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SERIES KMD MAGNETOSTRICTIVE LIQUID LEVEL TRANSMITTER INSTALLATION / OPERATION INSTRUCTIONS

TABLE OF CONTENTS

GENERAL DESCRIPTION

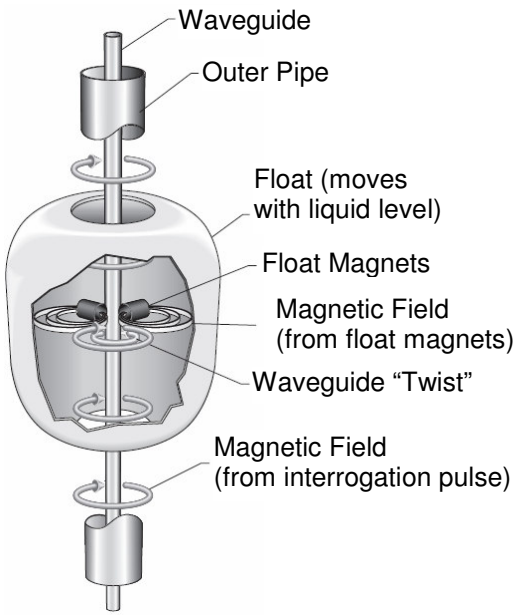
The KMD Series Magnetostrictive Liquid Level Transmitters are designed for very high accuracy measurement of virtually any liquid. The KMD can be used as a stand-alone transmitter to measure level and/or interface in a vessel, or can be combined with the Kenco Series MLG Magnetic Gauge to provide a 4-20mA signal along with visual indication.

PRINCIPLE OF OPERATION

The Series KMD Transmitter will precisely sense the position of an external float by applying an interrogation (electrical) pulse to the waveguide. This pulse creates a magnetic field around the waveguide. The magnets inside the float also have a magnetic field. Where the two magnetic fields intersect, a rotational force is created (waveguide twist). This "twist" creates a sonic pulse that travels along the waveguide.

The top of the sensing element houses the "pick-up" device that detects the sonic pulse and converts it into an electronic pulse. The electronic pulse is sent to the electronics module (puck), which calculates the time difference between the transmission of the interrogation pulse and the receipt of the sonic pulse. This time differential is used to determine the exact position of the float, and is converted into a 4-20mA output signal.

When used with a Magnetic Level Gauge (MLG), the float is contained in the MLG Chamber rather than on the Outer Pipe. However, the theory is the same.



MODEL DESCRIPTION

KMD - ☐☐1 - B☐☐☐-☐-☐-☐

- **Output**
- **Housing Type**
- **Construction Material**
- **Process Connection (Type)**
- **Process Connection (Size)**
- **RTD (must select Output Code 2)**
- **Measurement Units**
- **Sensor Length**

Output

Description	Code
In-Tank Single Loop	1
In-Tank Dual Loop	2
MLG Version (Display)	3
MLG Version (no Display)	4

Housing Type

Description	Code
Single Cavity	B
Dual Cavity	C
Single w/ Display	D
Dual w/ Display	E

Construction Material

Description	Code
316L SS	1
Hastelloy-C	3
Teflon Sheathed 316L SS	A

Process Conn. (Type)

Description	Code
Swaged NPT	1
Welded NPT	3
150# Flange	6
300# Flange	7
600# Flange	8
None	X

Process Conn. (Size)

Description	Code
¾"	A
1"	B
1½"	C
2"	D
2½"	E
3"	F
4"	G
6"	J
None	X

RTD

Description	Code
None	0
3" from Bottom Tip of Sensor	1
Customer Specified Location	2

Measurement Units

Description	Code
Millimeters	M
Inches	U

Sensor Length

Inches (xxx.x): (20-300 inches)
Millimeters (xxxxx): (508-7620 mm)

INSTALLATION
Unpack the switch carefully. Inspect all units for damage. Report any damage to carrier immediately. Check the contents against the packing slip and purchase order.

Kenco's Magnetostrictive Liquid Level Transmitters are manufactured to the highest quality standards. These instruments use electronic components that can be damaged by static electricity. Make sure that you are properly grounded before starting installation. Insure that all electrical connections are properly made, and that there are no "floating" connections.

Operational Check
Before installing the transmitter, a simple operational check should be performed, as follows:

General Test
1. Open the electronics housing cover and connect power (see section on ***Wiring***).
2. Using a DC Volt Meter, measure the voltage at the Loop #1 connections. The voltage must be ≥10.5Vdc and ≤36Vdc.
3. If Loop #2 is being used, perform Step #2 on Loop #2.
4. If the voltage levels are not in range (10.5 – 36Vdc), turn off the power.
5. Check for shorts/opens, power supply voltage (at supply), and excessive loop resistance (see resistance chart in section on ***Wiring***).
6. If the voltage is too high, place a resistor in series with the transmitter to "drop" the excess voltage. Contact Kenco if you need assistance in calculating the correct resistance value.

Loop #1 Test:
1. Connect a DC mA Meter in Loop #1
2. Lay the transmitter onto a flat surface.
3. Move the liquid level float along the operational range (zero to span) of the sensor. The output current should change as the float moves.
4. If the loop current is less than 4mA or greater than 20mA, this could indicate a problem with the transmitter. Contact Kenco for assistance.

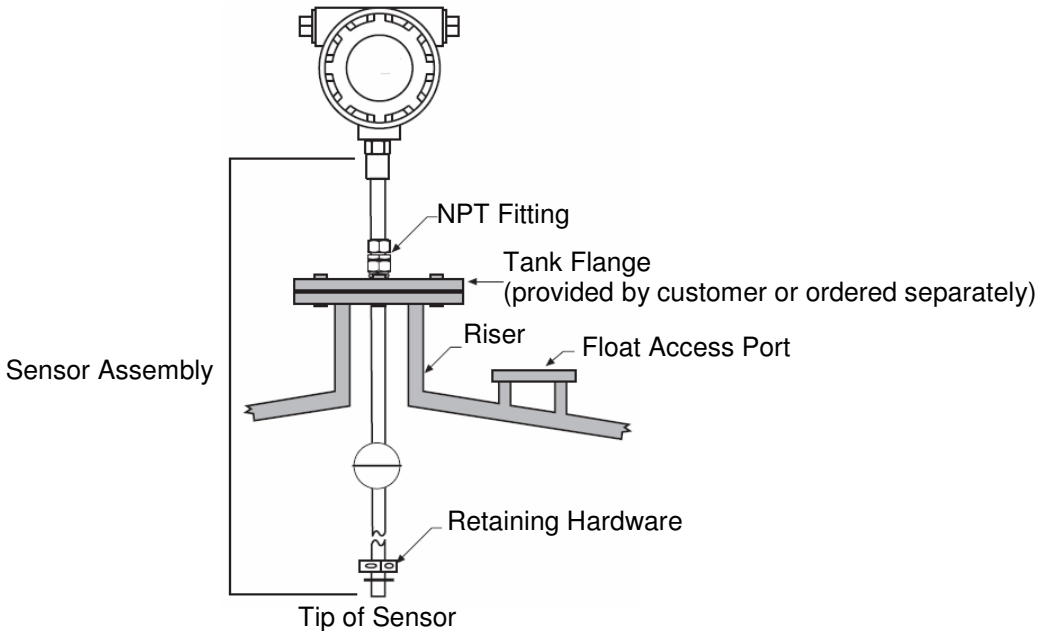
Loop #2 Test:
1. Connect a DC mA Meter in Loop #2
2. If Loop #2 is being used to measure Liquid Interface, perform the Loop #1 test (steps 2 -4) with the interface float.
3. If Loop #2 is being used to measure Temperature, perform the following:
   a. Measure the loop current.
   b. Calculate the Temperature with the following formula:

$$T = \left[\left(T_{20mA} - T_{4mA}\right) \div 16\right] \times \left(I - 4\right) + T_{4mA}$$

Where:
T = Temperature
T_{20mA} = Temperature @ 20mA Setpoint (Factory Setting: 300°F)
T_{4mA} = Temperature @ 4mA Setpoint (Factory Setting: -30°F)
I = Output Current (in mA)

   c. The transmitter's sensing RTD (Resistance Temperature Detector) is located approximately 3" from the bottom tip of the sensor (unless a different location is specified when ordered). Measure the temperature at this location to see if it is an approximation of the calculated value. If the output current is below 4mA or greater than 20mA there may be a problem with the sensing RTD. Contact Kenco for assistance.

Threaded Flange Mounting
In applications with smaller vessels and tanks, the transmitter can be mounted directly to the vessel, by direct threaded connection or mounting flange by using a threaded NPT fitting (supplied on the sensor). This fitting can be adjustable (swaged) or welded to the sensor (determined by model configuration). If the float will not fit through the process connection, there must also be some means to mount the float from the inside of the vessel (see the Float Access Port on the following drawing).

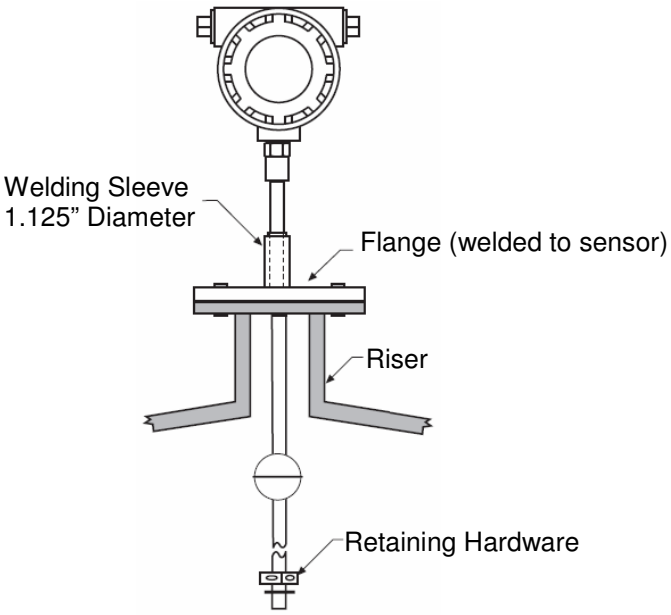


For threaded process connections, screw sensor into the opening using a wrench on the NPT Fitting (bottom half for swaged fittings). Do not overtighten the upper nut on swaged fittings. Use thread tape or suitable pipe compound on the process connection threads. If flanged, bolt the sensor flange to the mating flange with the proper gasket. Complete the following steps to mount the transmitter using the threaded flange method:

1. Remove the float retaining hardware, then remove the float.
2. Insert the tip of the sensor through the threaded vessel opening, or flange.
3. Before you completely insert the sensor tip to the bottom of the vessel, you must remount the float(s) and retaining hardware through an access port, or on the bottom side of the mounting flange.
4. The sensor tip can now be lowered to the vessel bottom and the connection can be made from the threaded NPT fitting to the vessel or mounting flange. In general, there should not be more than 12 inches of the Sensor Assembly extending above the vessel.

Welded Flange Mounting

The transmitter can also be mounted to a vessel flange with a flange welded to the sensor. Be sure to use the appropriate gasket between the flange faces.

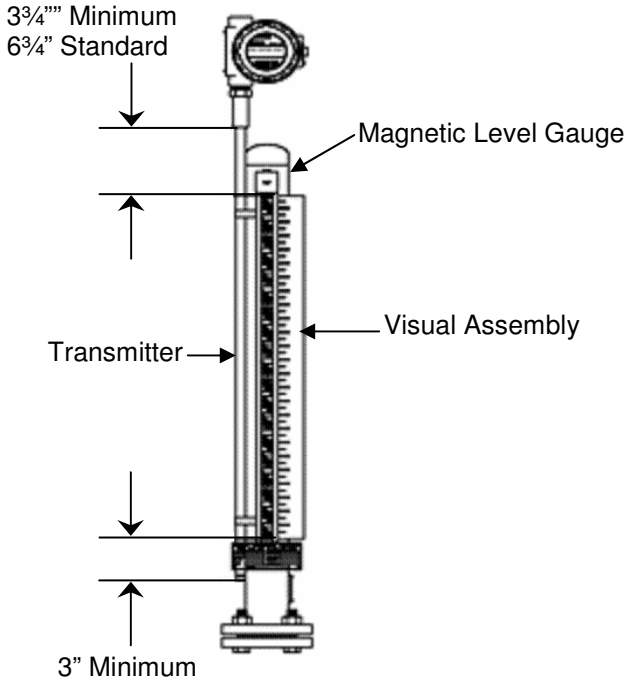


Complete the following steps to mount the sensor using the welded flange method:

1. Remove the Retaining Hardware. Install the float(s) onto the sensor. Remount the retaining hardware.
2. Insert the sensor into the vessel.
3. Attach the Sensor Flange to the Vessel Flange.

Magnetic Level Gauge (MLG) Mounting

The transmitter can also be used in conjunction with a Magnetic Level Gauge (MLG) to provide a 4-20mA output, as well as visual indication of the level in the vessel. The MLG float contains a magnet which actuates the transmitter. The transmitter is mounted alongside the MLG, and held in place by hose clamps. There is a minimum dead space of 3" at the bottom and 3¾"at the top. Kenco adds an additional 3" to the top (total of 6¾") for additional mounting flexibility.



Complete the following steps to mount the sensor to the MLG:

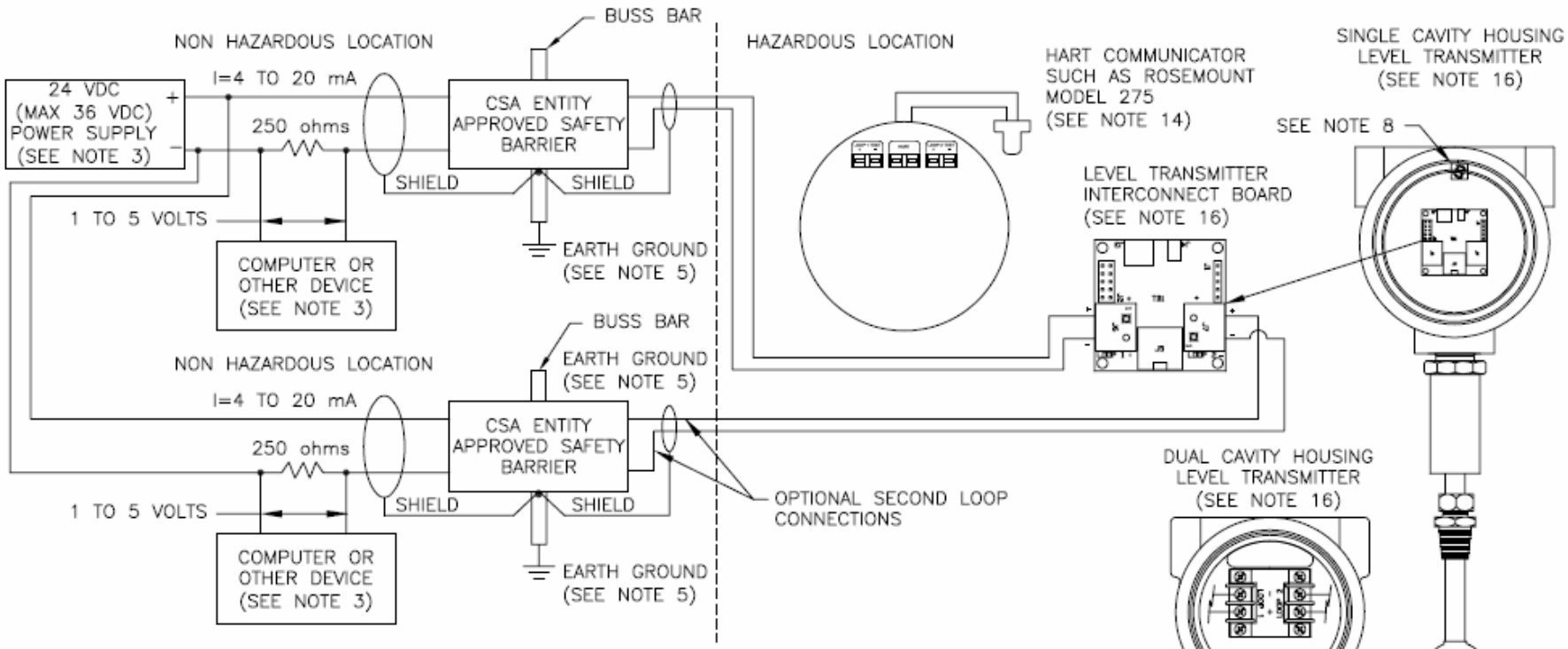
1. Open the hose clamps and place them around the MLG Chamber. Close the hose clamps, but leave them loose. For transmitters less than 6ft. in length there are two hose clamps. For longer gauges, there is an additional hose clamp for every 3ft. of length.
2. Mount the sensor alongside the MLG chamber, ±90° from the visual indicator. The sensor must be between the hose clamps and the MLG Chamber.
3. Tighten the bottom hose clamp directly above the bottom hose clamp holding the visual assembly in place. Tighten the top hose clamp directly below the top hose clamp holding the visual assembly in place. Starting at the bottom, tighten any additional hose clamps 36" apart.

Wiring

It is recommended that conduit be installed onto the ¾" NPT connection on the electronics housing. A seal drain fitting should be used to prevent moisture from entering the switch. In high humidity areas, use a breather drain to minimize moisture intrusion

All wiring, conduit, and fittings must conform to local electrical codes for the location selected. If the transmitter is to be used in a Hazardous Area, the applicable sections of the National Electric Code must be followed as well.

See the following page for the Hazardous area installation drawing. The barriers shown are not necessary for an Explosion-proof installation.



NOTES:

1. FOR I.S. FIELD INSTALLATION WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE COUNTRY IN USE (eg 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 CSA APPROVED GAUGES, BARRIERS MUST BE CSA APPROVED.
5. THE CONNECTION BETWEEN THE EARTH GROUND TERMINAL OF CSA ENTITY APPROVED SAFETY BARRIERS AND SYSTEM EARTH GROUND MUST BE LESS THAN 1 ohm.
6. SAFETY BARRIERS ARE 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 14)
8. TRANSMITTER ENCLOSURE SHALL BE GROUNDED TO EARTH GROUND THROUGH THE PROVIDED GROUND LUG IN THE ENCLOSURE.
9. NO REVISIONS SHALL BE MADE WITHOUT NOTIFICATION OF APPROVAL AGENCY(S).
10. INTRINSICIALLY SAFE FOR:
    CLASS I, DIVISION 1, GROUPS A, B, C AND D
    CLASS II, DIVISION 1, GROUPS E, F AND G, CLASS III,
    WITH NEMA/TYPE 4X, FOR OUTDOOR USE.
11. EACH LOOP ENTITY PARAMETERS
    Vmax= 36V
    Imax= 118mA
    Ci = 0
    Li = 200uH
12. TEMPERATURE CODE IS T4.
13. APPROVED METHODS FOR SEPARATION OF EACH LOOP ARE:
    * RUNNING LOOPS IN SEPARATE CABLES.
    * RUNNING LOOPS IN SEPARATE GROUNDED SHIELDS.
14. HART COMMUNICATOR WHICH CSA APPROVED MUST ONLY BE CONNECTED IN ACCORDANCE W/MFG I.S. INSTALLATION INSTRUCTIONS.
15. USE ONLY NRTL LISTED AND CSA CERTIFIED DUST–TIGHT SEAL FOR CLASS II AND CLASS III HAZARDOUS LOCATIONS.
16. FOR TRANSMITTERS WITH DUAL–CAVITY ENCLOSURES, CUSTOMER CONNECTIONS WILL BE MADE AT TERMINAL BLOCK ON POWER SIDE OF HOUSING (NOT TO TERMINAL BLOCK ON INTERCONNECT BOARD) VIEW SHOWN ABOVE

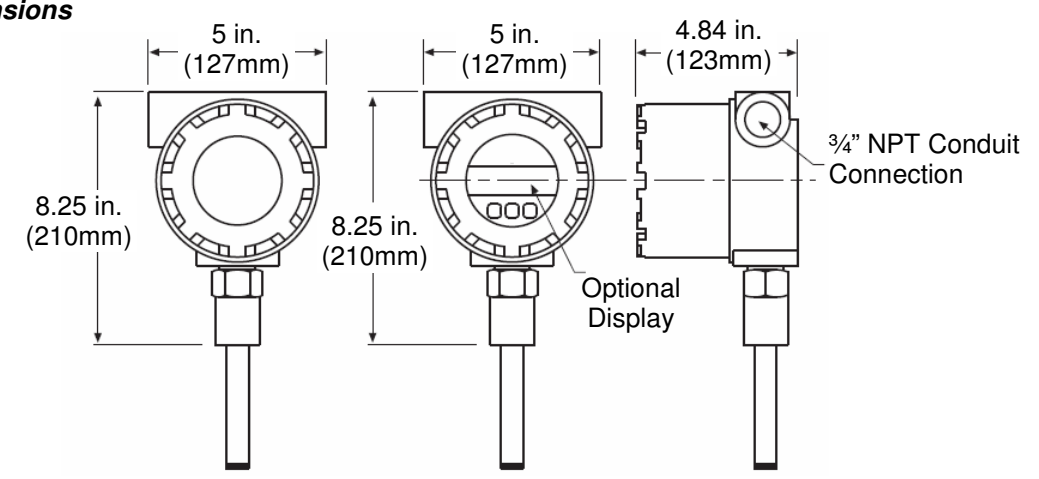
REV.	DATE	BY	ECN	EXPLANATION:
A	06–05–06	DS	–	CORECTED NOTES 7 AND 14

KENCO ENGINEERING COMPANY
TULSA, OKLAHOMA

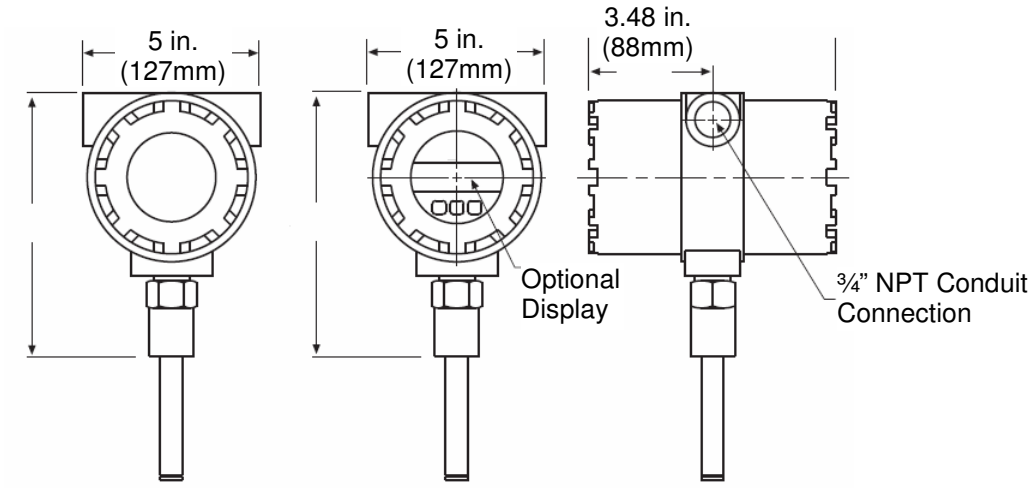
INSTALL DWG, TRANSMITTER EX HOUSING

DATE: 03–29–06	SHEET: 1 OF 1	DRAWING NUMBER
DRN. BY: DS	CHKD. BY: DD	C–50183
SCALE: NONE	REVISION: A	

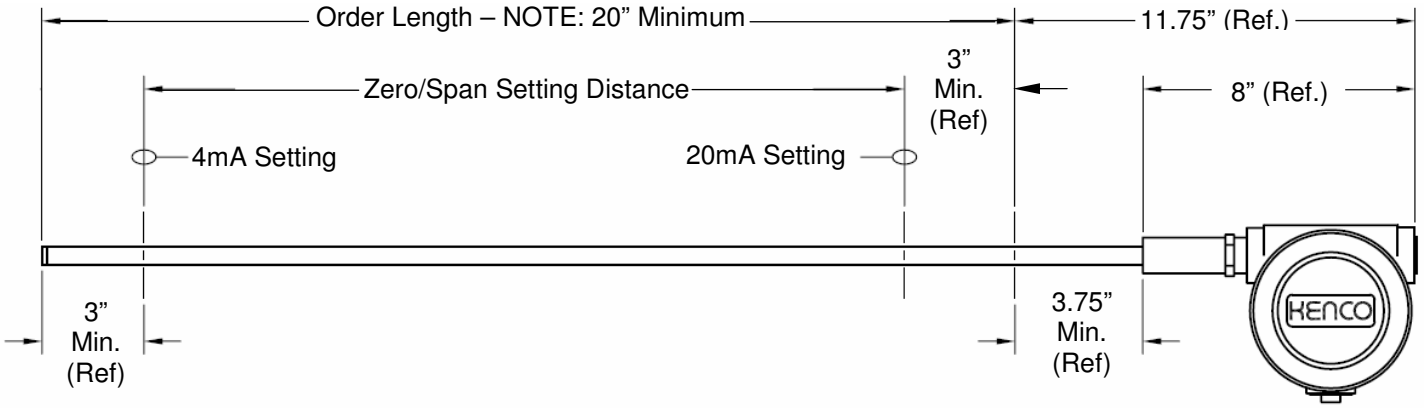
Product Dimensions



Single-cavity Enclosure

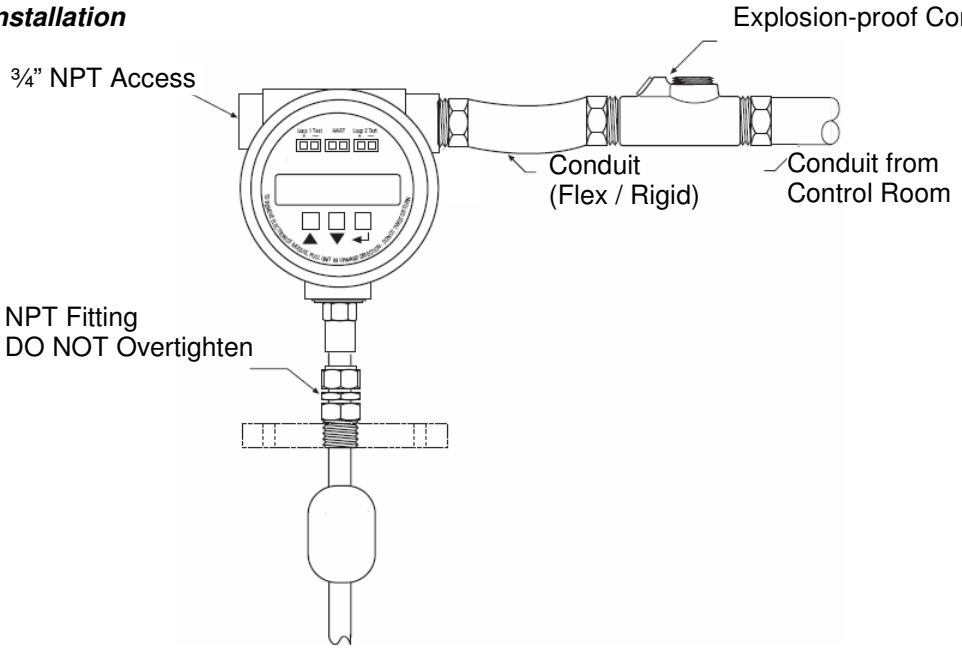


Dual-cavity Enclosure



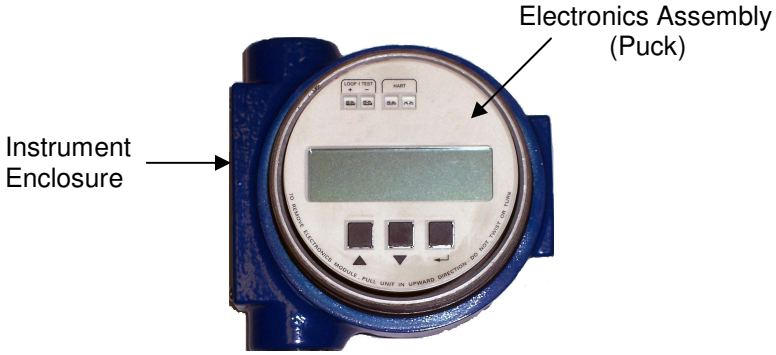
General Transmitter & Sensor Dimensions

Conduit Installation

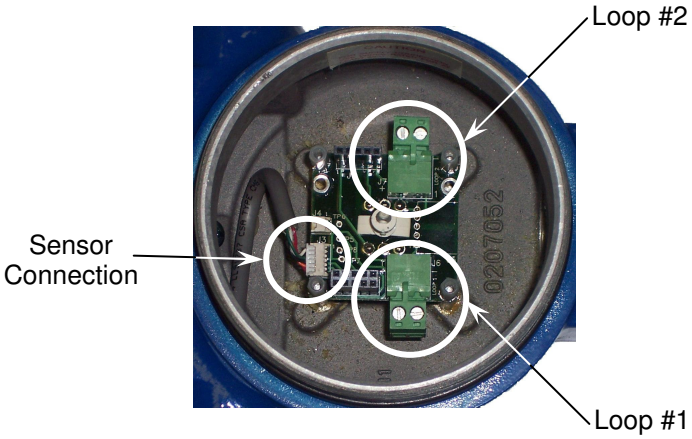


Wiring Connections

Before starting installation procedures in hazardous areas, insure that all power sources have been turned off and locked out. "Live" electrical circuits can ignite flammable gasses and dusts. Do not apply more than 36Vdc to the transmitter, as this may damage the instrument.

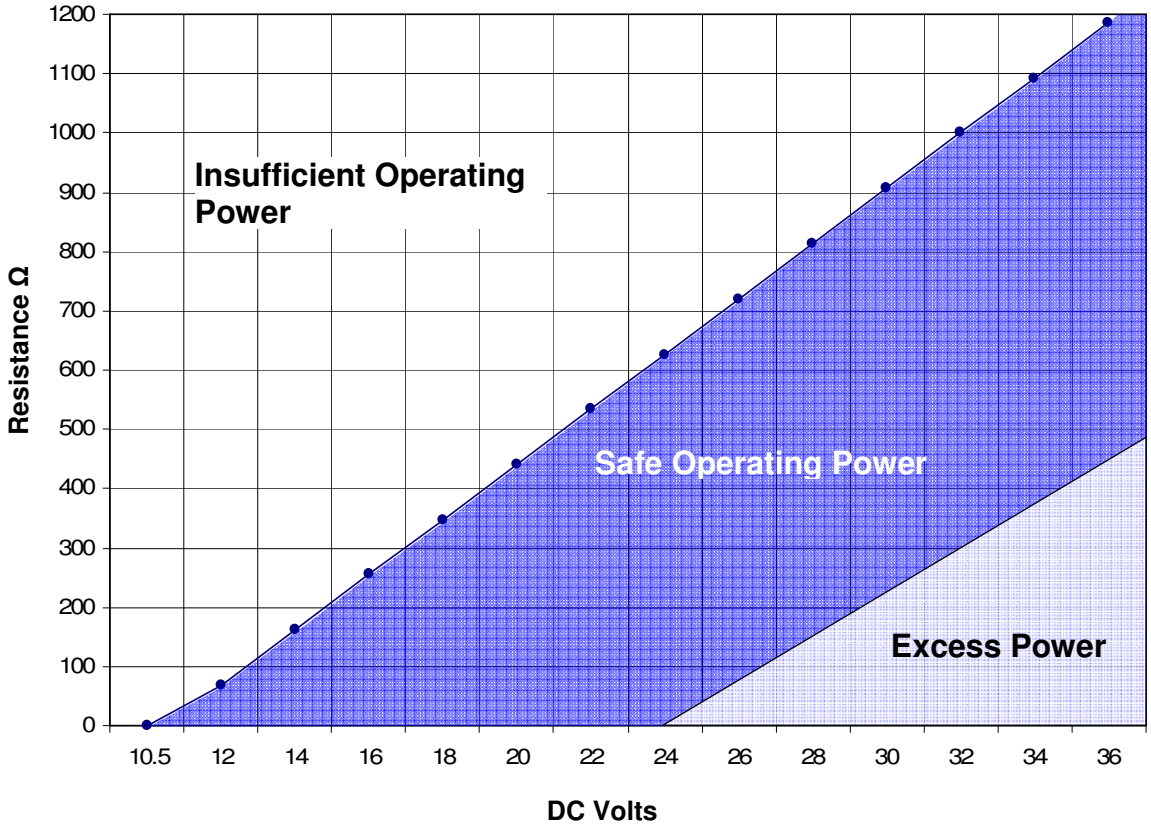


1. Remove the cover from the instrument enclosure.
2. Remove the electronics assembly (puck) from the instrument enclosure. Hold the puck firmly around the diameter and pull it out of the enclosure. No tools are necessary.



3. Unplug the connector from Loop #1. Using the above photo as a guide, pull the connector straight down. DO NOT pull the connector toward you. This is a (2) piece connector (plug & socket); the socket will remain on the board.

4. Pull the power/signal wires through the conduit opening.
5. Connect the (+) and (-) wires to the plug. In the photo, the (+) connection is on the side facing the sensor connection.
6. If this transmitter has (2) loops (interface or temperature measurement), repeat steps 3-5 for Loop #2. If the front of the electronics "puck" does not have "Loop 2 Test" connections, do not connect any wires to the Loop #2 connector shown in the above photo.
7. Reinsert the electronics module. It only fits in one way, and it does not require much force to seat the puck into the housing.



Loop Resistance Chart

CALIBRATION

The Series KMD transmitter can be calibrated using the HART communications protocol, or by the optional keypad and display. The keypad/display method has limited programming capability, as it is only capable of setting the zero & span points of Loops 1 & 2. It can also test and adjust the LCD Display. Full access to all transmitter parameters is possible through HART communications.

To calibrate the Model KMD with the onboard display/keypad, you must move the level/float to the zero and span positions. Calibration via HART does not require you to move the level/float.

Setup Using Onboard Keypad and Display

This section covers the modes of operation and the steps necessary to calibrate the transmitter using the optional keypad and display.

Operation Modes

Run Mode -- This is the primary mode of operation. It performs measurements, displays data, and responds to HART commands.

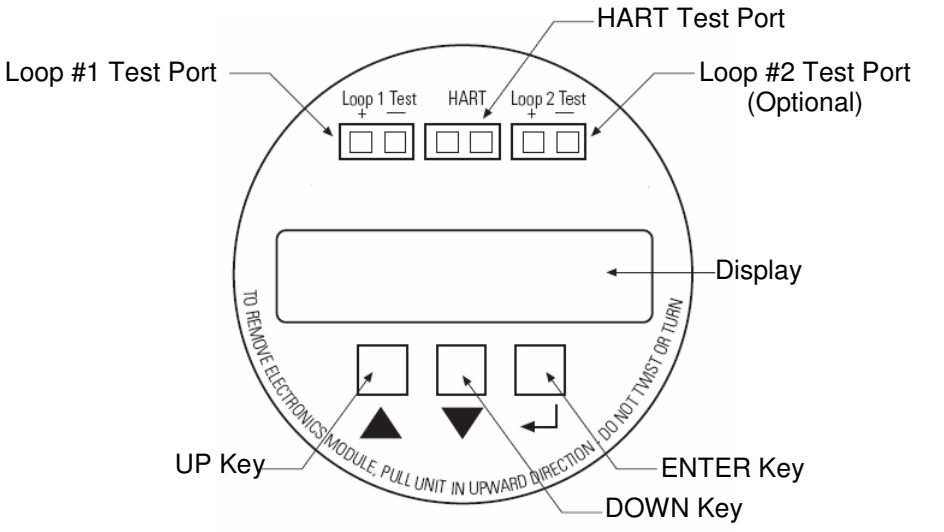
Program Mode -- To enter this mode press any of the three keys (UP, DOWN, or ENTER). Menus will guide you through the process of setting the zero & span settings for the two loops, as well as setting the LCD contrast and performing an LCD test. When in the Program Mode, HART communication is not functional. There I also an automatic time out feature. If a key is not pressed within a one minute timeframe, the transmitter automatically reverts back to the Run Mode.

Test Ports

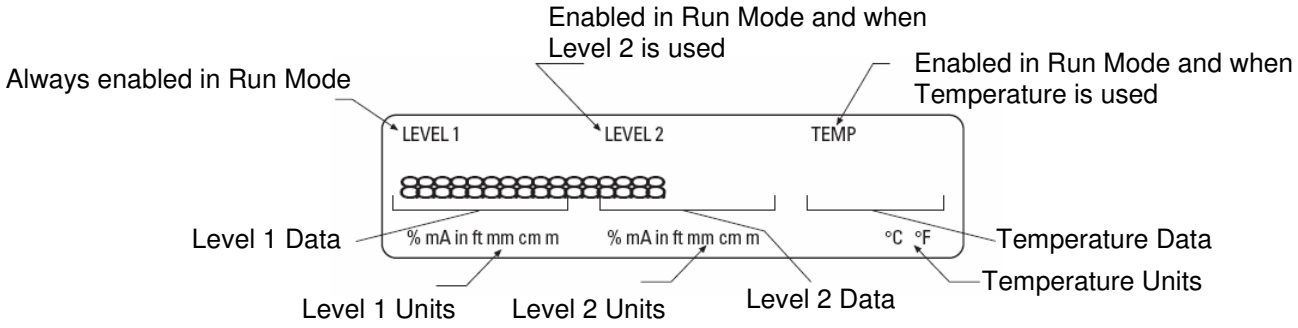
Loop #1 Test -- Use a multimeter set for DC mA and attach across the terminals. This puts your meter "in the loop" and allows you to measure loop current directly, without breaking the loop.

Loop #2 Test -- Same as Loop #1 Test

HART -- This port allows you to connect a HART Host Device (Handheld or Modem) to the transmitter. There must be at least a 250Ω load in Loop #1.

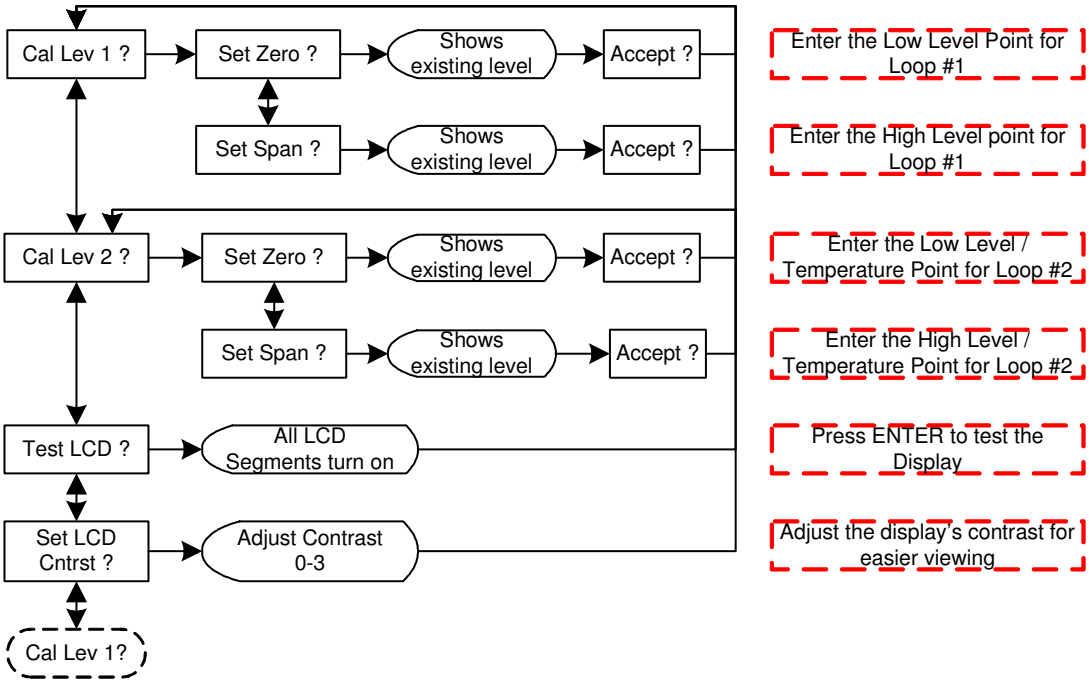


Series KMD Puck with Display



LCD Display Details

Menu Structure



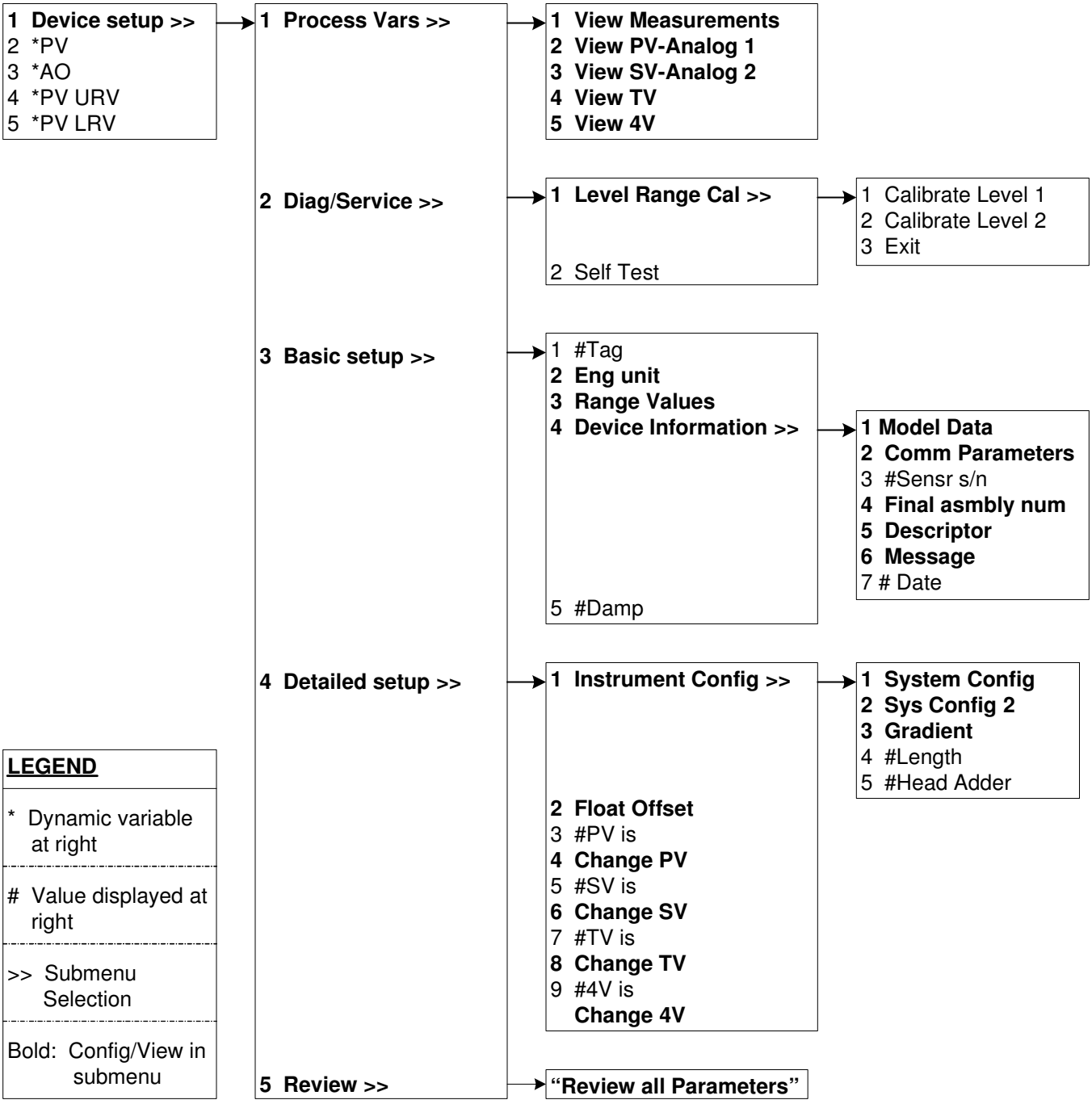
Setup Using HART® Handheld Communicator

HART is an acronym for "Highway Addressable Remote Transducer." The HART Protocol is the leading communication technology used with smart process instrumentation today. HART continues to grow in popularity and recognition in the industry as a global standard for smart instrument communication.

Unlike other digital communication technologies, the HART Protocol provides a unique communication solution that is backward compatible with the installed base of instrumentation in use today. This backward compatibility ensures that investments in existing cabling and current control strategies will remain secure well into the future.

Designed to compliment traditional 4-20mA analog signaling, the HART Protocol supports two way digital communications for process measurement and control devices. Applications include remote process variable interrogation, cyclical access to process data, parameter setting and diagnostics.

The menu structure of the HART Handheld Communicator is shown on the next page.



Setup Using PC Setup Software

The transmitter can also be calibrated using a HART Modem and a PC. Kenco can supply software, at no charge, to perform calibration by this method. Contact Kenco for more information.

The following parameters can be viewed / changed using this software:

Basic --	Manufacturing Information
Advanced --	Gauge Length, Gradient, Head Adder, Enable Display, Enable Loop 2, and Set Alarm Output
Calibration --	Level 1 Span and Offset (Zero), Level 2 Span and Offset, Temperature Span and Offset.
Output --	Level 1 Units of Measure, Level 2 Units of Measure, Temperature Units of Measure, Output Units of Measure, Output Designations, and View Output Data.

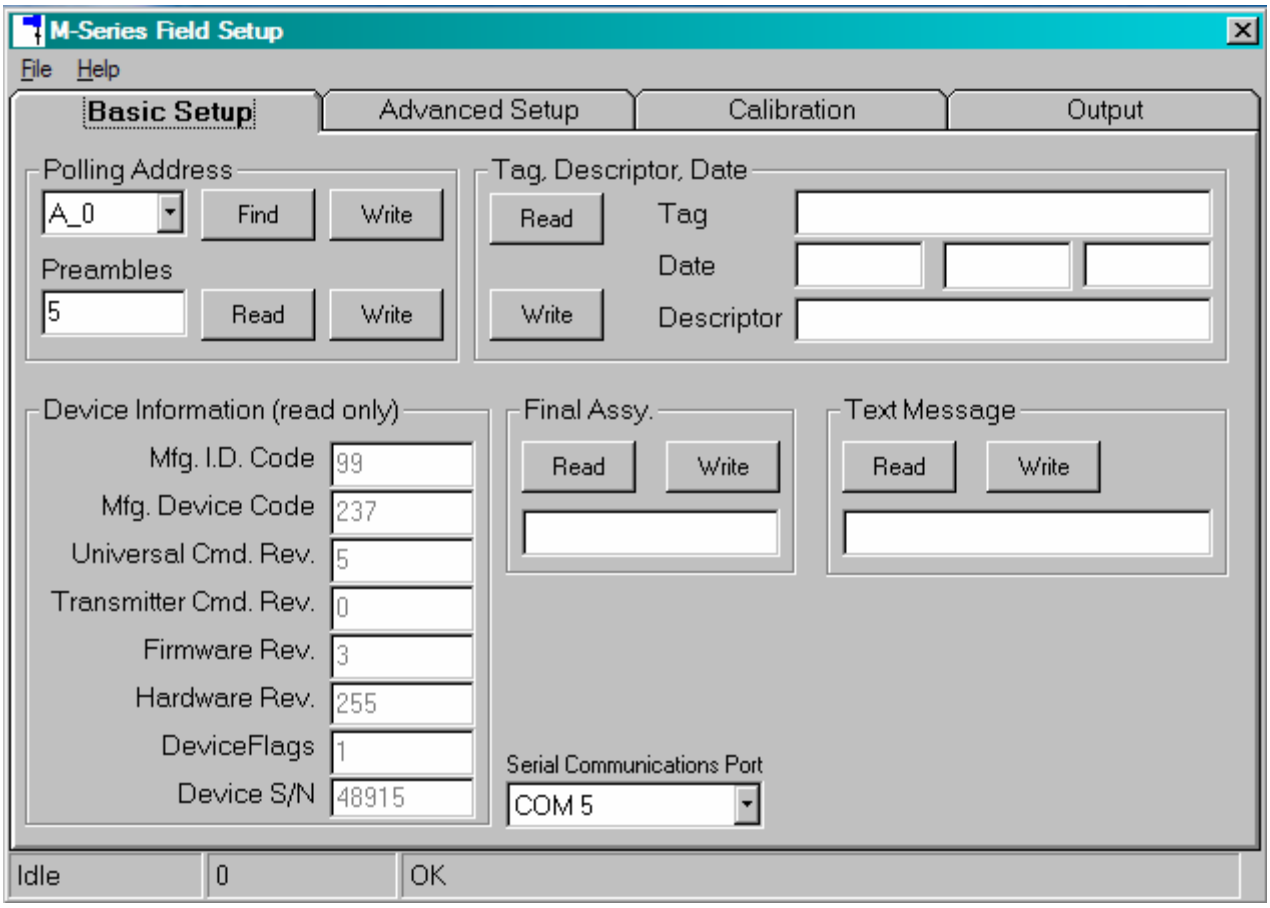
Installing the Software

1. Insert the CD into the proper drive.
2. If you don't have the CD, contact Kenco, and have a copy of the software e-mailed to you.
3. Run setup.exe
4. Follow the instructions on screen to install the program.

Prepare for Calibration

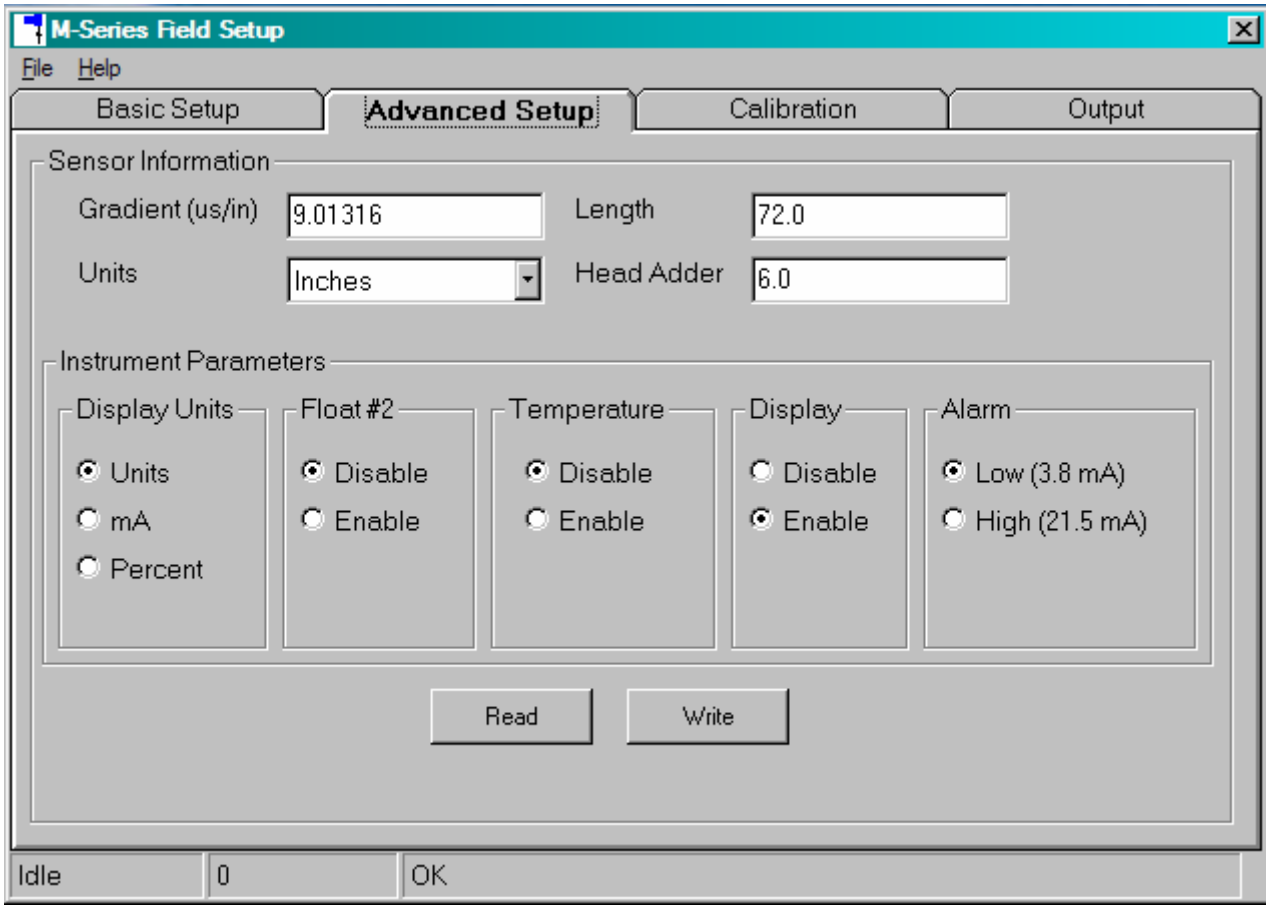
1. Obtain a Linear Power Supply (24Vdc nominal), Multimeter, PC, and a HART Modem (RS-232 or USB).
2. Connect the Power Supply, Multimeter, and transmitter. Set the Multimeter to DC mA scale. Put a load resistor in the loop (250-500Ω).
3. Connect the HART Modem to the PC using either the RS-232 port or an available USB port. DO not use an RS-232 to USB converter. The timing of the HART signals will be negatively affected.
4. Connect the HART Modem to the transmitter using the HART Test Port on the front of the puck.
5. Apply power to the transmitter.

Basic



The Basic Setup window will automatically search and receive configuration data from the transmitter. If there is no data, select a different serial communication port and click the "Find" button located next to the Polling Address drop-down box, to rerun the search program. In the example above, the COM 5 Port was used.

Advanced

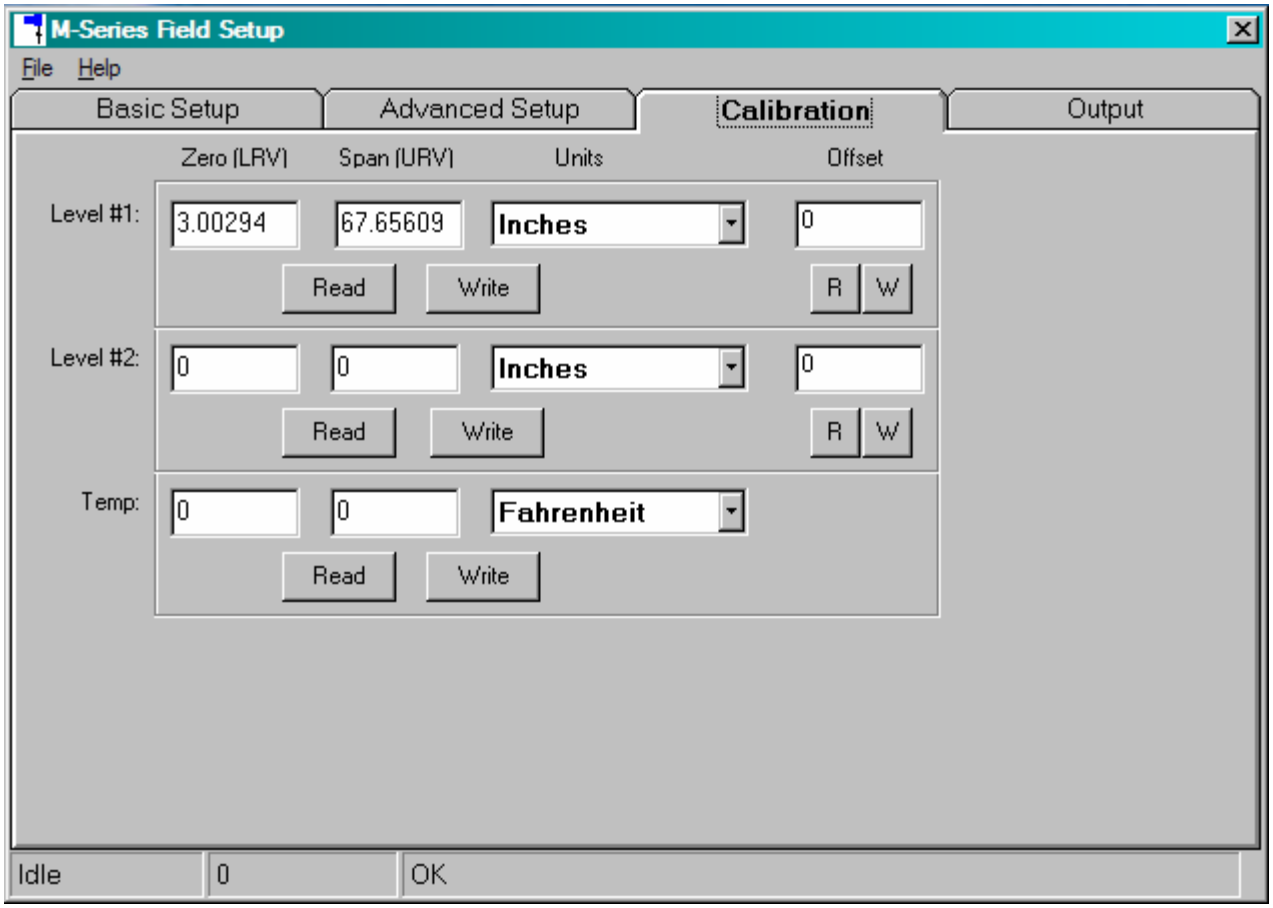


Click the Advanced Setup Tab. Confirm that the Gradient, Length, and Head Adder have been received from the transmitter. If not, click the Read Button. The fields are defined as follows:

Gradient -- Is slightly different fro each sensor. This number can be found on the sensor element head.
Units -- Determines the unit of measure for “Length” and “Head Adder”. See the section on “Output Tab” to change the unit of measure for all data.
Head Adder -- The difference between the sensor length and the order length; approximately 5.6”.

Display Units -- The units shown on the optional display.
Float #2 -- Enable/Disable optional second float.
Temperature -- Enable/Disable optional temperature measurement. Cannot be used unless and RTD was ordered with the sensor.
Display -- Enable/Disable optional display.
Alarm -- Determines the condition of the output current upon detection of a fault (sensor / electronics error).

Calibration

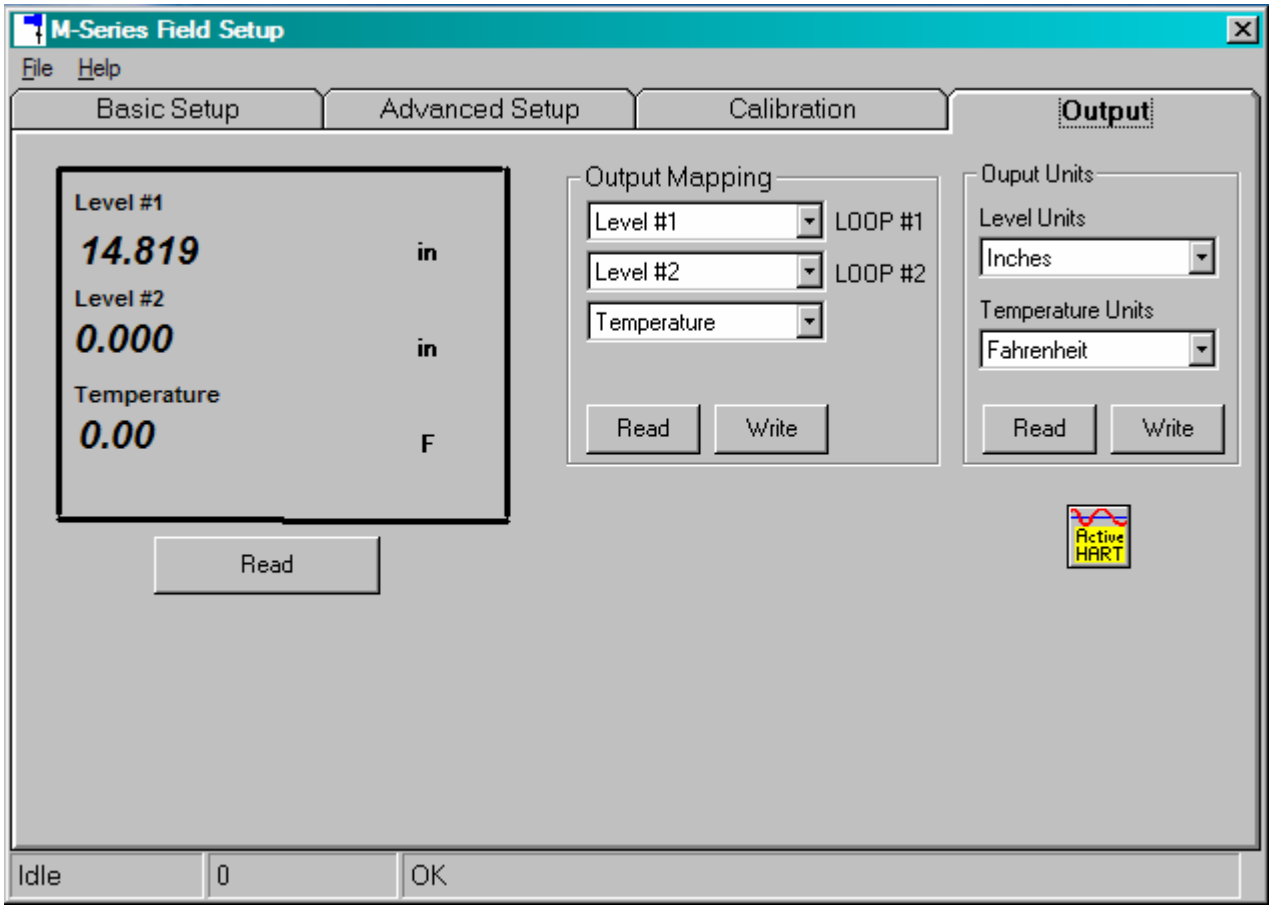


The Calibration Tab is used to set the Zero (LRV) and Span (URV) points for the Level Float (Level #1), Interface Float in a 2 float system (Level #2), and the Temperature sensor (if installed). To change a value, click the cell you want to change, type in the new value, and click Write.

The Units field shows the unit of measure used for the Zero and Span points. To change, click the drop-down arrow, and select the desired unit of measure. Click “Write” when finished. Make sure that the Zero and Span values match the unit of measure selected. This program does not convert between different units.

The Offset field is used for making adjustments to the optional display, not the output current. For example, if the float (Level #1) is at the 4mA point, but the display reads 0.25”, enter -0.25 in the Offset field and click “W” (Write). The display will now read 0.00” even though the current has remained at 4mA.

Output



The Output Tab shows you the present output values for the transmitter. To update the values, click the Read button under the black box.

Output Mapping allows you to select the loop for each measurement. Loop #1 (or #2) can be set to indicate Level #1, Level #2 or Temperature. Click Write after you make any changes. Click Read to see the existing setting.

Output Units allows you to set the units of measure for all data. Click the drop-down arrow and select the desired value. Click Write to accept any changes. Click Read to see the existing setting.

Specifications

Description		Specification
Power Supply		10.5 – 36.1Vdc; 24Vdc nominal
Temperature Range (Electronics)		-30°F to 160°F (-34°C to 71°C)
Temperature Range (Sensor)		-40°F to 257°F (-40°C to 125°C)
Humidity		0-100% non-condensing
Measurement Variables		Level, Interface, or Temperature
Level / Interface Output	Range	20 – 300 inches
	Linearity	±0.020% of span or 0.03125" whichever is greater
	Repeatability	±0.005% of span or 0.005" whichever is greater
Temperature Output	Type	1,000Ω Platinum RTD
	Repeatability	±0.18°F (0.1°C)
	Accuracy	±2.7°F (1.5°C)
	Drift	±0.9°F (0.5°C) per year
	Zero Adjust	-40°F to 255°F (-40°C to 124°C)
	Span Adjust	45°F (7.2°C) minimum; full scale = 300°F (149°C) maximum
Onboard Operator Interface (Optional)	Data Entry	3-button keypad
	Display	16-character custom LCD
Output Signal	Analog	4-20mA; reversible. 1 or 2 output loops
	Digital	HART® communications protocol
Error Indication		3.8mA or 21mA field selectable
Range		20 – 300 inches
Damping		0 – 60 seconds; field adjustable in 1 sec. increments
Maximum Signal Cable Length		5000 ft. (minimum of 10.5Vdc at transmitter)