

HYDRODATA™ MULTIMETER HDM-250

ELECTRONIC PRESSURE GAGE

GAGE PRESSURE • DIFFERENTIAL PRESSURE • TEMPERATURE

OPERATING INSTRUCTIONS



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1.0 SAFETY WARNINGS

READ ALL SAFETY WARNINGS CAREFULLY BEFORE USING HYDRODATA MULTIMETER.

Do **not** use the HydroData Multimeter or accessories on potable (drinkable) water or on any other fluid systems which may be used for human or animal consumption (or which may otherwise cause a health risk) because of the possibility of the system being tested becoming contaminated by residue from within the meter, piping or hoses.

The HydroData Multimeter and Valve Network Panel are designed for pressure measurement of **non-potable water** and **air** hydraulic and hydronic systems. This meter is not designed for and must not be used with potentially hazardous fluids or connected to any pressure source greater than 250 psi.

Do **not** use the HydroData Multimeter or Valve Network Panel to measure steam or high temperature hot water systems, or with acid, caustic, or any other hazardous chemicals.

Do **not** use the HydroData Multimeter or Valve Network Panel to measure oxygen, hydrogen, or any other explosive or flammable gases or liquids. Fire or explosion may result.

Observe all safety precautions when using this system with pressurized fluids. Be aware of possible line rupture and associated chemical, thermal and physical risk. Wear protective garments, gloves and eye protection as appropriate for the type of exposure.

Water or air pressure in the lines or Valve Network Panel must be released **before** disconnecting the pressure. Water or air discharged under pressure may cause significant eye or other injuries. Water discharged under pressure is a potential hazard around electrical motors, switch-gear, buss duct, convenience outlets, or other electrical equipment.

Water may enter the meter ports to a depth of one inch during pressure measurements. This residual fluid must be thoroughly drained after each use by disconnecting the meter ports from the Valve Network Panel and laying the meter on its back on absorbent material until completely drained. Do not reconnect the meter ports to the Valve Network Panel until completely drained and dry inside or when preparing to use the meter.

Check to be sure that the meter ports are reconnected to the Valve Network Panel prior to taking pressure measurements. Failure to reconnect the meter ports to the Valve Network Panel prior to taking pressure measurements will result in the discharge of pressurized water or air into the vicinity of the meter and create all the risks discussed above.

Water must be thoroughly drained from the Valve Network Panel and the inside of the piping and all hoses must be blown dry with compressed air after each use. Failure to keep the meter, Valve Network Panel, hoses, carrying case and discharge tubing clean and dry may result in the growth of hazardous microorganisms. Bacteria, viruses and fungi are known to multiply rapidly in moist environments.

Water hammer is a hydronic system effect that can seriously damage HydroData Multimeters. Water hammer is a shock wave of pressure, less than one second in duration, during which the gage pressure shoots up to a peak many times higher than the normal line pressure in a pipe. Water hammer is caused by sudden changes, such as a pump being turned on or off, or a valve being opened or closed. The HydroData Multimeter should only be connected to the system long enough to take the actual measurements. If the meter will be connected for several minutes (or longer) between measurements, close both the high-side and the low-side shutoff valves on the Valve Network Panel.

2.0 INTRODUCTION

The HydroData Multimeter HDM-250 is designed for efficient, accurate measurements of non-potable water and air pressures up to 250 psi, and also may be used for temperature measurement. This Instruction Manual will be much easier to follow if you have the meter in front of you as you read through it. You can note the various pressure and temperature connections and press the keys, observing the displayed results as you read through the various procedures. The operation of the meter is quite simple and straightforward, as will become apparent after a little practice.

This unique new instrument combines the functions and ranges of several gages into a single broad range meter. The meter functions as a compound pressure gage, simultaneously measuring the high side and low side pressures along with the differential pressure, and displaying each of the readings in sequence. Any reading may be alternately displayed in English or metric units and may be directly converted to any other units immediately following display of the reading. Any mix of readings or units can be stored for later recall.

The HydroData Multimeter HDM-250 is accurate across an extremely broad range of fluid gage pressures and differential pressures. The high pressures existing at pumps, chillers, cooling towers, and high rise building conditions can be measured up to 250 psi. The meter will also measure very low pressures, such as reheat coil pressure drops, and low flow conditions on flow measuring orifice plates, or pitot probes down to 0.1 in wc differential and gage pressures. Other applications requiring low pressure measurement may include the air side pressures of fans, coils, and filters.

This meter is ideally suited for temperature efficiency testing of boilers, chillers, cooling towers, coils, and all types of heat transfer and energy recovery systems. The 1/8" or 1/16" diameter, stainless steel TemProbes are uniquely suited for measuring air wet bulb, dry bulb, and water line temperatures. The optional AirData MultiTemp may be used with the HydroData Multimeter to measure temperatures at eight remote locations in very rapid sequence.

The HydroData Multimeter features an automatic reading and memory storage mode which records repeated measurements for any capability. The memory allows sequential storage and recall of up to 100 sets of automatically or individually obtained measurements with sequence tags for each reading. Recall of the associated high side or low side pressures for each reading in the stored sequence is also available at any point, without terminating the process. All readings are tagged and recalled in sequential order. Memory is particularly useful for comparing previous set points to final conditions during the hydronic balancing process.

The slow reading mode averages multiple measurements over a four to eight second sampling period to improve repeatability and reading accuracy of fluctuating pressures. Internal calibration of the HydroData Multimeter is fully automatic. The meter automatically selects the proper range and compensates for internal temperature prior to each reading.

The HydroData Multimeter comes complete with a shutoff, bypass, and blowdown valve network mounted on a portable meter panel. This Valve Network Panel has been designed specifically for use with the HydroData Multimeter and facilitates pressure selection and measurement, bleed-off of air, venting of pressures, or draining of water. The meter may also be removed from the Valve Network Panel and used independently.

The rugged carrying case is designed with storage compartments for accessories, hoses, tools, and reports or paperwork. The meter and Valve Network Panel are easily removed from the carrying case and carried to various project locations.

It is recommended that the HydroData Multimeter (meter only) be returned to the factory at least every two years for recalibration and software update. This preventive maintenance program will assure that the original accuracy of the meter is maintained throughout the life of the meter.

NOTE: Water hammer is a hydronic system effect that can seriously damage HydroData Multimeters. Water hammer is a shock wave of pressure, less than one second in duration, during which the gage pressure shoots up to a peak many times higher than the normal line pressure in a pipe. Water hammer is caused by sudden changes, such as a pump being turned on or off, or a valve being opened or closed. The HydroData Multimeter should only be connected to the system long enough to take the actual measurements. If the meter will be connected for several minutes (or longer) between measurements, close both the high-side and the low-side shutoff valves on the Valve Network Panel.

3.0 METER SPECIFICATIONS

NOTE: Pressure specifications require that the meter be stabilized for temperature (warmed up) and that the meter be zeroed prior to taking pressure readings.

DIFFERENTIAL PRESSURE (P_d): When measured in pounds per square inch (psi), the measurement range is from -10 psi to + 250.0 psi. Maximum safe pressures are 400 psid and 400 psia common mode. Accuracy is $\pm 2\%$ of reading $\pm$ last digit from 0.1 to 250.0 psi (meter must be zeroed prior to taking pressure readings).

GAGE PRESSURE (P_1): When readings are displayed in pounds per square inch (psi) with reference to the atmosphere, the range is zero to 250.0 psi. The high side (P_1) readout is the sum of the differential pressure (P_d) and low side (P_2) measured pressures (meter must be zeroed prior to taking pressure readings).

GAGE PRESSURE (P_2): When measured in pounds per square inch (psi) with reference to atmosphere, the measurement range is from minus one atmosphere to 250.0 psi. Accuracy is $\pm 2\%$ of reading $\pm$ last digit from 0.1 to 250.0 psi (meter must be zeroed prior to taking pressure readings).

PRESSURE LIMITS: Maximum safe pressures are 400 psid and 400 psi on either the positive port (high side)(P_1) or the negative port (low side) (P_2) of the meter.

TEMPERATURE: Accuracy is $\pm 0.5^\circ\text{F}$ from 32°F to 158°F with a resolution of 0.1°F using the ADT442, ADT443, ADT444, ADT445 or ADT446 TemProbes. Meter will display readings from -67.0°F to 250.0°F . Safe exposure range for the TemProbe is -100°F to 250°F . Do not expose the plastic base of the TemProbe or the extension wand to temperatures above 200°F .

MEMORY: One hundred (100) sets of readings with sequential recall of each reading and associated high side (P_1) and low side (P_2) pressures. Temperature readings can also be stored and sequentially recalled as needed. Any mix of pressure readings and/or temperature readings can be stored and sequentially recalled also.

RESPONSE TIME: Four seconds in manual or AUTO mode and four to eight seconds per reading in SLOW-READ MODE.

SLOW-READ MODE: Provides time averaged readings in four to eight seconds when selected.

READOUT: Eight digit, 0.5" high contrast liquid crystal display (LCD).

METER HOUSING: High impact, molded, "T" grade ABS.

WEIGHT: Meter only, 38 ounces. Meter and Valve Network Panel, 6 lbs. Standard kit shipping weight, 21 lbs.

DIMENSIONS: Meter only: 6.0" x 6.4" x 2.7". Meter & valve network: 15" x 7" x 4.5". Shipping 19" x 15" x 6".

BATTERY LIFE: A ten-hour charge will normally allow three working days of heavy use. Increasing the charge time to 48 hours (such as a weekend) will increase the working time by 25%.

A set of rechargeable type AA NiCad batteries is supplied in each meter. Each battery has a storage capacity of 1100 milliAmp hours. These batteries may be recharged up to 500 times before replacement. If 1100 mAh batteries are not available in a field situation, 700 mAh batteries (all 12) may be substituted. If 700 mAh batteries are mixed with 1100 mAh batteries, the 700 mAh batteries may be damaged as the battery charge is depleted. If rechargeable batteries are not available in a field situation, the batteries may be replaced with 12 non-rechargeable "AA" pen cell batteries.

WARNING: Do not plug the charger in if **any** non-rechargeable batteries are in the meter. The meter will be seriously damaged along with the batteries and charger.

OPERATIONAL TEMPERATURE LIMITS: The specified accuracy for measurements is maintained over a meter ambient exposure temperature range of 40° F to 140° F (5° C to 60° C). Recommended safe temperatures for fluid pressure measurement are from 32° F to 130° F (0° C to 55° C).

STORAGE TEMPERATURE LIMITS: 32° F to 140° F (0° C to 60° C). Water must be drained from the Valve Network Panel prior to storage at temperatures below freezing.

INTERNAL WETTED MATERIALS: The wetted materials in the HydroData Multimeter and valve network are #316 stainless steel, brass, nickel, chromium, nylon, neoprene, silicone gel, silicon chips, ceramics, polyurethane tubing, and cyanoacrylate (superglue). The usual additives in hydronic systems, such as ethylene glycol and corrosion inhibitors, will not harm the meter pressure sensor, valves or piping.

BATTERY CHARGER: The battery charger requires 120V, 60Hz, 6W. Batteries recharge in a maximum of 10 hours, and may be left on charge for an unlimited time without harm. The temperature of the instrument during charge should be kept between 40° F and 113° F (15° C to 45° C). The meter is fully operational during recharge.

TUBING: Recommended tubing size is 1/8 inch inside diameter minimum.

CONNECTIONS: Two quick disconnect fittings, 1/8" brass.

HOSES: Two 6' x 1/2" OD reinforced pressure hoses rated for 500 psi working and 2500 psi burst pressure with 1/4" flare ends. Kit also includes two 8' x 1/4" OD polyurethane drain/vent hoses.

FITTINGS: Set of 1/4" flare adapters and pipe thread fittings from 3/4" through 1/8" MPT and FPT.

CARRYING CASE: Compartmented high impact ABS carrying case.

4.0 EXTERNAL FEATURES

4.1 KEYPAD

The meter keypad has eight keys. Each key may include multiple functions that are activated either alternately, or by pressing the shift key followed by the function key. The instructions will often refer to a key by only one of the functions shown on the key.

Upper half of keys (SILVER - active only after pressing SHIFT key).

Control name	Function
SHIFT	Shifts control from lower to upper half of keys and vice versa.
ZERO	Zeroes the meter and adds one place in the last digit position for most pressure readings.
UNITS	Alternate action for English or metric units.
CLEAR	Clears memory, AUTO-READ, and SLOW-READ functions.
OFF	Turns the meter off after SHIFT is pressed (clear memory first).
AUTO	Selects automatic reading mode.

Lower half of keys (BLACK - always active except following SHIFT).

Control Name	Function
MODE	Sequential action for four different units of pressure and one unit of temperature, while in either English or metric units.
ASSOC	Sequential action to recall associated pressures: high side (P_1) and low side (P_2) pressures for the reading that is on display and returns to differential pressure (Pd).
STORE	Memory entry, then alternate action for sequence tag and pressure display (01: 0.50) and then units of that display (01: Pd PSI).
ON	Turns the meter on.
◀ RCL	Recalls stored readings in reverse order. Also used to discard an invalid reading before entry of a reading into memory.
RCL ▶	Recalls stored readings in entry order. Also used to discard an invalid reading before entry of a reading into memory.
READ	Initiate measurement or halt automatic readings. Also used to initiate the SLOW MODE when held down at the end of any manual reading.

4.2 FEATURES ON SIDES AND BACK OF METER

BATTERY CHARGER JACK

When viewed from the front, the battery charger jack is on the right side of the meter toward the top. The battery charger plug is to be connected here.

TEMPERATURE INPUT JACK

The temperature input jack is centered on the back of the meter, slightly toward the top. A

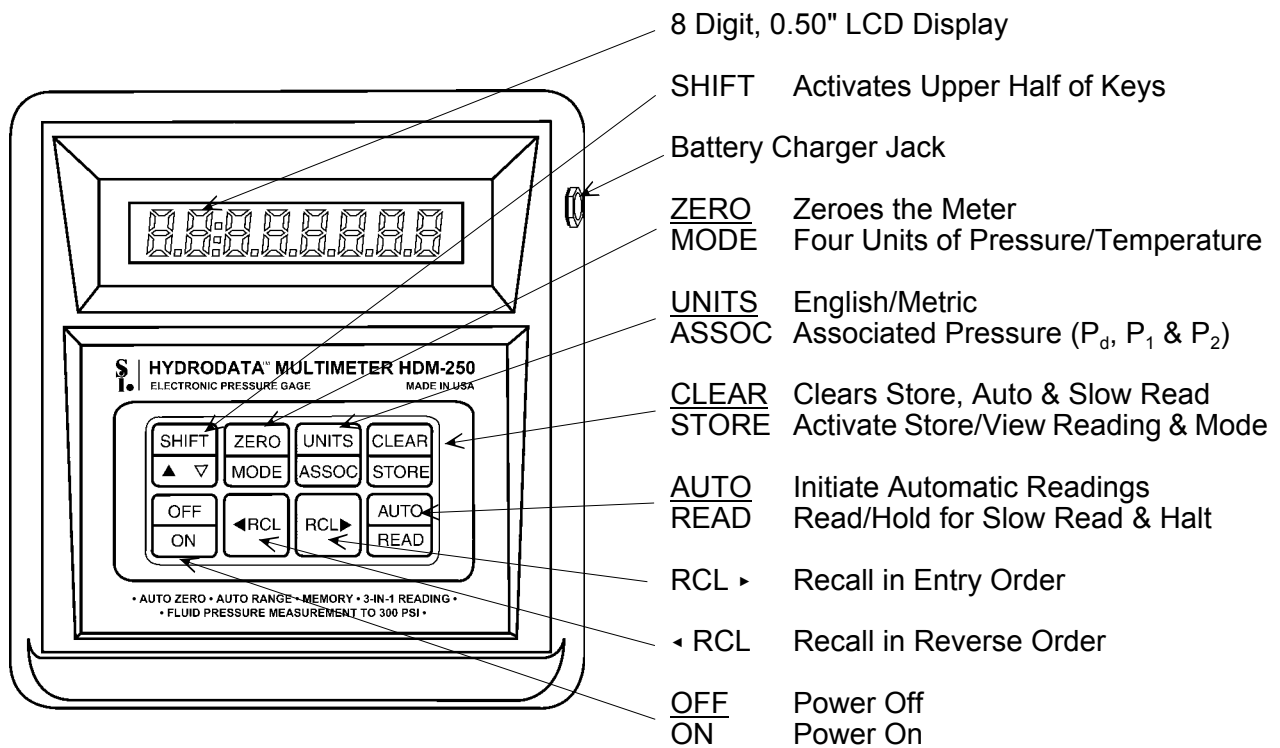
retractile cord and probe, or the AirData MultiTemp may be used for temperature performance testing.

OFF/RESET

The OFF/RESET red push-button switch is on the back of the meter in a recess near the upper left corner. This switch is used to reset the meter in the unlikely event that the microprocessor becomes lost in its program. This may occur if the meter is dropped, and may cause the keypad to become nonfunctional until the meter is reset. If the meter continues to fall into "lockout", the batteries and the tightness of the battery clips should be checked. If the problem continues, return the meter to the factory for repair.

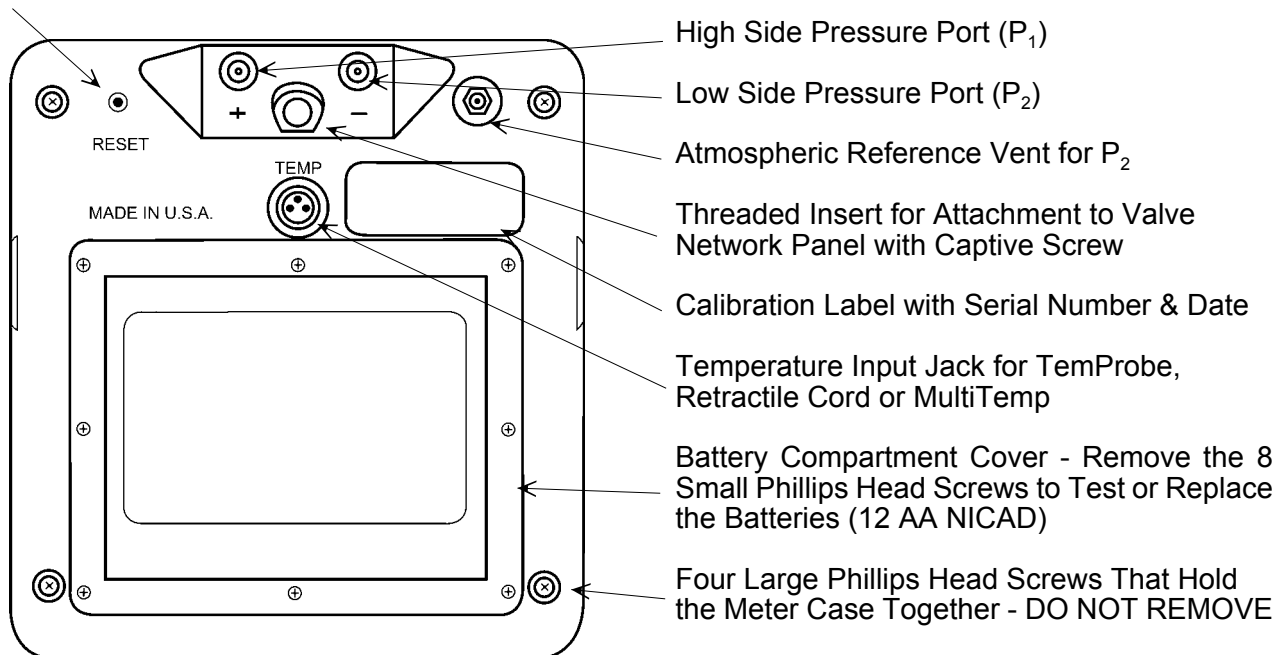
PRESSURE INLETS

The two pressure inlets, P_1 positive (+) and P_2 negative (-) are on the back of the meter at the top edge. These inlets may be connected to various pressure sources for the measurement of pressure. These sources include the Valve Network Panel, or the inlets may be connected directly to pressure sources not exceeding the safety limits for the meter. The positive (+) inlet senses the high side (P_1) for differential pressure. The negative (-) inlet senses the low side (P_2) for differential pressure measurements and for low side measurement of gage pressure relative to the atmosphere.



HYDRODATA MULTIMETER FRONT

Pushbutton Reset Switch



METER BACK

FIGURE 4.1 HDM-250 METER FRONT AND BACK

5.0 DISPLAY MESSAGES AND PROMPTS

5.1 READ PROMPTS

The following ten prompts all include the term READ, which is a signal for the operator to press the READ key to trigger the actual measurement.

English Units (listed in order of display as the MODE key is pressed.)

PSI: READ

This display indicates that the meter will read pressures in pounds per square inch (psi). This signal will appear automatically after turning the meter on.

Ft: READ

This display indicates that the pressure readings will be in feet of head (ft head).

In: READ

This display indicates that the pressure readings will be in inches of water column (in wc).

HG: READ

This display indicates that the pressure readings will be in inches of mercury (in Hg).

° F: READ

This display indicates that the temperature readings will be in degrees Fahrenheit (° F).

Metric Units (listed in order of display as the MODE key is pressed.)

kPA: READ

This display indicates that the pressure readings will be in kiloPascals (kPa).

≡Hd: READ

This display indicates that readings will be in meters of water column (meters of head).

H2O: READ

This display indicates that the pressure readings will be in millimeters of water column (mm wc).

HG: READ

This display indicates that the pressure readings will be in millimeters of mercury (mm Hg).

° C: READ

This display indicates that the temperature readings will be in degrees Celsius (° C).

The next ten examples represent measurement readouts after the operator has pressed the READ key. The letter n in each example indicates a space for a number in the result. If no sign is displayed, the result is a positive number. A negative sign indicates that the result is a negative number.

English Units (listed in order of display as the MODE key is pressed.)

PSI: n.nn

Indicates that the result represents a pressure measurement in pounds per square inch (psi).

Ft: n.nn

Indicates that the result represents a pressure measurement in feet of head (ft head).

In: n.nn

Indicates that the result represents a pressure measurement in inches of water column (in wc).

Hg: n.nn

Indicates that the result represents a pressure measurement in inches of mercury (in Hg).

° F: nnn.n

Indicates that the result represents a temperature measurement in degrees Fahrenheit (° F).

Metric Units (listed in order of display as the MODE key is pressed.)

kPA: n.nn

Indicates that the result represents a pressure measurement in kiloPascals (kPa).

≡Hd: n.nn

Indicates that the result represents a pressure measurement in meters of head (m hd).

H2O: nnnnn

Indicates that the result represents a pressure measurement in millimeters of water (mm wc).

HG: n.nn

Indicates that the result represents a pressure measurement in millimeters of mercury (mm Hg).

° C: nnn.n

Indicates that the result represents a temperature measurement in degrees Celsius (° C).

5.2 FUNCTION READOUTS

The following prompts and messages are listed in alphabetical order.

8.8:8.8.8.8.8.8

A sequence of eights will be flashed momentarily to test the operation of the display each time the meter is turned on.

AUTO RDY

This message indicates that the meter has been placed in the automatic reading function. Press SHIFT, then AUTO to enter this mode. Press the READ key to start the actual measurement. Holding the READ key down halts the automatic reading sequence. Pressing the READ key again restarts the AUTO-READ function.

AUTO STOR

This message indicates that the meter has been placed in the automatic memory mode. This mode integrates the automatic reading function with the sequential storage function, and permits recall of the readings and the associated values at any point. Press SHIFT, then AUTO, then STORE to enter this mode. Press the READ key to start the actual reading process. Press and **hold** the READ key until HALT is displayed to stop the automatic reading sequence.

CAL

When the meter is first turned ON, it will perform a self calibration process that takes a few seconds. The meter will display the software version number during this period and the operating controls will be inhibited. No READ operations or function changes can be made during this period. The meter will also briefly display CAL and perform a self calibration check about once every thirty seconds if the READ key has not been pressed.

CLEAR

This signal is flashed as the MEMORY, SLOW-READ, and AUTO-READ functions are cleared. Press SHIFT prior to pressing CLEAR.

ENGLISH

This message indicates that the readings will be in English units. Press the SHIFT key and then the UNITS key to switch to metric units. The meter automatically starts up in English units when first turned on.

HALT

This message will be displayed when an automatic reading sequence has been halted manually by holding down the READ key until HALT is displayed. The individual readings may now be displayed if the memory mode is active.

LOCHARGE

This message indicates that the battery cells are nearing the end of their useful charge. The meter will function normally for approximately one more hour of operation before recharge is required.

METRIC

This message indicates that the readings will be in metric units as selected by first pressing the SHIFT key and then the UNITS key.

NEG DIFF

Displayed when the pressure on the low side port (P_2) (-) is greater than the high side port (P_1) (+). This may result from reversed tube connections to the meter or from other conditions discussed under differential pressure measurement.

NO PROBE

This message appears when the operator has neglected to install the TemProbe sensor prior to initiating a temperature measurement. This term is also displayed if the TemProbe or extension cord has been damaged so as to create an open circuit.

OVERANGE

OVERANGE is displayed during a pressure measurement when the pressure applied to either port of the meter exceeds 250 psi or the differential pressure exceeds 250 psi. OVERPRES is displayed and no reading will be shown when the pressure exceeds 280 psi.

WARNING

Stop pressure readings and bleed off pressure immediately when OVERANGE is displayed to avoid damage to the meter and the valve network. The risk of damage to the meter pressure sensors is significant at 400 psi.

PROBE

A flashed message which appears during the actual temperature measurement to confirm that the TemProbe is functioning.

READING

This term is displayed during differential pressure measurements, and also during the first reading period of some auto-reading sequences.

RECHARGE

This message signals that the battery cells have reached the end of their useful charge, and must be recharged before further operation. The meter will turn off following the display of RECHARGE.

SHIFT

This message is displayed when the upper half of the keys are first activated by pressing the SHIFT key.

SLO RDY

This message is displayed when the meter is placed in the SLOW-READ function. This function is entered by holding the READ key down throughout a reading. The SLO RDY message will be displayed just before the reading is completed. The SLOW-READ function can not be entered if the meter is already in the AUTO-READ function. The SLOW-READ function must be entered first, and then AUTO-READ. The SLOW-READ function takes multiple readings for both differential and gage pressure and averages them over a period of four to eight seconds.

STOR FULL

This message indicates that the number of readings in memory has reached the storage capacity of 100 sets of readings. Readings may be pressures, temperatures, or any combination of either function. When the memory is full, no further readings may be taken until the memory is cleared by pressing SHIFT then CLEAR.

STOR RDY

This message indicates that the meter has been placed in the memory mode, and that selective individually obtained readings may be sequentially entered into memory. Pressing the READ key will store the displayed reading and start another reading. Pressing the STORE key will store the reading without taking another reading. Pressing the MODE key will store the reading on display and switch to any other mode. Press SHIFT, then CLEAR to exit the memory function.

TOO HOT or TOO COLD

If the internal temperature of the meter exceeds its operational limits, it will display TOO HOT or TOO COLD and shut down. However, if there are readings in memory, the meter will continue to display TOO HOT or TOO COLD, and will retain the readings in memory. The meter must be cooled down or warmed up, as the case may be, before normal operation can resume.

If the meter has displayed OVERANGE after displaying either TOO HOT or TOO COLD, but has not shut down, this message indicates that the TemProbe sensor was being exposed to temperature levels beyond the proper operating range. Also, if TOO HOT/OVERANGE has been displayed, but the meter has not shut

down, the TemProbe sensor may have become short circuited.

ZERO

This message is displayed when SHIFT and then ZERO are pressed in sequence. NOTE: All pressure sources **must** be shut off and the bypass valve and one vent valve must be open during the time that the meter is being zeroed.

6.0 USING THE HYDRODATA MULTIMETER

NOTE: Become thoroughly familiar with all Safety Warnings on the first page of this manual before using the HydroData Multimeter or its accessories.

The HydroData Multimeter is automatically set to read in English units. The SHIFT key must be pressed, followed by the UNITS key, to shift the meter into the metric units mode, or to shift it back to the English units mode after it has been placed in the metric mode. The meter will revert to English units each time it is turned off.

After being turned on, the meter will flash a full set of eights to test the display, and will display the software version number while performing a brief internal calibration test. The meter always defaults to English units and differential pressure in pounds per square inch (psi) when first turned on. The meter will display PSI: READ and is then ready for differential pressure measurements in psi.

Differential pressures may also be measured in three other sets of English units, any of which may be selected by pressing the MODE key repeatedly until the desired units are displayed. Temperature in ° F is displayed after the four types of differential pressure measurements. If metric units are required, press the SHIFT key, then the UNITS key to switch to metric units. Then press the MODE key to sequentially display each of the four metric units available for measuring differential pressure, followed by degrees Celsius for temperature. The meter may be reset to English units by pressing the SHIFT key and then the UNITS key or by turning the meter off and then on again.

The functions shown in the lower dark colored section of each key may be activated directly by pressing the desired key. The SHIFT key must be pressed prior to the selection of any of the functions shown in the light colored upper half of each key.

When the MODE key is pressed, the meter will display the letter abbreviation for the units being used, combined with READ; for example, PSI READ.

The meter will turn off automatically if it has not been used for approximately one hour, except when readings have been entered into memory, or if the meter is in the automatic reading mode. The meter is manually turned off by clearing memory (press the SHIFT key followed by the CLEAR key) then pressing the SHIFT key, followed by the OFF/ON key.

NOTE: Water hammer is a hydronic system effect that can seriously damage HydroData Multimeters. Water hammer is a shock wave of pressure, less than one second in duration, during which the gage pressure shoots up to a peak many times higher than the normal line pressure in a pipe. Water hammer is caused by sudden changes, such as a pump being turned on or off, or a valve being opened or closed. The HydroData Multimeter should only be connected to the system long enough to take the actual measurements. If the meter will be connected for several minutes (or longer) between measurements, close both the high-side and the low-side shutoff valves on the Valve Network Panel.

6.1 INDIVIDUAL READINGS

Press the UNITS and MODE keys until the required function and units are displayed. Press the READ key to take one reading. The selected function will be briefly displayed again, followed by READING during the actual measurement, and then by the result. Each successive measurement is triggered by pressing the READ key, which also clears the prior reading from the display.

The ASSOC function is used to display the associated high side (P_1) and low side (P_2) pressures after any differential pressure reading by pressing the ASSOC key repeatedly. Pressing the ASSOC key returns the display to the differential pressure reading (P_d). Pressing READ triggers another reading.

Readings may be converted from English to metric units, (or metric to English) by pressing SHIFT, then UNITS, while the reading is on display. Readings may also be converted to other types of measurement units (for example, converting psi to ft head) by pressing the MODE key while the reading is on display. When the new units are displayed, the ASSOC key may be pressed three times. The high side (P_1) and low side (P_2) pressures will be displayed, followed by the differential pressure (P_d) in the new type of units. Readings will continue to be displayed in the new units, unless another type of units are selected by pressing the MODE key until the required units are displayed.

The units represented by a displayed reading can be confirmed as necessary by pressing the SHIFT key twice when taking individual readings which are **not** being placed in memory. The display will show the units for the

reading on display. The actual reading can be returned to the display by pressing the ASSOC key until the required pressure type (P_1 , P_2 or P_d) is displayed.

6.2 INDIVIDUAL READING STORAGE

The STORE key must be pressed prior to entering any readings into memory. The meter will display STOR RDY. Press the READ key. The meter will display the selected function during the measurement. When the READ key is pressed again, the reading that is on display will be entered into memory as the next reading is being taken. The meter will briefly flash the sequence number of the reading being placed into memory. The reading and memory entry process will continue up to 100 readings.

A reading is not entered into memory until either the READ key is pressed for the next reading, the mode key is pressed to change modes, or STORE is pressed to enter the last reading of the sequence into memory. When the reading shown on the display is the last reading desired, press the STORE key to save that reading.

The STORE key may be pressed again to display the reading number, the type of reading and the units, ie. (01: Pd PSI). Pressing the STORE key a third time will return the display to the reading number and value. The measurement sequence may be resumed by pressing the READ key, and may be interrupted at any point by pressing the STORE key.

NOTE: Pressing SHIFT twice always displays the current measurement mode for the meter. The current measurement mode is not necessarily the same as the displayed reading when the meter is in the memory function. STORE must be pressed twice to check the units of a recalled reading.

The measurement MODE or UNITS may be changed while the meter is in the memory function by pressing the MODE key. The reading displayed will be saved, but will not be converted into the new units selected.

All readings have number sequence tags (01: 0.01) and may be recalled in sequential order by pressing one of the RCL (recall) keys. The associated high side (P_1) and low side (P_2) pressures may be displayed for any of the differential pressure readings in memory by pressing the ASSOC key when that particular differential pressure (P_d) is on display. The display will read P1: n.nn for high side readings, P2: n.nn for low side readings or NN: n.nn for differential pressure readings, where NN is the tag number for that differential pressure and replaces the (P_d) symbol.

The memory function is cleared by pressing SHIFT and then CLEAR. The meter may be turned off while in the memory mode, by pressing SHIFT, then CLEAR, then SHIFT, then OFF.

6.3 RECALL

The RCL keys are only used to sequentially recall readings that are in memory, and in general are used after the STORE key has been pressed. A brief press of a RCL key will advance the display one number at a time. Holding a RCL key down will fast forward or fast reverse the display through all the numbers that are in memory.

A displayed reading may appear to be abnormal; may have been taken at the wrong time; or with an improperly positioned sensor. If either RCL key is pressed while the last reading is on display, before it is entered into memory, that reading will be bypassed, and discarded, and will not be entered into memory. An interrupted sequence may be resumed by pressing the READ key. The readings taken after discarding the reading will be integrated with the readings already in memory.

If the meter's full capacity of 100 reading sets has been reached, STORE FULL will be displayed. Press the STORE key to alternately display the last reading, its type and units, or one of the RCL keys for recall of the individual readings. Reading number 100 is displayed as 00:nn.nn.

The memory is cleared by pressing the SHIFT key followed by the CLEAR key. This sequence removes all readings from memory and also ends the STORE, SLOW-READ and AUTO-READ processes. Press the STORE key a second time and a new memory sequence will be initiated.

Readings are still in memory after the SHIFT key has been pressed but before the CLEAR key is pressed. Pressing the SHIFT key a second time will return the meter to the previous mode and the existing readings will remain in memory. Pressing CLEAR does not affect the mode or the units currently being used.

6.4 AUTOMATIC READINGS

The meter can be set to take continuous automatic readings for as long as needed. Select the MODE and the UNITS as required. Press the SHIFT key, followed by the AUTO key to enter the automatic reading function. The meter will display AUTO RDY. Pressing the READ key will start the automatic reading process.

The series of readings may be interrupted at any point by holding the READ key down until the reading in

process has been completed and HALT is displayed. The associated pressure readings may be viewed, or MODE or UNITS changes may be made while the automatic readings are halted. The automatic reading sequence can be resumed by pressing the READ key again. The automatic reading process is ended by pressing the READ key until HALT is displayed, and then pressing the SHIFT key, followed by the CLEAR key.

6.5 AUTOMATIC READING STORAGE

The automatic reading function and the memory function may be combined to store up to 100 fully automatic, repeated readings for any function. This measurement and storage process will continue until interrupted by the operator, or until the meter registers STOR FULL at 100 readings.

The auto-reading memory sequence is initiated by first pressing the MODE and UNITS keys required. Then press the SHIFT key, followed by the AUTO key, then the STORE key. The meter will display AUTO STOR. Press the READ key to begin the actual readings.

The auto-reading memory sequence may be interrupted by holding the READ key down until the measurement in process has been completed. Release the READ key when HALT is displayed. The auto-reading memory sequence will be resumed if the READ key is pressed again. When the auto-reading memory sequence has been completed or interrupted, press the STORE key. The last stored number and value will be displayed. Press the STORE key a second time to display the reading number, its type and units, or press one of the RCL keys to recall individual readings.

The high side (P_1) and low side (P_2) pressure measurements may be viewed by pressing the ASSOC key as discussed under INDIVIDUAL READING STORAGE.

Automatic memory may be exited by pressing the SHIFT key followed by the CLEAR key, while the meter displays HALT. The meter can only be turned off while readings are in memory by pressing SHIFT, then CLEAR, then SHIFT, then OFF. This process reduces the probability of accidental loss of readings in memory.

6.6 SLOW-READ FUNCTION

The SLOW-READ function is used when the system pressure is fluctuating excessively. This mode takes time-averaged readings for both differential and gage pressures in about eight seconds. The SLOW-READ function is entered by holding the READ key down throughout an entire reading. SLO RDY will be displayed, followed by the results of that last reading (which was not taken in the SLOW-READ function). Press the READ key to take readings. All subsequent readings will be SLOW-READ time-averaged measurements, until SHIFT, then CLEAR is pressed, or until the meter is turned off.

The SLOW-READ function can be used with any pressure measurement units. It may also be used with the automatic reading and the storage functions. The SLOW-READ function must be entered before the AUTO-READ. The STORE function may be entered either before or after the SLOW-READ function. It is important to remember that pressing the SHIFT, then CLEAR keys to exit the SLOW-READ function also clears all stored data from memory.

7.0 PRESSURE MEASUREMENTS

The HydroData Multimeter is designed for pressure measurement of non-potable water and air hydraulic and hydronic systems.

7.1 OVERANGE

OVERANGE is displayed during a pressure measurement whenever the pressure applied to either port of the meter exceeds 250 psi or the differential pressure exceeds 250 psi. OVERPRES will remain on the display and no reading will be shown when the pressure exceeds 280 psi.

WARNING

Halt pressure readings and remove pressure source when OVERANGE is displayed to avoid damage to the meter and the Valve Network Panel. The risk of damage to the meter pressure sensors is significant at pressures greater than 400 psi.

7.2 NEG DIFF

The HydroData kit includes two hoses with female refrigeration type flare fittings for attachment to the high side (P_1)(+) and the low side (P_2)(-) connectors on the Valve Network Panel. The higher pressure line **must** be connected to the P_1 (+) connection on the network.

If the higher pressure line is connected to the P_2 (-) pressure port, the meter will read the differential pressure as negative. At pressures between zero and -3 psi, the meter will display negative readings (this allows for the occasional true negative reading at pressures close to zero).

At differential pressures between -3 and -10 psi, the meter will flash NEG DIFF and display the reading with a negative sign. If this occurs, the hoses should be checked for proper connections. At readings numerically greater than -10 psi, the meter will display NEG DIFF and will not display readings.

7.3 ZERO OFFSET

The meter will normally maintain a zero offset of less than .20 psi, which is usually insignificant when testing pumps, chillers, cooling towers, and other high pressure drop devices. However, the zero offset may be affected by temperature, so it is recommended that the meter be fully warmed up prior to taking readings to minimize this offset. If the meter is moved between areas with extreme temperature difference (changes of more than 20° F), it is best to let the meter settle into the new temperature for up to an hour. **It is best to check the meter zero after every position change, because this can also affect the zero offset.**

7.4 ZEROING THE METER

It is very important that there be no differential pressure across the meter, or any pressure applied to either port of the meter during the period when the meter is being set up to be zeroed. This is done by closing both the high side (+) and low side (-) shutoff valves, opening the bypass valve and one vent valve on the Valve Network Panel as shown in Figure 7.1. If the meter is not on the Valve Network Panel, the pressure lines must be removed from both ports of the meter during the zeroing process.

Press the SHIFT key and then the ZERO key. The meter will display ZERO and return to the selected pressure mode. Subsequent readings will now utilize the zero setting. (The valves on the Valve Network Panel must be readjusted as needed before readings are taken).

The zero function is most effective after the meter has been turned on for ten minutes or more. If the meter is moved between areas with extreme temperature difference (changes of more than 20° F), it is best to let the meter settle into the new temperature for up to an hour. **It is also necessary to re-zero the meter whenever the meter is repositioned or relocated. It is best to check the meter zero offset frequently.**

The zero function is useful for measuring very low gage and differential pressures below 10 psi. Zeroing the meter allows resolution to .01 psi for measurements up to 9.99 psi. Also, see Section 7.8 ZERO PROCEDURE FOR READING VERY LOW DIFFERENTIAL PRESSURES IN THE PRESENCE OF VERY HIGH LINE PRESSURES.

7.5 DIFFERENTIAL PRESSURE

The meter will automatically select the differential pressure in the PSI mode (P_d , P_1 & P_2) when first turned on. The meter will display all "eights", then the software version number, and then PSI: READ. Press the MODE key to select one of the four differential pressure units. Press the READ key to obtain the pressure measurement.

The positive (+) and negative (-) ports of the meter are connected as a pair to the pressure source for differential pressure measurements. NEG DIFF will be displayed if the pressure on the low side (-) port is greater than the pressure on the high side (+) port. If the meter reads NEG DIFF, check to see if the hoses have been connected incorrectly.

7.6 HIGH SIDE PRESSURE (P_1)

The high side pressure (P_1) associated with a given differential pressure measurement may be displayed by pressing the ASSOC key while the differential pressure reading is on display. The high side pressure readout (P_1) represents the calculated gage pressure applied to the positive (+) port of the meter and is the sum of the measured differential pressure (P_d) and the low side gage pressure (P_2).

Specific gage pressure measurements may also be obtained by connecting the pressure source directly to the positive (+) port of the Valve Network Panel and meter as shown in Figure 7.2. Leave the low side vent valve open to the atmosphere, and record the differential pressure (P_d) readout as gage pressure.

7.7 LOW SIDE PRESSURE (P_2)

The low side pressure (P_2) associated with a given differential pressure measurement may be displayed by pressing the ASSOC key after the high side pressure has been displayed. The low side pressure represents the measured gage pressure applied to the negative (-) port relative to the atmosphere.

The low side pressure (P_2) may be less than atmospheric pressure, in which case (P_2) will display a negative pressure down to as much as minus one atmosphere (-14.7 psig at sea level).

7.8 ZERO FOR VERY LOW DIFFERENTIAL WITH VERY HIGH LINE PRESSURES

The following special procedure for zeroing the meter when reading a very low differential pressure in the presence of a very high line pressure may be used to obtain a more precise differential pressure reading. This method may be useful when the differential pressure is less than 5 % of the gage pressure.

Zero the meter and take readings as described below, recording the gage pressures as actual and the differential pressure as a preliminary reading. Do not move the meter or disconnect the hoses while closing the high side and low side shutoff valves. This traps the high line pressure inside the Valve Network Panel, while isolating the sensor from pressure oscillations in the plumbing system. Open the bypass valve to equalize pressure to the ports. Press SHIFT / ZERO to zero the sensor. Press READ to check the zero. Close the bypass valve. Press READ to check the zero again. Open the high side and low side shutoff valves and press READ for the actual differential pressure measurement. Disregard the P_1 and P_2 readings as they do not represent true gage pressures.

7.9 VALVE NETWORK PANEL

The meter is attached to the portable Valve Network Panel using the captive fastener on the valve panel to secure it. The two female quick disconnects from the valve network attach to the pressure inlets on the meter. The positive (+) connection on the right side of the valve network connects to the positive (+) pressure inlet on the meter.

It is very important that these connections are not reversed, since this will cause false pressure measurements. If this occurs the meter will read NEG DIFF.

The TemProbe retractile cord or MultiTemp cord plugs into the receptacle on the back of the meter through the opening provided in the Valve Network Panel.

SAFETY NOTICE

Water or air pressure in the lines or the Valve Network Panel **must** be released **before** disconnecting the pressure hoses. Water discharged under pressure may cause eye injury, and is a potential hazard around electrical motors, meters, switch gear, buss duct, convenience outlets, or other electrical equipment.

Be very careful to direct the vent valve discharge into a drain, bucket, or through hoses to an appropriate receptacle. Use great care to avoid splashing or spattering anything in the area.

The Valve Network Panel and components must be stored in a clean and dry environment when not in use. Water must be completely drained from the Valve Network Panel and inside of tubes must be blown dry with compressed air after each use. Failure to keep the Valve Network Panel, tubing and carrying case clean and dry may result in the growth of hazardous microorganisms.

7.9.1 PURGING THE VALVE NETWORK

Connect the pressure hoses to the pressure source and flush out debris and air in the lines. Connect the hoses to the positive (+) and negative (-) connectors on the front of the Valve Network Panel shown in Figure 7.3. Close both vent valves and the bypass valve. Open both pressure input valves and bleed off the air in the valve network through the vent valves.

The bypass valve may also be opened to purge air from the valve network. Any air left in the lines will affect the zero offset and cause false readings.

Meter High Side or Low Side Vent Valve.
Open to atmosphere. Only one valve is to
be opened at a time to avoid draining of fluid.

High and Low Side Hoses can
remain connected.

High and Low Side Valves closed.

Bypass Valve open to relieve pressure
differential between meter (+) & (-) connectors.

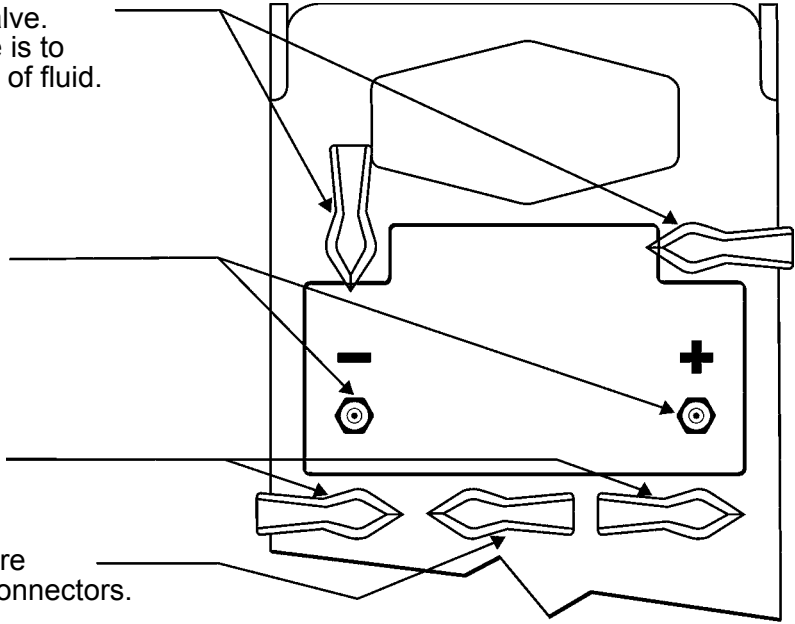


FIGURE 7.1 VALVE POSITIONS FOR ZEROING THE METER
NO PRESSURE ON P_1 , P_2 OR P_d
VALVE NETWORK PANEL - FRONT VIEW

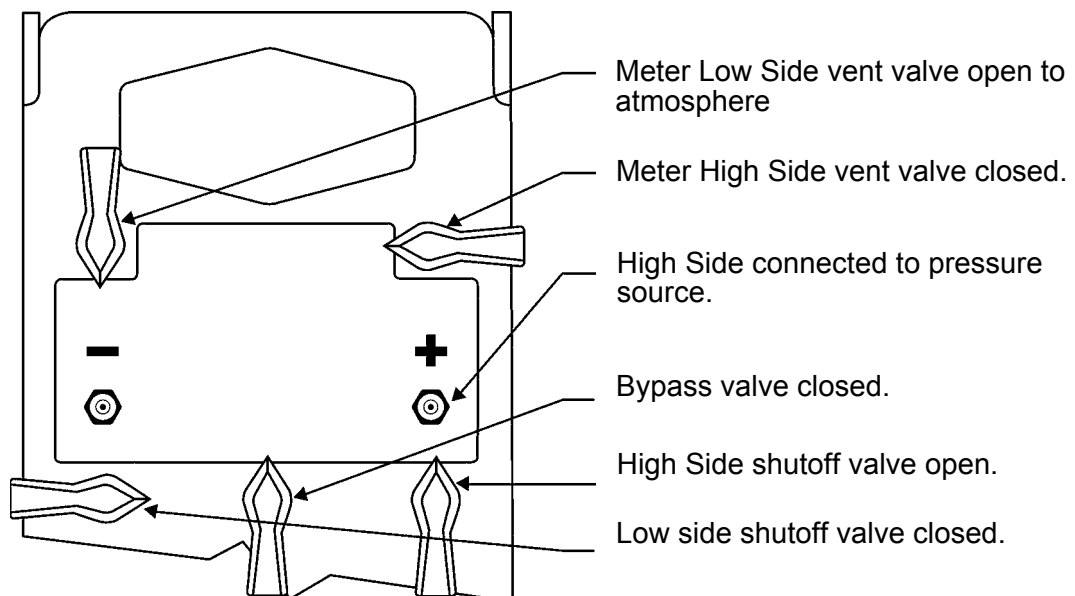


FIGURE 7.2 VALVE POSITIONS FOR GAGE PRESSURE MEASUREMENT
USING HIGH SIDE ONLY AND P_d READOUT
VALVE NETWORK PANEL - FRONT VIEW

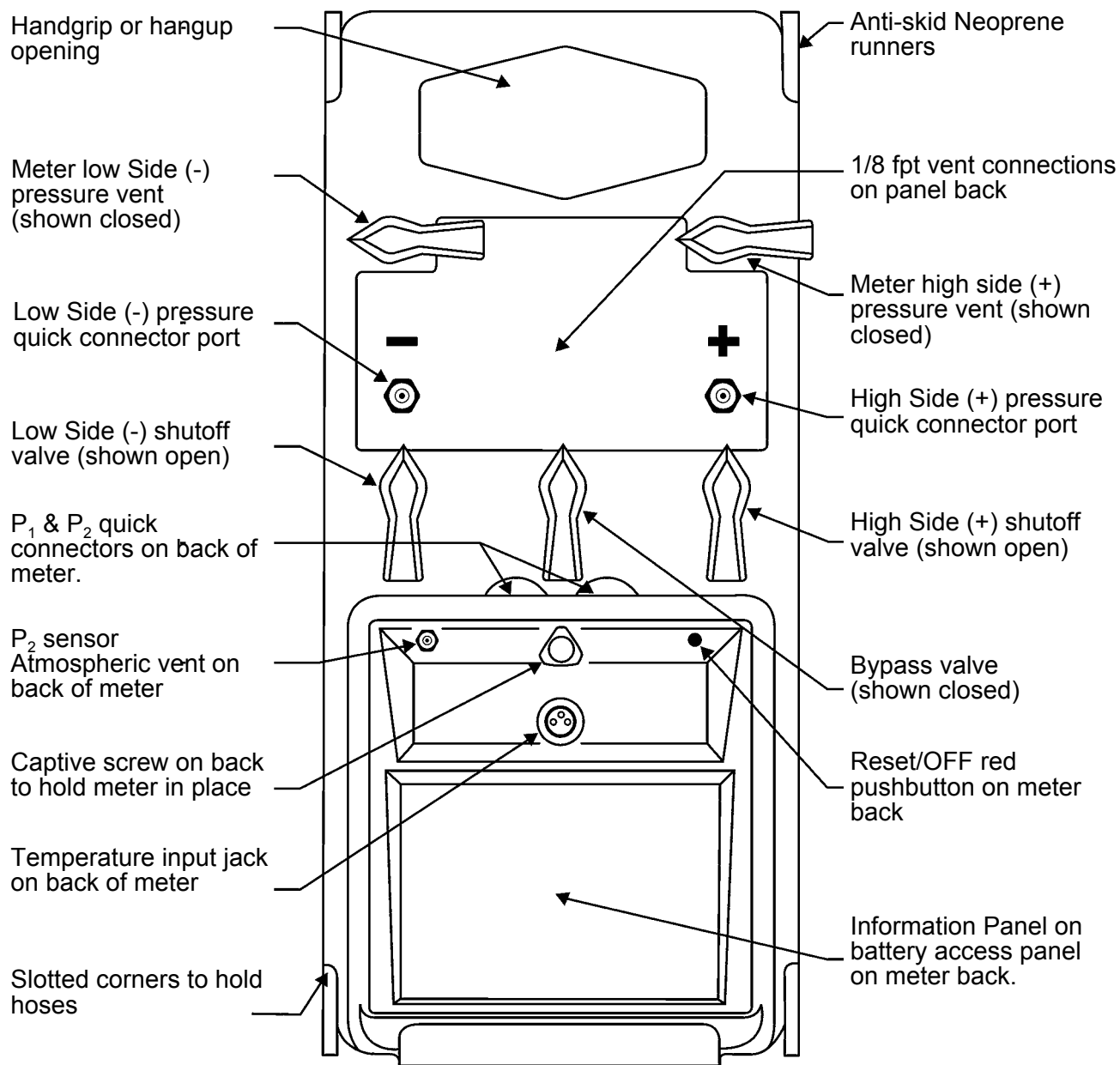


FIGURE 7.3 VALVE POSITIONS FOR DIFFERENTIAL PRESSURE MEASUREMENT

VALVE NETWORK PANEL - FRONT VIEW

8.0 TEMPERATURE MEASUREMENT

8.1 TEMPROBE

Temperature measurements are obtained using the TemProbe temperature probe and retractile cord. The retractile cord is plugged into the temperature input jack on the back of the meter. Since this receptacle is keyed, the plug on the retractile cord must be correctly aligned for proper insertion. (Pressing the release button on the side of the retractile cord connector will disconnect the plug for removal). The meter does not need to be used with the Valve Network Panel for temperature measurements.

After turning the meter on, press the MODE key until ° F: READ is displayed. Then, using the retractile cord place the TemProbe sensor in the medium to be sampled. If the TemProbe is not connected to the meter, or if it is open circuited (defective), the display will read NO PROBE.

Accuracy is $\pm 0.5^{\circ}\text{F}$ from 32°F to 158°F with a resolution of 0.1°F using the ADT400 Series TemProbes. Measurement range for the ADT446 TemProbe is -20°F to 180°F and -67.0°F to 250.0°F for all the other ADT400 Series TemProbes. Meter will display OVER TEMP or UNDER TEMP if the probe is exposed to temperatures beyond this range. The maximum recommended safe exposure range is -100°F to 250°F and the probe accuracy may be effected by exposure beyond this range. Do not expose the plastic base of the TemProbe or the extension wand to temperatures above 200°F .

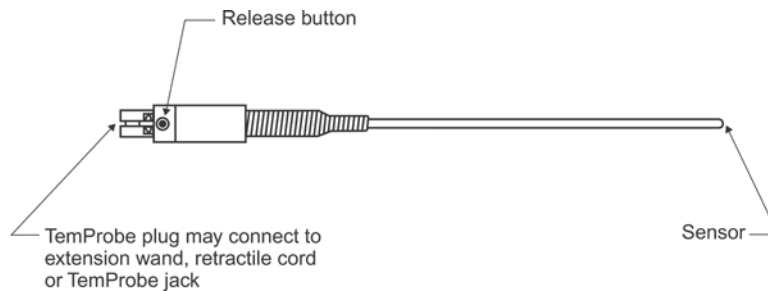


FIGURE 8.1 ADT442 TEMPROBE

NOTICE: The use of temperature cable extenders reduces the meter reading by a non-linear degree depending on the combination of cable type, length and TemProbe temperature. The offset correction must be determined by comparing readings taken with and without the extender cables at the temperature(s) to be measured.

8.2 AIRDATA MULTITEMP - Multipoint Readings

The MT-440K MultiTemp comes as a unit with six insertion probes, two surface probes, an eight-position switch, and a padded carrying case. The measuring capability of the MultiTemp combines with the memory function of the HydroData Multimeter to store up to 100 temperature readings along with the sequence tag for each reading. Each temperature reading may be entered into memory in two seconds or less. A full set of eight temperature readings may be entered into memory in about 15 seconds.

Plug the single cord on the bottom edge of the MultiTemp into the temperature input jack on the back of the HydroData Multimeter. Up to eight temperature probes (each with a 12' cord) can be connected into the eight small, numbered temperature input jacks on the top edge of the MultiTemp. The jack numbers correspond to the eight switch position numbers surrounding the switch.

Place each of the temperature probes in the system as required and allow the probe temperatures to stabilize. A typical system testing application is shown in Figure 8.2. Set the meter for the temperature function as discussed in Section 6.0 USING THE HYDRODATA MULTIMETER.

Set the MultiTemp for switch position #1 and take a reading for the probe connected to temperature input jack #1. Turn the switch to switch position #2 and take a reading for temperature jack #2. Continue for as many of the eight temperature jacks as needed.

The automatic reading function may be used with the MultiTemp. Set the meter for automatic readings and take as many readings as needed for any of the switch positions. Changing switch positions during the actual reading process will cause invalid readings.

The individual and automatic storage functions may also be used with the MultiTemp. Set the meter for the individual storage or automatic reading storage functions as needed. Take as many readings as needed for each of the switch positions. Careful recording of which switch position readings are entered into memory under which sequence tag is essential to accurate recall of readings for performance calculations. Additional points may be measured in the same measurement sequence by using more than one MultiTemp switch unit connected in series (piggybacking). Reading and memory entry of 64 temperature points would take about two minutes (after temperature probes have stabilized).

The temperature probes used with the MultiTemp are extremely accurate and are typically interchangeable to $\pm 0.4^{\circ}\text{F}$. These probes may be used in any liquid or gas compatible with stainless steel. Typical uses include: wet or dry bulb air temperatures; thermometer wells; "Pete's" plugs; or direct immersion. Some applications include humidity control systems; direct expansion A/C systems; outside air adjustment; hot water heating; chilled water; condenser water; and many other circulating process liquid systems. The surface probes may be used to measure pipeline surface temperatures when piping systems do not have thermometer wells. These probes may also be used as fast acting air probes.

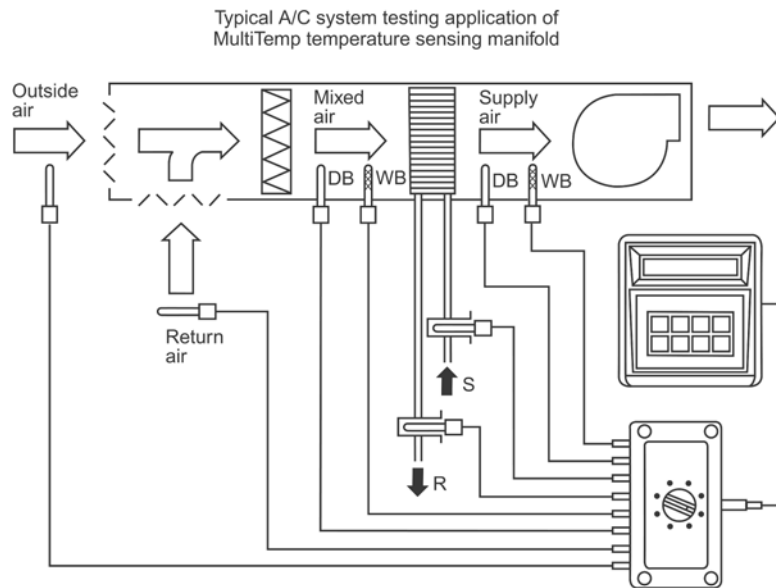


FIGURE 8.2 AIRDATA MULTITEMP

9.0 METER ACCURACY FIELD TESTING

9.1 ZERO OFFSET

The meter will normally maintain a zero offset of less than .20 psi. Check the pressure function zero offset by taking a reading with both meter ports open to the atmosphere. Be sure the ports are not exposed to residual pressure caused by a fluid column in the connecting hoses or in the valve network panel. The reading should be zero $\pm$.20 psi. The zero offset will stabilize after the meter has been on for about 10 minutes.

9.2 DIFFERENTIAL PRESSURE ACCURACY

Check the differential pressure reading accuracy by measuring a pressure source at the following pressures: 14 in wc; 10 in Hg; and 35 in Hg. Confirm the pressure readings at the 10 in wc differential pressure by comparison with an appropriately accurate manometer. The 10 in Hg and 35 in Hg differential may be checked using a standard mercury U-tube manometer.

9.3 METER NEGATIVE PRESSURE PORT (P₂)

You may confirm the accuracy of the gage pressure at the negative (-) port by the method outlined in the differential section by reading with the meter (-) port connected to the pressure source and the positive (+) port of the meter open to the atmosphere.

10.0 METER MAINTENANCE

The HydroData Multimeter is a precision instrument designed for long term field use if given reasonable care and maintenance. The meter should be kept reasonably clean, and should be stored in the protective case when not in use. The meter case and internal components are rugged, and well able to withstand normal handling. Continued rough handling will eventually cause damage.

The meter case is water resistant, but is not waterproof. Do not submerge the meter or store in any area where liquids or corrosive gases might enter the case.

Do not use or store the meter in temperatures outside the specified ranges. The meter may seem to tolerate summertime storage in such places as the trunk of a vehicle, but battery life and other functions will eventually deteriorate.

Battery life will be prolonged if the batteries are periodically permitted to discharge until the display registers LOCHARGE. The battery charger cord should be coiled in gentle loops rather than wound tightly around the body of the charger transformer. This will greatly extend the life of the charger cord.

When replacing the batteries, be very careful to insert each cell in its indicated position for polarity. The polarity position marking for each cell is embossed in the housing beneath each cell position. Take note that the cells are not all oriented in the same way. Failure to observe proper cell positioning can result in severe damage to the meter.

If rechargeable batteries are not available in a field situation, the batteries may be replaced with 12 nonrechargeable, alkaline "AA" pen cell batteries.

WARNING: Do not plug the charger in if **any** nonrechargeable batteries are in the meter. The meter may be seriously damaged along with the batteries and charger.

Any attempt to service or repair anything inside the meter will void the warranty and may cause serious damage to the sensitive electronic components.

The HydroData Multimeter should be returned to the factory at least every two years for recalibration, maintenance, and software update. This will keep the meter up to date with ongoing improvements and new features as they develop. This preventive maintenance program will assure that the original accuracy of the meter is maintained throughout the meter's life.

11.0 VALVE NETWORK PANEL MAINTENANCE

The Valve Network Panel should not be exposed to temperatures in excess of 140° F for extended periods, or 160° F for more than five minutes. Reasonable care will prolong the life of valves and tubing. Sharp objects or corners can puncture the tubing and affect the accuracy of the readings. Storage temperature limits for the Valve Network Panel are: -22° F to 140° F (-30° C to 60° C).

Water **must** be completely drained from the Valve Network Panel and inside of the tubing must be blown dry with compressed air after each use and prior to storage. The Valve Network Panel must be stored in a clean and dry environment with the valves open. Failure to keep the Valve Network Panel, tubing and carrying case clean and dry may result in the growth of hazardous microorganisms (bacteria, viruses, and other harmful microbials).

12.0 RECALIBRATION AND REPAIR INFORMATION

If an apparent problem develops with the HydroData Multimeter, contact the factory, specifying the model number, serial number, and details of the difficulty. Return only the meter to the factory, transportation prepaid. The repair purchase order and description of the problem should be enclosed in a packing slip on the **outside** of the shipping container. If the meter is no longer under warranty, regular repair charges will apply. An estimate of the cost will be furnished before repair begins unless the customer specifies otherwise.

Only the meter should be returned to the factory for recalibration and repair. Maintenance or repair on the Valve Network Panel or carrying case are not available, but replacement parts may be ordered as needed.

Ship directly to: Shortridge Instruments, Inc.
7855 E. Redfield Rd.
Scottsdale, Arizona 85260
Attention: Recalibration and Repair Dept.
Telephone: (480) 991-6744 Fax: (480) 443-1267
www.shortridge.com

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Several publications are available from the following organizations.

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Washington, DC 20005
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AABC offers membership, training programs and certification to air balance firms.

National Environmental Balancing Bureau (NEBB)
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WARRANTY

The seller warrants to the Purchaser that any equipment manufactured by it and bearing its name plate to be free from defects in material or workmanship, under proper and normal use and service, as follows: if, at any time within one (1) year from the date of shipment, the Purchaser notifies the Seller that in his opinion, the equipment is defective, and returns the equipment to the Seller's originating factory, prepaid, and the Seller's inspection finds the equipment to be defective in material or workmanship, the Seller will promptly correct it by either, at its option, repairing any defective part or material, or replacing it free of charge, and return shipped lowest cost transportation prepaid (if Purchaser requests premium transportation, Purchaser will be billed for difference in transportation costs). If inspection by the Seller does not disclose any defect in material or workmanship, the Seller's regular charges will apply. This warranty shall be effective only if use and maintenance is in accordance with our instructions and written notice of a defect is given to the Seller within such period. THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY OTHER WARRANTIES, WRITTEN, ORAL OR IMPLIED, SPECIFICALLY, WITHOUT LIMITATION, THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE. The liability of the Seller shall be limited to the repair or replacement of materials or parts as above set forth.

LIMITATION OF LIABILITY

The Seller shall not be liable for any claim or consequential or special loss or damage arising or alleged to have arisen from any delay in delivery or malfunction or failure of the equipment. The Seller's liability for any other loss or damage arising out of or connected with the manufacture or use of the equipment sold, including damage due to negligence, shall not in any event exceed the price of the equipment supplied by us.

Shortridge Instruments, Inc. reserves the right to make changes at any time, without notice, in prices, colors, materials, specifications and models, and also to discontinue models.

APPENDIX - BATTERY TEST PROCEDURE

Insufficient battery charge (entire set or individual cells) can cause the meter to display garbled messages or "TOO HOT", "TOO COLD", "RECHARGE" or other messages. This garbled display usually is seen when the meter is just turned on and the supply voltage drops so fast that the meter gets lost. The following tests should be performed before you call or return the meter.

1. Check the battery charger transformer. The output should be 24 to 30 volts AC with 115 volt, single phase input. Be sure the charger is plugged into a live outlet.
2. Does the meter function properly while the charger is attached and plugged-in? If so, a bad battery cell is likely. Allow ten minutes for minimum charging to take effect before testing meter function.
3. Place the meter face down with the air connectors turned away from you. Remove the battery compartment cover by unscrewing the (8) small phillips head screws. Check the battery clips. Remove the batteries and respring the clips to provide proper contact pressure with the ends of the batteries.

Be sure to reinstall the batteries in the proper orientation as shown in the compartment. Turn the meter on to see if the problem display still exists. If the problem persists, test the positive (+) and negative (-) charging circuits as follows:

- a. Measure the DC voltage of the upper half (positive)(+) (6 cells) of the battery set by placing your DC voltmeter common (ground) probe at the left center battery clip and the other probe at the upper right corner battery clip. The voltage should be between 6.6 volts and 7.8 volts DC.

This voltage should rise when the charger is plugged in and should fall when the charger is unplugged.

- b. If the voltage does not rise and fall with the changes in charger input, then the charging circuit in the meter is not working and the meter must be returned to the factory for repair.
 - c. Test the lower (negative)(-) half of the battery set in the same manner described above by placing the voltmeter probes at the left center battery clips and at the lower right corner battery clip.
4. Check each battery cell voltage with the charger unplugged and with the meter turned on (if it will stay turned on).

Each cell should have a voltage of 1.1 to 1.3 volts. If you find one or two very low cells, they may be weak cells and may need to be replaced. If most of the cells are less than 1.1 volts, it is possible that all batteries are near the end of the discharge cycle and just need to be recharged.

5. Replace weak or low capacity battery cells with rechargeable cells of the **same** capacity (milliamphr) as the existing cells. If the same capacity cells are not available, replace all 12 cells with new batteries. See "Operating Instructions" manual section titled "Meter Maintenance".
6. If the problem is not corrected through these procedures, please return the **METER ONLY** to our factory for repair and calibration services. Remove the meter from the Valve Network Panel and return only the meter.

Shortridge Instruments, Inc.
7855 E. Redfield Road Attn: Recalibration Department
Scottsdale, Arizona, USA 85260
Phone: (480) 991-6744 • Fax: (480) 443-1267 • www.shortridge.com

PROLONGING BATTERY LIFE

The NiCad "memory effect" occurs when batteries are only partially discharged and recharged repeatedly. This effect substantially reduces the level of useable charge in the batteries. The batteries can be restored to maximum usable capacity by discharging the batteries until the meter displays RECHARGE at least once a month. This can be accomplished at the end of the work week by running the meter continuously until the batteries run down. The meter will remain on if left in TREND mode. The back-light should be off during the discharge period. The meter will shut off

automatically when RECHARGE is displayed. Place the meter on charge for at least 24 hours, so the meter will be fully charged for the next week's work.

Long term storage of batteries can temporarily degrade their performance. If the meter is to be stored without being used for at least three months, discharge the batteries as described above. The temperature during storage should be less than 95 F. The batteries will function best after storage if reconditioned by performing two full cycles of 24 hour charge and full discharge, followed by a third 24 hour charge. This process will restore the batteries to maximum usable capacity.

WARNING: Do not plug in the charger if ANY nonrechargeable batteries are in the meter.

BATTERY RECYCLING



RECYCLE
1-800-822-8837

The EPA certified RBRC® Battery Recycling Seal on the nickel-cadmium (Ni-Cd) battery indicates Shortridge Instruments, Inc. is voluntarily participating in an industry program to collect and recycle these batteries at the end of their useful life, when taken out of service in the United States or Canada. The RBRC® program provides a convenient alternative to placing Ni-Cd batteries into the trash or the municipal waste stream, which may be illegal in your area. Please call 1-800-822-8837 for information on Ni-Cd battery recycling and disposal bans/restrictions in your area. Shortridge Instruments, Inc. involvement in this program is part of our commitment to preserving our environment and conserving our natural resources.

HDM-250 REPLACEMENT PARTS

Part no	No reqd per set	Description
HDM-250M	1	HydroData Multimeter
PS8201	1	Battery charger
AA-NICAD	12	Rechargeable batteries
ADT442	1	TemProbe temperature probe - 4" x 1/8" diameter
ADT446	1	TemProbe temperature probe - 4" x 1/16" diameter
GAP-062	2	HDM probe, SISCO 1/16" diameter with guard
GAP-125	2	HDM probe, SISCO 1/8" diameter
VNP300	1	Valve Network Panel Assy (400 PSI rated)
0412	1	Case, carrying, HDM kit
0413	1	HDM adapter fitting set, 36 pieces
0415	2	HDM drain hose assembly, 8' X .25" OD clear poly
0432	1	HDM drain/vent hose adapter, 1/8 B X 1/8 mpt
0433	1	HDM drain/vent hose adapter, 1/8 B X 1/8 fpt
0471	1	HDM pressure hose, blue, 6'
0472	1	HDM pressure hose, red, 6'
SK-101	1	Pressure snubber kit complete
IM-250	1	Instruction manual - HDM-250

VALVE NETWORK PANEL REPLACEMENT PARTS

Part no	No reqd per set	Description
VNP	1	HDM Valve Network Panel w/o hardware
0140	1	Washer, split
0144	1	Knob, meter retaining
0351	5	HDM ball valve for Valve Network Panel
0394	6	Elbow, street, 1/8 npt (6 for VNP with snubbers, 4 without)
0398	2	Tee, 1/4" tube, union
0399	2	Connector, 1/4" tube, 1/8 mpt
0400	4	Elbow, 1/4" tube, 1/8 mpt
0401	3	Tee, male, branch, 1/4 tube
0403	1	Black tubing, nylon, 3.5" long (VNP without snubbers)
0404	1	Red tubing, nylon, 3.5" long (VNP without snubbers)
0480	2	Connector, 1/4" tube, 1/8 fpt
0482	2	HDM quick connect body, 1/8" mpt for VNP300
0515	4	HDM tubing, nylon, natural, 4.5" long
0516	2	HDM tubing, nylon, natural, 6.5" long
0520	2	HDM tubing, nylon, natural, 7.25" long
0557	2	HDM pressure snubber
0558	4	Sleeve/nut assemblies for pressure snubber
0559	1	Black tubing, nylon, 2.5" long (VNP with snubbers)
0560	1	Red tubing, nylon, 2.5" long (VNP with snubbers)

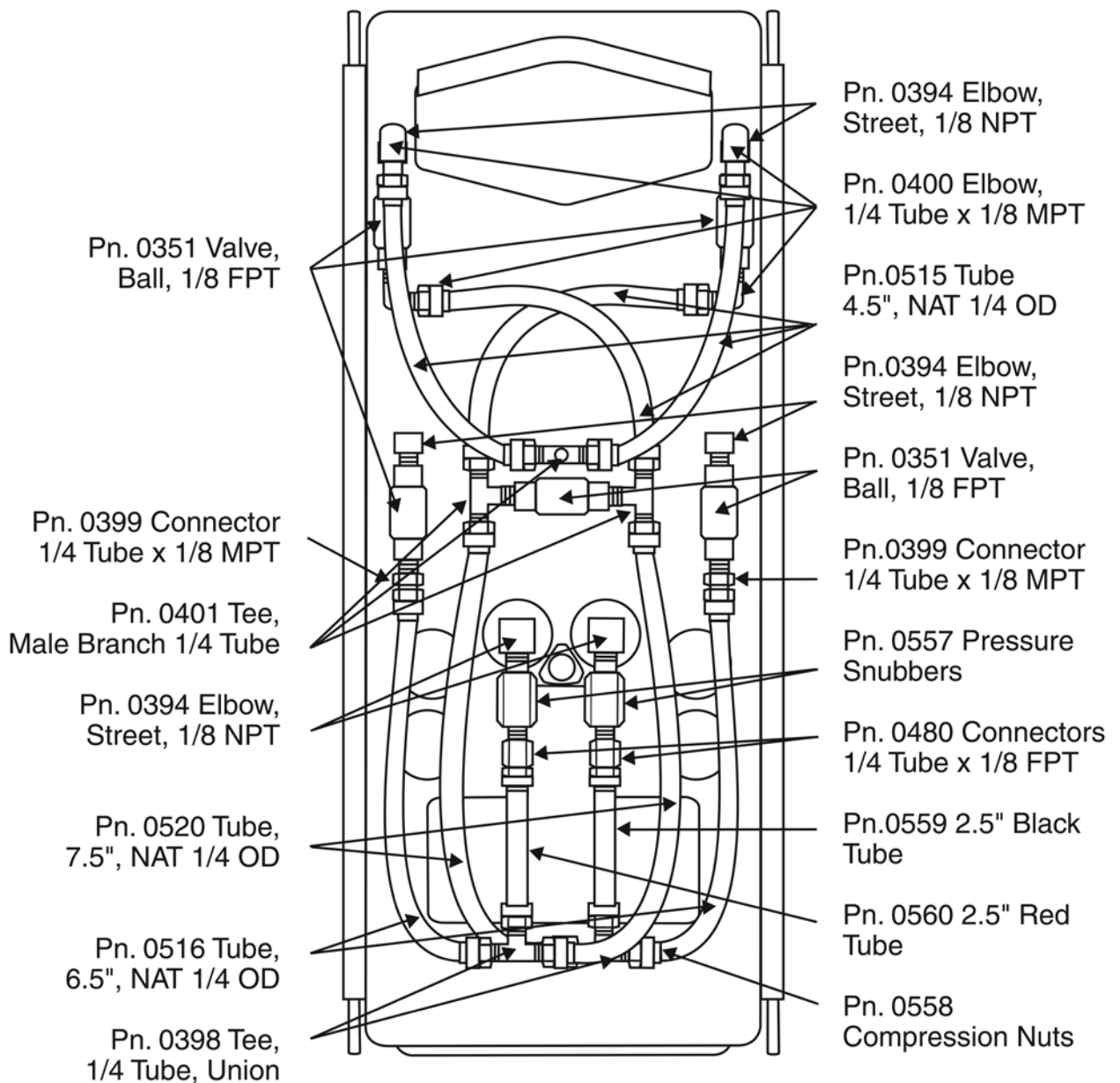
REPLACEMENT PARTS FOR P/N 0413 HDM ADAPTER FITTING SET

Part no	No reqd per set	Description
0385	2	Bushing, red, 3/4 X 1/8 npt
0386	2	Bushing, red, 1/2 X 1/8 npt
0387	2	Bushing, red, 3/8 X 1/8 npt
0388	2	Bushing, red, 1/4 X 1/8 npt
0389	2	Coupling, reducer, 1/2 x 3/8
0390	2	Coupling, reducer, 3/8 x 1/4
0391	2	Coupling, reducer, 1/4 x 3/8
0392	2	Nipple, hex, 1/8 npt

Continued on Next Page

REPLACEMENT PARTS FOR P/N 0413 HDM ADAPTER FITTING SET- CONTINUED

Part no	No reqd per set	Description
0393	2	Coupling, hex, 1/8 fpt-fpt
0395	2	Adapter, garden hose to 1/8
0396	2	Washer, garden hose, 5/8"
0425	2	HDM adapter, 1/4 fl x 1/8 mpt
0426	2	HDM adapter, 1/4 fl X 1/4 mpt
0427	2	HDM adapter, 1/4 fl X 1/8 fpt
0428	2	HDM adapter, 1/4 fl X 1/4 fpt
0429	2	HDM elbow, 1/4 fl X 1/8 mpt
0430	2	HDM elbow, 1/4 fl X 1/4 mpt
0431	2	HDM union, 1/4 flare, brass



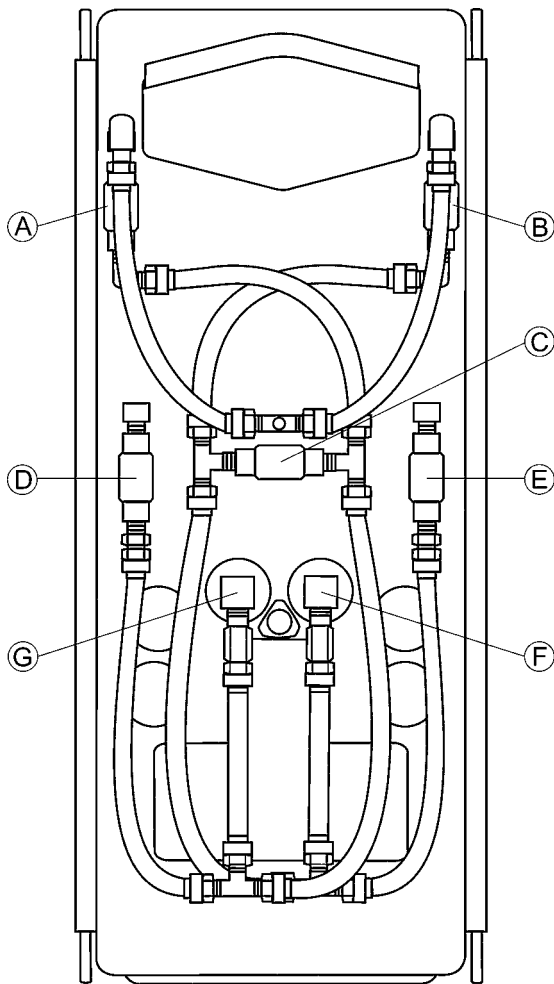
HDM Valve Network Panel Assembly With Snubbers

SEE NEXT PAGE FOR VALVE NETWORK PANEL WITHOUT SNUBBERS

HDM VALVE NETWORK PANEL WITH SNUBBERS

VALVE NETWORK PANEL
REPLACEMENT PARTS
NO SNUBBER KIT

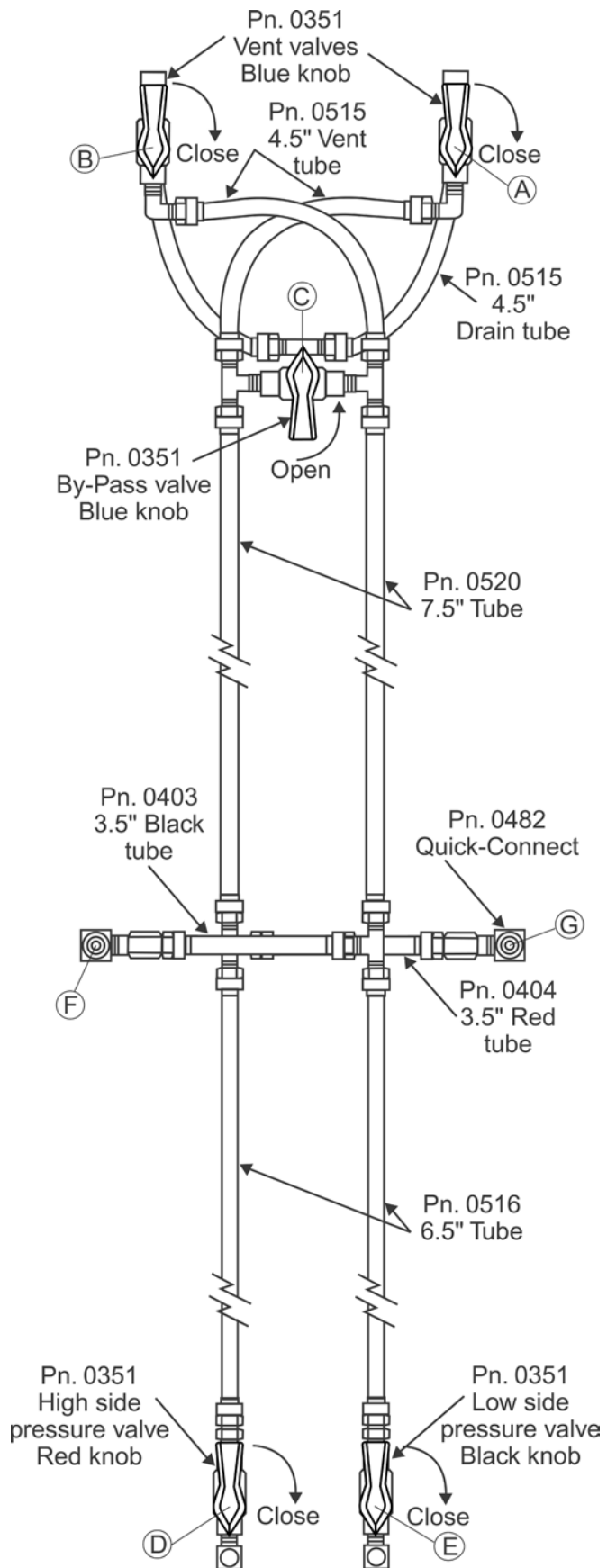
SEE PREVIOUS PAGE FOR
VALVE NETWORK PANEL WITH
SNUBBER KIT



HDM Valve Network Panel Assembly

VALVE NETWORK PANEL WITHOUT SNUBBERS

SEE PREVIOUS PAGE FOR
VALVE NETWORK PANEL WITH
SNUBBER KIT



HDM Tube & Valve Assembly

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