

Daniel™ Series 1500/1200 Liquid Turbine Meter Internal Display

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Return Material Authorization (RMA)

A Return Material Authorization (RMA) number must be obtained prior to returning any equipment for any reason. Download the RMA form from the Support Services web page by selecting the link below.

<http://www.emerson.com/en-us/automation/daniel>

Signal words and symbols

Pay special attention to the following signal words, safety alert symbols and statements:



Safety alert symbol

This is a safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER!

Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Notice is used to address safety messages or practices not related to personal injury.

Important

Important is a statement the user needs to know and consider.

Tip

Tip provides information or suggestions for improved efficiency or best results.

Note

Note is “general by-the-way” content not essential to the main flow of information.

Important safety instructions

Daniel Measurement and Control, Inc. (Daniel) designs, manufactures and tests products to function within specific conditions. Because these products are sophisticated technical instruments, it is important that the owner and operation personnel must strictly adhere both to the information printed on the product and to all instructions provided in this manual prior to installation, operation, and maintenance.

Daniel also urges you to integrate this manual into your training and safety program.

BE SURE ALL PERSONNEL READ AND FOLLOW THE INSTRUCTIONS IN THIS MANUAL AND ALL NOTICES AND PRODUCT WARNINGS.

WARNING!

Failure to follow the installation, operation or maintenance instructions for a Daniel product could lead to serious injury or death from explosion or exposure to dangerous substances.

To reduce the risk:

- **Comply with all information on the product, in this manual, and in any local and national codes that apply to this product.**
- **Do not allow untrained personnel to work with this product.**
- **Use Daniel parts and work procedures specified in this manual.**

Product owners (Purchasers):

- Use the correct product for the environment and pressures present. See technical data or product specifications for limitations. If you are unsure, discuss your needs with your Daniel representative.
- Inform and train all personnel in the proper installation, operation, and maintenance of this product.
- To ensure safe and proper performance, only informed and trained personnel should install, operate, repair and maintain this product.
- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from: <http://www.emerson.com/en-us/automation/daniel>.
- Save this instruction manual for future reference.
- If you resell or transfer this product, it is your responsibility to forward this instruction manual along with the product to the new owner or transferee.
- ALWAYS READ AND FOLLOW THE INSTALLATION, OPERATIONS, MAINTENANCE AND TROUBLESHOOTING MANUAL(S) AND ALL PRODUCT WARNINGS AND INSTRUCTIONS.
- Do not use this equipment for any purpose other than its intended service. This may result in property damage and/or serious personal injury or death.

Product operation (Personnel):

- To prevent personal injury, personnel must follow all instructions of this manual prior to and during operation of the product.
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- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from:
<http://www.emerson.com/en-us/automation/daniel> .
- Read and understand all instructions and operating procedures for this product.
- If you do not understand an instruction, or do not feel comfortable following the instructions, contact your Daniel representative for clarification or assistance.
- Install this product as specified in the INSTALLATION section of this manual per applicable local and national codes.
- Follow all instructions during the installation, operation, and maintenance of this product.
- Connect the product to the appropriate pressure and electrical sources when and where applicable.
- Ensure that all connections to pressure and electrical sources are secure prior to and during equipment operation.
- Use only replacement parts specified by Daniel. Unauthorized parts and procedures can affect this product's performance, safety, and invalidate the warranty. "Look-a-like" substitutions may result in deadly fire, explosion, release of toxic substances or improper operation.
- Save this instruction manual for future reference.

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Contents

Part I Plan

Chapter 1	Introduction	3
1.1	Introduction	3
1.1.1	Model numbers and accessories	3
1.2	General settings	4
1.3	Rate input settings	6
1.4	Rate/Display settings	7
1.5	4-20 mA transmitter output settings	8
1.6	Open collector output settings	9
1.7	Serial communication settings	10
1.8	Default settings for startup of Internal Display	10
Chapter 2	Product certifications	13
2.1	Agency certifications	13
2.2	Government installation regulations	13
Chapter 3	Product connections	15
3.1	Connection configuration	15
3.2	Input signal connections	16
3.3	DC power connection	18
3.4	External reset connection	19
3.5	4-20 mA transmitter output connections	19
3.6	RS-485 serial connections	20
3.7	Open collector output connections	20

Part II Install

Chapter 4	Installation requirements and limitations	25
4.1	Requirements and limitations for installation	25

Part III Operate

Chapter 5	Setup and programming	29
5.1	Function keys and display	29
5.2	Button tips	31
5.3	Set numeric values	32
5.4	Set alphanumeric labels (LABEL)	32
5.5	Main menu	33
5.6	Menu display functions	34
5.7	Set up the meter	36
5.7.1	Select input type (InPut)	37
5.7.2	Enter the K-Factor (FActr)	39
5.7.3	Display units (UnitS)	40
5.7.4	Set the decimal point (dEc.Pt)	48

	5.7.5	Configure the display (dSPly)	48
	5.7.6	Custom tag (tAG)	50
	5.7.7	Set the toggle time (TIME)	51
Chapter 6		Product advanced features	53
	6.1	Advanced features menu	53
	6.2	Advanced features menu and display messages	54
	6.3	Open collector outputs (OUTPUT)	59
	6.3.1	Output 1 and 2 Setup (OUT 1, OUT 2)	59
	6.4	Scaling the 4-20 mA analog output (Aout)	63
	6.5	Gate function (GATE)	64
	6.6	Contact debounce filter (FILTER)	65
	6.7	Low-flow cutoff (CUTOFF)	65
	6.8	Scaling and calibration (SCALCAL)	65
	6.8.1	Undo K-Factor, scale, and calibration (Undo?)	66
	6.8.2	Scale the meter (SCALE)	66
	6.8.3	Calibrate the meter (CAL)	68
	6.8.4	Multi-point linearization (noPts)	71
	6.9	Total reset (T RESEt)	71
	6.9.1	Manual or automatic total reset function (t rSt)	71
	6.9.2	Manual or automatic grand total reset function (GrtrSt)	72
	6.10	Set up passwords (PASSWRD)	73
	6.10.1	Lock meter setup parameters	74
	6.10.2	Reset total and grand total on a password protected meter	74
	6.10.3	Disable password protection	74
	6.10.4	Non-resettable grand total	75
	6.11	Custom (CUSTOM)	76
	6.12	System (SySTEM)	78
	6.12.1	Set real time clock (SETTIME)	79
	6.12.2	View data log (LOGVIEW)	81
	6.12.3	Backlight (BAKLITE)	81
	6.12.4	Analog output calibration (AO CAL)	81
	6.12.5	Backup and restore (BACKUP)	82
	6.12.6	Battery power symbol alert (BAT SyM)	83
	6.12.7	Information (INFO)	83
	6.13	Serial communications (COMM)	83
	6.14	Standby mode (STANDBy)	84
	6.14.1	Wakeup the meter (WAKEUP?)	85
Chapter 7		Startup procedure	87
	7.1	Operation and startup procedure	87
	7.2	Button tips	89
	7.3	Grand total reading (Gr TOTAL)	89
	7.4	Max/Min readings (MAXIMUM, MINIMUM)	89
	7.5	Reset the total (rESEt TOTAL?)	90
	7.6	Reset the grand total (rESEt Gr TOT?)	90
	7.7	Reset Max/Min readings (RESET MAXIMUM, MINIMUM)	90
	7.8	Reset meter to factory defaults	91
	7.9	Factory defaults and user settings	91

Part IV Maintain

Chapter 8	Maintenance	97
8.1	Troubleshooting tips	97
8.2	Quick user interface reference	98
8.3	Battery replacement	99

Part I

Plan

Chapters covered in this part:

- *Introduction*
- *Product certifications*
- *Product connections*

1 Introduction

Topics covered in this chapter:

- [Introduction](#)
- [General settings](#)
- [Rate input settings](#)
- [Rate/Internal Display settings](#)
- [4-20 mA transmitter output settings](#)
- [Open collector output settings](#)
- [Serial communication settings](#)
- [Default settings for startup of Internal Display](#)

1.1 Introduction

The Daniel Digital Rate Internal Display is an explosion-proof pulse input rate/display fully featured for demanding applications in hazardous areas or in the harshest environmental conditions. It can be programmed using the four through-glass buttons, without removing the cover, or with four internal push-buttons.

The numeric rate display reads up to five digits and the alphanumeric total/tag display reads up to 7 digits. The total overflow feature reads up to 12 digits. The alphanumeric display can also be programmed to display any combination of numbers and letters up to seven characters long for use as engineering units and/or the process identification tag.

The backlight increases the visibility of the display under various lighting conditions. The enclosure contains threaded conduit holes and integrated pipe or wall mounting slotted flanges.

1.1.1 Model numbers and accessories

These are the models and accessories that Daniel offers.

Daniel Part number	Description
899-10-230-32	24 VDC powered with battery backup. Isolated Mod-Bus Protocol enabled. Loop-Powered Backlight. Iso-lated 4-20 mA output. 2 pulse outputs.
899-10-230-30	4-20 mA powered with battery backup. Loop-Powered Backlight. Non-isolated 4-20 mA output. 2 pulse outputs.

1.2 General settings

The settings below are general specifications for the Internal Display. Except when noted, all specifications apply to operate at +25°C.

Table 1-1: General settings

Setting	Description	
Display	Five digits Top display (0 to 99999)	17.8 mm (0.7") high, 7-segment, automatic lead zero blanking.
	Seven characters Bottom display	10.2 mm (0.4")high, 14-segment, automatic lead zero blanking.
	Symbols	Total, grand total, battery power/low battery, high alarm, low alarm, 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 $\approx -20^{\circ}\text{C}$	
Alarm indication	Flashing display plus HI/LO indicators	
Display update rate	Ambient $> -25^{\circ}\text{C}$: 2 Update/Second Ambient $< -25^{\circ}\text{C}$: 1 Update/10 Seconds Note: Update is dependent on gate settings.	
Overrange	Display flashes 99999	
Underrange	Display flashes -9999	
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 acquired are stored until reset by the user or until power to the meter is cycled.	
Password menu options	Three programmable password selections can restrict modification of programmed 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 without re-entering the password. Pass T: Restricts the reset of total without re-entering the password. Disables the manual mode reset contact. Pass GT: Restricts the reset of grand total without re-entering the password. Enables a non-resettable total and permanent lockout of grand-total related settings with a specific password.	
Power options	9-30 VDC, 2.2 W max	
	4-20 mA Transmitter Output Power, 30 VDC max	

Table 1-1: General settings (continued)

Setting	Description		
	Battery Power		
	DC Power with battery backup		
	4-20 mA Output Power with battery backup		
Battery	3.6 V Primary Lithium (Li-SOCl ₂), non-rechargeable model 899-10-230-31		
	Expected Service Life and 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 kHz 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 year	2 years
	<5 kHz open collector outputs, minimal through-glass button or backlight use	1.3 year	1 year
	Backup power only	N/A	10 years
Data logging	Up to 512 records, recorded four/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	
	899-10-230-30	500 V input-to-output	
	899-10-230-32	500 V input/power-to-output Note: Requires separate output supply	
Environmental	Operating temperature range: -40° C to 75°C Storage temperature range: -40° C to 75°C Backlight deactivated below temperatures ≈ -20° C Relative humidity: 0 to 90% non-condensing		
Non-volatile memory	All programmed settings and total readings 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.		

Table 1-1: General settings (continued)

Setting	Description
Mounting	The display may be mounted directly to conduit by using slotted flanges for wall mounting or NPS 1½" to 2½" or DN 40 to 65 mm pipe mounting. Note: Certain sequences of events can cause unexpected results. To avoid unexpected issues, use factory defaults and anticipate the possibility of changes in the mounting strategy.
Overall dimensions	(144 mm x 133 mm x 124 mm) 5.67" x 5.24" x 4.88" (W x H x D)
Weight	5.00 lbs (80 oz, 2.27 kg)

1.3 Rate input settings

The settings below are rate input specifications for the Internal Display. Except when noted, all specifications apply to operation at +25°C (+77°F).

Table 1-2: Rate input settings

Setting	Description		
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	1.8
	Low	0.2	1.0
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 pick-up input	Sensitivity: 20 mVp-p to 24 Vp-p Maximum Frequency: 6 kHz		
Minimum input frequency	0.001 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.		

Table 1-2: Rate input settings (continued)

Setting	Description
Accuracy	$\pm 0.03\%$ 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

1.4 Rate/Internal Display settings

The settings below are rate/display specifications for the Internal Display. Except when noted, all specifications apply to operation at $+25^{\circ}\text{C}$ ($+77^{\circ}\text{F}$).

Table 1-3: Rate/Internal display settings

Setting	Display
Display assignment	The Top display calculates rate or total. The Bottom displays 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	Display rate may be calculated in terms of units per second, minute, hour, or day.
Total and 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.

Table 1-3: Rate/Internal display settings (continued)

Setting	Display
Total and 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 and grand total decimal point	Up to six decimal places or none: 6.666666, 55.55555, 444.4444, 3333.333, 22222.22, 111111.1 or 0000000 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, manual 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 pass word for the total and grand total. Total and grand total reset independently.
Total overflow and rollover	The total can display up to 999,999,999,999. Up to 9,999,999 can normally be displayed on the lower display. A rollover display toggles between the first 6 digits and last six digits (999,999 <> 999,999) for a 12 digit total. The total will rollover beyond 999,999,999,999.
Grand total overflow and rollover	The grand total can display up to 999,999,999,999. Up to 9,999,999 can normally be displayed on the lower display. A rollover display with toggle between the first 6 digits and last six digits (999,999 <> 999,999) for a 12 digit grand total. The grand total will rollover beyond 999,999,999,999.
External total reset	External reset connections are made between RST and COM. Logic High: 1.4V, 3.3V max; Logic Low: < 0.8V. 32 ms debounce.

1.5 4-20 mA transmitter output settings

The settings below are 4-20 mA transmitter output specifications for the Internal Display. Except when noted all specifications apply to operation at +25°C (+77°F).

Table 1-4: 4-20 mA transmitter output settings

Setting	Description
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

Table 1-4: 4-20 mA transmitter output settings (continued)

Setting	Description		
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	$\pm 0.05\%$ span ± 0.004 mA		
Temperature drift	0.08 $\mu\text{A}/^\circ\text{C}$ max from -40°C to 75°C ambient		
External loop power supply	30 VDC maximum		
Output loop resistance	Power supply	Minimum	Maximum
	24 VDC	10 Ω	700 Ω
	30 VDC	100 Ω	1200 Ω
	Note: loop-powered backlight subtracts 150 Ω from maximum resistance figures above.		

1.6 Open collector output settings

The settings below are open collector output specifications for the Internal Display. Except when noted all specifications apply to operation at $+25^\circ\text{C}$ ($+77^\circ\text{F}$).

Table 1-5: Open collector output settings

Settings	Description
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 (required 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 ACK 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 generates 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.

Table 1-5: Open collector output settings (continued)

Settings	Description
Pulse output Pulse width	Unless otherwise stated, pulses are 50% duty cycle for required frequency. A pulse rate retransmit output generates 100 to 130 μ s 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 displays PULSE OVERRNG
Quadrature output	Output set to quadrature lags 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.

1.7 Serial communication settings

The settings below are serial communication specifications for the Internal Display. Except when noted, all specifications apply to operation at +25°C (+77°F).

Table 1-6: Serial communication settings

Settings	Description
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 it	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 μ s
Note: Refer to Modbus Register Tables at www.predig.com for details.	

1.8 Default settings for startup of Internal Display

Internal Display factory settings are shown in the table below.

Table 1-7: Default settings for startup

Parameter	Display	Default setting
Input type	INPUT	Active
K - Factor units	FUN IT	Pulses/gallon

Table 1-7: Default settings for startup (continued)

Parameter	Display	Default setting
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	Gal
Grand total multiplier	MULT	x1
Rate decimal point	1111.1	1 place
Total decimal point	111111.1	1 place
Grand total decimal point	111111.1	1 place
Total conversion factor	TOTCF	N/A (Only valid with custom units)
Total reset	T RST	Manual - Enabled
Grand total conversion factor	GRTCF	N/A (Only valid with custom units)
Grand total reset	T RST	Manual - Enabled
Display	DSPLY	Total
Advanced features		
Output variable	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	20.000.0
Scale/Cal # Points	NOPT5	2
Scale/Cal Input 1	INPT 1	00000
Scale/Cal Display 1	DSPL 1	0000.0
Scale/Cal Input 2	INPT2	1000
Scale/Cal Display 1	DSPL2	1000.0
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

Table 1-7: Default settings for startup (continued)

Parameter	Display	Default setting
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

2 Product certifications

Topics covered in this chapter:

- *Agency certifications*
- *Government installation regulations*

2.1 Agency certifications

The following are product agency certifications applicable to the Internal Display.

Table 2-1: Agency certifications

Certification type	Description
Electrical	UL and CUL: Class I, Div. 1, Groups B, C & D ATEX: Ex d IIC T6 Gb IECEX: Ex d IIC T6 Gb INMETRO (Brazil)
Environmental	NEMA 4x (IP66)

Special conditions for safe use

Use a suitably certified and dimensioned cable entry device and/or plug. Install the equipment so that the supply cable is protected from mechanical damage. Do not subject the cable 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 is necessary.

Year of construction

This information is contained within the serial number with the first four digits representing the year and month in the YYMM format.

For European community

Install the Internal Display in accordance with the ATEX directive 94/9/EC.

2.2 Government installation regulations

Installation in USA

Install the Internal Display in accordance with the National Electrical Code (NEC) NFPA 70.

Installation in Canada

Install the Internal Display in accordance with the Canadian Electrical Code CSA 22.1.

Installation in the European Community

Install the Internal Display in accordance with the ATEX directive 94/9/EC.

3 Product connections

Topics covered in this chapter:

- *Connection configuration*
- *Input signal connections*
- *DC power connection*
- *External reset connection*
- *4-20 mA transmitter output connections*
- *RS-485 serial connections*
- *Open collector output connections*

3.1 Connection configuration

The information below describes the configuration for the connector board connections.

⚠ WARNING!

STATIC ELECTRICITY HAZARD

Static electricity can damage sensitive components. Observe safe handling precautions for static-sensitive components and 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 resulting in death or serious injury.

Figure 3-1: Connector board

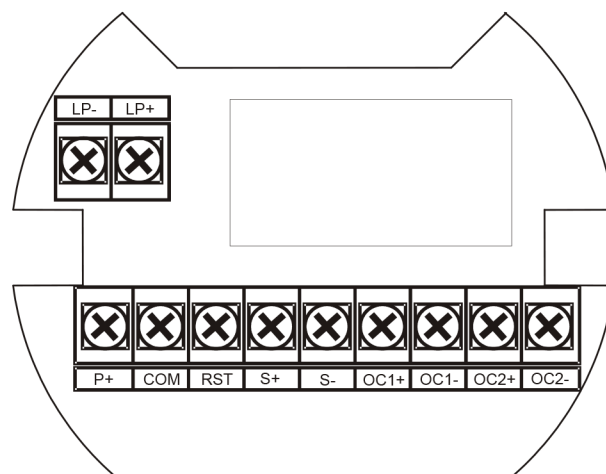


Table 3-1: Connector board connections

Connections	Description
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

3.2 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 side of the following figures.

Figure 3-2: Flowmeter powered by external supply (Active)

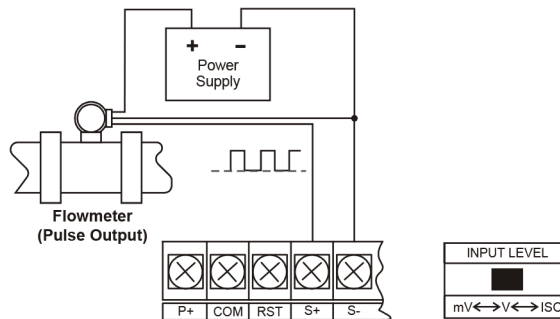


Figure 3-3: Isolated flowmeter powered by external supply (ISO)

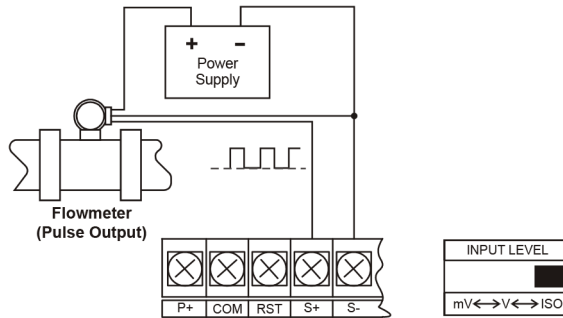


Figure 3-4: Self-powered magnetic pickup coil flowmeter (Coil)

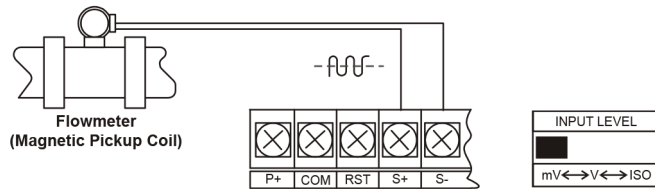


Figure 3-5: NPN open collector input (NPN)

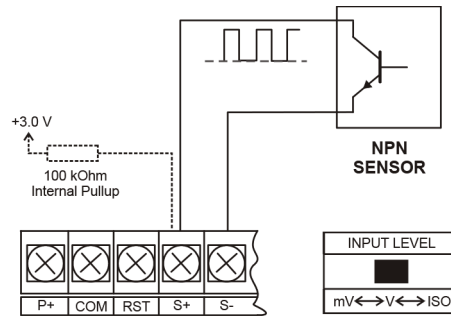
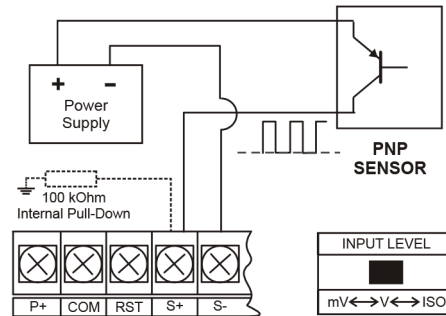
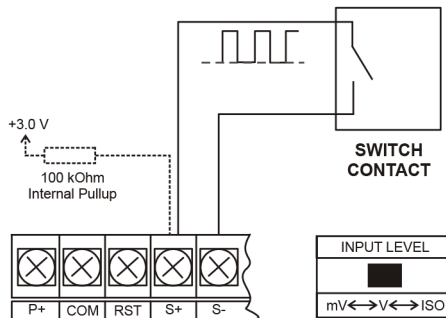
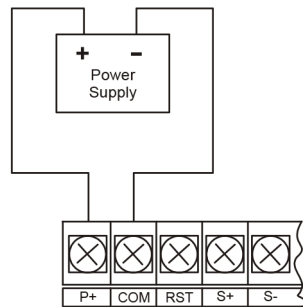


Figure 3-6: PNP sensor with external power (PNP)**Figure 3-7: Switch contact input (Reed)**

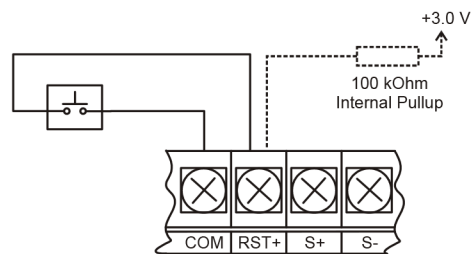
3.3 DC power connection

Models configured for DC power (899-10-230-32) are provided with a terminal labeled P+ and are wired as shown in [Figure 3-9](#). Models configured for battery power (899-10-230-30) 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 3-10](#) and/or to power the Opto-Isolated Flowmeter as shown in the figure below.

Figure 3-8: DC power connections

3.4 External reset connection

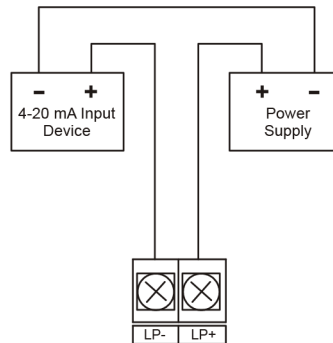
External reset connections are made between RST and COM. Connect to a contact closure source such as a relay or a push button as shown in [Figure 3-9](#). Avoid extended contact closure to preserve battery life. The total is reset when the button is pressed. The meter starts to totalize immediately. Holding down the button has no effect on the total.

Figure 3-9: Reset connections

3.5 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 the figure below.

Figure 3-10: 4-20 mA output connections



3.6 RS-485 serial connections

The meter may include an optional RS-485 two wire serial connection. For an RS-485 serial communications network should always be a Use high quality cable such as Belden 8162 or Alpha 6203C. For 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 3-11: RS-485 two wire serial connections

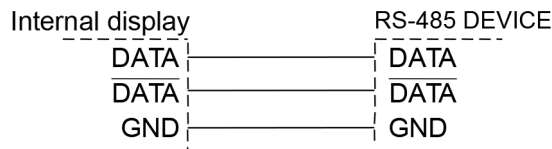
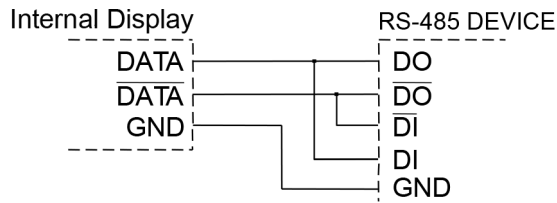


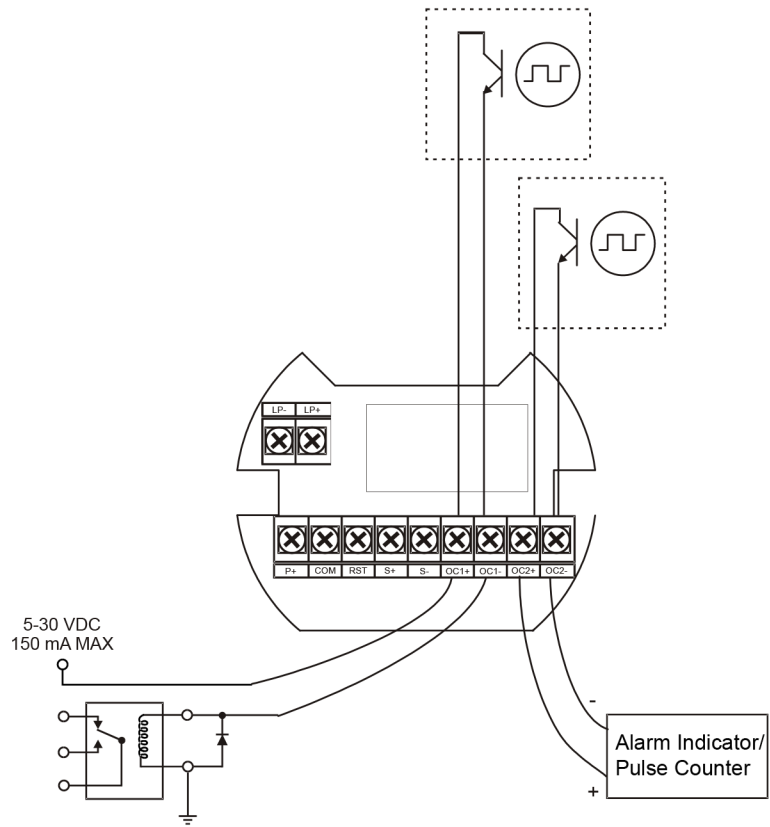
Figure 3-12: S-485 four wire serial connections



3.7 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 the figure below.

Figure 3-13: Open collector output connections



Part II

Install

4 Installation requirements and limitations

4.1 Requirements and limitations for installation

Follow the steps below to access the wiring connectors.

1.

⚠ WARNING!

ELECTROCUTION HAZARD

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

Failure to follow these instructions may result in death or serious injury.

Open the enclosure to access the wiring connectors. The jam screw on the cover may need to be loosened. Remove the internal electronic assembly from the enclosure to access the electrical connectors.

2. Remove the two captive screws. Disconnect the ribbon cable from the display module and set the display module aside.
3. Disconnect the wires/cables from the electronic board.
4. Install in accordance with applicable local and national regulations (e.g. NEC).
5. Install and service should be performed only by trained service personnel.
6. Service requiring replacement of internal components (not including battery, if equipped) must be performed at the factory.
7. Use suitably certified and dimensioned cable entry device and/or plug.
8. All input circuits must be derived from a CSA Approved Class 2 source.

Part III

Operate

Chapters covered in this part:

- *Setup and programming*
- *Product advanced features*
- *Startup procedure*

5 Setup and programming

Topics covered in this chapter:

- *Function keys and display*
- *Button tips*
- *Set numeric values*
- *Set alphanumeric labels (LAbEL)*
- *Main menu*
- *Menu display functions*
- *Set up the meter*

5.1 Function keys and display



Use the infrared through-glass buttons for setup and programming. Use manual buttons when uncovered. Two slide switches are located on the display module. One is used to configure the input and the other is used to lock or unlock the infrared through-glass buttons.

The Display has four infrared through-glass button sensors allowing the Display to be programmed and operated without removing the cover (and exposing the electronics) in a hazardous area. These buttons can be disabled for security via the THRU-GLASS BUTTONS on/off switch on the back of the removable electronics module. Select OFF to disable the infrared THRU-GLASS buttons.

Table 5-1: Button and display symbols


Button/Display symbol	Description
	Menu/Awake

Table 5-1: Button and display symbols (continued)


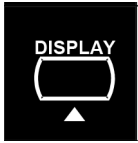




Button/Display symbol	Description
	Right arrow/Reset
	Up arrow/Display
	Enter/Alarm acknowledge
Hi	High alarm
Lo	Low alarm
Set	Total alarm
	Settings Lockout Password Enabled
	Through-glass power save/disable. Flashing: Temporarily disabled due to manual button
T	Total display Flashing: Temporarily disabled due to manual button
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

Table 5-2: Button operation

Button	Procedure
Menu	<ul style="list-style-type: none"> • Hold the Menu button when in Power Save Mode ((⏻) will display) to awaken through-glass buttons. • Press the Menu button to enter Programming Mode. • Press the Menu button during Programming Mode 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 <i>Advanced features</i> of the meter. • Press Menu while displaying grand total, max, or min reading to return to Run mode.
Right/Reset	<ul style="list-style-type: none"> • 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 Right to reset the total, or values displayed in the bottom display (grand total, max, or min). • Press Enter after Right to confirm the reset.
Up/Display	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Press the Enter button to access a menu or to accept a setting. • Press Enter to lock the grand total, maximum or minimum value display, and disable the 12 second time out. • Press Enter to acknowledge alarm (if enabled). • Press Enter to lock display of grand total, Max or Min readings (disables 10 second timeout).

5.2 Button tips

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.

1. Install the display facing away from sunlight, windows, reflective objects and any sources of infrared interference.
2. Keep the glass window clean.
3. Tighten the cover securely.
4. Use a password to prevent tampering.

If the cover has not been installed and secured tightly, allow up to one minute for the through-glass buttons to self calibrate when the cover is tightened.

Important

The Thru-glass buttons are designed to constantly recalibrate for ambient conditions. When the cover position is changed, the cover is removed, or an object that was placed over the front window is removed, it may take a moment for the Thru-glass buttons to recalibrate to the change in conditions.

Allow up to 2 minutes for the Thru-glass buttons to recalibrate to new conditions in these cases where the cover position was changed, or the front window is being unblocked.

5. Connect the ribbon cable to the display module, fasten the display module to the base, install enclosure cover, and apply power.

5.3 Set numeric values

Set the numeric values using the Right and Up arrow buttons.

1. Press the Right arrow to select the next digit and the Up arrow to increment the digit. The digit being changed blinks.
2. Press the Enter button at any time, to accept a setting or press the Menu button to exit without saving changes.

Use the Right or the Up arrow button in the Setup, Decimal Point menu to set the decimal point.

Figure 5-1: Setting numeric values



5.4 Set alphanumeric labels (LABEL)

Set alphanumeric values by 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 display **LABEL** in the upper display.

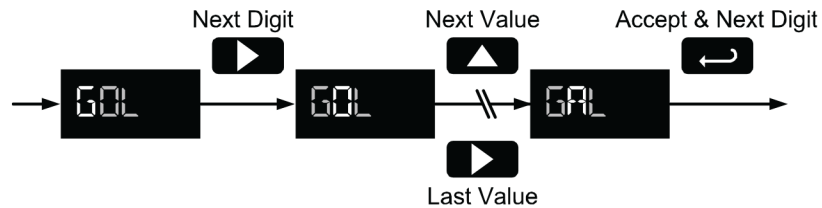
Procedure

1. Select the digit and use the Up and Right arrows to modify the digit.

The display reads **CHAR**

2. Enter confirms the new digit and returns the display to **LABEL**.
The digit being changed blinks.
3. Press the Menu button to exit without saving changes.

Figure 5-2: Setting alphanumeric labels (LABEL)

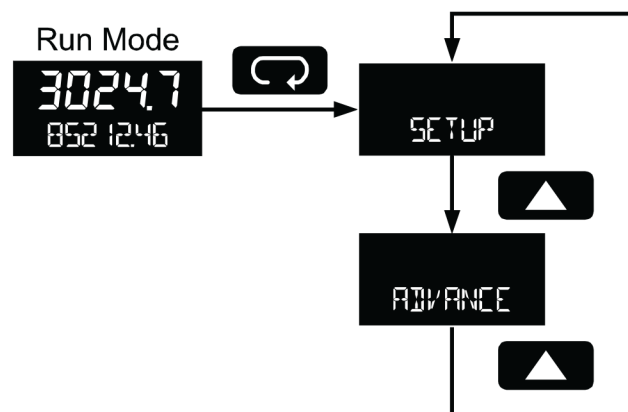


5.5 Main menu

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

1. Press the Menu button to enter the Programming Mode.
2. Press the Up arrow button to scroll through the main menu.

Figure 5-3: Main menu



3. Press Menu at any time, to return to the previous menu selection.
4. Press and hold the Menu button for 1.5 seconds at any time, to return to Run Mode.
5. Press Enter to save setting changes.
6. Press Enter to move to the next menu after a setting is saved.

5.6 Menu display functions

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

Table 5-3: Menu display functions

Parameter	Display	Action/Setting
Setup	SETUP	Enter Setup menu
Input	InPut	Enter Input type selection menu
Active	ActiV	Set Active input type
NPN	nPn	Set NPN input type
PNP	PnP	Set PNP input type
Reed	rEEd	Set reed switch input type
Coil	COIL	Set coil input type
Isolated	iSo	Set isolated input type
Active low	ActLO	Set active input type with low threshold
NPN low	nPnLO	Set NPN input type with low threshold
PNP low	PnPLO	Set PNP input type with low threshold
K-Factor	FActr	Enter the K-Factor menu
K-Factor units	FUn It	Enter the K-Factor units
Pulses/gallon	P/GAL	Set K-factor in pulses per gallon
Pulses/liter	P/L	Set K-factor in pulses per liter
Pulses/imp gallon	P/IGAL	Set K-factor in pulses per imperial gallon
Pulses/meter ³	P/M3	Set K-factor in pulses per meter cubed
Pulses/barrel	P/BBL	Set K-factor in pulses per barrel
Pulses/bushel	P/BUSH	Set K-factor in pulses per bushel
Pulses/cubic yard	P/ cuyD	Set K-factor in pulses per cubic yard
Pulses/cubic feet	P/cuFt	Set K-factor in pulses per cubic foot
Pulses/cubic inch	P/cuIn	Set K-Factor in pulses per cubic inch
Pulses/liquid barrel	P/LIBBL	Set K-factor in pulses per liquid barrel
Pulses/beer barrels	P/BBBL	Set K-factor in pulses per beer barrel
Pulses/hectoliter	P/HECTL	Set K-factor in pulses per hectoliter
Pulses/custom unit	P/CUST	Set K-factor in a custom unit
K-Factor decimal point	dEc.Pt	Set the number of decimal points in the K-factor
K-Factor value	FActr	Set the K-factor
Units	UnitS	Select standard units or custom unit/tag
Rate time base	tbASE	Enter the time base menu

Table 5-3: Menu display functions (continued)

Parameter	Display	Action/Setting
Second	SEC	Units per second
Minute	min	Units per minute
Hour	hour	Units per hour
Day	dAY	Units per day
Rate units	rAtEU	Select rate display units
Gallons	GAL	Set units as gallons
Liters	L	Set units as liters
Imperial gallons	IGAL	Set units as imperial gallons
Meters cubed	M3	Set units as cubic meters
Barrels	BBL	Set units as barrels
Bushels	BUSH	Set units as bushels
Cubic yards	cuyD	Set units as cubic yards
Cubic feet	cuFt	Set units as cubic feet
Cubic inches	culn	Set units as inches
Liquid barrels	LIBBL	Set units as liquid barrels
Beer barrels	BBBL	Set units as beer barrels
Hectoliter	HECtL	Set units as hectoliters
Custom unit	CUSt	Use a custom unit
User	USEr	Set a custom unit
Label	LABEL	Select a custom unit label character
Character	CHAR	Set a character in a custom unit label
Rate conversion factor	rAtCF	Enter the Rate Conversion Factor menu
Total units	tot U	Select total display units
Total multiplier	muLt	Select the total units multiplier
x1 (no multiplier)	X1	Select no multiplier
x100 (h)	X100 H	Select x100 multiplier with h unit prefix
x1000 (k)	X1000 K	Select x1,000 multiplier with k unit prefix
x1.0*10 ⁶ (M)	X1.0E6 M	Select x1,000,000 multiplier with M unit prefix
Total conversion factor	totCF	Enter the Total conversion factor menu
Grand total units	GtotU	Select grand total display units
Grand total multiplier	muLt	Select grand total units multiplier
Grand total conversion factor menu	GrtCF	Enter the Grand total conversion factor menu
Decimal point	dec.Pt	Enter Decimal point menu

Table 5-3: Menu display functions (continued)

Parameter	Display	Action/Setting
Rate decimal	rAtE	Set rate display decimal point
Total decimal	totAL	Set total display decimal point
Grant total	Grtot	Set grand total display decimal point
Display	dSPLY	Set the function of the bottom display
Top	tOP	Set the function of the top display
Rate	rAte	Display rate
Total	totAL	Display total
Bottom	bOtm	Set the function of the bottom display
Toggle	tOGLE	Toggle between the values shown in the bottom display
Total and units	TOTAL+U	Display total and units
Total and tag	TOT+TAG	Display the total and custom tag
Total and units and rate units	T+U+RU	Display the total, total units, and rate units
Grand total	Grtot	Display grand total
Grand total and units	Gr TOT+U	Display grand total and units
Grand total and tag	GT+TAG	Display the grand total and custom tag
Grand total and units and rate units	GT+U+RU	Display the grand total, grand total units, and rate units
Rate	rATE	Display the rate
Rate & total units	RATE+TU	Display the rate and total units
Rate & units	RATE+RU	Display the rate and rate units
Rate & tag	RAT+TAG	Display the rate and custom tag
Rate unit	rUn it	Display the rate units
Total units	tot Un	Display the total units
Custom tag	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
Unit Time	Unit TIME	Set time to display lower display unit
Rate Unit Time	rAtE TIME	Set time to display rate unit

5.7 Set up the meter

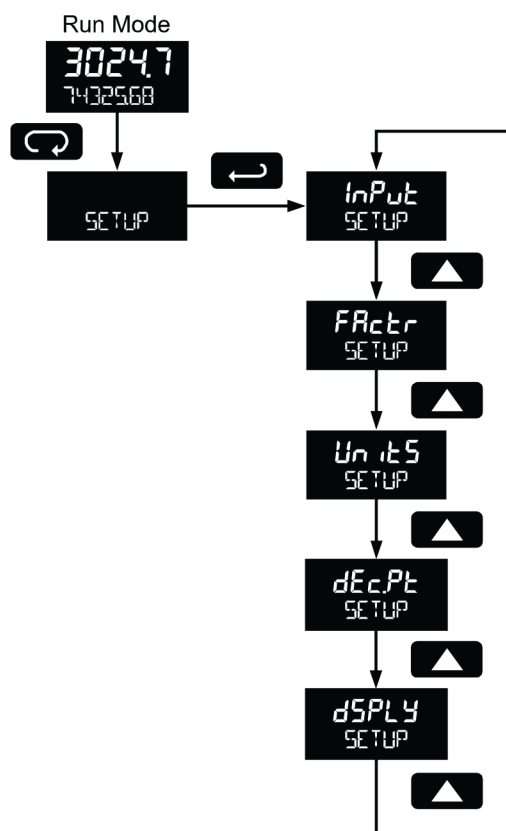
Use the **SETUP** menu to select:

1. Input type (**InPut**)

2. K-factor number and units (**FActr**)
3. Display rate, total and grand total units (**UnitS**)
4. Rate and total decimal point position (**dEc.Pt**)
5. Select what appears on the lower display (**dSPLAY**)

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

Figure 5-4: Setting up the meter (SETUP)



5.7.1 Select input type (InPut)

Refer to [Section 1.3](#) for input electrical specifications of the inputs.

Select from the following input types:

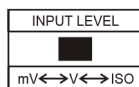
- Active (**ActiV**): External power supply driven pulse inputs
- NPN (**nPn**): Internal pull-up resistor on S+ for NPN inputs
- PNP (**PnP**): Internal pull-down resistor on S+ for PNP inputs
- Reed (**rEEd**): Internal pull-up resistor on S+ for switch inputs

- Coil (**COIL**): 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 high threshold (**ActLO**): 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

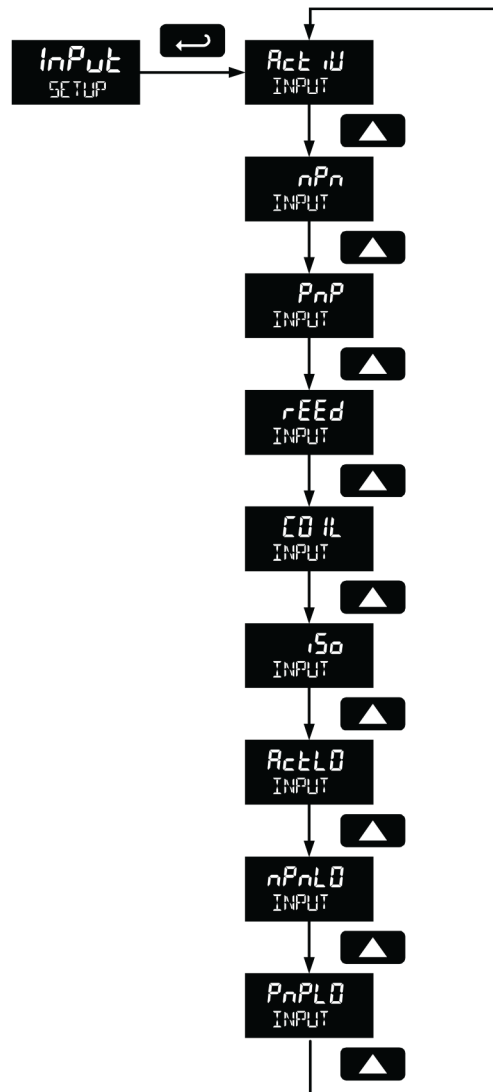
In addition to programming the Input parameter, set the input selector switch shown below. Input voltage level selections include mV, V and isolated voltage level inputs.

Figure 5-5: Input level



Refer to [Section 3.2](#) for details on wiring the input types.

Figure 5-6: Setting the input level selection switch



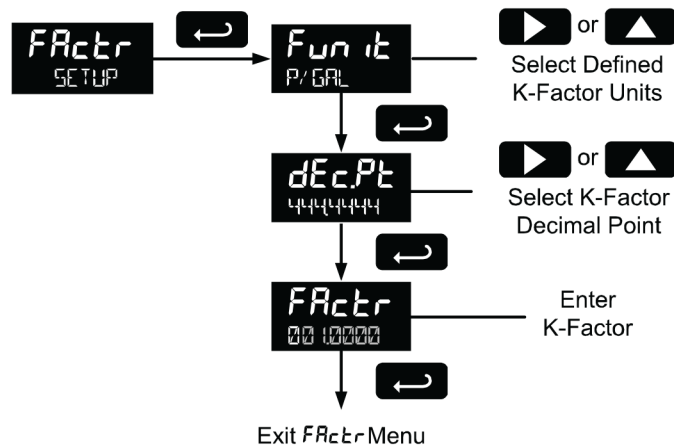
5.7.2 Enter the K-Factor (FActr)

Scale the meter using the K-factor, or conversion factor function. Most flow meter manufacturers include this information with the totalizer. From the K-Factor (**FActr**) menu select the units defined with the k-factor (example: pulses/gal) and the decimal point with highest resolution possible. Program the K-Factor value. The meter automatically calculates the flow rate using the selected K-Factor, the units and time base.

Important

Performing a K-Factor operation overrides any scaling or calibration programming. Refer to [Section 6.8](#) for more information on these programming methods.

Figure 5-7: Entering the K-Factor (FRctr)



K-Factor units (Fun it)

Select the units defined by the K-Factor (example: pulses/gal). Most flow meter manufacturers include this information with the totalizer. This only enters the K-Factor. See [Set rate display units \(rAtEU\)](#) to set or change the rate display units. 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. For information on this feature, see [Automatic unit conversions](#).

K-Factor decimal point (dEc.Pt)

Set the number of decimal places for the K-factor value (0.6 as needed). Pressing the Right arrow to move the decimal point one place to the right. Press the Up arrow to move the decimal point one place to the left.

K-Factor value (FActr)

Enter the K-factor value in Pulses/Unit as defined by the K-Factor Units parameter. Most flow meter manufacturers provide this information with the totalizer.

5.7.3 Display units (UnitS)

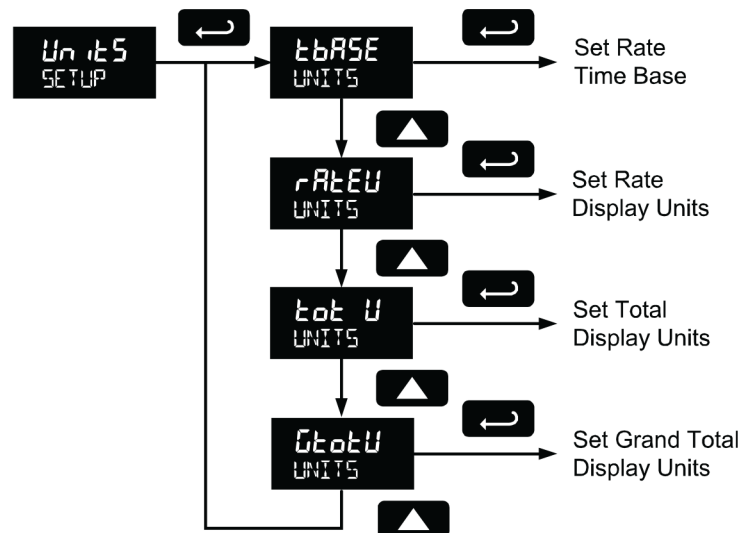
Use the *Units* menu to select the display rate units and time (example: Gal/s). Use the display units for total and grand total.

Important

Select only the display units. The units defined by the flowmeter K-Factor of a flow meter are entered in the K-Factor menu as part of the Factor Unit menu programming. Refer to [K-Factor units \(Fun it\)](#) for details.

This allows the display units to be different from the units defined by the flow meter, or they can be easily changed after initial programming. Unit conversions for rates and totals are automatically calculated by the meter. Refer to [Automatic unit conversions](#) for details.

Figure 5-8: Display units (UnitS)



Select the following units as the base units for rate, total, and grand total. Select the time base for rate and a multiplier for total and grand total units separately.

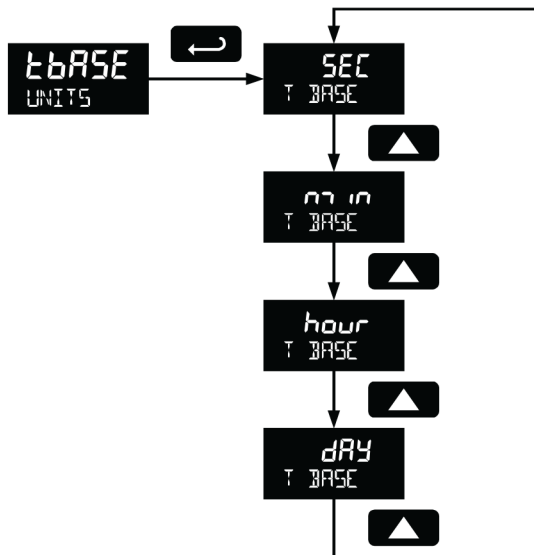
Table 5-4: Display units description

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

Set the time base (tbASE)

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

Figure 5-9: Setting the time base (tbASE)



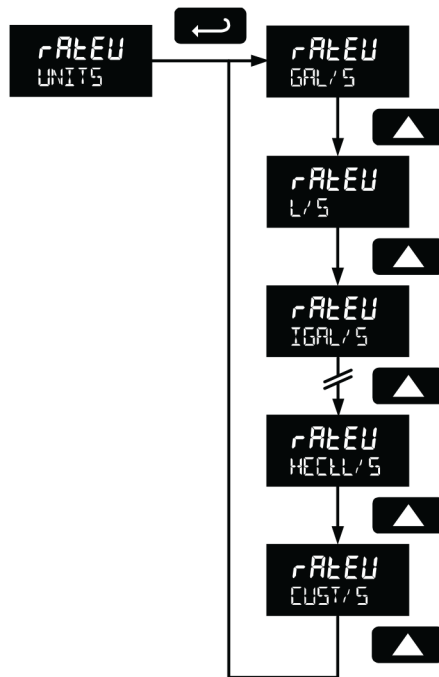
Press the Enter button at any time, to accept a setting or press the Menu button to exit without saving changes.

Set rate display units (rAtEU)

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

If a custom unit conversion factor is required, the user must enter the custom unit in the custom unit selection (**CUST**) option.

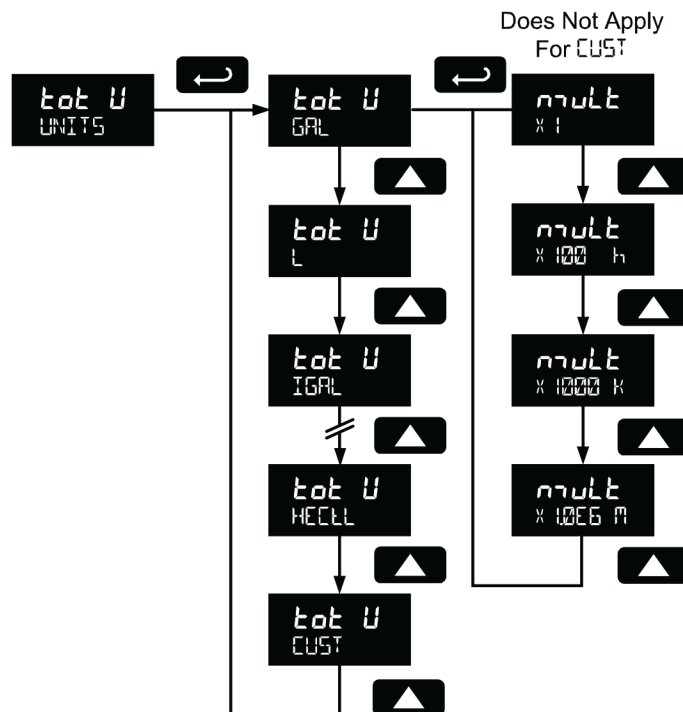
Figure 5-10: Setting rate display units (rAtEU)



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

Total units (tot U)

Select the display units for the total from this menu. Select the base unit and a multiplier prefix. If total and units are selected, the multiplier prefix will display before the total unit (example: MGAL, KL).

Figure 5-11: Total units (tot U)

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

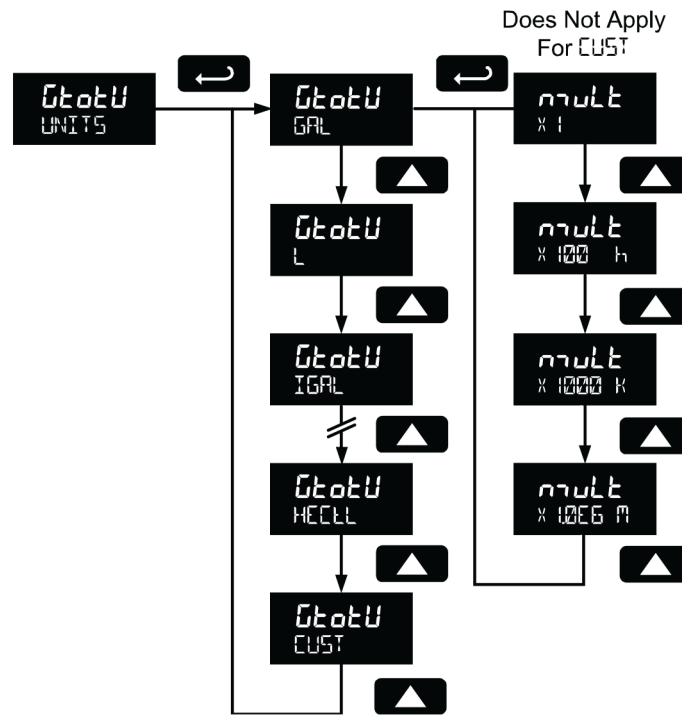
A custom unit may be selected (**CUST**), and no multiplier menu is required. In this case, use the total conversion factor as defined in the [Custom units total conversion factor \(totCF\)](#).

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

Grand total units (GtotU)

Use this menu to select the display units for the grand total. Select the base unit and a multiplier prefix. If grand total and units are selected to display, the multiplier prefix will appear before the total unit (example: **MGAL, KL**).

Figure 5-12: Grand total units (GtotU)



Multipliers convert the total for 1, 100, 1000, or 1 million units. The meter calculates the total 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 \(GrtCF\)](#).

Press the Enter button at any time, to accept a setting or press the 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 (**FuNIT**) 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)

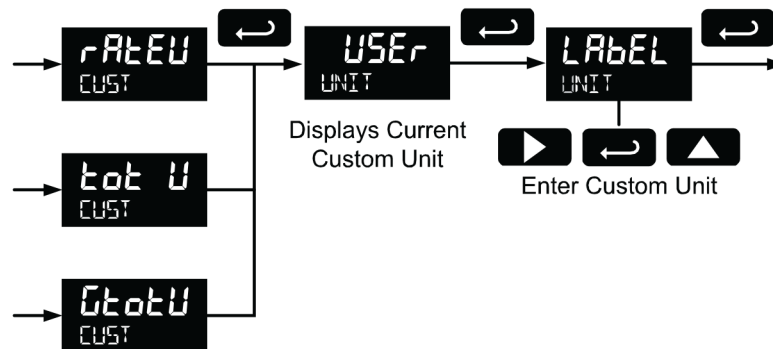
Select rate, total, or grand total, from a User menu to enter the custom unit.

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 does not allow a multiplier prefix. Enter a total or grand total conversion factor to define a custom total or grand total unit. Refer to [Custom units total conversion factor \(totCF\)](#) for details.

Figure 5-13: Custom units entry (USer)



Alphanumeric values are set by 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.

Refer to [Section 5.4](#) for details on setting alphanumeric labels.

Press Menu button to exit this menu without saving changes.

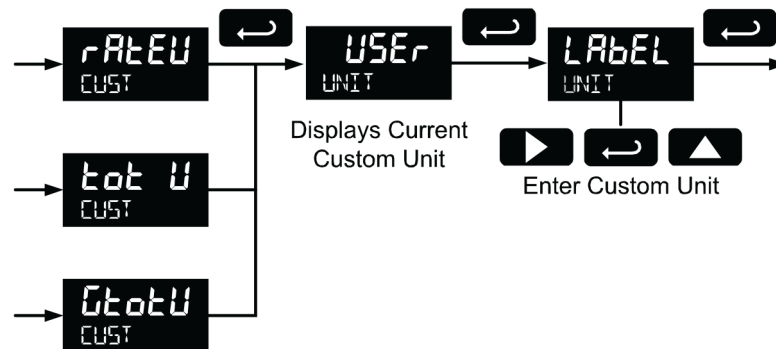
Custom units rate conversion factor (rAtCF)

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.

Figure 5-14: Custom units rate conversion factor (rAtCF)



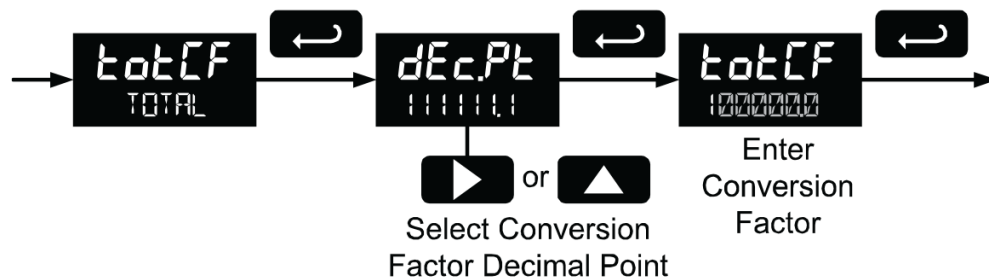
Custom units total conversion factor (totCF)

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

Use *Total conversion factor* to convert to a custom unit of total display. For example, to display total as quantity of 2.5 gallon containers when the flow rate units are set to gallons, enter a conversion factor of **2.500**.

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

Figure 5-15: Custom units total conversion factor (totCF)



Custom units grand total conversion factor (GrtCF)

Use the grand total conversion factor only 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.

Use the *Grand total conversion factor* to convert to a custom unit of total display. For example, to display grand total as a quantity of 2.5 gallon containers when the flow rate units are set to gallons, enter a conversion factor of **2.500**.

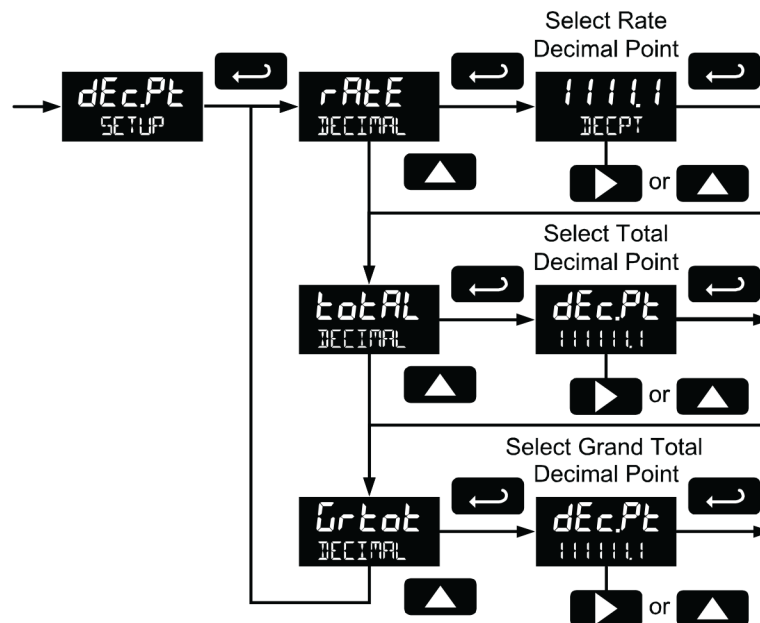
Press the Enter button at any time, to accept a setting or press the Menu button to exit without saving changes.

5.7.4 Set the decimal point (dEc.Pt)

Set the rate decimal point from 0-4 decimal places. The total decimal point may be set with 0-6 decimal places or Grand total. Rate decimal, total decimal, and grand total decimal are programmed individually.

Press the Right arrow to move the decimal point one place to the right (including no decimal point). Press the Up arrow to move the decimal point one place to the left.

Figure 5-16: Setting the decimal point (dEc.Pt)



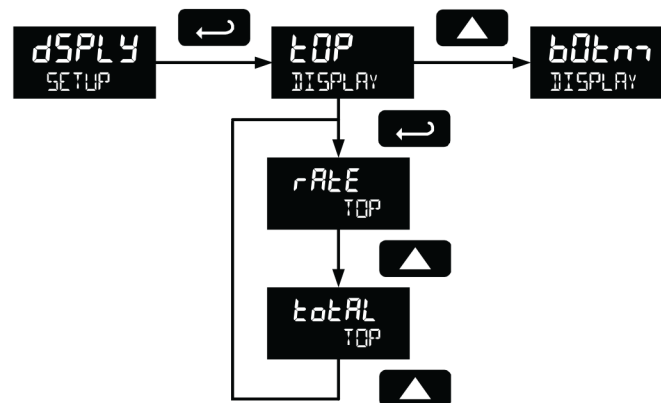
5.7.5 Configure the display (dSPLY)

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

Configure the top display (dSPLY)

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.

Figure 5-17: Top display (dSPLY)

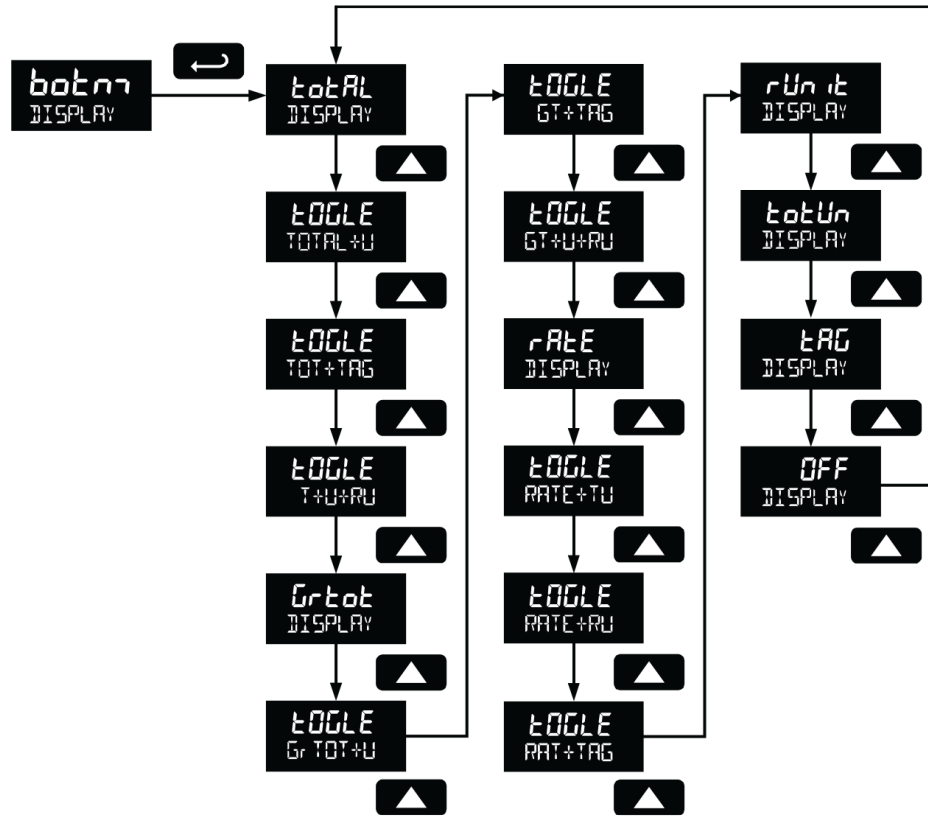


Configure the bottom display (dSPLY)

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 grand 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)

Figure 5-18: Configuring the bottom display (dSPly)

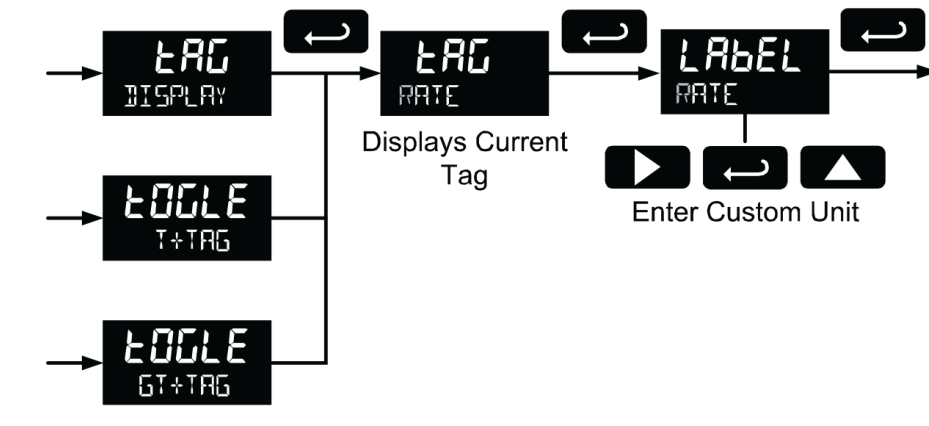


5.7.6 Custom tag (tAG)

When the bottom display selected includes a custom tag, a *User* menu executes the programming of the a custom tag.

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

Figure 5-19: Custom tag (tAG)



Alphanumeric values are set by using the Right button to select the digit, the Up and Right arrow buttons to select the digit reading. The Enter button confirms and selects the next digit.

Refer to [Section 5.4](#) for details on setting alphanumeric labels.

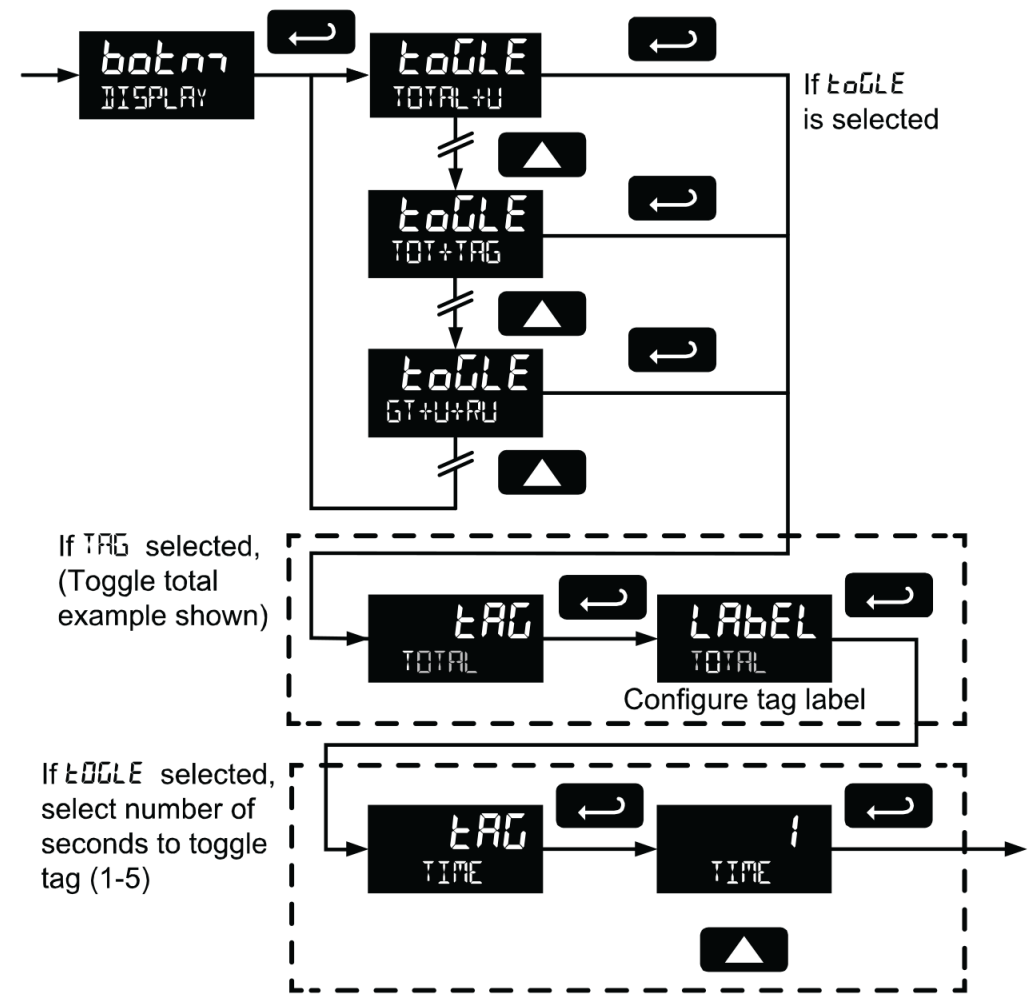
5.7.7 Set the toggle time (TIME)

If the bottom display is programmed to toggle (**tOGGLE**), the meter will prompt for a toggle time. In addition, you may be required to enter a tag. See 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 press the Menu button to exit without saving changes.

Figure 5-20: Setting the toggle time (TIME)



6 Product advanced features

Topics covered in this chapter:

- *Advanced features menu*
- *Advanced features menu and display messages*
- *Open collector outputs (OUTPUT)*
- *Scaling the 4-20 mA analog output (Aout)*
- *Gate function (GATE)*
- *Contact debounce filter (FILTER)*
- *Low-flow cutoff (CUTOFF)*
- *Scaling and calibration (SCALCAL)*
- *Total reset (T RESEt)*
- *Set up passwords (PASSWRD)*
- *Custom (CUSTOM)*
- *System (SySTEM)*
- *Serial communications (COMM)*
- *Standby mode (STANDBy)*

6.1 Advanced features menu

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

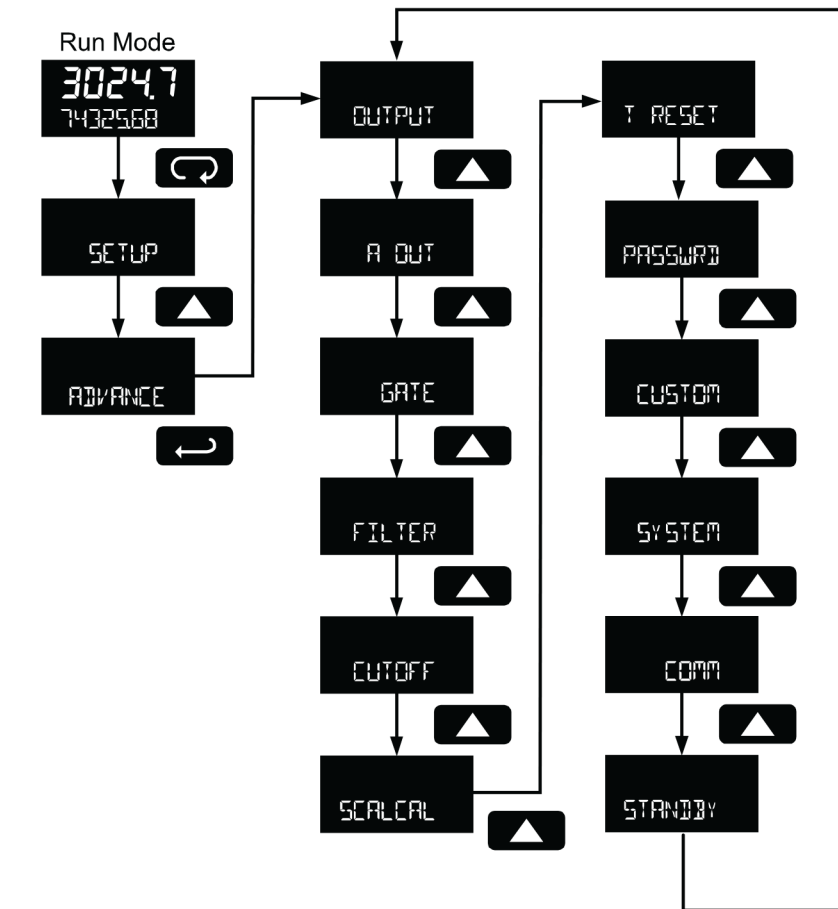
to access the Advanced features menu, press Enter in the Advance menu in the Main Menu. Refer to [Section 5.5](#) for details.

Use the Advanced menu 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**)

12. Enter low-power Standby Mode (**STANDBy**) on battery powered models

Figure 6-1: Advanced features menu



Advanced menu **A OUT** displays only for meters with the analog output option, **COMM** displays only for meters with the serial communications option, and **STANDBy** displays only for meters with battery or battery backup power.

Press the Enter button to access any menu or press the 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.

6.2 Advanced features menu and display messages

The *Advanced* features menu functions and messages in the order they appear in the menu are listed in the table below.

Table 6-1: Display, actions and settings

Parameter	Display	Action/Setting
Advanced	ADVANCE	Enter Advanced menu
Output	OUTPUT	Setup open collector outputs Out 1 and Out 2
Output 1	OUT 1	Assign function of pulse output 1
Output 2	OUT 2	Assign function of pulse 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
Grand total	Grtot	Assign pulse output to grand total
Decimal point	dec.Pt	Set K-factor decimal point
Count	count	Set K-factor
Retransmit	rEtr	Assign pulse output to retransmit
Quadrature	quAd	Assign pulse output to quadrature
Test	tESt	Assign pulse output to test mode
Alarm	ALrm	Assign Out 1 or Out 2 for alarm output mode
Rate	rAtE	Assign alarm output to rate
Set point	SEt	Set rate alarm set point
Reset point	rESEt	Set rate alarm reset point
Total	totAL	Assign alarm output to total
Grand total	Grtot	Assign alarm output to grand total
Set point	SEt	Set total or grand total alarm set point
On	On	Set output to on state
Off	Off	Set output to off state
Timer	tmEr	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
Off	Off	Set Out 1 or Out 2 as off
Analog output	A OUT	Enter Analog Output menu
Rate output	rAtE	Set rate as output variable
Total output	totAL	Set total as output variable
Grand total output	Grtot	Set grand total as output variable
Display 1	dSP 1	Output display 1 value
Output 1	OUT 1	Output 1 value

Table 6-1: Display, actions and settings (continued)

Parameter	Display	Action/Setting
Display 2	dSP 2	Output display 2 value
Output 2	Out 2	Output 2 value
Save	SAVE?	Save entered analog parameters
Disable	dSAbL	Turn off the analog output
Gate	GATE	Enter Gate menu
Low gate	LO	Set Low gate
High gate	HI	Set High gate
Filter	FILTER	Enter Filter menu
High speed filter	HI	Set high speed filter
Medium speed filter	mEd	Set medium speed filter
Low speed filter	LO	Set low speed filter
Low-flow cutoff	CUTOFF	Enter Low-Low cutoff menu
Scale & calibrate	SCALCAL	Enter the Scale & Calibrate menu to program without using a K-Factor
Scale	SCALE	Enter the Scale menu
Calibrate	CAL	Enter the Calibrate menu
Undo K-Factor	Undo? KFACTOR	Undo the K-Factor input programming
Undo scaling & calibration	Undo? SCALCAL	Undo the scaling and calibration input programming
No	no?	Do not undo other programming
Yes	YES?	Undo other programming
Number of points	noPtS	Enter the number of scaling or calibration points
Input 1	InP 1	Calibrate or scale input 1 value
Display 1	dSP 1	Program display 1 value
Input 2	InP 2	Calibrate or scale input 2 value
Display 2	dSp 2	Program display 2 value
Save	SAVE?	Save entered calibration or scale parameters
Total reset	T RESET	Enter the Total Reset menu
Total reset	t rSt	Select the Total Reset method
Manual	mAn	Manual total reset
Enable	EnAbl	Enable manual reset
Disable	dSAbL	Disable manual reset
Automatic	Auto	Automatic total reset
Time delay	T DELAY	Automatic reset time delay
Grand total reset	GtrSt	Select the Grand Total Reset method

Table 6-1: Display, actions and settings (continued)

Parameter	Display	Action/Setting
Password	PASSWRD	Enter the Password menu
Password	PASS	Program password to lock meter parameters
Password total	PASS T	Program password to prevent total reset
Password grand total	PASS GT	Enter password to permanently lock out grand total related parameters and reset
Unlock	UnLOC	Password has been unlocked
Lock	LOCd	Password has been locked
Unlocked	UNLOCKd	Program password to lock meter
Locked	LOCKED	Enter password to unlock meter
Custom	CUSTOM	Enter Custom menu
Position 1	POS 1	Set menu position 1 (1-8)
Position 8	POS 8	Set menu position 8
System	SySTEM	Enter System menu
Set time	SETTIME	Set real-time clock date and time
Year	YEAR	Set the year
Month	MONTH	Set the month
January	01	Set month as January
February	02	Set month as February
March	03	Set month as March
April	04	Set month as April
May	05	Set month as May
June	06	Set month as June
July	07	Set month as July
August	08	Set month as August
September	09	Set month as September
October	10	Set month as October
November	11	Set month as November
December	12	Set month as December
Day	DAy	Set the day
Data log	DATALOG	Enter Data Log menu
Log time	LOGTIME	Set daily data log times
Log 1	LOG 1	Set first daily log time (1-4)
Disable	dSAbL	Disable log number
Interval	INTERVL	Set interval log time
Start	StArt	Begin interval logging

Table 6-1: Display, actions and settings (continued)

Parameter	Display	Action/Setting
Log view	LOGVIEW	View data log
All log view	ALL LOGVIEW	View all data log points
Log number	LOG NUM	Go to specific log number
All erase	ALL ERASE	Erase all logs
Erase?	ErASE?	Confirm to erase all logs
Backlight	BAKLITE	Enable or disable backlight
Disable	dSABL	Disable backlight
Enable	EnAbl	Enable backlight
Analog output calibration	AO CAL	Enter Analog Output Calibration menu
Backup	BACKUP	Enter Backup menu
Save?	SAVE?	Save current parameters to backup restore
Load?	LOAD?	Load parameters from backup restore
Default	dEFLt	Restore factory default parameter settings
Reset defaults	rESEt DFALTS?	Confirm factory reset
Battery symbol	BAT SyM	Enter Battery Symbol menu
Disable	dSABL	Disable battery backup symbol
Enable	EnABL	Enable battery backup symbol
Info	INFO	Enter Info menu
Software	SOFT	Display software ID number
Version	VEr	Display software version number
Model	modL	Display model number
Communications	COMM	Enter Communications menu
Modbus	mbuS	Enter Modbus communications menu
Slave ID	SLU Id	Set Modbus slave ID
Baud rate	bAUD	Set baud rate
Transmit delay	tdELY	Set transmit delay time
Parity	PArtY	Set parity and stop bits
Standby	STANDBy	Enter standby mode (battery powered only)
Yes?	YES?	Confirm standby mode

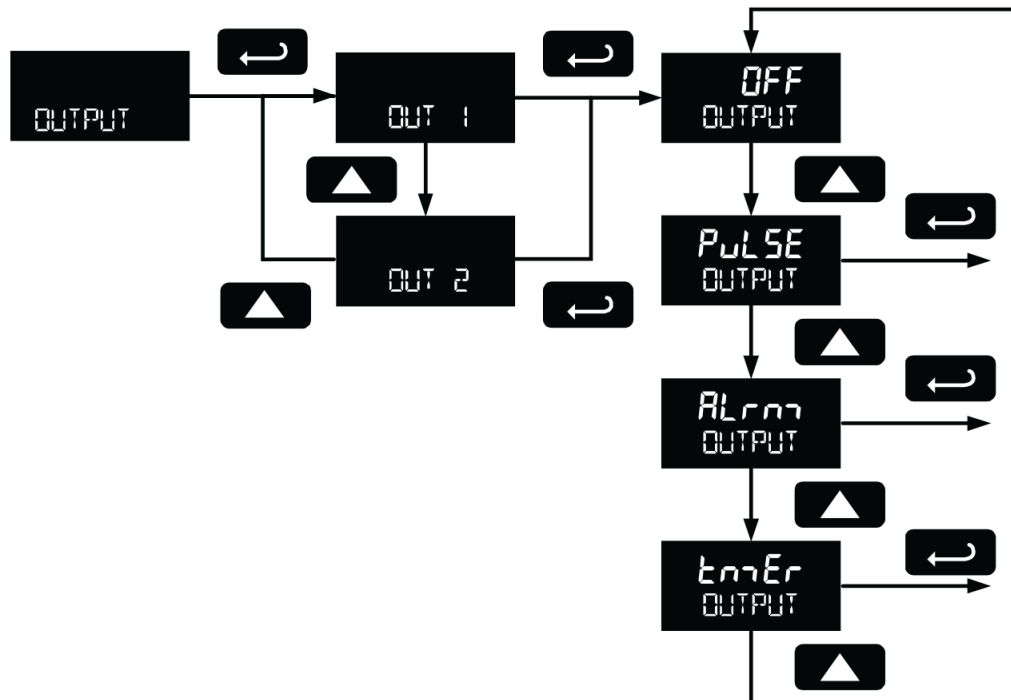
6.3 Open collector outputs (OUTPUT)

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 may be selected to generate pulses at a constant programmable frequency.

Alarms are available based on the rate, total, or grand total. The alarm status appears 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**.

Figure 6-2: Open collector outputs



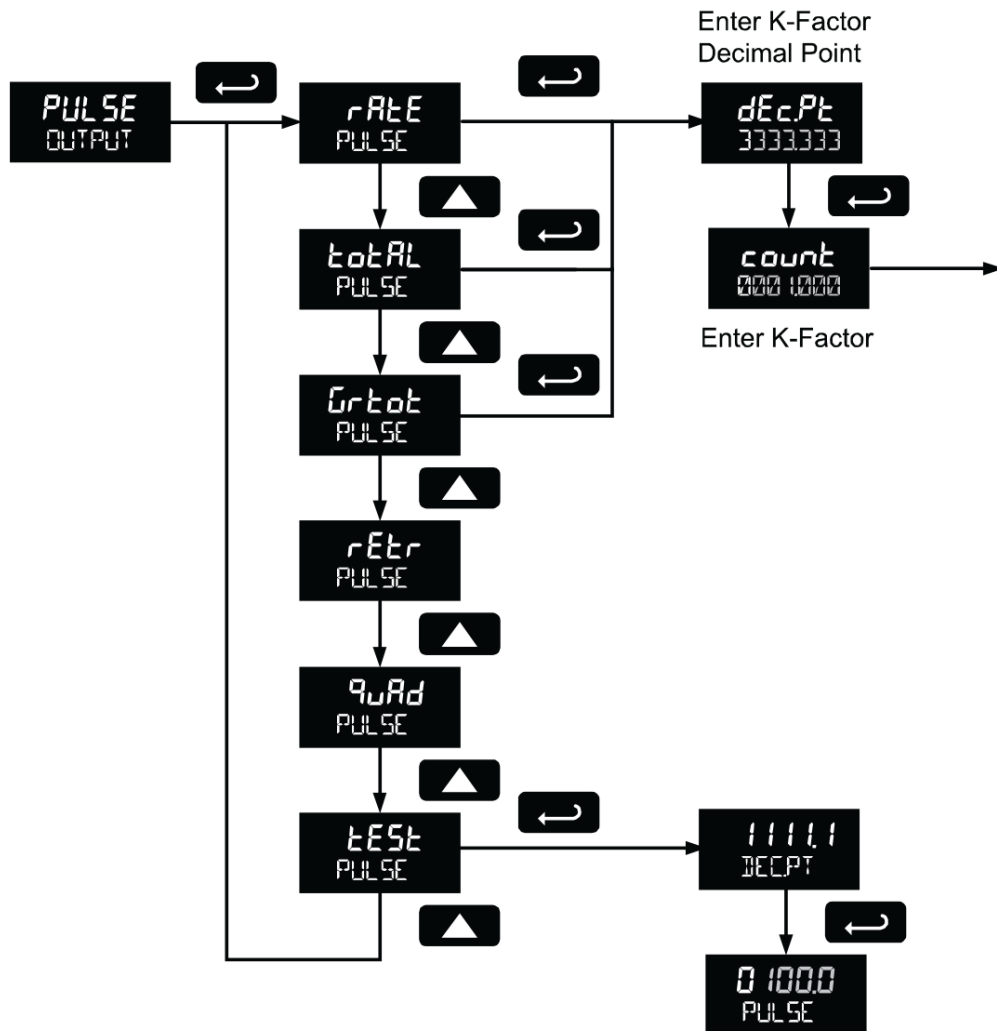
6.3.1 Output 1 and 2 Setup (OUT 1, OUT 2)

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

Pulse output (PULSE)

The pulse output may be assigned to rate, total, grand total, retransmit, quadrature, or test.

Figure 6-3: Pulse output (PULSE)



Rate pulse output (rAtE)

The 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.

Figure 6-4: Rate pulse output (rAtE) equation

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

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

Total and 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 is generated for every total accumulation amount equal to the count.

If the maximum output frequency is exceeded, the meter displays the message **PULSE OVERRNG** alternating on the display.

Retransmit output (rEtr)

The retransmitting pulse output sends an output pulse for every input pulse; duplicating the input signal. The output generates a pulse at the falling edge of the input pulses.

No additional programming is required for retransmitting the pulse output. If the maximum output frequency is exceeded, the meter displays the message **PULSE OVERRNG** alternating on the display.

Quadrature output (quAd)

The pulse output set to quadrature duplicates the other open collector output, but lags 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 required for the quadrature output function, and it must be a pulse (**PULSE**) output selection.

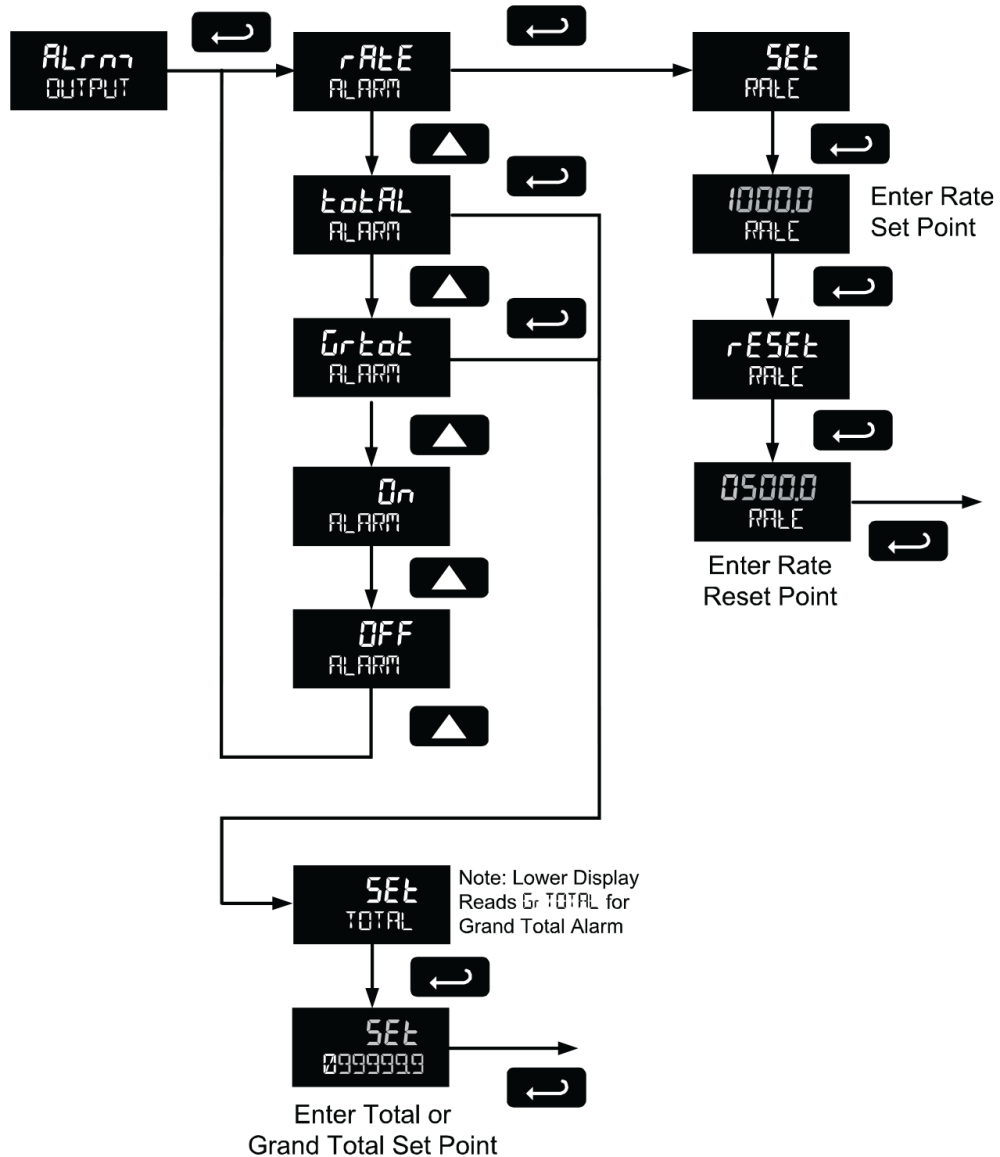
Test output (tEst)

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

Alarm output (ALrm)

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

Figure 6-5: Alarm output(ALrm)



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 generates 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 generates an alarm for a period of time programmed in **ADVANCED** → **T RESET** → **Auto** → **T DELAY**. After this time delay, the total/grand total resets to 0 and the alarm clears.

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 [Section 6.9](#).

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 (tmEr)

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.

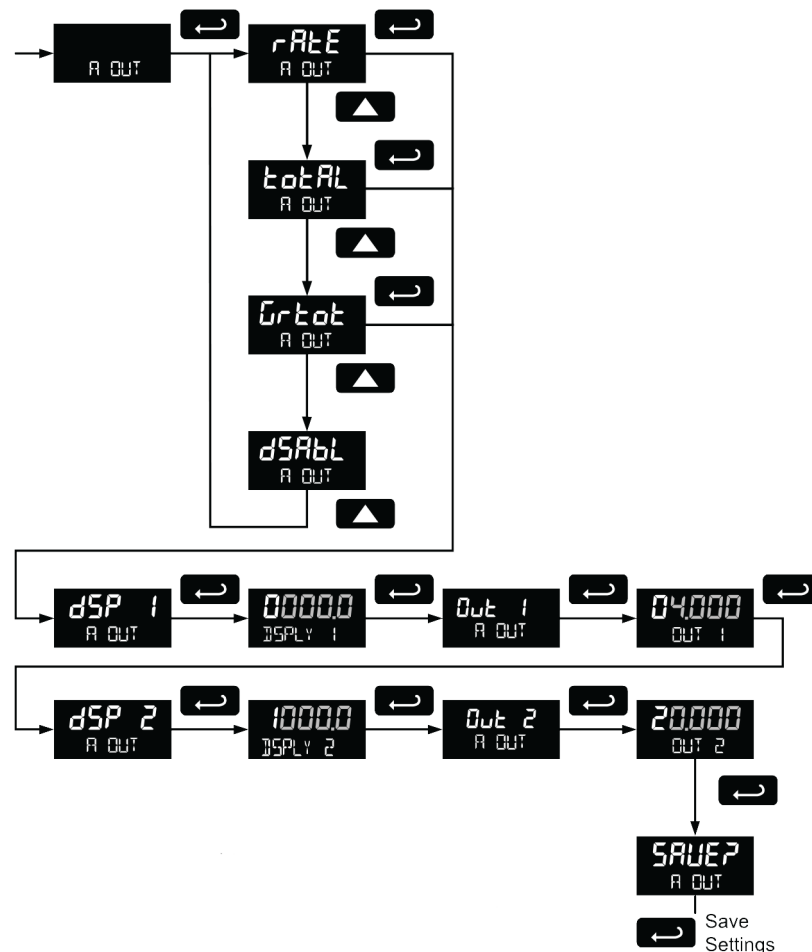
6.4 Scaling the 4-20 mA analog output (Aout)

Use the Analog output menu 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. Program two display values and corresponding mA output signals.

Figure 6-6: Scaling the 4-20 mA analog output (Aout)



NOTICE

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.

6.5 Gate function (GATE)

Use the gate function for displaying slow pulse rates. When using the programmable gate, the meter displays 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 the low gate setting should be left at 1 second. Increase the low gate setting to obtain a steadier rate display. The rate display updates in accordance with the low gate setting. For example, if the low gate is set at 10, the display will update every 10 seconds. Changes in rate between updates will not be reflected until the next display update.

High Gate (HI GATE)

Set the high gate value to correspond with 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.

6.6 Contact debounce filter (FILTER)

Use the filter function (**FILTER**) 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 input wired. Press ENTER when **med** or **LO** is displayed to enable the filter function.

The medium filter ignores 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.

6.7 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.

6.8 Scaling and calibration (SCALCAL)

Important

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.

Three methods of programming the display show the 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 independent 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 [Number of points \(noPts\)](#) for details.

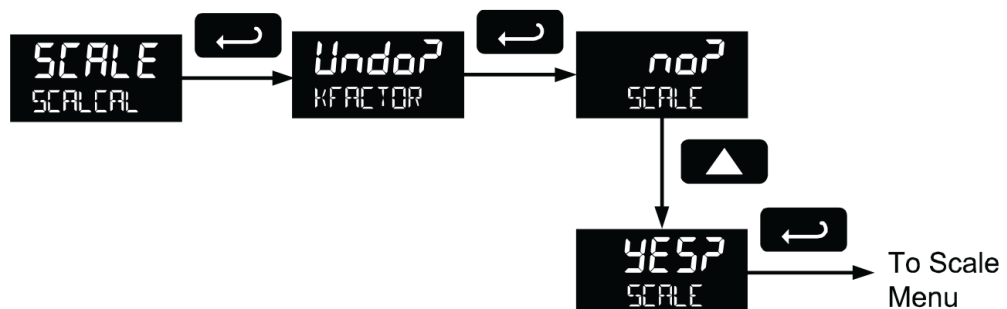
Scale and calibrate the meter using this menu. Refer to [Section 5.7.2](#) for information on using a K-Factor for programming the input.

6.8.1 Undo K-Factor, scale, and calibration (Undo?)

A confirmation menu appears whenever the input programming changes from K-Factor to scaling or calibration; or from scaling or calibration to K-Factor.

See figure below for an example of a meter programmed with a k-factor that is being reprogrammed to utilize input scaling.

Figure 6-7: Undoing K-Factor, scale and calibration (Undo?)



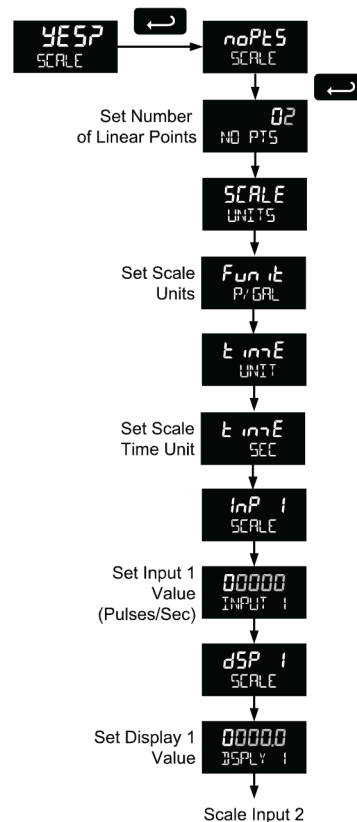
6.8.2 Scale the meter (SCALE)

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

A programmed scaled input works with *Automatic unit conversions*. The units for the display values being entered are a combination of the programmed *Rate unit* and the time unit (**timE UNIT**) entered in the Scale menu.

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

Figure 6-8: Scaling the meter (SCALE)



For instructions on how to program numeric values see [Section 5.3](#).

Multi-Point linearization (noPts)

Up to 32 linearization points can be selected under the **noPts** function. The multipoint 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, leave the number of points 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 (time UNIT)

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

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

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.

6.8.3 Calibrate the meter (CAL)

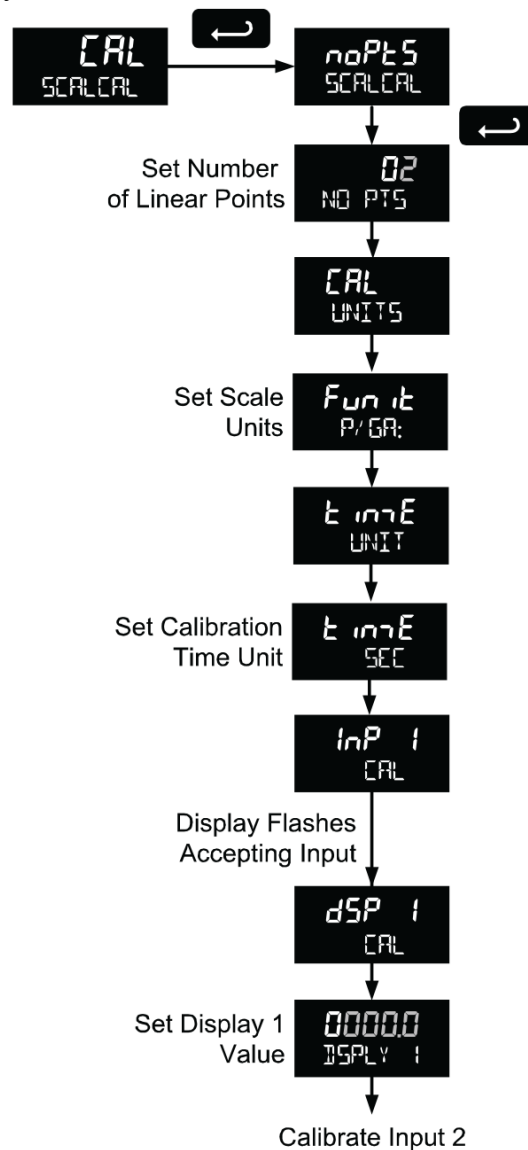
Refer to [Section 5.7.2](#) or [Section 6.8.2](#) to scale the meter without a signal source .

Calibrate the pulse input to display the process in engineering units. Apply the appropriate input signal and follow the calibration procedure. The use of a calibrated signal source is strongly recommended.

A calibrated input will work with [Automatic unit conversions](#). The units for the display values that are a combination of the programmed Rate Unit and the time unit (**time UNIT**) entered in the *Calibrate* menu.

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

Figure 6-9: Calibrating the meter (CAL)



The multi-point linearization (**noPTS**) can be used to linearize the display for non-linear signals. For instructions on how to use this feature, see [Multi-Point linearization \(noPTS\)](#).

For instructions on how to program numeric values see [Section 5.3](#).

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 the Up arrow. For a non-linear signal, refer to [Section 6.8.4](#).
3. The meter displays **CAL UNITS**. Press Enter to select the input units/pulse. The menu reads **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)*.
5. The meter displays **inP 1**. Apply a known signal and press Enter. The display flashes 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 flashes 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 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.

Error messages (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.

Conditions causing an error message:

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

Minimum input span

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

Important

After entering the last display value, save (**SAVE?**) the calibration entries. You may move past this selection using the Up arrow key if you need to go back and correct an earlier entry. Then save the changes on the Save menu screen (**SAVE?**) by pressing the Enter key.

6.8.4 Multi-point linearization (noPTS)

Up to 32 linearization points can be selected under the **noPTS** function. Use multi-point linearization to linearize the display for non-linear inputs. Enter linearization data using a known accurate signal source (**InP 1-32**) and enter the required/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 (timE UNIT)

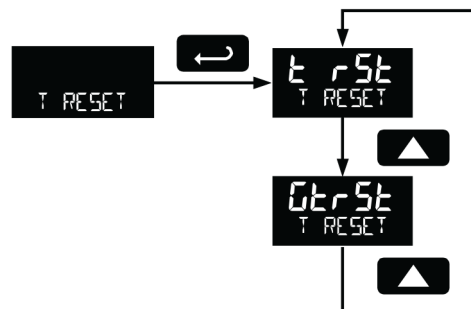
This is the time component to be used when calibrating a number of input pulses per time unit to equal a certain display value.

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

6.9 Total reset (T RESEt)

Select from total and grand total reset menu choices.

Figure 6-10: Total Reset menu

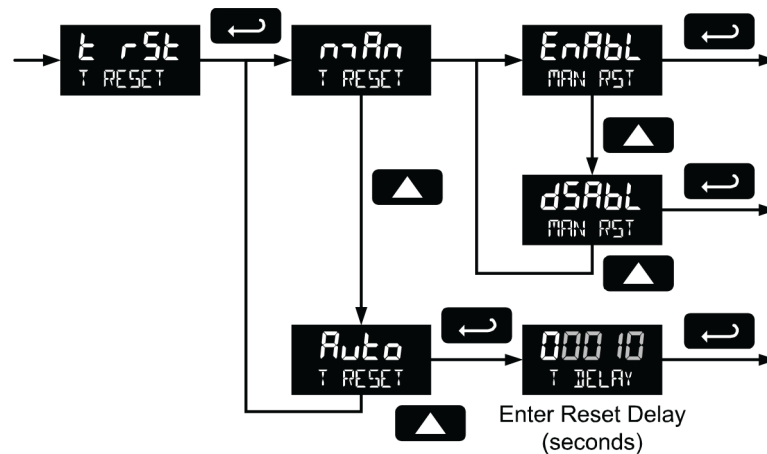


6.9.1 Manual or automatic total reset function (t rSt)

Select **T RESEt**> **t rSt**> **mAn** for manual reset and select enable (**EnAbl**) or disable (**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.

Select **T RESEt** > **t rSt** > **Auto** > **T DELAY** for automatic reset and enter reset delay time in seconds. Once the output alarm total set point is reached, there is a delay for a programmed amount of time (**T DELAY**) before the total resets to zero. Press the Enter button at any time, to accept a setting, or press the Menu button to exit without saving changes.

Figure 6-11: Manual or automatic Total reset function



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 \(ALrm\)](#).

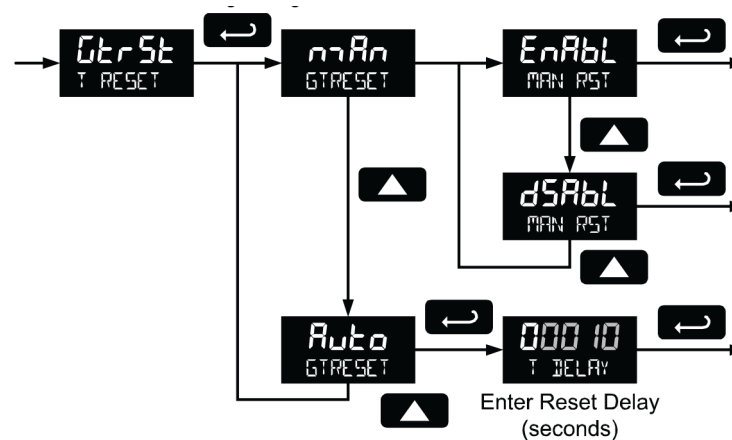
6.9.2 Manual or automatic grand total reset function (GrtrSt)

For manual reset, select **T RESEt** > **GtrSt** > **mAn** 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.

Figure 6-12: Manual or automatic grand total reset function (GtrSt)



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 \(ALrm\)](#) programming.

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

6.10 Set 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.

Figure 6-13: Setting up passwords (PASSWRD)

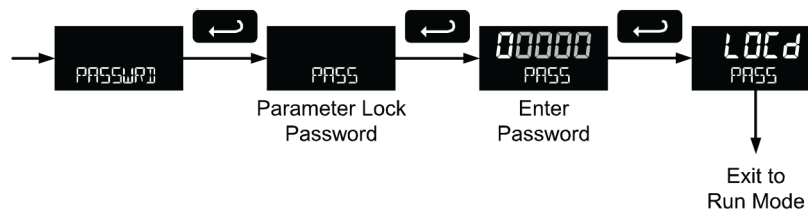
Model:	
Serial Number:	
Setting Lockout Password (PASS):	_____
Total Reset Password (PASS T):	_____
Grand Total Reset Password (PASS GT):	_____

6.10.1 Lock 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 [Section 5.3](#).

Figure 6-14: Locking meter setup parameters



6.10.2 Reset total and grand total on a password protected meter

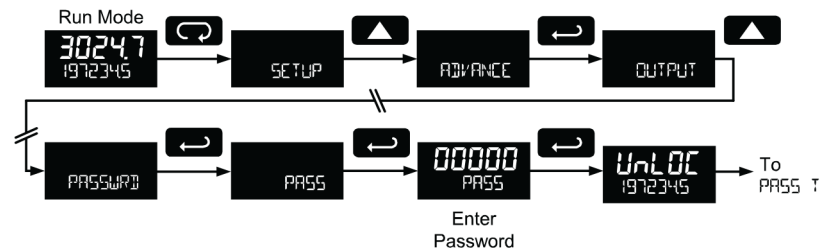
If the meter is password protected for total or grand total reset, the meter will display the message **PASS T** or **PASS GT** when an attempt is made to enter the password protected total or grand total *Reset* menus. Input the password and press the Enter button to reset the total or grand total.

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

6.10.3 Disable 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.

Figure 6-15: Disabling password protection



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.

6.10.4 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!

METER LOCKING HAZARD

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

Table 6-2: Non-resettable grand total locked menus and parameters

Display	Parameter/Menu	Action/Setting locked
InPut	Input	All <i>Input</i> type selection menu parameters
GtotU	Grand total units	Set grand total units
GrtCf	Grand total conversion factor	Enter the <i>Grand total conversion factor</i> menu
Grtot DECI-MAL	Grand total decimal point	Enter the grand total display decimal point
FActr	K-Factor	All <i>K-Factor</i> menu parameters
SCALE	Scale	All <i>Scale</i> menu parameters
CAL	Calibrate	All <i>Calibrate</i> menu parameters
GrtSt	Grand total reset	All <i>Grand total reset</i> menu parameters
PASS GT	Password grand total	Enter the grand total reset passwords
Grtot ALARM	Grand total alarm	All grand total alarm output menu parameters
FILTER	Filter	Enter <i>Filter</i> parameter
CUTOFF	Low-flow cutoff	Enter <i>Low-flow cutoff</i> parameter

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

6.11 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.

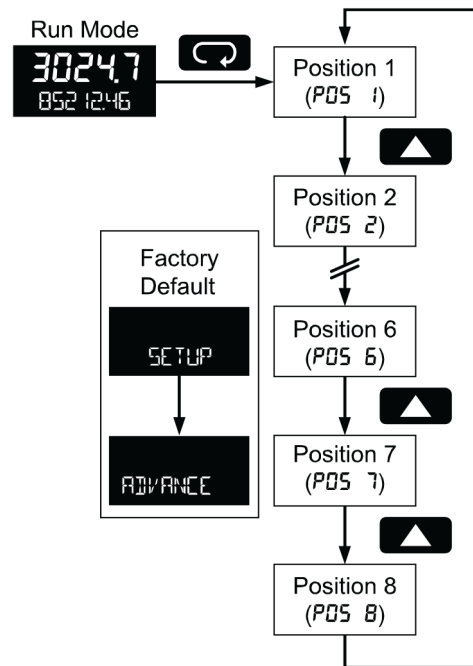
⚠ CAUTION!

PROGRAMMING AND OPERATION HAZARD

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.

Figure 6-16: Custom (CUSTOM)



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 table Custom menu parameters for a complete list of the available menu selections for each position.

Table 6-3: 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 output	Set to show Analog output menu
RATEDP	Rate decimal point	Set to show Rate decimal point menu
TOTALDP	Total decimal point	Set to show Total decimal point menu
GRTOTDP	Grand total decimal point	Set the show Grand total decimal point menu
SCALE	Scale	Set to show Scale menu

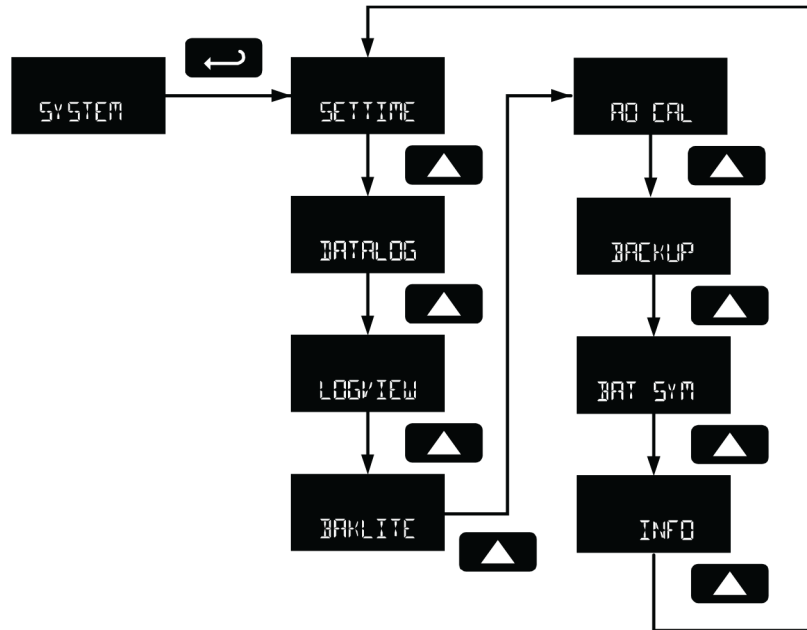
Table 6-3: Custom menu parameters (continued)

Display	Parameter/Menu	Action
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
GTFACR	Grand total conversion factor	Set to show Grand total conversion factor menu
GRESET	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

6.12 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.

Figure 6-17: System (SySTEM)



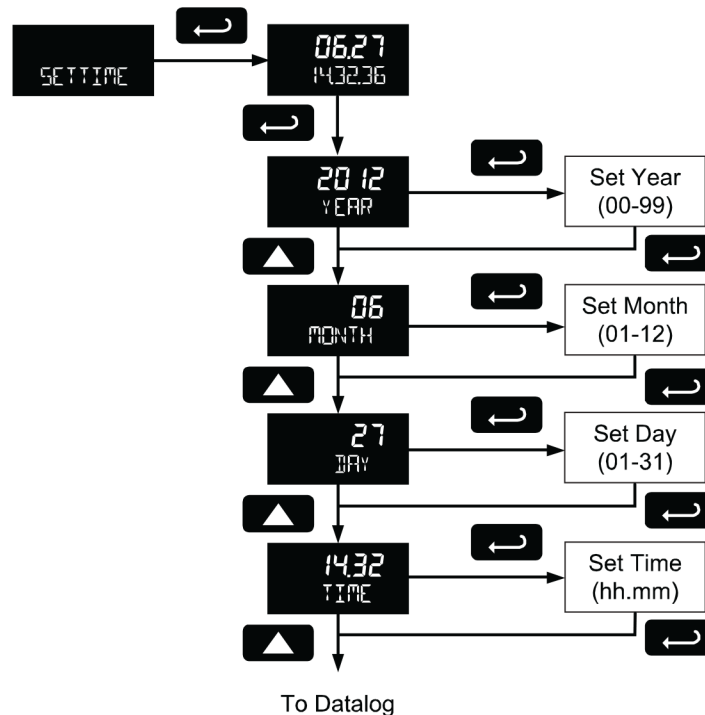
6.12.1 Set real time clock (SETTIME)

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 6-18: 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.

Figure 6-19: Setting real time clock (SETTIME)

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.

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)

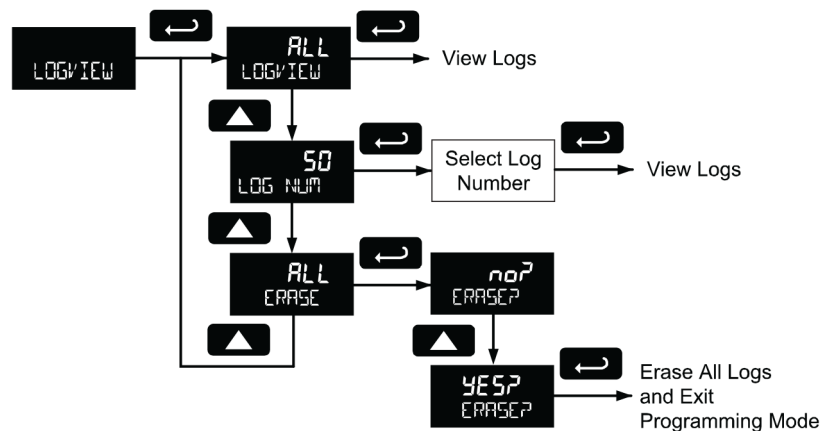
The Interval menu sets the time interval for data logging. Every time interval, one data point will be recorded. To enable interval data logging, enable the feature, and set the interval time for the hours and minutes between each log.

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.

6.12.2 View data log (LOGVIEW)

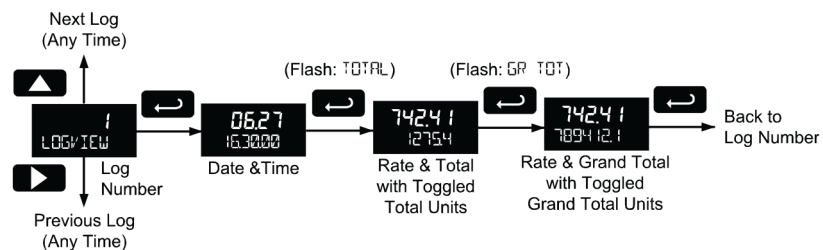
The Log View menu allows on-screen browsing of the data log points stored in the meter. Data points may be navigated by viewing the log number, date and time, total, or grand total amounts. A known log may be jumped to immediately, avoiding a lengthy search for data. All logs may be deleted with the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

Figure 6-20: View data log (LOGVIEW)



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.

Figure 6-21: Changing log entries



6.12.3 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.

6.12.4 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.

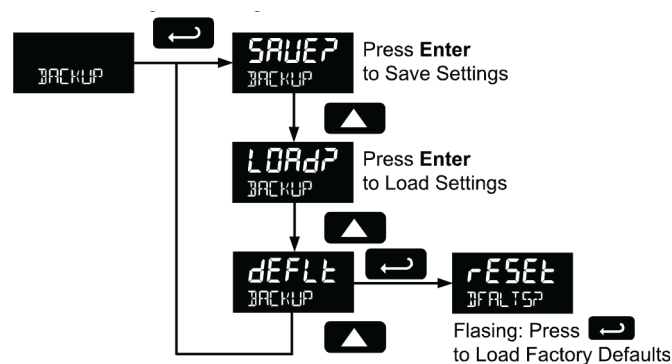
6.12.5 Backup and restore (BACKUP)

Important

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.

Figure 6-22: Backup and restore (BACKUP)



The save feature (**SAVE?**) 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 (**LoAd?**) 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 [Section 6.10.4](#).

⚠ 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 [Section 6.10.4](#).

6.12.6 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.

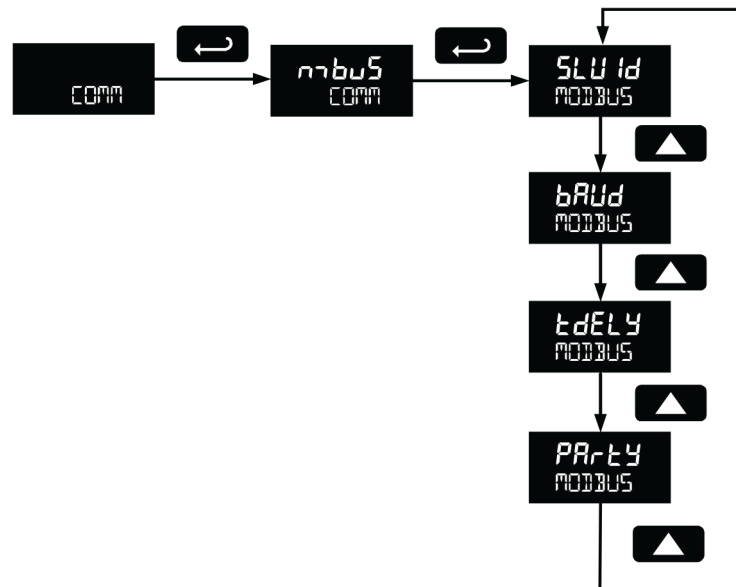
6.12.7 Information (INFO)

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:

1. Go to the Information menu (**INFO**) and press Enter button.
2. Continue pressing Enter to scroll through the displays.
3. Follow the information display to exit the meter's Advanced features menu and return to Run mode.

6.13 Serial communications (COMM)

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

Figure 6-23: Serial communications (COMM)

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

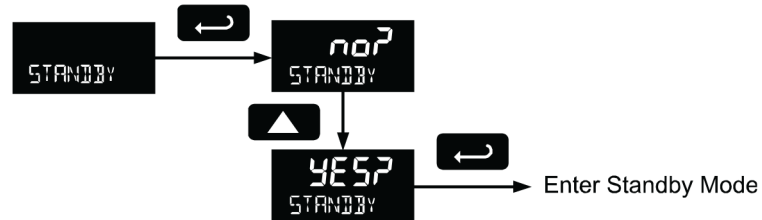
When using more than one meter in a multi-drop mode, each meter must be provided with its own unique address. The meter address (Slave ID) may be programmed between 1 and 247. The baud rate may be set to 1,200; 2,400; 4,800; 9,600; 19,200; 38,400; 57,600; or 115,200 bps. The transmit delay may be set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

For ProtEX Modbus Register Tables, contact Daniel.

6.14 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.

Figure 6-24: Standby mode (STANDBy)

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

6.14.1 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.

7 Startup procedure

Topics covered in this chapter:

- *Operation and startup procedure*
- *Button tips*
- *Grand total reading (Gr TOTAL)*
- *Max/Min readings (MAXIMUM, MINIMUM)*
- *Reset the total (rESEt TOTAL?)*
- *Reset the grand total (rESEt Gr TOT?)*
- *Reset Max/Min readings (RESET MAXIMUM, MINIMUM)*
- *Reset meter to factory defaults*
- *Factory defaults and user settings*

7.1 Operation and startup procedure

Through-glass button operation

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

Important

Through-glass buttons will not work if two or more buttons are pressed simultaneously. Avoid triggering multiple buttons by reaching across one button location to press another button.

Table 7-1: Front panel button operation


Symbol	Description
	<ol style="list-style-type: none"> 1. Hold the Menu button when in power save mode (display will show (⏻)) to awaken through-glass buttons. 2. Press the Menu button to enter Programming Mode. 3. Press the Menu button during Programming Mode to return to the previous menu selections. 4. Hold the Menu button for 1.5 seconds at any time to exit Programming Mode and return to Run mode. 5. Press and hold the Menu button for 3 seconds to access the Advanced features of the meter. 6. Press and hold the Menu button for 3 seconds to access the Advanced features of the meter.

Table 7-1: Front panel button operation (continued)




Symbol	Description
	<ol style="list-style-type: none"> 1. Press the Right arrow button to move to the next digit or decimal position during programming. 2. Press Right to go backward through most selection menus. 3. Press Reset to reset the total, or values displayed in the bottom display (grand total, max, or min). 4. Press Enter after Right to confirm the reset.
	<ol style="list-style-type: none"> 1. 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. 2. Press the Up arrow button to scroll forward through the menus, decimal point, or to increment the value of a digit.
	<ol style="list-style-type: none"> 1. Press the Enter button to access a menu or to accept a setting. 2. Press Enter to lock the grand total, maximum, or minimum value on the lower display, and disable the 12 second time out. 3. Press Enter while the grand total, max, or min reading is locked on the lower display to return to run mode. 4. Press Enter to acknowledge alarm (if enabled).

Table 7-2: Through-glass button modes

Mode	Description
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 side 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 manual buttons located next to the sensors may be used. The sensors are disabled when a manual button is pressed. They will automatically be re-enabled after 60 seconds of inactivity. The through-glass power symbol (⏸) will blink in the lower right side of the display if the buttons are disabled due to a mechanical pushbutton being pressed.

7.2 Button tips

For button tips, refer to [Section 5.2](#).

7.3 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 **Gr TOTAL**, 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.

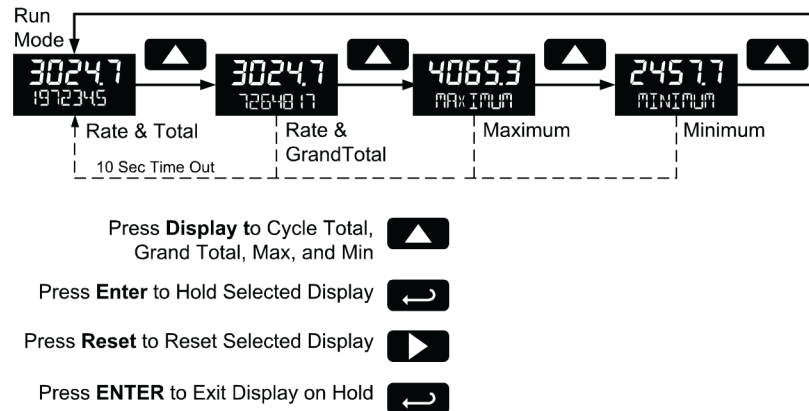
7.4 Max/Min readings (MAXIMUM, MINIMUM)

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.

Figure 7-1: Max/Min readings (MAXIMUM, MINIMUM)



7.5 Reset the total (rESEt TOTAL?)

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.

7.6 Reset the grand total (rESEt Gr TOT?)

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.

7.7 Reset 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.

7.8 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 [Section 6.10.4](#).

Instructions to load factory defaults can be found in the [Section 6.12.5](#) menu.

7.9 Factory defaults and 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.

Table 7-3: Default and user settings

Model:		S/N:	Date:
Parameter	Display	Default setting	User setting
Input type	InPUt	Active	
K-Factor units	Funit	Pulse/gallon	
F-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	11111.1	1 place	
Grand total decimal point	11111.1	1 place	
Total conversion factor	totCF	N/A (only valid with customs units)	
Grand total conversion factor	GrtCF	N/A (Only valid with custom units)	

Table 7-3: Default and user settings (continued)

Model:		S/N:	Date:
Parameter	Display	Default setting	User setting
Top display	tOP	Rate	
Bottom display	bOtm	Total	
Advanced features			
Total reset	t rSt	Manual - enable	
Grand total reset	t rSt	Manual - enable	
Analog out value	A out	Rate	
Output display 1	dSPL1	0000.0	
Output 1	Out 1	4.000	
Output display 2	dSPL2	1000.0	
Output 2	Out 2	20.000	
Scale enable	SCALE	No - use K-Factor	
Scale/Cal # points	noPtS	2 (N/A)	
Scale unit	Funit	Pulse/gallon (N/A)	
Scale unit time base	timE	Second (N/A)	
Scale/Cal Input 1	InPt 1	00000 (N/A)	
Scale/Cal display 1	dSPL1	0000.0 (N/A)	
Scale/Cal Input 2	InPt2	1000 (N/A)	
Scale/Cal display 2	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 (disable)	
Battery symbol	BAT SyM	Disable	
Modbus slave ID	SLV Id	247	
Baud rate	bAud	19,200 bps	
Time delay	tdELY	10 ms	
Parity	PArTY	Even	
<i>Additional parameters and notes</i>			

Table 7-3: Default and user settings (continued)

Model:		S/N:	Date:
Parameter	Display	Default setting	User setting

Part IV

Maintain

8 Maintenance

Topics covered in this chapter:

- [Troubleshooting tips](#)
- [Quick user interface reference](#)
- [Battery replacement](#)

8.1 Troubleshooting tips

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.

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.
Thru-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 manual 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 Advanced menu.
Meter displays error message during calibration (ERROR-SPAN)	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.

Symptom	Check/Action
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

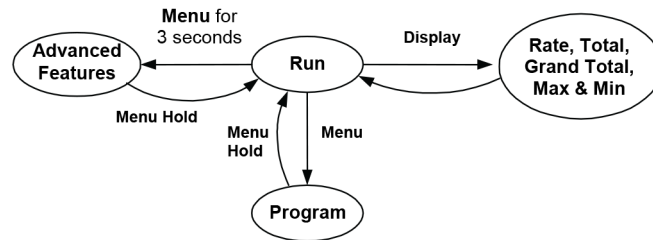
Certain sequences of events can cause unexpected results. To solve these issues, it is best to start fresh from factory defaults and map changes ahead of time, rather than at random.

8.2 Quick user interface reference

Table 8-1: 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.

Figure 8-1: Operational modes



8.3 Battery replacement

Battery-equipped internal displays 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 in [Table 1-1](#). Replace the battery when the low battery indication appears 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 HAZARD

Do not recharge, short circuit, crush, disassemble, heat above 100 °C (212 °F), incinerate, or expose contents of the battery to water. It is a special Lithium-metal (Li-SO Cl₂) 3.6V cell.

Failure to follow these instructions may cause fire or explosion resulting in death or serious injury.

Important

Follow applicable regulations, which vary by location, when disposing batteries. Spent Li-SO Cl₂ batteries may not be disposed of as normal trash. Disposal is handled by local battery disposal facilities.

Package spent batteries in such a way as to prevent short circuits during handling and transport.

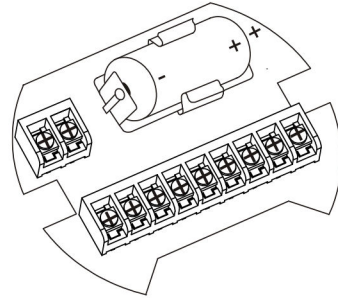
To replace the battery follow the steps below:

Procedure

1. Remove enclosure cover and display module.
2. Disconnect ribbon cable from the display module.
3. Carefully cut and remove any cable ties (if present).

4. Remove the spent battery and prepare it for disposal .
5. Install new battery into battery clip with polarity as shown in the figure below.
6. Reconnect the ribbon cable and attach the display module. Install enclosure cover.
7. Resume operation.

Figure 8-2: Battery orientation



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