specializes in pneumatic technologies for deriving accurate tank level readings remotely. This digital tank gauge system encompasses state-of-the-art engineering within the design spectrum of conventional well-type manometer gauge systems. The end result is an instrument that you can rely on for years of accurate level readings.

Thank you for placing your trust into our experienced hands. We look forward to exceeding your expectations.

OVERVIEW

In general, pressure measurement technology translates force from an induced pressure into an electrical quantity. Petro-Meter Series 5700 systems employ high-accuracy pressure transducers with piezoresistive elements for sensor signal processing to measure pressure. The pressure transducers used in this system are of the monolithic silicon type. A patented silicon shear stress strain gauge (resistive element) provides an accurate, high level analog output signal that is proportional to the hydrostatic pressure applied. This signal is further processed through an onboard A/D converter outputting a varying data stream that can be applied to a variety of microprocessor algorithms for tank level calculation processes. These processes can entail accessing a matrix (look-up table) with preprogrammed values or enable mathematical operations used to calculate numeric values (inches, pounds, gallons, liters, etc.) corresponding to the contents of a tank or vessel and display this data.

In practical terms, as hydrostatic pressure within a vessel changes with an increasing or decreasing liquid level, the pressure transducer will vary the output voltage accordingly and this signal is in turn interpreted by the controlling microprocessor. The microprocessor produces a readout after comparing the varying voltage against a pair of pre-set calibration parameters: **ZERO** and **GAIN**. This process resolves the pressure reading to an accurate approximation of product height within the vessel. The specific gravity of the product measured is implicit within the range determined by setting the **ZERO** and **GAIN** controls for each independent digital tank gauge. This data can then be used for reference look-up in a matrix or table (predominantly used in horizontal cylindrical vessels) with stored values to produce volumetric equivalents (gallons, liters, etc.), or linear units of pressure (pounds, inches of water column, PSI, etc.). For vessels with consistent, and as a result, linear increases in volume and pressure (i.e. vertical tanks) the display can be the product of multiplying a pre-calibrated increment (i.e. according to a tank diameter) by the number of microprocessor "counts" as determined by pressure transducer signal and the **ZERO** and **GAIN** settings for the application.

GAUGE CONSOLE AND FEATURES

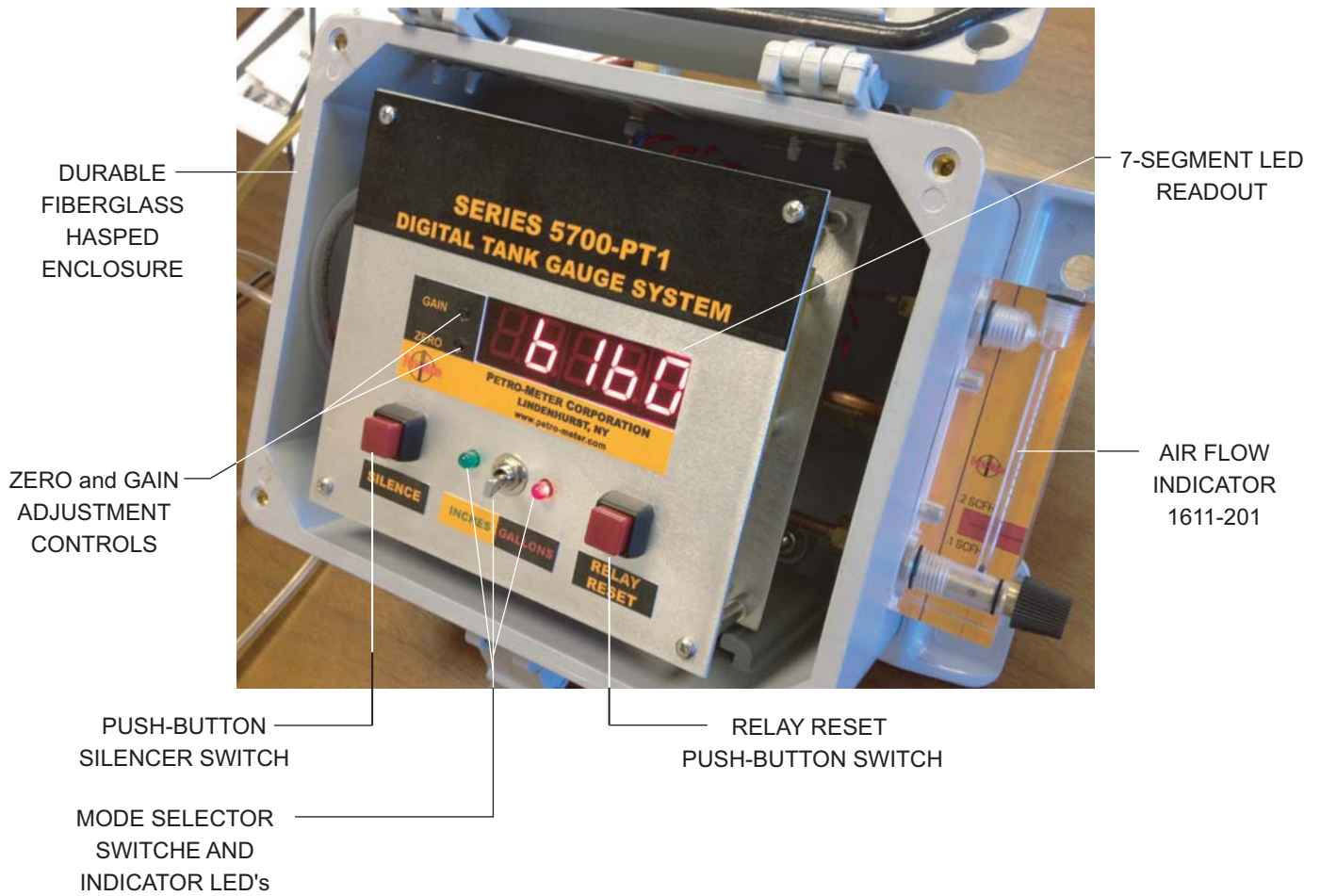


fig.1

PRESSURE TRANSDUCER CHARACTERISTICS AND SPECIFICATIONS

Operating Pressure	0-7.25 PSI (50 kPa)
Input Voltage	5 V
Output Current	0.2 to 4.7 V
Enclosure	Board Mounted Epoxy
Pressure Type	Gauge
Port Size	5mm Barb Connector
Accuracy	2.5% Max. 0°-85° C
Response Time	1.0 ms
Temp. Compensation	-40° to +125° C

COMPONENTS

Petro-Meter pneumatic digital gauge systems are modular in nature, and can be configured as single, stand-alone tank indicating units, or as multi-unit tank indication systems. In either case, the primary sensing element of the system is a high quality pressure transducer.

PRESSURE TRANSDUCERS: Featured as a PC board mounted component to benefit system upgrades where tank transmissin lines are already present and connected to existing analog (either Red-X or Mercury well-type) manometers. Upgrading is as easy as disconnecting the existing transmission lines from any analog gauge/s and reconnecting to any replacement digital gauge/s. Typically, analog gauge systems that feature air flow indicators will benefit from digital tank gauges with similar air flow dispensing means for the purpose of providing constant and automatic level indication. In any event, digital tank gauges will always require one element that conventional analog gauges *do not* require: electrical power. All Petro-Meter Series 5700 systems require a **115 VAC** outlet nearby and further reduce the input voltage to 9 VDC via a "wall wart" type AC adaptor (supplied)..

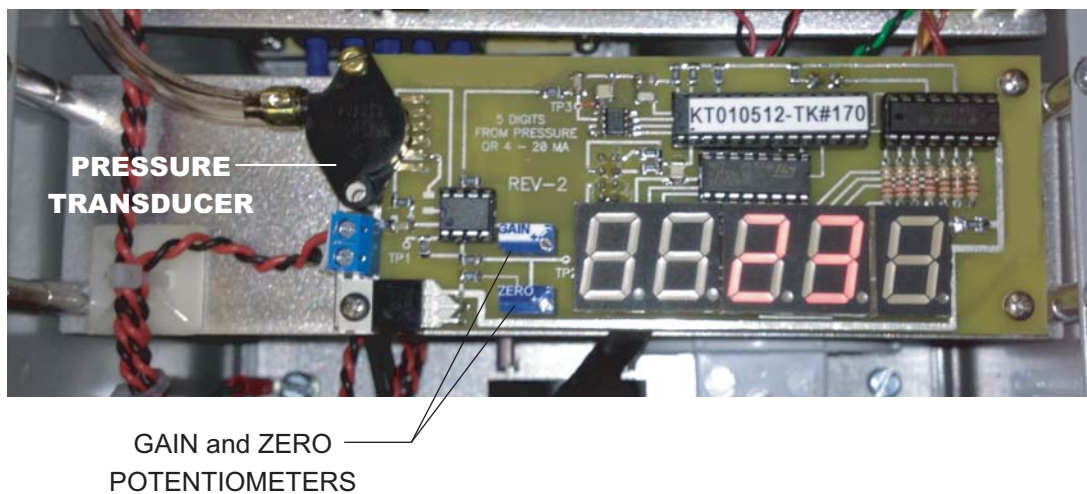


fig.2

AIR FLOW INDICATOR (P/N 1611-201 - see fig.1): As mentioned before, these devices provide a constant and steady stream of pressurized air or inert gas into a down pipe or tank assembly unit. In doing so, the hydrostatic pressure required to produce a bubble out of the bottom of this probe will be proportional the specific gravity of the product and its height. If the product specific gravity is known in advance, the pressure registered at the moment of producing a bubble from the fixed height determined by the probe at the bottom of the tank will allow for the calculation of the remaining variable in the equation: the height of the product. This is how all of Petro-Meter tank gauges produce remote readings, analog and digital models alike. The volume of air that these systems require is minimal: **0.10 to 0.20 SCFH** as indicated on the air flow indicator scale.

COMPONENTS

AIR DAMPENER TANK: In order to minimize pulsations in the air supply generated by the online compressor, Series 5700 systems employ an built-in dampener tank. This tank helps stabilize the hydrostatic pressure that is applied to the sensing element (pressure transducer) while eliminating minor variations caused by the mechanical forces that generate the pressurized air remotely (compressor "knock"). Normal operating pressure for this system should fall within conventional analog gauge guidelines: **30 to 40 PSI** and can be adjusted with a common air regulator (sold separately).

WARNING: TO REDUCE ANY RISK OF RUPTURE, THE INPUT SUPPLY PRESSURE TO THIS SYSTEM SHOULD NEVER EXCEED 40 PSI.



fig.3

DIGITAL READOUT GAUGE (see fig.1): The microprocessor controlled module that reflects all voltage changes as user interpretable data (inches, pounds, gallons, liters) is the main user interface and the means for remote level readings to be provided. These instruments typically feature high efficiency LED displays with a total of five or six 7-segment numeric displays. They convey level contents in a variety of pre-programmed units:

COMPONENTS

Among the most common units of measure utilized with these systems are:

Volume: Gallons, Liters, Barrels, Metric Tons. | **Pressure:** Pounds, Kilograms, Inches of Water Column.

Each system can be custom tailored according to user requirements and a **MODE SELECTOR** toggle switch is always featured to change the readout display to a unit of liquid depth, usually inches. The purpose of this feature is to simply provide a way of confirming all tank level readings by comparing the digital readout information to an actual tank "stick reading". This procedure may be useful for troubleshooting suspected errors in tank level readings, part of a scheduled maintenance program, or in the event of a change in tank product it may provide the best means for recalibrating the instrument by adjusting the **ZERO** and **GAIN** potentiometers and matching the digital display product height to the actual stick height for the new product.

MODE SELECTOR SWITCH (page 2, fig.1): An alternate mode is always featured for displaying not only product volume or weight, but the equivalent in product height. Considering that by large, most applications will produce a greater number of total integers in volumetric readings as opposed to integers representing product level in terms of inches, the resolution of all readings in inches will not be as refined. The system will display only **whole** values of product level in inches rounding all intermediate measurements to the nearest **whole** inch value. A toggle switch allows the user to change between modes independently for each individual tank.

HORN AND PUSH-BUTTON SILENCER (page 2, fig.1): All Petro-Meter digital gauge systems feature a piezo-electric horn and a push-button silencer switch and circuitry for various alarming modes:

- 1) The piezo-electric horn will always sound should any of the electrical connections between the pressure transducer/s and digital readout gauge be disconnected. Typically, this feature is of greater importance with systems that employ remote pressure transducers as opposed to printed circuit board style systems.
- 2) An audible alarm will be produced if a pressure greater than what has been established with the **GAIN** parameter is detected. This alarm feature should **NEVER** be used for the purpose of overfill prevention. Additionally, the digital readout gauge will display two "9" characters separated by two blank spaces. This will alert the user of the condition by producing a high-pitched 95dB audible alert. This audible alert can be silenced once the condition is acknowledged. The system will automatically reset once the condition has been corrected.

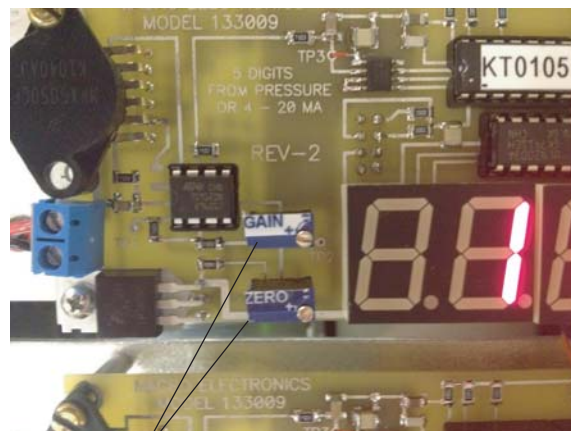
RELAY RESET PUSH-BUTTON (page 2, fig.1): Series 5700 systems feature Alarm level preset points, in other words, Petro-Meter will program each unit to trip an ALARM condition at a preset level. When any preset level is encountered (either a preset HIGH level as the level ascends, or a preset LOW level as the level descends) the unit will produce an audible ALARM condition. The audible alarm can be silenced as described above; see HORN and PUSHBUTTON SILENCER. Additionally, a set of featured isolated contacts will activate upon a preset alarm level. These contacts are not unique to any one preset alarm level, in other words ANY of the preset levels achieved WILL activate these contacts. The RELAY RESET PUSH-BUTTON can be used to manually reset these contacts as they WILL NOT RESET AUTOMATICALLY. The isolated contact feature can be use as pilot control for auxiliary signalling devices (external horns, claxons, strobes) or to operate auxiliary equipment with use of the proper external relays (see **ADDITIONAL FEATURES** for electrical information and relay ratings at the end of this manual).

CHANGING THE SYSTEM RANGE

NOTE: Pneumatic "disconnects" or leaks will cause the hydrostatic pressure within the down pipe to drop. The end result will be a digital gauge reading that is much lower than expected. Considering that every installation incorporates an air bell "gap" or datum mark equivalent to 2", 6", or the weld line of a bottom dish or cone where applicable, all volumetric or pressure readings will return to the lowest pre-programmed values as the instrument will resolve 0 PSI of hydrostatic pressure to be an empty tank. All pre-programmed values will be offered on a user specification data sheet. These quantities may vary from tank to tank according to their dimensions, however if all air bell gaps have been consistently set as described above, a pneumatic disconnect can simply be verified by flipping the toggle switch to inch mode and verifying the reading to be the corresponding height of the air bell "gap".

ZERO POTENTIOMETER (see fig.5): This variable resistance control allows the system to be calibrated accordingly to the lowest tank level that the pneumatic system is capable of recording. This datum reference is normally dictated by the gap between the open ended air bell and the bottom of the vessel as highlighted above. As standard convention, this datum reference is set to: 2", 6", or the weld line of a bottom dish or cone where applicable. Tank levels descending below this point cannot be sensed and recorded by the gauge system. Additionally, if the **ZERO** potentiometer is turned **below** a value corresponding to 0 PSI or an empty tank, the digital readout gauge will display two "1" characters separated by two blank spaces and an audible alert will be produced. This audible alert can be silenced and the adjusted to the original factory settings that correspond to the first recordable level in terms of liquid level height (air bell gap or datum) or the equivalent in terms of volume depending on the position of the **MODE SELECTOR SWITCH**.

GAIN POTENTIOMETER (see fig.5): This variable resistance control allows the system to be calibrated according to the highest tank level that the pneumatic system is expected to record. In systems with atmospheric venting, this pressure reference is dictated by the specific gravity of the stored liquid, and the maximum height that the given vessel may contain of this same liquid minus the air bell gap. Please note: this system cannot compensate for minor specific gravity changes caused by temperature fluctuations, however within reasonably stable storage temperature conditions, any temperature related variances are deemed too small to alter the overall accuracy of the system, and therefore considered negligible.



GAIN and ZERO
POTENTIOMETERS

fig.5

CHANGING THE SYSTEM RANGE

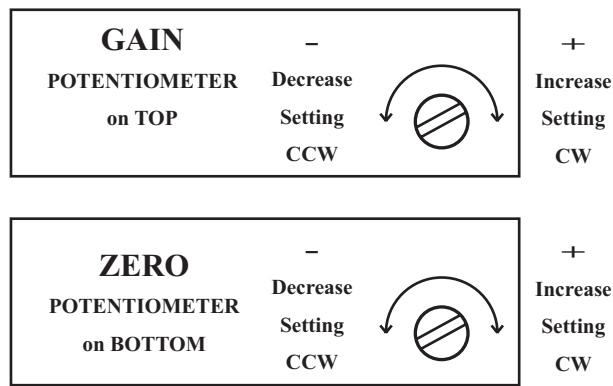
RANGE: Defined by the **ZERO** potentiometer setpoint and the **GAIN** potentiometer setpoint, an active range of operation can be defined. Within this range, the system will produce level readings in units of overall height (i.e. inches), as well as a volumetric equivalent (i.e. gallons) or direct pressure (i.e. pounds). The resolution of this output is dictated by the PSI rating of the pressure transducer employed, and how much of this range is effectively used given the PSI range generated by the hydrostatic pressure within the tank. The maximum resolution of the pressure transducers employed is 1/256, however the lower and higher limits are sacrificed to keep the active tank range within the middle "optimal" range of these sensors. A final resolution of 1/200 is used for all tank level readings. The total tank range is then divided into discreet data output points. Volumetric readings originate from a pre-programmed datum value according to the contents of the vessel air bell gap point or the point at which the system begins to record an ascending level. In general, volumetric readings are rounded to the nearest integer. In horizontal tanks, the largest volumetric increment will always be evident at mid-tank level, thus determining the greatest incremental volumetric "jump" from data output point to data output point. In the case of very large vessels, this may necessitate the use of a trailing "dummy" digit, or a digit that never changes from its zero value and basically determines the general resolution of the instrument.

ADJUSTMENTS: The variable **ZERO** and **GAIN** potentiometers can be adjusted to any desired values according to the installation. Aside from the ascending or descending values displayed on the digital readout modules, there are no other visual indications of the adjustment values for these potentiometers and as a consequence, the use of an adjacent manometer (analog or digital) may be needed to approximate the values to be set. The adjustment process should only be performed if the **factory setpoints are not satisfactory** and following these guidelines:

ZERO: Located on the **BOTTOM** of the two-potentiometer arrangement, this potentiometer varies the low end of the range established for a given tank. When the hydrostatic tank pressure is equal to 0 PSI or the point where the air purge encounters no resistance, the assumption will be that the tank is empty. The value reported is equal to the first count processed by microprocessor. This value will be set to the total tank contents at the datum point in terms of volume or pressure. If the toggle switch is set to **INCHES**, this value will be air bell datum gap in inches according to the installation. In other words, if the **MODE SELECTOR SWITCH** is set to **INCHES**, a value equivalent to the air bell gap will mean that the system is recording no hydrostatic pressure and that the volume or pressure reading displayed when toggling back will represent the contents of the tank up to that same point. This value could possibly be less as any hydrostatic system cannot record changes in level below the air bell gap datum point. To alter the set-point value of the **ZERO** potentiometer, when turned **COUNTERCLOCKWISE** the displayed values will **DECREASE**. Similarly, these values will **INCREASE** when turned **CLOCKWISE**.

CHANGING THE SYSTEM RANGE

GAIN: Located on the **TOP** of the two-potentiometer arrangement, this potentiometer varies the high end of the range established for a given tank. When the hydrostatic tank pressure is equal to the maximum PSI calculated for a certain product given its specific gravity, and the maximum height possible within the tank, the assumption will be that the tank is full. The value reported is equal to the highest count processed by microprocessor. This value will be set to the total tank contents in terms of volume or pressure. If the toggle switch is set to **INCHES**, this will be a value equal to the total height of the tank including the height of any bottom configuration (cone or dish) considered for the vessel. The volume or pressure displayed when toggling back to the **VOLUME** or **PRESSURE** position will represent the total contents of the tank. To alter the set-point value of the **GAIN** potentiometer, when turned **COUNTERCLOCKWISE** the displayed values will **DECREASE**. Similarly, these values will **INCREASE** when turned **CLOCKWISE**.



RANGE LIMITS: Pressurization above pre-set levels may produce irreparable damage to the pressure transducers utilized in this system. Please ensure that all pneumatic lines are disconnected if tank pressurization is needed for integral tank testing. Depressurization of any given tank system will result in a reading equivalent to the value listed for the tank contents at the height of the air bell.

START UP: Upon powering the digital tank gauge, the microprocessor will conduct a series of internal checks and it will display the following numeric characters: **4 3 2 1**. After this internal check, it will sound the piezo-electric horn and display two "9" characters separated by two blank spaces. This audible alarm may be silenced by depressing the push-button silencer switch. After these internal checks are performed, the preprogrammed value for the tank level height or contents, depending on the position of the **MODE SELECTOR SWITCH**, will be displayed according to the hydrostatic pressure being recorded. If the switch is set to display **INCHES** on an empty tank or disconnected tank line, the reading will be the height pre-programmed at the datum line according to the **MODE SELECTOR SWITCH**. If the switch is set to any measure of **VOLUME**, the corresponding reading will be displayed.

AIR SUPPLY: The system is designed to operate with an air source of "instrument quality". The optimum operating pressure for this system is 30-40 PSI maximum with 35 PSI as a desirable mean.

WARNING: To reduce any risk of air dampener tank rupture, the input supply pressure to this system should **NEVER** exceed 40 PSI.

ADDITIONAL FEATURES

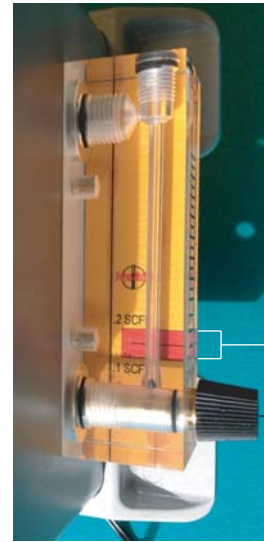


POWER SUPPLY
INPUT JACK
9 VDC

LATCH

AUDIBLE ALARM
HORN

fig.6



OPTIMAL PURGE
RANGE: 0.10-0.20 SCFH

ADJUSTING
KNOB

AIR FLOW INDICATOR
1611-201

fig.7

D-SUB CONNECTOR ARRANGEMENT

PINS 1 & 3 - COMMON CONTACT

PINS 4 & 6 - NORMALLY OPEN

PINS 7 & 8 - NORMALLY CLOSED

RELAY RATINGS

Load Resistive load

(cos = 1)

Inductive load

(cos = 0.4; L/R = 7 ms)

Rated load 0.5 A at 125 VAC;

2 A at 30 VDC

0.25 A at 125 VAC;

1 A at 30 VDC

Contact material Ag (Au-Alloy)

Rated carry current 3 A

Max. switching voltage 250 VAC, 220
VDC

Max. switching current 2 A 1 A

Max. switching power 125 VA, 60 W 62.5
VA, 30 W

Failure rate (reference value) (See
note.) 0.01 mA at 10 mVDC

9 Pin D-Sub
Male Connector



fig.8

MANUFACTURER'S LIMITED PRODUCT WARRANTY

Petro-Meter Corporation warrants all hydrostatic gauge and/or alarm systems to be free from manufacturing defects in materials and workmanship for a period of 180 days from the original date of purchase. Petro-Meter Corporation will, within said period, at its option, repair or replace any product failing to operate, and return such product, without charge, to the original purchaser or user, provided it is returned to Petro-Meter Corporation by the original user or purchaser, with all shipping costs prepaid and insured, in an appropriately protected shipping container if not the original protective packaging. Petro-Meter will not assume any additional liability for products that sustain further damage caused by inappropriate packaging when shipping items back for factory repair or replacement.

This warranty shall not apply to any equipment or any part thereof, which has been repaired by other than Petro-Meter Corporation, improperly installed, improperly used or adjusted, abused, altered, physically or electrically damaged, subjected to acts of God, or on which serial numbers have been altered, defaced or removed. The seller will not be responsible for any dismantling or reinstallation charges or fees.

There are no warranties, express or implied, which extend beyond the description on the face hereof. There is no express or implied warranty of merchantability or a warrant of fitness for a particular purpose. This warranty is the sole warranty in its entirety. Any prior agreements or representations, whether oral or written, are either merged in this warranty or are expressly cancelled. Petro-Meter Corporation Neither assumes, nor authorizes any other person purporting to act on its behalf to modify, to change, or to assume for it, any other warranty or liability concerning its products.

Additionally, this warranty is in lieu of all other obligations or liabilities on the part of Petro-Meter Corporation seller's warranty, as hereinabove set forth, shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of, seller's rendering of technical advice or service in connection with buyer's order of the goods furnished hereunder.

Petro-Meter Corporation requires that all hydrostatic alarm systems be completely tested on a regularly scheduled basis and that no adjustments be made to any component of the system, except for those made by personnel qualified and or trained in for field adjustments or modifications, and that no such adjustments or modifications be made without express written permission by Petro-Meter Corporation. Incorrect or inappropriate adjustments may cause these systems to fail or to operate improperly. Petro-Meter Corporation limits its liability for any loss or damage, including incidental or consequential damages arising from the failure of its product to the original selling price of the product regardless of the cause of such loss or damage.

Since Petro-Meter Corporation hereby represents that it is not an insurer of either the property or safety of the user's family or employees, if the user wishes to protect itself to a greater extent, Petro-Meter Corporation will, at the user's sole cost and expense, obtain an insurance policy to protect the user, supplemental to the user's own insurance policy, at a premium to be determined by Petro-Meter Corporation's insurer, upon written notice from the user, verified by certified mail, return receipt requested, to Petro-Meter Corporation's home address, and upon payment of the annual premium cost by the user.

Any action for breach of any expressed or implied warranty must be brought within 6 months following the end of warranty period. In no case shall Petro-Meter Corporation be liable to anyone for any consequential or incidental damages for breach of this or any other warranty, express or implied, even if the loss or damage is caused by the seller's own negligence or fault.

Warning: Any electronic system is susceptible to unforeseeable random failure, and as such, it is possible for this system to fail to operate or perform as expected despite frequent testing. Malfunction can be due to electrical disturbances or disruptions, communications malfunctions or disruptions, criminal tampering, unauthorized adjustments, or other means beyond the seller's control.

Petro-Meter Corporation does not represent that the system/product may not be compromised or circumvented; or that the product or system will prevent any personal injury or property loss. A properly installed and maintained system may only reduce the risk of tank overflow or annular space flooding, or otherwise but it is not insurance or guaranty that these events will never occur.

Consequently, the seller shall have no liability for any personal injury, property damage, or other loss based on a claim that the product failed to stop an overflow or annular space flooding event. To mitigate any such loss occurrence, system confidence testing on a weekly, or no longer that a monthly basis, is absolutely crucial. The consumer is hereby advised to take any and all precautions for his or her safety and the protection of the premises in order to mitigate the possibilities of harm and/or damage should the hydrostatic alarm system experience a random electronic failure beyond anyone's control or prediction.

This warranty shall be construed according to the laws of the state of New York. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, or differentiate in their treatment of limitations of liability for ordinary or gross negligence, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights that vary from state to state.