KENCO ENGINEERING COMPANY

P.O. BOX 470426, TULSA, OK 74147-0426
PHONE: (918) 663-4406 FAX: (918) 663-4480
http://www.kenco-eng.com e-mail: info@kenco-eng.com

KENCO Loop Powered Magnetostrictive Transmitter

KMD SERIES – Operation and Installation Manual

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1. INTRODUCTION

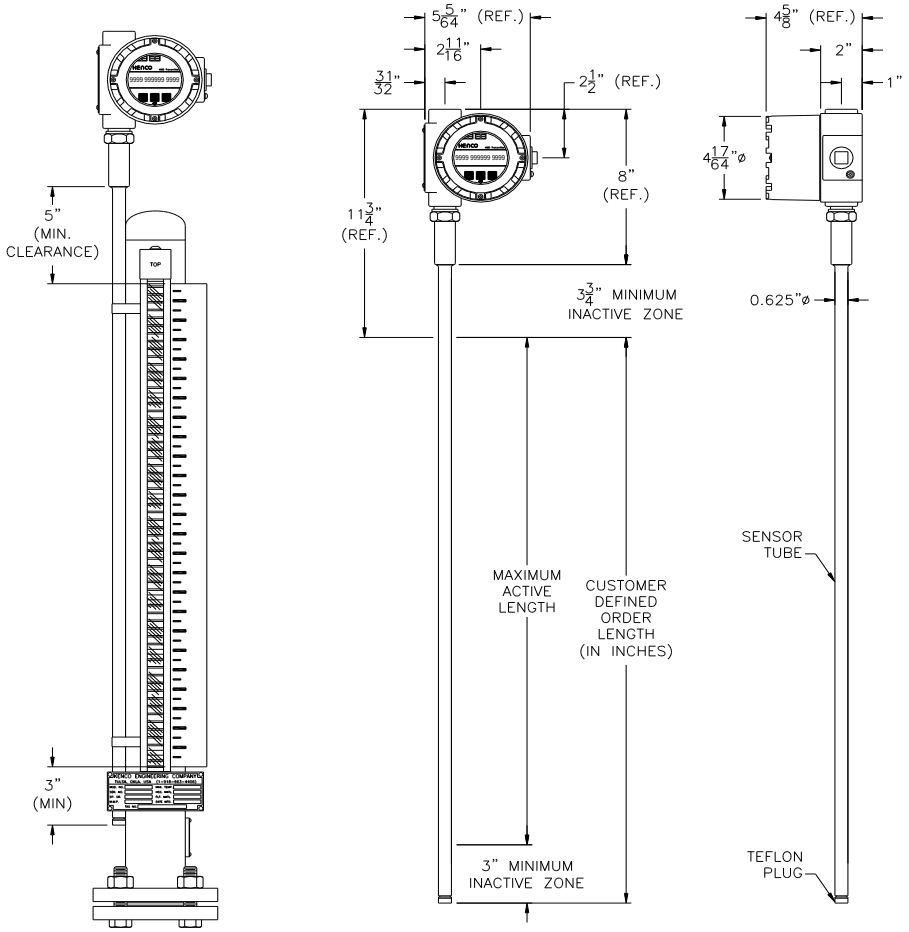
KENCO is pleased to update its loop powered magnetostrictive transmitter with the latest innovations in magnetostrictive technology, as well as adding new features to the product offering. The KENCO KMD Series magnetostrictive transmitter is designed solely for use with the KENCO magnetic liquid level indicator, the Magna-Site. The transmitter electronically monitors the location of the magnetic float within the Magna-Site gauge housing, providing an output in a unit of measure as a % of span or a 4-20 mA output. The KMD series also incorporates HART® communications and a visual display as part of the standard offering.

2. PRODUCT DESCRIPTION

KENCO transmitters electronically monitor the location of the magnetic float within the Magna-Site gauge housing, providing an output in a unit of measure as a % of span or a 4-20 mA output. The transmitter is available up to a length of 300 inches. Zero and span may be adjusted by using the HART® communications protocol or it may be manually calibrated using the keypad display inside of the explosion proof housing. These transmitters operate within a process temperature range of – 40°F to 300°F. Field replaceable electronics are potted and encapsulated. KENCO transmitters are available as standard with NEMA 4X/7 explosion-proof housings. These housings feature an industrial epoxy coating for corrosion resistance. All KENCO level transmitters use non-contacting, magnetostrictive technology. This simple design ensures no scheduled maintenance or re-calibration – ever. Accurate, non-contact float location sensing is achieved with absolutely no wear to any of the sensing elements.

Mounting Instructions / Transmitter Dimensions

The KMD Transmitter is mounted directly to the housing of the Magna-Site. In a typical application, the magnetic flag assembly is attached to the gauge housing chamber with hose clamps which have been welded to the back of the flag assembly, typically 180° from the flanged or threaded connections to the tank. Install the transmitter at least 90° to the right or the left of the flag assembly (your choice) by placing the outer pipe of the transmitter body adjacent to the gauge housing. Tighten the hose clamp of the flag assembly around the outer pipe of the transmitter. Allow for the inactive zone of 3 inches at the bottom of the transmitter by placing transmitter bottom 3 inches below the zero setting. Your application will allow for 5 inches of clearance at the top of the outer pipe. See dimensional information below.



Note: In a typical application, KENCO adds 2 inches to the order length so that the customer has additional mounting flexibility. Units are factory calibrated with the additional 2 inches at the top of the gauge, bringing the total inactive zone at the top to 7".

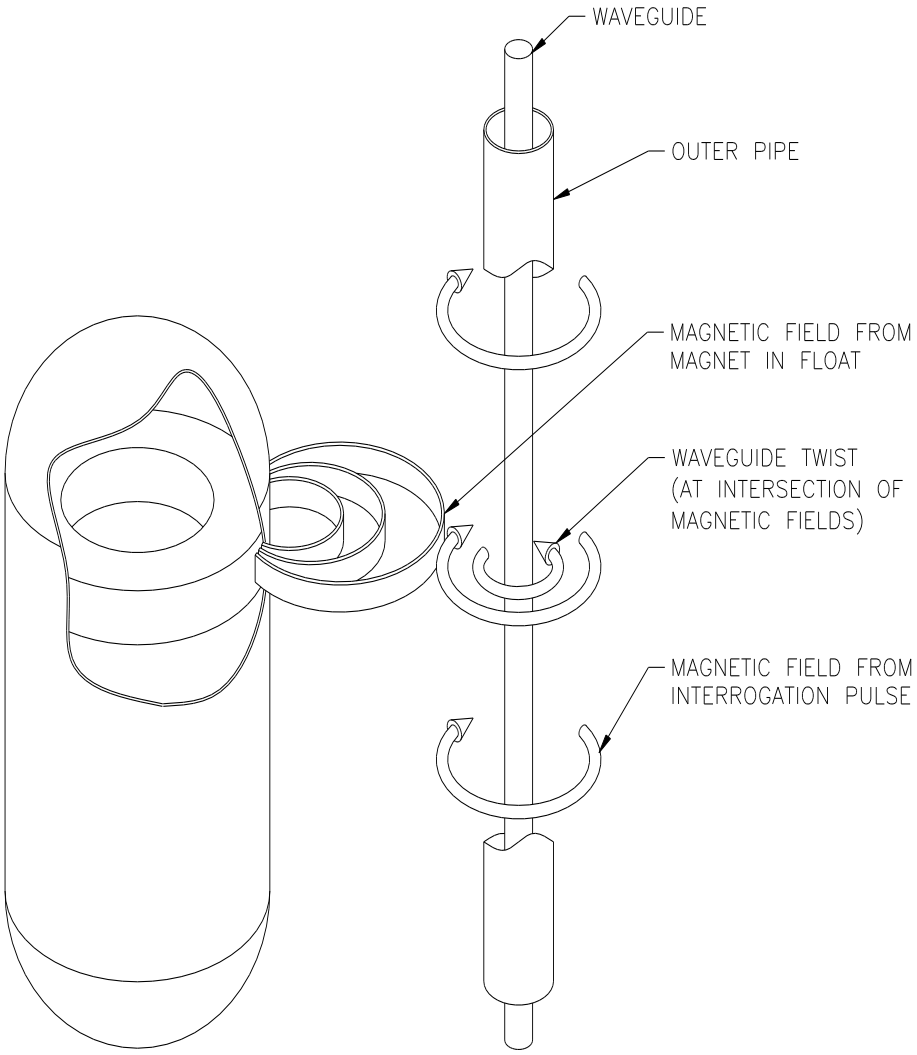
3. TRANSMITTER FEATURES

- **CSA approved explosion-proof enclosure**
- **Digital Display for zero and span settings and readout**
- **Readout is updated every 3 seconds**
- **Readout available as a % of span, a 4-20 mA output or any unit of measure**
- **Adjustments may be made using a HART ® hand held communicator**
- **Repeatability is .005% full span or .005 inches**
- **Temperature range: - 40°F to 300°F (call KENCO for higher temperature requirements)**
- **No maintenance required**
- **Immune from electrical and mechanical noise**

4. PRINCIPLE OF MAGNETOSTRICTION

The level transmitter is composed of 2 concentric members. The outermost member is a protective 316 stainless chamber that withstands aggressive environments. Inside of the chamber is the waveguide, a formed element constructed of a proprietary magnetostrictive material.

A pulse is induced in the waveguide by the momentary interaction of 2 magnetic fields, one from an electric current pulse launched along the waveguide and the other from the magnets inside the float. This interaction produces a strain pulse that travels along the waveguide. The location of the magnet inside the float is determined by measuring the elapsed time between the launching of the electronic pulse and the detection of the strain pulse that travels along the waveguide. The location of the magnet inside the float is determined by measuring the elapsed time between the launching of the electronic pulse and the detection of the strain pulse by the sensor head. The time period measurement is used to produce an output reading of the float location.



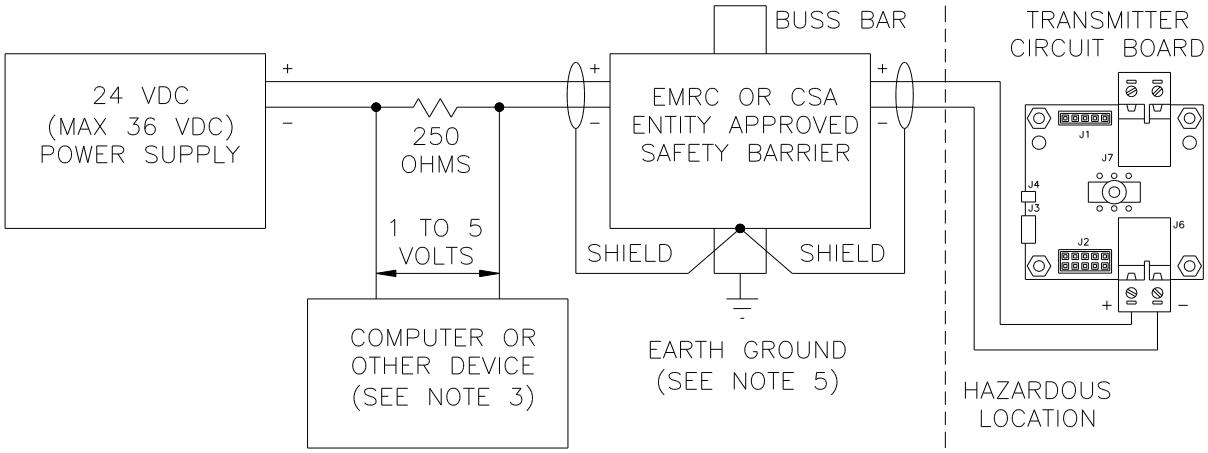
5. TRANSMITTER SPECIFICATIONS

Parameter	Specifications
Level Output	
Measured Variable	Liquid Level (as determined by location of magnetic float)
Full Range	18” to 300”
Non-Linearity Full Span	0.020 F.S. or 1/32”, whichever is greater
Repeatability	0.01% F.S. or 1/32”, whichever is greater
Sensor Operating Temp.	- 40°F to 300°F
Transmitter Loop	
Input Voltage Range	10.5 to 36.1 VDC
Reverse Polarity Protection	Series Diodes
Safety Approval	CSA Certified Explosion Proof C1.I, Grps. B, C, D C1.II Grps E, F, G Division 1, NEMA 4X CSA Certified Intrinsically Safe (when installed with I.S. Barriers) C1. I, Grps A, B, C, D; C1. II, Grps, E, F, G. Division 1, NEMA 4X
Calibration	
Zero Adjust Range	Anywhere within the active length
Span Adjust Range	Full scale more than or equal to 0.5” from zero
Environmental	
Electronics Operating Temp.	- 30°F to 160°F
Humidity	0 to 100% Relative Humidity
Materials/Outer Pipe	316 Stainless Steel
Field Installation	
Mounting	3/4” NPT fitting or flange mounting
Wiring	2 wire connection, shielded cable or twisted pair to screw terminals through a 3/4” NPT conduit opening
Display	
Measured Variables	Liquid Level
Update Rate:	3 seconds
Size:	0.5”
Number of digits:	16
Measurement:	% of span, a 4-20 mA output or any unit of measure
HART® Communications	
Method of Communication	Frequency Shift Keying (FSK) conforms with Bell 202 Modem Standards with respect to baud rate and digital “1” and “0” frequencies
Baud Rate	1200 bps
Digital “0” Frequency	2200 Hz.
Digital “1” Frequency	1200 Hz.
Data Byte Structure	1 Start Bit, 8 Data Bits, 1 Odd Parity Bit, 1 Stop Bit
Digital Process Structure Rate	Poll//Response Model 2.0 per second

6A. ELECTRICAL CONNECTIONS AND WIRING PROCEDURES

A typical intrinsically safe connection for the KMD Transmitter includes protective safety barriers, a power supply, and a reading or monitoring device.

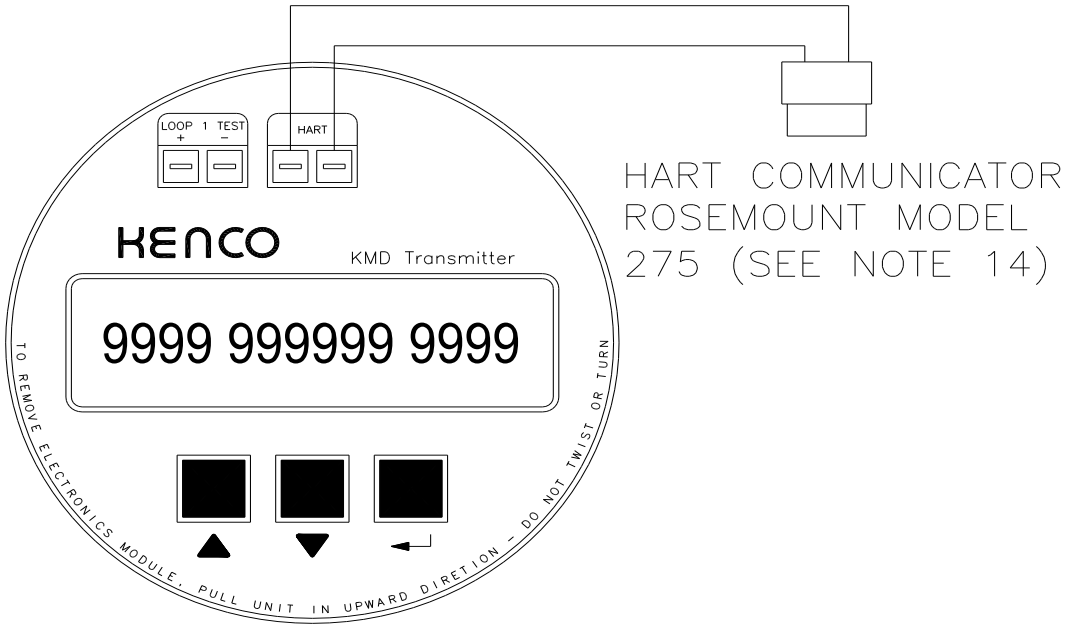
Non-Hazardous Locations (Intrinsically Safe):



Hazardous Location:

A typical explosion-proof connection for the KMD Transmitter includes a power supply and a reading or monitoring device connected via an explosion-proof conduit.

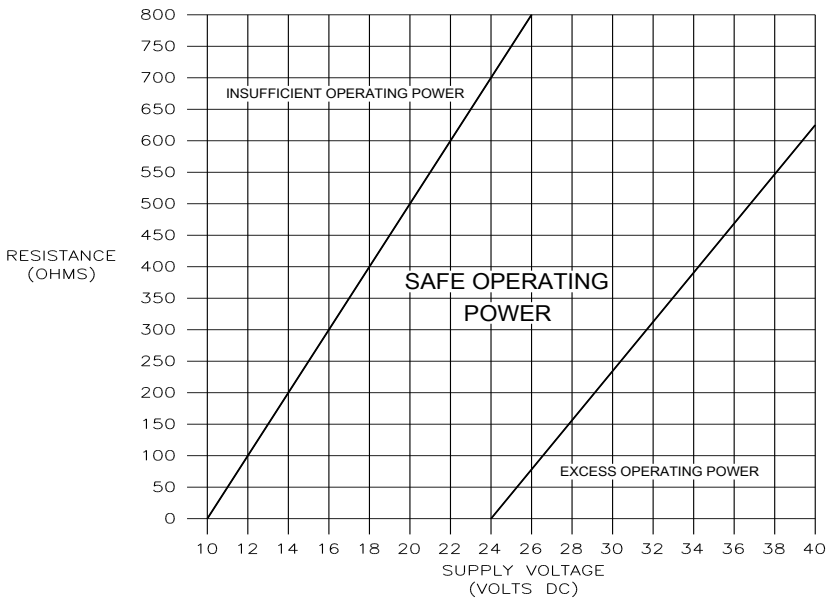
HART® Communications Inside Display Module:



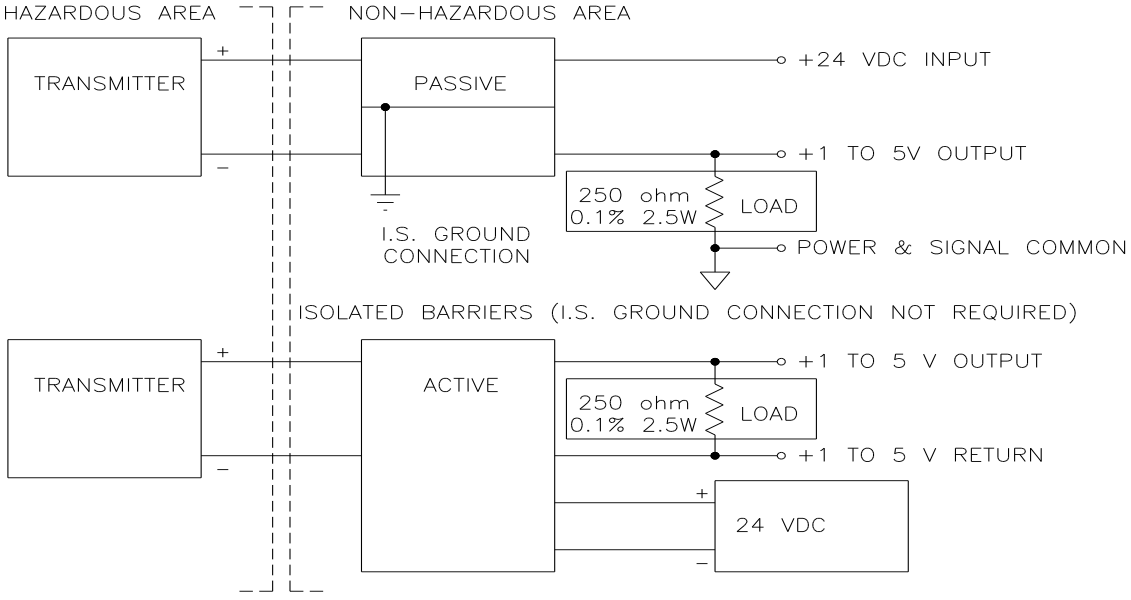
6B. NOTES FOR ELECTRICAL CONNECTIONS

1. For intrinsically safe installations, wiring shall be installed in accordance with the country in use. Example given: Canadian Electrical Code, Part 1, National Electric Code ANSI/NFPA 70 Article 504-30.
2. Shielded twisted cable of 24 AWG or heavier should be used. Cable capacitance shall be less than 30 PF per foot.
3. Control room equipment should not use or generate more than 250 V RMS.
4. For FMRC and CSA approved transmitters barriers must be FMRC and CSA approved.
5. The connection between the earth ground terminal of FMRC or CSA entity approved safety barriers and system earth ground must be less than 1 ohm.
6. Safety barriers are FMRC and CSA entity approved safety barriers used in an approved configuration where transmitter Vmax is greater than barrier Voc and transmitter Imax is greater than barrier Isc.
7. Transmitter Ci plus total cable capacitance for each loop must not exceed barrier Ca. transmitter Li plus total cable inductance for each loop must not exceed barrier La (see note 10).
8. Transmitter enclosure shall be grounded to earth ground through the provided ground lug in the enclosure.
9. Parameters for each loop entity:
   - Vmax = 36v
   - Imax = 118 mA
   - Ci = 0
   - Li = 200 μH
10. HART® communicator must be connected in accordance with manufacturers' I.S. installation instructions (FM and CSA approved procedures must be followed).
11. Use only NRTL listed and CSA certified dust-tight seal for Class II and Class III hazardous locations.
12. CSA file number is LR 81728.
13. Do not use plugged housing entry (at top of enclosure) for termination of conduit.
14. In high humidity areas, use a breather type conduit sealing fitting to minimize moisture intrusion.
15. **Safety recommendations:** Always follow applicable local and national electrical codes and observe polarity when making electrical connections. Never make electrical connections to the transmitter with power turned on. Make sure that no wire strands are loose or sticking out of the terminal block connections, which could short and cause a problem. Make sure that no wire strands, including shield, are in contact with the electronic module enclosure. The electronics module enclosure is grounded through internal circuitry and electrically isolated from the explosion proof enclosure.

6C. LOOP RESISTANCE VS. POWER SUPPLY



6D. RECOMMENDED SAFETY BARRIERS FOR INTRINSICALLY SAFE INSTALLATIONS



NOTES:

1. When selecting barrier types, the electrical specifications for the transmitter are:
   - Vmax = 36.1 Vdc
   - Imax = 118 mA
   - Ci = 0.0 µF
   - Li = 0.0 µHy
2. KENCO recommends the following safety barrier:
   - Stahl Model Number 9001/01-280-100-10

7. SYSTEM CHECK AND ALARM SETTINGS

System Check

After completing the wiring, the system is ready to be checked out. Apply power to the unit. Using a DC voltmeter, measure the voltage at Loop 1 connection. The voltage must be $\geq$ 10.5 v. If the voltage level is too low, shut down the system. Check for shorts, power supply voltage, and excessive loop resistance. Refer to the safe operating chart on the previous page, which shows the relationship between loop resistance and operating voltage.

To test Loop 1 on a bench, move the magnetic float (or a magnet) along the operational range of the transmitter body. If functioning properly, the output current will change as the float moves. An output range of less than 4 mA or greater than 20 mA could indicate a problem.

Alarm Settings

When a fault condition is detected by the internal microprocessor, the 4 to 20 mA current will go to the current selected. If in the 4 mA alarm mode when a fault is detected, the output will be continuous at 3.8 $\pm$ 0.1 mA. If in the 20 mA alarm mode when a fault is detected, the output will be continuous at 21.5 $\pm$ 0.2 mA.

8. MAINTENANCE

Removal of Electronic Puck

The transmitter is designed so that the user may remove the electronics module for any reason, including repair or replacement. Use the instructions below to remove the electronics module:

1. Remove power from transmitter.
2. Remove cover from explosion-proof housing.
3. Gently pull out the electronic puck by raising equally on all sides of the round puck.
4. Pull electronic puck completely free of connector pins on block cover.

Installation of Electronic Puck

1. Remove power from transmitter.
2. Remove cover from explosion-proof housing.
3. Place electronics puck on top of mating connector pins (2 places) and gently press down on puck.
4. Press down on puck until connection is made completely.

9. UNITS OF MEASURE FOR KMD TRANSMITTER

The KMD transmitter can be calibrated to read the following units of measure:

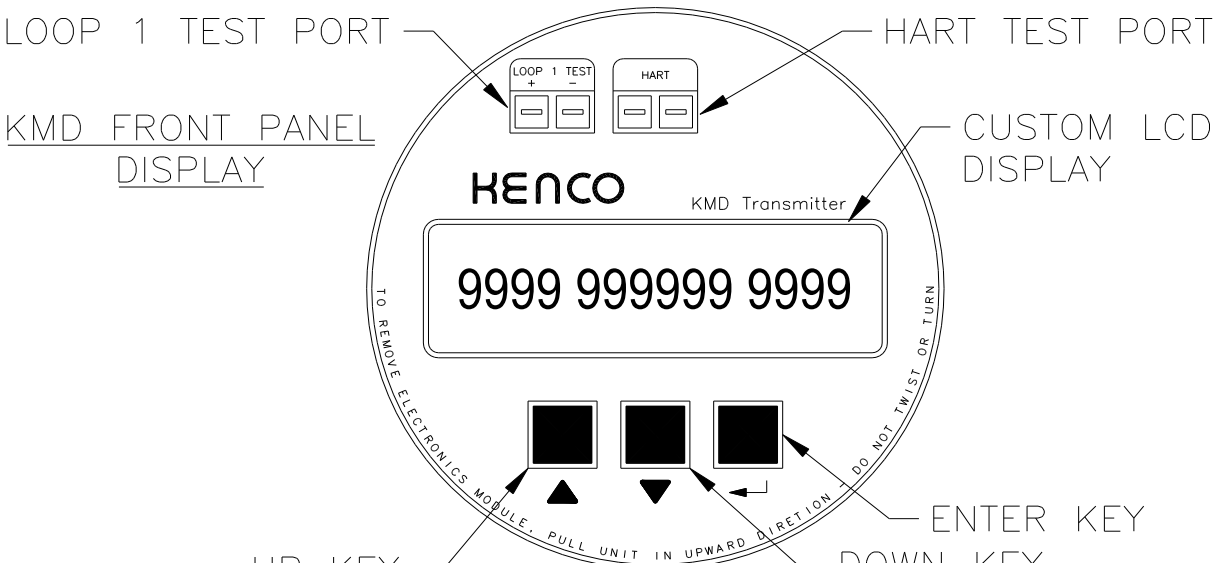
1. mA
2. % of Total Span
3. Inches
4. Feet
5. Centimeters
6. Meters

The unit of measurement must be decided at the time of order placement. Otherwise all units will be factory set so that the LCD display will readout in 4-20 mA.

10. CALIBRATION PROCEDURES USING FRONT PANEL DISPLAY

The KENCO level transmitter can be bench-calibrated with the display and the three push buttons. Please follow these procedures:

1. Change the mode of operation from the **Run Mode** to the **Program Mode**. To enter the Program Mode, press any of the following keys: **Up**, **Down** or **Enter** (see diagram below). Important Note: Upon entering the **Program Mode**, a one-minute timer is started. Each time a button is pressed, the timer will be reset. If the operator fails to press a menu button within one minute, the timer will expire and the display will return to **Run Mode**. This automatic timeout feature is incorporated so that the transmitter will not be inadvertently stuck in **Program Mode**.
2. **Calibrate Level 1?** appears on screen. **Press Enter**.
3. **Set Zero?** appears on screen. Place magnetic float (or a simple magnet) on outer pipe at desired zero position. **Press Enter key and hold for a one second count**. (Unit is factory set at 3" from end of pipe at the beginning of visual for the flag assembly).
4. **Press Enter** again.
5. **Accept New Value?** appears on screen. Press Enter if zero location is acceptable. If there is a need to reset this zero position, press up or down keys simultaneously to begin process again from step 2.
6. **Calibrate Level 1?** reappears on screen. **Press Enter**.
7. **Set Zero?** appears on screen. Press down key one time.
8. **Set Span?** appears on screen. Place magnetic float (or a simple magnet) on outer pipe at desired span location. **Press Enter** key and hold for a one second count. (Unit is factory set at the end of the visual for the flag assembly at the upper end of the gauge.
9. **Press Enter** again.
10. **Accept New Value?** appears on screen. **Press Enter** if span location is acceptable. If there is a need to reset this zero position, press up or down keys simultaneously to begin process again from step 7. Calibration is now complete.
11. Once all steps are complete, press all 3 buttons to get out of **Program Mode** and return to **Run Mode**, or allow the Program Mode timer to expire after one minute.



11. OTHER SETTINGS AVAILABLE ON LCD PANEL DISPLAY

Adjust LCD Contrast. This function allows the operator to adjust the brightness of the LCD readout.

1. Change the mode of operation from the **Run Mode** to the **Program Mode**. To enter the program mode, press any of the following keys: **Up**, **Down**, or **Enter** (see diagram on previous page).
2. **Calibrate Level 1?** appears on screen. Press **Up** or **Down** key until **Adjust LCD Contrast?** appears on screen.
3. **Press Enter**. **LCD Cntrst 0** appears on screen.
4. Using **Up** and **Down** keys, you can adjust the brightness of the LCD readout. 0 is the brightest setting, 3 is the faintest. **Press Enter** when desired brightness is displayed.
5. **Accept?** appears on screen. **Press Enter**. **Adjust LCD Contrast** function is complete.
6. Once all steps are complete, press all 3 buttons to get out of **Program Mode** and return to **Run Mode** or allow the Program Mode timer to expire after one minute.

Perform LCD Test. This function allows the operator to view all LCD digits available.
Note: Only Level 1 is applicable for the KENCO KMD transmitter. Level 2 and temperature readings are not applicable.

1. Change the mode of operation from the **Run Mode** to the **Program Mode**. To enter the Program Mode, press any of the following keys: **Up**, **Down** or **Enter** (see diagram on previous page).
2. **Calibrate Level 1?** appears on screen. Press **Up**, or **Down** key until **Perform LCD Test?** appears on screen.
3. **Press Enter**. All LCD digits are displayed for 10 seconds.
4. Once all steps are complete, press all 3 buttons to get out of Program Mode and return to **Run Mode**, or allow the Program Mode timer to expire after one minute.

12. ADJUSTMENTS FOR TRANSMITTER VIA HART®COMMUNICATIONS

Refer to the documentation supplied with your specific HART® software package or hand held communicator for details on performing sensor calibration. Using the HART® interface allows for calibration of the zero and span without having to remove the unit from the process and position the magnetic float. The HART® commands 35 and 65 are implemented for this function. Loop 1 (Zero and Span) is the primary variable.

Calibration set points are given as the absolute displacement from the tip of the sensor. For example, if the desired zero position is 3 inches, the transmitter will produce 4 mA when the float is 3 inches from the tip of the transmitter. If the desired span position is 30 inches, the transmitter will produce 20 mA when the float is 33 inches from the tip of the transmitter.

12. ADJUSTMENTS FOR TRANSMITTER (cont'd)

HART® Quick Start

The KMD transmitter can be calibrated using a HART® Model 275 hand-held terminal.

1. Be sure you have the transmitter Loop #1 connected to a load of 250 to 500 ohms. A unit installed in a control loop is a good example of this loop load. You may also use a load resistor in the range of the above value.
2. Be sure the transmitter is connected to a clean 24 VDC power supply. Use a linear supply, as switching types do not provide ripple free power. HART® cannot tolerate more than a 25 mV voltage ripple.
3. If the unit is installed in a live application, place your automatic controllers in manual mode and be advised that the output current will change during calibration.
4. Follow safe working procedures as applicable for working on live equipment in a hazardous location. When safety is secured, remove housing cover.
5. Press the black and black "I/O" button on the HART® terminal. The terminal will go into self test, then into the main screen. If not connected properly, you will get a "No device found" message.
6. From the main screen, press keypad #1, "Device Setup".
7. From the "Device Setup" screen, press key #3, "Basic Setup".
8. Press key #3, you are now in "Range Values" screen.
9. **To Set Low Value**: To set low value (4 mA), select key #1, PV LRV (Process Variable, Lower Range Value). You are now in the PV LRV screen. The current low value is displayed. Below this value is a highlighted value. Key in the desired low value (example: 3 inches is shown; if 4 inches is desired, key in 4.). When the new desired low value is keyed in, press "Enter" (F4) button located below the LCD display, right. To write the changed lower value to memory, press the "SEND" key now. Next, you will see two "WARNING" screens that ask if you are sure. If your new low values are correct, press "OK" for both messages. This action resets the Lower Range Value, or 4 mA position into the transmitter's memory.
   · Go back to the "Range Values" screen to verify that the new parameters have been accepted into the transmitter memory.
   · You may now exit program mode or continue on to reset the upper value. If you choose to exit the program mode, replace the calibration jumper to the "ON" position and return your controllers to automatic.
10. **To Set High Value**: You should now be in the "Range Values" screen. To set the 20 mA (Upper Range), press key #2. You are now in the "PV URV" (Process Variable, Upper Range Value) screen. As in the lower value screen, the current value is displayed with a highlighted number below it. To change the upper value, key in the desired value. You may use whole numbers or whole numbers and decimal numbers (40 = 40 inches; 40.5 = 40.50 inches). Whole numbers will be entered as their decimal equivalents by HART® automatically. Key in the desired upper range value desired. Press the "Enter" (F4) button.
    Caution! Do not enter a high value that exceeds the active length of the sensor!

12. ADJUSTMENTS FOR TRANSMITTER (cont'd)

11. You are back in the "Range Values" screen. If the numbers for lower and upper are correct, press the "Send " key. You will get a "WARNING!" Press the "OK" button. You will again get "WARNING!" Press "OK" again.
12. Startup is now complete.