SMRT-PRO EXPLOSION-PROOF PULSE INPUT RATE/TOTALIZER



- Pulse, Open Collector, NPN, PNP, TTL, Switch Contact, Sine Wave (Coil), Square Wave, Opto-Isolated Inputs
- Explosion-Proof, IP68, NEMA 4X Enclosure
- Isolated 4-20 mA Output for Rate, Total, or Grand Total
- 5-Digit 0.7" (17.8 mm)Top Display for Rate or Total
- 7 Alphanumeric Character 0.4" (10.2 mm) Bottom Display for Rate, Total, Grand Total, Units, and Tag
- 13-Digit Totalizer with Total Overflow Feature
- Through-Glass Button Programming
- Battery, DC, or Output Loop-Powered Models
- Two Isolated Open Collector Pulse Outputs, Up to 5 kHz
- Automatic Rate, Total, & Grand Total Unit Conversions
- Gate Function for Rate Display of Slow Pulse Rates
- K-Factor, Scaling, or Live Input Calibration with 32-Point Linearization
- Password Protection
- Backlight Standard on All Models
- Operates from -40 to 75°C
- Data Logging Functions and Modbus® Accessible Data

SIMARK CONTROLS

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Disclaimer

The information contained in this document is subject to change without notice. Simark makes no representations or warranties with respect to the contents hereof; and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose.



CAUTION: Read complete instructions prior to installation and operation of the meter.



WARNING: Risk of electric shock or personal injury.



WARNINGS

- This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at his/her own risk. Simark Controls Ltd shall not be held liable for damages resulting from such improper use.
- Failure to follow installation guidelines could result in death or serious injury. Make sure only qualified personnel perform the installation.
- Never remove the meter cover in explosive environments when the circuit is live.
- Cover must be fully engaged to meet flameproof/explosion-proof requirements.

Limited Warranty

Simark Controls Ltd warrants this product against defects in material or workmanship for the specified period under “Specifications” from the date of shipment from the factory. Simark’s liability under this limited warranty shall not exceed the purchase value, repair, or replacement of the defective unit.

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INTRODUCTION

The SMRT-PRO is a rugged, explosion-proof, pulse input rate/totalizer for demanding applications in hazardous areas or in harsh environments. It can be programmed using the four through-glass buttons, without removing the cover, or with four internal push-buttons. The top numeric display will read rate or total up to five digits and the alphanumeric bottom display will read up to 7 digits,
13 digits with the total overflow feature. The alphanumeric display can also be programmed to show any combination of numbers and letters up to seven characters long for rate, total, grand total, engineering units and/or identification tag. The backlight makes the display more visible in any lighting condition. The enclosure is provided with threaded conduit holes and integrated pipe or wall mounting flanges.

ORDERING INFORMATION

Model	Description
SMRT-PRO-AP0-0	9-30 VDC Powered, Constant Backlight, 2 Pulse Outputs
SMRT-PRO-APA-0	9-30 VDC Powered, Constant Backlight, Isolated 4-20 Output, 2 Pulse Outputs
SMRT-PRO-BM0-0	Battery Powered*, or DC-Powered with Battery Backup, Backlight**, 2 Pulse Outputs
SMRT-PRO-BMA-0	Battery (or 9-30 VDC) Powered*, or DC Powered with Battery Backup, Backlight**, Isolated 4-20 mA Output, 2 Pulse Outputs
SMRT-PRO-BTA-0	Battery Powered*, or DC Powered with Battery Backup, Loop Output Powered Backlight, Isolated 4-20 Output, 2 Pulse Outputs
SMRT-PRO-CTB-0	4-20 mA Output-Powered, Loop-Powered Backlight, Non-Isolated 4-20 mA Output, 2 Pulse Outputs
SMRT-PRO-DTB-0	4-20 mA Output-Powered with Battery Backup, Loop Output Powered Backlight**, Non-Isolated 4-20 mA Output, 2 Pulse Outputs
-M Option	2-wire RS-485 with Modbus protocol.*** Replace ending -0 in part number above with -M (Example: SMRT-PRO-APA-M). Not available on -CTB or -DTB models.
-I Option	Isolated 2-wire RS-485 with Modbus protocol.*** Replace ending -0 in part number above with -I (Example: SMRT-PRO-APA-I). Not available on -CTB or -DTB models.
** When DC-powered, battery will provide backup power when DC power is lost.* *** Backlight is constant when DC powered and momentary when battery powered.* ****Communication disabled when actively powered by battery.*	

Accessories

Model	Description
SMRT-PRO-PLUG	¾" Metal Conduit/Stopping Plug
SMRT-PRO-BAT	3.6 V C Cell Lithium Battery

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SPECIFICATIONS

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

General

DISPLAY	Five Digits Top Display (0 to 99999)	0.7" (17.8 mm) high, 7-segment, automatic lead zero blanking.
	Seven Characters Bottom Display	0.4" (10.2 mm) high, 14-segment, automatic lead zero blanking.
	Symbols	Total, grand total, battery power/low battery, high alarm, low alarm, Through-glass button sleep mode/disable, password lock
DISPLAY ASSIGNMENT	Top Display: Rate or total Bottom Display: Combinations of rate, total, grand total, units, and custom tag	
BACKLIGHT	White LED, 10 second auto-off when battery powered Backlight deactivated below temperatures ≈ -20°C	
ALARM INDICATION	Flashing display plus HI/LO (rate) or SET (total) indicators	
DISPLAY UPDATE RATE	Ambient > -20°C: 1 Update/Second Ambient < -20°C: 1 Update/10 Seconds *Note: Update is dependent on gate settings.*	
OVERRANGE	Display flashes 99999	
PROGRAMMING METHODS	Four through-glass buttons when cover is installed. Four internal pushbuttons when cover is removed.	
RECALIBRATION	All ranges are calibrated at the factory to read frequency in Hz. No recalibration required.	
MAX/MIN DISPLAY	Max/Min readings reached by the process are stored until reset by the user or until power to the meter is cycled.	
PASSWORD MENU OPTIONS	Three programmable password selections can be used for the following: restrict modification of settings, prevent resetting the total or grand total without the password, or permanently lock out the ability to change or reset the grand total or any grand total related settings (making a non-resettable grand total). Pass: Restricts modifications of programmed settings to require re-entering the password to make changes. Pass T: Restricts the reset of total to require re-entering the password. Disables the manual mode reset contact. Pass GT: Restricts the reset of grand total to Require re-entering the password. May enable a non-resettable grand total and permanent lockout of grand total-related settings with a specific password.	

POWER OPTIONS	9-30 VDC Powered, 2.2 W max		
	4-20 mA Output Powered, 30 VDC max		
	Battery Power		
	9-30 VDC Powered with Battery Backup		
	4-20 mA Output Powered with Battery Backup		
BATTERY	3.6 V Primary Lithium (Li-$SOCl_2$), non-rechargeable Model SMRT-PRO-BAT		
	Expected Service Life & Recommended Replacement Interval		
	Operating Condition	Estimated Service Life	Suggested Replacement Interval
	Open collector outputs off, Through-glass buttons off, minimal backlight use	7.5 years	5.5 years
	<100 Hz open collector outputs, minimal Through-glass button or backlight use	5.5 years	4 years
	<2 kHz open collector outputs, minimal Through-glass button or backlight use	2.5 years	2 years
	<5 kHz open collector outputs, minimal Through-glass button or backlight use	1.3 years	1 year
	Backup power only	N/A	10 years
DATA LOGGING	Up to 1024 records, recorded 4/day at specific times or at defined time intervals. Record contains date, time, rate, total, grand total, and log number.		
ISOLATION	All Models:	500 V opto-isolated input-to-power/output with isolated input enabled	
	SMRT-PRO-BTA:	500 V input-to-output	
	SMRT-PRO-APA:	500 V input/power-to-output *Note: Requires separate output supply*	
ENVIRONMENTAL	Operating temperature range: -40 to 75°C Storage temperature range: -40 to 75°C Backlight deactivated below temperatures ≈ -20°C Relative humidity: 0 to 90% non-condensing		

NON-VOLATILE MEMORY	All programmed settings and total reading are stored in non-volatile memory for a minimum of ten years if power is lost.
CONNECTIONS	Screw terminals accept 12 to 22 AWG wire
ENCLOSURE	Explosion-proof die-cast aluminum with glass window, corrosion resistant epoxy coating, color: blue. NEMA 4X, 7, & 9, IP68. Copper-free (0.3%). Default conduit connections: Three ¾" NPT threaded conduit openings. One ¾" NPT metal plug with 12 mm hex key fitting installed. Additional conduit opening configurations and plugs may be available; verify quantity and sizes on specific device labeling during installation.
MOUNTING	May be mounted directly to conduit. Two slotted flanges for wall mounting or NPS 1½" to 2½" or DN 40 to 65 mm pipe mounting. See Mounting Dimensions on page 96.
OVERALL DIMENSIONS	5.67" x 5.24" x 4.88" (W x H x D) (144 mm x 133 mm x 124 mm)
WEIGHT	5.00 lbs (80 oz, 2.27 kg)
WARRANTY	3 years parts and labor

Rate Input

PULSE/ TRANSISTOR/ CONTACT CLOSURE INPUT	Field selectable; Sourcing or sinking pulse or square wave 0-5 V, 0-12 V, or 0-24 V; TTL; NPN or PNP transistor; Open collector 100 kΩ pull-up to 3 V; Switch contact 100 kΩ pull-up to 3 V; PNP transistor 100 kΩ pull-down to ground (COM) Active input 100 kΩ to battery level, 10 kΩ to power		
	Maximum Frequency: 64 kHz Minimum Pulse Width: 5 µs		
	Threshold Setting	Low (V)	High (V)
	Normal	1.2	2.0
	Low	0.2	1.2
OPTO-ISOLATED INPUT	Sourcing pulse or square wave 0-5 V, 0-12 V, or 0-24 V; Logic High: 2-24 V, Logic Low: < 1 V		
	Maximum Frequency: 20 kHz Minimum Pulse Width: 20 µs Input Current: 1 mA @ 5 V, 2.5 mA @ 12 V, 5 mA @ 24 V		
LOW VOLTAGE MAG PICKUP INPUT	Sensitivity: 20 mVp-p to 24 Vp-p Maximum Frequency: 6 kHz		
MINIMUM INPUT FREQUENCY	0.0001 Hz. Minimum frequency is dependent on high gate setting (rate display).		

INPUT IMPEDANCE	Pulse input: Greater than 75 kΩ @ 1 kHz. Open collector/switch input: 100 kΩ pull-up to 3 V.
ACCURACY	±0.03% of calibrated span ±1 count
TEMPERATURE DRIFT	Rate display is not affected by changes in temperature.
LOW-FLOW CUTOFF	0-99,999 (0 disables cutoff function)
DECIMAL POINT	Up to four decimal places or none: 4.4444, 33.333, 222.22, 1111.1, or 00000
CALIBRATION	May be calibrated using K-Factor, scale without signal source, or by applying an external calibration signal.
K-FACTOR	Field programmable K-Factor converts input pulses to rate in engineering units. May be programmed from 0.000001 to 9,999,999 pulses/unit.
CALIBRATION RANGE	Input 1 signal must be ≥ 1 Hz; input 2 signal may be set anywhere above input 1 setting. Minimum input span is 1 Hz. An Error message will appear if the input 1 and input 2 signals are too close together.
INPUT CONTACT DEBOUNCE FILTER	Programmable contact debounce filter. Input signal frequency speed selections of Hi (no filter), Med (250 Hz max input, 2 ms pulse width), and Low (100 Hz max input, 5 ms minimum pulse width).
TIME BASE	Second, minute, hour, or day
GATE	Low gate: 1-99 seconds; High gate: 2-9,999 seconds

Rate/Totalizer

DISPLAY ASSIGNMENT	The Top display is assigned to rate or total. The Bottom display is programmable to display total; total and units; total and tag; total, total units, and rate units; grand total; grand total and grand total units; grand total and tag; grand total, grand total units, and rate units; rate units; rate; rate and total units; rate and rate units; rate and tag; rate units; total units; a custom tag; or be off (blank).
RATE DISPLAY UNITS	Gallons, liters, imperial gallons, cubic meters, barrels, bushels, cubic yards, cubic feet, cubic inches, liquid barrels, beer barrels, hectoliters, or custom.
RATE DISPLAY TIME BASE	Rate display may be calculated in terms of units per second, minute, hour, or day.

TOTAL & GRAND TOTAL DISPLAY UNITS	Gallons, liters, imperial gallons, cubic meters, barrels, bushels, cubic yards, cubic feet, cubic inches, liquid barrels, beer barrels, hectoliters, or custom. Setting is independent for each.
TOTAL & GRAND TOTAL DISPLAY UNIT MULTIPLIER	x1, x100 (h), x1000 (k), or x1,000,000 (M) multiplier (and prefix) applied to total or grand total display units. Setting is independent for each.
TOTAL & GRAND TOTAL DECIMAL POINT	Up to six decimal places or none: 6.666666, 55.55555, 444.4444, 3333.333, 22222.22, 111111.1 or 000000 Total and grand total decimal points are independently programmed, and are independent of rate decimal point.
TOTALIZERS	Calculates total and grand total based on rate and field programmable multiplier to display total in engineering units. Time base must be selected according to the time units in which the rate is displayed. The total and grand total utilize the same time base, with different conversion factors and resets.
TOTALIZER RESET	Via Through-glass RESET button, mechanical button (cover off), external contact closure (total only), automatically via user selectable preset value and time delay (1 – 99,999 sec). Manual reset may be disabled or protected by password for the total and grand total. Total and grand total reset independently.
TOTAL OVERFLOW AND ROLLOVER	The total can display up to 9,999,999,999,999. Up to 9,999,999 can be displayed on the lower display normally. An overflow display will toggle between the first six digits and last seven digits (999999 <> 9999999) for a 13-digit total. The total will rollover beyond thirteen digits. The T indicator on the display will flash to indicate total overflow, and the six most significant digits (first six numbers of the total) are indicated with the flashing overflow symbol -\.
GRAND TOTAL OVERFLOW AND ROLLOVER	The grand total can display up to 9,999,999,999,999. Up to 9,999,999 can be displayed on the lower display normally. An overflow display will toggle between the first six digits and last seven digits (999999 <> 9999999) for a 13-digit total. The grand total will rollover beyond thirteen digits. The GT indicator on the display will flash to indicate grand total overflow, and the six most significant digits (first six numbers of the grand total) are indicated with the flashing overflow symbol -\.
EXTERNAL TOTAL RESET	External total reset connections are made between RST and COM. Logic High: 1.4 V, 3.3V max; Logic Low: < 0.8 V. 32 ms debounce.

4-20 mA Transmitter Output

OUTPUT SOURCE	Rate/process, total, grand total, or disabled		
SCALING RANGE	4.000 to 20.000 mA for any display range.		
DISABLE	If disabled, the output will output 3.2 mA		
CALIBRATION	Factory Calibrated: 0.0 to 1000.0 = 4-20 mA output		
UNDERRANGE	Output Underrange: 3.8 mA		
OVERRANGE	Display Overrange: 20.5 mA		
	Output Overrange: 20.5 mA		
ACCURACY	± 0.05% span ± 0.004 mA		
TEMPERATURE DRIFT	0.08 µA/°C max from -40 to 75°C ambient,		
EXTERNAL LOOP POWER SUPPLY	30 VDC maximum		
OUTPUT LOOP RESISTANCE	Power supply	Minimum	Maximum
	24 VDC	10 Ω	750 Ω
	30 VDC	100 Ω	1100 Ω
	Note: loop-powered backlight subtracts 150 Ω from maximum resistance figures above.		

Open Collector Outputs

OUTPUT ASSIGNMENT	Two open collector pulse outputs Out 1 and Out 2. Individually programmable for rate, total, or grand total alarms; rate, total, or grand total pulse outputs; or retransmitting of pulse inputs; constant timed pulse output; quadrature outputs (requires Out 1 and Out 2); or off.
RATING	Isolated open collector, off: 24 VDC max, on: <1 V @ 150 mA max
ALARM OUTPUT	Assign to rate for high or low alarm trip point. Assign to total or grand total for total or grand total alarms.
ALARM DEADBAND	0-100% FS, user selectable
ALARM ACKNOWLEDGE	Front panel ENTER button resets output and screen indication.

PULSE OUTPUT K-FACTOR (COUNT)	K-factor (count) programmable from 0.000001 to 9999999. Rate pulses are generated as a scaled output of the rate input with one output pulse per K-factor (count) number of input pulses. Total and grand total pulses are generated for every total or grand total increment selected. (e.g. K-factor value of 100 will generate one pulse every time the total is incremented by 100 units) Rate retransmission pulses one to one for input pulses, up to maximum output speed. K-factor is not used for retransmitting outputs.
PULSE OUTPUT PULSE WIDTH	Unless otherwise stated, pulses are 50% duty cycle for required frequency. A pulse rate retransmit output will generate 100 to 130 μs pulses at the falling edge of every input pulse.
PULSE OUTPUT MAXIMUM FREQUENCY	5 kHz, pulse width at 50% duty cycle. If the programming of the outputs would exceed 5 kHz, the meter will display PULSE OVERRNG
QUADRATURE OUTPUT	Output set to quadrature will lag the other pulse output by 90° (1/4 duty cycle) at output frequency. Minimum 1 Hz
TIMER OUTPUT	Programmable on and off time, repeating cycle. Minimum period 0.1 second, maximum 100,000 seconds. Minimum pulse time 0.01 second, maximum 10,000 seconds.

Serial Communications

PROTOCOL	2-Wire RS-485 Modbus® RTU
METER ADDRESS/SLAVE ID	1 - 247
BAUD RATE	1,200; 4,800; 9,600; 19,200; 38,400; 57,600; or 115,200 bps
TRANSMIT TIME DELAY	Programmable between 0 and 199 ms
PARITY/STOP BIT	Even, odd, none with 1 stop bit, or none with 2 stop bits
BYTE-TO-BYTE TIMEOUT	Max of 1.5 character times or 750 μs

Note: Refer to Modbus Register Tables at www.simarkcontrols.com for details.

Product Ratings and Approvals

CSA	Class I, Division 1, Groups B, C, D Class II, Division 1, Groups E, F, G Class III, Division 1; Ex d IIC T6 Enclosure Type 4X, IP66/68: Ta = -40°C to +75°C Certificate number: 2600554

Special Conditions for Safe Use:
Use suitably certified and dimensioned cable entry device and/or plug. The equipment shall be installed such that the supply cable is protected from mechanical damage. The cable shall not be subjected to tension or torque. If the cable is to be terminated within an explosive atmosphere, then appropriate protection of the free end of the cable shall be provided.

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.

Electromagnetic Compatibility

EMISSIONS	EN 61326:2006 Safety requirements for measurement, control, and laboratory use – Industrial Group 1 Class A ISM emissions requirements
Radiated Emissions	Class A
IMMUNITY	EN 61326:2006 Safety requirements for measurement, control, and laboratory use
ESD	±4 kV contact, ±8 kV air
RFI – Amplitude Modulated	80-1000 MHz @ 10 V/m, 1.4-2.0 GHz @ 10 V/m, 2.0-2.7 GHz @ 10 V/m, 80% AM (1 kHz)
EFT	±2 kV DC mains, ±1 kV other
Telco Surge	±1 kV
CRFI	3 V, 0.15-80 MHz, 1 kHz 80% AM

SAFETY INFORMATION



WARNINGS

- 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 (not including battery, if equipped) must be performed at the factory.
- Disconnect from supply before opening enclosure. Keep cover tight while circuits are alive. Conduit seals must be installed within 18" (450mm) of the enclosure.
- Verify that the operating atmosphere of the meter is consistent with the appropriate hazardous locations certifications.
- If the meter is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on any lead.

INSTALLATION

For Installation in USA: The SMRT-PRO must be installed in accordance with the National Electrical Code (NEC) NFPA 70.

For Installation in Canada: The SMRT-PRO must be installed in accordance with the Canadian Electrical Code CSA 22.1.



WARNING Disconnect from supply before opening enclosure. Keep cover tight while circuits are alive. Conduit seals must be installed within 18" (450mm) of the enclosure.

Wiring connectors are accessed by opening the enclosure. Cover jam screw may need to be loosened on the cover. To access electrical connectors, remove the two captive screws, then disconnect the ribbon cable from the display module and set the display module aside.

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.

Pre-Installed Conduit/Stopping Plug

The SMRT-PRO typically includes three ¾" NPT threaded conduit openings and one ¾" NPT metal conduit plugs with 12 mm hex key fitting installed. Additional conduit opening configurations and plugs may be available; verify quantity and sizes on specific device labeling during installation. The pre-installed plug and its installation are included in the hazardous area approvals for the SMRT-PRO.

The conduit/stopping plug included in a typical SMRT-PRO has an internal 12 mm hexagonal socket recess for removal.



WARNING In hazardous areas, conduit and conduit/stopping plugs require the application of non-setting (solvent free) thread sealant. It is critical that all relevant hazardous area guidelines be followed for the installation or replacement of conduit or plugs.

Battery Activation Pull Tab

SMRT-PRO models with battery or battery backup power will include a battery activation pull-tab. This tab assures the meter is not operational during shipment or storage, and is located with the battery. Remove this tab during installation of the meter.

Mounting

The SMRT-PRO has two slotted mounting flanges that may be used for pipe mounting or wall mounting. Alternatively, the unit may be supported by the conduit using the conduit holes provided.

Refer to *Mounting Dimensions*, page 96 for details.



WARNING

Do not attempt to loosen or remove flange bolts while the meter is in service.

Cover Jam Screw

The cover jam screw should be properly installed once the meter has been wired and tested in a safe environment. The cover jam screw is intended to prevent the removal of the meter cover in a flameproof environment without the use of tools. Using a M2 hex wrench, turn the screw clockwise until the screw contacts the meter. Turn the screw an additional ¼ to ½ turn to secure the cover. Caution: Excess torque may damage the threads and/or wrench.

Connections



WARNINGS

- Static electricity can damage sensitive components.
- Observe safe handling precautions for static-sensitive components.
- Use proper grounding procedures/codes.
- If the meter is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on any lead or terminal.

To access the connectors, loosen the cover jam screw (if tightened) with an M2 hex wrench, remove the enclosure cover and unscrew the two captive screws that fasten the display module into the enclosure. Disconnect the ribbon cable and remove the display module. Power and signal connections are made to a barrier terminal connector in the base of the enclosure. Grounding connections are made to the two ground screws provided on the base – one internal and one external. Use proper grounding techniques for explosion-proof areas and observe all local and national electric codes.

Connections (continued)

S+ Signal input positive terminal connection
S- Signal input negative terminal connection
COM DC power supply input return/negative, reset contact closure common
RST Contact closure reset pull-up to 1.8 VDC
P+ DC Power positive terminal connection
LP+ 4-20 mA transmitter DC power positive terminal connection.
LP- 4-20 mA transmitter regulated current output terminal connection
OC1+ Open collector output 1 positive terminal
OC1- Open collector output 1 negative terminal
OC2+ Open collector output 2 positive terminal
OC2- Open collector output 2 negative terminal

Refer to Figure 1 for terminal positions.

WARNING 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.

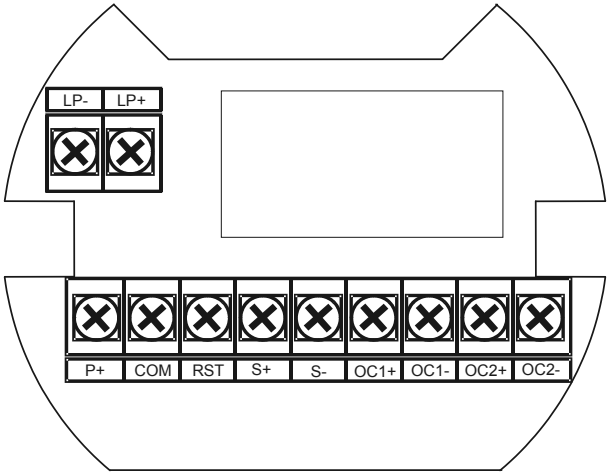


Figure 1. Connector Board

Input Signal Connections

Signal connections are made to a barrier terminal mounted in the base of the enclosure. Input level and type are configured using the slide switches on the bottom of the display module as shown in the lower right of the following figures.

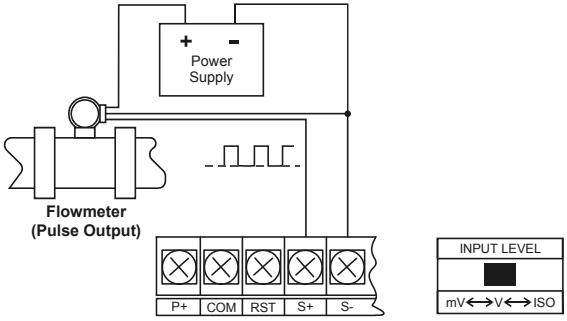


Figure 2. Flowmeter Powered by External Supply (Active)

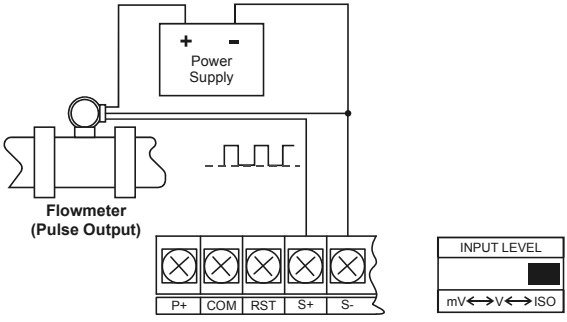


Figure 3. Isolated Flowmeter Powered by External Supply (ISO)

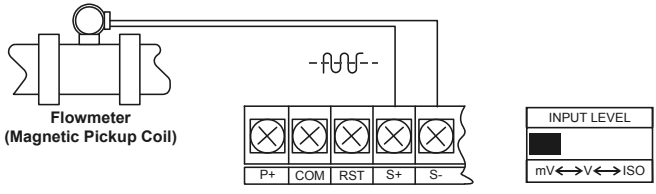


Figure 4. Self-Powered Magnetic Pickup Coil Flowmeter (Coil)

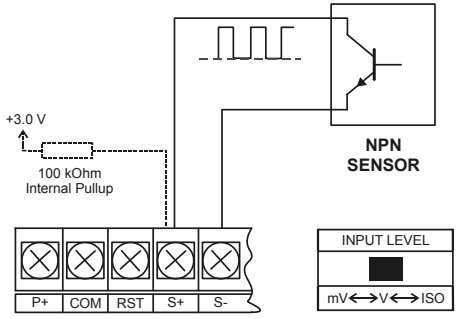


Figure 5. NPN Open Collector Input (NPN)

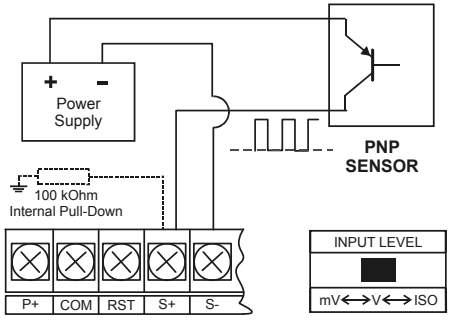


Figure 6. PNP Sensor with External Power (PNP)

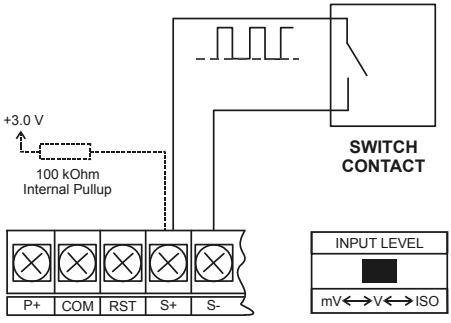


Figure 7. Switch Contact Input (Reed)

DC Power Connection

Models configured for DC power (SMRT-PRO-A) are provided with a terminal labeled P+ and are wired as shown in Figure 9. Models configured for battery power (SMRT-PRO-B) may optionally be connected to DC power and the battery will function as backup power when DC is lost. The same power supply may be used to power other circuits including a PNP-type sensor, however to maintain input isolation, a separate power supply must be used to power the isolated 4-20 mA transmitter as shown in Figure 10 and/or to power the Opto-Isolated Flowmeter as shown in Figure 3.

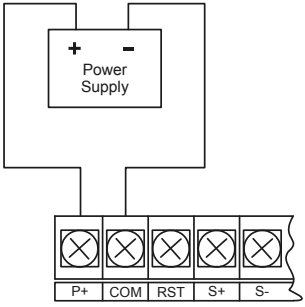


Figure 8. DC Power Connections

External Total Reset Connection

External total reset connections are made between RST and COM. Connect to a contact closure source such as a relay or a pushbutton as shown in Figure 9. Avoid extended contact closure to preserve battery life. The total is reset when he button is pressed. The meter will start to totalize immediately. Holding down the button has no effect on the total.

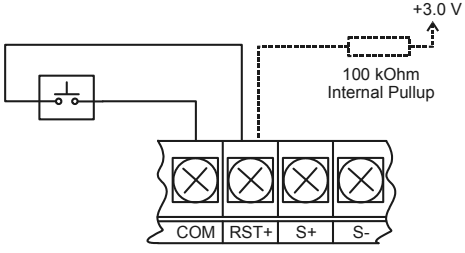


Figure 9. Reset Connections

4-20 mA Transmitter Output Connections

Output connections are made to two terminals labeled LP+ and LP-. Connect to an input device such as a remote display or chart recorder as shown in Figure 10.

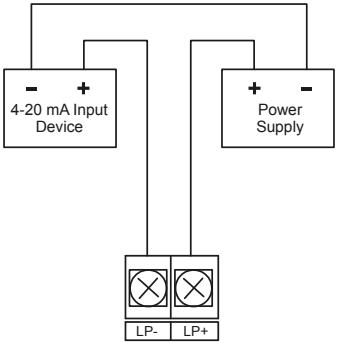


Figure 10. 4-20 mA Output Connections

RS-485 Serial Connections

The meter may include an optional RS-485 two-wire serial connection. The cabling used for an RS-485 serial communications network should always be a high quality cable such as Belden 8162 or Alpha 6203C. A two-wire system requires two twisted pairs, and a four-wire system requires three twisted pairs (the extra twisted pair is needed for the signal ground).

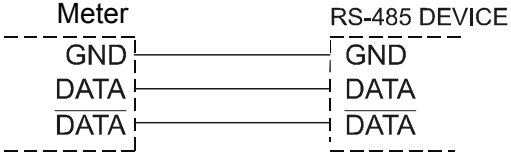


Figure 11. RS-485 2 Wire Serial Connections

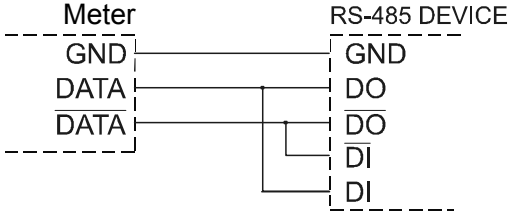


Figure 12. RS-485 4 Wire Serial Connections

Open Collector Output Connections

Open collector output 1 and 2 connections are made to terminals labeled OC1+ and OC1-, and OC2+ and OC2-. Connect the alarm or pulse input device as shown in Figure 13.

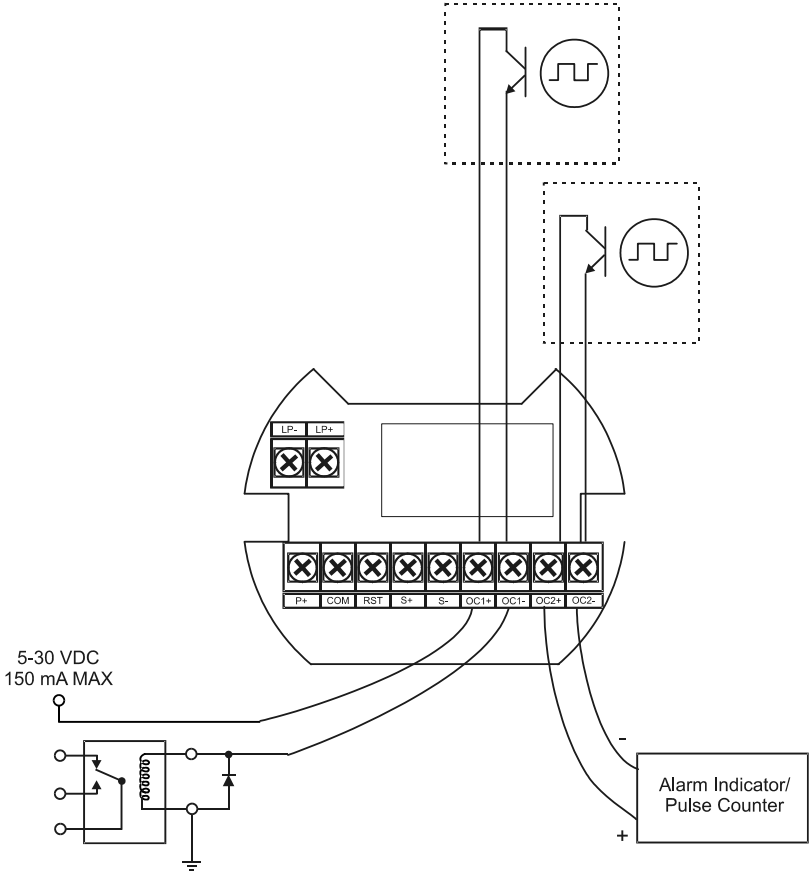


Figure 13. Open Collector Output Connections

Battery Replacement

Battery-equipped models have a battery charge monitor. When the battery is nearing the end of its capacity the screen will periodically flash the message LO BATTERY and the BAT indicator on the screen will flash. The recommended replacement interval for models using the battery as a primary power source is determined by the power and feature use, as shown on page 8. The battery should be replaced when the low battery indication is on the screen.

The total is backed up in non-volatile memory when the low battery monitor is tripped. It is recommended that an updated reading be manually backed up prior to changing out the battery.

WARNING

Fire, explosion and burns may result if not handled properly. Do not recharge, short circuit, crush, disassemble, heat above 100°C (212°F), incinerate, or expose contents to water.

Battery disposal should be in accordance with applicable regulations, which vary by location. In many locations trashing of used batteries is forbidden and disposal is done through local battery disposal facilities. Spent batteries should be packaged in such a way as to prevent short circuits during handling and transport.

NOTICE: Battery may only be replaced with an original Model SMRT-PRO-BAT supplied by Simark. Do not recharge battery. Do not replace with used battery.

- Remove cover and display module and disconnect display module ribbon cable.
- Carefully cut and remove the cable ties supplied for shipping (if present).
- Remove the spent battery and prepare it for disposal.
- Install new SMRT-PRO-BAT into battery clip with polarity as shown in Figure 14.
- Reconnect and fasten display module. Install enclosure cover.
- Resume operation.

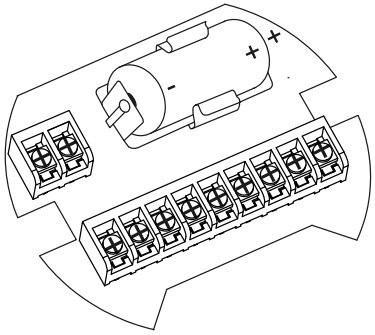


Figure 14. Battery Orientation

SETUP AND PROGRAMMING

There is **no need to recalibrate** the meter for frequency in Hz when first received from the factory.

The meter is ***factory calibrated*** for Hz prior to shipment. The calibration equipment is certified to NIST standards.

Overview

Setup and programming is done through the infrared through-glass buttons, or using the mechanical buttons when uncovered. There are two slide switches located on the display module. One is used to configure the input and the other is to lock or unlock the Through-glass Buttons.

Through-Glass Buttons

The SMRT-PRO is equipped with four sensors that operate as through-glass buttons so that it can be programmed and operated without removing the cover (and exposing the electronics) in a hazardous area. These buttons can be disabled for security by using the Thru-Glass Button switch and selecting the OFF setting. This switch is located on the back of the removable electronics module.

Through-Glass Button Operation

To actuate a button, press and remove one finger to the glass directly over the marked button area. Remove finger to at least 4 inches away from the glass in between button activations. Through-glass and mechanical buttons may be held to cycle through menus or digits in place of repeatedly pushing a button.

Through-Glass Power Save Mode

Through-Glass buttons enter a power saving mode after three minutes of inactivity. This mode is indicated by a pause symbol (⏻) appearing in the lower right of the display. Only the **MENU** button is monitored in this mode. To activate the Through-glass buttons, press and hold the menu button for up to five seconds. The display will read AWAKE, and the Through-glass buttons will be fully enabled.

Through-glass Disabled Mode

When the cover is removed, the four mechanical buttons located next to the sensors may be used. The sensors are disabled when a mechanical button is pressed and will automatically be re-enabled after 60 seconds of inactivity. The Through-glass power symbol (⏻) will blink in the lower right of the display if the buttons are disabled due to a mechanical pushbutton being pressed.

IMPORTANT

Through-glass buttons will not work if two or more buttons are detected as being pressed simultaneously. As a result, be careful to avoid triggering multiple buttons or reaching across one button location to press another.

Through-Glass Button Tips and Troubleshooting

The Through-Glass Buttons are designed to filter normal levels of ambient interference and to protect against false triggering, however it is recommended that the Through-Glass Buttons be turned off (slide THRU-GLASS BUTTONS switch to OFF) if there is an infrared interference source in line-of-sight to the display or if the buttons are not needed.

Through-Glass Button Tips:

- To the extent possible, install the display facing away from sunlight, windows, reflective objects and any sources of infrared interference.
- Keep the glass window clean.
- Tighten the cover securely.
- Use a password to prevent tampering.
- If the cover has not been installed and secured tightly, it may take a moment for the Through-Glass buttons to properly self calibrate when the cover is tightened.

After all connections have been completed and verified, connect the ribbon cable to the display module, fasten the display module to the base, install enclosure cover, and then apply power.

Through-Glass Button Equalize Delay

The Through-Glass buttons are designed to constantly recalibrate for ambient conditions. When the cover position is changed, the cover is removed, or an object is removed that was placed over the front window, it may take a moment for the Through-Glass buttons to recalibrate to new conditions in these cases where the cover position was changed, or the front window is being unblocked.

Buttons and Display



Button Symbol	Description
MENU	**Menu/ Through-glass Awake**
RESET ▶	**Right Arrow/Reset**
DISPLAY ▲	**Up Arrow/ Display**
ENTER	**Enter/ Alarm Acknowledge**

Symbol	Status
HI	High Alarm
LO	Low Alarm
SET	Total Alarm
🔒	Settings Lockout Password Enabled
⏻	Through-glass Power Save/Disable. Flashing: Temporarily Disabled Due to Mechanical Button
T	Total Display Flashing: Total Overflow Indication
GT	Grand Total Display Flashing: Total Overflow Indication
✳	13 Digit Total Overflow, 6 Most Significant Digits
BAT	Flashing: Low Battery Indicator Steady: Powered by Battery Backup

Menu Button

- Hold the **Menu** Through-glass button when in power save mode (display will show ⏻) to awaken Through-glass buttons.
- Press the **Menu** button to enter Programming Mode.
- Press the **Menu** button during Programming Mode to return to return to the previous menu selections.
- Hold the **Menu** button for 1.5 seconds at any time to exit Programming Mode and return to Run mode.
- Press and hold the **Menu** button for 3 seconds to access the *Advanced* features of the meter.

Right / Reset Button

- Press the **Right** arrow button to move to the next digit or decimal position during programming.
- Press **Right** to go backward through most selection menus.
- Press **Reset** to reset the total, or values displayed in the bottom display (grand total, max, or min). Press **Enter** after **Reset** to confirm the reset.

Up / Display Button

- Press **Display** when in Run mode to display the grand total, again to display the maximum, and again to display the minimum reading since last reset. These displays will time out in 12 seconds, or press **Display** until total is displayed in the lower display. Press **Enter** to lock this display, and disable the 12 second time out.
- Press the **Up** arrow button to scroll forward through the menus, decimal point, or to increment the value of a digit.

Enter Button

- Press the **Enter** button to access a menu or to accept a setting.
- Press **Enter** to lock the grand total, maximum, or minimum value on the lower display, and disable the 12 second time out.
- Press **Enter** while the grand total, max, or min reading is locked on the lower display to return to run mode.
- Press **Enter** to acknowledge alarm (if enabled).
- Press **Enter** to lock display of grand total, Max or Min readings (disables 10 second timeout).

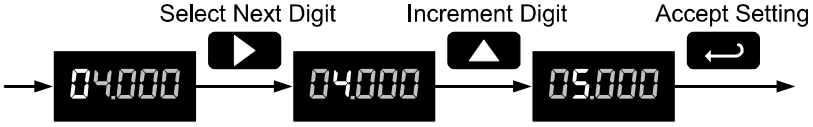
Setting Numeric Values

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** button, at any time, to accept a setting or **Menu** button to exit without saving changes.

The decimal point is set using the **Right** or **Up** arrow button in the *Setup, Decimal Point* menu.



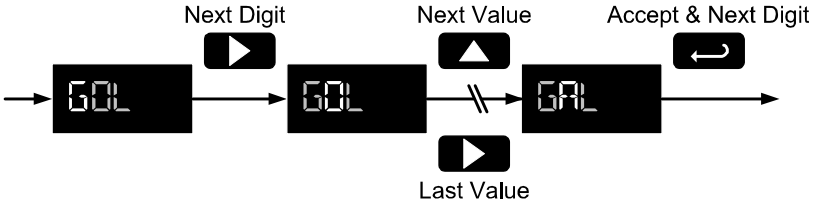
Setting Alphanumeric Labels (LAbEL)

Fully alphanumeric values are set using the **Right** button to select the digit, the **Up** and **Right** arrow buttons to select the digit reading, and the **Enter** button to confirm and select the next digit.

Menus using this entering method will display LAbEL in the upper display. After selecting the digit, and using the **Up** and **Right** arrows to modify the digit, the display will read CHAr. Using **Enter** to confirm the new digit will return the display to reading LAbEL.

The digit being changed blinks.

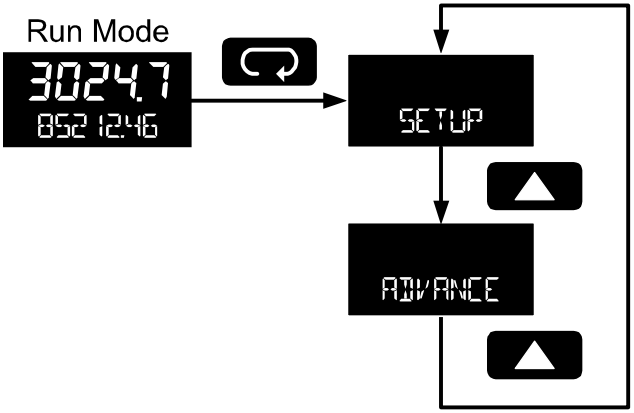
Press the **Menu** button to exit without saving changes.



Main Menu

The main menu separates the most commonly used functions in the *Setup menu*, and more complex features in the *Advanced* menu.

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



- Press **Menu**, at any time, to return to the previous menu selection. Press and hold the **Menu** button for 1.5 seconds at any time to return to Run Mode.
- Changes to the settings are saved to memory only after pressing **Enter**.
- The display moves to the next menu every time a setting is accepted by pressing **Enter**.

Setup 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
inPut	*Input*	Enter *Input* type selection menu
Act iU	*Active*	Set active input type
nPn	*NPN*	Set NPN input type
PnP	*PNP*	Set PNP input type
rEEd	*Reed*	Set reed switch input type
CO iL	*Coil*	Set coil input type
iSo	*Isolated*	Set isolated input type
ActLO	*Active low*	Set active input type with low threshold
nPnLO	*NPN low*	Set NPN input type with low threshold
PnPLO	*PNP low*	Set PNP input type with low threshold
FACtr	*K-factor*	Enter the *K-Factor* menu
FUn it	*K-factor units*	Enter the K-Factor units
P/GAL	*Pulses/gallon*	Set K-factor in pulses per gallon
P/L	*Pulses/liter*	Set K-factor in pulses per liter
P/IGAL	*Pulses/imp gallon*	Set K-factor in pulses per imperial gallon
P/M3	*Pulses/meter*^{3}	Set K-factor in pulses per meter cubed
P/BBL	*Pulses/barrel*	Set K-factor in pulses per barrel
P/BUSH	*Pulses/bushel*	Set K-factor in pulses per bushel
P/cuYD	*Pulses/cubic yard*	Set K-factor in pulses per cubic yard
P/cuFt	*Pulses/cubic feet*	Set K-factor in pulses per cubic foot
P/cuIn	*Pulses/cubic inch*	Set K-factor in pulses per cubic inch
P/L iBBL	*Pulses/liquid barrel*	Set K-factor in pulses per liquid barrel
P/BBBL	*Pulses/beer barrels*	Set K-factor in pulses per beer barrel
P/HECtL	*Pulses/hectoliter*	Set K-factor in pulses per hectoliter

Display	Parameter	Action/Setting
P/CUST	*Pulses/custom*	Set K-factor custom unit
dEcPt	*K-factor decimal point*	Set the number of decimal points in the K-factor
FActr	*K-factor value*	Set the K-factor for custom units
Units	*Units*	Select standard units or custom unit/tag
tbASE	*Rate time base*	Enter the *Time Base* menu
SEC	*Second*	Units per *second*
mn in	*Minute*	Units per *minute*
hour	*Hour*	Units per *hour*
dAY	*Day*	Units per *day*
rAtEU	*Rate units*	Select rate display units
GAL	*Gallons*	Set units as gallons
L	*Liters*	Set units as liters
IGAL	*Imperial gallons*	Set units as imperial gallons
M3	*Meters cubed*	Set units as cubic meters
BBL	*Barrels*	Set units as barrels
BUSH	*Bushels*	Set units as bushels
cuYD	*Cubic yards*	Set units as cubic yards
cuFt	*Cubic feet*	Set units as cubic feet
cuIn	*Cubic inches*	Set units as cubic inches
LIBBL	*Liquid barrels*	Set units as liquid barrels
BBBL	*Beer barrels*	Set units as beer barrels
HECLL	*Hectoliter*	Set units as hectoliters
CUSt	*Custom unit*	Use a custom unit
USEr	*User*	Set a custom unit
LAbEL	*Label*	Select a custom unit label character
CHAr	*Character*	Set a character in a custom unit label
rAtCF	*Rate conversion factor*	Enter the *Rate Conversion Factor* menu

Display	Parameter	Action/Setting
tot U	*Total units*	Select total display units
mult	*Total multiplier*	Select the total units multiplier
x 1	*x1 (no multiplier)*	Select no multiplier
x 100 h	*x100 (h)*	Select x100 multiplier with h unit prefix
x 1000 K	*x1000 (k)*	Select x1,000 multiplier with k unit prefix
x 1.0E6 M	*x1.0*10^6 (M)*	Select x1,000,000 multiplier with M prefix
totCF	*Total conversion factor*	Enter the *Total Conversion Factor* menu
GtotU	*Grand total untis*	Select grand total display units
mult	*Grand total multiplier*	Select the grand total units multiplier
GrtCF	*Grand total conversion factor*	Enter the *Grand Total Conversion Factor* menu for custom units
dEc.Pt	*Decimal point*	Enter *Decimal Point* menu
rAtE	*Rate decimal*	Set rate display decimal point
totAL	*Total decimal*	Set total display decimal point
Grtot	*Grant total*	Set grand total display decimal point
dSPLY	*Display*	Set the function of the top and bottom displays
tOP	*Top*	Set the function of the top display
rAtE	*Rate*	Display rate
totAL	*Total*	Display total
bOtm	*Bottom*	Set the function of the bottom display
totAL	*Total*	Display total
tOGLE	*Toggle*	Toggle between the values shown in the bottom display
TOTAL+U	*Total & units*	Display total and units
TOT+TAG	*Total & Tag*	Display the total and custom tag
T+U+RU	*Total & units & rate units*	Display the total, total units, and rate units
Grtot	*Grand total*	Display grand total

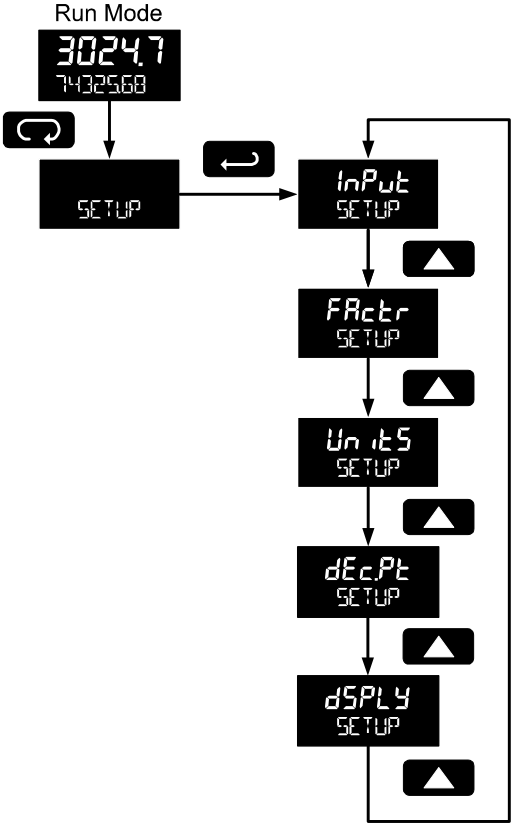
Display	Parameter	Action/Setting
Gr TOT+U	*Grand total & units*	Display grand total and units
GT+TAG	*Grand total & tag*	Display the grand total and custom tag
GT+U+RU	*Grand total & units & rate units*	Display the grand total, grand total units, and rate units
rAtE	*Rate*	Display the rate
RATE+TU	*Rate & total units*	Display the rate and total units
RATE+RU	*Rate & units*	Display the rate and rate units
RAT+TAG	*Rate & tag*	Display the rate and custom tag
rUn it	*Rate unit*	Display the rate units
totUn	*Total units*	Display the total units
tAG	*Custom tag*	Enter the custom tag to be displayed
OFF	*Off*	Turn off the bottom display
tAG TIME	*Tag Time*	Set time to display custom tag
Un it TIME	*Unit Time*	Set time to display lower display unit
rAtE TIME	*Rate Unit Time*	Set time to display rate unit

Setting Up the Meter (SETUP)

The *Setup* menu is used to select:

1. Input type selection (InPut)
2. K-factor number and units (FActr)
3. Display rate, total, and grand total units (Un itS)
4. Rate and total decimal point position (dEcPt)
5. Select what will appear on the lower display (dSPLY)

Press the **Enter** button to access any menu or press **Up** arrow button to scroll through choices. Press the **Menu** button to back out of a menu, or hold the **Menu** button to exit at any time.



Selecting Input Type (InPut)

Seven input types may be set. See Rate Input specifications on page 9 for electrical specifications of the inputs.

The following input types may be selected:

Active (Act iU)
External power supply driven pulse inputs

NPN (nPn)
Internal pull-up resistor on S+ for NPN inputs

PNP (PnP)
Internal pull-down resistor on S+ for PNP inputs

Reed (rEEd)

Internal pull-up resistor on S+ for switch inputs

Coil (CO iL)
Magnetic coil flowmeter inputs (input selector switch must be set to mV)

Isolated active input (iSo)

External power supply driven isolated pulse inputs (input selector switch must be set to ISO)

Active with low threshold (AcLO)

External power supply driven pulse inputs with a low threshold

NPN with low threshold (nPnLO)

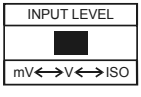
Internal 3 V pull-up resistor on S+ for NPN inputs with a low threshold

PNP with low threshold (PnPLO)

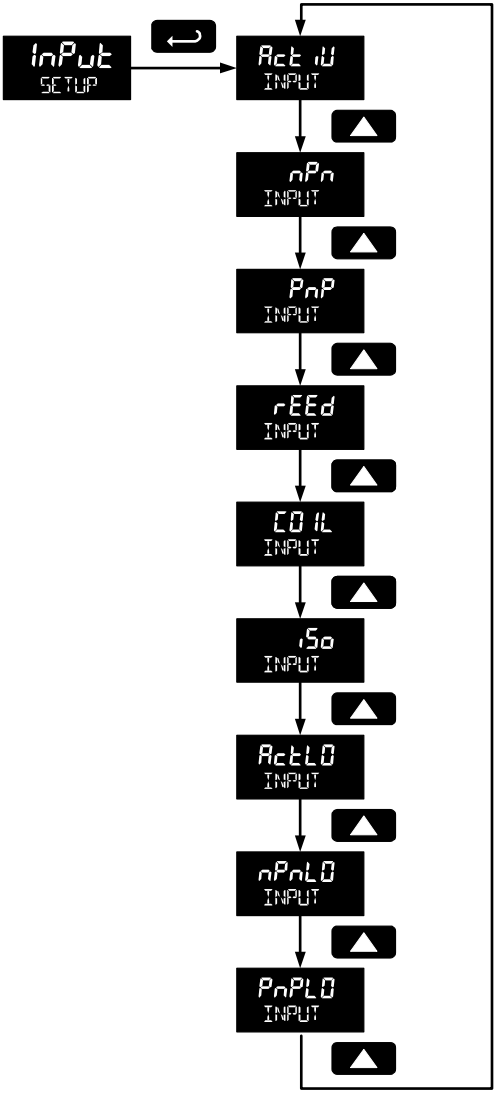
Internal pull-down resistor on S+ for PNP inputs with a low threshold

Input Level Selection Switch

In addition to programming the InPut parameter, the input selector switch shown below must also be set. Input voltage level selections include mV, V and isolated voltage level inputs.



See Rate Input specifications on page 9 for electrical specifications of the inputs.
See Input Signal Connections on page 19 for details on wiring the input types.

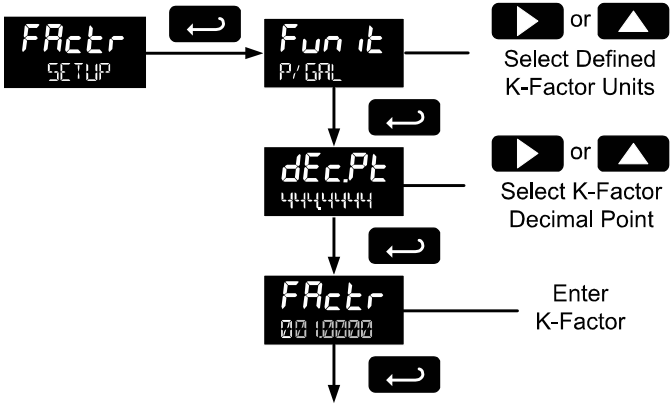

InPut
SETUP
Act iU
INPUT
nPn
INPUT
PnP
INPUT
rEEd
INPUT
CO iL
INPUT
,So
INPUT
ActLO
INPUT
nPnLO
INPUT
PnPLO
INPUT

Entering the K-Factor (FACtr)

The meter may be scaled using the *K-factor*, or conversion factor, function. Most flowmeter manufacturers provide this information with the device. Enter the *K-Factor* (FACtr) menu and select the units defined with the k-factor (example: pulses/gal), the decimal point with highest resolution possible, and program the K-Factor value. The meter will automatically calculate the flow rate using the K-Factor and the units and time base selected.

IMPORTANT

Performing a k-factor operation will override any scaling or calibration programming. Refer to Scaling & Calibration (SCALCAL) on page 66 for more information on these programming methods.



K-Factor Units (Fun it)

Select the units defined with the k-factor (example: pulses/gal). This is usually provided by the flowmeter manufacturer. This does not set the rate display units, and only relates to entering the K-factor. To set or change the rate display units, see Setting the Rate Display Units (rAtEU) on page 42

The K-factor unit may be a custom unit (CUST).

Automatic unit conversions are not performed when the K-factor unit is set to custom. See page 45 for information on the automatic unit conversion feature.

K-Factor Decimal Point (dECPt)

Set the number of decimal places necessary to enter the K-factor value. The decimal point may be set with up to six decimal places or with no decimal point at all.

Pressing the **Right** arrow moves the decimal point one place to the right (including no decimal point). Pressing the **Up** arrow moves the decimal point one place to the left.

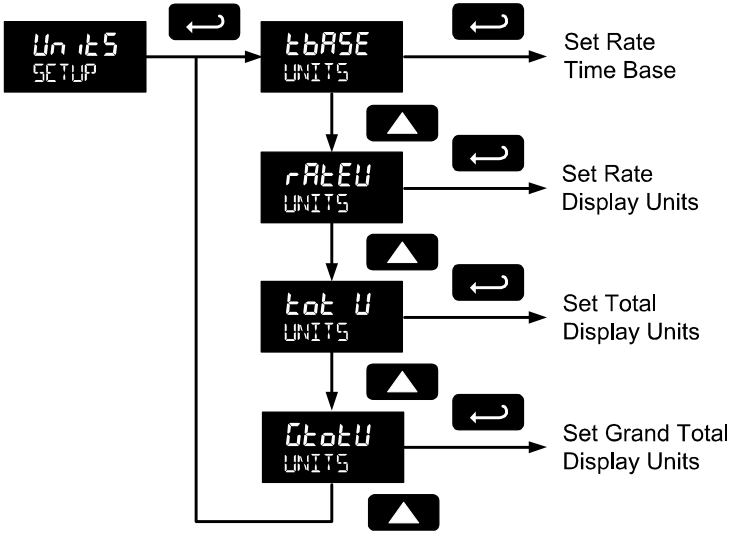
K-Factor Value (FACtr)

Enter the K-factor value. This value is entered in Pulses/Unit as defined by the *K-Factor Units* parameter. Most flowmeter manufacturers provide this information with the device.

Display Units (Un itS)

The *Units* menu is used to select the display rate units and time (example: Gal/s) and the display units for total and grand total.

Important Programming Note:
The units selected in this menu are the desired display units only. The units defined by the k-factor of a flow meter are entered in the K-Factor menu as part of the Factor Unit menu programming. See K-Factor Units (Fun it) on page 38 for details.
This allows the display units to be different than the units defined by the flow meter, or be changed easily after initial programming. Unit conversions for rates and totals are performed automatically by the meter. See Automatic Unit Conversions on page 45 for details.



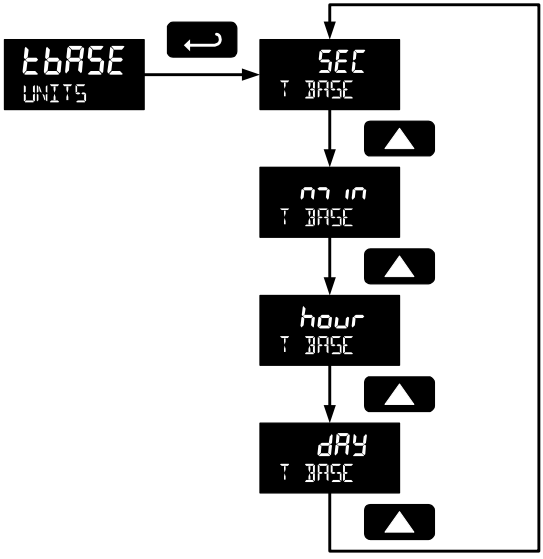
The following units may be selected as the base units for rate, total, and grand total. Time base for rate and a multiplier for total and grand total units may also be selected separately.

Units	Unit	Description
GAL	*Gallons*	Set units as gallons
L	*Liters*	Set units as liters
IGAL	*Imperial gallons*	Set units as imperial gallons
M3	*Meters cubed*	Set units as cubic meters
BBL	*Barrels*	Set units as barrels
BUSH	*Bushels*	Set units as bushels
cuYD	*Cubic yards*	Set units as cubic yards
cuFt	*Cubic feet*	Set units as cubic feet
cuIn	*Cubic inches*	Set units as cubic inches
LIQBBL	*Liquid barrels*	Set units as liquid barrels
BEERBBL	*Beer barrels*	Set units as beer barrels
HECTL	*Hectoliter*	Set units as hectoliters
CUSt	*Custom unit*	Use a custom unit

Setting the Time Base (tbASE)

The meter calculates rate based on rate time base and rate display units. The time base is the unit of time used to calculate the rate, and can be set as units per second, minute, hour, or day.

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

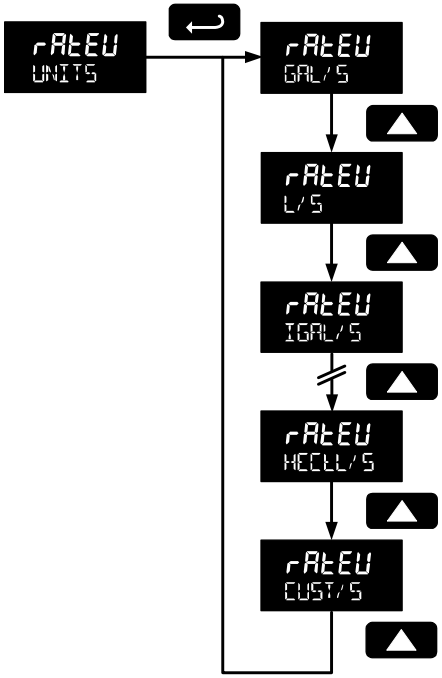


Setting the Rate Display Units (rAtEU)

Rate is displayed in terms of a unit of volume, and a time base. The unit selected will be used with the time base to establish the rate unit (example: GAL/S when *Units* is GAL, and time base is seconds).

The custom unit selection (CUST) will require the custom unit to be entered by the user. See Custom Units Rate Conversion Factor on page 45.

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



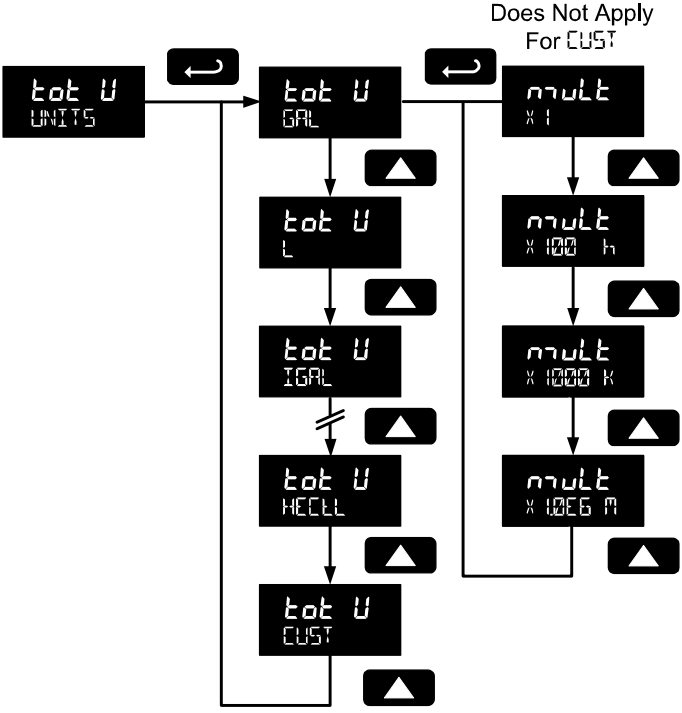
Total Units (tot U)

This menu is used to select the display units for the total. The base unit and a multiplier prefix are selected. If total and units are selected to display, the multiplier prefix will appear before the total unit (example: MGAL, KL).

Multipliers will convert the total for 1, 100, 1000, or 1 million units. The meter will calculate the total appropriately for display with the programmed multiplier and units.

A custom unit may be selected (CUST), and no multiplier menu will be required. In this case, use the total conversion factor as defined in Custom Units Total Conversion Factor on page 46.

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



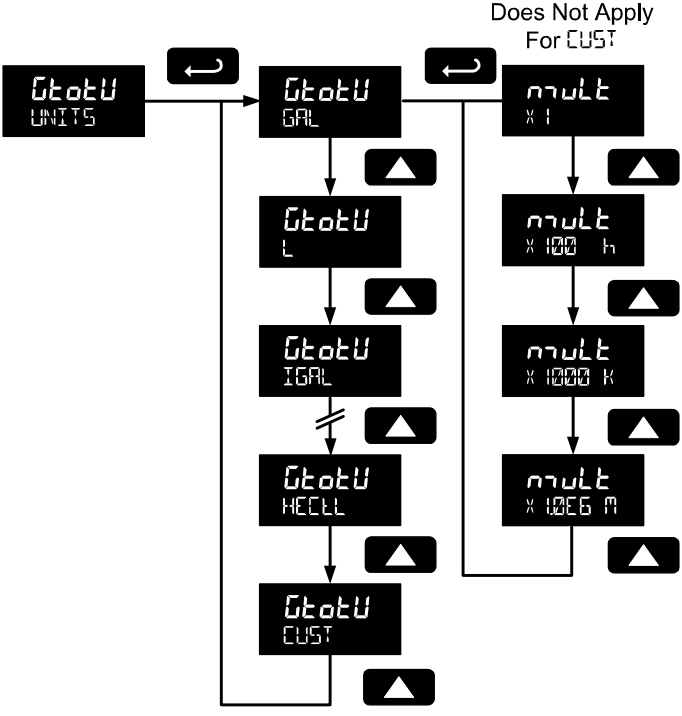
Grand Total Units (GtotU)

This menu is used to select the display units for the grand total. The base unit and a multiplier prefix are selected. If grand total and units are selected to display, the multiplier prefix will appear before the total unit (example: MGAL, KL).

Multipliers will convert the total for 1, 100, 1000, or 1 million units. The meter will calculate the total appropriately for display with the programmed multiplier and units.

A custom unit may be selected (CUST), and no multiplier menu will be required. In this case, use the grand total conversion factor as defined in Custom Units Grand Total Conversion Factor (GrtCF) on page 46.

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



Automatic Unit Conversions

When switching from any standard unit of rate, total, or grand total to any other standard unit, automatic unit conversions are performed by the meter.

No unit conversions will be performed when the K-Factor Units (FUn it) menu is set to custom (CUST).

A total or grand total unit conversion will automatically change the displayed total and grand total to the equivalent volume of the newly selected unit.

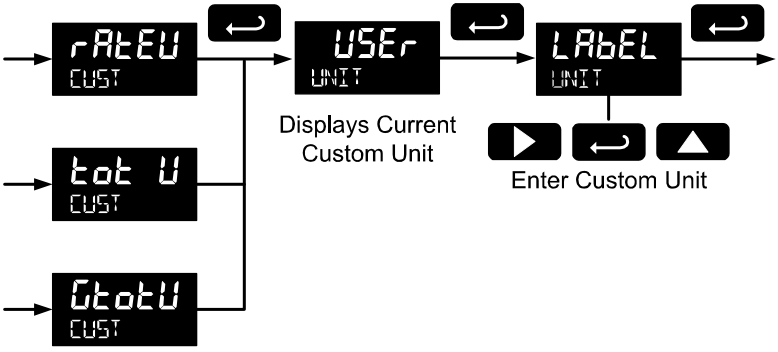
Custom Units Entry (USEr)

When a custom unit is selected for rate, total, or grand total, a *User* menu allows for entry of the custom unit.

Any 5-digit 14-segment unit may be entered for a custom rate unit (example: mL).

Any 7-digit 14-segment unit may be entered for a custom total or grand total unit (examples: GALLONS, BOTTLES, DRUMS).

When selected for total or grand total, a custom unit will not allow a multiplier prefix. A custom total or grand total unit will allow a total or grand total conversion factor to be entered to define the unit. See Custom Units Total Conversion Factor on page 46 for details.



Fully alphanumeric values are set using the **Right** button to select the digit to be changed. Press the **Up** button to begin editing the digit, then the **Up** and **Right** arrow buttons to select the next or previous alphanumeric character. Press the **Enter** button to confirm and select the next digit to change.

For details on setting alphanumeric labels, refer to Setting Alphanumeric Labels (LAbEL) on page 29.

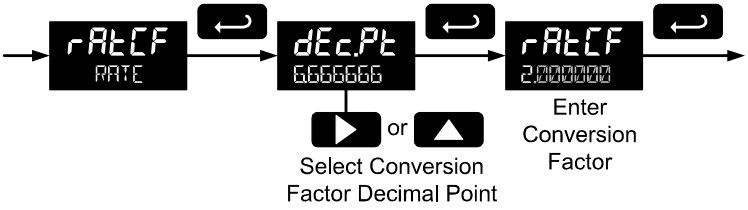
Press **Menu** button to exit this menu without saving changes.

Custom Units Rate Conversion Factor (rAtCF)

The rate conversion factor is only used when the *Units* for rate have been set to custom (CUST). This menu will not appear if standard display units are selected for the rate unit.

Rate Conversion Factor is used to convert to a custom unit of rate display. For example, to display rate as quantity of 2.5 gallon containers when the K-Factor units are set to gallons, enter a conversion factor of 2.500.

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

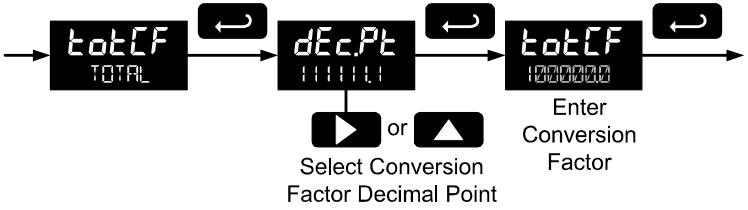


Custom Units Total Conversion Factor (totCF)

The total conversion factor is only used when the *Units* for total have been set to custom (CUST). This menu will not appear if standard display units are selected for total.

Total Conversion Factor is used to convert to a custom unit of total display. For example, to display total as quantity of 2.5 gallon containers when the K-Factor units are set to gallons, enter a conversion factor of 2.500.

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



Custom Units Grand Total Conversion Factor (GrtCF)

The grand total conversion factor is only used when the *Units* for grand total have been set to custom (CUST). This menu will not appear if standard display units are selected for grand total.

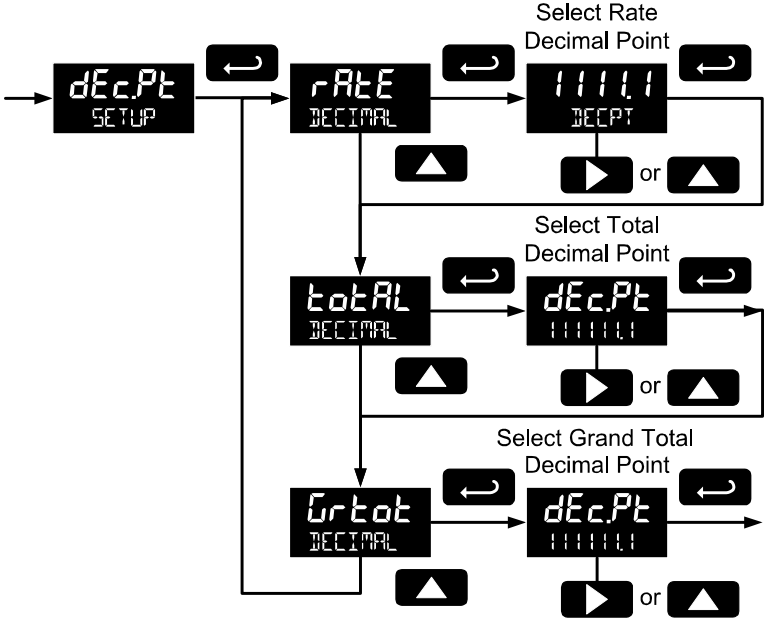
Grand Total Conversion Factor is used to convert to a custom unit of total display. For example, to display grand total as quantity of 2.5 gallon containers when K-Factor units are set to gallons, enter a conversion factor of 2.500.

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

Setting the Decimal Point (dEcPt)

Rate decimal point may be set with up to four decimal places or with no decimal point at all. Total decimal point may be set with up to six decimal places or with no decimal point at all. Grand total decimal point may be set with up to six decimal places or with no decimal point at all. Rate decimal, total decimal, and grand total decimal are programmed individually.

Pressing the **Right** arrow moves the decimal point one place to the right (including no decimal point). Pressing the **Up** arrow moves the decimal point one place to the left.

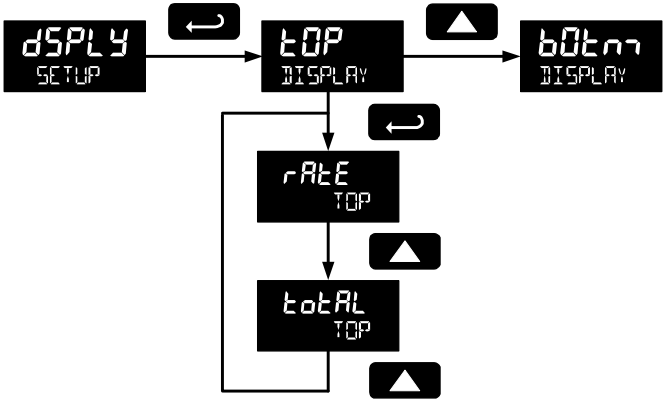


Configuring the Display (dSPLY)

The top and bottom displays can be independently programmed to display selected information.

Top Display (tOP)

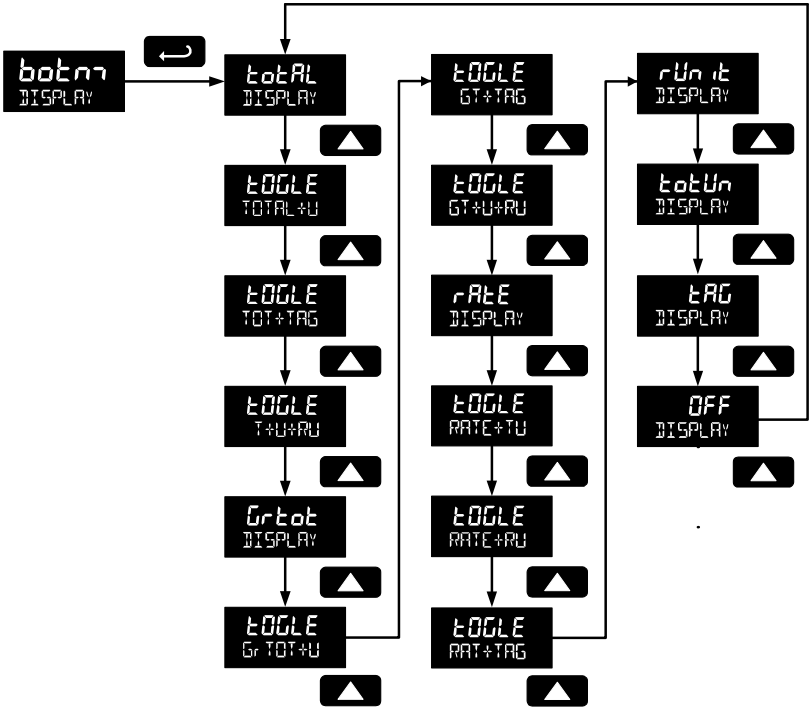
The top display can be programmed to display rate or total. When displaying total, the top display will only show the 5 least significant digits, with no overflow display, for a total from 0 to 99999. The total rolls over at 99999 to 0 when on the top display. For a full 7-digit total with 13-digit total overflow display function, use the bottom display for total.



Bottom Display (bOtm)

The bottom display can be programmed to display the following information.

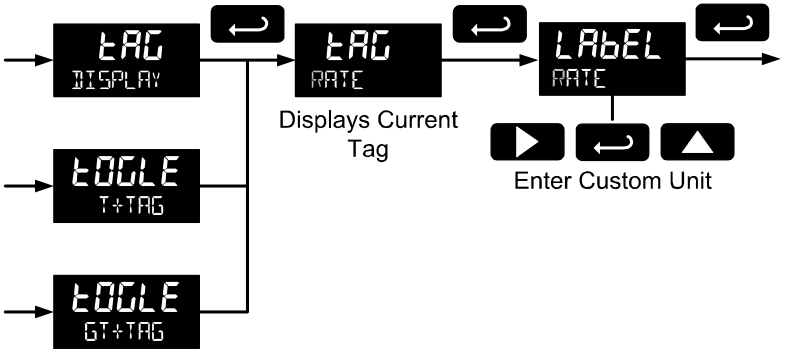
1. Total
2. Alternating total and total units
3. Alternating total and custom tag
4. Alternating total, total units, and rate units
5. Grand total
6. Alternating grand total and grand total units
7. Alternating grand total and custom tag
8. Alternating grant total, grand total units, and rate units
9. Rate
10. Alternating rate and total units
11. Alternating rate and rate units
12. Alternating rate and custom tag
13. Rate units
14. Total units
15. Custom tag
16. Off (blank)



Custom Tag (tAG)

When the bottom display selected includes a custom tag, a *User* menu will then allow a custom tag to be programmed.

Any 7-digit 14-segment label may be entered for a custom tag (examples: RATE, LINE 3, WATER).



Fully alphanumeric values are set using the **Right** button to select the digit, the **Up** and **Right** arrow buttons to select the digit reading, and the **Enter** button to confirm and select the next digit.

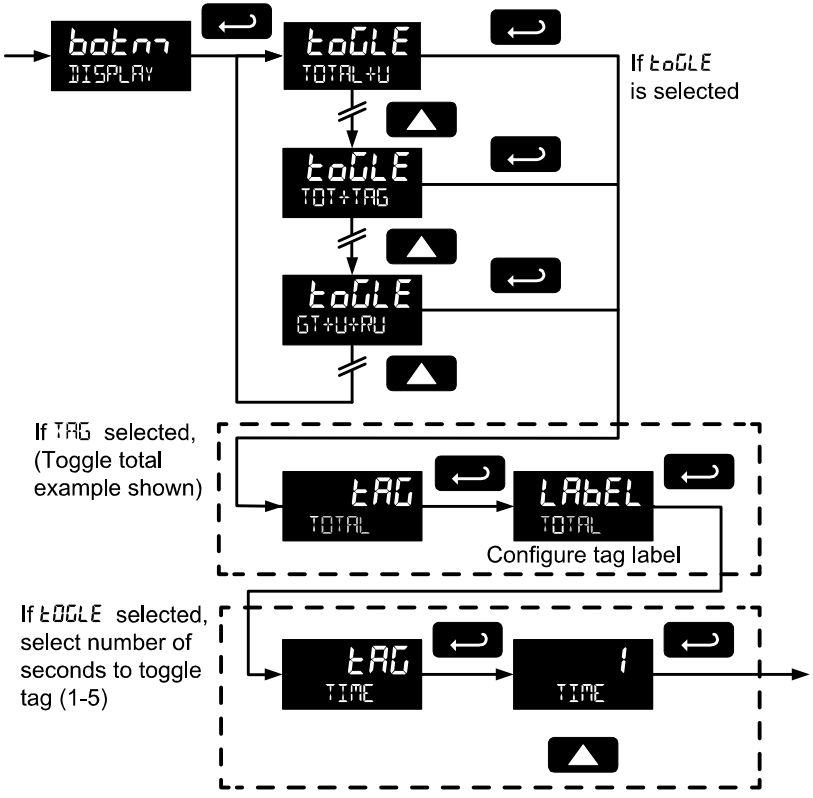
For details on setting alphanumeric labels, refer to Setting Alphanumeric Labels (LAbEL) on page 29.

Setting the Toggle Time (TIME)

If the bottom display is programmed to toggle (tOGLE), the meter will prompt for a toggle time. In addition, it may require a tag be entered, as shown in the example below.

Enter the time in seconds for the unit or tag to display in the bottom window every 10 seconds. The unit may be programmed to display for 1 to 5 seconds.

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

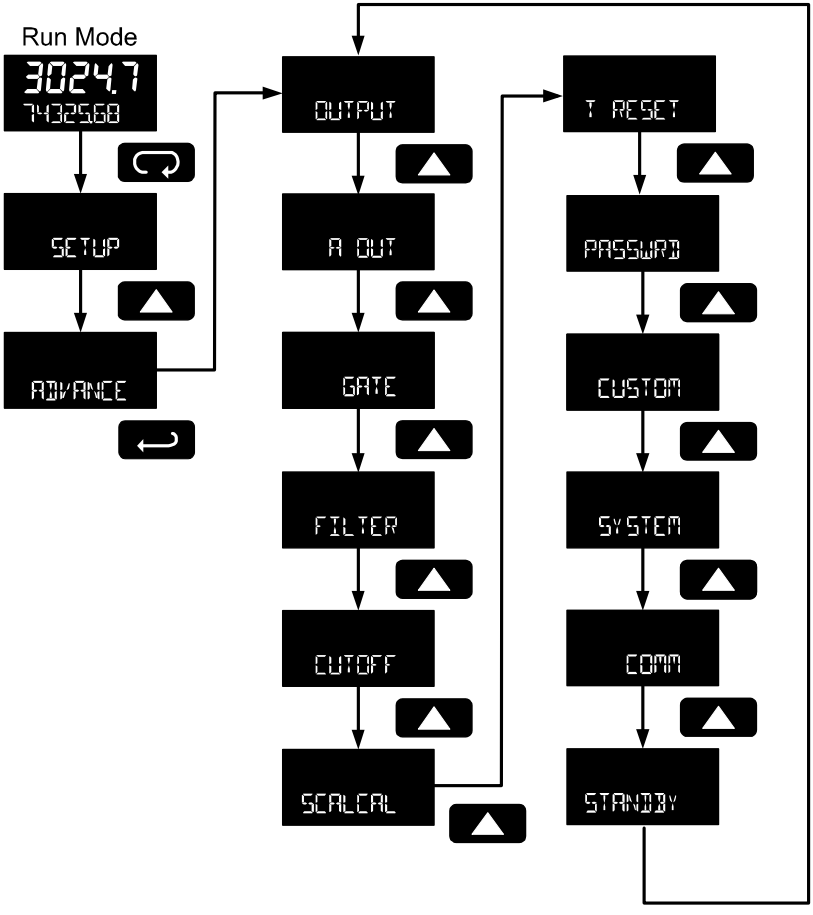


Advanced Features Menu

To simplify the setup process, functions not needed for most applications are located in the *Advanced* features menu. Access the Advanced features menu by pressing **Enter** at the *Advance* menu in the Main Menu defined on page 30.

The *Advanced* menu is used to select:

1. Open collector output configuration (OUTPUT)
2. Analog output configuration (A OUT)
3. Gate function for low speed inputs (GATE)
4. Set the input filter (FILTER)
5. Set low flow cutoff (CUTOFF)
6. Scale or live calibrate the meter and override k-factor (SCALCAL)
7. Select method of total and grand total reset (T RESET)
8. Set passwords (PASSWRD)
9. Reconfigure the *Main* menu structure (CUSTOM)
10. Enter the *System* menu for meter settings and data logging (SYSTEM)
11. Configure serial communication settings (COMM) – if applicable
12. Enter low-power Standby Mode (STANDBY) on battery powered models



Advanced menus A OUT displayed only for meters with the analog output option, COMM displayed only for meters with the serial communications option, and STANDBY only for meters with battery or battery backup power.

Press the **Enter** button to access any menu or press **Up** arrow button to scroll through choices. Press the **Menu** button to back out of a menu, or hold the **Menu** button to exit at any time.

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
ADVANCE	*Advanced*	Enter *Advanced* menu
OUTPUT	*Output*	Setup open collector outputs Out 1 and Out 2
OUT 1	*Output 1*	Assign function of open collector output 1
OUT 2	*Output 2*	Assign function of open collector output 2
PuLSE	*Pulse*	Set Out 1 or Out 2 for pulse output mode
rAtE	*Rate*	Assign pulse output to rate
totAL	*Total*	Assign pulse output to total
Grtot	*Grand total*	Assign pulse output to grand total
dEc.Pt	*Decimal point*	Set K-factor decimal point
count	*Count*	Set K-factor
rEtr	*Retransmit*	Assign pulse output to retransmit
QuAd	*Quadrature*	Assign pulse output to quadrature
tESt	*Test*	Assign pulse output to test mode
ALrm1	*Alarm*	Assign Out 1 or Out 2 for alarm output mode
rAtE	*Rate*	Assign alarm output to rate
SEt	*Set point*	Set rate alarm set point
rESEt	*Reset point*	Set rate alarm reset point
totAL	*Total*	Assign alarm output to total
Grtot	*Grand total*	Assign alarm output to grand total
SEt	*Set point*	Set total or grand total alarm set point
On	*On*	Set output to on state
OFF	*Off*	Set output to off state
tmrEr	*Timer*	Set Out 1 or Out 2 for timed pulse output mode
StArt	*Start*	Activate timed pulse output
dELAY	*Delay*	Set the time of one period (seconds)
On	*On*	Set the active low pulse width

Display	Parameter	Action/Setting
OFF	*Off*	Set Out 1 or Out 2 as off
A OUT	*Analog Output*	Enter *Analog Output* menu
rAtE	*Rate output*	Set rate as output variable
totAL	*Total output*	Set total as output variable
Grtot	*Grand total output*	Set grand total as output variable
dSP 1	*Display 1*	Output display 1 value
OUt 1	*Output 1*	Output 1 value
dSP 2	*Display 2*	Output display 2 value
OUt 2	*Output 2*	Output 2 value
SAUEP	*Save*	Save entered analog parameters
dSAbL	*Disable*	Turn off the analog output
GATE	*Gate*	Enter *Gate* menu
LO	*Low gate*	Set *Low Gate*
HI	*High gate*	Set *High Gate*
FILTER	*Filter*	Enter *Filter* menu
HI	*High speed filter*	Set *high speed* filter
mEd	*Medium speed filter*	Set *medium* speed filter
LO	*Low speed filter*	Set *low speed* filter
CUTOFF	*Low-flow cutoff*	Enter *Low-Low Cutoff* menu
SCALCAL	*Scale & calibrate*	Enter the *Scale & Calibrate* menu to program without using a k-factor
SCALE	*Scale*	Enter the *Scale* menu
CAL	*Calibrate*	Enter the *Calibrate* menu
Undo? KFACTOR	*Undo k-factor*	Undo the *K-Factor* input programming
Undo? SCALCAL	*Undo scaling & calibration*	Undo the scaling and calibration input programming
no?	*No*	Do not undo other programming

Display	Parameter	Action/Setting
YESP	*Yes*	Undo other programming
noPtS	*Number of points*	Enter the number of scaling or calibration points
InP 1	*Input 1*	Calibrate or scale input 1 value
dSP 1	*Display 1*	Program display 1 value
InP 2	*Input 2*	Calibrate or scale input 2 value
dSP 2	*Display 2*	Program display 2 value
SAUEP	*Save*	Save entered calibration or scale parameters
T RESET	*Total reset*	Enter the *Total Reset* menu
t rSt	*Total reset*	Select the *Total Reset* method
nn An	*Manual*	*Manual* total reset
EnAbL	*Enable*	*Enable* manual reset
dSAbL	*Disable*	*Disable* manual reset
Auto	*Automatic*	*Automatic* total reset
T DELAY	*Time delay*	Automatic reset t*ime delay*
GtrSt	*Grand total reset*	Select the *Grand Total Reset* method
PASSWRD	*Password*	Enter the *Password* menu
PASS	*Password*	Program password to lock meter parameters
PASS T	*Password total*	Program password to prevent total reset
PASS GT	*Password grand total*	Enter password to *permanently* lock out grand total related parameters and reset
UnLOC	*Unlock*	Password has been unlocked
LOCd	*Lock*	Password has been locked
UNLOCKD	*Unlocked*	Program password to lock meter
LOCKED	*Locked*	Enter password to unlock meter
CUSTOM	*Custom*	Enter *Custom* menu
POS 1	*Position 1*	Set menu position 1 (1-8)
POS 8	*Position 8*	Set menu position 8
SYSTEM	*System*	Enter *System* menu
SETTIME	*Set time*	Set real-time clock date and time

Display	Parameter	Action/Setting
YEAR	*Year*	Set the year
MONTH	*Month*	Set the month
01	*January*	Set month as January
02	*February*	Set month as February
03	*March*	Set month as March
04	*April*	Set month as April
05	*May*	Set month as May
06	*June*	Set month as June
07	*July*	Set month as July
08	*August*	Set month as August
09	*September*	Set month as September
10	*October*	Set month as October
11	*November*	Set month as November
12	*December*	Set month as December
DAY	*Day*	Set the day
TIME	*Time*	Set the hour and minue
DATALOG	*Data log*	Enter *Data Log* menu
LOGTIME	*Log time*	Set daily data log times
LOG 1	*Log 1*	Set first daily log time (1-4)
dSAbL	*Disable*	Disable log number
INTERVL	*Interval*	Set interval log time
StArt	*Start*	Begin interval logging
LOGVIEW	*Log view*	View data log
ALL LOGVIEW	*All log view*	View all data log points
LOG NUM	*Log number*	Go to specific log number
ALL ERASE	*All erase*	Erase all logs
ErASE?	*Erase?*	Confirm to erase all logs
BAKLITE	*Backlight*	Enable or disable backlight

Display	Parameter	Action/Setting
dSAbL	*Disable*	*Disable* backlight
EnAbL	*Enable*	*Enable* backlight
AO CAL	*Analog output calibration*	Enter *Analog Output Calibration* menu
BACKUP	*Backup*	Enter *Backup* menu
SAUE?	*Save?*	Save current parameters to backup restore
LOAd?	*Load?*	Load parameters from backup restore
dEFLt	*Default*	Restore factory default parameter settings
rESEt DFALTS?	*Reset defaults*	Confirm factory reset
BAL SYM	*Battery symbol*	Enter *Battery Symbol* menu
dSAbL	*Disable*	*Disable* battery backup symbol
EnAbL	*Enable*	*Enable* battery backup symbol
INFO	*Info*	Enter *Info* menu
SOFt	*Software*	Display software ID number
UEr	*Version*	Display software version number
modL	*Model*	Display model number
COMM	*Communications*	Enter *Communications* menu
mbuS	*Modbus*	Enter Modbus communications menu
SLU Id	*Slave ID*	Set Modbus slave ID
bAUd	*Baud rate*	Set baud rate
tdELY	*Transmit delay*	Set transmit delay time
PArtY	*Parity*	Set parity and stop bits
STANDBY	*Standby*	Enter standby mode (battery powered only)
YES?	*Yes*	Confirm standby mode

Open Collector Outputs (OUTPUT)

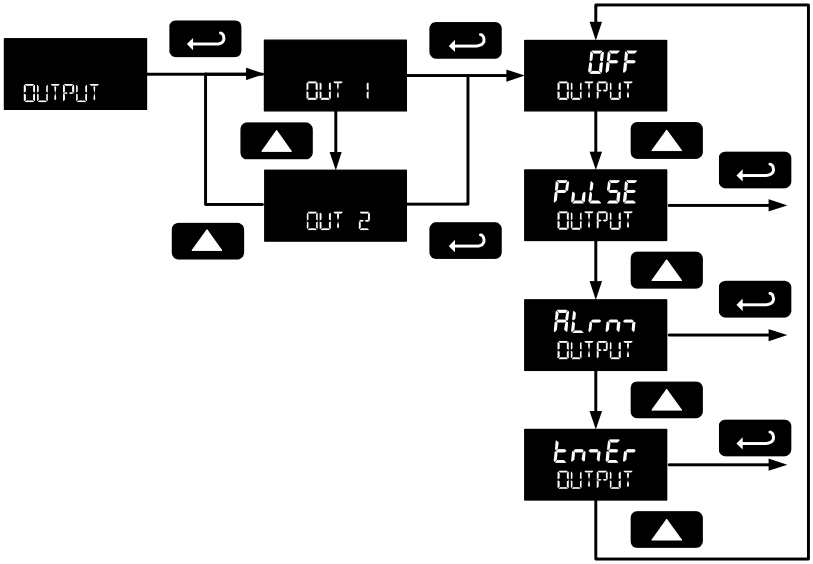
The meter is equipped with two NPN open collector outputs that may be set up for pulse outputs, alarms, timed pulses, or turned off.

Pulse outputs are based on K-factor, total or grand total counts, or one-for-one retransmit for input pulses. Both outputs may be used to generate a quadrature output based on any pulse menu output type. An output test mode is also selectable to generate pulses at a constant programmable frequency.

Alarms are available based on the rate, total, or grand total. The alarm status will show on the display even if the output is not wired. The outputs may also be forced on or off.

A timed pulse output generates constant pulses at a specified frequency and on time.

The output may be disabled by selecting OFF.

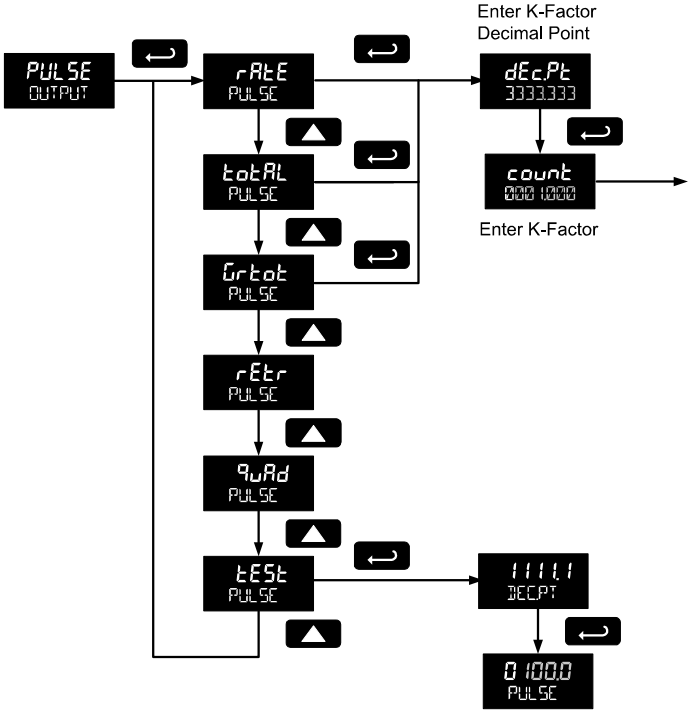


Output 1 and 2 Setup (OUT 1, OUT 2)

The function of open collector output 1 and 2 is configured using the *Off*, *Pulse*, *Alarm*, and *Timer* menus detailed below.

Pulse Output (PULSE)

Pulse outputs may be assigned to rate, total, grand total, retransmit, quadrature, or test.



Rate Pulse Output (rAtE)

A rate based pulse output is a factor of the rate display and count (output K-factor). The rate display is a factor of the input pulses, time base, and the input K-factor. The rate of output pulses over one time base (seconds, minutes, hours, days) is defined below in terms of input pulses and the input K-factor and count parameters.

$$Number\ of\ Output\ Pulses = \frac{\left(\frac{\text{Input Pulses}}{\text{Input K-Factor}}\right)}{\text{Count}}$$

For example, if the input K-factor value is set to 10, and the count set to 10, one output pulse is generated for every 100 input pulses.

Total & Grand Total Pulse Output (totAL, Grtot)

A total and grand total based pulse output is a factor of the associated total and count (output K-factor). A pulse will be generated for every total accumulation amount equal to the count.

If the maximum output frequency would be exceeded, the meter will display the message PULSE OVERRNG alternating on the display.

Retransmit Output (rEtr)

The retransmitting pulse output will send an output pulse for every input pulse, essentially duplicating the input signal. The output will generate a pulse at the falling edge of every input pulse.

No additional programming is required for a retransmitting pulse output.

If the maximum output frequency would be exceeded, the meter will display the message PULSE OVERRNG alternating on the display.

Quadrature Output (quAd)

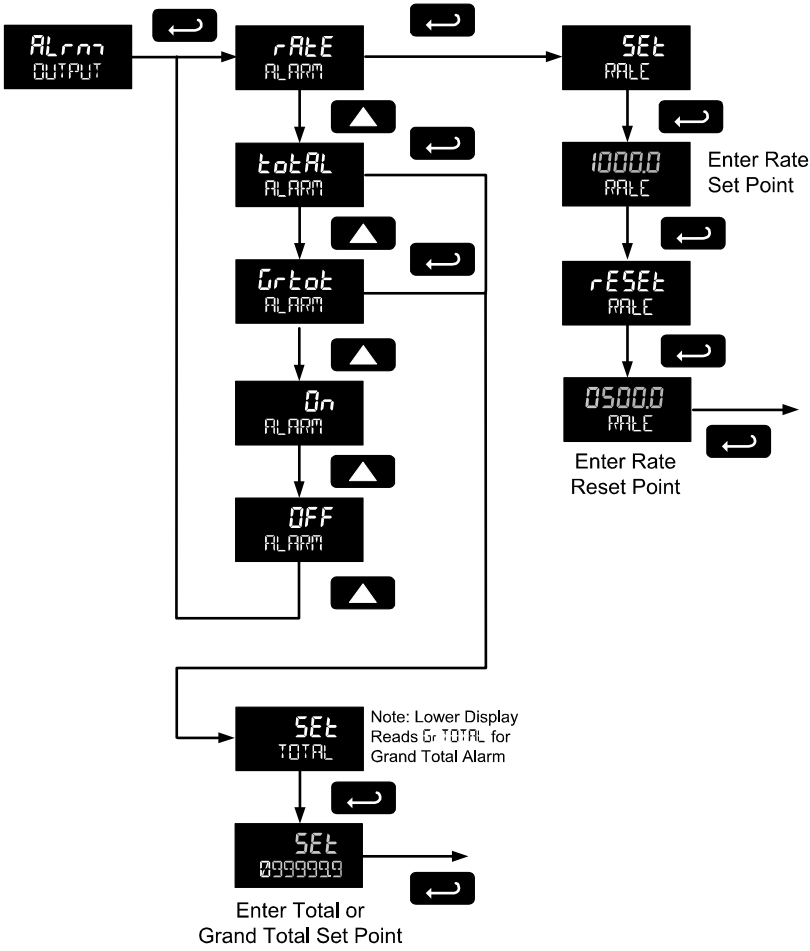
The pulse output set to quadrature will duplicate the other open collector output, but lag by ¼ duty cycle (90 degrees out of phase). For example, Out 1 will follow Out 2, if Out 1 is set to quAd. Only one output should be set to quAd. If both outputs are set to quAd , both outputs will be disabled. The other output should be programmed as desired for the quadrature output function, and must be a pulse (PULSE) output selection.

Test Output (tESt)

The test output setting programs the output to generate pulses at a programmed constant frequency. Set the frequency decimal point location in the dECPt menu, and then enter the desired output frequency in Hz in the PULSE menu.

Alarm Output (ALrn1)

Alarm outputs may be assigned to rate, total, or grand total; or be forced on or off.



Rate Alarm (rAtE)

Program the rate *set point* to trigger the alarm. 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 or Grand Total Alarm (totAL, Grtot)

Program total or grand total *set point*. A pulse alarm will generate when the *set* value is reached by the total or grand total.

If the total/grand total is set for manual reset, this alarm will remain until the total/grand total is reset to 0.

If automatic total/grand total reset is enabled, the output will generate an alarm for a period of time programmed in ADVANCE → T RESET → Auto → T DELAY. After this time delay, the total/grand total will reset to 0 and the alarm will clear.

If Out 1 and Out 2 are set for total or grand total alarm, the auto reset will be triggered on the highest of the two alarm set points.

For details on setting the total or grand total automatic reset time delay, see Total Reset (T Reset) on page 72.

Force On State (On)

This alarm mode forces the output to be active, or on. This mode is primarily used to test alarm systems.

Force Off State (OFF)

This alarm mode forces the output to be inactive, or off. This mode is primarily used to test alarm systems.

Timer Output (tmr Er)

The timer output produces a constant width pulse at a constant rate. Program the *Delay Period* for one period from 0.1 to 999999.9 seconds (time from the start of one pulse to the start of the next pulse).

Program the *On Time* for the active low pulse from .01 to 99999.99 seconds (pulse width). The *on* time must be less than the delay time.

Select *Start* to begin outputting the constant timed pulse.

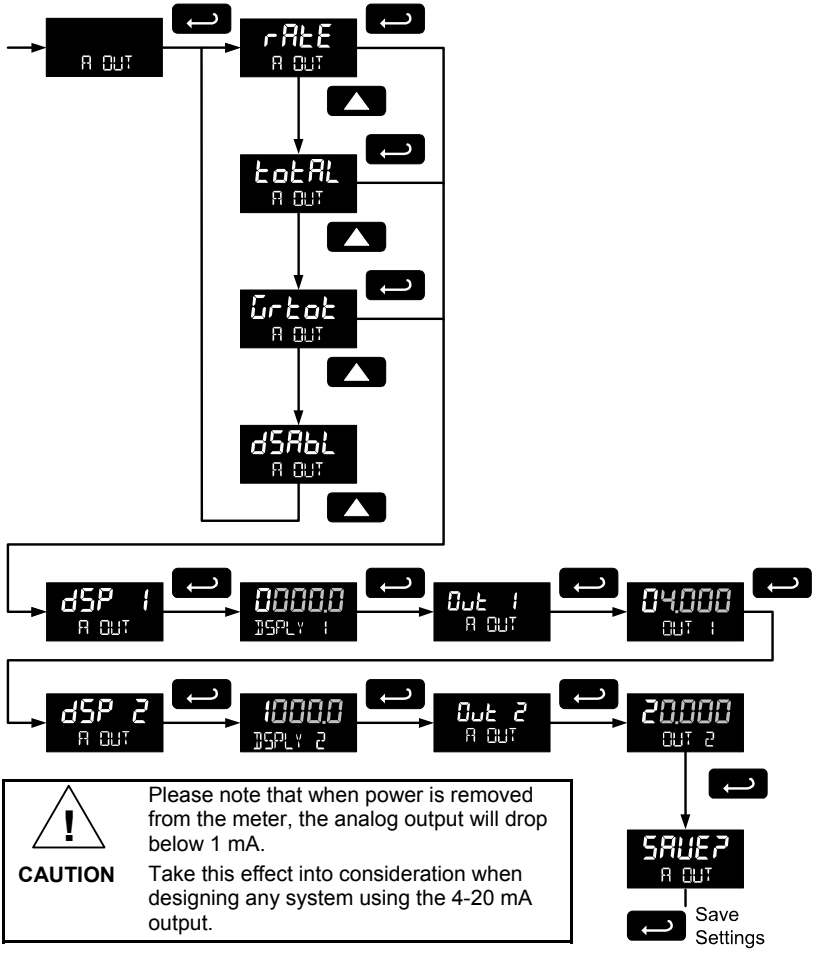
Select *Stop* to end outputting the constant timed pulse.

Scaling the 4-20 mA Analog Output (Aout)

The *Analog Output* menu is used to program the 4-20 mA output based on display values.

The 4-20 mA analog output (if equipped) can be scaled to provide a 4-20 mA signal for any display range selected for either the rate, total, or grand total. The output may be disabled (dSAbL), and will only output the minimum signal.

No equipment is needed to scale the analog output; simply program two display values and corresponding mA output signals.



CAUTION

Please note that when power is removed from the meter, the analog output will drop below 1 mA.

Take this effect into consideration when designing any system using the 4-20 mA output.

Gate Function (GATE)

The gate function is used for displaying slow pulse rates. Using the programmable gate, the meter is able to display pulse rates as slow as 1 pulse every 9,999 seconds (0.0001 Hz). The gate function can also be used to obtain a steady display reading with a fluctuating input signal.

There are two settings for the GATE, low gate (LO) and high gate (HI).

Low Gate (LO GATE)

For most applications, low gate setting should be left at 1 second. Increase low gate setting to obtain a steadier rate display. The rate display will update in accordance with the low gate setting, for example if low gate is set at 10, the display will update every 10 seconds; changes in rate between updates will not be reflected until next display update.

High Gate (HI GATE)

Set the high gate value to correspond to the highest expected pulse period (lowest pulse rate). For instance if the meter must display a rate when there is 1 pulse coming into the meter every 10 seconds, set the high gate to 11 seconds. When the signal is removed from the meter, the display will show the last reading for 11 seconds; then it will read zero.

Contact Debounce Filter (FILTER)

The filter function (FILTER) can be used for applications where the meter is set up to count pulses generated by switch contacts. There are three settings, HI (high speed), mEd (medium speed), and LO (low speed). High speed disables the contact debounce filter and allows any pulse of the minimum specified width for the selected input type. Press ENTER when mEd or LO is displayed to enable the filter function. The medium filter ignored signals faster than 250 Hz max, or pulse widths less than 2 ms at 50% duty cycle. The low filter ignores signals higher than 100 Hz, or pulse widths less than 5 ms at 50% duty cycle.

Low-Flow Cutoff (CUTOFF)

The low-flow cutoff feature allows the meter to be programmed so that the often-unsteady output from a transmitter at low flow rates, always displays zero on the meter.

The cutoff value may be programmed from 0 to 9999.9. Below the cutoff value, the meter will display zero. Programming the cutoff value to zero disables the cutoff feature.

Scaling & Calibration (SCALCAL)

It is **very important** to read the following information, before proceeding to program the meter:

- There is **no need to recalibrate** the meter for frequency in Hz when first received from the factory.
- The meter is ***factory calibrated*** for Hz prior to shipment. The calibration equipment is certified to NIST standards.

IMPORTANT	**Performing a scaling or calibration operation will override any k-factor programming.** Similarly, completing the k-factor menu will override any scaling or calibration performed on the meter. Verify the method of programming required, use the password protection feature to secure the meter if necessary.

There are three methods of programming the display to show the correct engineering units based on input pulses.

- Use the *Factor* menu to enter a K-Factor.
- Use the *Scale* menu to enter the scaling without a signal source.
- Use the *Calibrate* menu to apply a signal from a calibrator or a flowmeter.

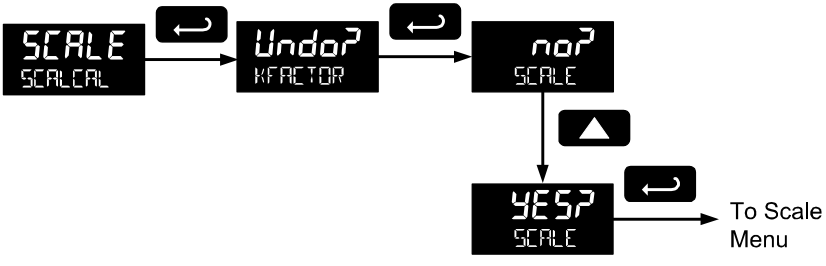
The k-factor, scale, and calibrate functions are exclusive of each other. The meter uses the last function programmed. The *Scale and Calibrate* functions can use up to 32 points (default is 2). The number of points should be set in *Scale and Calibrate* accordingly under the Number of Points (noPtS) menu selection prior to scaling and calibration of the meter, see page 67 for details.

This menu is used to scale and calibrate the meter. For information on using a k-factor for programming the input, refer to Entering the K-Factor (FActr) on page 38.

Undoing K-Factor, Scale, and Calibration (UndoP)

Whenever the input programming is being changed from using k-factor to scaling or calibration; or from scaling or calibration to k-factor, a confirmation menu appears. This prevents accidental changing of the input programming.

The example below shows a meter programmed with a k-factor being reprogrammed to utilize input scaling.

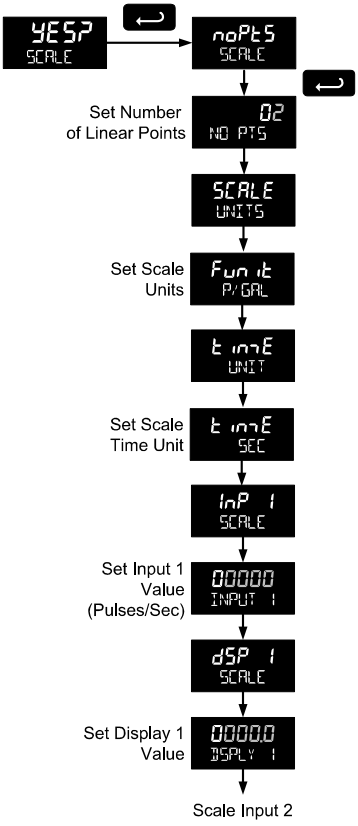


Scaling the Meter (SCALE)

The pulse input can be scaled to display the process variable in engineering units. A signal source is not needed to scale the meter; simply program the inputs and corresponding display values.

A programmed scaled input will work with Automatic Unit Conversions as described on page 45. The units for the display values that must be entered are a combination of the programmed *Rate Unit* and the time unit (t imE UNIT) entered in the *Scale* menu.

For example, if the *Rate Unit* is gallons, and the time unit (t imE UNIT) is seconds, the units for the display values entered in the *Scale* menu are gallons/second.



For instructions on how to program numeric values see page 29.

Multi-Point Linearization (noPtS)

Up to 32 linearization points can be selected under the noPtS function. The multi-point linearization can be used to linearize the display for non-linear inputs.

Number of Points (noPtS)

Enter number of linearization points. The default value is 2 points. For linear inputs requiring only 2 scale points, the number of points can be left at 2.

Scale Units (SCALE UNITS)

Enter the units associated with the desired scale values. Selecting the scale display units allows the meter to perform automatic unit conversions.

Pulse Input Time Unit (t in E UNIT)

This is the time component for the engineering units of the display values being entered. Enter the appropriate units/second, units/minute, units/hour, or units/day that corresponds to the values being entered at the *display 1-32* (dSP) menus.

For example, if the display values are being entered in gallons/second the time unit would be set to seconds.

Manual Multi-point Entry (inP, dSP)

Manual entry of the linearization data is done once the number of points has been selected (NO PTS). Input signal levels (inP 1-32) for up to 32 points, along with the desired/corresponding meter reading (dSP 1-32), should be entered for each linearization point.

Each scale point (1-32) has an input value and a display value. The input value is the number of pulses/sec (frequency), and the display value is the corresponding display value for that input in the time unit selected (example: gallons per minute, or GAL/M)

Important Programming Note: Save (SAVE?)
After entering the last display value, the scaling entries must be saved (SAVE?) before they will be put into effect. *However*, you may move past this selection using the Up arrow key if you need to go back and correct an earlier entry. Once confident in the entries, however, the user must navigate back to the Save menu screen (SAVE?) and press the **Enter** key to save the changes.

Calibrating the Meter (CAL)

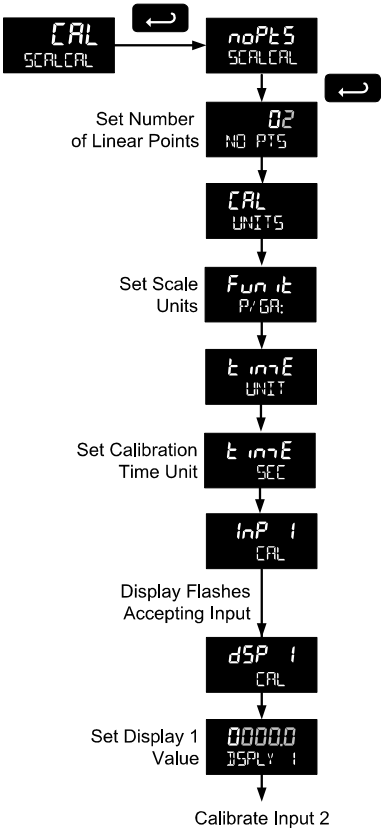
To scale the meter without a signal source refer to Entering the K-Factor (FACtr) on page 38 or Scaling the Meter (SCALE) on page 67.

The pulse input 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.

A calibrated input will work with Automatic Unit Conversions as described on page 45. The units for the display values that must be entered are a combination of the programmed *Rate Unit* and the time unit (t imE UNIT) entered in the *Calibrate* menu.

For example, if the *Rate Unit* is gallons, and the time unit (t imE UNIT) is seconds, the units for the display values entered in the *Calibrate* menu are gallons/second.



The multi-point linearization feature (noPtS) can be used to linearize the display for non-linear signals. For instructions on how to utilize this feature, see Multi-Point Linearization (noPtS), page 71.

For instructions on how to program numeric values see *Setting* Numeric Values, page 29.

1. Press the **Up** arrow button to scroll to the *Calibration* menu (CAL) and press **Enter**.
2. The meter displays noPtS. For a linear signal, press **Up** arrow. For a non-linear signal, refer to Multi-Point Linearization (noPtS), page 71.
3. The meter displays CAL UNITS. Press **Enter** to select the input units/pulse. The menu will read Fun it.
4. Use the **Up** arrow to select the time unit. If entering display values in units/second, press **Enter.** Otherwise, select the time unit. Refer to Pulse Input Time Unit (Time UNIT) on page 71.
5. The meter displays inP 1. Apply a known signal and press **Enter**. The display will flash while accepting the signal.
6. After the signal is accepted, the meter displays dSP 1 Press **Enter**. Enter a corresponding display value for the signal input, and press **Enter** to accept.
7. The meter displays inP 2. Apply a known signal and press **Enter**. The display will flash while accepting the signal.
8. After the signal is accepted, the meter displays dSP 2. Press **Enter**. Enter a corresponding display value for the signal input and press **Enter** to accept.
9. After completing calibration the SAVE? display will need to be acknowledged using the **Enter** key before calibration will take effect.

Important Programming Note: Save (SAVE?)
After entering the last display value, the calibration entries must be saved (SAVE?) before they will be put into effect. *However*, you may move past this selection using the Up arrow key if you need to go back and correct and earlier entry. Once confident in the entries however, the user must navigate back to the Save menu screen (SAVE?) and press the Enter key to save the changes.

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 2 during calibration or scaling, allowing the appropriate input signal to be applied or programmed.

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

1. Input signal is not connected to the proper terminals or it is connected backwards.
2. Minimum input span requirements not maintained.
3. Input 1 signal inadvertently applied to calibrate input 2.

Minimum Input Span

The minimum allowed input span is 1 Hz, which is the minimum difference between input 1 and input 2 signals required to complete the calibration or scaling of the meter.

Multi-Point Linearization (noPtS)

Up to 32 linearization points can be selected under the noPtS function. The multi-point linearization can be used to linearize the display for non-linear inputs. Linearization data can be entered using a known accurate signal source (inP 1-32) and then entering the desired/corresponding meter reading (dSP 1-32) for that input signal level. These points are established via direct entry (SCALE) or with an external calibration signal (CAL).

Calibration Units (CAL UNITS)

Enter the units associated with the desired scale values. Selecting this unit allows the meter to perform automatic unit conversions.

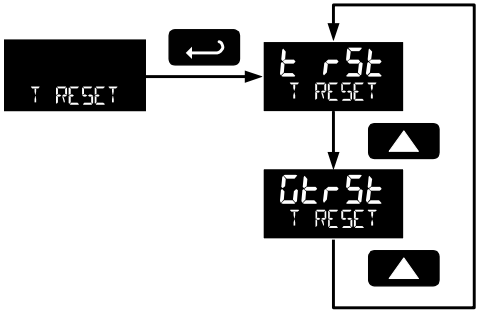
Pulse Input Time Unit (t inP E UNIT)

This is the time component to be used when calibrating a number of input pulses per time unit to equal a certain display value.

For example, if the inputs being entered in pulses/second the time unit would be set to seconds.

Total Reset (T RESET)

This menu is used to select the ways the total and grand total may be reset.

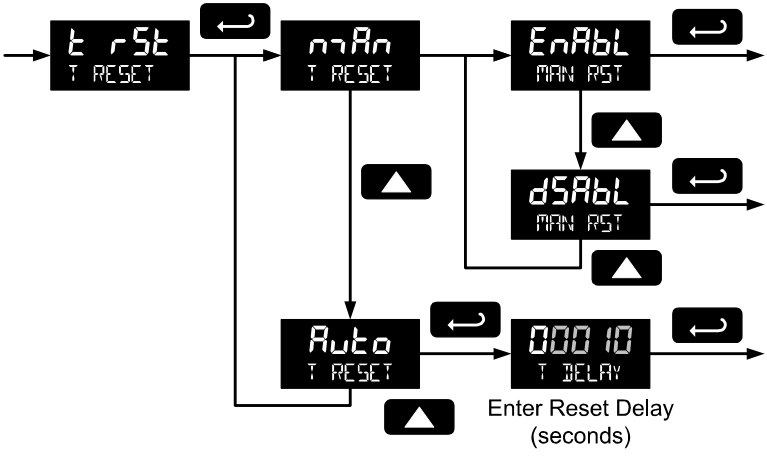


Manual or Automatic Total Reset Function (t rSt)

For manual reset, select T RESET → t rSt → mn An and then select whether manual reset will be enabled (EnAbL) or disabled (dSAbL) using the **Up** arrow key. Press the **Enter** button to accept. Disabling reset will avoid inadvertent resets of the total via the front reset button or external reset contact.

For automatic reset, select T RESET → t rSt → Auto → T DELAY and enter reset delay time in seconds. Once the output alarm total set point is reached, the meter waits for a programmed amount of time (T DELAY) and then resets the total to zero.

Press the **Enter** button, at any time, to accept a setting; otherwise press the **Menu** button to exit without saving changes.



Total Alarm Time

The T DELAY parameter is used by the NPN open collector outputs when they are programmed as total alarms. If *total reset* (t rSt) is programmed to Auto the *time delay (*T DELAY) is the length of the associated Out 1 or Out 2 total alarm prior to the total being reset to 0.

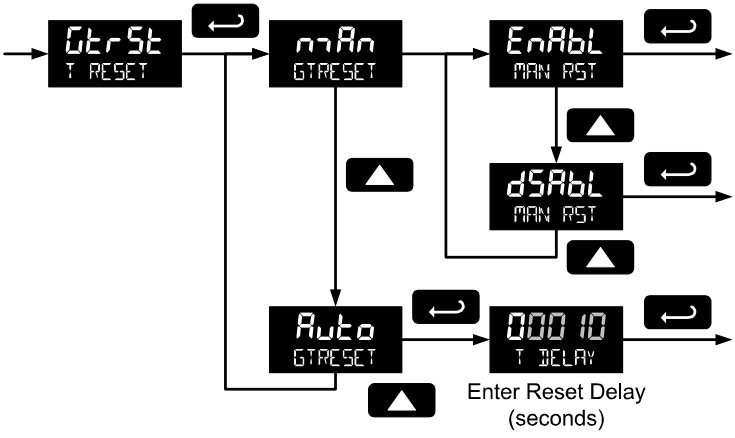
For information on programming the NPN open collector pulse outputs as total alarms, see Alarm Output programming on page 62.

Manual or Automatic Grand Total Reset Function (GtrSt)

For manual reset, select T RESET → GtrSt → mnAn and then select whether manual reset will be enabled (EnAbL) or disabled (dSAbL) using the **Up** arrow key. Press the **Enter** button to accept. Disabling reset will avoid inadvertent resets of the total via the front reset button.

For automatic reset, select T RESET → GtrSt → Auto →T DELAY and enter reset delay time in seconds. Once the grand alarm output grand total set point is reached, the meter waits for a programmed amount of time (T DELAY) and then resets the grand total to zero.

Press the **Enter** button, at any time, to accept a setting; otherwise press the **Menu** button to exit without saving changes.



Grand Total Alarm Time

The T DELAY parameter is used by the NPN open collector outputs when they are programmed as grand total alarms. If *grand total reset* (GtrSt) is programmed to Auto,the *time delay (*T DELAY) is the length of the associated Out 1 or Out 2 grand total alarm prior to the grand total being reset to 0.

For information on programming the NPN open collector pulse outputs as grand total alarms, see Alarm Output programming on page 62.

Press the **Enter** button, at any time, to accept a setting; otherwise press the **Menu** button to exit without saving changes.

Setting Up Passwords (PASSWRD)

The *Password* menu is used to program a five-digit password to prevent unauthorized changes to the programmed parameter settings, to restrict the ability to reset the total and grand total, and to permanently lockout the ability to reset the grand total and any grand total related parameters.

The lock symbol is displayed to indicate that settings are password protected.

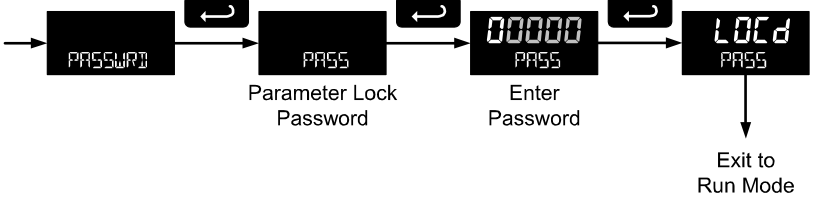
Record all passwords for future reference. If appropriate, it may be recorded in the space provided.

Model:	
Serial Number:	
Setting Lockout Password (PASS):	__ __ __ __ __
Total Reset Password (PASS T):	__ __ __ __ __
Grand Total Reset Password (PASS GT)	__ __ __ __ __

Locking Meter Setup Parameters

Enter the *Password* menu, select PASS, and program a five-digit password. The meter will return to Run mode after locking any of the passwords.

For instructions programming numeric values see Setting Numeric Values, page 29.



Making Changes to a Password Protected Meter

If the meter is password protected, the meter will display the message PASS LOCKED when an attempt is made to enter the *Setup* menu or *Advanced* menu. Press the Enter button while the message is being displayed and input the correct password followed by the **Enter** button to gain access to the menu. After exiting the programming mode, the meter returns to its password protected condition.

Password Restricting Total & Grand Total Reset

To restrict resetting of the total, enter the *Password* menu, select PASS T, and program a five-digit password. This will deactivate the remote reset connections. Total will only be able to be reset through the Through-glass Buttons or mechanical pushbuttons, if the appropriate password is entered.

To restrict resetting of the grand total, enter the *Password* menu, select PASS GT, and program a five-digit password.

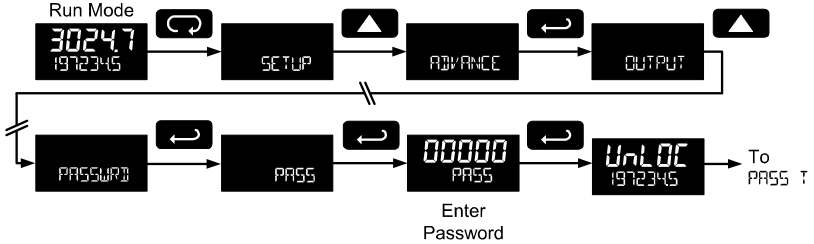
Resetting Total & Grand Total on a Password Protected Meter

If the meter is password protected for total or grand total reset, the meter will display the message PASS T or PASS GT when an attempt is made to enter the password protected total or grand total *Reset* menus. Input the password and press the **Enter** button to reset the total or grand total.

The password requirement may be disabled by entering the password in the *Password* menu for total (PASS T) or grand total (PASS GT).

Disabling Password Protection

To disable the password protection, access the *Password* menu, select the type of password to be disabled, and enter the correct password as shown below. That password is now disabled until a new password is entered.



If the correct five-digit password is entered, the meter displays the message UnLOC (*unlocked*) and the protection is disabled until a new password is programmed.

If the password entered is incorrect, the meter displays the message LOCd.

Did you forget the passwords?

The password may be disabled by entering a master password. If you are authorized to make changes, enter the master settings lockout (PASS) password 50865, the master total reset (PASS T) password 80034, or the master grand total reset (PASS GT) password 80034 to unlock the meter.

Non-Resettable Grand Total

The grand total may be configured to be a non-resettable grand total. This is a permanent setting. Configuring the grand total as a non-resettable grand total locks out all setup parameters that could be used to reset the grand total or change the setup of the grand total; including input selection, rate scaling, and conversion factors.

To configure the meter for non-resettable grand total mode, enter the non-resettable grand total password below into the *Pass GT* parameter in the *Password* menu.

The non-resettable grand total permanently locks the following setup menus and parameters from being changed: input selection, K-factor, K-factor units, grand total units, grand total conversion factor, grand total decimal point, scaling, calibration, grand total alarms, pulse input filter, and cutoff.



CAUTION

Locking the meter into a non-resettable grand total is not reversible. It is a permanent meter configuration. Doing so will permanently prevent most input parameters from being altered. This should be the last step after verifying all setup parameters.

Non-resettable grand total password: 50873

Non-Resettable Grand Total Locked Menus & Parameters

Display	Parameter/Menu	Action/Setting Locked
InPut	*Input*	All *Input* type selection menu parameters
GtotU	*Grand total units*	Set grand total units
GrtCF	*Grand total conversion factor*	Enter the *Grand Total Conversion Factor* menu
Grtot DECIMAL	*Grand total decimal point*	Enter the grand total display decimal point
FActr	*K-factor*	All *K-Factor* menu parameters
SCALE	*Scale*	All *Scale* menu parameters
CAL	*Calibrate*	All *Calibrate* menu parameters
GtrSt	*Grand total reset*	All the *Grand Total Reset* menu parameters
PASS GT	*Password grand total*	Enter the grand total reset password
Grtot ALARM	*Grand total alarm*	All grand total alarm output menu parameters
FILTER	*Filter*	Enter *Filter* parameter
CUTOFF	*Low-flow cutoff*	Enter *Low-Flow Cutoff* parameter

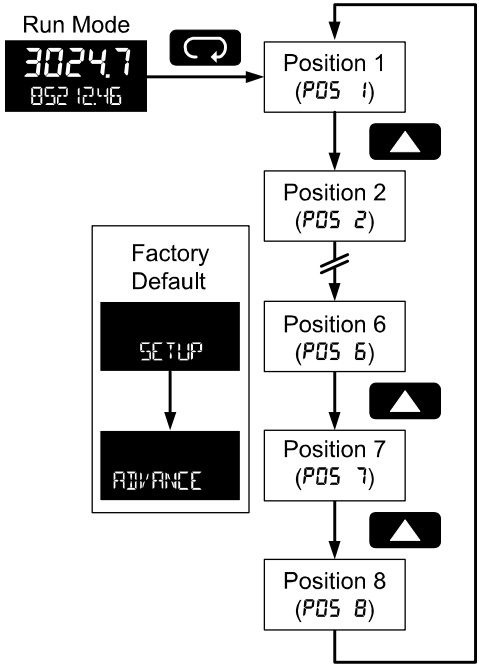
The above menus remain accessible; however the parameters listed above within the menus are locked and may not be changed.

Custom (CUSTOM)

The *Custom* menu is used to modify the initial programming menus that appear in the Main Menu when the **Menu** button is pressed in Run Mode.

CAUTION	Changing the default menu setup with the *Custom* menu feature may change the setup and operation procedures described in this manual. Only operators familiar with the programming and operation of this unit should use this feature.

Eight menu positions are available. Menu positions 6 and 7 are factory programmed for *Setup* and *Advanced*.



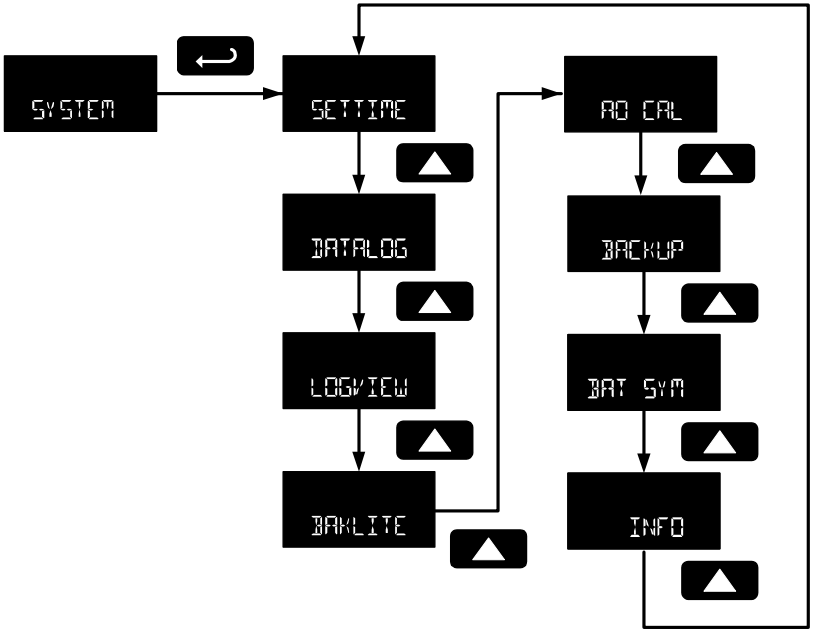
To add a menu or parameter to the menu structure, or change the default menus, press **Enter** at the desired menu in the position (POS) to be edited, and use the **Up** or **Right** arrows to select the desired menu item for that position. See page 78 for a complete list of the available menu selections for each position.

Custom Menu Parameters		
Display	**Parameter/Menu**	**Action**
NONE	*None*	Set no menu position display
INPUT	*Input*	Set to show *Input* menu
KFACTOR	*K-Factor*	Set to show *K-Factor* menu
UNITS	*Units*	Select standard units or custom unit/tag
DECIMAL	*Decimal*	Set to show *Decimal* menu
DISPLAY	*Display*	Set to show *Display* menu
A OUT	*Analog out*	Set to show *Analog Output* menu
RATE.DP	*Rate decimal Point*	Set to show *Rate Decimal Point* menu
TOTAL.DP	*Total decimal point*	Set to show *Total Decimal Point* menu
GRTOT.DP	*Grand total decimal point*	Set to show *Grand Total Decimal Point* menu
SCALE	*Scale*	Set to show *Scale* menu
CAL	*Calibrate*	Set to show *Calibrate* menu
T BASE	*Time base*	Set to show *Time Base* menu
T FACTR	*Total conversion factor*	Set to show *Total Conversion Factor* menu
T RESET	*Total reset*	Set to show *Total Reset* menu
GTFACTR	*Grand total conversion factor*	Set to show *Grand Total Conversion Factor* menu
GTRESET	*Grand total reset*	Set to show *Grand Total Reset* menu
PASS	*Password*	Program password to lock meter parameters
PASS T	*Total password*	Program password to prevent total reset
PASS GT	*Grand total password*	Program password to prevent grand total reset. May *permanently* lock out grand total related parameters and reset
OUTPUT	*Output*	Set to show *Output* menu
OUT 1	*Out 1*	Assign function of pulse output 1
OUT 2	*Out 2*	Assign function of pulse output 2

DATALOG	*Data Log*	Enter *Data Log* menu
LOGTIME	*Log Time*	Set daily data log times
INTERVL	*Interval*	Set interval log times
LOGVIEW	*Log View*	Enter *Log View* menu
PASSWRD	*Password*	Set to show Password menu
SETUP	*Setup*	Set to show Setup menu
ADVANCE	*Advance*	Set to show Advanced menu
SYSTEM	*System*	Set to show *System* menu

System (SYSTEM)

The system function is used to set the real time clock, set daily data log times, enable/disable the backlight, access analog output controls used in troubleshooting, store, restore, and backup restore feature, enable/disable the battery power alert symbol on the display, and review basic system identification information.



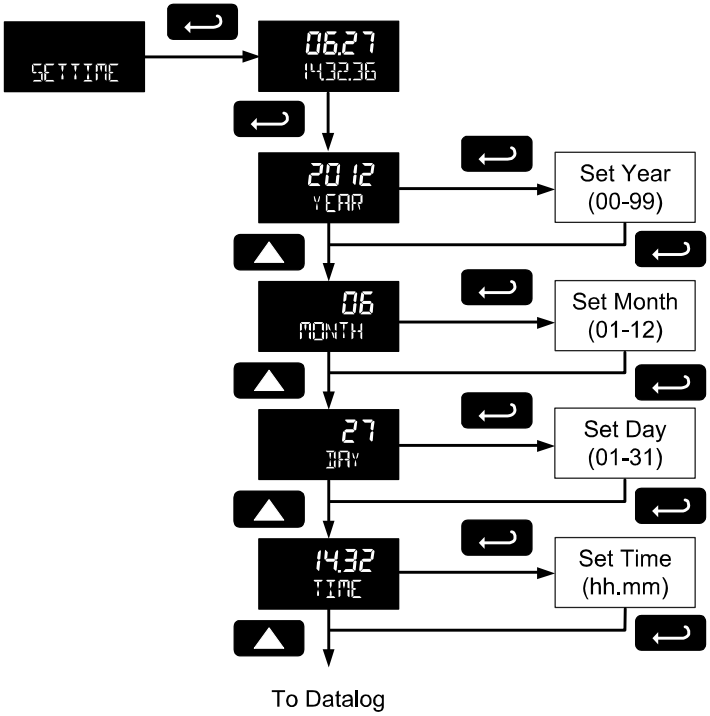
Set Real Time Clock (SETTIME)

The real time clock is used to trigger data log events, and is recorded at every logged data point. The menu displays the date and time.



Figure 15. Date Display Example

The above display example shows the date to be June 27, at 14 hours, 32 minutes, and 36 seconds. The display date will toggle with the year.

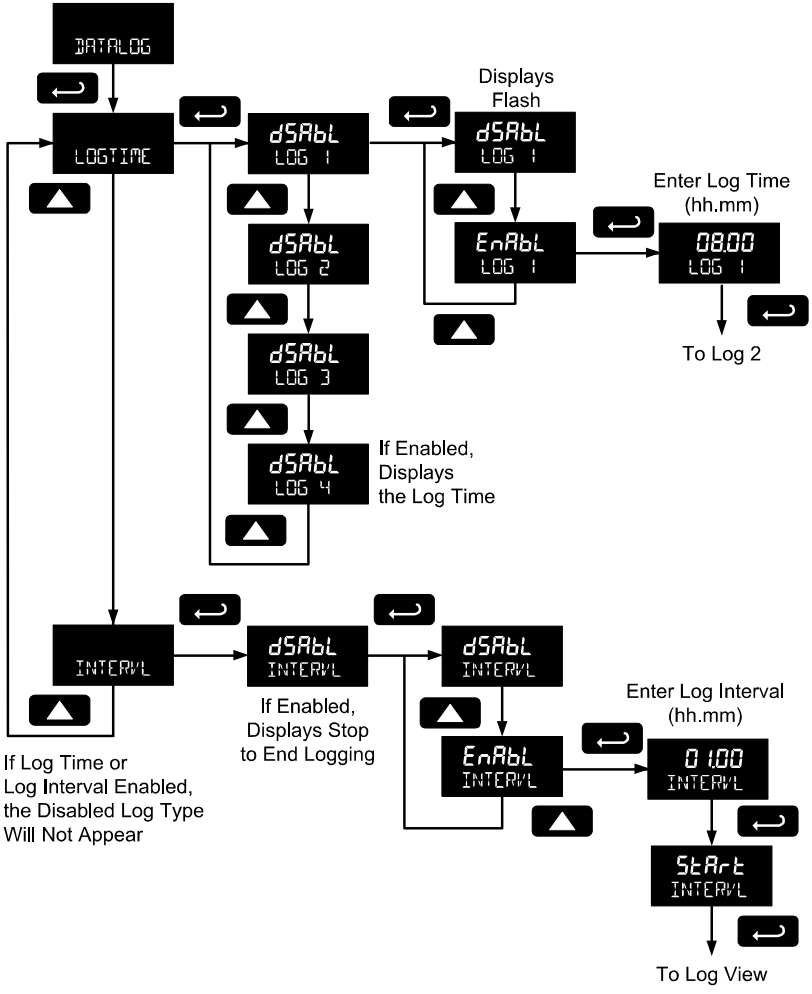


The year, month, day, hour, and minute may all be set by the user. The real time clock will need to be reset if external power and battery power are lost.

Changing the time (hours and minutes) will reset the seconds clock to 0.

Data Log Setup (DATALOG)

The *Data Log* menu is used to setup and enable the data log functions. The meter may contain up to 1024 records, each containing date, time, rate, total, grand total, and log number.



There are two ways to configure the time when a data log is recorded. The *Log Time* feature allows up to 4 data logs to be recorded each day, at specific times. The *Log Interval* feature allows a data log to be recorded each time a time interval has passed.

Only the *Log Time* or *Log Interval* may be active at once. While one type of data logging has been enabled, the other menu will be inaccessible.

Log Time Setup (LOGTIME)

The *Log Time* menu contains four log points (LOG 1 to LOG 4). Each log time is configured separately. For each daily log time desired, enable a log, and set the log time for the hours and minutes the log is to be recorded. The time is set in real-time, based on the real time clock setup.

The *Log Time* feature will roll-over, deleting the oldest data logs (in blocks of 8) when the log is full and new logs must be recorded. This makes it the most useful for long-term data logging.

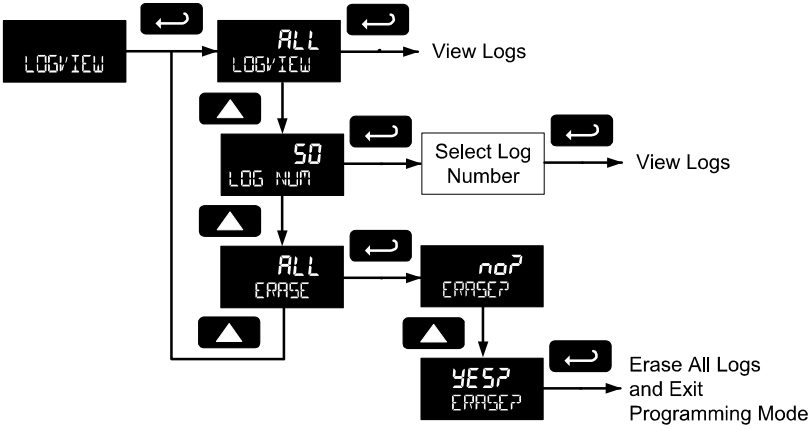
Interval Setup (INTERVL)

The *Interval* menu sets the time interval for data logging. Every time interval, one data point will be recorded. To enable interval data logging, enable the feature, and set the interval time for the hours and minutes between each log.

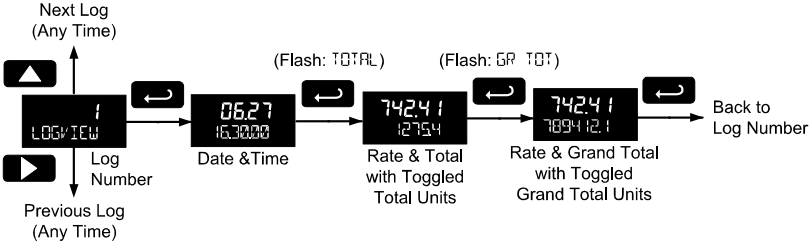
The *Log Interval* feature will not delete old data, and data logging will stop when the log is full. This makes it the most useful for short periods and logging specific functions.

View Data Log (LOGVIEW)

The *Log View* menu allows on-screen browsing of the data log points stored in the meter. Data points may be navigated by viewing the log number, date and time, total, or grand total amounts. A known log may be jumped to immediately, avoiding a lengthy search for data. All logs may be deleted with the ERASE command, requiring confirmation.



Once the log records are displayed, use the **Up** and **Right** arrows to change the log entry being viewed. The **Enter** key changes the displayed information for the same log.



Backlight (BAKLITE)

The *Backlight* menu is used to enable or disable the backlight. This feature is particularly important for the battery-powered models with momentary backlight. This feature is not available for models with a loop output powered backlight.

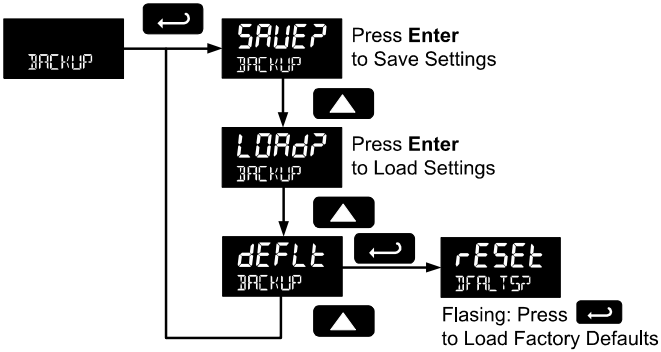
Analog Output Calibration (AO CAL)

This feature is only used at the factory for diagnostic purposes. It is not recommended to access this menu without instruction from technical support.

Backup & Restore (bACKUP)

The meter saves all parameter settings and no reprogramming is necessary when power is lost and restored to the meter. The total and grand totals are saved during a power loss. Only the maximum and minimum displays are reset when power is lost.

The features are used to save and restore programmed settings. Programming can be restored to a known saved good configuration, or to factory defaults. This is useful to restore meters whose programming has been altered in unknown ways, or to quickly restore known good settings if mistakes are made during reprogramming.



The *save* feature (**SAVEP**) saves all current parameter settings into the memory of the backup restore. The backup restore feature is loaded with factory default settings until a new configuration is saved.

The *load* feature (**LoAdP**) restores all parameters to the programmed values stored in backup restore memory. The *load* feature will not affect the current password settings, or allow the editing of permanently locked parameters due to the enabling of the non-resettable grand total feature. See Non-Resettable Grand Total described on page 75.

CAUTION

Once meter parameters have been saved to memory by the backup restore feature there is no recovering the previously saved settings.

Once parameters have been loaded into the meter from the backup restore feature there is no recovering the previously programmed settings.

The *default* feature (**dEFLt**) restores all parameters to the factory default values. Factory default reset does not change the saved backup restore settings, override passwords, or edit parameters locked by a permanent non-resettable grand total. See Non-Resettable Grand Total, as described on page 75.

Battery Power Symbol Alert (bAT SYM)

The *Battery Power Symbol Alert* menu is used to enable or disable the battery alert symbol on the display. This is a useful way to be aware of a power failure to a model with battery backup.

When enabled, the battery symbol will appear whenever the meter is powered as a battery backup. This is detected when the meter being powered from DC or loop-power experiences power loss, subsequently switching over to battery power.

The indicator will not appear if the meter is powered on via battery power, only when there is applied power to the DC or loop-power lines, followed by power loss. This prevents the batter indicator from appearing at all times for a primarily battery powered application.

The battery symbol will flash in a low battery condition regardless of the setting of this parameter.

Information (INFO)

The *Information* menu is part of the *System* features menu. It shows software identification number, version number, and extended model number. To view this information:

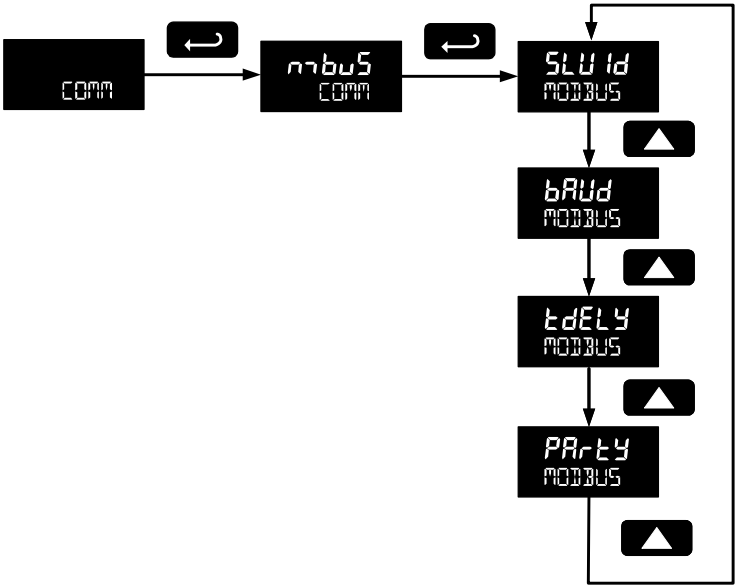
Go to the *Information* menu (INFO) and press **Enter** button.

Continue pressing **Enter** to scroll through the displays.

Following the information display, the meter will exit the *Advanced* features menu and return to run mode.

Serial Communications (COMM)

The *Communications* menu is used to setup serial communications parameters necessary for communication via Modbus.



Modbus communications is performed with the 2-wire RS-485 with Modbus RTU option.

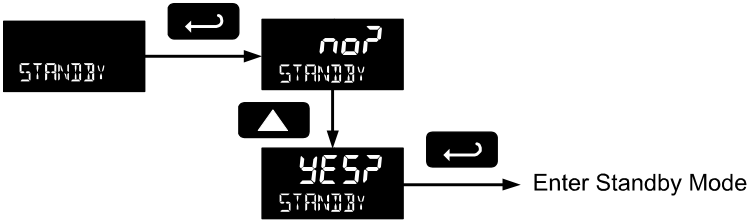
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) may be programmed between 1 and 247. The baud rate may be set to 1,200; 2,400; 4,800; 9,600; 19,200; 38,400; 57,600; or 115,200 bps. The transmit delay may be set between 0 and 199 ms. The parity can be set to even, odd, or none with 1 or 2 stop bits.

Refer to the SMRT-PRO Modbus Register Tables located at www.simarkcontrols.com for details.

Standby Mode (STANDBY)

Standby mode is available on battery powered and battery backup models only.

The *Standby* menu is used to enter a power-saving standby mode that will turn off the display and activate a low power mode for the through-glass buttons. Signal processing operations will continue to run. This mode may be used to reduce power consumption and increase battery life when the meter is not in use.



It may take up to 3 seconds for the meter to enter standby mode after confirming the flashing display with the **Enter** button.

Wakeup the Meter (WAKEUP?)

To bring the meter out of standby mode, press any button and Wakeup (WAKEUP?) will flash. If using Through-glass buttons, it may be required to hold the button for several seconds.

Confirm that the meter should awaken to run mode by pressing the **Enter** key while WAKEUP? is flashing. The meter will return to the normal run mode.

OPERATION

Front Panel Buttons Operation

Symbol	Description
	• Hold the **Menu** Through-glass button when in power save mode (display will show ⏻) to awaken Through-glass buttons. • Press the **Menu** button to enter Programming Mode. • Press the **Menu** button during Programming Mode to return to return to the previous menu selections. • Hold the **Menu** button for 1.5 seconds at any time to exit Programming Mode and return to Run mode. • Press and hold the **Menu** button for 3 seconds to access the *Advanced* features of the meter.
	• Press the **Right** arrow button to move to the next digit or decimal position during programming. • Press **Right** to go backward through most selection menus. • Press **Reset** to reset the total, or values displayed in the bottom display (grand total, max, or min). Press **Enter** after **Reset** to confirm the reset.
	• Press Display **when** in Run mode to display the grand total, again to display the maximum, and again to display the minimum reading since last reset. These displays will time out in 12 seconds, or press Display until **total** is displayed in the lower display. **Press** Enter to lock this display, and disable the 12 second time out. • Press the **Up** arrow button to scroll forward through the menus, decimal point, or to increment the value of a digit.
	• Press the **Enter** button to access a menu or to accept a setting. • Press **Enter** to lock the grand total, maximum, or minimum value on the lower display, and disable the 12 second time out. • Press **Enter** while the grand total, max, or min reading is locked on the lower display to return to run mode. • Press **Enter** to acknowledge alarm (if enabled).

The following Through-glass button information is reprinted from Through-Glass Button Operation on page 25.

Through-Glass Button Operation

To actuate a button, press and remove one finger to the glass directly over the marked button area. Remove finger to at least 4 inches away from the glass in between button activations. Through-glass and mechanical buttons may be held to cycle through menus or digits in place of repeatedly pushing a button.

Through-Glass Power Save Mode

Through-Glass buttons enter a power saving mode after three minutes of inactivity. This mode is indicated by a pause symbol (⏻) appearing in the lower right of the display. Only the **MENU** button is monitored in this mode. To activate the Through-glass buttons, press and hold the menu button for up to five seconds. The display will read AWAKE, and the Through-glass buttons will be fully enabled.

Through-glass Disabled Mode

When the cover is removed, the four mechanical buttons located next to the sensors may be used. The sensors are disabled when a mechanical button is pressed and will automatically be re-enabled after 60 seconds of inactivity. The Through-glass power symbol (⏻) will blink in the lower right of the display if the buttons are disabled due to a mechanical pushbutton being pressed.

IMPORTANT

Through-glass buttons will not work if two or more buttons are detected as being pressed simultaneously. As a result, be careful to avoid triggering multiple buttons or reaching across one button location to press another.

Through-Glass Button Tips and Troubleshooting

The Through-Glass Buttons are designed to filter normal levels of ambient interference and to protect against false triggering, however it is recommended that the Through-Glass Buttons be turned off (slide THRU-GLASS BUTTONS switch to OFF) if there is an infrared interference source in line-of-sight to the display or if the buttons are not needed.

Through-Glass Button Tips:

- To the extent possible, install the display facing away from sunlight, windows, reflective objects and any sources of infrared interference.
- Keep the glass window clean.
- Tighten the cover securely.
- Use a password to prevent tampering.
- If the cover has not been installed and secured tightly, it may take a moment for the Through-Glass buttons to properly self calibrate when the cover is tightened.

After all connections have been completed and verified, connect the ribbon cable to the display module, fasten the display module to the base, install enclosure cover, and then apply power.

Through-Glass Button Equalize Delay

The Through-Glass buttons are designed to constantly recalibrate for ambient conditions. When the cover position is changed, the cover is removed, or an object is removed that was placed over the front window, it may take a moment for the Through-Glass buttons to recalibrate to new conditions in these cases where the cover position was changed, or the front window is being unblocked.

Grand Total Reading (Gr TOTAL)

The grand total is a separate total that is not reset when the total is reset. This allows the complete total to be tracked by the grand total, while individual batch, or daily totals are reset regularly.

To display the grand total, press the **Up/Display** button. The display will read GRTOTAL, and the **GT** symbol will appear indicating the grand total is being displayed on the bottom display. After 10 seconds, the bottom display will return to showing total. To lock the grand total on the display, press **Enter**. Pressing **Menu** at any time will return to normal run mode.

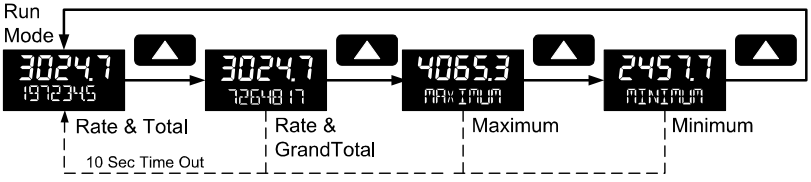
Note: *If the Display menu has been setup to display the grand total on the bottom display, pressing the* **Up/Display** *button will display the maximum and minimum readings followed by the total.*

Max/Min Readings (MAXIMUM, MINIMUM)

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

To display the maximum and minimum readings use **Up/Display** button to cycle the bottom display. Maximum and minimum are displayed after the grand total.

Press the **Enter** button to remain in Max/Min display mode. If **Enter** is not pressed, the Max/Min display readings will time out after ten seconds. The meter will return to display the actual reading. Pressing **Menu** at any time will return to normal run mode.



Press **Display t**o Cycle Total, Grand Total, Max, and Min

Press **Enter** to Hold Selected Display

Press **Reset** to Reset Selected Display

Press **ENTER** to Exit Display on Hold

Resetting the Total (rESEt TOTALP)

If manual *Total Reset* is enabled in the *Program* menu, the total may be reset by pressing the **Reset** button and using the **Enter** button to confirm the reset.

Additionally if programmed for manual reset, the total may be reset using a normally open pushbutton connected across the terminals RST and COM.

Note: *The total is cleared immediately when* **Enter** *button is pressed. Totalization will then continue, even if the* **Enter** *button or external reset button continues to be held down/triggered.*

Resetting the Grand Total (rESEt Gr TOTP)

If manual *Grand Total Reset* is enabled in the *Program* menu, the grand total may be reset using the **Reset** button.

To reset the grand total, display the grand total by pressing the **Up/Display** button. While grand total is being displayed, press the **Reset** button. Confirm the reset with the **Enter** button.

Resetting Max/Min Readings (RESET MAXIMUM, MINIMUM)

The maximum and minimum readings may be reset by pressing the Reset button while displaying either the maximum or minimum. The display will show RESET to verify the reset of maximum or minimum value.

The maximum and minimum must be reset individually.

Reset Meter to Factory Defaults

Reset to factory defaults will restore most meter parameters to their factory default setting.

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.

Factory default reset does not change the saved backup restore settings, override passwords, or edit parameters locked by a permanent non-resettable grand total. See Non-Resettable Grand Total, as described on page 75.

Instructions to load factory defaults can be found in the Backup & Restore (bACKUP) menu on page 84.

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
Input Type	InPUt	Active	
K-Factor units	Fun it	Pulses/Gallon	
K-Factor	FActr	1.0000	
Rate Time Base	tbASE	Second	
Rate Unit	rAtEU	Gallons/second	
Total Unit	tot U	Gallons	
Total Multiplier	muLt	x1	
Grand Total Unit	GtotU	Gallons	
Grand Total Multiplier	muLt	x1	
Rate Decimal Point	1111.1	1 place	
Total Decimal Point	1111111.1	1 place	
Grand Total Decimal Point	1111111.1	1 place	
Total Conversion Factor	totCF	N/A (Only valid with custom units)	
Grand Total Conversion Factor	GrtCF	N/A (Only valid with custom units)	
Top Display	tOP	Rate	
Bottom Display	bOtm	Total	
Advanced Features			
Total Reset	t rSt	Manual - Enabled	
Grand Total Reset	t rSt	Manual - Enabled	
Analog Out Value	A out	Rate	
Output Display 1	dSPL 1	0000.0	
Output 1	Out 1	4.000	
Output Display 2	dSPL2	1000.0	
Output 2	Out 2	20.000	

Parameter	Display	Default Setting	User Setting
Scale Enable	SCALE	No – Use K-Factor	
Scale/Cal # Points	noPtS	2 (N/A)	
Scale Unit	Fun it	Pulses/Gallon (N/A)	
Scale Unit Time Base	t imE	Second (N/A)	
Scale/Cal Input 1	inPt 1	00000 (N/A)	
Scale/Cal Display 1	dSPL 1	0000.0 (N/A)	
Scale/Cal Input 2	inPt2	1000 (N/A)	
Scale/Cal Display 1	dSPL2	1000.0 (N/A)	
Parameter Lock Password	PASS	00000 (unlocked)	
Total Reset Password	PASS T	00000 (unlocked)	
Grand Total Reset Password	PASS GT	00000 (unlocked)	
Output 1	OUT 1	Off	
Output 2	OUT 2	Off	
Low Gate	LO GATE	1	
High Gate	HI GATE	2	
Filter	FILTER	High Speed	
Cutoff	CUTOFF	0 (disabled)	
Battery Symbol	BAT SYM	Disabled	
Modbus Slave ID	SLU id	247	
Baud Rate	bAud	19,200 bps	
Time Delay	tdELY	10 ms	
Parity	PArtY	Even	
Additional Parameters & Notes			

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	Check power connection. Press and hold **Menu** key for 5 seconds to check for Standby mode. If "WAKEUP?" is displayed, press the **Enter** key to awaken the meter from Standby mode.
Through-glass Buttons do not respond	If ⏻ is displayed, hold **Menu** Through-glass button to leave power save mode. If ⏻ is flashing, wait 60 seconds to leave mechanical pushbutton lockout mode. If the cover was recently tightly secured, you may need to wait up to 2 minutes for buttons to self-calibrate to the new cover position due to glass reflection. Verify Through-Glass Button switch on display module is in ON position. Sunlight can interfere with the sensors. It is recommended to shield the window while operating the buttons by standing so as to block direct sunlight.
Rate display unsteady	Increase low gate setting in Ad*vanced* menu.
Meter displays error message during calibration (ERRORSPAn)	Verify minimum input span requirements
Meter flashes 99999	Check input signal is within scaled range of 99999.
Display stuck displaying MAXIMUM or MINIMUM	Press **Enter** (Unlock) to exit Max/Min display
Display response is too slow	Check if gate settings can be lowered.
If the display locks up or the meter does not respond	Perform hard reset by removing the display module or by removing external loop or DC power.
Backlight does not appear.	Backlight is intended for viewing assistance in dim lighting. It may not be noticeable under good lighting conditions. Battery powered models turn off the backlight after ten seconds of button inactivity.
Other symptoms	Call Technical Support for assistance.

Note: Certain sequences of events can cause unexpected results. To solve these issues, it is best to start fresh from factory defaults and map changes ahead of time, rather than at random.

MOUNTING DIMENSIONS

All units: inches [mm]

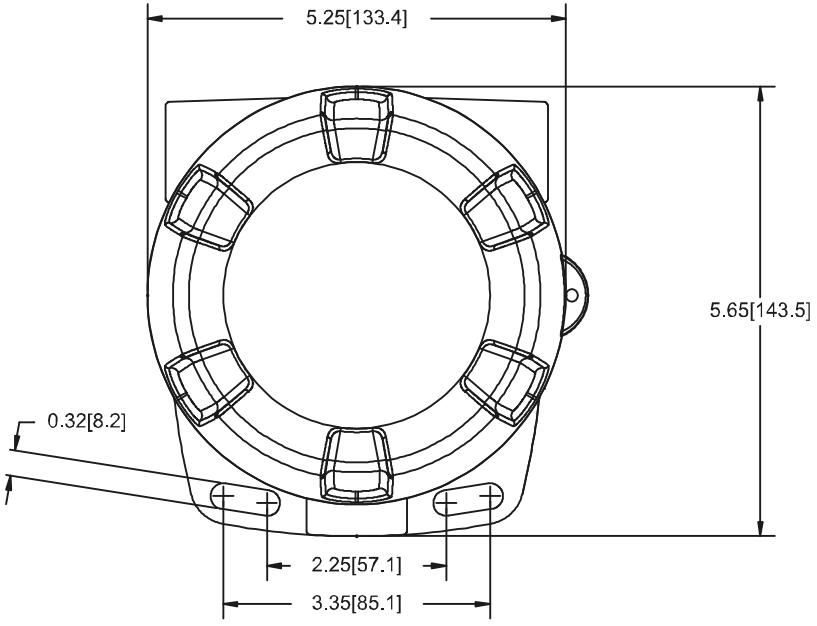


Figure 16. Enclosure Dimensions – Front View

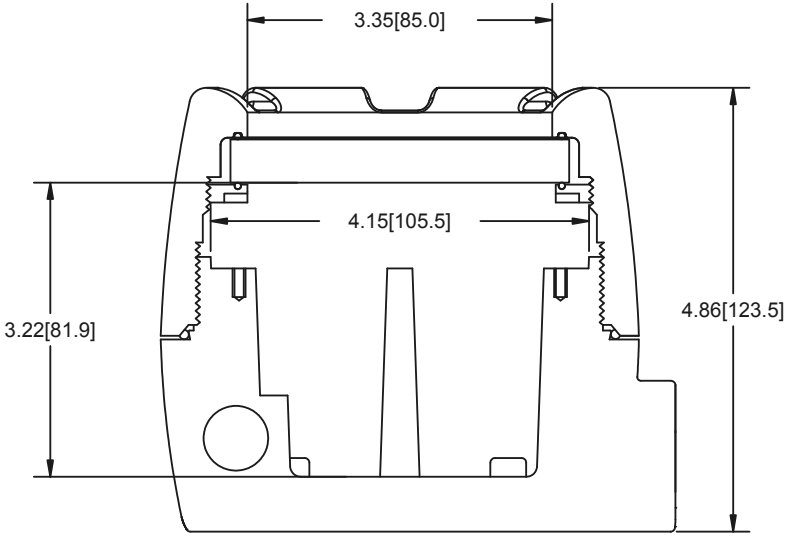


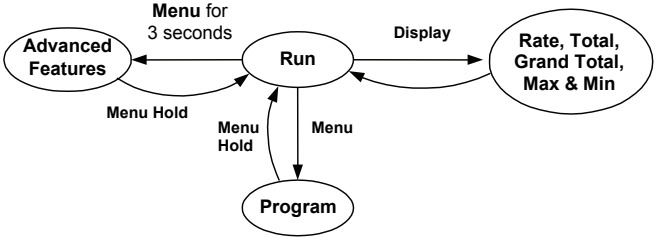
Figure 17. Enclosure Dimensions – Side Cross Section View

QUICK USER INTERFACE REFERENCE

Pushbutton	Function
Menu	Go to Programming mode, back out one level of programming. Hold to enter Advanced Features mode. Leave grand total/max/min mode.
Right Arrow	Move to next digit or decimal point position. Go to *reset* menu Return to last programming menu.
Up Arrow	Move to next selection or increment digit. Enter grand total/max/min display mode.
Enter	Accept selection/value and move to next selection. Acknowledge Alarm.

Cycle Rate, Total, Grand Total, and Max/Min on Lower Display
While in Run Mode, pressing **Display** will cycle the rate, total, grand total, and max/min display. In this mode, the display will show the rate, total, grand total, maximum, or minimum values since last reset when they are not selected as the top or bottom display. The grand total, max, or min will display for 10 seconds. Press **Enter** while displaying the rate, total, grand total, max, or min, to disable the 10 second time-out and continuously display the rate, total, grand total, max, or min. Press **Enter** again to disable this display lock.

Operational Modes



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