

PDS-360 / 360DX
Ultrasonic
Open-Channel
Flowmeter

Instruction Manual
Series 'E', Rv 2020.2.9

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Electronics

Power: 120/220 VAC, ±15%, 50/60 Hz @ 15 watts max.
Temperature: 20°F to 120°F
Display: 2 x 20 character, alphanumeric LCD with backlight
Totalizer: 8 digit accumulative with programmable multiplier; x1, x10, x100, x1000
Outputs*: Two independent 4-20 mA isolated into 1000 ohm load each, ±1.0% of full scale. RS-232 terminal, 4 alarm control relays and 1 Sample Pulse relay, all programmable. Relay contacts SPDT 5A/250 VAC
Span Range: 0-1.00" to 0-100.00" full scale - programmable
Dead Band: 12.0" to 36.0"
Resolution: 0.01", 0.01 GPM (LCD Display)
Accuracy:** ±0.5% of range. Calculated error ±0.04%
Memory: Flash and non-volatile RAM (3 V battery backup)
Flow Equations: Parshall, Palmer Bowlus, Leopold Lagco flumes, V-notch Weirs, Rectangular Weirs with or without end contractions, User Defined.
Data Log*: **200 day, 24 hour flow summary:** min, max, avg GPM, total gallons - time stamped. (down load or view on LCD display)
Avg GPM flow rate with programmable log rate of 00-99 minutes (1 minute increments) time stamped.
EVENT list time stamped (view by down load only) using any standard communication software.

* The PDS-360DX unit has no relay/RS-232 outputs or data logging
 ** Field conditions, such as turbulence, poor installation etc., may affect the apparent accuracy.

Sensor w/Temp Probe (US70TC Sensor)

Material: PVC Housing, Epoxy
Beam / Freq.: 5° Conical, 40 Khz pulsed
Temperature: -10°F to 120°F operating
Cable: 30 foot twisted pair
 Up to 700 ft. spliced. Belden # 8451 or equal.
Dimensions: 3.0" dia. x 4.2" len
Mounting: 3/4" male (3/4" female with supplied union joint)
Rating: Sensor is considered explosion proof, corrosion resistant, immersible

Enclosure

Material: Fiberglass with clear hinged Polycarbonate cover, stainless steel mounting hardware
Rating: NEMA 4X, IP65, Dust-Tight, Water-Tight, Corrosion Resistant, CSA / UL listed
Dimensions: 7.2" x 11.8" x 6.8"
Mounting: 4.92" x 12.3"

Options

PVC Sensor Mounting Kit
 Additional Sensor cable

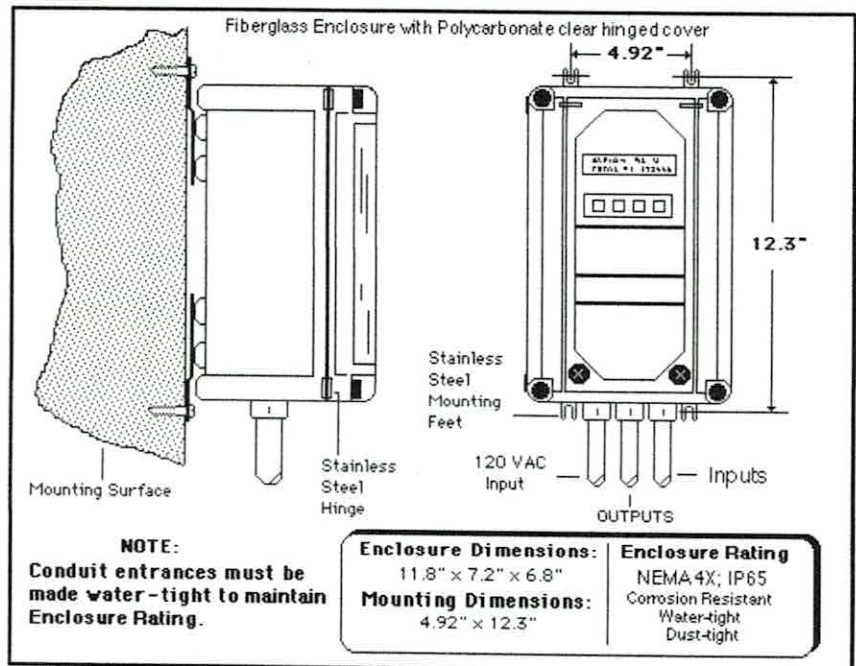
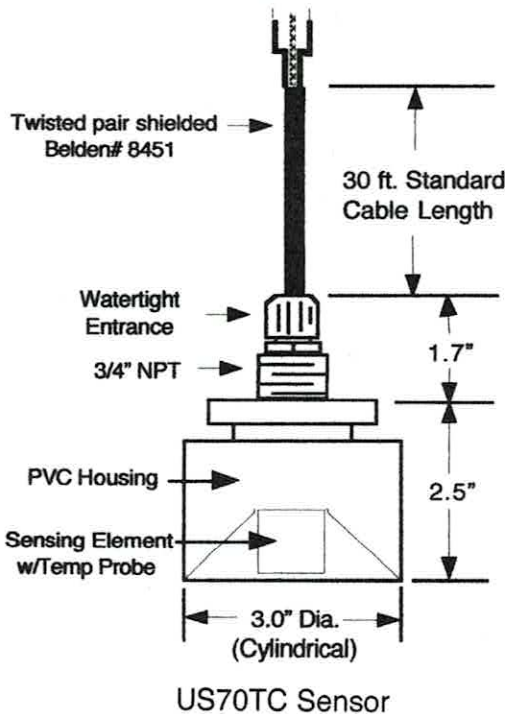
Warranty

The PDS-360 and 360DX units are pretested and inspected before shipping. Warranty is against defects in parts and workmanship for a period of one (1) year from ship date.

Specifications and Design are subject to change without notice.

These specifications supersede all other published specifications.

Made in USA



Repair Policy:

All repairs are performed on our premises. Repairs must be sent by UPS prepaid. **NO ARM** number is required. However ...

Customer must enclose:

- 1] a description of problem
- 2] who to contact
- 3] phone number
- 4] return ship-to address
- 5] **method of payment**, Credit Card or COD. A Company Purchase Order Number must be supplied if other payment method is to be arranged.
- 6] **Unit / Sensor must be cleaned** before shipping . We reserve the right to refuse repair or to apply a \$ 50.00 charge to repair of a product that has not been received cleaned. **Cleaned unit means** removing any debris that may be clinging to the unit; wiping off loose dirt, cob webs, dead insects etc.

Delay of repair may occur if any of the above is not provided. Most repairs are processed and shipped within 48 hours of receiving repair.

Repair Cost:

A minimal charge will be applied regardless of repair needed plus return shipping charges. If repair exceeds quoted minimal charge (call factory for quote), we will notify the customer before we proceed.

Payment is COD or Credit Card only unless other arrangements are made.

Warranty Repairs:

Warranty repairs are made at our discretion and returned UPS GROUND at our expense.

Return Policy:

We will accept 'return of product' for credit within 6 months of shipping date if it is determined that the product is not performing to specification as described in Product Performance statement in this manual (provided application is not the cause of problem). We do not accept returns for credit when the application is the source of the problem (i.e. poorly installed flumes, poor piping arrangements, **interference from other equipment** etc.) , product is misapplied or not used properly and/or if product is out of warranty.

A **35% restocking charge** will be applied if the product is returned for credit after 6 months from ship date.

We do not accept returns of options such as used Sensors, cables, or spare parts unless shown to be defective under warranty or not performing as specified.

Any credit issued will be at our discretion. Warranty of product is limited only to the repair or replacement (with same model) of defective product.

Any product or part of product returned damaged will not be considered for any credit.

Customer must call for authorization before returning product for credit. Products returned for credit will not be considered without prior authorization.

A description of how it was determined that the product was not performing to specification must accompany the return of the product for our evaluation before we will consider any credit. The name of who to contact along with phone number should also be included with the return.

Packing:

Repair/returned units must be packed (not loosely) in a suitable card board box with sufficient packing material (newspaper, packing peanuts etc.). We are not responsible for any product damaged through shipping. Make sure you insure the package for replacement cost. **DO NOT pack the unit upside down or sideways in the box.** Damage could result to product if you do.

PDS-360 Product Performance

The PDS-360 Flowmeter will perform as specified when tested under known, simulated conditions. All PDS-360 Flowmeters are tested for full functionality and performance before shipping.

The *accuracy* of the product is determined by inputting a known, stable target distance into the system and monitoring its ability to process the return ECHO delay accurately and conversion of the calculated DEPTH indication to GPM and TOTAL flow as related to the built-in equations. Specifications for the product are determined by this method.

The *accuracy* of the product is not determined by any other method. Other test methods indicate the accuracy of the over-all application / installation, not just that of the product. Such tests are not acceptable as an indication of product(s) accuracy. However, other tests methods can be used to determine if the calibration of the product should be changed in attempt to compensate for application / installation conditions. This should only be done if no other application / installation corrections can be initiated to correct the problem.

Some examples of application / installation issues:

- 1] Flume / Weir not sized properly
- 2] Flume / Weir conversion accuracy, i.e. Depth to Flow
- 3] Vapors from liquid or severe air density changes
- 4] Turbulence or foaming on the liquid surface
- 5] Flow moving too fast through the flume / weir
- 6] Flow approach to flume / weir incorrect
- 7] Sensor not installed properly

Some equipment such as variable speed drives, nearby radio transmitters etc. located next to the product or even at times in adjacent rooms may possibly interfere with the products performance. Variable speed drives produce large amounts of electrical and RF (radio frequency) noise that can interfere with the products ability to interpret the return ECHO signal. Ultimately, it is up to the user to make the corrections necessary and require that the source of the interference be corrected.

CONTROL ELECTRONICS, INC.

PRODUCT WARRANTY

WARRANTY:

Control Electronics, Inc. warrants to the buyer that its products are free from defects in materials and workmanship at the time of shipment and during the WARRANTY PERIOD. Control Electronics, Inc. obligation under this warranty is limited to the replacement of the product(s) by same product(s) manufactured by Control Electronics, Inc. or repair of the product(s) at the Control Electronics, Inc. facility. Control Electronics, Inc. products are sold with the understanding that the buyer has determined the applicability of the product(s) to its intended use. It is the responsibility of the buyer to verify acceptability of performance to the actual conditions of use. Performance may vary depending upon these actual conditions.

This Warranty is in lieu of any other warranty, expressed or implied. This includes, but is not limited to, any implied warranty of fitness for a particular purpose, or other obligations or liabilities on the part of Control Electronics, Inc. Under no circumstances will Control Electronics, Inc. be liable for any loss, damage, expense, or consequential damages of any kind arising in connection with the use, or inability for use, of Control Electronics, Inc. products.

WARRANTY PERIOD:

This warranty is in effect for twelve (12) months from the date of shipment from Control Electronics, Inc. place of business. Any extension of warranty period must be requested at time of purchase and made part of purchase order.

LIMITATIONS:

Control Electronics, Inc. products must be installed and maintained in accordance with Control Electronics, Inc. published instructions. Users are responsible for the suitability of the product(s) to their application. There is no warranty against damage resulting from corrosion, misapplication, improper specification, improper installation or any conditions beyond the control of Control Electronics, Inc. Claims against carriers for damage in transit must be filed by the buyer. Control Electronics, Inc. is not liable for labor costs incurred in removal, reinstallation, or unauthorized repair of its product(s). Control Electronics, Inc. warranty does not cover travel time or expenses for job site service. Requests for field service must be accompanied by a signed purchase order. Travel time and expenses will be charged to this purchase order, along with service time if the cause of the failure is not covered by the warranty. No service will be performed on any product(s) unless full payment has been made for product(s).

WARRANTY CLAIM:

If Control Electronics, Inc. products are found to be defective in materials or workmanship within twelve (12) months of the date of shipment, they will be repaired or replaced with same product at the discretion of Control Electronics, Inc. at its place of business at no charge to the buyer. The defective product(s) must be sent, freight prepaid, to the ship-to address on the front page of this manual for warranty claim. All claims must be made in writing. Enclose a brief description of problem, person to contact, phone number and return ship-to address. Product(s) received without this information may not be processed on a timely basis.

<p>If warranty and/or product(s) is not acceptable to buyer, please contact Control Electronics, Inc. and/or return product(s) <u>unused</u> for credit. This action must be made within 60 days from ship date from Control Electronics, Inc. Installation of product(s) or non-response within 60 day period indicates the buyers acceptance of product(s) and above warranty.</p>
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NOTE

This manual covers both the PDS-360 and PDS-360DX Flowmeters. The PDS-360DX Flowmeter is the same as the PDS-360 system with the following exceptions.

The PDS-360DX system does not have:

- 1] Relay Outputs - no alarms or Sampler pulse
- 2] No Clock or Date
- 3] No RS-232 output port
- 4] No Data Logging

This will be noted in the manual by - N/A on 360DX.

You may want to copy the following numbers from the upper left corner of the printed circuit board inside the enclosure for future reference. These numbers should be available if calling Control Electronics for tech support.

Serial Number: _____

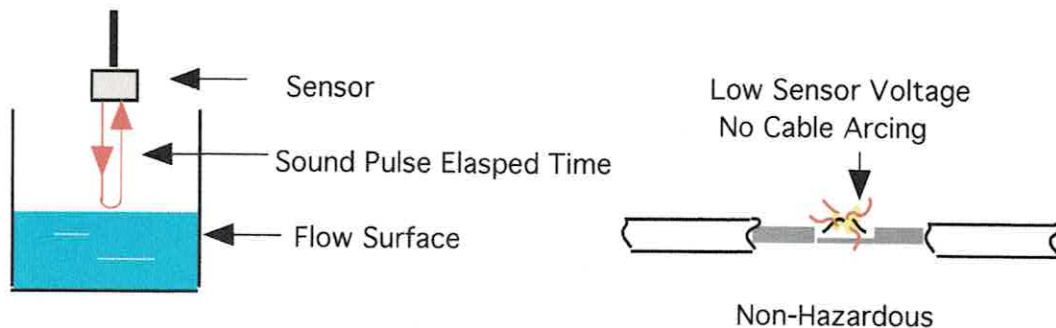
Software Version: _____

Model Number: _____

INTRODUCTION

Control Electronics model PDS-360 Ultrasonic Open Channel flowmeter is a microprocessor controlled, non-contacting flowmetering system designed to accurately measure liquid flow through most standard primary flow devices. The PDS-360 flowmeter has been designed with the user in mind, allowing for simple, intuitive set-up through a menu driven programming interface. Control Electronics has been designing and manufacturing Ultrasonic type flowmeters since 1980.

In theory, the PDS-360 system transmits a high-frequency sound pulses from the sensor 4 times a second. The sound pulse travels through the air toward the liquid flow surface and reflects back as an ECHO return. The system calculates the elapsed time of echo return. The elapsed time is directly related to the distance of the sensor to the flow surface and is used, along with a temperature measurement, to calculate an accurate Depth-of-Flow measurement. The system makes these measurements continuously and without contact to the flow. Depth-of-Flow is then converted to flow rate indication and totalization through the built-in mathematical conversion equations for the Primary Flow Device selected by the user.



The Sensing element is a non-contacting probe capable of transmitting and receiving high frequency sound waves. The Sensor requires less transmit power than most other systems. A pulse of approximately 40 to 60 volts peak-to-peak is required as opposed to some manufacturers that use as much as 400 to 1700 volts to pulse their Sensors. The higher voltages are hazardous to personnel and explosive atmospheres. Additionally, the PDS-360 Sensors unique design reduces both the dead-band (minimum range) and the signals beam spread. Two important considerations when monitoring flows in a flume with a narrow throat and approach section or manholes with low ceilings. The PDS-360 sensor, model US70TC, is suitable for Class 1, Div. 1, Groups C & D and Class II, Div. 1, Groups E, F & G environments.

All PDS-360 circuits are protected in a NEMA 4X corrosion resistant fiberglass enclosure with a clear polycarbonate hinged cover for easy viewing of the flow indications.

After installing the flowmeter and Sensor, the operator will find the PDS-360 Programming Flowchart in the back of this manual extremely helpful in navigating through the many options and features of the flowmeter.

INSTALLING THE FLOWMETER

The PDS-360 Flowmetering system is easy to install. Adherence to all installation instructions will result in successful operation of your system. If any deviation must be made from the prescribed installation procedures, please call our service department for change approval. Failure to install your system properly could lead to operational problems and become costly if a service technician is required on site to remedy. We suggest you read the entire manual to familiarize yourself with the equipment before installing.

1. Controller Installation

The PDS-360 electronics controller is housed in a NEMA 4X fiberglass enclosure. This enclosure is UL listed and rated as being water-tight, dust-tight and corrosion resistant. However, care should be taken in selecting a location that will offer protection from rain, chemical spills, extreme temperatures etc.

The electronics enclosure is suitable for outdoor installation, but it is recommended that the enclosure be mounted indoors or in a fiberglass shed located next to the measuring site. If the instrument has to be located outdoors, provisions should be made to maintain a temperature range between 25°F and 120°F within the enclosure. For cold locations, our optional Heater and Thermostat should be considered. This option can be installed at any time by the user. In warmer climates the enclosure should be mounted away from direct sunlight or a sun shade should be provided.

IMPORTANT

On a hot day, direct sun light could damage the LCD display and raise the internal temperature of the enclosure above ambient temperature causing malfunction and/or possible damage to the unit. A Sun Shade should be provided.

The PDS-360 Electronics requires a 120/220 VAC power source. Though the flowmeter is designed to minimize electrical noise interference you should avoid installation in locations near equipment that may be electrically noisy or instruments that generate R.F. (radio frequency) noise such as SCR controlled equipment (i.e. variable speed controllers).

The enclosure may be located up to 700 feet from the measuring site. It is recommended that you keep the distance as short as possible. Metal conduit will be required between the measuring site and controller (note: do not attach metal conduit to sensor). It is important that no other cables run in this conduit. Cable lengths less than 50 feet may be run in PVC conduit if there are no other AC signal wires in close proximity.

Once a suitable location has been selected for the controller, carefully screw mount the enclosure as shown in figure1. Be sure to allow room for the conduit entrance to the enclosure as shown. All conduit entrances must be made through the bottom side of the enclosure. Do not enter through the top. This could cause possible water damage from leaks if the enclosure is rained on or hosed down. Separate conduits should be provided for AC power source (conduit not required if supplied with optional AC power cord), output signal wires (4-20 mA., relay outputs etc.) and Sensor cable.

Protect the electronics circuit card from damage when punching holes in the enclosure for conduit entrance. The circuit card may be removed from the enclosure by removing the four retaining screws (along the top and bottom edge of circuit board) and unplugging the ribbon cable. A GREEN-LEE punch is recommended for punching the holes.

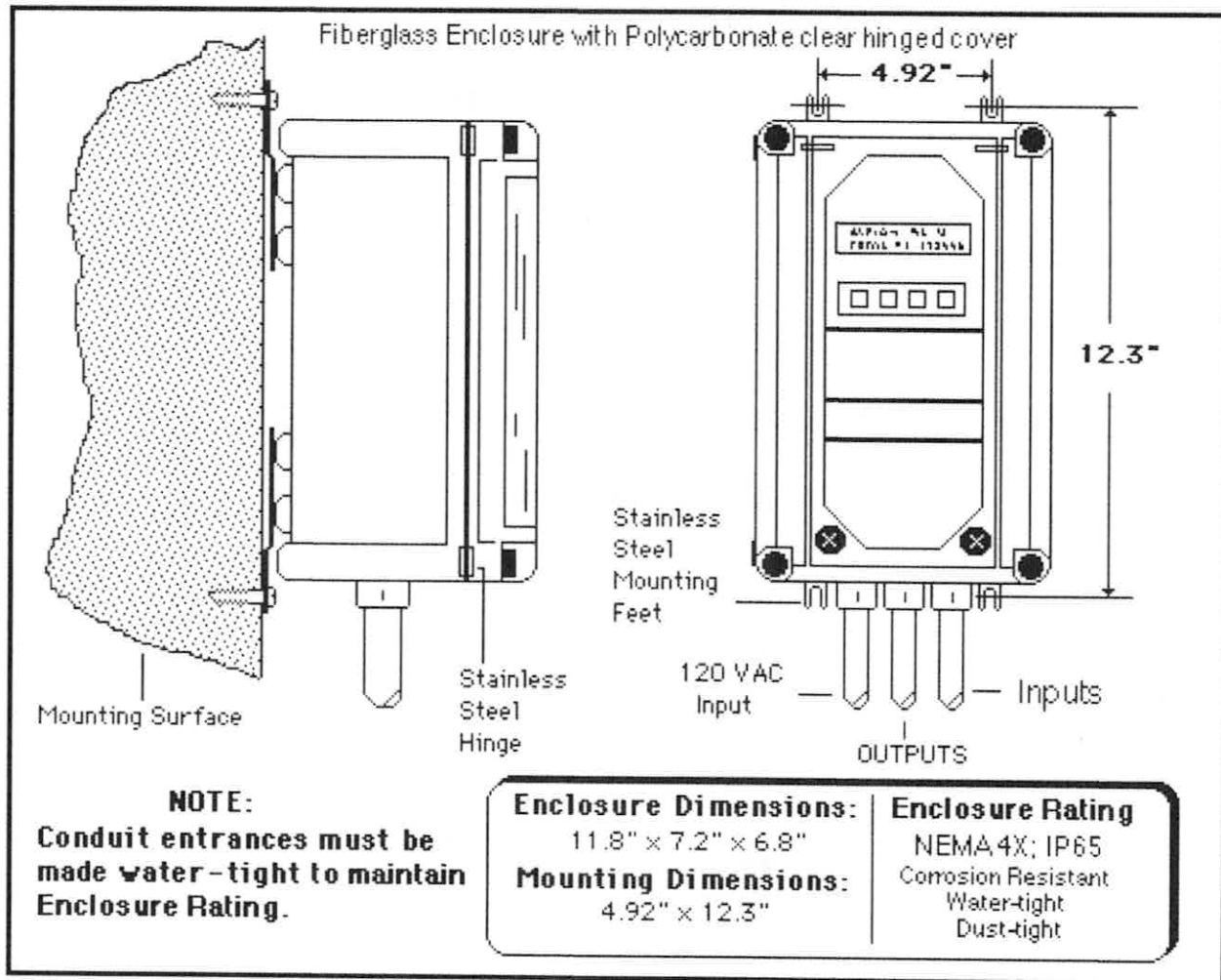


Figure 1.

Enclosure Installation Notes

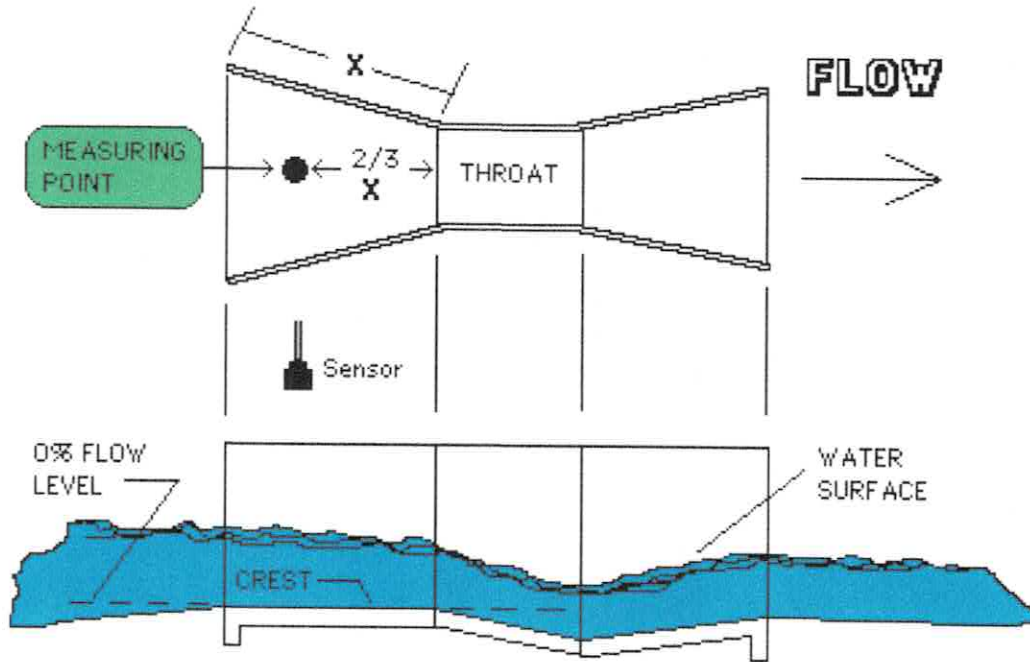
- 1] Mount enclosure in a suitable location as described above. DO NOT locate in a confined or hard to reach area.
- 2] All conduit/wire entrances must be made at bottom of enclosure.
- 3] Conduit/wire entrances must be watertight to maintain enclosure rating. Use electricians putty or caulking to plug conduit entrances to prevent condensation and vapor migration.
- 4] Do Not mount enclosure in direct sun light. This could raise the internal temperature above ambient and damage the unit. A sun shade should be considered.

2. Sensor Installation

Correct Sensor mounting and location is important for satisfactory performance from the flowmeter. The location of the measuring point over the flow device varies with the type used. Refer to flow device manufacturer instructions. Three most widely used flow devices are:

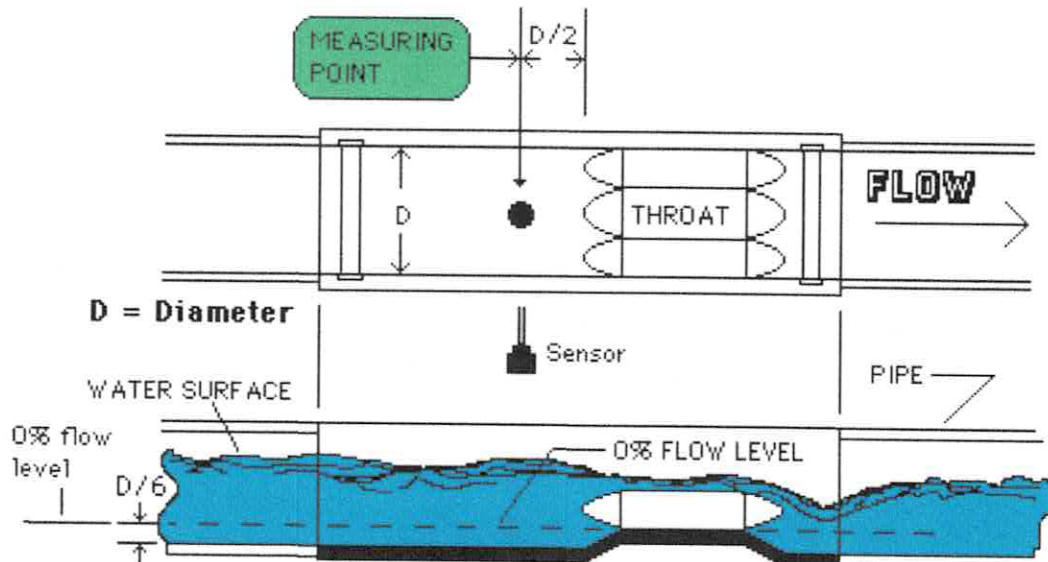
1] PARSHALL FLUME:

Mount the Sensor $\frac{2}{3}$ of the distance upstream from the start of the throat section and the beginning or edge of flume.



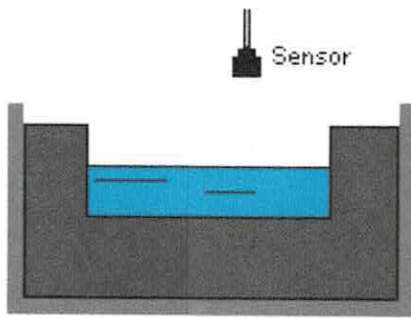
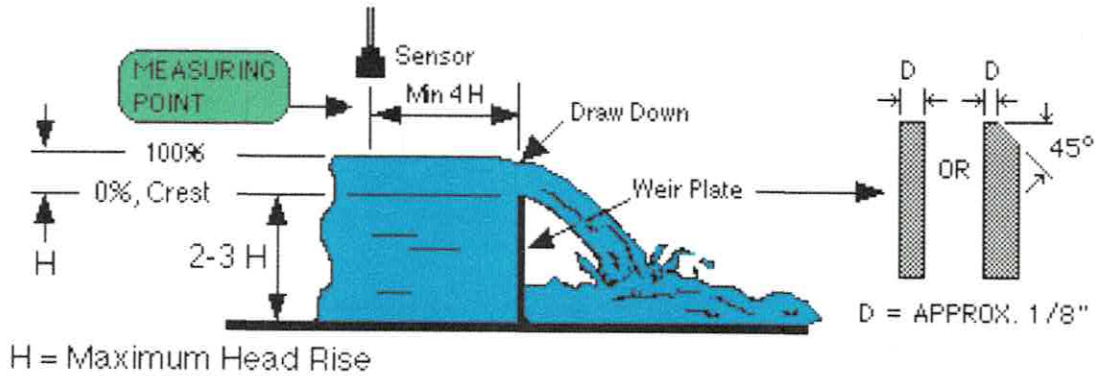
2] PALMER-BOWLUS FLUME:

Mount Sensor $\frac{1}{2}$ the flumes diameter ($D/2$) upstream from throat section.

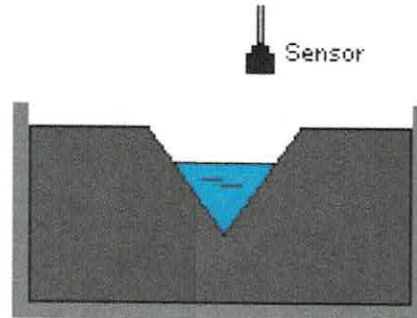


3] V-NOTCH/RECTANGULAR WEIRS:

Mount the Sensor before the Weir plate a distance of at least 3 to 4x the maximum flow depth to be measured. DO NOT mount the Sensor over the Weir plate or the waters drawdown.



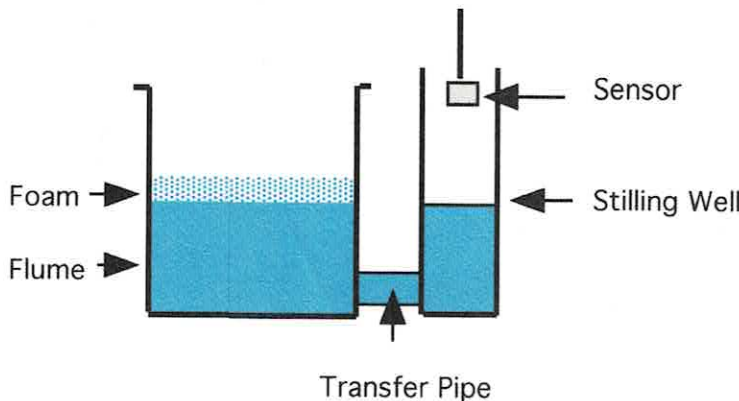
Rectangular Weir with End Contractions



V-Notch Weir

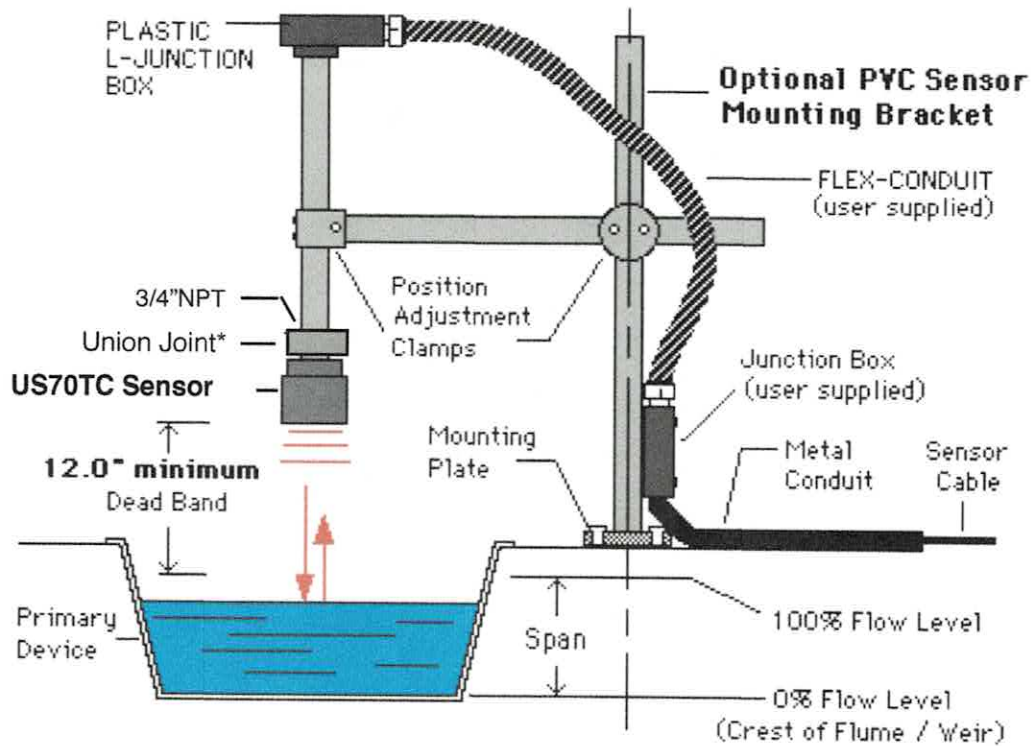
Using A Stilling Well

A stilling well may be used if there is difficulty in measuring the flow level due to turbulence, thick foam etc. The stilling well must maintain a smooth inside surface for best results. Eliminate any gasket protrusion if two sections of pipe are joined to form a longer pipe. We recommend PVC pipe, at least 8 inch diameter or greater for the stilling well. Be aware that the water in the stilling well may freeze in winter causing erroneous readings.



It is necessary that the Sensor be mounted over the flume or weir as illustrated in figure 2.

The Sensors radiating surface must be parallel to the liquid flow surface in the flow device or the returning ECHO may be reflected away from the Sensor.



* Use Supplied Union Joint for best results. **Do not over tighten to sensor ... hand tighten only.**

The Ultrasonic Pulse transmitted by the sensor will reflect off the water surface and return to the Sensor. The time delay from transmit to receiving the ECHO is an indication of the distance of the liquid surface from the Sensor. This distance is subtracted from the 0% flow level (crest) programmed by the user to determine the depth of flow.

Figure 2.

The Sensor mounting should take into account the 12.0" minimum DEAD BAND as specified. When programming the PDS-360, you should not allow for less than a 12.0" DEAD BAND. (DEAD BAND equals ZERO % setting less the SPAN setting).

IMPORTANT

If the flow surface comes closer than the specified or programmed DEAD BAND to the Sensor, the system may not respond to further increase of flow and all readings may be considered invalid.

The Sensor is provided with at least 30 feet of cable (standard). An electrical non-corrosive plastic junction box should be located near the Sensor to allow splicing of its cable to additional cable length, if required. Use supplied cable (optional) or twisted pair shielded (Belden# 8451 or equal) for the sensor connection.

IMPORTANT

It is Mandatory that the cable be ran in a PVC conduit using PVC watertight fittings, junction box etc. for the first 2 to 3 feet from the Sensor. If the Sensor is mounted to metallic pipe, fittings or bracket the flowmeter may not work !!

The cable running from the junction box to the electronics must run in a metal conduit for lengths greater than 50 feet. This conduit must be committed only to this cable. Running any other cables in this conduit will very likely interfere with the flowmeters operation.

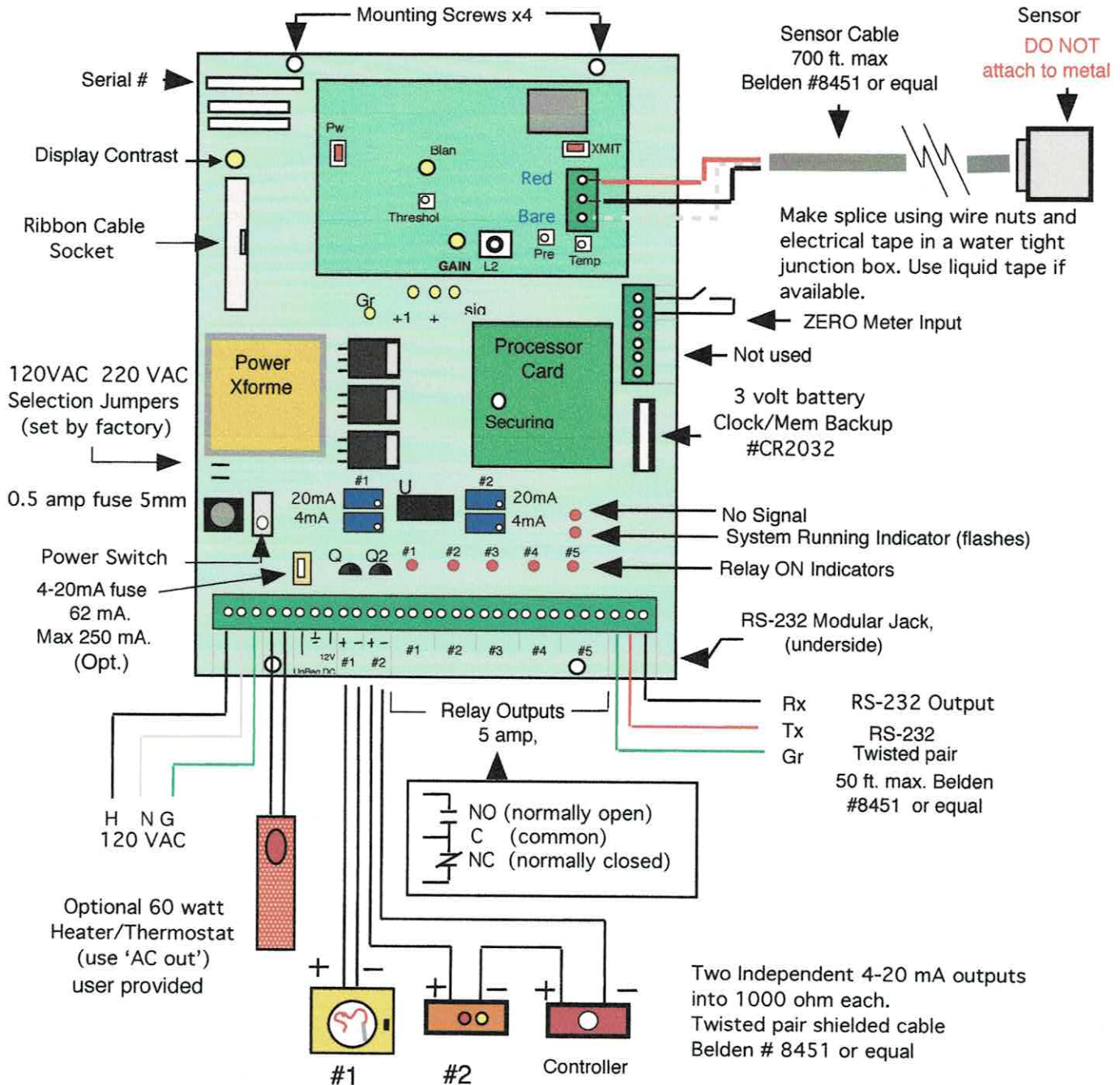
Mount the Sensor with the supplied PVC Union Joint over the prescribed measuring point in the flume or Weir, as shown above, using Control Electronics PVC Sensor Mounting Bracket (optional) or a Sensor mounting bracket of your own construction (see figure 2). Be sure the Sensor mounting bracket is made from PVC, not metal, and is plumb and secure. Make certain that the elevation of the Sensor allows for at least a 12.0" DEAD BAND (12.0" above maximum flow depth anticipated plus at least another 2 inches (recommended)). DO NOT over tighten the Sensor to the bracket. This could cause extended Sensor ring-time that may interfere with the ECHO return signal.

Sensor Installation Notes

- 1] Determine Sensor location over Flume/Weir (see page 4-5).
- 2] Install PVC Sensor Mounting Bracket. DO NOT use any metal components on bracket. Refer to figure 2.
- 3] Make sure Sensor support is plumb and secure. Use supplied PVC Union Joint for best results.
- 4] Make certain that the elevation of the Sensor allows for at least a 12.0" DEAD BAND (12.0" above maximum flow depth anticipated plus at least another 2 inches (recommended)).
- 5] Run PVC or metal conduit from Sensor location as described above to flowmeter enclosure.
- 6] Make any splices to sensor cable required. Use wire nut, liquid tape (to water proof) and electrical tape to make splices.
- 7] Do not over tighten Sensor to Bracket. This could cause extended sensor ring time that may interfere with ECHO signal.
- 8] Seal and tighten all junction box lids and conduit connections to prevent water infiltration.

3. ELECTRICAL CONNECTIONS

General Overview



Note: Relays and RS-232 Output are not available on the PDS-360DX

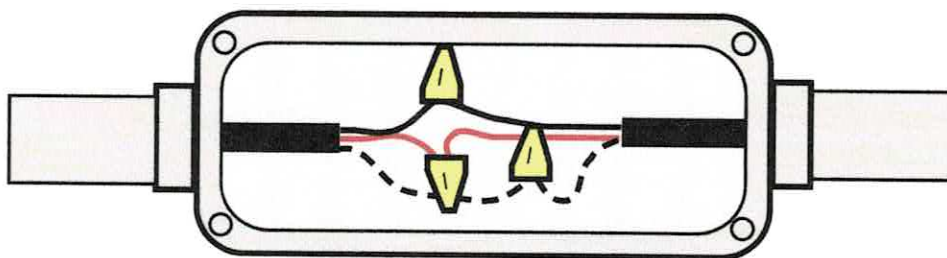
Figure 3.

SENSOR CABLE

The standard US70TC Sensor is supplied with a 30 foot interconnecting cable (unless ordered otherwise). You can splice additional cable length using wire nuts and electrical tape, but be sure to keep it as short as possible (maximum 700 feet) using only specified cable (Belden# 8451 twisted pair shielded or equal). Any splices should be made in a watertight junction box. Avoid close proximity to AC power lines and other frequency carrying lines. Run the Sensor cable through its own committed, watertight conduit. No other cables should be allowed to run in the same conduit. The Sensor cable MUST enter through the bottom side of the controller enclosure.

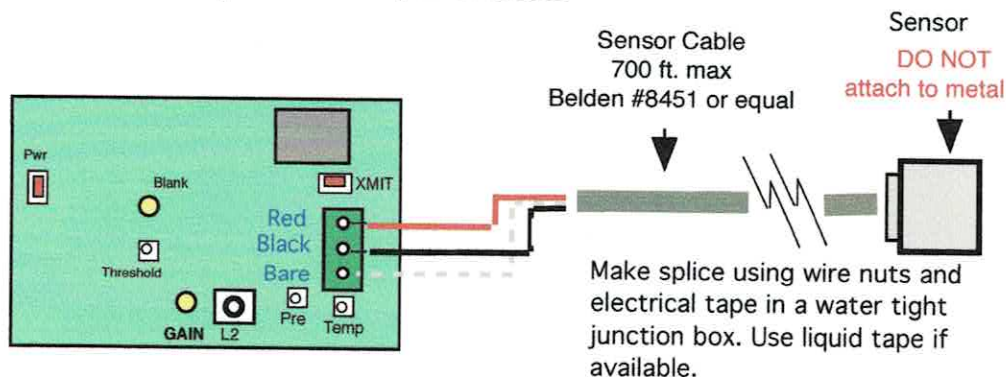
IMPORTANT

Be certain to make a good water tight entrance with the conduit to maintain the NEMA 4X rating. The conduit should be plugged with electricians putty or caulking to prevent moisture / vapors migrating from the Sensor to the enclosure. This will help to prevent condensation forming in the conduit and enclosure.



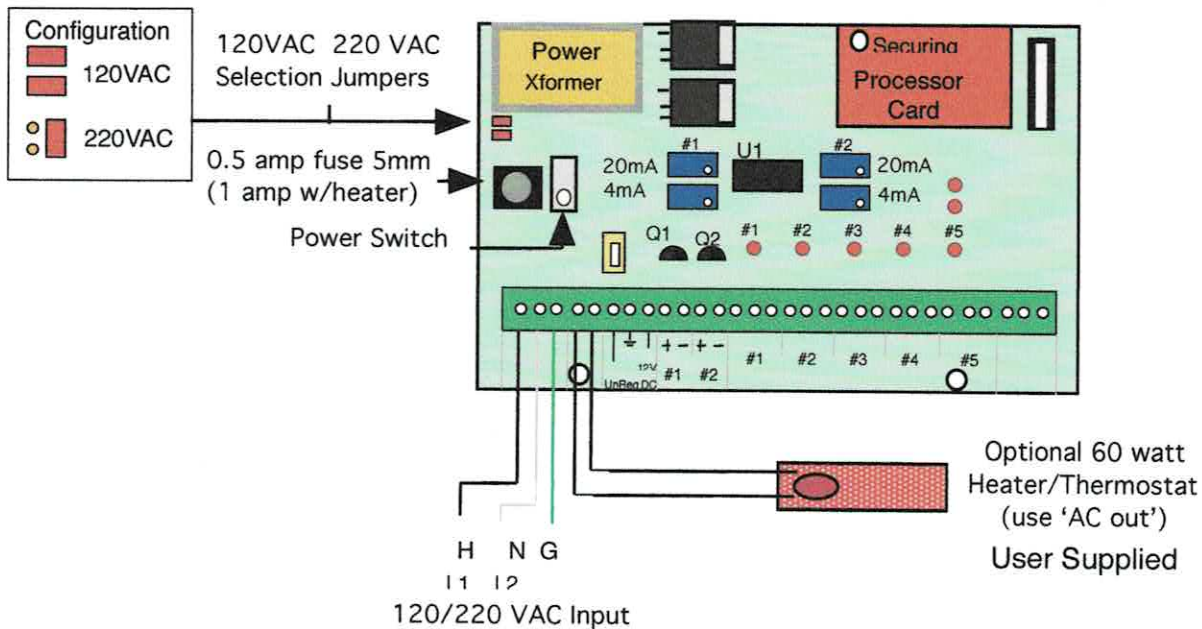
Typical Sensor Cable splicing using wire nuts in a water tight junction box.
Use liquid tape on exposed wires if available.

Connect the Sensors cable to the Three (3) pin terminal barrier strip on PC-548 Open-Channel flow card marked SENSOR. The Red wire to RED, Black to BLACK and bare (ground return) to BARE.
Cable type: Belden #8451 or equal - twisted pair shielded.



Sensor Cable Connection to PC-548

POWER CONNECTIONS



120/220 VAC INPUT

120 VAC power (220 VAC Selectable) **MUST** enter through the bottom side of the enclosure in its own committed conduit (not required if supplied with optional AC power cord). Connect AC power to the terminal barrier strip marked AC INPUT. DO NOT allow the AC wires to lay all about in the enclosure. Keep as short as possible to avoid AC interference. 14 gauge wire is preferred over a heavier wire that may put unnecessary stress on the terminal barrier strip. Fuse power line if needed so as not to exceed wire capacity. The flowmeter has an on board 0.5 amp fuse (1 amp with user supplied 60 watt heater).

AC OUT / HEATER-THERMOSTAT

Provides AC power to control an external recorder or optional 60 watt Heater/Thermostat (user supplied) that operate in conjunction with the flowmeter. Power is applied by ON/OFF switch.

NOTE: The flowmeter has a .5 amp 5mm fuse, use 1 amp with max. 60 watt heater. It may be necessary to increase the fuse rating to accommodate external devices. Max rating should not exceed 3 amps.

UNREG DC, $\frac{\ominus}{\oplus}$ (ground) , 12 VDC (Bat), 24 VDC

These inputs/outputs provide DC power for optional accessories or allow for battery only operation of the flowmeter. UNREG DC is both an input and an output. When AC power is applied, an unregulated voltage of approximately 16~18 VDC will be found at this point between UNREG DC and GROUND ($\frac{\ominus}{\oplus}$) and 12 VDC between 12VDC and GROUND.

24 VDC is available between '+' of the 4-20mA output and ground ($\frac{\ominus}{\oplus}$). This may be used to power customer options. Max current draw should not exceed 150 mA. The 4-20 mA fuse (opt.) should be increased to 250 mA or 1/4 amp. when using 24 VDC for external options.

BATTERY OPERATION

BATTERY ONLY OPERATION

If the flowmeter is going to operate from a battery only (no AC power), a standard 12 volt gel cell battery may be connected between 12VDC and Ground on the terminal barrier. The plus '+' of battery to 12VDC and the negative '-' to GROUND (\perp). A minimal 6 amp hour battery is recommended .. max run time approx. 30 Hr.

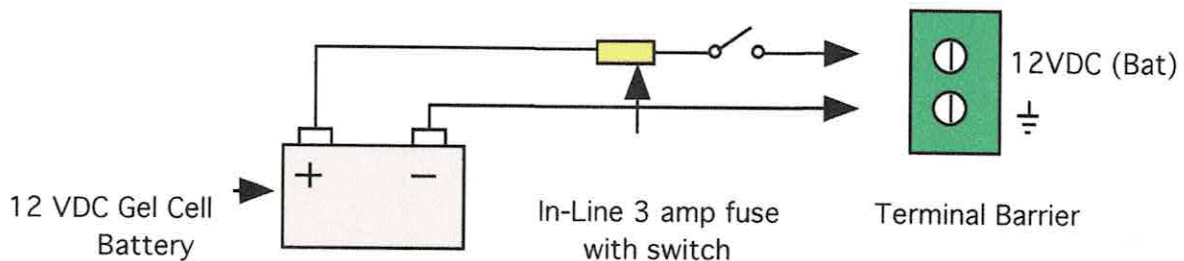
BATTERY BACK-UP OPERATION

If battery back-up is desired to maintain operation of the flowmeter in the event of a power failure, we recommend the use of a UPS (uninterruptible power supply).

NOTE: battery back-up is not required to retain the programming.

IMPORTANT

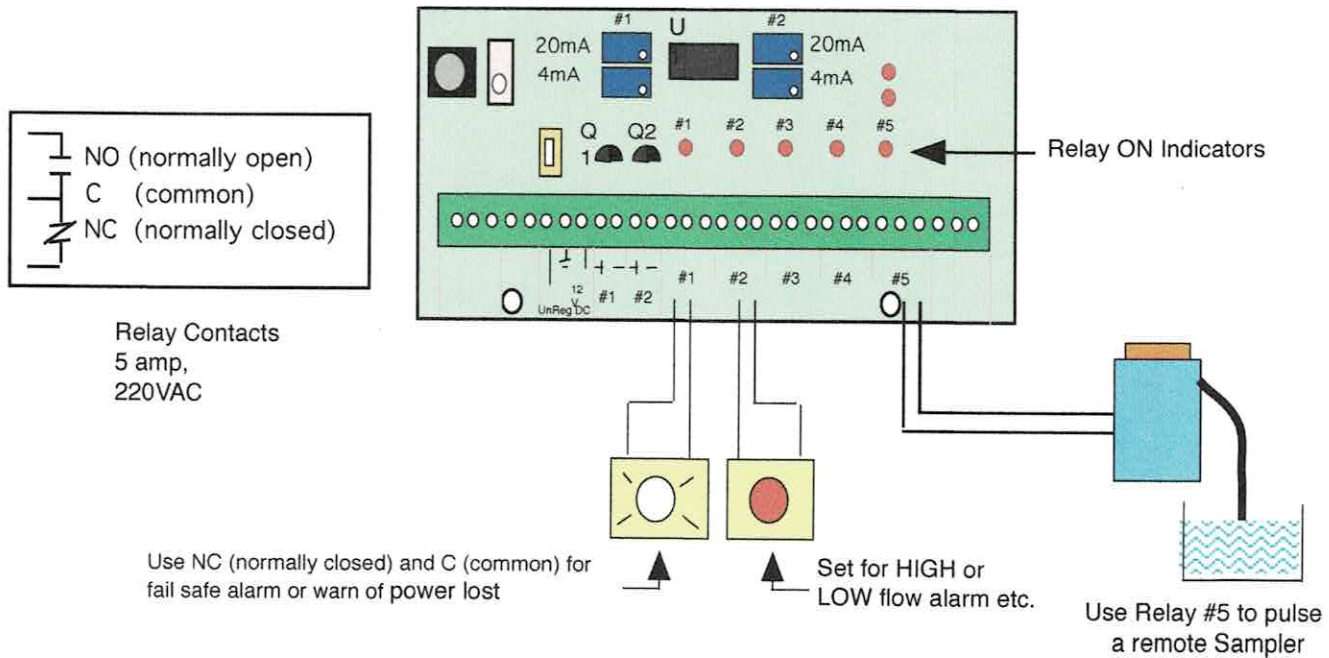
The power switch on the circuit board does not switch the battery supply nor does the fuse offer any protection. Power is applied as soon as the battery is connected to the terminal barrier. We recommend you install a switch and an in-line 3 amp fuse for protection if no on-board fuse is provided for battery.



Battery Operation Only connections

Note: If using 12VDC operation, you must connect '+' lead of 4-20 mA loop to 12VDC.

RELAY OUTPUTS



Note: 360DX system does not have Relay outputs

RELAY #1, 2, 3 and 4 outputs (N/A On 360DX)

Relay #1 thru #4 are independently programmable alarm setpoints used for alarming and control. Both the ON and OFF settings are programmable allowing for pump UP or DOWN control, valve control etc. They are 5 amp, 220 VAC contacts with associated LED status indicators on circuit board. Use wire suitable for electrical load to be carried by contacts. Fuse line if needed so as not to exceed contact rating.

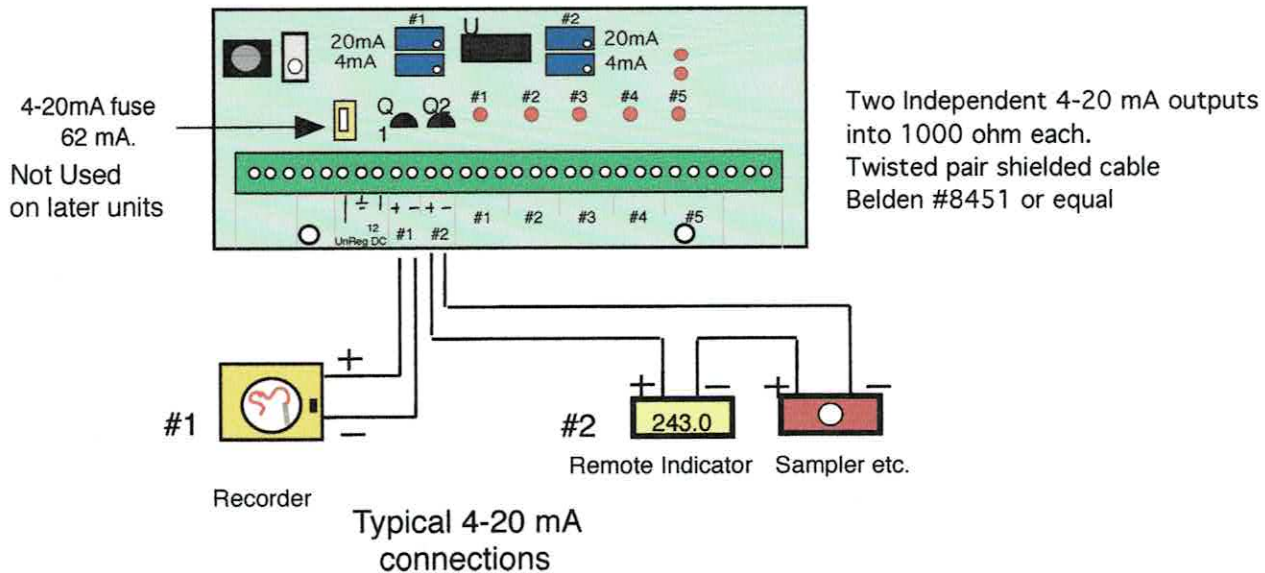
RELAY #5 output (Programmable Pulse, Sampler ... N/A On 360DX)

Relay #5 is a programmable pulse output used for pulsing a remote totalizer counter or for Sampler control. The output is a dry contact rated at 5 amp, 220 VAC. Closure duration when programmed count is met is 250ms. (milli-seconds). After count is reached, the counter will reset for next sample/pulse automatically.

ZERO METER input

A dry contact closure across ZERO METER input will force the Flowmeter to go to a preprogrammed percentage of flow value as entered by the operator (ON ECHO LOSS GO TO in program section). This will also display ECHO LOSS warning.

4-20 mA OUTPUTS



There are two independent 4-20mA. outputs, individually adjustable. They are used to control samplers, setpoint controls, recorders, chlorinators etc. The two analog output signals are FLOATING outputs (both the '+' and '-' terminals have their potential above system ground) and are DC isolated from electrical ground. The signal outputs are connected as shown. Polarity must be observed through the entire control loop for proper operation. Maximum loop resistance for each output is 1000 ohms. Twisted pair shielded wire should be used, Belden #8451 or equal. Ground wire (bare wire) may be connected to ground (\oplus) on the terminal barrier or remote device. Make connection only at one end.

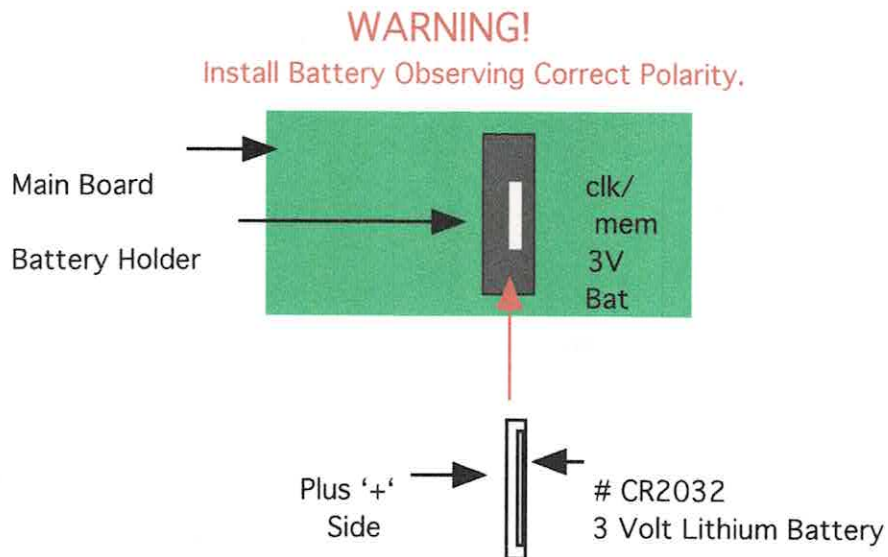
- Notes:
- 1] the 4-20 mA output is fused (optional). Fuse is rated for 62 mA. Do not exceed 250 mA.
 - 2] If 12VDC battery operation only is used, you must connect the '+' lead on the 4-20 mA loop to '+' 12V. Max loop resistance will be reduced to 500 ohm.
 - 3] Output #1 will be in GPM (gallons/ minute) only. Output #2 may be set for GPM, INCHES or TEMPERATURE in the programming.
See 'SETTING THE 4-20 mA OUTPUT'.

REPLACING THE CLOCK / MEMORY BATTERY

This battery is for retaining programmed information and keeping the clock running when power is turned OFF. The battery should last for approximately 8 to 10 years under normal operation. You may replace the battery when power is 'ON' by pulling the battery out of its holder and replacing it with a '#CR2025' or 'CR2032' (recommended) 3 volt lithium coin battery or equal.

WARNING!!

If battery is removed when power is 'OFF', all programming and clock / date will be lost. You will need to restart the system as described in the Programming Flowchart in this manual by using the 'SHIFT' button to RESET the meter to defaults and then reprogram.
Replace the battery only when power is ON.



4. ADJUSTMENTS AND CONTROLS

There are very few adjustments that can be made on the PDS-360 system. Do not attempt to make any if you do not understand their purpose. To do so may void your warranty and result in a costly service charge.

Please note: The following adjustments/calibrations are factory set and should not be touched unless authorized by service technician from Control electronics.

Ultrasonic Transmitter / Receiver Card Refer to Figure 4

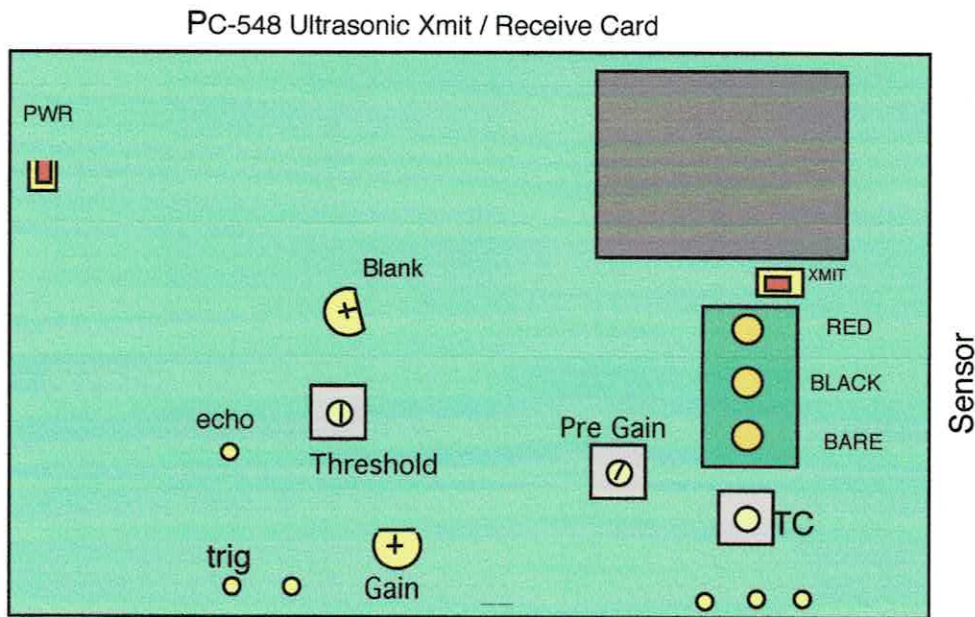


Figure 4.

GAIN

The gain has been factory set. Normally the GAIN setting does not need to be adjusted. Typical adjustment is set to one half of its turn. If adjustment needs to be made, first make certain that the Sensor is plumb to the flow surface (see SENSOR INSTALLATION). Too much or too little GAIN may cause the unit to respond to unwanted noise or cause loss of signal. Do Not mistaken Sensor mounting problems for electrical noise problems. Always check your installation first before making any adjustments.

PRE GAIN

Factory set and should not be touched. CW increases GAIN.

THRESHOLD

The THRESHOLD is factory set. Full CW or CCW will cause loss of signal. Increasing (CW) the THRESHOLD may help in rejecting unwanted electrical noise. If the meter appears erratic try increasing the THRESHOLD.

Note: changes to the GAIN or THRESHOLD setting may effect the apparent calibration. You may need to offset the calibration under MISC Settings mode RANGE = xxx.xx Cal Factor = 1.000 in the programming.

BLANK

This setting BLANKS the transmit pulse and ringing in the sensor - Factory Set. Caution: too much blanking may cause close echo signals (12 to 16 inches from sensor) to be blanked and not processed. NOTE: BLANKING is also automatically set in the programming BLANK = ZERO setting - SPAN

XMIT LED

The XMIT LED indicates a pulse has been sent to the sensor. This should pulse the same time the RUNNING LED pulses on the main circuit board.

TC (Temp Cal)

The TC adjustment is used to calibrate the temperature input from the Temp Probe (Factory Set).

Main Circuit Board (Refer to Figure 3)

ON/OFF Switch

Applies AC power to the circuit board and AC out to the AC OUT on the terminal barrier.

Note: this switch does not control battery operation if connected.

120/220 VAC

Install or remove appropriate jumper(s) to change operating voltage to 120 or 220 VAC operation.

Note: this is factory set. Jumpers are located under left-bottom corner of power transformer.

4 and 20 mA

The 4 and 20 mA adjustments are used to set the 4-20 mA output. See SETTING THE 4-20 MA OUTPUTS.

Note: 4-20 mA adjustments have been factory set and should not require any adjustment.

LED's 1 thru 5 (N/A PDS-360DX)

These LED lights will light when associated relay is energized. LED 1 thru 4 represent setpoints. LED 5 represents the programmable pulse to a sampler or remote counter.

RUNNING LED

Each time the system makes a flow measurement, this LED will flash. Typical rate is 4 times per second.

This is considered normal operation and should be flashing steadily.

Note: when downloading data log this LED will appear erratic.

NO SIGNAL LED

This LED will turn 'ON' when no ECHO signal is received. The LED will flash erratically under turbulent flow conditions or a misaligned sensor mounting. This is normal. The percent of ON/OFF will be an indication of signal strength. If the ECHO signal return is lost (LED ON) for at least 12 continuous seconds, a warning will be displayed. See troubleshooting guide in back of manual.

STARTING UP THE FLOWMETER

Once all installation procedures have been completed, the PDS-360 Flowmeter is ready to be powered up. But before doing so, it is advisable that you go back and check your installation to ...

Before Applying Power Quick Check List

- 1] confirm that all wire connections are correct and secure, particularly the AC power input with correct circuit breaker size.
- 2] confirm that the sensor has been installed properly using the correct type of cable (Belden# 8451 or equal) and any splices made to the sensor cable are correct, secure and moisture tight (use liquid tape, available at most electrical and hardware stores).
- 3] make sure all conduit entrances to the enclosure are watertight. Use electricians putty to plug conduits to prevent condensation and gases migrating to enclosure.
- 4] measure the distance from the sensor face to the zero flow point (0%) in the flume/weir. You will need this value in inches when programming.

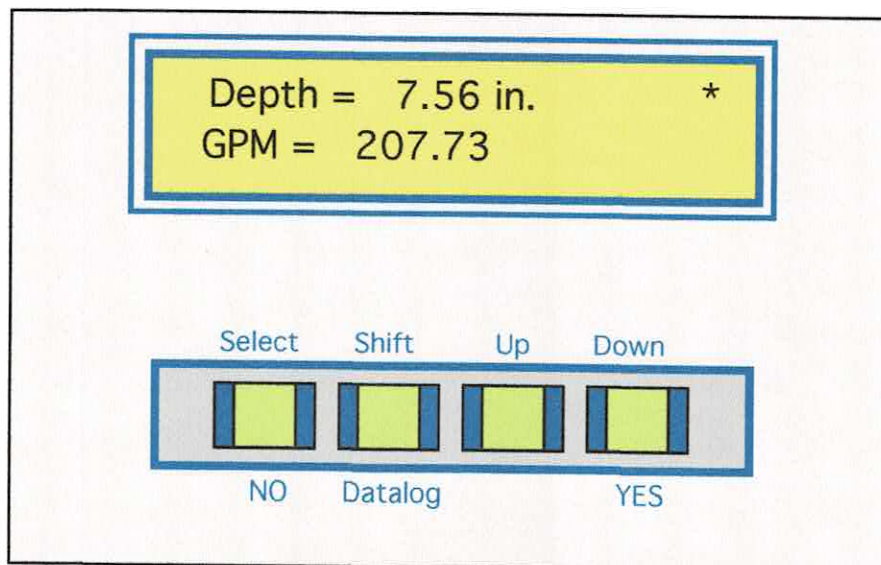
You are now ready to power up the flowmeter.

TURNING POWER ON

Turn AC power Circuit Breaker ON back at the electrical panel if needed. Switch the POWER ON to the flowmeter by switching the small toggle switch on the lower left of the main circuit board to ON.

Once power is applied, the flowmeter will power up and display a few banners indicating manufacturer and software revision number. Before shipping, the flowmeter was set to factory defaults and should now display DEPTH of flow and GPM.

INITIAL RUN MODE DISPLAY AND KEYPAD LAYOUT



- Note:** 1] The values displayed will most likely be incorrect at this time, possibly showing a negative depth. This is normal. The flowmeter has not yet been set up to your application.
- 2] The ASTERISK '*' on line 1 indicates ECHO signal is received. A '-' indicates NO signal received. These symbols will alternate under normal turbulent conditions. They will follow the NO SIGNAL LED. LED 'ON' = '-' on LCD display LED 'OFF' = '*'

Wait approximately 15 seconds to make sure the meter does not display any warnings with respect to ECHO signal or TEMPERATURE. If warnings are displayed, check wiring and see troubleshooting guide in back of manual.

The Flowmeter is now operating. The 'RUNNING' LED light on the main circuit board should be flashing (approx. 4 times per second) and the 'NO SIGNAL' LED should be OFF or intermittent if flow is turbulent. (note: when the NO SIGNAL LED is ON, a '-' symbol will be indicated on line 1 of display ... an '*' when NO SIGNAL LED is OFF). Some relays may energize (N/A on PDS-360DX), depending on the default settings.

Processes used in ECHO Signal Recovery refer to PROGRAMMING FLOW CHART #3 in manual

BLANKING

The Ultrasonic Transmit / Receive card has been factory set for best response. The cards BLANKING has been set to minimize any affects the transmit pulse may have on the received ECHO. The software (programming) also calculates a BLANK time to ignore any ringing from the sensor or other interfering signal after the sensor has been pulsed. The BLANK time (or distance) is equal to: $BLANKING = ZERO \text{ distance setting} - SPAN \text{ setting in the programming}$. i.e. if ZERO is set to 31.0" and SPAN to 15.0" then the BLANKING distance = $31.0" - 15.0"$ or 16.0".

If the systems seems to be responding to ring time signals (i.e.: indicates max flow or intermittent spiking), increase the ZERO distance and reset the SPAN for a longer BLANKING.

AVERAGE READINGS

AVERAGE READINGS increases the readability and stability of flow indications. The flowmeter will make a number of measurements as programmed in AVERAGE READINGS (best setting is 10) and average the measurements before displaying. An average of 4 equals approximately 1 second before updating the display. Average of 8, approximately 2 seconds and so on.

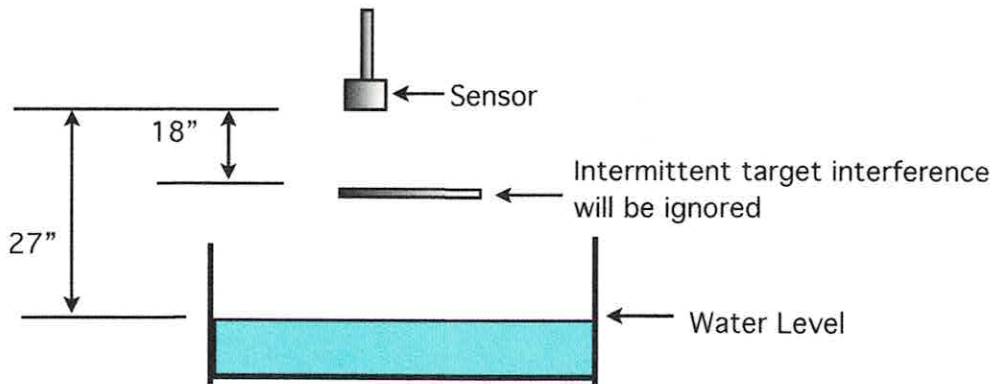
DAMP FACTOR

DAMP FACTOR dampens the displayed values for smoother response of flow indications. i.e.: the higher the damp factor, the slower the measured value displayed will change from one reading to the updated reading. Damp Factor is 00 to 10, Ten is max.

Note: if flow levels (echo) change quickly but stay within a small range (i.e. turbulent flow) you may increase the damp factor for best display of flow values. Typically a damp factor of 3 is recommended.

SPURIOUS SIGNAL REJECTION

The PDS-360 flowmeter has a false ECHO or Spurious signal rejection time built-in to the program. The system must have repeated echoes within a given time before it will respond. Intermittent noise, splashing or false targets will be ignored. As an example, if the target distance or water level is 27" from the sensor and an intermittent target enters the sensors path at 18" from the sensor, the system will ignore the 18" target and continue to use the 27" target as its true water level. If the 18" target remains for the rejection time 'time-out' (as set by the operator), then the system will use the 18" target as the new water level. The system rejects signals that are +/- 1.0" from its working target.



PROGRAMMING THE FLOWMETER

You can now begin programming the flowmeter once the STARTUP procedure above has been completed successfully. The keypad on the front panel is used for selecting the various RUN MODE indications and PROGRAMMING MODES of the flowmeter.

- 1] Use the SELECT button to scroll through the program selections, selecting NO/YES where needed.
- 2] To change any value, use the SHIFT button. This moves the cursor ('_') under the digit you want to change.
- 3] Use the UP and DOWN buttons to change the value of the selected digit.

When in the RUN MODE, press the UP or DOWN button to display the RUN MODE parameter you desire. The 4-20 mA. output is not affected by the selection of any RUN MODE window.

Selections:

GPM .. TOTALIZER or MGD .. TOTALIZER

Flow may be displayed in GPM (gallons per minute) or in MGD (million gallons per day) units with TOTALIZER count. The TOTALIZER is an 8 digit counter that indicates the total accumulated flow in gallons to date. The total will be equal to the count displayed times the multiplier (i.e. x100) indicated. The multiplier may be programmed under the SET FLOW PARAMETERS section. See PROGRAM FLOW CHART #3 in manual.

DEPTH .. GPM

DEPTH indicates the measured HEAD (depth) of water as it passes through the flume or over the weir plate. DEPTH may be displayed in inches or feet. This reading is used in the equation for the selected primary device to calculate the GPM flow reading and total accumulated flow. $\text{Depth} = \text{ZERO\% distance} - \text{SENSOR to FLOW SURFACE distance (Range)}$

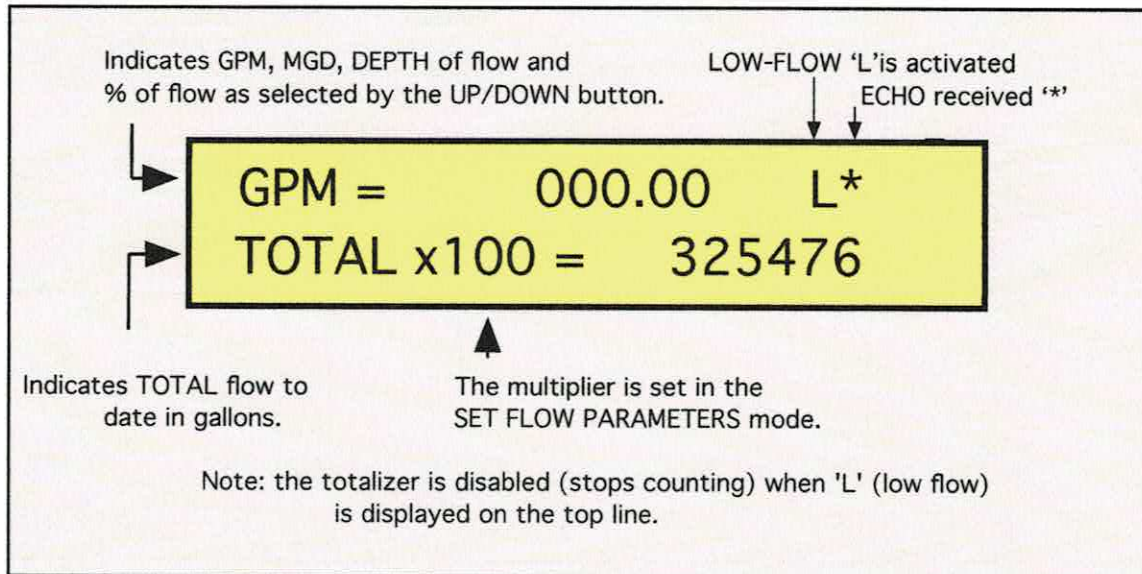
Note: if the flow level drops below the ZERO % setting, the DEPTH will be displayed as a negative number.
i.e. DEPTH = - 2.34" (means 2.34" below the programmed ZERO % point).

Flow % .. TEMPERATURE

FLOW % indicates the percent of flow as found on the 4-20 mA. output #1. The output is scaled by the SCALE 20 mA. OUTPUT #1 under the SET 4-20 mA OUTPUTS mode in programming.

The outside temperature at the Sensor is also indicated. The temperature is in degree fahrenheit $\pm 3^\circ$. The flowmeter must have a temperature reading to do flow calculations. If the probe is damaged or not used, you must manually turn the probe 'OFF' and enter a temperature under MISC Settings ... Temp Probe ON / OFF. If the Temperature Probe is 'ON' and the system senses a probe failure, the flowmeter will automatically use the default temperature you entered in Enter Outside Temp if you select Temperature Probe is OFF. Factory default temperature is 60° F. A TEMP PROBE failure warning will be displayed.

Note: Temperature may indicate as much as 10° warmer than the ambient air if the sun is shining directly on the sensor.



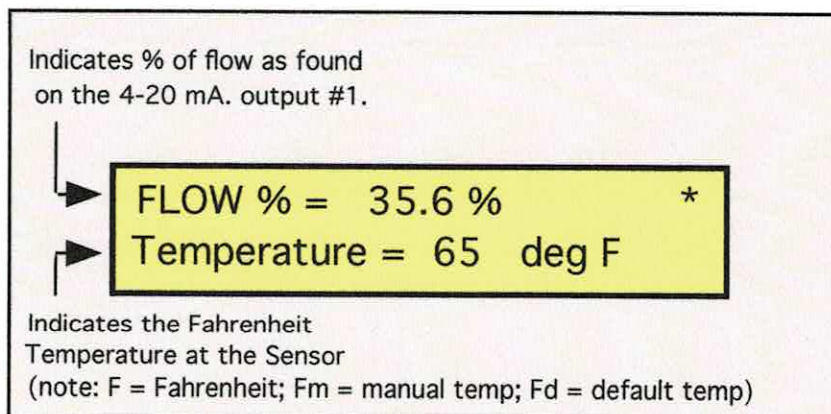
TYPICAL RUN DISPLAY

LOW FLOW ('L')

If the letter 'L' is displayed in the top right corner of the display, this indicates that the LOW-FLOW SHUT-OFF is activated. When the GPM flow calculated by the flowmeter is below the LOW FLOW SHUT OFF GPM setting programmed by the operator, the %, GPM, MGD readings and analog outputs (i.e.4-20mA) will be forced to zero. The totalizer also stops counting at this time. The DEPTH display will continue to indicate the flow depth as measured by the flowmeter.

ASTERISK ('')**

An ASTERISK in the top left corner of the display indicates an ECHO signal is received. A '-' sign will display if ECHO signal is not received or lost. It is normal for this to fluctuate in turbulent flows.



Note: Metric equivalents are also available by pressing the UP or DOWN button. LPM (liters/minute)...Total Liters; Cubic Meters/hour ... Total Cubic Meters; Depth in cm or mm; Temperature in °C.

BEGIN PROGRAMMING

The programming of the flowmeter is accomplished by first pressing the SELECT button. You will be asked if you want to GO TO PROGRAM MODE? If you select YES you will be asked to ENTER YOUR PASS CODE. Enter the PASS CODE using the SHIFT , UP and DOWN buttons . If the wrong PASS CODE is entered, the display will return to the RUN MODE last selected.

Note: The flowmeter leaves the factory with pass code '0000'.

Press the SELECT button again. You are now asked CHANGE PASS CODE?. If you like, you may change the pass code at this time by using the SHIFT, UP and DOWN buttons. If you change the pass code

IMPORTANT

Remember your new PASS CODE !!!

If you forget your pass code and can not enter the programming section, you will need to call the factory at 610-942-3190. Please have your flowmeters serial number available. It is found on the upper left corner of the main circuit board.

Press the SELECT button and you will be asked SET PRIMARY DEVICE? Select YES to enter PRIMARY DEVICE selection. Use the UP/DOWN buttons to select the type of primary device you are using.

Refer to the PROGRAM FLOWCHART in this manual for navigating through all the programming functions.

Press SELECT and enter the size of the Primary Device, again using the UP/DOWN buttons.

Next press SELECT until asked SET FLOW PARAMETERS. Select YES. Enter the measured ZERO FLOW DISTANCE (distance from sensor face to zero flow - crest - of flow device) point using the SHIFT, UP and DOWN buttons. Press SELECT. Enter the SET SPAN (max head). Refer to figure 2, page 6.

Note: If the ZERO FLOW DISTANCE value is changed, the SPAN will automatically set itself according to $SPAN = ZERO\ DISTANCE\ setting - 12.0"$. You may change the SPAN to any value that is less then the value displayed. Minimum SPAN is 1.00".

You should set the SPAN for max flow depth anticipated plus 1 to 2 inches for best operation. Maintain at least 12" dead band.

Continue down the FLOW PARAMETERS list referring to the PROGRAM FLOW CHART #3 in this manual. A brief explanation of each parameter is given in the programming flow chart.

SETTING/TESTING RELAY OUTPUTS

(N/A on 360DX)

TESTING THE RELAY OUTPUTS

The relay outputs can be tested by going to SET RELAY OUTPUTS mode in the programming (refer to flow chart #4), select YES. Select 'YES' at TEST RELAY OUTPUTS?. The display will show

Test Relay #0
Done ON OFF Select

- 1] Use the DOWN button to Select the relay number (1 thru 5).
- 2] Press the SHIFT button to turn the selected relay 'ON'.
- 3] Press the UP button to turn the selected relay 'OFF'.
- 4] Press the SELECT button when 'DONE'.

The associated LED will light when relay is energized.

SET RELAY OUTPUTS .. Relay 1 ~ 4

The PDS-360 has four (4) independently programmed alarm relay outputs. The programming is performed under the SET RELAY OUTPUTS? mode. Each Relay output has a separate ON and OFF setting for differential control of pump ON and pump OFF or valve open/close etc. The program values are in GPM (gallons per minute). The relay contacts are dry contact closures rated 5 amp, 220VAC. An associated LED will light when the relay is energized.

Note: while in the program mode, the relay outputs will not be affected by any program change. Once you are back in the RUN MODE, the new values will take affect.

SAMPLER OUTPUT ... Relay #5

The SAMPLER PULSE output, Relay #5, is used to pulse a remote Sampler or counter. It is programmed under the SET RELAY OUTPUTS? mode ... Relay #5 Sampler Pulse ... 1 Pulse = 000000 gal. Example: if you need to sample your flow every 1000 gallons, you would program the SAMPLER PULSE rate for '001000'. If a remote counter needs to be pulsed, enter a multiplier i.e enter '000100' for x100. A programmed setting of '000000' gallons disables the pulse output.

The relay will close for a duration of 250 ms. (= 1/4 sec) when the count is reached. The function will automatically reset itself for the next count. The relay contact is a dry contact rated 5 amp, 220 VAC. An associated LED will flash when the Sample is made.

After setting the RELAYS and SAMPLER outputs, you may choose to log the time and date each sample is taken or relay changes state (i.e. OFF to ON, ON to OFF) by selecting 'YES' or 'NO' when asked LOG SAMPLER EVENT? and/or LOG RELAY EVENT ?. The EVENT LIST can be viewed by downloading the data to a PC/Lap Top through the RS-232 output (see using the RS-232 Output).

SETTING COMMUNICATIONS / DATA LOG

Set the RS-232 output parameters and DATA LOG sample rate and 24 hour Summary start time by selecting 'YES' at SET COMMUNICATIONS (see program flow chart #5).

BAUD RATE

Set the BAUD RATE to desired setting by pressing the UP or DOWN button. Rates are 2400, 9600 or 19200. Make sure the selection matches the device connected to the RS-232 output.

DESTINATION

Set SEND DATA TO... PRINTER, PC/LAP TOP, MODEM 1 (LUCENT) or MODEM 2 (CONEX) by pressing the UP or DOWN button. This is only necessary if using an external serial printer or modem.

ID NUMBER

Set the flowmeters ID# if desired. FT-0000 is default. Use the SHIFT, UP and DOWN buttons to set.

COM ADDRESS

Set COM (communication) ADDRESS. The default is 'A'. Select the '#' sign if using a modem. Note: if modem is selected above, the '#' sign will automatically be set. When using a modem, you can change the COM ADDRESS to other value except 'A', 'N' or 'Y'. These are reserved. The COM ADDRESS will be used when downloading data to a PC/Lap Top.

DATA LOG SAMPLE RATE

Sets the SAMPLE RATE for Data Logging. i.e., entering 30 minutes indicates that every 30 minutes the GPM Flow Rate for the past 30 minutes will be averaged, logged and time stamped. If you set to '00' minutes, the data logging will be disabled. The Data can only be viewed by downloading to a PC/Lap Top. Note: this setting does not affect the 24 hour summary logging.

24 HOUR SUMMARY

Set the time to begin the 24 hour summary data logging. This will time stamp the MIN/MAX/AVG GPM flow rate and TOTALS for the 24 hour period for over the past 6 months. This data may be printed to a serial printer on demand or automatically at end of 24 hour period or viewed on the display by pressing the SHIFT (data log) button while in the RUN mode. The data is best viewed by downloading to a PC/Lap Top.

SETTING/TESTING ... 4-20mA OUTPUTS

TESTING

There are two (2) 4-20 mA. outputs on the PDS-360 flowmeter that can be set independently and tested using the TEST 4-20mA OUTPUT? function under SET 4-20 mA.... mode. Enter the TEST 4-20mA OUTPUT by selecting 'YES'. The 4-20mA outputs should go to 4 mA. or 0%. The display will read ...

4-20mA Output = 00%.
Done +25 +10 -10

- 1] Adjust the '4 mA.' potentiometer adjustment of output #1 and #2 (see figure 3, page 8) for 4 mA. output.
(Note: perform the 4 mA. adjustment first to eliminate any interaction between the 4 and 20 mA. adjustments).
- 2] Press the SHIFT button 4 times to simulate 100% or 20mA.
(Note: Pressing the SHIFT button adds 25% to the output; the UP button adds 10% and the DOWN button minus 10%. By using the SHIFT, UP and DOWN buttons, you can increment and decrement the output in 5% increments).
- 3] Adjust the '20 mA.' potentiometer of each output for 20 mA. output.
- 4] Repeat steps above using the Keypad to simulate an output and confirm the 4-20 mA output.
- 5] Press SELECT (Done) when completed to exit simulate of 4-20mA output.

This completes the testing of the 4-20 mA outputs.

SCALE THE 4-20 mA

Set the SCALE 20 mA. OUTPUTs #1 and #2 to scale the 4-20mA outputs to a remote recorder or other device if needed. For example, the recorder charts are printed 0-500 (GPM). Set the OUTPUT #1 for 000500.00 GPM. Note: Output#1 is scaled in GPM (gallons/minute) by default.

Output #2 may be scaled for Gal/Min (GPM), Flow Depth (inches) or Temperature (Deg F) ... Set Output #2 for.. in programming. Press the UP or DOWN button to make selection. Output #1 is by default, Gal/Min (GPM).

Press SELECT and scale output #2.

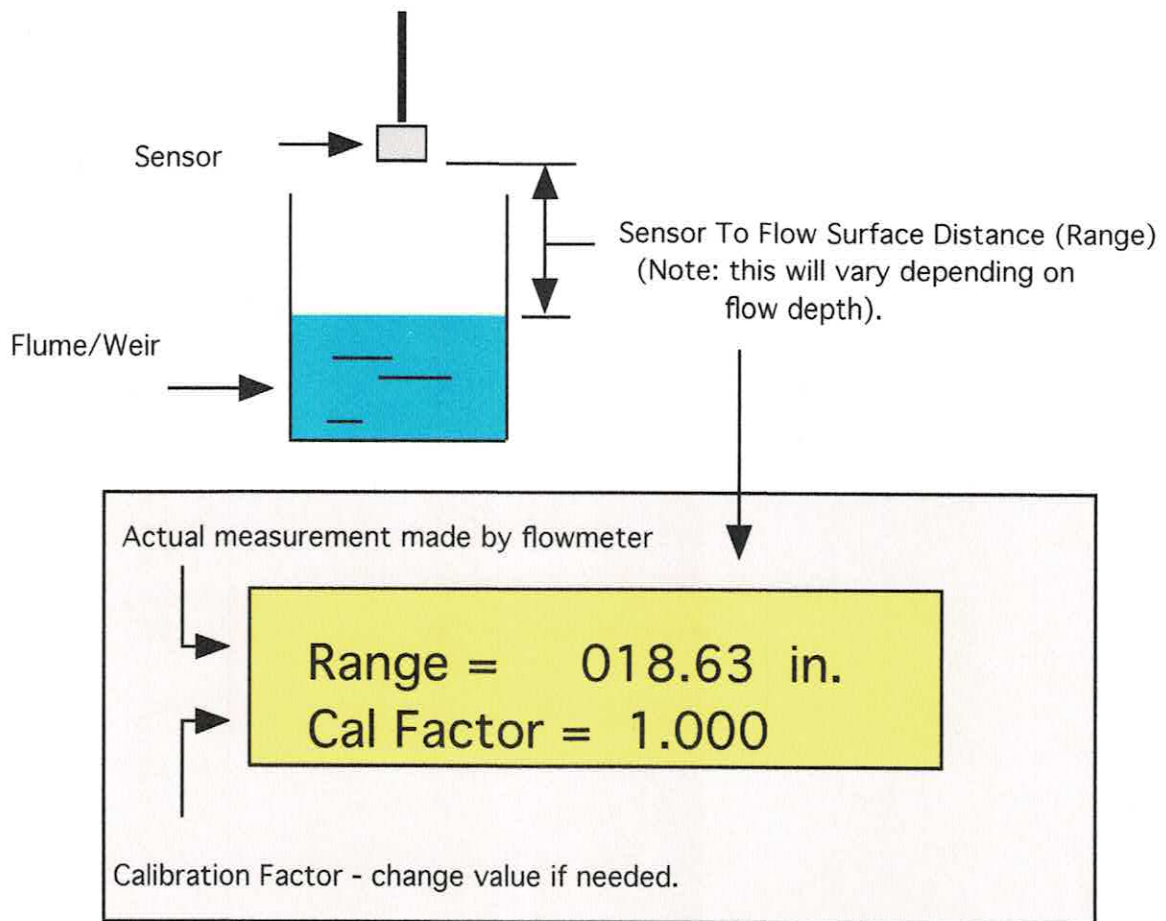
SET OUTPUT DAMP FACTOR

The DAMP FACTOR controls the response rate of the 4-20 mA outputs. Set the DAMP FACTOR for each of the 4-20 mA outputs by entering a value of 1 to 10 when prompted. 1 being the fastest response, 10 the slowest. A value of 3 is typical.

MISC SETTINGS

CHANGING THE CALIBRATION REFERENCE

Make a measurement from the Sensors face to the surface of the flow. Go to MISC Settings.... mode in the flowmeter and check the RANGE = display value. This is the actual measurement the flowmeter is making. If the distance is not correct, use the SHIFT, UP and DOWN buttons to change the CAL FACTOR value. i.e. if the displayed value is found to be 2% low, enter a CAL FACTOR of 1.020 to increase value by 2%. If the displayed value is 1.5% high, enter a CAL FACTOR of 0.985. Changing the CAL FACTOR alters the microsecond reference used in the distance calculation to compensate for installation anomalies, sensor tolerances, atmosphere conditions etc. DO NOT attempt to correct flow indication unless you are absolutely certain that the instrument is incorrect.



IMPORTANT

Be sure the Sensor has been installed properly over the flume or weir (see sensor installation), programmed data is correct, Temperature Reading is correct, all cables have been properly connected and your physical measurement is correct before making any CAL FACTOR change.

SETTING THE TIME AND DATE (N/A on 360DX)

Under the MISC Settings ? Set the Time and Date using the SHIFT, UP and DOWN buttons. The Data Logging and 24 hour Summary use the time/date for logging purposes. The time/date is generally set when it leaves the factory but should be checked.

RESET THE TOTALIZER ... DATA LOG

Under the MISC Settings? you can RESET the Totalizer to zero and/or RESET (clear) the Data Log (N/A on 360DX) by selecting 'YES' when asked. It is best to do the RESETs when starting up the flowmeter or when the Time/Date have been changed.

Note: The EVENT LIST is not Reset by the Data Log RESET (N/A on 360DX).

TEMPERATURE PROBE ON/OFF

Under the MISC Settings ? you can disable (turn OFF) the temperature probe and enter a manual temperature for the flowmeter to use. This may be necessary to do if your temperature probe is defective.

If the flowmeter detects a defective or disconnected temperature probe, it will automatically use the entered manual temperature. This is considered the default temperature. You can enter a default temperature and still use the temperature probe by

- 1] Go to TEMP PROBE ON/OFF and press the UP or DOWN button until the flowmeter displays Temp Probe is 'OFF'.
- 2] Press SELECT button. You will be asked to ENTER OUTSIDE TEMP.
- 3] Use the SHIFT, UP and DOWN buttons to enter a temperature. This is also the flowmeters new default temperature.
Note: you can enter something other than the actual temperature (default temp). Enter the actual temperature only when the temperature probe is defective and/or you are not going to use the temperature probe.
- 4] Press the SELECT button to exit.
- 5] Leave Temp Probe OFF if the temperature probe is defective or you are not using the probe. The flowmeter will use the default temperature you just entered.

- OR -

Scroll back around and press the UP or DOWN button to select Temp Probe is 'ON'
The flowmeter will use the temperature probe. If the probe fails or is defective, the flowmeter will automatically use the default temperature entered and display a warning. If the warning is displayed and you can not immediately correct the problem, return to this section and select TEMP PROBE is OFF until the problem is corrected, at which time you would return and select TEMP PROBE is ON

Note: If the temperature display shows:

- 1] 67 F, means the temperature at the sensor is 67 deg. fahrenheit and probe is ON.
- 2] xx Fm, the 'm' means the user has turned the temperature probe OFF and entered a MANUAL temperature of xx °F.
- 3] xx Fd, the 'd' means there has been a temperature error detected. A warning will have been displayed. After pressing any button, Fd will show in the temperature reading until the problem is fixed or the user turns the temp probe OFF and enters a manual temperature as in note number 2.

Data Logging (N/A on 360DX)

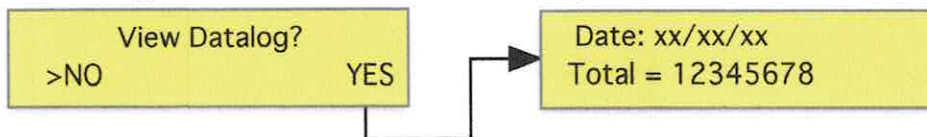
The PDS-360 Flowmeter continuously logs data as flow measurements are being made. Once filled, old data will be written over by new data (auto wrap around). The flowmeter has three (3) independent data log types. They are 1] a 24 hour flow summary; 2] average flow samples and 3] an event list. All data log may be downloaded to a PC/Lap Top for viewing using the RS-232 output (see using the RS-232 output). The 24 hour summary may be directly printed to a serial printer connected to the RS-232 output either on demand or set for AUTO print. The flow totals, Avg, Min and Max GPM for the past 6 months may be viewed at the flowmeter.

24 Hour Summary

The 24 HOUR SUMMARY data log keeps track of each days flow totals, the MIN, MAX and Average GPM flow rates and time they occurred for the past 6 months. The START time for the 24 hour summary may be set by the operator under the Set Communications ... Begin 24 Hr. Summary section in the programming. The default setting is 12:00 midnight. The START time begins a new summary page with date and times. To view the 24 Hour Summary it is best to download the data to a PC/Lap Top computer using the RS-232 output. You will be able to select up to 6 months of data, pre-formatted for quick viewing and print out. (see using the RS-232 output for download instructions).

Viewing Daily Totals, Min, Max, Avg (24 hour Summary)

The daily totals with Min, Max and Avg GPM flow rates are found in the 24 Hour Summary described above or viewed at the flowmeter by pressing the SHIFT (DataLog) button while in the Run Mode. You will be asked View Data Log?... Press YES. The Date and Total gallons for that date will be displayed. (Note: the Flowmeter will always begin with today's date. Today's date will show total gallons so far for the day.) Press the UP or DOWN button to select the next or previous date; the SHIFT button to see AVG GPM; SHIFT again to see MIN GPM and then again for MAX GPM. Press the SELECT button while viewing the TOTAL to EXIT the Data Log section. There are over 200 days of Data.



- 1] Press SELECT to EXIT
- 2] Press SHIFT for AVG, MIN, MAX
- 3] Press and hold the UP or DOWN button for 3 seconds to jump ahead or back 1 week

Print Daily Readings (using Serial Printer)

If NO is selected in VIEW TOTALS?, you will then be asked Print Daily Readings? If NO, you will return to the Run Mode. If YES, you can select ...

Print NOW. You will enter number of days to print (up to 200). Press Select to begin printing to your serial printer. (Note: the flowmeter sends one data line to the printer and waits approximately 2 seconds for the printer to print before sending the next line. Printing a large number of days may take some time. Approximately 15 seconds per days data).

Print AUTO. The flowmeter will display the time the 24 Hour Summary will print each day. (Note: this time is set under Set Communications.... Make sure your printer is turned ON). When the 24 hour period ends, data will be sent to the printer and a new 24 hour summary will begin.

Average Flow Samples

The flowmeter may be set to log average flow rates, set under Set Communications. You can program the Data Log Sample Rate to sample flow every 1 to 99 minutes in 1 minute increments. If the setting is programmed for 00 minutes, the data log sampling is disabled. Note: this does not affect the 24 hour summary.

When a sample rate is set, the flowmeter will average the flow rate from the previous log time to the next log time then save and time stamp it.

Example: the flowmeter is set to log data every 30 minutes. The last logged average flow rate was at 10:05 AM. The flowmeter will keep a running flow rate average from 10:05 AM to the next sample time at 10:35 AM at which time it will log the average flow rate and begin the next sample period. The flowmeter does not log instantaneous flow rates which can be misleading.

This data can be downloaded to a PC/Lap Top using the RS-232. The data will show DATE, TIME and FLOW RATE. You can also select the data to show a bar graph next to itself to see a visual trend.

Event List

The Event List logs the date, time and event type when it happens. Events types are ...

- | | |
|-------------------------|--------------------------|
| 1] System Restart | 8] Sampler Pulsed |
| 2] Entered Programming | 9] Reset Totalizer |
| 3] Echo Signal Lost | 10] Reset Data Log |
| 4] Echo Signal Returned | 11] Reset Event List |
| 5] Temperature Error | 12] Master Reset/Startup |
| 6] Relay #x ON | |
| 7] Relay #x OFF | |

The Events may be viewed by downloading to a PC/Lap Top using the RS-232 output.

Resetting The Data Log

The Data Log may be RESET (clear all data) by selecting YES when asked Reset The Data Log? under Misc Settings. Note: this does not RESET the Event List. This can only be Reset by doing a MASTER RESET to the meter.

Resetting The Flowmeter

If the SELECT button is held when power is applied to the flowmeter, then released, the user will have access to the flowmeters reset functions. The flowmeter will display manufacture, model, type meter and software revision number (Rv).

If the SELECT was held, the user may reset the flowmeter to FACTORY DEFAULTS by selecting YES to. The operator will need to proceed to reprogramming the flowmeter.

Note: This reset will set the pass code to '0000'.

The user will now be prompted to RESET the Totalizer and Clock / Date. Press YES to RESET. The operator will need to reset the Clock and Date if the unit is not a DX unit.

The Resets can help recover from a processor crash or lockup due to lightning etc. The resets do not affect the data log. The user may proceed to resetting the totalizer and /or data log in the PROGRAMMING section and setting the time/date if needed.

If The Flowmeter Should Lockup or Crash

It is possible that the flow of the program may be interrupted by some external event such as lightning, testing back-up generators or some other anomaly on the AC or Sensor input that may cause the flowmeter to crash or lockup. Turning power OFF and waiting approximately 10 seconds before turning the meter back ON may correct/unlock the meter. If not, it may be necessary to perform a RESET using the SELECT button mentioned above, RESETTING THE FLOWMETER. You should only need to do a FACTORY DEFAULT reset and then reprogram the flowmeter. You should not need to reset the totalizer or data log.

In extreme cases, it may be necessary to do a HARD Reset by first turning power OFF to the flowmeter and then removing the 3 volt clock/memory coin battery from its holder for about 1 minute. This will cause a loss of all data, including totals and data logging.

Reinstall the coin battery (note polarity) and do a power up reset using the SHIFT button as mentioned above. Proceed to reprogramming the meter. Set the clock and date and RESET the totalizer and data log when asked.

Using The PDS-360 FLOWCHART

OPERATING INSTRUCTIONS

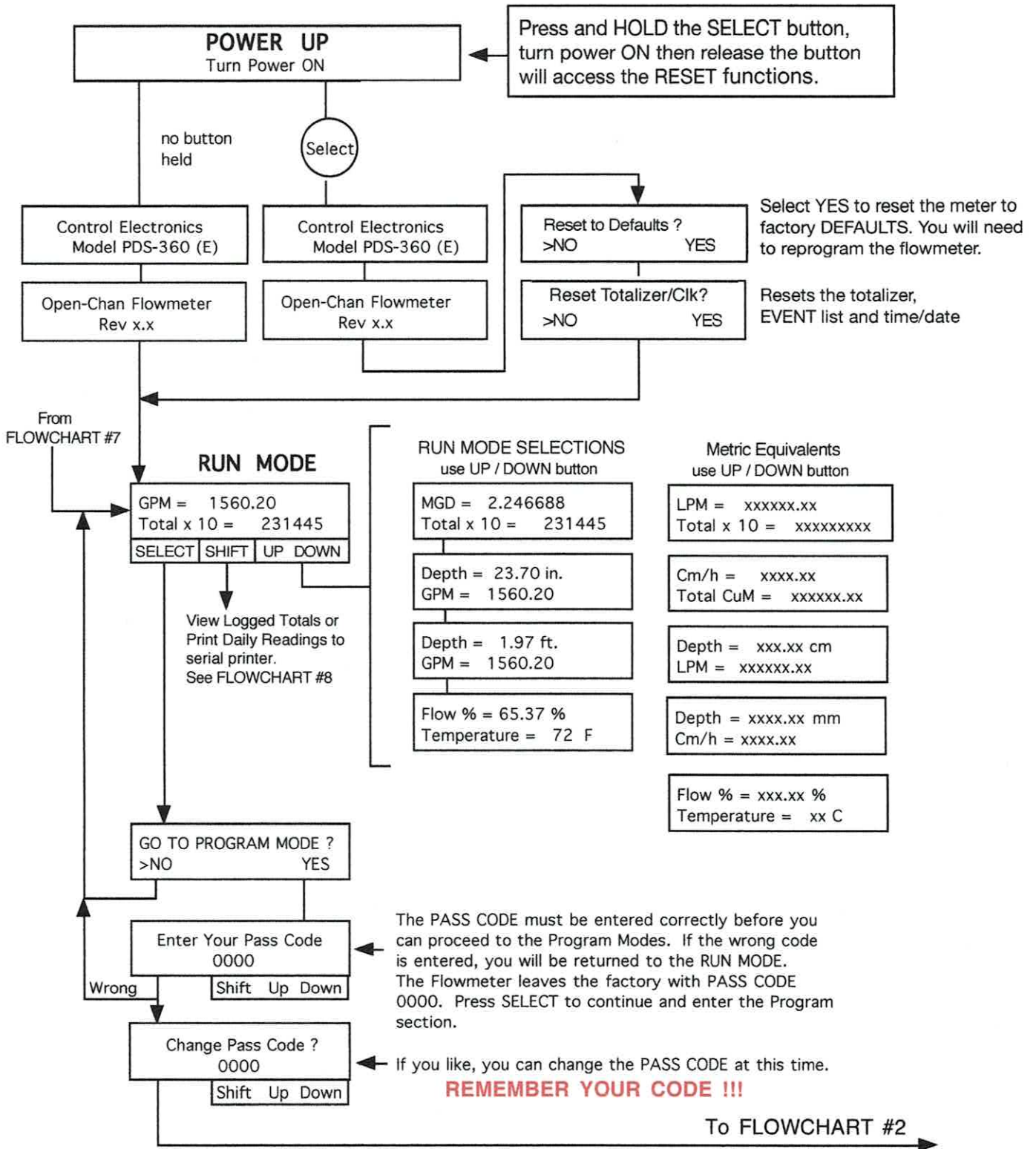
When power is first applied, the PDS-360 flowmeter will run through its POWER-UP windows. It should display 2 windows indicating name of manufacturer, model number, type of meter and the software revision number. The process takes a few seconds and will then enter the RUN MODE. The flowmeter will display the window that was ON (selected) prior to turning power 'OFF'. To select or scroll through the RUN MODES, use the UP/DOWN buttons. Each press of the button takes you to the next window. Selecting any of the RUN MODES will not affect the 4-20 mA. output or any of the programmed settings. The flowmeter begins monitoring flow automatically.

To enter the PROGRAM MODE, press the SELECT button. You will be asked GO TO PROGRAM MODE?. Press YES. You will be asked for the PASS CODE before you can enter into the PROGRAM MODES. The pass code is 0000 when it leaves the factory and will remain this until you change it. Press SELECT. If you like to change the code at this time, use the SHIFT, UP and DOWN buttons to enter your new pass code then press SELECT. This stores your new code. You now have access to the program section. If the incorrect pass code is entered, you will be returned to the RUN MODE.

REMEMBER YOUR PASS CODE!!!

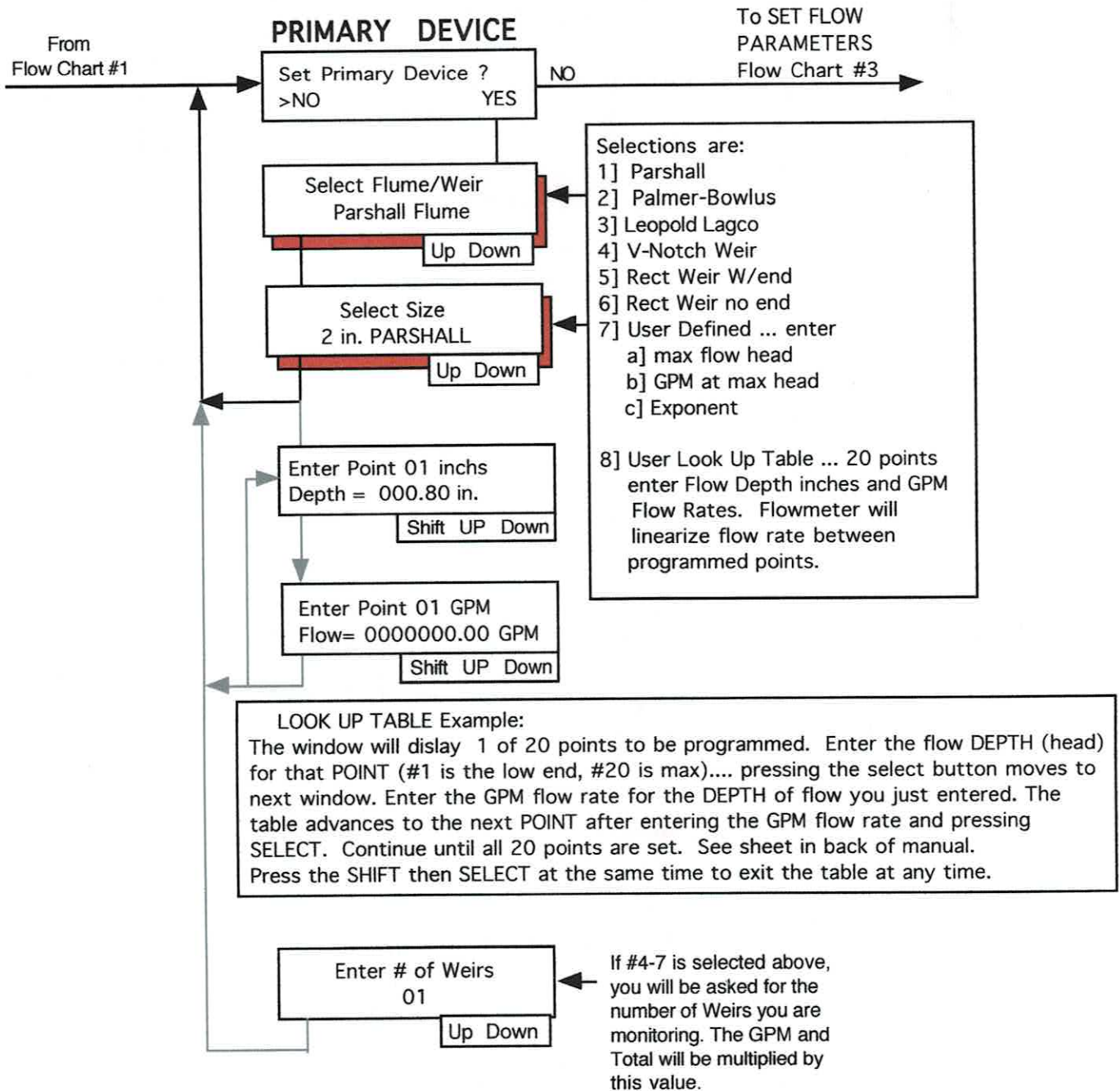
Once you entered the PROGRAM MODE you can scroll through it by pressing the SELECT button. The SELECT button performs three functions: 1] NO, 2] ENTER and 3] NEXT WINDOW. Use the SHIFT, UP and DOWN buttons to change the values in each window as needed. The DOWN button is used to select YES when data values are not displayed. The Programming Flowchart will guide you through the many features and functions available to you. A brief explanation for each window is provided in the flowchart.

PDS-360 PROGRAM FLOWCHART #1



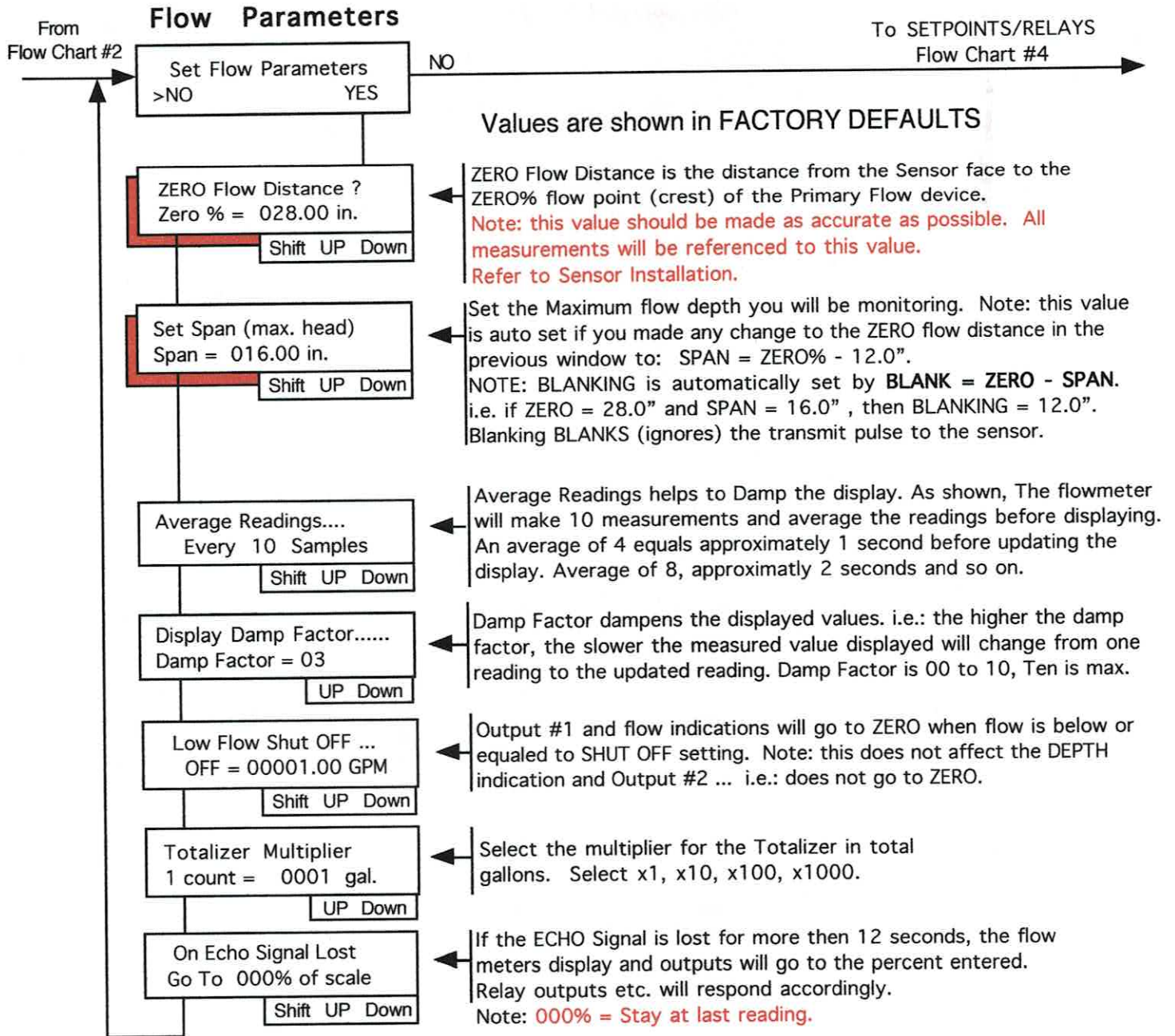
PDS-360 PROGRAM FLOWCHART #2

Note: Shadowed Windows must be set by the user. All others are optional.



Select the Primary Device you are monitoring or use the USER DEFINED or USER LOOK UP TABLE to enter your own flow curve. USER DEFINED uses the ratiometric method to calculate flow. You will most likely need the flow chart for the flow device your using to look up the required information to enter in the programming. USER LOOK UP TABLE is a 20 point look up table with DEPTH vs. GPM flow parameters programmed. All others use the accepted equation for the selected Flume/Weir and do not require you to enter specific information from a flow chart.

PDS-360 PROGRAM FLOWCHART #3

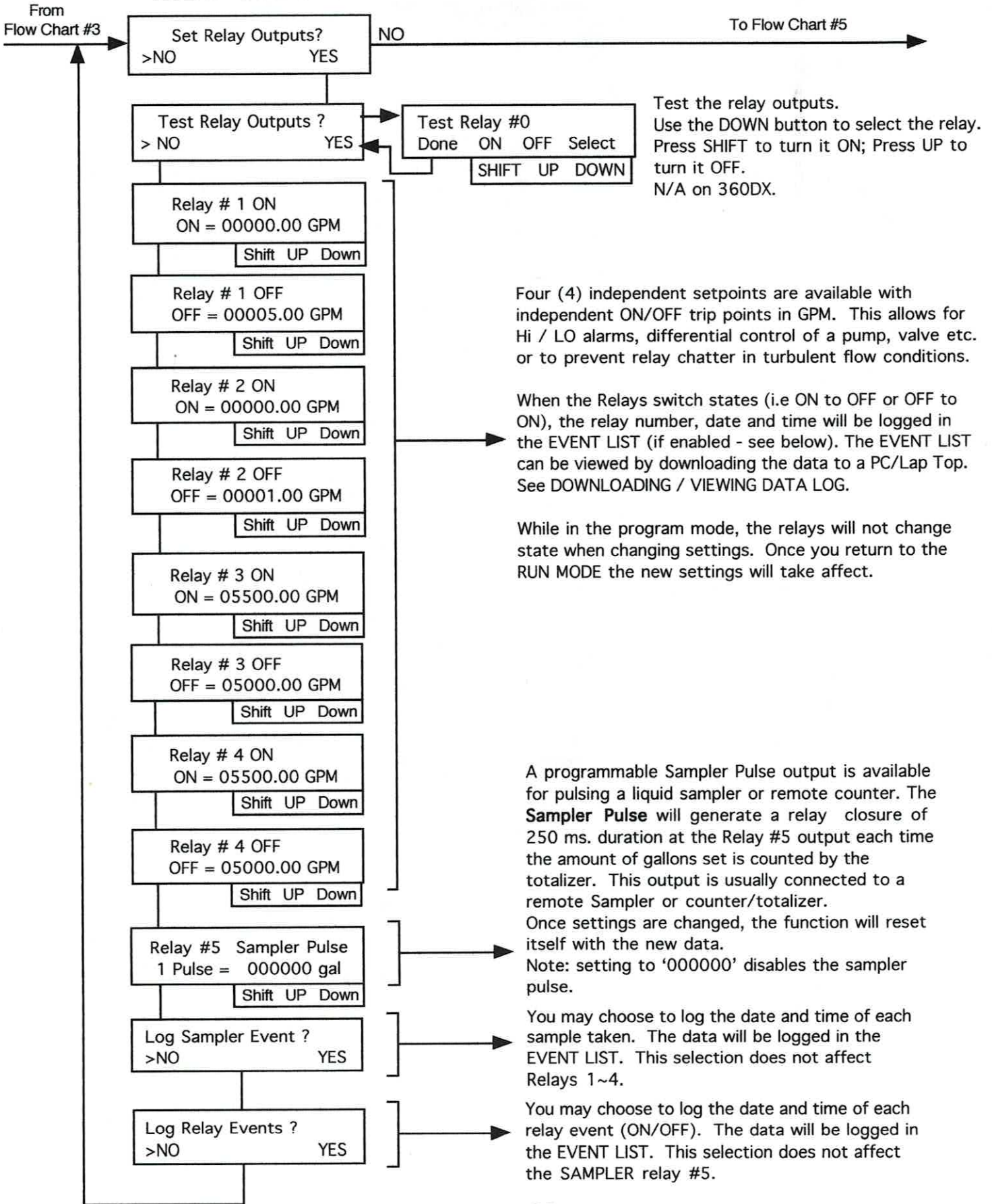


Note:

RED shadowed Windows indicate that these parameters MUST be set by the operator to calibrate the flowmeter to the application. All other settings are optional to the user.

PDS-360 PROGRAM FLOWCHART #4

RELAY OUTPUTS - N/A on 360DX



Test the relay outputs. Use the DOWN button to select the relay. Press SHIFT to turn it ON; Press UP to turn it OFF. N/A on 360DX.

Four (4) independent setpoints are available with independent ON/OFF trip points in GPM. This allows for Hi / LO alarms, differential control of a pump, valve etc. or to prevent relay chatter in turbulent flow conditions.

When the Relays switch states (i.e ON to OFF or OFF to ON), the relay number, date and time will be logged in the EVENT LIST (if enabled - see below). The EVENT LIST can be viewed by downloading the data to a PC/Lap Top. See DOWNLOADING / VIEWING DATA LOG.

While in the program mode, the relays will not change state when changing settings. Once you return to the RUN MODE the new settings will take affect.

A programmable Sampler Pulse output is available for pulsing a liquid sampler or remote counter. The **Sampler Pulse** will generate a relay closure of 250 ms. duration at the Relay #5 output each time the amount of gallons set is counted by the totalizer. This output is usually connected to a remote Sampler or counter/totalizer.

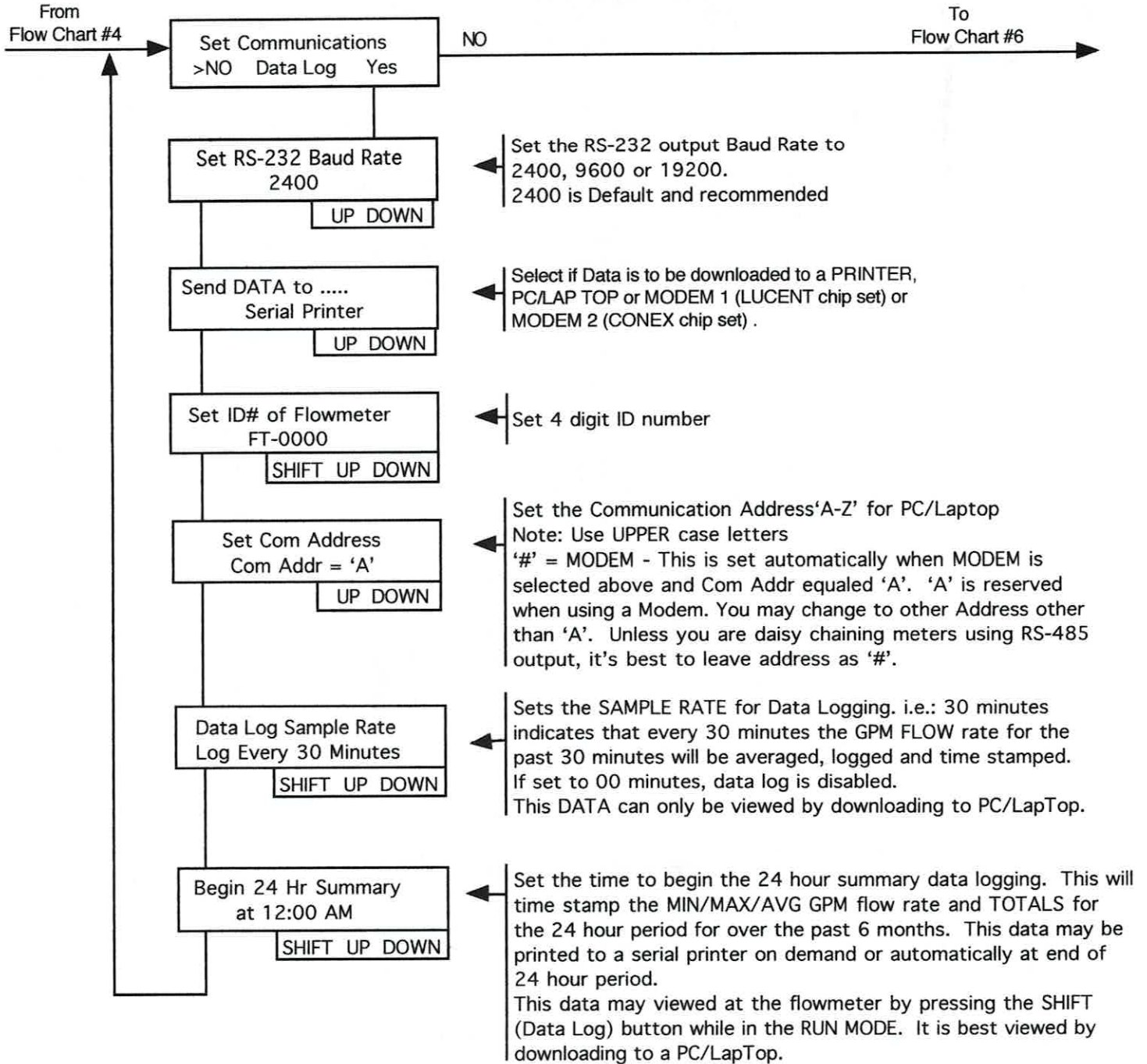
Once settings are changed, the function will reset itself with the new data. Note: setting to '000000' disables the sampler pulse.

You may choose to log the date and time of each sample taken. The data will be logged in the EVENT LIST. This selection does not affect Relays 1~4.

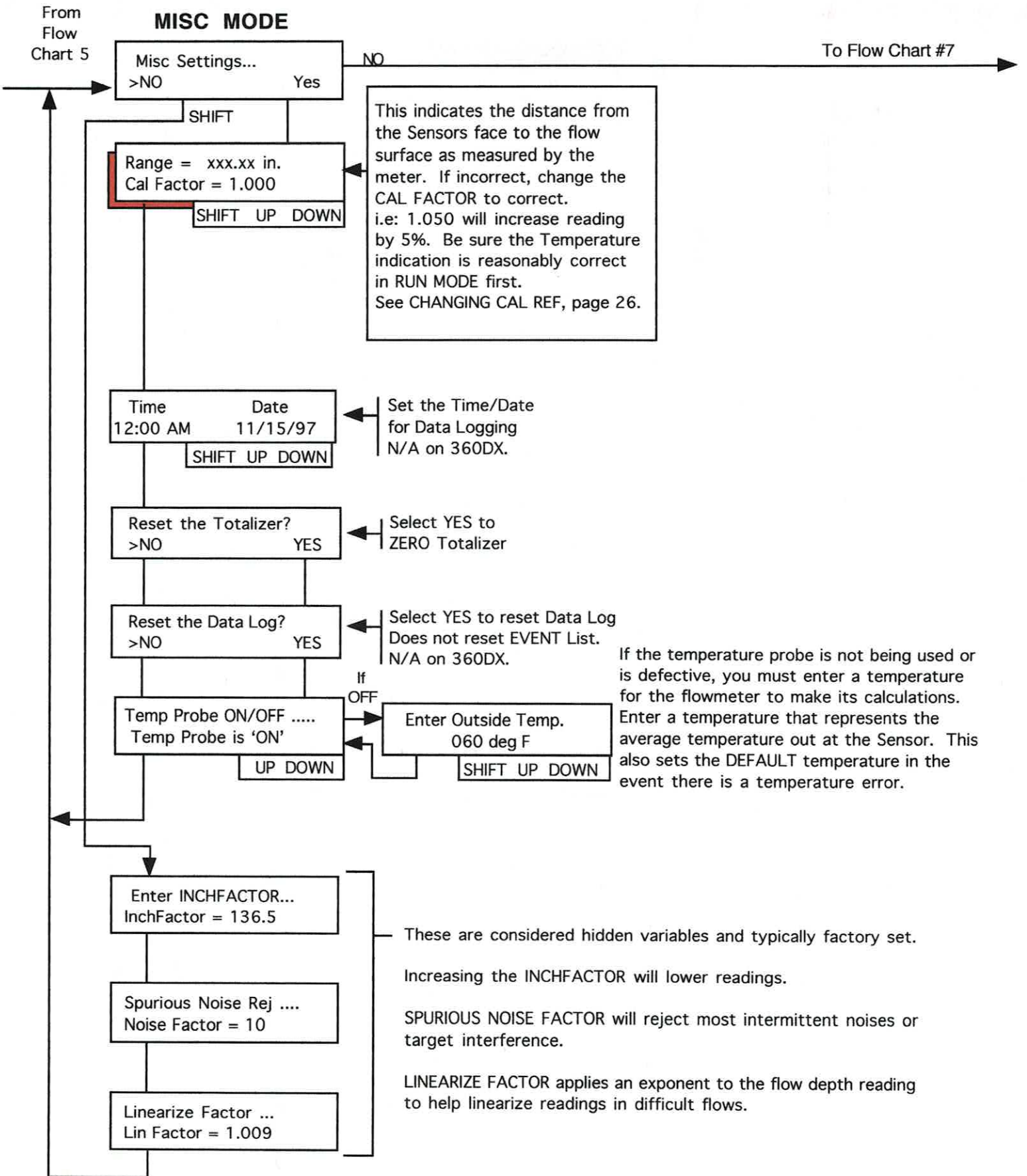
You may choose to log the date and time of each relay event (ON/OFF). The data will be logged in the EVENT LIST. This selection does not affect the SAMPLER relay #5.

PDS-360 PROGRAM FLOWCHART #5

COMMUNICATIONS / DATA LOG - N/A on 360DX

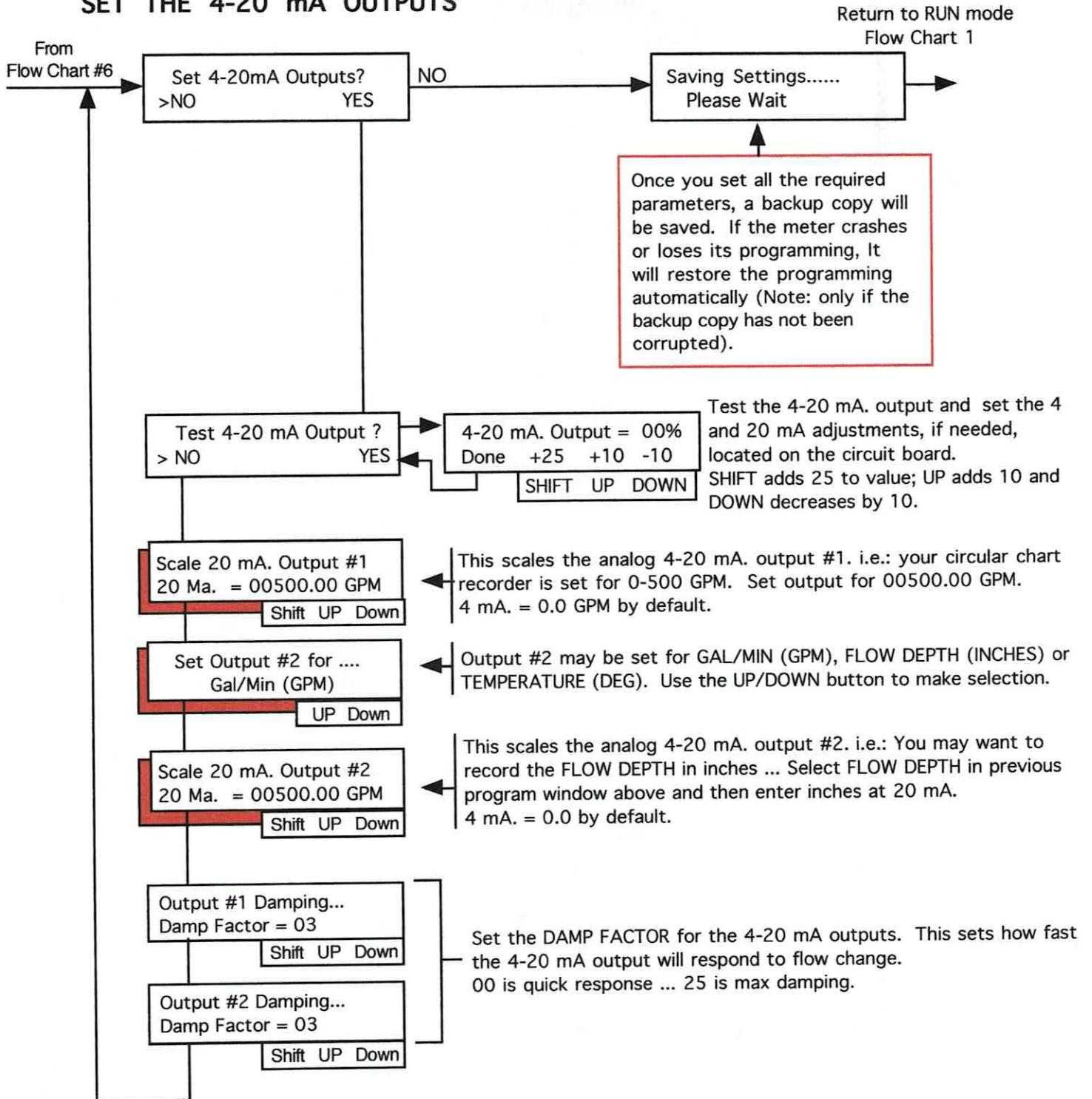


PDS-360 PROGRAM FLOWCHART #6



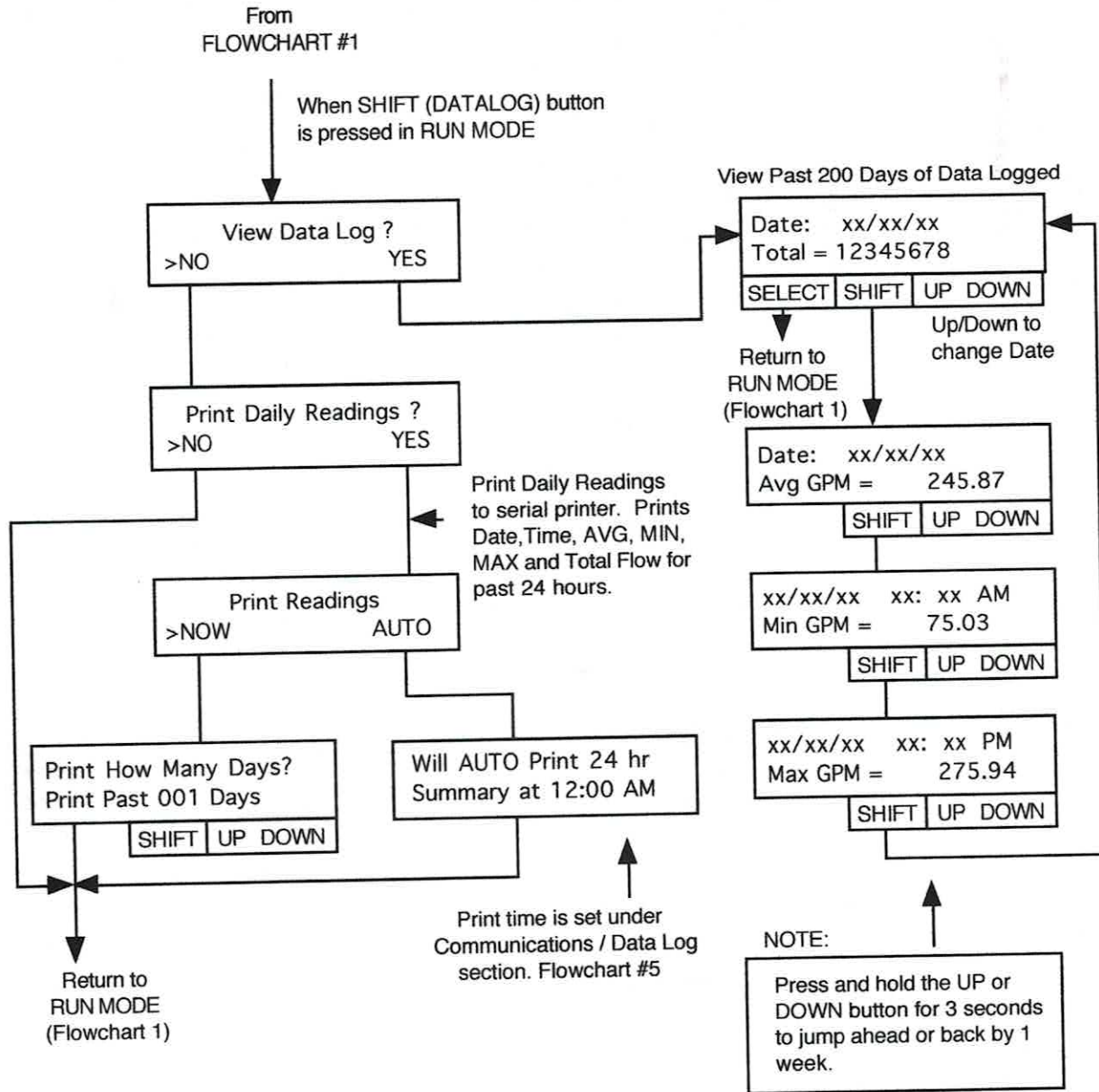
PDS-360 PROGRAM FLOWCHART #7

SET THE 4-20 mA OUTPUTS



PDS-360 PROGRAM FLOWCHART #8

N/A on 360DX



Display Warnings - 360 and 360DX systems

Echo Signal Lost!
Check Sensor & Wires

Temperature Error!
Check Probe & Wires

Check Sensor Wiring!
Echo & Temp ERROR...

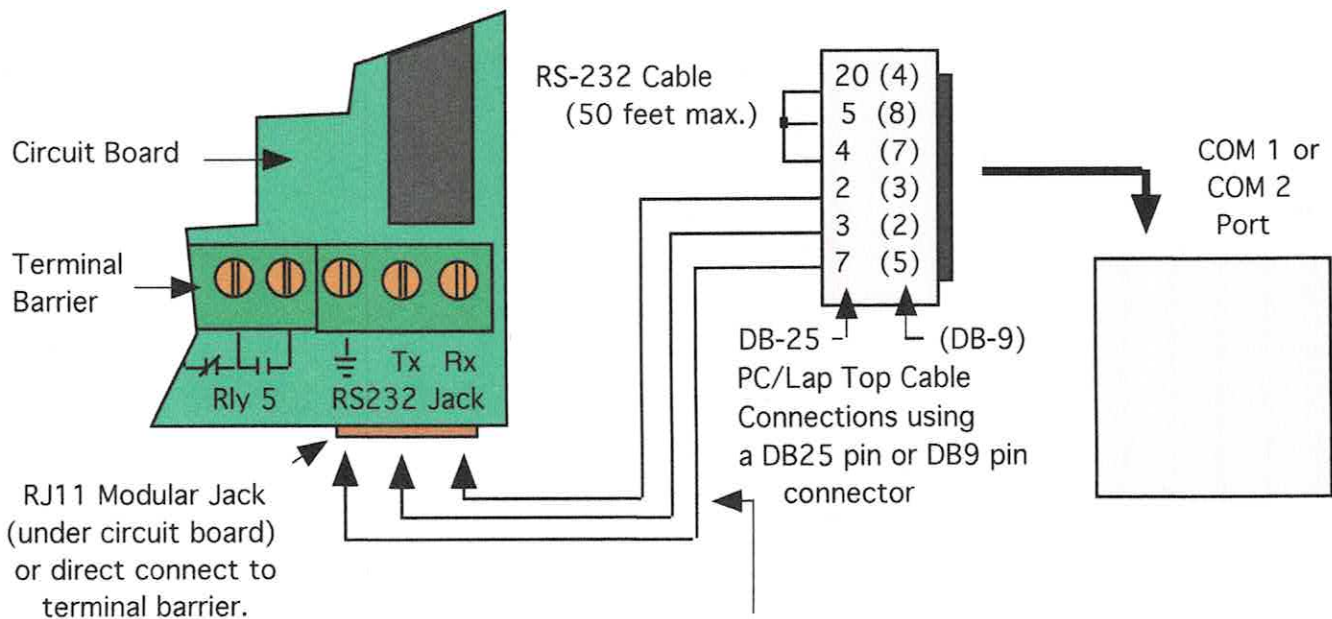
If the PDS-360 or 360DX system loses the ECHO return signal or senses a temperature error (greater than 140° F) or both, 1 of the 3 warnings will be displayed. If this occurs, check the sensor mounting, installation and wire connections / splices for damage or sensor misalignment.

Other causes of error could be defective sensor and/or temp probe, malfunction of ultrasonic card or other. Call Factory for assistance.

Press any button to remove warning.

Using the RS232 Communication Output Port (N/A360DX)

The Operator may choose to communicate with the flowmeter using their PC/Lap Top computer or Modem to download the logged data for further viewing and analysis or view the present status of the flowmeter. This may be accomplished by using any standard communication software package such as HYPER-TERMINAL (if needed, go to Hyper Terminal web site for software download). All data downloaded is in ASCII format. Each line of data is terminated by a CR (carriage return) and line feed. Downloading of flow data may be initiated from the flowmeter using the PRINT function (Press SHIFT when in RUN MODE) or by the PC/ Lap top computer. Connect your communication cable to the RS-232 terminal barrier or RJ11 modular jack (located at bottom right corner of circuit board) and your PC communication port (COM 1 or COM 2) as indicated. Note: make connections BEFORE turning on PC/Lap Top to prevent port damage.



Make the connections shown to a 25 pin or 9 pin cable connector/socket as shown. An RJ11 modular cable with 9 pin adapter to COM 1 or COM 2 port on PC/Lap Top may also be used. Maximum cable length not to exceed 50 feet.

In order to successfully download data, you must first match the communication settings in both the flowmeter and the PC. The flowmeter sends data in one of three baud rates - 2400 (default), 9600 baud or 19200. The baud rate is set in the flowmeter by the user under the Set Communications program section. You may set the flowmeter ID# at this time, the Com Address (default = 'A', recommend leaving as 'A') and whether data will be sent to a SERIAL PRINTER, PC/Lap Top or MODEM.

Saving To File

If you like to save the data to a file, you must first set your communication software in the PC to 'begin capture' (under HYPER TERMINAL 'TRANSFER' menu. See your owners manual for assistance). It is not necessary to 'capture' the data if you only want to view it on the PC/Lap top. You may set the 'begin capture' after the initial 'MENU' from the flowmeter has been downloaded and before making a MENU selection. When Download is completed, select 'Stop capture' under the 'TRANSFER' menu.

Communication Settings Using A Modem

You will first need to open HYPER TERMINAL (or other communication software you are using) by selecting: START/PROGRAMS/ACCESSORIES/COMMUNICATIONS/HYPER TERMINAL.

Open HYPER TERMINAL and select if necessary under FILE and PROPERTIES... 'CONNECT USING' and your PC MODEM. Enter phone number etc. for the flowmeter location. (see drawing 100-05 for cable connections).

Communication Settings Using A Direct Connection to COM Port

Same as above (Using A Modem) except under 'CONNECT USING', select 'Direct COM 1 or COM 2', whichever you are connected to with your RS-232 cable. You should set the PC parameters to match the flowmeters baud rate, no parity, 8 bit, 1 stop bit, XON/XOFF disabled (i.e. 2400,N,8,1)

Note: It is necessary to disable all communication 'Flow Control' . Do Not use XON/XOFF or other hardware handshaking.

Using A Serial Printer

Select SERIAL PRINTER under Set Communications Send DATA to....

This mode is used to send data to a serial printer and is fairly slow, because a 2 second delay is performed by the flowmeter for each line sent to allow the printer time to print the line. Be sure to set the serial printers baud rate to match the flowmeters. See drawing 100-06. Printing of data is initiated from the flowmeter by pressing the SHIFT (Data Log) button while in the Run Mode.

To Initiate Download from a PC/Laptop or Modem:

Connect the communication cable to the RS-232 connector on the Flowmeter to your PC/Lap Top COM port if not using a MODEM. Open your PC communication software (i.e. HYPER TERMINAL), then:

- 1] If Direct Connection...
type SHIFT-'A' (= com addr as set by user - 'A' is default) to get the flowmeters attention.
If using a MODEM...
dial up the flowmeter first. Once connection is made, type SHIFT-'#' or Com Address programmed other than 'A'. 'A' is reserved when using a MODEM.
- 2] Flowmeter should respond with a greeting, model number and a short menu.

```
Hello!  
Control Electronics PDS-360 Flowmeter  
Enter Download Selection Type....  
1] 24 Hour Daily Flow Summary  
2] Data Entries  
3] Present Status  
4] Data Entries with Plot  
5] Event List  
6] Reset Data Log  
7] Terminate Communication  
8] Show Menu  
Hit SPACE Bar to interrupt Download.  
Your Choice .....>
```

Once communication is established, you may select type of download by typing the number of the selection.

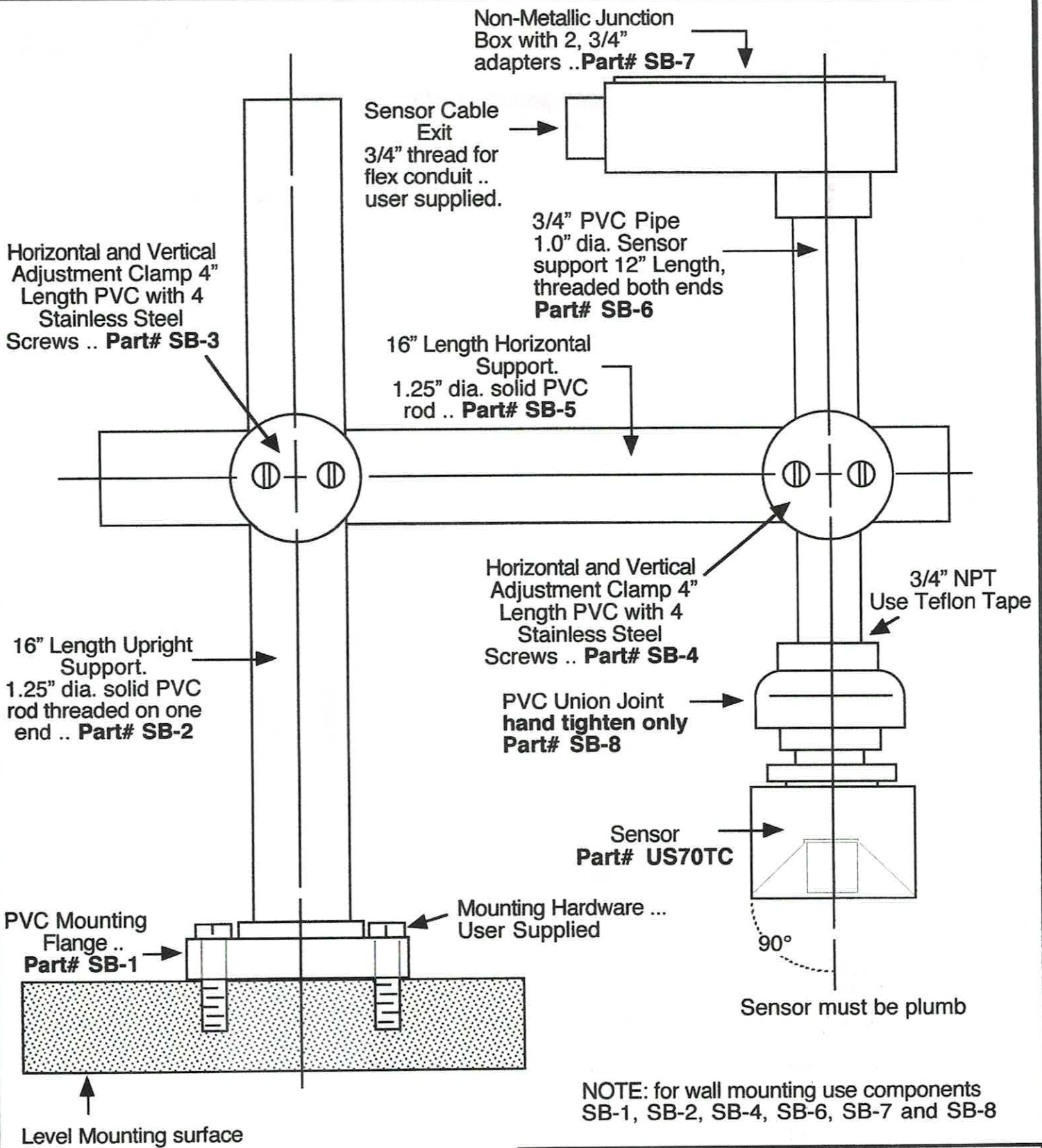
- Selection 1: will download the past 30 to 200 days 24 hour flow summary with DATE, MIN/MAX GPM with TIME, AVG GPM and TOTALS.
- Selection 2: will download data entries as logged, time stamped. This download could take a few minutes depending on baud rate and data size.
- Selection 3: this will display the present flowmeter status. The GPM flow rate, Flow Depth, Temperature and Total will be displayed.
- Selection 4: same as number 2, but with plot.
- Selection 5: will download the event list.
- Selection 6: resets the Data Log and terminates communication with flowmeter.
- Selection 7: terminates communication with flowmeter only. Modem is terminated under HYPER TERMINALS 'CALL' menu.
- Selection 8: Show MENU again.

NOTE:

- 1] while the flowmeter is downloading data, the flowmeter may stop flow measurements until download is completed.
- 2] Hit 'SPACE' bar at any time to interrupt the download.
- 3] All downloads begin with the most recent data.
- 4] All downloads begin with a header indicating model#, ID# and date.
- 5] Pressing any key on the flowmeter will terminate communication.

NOTE: USB ports

If your computer or lap top does not have an RS232 COM port, you will need to purchase an RS232 to USB converter. This is available through most office supply stores.



PVC Sensor Mounting Kit
Part# SBK-2
Sensor ... order separately

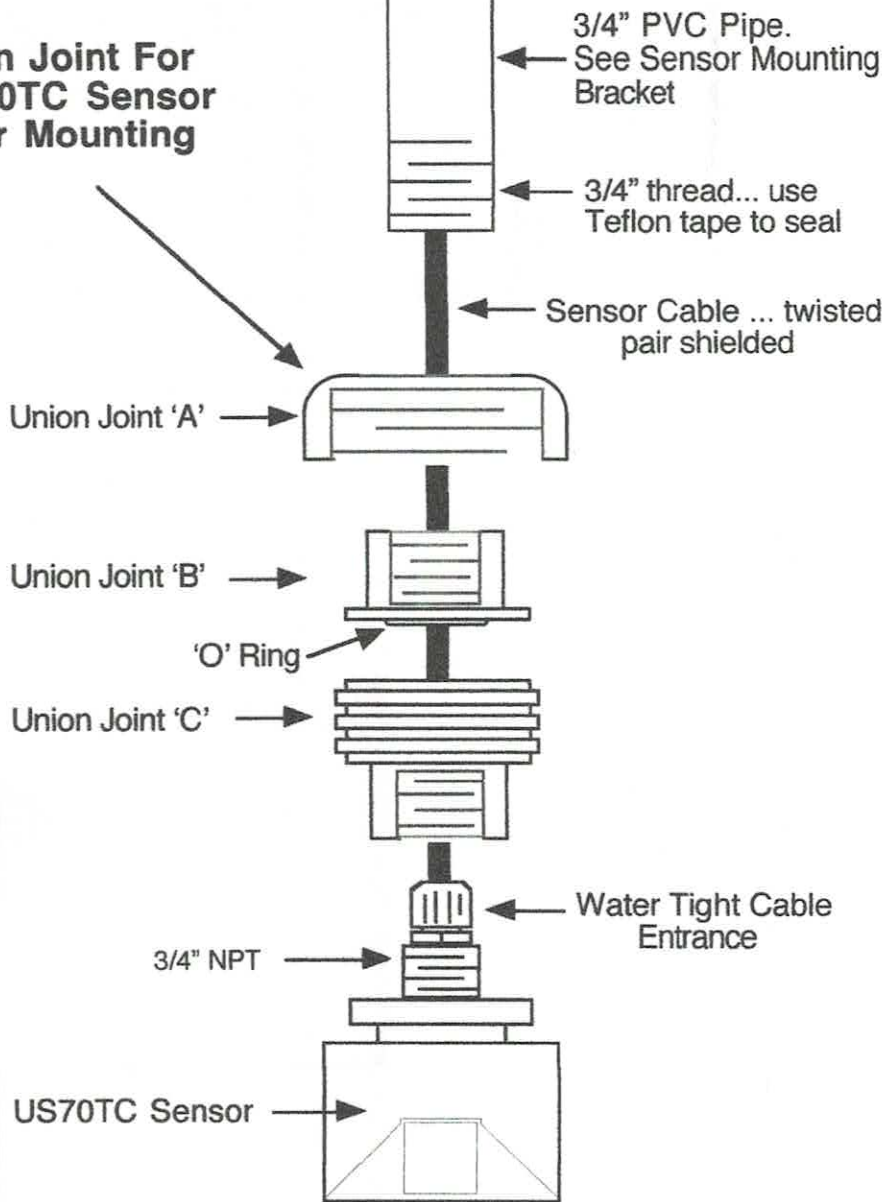
Control Electronics, Inc.		
PVC Sensor Mounting Bracket		
Date: 10/12/06	Rv 2	Drawing 100-04

3/4" PVC Union Joint For Mounting US70TC Sensor to PVC Sensor Mounting Bracket.

- 1] Slide part 'A' onto 3/4" PVC Sensor Mounting Pipe and screw mount Part 'B' to pipe. Use Teflon tape on threads. Note: make sure 'O' Ring does not fall off..
- 2] Screw mount part 'C' to US70TC Sensor. **Handtighten ONLY.**
- 3] Slide Sensor cable through Union Joint and 3/4" PVC mounting pipe and tighten part 'A' to part 'C'.

See Sensor Mounting Bracket for further detail.

Union Joint is recommended for easy connection to and removing from PVC sensor bracket. Use of the Union Joint will prevent the sensor cable from being twisted in the 3/4" PVC pipe and provide decoupling of sensor vibration from mounting bracket.



Control Electronics, Inc.

Union Joint To Sensor Detail

Date: 9/01/06

Drawing 100-08

PDS-360 Troubleshooting Guide

Symptom	Cause	Check or Try
<p>#1 No display</p> <p>No Display backlighting</p>	<p>No Power</p> <p>Defective Display</p>	<p>Check power circuit breaker and wiring</p> <p>ON/OFF switch on main circuit board</p> <p>Ribbon cable not secure</p> <p>0.5 amp fuse on main circuit board</p>
<p>#2 Keypad Does Not Respond</p>	<p>Ribbon Cable</p> <p>Lightning or Power surge</p>	<p>Check ribbon cable</p> <p>Turn unit OFF, wait 10 sec. turn back ON</p> <p>RESET and Reprogram meter</p>
<p>#3 4-20 mA. Output Not Functioning</p> <p>4-20 mA. Output Indicates Max All The Time (see #9 below)</p> <p>Output Not Same As Display</p>	<p>Defective Wiring</p> <p>Defective Output and/or Lightning Damage</p> <p>Not Scaled Correctly</p>	<p>Check wiring and polarity Disconnect output wires and check 4-20 with current meter. If OK, receiver or wiring is problem.</p> <p>Replace Q1 and/or Q2 (2N3904 transistor) and U1(LM324 IC) on main circuit board.</p> <p>Go to programming, 'SCALE 20mA OUTPUT' and 'TEST ANALOG OUTPUT'</p>
<p>#4 Display Does Not Change or Update</p>	<p>Processor Crash</p> <p>Lightning or Power Surge</p>	<p>Turn unit OFF, wait 10 sec. turn back ON</p> <p>RESET/Reprogram meter</p>
<p>#5 Pass Code Lockout</p>	<p>Wrong Code</p> <p>Code Corrupted</p>	<p>Call Factory for alternate code</p> <p>Provide product SN# on Printed Circuit Board. Call (610) 942-3190</p>
<p>#6 Display Says 'ECHO LOST, Check Wiring</p>	<p>Sensor NOT LEVEL</p> <p>Acoustic Signal Path Obstructed</p> <p>Defective wiring or wrong cable type</p> <p>Defective Sensor</p>	<p>Check sensor mounting for plumb</p> <p>Check for signal path obstructions</p> <p>Check wire splices for break or short - Do not solder or use wire connectors at splice - use wire nut and electrical tape</p> <p>Test sensor back at the meter to by-pass cable run ... replace sensor and/or PC-548 transmit/receive circuit card if needed.</p>

PDS-360 Troubleshooting Guide

Symptom	Cause	Check or Try
<p>#7 Display Says 'Temperature Error Check wires ...'</p>	<p>Defective wiring</p> <p>Defective Temp Probe</p>	<p>Check wire splices for break or short - Do not solder or use wire connectors at splice - use wire nut and electrical tape. Make sure all three (3) wires (Red, Black, Bare) are connected.</p> <p>Turn Probe OFF in Programing and Enter Manual (default) Temperature until corrected.</p> <p>Use DC volt meter to check RETURN signal from probe (+ to TC [black wire] and - to BARE wire [gnd] at terminal barrier). DC volt range is 1 to 4.4 volts. 0 or 5 volts indicates bad probe.</p>
<p>#8 Readings Fluctuate</p>	<p>Severe Turbulence, eddy currents, Intermittent Foam, Floating Debris</p> <p>Electrical Noise</p>	<p>Reduce source of turbulence, foam and/or debris. May need stilling well to correct.</p> <p>Check that sensor is plumb.</p> <p>Increase programmed DAMP FACTOR Best setting is DAMP FACTOR of 3 to 5.</p> <p>Do not run sensor wires with other wires or parallel with electrical wires ... Do not locate system in same area as VFD (variable speed drive).</p>
<p>#9 Readings Are Fixed</p> <p>Reads MAX All The Time</p> <p>Spikes to MAX readings randomly</p>	<p>Sensor Not Plumb or Obstruction in Accoustic Path</p> <p>Sensor is Mounted To Metal Support or Sensor screwed too tight to mounting bracket</p> <p>Ring Time Problem</p> <p>Very Cold Temperatures (may extend sensor ring time)</p>	<p>Check sensor for plumb and obstructions</p> <p>Remove ANY METAL (including pipe nipples) from sensor mounting. Use only PVC mounting components. Loosen Sensor slightly. Check for water collecting in conduit behind sensor head.</p> <p>Increase THRESHOLD (CW) on XMIT/REC circuit board, PC-548 Reduce PRE-GAIN (CCW) adjustment on circuit board or increase BLANK (CW) slightly.</p>
<p>#10 Depth / Flow Readings Not Correct</p>	<p>Program Data Incorrect</p> <p>Incorrect Temperature Reading</p>	<p>Check ALL program data and CAL FACTOR</p> <p>Check Temperature Reading on display . if reading is greater than $\pm 10^{\circ}\text{F}$, check probe - see symptom #7 above.</p>
<p>#11 Flow Readings Are ZERO when there is flow</p>	<p>LOW FLOW SHUT OFF Set Too High</p>	<p>Check LOW FLOW SHUT OFF and other settings in program. Flow Readings will go to ZERO if Flow Rate is below LOW FLOW setting. Note: LOW FLOW does not affect DEPTH indication.</p>

1.0 SCOPE

Recommended 'Preventive Maintenance' to be performed every 6 months to maintain calibration and functionality of model PDS-360/360DX Ultrasonic Open-Channel Flowmeter.

2.0 TOOLS / EQUIPMENT NEEDED

1. Medium size screwdriver
2. Small jewelers type screwdriver
3. Tape measure
4. DC Multi meter
5. Clean damp cloth
6. Flowmeters Instruction manual (available on web site)

3.0 PROCEDURE

1. Using a clean damp cloth, wipe any dirt, cob webs etc. from the face of the flowmeters sensor. Be careful not to disturb the sensor mounting.
2. If a wiring junction box for sensor cable splicing has been used, open the junction box and check the condition of the splices. Make corrections if needed.
3. Check that the sensor support is in good condition, all screws are tighten and the sensor is plumb. The Sensors face must be parallel to the liquid flow surface. Make corrections if needed. Refer to manual, Sensor Installation.
4. Using a tape measure, measure the distance from the face of the sensor to the zero flow level. Remember this number. Refer to manual, Sensor Installation.
5. Using a clean damp cloth, wipe any dirt etc. off the flowmeters enclosure.
6. Using a medium size screwdriver, open the lid to the enclosure by loosening the 2 corner screws.
7. Using a DC volt meter, connect the common to GRD lug on circuit board located next to the ribbon cable connector. Check for +12 VDC (± 0.3) using volt meters test probe at test point labeled +12V at center of circuit board. Check for +5 VDC (± 0.2) at test point +5 V. If voltage values are not within spec, contact Control Electronics.
8. Touch the test probes across the 3V memory backup coin battery. Check for 3.2 VDC. If less than 2.9VDC, replace battery.
9. Check conduit entrances to enclosure for tightness and that they are sealed to maintain NEMA 4X rating. Use electricians putty or caulking to seal.
10. Check the programming of the flowmeter to make sure previously entered values have not changed. Use the front panel keypad to check values. Refer to manuals '**Program Flowchart**' if needed. Confirm that the ZERO DISTANCE value in the programming is the same as measured in step 4 above. Make corrections as needed. Make sure to document any changes for future reference.
11. Enter the 'TEST 4-20 mA OUTPUT' function. Simulate 4 mA output by pressing the UP or DOWN button on the front panel until the output displayed equals 00%. Adjust the 4 mA potentiometers using a small screwdriver for 4 mA. on the 4-20 mA outputs. Use a DC multi meter to measure the output (4 mA on the 4-20 mA outputs. Use a DC multi meter to measure the output (4 mA on the 4-20 mA outputs. Use a DC multi meter to measure the output (4 mA on the 4-20 mA outputs. Use a DC multi meter to measure the output (4 mA on the 4-20 mA outputs. Use a DC multi meter etc.). Refer to manual.

12. Simulate 20 mA. output by pressing the UP or DOWN button until the output displayed equals 100%. Adjust the 20 mA. potentiometers using a small screwdriver for 20 mA. on the 4-20 mA. outputs.
13. Enter 'TEST RELAY OUTPUTS' function (note: not available on 360DX units). Press the DOWN button to select relay number 1. Press the SHIFT button to turn relay ON. The Red LED above relay should turn ON. Press the UP button to turn relay OFF. **Note: make sure when testing relay outputs you do not turn ON/OFF devices connected to the relay that would interfere with normal operation of your process.** Press the DOWN button to select the next relay for testing. Do this until all 5 relays are tested.
14. Check the 'CLOCK/DATE' for correct time and date. Make correction if needed. (note: not available on 360DX unit).
15. Press the SELECT button until you return to the RUN modes and display the 'FLOW% ... TEMPERATURE'. Check the TEMPERATURE indicated ($\pm 10^\circ$ F). Using a small screwdriver, make correction if needed by adjusting the small potentiometer on the xmit/rec circuit board below the 3 pin terminal barrier that the sensor connects to. (earlier units adjust the 'A/D Ref' located on main circuit board). Note: this adjustment is sensitive.
16. Make sure the flowmeter is receiving a good flow signal. The RED LED on the main circuit board labeled 'NO SIGNAL' should be OFF. Note: this may flash ON intermittently in turbulent flows. If no signal, recheck the sensor mounting and wiring. Refer to manuals troubleshooting guide or call factory service.
17. Make a measurement of the distance from the sensors face to the top of the liquid flow. Enter the programming of the flowmeter and go to 'MISC SETTINGS' and select 'YES'. Check the RANGE value displayed. This should be equal to the measured distance (± 0.2 "). Make correction if needed by changing the CAL FACTOR value.
18. Close the lid of the enclosure and clear cover. Secure by tightening the screws.
19. Place a 'CHECKED BY' label with date and initials on the flowmeter.

This completes the Preventive Maintenance Procedure.

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