TEK-LCD 7800A-0L1

NEMA 4X Loop Powered Level Indicator

Instruction Manual

Document Number: IM-7800A-0L1

www.tek-trol.com

NOTICE
Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.
For technical assistance, contact
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Disclaimer

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

WARNING

- Risk of electric shock or personal injury.
- This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at his/her own risk. Tek-Trol LLC shall not be held liable for damages resulting from such improper use.
- Failure to follow installation guidelines could result in death or serious injury. Make sure only qualified personnel perform the installation.

CAUTION

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

Limited Warranty

Tek-Trol LLC warrants this product against defects in material or workmanship for the specified period under "Specifications" from the date of shipment from the factory.
Tek-Trol's liability under this limited warranty shall not exceed the purchase value, repair, or replacement of the defective unit.

Registered Trademarks

All trademarks mentioned in this document are the property of their respective owners.

1   Safety Instructions

WARNING

- Read complete instructions prior to installation and operation of the meter.
- Installation and service should be performed only by trained service personnel. Service requiring replacement of internal components must be performed at the factory.
- Disconnect from supply before opening enclosure. Keep cover tight while circuits are alive.
- 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.

1.1   Installation

WARNING

Hazardous voltages may exist within enclosure. Installation and service should be performed only by trained service personnel.

Wiring connectors are accessed by opening the enclosure. To access electrical connectors, remove the 2 captive screws, then disconnect the ribbon cable from the display module and set the display module aside.

1.2   Unpacking

Remove the scanner from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier. If any part is missing or the scanner malfunctions, please contact your supplier or the factory for assistance.

1.3   Conduit/Stopping Plug

The Tek-LCD 7800A-0L1 is provided with three ¾ NPT threaded conduit openings and one IP68 rated ¾ NPT plastic conduit plug.

The conduit/stopping plug included has 1.29 wrenching flats and a screwdriver slot.

2   Product Description

2.1   Introduction

The Tek-LCD 7800A-0L1 is a plastic field mounted loop-powered meter fully featured for demanding applications in the harshest environmental conditions. The bar graph representation of the process input is perfect for level applications and allows for quick assessment of current conditions. The meter derives all of its power from the 4- 20 mA loop. It is programmed using the four through-window buttons, without removing the cover, and can be scaled with or without a calibration signal. The numeric display will read up to 99999 and the alphanumeric display can be programmed to show any combination of numbers and letters up to seven characters long for use as engineering units, the process identification tag or a display for the calculated volume when using for level applications. The backlight lets you see the display under any lighting condition and can be powered from either the 4-20 mA loop or from a separate DC power supply.

The enclosure has three threaded conduit holes, integrated pipe or wall mounting flanges, and allows for easy installation of tamper seals.

2.2   Specifications

Except where noted all specifications apply to operation at 25°C (77°F).

GENERAL		
DISPLAY	Five Digits Top Display (-9999 to 99999)	0.6" (0.05 ft) high, 7-segment, automatic lead zero blanking.
	Seven Characters	0.4" (0.03 ft) high, 14-segment
	Symbols	Bar Graph which displays process input from 0-100% of scaled value.
	Backlight	White
DISPLAY UPDATE RATE	Ambient > -13°F (-25°C): 2 Updates/Second Ambient < -13°F (-25°C): 1 Update/5 Seconds	
OVERRANGE	Display flashes 99999	
UNDERRANGE	Display flashes -9999	
PROGRAMMING METHOD	Four through-window buttons when cover is installed. Four internal pushbuttons when cover is removed.	
NOISE FILTER	Programmable LO, MED, HI, or OFF	
RECALIBRATION	Recalibration is recommended at least every 12 months.	
MAX/MIN DISPLAY	Max/Min readings reached by the process are stored until reset by the user or until power to the meter is turned off.	
PASSWORD	Programmable password restricts modification of programmed settings.	
NON-VOLATILE MEMORY	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.	

NORMAL MODE REJECTION	64 dB at 50/60 Hz
ENVIRONMENTAL	Operating temperature range: -40°F to 167 °F (-40°C to 75°C) Storage temperature range: -40°F to 167 °F (-40°C to 75°C) Relative humidity: 0 to 90% non-condensing
CONNECTIONS	Screw terminals accept 12 to 22 AWG wire
MOUNTING	May be mounted directly to conduit. Two slotted flanges for wall mounting or NPS 1½" to 2½" or DN 0.13 to 0.21 ft. pipe mounting.
ENCLOSURE	NEMA 4X, IP65 plastic field enclosure. Color: blue. Three ¾" NPT threaded conduit openings. One ¾" NPT plastic conduit plug, with 1.29 wrenching flats and a screwdriver slot, is included.
OVERALL DIMENSIONS	5.67 x 5.25 x 4.18 (0.47 ft x 0.43 ft x 0.34 ft) (W x H x D)
WEIGHT	1.65 lbs (26.4 oz, 0.75 kg)
WARRANTY	3 years parts and labor
INPUT	
ACCURACY	±0.03% of calibrated span ±1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span
MULTI-POINT LINEARIZATION	2 to 32 points
PROGRAMMABLE EXPONENT	1.0001 to 2.9999
LOW FLOW CUT- OFF	0-99999 (0 disables cutoff function)
TEMPERATURE DRIFT	50 PPM/°C from -40°F to 167 °F (-40°C to 75°C) ambient
DECIMAL POINT	User selectable decimal point
MINIMUM SPAN	Input 1 & Input 2: 0.10 mA
CALIBRATION RANGE	An *Error* message will appear if input 1 and input 2 signals are too close together. **Input Range:** 4-20 mA, **Minimum Span Input 1 & Input 2:** 0.10 mA
MAXIMUM VOLTAGE DROP	**Without Backlight or with Externally-Powered (DC Powered) Backlight:** 3.0 VDC @ 20 mA **With Loop-Powered Backlight:** 6.0 VDC @ 20 mA
EQUIVALENT RESISTANCE	**Without Backlight or with Externally-Powered (DC Powered) Backlight:** 150 Ω @ 20 mA **With Loop-Powered Backlight:** 300 Ω @ 20 mA
EXTERNALLY POWERED BACKLIGHT	**Voltage Range:** 9-36 VDC **Maximum Power:** 9 VDC (0.2 W), 12 VDC (0.25 W), 24 VDC (0.5 W),

	36 VDC (0.75 W),
INPUT OVERLOAD	Over current protection to 2 A max.
OPEN COLLECTOR OUTPUT	
RATING	Isolated open collector, 30 VDC @ 150 mA max.
ALARM OUTPUT	Assign to level or volume for high or low alarm trip point.
DEADBAND	0-100% FS, user selectable
ACKNOWLEDGE	Front panel ENTER button and external RESET terminals resets output and screen indication.

2.3   Dimensional Drawing

Enclosure Dimensions – Front View
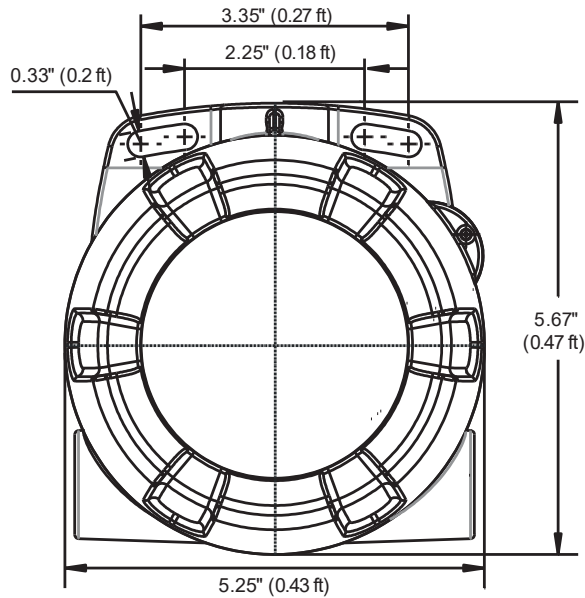
Enclosure Dimensions – Side Cross Section View
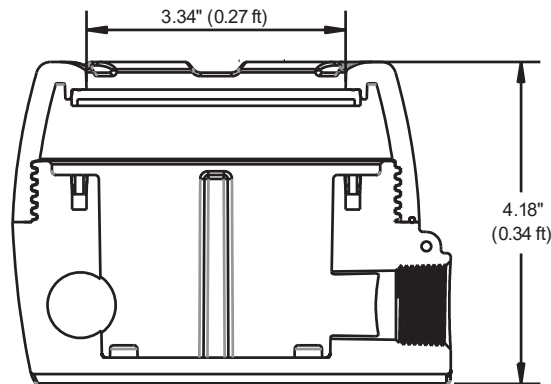
2.4 Ordering Information

Popular Model

Model	Description
Tek-LCD 7800A-0L1	NEMA 4X Loop-Powered Level Meter with Bar Graph

Accessories

Model	Description
Tek-LCD 7800A-PLUG75P	¾" NPT Plastic Conduit Plug
Tek-LCD 7800A-6846	Steel Pipe Mounting Kit
Tek-LCD 7800A-6846SS	Stainless Steel Pipe Mounting Kit

2.5 Mounting

The Tek-LCD 7800A-0L1 has two slotted mounting flanges that may be used for pipe mounting or wall mounting. Alternatively, the unit may be supported by the conduit using the conduit holes provided.

WARNING

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

2.6 Connections

WARNING

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

To access the connectors, remove the enclosure cover and unscrew the two captive screws that fasten the display module. Disconnect the ribbon cable and remove the display module. Signal connections are made to a four-terminal connector in the base of the enclosure.

SIGNAL +   4-20 mA signal input positive terminal connection
SIGNAL -   4-20 mA signal return/negative terminal connection when not using loop powered backlight.
BACKLIGHT +   +9-36 VDC when powering backlight from external supply.
BACKLIGHT -   4-20 mA signal return/negative terminal when using the installed loop powered backlight or ground/negative when powering backlight from external supply.
OUTPUT+   NPN open collector output positive.

OUTPUT-	NPN open collector output negative.
RESET +	Contact closure alarm acknowledge pull up to 3 VDC.
RESET-	Contact closure alarm acknowledge ground/negative.

Refer to Figure 1 for terminal positions.

⚠ **WARNING**

Observe all safety regulations. Electrical wiring should be performed in accordance with all agency requirements and applicable national, state, and local codes to prevent damage to the meter and ensure personnel safety.
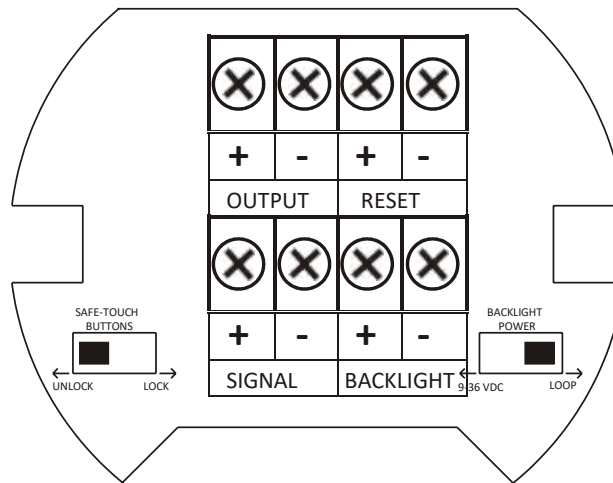
Figure 1. Connector Board

2.7   Connections & Wiring Diagrams

Signal connections are made to a four-terminal connector mounted in the base of the enclosure. For installations without backlight, only the two signal terminals are connected. The 4-20 mA input with no backlight has a maximum voltage drop of 3 V and is wired as shown in Figure 2. The loop-powered backlight configuration requires a total maximum voltage drop of 6 V. The backlight is recommended for dim lighting conditions and is enabled when wired as shown in Figure 3 or Figure 4.
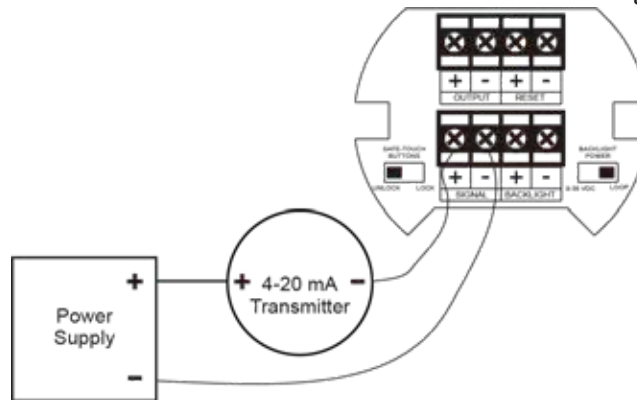
Figure 2. Connections without Backlight
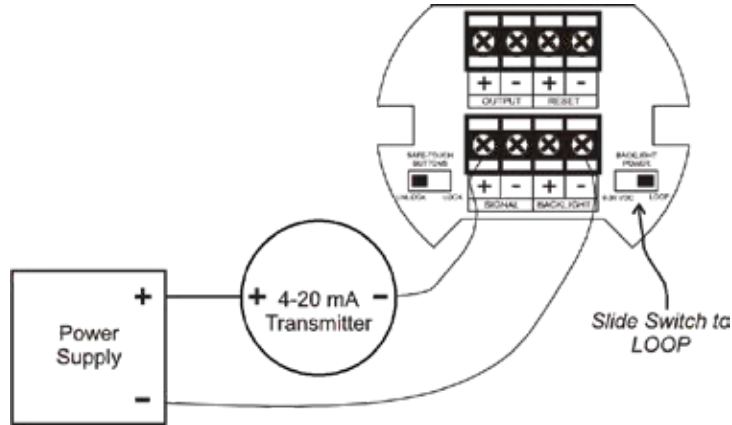
Figure 3. Connections with Loop-Powered Backlight
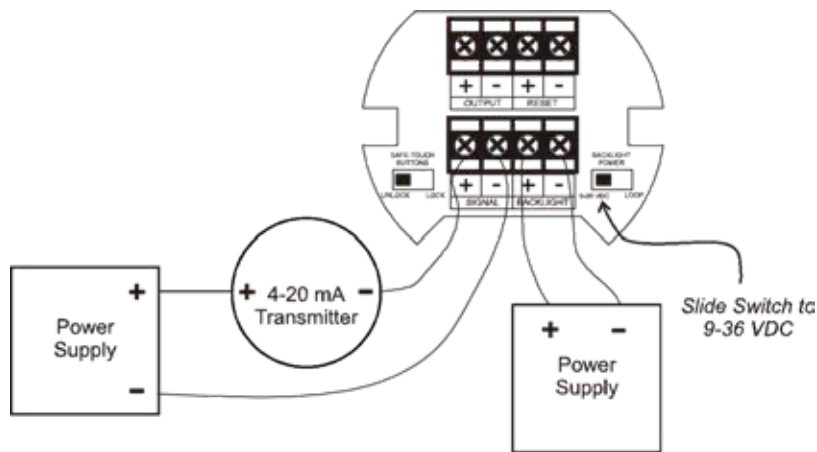
Figure 4. Connections with Externally-Powered Backlight

It is possible to use the same transmitter (signal loop) power supply for the externally powered backlight. The backlight circuit will draw 25 mA in addition to the loop circuit.

2.8 External Acknowledge Connection

External acknowledge connections are made to two terminals labeled ⌐ESEᒪ. Connect to a contact closure source such as a relay or a pushbutton as shown in
Figure 5.
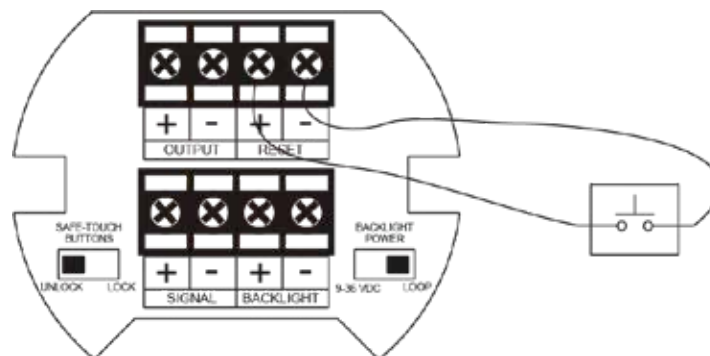
Figure 5. External Alarm Reset/Acknowledge Connections

2.9 Open Collector Output Connections

Output connections are made to two terminals labeled OUTPUT. Connect to an input device such as alarm indicator as shown in Figure 6, or drive a relay as shown in Figure 7.

⚠️ **WARNING**

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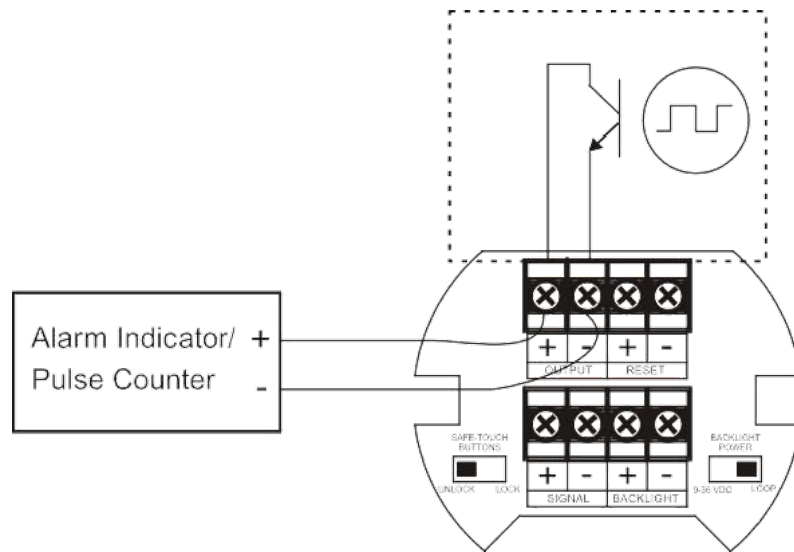
Figure 6. Connection to Device with Internal Pull-Up

Figure 7. Output Connections

3   Setup and Programming

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

3.1   Overview

Setup and programming are done through the infrared through-window buttons or using the mechanical buttons when uncovered. There are two slide switches located on the connector board. One is used to select backlight power (if equipped) and the other is to lock or unlock the through-window buttons.
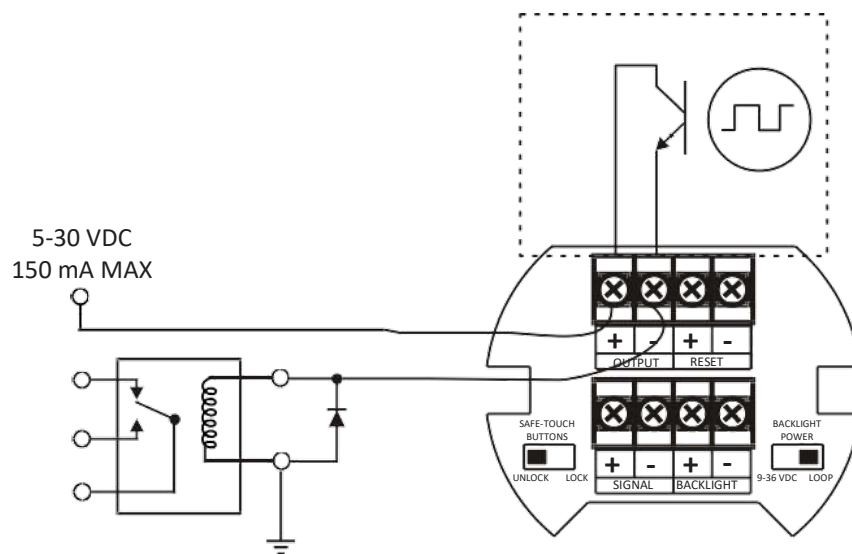
After all connections have been completed and verified, connect the ribbon cable to the display module, fasten the display module to the base, install enclosure cover, and then apply power.

3.2   Through-Window Buttons

The Tek-LCD 7800A-0L1 is equipped with four sensors that operate as through-window buttons so that it can be programmed and operated without removing the cover (and exposing the electronics) in a hazardous area. These buttons can be disabled for security by selecting the LOCK setting on the SAFE-TOUCH BUTTONS switch located on the connector board in the base of the enclosure.

3.2.1   Through-Window Button Operation

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

The sensors are disabled when a mechanical button is pressed and will automatically be re-enabled after 60 seconds of inactivity.

3.2.2   Through-Window Button Tips and Troubleshooting

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

Through-window button Tips:

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

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

3.3 Buttons and Display

Button Symbol	Description
⟳ MENU	Menu
RESET ▶	Right-arrow/Reset
DISPLAY ▲	Up-arrow/Display
↵ ENTER	Enter

Symbol	Status
100% ▯ 0%	Tank Level Indicator

3.3.1 Menu Button

- 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 *Advanced Fea- tures* of the

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meter.

3.3.2 Right / Reset Button

- Press the **Right**-arrow button to reset the maximum or minimum value while it is being displayed (see **Up / Display Button** below).
- 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.

3.3.3 Up / Display Button

- Press Display when in *Run Mode* to cycle through displaying the maximum value, minimum value, and the loop input value in mA. The display will time out in 12 seconds. Press Display again to resume normal lower display oper- ation (lower display will read RESUME).
- Press the **Up**-arrow button to scroll forward through the menus, decimal point, or to increment the value of a digit.
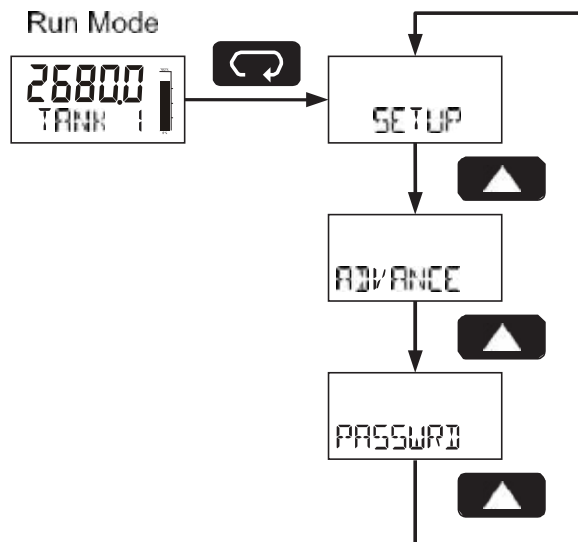
3.3.4 Enter Button

- Press the **Enter** button to access a menu or to accept a setting.
- Press **Enter** to acknowledge alarm (if enabled).

3.4 Main Menu

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

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

- Hold MENU, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing **ENTER** are not saved.
- Press the MENU button during Programming Mode to return to return to the previous menu selections.
- Changes to the settings are saved to memory only after pressing **ENTER**.
- The display moves to the next menu every time a setting is accepted by pressing **ENTER**.

3.5   Setting Up the Meter (SETUP)

The *Setup* menu is used to select:

1. Engineering unit's decimal location
2. Engineering units display scale
3. Tank indicator full and empty values
4. Bottom display selection

Press the **ENTER** button to access any menu or press **UP** arrow button to scroll through choices.

Hold **MENU**, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing **ENTER** are not saved.

Press the **MENU** button during Programming Mode to return to return to the previous menu selections.
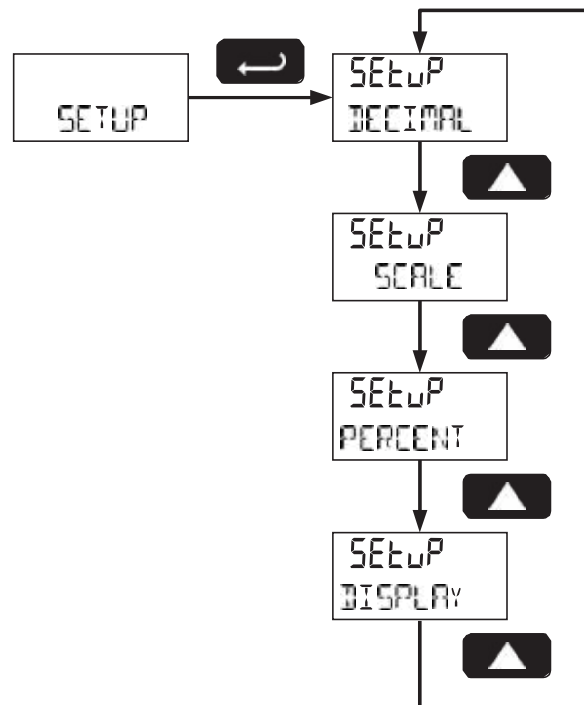
3.5.1 Setting Numeric Values

The numeric values are set using the **RIGHT** and **UP** arrow buttons. Press **RIGHT** arrow to select next digit and **UP** arrow to increment digit. The digit being changed blinks.

Press the **ENTER** button, at any time, to accept a setting.

Hold **MENU**, at any time, to exit and return to Run Mode. Changes made to settings prior to pressing **ENTER** are not saved.

Press the **MENU** button during Programming Mode to return to return to the previous menu selections.

Note: The currently selected digit will blink. Pressing the Right Arrow button will select the next digit, causing it to blink.

3.5.2 Setting the Level Decimal Point (DECIMAL)

Decimal point may be set with up to four decimal places or with no decimal point.

Pressing the **Right** arrow moves the decimal point one place to the right and pressing the **Up** arrow moves the decimal point one place to the left.
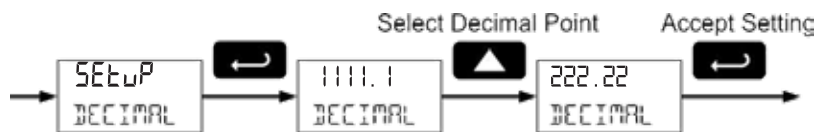
3.5.3 Main Menu Display Functions & Messages

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

Display	Parameter	Action/Setting
SETUP	Setup	Enter Setup menu
DECIMAL	Decimal Point	Enter the decimal point location
SCALE	Scale	Enter the Scale menu for engineering units
INPUT 1	Input 1	Set input 1 value in mA
DSPLY 1	Display 1	Set display 1 engineering units
INPUT 2	Input 2	Set input 2 value in mA
DSPLY 2	Display 2	Set display 2 engineering units
SAVE ?	Save	Save entered scale parameters
SPN ERR	Span Error	Scale point 1 and 2 span error
PERCENT	Percent	Scale the tank indicator full and empty values

`0 PCT`	*0 Percent*	Set the tank empty value
`100 PCT`	*100 Percent*	Set the tank full value
`DISPLAY`	*Display*	Enter *Bottom Display* menu
`TAG`	*Tag*	Display a custom unit or tag
`VOLUME`	*Volume*	Display volume
`VOL+TAG`	*Volume + Tag*	Display volume and custom tag
`PCT HT`	*Percent Height*	Display percent height
`PCT+TAG`	*Percent Height + Tag*	Display percent height and custom tag
`OFF`	*Off*	Disable bottom display
`ADVANCE`	*Advanced*	Advanced Features Menu (See Advanced Features
`PASSWRD`	*Password*	Enter the *Password* menu
`UNLOCKD`	*Unlocked*	Program password to lock meter
`LOCKED`	*Locked*	Enter password to unlock meter

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

3.5.4 Scaling the Meter (`SCALE`)

The 4-20 mA input can be scaled to display the process in engineering units. To scale the meter, enter the value in milliamps (mA) for input 1, and then the corresponding engineering units display value. Do the same for input 2.

After entering the display 2 value, confirm the new scale by pressing **ENTER** at the Save menu.

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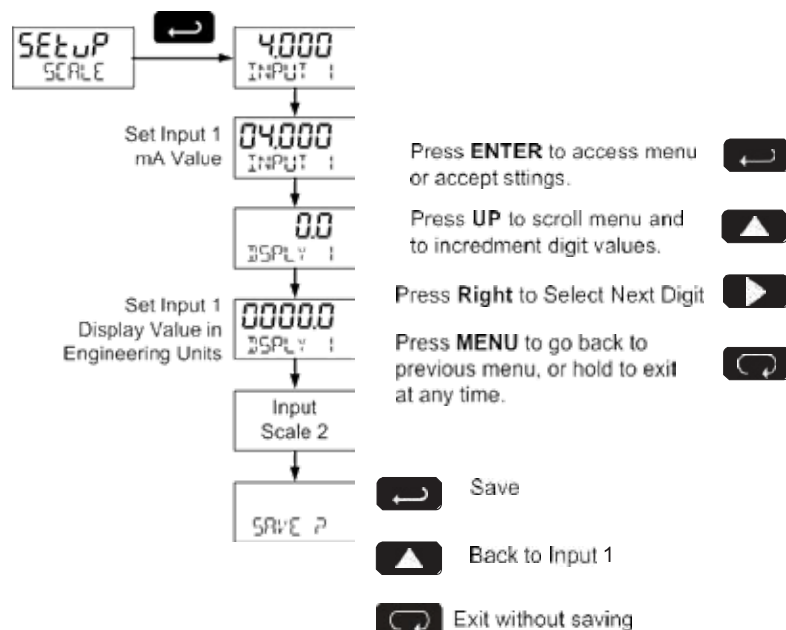

Figure 8. Scale Menu

For instructions on using multipoint scaling, see Level Input Multipoint Linearization (MULTIPT). For instructions on how to program numeric values see Setting Numeric Values.

3.5.5 Minimum Input Span

The minimum input span is the minimum difference between input 1 and input 2 signals required to complete the calibration or scaling of the meter. The minimum span is 0.10 mA.

3.5.6 Scale Error Message (SPN ERR)

If the minimum span is not maintained, the meter will show a span error (SPN ERR) and revert to input 2, allowing the appropriate input signals to be applied.

3.5.7 Scaling the Tank Height Indicator (TANK HT)

The display includes a 20-segment tank level indicator. This menu sets full and empty values, in engineering units, for the tank level indicator.

This value may differ from the 20 mA full-scale and 4 mA empty-scale values programmed in the Scale menu. This is ideal for level transmitters that output less than 20 mA at the maximum height of the tank or pit or more than 4 mA at the minimum height.

As an example, when using a level transmitter that outputs 20 mA at 25 meters, the tank height indicator may be set for a maximum of 10 meters. When the meter reaches 10 meters on the display, the tank height indicator will show full, even though the input is not 20 mA.
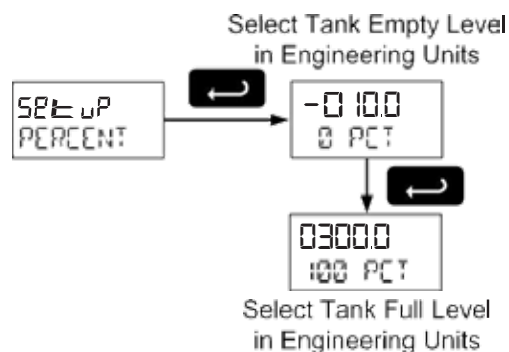

3.5.8 Configuring the Lower Display (DISPLAY)

The lower display may be configured to display a custom tag (TAG), volume (VOLUME), volume and tag (VOL+TAG), percent of full height (PCT HT), or percent of full height and tag (PCT+TAG) or be blank (OFF).

A custom tag may be up to seven alphanumeric characters programmed for identification (e.g. TANK 3) or for engineering units (e.g. GALLONS).

Volume is a separate, second scale of the input process variable. This is configured in Volume Display Scaling (VOLSCAL).
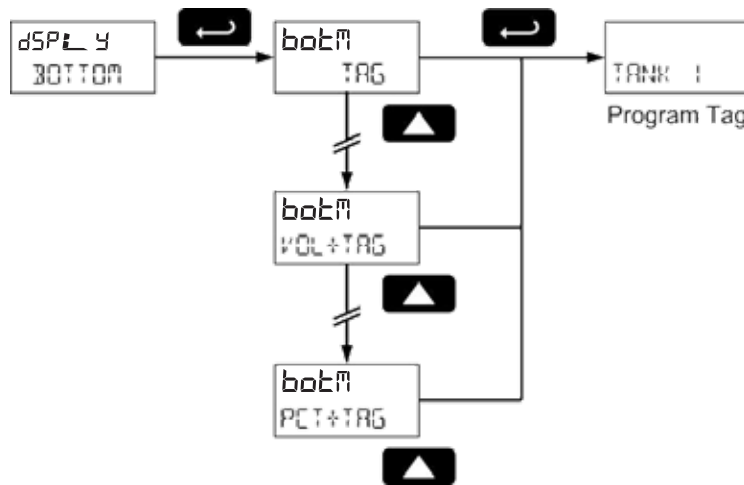
Percent full height shows the percent full of the tank height level indicator programmed in the Scaling the Tank Height Indicator (TANK HT) menu.

The tank level indicator (GRAPH) may also be turned on or off from the display menu.
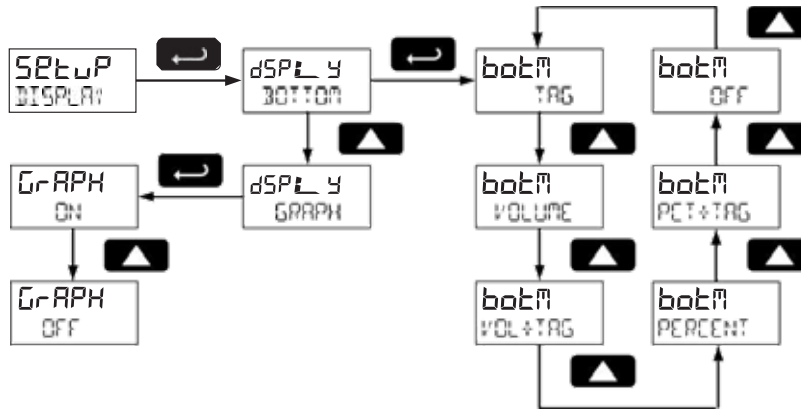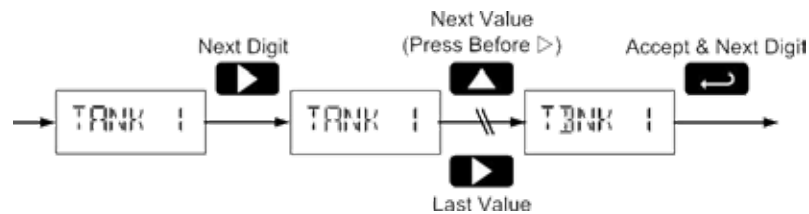
3.5.9 Setting the Tag

Any bottom display setting that includes a tag will require the tag to be entered.

The fully alphanumeric values for the tag are set using the RIGHT button to select the digit, the UP and RIGHT arrow buttons to select the digit reading, and the ENTER button to confirm and select the next digit.

### 3.6 Setting Up the Password (PASSWRD)

The Password menu is used to program a five-digit password to prevent unauthorized changes to the programmed parameter settings. A password protected meter will display LOCKED when the **MENU** button is pressed. The service menu is not shown when the through-window buttons are disabled using the slide switch located on the connector board.

3.6.1 Locking the Meter

Enter the Password menu and program a five-digit password.
For instructions on how to program numeric values see Setting Numeric Values.
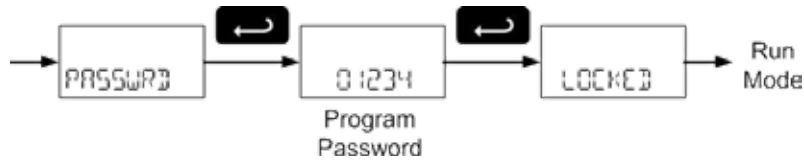
Record the password for future reference. If appropriate, it may be recorded in the space provided.

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

3.6.2 Making Changes to a Password Protected Meter

If the meter is password protected, the meter will display the message LOCKED when the **Menu** button is pressed. Press the Enter button while the message is being displayed and enter the correct password to gain access to the menu. After exiting the programming mode, the meter returns to its password protected condition.
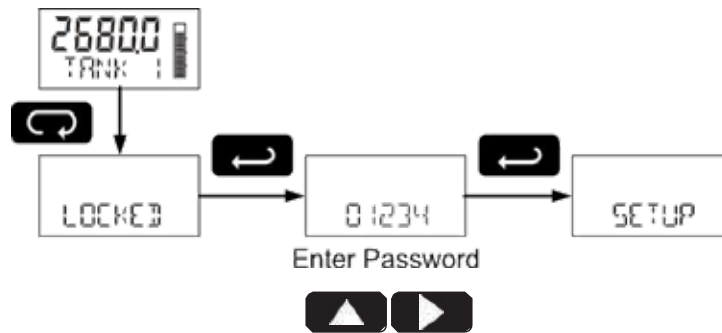
3.6.3   Disabling Password Protection

To disable the password protection, access the Password menu and enter the correct password, as shown below.

If the correct five-digit password is entered, the meter displays the message UNLOCKD (unlocked) and the protection is disabled until a new password is programmed.
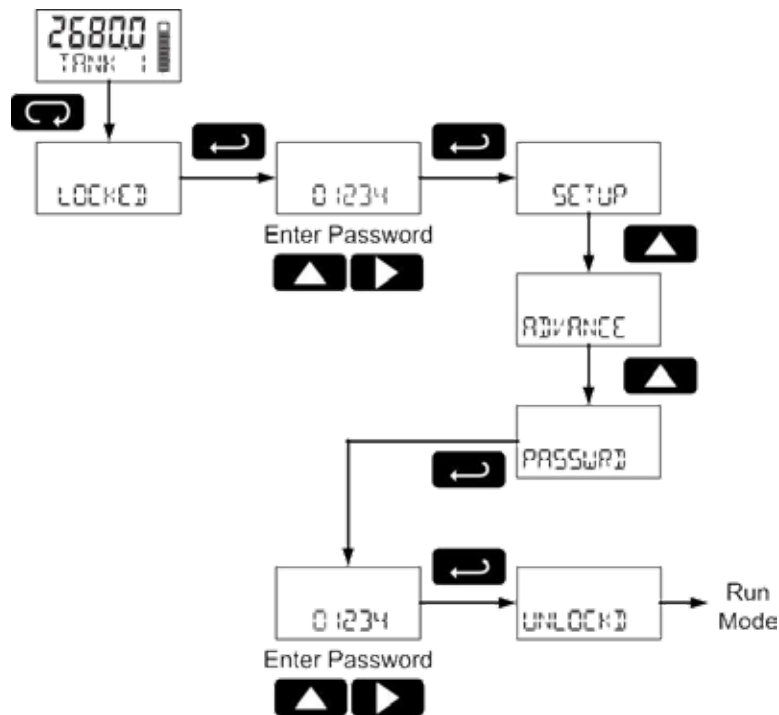
If the password entered is incorrect, the meter displays the message LOCKED and returns to Run Mode. To try again, repeat the above procedure.

**Did you forget the password?**

The password may be disabled by entering a master password. If you are authorized to make changes, enter the master password 50865 to unlock the meter.

3.7 Advanced Features Menu (ADVANCE)

To simplify the setup process, functions not needed for most applications are located in the Advanced Features Menu. Access the Advanced Features Menu by pressing ENTER at the ADVANCE menu in the Main Menu defined.

The Advanced Features Menu is used to select:
1. Open collector output configuration (OUTPUT)
2. Input filter (FILTER)
3. Volume display scale (VOLSCAL)
4. Live signal level display calibration (LVL CAL)
5. Internal Calibration (ICAL)
6. Multipoint linearization for level (MULTIPT)
7. Meter system information display (INFO)
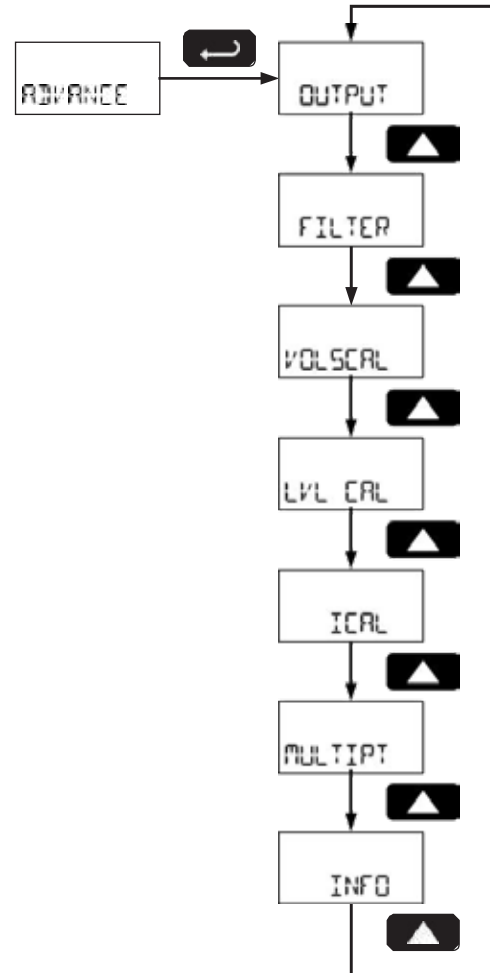
3.8 Advanced Features Menu & Display Messages

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

Display	Parameter	Action/Setting
OUTPUT	Output	Enter output menu
OFF	Off	Disable output
ALARM	Alarm Output	Enter alarm output menu
LEVEL	Level Alarm	Assign alarm output to level
SET	Set Point	Set alarm set point
RESET	Reset Point	Set alarm reset point
VOLUME	Volume Alarm	Assign alarm output to volume

| Display	Parameter	Action/Setting
FILTER	*Filter*	Set noise filter
LO	*Filter Low*	Set noise filter to low setting
NMED	*Filter Medium*	Set noise filter to medium setting
HI	*Filter High*	Set noise filter to high setting
OFF	*Filter Off*	Disable noise filter
VOLSCAL	*Volume Scale*	Scale the volume display
VOL DECIMAL	*Volume Decimal*	Set the decimal position for volume scaling
NO PTS	*Number of Points*	Set the number of points for volume scaling
INPUT 1	*Input 1*	Set volume input 1 on the level display
DSPLY 1	*Display 1*	Set volume display 1
INPUT 2	*Input 2*	Set volume input 2 on the level display
DSPLY 2	*Display 2*	Set volume display 2
SAVE ?	*Save*	Save entered volume scale parameters
LVL CAL	*Level Calibration*	Calibrate the level display
INPUT 1	*Input 1*	Calibrate input 1 value
DSPLY 1	*Display 1*	Set display 1 feet and inches
INPUT 2	*Input 2*	Calibrate input 2 value
DSPLY 2	*Display 2*	Set display 2 feet and inches
SAVE ?	*Save*	Save entered calibration parameters
ICAL	*Internal Calibration*	Enter internal reference calibration
4.000	*4.000 mA*	Calibrate input at 4 mA
20.000	*20.000 mA*	Calibrate input at 20 mA
ERROR SPAN	*Error Span*	Error with calibration point 1 and 2 span
MULTIPT	*Multipoint*	Set level display multipoint linearization
DISABLE	*Disable*	Disable multipoint linearization
ENABLE	*Enable*	Enable multipoint linearization
INFO	*Meter Information*	Show software number and version, or reset to factory defaults
SOFT	*Software*	Software number
VER	*Software Version*	Software version
DFALTS?	*Reset Defaults*	Restore factory default parameter settings

3.8.1 Alarm Output (OUTPUT)

The Tek-LCD 7800A-0L1 is equipped with an NPN open collector output that may be set up for high or low alarm trip point based on the level display (LEVEL) or the volume scale (VOLUME). The output may be disabled by selecting OFF.

When the alarm is enabled for level and the alarm set point has been reached, the level display will flash, accompanied by the bottom display alternating between normal display and HI ALRM or LO ALRM, depending on whether a high alarm or a low alarm has been set. A tank height indicator segment will flash at the level to which the alarm is set while the level indicator is at or above the alarm point.

When the alarm is enabled for volume and the alarm set point has been reached, the bottom display will flash, alternating between its normal display and HI ALRM or LO ALRM, depending on whether a high alarm or a low alarm has been set. To set a high alarm, program the set point above the reset point. To set a low alarm, program the set point below the reset point.

To acknowledge an alarm, press the **ENTER** button once for acknowledge prompt and a second time to confirm. Acknowledging an alarm will turn off the alarm output and stop the display from flashing. The HI or LO symbol will remain until the alarm condition is cleared.

The alarm status will show on the display even if the output is not wired.
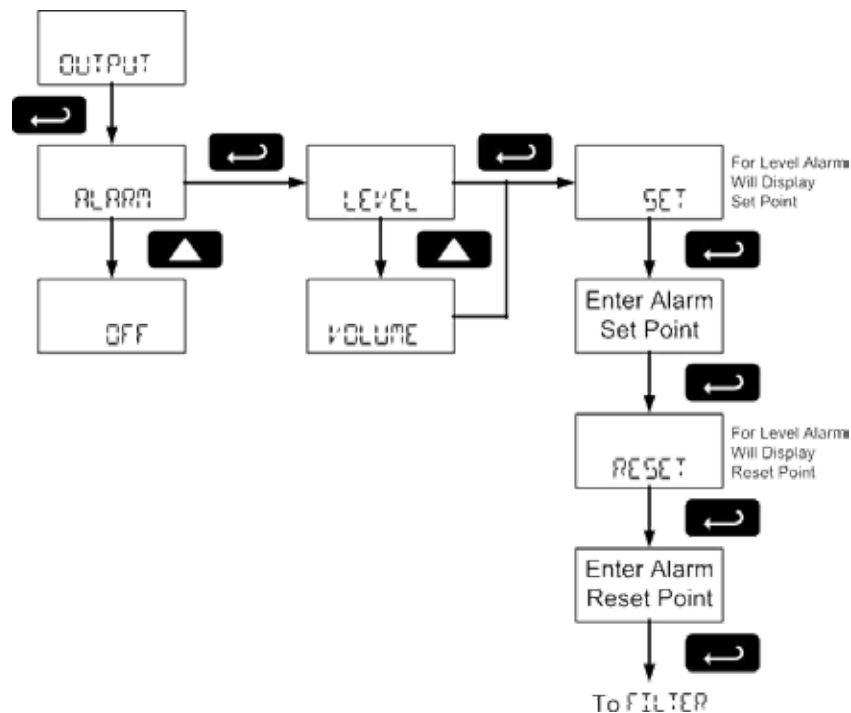
3.8.2 Input Signal Filter (FILTER)

The noise filter is available for unusually noisy signals that cause an unstable process variable display. The noise filter averages the input signal over a certain period. The filter level can be set to low (LO), medium (MED), high (HI), or off (OFF). The higher the filter setting, the longer the averaging time and so the longer the display may take to find its final value.

The filter contains a noise filter bypass feature so that while small variations in the signal will be filtered out, large, abrupt changes to the input signal are displayed immediately.

3.8.3   Volume Display Scaling (VOLSCAL)

Volume may be scaled as a function of the level display. It may use up to 32-point linearization. The multi-point linearization can be used to linearize the display for non-linear signals such as those from level transmitters used to measure volume in odd-shaped tanks.

To display the volume, select a bottom display including the volume display in the Display menu as shown in Configuring the Lower Display (DISPLAY).

To scale the volume display, select the decimal point location (0, 1, 2, 3, or 4), then enter the level in engineering units for input 1, the corresponding volume display value, and the same for input 2.
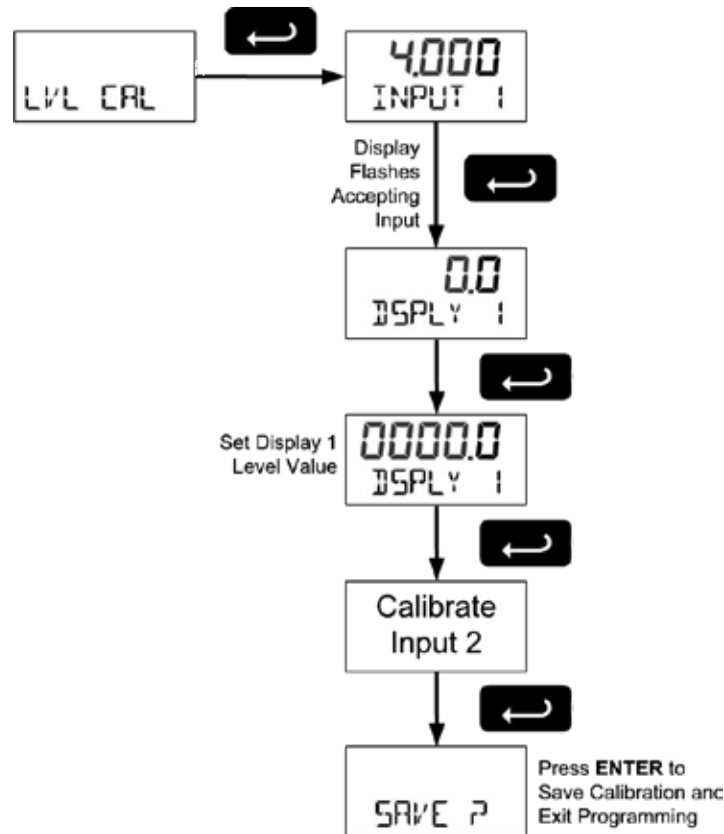
After entering the display 2 value, confirm the new volume scale by pressing **ENTER** at the Save menu.
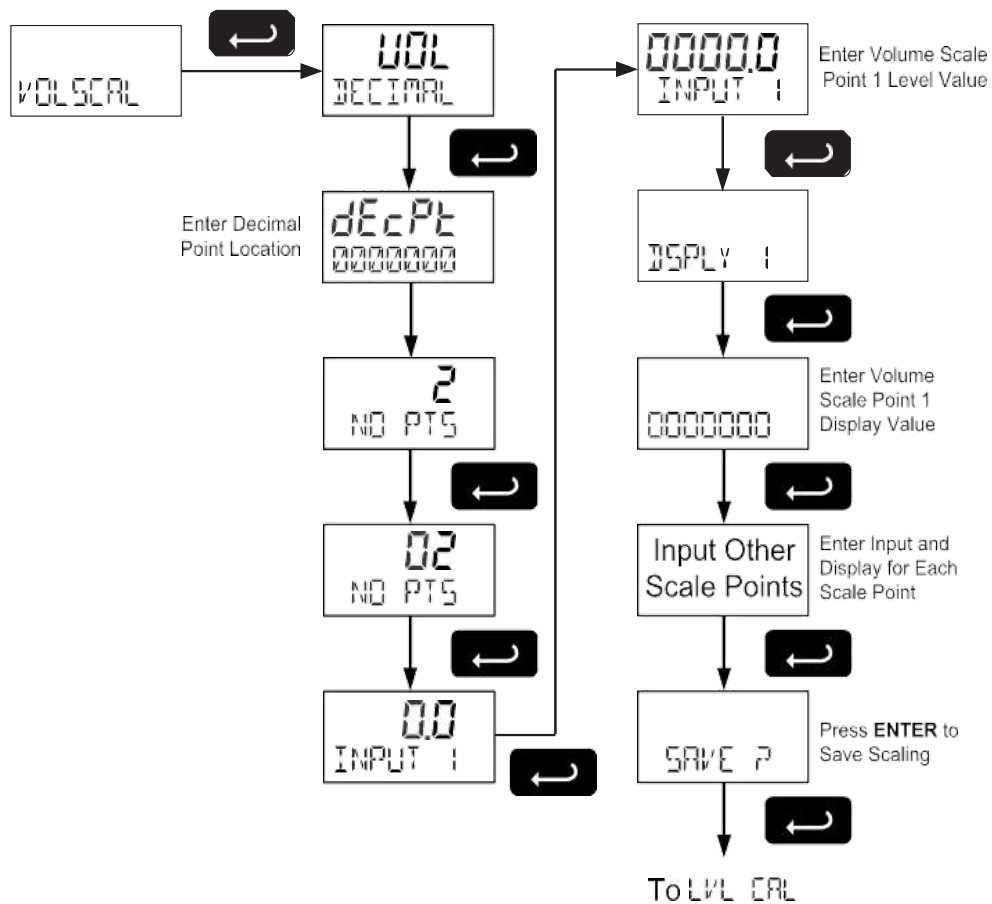
3.8.4   Level Input Live Signal Calibration (LVL CAL)

The meter can be calibrated using a current source instead of scaling. This process will override previously programmed scaling of the level display.

The use of a calibrated signal source is strongly recommended.

3.8.5 Internal Calibration (ICAL)

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

The internal calibration is the meter's master calibration that makes scaling the meter without a signal source possible. Use of a calibrated signal source is necessary to perform an internal calibration of the meter. Check calibration of the meter at least every 12 months. Incorrect calibration will affect the ability of the meter to properly read, scale, and display the input.

> **Notes:**
> The signal source must have a full-scale accuracy of 0.002% or better between 4 and 20 mA in order to maintain the specified accuracy of the meter.
>
> Allow the meter to warm up for at least 15 minutes before performing the calibration procedure.

Press **MENU** navigate to ADVANCEand press enter to access the *Advanced Features Menu*. Press the **UP-arrow** button to scroll to the *Internal Calibration* menu (ICAL) and press **ENTER**.

The meter displays 4.000. Apply a 4.000 mA signal and press **ENTER**. The display flashes for a moment while the meter is accepting the signal.

After the signal is accepted, the meter displays 20000. Apply a 20.000 mA signal and press **ENTER**. The display flashes for a moment while the meter is accepting the signal.

3.8.6   Calibration Error Message (ERROR SPAN)

An error message indicates that the calibration process was not successful. After the error message is displayed, the meter will revert to the 4.000 calibration menu. The error message might be caused by inadvertently leaving the signal at the previous level or not maintaining the minimum span. Press the **MENU** button to cancel the current calibration process if necessary.

3.8.7   Level Input Multipoint Linearization (MULTIPT)

This menu enables multipoint linearization for scaling and calibrating of the level display. Setting MULTIPT to ENABLE will alter the level display Scaling (See Scaling the Meter) and Level Calibration (See Level Input Live Signal Calibration) menus to include a Number of Points (NO PTS) parameter before entering Input 1.

32-point linearization can be used to linearize the display for non-linear signals.

3.8.8   Information (INFO)

The Information menu shows the software identification number and version number. To determine the software version of a meter:

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

Continue pressing **ENTER** to scroll through the software release number and software version.

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

4   Operation

4.1   Front Panel Buttons Operation

Button Symbol	Description
⟳ MENU	Press to Enter or Exit Programming Mode
RESET ▶	Used to Reset Maximum and Minimum Values
DISPLAY ▲	Press to Cycle Displaying Maximum Value, Minimum Value, and Input Current in mA. Press to Resume Run Mode in Lower Display
↵ ENTER	Press to Acknowledge Alarm (if Enabled)

4.2   Display Maximum, Minimum, and Input Current

The maximum and minimum values and the measured input loop current may be displayed temporarily on the lower display. To display these values, press the **DISPLAY** button. The meter will display the word ᴹᴬˣᴵᴹᵁᴹ on the bottom display and the maximum value reached (since the last maximum reset) on the top display. Press the **DISPLAY** button again and the meter will display the word ᴹᴵᴺᴵᴹᵁᴹ on the bottom display and the minimum value reached on the top display. Pressing the **RESET** button while either of these values is displayed will reset that value to the current display value.

Press the **DISPLAY** button a third time and the meter will display LOOP MA on the bottom display and the measured input current in milliamps (mA) on the top display. The current display will remain for 10 seconds and then the lower display will return to normal run mode as programmed in Configuring the Lower Display (ᴰᴵˢᴾᴸᴬʸ). Press the **DISPLAY** button a fourth time to return to the normal operation. The meter will display ᴿᴱˢᵁᴹᴱ followed by the run mode lower display.
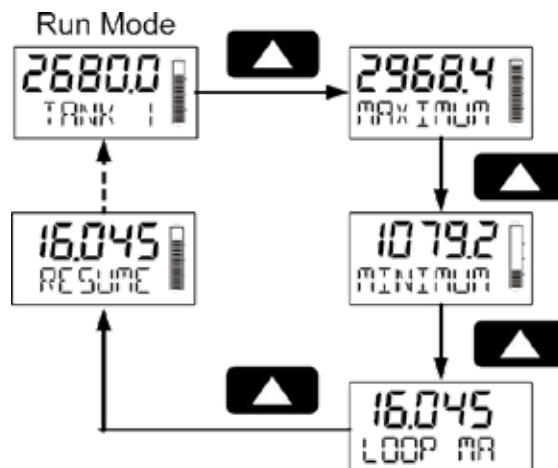
4.3   Reset Meter to Factory Defaults

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

Enter the *Advanced* features menu.

Press and hold **Reset** button when INFO is shown. For information on navigating to the *Information* menu, refer to *Advanced Features Menu*

Press **Enter** when RESET DFALTS? prompt is shown

Note: If **Enter** is not pressed within three seconds, the prompt will stop flashing return to showing INFO.
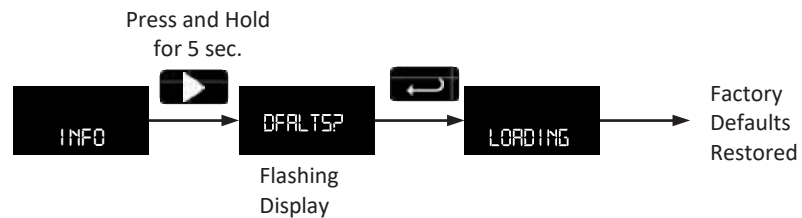
4.4 Factory Defaults & User Settings

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

Model: _____   S/N: _____   Date: _____

Parameter	Display	Default Setting	User Setting
Basic Setup			
Level Decimal Point	DECIMAL	1111.1	
Input 1	INPUT 1	4.000 mA	
Display 1	DSPLY 1	0.0	
Input 2	INPUT 2	20.00 mA	
Display 2	DSPLY 2	100.0	
Tank Indicator 0%	0 PCT	0.0	
Tank Indicator 100 %	100 PCT	100.0	
Bottom Display	BOTTOM	Tag	
Bar Graph	GRAPH	On	
Tag	TAG	TANK 1	
Advanced Features			
Output	OUTPUT	Off	
Filter	FILTER	Low	
Volume Decimal Point	VOL DECIMAL	0000000	
Volume Scale Number of Points	NO PTS	02	
Volume Scale Input 1	INPUT 1	0.0	
Volume Display 1	DSPLY 1	0	
Volume Scale Input 2	INPUT 2	100.0	
Volume Display 2	DSPLY 2	100,000	
Multipoint	MULTIPT	Disable	
Password			
Password	PASSWRD	00000 (unlocked)	

5   Troubleshooting

Due to the many features and functions of the meter, it's possible that the setup of the meter does not agree with what an operator expects to see. If the meter is not working as expected, refer to the Diagnostics menu and consult the recommendations described below.

5.1   Troubleshooting Tips

| Symptom	Check/Action
No display or faint display	Check input signal connections.
	Perform hard reset by shorting S+ and S- terminals.
Level display unsteady	Increase filter setting in *Advanced* menu.
Meter displays error message during calibration (error SPAN)	Check signal connections.
	Verify minimum input span requirements
Level display flashes 99999 or -9999	Check input signal and scaling within range of 99999 and -9999
Volume display flashes 9999999 or -999999	Check level display within volume scale range of 9999999 and -999999.
Display response is too slow	Check filter setting to see if it can be lowered to LO or OFF.
If the display locks up or the meter does not respond at all	Perform hard reset by shorting S+ and S- terminals.
Backlight does not appear.	Backlight is intended for viewing assistance in dim lighting conditions. It may not be noticeable under good lighting conditions.
	Check connections are as shown in Figure 3 or Figure 4 .
Other symptoms not described above	Call Technical Support for assistance.
Through-window buttons do not respond	Mechanical button was pushed or through-window button slide switch is in lock position. The through-window buttons will be re-enabled automatically 60 seconds after the last button push.
	If slide switch on connector board is in Lock position, switch to Unlock.
	Sunlight can interfere with the sensors. It is recommended to shield the window from sunlight while operating the buttons by standing so as to block direct sunlight.

6   Quick User Interface Reference

| Pushbutton	Function
MENU	Go to programming mode or leave programming. Hold for 5 seconds to enter *Advanced Features Menu* directly.
▶ **Right Arrow**	Move to next digit. Go to previous menu or alphanumeric character selection. Reset max or min while displayed.
▲ **Up Arrow**	Move to next selection or increment digit. Cycle through maximum, minimum, and mA display mode.
⟲ **Enter / Ack**	Accept selection/value and move to next selection. Acknowledge Alarm.

Operational Modes
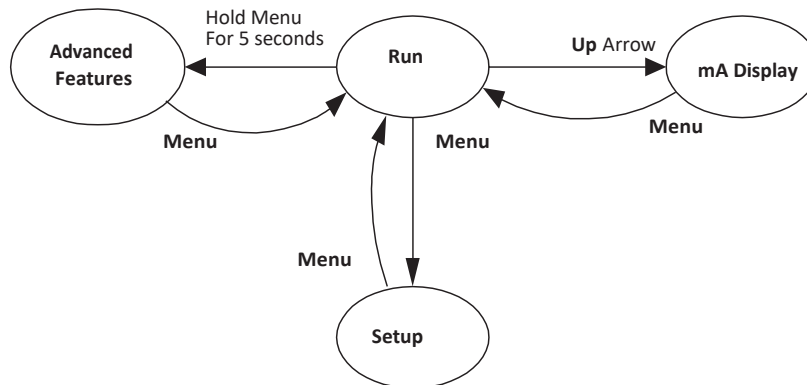
Main Menu
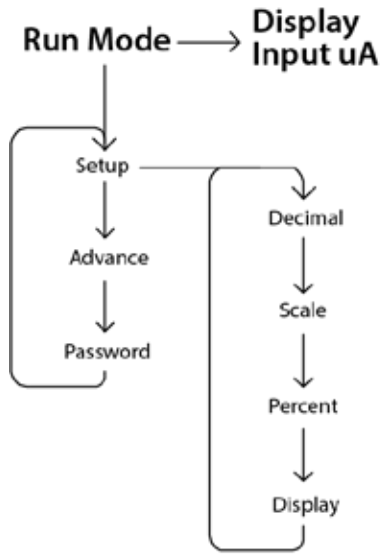
Advanced Menu
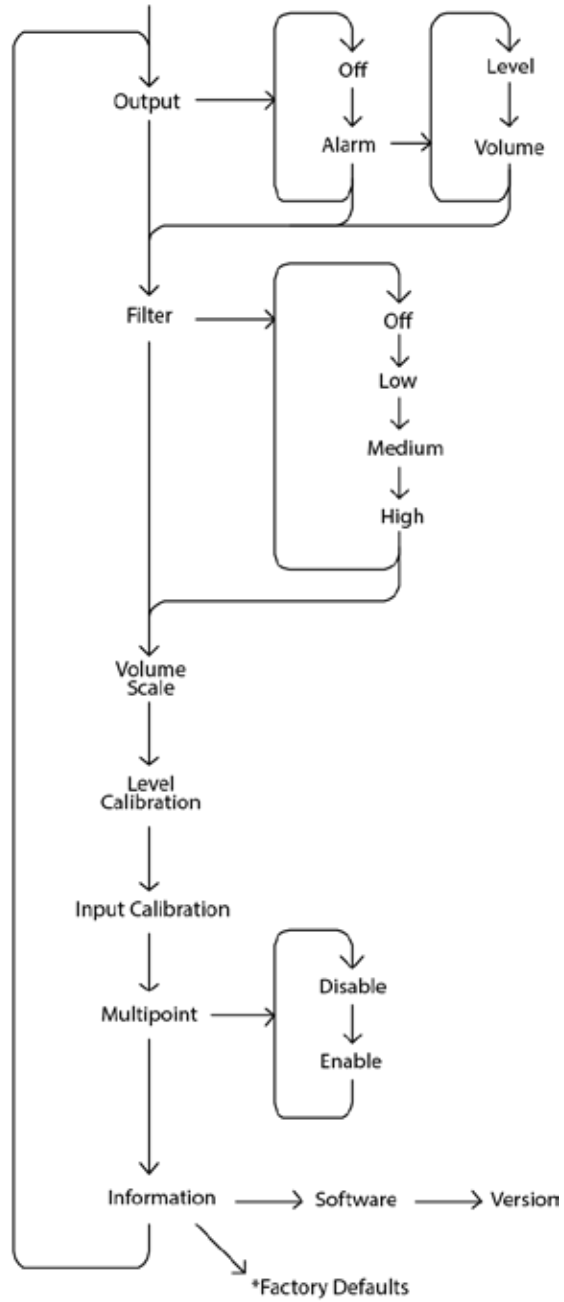
*Access by hoding Right/Reset for 3 seconds

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