PD684 & PD689 LOOP-POWERED RATE/TOTALIZERS
Instruction Manual

PD689 only

CE

- 2 V drop (5.7 V with backlight)
- 5-Digit LCD, 0.6" (15.2 mm) High
- 3 Digit Automatic Total Overflow
- Rate in Second, Minute, Hour, or Day
- Open Collector Pulse or Alarm Output
- Custom Engineering Units
- 20-Segment Bargraph Display
- Type 4X, NEMA 4X, IP65 Front
- Maximum & Minimum Display
- Linear, Square Root, or Programmable Exponent
- Non-Volatile Memory – No Battery Needed

Loop-Powered Backlight Standard!

PRECISION DIGITAL CORPORATION

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INTRODUCTION

The PD689 is an intrinsically safe and nonincendive loop-powered rate/totalizer approved for hazardous area locations. The PD684 is a general-purpose loop-powered rate/totalizer for safe area applications. The four front panel buttons make the setup and programming an easy task. Five digits, bargraph, engineering units, scientific notation, rate & total indication, and trend arrows provide a clear and attractive presentation of the process.

The square root and programmable exponent functions allow for conditioning of signals from non-linear transmitters without adding external components to the system and the convenience of scaling without a calibrated signal source make the PD684 & PD689 the ideal choice for flow rate & total display applications.

ORDERING INFORMATION

Model	Description
PD683-0K0*	Loop-Powered Panel Meter for Safe Area
PD684-0K1	Loop-Powered Rate/Totalizer for Safe Area
PD688-0K0*	ATEX/FM/CSA Approved Loop-Powered Panel Meter
PD689-0K1	ATEX/FM/CSA Approved Loop-Powered Rate/Totalizer

Enclosures and Accessories

Model	Meters	Description	Mounting
PDA2407	1	Plastic NEMA 4X Enclosure	Inside Cover
PDA2410	3	Plastic NEMA 4X Enclosure	Inside Cover
PDA2411	2	Plastic NEMA 4X Enclosure	Inside Cover
PDA23XX	1-10	Economical Plastic NEMA 4X Enclosure	Through Door
PDA25XX	1-10	Plastic NEMA 4X Enclosure	Through Door
PDA26XX	1-6	Stainless Steel NEMA 4X Enclosure	Through Door
PDA27XX	1-6	Steel NEMA 4 Enclosure	Through Door
PDA2801*	1	Low-Cost Plastic NEMA 4X Enclosure	Through Cover
PDA2812	2	Low-Cost Plastic NEMA 4X Enclosure	Through Cover

Note: XX = the last two digits of the model number.
　　　Go to www.predig.com to find individual part numbers.

* Quick Shipment Program product, typically shipped within 2 working days

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SPECIFICATIONS

Except where noted all specifications apply to operation at +25°C.

General

DISPLAY	Five digits (-99999 to 99999)	0.60" (15.2 mm) high, 7-segment, automatic lead zero blanking.
	Four characters (Engineering Units)	0.25" (6.4 mm) high, 14 segment.
	Bargraph	20-segment, 0% to 100% indication.
	Trend arrows	Up and down trend indication.
	Backlight	Orange (intensity varies with signal)
DISPLAY UPDATE RATE	1 update/second	
OVERRANGE	Display flashes *99999*	
UNDERRANGE	Display flashes *-99999*	
PROGRAMMING METHOD	Four front panel buttons	
NOISE FILTER	Programmable from 1 to 199	
RECALIBRATION	Recalibration is recommended at least every 12 months.	
MAX/MIN DISPLAY	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.	
PASSWORD	Programmable password restricts modification of programmed settings.	
NON-VOLATILE MEMORY	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.	
NORMAL MODE REJECTION	64 dB at 50/60 Hz	
ENVIRONMENTAL	Operating temperature range: -20 to 65°C (-40°C allowed)* Storage temperature range: -40 to 65°C Relative humidity: 0 to 90% non-condensing *Below -20°C, the LCD becomes less readable.	
CONNECTIONS	Removable screw terminals accept 12 to 22 AWG wire	
ENCLOSURE & MATERIALS	1/8 DIN, high impact plastic, UL 94V-0, color: gray NORYL® Polyphenylene Ether & Polystyrene blend (PPE PS) Resin LEXAN® Polycarbonate (PC) Film	
MOUNTING	1/8 DIN panel cutout required. Two panel mounting bracket assemblies provided	

TIGHTENING TORQUE	Screw terminal connectors: 4.5 lb-in (0.5 Nm) Mounting screws: 8.0 lb-in max. (0.9 Nm)
OVERALL DIMENSIONS	4.68" x 2.45" x 3.79" (119 mm x 62 mm x 96 mm) (W x H x D)
WEIGHT	5.7 oz (162 g)
WARRANTY	3 years parts and labor
EXTENDED WARRANTY	1 or 2 years, refer to Price List for details

Input

ACCURACY	±0.03% of span ±1 count, square root and programmable exponent: 10-100% FS
FUNCTION	Linear, square root, or programmable exponent
LOW-FLOW CUTOFF	-99999 to 99999 (-99999 disables cutoff function)
TEMPERATURE DRIFT	50 PPM/°C from -40 to 65°C ambient
DECIMAL POINT	Up to four decimal places: *d.dddd*, *dd.ddd*, *ddd.dd*, *dddd.d*, or *ddddd*
TOTAL DISPLAY OVERFLOW	Total up to 99,999,999 with total overflow feature. "*oF*" is displayed to the left of total overflow value (e.g. *oF 999*).
TOTALIZER	Calculates total based on rate, time base of second, minute, hour, or day, and field programmable multiplier; stored in non-volatile memory upon power loss.
TOTALIZER RESET	User selectable via panel button, time delay, or protected
CALIBRATION RANGE	An *Error* message will appear if input 1 and input 2 signals are too close together. **Input Range** / **Minimum Span Input 1 & Input 2** 4-20 mA / 0.40 mA

VOLTAGE DROP	**Without Backlight**	**With Backlight**
	2.0 V maximum	5.7 V maximum
EQUIVALENT RESISTANCE	100 Ω @ 20 mA	285 Ω @ 20 mA

INPUT OVERLOAD	Over current protection to 2 A max.
HART TRANSPARENCY	Analog input will not interfere with existing HART communications on the wired 4-20 mA signal

Open Collector Output

RATING	Isolated open collector, 30 VDC @ 175 mA max.
ALARM OUTPUT	Assign to rate for high or low alarm trip point. Assign to total for total alarm trip point.
DEADBAND	0-100% FS, user selectable
ACKNOWLEDGE	Front panel ACK button resets output and screen indication.
PULSE OUTPUT K-FACTOR	K-factor programmable from 0.0001 to 99999. One pulse is generated for every total increment selected (e.g. K-factor value of 100 will generate one pulse every time the total is incremented by 100 units). If the pulse output exceeds the programmed output frequency, pulses are accumulated as pending and are not lost. Pulses will continue to output until the buffer is emptied or the total is reset from the front panel.
PULSE OUTPUT FREQUENCY	Programmable frequency: 2, 4, 8, 16, 32, 64, 128 Hz. Minimum pulse width: 3.9 ms @ 128 Hz Maximum pulse width: 250 ms @ 2 Hz Factory default pulse width: 31 ms @ 16 Hz

PD689 COMPLIANCE INFORMATION

Ratings and Approvals

FM & CSA	Certified as intrinsically safe with entity for use in: Class I, Div 1, 2, Groups ABCD Class II, Div 1, Groups EFG Class II, Div 2, Groups FG Class III, Div 1, 2 Class 1, Zone 0, Group IIC
	Non-incendive: Suitable for use in Class I, Div 2, Groups ABCD; Class II, Div 2, Groups FG; Class III, Div 2.
	Entity Parameters: U_i: 30 V; I_i: 175 mA; C_i: 0; L_i: 0; P_i: 1.0 W
ATEX	⟨Ex⟩ II 1G Ex ia IIC T4 IP65 Ta = -40°C to 65°C
CE	EMC Emissions and Immunity:
	EN 61326:2013 EMC requirements for Electrical equipment for measurement and laboratory use – Industrial
	IEC 61010-1:2010 & EN 61010-1:2010, including Group and National Differences as they apply for AU, CA, US and KR

Special Conditions for Safe Use:
The permitted ambient temperature range for the PD689 is -40°C to 65°C.
Year of Construction
This information is contained within the serial number with the first four digits representing the year and month in the YYMM format.
For FM/CSA applications: The PD689 installation must be performed in accordance with Control Drawing **LIM688-2**
For European Community: The PD689 must be installed in accordance with the ATEX directive 94/9/EC, the product certificate FM08ATEX0058X, and **LIM688-2**

SAFETY INFORMATION

⚠ ! **CAUTION**: Read complete instructions prior to installation and operation of the meter.	Installation and service should be performed only by trained service personnel. Service requiring replacement of internal components must be performed at the factory.

INSTALLATION

There is no need to remove the meter from its case to complete the installation, wiring, and setup of the meter.

Unpacking

Remove the meter from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier.

If any part is missing or the meter malfunctions, please contact your supplier or the factory for assistance.

Panel Mounting

- Prepare a standard 1/8 DIN panel cutout – 3.622" x 1.772" (92 mm x 45 mm). Refer to *Mounting Dimensions*, page 41 for more details.

- Clearance: allow at least 4" (102 mm) behind the panel for wiring.

- Panel thickness: 0.04" - 0.25" (1.0 mm - 6.4 mm).
  Minimum steel/stainless steel panel thickness to maintain watertight rating: 0.06" (1.5 mm).
  Note: A steel or stainless steel panel rather than plastic is recommended in cases where a watertight or dust-tight seal is required between the meter and the panel.

- Remove the two mounting brackets provided with the meter (back-off the two screws so that there is ¼" (6.4 mm) or less through the bracket. Slide the bracket toward the front of the case and remove).

- Insert meter into the panel cutout.

- Install mounting brackets and tighten the screws against the panel. To achieve a proper seal, tighten the mounting bracket screws evenly until meter is snug to the panel along its short side. DO NOT OVER TIGHTEN, as the rear of the panel may be damaged.
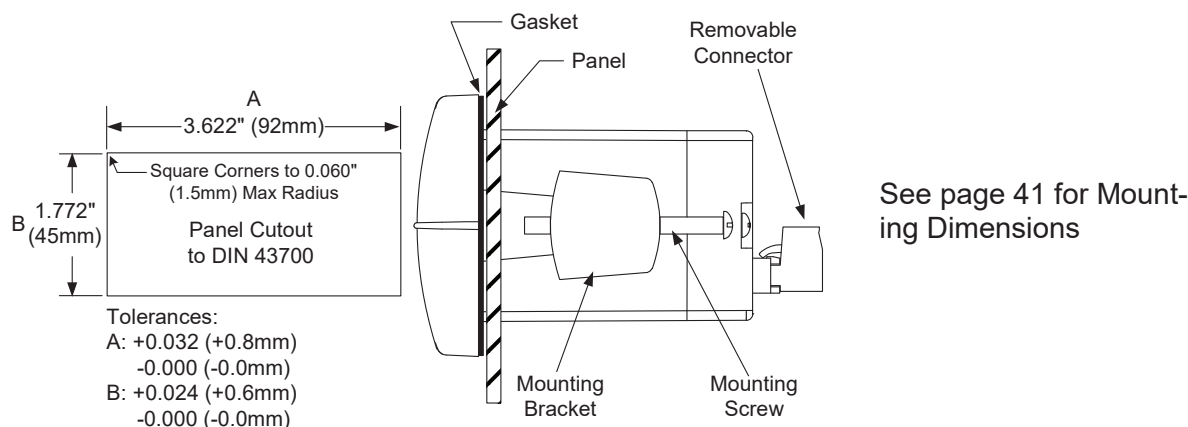
Figure 1. Panel Cutout and Mounting

Wiring Connections

Signal connections are made to a four-terminal and a two-terminal removable connector. This section is only intended for the PD684.
PD689 installation must be performed in accordance with Control Drawing LIM688-2 in order to meet agency approval ratings.

⚠	Observe all safety regulations. Electrical wiring should be performed in accordance with all agency requirements and applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.
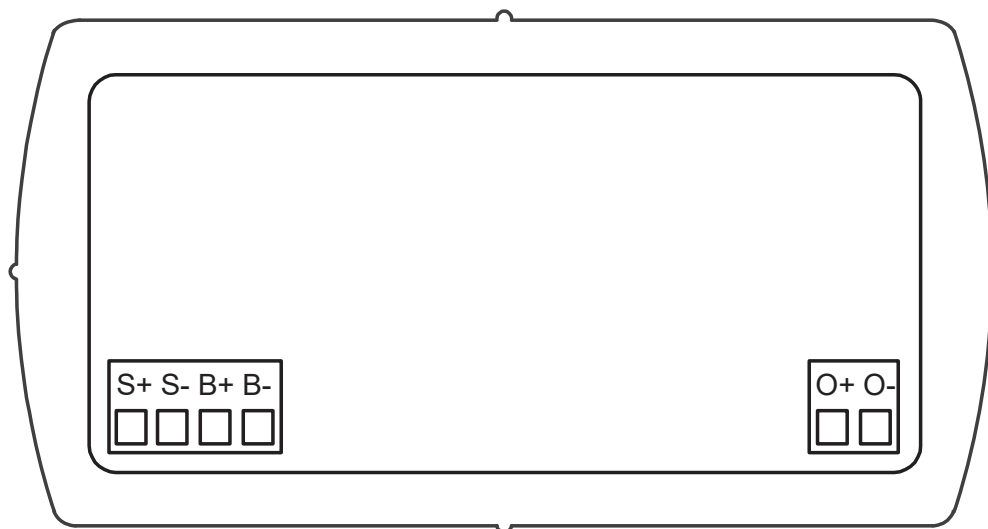
Figure 2. PD684 & PD689 Rear View

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4-20 mA Input Connections

Input connections are made to a four-terminal connector labeled S+|S-|B+|B-. The loop-powered backlight is an optional configuration and requires a total maximum voltage drop of 5.7 V. The backlight is recommended for dim lighting conditions and is enabled when wired as shown in Figure 3. It may be bypassed if installed in bright lighting conditions to reduce the maximum voltage drop to 2.0 V as shown in Figure 4.
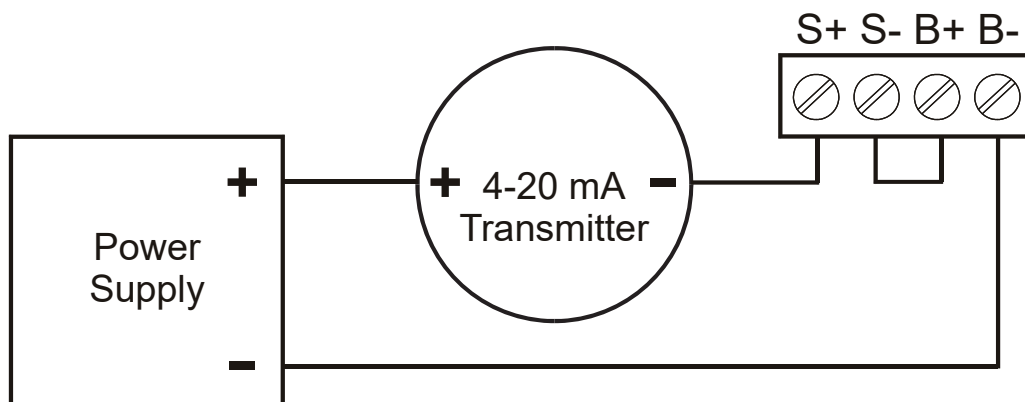
Figure 3. PD684 Input Connections with Backlight
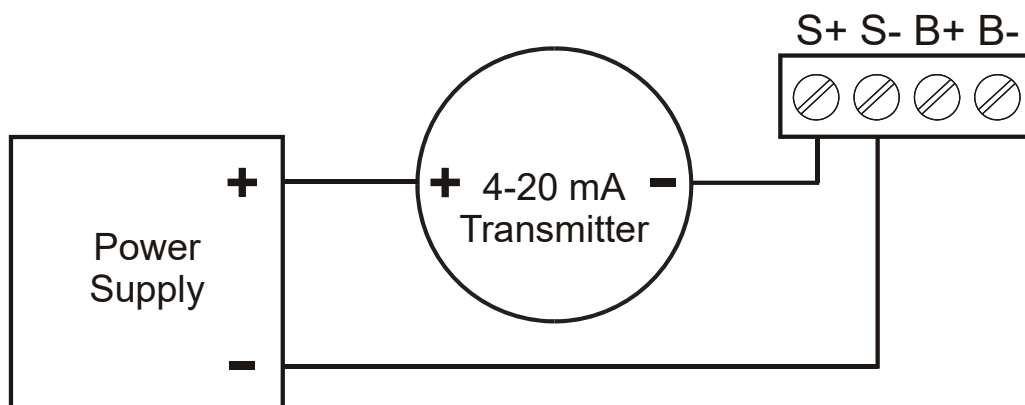
Figure 4. PD684 Input Connections without Backlight

Open Collector Output Connections

Output connections are made to a two-terminal connector labeled O+|O-. Connect to an input device such as alarm indicator or pulse counter as shown in Figure 5, or drive a relay as shown in Figure 6.

To avoid damaging the PD684's amplifying components, use care not to wire incorrectly or exceed output ratings. A diode, such as 1N4000 series, will provide protection from relay transients.
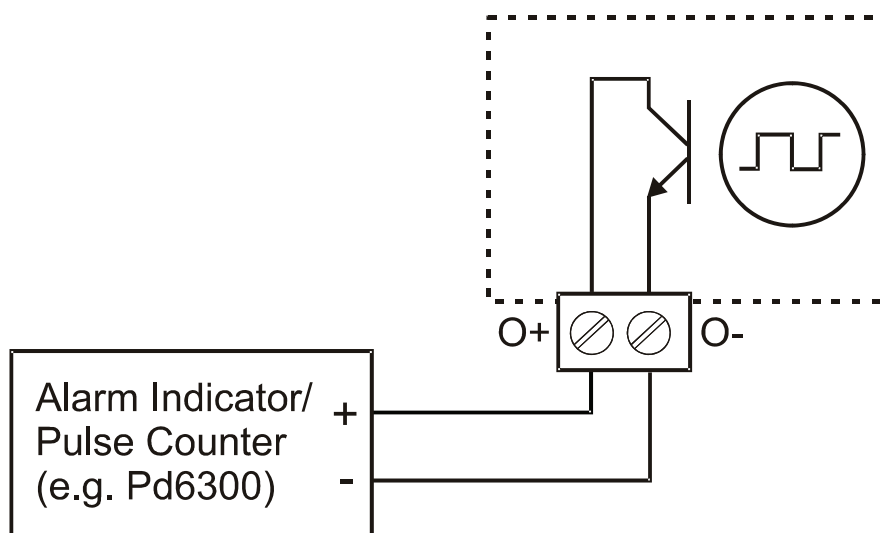
Figure 5. PD684 Connection to Device with Internal Pull-Up
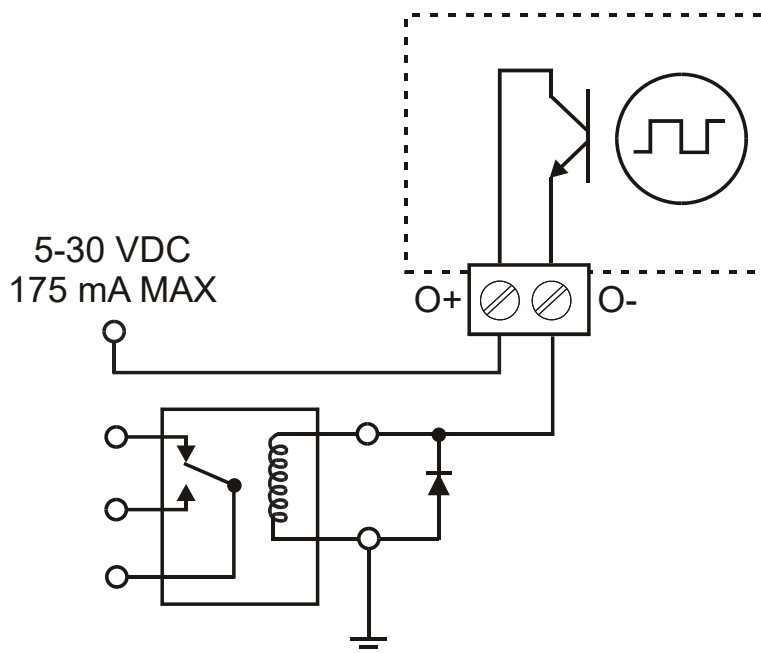
Figure 6. PD684 Connection to External Relay

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SETUP AND PROGRAMMING

> - There is **no need to recalibrate** the meter for milliamps when first received from the factory.
> - The meter is *factory calibrated* for milliamps prior to shipment. The calibration equipment is traceable to NIST standards.

Overview

There are no jumpers involved in the setup process of the meter. Setup and programming is done through the front panel buttons.

After all connections have been completed and verified, apply power to the loop.

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Front Panel Buttons & Status Indicators

Button Symbol	Description
↻	**Menu**
▶	**Right arrow/Reset**
▲	**Up arrow/Max**
↵	**Enter/Ack**

Symbol	Status
0%	Bargraph minimum
100%	Bargraph maximum
▲	Increasing trend
▼	Decreasing trend

- Press the **Menu** button to enter or exit the Programming Mode at any time.
- Press the **Right** arrow button to move to the next digit or decimal position during programming.
- Press the **Up** arrow button to scroll through the menus, decimal point, or to increment the value of a digit.
- Press the **Enter/Ack** button to access a menu or to accept a setting.
- Press and hold the **Menu** button for five seconds to access the *Advanced Features* of the meter.

Main Menu Display Functions & Messages

The meter displays various functions and messages during setup, programming, and operation. The following table shows the main menu functions and messages in the order they appear in the menu.

Display	Parameter	Action/Setting
SEtuP	*Setup*	Enter *Setup* menu
dEC.Pt	*Decimal point*	Enter *Decimal Point* menu
rAtE	*Rate*	Set *Rate* decimal point
totAL	*Total*	Set *Total* decimal point
un itS	*Units*	Enter the *Units* menu
rAtE	*Rate*	Set *Rate* units
totAL	*Total*	Set *Total* units
tbASE	*Time Base*	Enter the *Time Base* menu
SEc	*Second*	Units per *second*
m in	*Minute*	Units per *minute*
Hour	*Hour*	Units per *hour*
dAY	*Day*	Units per *day*
tot.CF	*Conversion Factor*	Enter the *Conversion Factor* menu
t rSt	*Total Reset*	Enter the *Total Reset* menu
Auto	*Automatic*	*Automatic* Total Reset
tdLY	*Time Delay*	Automatic Reset *Time Delay*
m An	*Manual*	*Manual* Total Reset
EnAbL	*Enable*	*Enable* Manual reset
dSAbL	*Disable*	*Disable* Manual reset
dSPLY	*Display*	Enter the *Display* menu
r -t	*Rate-Total*	Display *Rate or Total*
rAtE	*Rate*	Display *Rate* only
totAL	*Total*	Display *Total* only
toGLE	*Toggle*	Toggle between Rate & Total every 10 sec

Display	Parameter	Action/Setting
ProG	Program	Enter the Program menu
SCALE	Scale	Enter the Scale menu
CAL	Calibrate	Enter the Calibrate menu
inPt 1	Input 1	Calibrate input 1 signal or program input 1 value
dSPL 1	Display 1	Program display 1 value
inPt2	Input 2	Calibrate input 2 signal or program input 2 value
dSPL2	Display 2	Program display 2 value
Error	Error	Error, calibration not successful, check signal
GrAPh	Graph	Enter the Graph menu
PASS	Password	Enter the Password menu
unLoc	Unlocked	Program password to lock meter
Locd	Locked	Enter password to unlock meter
99999 −99999	Flashing display	Overrange condition Underrange condition
oF	Overflow	Total Overflow condition

Main Menu

The main menu consists of the most commonly used functions: *Setup*, *Program*, and *Password*.

• Press **Menu** button to enter Programming Mode then press **Up** arrow button to scroll main menu.
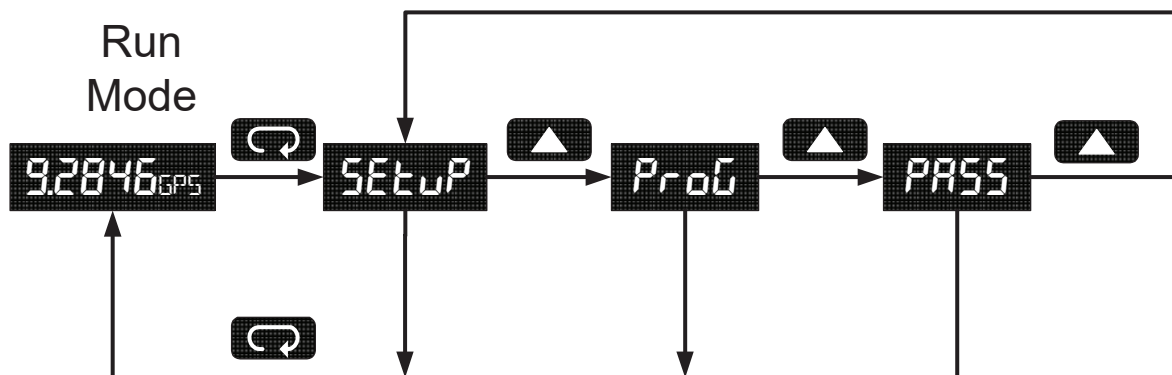
Run Mode

• Press **Menu**, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing **Enter/Ack** are not saved.

• Changes to the settings are saved to memory only after pressing **Enter/Ack**.

• The display moves to the next menu every time a setting is accepted by pressing **Enter/Ack**.

Setting Numeric Values

The numeric values are set using the **Right** and **Up** arrow buttons. Press **Right** arrow to select next digit and **Up** arrow to increment digit.

The digit being changed blinks.

Press the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

Increment Digit Value

Select Next Digit   Accept Setting
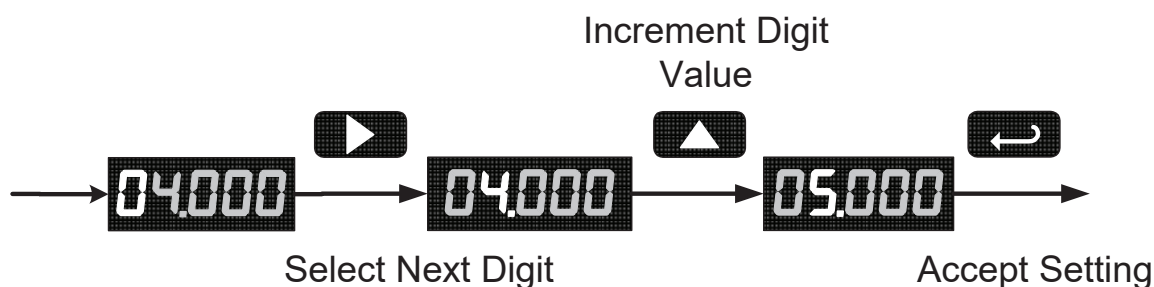
The decimal point is set using the **Right** or **Up** arrow button in the *Setup-decimal point* menu.

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Setting Up the Meter (SEtuP)

The *Setup* menu is used to select:

1. Rate and total decimal point position
2. Rate and total engineering units display
3. Time base
4. Total conversion factor
5. Manual or automatic total reset function
6. Rate or total display mode

Press the **Enter/Ack** button to access any menu or press **Up** arrow button to scroll through choices. Press the **Menu** button to exit at any time.
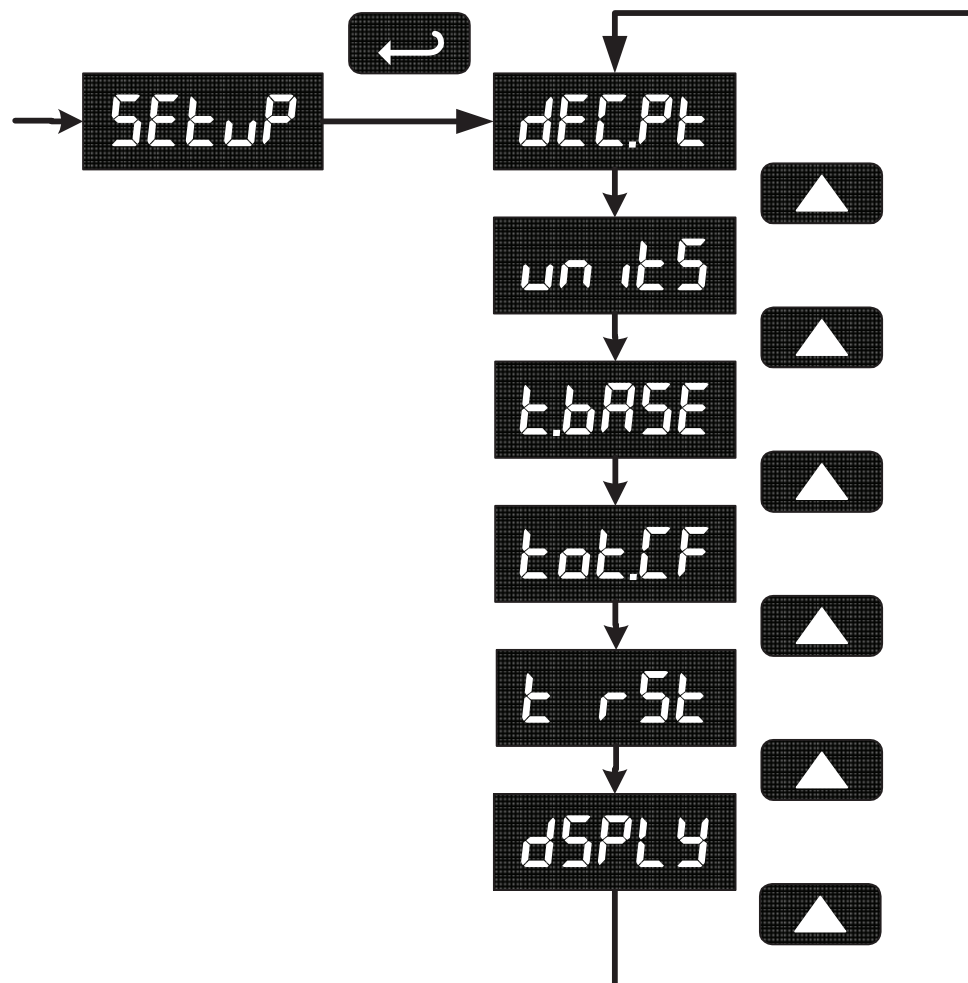
Setting the Decimal Point (*dEc.Pt*)

Decimal point may be set with up to four decimal places or with no decimal point at all. Rate decimal and total decimal are programmed individually.

Pressing the **Right** or **Up** arrow moves the decimal point one place to the right until no decimal point is displayed, then it moves to the left most position.

Select Rate/Total

Select Decimal Point

Setting the Units Display (𝘶𝘯𝘪𝘵𝘚)

The meter can be set to display a combination of three alphanumeric characters for engineering units (e.g. 𝘎/𝘚, 𝘓𝘗𝘔) or for identification (e.g. 𝘛𝘒3, 𝘓7). There is also a fourth alphanumeric character located above this row, which supports a degrees symbol and "**x10**" symbol (e.g. °𝘊, °𝘍, ₓ₁₀3, ₓ₁₀6, ₓ₁₀9). Rate and total units are programmed individually allowing for combinations (e.g. 𝘎𝘗𝘔 and 𝘎𝘈𝘓, 𝘓𝘗𝘚 and 𝘓𝘛𝘙ₓ₁₀3).

Press **Right** arrow to select next unit and **Up** arrow to increment unit. The unit being changed blinks.

Press the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

Select Next Character

Increment Character
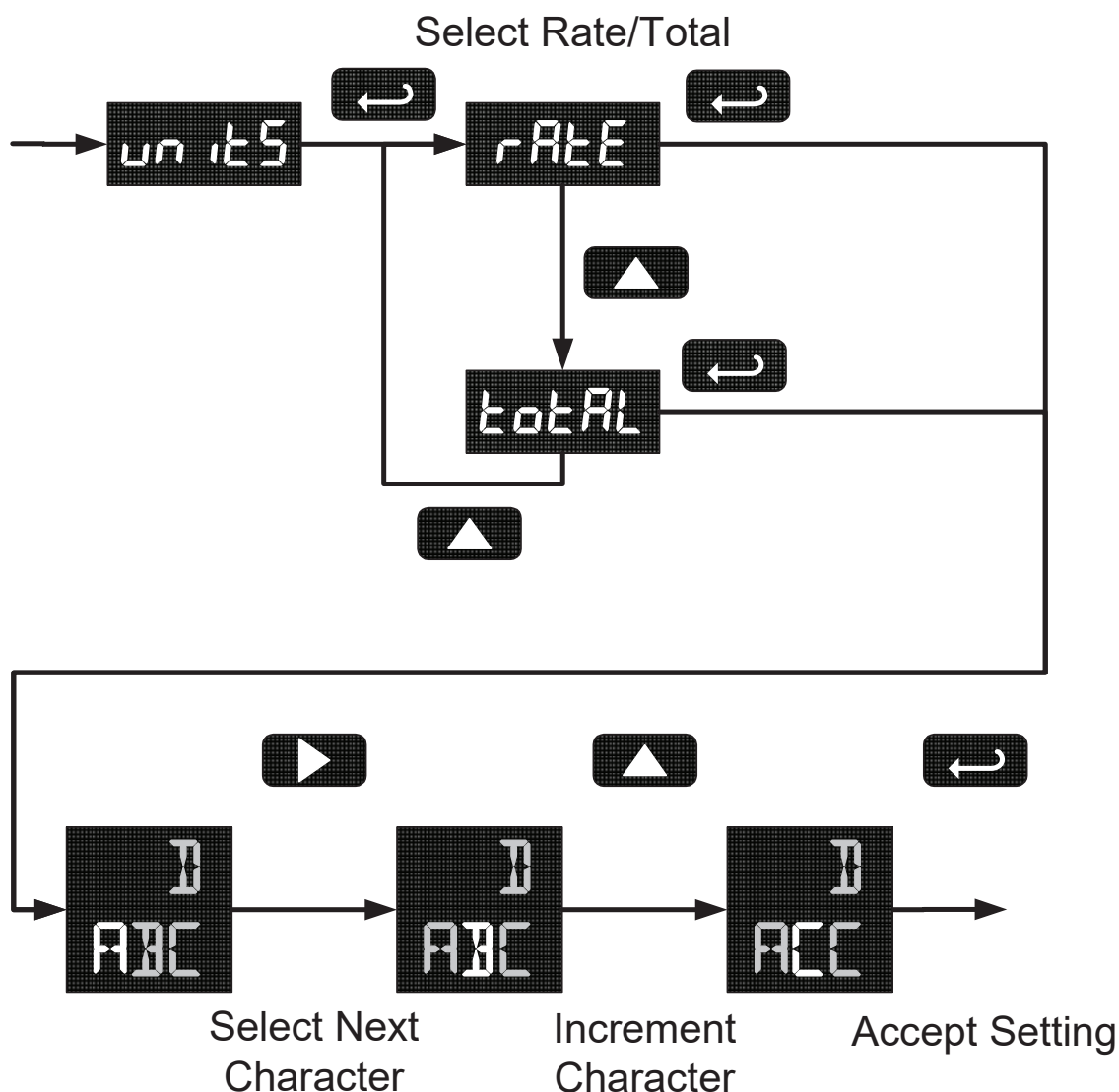
Accept Setting

Setting the Time Base (t.bASE)

The meter calculates total based on rate and a time base of units per second, minute, hour, or day.

Press the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

Setting the Total Conversion Factor (tot.CF)

Total Conversion Factor is used to convert to a different unit of total display. For example, to display rate in gallons and total in liters, enter a conversion factor of 3.7854. When rate and total units are the same, the Conversion Factor should be 1.0000.

Press the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

Select Decimal Point

Enter Conversion Factor

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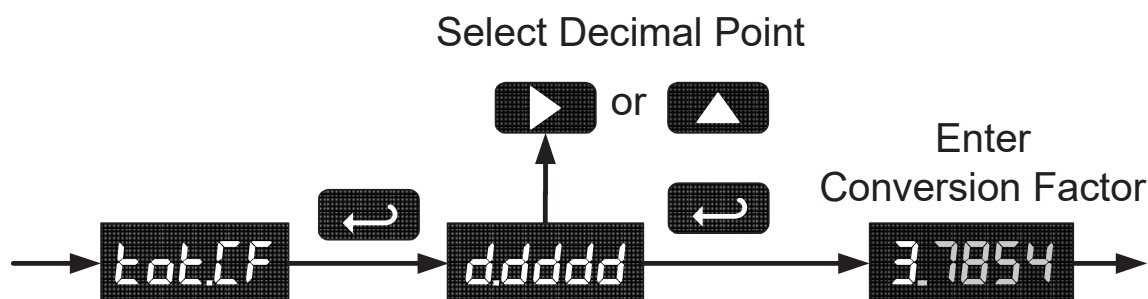
Manual or Automatic Total Reset Function (t rSt)

The meter may be programmed to reset the total either manually using the **Reset** button or automatically. Manual reset button may be disabled to avoid inadvertent total reset.

The automatic reset is based on the set point programmed in the *Advanced Features* menu: out → ALrm → totAL. Once the set point is reached, the meter waits for a programmed amount of time (t dLY) and then resets the total to zero.

- To enable total reset by **Reset** button, choose mAn → EnAbL.
- To disable total reset by **Reset** button, choose mAn → dSAbL.
- To reset total upon total alarm set point, choose Auto, enter a time delay (t dLY), and proceed to Alarm Output (alrm) programming, page 35.

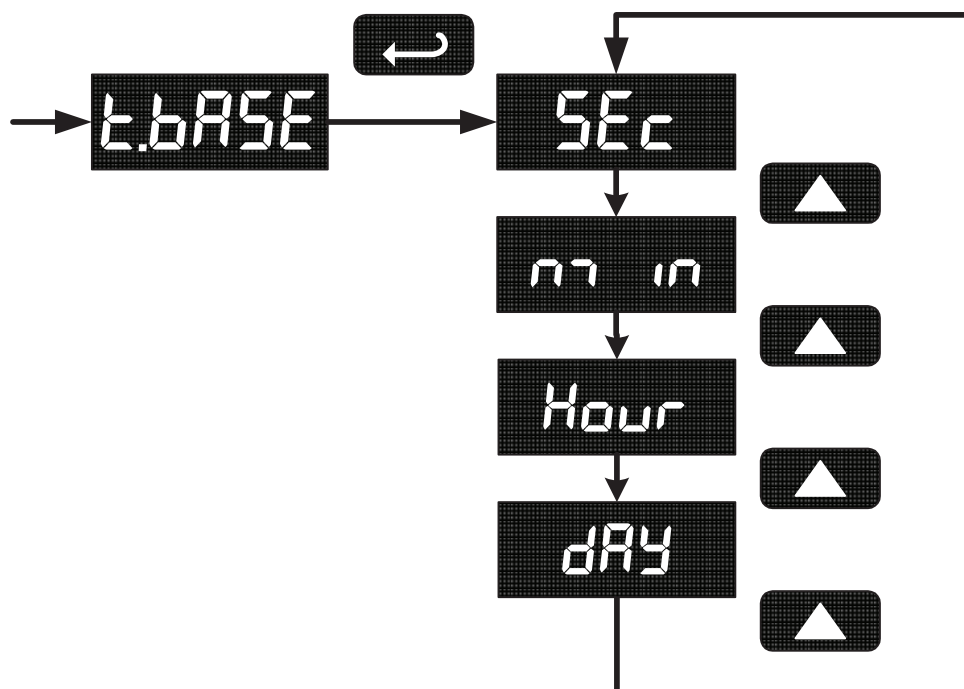Press the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

Select Manual/Auto   Select Enable/Disable

Enter Reset Delay
(seconds)
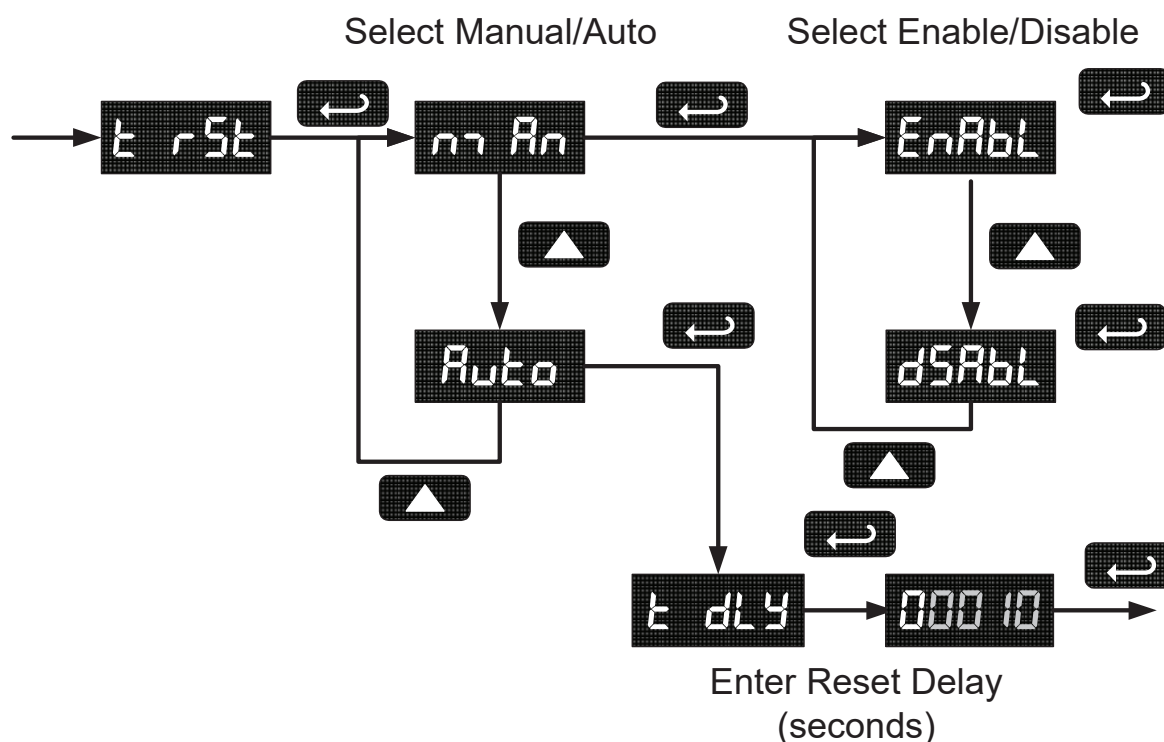
Display Rate or Total Mode (d5PLY)

The meter may be programmed to switch between rate and total with **Enter/Ack** button press, display rate only, display total only, or to automatically toggle between rate and total display every 10 seconds.

- To enable rate or total display toggle by **Enter/Ack** button, choose r-t.

- To display rate only (disable button toggle), choose rAtE.

- To display total only (disable button toggle), choose totAL.

- To automatically toggle between rate and total display every 10 seconds, choose toGLE. Pressing **Enter/Ack** button will also toggle the display.

Press the **Enter/Ack** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

Programming the Meter (ProG)
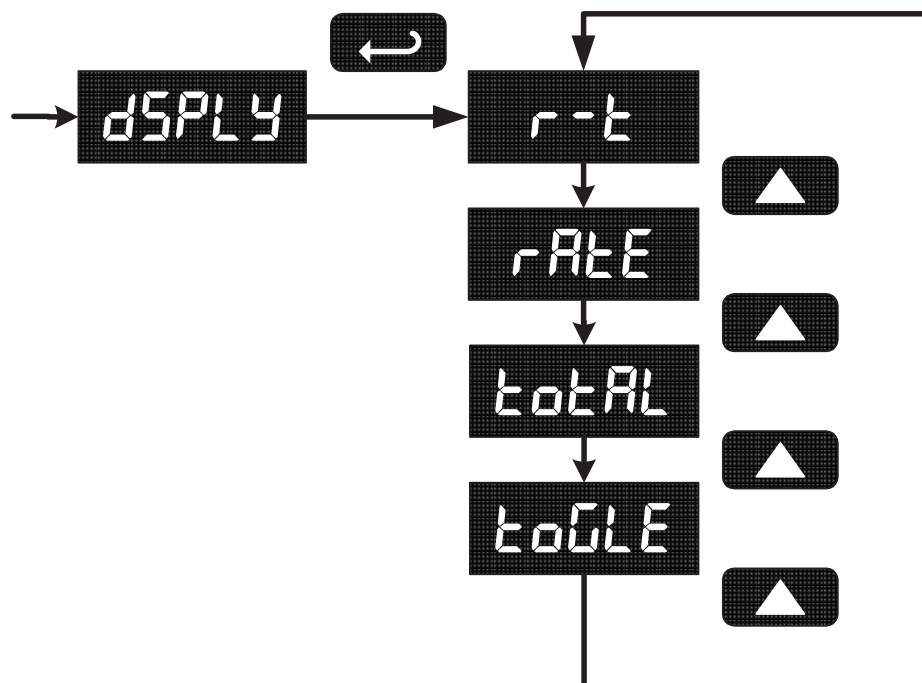
It is **very important** to read the following information, before proceeding to program the meter:

- There is **no need to recalibrate** the meter for milliamps when first received from the factory.

- The meter is **factory calibrated** for milliamps prior to shipment. The calibration equipment is traceable to NIST standards.

- Use the *Scale* menu to enter scale parameters without applying a live signal.

- Alternatively, use the *Calibrate* menu to apply a signal from a calibrator or a 4-20 mA transmitter to calibrate the meter.

The *Program* menu contains the *Calibrate* and the *Scale* menus.

Inputs may be calibrated or scaled to any display within the range of the meter.
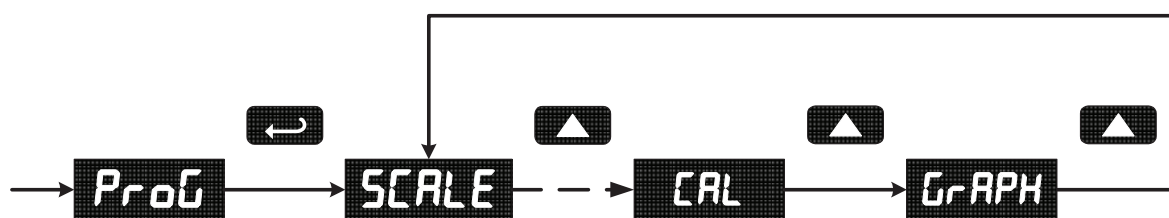
Additional parameters, not needed for most applications, are programmed with the *Advanced* features menu, see Advanced Features Menu, page 31.

Error Message (Error)

An error message indicates that the calibration or scaling process was not successful.

After the error message is displayed, the meter reverts to input 1, allowing the appropriate input signals to be applied.

The error message might be caused by one of the following conditions:

1. Minimum input span requirements not maintained.
2. Input 1 signal inadvertently applied to calibrate input 2.

Minimum Input Span

The minimum input span is the minimum difference between input 1 and input 2 signals required to complete the calibration or scaling of the meter. The minimum span is 0.40 mA.

Scaling the Meter (SCALE)

The 4-20 mA input can be scaled to display the process in engineering units.

A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.

SCALE	Press Enter to Accept Setting	⏎
	Press Up to Set Digit Value	▲
inPt 1	Press Right to Select Next Digit	▶
	Press Menu to Exit at any Time	⟲

04.000 → **dSPL 1** → **0.0000** → **inPt2**

Set Input 1
Value

Set Display 1
Value
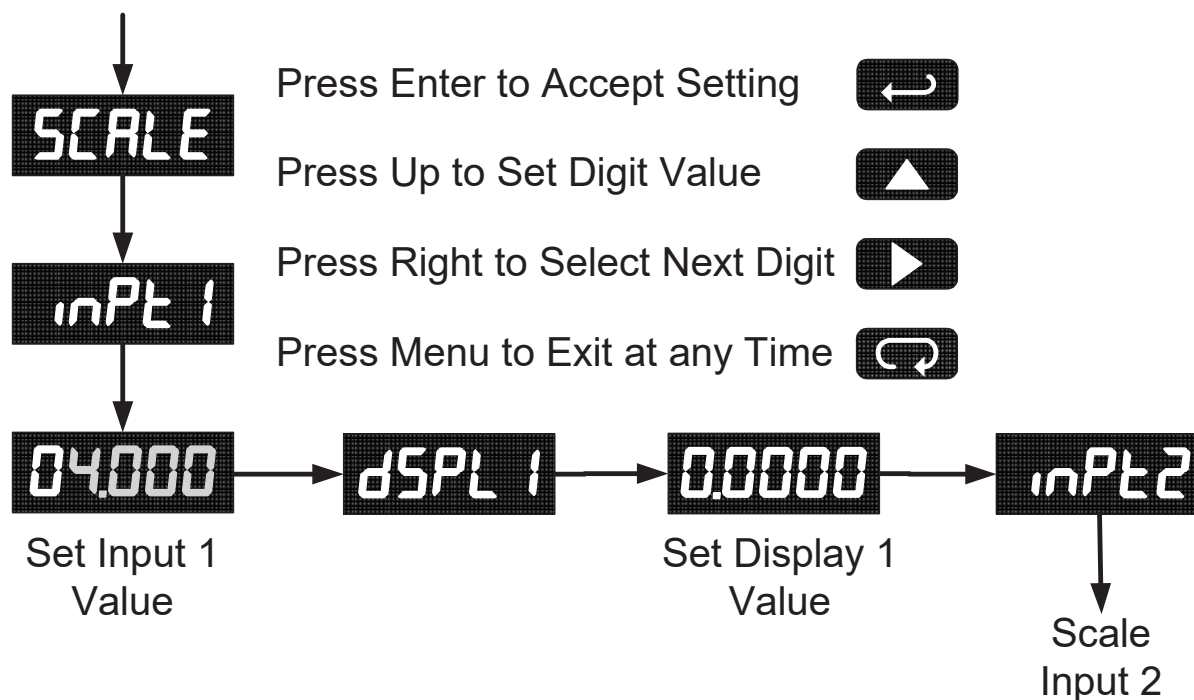
Scale
Input 2

For instructions on how to program numeric values see *Setting Numeric Values*, page 18.

Calibrating the Meter (CAL)

> To scale the meter without a signal source, refer to Scaling the Meter (SCALE), page 26.

The meter can be calibrated to display the process in engineering units by applying the appropriate input signal and following the calibration procedure.

The use of a calibrated signal source is strongly recommended.

Press Enter to Accept Setting ⏎

Press Up to Set Digit Value ▲

Press Right to Select Next Digit ▶

Press Menu to Exit at any Time 🔁

CAL

inPt 1 → dSPL 1 → 04.000 → inPt2

Display Flashes Accepting Input

Set Display 1 Value

Calibrate Input 2
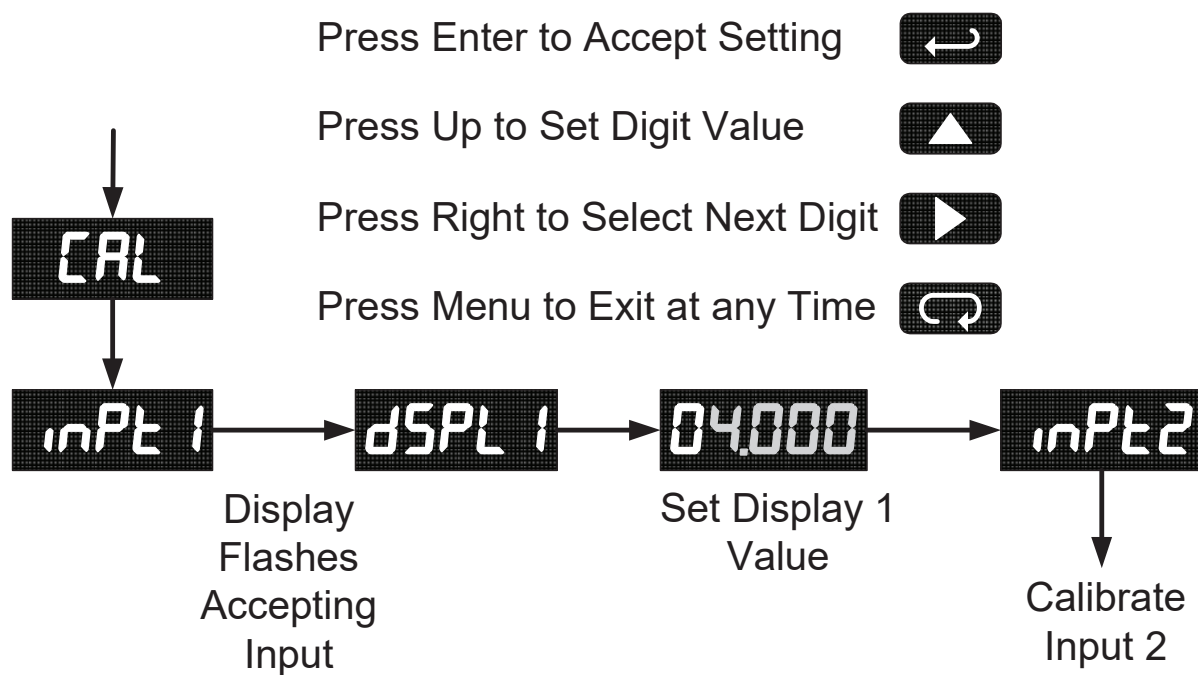
Recalibrating the Internal Calibration Reference (ICAL)

The *Internal Calibration* (ICAL) menu, located in the *Advanced* features menu, is used to recalibrate the internal calibration reference. Recalibration is recommended at least every twelve months.

Refer to Internal Calibration (ICal), page 37 for instructions.

Setting Up the Bargraph (GrAPH)

The meter can be set to display a bargraph proportional to the percentage process reading within a user-defined span.

The span is determined by values entered for 0% and 100%.
If the 0% and 100% values are the same as the values that were entered for display 1 and display 2, respectively, from the scale or calibrate steps, then it is not necessary to modify them.

The bargraph may be disabled by selecting *OFF* from the bargraph menu.

Set 0% Value	Press Up to Set Digit Value
	Press Right to Select Next Digit
	Press Menu to Exit at any Time
Set 100% Value	

Run Mode
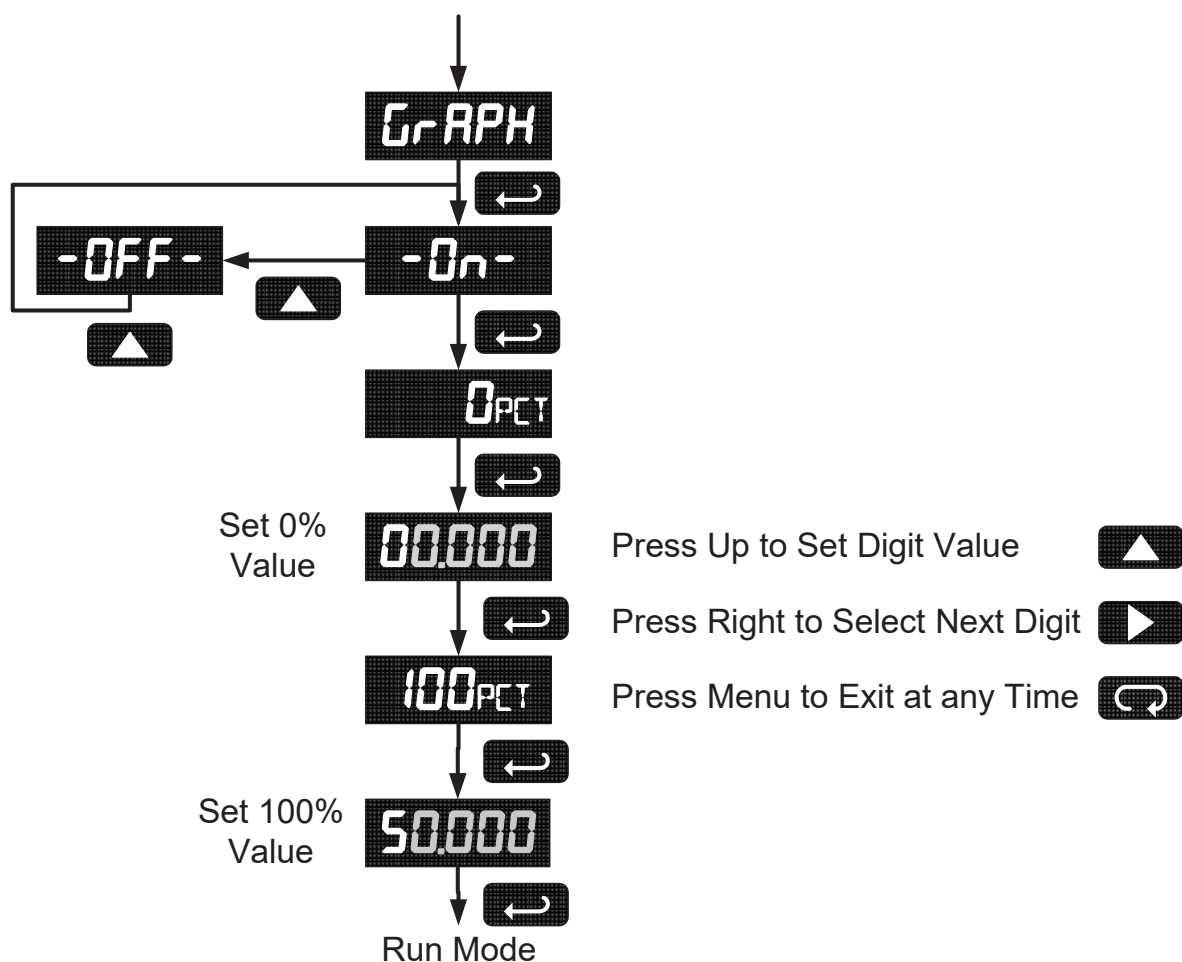
Setting Up the Password (*PASS*)

The *Password* menu is used to program a five-digit password to prevent unauthorized changes to the programmed parameter settings.

Locking the Meter

Enter the *Password* menu and program a five-digit password.

For instructions on how to program numeric values see *Setting Numeric Values*, page 18.

Run Mode

```
→ PASS   ⮐ →  unLoc   ⮐ →  00000   ⮐ →  Locd
```

Program
Password
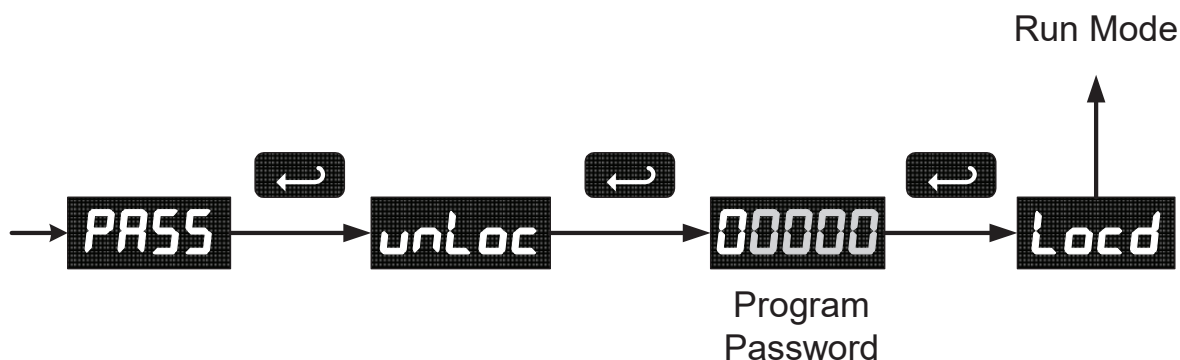
Record the password for future reference. If appropriate, it may be recorded in the space provided.

Model:	
Serial Number:	
Password:	__ __ __ __ __

Unlocking the Meter

If the meter is password protected, the correct password must be entered in order to make changes to the parameter settings.

Run Mode

PASS → Locd → 00000 → unLoc
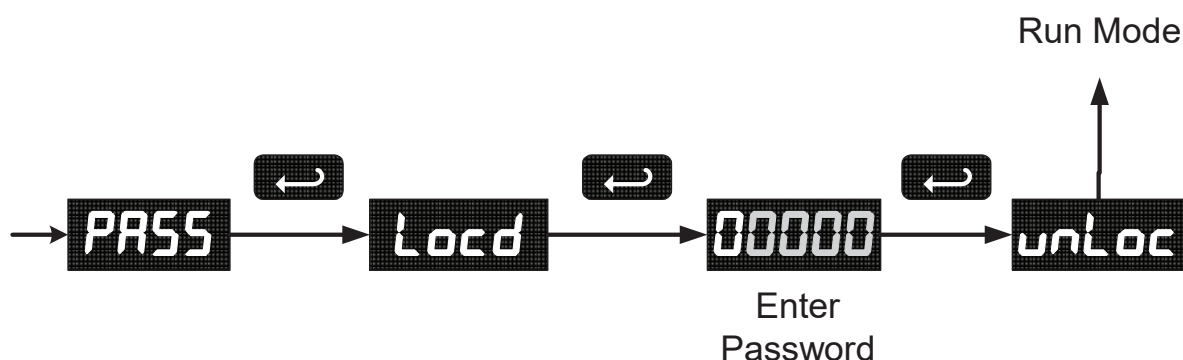
Enter
Password

Entering the correct five-digit number sets the password to 00000, disabling the protection. The meter remains unlocked until a new password is programmed or the former password is re-programmed using the *Password* menu.

Changes to the programmed parameter settings are allowed only with the password set to 00000.

If the password entered is incorrect, the meter displays *Locd* (Locked) for about three seconds, then it returns to Run Mode. To try again, press **Enter/Ack** while the *Locked* message is displayed.

Forgot the Password?

The password may be disabled by the following procedure:

1. Note rate reading prior to pressing the Menu button. Ignore decimal point and sign.

2. Access the *Password* menu, add 2 to the noted reading and enter that number as the password (e.g. display reading = -1.23, password = 00125).

    OR

3. If rate display is not available, enter 01179.

Advanced Features Menu

To simplify the setup process, functions not needed for most applications are located in the *Advanced* features menu.

Press and hold the **Menu** button for five **seconds** to access the Advanced Features of the meter.

Run Mode

`9.2846` GPS

⟳ Press and hold for five seconds

`out`

`Funct`

Press **Enter/Ack** to Access
Menu or to Accept Setting   ↵

Press **Up** to Scroll Menu and
to Increment Digit Value   ▲

`contr`

Press **Right** to Select Next Digit   ▶

Press **Menu** to Exit at any Time   ⟳

`FLtEr` → `bYPAS` → `trEnd` → `1 CAL` → `inFo`

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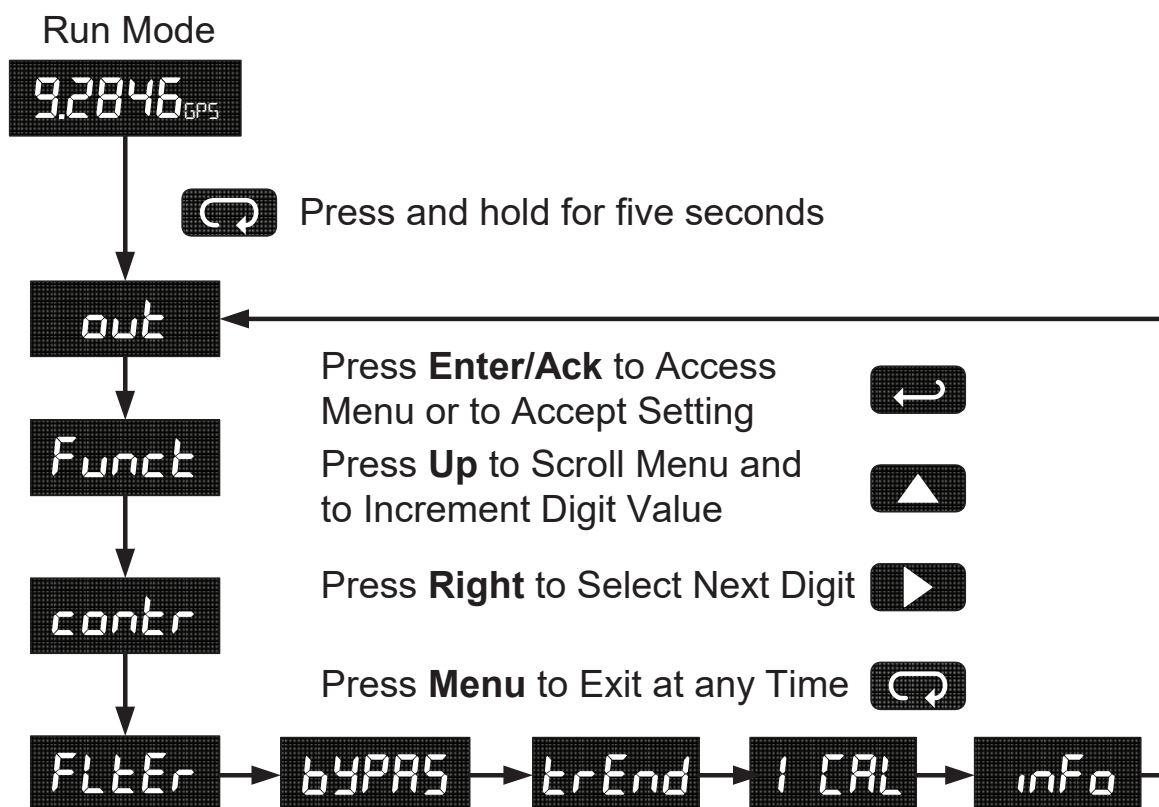
Advanced Features Menu & Display Messages

The following table shows the *Advanced* features menu functions and messages in the order they appear in the menu.

Display	Parameter	Action/Setting
Out	*Output*	Enter output menu
OFF	*Off*	Disable output
ALrm	*Alarm Output*	Enter alarm output menu
rAtE	*Rate Alarm*	Assign alarm output to rate
totAL	*Total*	Assign alarm output to total
SEt	*Set Point*	Program set point
rESEt	*Reset Point*	Program reset point
PuLSE	*Pulse Output*	Program pulse output K-factor
FrE9	*Frequency*	Program pulse output frequency
Funct	*Function*	Enter function menu
LnEAr	*Linear*	Set linear scaling
S9uAr	*Square Root*	Set square root extraction
ProGE	*Programmable Exponent*	Set programmable exponent
cutoF	*Low-Flow Cutoff*	Set low-flow cutoff
contr	*Contrast*	Enter contrast adjustment menu
FLtEr	*Filter*	Set noise filter value
bYPAS	*Bypass*	Set filter bypass value
trEnd	*Trend Arrows*	Enable or disable trend arrows
-On-	*On*	Enable trend arrow display
-OFF-	*Off*	Disable trend arrow display
iCAL	*Internal Calibration*	Enter internal reference calibration
InFo	*Meter Information*	Show software number and version, or reset to factory defaults
rESEt	*Reset Defaults*	Restore factory default parameter settings

> For instructions on how to program numeric values see *Setting Numeric Values,* page 18.

Noise Filter (FLtEr)

Most applications do not require changing this parameter. It is intended to help attain a steady display with an unsteady (noisy) input signal.

The field selectable noise filter averages any minor or quick changes in the input signal and displays the reading with greater stability.

Increasing the filter value will help stabilize the display, however this will reduce the display response to changes on the input signal.

The filter level may be set anywhere from 1 to 199.

Noise Filter Bypass (bYPAS)

The meter can be programmed to filter small input changes, but allow larger input changes to be displayed immediately, by setting the bypass value accordingly.

If the input signal goes beyond the bypass value, it will be displayed immediately with no averaging done on it.

The noise filter bypass value may be set anywhere from 0.2 to 99.9. It corresponds to percentage of full scale.

Increasing the bypass value may slow down the display response to changes on the input signal.

Contrast (contr)

LCD contrast is adjustable through the front panel buttons. Select contr and increase level using **Up Arrow/Max** button. Settings 1 through 9 will be displayed on the screen as 11111 to 99999. Settings 1 through 4 are usually best when viewing from below the angle perpendicular to the display. Settings 5 through 9 are usually best when viewing straight on (meter is at eye level) or when viewing from above.

Alarm & Pulse Output (out)

The PD684 & PD689 are equipped with an NPN open collector output that may be set up for high or low rate alarm trip point, total alarm trip point, or pulse output based on K-factor. The pulse output frequency may be programmed for 2, 4, 8, 16, 32, 64, or 128 Hz.

The output may be disabled by selecting -oFF-. The alarm status will show on the display even if the output is not wired.

Select Alarm/Pulse   Select Rate/Total

Enter K-Factor
to generate one pulse out
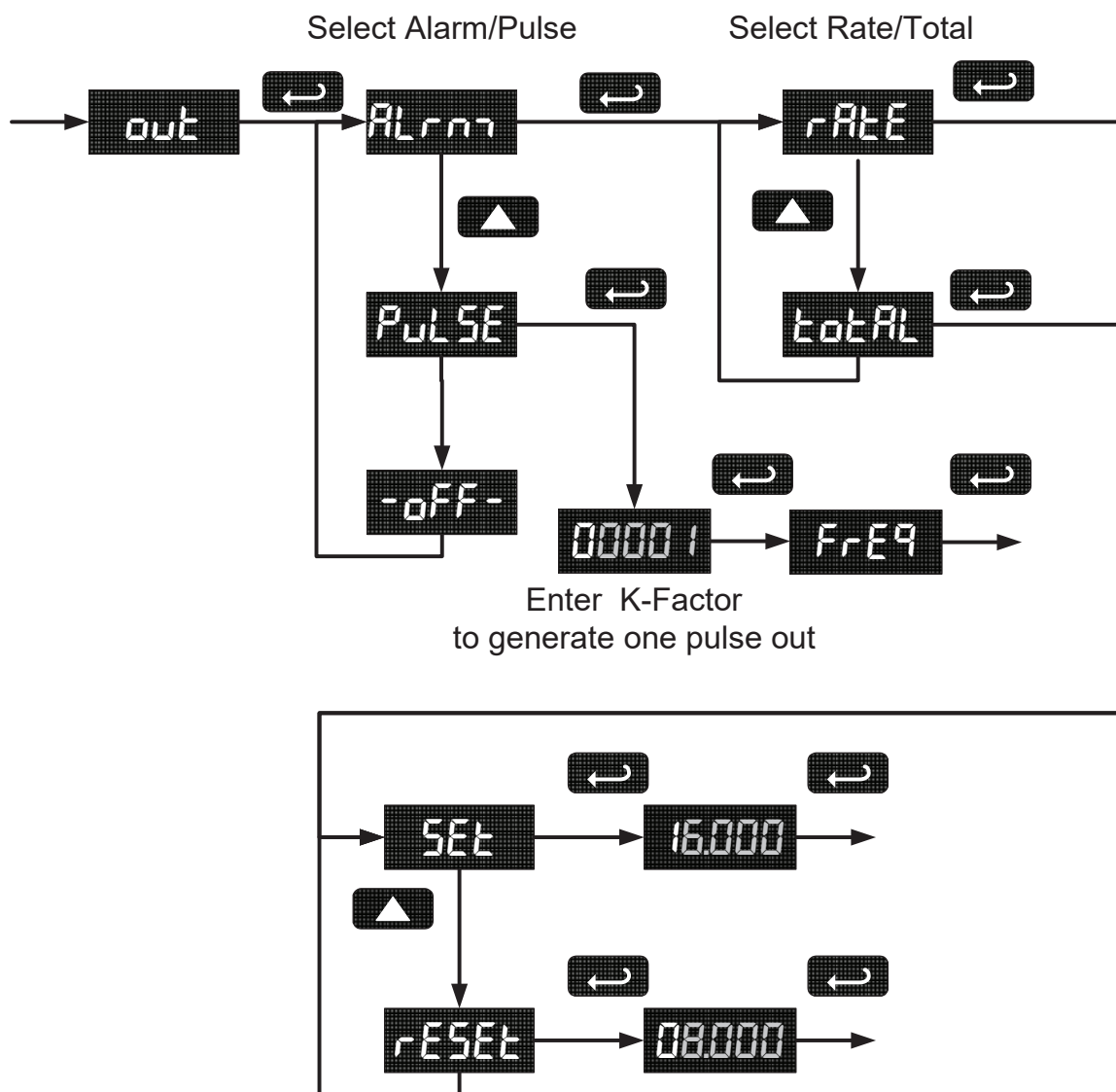
Alarm Output (ﾄLﾄｦｱ)

- **Rate high alarm trip point:** program set point above reset point.

- **Rate low alarm trip point:** program set point below reset point.

- Rate alarm deadband is determined by the difference between set and reset points. Minimum deadband is one display count. If set and reset points are programmed the same, output will reset one count below set point.

- **Total alarm trip point:** program total set point. Alarm reset is triggered by total reset (There is no reset parameter entered for total). If automatic total reset is enabled, this setting will be the trigger point for the timer. *It is not necessary to have the output wired for automatic reset function to work.*

To acknowledge rate or total alarm, press and hold **Enter/Ack** button for two seconds.

Pulse Output K-Factor (PuLSE)

The pulse output K-factor corresponds to the total units (e.g. gallons) needed to generate one pulse. For example, if the K-factor value is set to 10, one pulse is generated for every 10 counts incremented on the display. Likewise, if the K-factor value is set to 100, one pulse is generated for every 100 counts incremented on the display.

If the pulse output exceeds the programmed output frequency, pulses are accumulated as pending and are not lost. Pulses will continue to output until the buffer is emptied or the total is reset from the front panel.

Enter K-Factor
to generate one pulse

Select Frequency
2 - 4 - 8 - 16 - 32 - 64 - 128
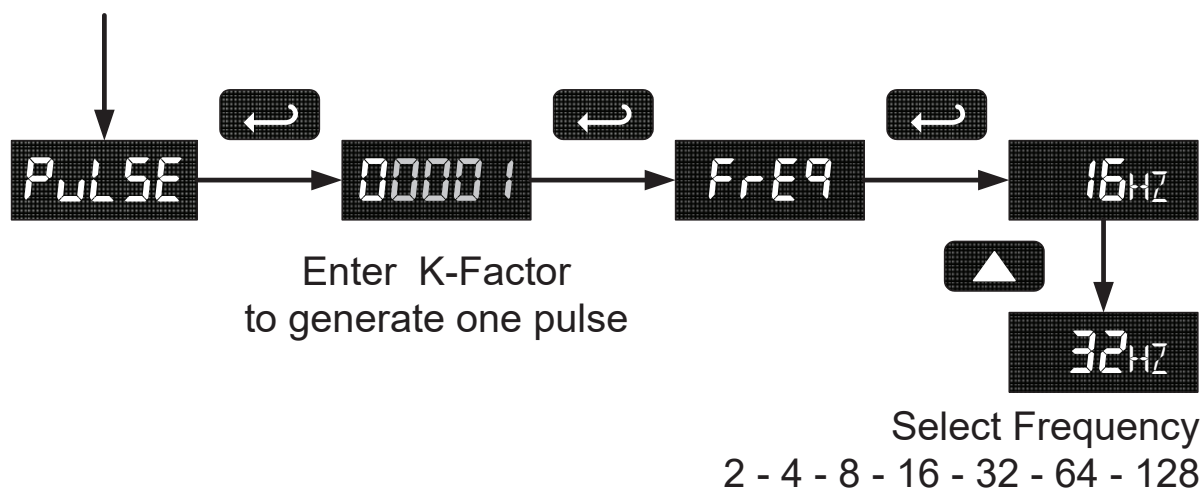
Math Functions (LnERr, SQuRr, ProGE, CutoF)

The PD684/PD689 provides a number of functions to condition outputs from linear and non-linear transmitters.
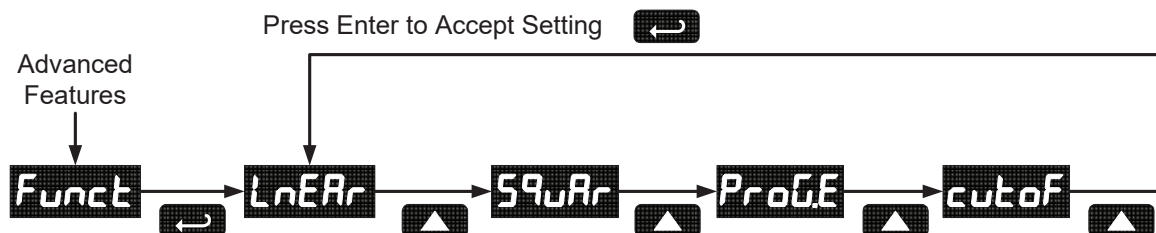
Linear (LnERr)

Meters are set up at the factory for linear function. The linear function provides a display that is linear with respect to the input signal.

Square Root (SQuRr)

The square root function is used to linearize the signal from a differential pressure transmitter and display flow rate in engineering units.

Programmable Exponent (ProGE)

The programmable exponent function is used to linearize the level signal in applications using weirs and flumes and display flow rate in engineering units. Upon selecting programmable exponent (ProGE), the meter prompts entry of a 5-digit value between 0.5000 and 3.0000 as the exponent.

Low-Flow Cutoff (CutoF)

The low-flow cutoff feature allows the meter to be programmed so that the often-unsteady output from a differential pressure transmitter, at low flow rates, always displays zero on the meter. The default cutoff is zero to prevent negative readings, but this may be overridden to allow them.

The cutoff value may be programmed from -99999 to 99999. Below the cutoff value, the meter will display zero. Selecting either square root or programmable exponent will set the cutoff value to 0. Program the cutoff value to -99999 to disable.

Internal Calibration (ICAL)

> - There is **no need to recalibrate** the meter for milliamps when first received from the factory.
> - The meter is *factory calibrated* for milliamps prior to shipment. The calibration equipment is traceable to NIST standards.

The internal calibration allows the user to scale the meter without applying a signal. The use of a calibrated signal source is necessary to perform the internal calibration of the meter. Check calibration of the meter at least every 12 months.

> Notes:
> - The signal source must have a full-scale accuracy of 0.01% or better between 4 and 20 mA in order to maintain the specified accuracy of the PD689.
> - Allow the meter to warm up for at least 15 minutes before performing the internal calibration procedure.

The *Internal calibration* menu is part of the *Advanced* features menu.

1. Press and hold the **Menu** button for five **seconds** to access the *Advanced Features* of the meter.
2. Press the **Up** arrow button to scroll to the *Internal calibration* menu (ICAL) and press **Enter/Ack**.
3. The meter displays 4.000 mA. Apply a 4.000 mA signal and press **Enter/Ack**. The display shows both trend arrows for a moment while the meter is accepting the signal.
4. After the signal is accepted, the meter displays 8.000 mA. Apply an 8.000 mA signal and press **Enter/Ack**. The display shows both trend arrows for a moment while the meter is accepting the signal.
5. Continue, as in the previous step, for the remaining signals: 12.000 mA, 16.000 mA, and 20.000 mA.

Error Message (Error)

An error message indicates that the calibration or scaling process was not successful. After the error message is displayed, the meter reverts to the previous signal prompt, allowing the appropriate input signal to be applied. The error message might be caused by inadvertently leaving the signal at the previous level.

Information Menu (ɪn‍Fο)

The *Information* menu is located in the *Advanced* features menu, to access *Information* menu see Advanced Features Menu, page 31.

It shows software and version number. To determine the software version of a meter:

1. Go to the *Information* menu (ɪn‍Fο) and press **Enter/Ack** button. The number shown is the software number.
2. Press **Enter/Ack** again to display the release version.

OPERATION

Front Panel Buttons Operation

Button Symbol	Description
↻	Press to enter or exit Programming Mode, view settings, or exit Max/Min readings
▶	Press to reset total (if enabled) Press to reset Max/Min readings
▲	Press to display Max/Min readings alternately
↵	Press to toggle between rate and total display (if enabled) Press and hold 2 seconds to acknowledge alarm Press to display Max/Min reading indefinitely while displaying Max/Min

Rate or Total Display Readings

During operation, the front panel buttons control toggling of rate and total display, total reset, and alarm acknowledge. Depending on setup, some displays and functions may not be allowed.

The corresponding programmed rate and total engineering units are displayed to differentiate between the two. (Default includes R & T)

Total

Hold 2 Sec

Rate

3 Sec Time Out
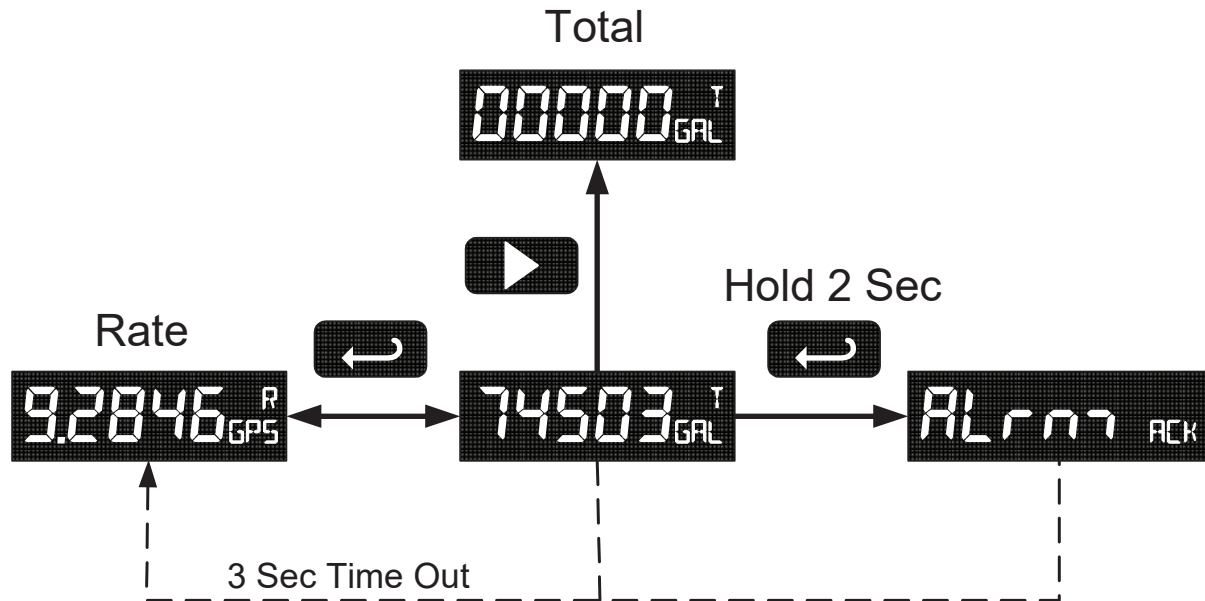
Press **Enter** to Toggle Rate/Total
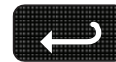
Hold **Enter** 2 Sec to Ack Alarm

Press **Right** to Reset Total

Press **Menu** to Enter Setup Menu

Press **Up** to Enter Max & Min Menu

1. Press **Enter/Ack** to switch between displaying rate and total (if enabled).
2. Press and hold **Enter/Ack** 2 seconds to acknowledge alarm output.
3. Press **Right** to reset total (if enabled).
4. Press **Menu** to enter the setup menu.
5. Press and hold **Menu** 5 seconds to enter *Advanced* menu.
6. Press **Up/Max** to enter Max/Min menu.

Maximum & Minimum Readings (MAX & MIN)

The maximum and minimum (peak & valley) readings reached by the process are stored in the meter since the last reset or power-up. The meter shows MIN or MAX to differentiate between run mode and max/min display.

Run Mode

9.2846 GPS → 9.5320 MAX → 6.1391 MIN

10 Sec Time Out

Press **Up** to Display and to Toggle Between Max & Min
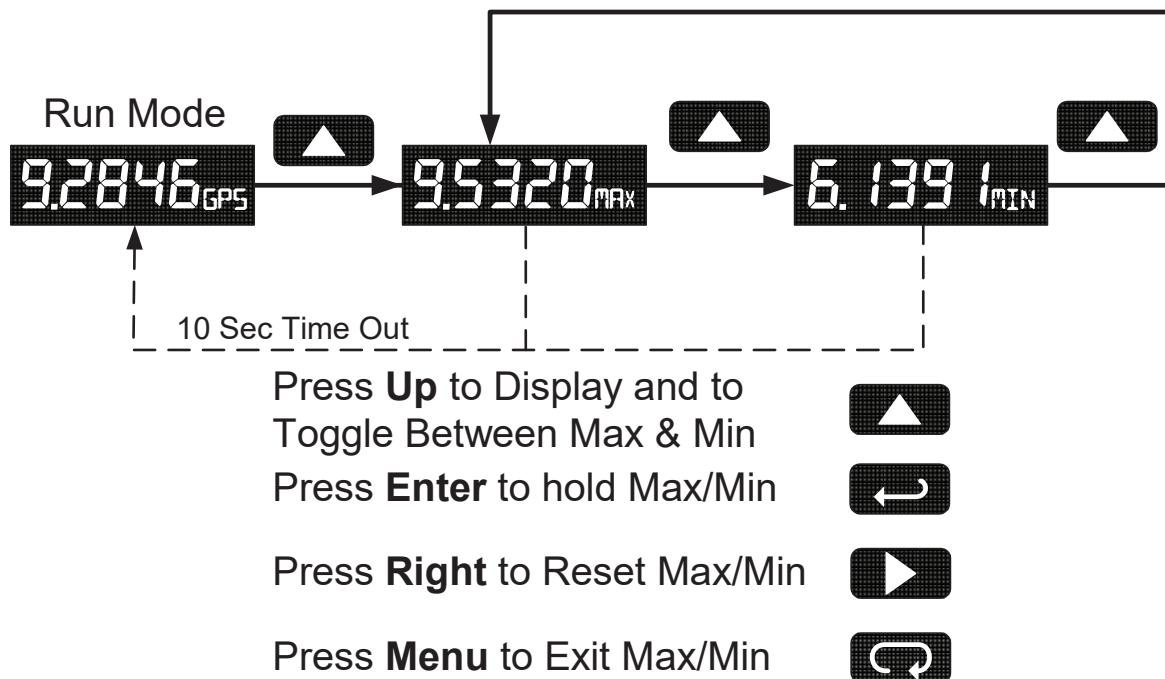
Press **Enter** to hold Max/Min

Press **Right** to Reset Max/Min

Press **Menu** to Exit Max/Min

7.   Press **Up**/**Max** button to display maximum rate since the last reset/power-up.

8.   Press **Up**/**Max** again to display the minimum rate since the last reset/power-up.

9.   Press **Enter/Ack** to hold Max/Min display reading, the meter will continue to track new Max/Min readings.

10. If **Enter/Ack** is not pressed, the Max/Min display reading will time out after ten seconds and the meter will return to display the actual reading.

11. Press **Right/Reset** button to reset Max/Min while reading is being displayed. Max/Min display readings are reset to actual reading.

12. Press **Menu** to return to Rate or Total display (run mode).

MOUNTING DIMENSIONS

1.76"
(45mm)

2.45"
(62mm)

0.59"
(15mm)

3.2"
(81mm)
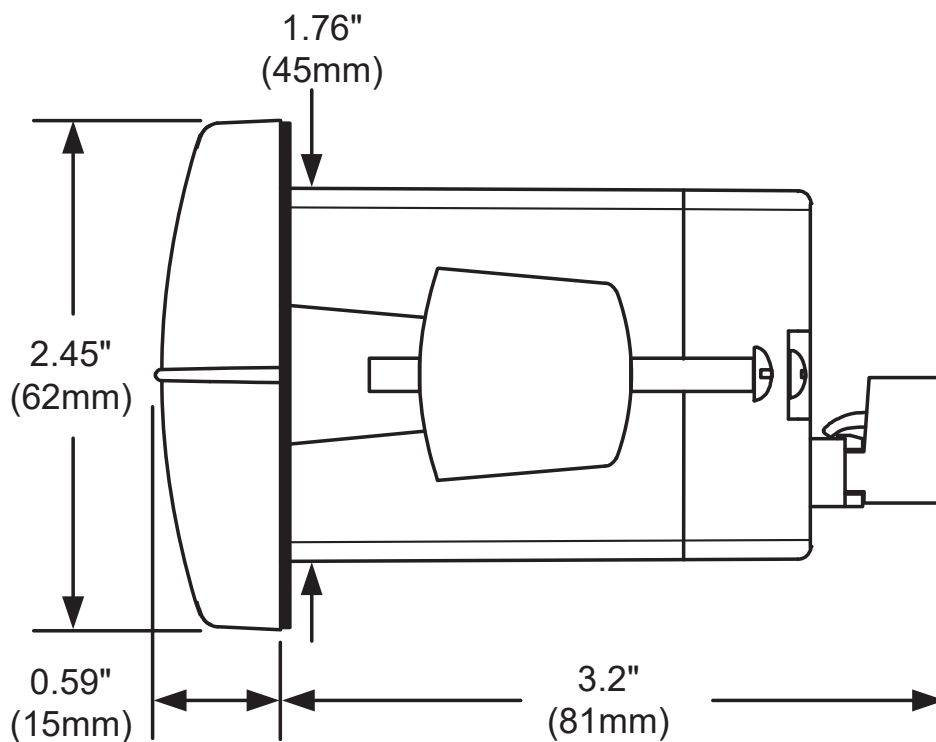
Figure 7. Meter Dimensions – Side View

2.50"
(64mm)

3.61"
(92mm)

4.68"
(119mm)
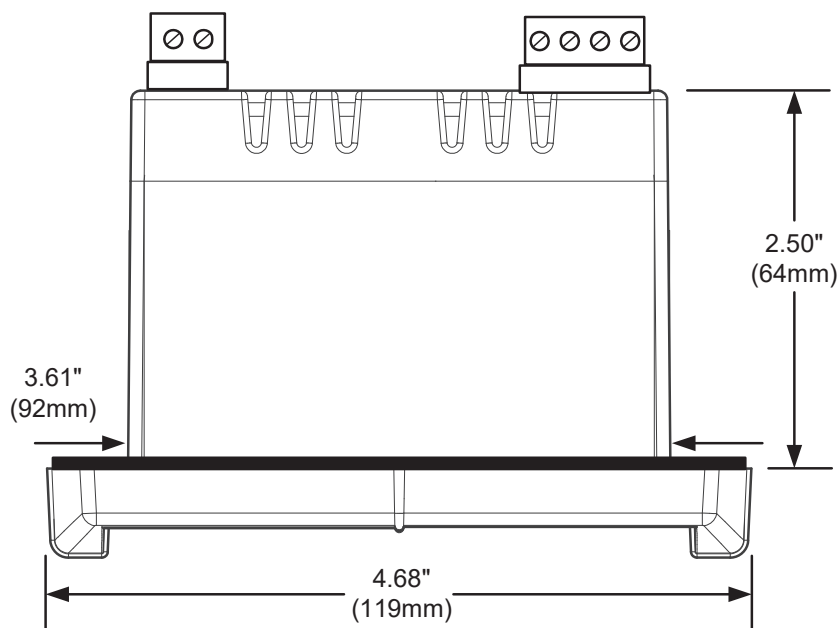
Figure 8. Case Dimensions – Top View

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Reset Meter to Factory Defaults

When the parameters have been changed in a way that is difficult to determine what's happening, it might be better to start the setup process from the factory defaults.

Instructions to load factory defaults:

1. Enter the *Advanced* features menu. See Advanced Features Menu, page 31.

2. Press **Up** arrow until ɪnFo is shown.

3. Press and hold **Right** arrow/Reset for five seconds, press **Enter/Ack** when display flashes rESEt.
   Note: If **Enter/Ack** is not pressed within three seconds, display returns to *Information* menu.

4. The meter goes through an initialization sequence (same as on power-up), and loads the factory default settings.

Press and Hold for 5 Sec

Flashing Display

ɪnFo → **rESEt** → Meter Re-Initializes

Press and Hold for 3 Sec
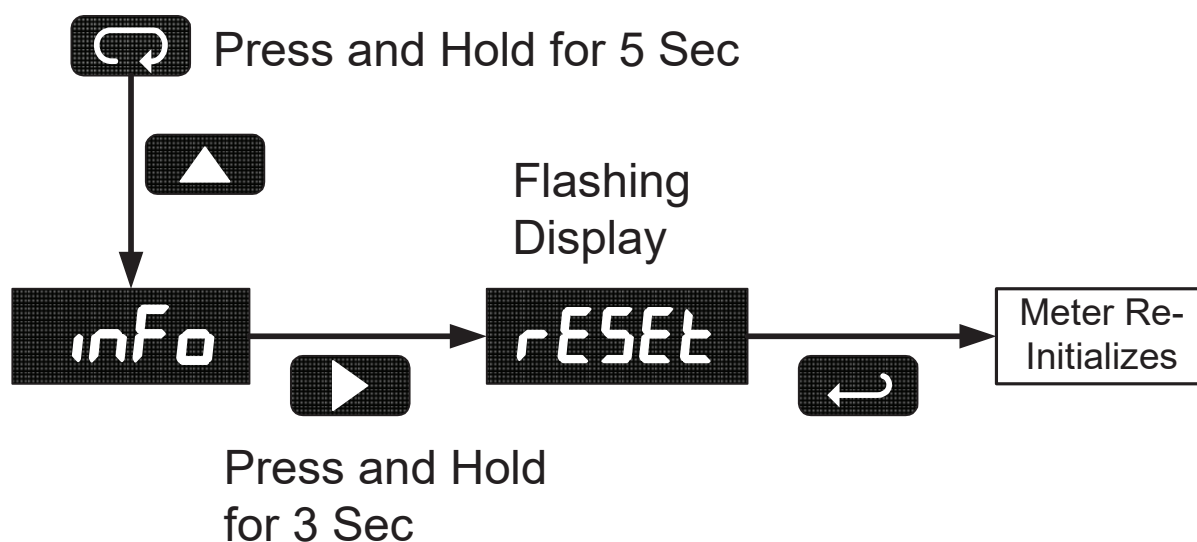
Factory Defaults & User Settings

The following table shows the factory setting for most of the programmable parameters on the meter. Next to the factory setting, the user may record the new setting for the particular application.

Model: _____   S/N: _____   Date: _____

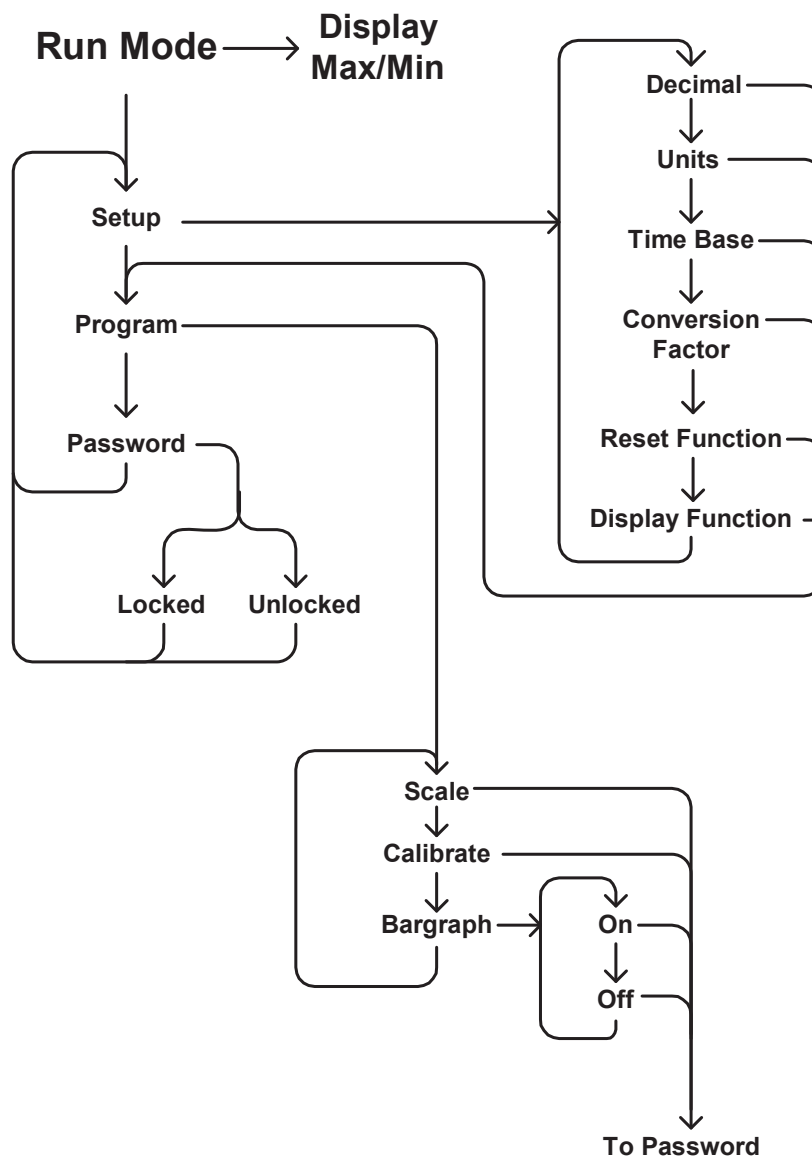| Parameter	Display	Default Setting	User Setting
Programming	ProG	Scale	
Input 1	inPt 1	4.000 mA	
Display 1	dSPL 1	4.000	
Input 2	inPt2	20.00 mA	
Display 2	dSPL2	20.000	
Decimal point rate	dd.ddd	3 places	
Decimal point total	dd.ddd	none	
Units	un itS	mA – R, mA – T	
Time Base	t.bASE	Minute	
Conversion Factor	tot.CF	1.0000	
Total Reset Function	t rSt	Manual - Enabled	
Display	dSPLY	Rate or Total (r -t)	
Bargraph	GrAPH	On (enabled)	
Bargraph 0%	0 PCT	4.000	
Bargraph 100%	100 PCT	20.000	
Password	PASS	00000 (unlocked)	
Advanced Features			
Output	Out	Off	
Function	Funct	Linear	
Contrast	contr	5 (55555)	
Cutoff	cutoFF	0 (no negative rate)	
Filter	FLtEr	1	
Bypass	bYPAS	0.2	
Trend Arrows	trEnd	On (enabled)	

TROUBLESHOOTING

The rugged design and the user-friendly interface of the meter should make it unusual for the installer or operator to refer to this section of the manual.

If the meter is not working as expected, refer to the recommendations below.

Troubleshooting Tips

Symptom	Check/Action
No display or faint display	1. Check connections. 2. Increase contrast setting in *Advanced* menu. 3. Perform hard reset by temporarily shorting S+ and S- terminals for a few seconds.
Rate display unsteady	Increase filter setting in *Advanced* menu.
Not able to change setup or programming, *Locd* is displayed	Meter is locked, enter correct five-digit password to unlock
Meter displays error message during calibration (*Error*)	Check: 1. Signal connections 2. Minimum input span requirements
Meter displays • *99999* • *-99999*	Check: 1. Input signal within range. 2. When using square root or programmable exponent, cutoff must be 0 or greater.
Display stuck showing a number and *MAX* or *MIN*	Press **Menu** to exit Max/Min display readings.
Display response is too slow	Check filter and bypass values to see if they can be lowered.
If the display locks up or the meter does not respond at all	Perform hard reset by temporarily shorting S+ and S- terminals for a few seconds and then removing short.
Display shows blurry, hard-to-read digits in below freezing temperatures (less than -18°C or 0°F).	Increase the filter setting to 10 or greater and the bypass setting to 50 or greater. This will slow the display response rate, but digits will be steady and appear more clearly.
Other symptoms not described above	Call Technical Support for assistance.

QUICK USER INTERFACE REFERENCE GUIDE

Run Mode → Display Max/Min

Setup

Program

Password

Locked   Unlocked

Decimal

Units

Time Base

Conversion Factor

Reset Function

Display Function

Scale

Calibrate

Bargraph → On

Off

To Password

Pushbutton	Function
Menu	Go to Programming Mode or leave Programming, Advanced Features, and Max/Min Modes.
Right Arrow	Move to next digit or decimal point position. Reset Total.
Up Arrow	Move to next selection or increment digit. Go to Max/Min Mode.
Enter/Ack	Accept selection/value and move to next selection. Toggle Rate/Total.
	Hold to Acknowledge Alarm.

Menu held for 5 seconds enters Advanced Features

Max/Min Mode
While in Run Mode, pressing **Up** Arrow will initiate Max/Min Mode. **Up** Arrow toggles between Max & Min displays, and **Right** Arrow resets the Max/Min to the current value. Press **Menu** or wait 10 seconds to return to Run Mode. Pressing **Enter/Ack** will disable the 10 second timeout and continuously display Max or Min.

Press & hold **Menu** for 5 seconds to access Advanced Features Menu

When a password is enabled, parameter settings are locked, but scale settings can be displayed by selecting the program menu.

Operational Modes
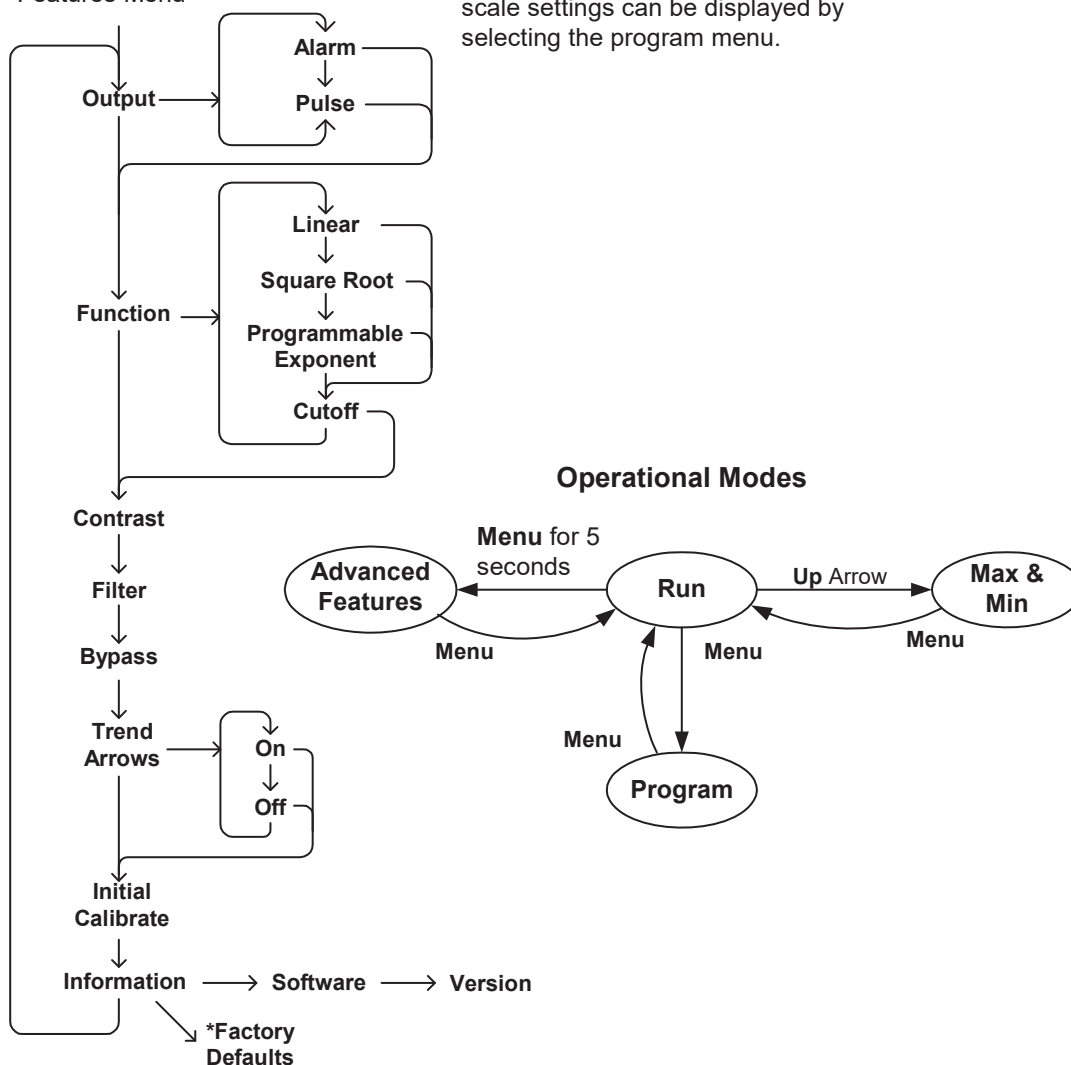
*Access by holding **Right/Reset** for 3 seconds

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EU DECLARATION OF CONFORMITY FOR PD689

Issued in accordance with ISO/IEC 17050-1:2004 and ATEX Directive 2014/34/EU.

We,

Precision Digital Corporation
233 South Street
Hopkinton, MA 01748 USA

as the manufacturer, declare under our sole responsibility that the product(s),

Model PD689 Loop Powered Rate/Totalizer

to which this declaration relates, is in conformity with the European Union Directives shown below:

2014/35/EU   **Low Voltage Directive**
2014/34/EU   **ATEX Directive**
2014/30/EU   **EMC Directive**
2011/65/EU   **RoHS Directive**

This conformity is based on compliance with the application of harmonized or applicable technical standards and, when applicable or required, a European Union notified body certification.

Standards:

EN 60079-0:2006   EN 60079-11:2007   EN 60079-26:2007
EN 61010-1:2001   EN 61326:2006

The standards EN 60079-0:2006, EN 60079-11:2007, EN 60079-26:2007, EN 61010-1:2001, and EN 61326:2006 are no longer harmonized. The requirements of these standards have been checked against the harmonized standard EN 60079-0:2012+A11:2013, EN 60079-11:2012, EN 60079-26:2015, EN 61010-1:2010, and EN 61326:2013 and there were no major technical changes affecting the latest technical knowledge for the products listed above.

EC Type Examination Certificate: FM08ATEX0058X

Product Markings: 〈Ex〉   II 1 G
                                Ex ia IIC T4
                                Tamb = -40°C to +65°C

ATEX Notified Body for EC Type Examination Certificate: FM Approvals Ltd., NB 1725
                                                                1 Windsor Dials
                                                                Windsor, Berkshire, SL4 1RS, UK

ATEX Quality Assurance Notification No.:   SIRA 10 ATEX M462

ATEX Notified Body for Quality Assurance: Sira Certification Service, NB 0518
                                                  Unit 6, Hawarden Industrial Park
                                                  Hawarden, Deeside, CH5 3US, UK

Signed for and on behalf of Precision Digital Corporation:

Name: Jeffrey Peters
Company: Precision Digital Corporation
Title: President
Date: 02/12/2018

PRECISION DIGITAL ÷

Document No: DoC PD689 {021218}

EU DECLARATION OF CONFORMITY FOR PD684

Issued in accordance with ISO/IEC 17050-1:2004.

We,

Precision Digital Corporation
233 South Street
Hopkinton, MA 01748 USA

as the manufacturer, declare under our sole responsibility that the product(s),

Model PD684 Loop Powered Rate/Totalizer

to which this declaration relates, is in conformity with the European Union Directives shown below:

2014/35/EU	**Low Voltage Directive**
2014/30/EU	**EMC Directive**
2011/65/EU	**RoHS Directive**

This conformity is based on compliance with the application of harmonized or applicable technical standards and, when applicable or required, a European Union notified body certification.

Standards:

EN 60079-0:2006
EN 60079-11:2007
EN 60079-26:2007
EN 61010-1:2001
EN 61326:2006

The standards EN 60079-0:2006, EN 60079-11:2007, EN 60079-26:2007, EN 61010-1:2001, and EN 61326:2006 are no longer harmonized. The requirements of these standards have been checked against the harmonized standard EN 60079-0:2012+A11:2013, EN 60079-11:2012, EN 60079-26:2015, EN 61010-1:2010, and EN 61326:2013 and there were no major technical changes affecting the latest technical knowledge for the products listed above.

Product Markings: CE

Signed for and on behalf of Precision Digital Corporation:

Name: Jeffrey Peters
Company: Precision Digital Corporation
Title: President
Date: 04/20/2016

PRECISION DIGITAL

Document No: DoC PD684 {042016}

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