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**Power Requirements:**

- Temperature: 120/220 VAC, ±15%, 50/60 Hz
- Display: 2 line x 20 character, Alphanumeric, LCD with LED backlighting
- Totalizer: 8 digit cumulative with programmable multiplier; x1, x10, x100, x1000, 200 daily, 8 digit totalizers
- Outputs: Two (2) independent 4-20 mA isolated into 1000 ohm, RS-232 terminal and RJ11 modular jack, 5 relays - 4 control and 1 programmable (sampler) pulse, SPDT 5A/250 VAC contacts
- Span Range: 0-1.00” to 0-150.00” full scale
- Dead Band (blanking): 10” to 36” ... 12” typical
- Display Resolution: 0.01”, 0.01 gal/min
- Accuracy*: ±0.5% of range, calculated error less than ±0.04%
- Memory: Flash and non-volatile RAM
- Flow Equations:
  - Parshall, Palmer-Bowls, Leopold-Lagco,
  - Rectangular Weirs with or without end contractions,
  - V-Notch Weirs, User Defined, programmable 20 point lookup table
- Data Log:
  - 200 day 24 hour flow summary: min, max, avg GPM, total gallons - time stamped
  - Avg. GPM flow rate with programmable log rate of 00-99 minutes in 1 minute increments - time stamped

* Note: field conditions, such as turbulence, poor installation etc., may affect the apparent accuracy.

**Dimensions**

- Sensor: Solid PVC Housing submersible, 3/4” NPT, 3.0” Dia., 20 ft. standard
- Enclosure: Fiberglass with clear hinged Polycarbonate cover, NEMA 4X, IP65, Dust-Tight, Water-Tight, Corrosion Resistant, CSA, UL listed, 7.2”x11.8”x6.8”, 4.92”x12.3” with stainless steel mounting feet

**Options**

- Heater/Thermostat, PVC Sensor Bracket, Sensor Cable ....

Warranty: the PDS-360 system is 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 subject to change without notice. Made in USA.
**Repair Policy:** All repairs are performed on our premises. Repairs must be sent to Control Electronics by UPS prepaid. Customer must enclose a description of problem, who to contact, phone number, return ship-to address and purchase order number to cover repairs. Delay of repair may occur if information is not provided. No ARM number is required. Most repairs are processed within 48 hours unless major repair is required.

**Repair Cost:** A minimal charge will be applied regardless of repair needed plus return shipping charges. If repair exceeds quoted minimal charge, we will notify the customer before we proceed. Payment is COD or Credit Card only unless other arrangements are made.

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

**Return Policy:**

(Within 6 months) Control Electronics 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 (12 months from ship date).

(After 6 months) A 35% restocking charge will be applied if product is returned for credit after 6 months from ship date. (7 to 12th month from shipping date).

Control Electronics does not accept returns of options such as circular recorders and other products not manufactured by Control electronics, Inc.

Control Electronics will not accept returns of used Sensors, cables, or spare parts unless shown to be defective under warranty or not performing as specified.

Any credit issued will be at the discretion of Control Electronics, Inc. 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 Control Electronics will consider any credit. The name of who to contact along with phone number should also be included with the return.

**Ship To Address:** All repairs or returns must be shipped prepaid via UPS or equal to:
Control Electronics, Inc., 148 Brandamore Rd., Brandamore, PA 19316
PDS-360 Product Performance

Control Electronics PDS-360 Flowmeter will perform as specified when tested under known, simulated conditions. All PDS-360’s 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 tests 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 test 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 problems are:

1. Flume/Weir not sized properly
2. Strong vapours from liquid or severe air density changes
3. too much turbulence or foaming on the liquid surface
4. Flow moving too fast through the flume/Weir
5. Flow approach to flume/ weir incorrect
6. Sensor not installed properly etc.

Some equipment such as variable speed drives, nearby radio transmitters (i.e.: radio dispatch or hand held transmitters) etc. located next to the product or even at times in adjacent rooms may possibly interfere with the products performance. The worst of these is the variable speed drive controllers. This type of equipment generates large amounts of electrical and RF (radio frequency) noise that can interfere with the products ability to interpret the return ECHO signal. Some adjustment to the product, relocation of the product or different electrical grounding attempts may minimize or eliminate the interference. Ultimately, it is up to the user to make the corrections necessary and require that the source that is causing the interference be corrected.

If you have any questions in regards to product performance, please contact Control Electronics at (610) 942-3190 or fax us with application conditions and questions at (610) 942-3672. You may also E-mail us at: cei@controlelectronics.com.
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.

If warranty and/or product(s) is not acceptable to buyer, please contact Control Electronics, Inc. and/or return product(s) unused 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.

Control Electronics, Inc., P.O. Box 330, Brandamore, PA 19316 Tel: (610) 942-3190

VII.
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 - PDS-360 Only.

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: ___________________________
Control Electronics model PDS-360 Ultrasonic Open Channel flowmeter is a microprocessor controlled, non-contacting flowmetering system designed to accurately measure liquid flow through any standard primary flow device. 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 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 the flow surface is from the sensor 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 operator.

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. Approximately 24 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.

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 Flowchart in the back of this manual extremely helpful in navigating through the many options and features of the flowmeter.

With proper understanding of open-channel flowmetering and the successful installation of the flowmeter, the PDS-360 system will provide the user with many years of continuous, reliable operation.
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 purchased. 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 VAC power source. Though the PDS-360 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). This will minimize any potential problems.

The enclosure may be located up to 1500 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. Maintain at least 3 foot separation.) electronics for the Sensor cable to run through. **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 vicinity.

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 120VAC power source (conduit not required if supplied with optional AC power cord), output signal wires (4-20 mA., relay outputs etc.) and Sensor cable.

Use care to 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 and unplugging the ribbon cable. A GREENLEE punch is recommended for punching the holes.

Figure 1.

Enclosure Installation
In General....

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 should be made at bottom of enclosure.
3] Conduit/wire entrances should be watertight to maintain enclosure rating.
4] Do Not mount enclosure in direct sun light. This could overheat the unit on hot days. A sun shade should be considered.
2. Sensor Installation

The Sensor location over the Primary Flow Device (flume/Weir etc.) is very important so the PDS-360 can accurately measure the flow. The location of the measuring point over the flow device varies with the type of flow device used. Refer to flow device manufacturer instructions.

Three most widely used flow devices are:

1] **PARSHALL FLUME**: Mount the Sensor 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 the Sensor 1/2 the flumes diameter (D/2) upstream from the start of the throat section.
3) V-NOTCH/RECTANGULAR WEIRS: Mount the Sensor before the Weir plate a distance of at least 4x the maximum flow depth to be measured. DO NOT mount the Sensor over the Weir plate or the waters drawdown.

\[ H = \text{Maximum Head Rise} \]

### Sharp-Crested Rectangular and Y-Notch Weirs

**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 the water in the stilling well may freeze in winter causing erronious readings.

If there is any question about the orientation of the Sensor, contact the flume/weir manufacturer or our service department.
Correct Sensor mounting is important for satisfactory performance from the flowmeter. 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 surface in the flow device or the returning ECHO may be reflected away from the Sensor.

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.**

**IMPORTANT**

DO NOT use any metallic pipe or fittings to mount the Sensor. The Sensor must be mounted to PVC or other plastic type material for the sensor to work properly, no exceptions!!

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 20 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 4 conductor shielded with ground (Beldon# 8723 or equal) for the sensor connections.

**IMPORTANT**

*It is Mandatory that the cable be ran in a PVC conduit using PVC watertight fittings, junction box etc. for the first 3 to 5 feet from the Sensor. If the Sensor is mounted to metallic pipe, fittings or bracket .... the flowmeter will 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 over the prescribed measuring point in the flume or Weir (see page 4-5) 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, not just dangling over the flume. 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 overtighten** the Sensor to the bracket. This could cause extended Sensor ring-time that may interfere with ECHO signal.

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**Sensor Installation**

**In General.....**

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. Make sure Sensor support is plumb and secure.
3] 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)).
4] Run PVC or metal conduit from Sensor location as described above to flowmeter enclosure.
5] Pull Sensor cable through conduit being careful not to nick or puncture the cables outer insulation.
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 overtighten 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

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

**SENSOR CABLE**
When running the Sensor's interconnecting cable, be sure to keep it as short as possible (maximum 1500 feet) using only specified cable or supplied cable (optional). Avoid close proximity to AC power lines and other frequency carrying lines. Run the Sensor cable through its own committed conduit. No other cables should be allowed to run in the same conduit. The Sensor cable should 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 also be plugged with electricians putty to prevent moisture migrating from the Sensor to the enclosure and vice versa. This will help to prevent condensation forming in the conduit and enclosure.

Connect the Sensors cable to the five (5) pin terminal barrier strip on PC-548 Open-Channel flow card marked SENSOR and TEMP PROBE. The WHITE wire to WHITE, GREEN wire to GREEN etc. Refer to figure 3. Cable type: Beldon #8723 or equal - 2 twisted pair shielded with ground return.

120 VAC input

120 VAC power 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.

AC OUT

This provides a switched 120 VAC power to control an external recorder or optional 60 watt Heater/Thermostat that operate in conjunction with the flowmeter.

NOTE: The flowmeter has a .5 amp 5mm fuse. It may be necessary to increase the fuse rating to accommodate external devices. Max rating should not exceed 3 amps.

4-20mA 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 in figure 3. 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 (G) on terminal barrier or remote device. Make connection only at one end.

Note: the 4-20 mA output is fused. Fuse is rated for 0.062 mA. Do not exceed 250 mA.

RELAY #1, 2, 3 and 4 outputs (PDS-360 only)

Relay #1 thru #4 are independently programmable alarm setpoints used for alarming and control. They are 5 amp, 220 VAC contacts with associated LED status indicators on 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, PDS-360 only)

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. (milliseconds).

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.

UNREG DC, $\frac{1}{2}$ (ground), 12 VDC (Bat), 24VDC

These inputs/outputs provide DC power for optional accessories or allow for battery operation of the flowmeter. UNREG DC is both an input and an output. When AC power is applied to unit, an unregulated voltage of approximately 16–18 VDC will be found at this point between UNREG DC and GROUND ($\frac{1}{2}$) and 12 VDC between 12VDC and GROUND. 24 VDC is available between ‘+’ of the 4-20mA output and ground ($\frac{1}{2}$). This may be used to power customer options.

Max current draw should not exceed 150 mA.

Note: 4-20 mA fuse may need to be increased to a maximum of 250 mA.

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 between12VDC and Ground on the terminal barrier. The plus ‘+’ of battery to 12VDC and the negative ‘-’ to GROUND ($\frac{1}{2}$). 6 amp hour battery recommended.

BATTERY BACK-UP OPERATION

If battery back-up is desired to maintain operation of the flowmeter in the event of a power failure, you may connect a standard 12 volt gel cell battery of at least 1 amp hour or greater at the12VDC (Bat) connection (plus ‘+’) and ground ($\frac{1}{2}$) (negative ‘-’) on the terminal barrier. The flowmeter will maintain a charge to the battery when AC power is applied. 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.
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.

Ultrasonic Transmitter / Receiver Card

Refer to Figure 4

GAIN
The gain should always be set before programming begins. Normally the GAIN setting does not need to be touched. 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. Keep in mind that changes in the GAIN setting may effect the apparent calibration and you may have to offset the calibration under MISC Settings mode - RANGE = xxx.xx Cal Factor = 1.000 in the programming. Too much or too little GAIN may cause the unit to respond to unwanted noise or cause loss of signal.

IMPORTANT
Do Not mistaken Sensor mounting problems for electrical noise problems. Always check installation first before making any adjustments.

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: Sensor mounted to any metallic fittings, braces etc. may cause problems that may not be resolved by GAIN or THRESHOLD. See Sensor Installation and troubleshooting in back of manual.

PC-548 Ultrasonic Xmit / Receive Card

Adjustments shown in their NORMAL position

Figure 4.
XMIT / L2
XMIT is for setting the transmit frequency (40kHz.) and L2 (tuning coil) for setting the receivers frequency. The XMIT pot is typically set to approximately 1/3 to 1/2 of its turn from CCW position. Slight adjustments of these settings will affect the gain of the flowmeter and may help minimize noise problems.

BLANK
This setting BLANKS the transmit pulse and ringing in the sensor. Caution: too much blanking may cause close echo signals (12 to 16 inches from sensor) to be blanked and not processed.

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

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.

**Main Circuit Board**
Refer to Figure 3, page 8, for the following adjustments.

4 mA.
The 4 mA. adjustment is used to set the 4-20 mA. current output loop to 4 mA. This should be set before the 20 mA. adjustment. This will prevent any apparent interaction of the 4 and 20 mA. adjustments. You can Simulate 0% output using the TEST 4-20 mA OUTPUT feature under MISC Settings? mode in the programming to set the 4 mA. output. Outputs #1 and #2 may be adjusted at this time. Note: output 1 and 2 are independent and have no affect on each other when adjustments are made.

20 mA.
Adjust the 20 mA. control for 20 mA. output on the 4-20 mA. current output loop. Simulate 100% output using the TEST 4-20 mA OUTPUT feature found under MISC Settings? mode in the programming. Note: output 1 and 2 are independent and have no affect on each other when adjustments are made.

4-20 mA. DAMPING
Adjust clockwise to increase the 4-20 mA. Analog Output Dampening for steadier chart recordings. DAMP adjustments 1 and 2 are independent of each other.

A/D REF
This sets the reference voltage for the A/D converter input which measures the temperature voltage from the temperature probe in the sensor, i.e.: calibrates the temperature reading as displayed \( \text{TEMPERATURE} = XX \ F \).

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 if connected.

120/220 VAC
Install or remove appropriate jumper(s) to change operating voltage to 120 or 220 VAC. Note: this is factory set. Jumpers are located under left-bottom corner of power transformer.
LED's 1 thru 5 (PDS-360 only)
These LED lights will lite 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
If the ECHO signal return is lost or not processed for at least 12 continuous seconds, this LED will light and a warning will be displayed. 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. See troubleshooting guide in back of manual if this LED is ‘ON’ steadily.

CLK/MEM 3V Bat
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’ 3 volt lithium battery.

WARNING!
Install Battery Observing Correct Polarity.

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.
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# 8723 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.

Please note: The values displayed will most likely be incorrect, possibly showing a negative depth. This is normal. The flowmeter has not yet been set up to your application.

**INITIAL RUN MODE DISPLAY AND KEYPAD LAYOUT**

Depth = 7.56 in.  
GPM = 207.73
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. Some relays may energize (PDS-360 only), depending on the default settings.
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. Use the SELECT button to scroll through the program selections, selecting NO/YES where needed. To change any value, use the SHIFT button (moves cursor under digit you want to change), 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.

**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 finally a 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. \text{DEPTH} = -2.34" (means 2.34" below the programmed ZERO % point).

Indicates GPM, MGD, DEPTH of flow and % of flow as selected by the UP/DOWN button.

LOW-FLOW is activated

| GPM = 000.00 LF | TOTAL x100 = 325476 |

Indicates TOTAL flow to date in gallons.

The multiplier is set in the SET FLOW PARAMETERS mode.

Note: the totalizer is disabled (stops counting) when 'LF' (low flow) is displayed on the top line.

**TYPICAL RUN DISPLAY**
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 FLOW PARAMETERS mode in programming.

The outside temperature at the Sensor is also indicated. The temperature is in degree fahrenheit ±3°. 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 probe fails, the flowmeter will automatically use the default temperature you entered in Enter Outside Temp when you select ‘Temperature Probe is OFF’. Factory default temperature is 60° F. A TEMP PROBE failure warning will be displayed. See troubleshooting guide in back of manual.

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

LF (Low Flow)
If the letters LF are 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.

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’. 

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- 17 -
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.

Next press SELECT until asked **SET FLOW PARAMETERS.** Select ‘YES’. Enter the measured **ZERO FLOW DISTANCE** point using the SHIFT, UP and DOWN keys. 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 less 12.0". You may change the SPAN to any value that is less than the value displayed. Minimum SPAN is 1.00".

Set the **SCALE 20 mA. OUTPUTs #1 and #2** to set the 4-20mA outputs to a remote recorder if needed. For example, the recorder charts are printed 0-500 (GPM). Set the OUTPUT for 000500.00 GPM.

Note: Output #2 may be scaled for Gal/Min (GPM), Flow Depth (inches) or Temperature (Deg) ... **Set Output #2 for..** in programming. Output #1 is by default, Gal/Min (GPM).

This completes the basic calibration.

Proceed through the PROGRAM MODEs refering to the PROGRAM FLOWCHART, page 27, to help you navigate through the program section.

**SETTING/TESTING ... 4-20mA OUTPUTS**

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 the **MISC Setting...** 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
```
(Note: the 4-20mA outputs are damped by the 4-20mA Damping adjustments on the main circuit board. You may want to turn the adjustments fully CCW for quick response of output while testing).

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 minus10%. 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] When completed, adjust the 4-20mA DAMPING output on main circuit board to desired 4-20mA response.

6] Press SELECT (Done) when completed to exit simulate of 4-20mA output.

7] Scale each 4-20 mA. output under FLOW PARAMETERS .... SCALE OUTPUT #1 .... SCALE OUTPUT #2. Note: Output #2 may be set for GPM, Flow Depth in inches or Temperature in Deg F. See FLOWCHART Page 29.

Note: if the 4-20mA output is not responding correctly or is reading above 22mA., the output is most likely defective and will require repair or the loop resistance is too high. Do not adjust the 4 and 20mA adjustments to correct for large descrepancies (more than 3 mA.).

SAMPLER OUTPUT ... Relay #5 (PDS-360 Only)

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 gal 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 light will flash when the Sample is made.

After setting the SAMPLER output, you may choose to log the time and date each sample is taken by selecting ‘YES’ when asked LOG SAMPLER 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.

RELAY OUTOUTS ... Relay 1 ~ 4 (PDS-360 Only)

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. 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.*

When a relay switches state (i.e. OFF to ON, ON to OFF), the relay number, time and date will be logged in the EVENT LIST. 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.

**TESTING THE RELAY OUTPUTS**
(PDS-360 Only)

The relay outputs can be tested by going to MISC Settings ? mode, TEST RELAY OUTPUTS? Select ‘YES’. The display will show ....

![Test Relay Outputs](image)

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 light will light when relay is energized.

**Setting the Time and Date** (PDS-360 Only)

Under the MISC Settings ? Set the Time and Date using the SHIFT, UP and DOWN buttons. The Data Logging and 24 hour Summary uses 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 (PDS-360 only) 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 (PDS-360 only).

**Temp 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 button 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 return to TEMP PROBE ON/OFF ...
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 -

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
6] Press the SELECT button to continue.
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 button 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.

Sensor To Flow Surface Distance (Range) (Note: this will vary depending on flow depth).

Actual measurement made by flowmeter

Range = 018.63 in.
Cal Factor = 1.000

Calibration Factor - change value if needed.

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.
Data Logging (PDS-360 Only)

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 in gallons for the past 6 months may be viewed at the flowmeter.

24 Hour Summary
The 24 HOUR SUMMARY data log keeps track of the 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 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 you must 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, preformatted for quick viewing and print out. (see using the RS-232 output for download instructions).

Viewing Daily Totals, Min, Max, Avg
The daily totals with Min, Max and Avg GPM flow rates can be 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: Flowmeter will always begin with todays date. Todays date will show total gallons so far for the day.) Press the UP or DOWN button to select next or previous date; the SHIFT button to see AVG GPM, again to see MIN GPM and then MAX GPM. Press the SELECT button while viewing the TOTAL to EXIT the Data Log section. There are up to 200 days of Data.

Print Daily Readings
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 then will be asked number of days (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).

**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.

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 ...

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System Restart</td>
</tr>
<tr>
<td>2</td>
<td>Entered Programming</td>
</tr>
<tr>
<td>3</td>
<td>Echo Signal Lost</td>
</tr>
<tr>
<td>4</td>
<td>Echo Signal Returned</td>
</tr>
<tr>
<td>5</td>
<td>Temperature Error</td>
</tr>
<tr>
<td>6</td>
<td>Relay #x ON</td>
</tr>
<tr>
<td>7</td>
<td>Relay #x OFF</td>
</tr>
<tr>
<td>8</td>
<td>Sampler Pulsed</td>
</tr>
<tr>
<td>9</td>
<td>Reset Totalizer</td>
</tr>
<tr>
<td>10</td>
<td>Reset Data Log</td>
</tr>
<tr>
<td>11</td>
<td>Reset Event List</td>
</tr>
<tr>
<td>12</td>
<td>Master Reset/Startup</td>
</tr>
</tbody>
</table>

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 or SHIFT button is held when power is applied to the flowmeter, then released, the user will have access to the flowmeters reset functions.

If SELECT is used, the user may reset the flowmeter by saying ‘YES’ to FACTORY DEFAULTS and ‘NO’ to USER PRESETS when prompted. The operator must now proceed to reprogramming the flowmeter.
Note: This reset will set the pass code to ‘0000’.

If the SHIFT button is used, MASTER RESET, it will do the same as above plus reinitialize the time/date and reset the Event List. It will be necessary to set the clock and date. Do this RESET if using the SELECT button above does not work.

The Resets can help recover from a processor crash or lockup due to lightning etc. The resets do not affect the totalizer or 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 or SHIFT 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.
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.
The PDS-360 PROGRAM FLOWCHART

POWER UP
Turn Power ON

Control Electronics
Model PDS-360B

Open-Chan Flowmeter
Rev x.x

Select
Shift

no button held

Reset to Defaults?
>NO    YES

Reset to USER PRESETS?
>NO    YES

From FLOWCHART #6

RUN MODE

GPM = 1560.20
Total x 10 = 231445

SELECT  SHIFT  UP  DOWN

View Logged Totals or Print Daily Readings to serial printer.
See FLOWCHART #7

GO TO PROGRAM MODE?
>NO    YES

Enter Your Pass Code
0000

Wrong
Shift  Up  Down

Change Pass Code?
0000
Shift  Up  Down

RUN MODE SELECTIONS
use UP / DOWN button

MGD = 2.246688
Total x 10 = 231445

Depth = 23.70 in.
GPM = 1560.20

Depth = 1.97 ft.
GPM = 1560.20

Flow % = 65.37 %
Temperature = 72 F

To FLOWCHART #2

Pressing and holding the SELECT or SHIFT button when power is applied, then releasing the button, will access the meters RESET functions.

Reset the Flowmeter to Factory Defaults.
If the SHIFT button was held, the time/date and EVENT log list will RESET. You will need to set clock.

Reset the flowmeter to USERS saved PRESETS.
Note: if PRESETS are corrupted, this function will not work and you will need to reprogram the flowmeter.

The PASS CODE must be entered correctly before you can proceed to the Program Modes. If the wrong code is entered, you will be returned to the RUN MODE.
The Flowmeter leaves the factory with PASS CODE 0000. Press SELECT to continue and enter the Program section.

If you like, you can change the PASS CODE at this time.

REMEMBER YOUR CODE !!!
The PDS-360 PROGRAM FLOWCHART

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

From Flow Chart #1

Set Primary Device?

> NO YES

Select Flume/Weir

Parshall Flume

Select Size

2 in. PARSHALL

Enter Point 01 inches

Depth = 000.80 in.

Enter Point 01 inches

Flow = 0000000.00 GPM

Select Flumes are:

1) Parshall
2) Palmer-Bowlus
3) Leopold Lagco
4) V-Notch Weir
5) Rect Weir W/end
6) Rect Weir no end
7) User Defined ... enter
   a] max flow head
   b] GPM at max head
   c] Exponent
8] User Look Up Table ... 20 points enter Flow Depth inches and GPM Flow Rates. Flowmeter will
   linearize flow rate between programmed points.

To SET FLOW PARAMETERS Flow Chart #3

LOOK UP TABLE Example:
The window will display 1 of 20 points to be programmed. Enter the flow DEPTH (head) for that POINT (#1 is the low end, #20 is max).... pressing the select button moves to next window. Enter the GPM flow rate for the DEPTH of flow you just entered. The table advances to the next POINT after entering the GPM flow rate and pressing SELECT. Continue until all 20 points are set. See sheet in back of manual. Press the SHIFT then SELECT at the same time to exit the table at any time.

Enter # of Weirs

01

If #4-7 is selected above, you will be asked for the number of Weirs you are monitoring. The GPM and Total will be multiplied by this value.

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.
Values are shown in FACTORY DEFAULTS

ZERO Flow Distance is the distance from the Sensor face to the ZERO% flow point (crest) of the Primary Flow device.
Note: this value should be made as accurate as possible. All measurements will be referenced to this value.
Refer to Sensor Installation.

Set the Maximum flow depth you will be monitoring. Note: this value is auto set if you made any change to the ZERO flow distance in the previous window to: SPAN = ZERO% - 12.0".

This scales the analog 4-20 mA. output #1. i.e.: your circular chart recorder is set for 0-500 GPM. Set output for 00500.00 GPM.
4 mA. = 0.0 GPM by default.

Output #2 may be set for GAL/MIN (GPM), FLOW DEPTH (INCHES) or TEMPERATURE (DEG). Use the UP/DOWN button to make selection.

This scales the analog 4-20 mA. output #2. i.e.: You may want to record the FLOW DEPTH in inches ... Select FLOW DEPTH in previous program window above and then enter inches at 20 mA.
4 mA. = 0.0 by default. (Note: window is showing output for GPM.)

Average Readings helps to Damp the display. As shown, The flowmeter will make 10 measurements and average the readings 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 dampens the displayed values. 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.

Output #1 and flow indications will go to ZERO when flow is below or equaled to SHUT OFF setting. Note: this does not affect the DEPTH indication and Output #2 ... i.e.: does not go to ZERO.

Select the multiplier for the Totalizer in total gallons. Select x1, x10, x100, x1000.

If the ECHO Signal is lost for more then 12 seconds, the flow meters display and outputs will go to the percent entered. Relay outputs etc. will respond accordingly.
Note: 000% = Stay at last reading.

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.
The PDS-360 PROGRAM FLOWCHART

RELAY OUTPUTS - PDS-360 Only

Set Relay Outputs? >NO YES

 Relay # 1 ON
 ON = 00000.00 GPM
 Shift UP Down

 Relay # 1 OFF
 OFF = 00005.00 GPM
 Shift UP Down

 Relay # 2 ON
 ON = 00000.00 GPM
 Shift UP Down

 Relay # 2 OFF
 OFF = 00001.00 GPM
 Shift UP Down

 Relay # 3 ON
 ON = 05500.00 GPM
 Shift UP Down

 Relay # 3 OFF
 OFF = 05000.00 GPM
 Shift UP Down

 Relay # 4 ON
 ON = 05500.00 GPM
 Shift UP Down

 Relay # 4 OFF
 OFF = 05000.00 GPM
 Shift UP Down

 Relay #5 Sampler Pulse
 1 Pulse = 000000 gal
 Shift UP Down

 Log Sampler Event? >NO YES

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. 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.

Relay outputs can be tested under the MISC MODE, Flowchart #6.

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.
The PDS-360 PROGRAM FLOWCHART

COMMUNICATIONS / DATA LOG - PDS-360 Only

- Set Communications
  - >NO Data Log Yes
  - NO

- Set RS-232 Baud Rate
  - 2400
  - UP DOWN

- Send DATA to ..... Serial Printer
  - UP DOWN

- Set ID# of Flowmeter
  - FT-0000
  - SHIFT UP DOWN

- Set Com Address
  - Com Addr = ‘A’
  - UP DOWN

- Data Log Sample Rate
  - Log Every 30 Minutes
  - SHIFT UP DOWN

- Begin 24 Hr Summary at 12:00 AM
  - SHIFT UP DOWN

- Set the RS-232 output Baud Rate to 2400, 9600 or 19200.
  - 2400 is Default and recommended

- Select if Data is to be downloaded to a PRINTER, PC/LAP TOP or MODEM 1 (LUCENT chip set) or MODEM 2 (CONEX chip set).

- Set 4 digit ID number

- Set the Communication Address ‘A-Z’ for PC/Laptop
  - Note: Use UPPER case letters
  - ‘#’ = MODEM - This is set automatically when MODEM is selected above and Com Addr equals ‘A’. ‘A’ is reserved when using a Modem. You may change to other Address other than ‘A’. Unless you are daisy chaining meters using RS-485 output, it’s best to leave address as ‘#’.

- Sets the SAMPLE RATE for Data Logging, i.e.: 30 minutes indicates that every 30 minutes the GPM FLOW rate for the past 30 minutes will be averaged, logged and time stamped. If set to 00 minutes, data log is disabled.

- This DATA can only be viewed by downloading to PC/LapTop.

- 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.

- This data is best viewed by downloading to a PC/LapTop.
**MISC MODE**

**Misc Settings...**  
> NO  Yes

- **Range =** xxx.xx in.  
- **Cal Factor =** 1.000

**SHIFT UP DOWN**

This indicates the distance from the Sensors face to the flow surface as measured by the meter. If incorrect, change the CAL FACTOR to correct. i.e: 1.050 will increase reading by 5%. Be sure the Temperature indication is reasonably correct in RUN MODE first. See CALIBRATION section for more information.

**Test 4-20 mA Output?**  
> NO  YES

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

**SHIFT UP DOWN**

Test the 4-20 mA. output and set the 4 and 20 mA adjustments, if needed, located on the circuit board. SHIFT adds 25 to value; UP adds 10 and DOWN decreases by 10.

**Test Relay Outputs?**  
> NO  YES

- **Test Relay #0**  
- **Done ON OFF Select**

**SHIFT UP DOWN**

Test the relay outputs. Use the DOWN button to select the relay. Press SHIFT to turn it ON; Press UP to turn it OFF. PDS-360 Only

---

**Time**

**Date**

- 12:00 AM
- 11/15/97

**Shift Up Down**

Set the Time/Date for Data Logging  
PDS-360 Only

**Reset the Totalizer?**  
> NO  YES

**Reset the Data Log?**  
> NO  YES

If the temperature probe is not being used or is defective, you must enter a temperature for the flowmeter to make its calculations. Enter a temperature that represents the average temperature out at the Sensor. This also sets the DEFAULT temperature in the event there is a temperature error.

Enter Outside Temp.  
060 deg F

**Shift Up Down**

- Temp Probe ON/OFF .....  
- Temp Probe is 'ON'

- **UP DOWN**

- **Enter Outside Temp. 060 deg F**

**Shift Up Down**

**Once you set all the required parameters, a backup copy will be saved. If the meter crashes or loses its programming, it will restore the programming automatically (Note: only if the backup copy has not been corrupted).**

---

**Save Settings......**  
**Please Wait**

Return to RUN mode

Flow Chart 1
The PDS-360 PROGRAM FLOWCHART

PDS-360 Only

From FLOWCHART #1

When SHIFT (DATALOG) button is pressed in RUN MODE

View Data Log?
>NO YES

Print Daily Readings?
>NO YES

Print Readings
>NOW AUTO

Print How Many Days?
Print Past 001 Days

Will AUTO Print 24 hr Summary at 12:00 AM

View Past 200 Days of Data Logged

Date: xx/xx/xx
Total = 12345678

SELECT SHIFT UP DOWN

Return to RUN MODE (Flowchart 1)

Date: xx/xx/xx
Avg GPM = 245.87

SHIFT UP DOWN

xx/xx/xx xx: xx AM
Min GPM = 75.03

SHIFT UP DOWN

xx/xx/xx xx: xx PM
Max GPM = 275.94

SHIFT UP DOWN

Print time is set under Communications / Data Log section. Flowchart #5

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 losses 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.

Press and hold the UP or DOWN button for 3 seconds to jump ahead or back by 1 week.
Using the RS-232 Communication Output Port (PDS-360)

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 Microsofts WINDOWS HYPER-TERMINAL. All data downloaded is in ASCII format. Each line of data is terminated by a CR (carrage return) and line feed. Downloading of flow data may be initiated from the flowmeter using the PRINT function (see FLOWCHART #7) 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 or Modem (see drawing 100-05).

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 or 19200 baud. 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’, suggest 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 PC/software 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’ has been downloaded from the flowmeter and before making a MENU selection. When Download is completed, select ‘Stop capture’ under the ‘TRANSFER’ menu in HYPER TERMINAL.
Communication Settings  Using A Modem
You will first need to open WINDOWS HYPER TERMINAL 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 (no handshaking). (i.e. 2400,N,8,1)

**IMPORTANT**

*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. (See FlowChart #7).

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. GPM, 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.

Please 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.

6] The optional RS-485 output allows communication with the flowmeter up to 4000 feet away. It does require that the receiving end has an RS-485 receiver.
Supplied cable, 10 ft.
(max length, 50 feet)

Make connections shown with supplied cable

25 pin Cable Connector to Printer

To Meters
RS-232 Output

Tx
Red

Ground
Bare

Cable Pin Out

Control Electronics, Inc.

PRINTER Connection

Date: 1/1/05
Drawing 100-05
The Meter has been programmed to operate with most modems. Some modems may not function properly.

Connect as shown and turn ON the modem. Select MODEM under DOWNLOAD DATA TO in programming of the meter. See FLOWCHART for assistance.

Use Micorsoft's HYPER TERMINAL for WINDOWS to dial up modem. Once modem answers and connection is made, the dial-up window will close. Type 'SHIFT-#' or selected COM ADDRESS (other than 'A') to download meters MENU.

SENSOR MOUNTING BRACKET COMPONENTS

1. PVC mounting flange.
2. 15" length Upright Support. 1.25" dia. solid PVC rod threaded on one end.
3. Horizontal and Vertical Adjustment Clamp. 4" length PVC rod.
5. 15" length Horizontal Support. 1.25" solid PVC rod.
6. 3/4" PVC pipe (1.0" dia.) Sensor support 12" length, threaded both ends.
7. Non-metallic L-junction box.

Note: for wall mounting use components 1, 2, 3B and 6.
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<td>No Power</td>
<td>Check power circuit breaker and wiring</td>
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<tr>
<td>No Display backlighting</td>
<td>Defective Display</td>
<td>ON/OFF switch on main circuit board</td>
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<tr>
<td>Ribbon cable not secure</td>
<td>0.5 amp fuse on main circuit board</td>
<td></td>
</tr>
<tr>
<td>#2 Keypad Does Not Respond</td>
<td>Ribbon Cable</td>
<td>Check ribbon cable</td>
</tr>
<tr>
<td>Lightning or Power surge</td>
<td></td>
<td>RESET/Reprogram meter</td>
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<tr>
<td>#3 4-20 mA. Output Not Functioning</td>
<td>Defective Wiring</td>
<td>Check wiring and polarity</td>
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<tr>
<td>4-20 mA. Output Indicates Max All The Time (see #9 below)</td>
<td>Defective Output and/or Lightning Damage</td>
<td>Disconnect output wires and check 4-20 with current meter. If OK, receiver or wiring is problem.</td>
</tr>
<tr>
<td>Output Not Same As Display</td>
<td>Not Scaled Correctly</td>
<td>Replace Q1 and/or Q2 (2N3904 transistor) and U1(LM324 IC) on main circuit board.</td>
</tr>
<tr>
<td>#4 Display Does Not Change or Update</td>
<td>Processor Crash</td>
<td>RESET/Reprogram meter</td>
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<tr>
<td>Lightning or Power Surge</td>
<td></td>
<td></td>
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<tr>
<td>#5 Pass Code Lockout</td>
<td>Wrong Code</td>
<td>Call Factory for alternate code</td>
</tr>
<tr>
<td>Code Corrupted</td>
<td></td>
<td>Provide product SN# on Printed Circuit Board. Call (610) 942-3190</td>
</tr>
<tr>
<td>#6 Display Says ‘ECHO LOST, Check Wiring ....’</td>
<td>Sensor NOT LEVEL</td>
<td>Check sensor mounting for plumb</td>
</tr>
<tr>
<td>Accustic Signal Path Obstructed</td>
<td></td>
<td>Check for signal path obstructions</td>
</tr>
<tr>
<td>Defective wiring or wrong cable type</td>
<td></td>
<td>Check wire splices for break or short - Do not solder or use wire connectors at splice - use wire nut and electrical tape</td>
</tr>
<tr>
<td>Defective Sensor</td>
<td></td>
<td>Test sensor back at the meter to by-pass cable run ... replace sensor and/or PC-547 or PC-548 transmit/receive circuit card if needed.</td>
</tr>
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### PDS-360 Troubleshooting Guide

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<td>Defective wiring</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Defective Temp Probe</td>
<td>Turn Probe OFF in Programing and Enter Manual Temperature until corrected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use DC volt meter to check RETURN signal from probe (+ to TC [black wire] and - to BARE wire [gnd] at terminal barrier). i.e. 0.71 VDC = 71°F. Replace probe if needed.</td>
</tr>
<tr>
<td><strong>#8</strong> Readings Fluctuate</td>
<td>Severe Turbulence, eddy currents, Intermittent Foam, Floating Debris</td>
<td>Reduce source of turbulence, foam and/or debris. May need stilling well to correct.</td>
</tr>
<tr>
<td></td>
<td>Electrical Noise</td>
<td>Check that sensor is plumb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase programmed DAMP FACTOR Best setting is 3 to 5.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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).</td>
</tr>
<tr>
<td><strong>#9</strong> Readings Are Fixed</td>
<td>Sensor Not Plumb or Obstruction in Acoustic Path</td>
<td>Check sensor for plumb and obstructions</td>
</tr>
<tr>
<td>Reads MAX All The Time</td>
<td>Sensor is Mounted To Metal Support or Sensor screwed too tight to mounting bracket</td>
<td>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.</td>
</tr>
<tr>
<td>Spikes to MAX readings randomly</td>
<td>Ring Time Problem</td>
<td>Move THRESHOLD jumper to position 2 on XMIT/REC circuit board, PC -547 or adj. PC-548</td>
</tr>
<tr>
<td></td>
<td>Very Cold Temperatures (may extend sensor ring time)</td>
<td>Reduce GAIN (CCW) adjustment on circuit board or increase (CW) the TVG /BLANK slightly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase DEAD BAND by raising Sensor and programing new ZERO% DISTANCE.</td>
</tr>
<tr>
<td><strong>#10</strong> Depth / Flow Readings Not Correct</td>
<td>Program Data Incorrect</td>
<td>Check ALL program data and CAL FACTOR</td>
</tr>
<tr>
<td></td>
<td>Incorrect Temperature Reading</td>
<td>Check Temperature Reading on display . if reading is greater than ±10°F, check probe - see symptom #8 above.</td>
</tr>
<tr>
<td><strong>#11</strong> Flow Readings Are ZERO when there is flow</td>
<td>LOW FLOW SHUT OFF Set Too High</td>
<td>Check LOW FLOW SHUT OFF and other settings in program. Flow Readings will go to ZERO if Flow Rate is below LOW FLOW setting.</td>
</tr>
</tbody>
</table>