ECLIPSE®
706GWR

HART® Installation and Operating Manual for Eclipse® Model 706

Software Version 1.x

High Performance,
4th Generation
Guided Wave Radar
Level Transmitter



MAGNETROL® / AMETEK®

LEVEL MEASUREMENT
SOLUTIONS

Read this Manual Before Installing

This manual provides information on the Eclipse® transmitter. It is important that all instructions are read carefully and followed in sequence. The *QuickStart Installation* instructions are a brief guide to the sequence of steps for experienced technicians to follow when installing the equipment. Detailed instructions are included in the *Complete Installation* section of this manual.

Conventions Used in this Manual

Certain conventions are used in this manual to convey specific types of information. General technical material, support data, and safety information are presented in narrative form. The following styles are used for notes, cautions, and warnings.

NOTES

Notes contain information that augments or clarifies an operating step. Notes do not normally contain actions. They follow the procedural steps to which they refer.

Cautions

Cautions alert the technician to special conditions that could injure personnel, damage equipment, or reduce a component's mechanical integrity. Cautions are also used to alert the technician to unsafe practices or the need for special protective equipment or specific materials. In this manual, a caution box indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

WARNINGS

Warnings identify potentially dangerous situations or serious hazards. In this manual, a warning indicates an imminently hazardous situation which, if not avoided, could result in serious injury or death.

Safety Messages

The Eclipse system is designed for use in Category II, Pollution Degree 2 installations. Follow all standard industry procedures for servicing electrical and computer equipment when working with or around high voltage. Always shut off the power supply before touching any components. Although high voltage is not present in this system, it may be present in other systems.

Electrical components are sensitive to electrostatic discharge. To prevent equipment damage, observe safety procedures when working with electrostatic sensitive components.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

WARNING! Explosion hazard. Do not connect or disconnect designs rated Explosion proof or Non-incendive unless power has been switched off and/or the area is known to be non-hazardous.

Low Voltage Directive

For use in Installations Category II, Pollution Degree 2. If equipment is used in a manner not specified by the manufacturer, protection provided by equipment may be impaired.

Warranty

All AMETEK Level Measurement Solutions (LMS) electronic level and flow controls are warranted free of defects in materials or workmanship for eighteen months from the date of original factory shipment. If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, AMETEK LMS will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

AMETEK LMS shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some AMETEK LMS products.

Quality Assurance

The quality assurance system in place at AMETEK LMS guarantees the highest level of quality throughout the company. AMETEK LMS is committed to providing full customer satisfaction both in quality products and quality service.

The AMETEK LMS quality assurance system is certified to ISO 9001, affirming our commitment to internationally recognized quality management standards and continuous improvement.

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Performance specifications are effective with date of issue and are subject to change without notice. AMETEK LMS reserves the right to make changes to the product described in this manual at any time without notice. AMETEK LMS makes no warranty with respect to the accuracy of the information in this manual.

MAGNETROL® / AMETEK®
LEVEL MEASUREMENT SOLUTIONS

Eclipse® Model 706 Guided Wave Radar Transmitter

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1.0 QuickStart Installation

The QuickStart Installation procedures provide an overview of the key steps required for mounting, wiring, and configuring the Eclipse Model 706 Guided Wave Radar level transmitter. These procedures are intended for more experienced installers of Eclipse transmitters (or other electronic level measurement instruments).

Section 2.0, Complete Installation, offers more detailed installation instructions for the first time user.

WARNING: Overfill-capable probes such as the Model 7yD, 7yG, 7yJ, 7yL, 7yP, or 7yT should be used for all Safety Shutdown/Overfill applications.

The Model 706 transmitter, when used with an overfill coaxial or caged probe, is capable of measuring true liquid level all the way up to the face of the flange or NPT connection. This is a very unique advantage as compared to other Guided Wave Radar (GWR) devices that may infer level at the top of the probe when signals are lost or uncertain. Refer to Section 3.2.6 for additional information on overfill capability.

Depending on the probe type, all other Eclipse probes should be installed so the maximum overfill level is a minimum of 6"-12" (150–300 mm) below the flange or NPT connection. This may include utilizing a nozzle or spool piece to raise the probe. Consult factory to ensure proper installation and operation.

1.1 Getting Started

Have the proper equipment, tools, and information available before beginning the QuickStart Installation procedures.

1.1.1 Equipment and Tools

- Open-end wrenches (or adjustable wrench) to fit the process connection size and type.
  - Coaxial probe: 1½" (38 mm)
  - Single rod probe: 1⅞" (47 mm)
  - Transmitter 1½" (38 mm).
  - A torque wrench is highly desirable.
- Flat-blade screwdriver
- Cable cutter and 3⁄32" hex wrench (for flexible cable probes only)
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA minimum

1.1.2 Configuration Information

To utilize the QuickStart menu available on the Eclipse Model 706, some key information is required for configuration.

Gather the information and complete the following operating parameters table before beginning configuration.

NOTES: The QuickStart menu is available for Level Only applications.

1. Refer to Section 2.6.5 for configuration menus for Interface, Volume or Flow applications.
2. These configuration steps are not necessary if the transmitter was pre-configured prior to shipment.

Display	Question	Answer
Level Units	What units of measurement will be used? (inches, millimeters, centimeters, feet or meters)	_____
Probe Model	What probe model is listed on the model information? (first three digits of probe model number)	_____
Probe Mount	Is the probe mounted NPT, BSP, or flange? (Refer to probe model.)	_____
Probe Length	What probe length is listed on the probe model information? (last three digits of the probe model number)	_____
Level Offset	The desired level reading when the liquid is at the tip of the probe. (Refer to Section 3.4 for more information.)	_____
Dielectric Range	What is the dielectric constant range of the process medium?	_____
4.0 mA Set Point (LRV) *(Does not apply for FOUNDATION fieldbus™ or PROFIBUS PA)*	What is the 0% reference point for the 4.0 mA value?	_____
20.0 mA Set Point (LRV) *(Does not apply for FOUNDATION fieldbus™ or PROFIBUS PA)*	What is the 100% reference point for the 20.0 mA value? (Ensure that this value is outside of the Blocking Distance when utilizing non-overfill-capable probes.)	_____
Failure Alarm *(Does not apply for FOUNDATION fieldbus™ or PROFIBUS PA)*	What output current is desired when a Failure Indicator is present?	_____

1.2 QuickStart Mounting

Ensure that the configuration style and process connection size/type of the Eclipse transmitter and probe matches the requirements of the installation before continuing with the QuickStart installation.

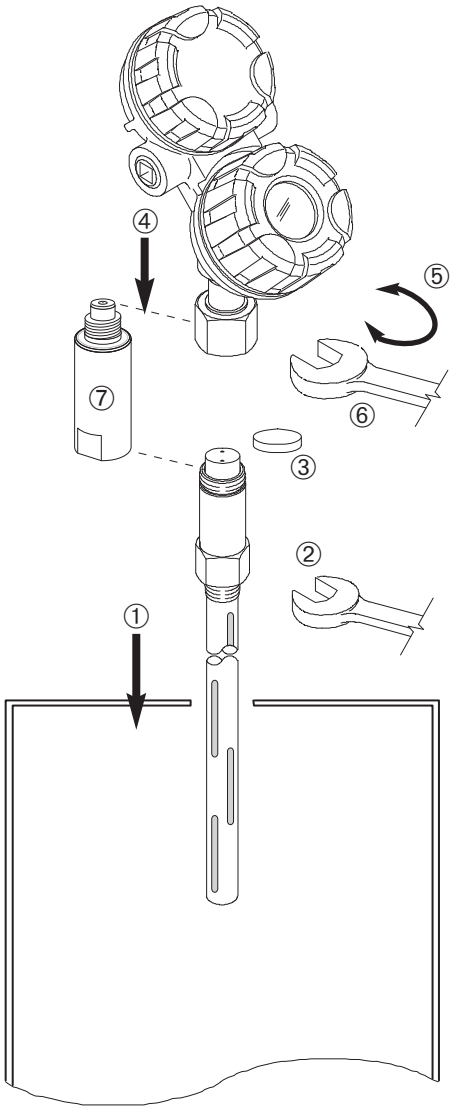
For optimal performance (and correlation to the Calibration Certificate included with all units), confirm the model and serial numbers shown on the nameplates of the Eclipse probe and transmitter are identical.

NOTES: For applications using the Model 7yS Steam Probe, it is mandatory to keep the transmitter and probe matched as a set. (Refer to Section 3.2.5 for additional information regarding saturated steam applications.)

To avoid moisture ingress in the housing, covers should be fully tightened at all times. For same reason, conduit entries should be properly sealed.

1.2.1 Probe

1. Carefully place the probe into the vessel. Align the probe process connection with the threaded or flanged mounting on the vessel.
2. Tighten the hex nut of the probe process connection or flange bolts.



NOTES: Leave the plastic protective cap in place on the probe until you are ready to install the transmitter. Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed with a Viton® o-ring.

If using a segmented probe or removable rod, ensure that all pieces are assembled and connected before installation.

1.2.2 Transmitter

3. Remove the protective plastic cap from the top of the probe and store for future use. Make sure the top probe connector (male connection) is clean and dry. Clean with isopropyl alcohol and cotton swabs if necessary.
4. Carefully place the transmitter onto the probe. Align the universal connection at the base of the transmitter housing with the top of the probe. Only hand-tighten the connection at this point in time.
5. Rotate the transmitter so that it is in the most convenient position for wiring, configuring and viewing.
6. Using a 1½" (38 mm) wrench, tighten the universal connection on the transmitter ¼ to ½ turn beyond hand-tight. As this is a critical connection, a torque wrench is highly recommended to obtain 45 ft-lbs (60 Nm).

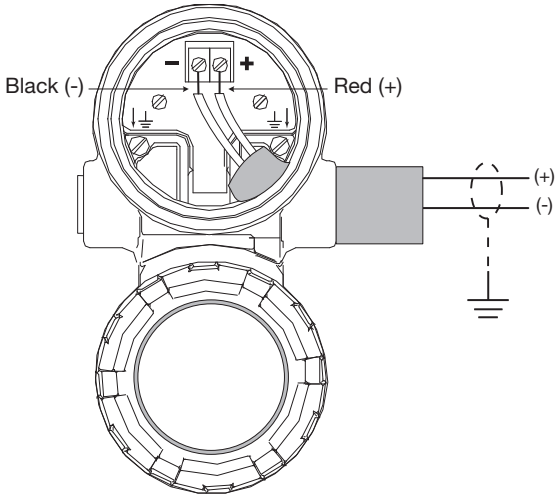
   DO NOT LEAVE HAND-TIGHT.

NOTE: The Eclipse Model 706 transmitter can be supplied with a universal connector containing lock screws for applications with significant vibration. Contact the factory for additional information.

7. If available, install optional adapter (for use with Model 705 probes. As this is a critical connection, a torque wrench is highly recommended to obtain 45 ft-lbs (60 Nm).

1.3 QuickStart Wiring

WARNING! Possible explosion hazard. Do not connect or disconnect equipment unless power has been switched off and the area is known to be non-hazardous.



NOTE: Ensure that the electrical wiring to the Eclipse Model 706 transmitter is complete and in compliance with all local regulations and codes.

1. Remove the cover of the upper wiring compartment of the Model 706 transmitter.
2. Attach a conduit fitting and mount the conduit plug in the spare opening. Pull the power supply wire through the conduit fitting.
3. If present, connect cable shield to an earth ground at the power supply.
4. Connect an earth ground to the nearest green ground screw. (Not shown in illustration.)
5. Connect the positive supply wire to the (+) terminal and the negative supply wire to the (-) terminal. For Explosion Proof Installations, see Wiring, Section 2.5.3.
6. Replace and tighten the cover.

1.4 QuickStart Configuration



If requested, the Eclipse Model 706 transmitter is shipped fully pre-configured for the application and can be installed immediately. Otherwise it is shipped configured with default values from the factory and can be easily reconfigured in the shop.

The minimum configuration instructions required for using the QuickStart menu follow. Use the information from the operating parameters table in Section 1.1.2 before proceeding with the configuration.

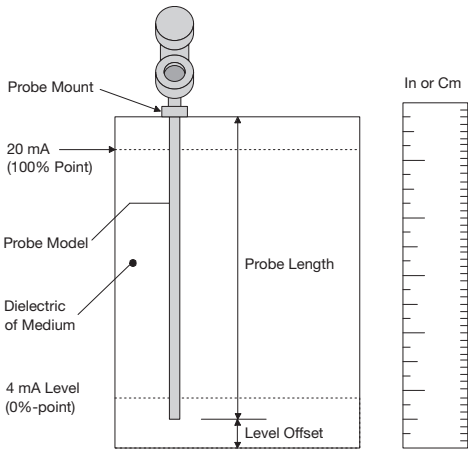
The QuickStart menu offers a very simple two screen overview showing the basic parameters required for typical “Level Only” operation.

1. Apply power to the transmitter.

   The graphic LCD display can be programmed to change every 2 seconds to show pertinent Measured Values on the Home Screen. For example: Level, %Output, and Loop current can all be displayed on a rotating screen.

   The LCD can also be programmed to always show just one of the Measured Variables at all times. For example: Level can be the only value displayed on the screen.

2. Remove the lower electronic compartment cover.



NOTE: A small transition zone (0–12") (0-300 mm) may exist at the top and bottom of certain probes.

STEP 4



STEP 5



STEP 6



3. The push buttons offer multiple forms of functionality for menu navigation and data entry. (See Section 2.6 for complete explanation).

   ⇧ **UP** moves up through the menu or increases a displayed value.

   ⇩ **DOWN** moves down through the menu or decreases a displayed value.

   ⇦ **BACK** exits a branch of the menu or exits without accepting entered value.

   ⇨ **ENTER** enters a branch of the menu or accepts a displayed entry.

NOTE: Holding down ENTER when any menu or parameter is highlighted will show help text in reference to that item.

The default User Password = 0. (If a password is requested, enter it at that time.)

The following configuration entries are the minimum required for a QuickStart configuration. Refer to figures at left.

4. Press any key at the Home Screen to access the Main Menu.
5. Press ⇨ ENTER with the DEVICE SETUP menu item highlighted.
6. Press ⇨ ENTER with the QUICKSTART menu item highlighted.

   The QuickStart shows the basic parameters, with the present value of the highlighted parameter shown at the bottom of the screen.

   One can now quickly and easily scroll through the QuickStart configuration items, changing those parameters as required:

   - Scroll to the parameter to be changed.
   - Press ⇨ ENTER at the highlighted parameter.
   - Scroll to the desired option, then press ⇨ ENTER.
   - Scroll to next parameter or press ⇦ BACK when finished to exit the QuickStart menu.

   Section 1.4.1 lists and describes the nine parameters in the QuickStart menu.

7. After making all of the necessary changes in the QuickStart menu, press the BACK button three times to return to the Home Screen.
8. The QuickStart configuration is complete. If properly configured, the Model 706 transmitter is measuring level and is ready for service.

1.4.1 QuickStart Menu Options

Level Units		Select the Units of measurement for the level readout: • Inches • Feet • Millimeters • Centimeters • Meters
Adapter		YES — Model 705 probe models appear below NO — Model 706 probe models appear below
Probe Model		Select the Probe Model to be used with Model 706: (NOTE: All Probe Models may not be available depending on the firmware version.) • 7YD Coaxial High Temperature High Pressure • 7YF Single Rod for installation onto tanks • 7YG Single Rod for installation into cages • 7YH Single Hygienic • 7YJ Single High Temperature High Pressure for cages • 7YL Single Rod High Pressure for cages • 7YM Single Rod High Pressure for tanks • 7YN Single Rod High Temperature High Pressure for tanks • 7YP Coaxial High Pressure • 7YS Coaxial Steam • 7YT Coaxial Standard • 7YV Coax High Vibration (Future) • 7Y1 Single Flexible Standard • 7Y2 Single Flexible Bulk Solids • 7Y3 Single Flexible Standard High Temperature High Pressure • 7Y5 Twin Flexible Bulk Solids • 7Y6 Single Flexible High Temperature High Pressure for Cages • 7Y7 Twin Flexible with FEP Coating
Probe Mount		Select the type of Probe Mounting to the vessel: (NOTE: All Probe Mount options may not be available depending on the firmware version). • NPT (National Pipe Thread) • BSP (British Standard Pipe) • Flange (ASME or DIN) • NPT with Flushing Connection • BSP with Flushing Connection • Flange with Flushing Connection • Hygienic
Probe Length		Enter the exact Probe Length as printed on the probe nameplate. Probe Length is shown as the last three digits of the Probe Model number. Range is 12 inches to 100 feet (30 cm to 30 meters) probe dependent. Refer to Section 1.4.1.1.
Level Offset		Enter the desired level reading when the liquid is at the end of the probe. Range is -25 feet to 75 feet (-762 cm to 22 meters). Refer to Section 3.4 for further information. (With default Level Offset = 0, all measurements are referenced from the bottom of the probe.)
Dielectric Range		Enter the Dielectric Range for the material to be measured. Below 1.7 (Light Hydrocarbons like Propane and Butane) 1.7 to 3.0 (Most typical hydrocarbons) 3.0 to 10 (Varying dielectric, for example: mixing tanks) Above 10 (Water-based media)
HART Only	**4 mA Set Point (LRV)**	Enter the level value (0%-point) for the 4 mA point. Lower Range Value (LRV). Refer to Section 1.4.1.1.
	20 mA Set Point (URV)	Enter the level value (100%-point) for the 20 mA point. Upper Range Value (URV). Refer to Section 1.4.1.1.
	Failure Alarm	Enter the desired output state when a Failure Indicator is active. • 22 mA • 3.6 mA • Hold (Hold last value is not recommended)

1.4.1.1 QuickStart Numerical Data Entry

To make numerical entry changes to Probe Length and Level Offset:

- **UP** moves up to the next highest digit (0,1,2,3,....,9 or the decimal point).
  If held down the digits scroll until the push button is released.
- **DOWN** moves up to the next lowest digit (0,1,2,3,....,9 or the decimal point). If held down the digits scroll until the push button is released.
- **BACK** moves the cursor to the left and deletes a digit. If the cursor is already at the leftmost position, then the screen is exited without changing the previously saved value.
- **ENTER** Moves the cursor to the right. If the cursor is located at a blank character position, the new value is saved.

Scrolling further DOWN in the QuickStart menu results in the remaining parameters appearing one by one, with the present highlighted value shown at the bottom of the screen.

- **BACK** returns to the previous menu without changing the original value, which is immediately redisplayed.
- **ENTER** accepts the displayed value and returns to the previous menu.

Negative values can be entered by highlighting the “+” sign shown prior to the number, then pressing **UP** to change it to show “-”.

2.0 Complete Installation

This section provides detailed procedures for properly installing, wiring, and configuring the Eclipse Model 706 Guided Wave Radar Level Transmitter.

2.1 Unpacking

Unpack the instrument carefully. Make sure all components have been removed from the packing material. Check all the contents against the packing slip and report any discrepancies to the factory.

Before proceeding with the installation, do the following:

- Inspect all components for damage. Report any damage to the carrier within 24 hours.
- Make sure the nameplate model number on the probe and transmitter agree with the packing slip and purchase order.
- Record the model and serial numbers for future reference when ordering parts.

Model Number

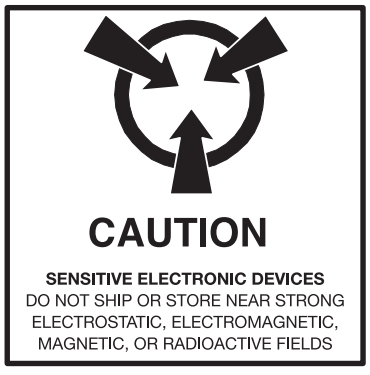
Serial Number

For optimal performance (and correlation to the Calibration Certificate included with all units), confirm the model and serial numbers shown on the nameplates of the Eclipse probe and transmitter are identical.

NOTES: For applications using the Model 7yS Steam Probe, it is mandatory to keep the transmitter and probe matched as a set. (Refer to section 3.2.5 for additional information regarding saturated steam applications.)

To avoid moisture ingress in the housing, covers should be fully tightened at all times. For same reason, conduit entries should be properly sealed.

2.2 Electrostatic Discharge (ESD) Handling Procedure



AMETEK LMS electronic instruments are manufactured to the highest quality standards. These instruments use electronic components that may be damaged by static electricity present in most work environments.

The following steps are recommended to reduce the risk of component failure due to electrostatic discharge.

- Ship and store circuit boards in anti-static bags. If an antistatic bag is not available, wrap the board in aluminum foil. Do not place boards on foam packing materials.

- Use a grounding wrist strap when installing and removing circuit boards. A grounded workstation is recommended.
- Handle circuit boards only by the edges. Do not touch components or connector pins.
- Make sure that all electrical connections are completely made and none are partial or floating. Ground all equipment to a good, earth ground.

2.3 Before You Begin

2.3.1 Site Preparation

Each Eclipse Model 706 transmitter/probe is built to match the physical specifications of the required installation. Ensure that the probe process connection is correct for the threaded or flanged mounting on the vessel where the transmitter will be placed. See Mounting, Section 2.4.

Ensure that all local, state, and federal regulations and guidelines are observed. See Wiring, Section 2.5.

Ensure that the wiring between the power supply and Eclipse transmitter is complete and correct for the type of installation. See Specifications, Section 3.6.

2.3.2 Equipment and Tools

No special equipment or tools are required to install the Eclipse transmitter. The following items are recommended:

- Open-end wrenches (or adjustable wrench) to fit the process connection size and type.
  - Coaxial probe: 1½" (38 mm)
  - Single Rod probe: 1⅞" (47 mm)
  - Transmitter 1½" (38 mm)

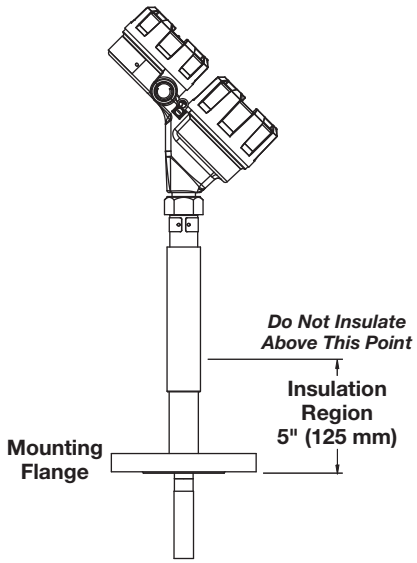
  A torque wrench is highly desirable.
- Flat-blade screwdriver
- Cable cutter and ⅜" hex wrench (for flexible cable probes only)
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA minimum

2.3.3 Operational Considerations

Operating specifications vary based on probe model number. See Specifications, Section 3.6.

2.4 Mounting

An Eclipse Model 706 GWR probe can be mounted on to a tank using a variety of process connections. Generally, either a threaded or flanged connection is used. For information about the sizes and types of connections available, see Probe Model Numbers, Section 3.7.2.



Model 7yS Probe

NOTE: Do not place insulating material around any part of the Eclipse Model 706 transmitter as this may cause excessive heat buildup. The figure at left shows an example of properly installed insulation. Insulation is critical in high temperature applications where condensation can occur at the top of the probe.

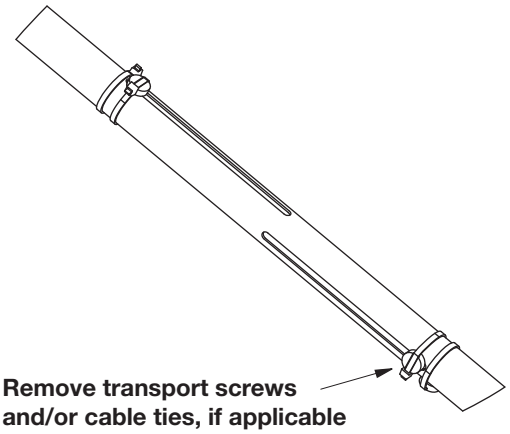
Ensure that all mounting connections are properly in place on the tank before installing the probe.

Compare the nameplate on the probe and transmitter with the product information to confirm that the Eclipse probe is correct for the intended installation.

WARNING! Overfill-capable probes such as the Model 7yD, 7yG, 7yJ, 7yL, 7yP, or 7yT should be used for all Safety Shutdown/Overfill applications.

The Model 706 transmitter, when used with an overfill coaxial or caged probe, is capable of measuring true liquid level to within specification all the way up to the face of the flange or NPT connection. This is a very unique advantage as compared to other Guided Wave Radar (GWR) devices that may infer level at the top of the probe when signals are lost or uncertain. Refer to Section 3.2.6 for additional information on overfill capability.

All other Eclipse probes should be installed so the maximum overfill level is a minimum of 6" (150 mm) below the flange or NPT connection. This may include utilizing a nozzle or spool piece to raise the probe. Consult factory to ensure proper installation and operation.



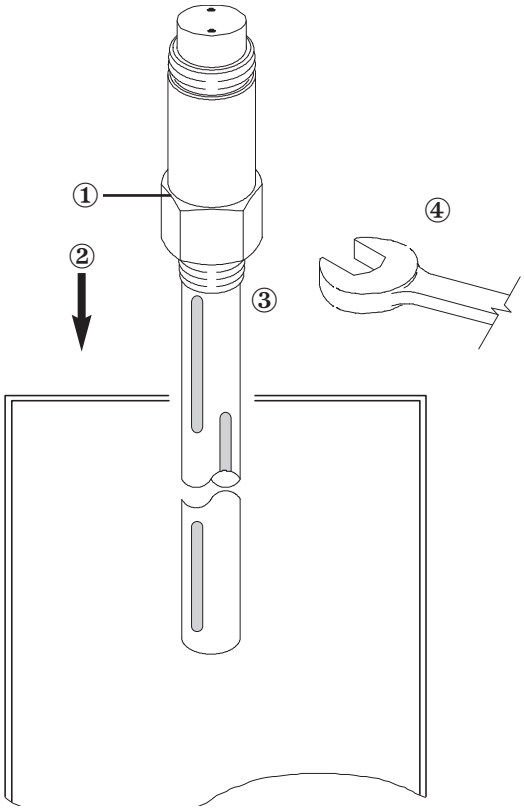
WARNING! Do not disassemble probe when in service and under pressure.

NOTE: Models 7yD, 7yJ, 7yL, 7yM, 7yN, 7yP and 7yS High Temperature/High Pressure probes (containing a glass ceramic alloy process seal) should be handled with extra care. Only handle these probes by the flanges or NPT connections. Remove transport hardware as shown at left.

2.4.1 Installing a Coaxial Probe (Models 7yD, 7yP, 7yS, and 7yT)

Before installing, ensure that:

- The model and serial numbers shown on the nameplates of the Eclipse probe and transmitter are identical. For optimal performance (and correlation to the Calibration Certificate included with all units), transmitters and probes should be installed as a matched set.



NOTE: For applications using the Model 7yS Steam Probe, it is mandatory to keep the transmitter and probe matched as a set. Refer to Section 3.2.5 for additional information regarding saturated steam applications.

- Probe has adequate room for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, and viscosity are within the probe specifications for the installation. See Specifications, Section 3.6.

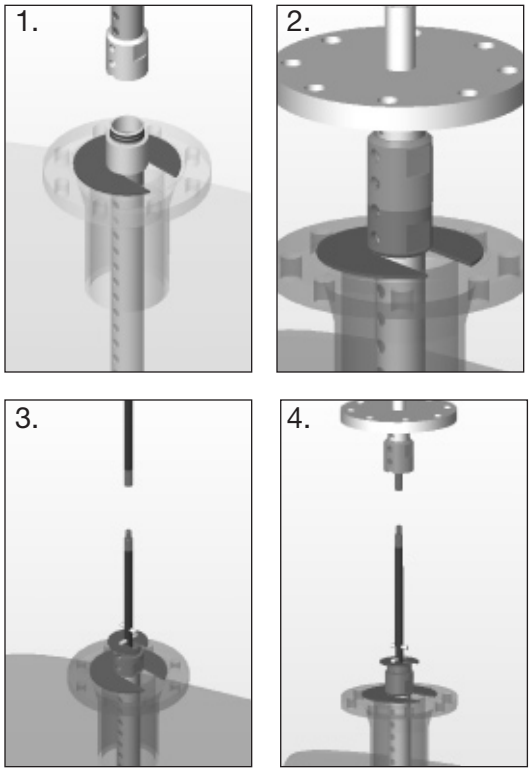
2.4.1.1 To install a coaxial probe:

1. Ensure that the process connection is the correct threaded or flanged mounting.
2. Carefully place the probe into the vessel. Properly align the gasket on flanged installations.
3. Align the probe process connection with the threaded or flanged mounting on the vessel.
4. For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.

NOTE: If the transmitter is to be installed at a later time, do not remove the protective cap from the probe.

NOTE: Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® o-ring.

2.4.2 Installing a Segmented Coaxial Probe



1. Use the large installation plate with the 1.88" slot (provided with the order) to hold the lower section of the outer tube. Using two 2" wrenches, tighten couplings. Threads will be self-locking.

   Repeat for the second outer tube section.
2. Use the smaller installation plate to hold the lower section of the extension shaft, resting one of the spacers on the plate. Using two ½" wrenches, tighten extension shaft coupling. Secure with set screws.

   Repeat for the second extension shaft section.
3. Using two ½" wrenches, attach the middle extension shaft segment to the top segment (built into the probe head). The flange gasket should be in place before assembling this joint. It may be taped to the probe flange to hold it out of the way.
4. Remove the smaller installation plate from the extension shaft and assemble the middle outer tube segment to the coupling on the probe head. Remove the large installation plate, and assemble the flanges.

2.4.3 Installing a Caged Probe Models 7yG, 7yL and 7yJ

Before installing, ensure that the:

- The model and serial numbers shown on the nameplates of the Eclipse probe and transmitter are identical. For optimal performance (and correlation to the Calibration Certificate included with all units), transmitters and probes should be installed as a matched set.
- Probe has adequate room for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, and viscosity are within the probe specifications for the installation. See Specifications, Section 3.6.

NOTES: Model 7yL and 7yJ probes (High Pressure/High Temperature probes (containing a glass ceramic alloy process seal) should be handled with extra care. Only handle these probes by the flanges or NPT connection. Do not lift probes by the shaft.

If using a segmented caged probe, ensure that all pieces are assembled and connected before installation.

2.4.3.1 To install a caged probe:

1. Ensure that the process connection is the correct flanged mounting.
2. Carefully place the probe into the vessel. Properly align the gasket on flanged installations.

NOTE: A metallic gasket must be used to ensure an adequate electrical connection between the probe flange and the cage (chamber). This connection is critical to obtain true overfill performance.

3. Align the probe process connection flanged mounting on the cage.
4. Tighten flange bolts.

NOTES: If the transmitter is to be installed at a later time, do not remove the protective cap from the probe.

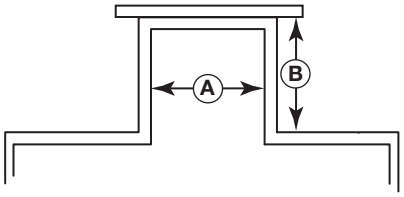
Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® o-ring.

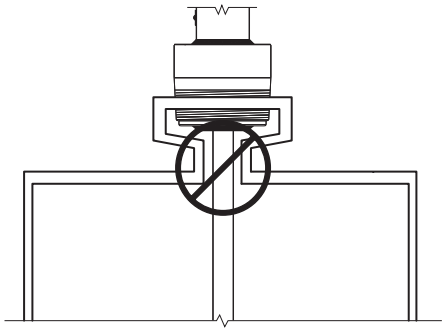
2.4.4 Installing a Single Rod Probe
Rigid Models 7yF, 7yG, 7yJ, 7yL, 7yM and 7yN
Flexible Models 7y1, 7y2, 7y3 and 7y6

Before installing, ensure that the:

- The model and serial numbers shown on the nameplates of the Eclipse probe and transmitter are identical. For optimal performance (and correlation to the Calibration Certificate included with all units), transmitters and probes should be installed as a matched set.
- Probe has adequate room for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, and viscosity are within the probe specifications for the installation. See Specifications, Section 3.6.

For standard Non-Overfill-Capable Single Rod probes installed directly into a vessel:

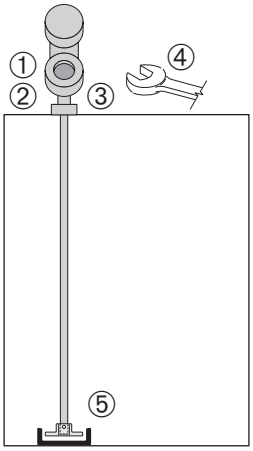




NOTE: If using a removable rod, ensure that all pieces are assembled and connected before installation.

1. Ensure that the nozzle does not restrict performance by ensuring the following:
   - Nozzle is > 2" (50mm) diameter.
   - Ratio of Diameter: Length (A:B) is 1:1 or greater; any ratio <1:1 (e.g., a 2"× 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC RANGE adjustment.
2. No pipe reducers (restrictions) are used.
3. Probe is kept away from conductive objects to ensure proper performance.
   - See Probe Clearance Table below. A lower gain (increase in DIELECTRIC RANGE setting) may be necessary to ignore certain objects
   - This table is only a recommendation. These distances can be improved by optimizing the transmitter configuration with PACT*ware*™.

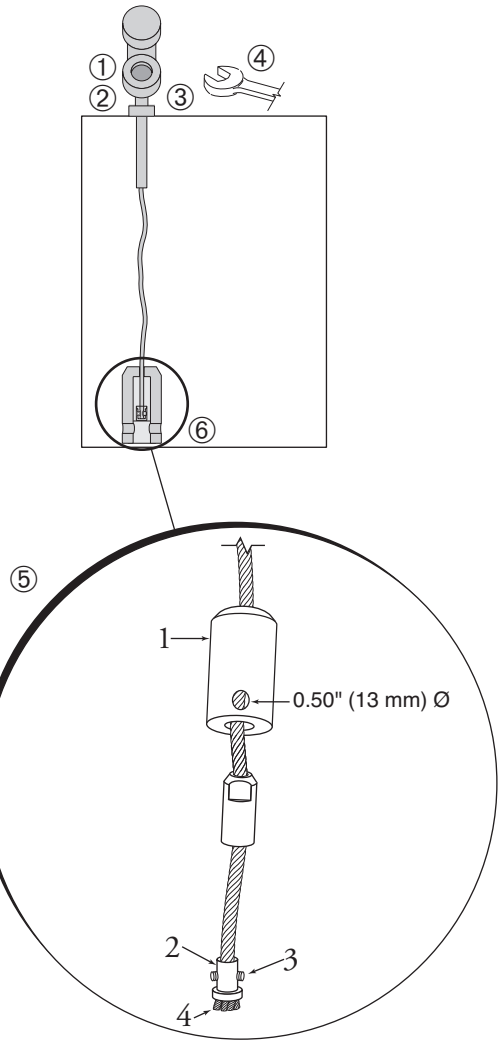
Distance to Probe	Acceptable Objects
<6" (15 cm)	Continuous, smooth, parallel conductive surface, for example a metal tank wall; important that probe does not touch wall
>6" (15 cm)	<1" (25 mm) diameter pipe and beams, ladder rungs
>12" (30 cm)	<3" (75 mm) diameter pipe and beams, concrete walls
>18" (46 cm)	All remaining objects



2.4.4.1 To install a rigid single rod probe:

1. Ensure that the process connection is at least 1" NPT or a flanged mounting.
2. Carefully place the probe into the vessel. Align the gasket on flanged installations.
3. Align the probe process connection with the threaded or flanged mounting on the vessel.
4. For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
5. When mounted directly into vessels, the probe can be stabilized by placing the tip of the probe into a non-metallic cup or bracket at the bottom of the probe.

   A bottom spacer option is offered for mounting into a metallic cup or bracket or for centering within a pipe/chamber. Refer to Replacement Parts, Section 3.8 for additional information.



NOTE: If the transmitter is to be installed at a later time, do not remove the protective cap from the probe. Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® O-ring.

2.4.4.2 To install a flexible single rod probe for liquids:

1. Make sure the process connection is at least 1" NPT or a flanged mounting.
2. Carefully place the probe into the vessel. Align the gasket on flanged installations.
3. Align the probe process connection with the threaded or flanged mounting on the vessel.
4. For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
5. Probe can be shortened in field:
   a. Raise TFE weight (1) exposing securing device (2).
   b. Loosen both #10–32 set screws (3) using 3⁄32" hex wrench and remove securing device.
   c. Cut and remove needed cable (4) length.
   d. Reattach securing device and tighten screws.
   e. Enter new probe length (in the appropriate units) into the transmitter.
6. Probe can be attached to the tank bottom using the 0.50" (13 mm) hole provided in the TFE weight. Cable tension should not exceed 50 lbs (23 Kgs).

2.4.4.3 To install a flexible single rod probe for solids:

The Model 7y2 Single Flexible Bulk Solids probe is designed for a 3000 lb. (1360 kg) pull-down force for use in applications such as sand, plastic pellets and grains. It is offered with a maximum 100 foot (30.5 meter) probe length.

Model 7y2 Single Rod — dielectric ≥4 probe length dependent.

Applications

- Salts: Dielectric constant 4.0–7.0
- Metallic powder, coal dust: Dielectric constant >7

NOTE: Contact the factory for those applications requiring additional pull down forces such as cement, heavy gravel, etc.

Mounting recommendations

- To reduce forces, utilize the standard 5 lb. (2.3 kg) weight at the bottom of the probe instead of securing the probe to the vessel.
- Mount the probe at least 12 inches (30 cm) from the wall. Ideal location is ¼ to ⅙ the diameter to average the angle of repose.
- A metal flange must be used when mounting on plastic vessels.

1. Ensure the process connection is at least 2" NPT or a flanged mounting.
2. Carefully place the probe into the vessel. Align the gasket on flanged installations.
3. Align the probe process connection with the threaded or flanged mounting on the vessel.
4. For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
5. Probe can be shortened in field:
6. a. Loosen and remove the two cable clamps.

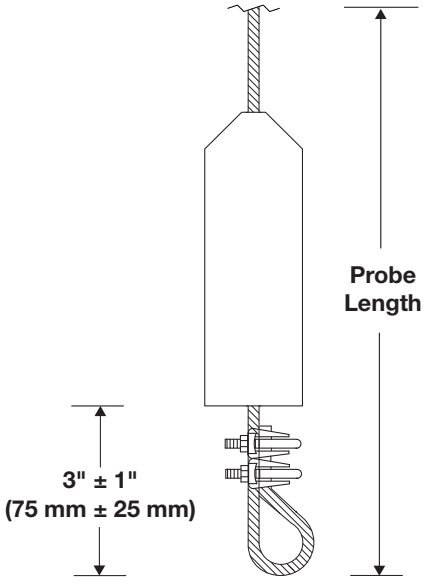
   b. Slide the weight off of the probe.

   c. Cut the cable to the required length plus 6.5 inches (165 mm).

   d. Slide the weight back on to the probe.

   e. Reinstall the two cable clamps and tighten.

   f. Enter the new probe length (in the appropriate level units) into the transmitter.



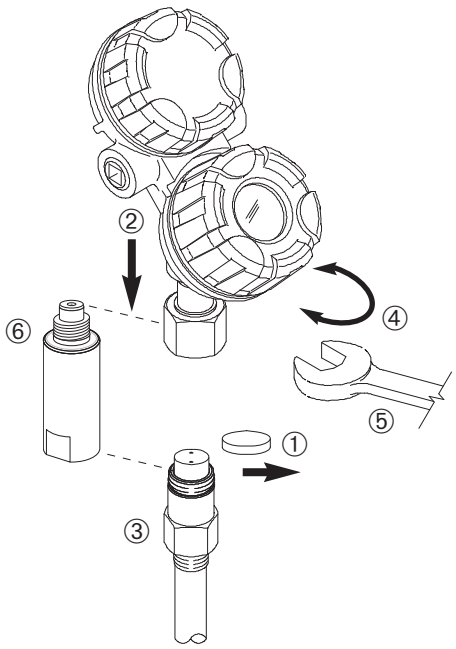
Model 7y2 Single Rod Bulk Solids Probe

2.4.5 Installing the Eclipse Model 706 Transmitter

The transmitter can be ordered for installation in three configurations;

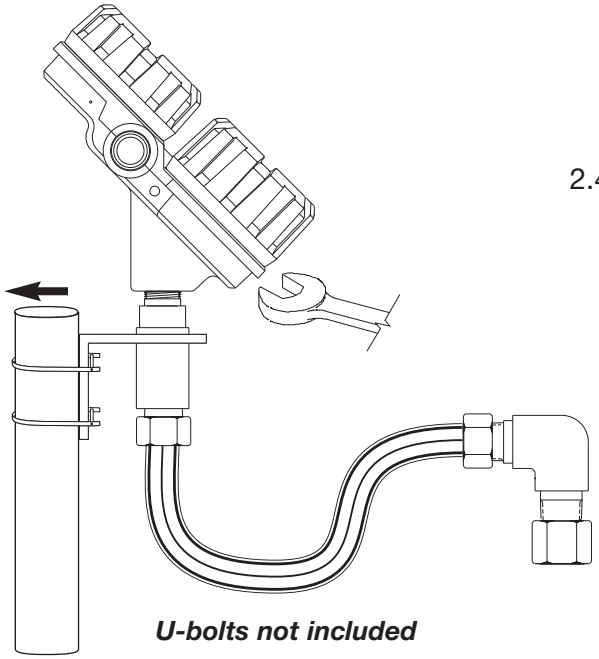
1) As an Integral version, mounted directly on to the probe.
2) As a Remote version, with the transmitter separated from the probe by a distance of 3 feet (84 cm).
3) As a Remote version, with the transmitter separated from the probe by a distance of 12 feet (366 cm).

NOTE Due to their extra weight, remote mounted transmitter Model Number 706-5xxx-x2x is recommended for:
- All applications utilizing the cast 316 SS enclosure
- Those applications having potential vibration



2.4.5.1 Integral Mount

1. Remove the protective plastic cap from the top of the probe. Store the cap in a safe place in case the transmitter has to be removed later.
2. Place the transmitter on the probe. Do not allow the gold pin in the high frequency connector or the gold socket on the probe to get dirty.
3. Align the universal connection at the base of the transmitter housing with the top of the probe. Only hand-tighten the connection at this time.
4. Rotate the transmitter to face the most convenient direction for wiring, configuration, and viewing.
5. When the transmitter is facing the desired direction, use a 1½" wrench to tighten the universal connection on the transmitter to 45 ft-lbs (60 Nm). A torque wrench is highly recommended. This is a critical connection. DO NOT LEAVE HAND-TIGHT.
6. If available, install optional adapter (for use with Model 705 probes. As this is a critical connection, a torque wrench is highly recommended to obtain 45 ft-lbs (60 Nm).



2.4.5.2 Remote Mount

1. Mount the transmitter/remote bracket as an assembly within 33" or 144" (84 or 366 cm) of the probe. DO NOT REMOVE TRANSMITTER OR REMOTE CABLE FROM THE MOUNTING BRACKET.
2. Remove the protective plastic cap from the top of the probe. Store the cap in a safe place in case the transmitter has to be removed later.
3. Align the universal connection at the end of the remote assembly with the top of the probe. Using a 1½" wrench, tighten the universal connection on the transmitter to 45 ft-lbs (60 Nm). A torque wrench is highly recommended. This is a critical connection. DO NOT LEAVE HAND-TIGHT.

2.5 Wiring

Caution: HART versions of the Eclipse Model 706 transmitter operate at voltages of 11–36 VDC, FOUNDATION fieldbus versions operate at 9–17.5 VDC, and Modbus versions operate at 8–30 VDC. Higher voltages will damage the transmitter.

Wiring connections between the power supply and the Eclipse Model 706 transmitter should be made using 18–22 AWG shielded twisted pair instrument cable. Connections are made to the terminal strip and the ground connections within the top enclosure compartment.

The directions for wiring the Eclipse transmitter depend on the application:

- General Purpose or Non-Incendive (Cl I, Div. 2)
- Intrinsically Safe
- Explosion Proof

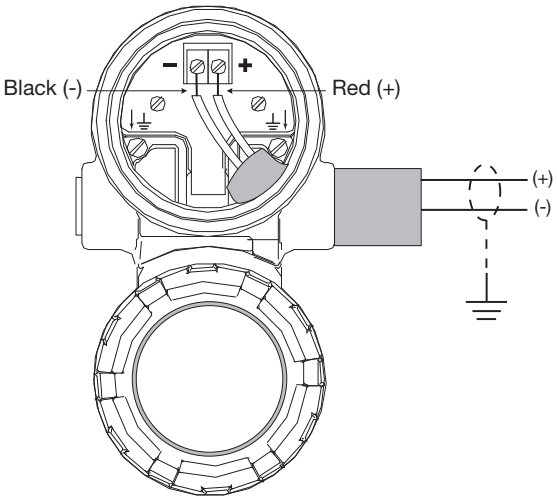
WARNING! Explosion hazard. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

2.5.1 General Purpose or Non-Incendive (Cl I, Div. 2)

A general purpose installation does not have flammable media present.

Areas rated Non-Incendive (Cl I, Div. 2) have flammable media present only under abnormal conditions.

No special electrical connections are required.



Wiring Diagram

Caution: If flammable media is contained in the vessel, the transmitter must be installed per Class I, Div 1 standards of area classification.

To install General Purpose or Non-Incendive wiring:

1. Remove the cover from the wiring compartment of the transmitter. Install the conduit plug in the unused opening and use PTFE tape/sealant to ensure a liquid-tight connection.
2. Install a conduit fitting and pull the supply wires.
3. Connect shield to an earth ground at power supply.
4. Connect an earth ground wire to the nearest green ground screw (not shown in illustration).
5. Connect the positive supply wire to the (+) terminal and the negative supply wire to the (-) terminal. (The recommended torque on terminal block screws is 7–10 in-lbs.)
6. Replace and tighten the cover to the transmitter wiring compartment before applying power.

2.5.2 Intrinsically Safe

An Intrinsically Safe (IS) installation potentially has flammable media present. An approved IS barrier must be installed in the non-hazardous (safe) area to limit the available energy out to the hazardous area.

See Agency Drawing – Intrinsically Safe Installation, Section 3.5.3.

To install Intrinsically Safe wiring:

1. Ensure that the IS barrier is properly installed in the safe area (refer to local plant or facility procedures). Complete the wiring from the power supply to the barrier and from the barrier to the Eclipse transmitter.
2. Remove the cover from the wiring compartment of the transmitter. Install the conduit plug in the unused opening and use PTFE tape/sealant to ensure a liquid-tight connection.
3. Install a conduit fitting and pull the supply wires.
4. Connect shield to an earth ground at power supply.
5. Connect an earth ground wire to the nearest green ground screw (not shown in illustration).
6. Connect the positive supply wire to the (+) terminal and the negative supply wire to the (-) terminal. (The recommended torque on terminal block screws is 7–10 in-lbs. (0.8–1.1 Nm)).
7. Replace and tighten the cover to the wiring compartment of the transmitter before applying power.

2.5.3 Explosion Proof

Explosion Proof (also referred to as XP or flameproof) is another method of designing equipment for installation into hazardous areas. A hazardous location is an area in which flammable gases or vapors are (or may be) present in the air in quantities sufficient to produce explosive or ignitable mixtures.

The wiring for the transmitter must be contained in Explosion Proof conduit extending into the safe area.

- Due to the specialized design of the Eclipse transmitter, no Explosion Proof conduit fitting (EY seal) is required within 18" (46 cm) of the transmitter.
- An Explosion Proof conduit fitting (EY seal) is required between the hazardous and safe areas. See Agency Specifications, Section 3.5.

To install an Explosion Proof transmitter:

1. Install Explosion Proof conduit from the safe area to the conduit connection of the Eclipse transmitter (refer to local plant or facility procedures).
2. Remove the cover from the wiring compartment of the transmitter.
3. Connect shield to an earth ground at the power supply.
4. Connect an earth ground wire to the nearest green ground screw per local electrical code (not shown in illustration).
5. Connect the positive supply wire to the (+) terminal and the negative supply wire to the (-) terminal. (The recommended torque on terminal block screws is 7–10 in-lbs. (0.8–1.1 Nm)).
6. Replace and tighten the cover to the wiring compartment of the transmitter before applying power.

2.6 Configuration

Although the Eclipse Model 706 transmitter can be delivered pre-configured from the factory, it can also be easily reconfigured in the shop or at the installation using the local LCD/Keypad or PACT*ware*/DTM. Bench configuration provides a convenient and efficient way to set up the transmitter before going to the tank site to complete the installation.

Before configuring any transmitter, collect all operating parameters information (refer to Section 1.1.2).

Apply power to the transmitter and follow the step-by-step procedures below for the menu-driven transmitter display. Refer to Sections 2.6.2 and 2.6.4.

Information on configuring the transmitter using a HART communicator is given in Section 2.7, Configuration Using HART.

Refer to I/O manuals:

- 57-646 for information on FOUNDATION fieldbus output.
- 57-658 for information on PROFIBUS PA output.
- 41-621 for information on Modbus output.

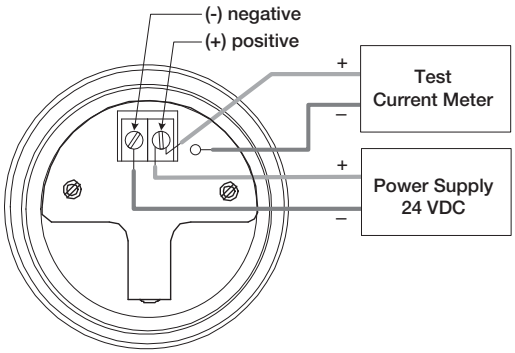
2.6.1 Bench Configuration

The Eclipse Model 706 transmitter can be easily configured at a test bench by connecting a standard 24 VDC power supply directly to the transmitter terminals as shown in the accompanying diagram. An optional digital multimeter is shown in the event that mA current measurements are desired.

NOTE: Current measurements taken at these test points are an approximate value. Accurate current readings should be taken with the digital multimeter directly in series with the loop.

NOTE: When using a HART communicator for configuration, a minimum 250-ohm line load resistance is required. Refer to your HART communicator manual for additional information.

NOTE: The transmitter can be configured without the probe. Disregard the “No Probe” diagnostic indicator that will appear.



G.P./I.S./Explosion Proof Model

2.6.2 Menu Traversal and Data Entry

The four push buttons offer various forms of functionality for navigation and data entry.

The Model 706 user interface is hierarchical in nature, best described as a tree structure. Each level in the tree contains one or more items. Items are either menu labels or parameter names.

- Menu labels are presented in all capital letters
- Parameters are capital words



2.6.2.1 Navigating the Menu

⇧ **UP** moves to the previous item in the menu branch.

⇩ **DOWN** moves to the next item in the menu branch.

⇦ **BACK** moves back one level to the previous (higher) branch item.

⇨ **ENTER** enters into the lower level branch or switches to the entry mode. Holding the ENTER down on any highlighted menu name or parameter will show help text for that item.

2.6.2.2 Data Selection

This method is used for selecting configuration data from a specific list.

⇧ **UP** and ⇩ **DOWN** to navigate the menu and highlight the item of interest.

⇨ **ENTER** allows modification of that selection.

⇧ **UP** and ⇩ **DOWN** to choose new data selection.

⇨ **ENTER** to confirm selection.

Use ⇦ **BACK** (Escape) key at any time to abort the procedure and escape to previous branch item.

2.6.2.3 Entering Numeric Data Using Digit Entry

This method is used to input numeric data, e.g., Probe Length, set 4mA and set 20mA.

Push button		Keystroke Action
	Up	Moves up to the next highest digit (0,1,2,3,....,9 or decimal point). If held down the digits scroll until the push button is released.
	Down	Moves up to the next lowest digit (0,1,2,3,....,9 or decimal point). If held down the digits scroll until the push button is released.
	Back	Moves the cursor to the left and deletes a digit. If the cursor is already at the leftmost position, then the screen is exited without changing the previously saved value.
	Enter	Moves the cursor to the right. If the cursor is located at a blank character position, the new value is saved.

All numeric values are left-justified, and new values are entered from left to right. A decimal point can be entered after the first digit is entered, such that .9 is entered as 0.9.

Some configuration parameters can have a negative value. In this case, the leftmost position is reversed for the sign (either "-" for a negative value, or "+" for a positive value).

2.6.2.4 Entering Numeric Data Using Increment/Decrement

Use this method to input the following data into parameters such as Damping and Failure Alarm.

Push button		Keystroke Action
	Up	Increments the displayed value. If held down the digits scroll until the push button is released. Depending on which screen is being revised, the increment amount may increase by a factor of 10 after the value has been incremented 10 times.
	Down	Decrements the displayed value. If held down the digits scroll until the push button is released. Depending on which screen is being revised, the decrement amount may increase by a factor of 10 after the value has been decremented 10 times.
	Back	Returns to the previous menu without changing the original value, which is immediately redisplayed.
	Enter	Accepts the displayed value and returns to the previous menu.

2.6.2.5 Entering Character Data

This method is used for parameters requiring alphanumeric character entry, such as for entering tags, etc.

General Menu Notes:

Push button		Keystroke Action
	Up	Moves to the previous character (Z...Y...X...W). If held down, the characters scroll until the push button is released.
	Down	Moves to the next item character (A...B...C...D). If held down, the characters scroll until the push button is released.
	Back	Moves the cursor back to the left. If the cursor is already at the leftmost position, then the screen is exited without changing the original tag characters.
	Enter	Moves the cursor forward to the right. If the cursor is at the rightmost position, then the new tag is saved.

2.6.3 Password Protection

The Eclipse Model 706 transmitter has three levels of password protection to restrict access to certain portions of the menu structure that affect the operation of the system. The user password can be changed to any numerical value up to 59999. When the transmitter is programmed for password protection, a password is required whenever configuration values are changed.

User Password

The User Password allows the customer to limit access to the basic configuration parameters.

The default User Password installed in the transmitter at the factory is 0. With a password of 0, the transmitter is no longer password protected and any value in the basic user menus can be adjusted without entering a confirming password.

NOTE: If a User Password is not known or has been misplaced, the menu item New Password in the DEVICE SETUP/ADVANCED CONFIG menu displays an encrypted value representing the present password. Contact Technical Support with this encrypted password to retrieve the original User Password.

Advanced Password

Certain portions of the menu structure that contain more advanced parameters are further protected by an Advanced Password.

This password will be provided, when necessary, by Factory technical support.

Factory Password

Calibration-related and other factory settings are further protected by a Factory Password.

2.6.4 Model 706 Menu: Step-By-Step Procedure

The following tables provide a complete explanation of the software menus displayed by the Eclipse transmitter. The menu layout is similar between the local Keypad/LCD interface, the DD, and the DTM.

Use these tables as a step-by-step guide to configure the transmitter based on the desired measurement type from the following selections:

- **Level Only**
- **Interface & Level**
- **Interface & Volume**
- **Level & Volume**
- **Flow**



HOME SCREEN

The Home Screen consists of a “slide show” sequence of Measured Values screens which are rotated at 2-second intervals. Each Home Measured Value screen can present up to four information items:

- **HART® Tag**
- **Measured Value**
  Label, Numerical Value, Units
- **Status**
  Will be displayed as text or optionally with NAMUR NE 107 symbol
- **Primary Value Bar Graph** (shown in %)

The Home Screen presentation can be customized by viewing or hiding some of these items. See DISPLAY CONFIG under the DEVICE SETUP menu in Section 2.6.5 — Configuration Menu.

At left is an example of a Home Screen for a Model 706 configured for a Level Only application.



MAIN MENU

Pressing any key on the Home Screen will present the Main Menu, consisting of three basic menu labels shown in all capital letters.

- **DEVICE SETUP**
- **DIAGNOSTICS**
- **MEASURED VALUES**

As shown, the reverse video represents a cursor identifying the selected item, which will appear in reverse video on the LCD. The actions of the keys at this point are:

Push button		Keystroke Action
↑	Up	No action as the cursor is already at the first item in the MAIN MENU
↓	Down	Moves the cursor to DIAGNOSTICS
←	Back	Moves back to HOME SCREEN, the level above MAIN MENU
→	Enter	Presents the selected item, DEVICE SETUP

NOTES:
1. Items and parameters that are shown in lower level menus will depend on the Measurement Type chosen. Those parameter not applicable to the present Measurement Type will be hidden.
2. Holding down the Enter key when the cursor is highlighted over a parameter or menu will provide additional information about that item.



DEVICE SETUP

Choosing DEVICE SETUP from the MAIN MENU will result in an LCD presentation as shown at left.

The small down arrow shown at the right hand side of the screen is the indication that more items are available below and can be accessed by pressing the DOWN key.

Section 2.6.5 shows the entire tree menu for the Model 706 DEVICE SETUP Menu.

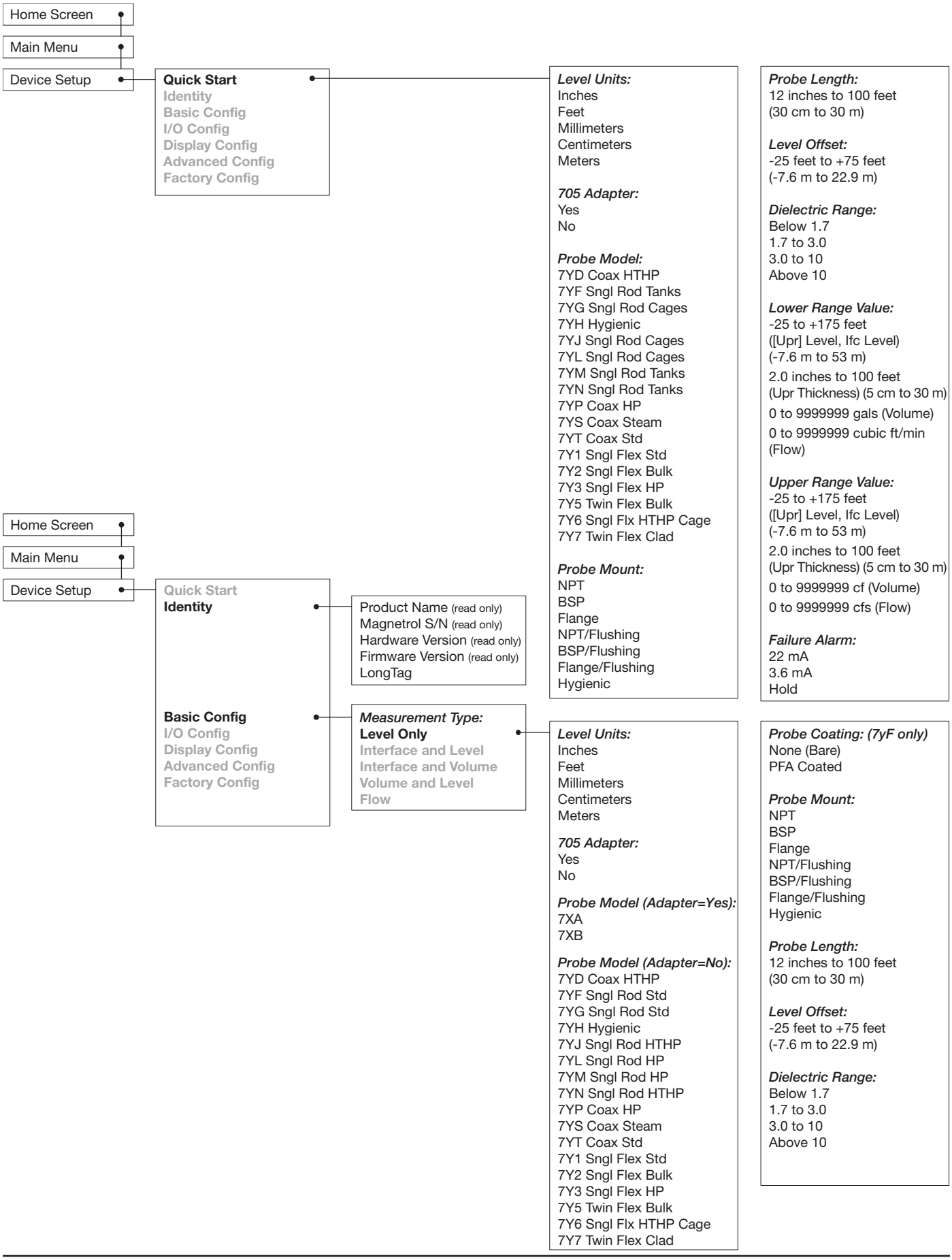
DIAGNOSTICS

Refer to Section 3.3.4

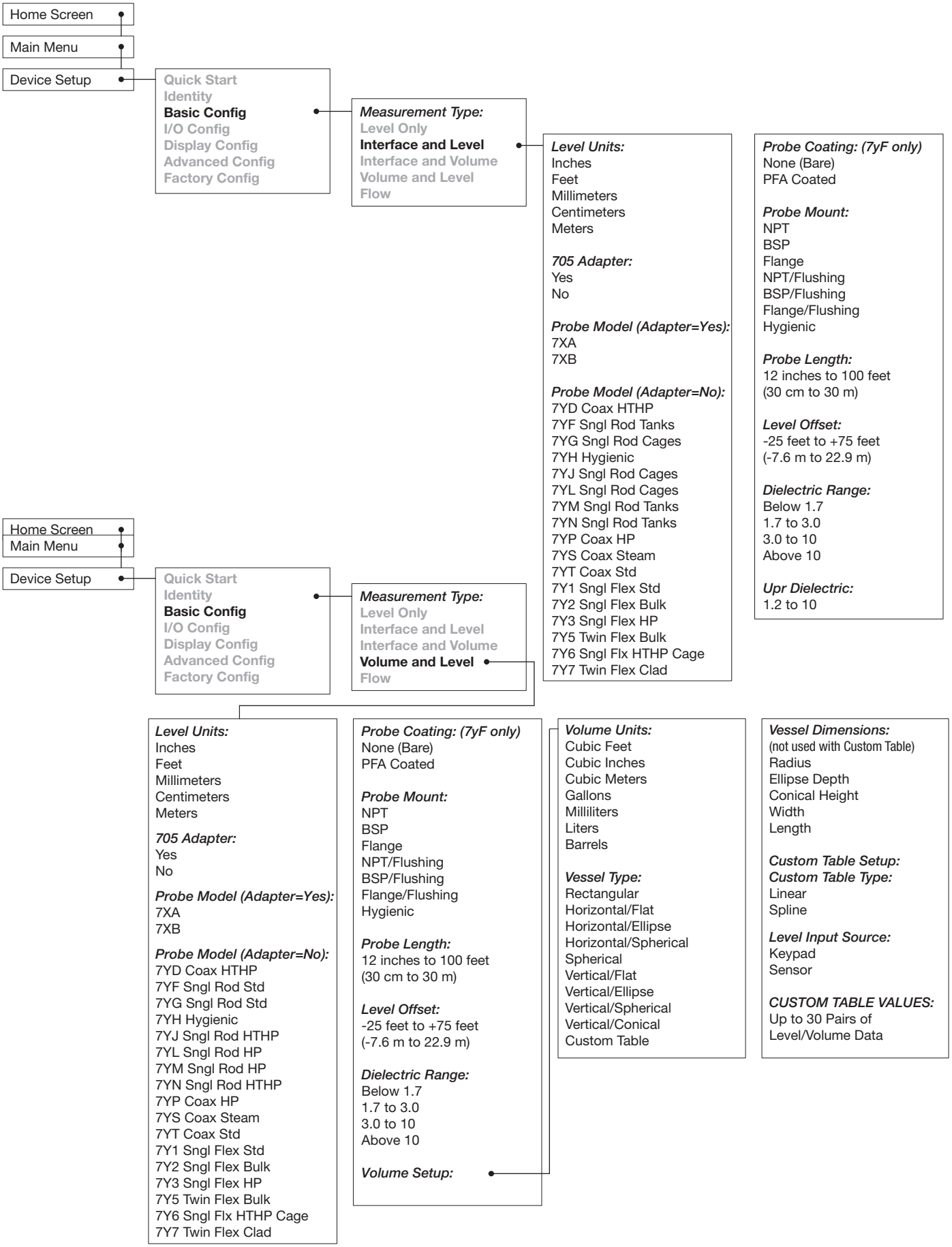
MEASURED VALUES

Allows the user to scroll through all of the available measured values for the measurement type chosen.

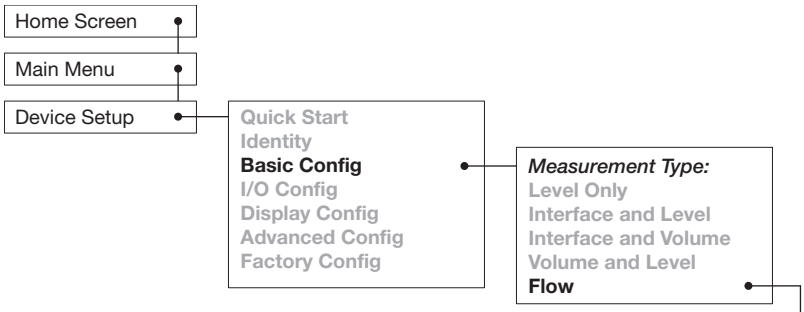
2.6.5 Model 706 Configuration Menu — Device Setup



2.6.5 Model 706 Configuration Menu — Device Setup



2.6.5 Model 706 Configuration Menu — Device Setup



Level Units:
Inches
Feet
Millimeters
Centimeters
Meters

705 Adapter:
Yes
No

Probe Model (Adapter=Yes):
7XA
7XB

Probe Model (Adapter=No):
7YD Coax HTHP
7YF Sngl Rod Std
7YG Sngl Rod Std
7YH Hygienic
7YJ Sngl Rod HTHP
7YL Sngl Rod HP
7YM Sngl Rod HP
7YN Sngl Rod HTHP
7YP Coax HP
7YS Coax Steam
7YT Coax Std
7Y1 Sngl Flex Std
7Y2 Sngl Flex Bulk
7Y3 Sngl Flex HP
7Y5 Twin Flex Bulk
7Y6 Sngl Flx HTHP Cage
7Y7 Twin Flex Clad

Probe Mount:
NPT
BSP
Flange
NPT/Flushing
BSP/Flushing
Flange/Flushing
Hygienic

Probe Coating:
None (Bare)
PFA Coated

Probe Length:
12 inches to 100 feet
(30 cm to 30 m)

Level Offset:
-25 feet to +75 feet
(-7.6 m to 22.9 m)

Dielectric Range:
Below 1.7
1.7 to 3.0
3.0 to 10
Above 10

Flow Setup:

Flow Units:
Cubic Ft/Second
Cubic Ft/Minute
Cubic Ft/Hour
Gallons/Minute
Gallons/Hour
Mil Gallons/Day
Liters/Second
Liters/Minute
Liters/Hour
Cubic Meters/Hour

Flow Element:
Palmer-Bowlus Flume
Flume Channel Width:
4 inches
6 inches
8 inches
10 inches
12 inches
15 inches
18 inches
21 inches
24 inches
27 inches
30 inches

Parshall Flume
Flume Channel Width:
1 inch
2 inches
3 inches
6 inches
9 inches
12 inches
18 inches
24 inches
36 inches
48 inches
60 inches
72 inches
96 inches
120 inches
144 inches

V-notch Weir
V-notch Weir Angle:
22.5°
30°
45°
60°
90°
120°

Rect Weir with Ends
0 to 215.0 feet
(0 to 65 m)

Rect Weir w/o Ends
0 to 215.0 feet
(0 to 65 m)

Cipolletti Weir
0 to 215.0 feet
(0 to 65 m)

Generic Equation
K
L
C
n

Custom Table
Custom Table Type:
Linear
Spline

CUSTOM TABLE VALUES:
Up to 30 Pairs of
Head/Flow Data

Reference Distance:
11.8 inches to 100 feet
(30 cm to 30 m)

Maximum Head
The *Maximum Head* value can be revised depending on the value of the *Reference Distance*, or for end user preference.

Maximum Flow
(calculated, read only)

Low Flow Cutoff:
0 to 9999999 cubic ft/min

TOTALIZER SETUP:
Units:
Cubic Feet
Gallons
Mil Gallons
Liters
Mil Liters
Cubic Meters

NON-RESET TOTALIZER:
Multiplier:
1
10
100
1,000
10,000
100,000

Value (read only)
RunTime (read only)

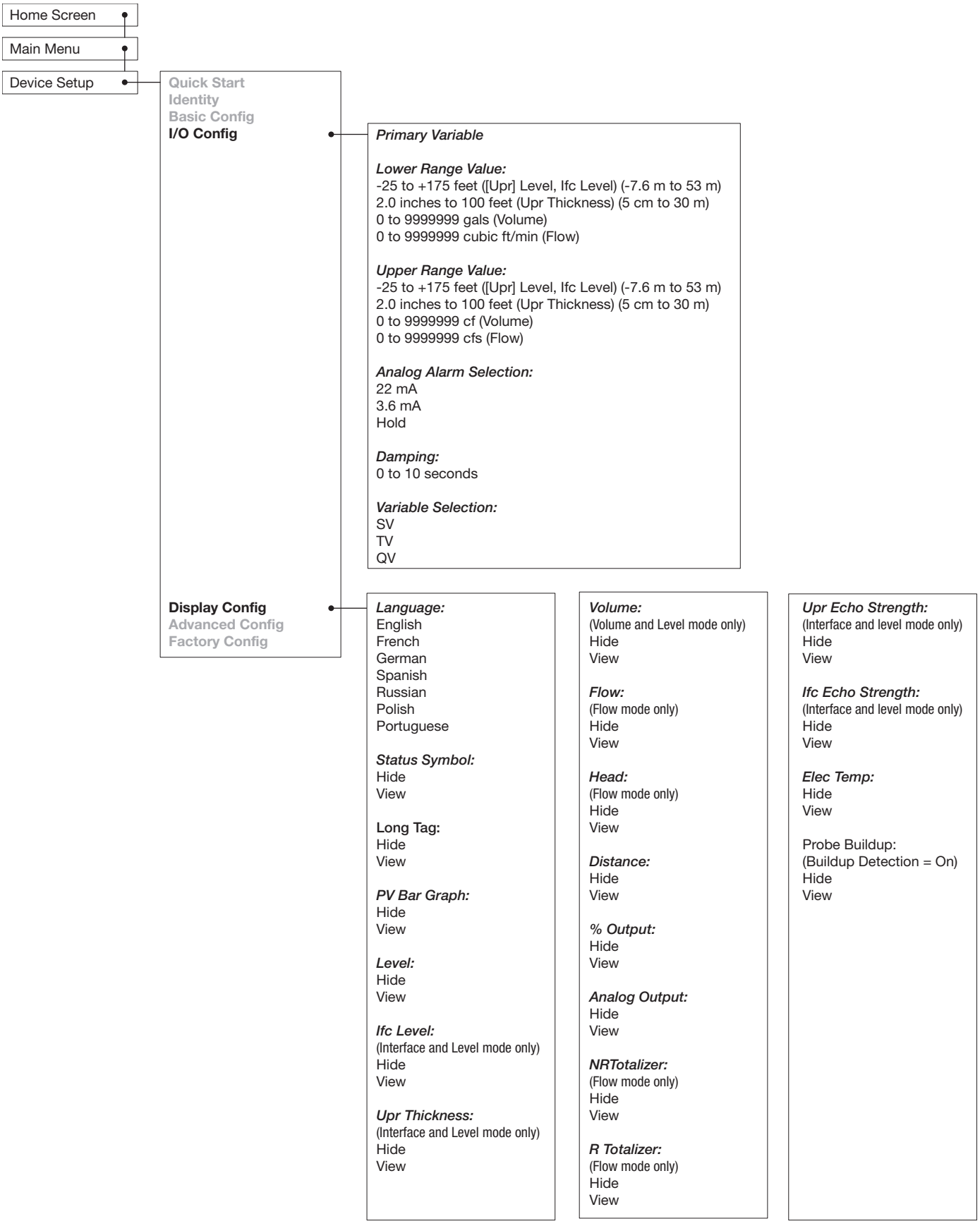
RESETTABLE TOTALIZER:
Mode:
Disabled
Enabled

Multiplier:
1
10
100
1,000
10,000
100,000

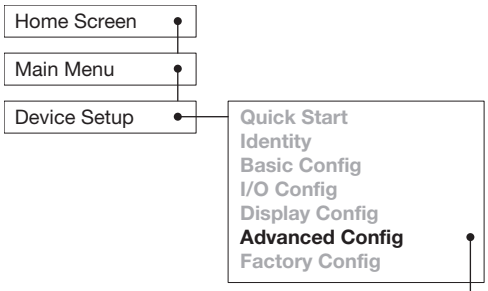
Value (read only)
RunTime (read only)

Reset

2.6.5 Model 706 Configuration Menu — Device Setup



2.6.5 Model 706 Configuration Menu — Device Setup



Sensitivity:
0 to 100 echo strength units

Blocking Distance:
-7.5 to +100 feet
(-2 m to 30 m)

Safety Zone Alarm:
None
3.6 mA
22 mA
Latched 3.6 mA
Latched 22 mA

Safety Zone Height:
(not used when Safety Alarm is None)
2 inches to 100 feet
(5 cm to 30 m)

Reset SZ Alarm
(used when Safety Alarm is Latch 3.6 mA or Latch 22 mA)

Failure Alarm Delay:
0 to 5 seconds

Level Trim:
-2.00 to + 2.00 feet
(-0.6 m to + 0.6 m)

THRESHOLD SETTINGS
Lvl Thresh Mode:
Auto Largest
(not used with Interface and Level)
Fixed Value
Auto Upper
Sloped

Lvl Thresh Value:
0 to 100 echo strength units
Sloped Start Value
(used when Lvl Thresh Mode is Sloped)
0 to 100 echo strength units

Sloped Start Value:
(used when Lvl Thresh Mode is Sloped)

Sloped Start Distance:
(used when Lvl Thresh Mode is Sloped)

Sloped End Dist:
(used when Lvl Thresh Mode is Sloped)
25 to 100 feet
(7 to 30 m)

Auto Upper Limit:
(used when Lvl Thresh Mode is Auto Upper)

Ifc Lvl Thresh Mode:
(Interface and Level only)
Auto Largest
Fixed Value

Ifc Lvl Thresh Value:
(Interface and Level only)
0 to 100 echo strength units

EoP Thresh Mode:
Auto Largest
Fixed Value

EoP Thresh Value:
0 to 100 echo strength units

ENDofPROBE ANALYSIS:
EoP Polarity:
Positive
Negative

EoP Analysis:
(not used with Interface and Level)
Off
On

EoP Dielectric:
(not used with Interface and Level)
1.20 to 9.99

ECHO REJECTION:
View Echo Curve

REJECTION CONTROL:
Reject Curve State:
Off
Disabled
[Enabled]

Reject Curve Mode:
Level
Distance

Saved Medium

NEW REJECT CURVE:
Actual Medium
Save Reject Curve

Compensation:
None
Auto
Manual

Vapor Dielectric:
1.00 to 2.00

Max. Level Jump

HF Cable Length:
Integral
3 feet
12 feet

Buildup Detection:
Off
On

LEVEL TABLE SETUP:
Level Table Mode:
Disabled
Enabled

ANALOG OUTPUT:
HART Poll Address:
0 to 63

Analog Output Mode:
Disabled (Fixed)
Enabled (PV)
[Fixed Current Value]
4 to 20 mA

ADJUST ANALOG OUTPUT:
Adjust 4mA
Adjust 20mA

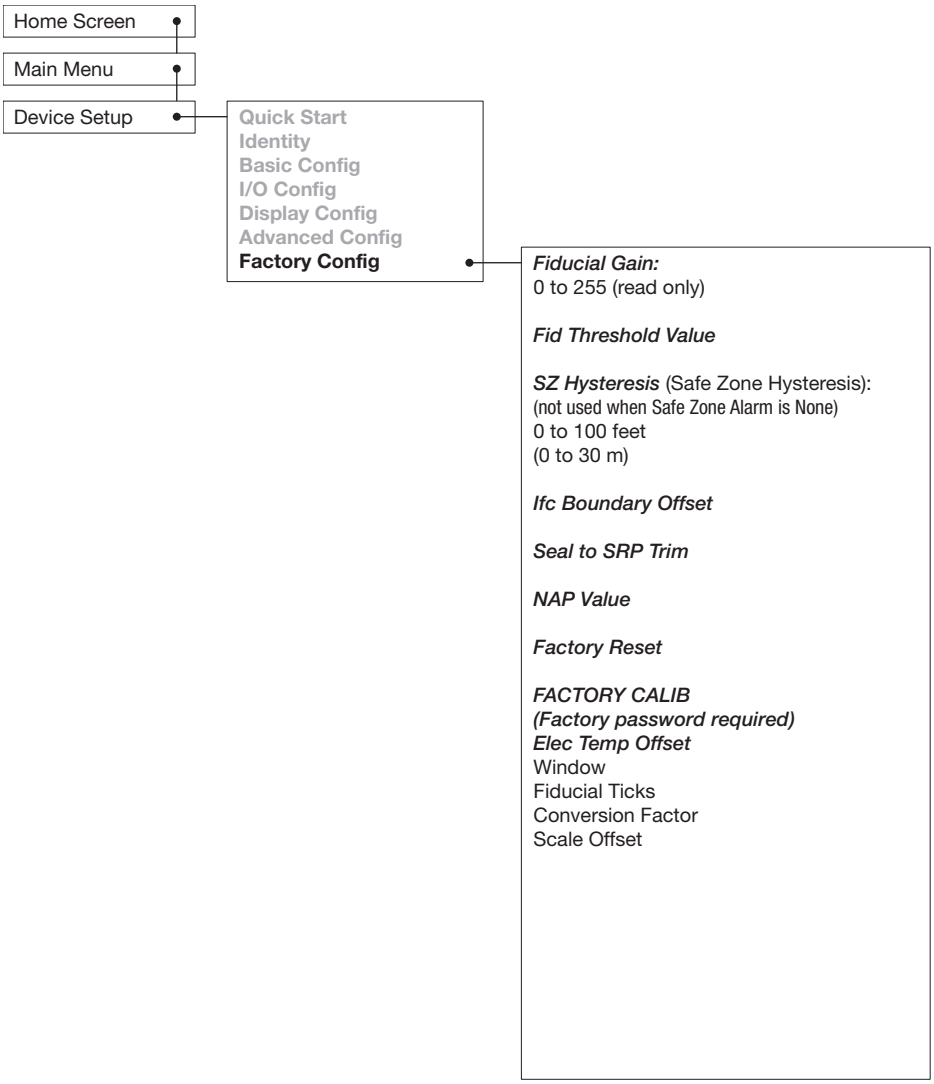
New User Password:
0 to 59,999

CONFIG CHANGED:
Indicator Mode:
Disabled
Enabled

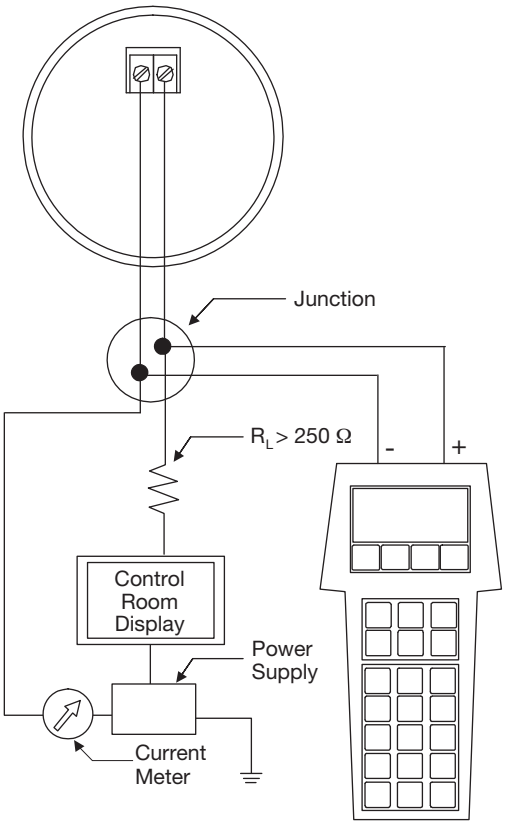
Reset Config Chngd:
Reset?
No
Yes

Reset Parameters:
No
Yes

2.6.5 Model 706 Configuration Menu — Device Setup



2.7 Configuration Using HART



A HART (Highway Addressable Remote Transducer) remote unit, such as a HART communicator, can be used to provide a communication link to the Eclipse Model 706 transmitter. When connected to the control loop, the same system measurement readings shown on the transmitter are also shown on the communicator. The communicator can also be used to configure the transmitter.

The HART communicator may need to be updated to include the Eclipse Model 706 software (Device Descriptions). Refer to your HART Communicator Manual for update instructions.

One can also access configuration parameters using PACT*ware* and the Model 706 DTM, or using the AMS with EDDL.

2.7.1 Connections

A HART communicator can be operated from a remote location by connecting it to a remote junction or by connecting it directly to the terminal block in the wiring compartment of the Eclipse transmitter.

HART uses the Bell 202 frequency shift keying technique of high-frequency digital signals. It operates on the 4–20 mA loop and requires 250 Ω load resistance. A typical connection between a communicator and the Eclipse transmitter is shown at left.

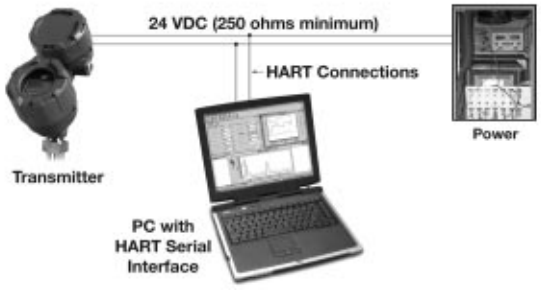
2.7.2 HART Communicator Display

A typical communicator display is an 8-line by 21-character LCD. When connected, the top line of each menu displays the model (Model 706) and its tag number or address. For detailed operating information, refer to the instruction manual provided with the HART communicator.

2.7.3 HART Revision Table

Model 706 1.x

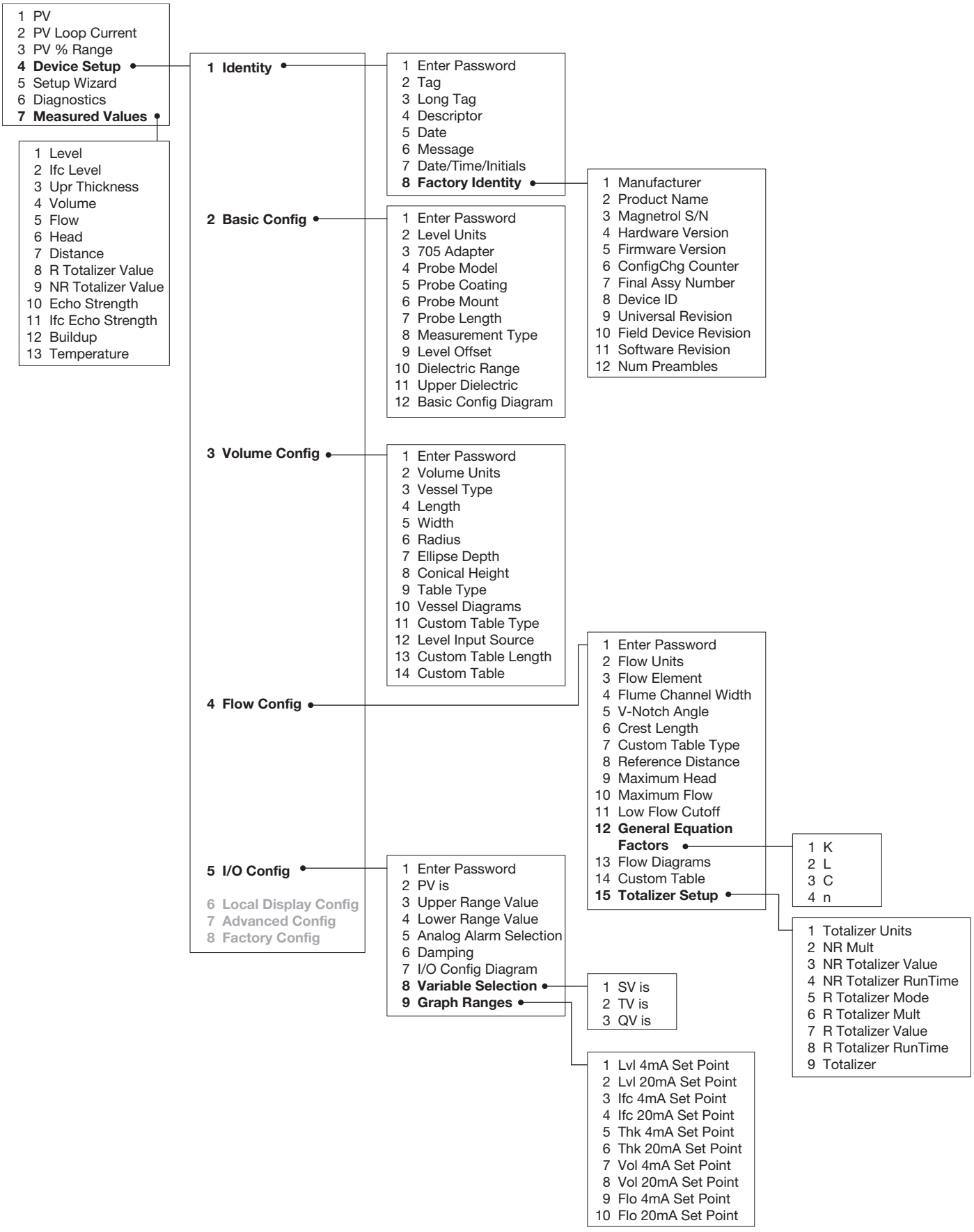
HART Version	HCF Release Date	Compatible with 706 Software
Dev Rev 2, DD Rev 1	August 2019	Version 1.1d and later



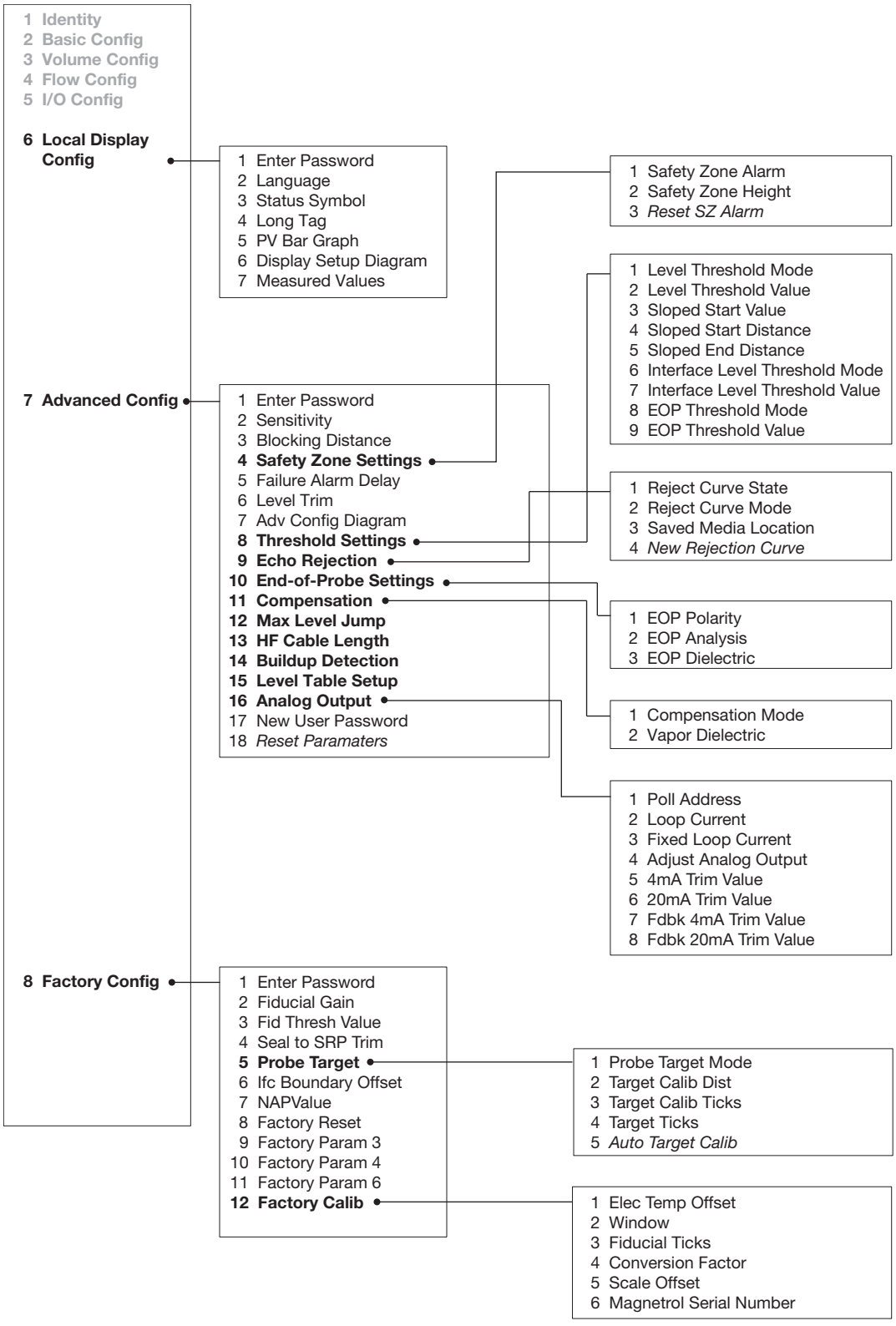
2.7.4 HART Menu – Model 706

The Eclipse transmitter HART menu trees are shown in the following pages. Open the menu by pressing the alphanumeric key 4, then Device Setup, to display the second-level menu.

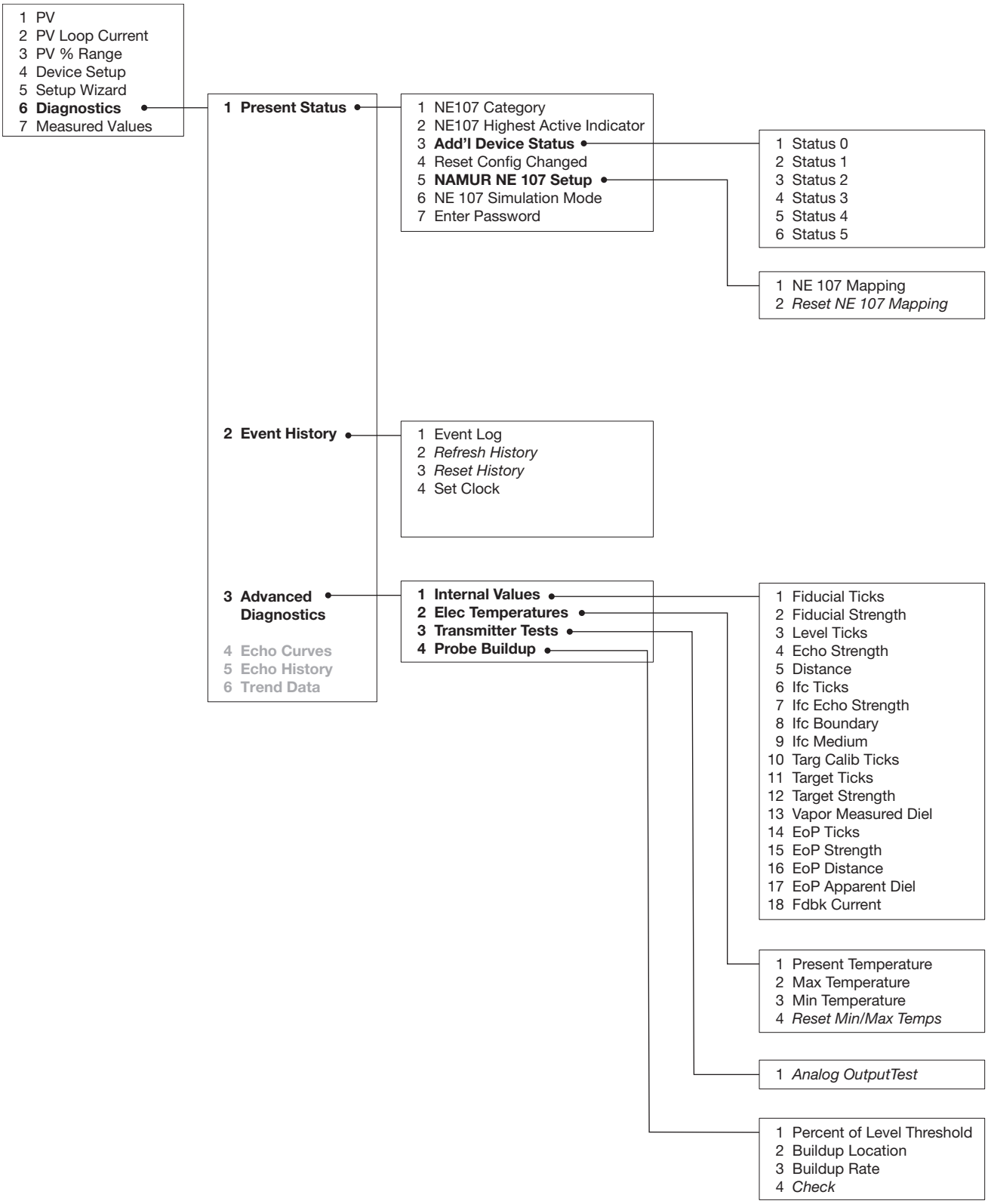
2.7.4 HART Menu – Model 706



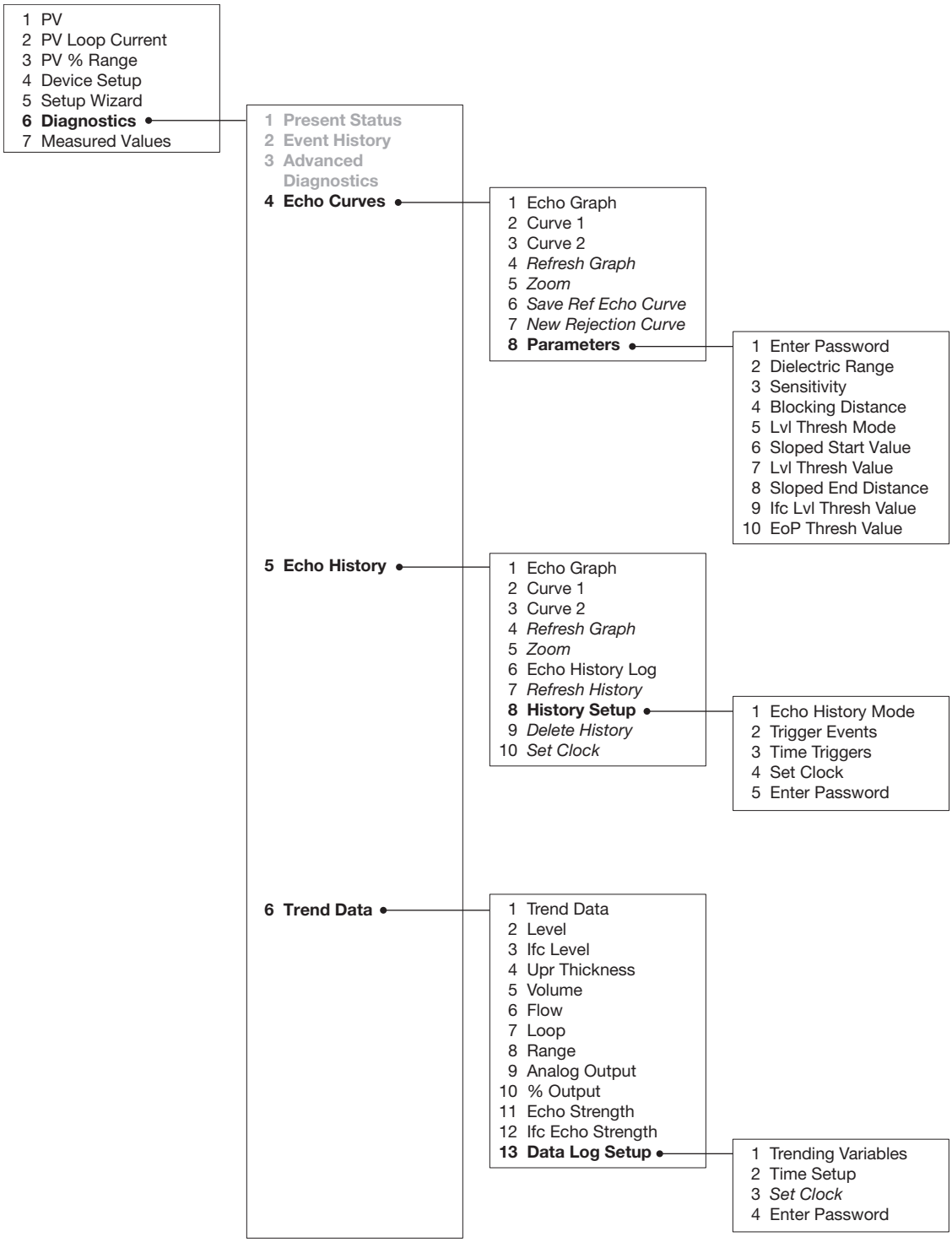
2.7.4 HART Menu – Model 706



2.7.4 HART Menu – Model 706



2.7.4 HART Menu – Model 706



3.0 Reference Information

This section presents an overview of the operation of the Eclipse Model 706 Guided Wave Radar Level Transmitter, information on troubleshooting common problems, listings of agency approvals, lists of replacement and recommended spare parts, and detailed physical, functional, and performance specifications.

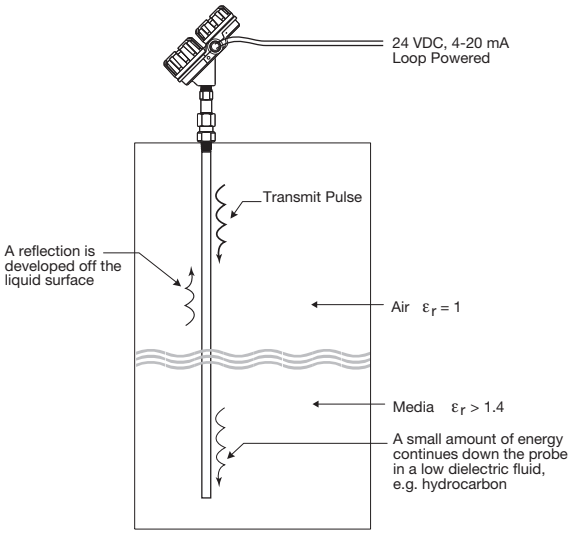
3.1 Transmitter Description

The Eclipse Model 706 is a loop-powered two-wire, 24 VDC, level transmitter based on the concept of Guided Wave Radar.

The Eclipse Model 706 electronics are housed in an ergonomic housing comprised of two tandem compartments angled at a 45-degree angle for ease of wiring and calibration. These two compartments connect via a watertight feedthrough.

3.2 Theory of Operation

3.2.1 Guided Wave Radar



Guided Wave Radar (GWR) combines Time Domain Reflectometry (TDR), Equivalent Time Sampling (ETS) and modern low power circuitry. This synthesis of technologies brings to the level market a high-speed radar circuit (speed of light transmission). The electromagnetic pulses are propagated via a waveguide that yields a system many times more efficient than through-air radar.

3.2.2 Time Domain Reflectometry (TDR)

TDR uses pulses of electromagnetic (EM) energy to measure distances or levels. When a pulse reaches a dielectric discontinuity (created by the surface of a process medium), part of the energy is reflected. The larger the dielectric discontinuity, the larger the amplitude (strength) of the reflection.

Although TDR is relatively new to the industrial level measurement industry, it has been used for decades in the telephone, computer, and power transmission industries. In these industries, TDR is used to successfully find wire or cable breaks and shorts. An EM pulse is sent through the wire, traveling unimpeded until it finds line damage due to a break or short. A reflection is then returned from the damaged area of the wire, enabling a timing circuit to pinpoint the location.

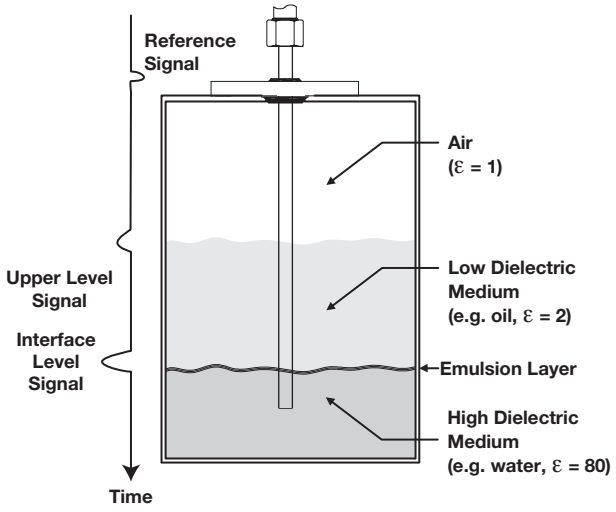
In the Eclipse transmitter, a waveguide with a characteristic impedance in air is used as a probe. When part of the probe is immersed in a material other than air, there is lower impedance due to the fact that a liquid will have a higher dielectric constant than air. When an EM pulse is sent down the probe and meets the dielectric discontinuity that occurs at the air/liquid surface, a reflection is generated.

3.2.3 Equivalent Time Sampling (ETS)

ETS (Equivalent Time Sampling) is used to measure the high speed, low power EM energy. ETS is a critical key in the application of TDR to vessel level measurement technology. The high speed EM energy (1000 ft/s (305 m/s)) is difficult to measure over short distances and at the resolution required in the process industry. ETS captures the EM signals in real time (nanoseconds) and reconstructs them in equivalent time (milliseconds), which is much easier to measure with today's technology.

ETS is accomplished by scanning the waveguide to collect thousands of samples. Approximately five scans are taken per second; each scan gathers more than 50,000 samples.

3.2.4 Interface Detection



Interface Detection

The Eclipse Model 706, when used with the appropriate probes, is a transmitter capable of measuring both an upper level and an interface level. It is required that the upper liquid have a dielectric constant between 1.4 and 10 and the two liquids have a difference in dielectric constants greater than 10. A typical application would be oil over water, with the upper layer of oil being non-conductive with a dielectric constant of approximately 2 and the lower layer of water being very conductive with a dielectric constant of approximately 80. This interface measurement can only be accomplished when the dielectric constant of the upper medium is lower than the dielectric constant of the lower medium.

As mentioned above Eclipse Guided Wave Radar is based upon the technology of TDR, which utilizes pulses of electromagnetic energy transmitted down a wave guide (probe). When the transmitted pulse reaches a liquid surface that has a higher dielectric constant than the air (dielectric constant of 1) in which it is traveling, the pulse is reflected and ultra high speed timing circuitry provides an accurate measure of liquid level. Even after some of the pulse is reflected from the upper surface, energy continues down the length of the probe through the upper liquid. The pulse is again reflected when it

reaches the higher dielectric lower liquid (refer to figure at left). Since the propagation speed of the signal through the upper liquid is dependent on the dielectric constant of the medium in which it is traveling, the dielectric constant of the upper liquid must be known to accurately determine the interface level.

The thickness of the upper layer can be determined by knowing the time between the first and second reflections as well as the upper layer dielectric constant.

In order to properly process the reflected signals, the Model 706 is specified for those applications where the thickness of the upper layer is greater than 2 inches (5 cm). The maximum upper layer is typically limited to the length of the probe.

Emulsion Layers

As emulsion (rag) layers can decrease the strength of the reflected signal, GWR offers best performance in applications having clean, distinct layers. However, the Eclipse Model 706 transmitter will operate in most emulsions and tend to read the top of the emulsion layer. Contact the factory for application assistance and questions regarding emulsion layers.

3.2.5 Saturated Steam Applications *(Boilers, Feedwater Heaters, etc.)*

As the temperature of a saturated steam application increases, the dielectric constant of the steam vapor space also increases. This increase in vapor space dielectric causes a delay in the GWR signal propagation as it travels down the probe, causing the liquid level to appear lower than actual.

NOTE: The measurement error associated with this propagation delay does depend on temperature and is a function of the square root of the vapor space dielectric constant. For example, with no compensation, a +450 °F (+230 °C) application would show a level error of about 5.5%, while a +600 °F (+315 °C) application would show an error approaching 20%!

The Eclipse Model 706 transmitter and Model 7yS Coaxial Steam probe provide a unique solution to this application. The effects of the changing steam conditions can be compensated for by utilizing a mechanical steam target placed inside and near the top of the Model 7yS coaxial probe.

Knowing exactly where the target is located at room temperature, and then continuously monitoring its apparent location, the vapor space dielectric can be back-calculated. Knowing the vapor space dielectric, accurate compensation of the actual liquid level reading is accomplished.

This is a patented technique with two US Patents (US 6642801 and US 6867729) issued for both the mechanical target concept and the associated software algorithm.

Contact the factory for additional information relating to saturated steam applications.

3.2.6 Overfill Capability

Although agencies like WHG or VLAREM certify Overfill proof protection, defined as the tested, reliable operation when the transmitter is used as overfill alarm, it is assumed in their analysis that the installation is designed in such a way that the vessel or side mounted cage cannot physically overfill.

However, there are practical applications where a GWR probe can be completely flooded with level all the way up to the process connection (face of the flange). Although the affected areas are application dependent, typical GWR probes have a transition zone (or possibly dead zone) at the top of the probe where interacting signals can either affect the linearity of the measurement or, more dramatically, result in a complete loss of signal.

While some manufacturers of GWR transmitters may use special algorithms to “infer” level measurement when this undesirable signal interaction occurs and the actual level signal is lost, the Eclipse Model 706 offers a unique solution by utilizing a concept called Overfill-Safe Operation.

An Overfill-safe probe is defined by the fact that it has a predictable and uniform characteristic impedance all the way down the entire length of the waveguide (probe). These probes allow the Eclipse Model 706 to measure accurate levels up to the process flange without any non-measurable zone at the top of the GWR probe.

Overfill-safe GWR probes are unique to Eclipse GWR, and coaxial probes can be installed at any location on the vessel. Overfill-safe probes are offered in a variety of coaxial and caged designs.

3.3 Troubleshooting and Diagnostics

The Eclipse Model 706 transmitter is designed and engineered for trouble-free operation over a wide range of operating conditions. The transmitter continuously runs a series of internal self-tests and displays helpful messages on the large graphic liquid crystal display (LCD) when attention is required.

The combination of these internal tests and diagnostics messages offer a valuable proactive method of troubleshooting. The device not only tells the user what wrong, but also, and more importantly, offers suggestions on how to solve the problem.

All of this information can be obtained directly from the transmitter on the LCD, or remotely by using a HART communicator or PACT*ware* and the Eclipse Model 706 DTM.

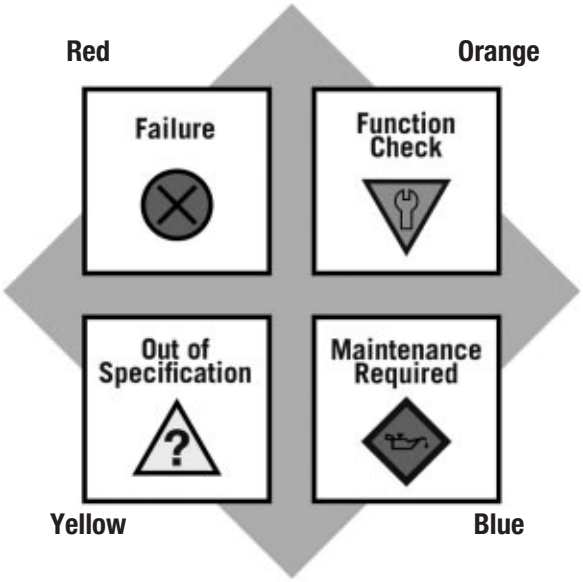
PACTware™ PC Program
The Eclipse Model 706 offers the ability to perform more advanced diagnostics such as Trending and Echo Curve analysis using a PACT*ware* DTM. This is a powerful troubleshooting tool that can aid in the resolution of any diagnostic indicators that may appear.

Refer to section 4.0 “Advanced Configuration/ Troubleshooting Techniques” for additional information.

3.3.1 Diagnostics (Namur NE 107)

The Eclipse Model 706 transmitter includes an exhaustive list of Diagnostic Indicators which follow the NAMUR NE 107 guidelines.

NAMUR is an international user association of automation technology in process industries, whose goal is to promote the interest of the process industry by pooling experiences among its member companies. In doing so, this group promotes international standards for devices, systems, and technologies.



The objective of NAMUR NE 107 was essentially to make maintenance more efficient by standardizing diagnostics information from field devices. This was initially integrated via FOUNDATION fieldbus, but the concept applies regardless of the communication protocol.

According to the NAMUR NE107 recommendation, "Self Monitoring and Diagnosis of Field Devices," fieldbus diagnostic results should be reliable and viewed in the context of a given application. The document recommends categorizing internal diagnostics into four standard status signals:

- Failure
- Function Check
- Out of Specification
- Maintenance required

These categories are shown by both symbols and colors, depending on the display capability.

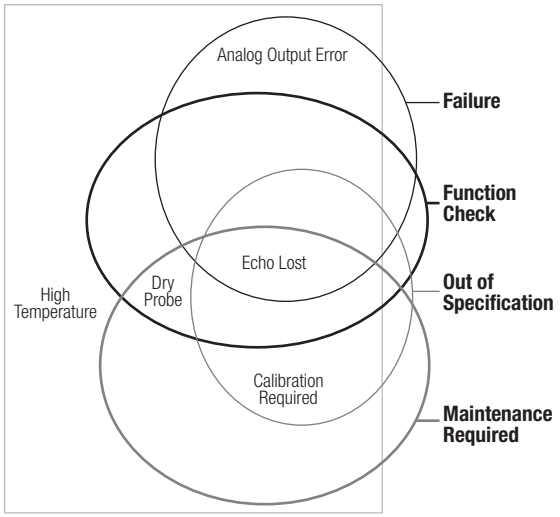
In essence, this approach ensures that the right diagnostic information is available to the right person-at the right time. In addition, it allows diagnostics to be applied, as most appropriate, for a particular plant application (such as process control engineering or asset management maintenance). Customer specific mapping of diagnostics to these categories allows for flexible configuration depending on the user's requirements.

From an external Model 706 transmitter perspective, diagnostic information includes measurement of process conditions, in addition to detection of internal device or system anomalies.

As mentioned above, the indicators can be assignable (via the DTM or host system) by the user to any (or none) of the NAMUR recommended Status Signal categories: Failure, Function Check, Out of Specification, and Maintenance Required.

The FOUNDATION fieldbus transmitter version of the Model 706 was implemented according to the Field Diagnostics Profile, which is consistent with the objectives of NE 107.

In the FOUNDATION fieldbus version, diagnostic indicators can be mapped to multiple categories, an example is shown in the diagram at left.



In this example, “Calibration Required” is mapped to both the Out of Specification and Maintenance Required status signals, and the diagnostic indicator named “High Temperature” is mapped to none of the signals.

Indicators that are mapped to the Failure category will normally result in a current loop alarm output. The alarm state for HART transmitters is configurable as high (22 mA), Low (3.6 mA), or Hold (last value).

Users will not have the ability to unassign certain indicators from the Failure signal category as the Model 706 user interfaces will prohibit or reject such re-assignment entries). This is to ensure that current loop alarms are asserted in situations where the device is not able to provide measurements due to critical failures. (For example, if the alarm selection has not been set to Hold, or a fixed current mode is in effect.)

A default mapping of all diagnostic indicators will be applied initially, and can be re-applied through use of a reset function.

Refer to the table below for a complete listing of the Model 706 diagnostic indicators, along with their explanations, default categories, and recommended remedies.

NOTES: 1) The remedies shown in this table can also be seen on the transmitter LCD by viewing the present status screen when the device is in a diagnostic condition.

2) Those indicators showing failure as the default result in an alarm condition.

3.3.2 Diagnostic Indication Simulation

The DD and DTM allow for the ability to manipulate diagnostic indicators. Intended as a means to verify the configuration of the diagnostic parameters and connected equipment, a user can manually change any indicator to and from the active state.

3.3.3 Diagnostic Indicator Table

Below is a listing of the Model 706 diagnostic indicators, showing their priority, explanations and recommended remedies. (Priority 1 is highest priority.)

Priority	Indicator Name	Default Category	Explanation	Remedy (Context Sensitive Help)
1	Software Error	Failure	Unrecoverable error occurred in stored program.	Contact AMETEK LMS Technical Support.
2	RAM Error	Failure	RAM (read/write) memory failing.	
3	ADC Error	Failure	Analog-to-digital converter failure.	
4	EEPROM Error	Failure	Non-volatile parameter storage failing.	
5	Analog Board Error	Failure	Unrecoverable hardware failure.	
6	Analog Output Error	Failure	Actual loop current deviates from commanded value. Analog output is inaccurate.	Perform Adjust Analog Output maintenance procedure.
7	Spare Indicator 1	OK	Reserved for future use.	
8	Default Parameters		Saved parameters are set to default values.	Perform complete Device Configuration.
9	No Probe	Failure	No Probe Connected.	Attach a probe. Torque HF nut. Clean gold pin on transmitter and socket on probe. Ensure Model 705 adapter is properly secured. Contact AMETEK LMS Technical Support.
10	No Fiducial	Failure	Reference signal too weak to detect.	Torque HF nut. Clean gold pin on transmitter and socket on probe. Check settings: Fiducial Gain HF Cable Length Window Increase Fid Gain. Contact AMETEK LMS Technical Support.

3.3.3 Diagnostic Indicator Table

Priority	Indicator Name	Default Category	Explanation	Remedy
11	No Echoes	Failure	No signal detected anywhere on probe.	Check settings: Dielectric Range Sensitivity EoP Thresh Value Increase Sensitivity. Lower EoP Thresh. View Echo Curve.
12	Upr Echo Lost	Failure	Signal from upper liquid too weak to detect.	Check settings: Upper Dielectric, Blocking Distance, Sensitivity Ensure Upr Level is below blocking distance. View Echo Curve.
13	Spare Indicator 2	OK	Reserved for future use.	
14	EoP Above ProbeEnd	Failure	End of Probe appears above Probe Length	Check settings: Probe Length Decrease Sensitivity Increase Blocking Distance View Echo Curve.
15	Lvl Below ProbeEnd	Failure	Level signal appears beyond Probe Length. (Possible water bottom situation)	Check settings: Probe Model, Probe Length, Level Threshold = Fixed Increase Sensitivity View Echo Curve.
16	EoP Below ProbeEnd	Failure	End of Probe appears beyond Probe Length.	Check settings: Probe Length Dielectric Range Sensitivity View Echo Curve.
17	Safety Zone Alarm	Failure	Risk of echo loss if liquid rises above Blocking Distance.	Ensure that liquid cannot reach Blocking Distance.
18	Config Conflict	Failure	Measurement type and primary variable selection parameters are inconsistent.	Confirm proper configuration. Check Measurement Type.
19	High Volume Alarm	Failure	Volume calculated from Level reading exceeds capacity of vessel or custom table.	Check settings: Vessel Dimensions, Custom Table entries
20	High Flow Alarm	Failure	Flow calculated from Distance reading exceeds capacity of flow element or custom table.	Check settings: Flow Element Reference Distance Gen Eqn Factors Custom Table entries
21	Spare Indicator 3	OK	Reserved for future use	
22	Initializing	Function Check	Distance measurement is inaccurate while internal filters are settling.	Standard start-up message. Wait for up to 10 seconds.
23	Analog Output Fixed	Function Check	Loop current not following PV. May be caused by existing alarm condition, ongoing Loop Test or Trim Loop operations.	If unexpected, check Loop Current Mode. Ensure device is not in Loop Test.
24	Config Changed	Function Check	A parameter has been modified from the User Interface.	If desired, reset Config Changed indicator in ADVANCED CONFIG menu.
25	Spare Indicator 4	OK	Reserved for future use.	
26	Spare Indicator 5	OK	Reserved for future use.	

3.3.3 Diagnostic Indicator Table

Priority	Indicator Name	Default Category	Explanation	Remedy
27	Spare Indicator 6	OK	Reserved for future use.	
28	Ramp Interval Error	Out of Spec	Internal signal timing out of limits causing inaccurate distance measurement.	Check accuracy of Level reading.Replace transmitter electronics. Contact AMETEK LMS Technical Support.
29	High Elec Temp	Out of Spec	Electronics too hot. May compromise level measurement or damage instrument.	Shield transmitter from heat source or increase air circulation. Locate transmitter remotely in a cooler area.
30	Low Elec Temp	Out of Spec	Electronics too cold. May compromise level measurement or damage instrument.	Insulate transmitter. Locate transmitter remotely in a warmer area.
31	Calibration Req'd	Out of Spec	Factory calibration has been lost. Measurement accuracy may be diminished.	Return transmitter to factory for recalibration.
32	Echo Reject Invalid	Out of Spec	Echo Rejection inoperative. May report erroneous Level readings. Upr Echo may be lost near top of probe.	Save a fresh Echo Rejection Curve.
33	Spare Indicator 7	OK	Reserved for future use.	
34	Inferred Level	Out of Spec	Distance measurement calculated indirectly from probe elongation. Level reading is only approximate.	Verify Level reading. If incorrect, compare Dielectric Range against EoP Dielectric reading.
35	Adjust Analog Out	Out of Spec	Loop current is inaccurate.	Perform Adust Analog Output maintenance procedure.
36	Totalizer Data Lost	Out of Spec	Non-volatile Totalizer Data storage failing.	Contact AMETEK LMS Technical Support.
37	No Probe Target	Out of Spec	Not actively compensating	Check settings: Probe Model Target Ticks
38	Low Supply Voltage	Out of Spec	Loop current may be incorrect at higher values. Analog output is inaccurate.	Verify loop resistance. Replace loop power supply.
39	Dry Probe	OK	No liquid is contacting probe. Level at unknown distance beyond probe.	If unexpected, verify proper probe length for application.
40	Bad Target Location	Maintenance Required	Incorrect steam target location	Contact AMETEK LMS Technical Support.
41	Low Echo Strength	Maintenance Required	Risk of Echo Lost due to weak signal.	Check settings: Dielectric Range Sensitivity View Echo Curve.
42	Low Ifc Echo Str	Maintenance Required	Risk of Interface Echo Lost due to weak signal.	Check settings: Dielectric Range Sensitivity View Ifc Echo Curve.
43	Max Jump Exceeded	Maintenance Required	Transmitter has jumped to an echo at location that exceeds “Max Level Jump” from previous echo location.	Check settings: Dielectric Range Sensitivity View Echo Curve.
44	Spare Indicator 10	OK	Reserved for future use.	
45	Sequence Record	OK	A Sequence Record number has been stored in Event Log.	If desired, report Sequence Record number to factory.

The ECLIPSE Model 706 offers the ability to do Trending and Echo Curve analysis via the local graphical LCD or by using PACT*ware* and the Model 706 DTM. The Model 706 DTM is a power troubleshooting tool that can aid in the resolution of some of the Diagnostic Indicators shown above.

3.3.4 Diagnostic Help



Selecting DIAGNOSTICS from the MAIN MENU presents a list of five ITEMS from the top level of the DIAGNOSTICS tree.

When Present Status is highlighted, the highest priority active diagnostic indicator (numerically lowest in Table 3.3.3) is displayed on the bottom LCD line, which is "OK" as shown at left. Pressing the ENTER key moves the active diagnostic indicator to the top line outdented and presents in the lower area of the LCD a brief explanation of and possible remedies for the indicated condition. A blank line separates the explanation from the remedies. Additional active diagnostic indicators, if any, appear with their explanations in descending priority order. Each additional active indicator name-explanation pair is separated by a blank line from the one above.



If the explanation and remedy text (and additional name-explanation pairs) exceeds the available space, a ⇩ appears in the rightmost column of the last line indicating more text below. In this situation, the DN key scrolls text up one line at a time. Similarly, while text exists above the upper line of the text field, a ⇧ appears in the rightmost column of the top (text) line. In this situation, the UP key scrolls the text down one line at a time. Otherwise the DN and UP keys are inoperative. In all cases the ENT or DEL key reverts to the previous screen.

When the transmitter is operating normally and the highlight cursor is positioned on Present Status, the bottom LCD line displays "OK" because no diagnostic indicators are active.



EVENT HISTORY – This menu displays the parameters related to diagnostic event logging.

ADVANCED DIAGNOSTICS – This menu displays parameters related to some of the advanced diagnostics available within the Model 706.

> **INTERNAL VALUES** – Displays read-only internal parameters.
>
> **ELEC TEMPERATURES** – Displays temperature information as measured in the potted module in degrees F or C.
>
> **TRANSMITTER TESTS** – Allows the user to manually set the output current to a constant value. This is a method for the user to verify operation of the other equipment in the loop.

ECHO CURVES – This menu allows the user to display the various Echo Curves on the LCD.

ECHO HISTORY SETUP – The Model 706 contains the unique and powerful feature that allows waveforms to be automatically captured based on Diagnostic Events, Time or both. This menu contains those parameters that configure that feature.

Eleven (11) waveforms can be saved directly into the transmitter.

- Nine (9) Troubleshooting Curves
- One (1) Echo Rejection Curve
- One (1) Reference Curve

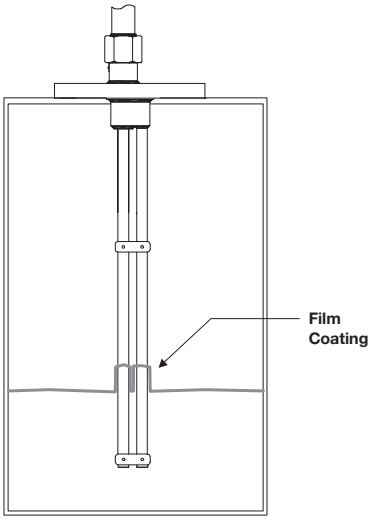
TREND DATA – A 15-minute trend of the PV can be displayed on the LCD.

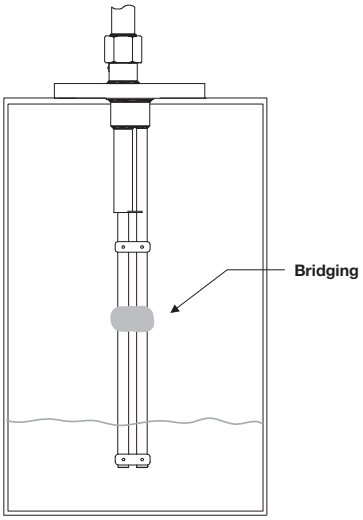
3.3.5 Troubleshooting Application Issues

There can be numerous reasons for application-related issues. Media buildup on the probe is covered here.

Media buildup on the probe is typically not a problem in most cases—Eclipse circuitry works very effectively. Media buildup should be viewed as two types:

- Continuous Film Coating
- Bridging





3.3.5.1 Model 706 (Dual Element Coaxial or Twin Flexible probe)

Continuous Film Coating

One type of potential application problem is when the media forms a continuous coating on the probe. Although the Eclipse Model 706 will continue to measure effectively, some small inaccuracies may occur as the signal propagation is affected by the thickness, length, and dielectric constant of the coating.

It is a very rare case where filming causes a noticeable performance degradation.

Bridging

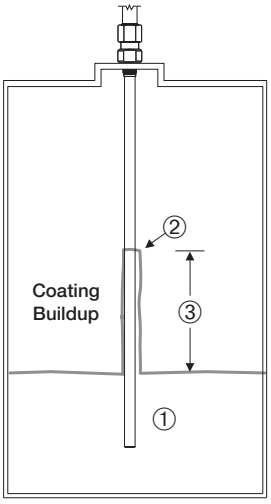
A more common coating problem occurs when the process medium is viscous or solid enough to actually clog, or bridge, between the elements. This bridging can cause a noticeable degradation in performance. For example, high dielectric media (e.g., water-based) can be detected as level at the location of the bridging.

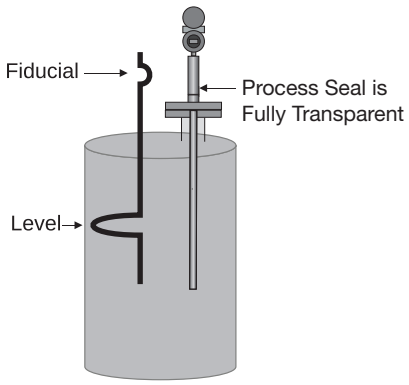
Similarly, a problem can develop if the product begins to build up on the spacers that separate the coaxial probe elements. High dielectric media (e.g., water-based) will cause the greatest error.

Single rod GWR probes are typically the best probes for applications with potential buildup, but other factors in the application must be considered (such as mounting, sensitivity, etc). For this reason, the Eclipse Model 706 is offered with a variety of coaxial, single rod, and twin flexible probes so the correct probe can be used for the given application.

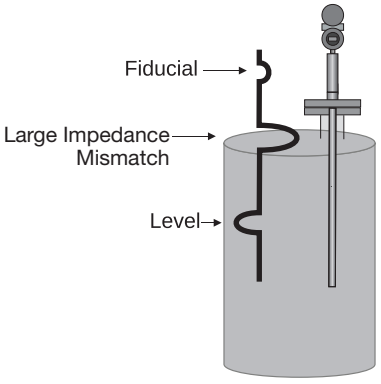
Refer to Section 3.6.4 for viscosity specifications on the various Eclipse probes.

Contact the factory for any questions regarding applications with potential coating and buildup.





Coaxial Probe



Standard Single Rod Probe

3.3.5.2 Model 706 (Single Rod Probe)

The Model 706 and Single Rod probe were designed to operate effectively in the presence of media building up. Some expected error may be generated based upon the following factors:

1. Dielectric of the media that created the coating
2. Thickness of the coating
3. Amount (length) of the coating above the present level

Although more immune to thick, viscous, buildup, performance of Single Rod GWR probes is always dependent on the installation and application. The electromagnetic field surrounding a single rod probe makes it more vulnerable to influence from objects in the vicinity of the probe.

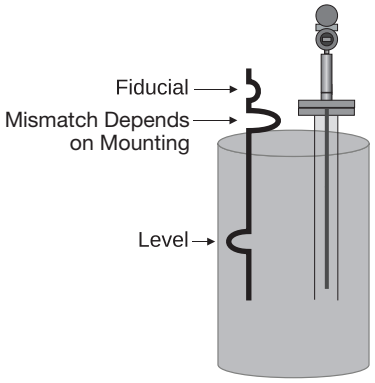
NOTE: It is important to note that this influence from the installation/application also depends on the configuration of the transmitter. Those devices configured with lower gain will be less affected by external objects.

Nozzles

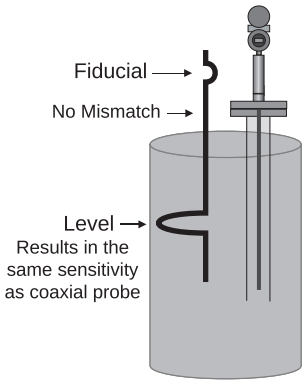
Due to the impedance mismatch that takes place at the end of a nozzle, they can create false echoes that can cause diagnostic indicators and/or errors in measurement.

As mentioned above, by virtue of the pure physics of the technology, all single rod GWR probes are influenced by the application and installation. Mismatches in impedance along the length of the probe, whether they be expected (liquid level) or unexpected (metal in close proximity), will result in reflections.

To better illustrate this, a comparison between a coaxial probe and single rod probe mounted in the same application is shown at left.

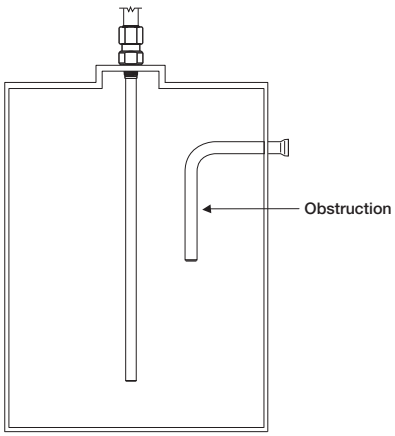


Single Rod Probe in a Stillwell



Caged Probe
(waveform is similar to that of a coaxial probe)

Nozzles
- **2" Diameter minimum**
- **Ratio of Diameter: Length should be >1:1**
- **Do not use Pipe Reducers (restriction)**



Since the outer tube of the coaxial probe is grounded, there are no proximity affects and there is no influence from the nozzle. The only reflections along the length of the probe are expected. Those being the fiducial (reference signal) and the return signal from the process.

On the other hand, a single rod probe mounted in the exact same nozzle will have additional (unwanted) reflections where the probe enters and exits the nozzle. These reflections are a result of the impedance changes that occur at those points:

- The large reflection is due to the impedance developed between the rod and nozzle ID as compared to the impedance developed between the rod and the tank ID. (The larger the nozzle ID, the smaller the reflection).

One way to eliminate the reflection at the bottom of the nozzle is to use a continuous stillwell in conjunction with a caged GWR probe. In doing so, there will be no impedance changes all the way down the probe.

Refer to Section 3.2.6 for a discussion on overfill-capable probes for suggestions on how to eliminate these unwanted single rod reflections. Magnetrol is unique in the fact that we offer a special caged probe that, when installed properly, has no unwanted reflections.

Obstructions

Metallic obstructions in the vicinity of a single rod probe can also affect the performance. If the level reading repeatedly locks on to a specific level higher than the actual level, it may be caused by a metallic obstruction. Obstructions in the vessel (e.g., pipes, ladders) that are located close to the probe may cause the instrument to show them as level.

Refer to the Probe Clearance Table for recommended clearance distances. The distances shown in this table can be dramatically reduced by utilizing the Echo Rejection feature (within the transmitter or) in PACT*ware* and the Eclipse Model 706 DTM.

NOTE: Use caution when rejecting large positive going signals as the negative going level signal can be lost when passing through them.

PROBE CLEARANCE TABLE

Distance to Probe	Acceptable Objects
<6" (15 cm)	Continuous, smooth, parallel conductive surface, for example a metal tank wall; important that probe does not touch wall
>6" (15 cm)	<1" (25mm) diameter pipe and beams, ladder rungs
>12" (30 cm)	<3" (75mm) diameter pipe and beams, concrete walls
>18" (46 cm)	All remaining objects

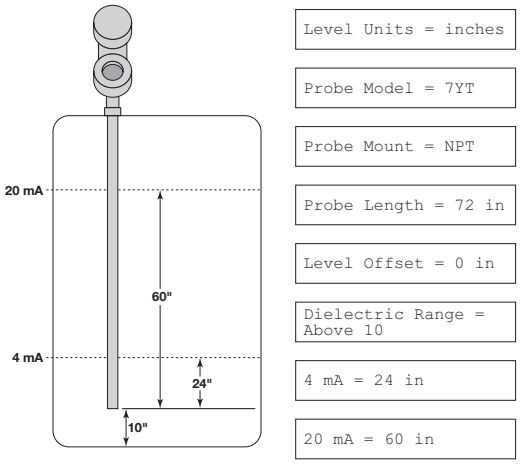
3.4 Configuration Information

This section is intended to offer additional configuration-related details with respect to some of the parameters shown in the Menu in Section 2.6.

3.4.1 Level Offset Description

The parameter referred to as Level Offset in the Eclipse Model 706 DEVICE SETUP/BASIC CONFIG menu is defined as the desired level reading when liquid surface is at the tip of the probe.

The Eclipse Model 706 transmitter is shipped from the factory with Level Offset set to 0. With this configuration, all measurements are referenced from the bottom of the probe. See Example 1.



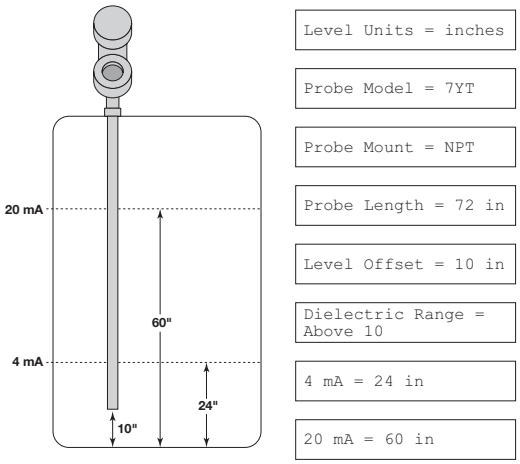
Example 1

Example 1 (Level Offset = 0 as shipped from factory):

Application calls for a 72-inch Model 7yT coaxial probe with an NPT process connection. The process medium is water with the bottom of the probe 10 inches above the bottom of the tank.

The user wants the 4 mA Set Point (LRV) at 24 inches and the 20 mA Set Point (URV) at 60 inches **as referenced from the bottom of the probe**.

In those applications in which it is desired to reference all measurements from the bottom of the vessel, the value of Level Offset should be changed to the distance between the bottom of the probe and the bottom of the vessel as shown in Example 2.



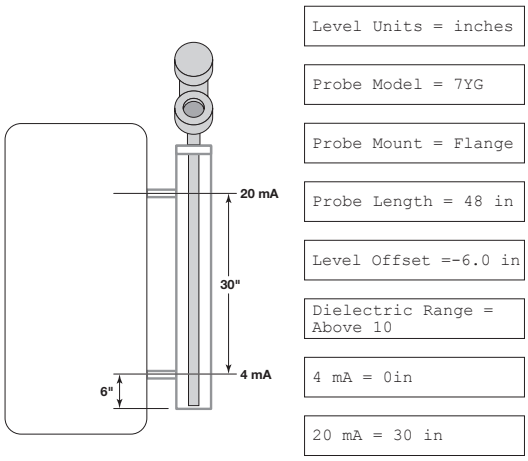
Example 2

Example 2:

Application calls for a 72-inch Model 7yT coaxial probe with an NPT process connection. The process medium is water with the bottom of the probe 10 inches above the bottom of the tank.

The user wants the 4 mA Set Point (LRV) at 24 inches and the 20 mA Set Point (URV) at 60 inches **as referenced from the bottom of the tank**.

When the Eclipse transmitter is mounted in a chamber/bridle, it is usually desirable to configure the unit with the 4 mA Set Point (LRV) at the lower process connection and the 20 mA Set Point (URV) at the upper process connection. The measuring range then becomes the center-to-center dimension. In this case, a negative Level Offset needs to be entered. In doing so, all measurements are then referenced at a point up on the probe, as shown in Example 3.



Example 3

Example 3:

Application calls for a 48-inch Model 7yG caged-coaxial flanged probe measuring water in a chamber with the bottom of the probe extending six inches below the lower process connection. The user wants the 4 mA point to be 0 inches at the bottom process connection and the 20 mA point to be 30 inches at the top process connection.

3.4.2 End-of-Probe Analysis

A new addition to the Model 706 Eclipse transmitter is a feature called End-of-Probe Analysis (EoPA).

Located in the DEVICE SETUP/ADVANCED CONFIG Menu, this feature is patterned after the “Tank-Bottom Following” algorithms of the early Non-Contact radar transmitters. When the return signal from the level is lost, this feature allows the Model 706 transmitter to infer level measurement based on the apparent location of the end-of-probe (EoP) signal.

Due to the fact that the propagation of the GWR signal is affected by the dielectric constant of the medium in which it is traveling, signals along the probe are delayed in proportion to the dielectric constant. By monitoring the location of the (delayed) EoP signal and knowing the dielectric constant of the medium, the level signal can be back-calculated, or inferred.

The End-of-Probe Analysis feature is located in the Advanced Config menu and requires an Advanced Password to activate. Several additional parameters will need to be configured for optimum performance.

NOTE: The accuracy of this level measurement mode is not that of detecting true product level, and can vary depending on the process. Magnetrol recommends that this feature be used only as last resort for measuring levels in those rare applications in which the level signals are inadequate, even after the common troubleshooting techniques of gain increase and threshold adjustment are implemented.

Refer to section 4.0 “Advanced Configuration/ Troubleshooting Techniques” or contact AMETEK LMS Technical Support for additional instructions.

3.4.3 Echo Rejection

Due to the fact that GWR transmitters are less susceptible to obstructions in a vessel (as compared with Non-Contact Radar transmitters) , early versions of the Eclipse Model 705 transmitters did not have Echo Rejection capability.

However, due to our vast experience in the field, we have found that there are (albeit rare) occasions when it is desirable to have the ability to “ignore” unwanted signals along the probe.

The Model 706 transmitter Echo Rejection feature is located in the DEVICE SETUP/ADVANCED CONFIG menu, and requires an Advanced Password to activate. It is highly recommended that this feature be used with the waveform capture capability of the Model 706 DTM and PACT*ware*™.

Refer to Section 4 “Advanced Configuration/ Troubleshooting Techniques” or contact AMETEK LMS Technical Support for additional instructions.

3.4.4 Volumetric Capability

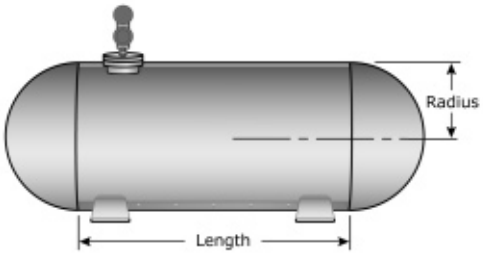
Selecting Measurement Type = Volume and Level allows the Model 706 transmitter to measure volume as the Primary Measured Value.

3.4.4.1 Configuration using built-in Vessel Types

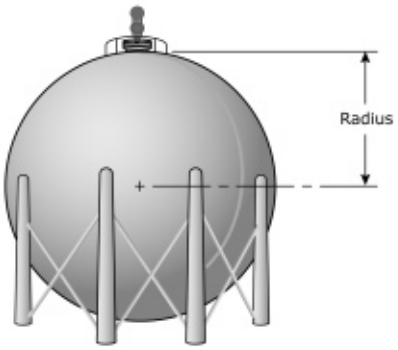
The following table provides an explanation of each of the System Configuration parameters required for volume applications that use one of the nine Vessel Types.

Configuration Parameter	Explanation
Volume Units	A selection of Gallons (factory default Volume Unit), Milliliters, Liters, Cubic Feet, or Cubic Inches, is provided.
Vessel Type	Select either Vertical/Flat (factory default Vessel Type), Vertical/Elliptical, Vertical/Spherical, Vertical/Conical, Custom Table, Rectangular, Horizontal/Flat, Horizontal/Elliptical, Horizontal/Spherical, or Spherical. Note: Vessel Dims is the next screen only if a specific Vessel Type was selected. If Custom Table was selected. Refer to page 61 to select the Cust Table Type and Cust Table Vals.
Vessel Dims	See the vessel drawings on the following page for relevant measuring areas.
Radius	Used for all Vessel Types with the exception of Rectangular.
Ellipse Depth	Used for Horizontal and Vertical/Elliptical vessels.
Conical Height	Used for Vertical/Conical vessels.
Width	Used for Rectangular vessels.
Length	Used for Rectangular and Horizontal vessels.

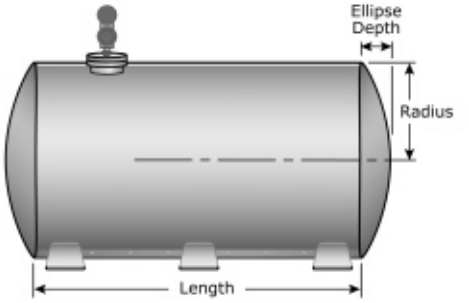
Vessel Types



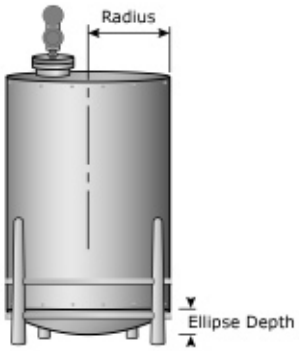
HORIZONTAL/SPHERICAL



SPHERICAL



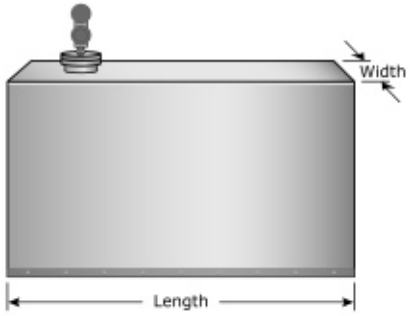
HORIZONTAL/ELLIPTICAL



VERTICAL/ELLIPTICAL



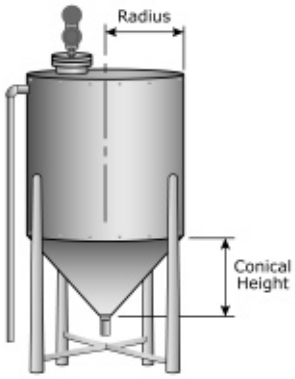
VERTICAL/SPHERICAL



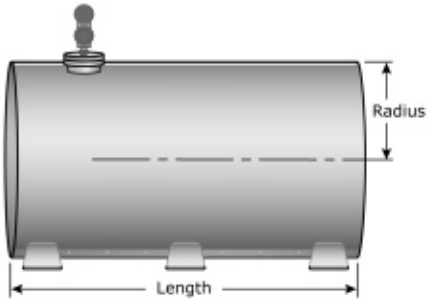
RECTANGULAR



VERTICAL/FLAT



VERTICAL/CONICAL

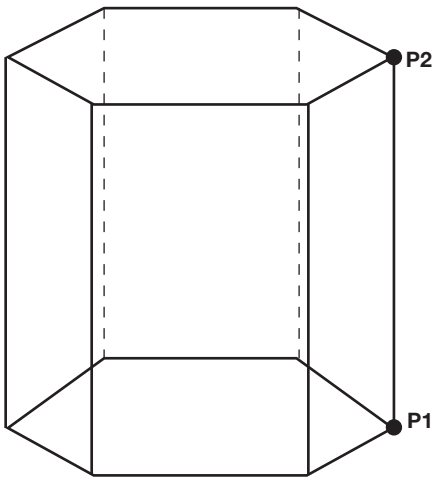


HORIZONTAL/FLAT

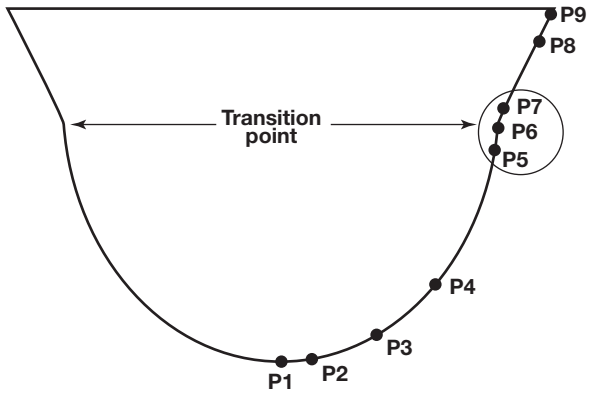
3.4.4.2 Configuration using Custom Table

If none of the nine ***Vessel Types*** shown can be used, a ***Custom Table*** can be created. A maximum of 30 points can be used to establish the level to volume relationship. The following table provides an explanation of each of the System Configuration parameters for volume applications where a Custom Table is needed.

Configuration Parameter	Explanation (Custom Volumetric Table)
Volume Units	A selection of **Gallons** (factory default *Volume Unit*), **Milliliters**, **Liters**, **Cubic Feet**, or **Cubic Inches**, is provided.
Vessel Type	Select **Custom Table** if none of the nine *Vessel Types* can be used.
Cust Table Type	The *Custom Table* points can be a **Linear** (straight line between adjacent points) or **Spline** (can be a curved line between points) relationship. See below drawing for more information.
Cust Table Vals	A maximum of 30 points can be used in building the *Custom Table*. Each pair of values will have a level (height) in the units chosen in the *Level Units* screen, and the associated volume for that level point. The values must be monotonic, i.e. each pair of values must be greater than the previous level/volume pair. The last pair of values should have the highest level value and volume value associated with the level in the vessel.



LINEAR

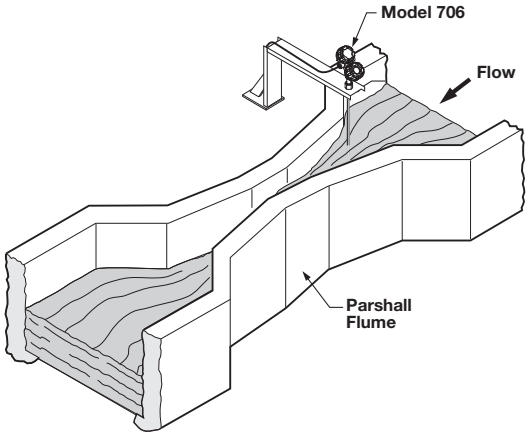


Use where walls are not perpendicular to base.

Concentrate at least two points at beginning (P1) and end (P9); and three points at either side of transition points.

SPLINE

3.4.5 Open Channel Flow Capability



Open Channel Flow Measurement
Parshall Flume

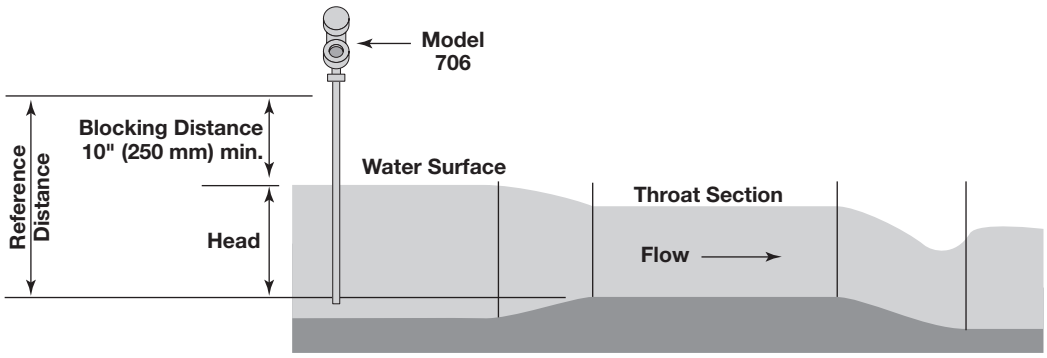
Selecting Measurement Type = Flow allows the Model 706 transmitter to measure flow as the Primary Measured Value.

Open channel flow is performed by using the Eclipse Model 706 to measure the Head in a hydraulic structure. The hydraulic structure is the primary measuring element, of which the two most common types are weirs and flumes.

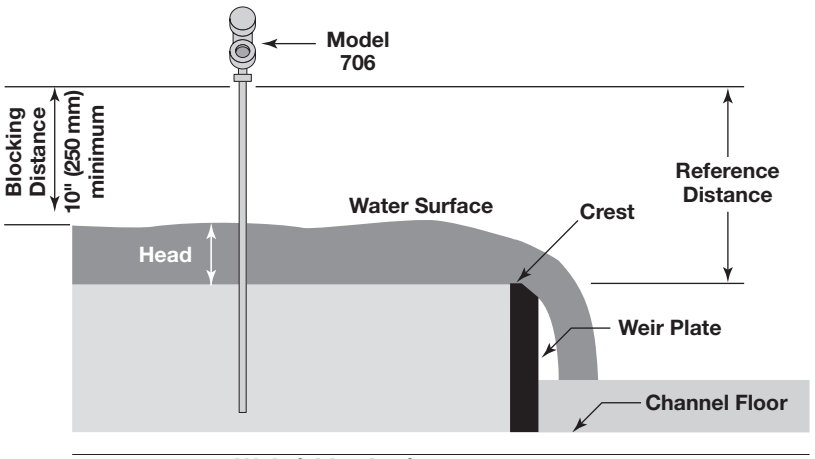
Since the primary element has a defined shape and dimensions, the rate of flow through the flume or over the weir is related to the Head at a specified measurement location.

The Eclipse Model 706 is the secondary measuring device, which measures the Head of the liquid in the flume or weir. Open channel flow equations stored in the transmitter firmware convert the measured Head into units of flow (volume/time).

NOTE: Proper positioning of the Model 706 should be per the recommendation of the flume or weir manufacturer.



Flume (side view)



Weir (side view)

3.4.5.1 Configuration using Flume/Weir Equations

The following table provides an explanation of each of the System Configuration parameters required for open channel flow applications using one of the Flow Elements that are stored in the firmware.

Configuration Parameter	Explanation
Flow Units	A selection of **Gallons/Minute** (factory default *Flow Unit*), **Gallons/Hour, Mil Gallons/Day, Liters/Second, Liters/Minute, Liters/Hour, Cubic Meter/Hour, Cubic Ft/Second, Cubic Ft/Minute,** and **Cubic Ft/Hour** are provided.
Flow Element	Select one of the following primary *Flow Elements* that are stored in the firmware: **Parshall** flume sizes of **1", 2", 3", 6", 9", 12", 18", 24", 36", 48", 60", 72", 96", 120"** and **144". Palmer-Bwls** (Palmer-Bowlus) flume sizes of **4", 6", 8", 10", 12", 15", 18", 21", 24", 27"** and **30"**. **V-notch** weir sizes of **22.5°, 30°, 45°, 60°, 90° and 120°**. **Rect with Ends** (Rectangular Weir with End Contractions), **Rect w/o Ends** (Rectangular Weir without End Contractions), and **Cipoletti** weir. **Custom Table** (see page 64 can be selected if none of the stored *Flow Elements* can be used. The table can be built with a maximum of 30 points. The Model 706 also has the capability of using a **Generic Equation** (see page 60) for flow calculation.
Weir Crest Length	The *Weir Crest Length* screen only appears when the chosen *Flow Element* is Cipoletti or one of the *Rectangular* weirs. Input this length in the user-selected level units.
Flume Channel Width	Allows for entry of the width of the palmer bowlus flume.
V-Notch Weir Angle	Only appears when flow element is V-Notch weir. It allows for the entry of angle of the V-Notch weir.
Reference Dist	The *Reference Distance* is measured from the sensor reference point to the point of zero flow in the weir or flume. This must be measured very accurately in the user-selected level units.
Maximum Head	*Maximum Head* is the highest liquid level (Head) value in the flume or weir before the flow equation is no longer valid. The *Maximum Head* is expressed in the user-selected *Level Units.* The Model 706 will default to the largest *Maximum Head* value that is allowed for any given flume or weir. The *Maximum Head* value can be revised depending on the value of the *Reference Distance*, or for end user preference.
Maximum Flow	*Maximum Flow* is a read-only value that represents the flow value corresponding to the *Maximum Head* value for the flume or weir.
Low Flow Cutoff	The *Low Flow Cutoff* (in user-selected level units) will force the calculated flow value to zero whenever the *Head* is below this point. This parameter will have a default and minimum value of zero.

3.4.5.2 Configuration using Generic Equation

The following table provides an explanation of each of the System Configuration parameters for Open channel flow applications using the Generic Equation.

Configuration Parameter	Explanation (Open Channel Flow — using the Generic Equation)
Flow Units	A selection of **Gallons/Minute** (factory default *Flow Unit*), **Gallons/Hour, Mil Gallons/Day, Liters/Second, Liters/Minute, Liters/Hour, Cubic Meter/Hour, Cubic Ft/Second, Cubic Ft/Minute,** and **Cubic Ft/Hour** are provided.
Flow Element	Select one of the following primary *Flow Elements* that are stored in the firmware: **Parshall** flume sizes of **1", 2", 3", 6", 9", 12", 18", 24", 36", 48", 60", 72", 96", 120"** and **144". Palmer-Bwls** (Palmer-Bowlus) flume sizes of **4", 6", 8", 10", 12", 15", 18", 21", 24", 27"** and **30"**. **V-notch** weir sizes of **22.5°, 30°, 45°, 60°, 90° and 120°**. **Rect with Ends** (Rectangular Weir with End Contractions), **Rect w/o Ends** (Rectangular Weir without End Contractions), and **Cipoletti** weir. **Custom Table** (see page 61 can be selected if none of the stored *Flow Elements* can be used. The table can be built with a maximum of 30 points. The Model 706 also has the capability of using a **Generic Equation** for flow calculation. See example below.
Generic Eqn Factors	*Generic Equation* is a discharge flow equation in the form of $Q = K(L-CH)H^n$, where Q = flow (Cu Ft/Second), H = Head (Feet), K = a constant, and L, C and n are user input factors that depend on which *Flow Element* is being used. Make sure the flow equation is in the form of $Q = K(L-CH)H^n$, and proceed to enter the values of K,L,C,H and n. See example below. **NOTE:** The Generic Equation parameters **must be entered in Cu Ft/Second units**. The resultant flow is converted by the Model 706 into whatever Flow Units are selected above. See example below.
Reference Dist	The *Reference Distance* is measured from the sensor reference point to the point of zero flow in the weir or flume. This must be measured very accurately in the user-selected level units.
Maximum Head	*Maximum Head* is the highest liquid level (Head) value in the flume or weir before the flow equation is no longer valid. The *Maximum Head* is expressed in the user-selected level units. The Model 706 will default to the largest *Maximum Head* value that is allowed for any given flume or weir. The *Maximum Head* value can be revised depending on the value of the *Reference Distance*, or for end user preference.
Maximum Flow	*Maximum Flow* is a read-only value that represents the flow value corresponding to the *Maximum Head* value for the flume or weir.
Low Flow Cutoff	The *Low Flow Cutoff* (in user-selected level units) will force the calculated flow value to zero whenever the *Head* is below this point. This parameter will have a default and minimum value of zero.

Generic Equation Example (using equation for an 8' rectangular weir w/ end contractions)		
Q = **Cubic Ft/Second** flow rate	L = 8' (weir crest length in feet)	H = Head value
K = 3.33 for **Cubic Ft/Second** units	C = 0.2 (constant)	n = 1.5 as an exponent

$$\mathbf{Q = K(L-CH)H^n}$$

Using the factors above the equation becomes:

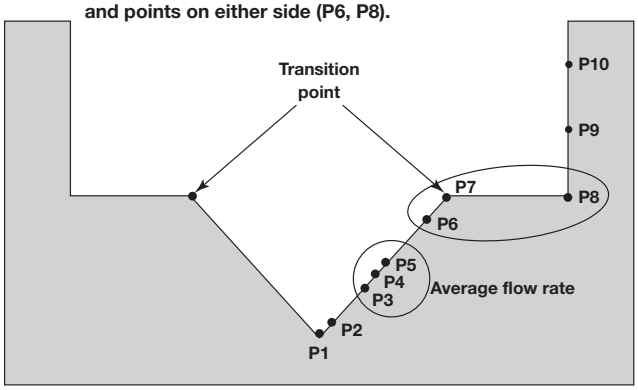
$Q = 3.33\ (8-0.2H)\ H^{1.5}$

The discharge flow value for a Head value of three feet becomes 128.04 **Cubic Ft/Second**. If GPM was selected for the Flow Units, the Model 706 Measured Values screen would display this value converted to 57,490 GPM.

3.4.5.3 Configuration using Custom Table

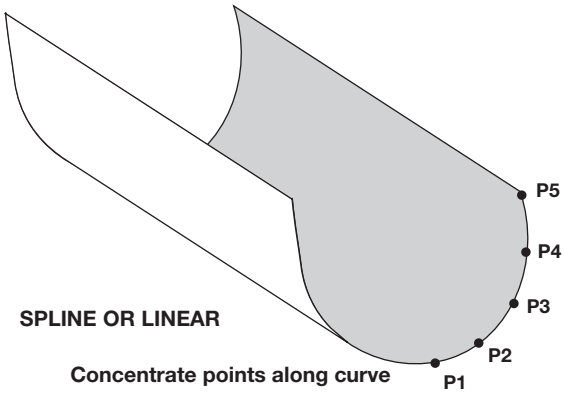
Concentrate points as follows:

A. At least two points at beginning (P1 and P2);
B. At least two points at end (P9 and P10);
C. Three points at approximate average flow rate (for example, P3, P4, P5); and at transition point (P7) and points on either side (P6, P8).



SPLINE

The following table provides an explanation of each of the System Configuration parameters for open channel flow applications using the Custom Table.



SPLINE OR LINEAR

Concentrate points along curve

Configuration Parameter	Explanation (Open Channel Flow — Custom Table)
Flow Units	A selection of **Gallons/Minute** (factory default *Flow Unit*), **Gallons/Hour, Mil Gallons/Day, Liters/Second, Liters/Minute, Liters/Hour, Cubic Meters/Hour, Cubic Ft/Second, Cubic Ft/Minute,** and **Cubic Ft/Hour** are provided.
Flow Element	Select one of the following primary *Flow Elements* that are stored in the firmware: **Parshall** flume sizes of **1", 2", 3", 6", 9", 12", 18", 24", 36", 48", 60", 72", 96", 120"** and **144". Palmer-Bwls** (Palmer-Bowlus) flume sizes of **4", 6", 8", 10", 12", 15", 18", 21", 24", 27"** and **30"**. **V-notch** weir sizes of **22.5°, 30°, 45°, 60°, 90° and 120°**. **Rect with Ends** (Rectangular Weir with End Contractions), **Rect w/o Ends** (Rectangular Weir without End Contractions), and **Cipoletti** weir. **Custom Table** (see page 61 can be selected if none of the stored *Flow Elements* can be used. The table can be built with a maximum of 30 points. The Model 706 also has the capability of using a **Generic Equation** (see page 60) for flow calculation.
Custom Table	The *Custom Table* points can be a **Linear** (straight line between adjacent points) or **Spline** (can be a curved line between points) relationship. Refer to the drawing above for more information.
Cust Table Vals	A maximum of 30 points can be used in building the *Custom Table*. Each pair of values will have a Head (height) in the units chosen in the *Level Units* screen, and the associated flow for that Head value. The values must be monotonic, i.e., each pair of values must be greater than the previous Head/flow pair. The last pair of values should have the highest Head value (usually the *Maximum Head* value) and the flow associated with that Head value.
Reference Dist	The *Reference Distance* is measured from the sensor reference point to the point of zero flow in the weir or flume. This must be measured very accurately in the user-selected level units.
Maximum Head	*Maximum Head* is the highest liquid level (Head) value in the flume or weir before the flow equation is no longer valid. The *Maximum Head* is expressed in the user-selected *Level Units*. The Model 706 will default to the largest *Maximum Head* value that is allowed for any given flume or weir. The *Maximum Head* value can be revised depending on the value of the *Reference Distance*, or for end user preference.
Maximum Flow	*Maximum Flow* is a read-only value that represents the flow value corresponding to the *Maximum Head* value for the flume or weir.
Low Flow Cutoff	The *Low Flow Cutoff* (in user-selected level units) will force the calculated flow value to zero whenever the *Head* is below this point. This parameter will have a default and minimum value of zero.

3.4.6 Reset Function

A parameter labeled “Reset Parameter” is located at the end of the DEVICE SETUP/ADVANCED CONFIG menu. In the event a user gets confused during configuration or advanced troubleshooting, this parameter gives the user the ability to reset the Model 706 transmitter configuration.

Unique to the Model 706 transmitter is the ability for Magnetrol to fully “pre-configure” devices to customer requests. For that reason, the Reset function will return the device back to the state **at which it left the factory**.

It is recommended that AMETEK LMS Technical Support be contacted as the Advanced User password will be required for this reset.

3.4.7 Additional Diagnostic/Troubleshooting Capabilities

3.4.7.1 Event History

As a means for improved troubleshooting capability, a record of significant diagnostic events is stored with time and date stamps. A real time on board clock (which must be set by the operator), will maintain the current time.

3.4.7.2 Context-sensitive Help

Descriptive information relevant to the highlighted parameter in the menu will be accessible via the local display and remote host interfaces. This will most often be a parameter-related screen, but could also be information about menus, actions (for example, Loop [Analog Output] Test, resets of various types), diagnostic indicators, etc.

For example: Dielectric Range — Selects the range bounding the dielectric constant of the medium in vessel. For interface measurement mode, it selects the range bounding the dielectric constant of the lower liquid medium. Some ranges may not be selectable depending on the probe model.



3.4.7.3 Trend Data

Another new feature to the Model 706 is the ability to log several measured values (selectable from any of the primary, secondary, or supplemental measured values) at a configurable rate (for example, once every five minutes) for a period ranging from several hours to a number of days (depending on the configured sample rate and number of values to be recorded). The data will be stored in non-volatile memory in the transmitter with date and time information for subsequent retrieval and visualization using the associated Model 706 DTM.

3.5 Agency Approvals








CE These units are in compliance with the EMC-directive 2014/30/EU, the PED-directive 2014/68/EU and the ATEX directive 2014/34/EU.

AVERTISSEMENT! Danger d'explosion éventuel. Ne brancher ou débrancher des équipements que si l'alimentation électrique a été coupée ou si la zone est réputée non dangereuse.

Explosion Proof (with intrinsically Safe Probe)

US/Canada:
Class I, Div 1, Group B, C and D, T4
Class I, Zone 1 AEx db/ia [ia IIC Ga] IIB + H2 T4 Gb/Ga
Class I, Zone 1 Ex db/ia [ia IIC Ga] IIB + H2 T4 Gb/Ga
Ta = -40ºC to +70ºC
Type 4X, IP66/IP67

Flame Proof
ATEX – FM14ATEX0041X:
II 2/1 G Ex db/ia [ia IIC Ga] IIB + H2 T6 to T1 Gb/Ga
Ta = -40ºC to +70ºC
IP66/IP67

IEC- IECEx FMG 14.0018X:
Ex db/ia [ia IIC Ga] IIB + H2 T6 to T1 Gb/Ga
Ta = -40ºC to +70ºC
IP66/IP67

Non- Incendive

US/Canada:
US: Class I, II, III, Division 2, Group A, B, C, D, E, F, G, T4
Canada: Class I, Division 2, Group A, B, C, D
Class I, Zone 2 AEx ec [ia Ga] IIC T4 Gc
Class I, Zone 2 Ex ec [ia Ga] IIC T4 Gc
Ta = -40ºC to +70ºC
Type 4X, IP66/IP67

ATEX – FM14ATEX0042X:
II 3 (1) G Ex ec [ia Ga] IIC T4 Gc
Ta = -15ºC to +70ºC
IP66/IP67

ATEX – FM22ATEX0003X
II 3 G Ex ic IIC T4 Gc
Ta = -40ºC to +70ºC
IP66/IP67

IEC – IECEx FMG 14.00018X:
Ex ec [ia Ga] IIC T4 Ga/Gc
Ta = -15ºC to + 70ºC
IP66/IP67

Intrinsically Safe

US/Canada:
Class I, II, III, Div 1, Group A, B, C, D, E, F, G, T4,
Class I, Zone 0 AEx ia IIC T4 Ga
Class I, Zone 0 Ex ia IIC T4 Ga
Class I, Zone 2 AEx ic IIC T4 Gc
Class I, Zone 2 Ex ic IIC T4 Gc
Ta =-40ºC to + 70ºC
Type 4X, IP66/IP67

ATEX – FM14ATEX0041X:
II 1 G Ex ia IIC T4 Ga
Ta = -40ºC to +70ºC
IP66/IP67

ATEX – FM22ATEX0003X:
II 3 G Ex ic IIC T4 Gc
Ta = -40ºC to +70ºC
IP66/IP67

IEC – IECEx FMG 14.0018X:
Ex ia IIC T4 Ga
Ex ic IIC T4 Gc
Ta = -40ºC to +70ºC
IP66/IP67

Dust Ignition Proof

US/Canada:
Class II, III, Division 1, Group E, F and G, T4
Ta = -40ºC to +70ºC
Type 4X, IP66/IP67

ATEX – FM14ATEX0041X:
II 1/2 D Ex ia/tb [ia Da] IIIC T85ºC to T450ºC Da/Db
Ta = -15ºC to +70ºC
IP66/IP67

IEC – IECEx FMG 14.0018X:
Ex ia tb [ia Da] IIIC T85ºC to T450ºC Db
Ex ia IIIC T85ºC to T450ºC Da
Ta = -15ºC to +70ºC
IP66/IP67

INMETRO Certification

Brazil:
InMetro -TUV 13.1484X:
BR-Ex ia IIC T4 Ga -40 C < Ta < +70 C
BR-Ex ec [ia GA] IIC T4 Gc -15 C < Ta < +70 C
BR-Ex db/ia [ia IIC Ga] IIB + H2 T6…
T1 Ga/Gb -40 C < Ta < +70 C
BR-Ex ia tb [ia Da] IIIC T85 C…T450 C -15 C < Ta < +70 C
BR-Ex db [ia] IIC T6…T1 Ga/Gb -40 C < Ta < +70 C
BR-Ex tb [ia] IIIC T85C…T450C Da/Db -15 C < Ta < +70 C
BR-Ex ic IIC T4 Gc -40 C < Ta < +70 C
IP66/IP67

3.5.1 Special Conditions of Use

1. The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.
2. The risk of electrostatic discharge shall be minimized at installation, following the directions given in the instructions.
3. Contact the original manufacturer for information on the dimensions of the flameproof joints.
4. For installation with ambient temperature of +70 °C, refer to the manufacturer's instructions for guidance on proper selection of conductors.
5. WARNING—Explosion Hazard: Do not disconnect equipment when flammable or combustible atmoshpere is present.
6. For IEC and ATEX: To maintain the T1 to T6 temperature codes, care shall be taken to ensure the enclosure temperature does not exceed +75 °C.
7. For U.S. and Canada: To maintain the T4 temperature code, care shall be taken to ensure the enclosure temperature does not exceed +70 °C.
8. Temperature codes for the ratings Ex db/ia [ia IIC] IIB+H2 and Ex ia/tb [ia] IIIC are defined by the following table:

Process Temperature (PT)	Temperature Code-TCG (GAS)	Temperature Code-TCD (Dust)
Up to 75 °C	T6	TCD= PT+10K=85 °C
From 75 to 90 °C	T5	TCD= PT+10K=100 °C
From 90 to 120 °C	T4	TCD= PT+15K=135 °C
From 125 to 185 °C	T3	TCD= PT+15K=200 °C
From 185 to 285 °C	T2	TCD= PT+15K=300 °C
From 285 to 435 °C	T1	TCD= PT+15K=450 °C

9. Flameproof joints are not intended to be repaired.
10. To maintain FM approval, the Model 706 transmitter with adapter shall only be used on Model 705 assemblies approved by FM Global. (Includes FM, CSA, ATEX and IEC).
11. Provisions shall be made to provide transient over-voltage protection to a level not to exceed 119Vdc.

3.5.2 Agency Specifications – Explosion Proof Installation

Factory Sealed: This product has been approved by Factory Mutual Research (FM) as a Factory Sealed device.

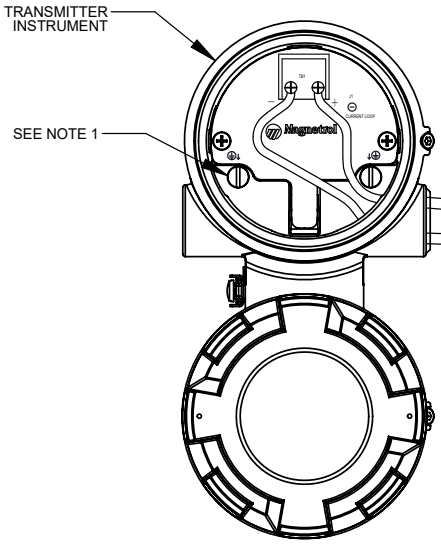
NOTE: Factory Sealed: No Explosion Proof conduit fitting (EY seal) is required within 18" of the transmitter. However, an Explosion Proof conduit fitting (EY seal) is required between the hazardous and safe areas.

HAZARDOUS LOCATION

MODEL 706 LEVEL TRANSMITTER

INTRINSICALLY SAFE FOR:
CLASS I, II, III DIV. I GROUPS A, B, C, D, E, F, G & T4
CLASS I, ZONE 0 AEx\Ex ia IIC T4 Ga
CLASS I, ZONE 2 AEx\Ex ic IIC T4 Gc
Ta = -40°C TO 70°C

ENTITY
Ui = 28.4 V
Ii = 120 mA
Pi = 0.84 W
Ci = 4.4 nF
Li = 2.7 µH



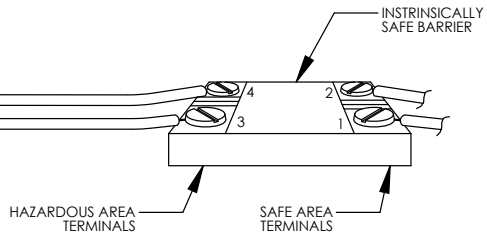
MODEL 706-51XX-XXX

NON-HAZARDOUS LOCATION

LIMITING VALUES

Voc ≤ 28.6V Ca ≥ 4.4nF
Isc ≤ 140 mA La ≥ 2.7µH

THE VOLTAGE (V max) AND CURRENT (I max), WHICH THE TRANSMITTER CAN RECEIVE MUST BE EQUAL TO OR GREATER THAN THE MAXIMUM OPEN. CIRCUIT VOLTAGE (Voc OR V+) AND THE MAXIMUM SHORT CIRCUIT CURRENT (Isc OR IE), WHICH CAN BE DELIVERED BY THE SOURCE DEVICE. IN ADDITION, THE MAXIMUM CAPACITANCE (Ci) AND INDUCTANCE (Li) OF THE LOAD AND THE CAPACITANCE AND INDUCTANCE OF THE INTERCONNECTING WIRING, MUST BE EQUAL TO LESS THAN THE CAPACITANCE (Ca) OR THE INDUCTANCE (La), WHICH CAN BE DRIVEN BY THE SOURCE DEVICE.



SEE NOTE 2

SPECIAL CONDITIONS OF USE:

1. THE ENCLOSURE CONTAINS ALUMINUM AND IS CONSIDERED TO PRESENT A POTENTIAL RISK OF IGNITION BY IMPACT OR FRICTION. CARE MUST BE TAKEN DURING INSTALLATION AND USE TO PREVENT IMPACT OR FRICITON.
2. THE RISK OF ELECTROSTATIC DISCHARGE SHALL BE MINIMIZED AT INSTALLATION, FOLLOWING THE DIRECTIONS GIVEN IN THE INSTRUCTIONS.
3. FOR IEC AND ATEX - TO MAINTAIN THE T1 TO T6 TEMPERATURE CODES, CARE SHALL BE TAKEN TO ENSURE THE ENCLOSURE TEMPERATURE DOES NOT EXCEED 70 ºC.
4. FOR US AND CANADA - TO MAINTAIN THE T4 TEMPERATURE CODE, CARE SHALL BE TAKEN TO ENSURE THE ENCLOSURE TEMPERATURE DOES NOT EXCEED 70 ºC.
5. PROVISIONS SHALL BE MADE TO PROVIDE TRANSIENT OVERVOLTAGE PROTECTION TO A LEVEL NOT EXCEEDING 119 Vdc.
6. THE MODEL 706 TRANSMITTER WITH ADAPTOR SHALL BE USED ONLY ON FM APPROVED MODEL 705 ASSEMBLIES.

NOTES:

1. FOR EXPLOSIONPROOF OR DUST-IGNITIONPROOF INSTALLATIONS. THE I.S. GROUND TERMINAL SHALL BE CONNECTED TO APPROPRIATE INTRINSICALLY SAFE GROUND INACCORDANCE WITH THE CANADIAN ELECTRICAL CODE [CEC] [FOR CSA] OR THE NATIONAL ELECTRINCAL CODE [NEC, ANSI/NFPA 70] [FOR FMRC]. FOR INTRINSICALLY SAFE INSTALLATIONS. THE I.S. GROUND TERMINAL DOES NOT REQUIRE GROUNDING.
2. MANUFACTURER'S INSTALLATION INSTRUCTIONS SUPPLIED WITH THE PROTECTIVE BARRIER AND THE CEC [FOR CSA] OR THE NEC AND ANSI/ISA RP 12.6 [FOR FMRC] MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT. BARRIER MUST BE CSA CERTIFIED FOR CANADIAN INSTALLATIONS & FM APPROVED FOR U.S. INSTALLATION.
3. CONTROL EQUIPMENT CONNECTED TO PROTECTIVE BARRIERS MUST NOT USE OR GENERATE MORE THAN 250 VDC OR VRMS.
4. NRTL LISTED DUST-TIGHT SEALS MUST BE USED WHEN TRANSMITTER IS INSTALLED IN CLASS II & III ENVIRONMENTS.
5. NO REVISIONS TO THIS DRAWING WITHOUT CSA AND FMRC APPROVAL.
6. FOR CSA: EXIA INTRINSICALLY SAFE/SECURITE INTRINSEQUE.
7. FOR CSA: WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABLITY FOR HAZARDOUS LOCATIONS.
8. FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 80º C AMBIENT, USE WIRE WITH A MINIMUM TEMPERATURE RATING OF 85º C.
9. THE TRANSMITTER CAN ALSO BE INSTALLED IN:
   CLASS I, DIVISION 2, GROUPS A, B, C & D
   CLASS II, DIVISION 2, GROUPS E, F & G (F & G ONLY FOR FMRC)
   CLASS III, DIVISION 2, HAZARDOUS LOCATIONS AND DOES NOT REQUIRE CONNECTION TO A PROTECTIVE BARRIER WHEN INSTALLED PER THE CEC (FOR CSA) OR THE NEC (FOR FMRC) AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 36 VDC.
10. FM APPROVED AND CSA CERTIFIED BARRIERS WITH LINEAR OUTPUT CHARACTERISTICS **MUST BE USED**.

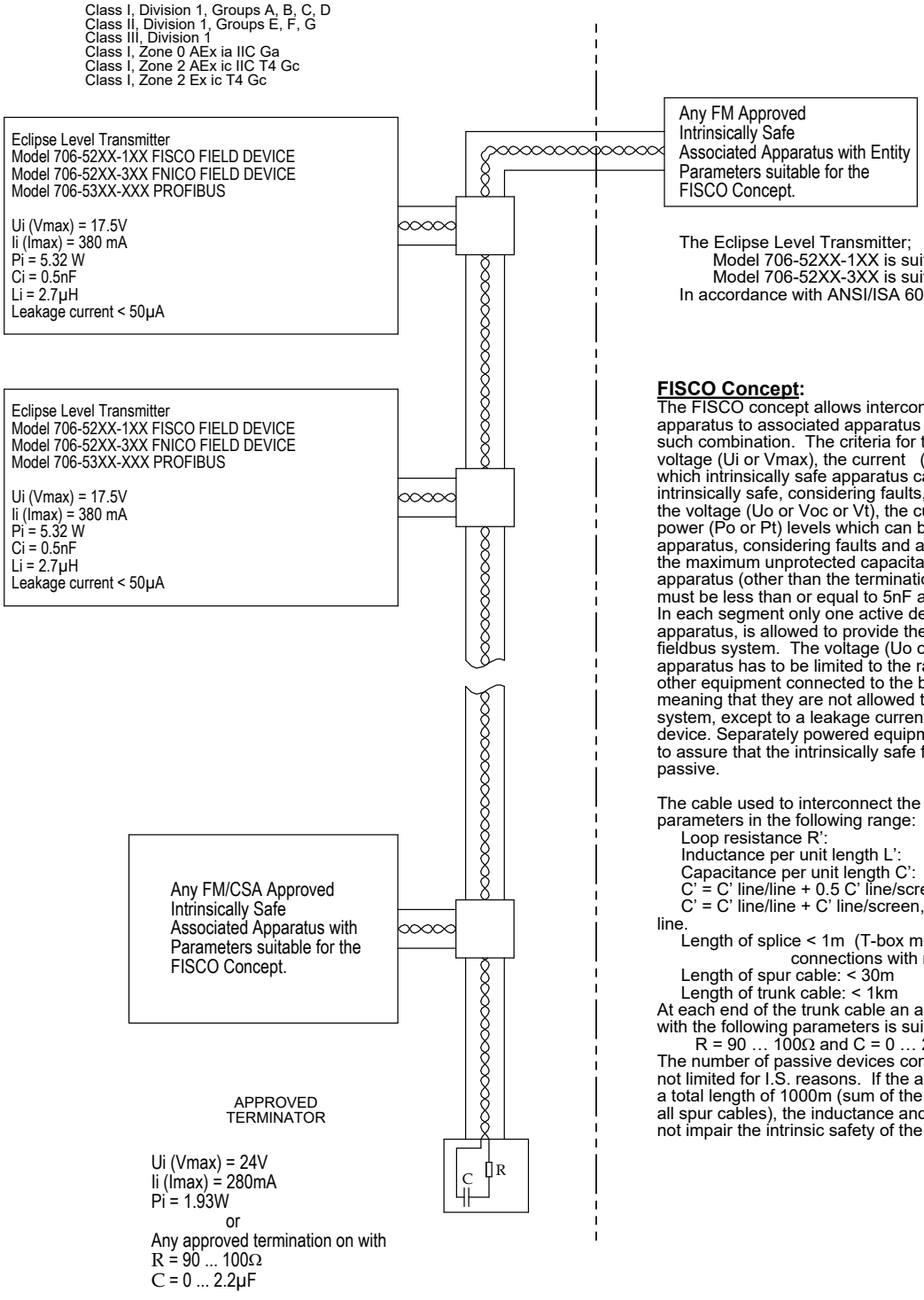
099-5072-L

SHEET 2 OF 3

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Division 1, Groups A, B, C, D
Class II, Division 1, Groups E, F, G
Class III, Division 1
Class I, Zone 0 AEx ia IIC Ga
Class I, Zone 2 AEx ic IIC T4 Gc
Class I, Zone 2 Ex ic T4 Gc

UNCLASSIFIED LOCATION



The Eclipse Level Transmitter;
Model 706-52XX-1XX is suitable for use in a FISCO system
Model 706-52XX-3XX is suitable for use in a FNICO system
In accordance with ANSI/ISA 60079-27:2006.

FISCO Concept:

The FISCO concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for the interconnection is that the voltage (Ui or Vmax), the current (Ii or Imax) and the power (Pi) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo or Voc or Vt), the current (Io or Isc or It) and the power (Po or Pt) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5nF and 10µH respectively.
In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The voltage (Uo or Voc or Vt), of the associated apparatus has to be limited to the range of 14V to 24V d.c. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

Loop resistance R':	15 … 150Ω/km
Inductance per unit length L':	0.4 … 1mH/km
Capacitance per unit length C':	80 … 200nF/km

C' = C' line/line + 0.5 C' line/screen, if both lines are floating or
C' = C' line/line + C' line/screen, if screen is connected to one line.
Length of splice < 1m (T-box must only contain terminal connections with no energy storage capability)
Length of spur cable: < 30m
Length of trunk cable: < 1km
At each end of the trunk cable an approved infallible termination with the following parameters is suitable:
R = 90 … 100Ω and C = 0 … 2.2µF
The number of passive devices connected to the bus segment is not limited for I.S. reasons. If the above rules are followed, up to a total length of 1000m (sum of the length of the trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

099-5072-L

SHEET 3 OF 3

3.6 Specifications

3.6.1 Functional/Physical

System Design		
Measurement Principle		Guided Wave Radar based on Time Domain Reflectometry (TDR)
Input		
Measured Variable		Level, as determined by GWR time of flight
Span		6 inches to 100 feet (15 cm to 30 m); Model 7yS Probe 20 feet (610 cm) max.
Output		
Type		4 to 20 mA with HART: 3.8 mA to 20.5 mA useable (per NAMUR NE43)
		FOUNDATION fieldbus™: H1 (ITK Ver. 6.2.0)
		PROFIBUS PA
		Modbus
Resolution	Analog:	.003 mA
	Digital Display:	1 mm
Loop Resistance		591 ohms @ 24 VDC and 22 mA
Diagnostic Alarm		Selectable: 3.6 mA, 22 mA (meets requirements of NAMUR NE 43), or HOLD last output
Diagnostic Indication		Meets requirements of NAMUR NE107
Damping		Adjustable 0–10 seconds
User Interface		
Keypad		4-button menu-driven data entry
Display		Graphic liquid crystal display
Digital Communication/Systems		HART Version 7— with Field Communicator, AMS, or FDT
		DTM (PACT*ware*™), EDDL
		FOUNDATION fieldbus, PROFIBUS PA or Modbus
Menu Languages	Transmitter LCD:	English, French, German, Spanish, Russian, Polish
	HART DD:	English, French, German, Spanish, Russian, Chinese, Portuguese, Polish
		FOUNDATION fieldbus, PROFIBUS PA and Modbus Host System: English
Power (at transmitter terminals)		HART: General Purpose (Weatherproof)/Intrinsically Safe/Explosion-proof:
		16 to 36 VDC
		11 VDC minimum under certain conditions
		FOUNDATION fieldbus and PROFIBUS PA: 9 to 17.5 VDC
		FISCO ia / FNICO ic, Explosion Proof, General Purpose and Weatherproof
		Modbus: 8 to 30 VDC
		Explosion Proof, General Purpose, and Weatherproof
Housing		
Material		IP66/IP67/die-cast aluminum A413 (<0.4% copper); optional stainless steel
Net/Gross Weight	Aluminum:	4.5 lbs. (2.0 kg)
	Stainless Steel:	10.0 lbs. (4.50 kg)
Overall Dimensions		H 8.34" (212 mm) x W 4.03" (102 mm) x D 7.56" (192 mm)
Cable Entry		½" NPT or M20
SIL 2/3 Capable (Certified)		Safe Failure Fraction = 93% (HART only)
		Functional Safety to SIL 2/3 in accordance with IEC 61508

3.6.1 Functional/Physical

Environment	
Operating Temperature	-5 to +160 °F (-20 to +70 °C)
Storage Temperature	-22 to +176 °F (-30 to +80 °C)
Humidity	0 to 99%, non-condensing
Electromagnetic Compatibility	Meets CE requirement (EN 61326) and NAMUR NE 21 ①
Surge Protection	Meets CE EN 61326 (1000V)
Shock/Vibration	ANSI/ISA-S71.03 Class SA1 (Shock); ANSI/ISA-S71.03 Class VC2 (Vibration)
Performance	
Reference Conditions ②	Reflection from liquid, with dielectric constant in center of selected range,
	with a 72" (1.8 m) coaxial probe at +70 °F (+20 °C), in Auto Threshold Mode
Linearity③ Coaxial/Caged/Single Rod (rigid or cable):	<0.1% of probe length or 0.1 inch (2.5 mm), whichever is greater
Twin Cable:	<0.3% of probe length or 0.3 inch (7.5 mm), whichever is greater
Accuracy④ Coaxial/Caged/Single Rod (rigid or cable):	±0.1% of probe length or ±0.1 inch (2.5 mm), whichever is greater
Twin Cable:	±0.5% of probe length or ±0.5 inch (13 mm), whichever is greater
Interface Operation:	±1 inch (25 mm) for an interface thickness greater than 2 inches (50 mm)
	Twin Flexible probes: ±2 inch (50 mm) for an interface thickness greater than
	8 inches (200 mm)
Resolution	±0.1 inch or 1 mm
Repeatability	<0.1 inch (2.5 mm)
Hysteresis	<0.1 inch (2.5 mm)
Response Time	Approximately 1 second
Initialization Time	Less than 10 seconds
Ambient Temperature Effect	Approx. ±0.02% of probe length/degree C (for probes greater than 8 feet (2.5 m))
Process Dielectric	<0.3 inch (7.5 mm) within selected range
FOUNDATION fieldbus™	
ITK Version	6.2.0
H1 Device Class	Link Master (LAS) — selectable ON/OFF
Function Blocks	(8) AI, (3) Transducer, (1) Resource, (1) Arithmetic, (1) Input Selector,
	(1) Signal Characterizer, (2) PID, (1) Integrator
Quiescent Current	15 mA
Execution Time	15 ms (40 ms PID Block)
Device Revision	02
DD Version	0x01
PROFIBUS PA	
Device Revision	0x101A
Digital Communication Protocol	Version 3.02 MBP (31.25 kbits/sec)
Function Blocks	(1) × Physical Block, (8) × AI Blocks, (3) × Transducer Block
Quiescent Current	15 mA
Execution Time	15 ms
Modbus	
Power Consumption	<0.5W
Signal Wiring	Two-wire half duplex RS-485 Modbus
Ground (common mode) Voltage	±7V
Bus Termination	Per EIA-485

① Single rod and twin cable probes must be used in metallic vessel or stillwell to maintain CE noise immunity

② Specifications will degrade in Fixed Threshold mode.

③ Linearity in top 18 inches (46 cm) of twin cable and single rod probes in tanks will be application dependent.

④ Accuracy may degrade when using manual or automatic compensation.

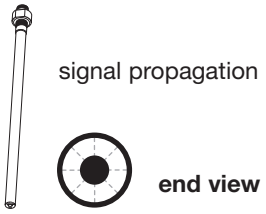
3.6.2 O-ring (Seal) Selection Chart

Code	O-Ring/Seal Material	Max. Process Temperature	Min. Process Temperature	Max. Process Pressure	Not Recommended For Applications	Recommended for Applications
0	**Viton® GFLT**	400 °F @ 230 psi (200 °C @ 16 bar)	-40 °F (-40 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Ketones (MEK, acetone), skydrol fluids, amines, anhydrous ammonia, low molecular weight esters and ethers, hot hydrofluoric or chlorosulfuric acids, sour HCs	General purpose, ethylene
1	**EPDM**	250 °F @ 200 psi (120 °C @14 bar)	-60 °F (-50 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Petroleum oils, di-ester base lubricant, steam	Acetone, MEK, skydrol fluids
2	**Kalrez® 4079**	400 °F @ 232 psi (200 °C @ 16 bar)	-40 °F (-40 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Hot water/steam, hot aliphatic amines, ethylene oxide, propylene oxide	Inorganic and organic acids (including hydro fluids and nitric), aldehydes, ethylene, organic oils, glycols, silicone oils, vinegar, sour HCs
3	**HSN** (Highly Saturated Nitrile)	275 °F @ 320 psi (135 °C @ 22 bar)	-4 °F (-20 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Halogenated HCs, nitro HCs, phosphate ester hydraulic fluids, ketones (MEK, acetone), strong acids, ozone, automotive brake fluid, steam	NACE applications
4	**Buna-N**	275 °F @ 320 psi (135 °C @ 22 bar)	-4 °F (-20 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Halogenated HCs, nitro HCs, phosphate ester hydraulic fluids, ketones (MEK, acetone), strong acids, ozone, automotive brake fluid	General purpose sealing, petroleum oils and fluids, cold water, silicone greases and oils, di-ester base lubricants, ethylene glycol base fluids
5	**Neoprene®**	250 °F @ 290 psi (120 °C @ 20 bar)	-65 °F (-55 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Phosphate ester fluids, ketones (MEK, acetone)	Refrigerants, high anline point petroleum oils, silicate ester lubricants
6	**Chemraz® 505**	400 °F @ 200 psi (200 °C @ 14 bar)	-20 °F (-30 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Acetaldehyde, ammonia + lithium metal solution, butyraldehyde, di-water, freon, ethylene oxide, liquors, isobutyraldehyde	Inorganic and organic acids, alkalines, ketones, esters, aldehydes, fuels
7	**Polyurethane**	200 °F @ 420 psi (95 °C @29 bar)	-65 °F (-55 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Acids, Ketones, chlorinated HCs,	Hydraulic systems, petroleum oils, HC fuel, oxygen, ozone
8	**Simriz SZ485** (formerly Aegis PF128) ①	400 °F @ 232 psi (200 °C @ 16 bar)	20 °F (-7 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Black liquor, freon 43, freon 75, galden, KEL-F liquid, molten potassium, molten sodium	Inorganic and organic acids (including hydro fluids and nitric), aldehydes, ethylene, organic oils, glycols, silicone oils, vinegar, sour HCs, steam, amines, ethylene oxide, propylene oxide, NACE applications
A or B	**Kalrez® 6375**	400 °F @ 232 psi (200 °C @ 16 bar)	-40 °F (-40 °C)	1000 psi 70 °F (70 bar @ 20 °C)	Hot water/steam, hot aliphatic amines, ethylene oxide, propylene oxide	Hydrofluoric Acid
D or N	**Glass Ceramic Alloy**	850 °F @ 3600 psi (450 °C @ 248 bar)	-320 °F (-195 °C)	6250 psi 70 °F (431 bar @ 20 °C)	Hot alkaline solutions HF acid, media with ph>12, direct exposure to saturated steam	General high temperature/high pressure applications, hydrocarbons, full vacuum (hermetic), ammonia, chlorine

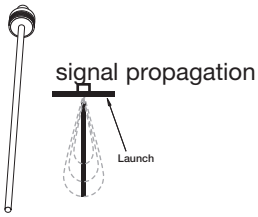
① Maximum +300 °F (+150 °C) for use on steam.

3.6.3 Probe Selection Guide

COAXIAL/CAGED GWR PROBE



SINGLE ROD/CABLE PROBE



GWR Probe①	Description	Application	Installation	Dielectric Range ②③	Temperature Range ④	Max. Pressure	Vacuum ⑤	Overfill Safe	Viscosity cP (mPa.s)
Coaxial GWR Probes— Liquids									
7yT	Standard Temperature	Level/Interface	Tank/Chamber	ε_r 1.4–100	-40 to +400 °F (-40 to +200 °C)	1000 psi (70 bar)	Yes	Yes	500/2000
7yP	High Pressure	Level/Interface	Tank/Chamber	ε_r 1.4–100	-320 to +400 °F (-196 to +200 °C)	6250 psi (431 bar)	Full	Yes	500/2000
7yD	High Temp./ High Press.	Level/Interface	Tank/Chamber	ε_r 1.4–100	-320 to +850 °F (-196 to +450 °C)	6250 psi (431 bar)	Full	Yes	500/2000
7yS	Steam Probe	Saturated Steam	Tank/Chamber	ε_r 10–100	-40 to +800 °F ⑥ (-40 to +425 °C)	3000 psi (207 bar)	Full	No ⑦	500
Caged GWR Probes— Liquids									
7yG	Standard Temperature	Level/Interface	Chamber	ε_r 1.4–100	-40 to +400 °F (-40 to +200 °C)	1000 psi (70 bar)	Yes	Yes	10000
7yL	High Pressure	Level/Interface	Chamber	ε_r 1.4–100	-320 to +400 °F (-196 to +200 °C)	6250 psi (431 bar)	Full	Yes	10000
7yJ	High Temp./ High Press.	Level/Interface	Chamber	ε_r 1.4–100	-320 to +850 °F (-196 to +450 °C)	6250 psi (431 bar)	Full	Yes	10000
Single Rod Rigid GWR Probes— Liquids									
7yF	Standard Temperature	Level/Interface	Tank	ε_r 1.7–100	-40 to +400 °F (-40 to +200 °C)	1000 psi (70 bar)	Yes	No ⑧	10000
7yH	Hygienic	Level	Tank	ε_r 1.7–100	-40 to 300 °F (-40 to +150 °C)	200 psi (13.8 bar)	Yes	No ⑧	10000
7yM	High Pressure	Level	Tank	ε_r 1.7–100	-320 to +400 °F (-196 to +200 °C)	6250 psi (431 bar)	Full	No ⑧	10000
7yN	High Temp./ High Press.	Level	Tank	ε_r 1.7–100	-320 to +850 °F (-196 to +450 °C)	6250 psi (431 bar)	Full	No ⑧	10000
Single Cable Flexible GWR Probes— Liquids									
7y1	Standard Temperature	Level/Interface	Tank	ε_r 1.7–100	-40 to +400 °F (-40 to +200 °C)	1000 psi (70 bar)	Yes	No ⑧	10000
7y3	High Pressure	Level	Tank	ε_r 1.7–100	-320 to +400 °F (-196 to +200 °C)	6250 psi (431 bar)	Full	No ⑧	10000
7y4	Standard Temperature	Level/Interface	Chamber	ε_r 1.4–100	-40 to +400 °F (-40 to +200 °C)	1000 psi (70 bar)	Yes	No ⑧	10000
7y6	High Temp./ High Press	Level/Interface	Chamber	ε_r 1.4–100	-320 to +850 °F (-196 to +450 °C)	6250 psi (431 bar)	Full	No ⑧	10000
Single Cable Flexible GWR Probes— Solids									
7y2	Bulk Solids Probe	Level	Tank	ε_r 1.7–100	-40 to +150 °F (-40 to +65 °C)	Atmos.	No	No ⑧	10000

① 2nd digit A=English, C=Metric
② Minimum ε_r 1.2 with end of probe analysis enabled.
③ Single rod probes mounted directly into the vessel must be within 3–6 inches of metal tank wall to obtain minimum dielectric of 1.4, otherwise ε_r min = 1.7.
④ Depends on the probe spacer material. Refer to Model Selection for spacer options.
⑤ Eclipse probes containing o-rings can be used for vacuum (negative pressure) service, but only those probes with glass seals are hermetically sealed to $<10^{-8}$ cc/sec @ 1 atmosphere helium.
⑥ When installed in side-mounted chamber.
⑦ Consult factory for overfill applications
⑧ Overfill capability can be achieved with software.

3.6.4 Probe Specifications

Dual-element Probes

Model	Coaxial / Cage (7yG, 7yT)	HP Coaxial/Cage (7yL, 7yP) ①	HTHP Coaxial/Cage (7yD, 7yJ) ①	Steam (7yS) ①
Materials	316/316L SS (Hastelloy C and Monel opt.) TFE spacers, Viton® O-rings	316/316L SS, Glass Ceramic Alloy, Inconel TFE spacers	316/316L SS, Glass Ceramic Alloy, Inconel TFE or Peek™ spacers	316/316L SS, Peek™, Inconel Aegis PF 128 O-ring
Diameter	Small Coaxial: .3125" (8 mm) diameter rod, .875" (10 mm) diameter tube			.875" (10 mm) +575 °F
	Enlarged Coaxial: .6" (15 mm) dia. rod, 1.75" (44 mm) dia. tube			1.62 (42 mm) +800 °F
	Caged: 0.5" – 1.50" (13 – 38 mm) dia. rod			N/A
Process Connection	¾" NPT, 1" BSP ASME or EN flanges	¾" NPT, 1" BSP ASME or EN flanges		¾" NPT, 1" BSP ASME or EN flanges
Transition Zone (Top)	None			8" (200 mm) @ ε_r = 80
Transition Zone (Bottom)	6" (150 mm) @ ε_r = 1.4 1" (25 mm) @ ε_r = 80.0	6" (150 mm) @ ε_r = 1.4 1" (25 mm) @ ε_r = 80.0		1" (25 mm)@ ε_r = 80
Pull Force/Tension	N/A			

NOTE: Transition Zone is dielectric dependent; ε_r = dielectric permittivity. The transmitter still operates but level reading may become nonlinear in Transition Zone.

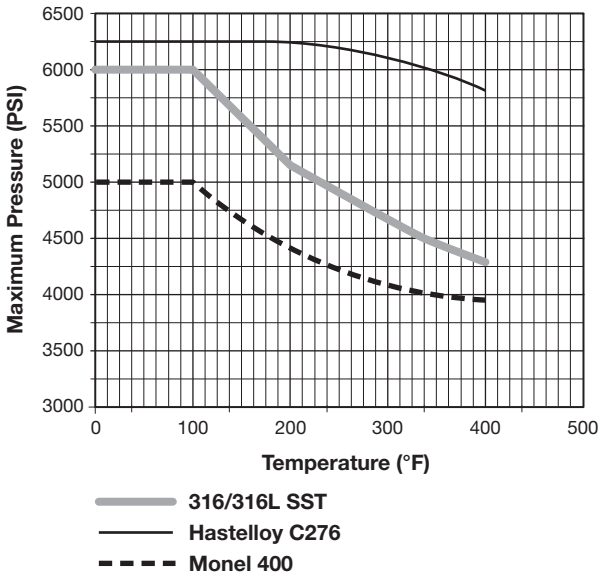
Single Rod Probes

Model	7yF	7yH	7yM, 7yN ①	7y1 Flexible	7y3, 7y6 Flexible ①	7y2 Flexible
Materials	316/316L SS (Hastelloy® C and Monel optional) Viton®/PEEK™ O-rings	316L SS, <15 Ra electropolished finish (Optional: Hastelloy C, AL6XN SS) PEEK and O-ring (Viton or EPDM) (GRAS 21CFR177 and USP <88> Class VI at 121 °C)	316/316L SS, Inconel (Hastelloy® C and Monel optional) Viton®/PEEK™ O-rings	316/316L SS, Viton® O-rings (optional PFA coating)	316/316L SS, Inconel, Viton® O-rings	316/316L SS, Viton® O-rings
Diameter	0.5" (13 mm)			0.25" (6 mm)		
Blocking Distance - Top	0–36" (0–91 cm) Installation dependent (adjustable)	N/A	0–36" (0–91 cm) Installation dependent (adjustable)			
Process Connection	1" NPT (7yF) ASME or EN flange	2" to 4" (50 to 100 cm); Tri-Clamp® fitting	1" NPT (7yF) ASME or EN flange	2" NPT ASME or EN flange		
Transition Zone (Top)	Application Dependent	1" (25 mm) @ ε_r > 10	Application Dependent			
Transition Zone (Bottom)	6" (150 mm) @ ε_r = 1.4 2" (50 mm) @ ε_r >10	1" (25 mm) @ ε_r > 10	6" (150 mm) @ ε_r = 1.4 2" (50 mm) @ ε_r >10	12" (305 mm) minimum		
Pull Force/Tension	N/A			20 lbs. (9 Kg)		3000 lbs. (1360 Kg)
Side Load	Not more than 3" (7.6 cm) deflection at end of 120" (305 cm) probe			Cable not to exceed 5° from vertical		

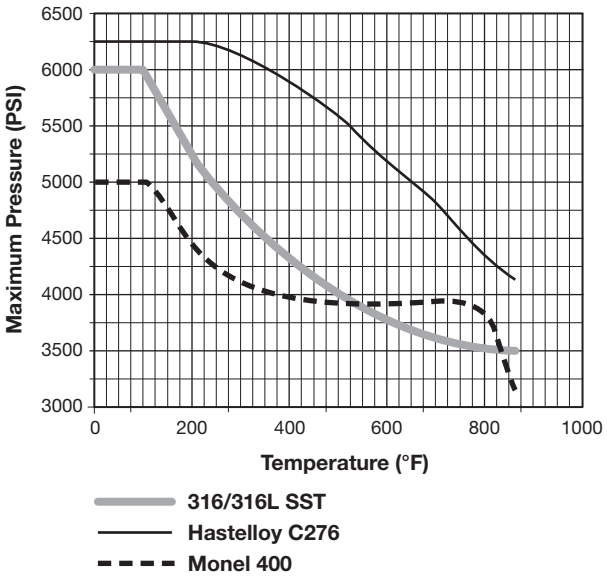
① Probes of Hastelloy C contain an Inconel 625 to Hastelloy C seal weld.

Temperature/Pressure Charts

7yL, 7yM and 7yP (high pressure probes)
Temperature/Pressure Ratings



7yD, 7yJ, 7yN, 7y3 and 7y6 (high temp./high pressure probes)
Temperature/Pressure Ratings



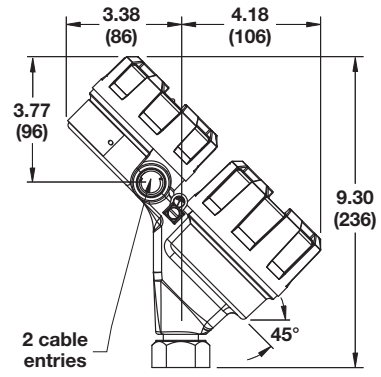
NOTES:

- 7yS steam probes are rated to 3000 psi (207 bar) up to +800 °F (+425 °C) when installed in side-mounted chamber.
- 7y3, 7y6 flexible probes: Pressure is limited by the chamber.
- 7y2, 7y5 bulk solids probes: 50 psi (3.45 bar) to +150 °F (+65 °C)

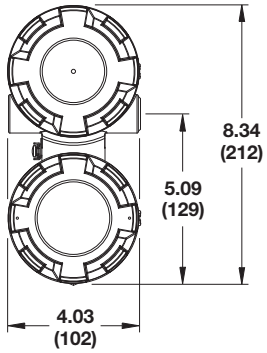
High Pressure Probes				Low Pressure	High Pressure Probes				Low Pressure
Temp.	SST	Hastelloy	Monel	All Materials	Temp.	SST	Hastelloy	Monel	All Materials
-40	6000	6250	5000	750	+600	3760	5040	3940	—
+70	6000	6250	5000	1000	+650	3680	4905	3940	—
+100	6000	6250	5000	1000	+700	3620	4730	3920	—
+200	5160	6250	4380	650	+750	3560	4430	3880	—
+300	4660	6070	4080	400	+800	3520	4230	3820	—
+400	4280	5820	3940	270	+850	3480	4060	3145	—
+500	3980	5540	3940	—					

3.6.5 Physical Specifications – Transmitter

inches (mm)



Integral Electronics
Eclipse® Housing
(45° View)

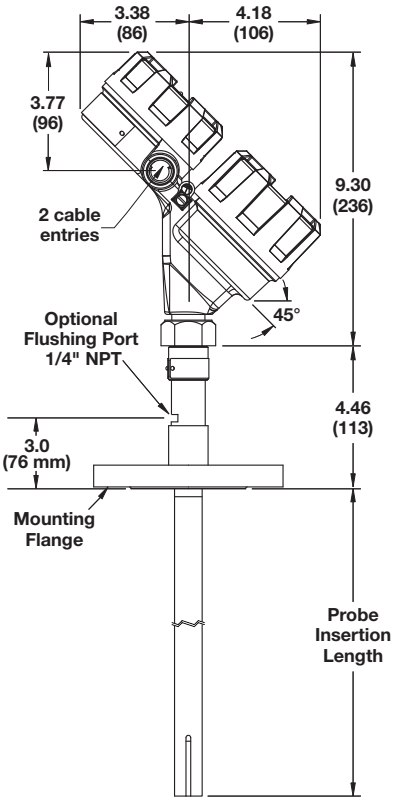


Eclipse® Housing
(45° View)

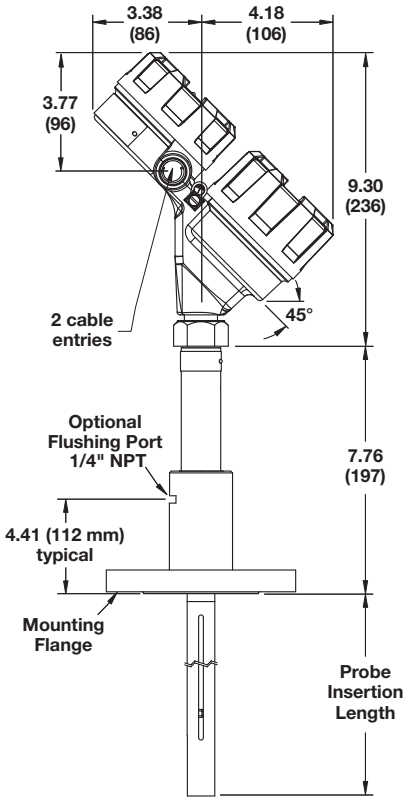
Eclipse® Remote Configurations

3.6.6 Physical Specifications – Coaxial Probes

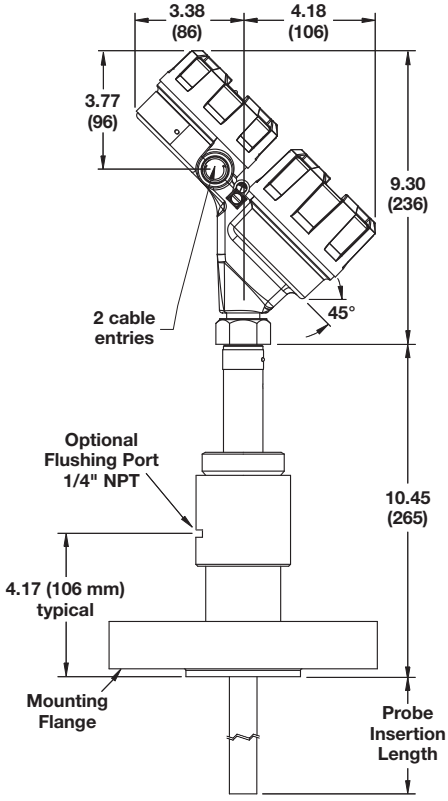
inches (mm)



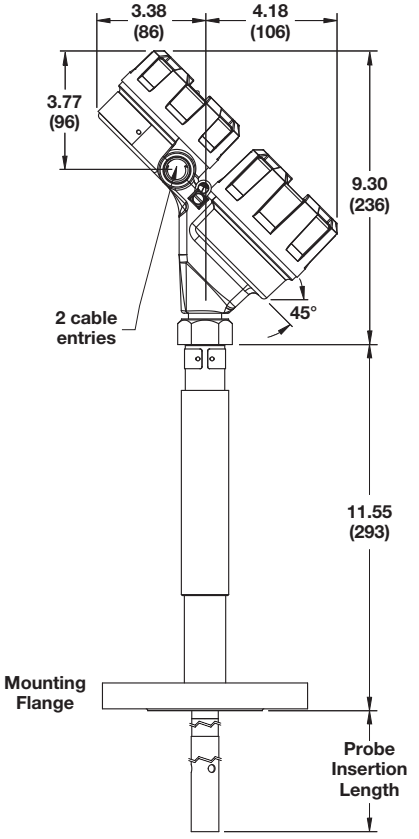
Model 7yT
with flanged connection



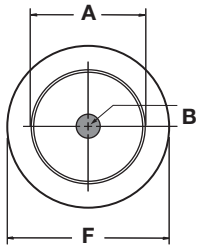
Model 7yP
with flanged connection



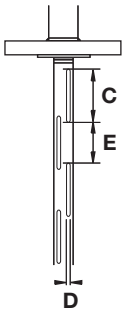
Model 7yD
with flanged connection



Model 7yS
with flanged connection



Coaxial GWR Probe,
End View



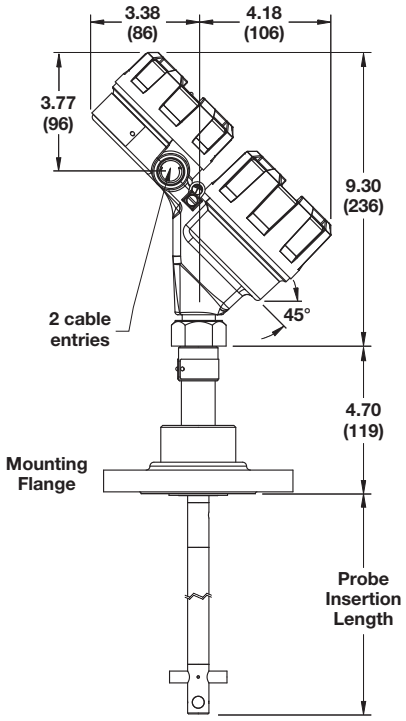
Coaxial Probe Slots

Inches (mm)

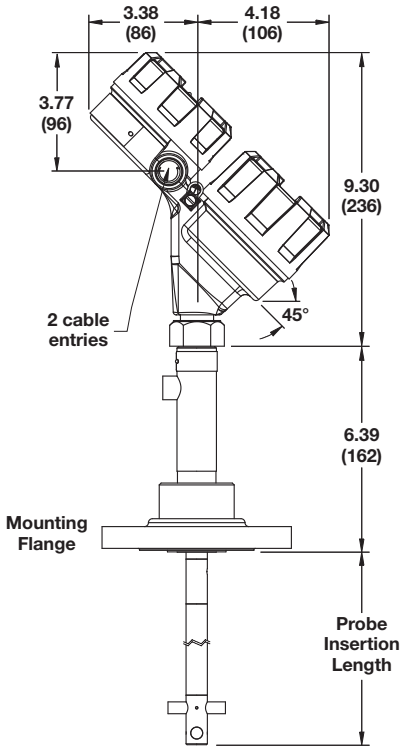
Dim.	Small Diameter	Large Diameter	Enlarged (standard)
A	0.88 (22.5)	1.62 (41.1)	1.75 (45) - SST 1.92 (49) - HC and Monel
B	0.31 (8)	0.50 (13) max.	0.63 (16) maximum
C	4.08 (100)	6.05 (153)	6.05 (153)
D	0.15 (4)	0.30 (8)	0.30 (8)
E	3.78 (96)	5.45 (138)	5.45 (138)
F	1.25 (31.75)	—	—

3.6.7 Physical Specifications – Caged Probes

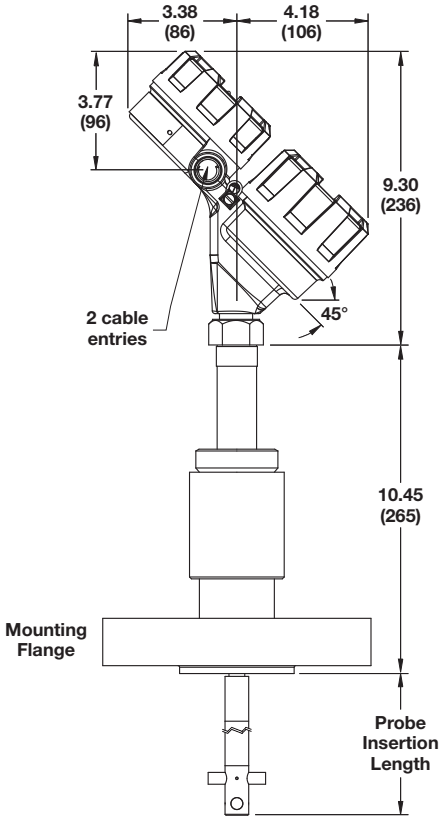
inches (mm)



Model 7yG
with flanged connection



Model 7yL
with flanged connection

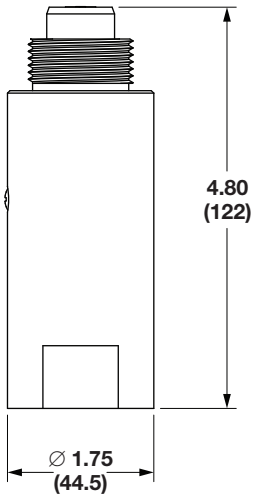


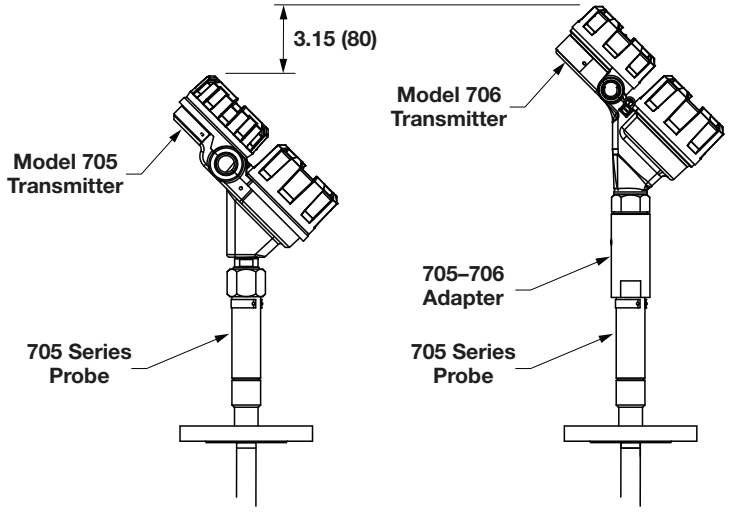
Model 7yJ
with flanged connection

Cage Size	Probe Rod Diameter (D)	Spacer Length (L)
2"	0.5 to 0.75" (13 to 19 mm)	1.82" (46 mm)
3"	0.75 to 1.13" (19 to 29 mm)	2.64" (67 mm)
4"	1.05 to 1.50" (27 to 38 mm)	3.60" (91 mm)

3.6.8 Physical Specifications – Model 705/706 Adapter (032–6923-001)

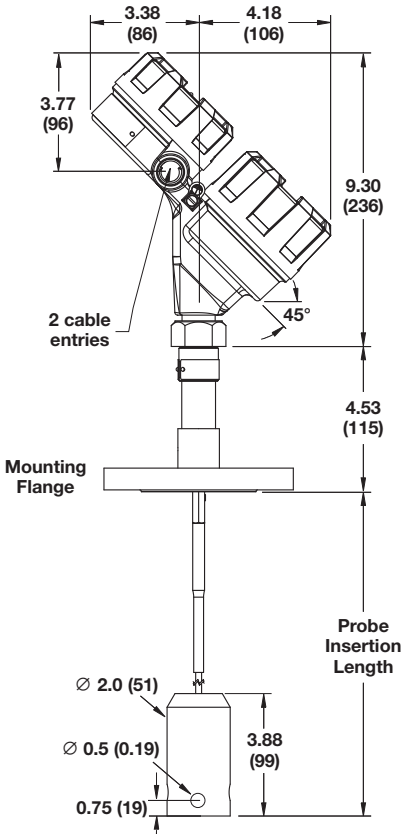
inches (mm)



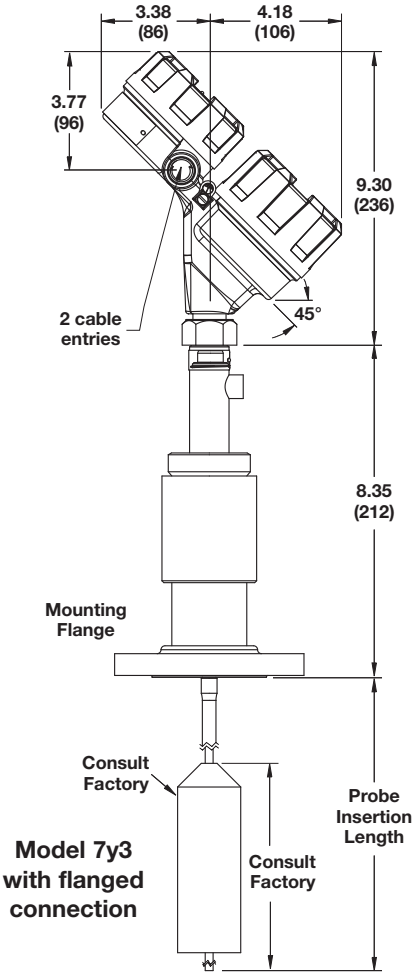


3.6.9 Physical Specifications – Single Cable Flexible Probes

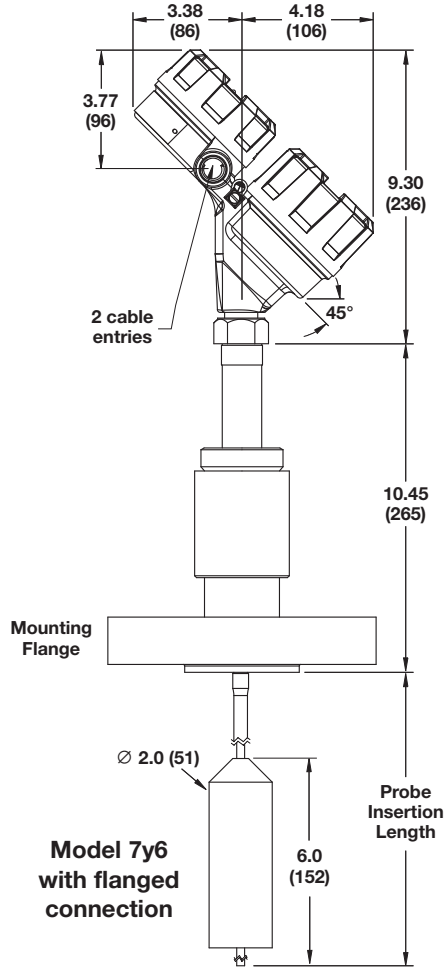
inches (mm)



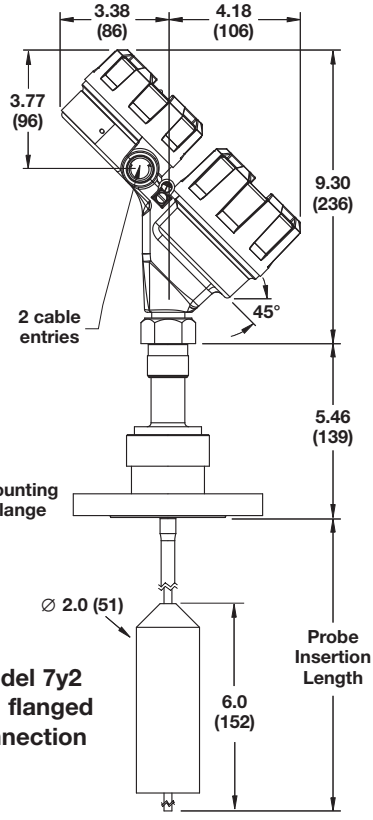
Model 7y1
with flanged connection



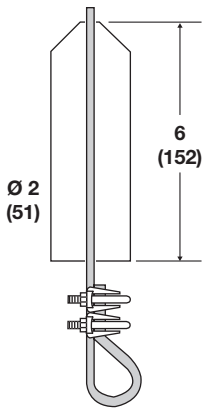
Model 7y3
with flanged connection



Model 7y6
with flanged connection



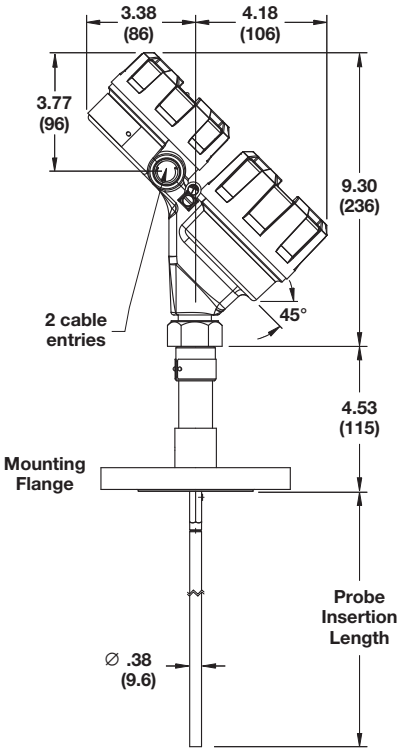
Model 7y2
with flanged connection



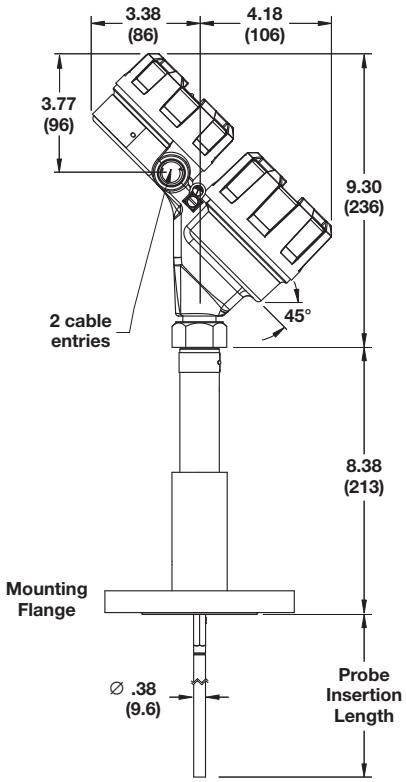
7y2: SST Weight
5 lbs (2.25 kg)
order code: 004-8778-001
(2) 010-1731-001

3.6.10 Physical Specifications – Single Rod Rigid Probes

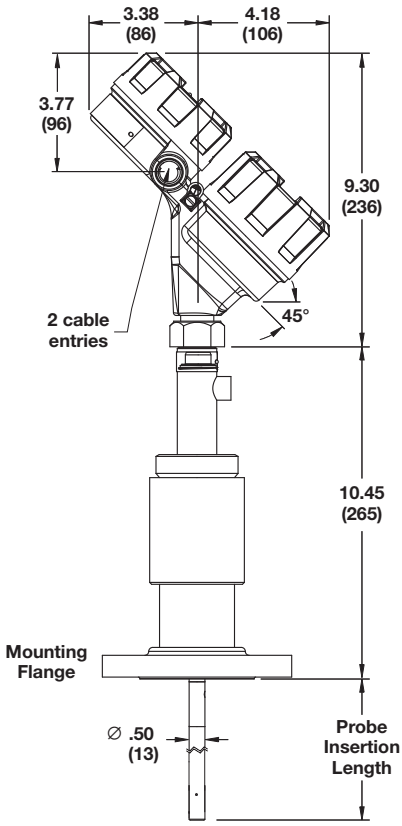
inches (mm)



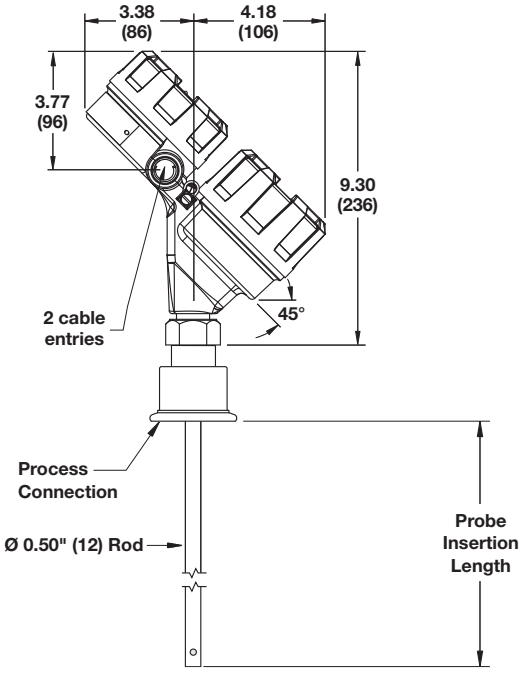
Model 7yF
with flanged connection



Model 7yM
with flanged connection



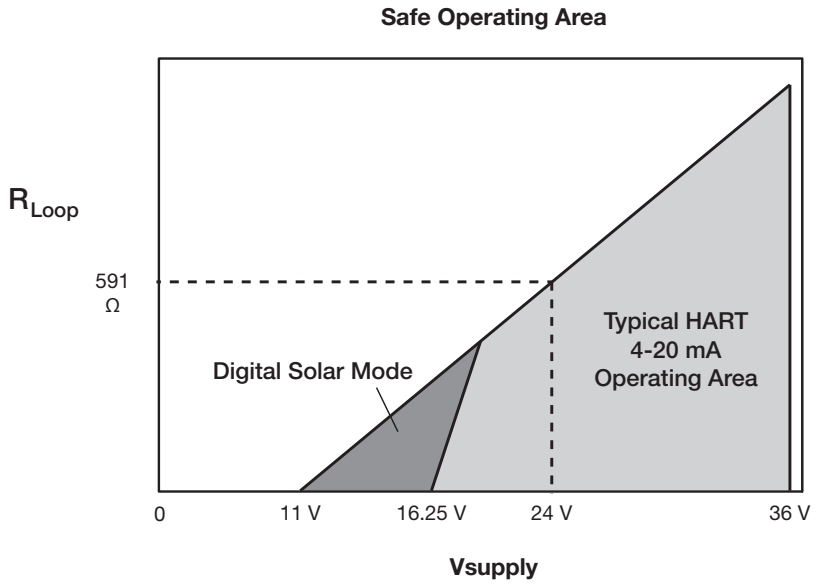
Model 7yN
with flanged connection



Model 7yH
with hygienic connection

3.6.11 Power Supply Requirements

3.6.11.1 Safe Operating Area



3.6.11.2 Supply Voltage

Operational Mode	Current Consumption	Vmin	Vmax
HART			
General Purpose	4mA 20mA	16.25V 11V	36V 36V
Intrinsically Safe	4mA 20mA	16.25V 11V	28.6V 28.6V
Explosion Proof	4mA 20mA	16.25V 11V	36V 36V
Fixed Current-Solar Power Operation (PV transmitter via HART)			
General Purpose	10mA①	11V	36V
Intrinsically Safe	10mA①	11V	28.6V
HART Multi-Drop Mode (Fixed Current)			
Standard	4mA①	16.25V	36V
Intrinsically Safe	4mA①	16.25V	28.6V
FOUNDATION fieldbus™ / PROFIBUS PA			
Supply Voltage	9V to 17.5V	9V to 17.5V	9V to 17.5V

① Start-up current 12 mA minimum.

3.7 Model Number

3.7.1 Transmitter

1 2 3 | BASIC MODEL NUMBER

7 0 6	Eclipse 4th Generation Guided Wave Radar (GWR) Level Transmitter

4 | POWER

5	24 VDC, Two-Wire

5 | SIGNAL OUTPUT

1	4–20 mA with HART
2	FOUNDATION fieldbus™ Communication
3	PROFIBUS PA Communication
4	Modbus Communication (8th Digit = 0 or 3 only)

6 | SAFETY OPTIONS

0	None – FOUNDATION fieldbus, PROFIBUS PA and Modbus only (5th digit = 2, 3 or 4)
2	SIL 2/3 Certified - HART only (5th digit = 1)

7 | ACCESSORIES/MOUNTING

0	No Digital Display or Keypad – Integral
A	Digital Display and Keypad – Integral
B	Digital Display and Keypad – 3-foot (1 meter) remote
C	Digital Display and Keypad – 12-foot (3.6 meter) remote

8 | CLASSIFICATION

0	General Purpose, Weatherproof (IP66/IP67)
1	Intrinsically Safe (FM & CSA CL 1 Div 1, Grps A, B, C, D) (5th digit = 1, 2 or 3)
3	Explosion-proof (FM & CSA CL 1 Div 1, Grps B, C, D)
A	Intrinsically Safe (ATEX/IEC Ex ia IIC T4) (5th digit = 1, 2 or 3)
B	Flame-proof (ATEX/IEC Ex d ia IIC T6) (5th digit = 1, 2 or 3)
C	Non-sparking (ATEX Ex n IIC T6) / Non-incendive (FM & CSA, CL 1 Div 2) (5th digit = 1, 2 or 3)
D	Dust Ex (ATEX II) (5th digit = 1, 2 or 3)

9 | HOUSING

1	Die-cast Aluminum, Dual-compartment, 45-degree
2	Investment Cast, Stainless Steel, Dual-compartment, 45-degree
A	Die-cast Aluminum, Dual-compartment, 45-degree with 705/706 adapter ①
B	Investment Cast, Stainless Steel, Dual-compartment, 45-degree with 705/706 adapter ①

① Not available with 5th digit = 3.

10 | CONDUIT CONNECTION

0	½" NPT
1	M20 x 1.5
2	½" NPT with sunshade
3	M20 x 1.5 with sunshade

7	0	6	—	5				—			
1	2	3		4	5	6	7		8	9	10

3.7.2 Enlarged Coaxial Probe

1 | TECHNOLOGY

7	Eclipse GWR Probes - Model 706

2 | MEASUREMENT SYSTEM

A	English (inches)
C	Metric (centimeters)

3 | CONFIGURATION/STYLE (RIGID)

D	Enlarged Coaxial, High Temp/High Pressure: Overfill w/Glass Seal (+850 °F/+450 °C) — Available only with 10th digit N or D
P	Enlarged Coaxial, High Pressure: Overfill w/Glass Seal (+400 °F/+200 °C) — Available only with 10th digit N or D
T	Enlarged Coaxial, Overfill Standard O-Ring Seal (+400 °F/+200 °C) — NOT available with 10th digit N or D

4 5 | PROCESS CONNECTION – SIZE/TYPE (consult factory for other process connections)

Threaded

4 1	2" NPT Thread ①
4 2	2" BSP (G1) Thread ①
5 2	3" BSP (G1) Thread ②

ASME Flanges

4 3	2"	150# ASME RF ①
4 4	2"	300# ASME RF ①
4 5	2"	600# ASME RF ①
4 K	2"	600# ASME RTJ ①
5 3	3"	150# ASME RF
5 4	3"	300# ASME RF
5 5	3"	600# ASME RF
56	3"	900# ASME RF
57	3"	1500# ASME RF
58	3"	2500# ASME RF
5K	3"	600# ASME RTJ
5L	3"	900# ASME RTJ
5M	3"	1500# ASME RTJ
5N	3"	2500# ASME RTJ
6 3	4"	150# ASME RF
6 4	4"	300# ASME RF
6 5	4"	600# ASME RF
6 6	4"	900# ASME RF
6 7	4"	1500# ASME RF
6 8	4"	2500# ASME RF
6K	4"	600# ASME RTJ
6L	4"	900# ASME RTJ
6M	4"	1500# ASME RTJ
6N	4"	2500# ASME RTJ

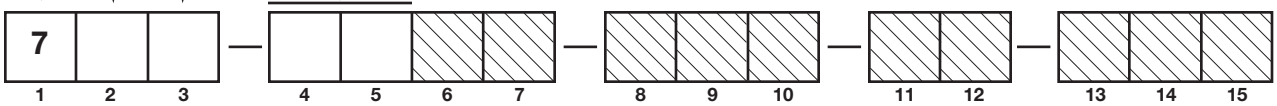
EN Flanges

D A	DN 50, PN 16	EN 1092-1 TYPE A ①
D B	DN 50, PN 25/40	EN 1092-1 TYPE A ①
D D	DN 50, PN 63	EN 1092-1 TYPE B2 ①
D E	DN 50, PN 100	EN 1092-1 TYPE B2 ①
E A	DN 80, PN 16	EN 1092-1 TYPE A
E B	DN 80, PN 25/40	EN 1092-1 TYPE A
E D	DN 80, PN 63	EN 1092-1 TYPE B2
E E	DN 80, PN 100	EN 1092-1 TYPE B2
E F	DN 80, PN 160	EN 1092-1 TYPE B2
E G	DN 80, PN 250	EN 1092-1 TYPE B2
E H	DN 80, PN 320	EN 1092-1 TYPE B2
E J	DN 80, PN 400	EN 1092-1 TYPE B2
F A	DN 100, PN 16	EN 1092-1 TYPE A
F B	DN 100, PN 25/40	EN 1092-1 TYPE A
F D	DN 100, PN 63	EN 1092-1 TYPE B2
F E	DN 100, PN 100	EN 1092-1 TYPE B2
F F	DN 100, PN 160	EN 1092-1 TYPE B2
F G	DN 100, PN 250	EN 1092-1 TYPE B2
F H	DN 100, PN 320	EN 1092-1 TYPE B2
F J	DN 100, PN 400	EN 1092-1 TYPE B2

Torque Tube Mating Flanges ③

T T	600# Fisher (249B/259B) in carbon steel
T U	600# Fisher (249C) in stainless steel
U T	600# Masoneilan flange in carbon steel
U U	600# Masoneilan flange in stainless steel

① Confirm mounting conditions/nozzle diameter to ensure sufficient clearance.
② Only available with 3rd digit = T
③ Always check dimensions if ASME/EN flanges are not used.



3.7.2 Enlarged Coaxial Probe continued

6 | CONSTRUCTION CODES

0	Industrial
K	ASME B31.1
L	ASME B31.3
M	ASME B31.3 & NACE MR0175/MR0103
N	NACE MR0175/MR0103

7 | FLANGE OPTIONS — Offset flanges are only available with small coaxial probes

0	None

8 | MATERIAL OF CONSTRUCTION - FLANGE/NUT/ROD/INSULATION

A	316 SS/316L SS (Probe O.D. 1.75” (45mm))
B	Hastelloy C (Probe O.D. 1.93” (49mm))
C	Monel (Probe O.D. 1.93” (49mm))
R	316 SS/316L SS with Carbon Steel Flange (Probe O.D. 1.75” (45 mm))
S	Hastelloy C with Carbon Steel Flange (Probe O.D. 1.93” (49mm))
T	Monel with Carbon Steel Flange (Probe O.D. 1.93” (49mm))

9 | SPACER MATERIAL

1	TFE (+400 °F/+200 °C) — Only available with 3rd digit P or T — $\varepsilon_r \geq 1.4$
2	PEEK HT — Only available with 3rd digit D (+650 °F/+345 °C) — $\varepsilon_r \geq 1.4$
3	Ceramic (High Temp. >+800 °F/+425 °C) — Only available with 3rd digit D — $\varepsilon_r \geq 2.0$
4	Duratron® CU60 PBI (+800 °F/+425 °C) — Only available with 3rd digit D — $\varepsilon_r \geq 1.4$
5	None - with metal shorting rod — $\varepsilon_r \geq 1.4$ — Future

10 | O-RING MATERIALS/SEAL OPTIONS

0	Viton® GFLT — Only available with 3rd digit T
2	Kalrez 4079 — Only available with 3rd digit T
8	Aegis PF 128 (NACE) — Only available with 3rd digit T
A	Kalrez 6375 — Only available with 3rd digit T
B	HF Acid Probe — Only available with 3rd digit T and 8th digit C
D	None/Glass Ceramic Alloy (Dual Seal Design with annunciator fitting) Only available with 3rd digit D or P
N	None/Glass Ceramic Alloy — Only available with 3rd digit D or P

11 | PROBE SIZE/ELEMENT TYPE/FLUSHING CONNECTION

0	Standard Enlarged Coaxial Probe
1	Standard Enlarged Coaxial Probe with Flushing Port

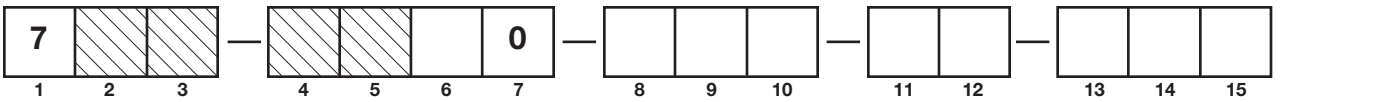
12 | SPECIAL OPTIONS — See page 89

0	Single Length Probe (Non-Segmented)
1	1-piece Enlarged Segmented Probe OD=2.5"(64mm)
2	2-piece Enlarged Segmented Probe OD=2.5"(64mm)
3	3-piece Enlarged Segmented Probe OD=2.5"(64mm)
4	4-piece Enlarged Segmented Probe OD=2.5"(64mm)
5	5-piece Enlarged Segmented Probe OD=2.5"(64mm)
6	6-piece Enlarged Segmented Probe OD=2.5"(64mm)

13 14 15 | INSERTION LENGTH See page 89

X X X	inches (012 – 396) cm (030 – 999)

unit of measure determined by 2nd digit of model number



3.7.3 Small Coaxial Probe

1 | TECHNOLOGY

7	Eclipse GWR Probes - Model 706

2 | MEASUREMENT SYSTEM

A	English (inches)
C	Metric (centimeters)

3 | CONFIGURATION/STYLE (RIGID)

D	Small Coaxial, High Temp/High Pressure: Overfill w/Glass Seal (+850 °F/+450 °C) — Available only with 10th digit N or D
P	Small Coaxial, High Pressure: Overfill w/Glass Seal (+400 °F/+200 °C) — Available only with 10th digit N or D
S	Coaxial, Saturated Steam (up to +800 °F/+425 °C) — Available only with 10th digit N, 9th digit 2, 3 or 5
T	Small Coaxial, Overfill Standard O-Ring Seal (+400 °F/+200 °C) — NOT available with 10th digit N or D

4 5 | PROCESS CONNECTION – SIZE/TYPE (consult factory for other process connections)

Threaded

1 1	¾" NPT Thread ③
4 1	2" NPT Thread — Available only with 3rd digit D

2 2	1" BSP (G1) Thread ③
4 2	2" BSP (G1) Thread — Available only with 3rd digit D
5 2	3" BSP (G1) Thread ⑤

ASME Flanges

2 3	1"	150# ASME RF ① ④	3 8	1½"	2500# ASME RF ④	5 3	3"	150# ASME RF	6 3	4"	150# ASME RF
2 4	1"	300# ASME RF ① ④	3 N	1½"	2500# ASME RTJ ④	5 4	3"	300# ASME RF	6 4	4"	300# ASME RF
2 5	1"	600# ASME RF ① ④	4 3	2"	150# ASME RF	5 5	3"	600# ASME RF	6 5	4"	600# ASME RF
2 K	1"	600# ASME RTJ ① ④	4 4	2"	300# ASME RF	5 6	3"	900# ASME RF	6 6	4"	900# ASME RF
3 3	1½"	150# ASME RF ④	4 5	2"	600# ASME RF	5 7	3"	1500# ASME RF	6 7	4"	1500# ASME RF
3 4	1½"	300# ASME RF ④	4 7	2"	900/1500# ASME RF	5 8	3"	2500# ASME RF	6 8	4"	2500# ASME RF
3 5	1½"	600# ASME RF ④	4 8	2"	2500# ASME RF	5 K	3"	600# ASME RTJ	6 K	4"	600# ASME RTJ
3 K	1½"	600# ASME RTJ ④	4 K	2"	600# ASME RTJ	5 L	3"	900# ASME RTJ	6 L	4"	900# ASME RTJ
3 7	1½"	900/1500# ASME RF④	4 M	2"	900/1500# ASME RTJ	5 M	3"	1500# ASME RTJ	6 M	4"	1500# ASME RTJ
3 M	1½"	900/1500# ASME RTJ④	4 N	2"	2500# ASME RTJ	5 N	3"	2500# ASME RTJ	6 N	4"	2500# ASME RTJ

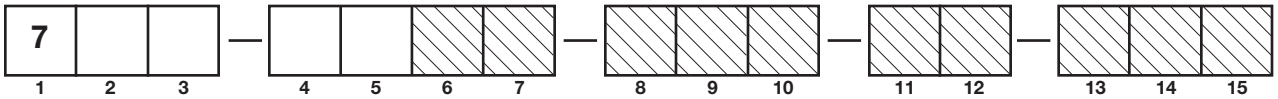
EN Flanges

B B	DN 25, PN 16/25/40	EN 1092-1 TYPE A ① ③	E A	DN 80, PN 16	EN 1092-1 TYPE A
B C	DN 25, PN 63/100	EN 1092-1 TYPE B2 ① ③	E B	DN 80, PN 25/40	EN 1092-1 TYPE A
C B	DN 40, PN 16/25/40	EN 1092-1 TYPE A ③	E D	DN 80, PN 63	EN 1092-1 TYPE B2
C C	DN 40, PN 63/100	EN 1092-1 TYPE B2 ③	E E	DN 80, PN 100	EN 1092-1 TYPE B2
C F	DN 40, PN 160	EN 1092-1 TYPE B2 ③	E F	DN 80, PN 160	EN 1092-1 TYPE B2
C G	DN 40, PN 250	EN 1092-1 TYPE B2 ③	E G	DN 80, PN 250	EN 1092-1 TYPE B2
C H	DN 40, PN 320	EN 1092-1 TYPE B2 ③	E H	DN 80, PN 320	EN 1092-1 TYPE B2
C J	DN 40, PN 400	EN 1092-1 TYPE B2 ③	E J	DN 80, PN 400	EN 1092-1 TYPE B2
D A	DN 50, PN 16	EN 1092-1 TYPE A	F A	DN 100, PN 16	EN 1092-1 TYPE A
D B	DN 50, PN 25/40	EN 1092-1 TYPE A	F B	DN 100, PN 25/40	EN 1092-1 TYPE A
D D	DN 50, PN 63	EN 1092-1 TYPE B2	F D	DN 100, PN 63	EN 1092-1 TYPE B2
D E	DN 50, PN 100	EN 1092-1 TYPE B2	F E	DN 100, PN 100	EN 1092-1 TYPE B2
D F	DN 50, PN 160	EN 1092-1 TYPE B2	F F	DN 100, PN 160	EN 1092-1 TYPE B2
D G	DN 50, PN 250	EN 1092-1 TYPE B2	F G	DN 100, PN 250	EN 1092-1 TYPE B2
D H	DN 50, PN 320	EN 1092-1 TYPE B2	F H	DN 100, PN 320	EN 1092-1 TYPE B2
D J	DN 50, PN 400	EN 1092-1 TYPE B2	F J	DN 100, PN 400	EN 1092-1 TYPE B2

Torque Tube Mating Flanges ②

T T	600# Fisher (249B/259B) in carbon steel
T U	600# Fisher (249C) in stainless steel
U T	600# Masoneilan flange in carbon steel
U U	600# Masoneilan flange in stainless steel

① Confirm mounting conditions/nozzle diameter to ensure sufficient clearance.
② Always check dimensions if ASME/EN flanges are not used.
③ Not available with 3rd digit 'D'
④ Not available with 3rd Digit D or P
⑤ Only available with 3rd digit = T



3.7.3 Small Coaxial Probe continued

6 | CONSTRUCTION CODES

0	Industrial
K	ASME B31.1 — NOT available with 4th digits T or U
L	ASME B31.3
M	ASME B31.3 & NACE MR0175/MR0103 — NOT available with carbon steel flange
N	NACE MR0175/MR0103 — NOT available with carbon steel flange

7 | FLANGE OPTIONS — Offset flanges are available only with small coaxial probes

0	None
1	Offset (For use with AURORA)
2	Offset with ½" NPT Vent (For use with AURORA)
3	Offset with ¾" NPT Vent (For use with AURORA)

8 | MATERIAL OF CONSTRUCTION - FLANGE/NUT/ROD/INSULATION

A	316 SS/316L SS
B	Hastelloy C — NOT available with 3rd digit S
C	Monel — NOT available with 3rd digit S
R	316 SS/316L SS with Carbon Steel Flange
S	Hastelloy C with Carbon Steel Flange
T	Monel with Carbon Steel Flange — NOT available with 3rd digit S

9 | SPACER MATERIAL

1	TFE (+400 °F/+200 °C) — Available only with 3rd digit P or T — $\varepsilon_r \geq 1.4$
2	PEEK HT — Available only with 3rd digit D — $\varepsilon_r \geq 1.4$ (+650 °F/+345 °C) or S (+575 °F/+300 °C)
3	Ceramic (Temp. +800 °F/+425 °C) — Available only with 3rd digit D with $\varepsilon_r \geq 2.0$ or with 3rd digit S *
5	None - Single bottom metal spacer — Available only with 3rd digit S* and 11th digit B*

* Not available with 5th digit 1 or 2.

10 | O-RING MATERIALS/SEAL OPTIONS

0	Viton® GFLT — Available only with 3rd digit T
2	Kalrez® 4079 — Available only with 3rd digit T
8	Aegis PF 128 (NACE) — Available only with 3rd digit T
A	Kalrez 6375 — Available only with 3rd digit T
B	HF Acid Probe — Available only with 3rd digit T and 8th digit C
D	None/Glass Ceramic Alloy (dual-seal design with annunciator fitting)—Available only with 3rd digit D or P
N	None/Glass Ceramic Alloy — Available only with 3rd digit D, P or S

11 | PROBE SIZE/ELEMENT TYPE/FLUSHING CONNECTION

2	Small Coaxial (0.875 inches/22 mm)
B	Large Coaxial (1.62 inches/42 mm) ⑥

⑥ 120 inches (305 cm) maximum length

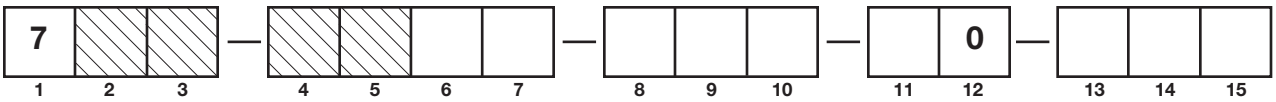
12 | SPECIAL OPTIONS

0	Single Length Probe (Non-Segmented)

13 14 15 | INSERTION LENGTH

X X X	inches (012 – 240) cm (030 – 610)

unit of measure determined by 2nd digit of model number



3.7.4 Caged Probe

1 | TECHNOLOGY

7	Eclipse GWR Probes - Model 706

2 | MEASUREMENT SYSTEM

A	English (inches)
C	Metric (centimeters)

3 | CONFIGURATION/STYLE (RIGID)

G	Overfill Caged Rigid Probe for use in chambers +400 °F (+200 °C) — Available only with 2", 3" and 4" flanges
J	Overfill Caged High Temp/High Pressure Probe with Glass Seal for use in chambers +850 °F (+450 °C) Only available with 2", 3" and 4" flanges
L	Overfill Caged High Pressure Probe with Glass Seal for use in chambers +400 °F (+200 °C) Only available with 2", 3" and 4" flanges

4 5 | PROCESS CONNECTION – SIZE/TYPE (consult factory for other process connections) ①

ASME Flanges

4 3	2" 150# ASME RF	5 4	3" 300# ASME RF	6 3	4" 150# ASME RF
4 4	2" 300# ASME RF	5 5	3" 600# ASME RF	6 4	4" 300# ASME RF
4 5	2" 600# ASME RF	5 6	3" 900# ASME RF	6 5	4" 600# ASME RF
4 7	2" 900/1500# ASME RF	5 7	3" 1500# ASME RF	6 6	4" 900# ASME RF
4 8	2" 2500# ASME RF	5 8	3" 2500# ASME RF	6 7	4" 1500# ASME RF
4 K	2" 600# ASME RTJ	5 K	3" 600# ASME RTJ	6 8	4" 2500# ASME RF
4 M	2" 900/1500# ASME RTJ	5 L	3" 900# ASME RTJ	6 K	4" 600# ASME RTJ
4 N	2" 2500# ASME RTJ	5 M	3" 1500# ASME RTJ	6 L	4" 900# ASME RTJ
5 3	3" 150# ASME RF	5 N	3" 2500# ASME RTJ	6 M	4" 1500# ASME RTJ
				6 N	4" 2500# ASME RTJ

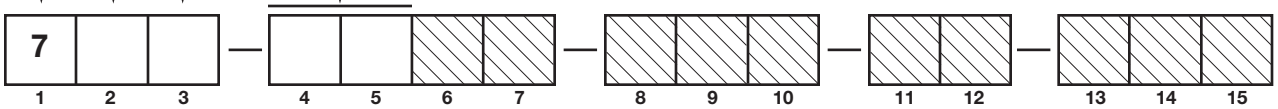
EN Flanges

D A	DN 50, PN 16	EN 1092-1 TYPE A	E F	DN 80, PN 160	EN 1092-1 TYPE B2
D B	DN 50, PN 25/40	EN 1092-1 TYPE A	E G	DN 80, PN 250	EN 1092-1 TYPE B2
D D	DN 50, PN 63	EN 1092-1 TYPE B2	E H	DN 80, PN 320	EN 1092-1 TYPE B2
D E	DN 50, PN 100	EN 1092-1 TYPE B2	E J	DN 80, PN 400	EN 1092-1 TYPE B2
D F	DN 50, PN 160	EN 1092-1 TYPE B2	F A	DN 100, PN 16	EN 1092-1 TYPE A
D G	DN 50, PN 250	EN 1092-1 TYPE B2	F B	DN 100, PN 25/40	EN 1092-1 TYPE A
D H	DN 50, PN 320	EN 1092-1 TYPE B2	F D	DN 100, PN 63	EN 1092-1 TYPE B2
D J	DN 50, PN 400	EN 1092-1 TYPE B2	F E	DN 100, PN 100	EN 1092-1 TYPE B2
E A	DN 80, PN 16	EN 1092-1 TYPE A	F F	DN 100, PN 160	EN 1092-1 TYPE B2
E B	DN 80, PN 25/40	EN 1092-1 TYPE A	F G	DN 100, PN 250	EN 1092-1 TYPE B2
E D	DN 80, PN 63	EN 1092-1 TYPE B2	F H	DN 100, PN 320	EN 1092-1 TYPE B2
E E	DN 80, PN 100	EN 1092-1 TYPE B2	F J	DN 100, PN 400	EN 1092-1 TYPE B2

Torque Tube Mating Flanges ②

T T	600# Fisher (249B/259B) in carbon steel
U T	600# Masoneilan flange in carbon steel
U U	600# Masoneilan flange in stainless steel

① Confirm mounting conditions/nozzle diameter to ensure sufficient clearance.
② Always check dimensions if ASME/EN flanges are not used.



6 | CONSTRUCTION CODES

0	Industrial
K	ASME B31.1
L	ASME B31.3
M	ASME B31.3 & NACE MR0175/MR0103 — Not available with carbon steel flange
N	NACE MR0175/MR0103 — Not available with carbon steel flange

7 | FLANGE OPTIONS

0	None
1	Offset (For use with AURORA) – 4" available only with 3rd digit G and J and 4th digit 6
2	Offset with ½" NPT Vent (For use with AURORA)–4" available only with 3rd digit G and J and 4th digit 6
3	Offset with ¾" NPT Vent (For use with AURORA)–4" available only with 3rd digit G and J and 4th digit 6

8 | MATERIAL OF CONSTRUCTION - MFG/NUT/ROD/INSULATION

A	316 SS/316L SS
B	Hastelloy C
C	Monel
R	316 SS/316L SS with Carbon Steel Flange
S	Hastelloy C with Carbon Steel Flange
T	Monel with Carbon Steel Flange

9 | SPACER MATERIAL

2	PEEK HT (+650 °F/+345 °C)
3	Ceramic (High Temp.>+800 °F/+425 °C) — Available only with 3rd digit J
4	Duratron® CU60 PBI (+800 °F/+425 °C) — Available only with 3rd digit J

10 | O-RING MATERIALS/SEAL OPTIONS

0	Viton® GFLT — NOT available with 3rd digit J or L
2	Kalrez 4079 — NOT available with 3rd digit J or L
8	Aegis PF 128 (NACE) — NOT available with 3rd digit J or L
A	Kalrez 6375 — NOT available with 3rd digit J or L
B	HF Acid Probe — Available only with 3rd digit G and 8th digit C
D	None/Glass Ceramic Alloy (Dual Seal Design with annunciator fitting) — NOT available with 3rd digit G
N	None/Glass Ceramic Alloy — NOT available with 3rd digit G

11 | PROBE SIZE/ELEMENT TYPE/FLUSHING CONNECTION

0	None

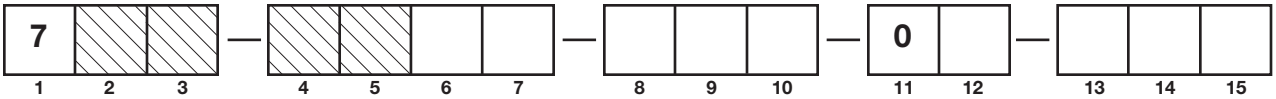
12 | SPECIAL OPTIONS — See page 89

1	Single Length Removable Probe
2	2-piece Segmented Probe
3	3-piece Segmented Probe
4	4-piece Segmented Probe

13 14 15 | INSERTION LENGTH
See page 89

X X X	inches (012 – 288) cm (030 – 732)

unit of measure determined by 2nd digit of model number



3.7.5 Single Rod Rigid Probe

1 | TECHNOLOGY

7	Eclipse GWR Probes - Model 706

2 | MEASUREMENT SYSTEM

A	English (inches)
C	Metric (centimeters)

3 | CONFIGURATION/STYLE (RIGID)

F	Single Rod, Standard (+400 °F/200 °C) for in-tank applications NOT available with 10th digit N or D
H	Single Rod, Hygienic, 15 Ra Surface
M	Single Rod, High Pressure Probe with glass seal (+400 °F/+200 °C), for in-tank applications. Available only with 10th digit N or D
N	Single Rod, High Temp/High Pressure with glass seal (+850 °F/+450 °C), for in-tank applications. Available only with 10th digit N or D

4 5 | PROCESS CONNECTION – SIZE/TYPE (consult factory for other process connections) ①

Threaded

1 1	¾" NPT Thread ②
2 1	1" NPT Thread ②
4 1	2" NPT Thread
2 2	1" BSP (G1) Thread ②
4 2	2" BSP (G1) Thread

Hygienic

3 P	1½" Tri-Clover® type, 16 AMP Hygienic Flange
4 P	2" Tri-Clover® type, 16 AMP Hygienic Flange
5 P	3" Tri-Clover® type, 16 AMP Hygienic Flange
6 P	4" Tri-Clover® type, 16 AMP Hygienic Flange
9 P	2½" Tri-Clover® type, 16 AMP Hygienic Flange

ASME Flanges

3 3	1½" 150# ASME RF ① ③
3 4	1½" 300# ASME RF ① ③
3 5	1½" 600# ASME RF ① ③
4 3	2" 150# ASME RF ①
4 4	2" 300# ASME RF ①
4 5	2" 600# ASME RF ①
4 7	2" 900/1500# ASME RF
4 8	2" 2500# ASME RF
4 K	2" 600# ASME RTJ
4 M	2" 900/1500# ASME RTJ

4 N	2" 2500# ASME RTJ
5 3	3" 150# ASME RF
5 4	3" 300# ASME RF
5 5	3" 600# ASME RF
5 6	3" 900# ASME RF
5 7	3" 1500# ASME RF
5 8	3" 2500# ASME RF
5 K	3" 600# ASME RTJ
5 L	3" 900# ASME RTJ
5 M	3" 1500# ASME RTJ

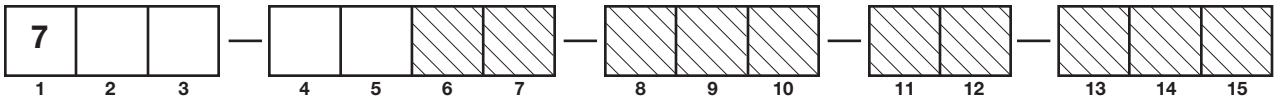
5 N	3" 2500# ASME RTJ
6 3	4" 150# ASME RF
6 4	4" 300# ASME RF
6 5	4" 600# ASME RF ④
6 6	4" 900# ASME RF ④
6 7	4" 1500# ASME RF ④
6 8	4" 2500# ASME RF ④
6 K	4" 600# ASME RTJ ④
6 L	4" 900# ASME RTJ ④
6 M	4" 1500# ASME RTJ ④
6 N	4" 2500# ASME RTJ ④

EN Flanges

C B	DN 40, PN 16/25/40	EN 1092-1 TYPE A
C C	DN 40, PN 63/100	EN 1092-1 TYPE B2
C F	DN 40, PN 160	EN 1092-1 TYPE B2
C G	DN 40, PN 250	EN 1092-1 TYPE B2
D A	DN 50, PN 16	EN 1092-1 TYPE A ①
D B	DN 50, PN 25/40	EN 1092-1 TYPE A ①
D D	DN 50, PN 63	EN 1092-1 TYPE B2 ①
D E	DN 50, PN 100	EN 1092-1 TYPE B2 ①
D F	DN 50, PN 160	EN 1092-1 TYPE B2 ④
D G	DN 50, PN 250	EN 1092-1 TYPE B2 ④
D H	DN 50, PN 320	EN 1092-1 TYPE B2 ④
D J	DN 50, PN 400	EN 1092-1 TYPE B2 ④
E A	DN 80, PN 16	EN 1092-1 TYPE A ①
E B	DN 80, PN 25/40	EN 1092-1 TYPE A

E D	DN 80, PN 63	EN 1092-1 TYPE B2
E E	DN 80, PN 100	EN 1092-1 TYPE B2
E F	DN 80, PN 160	EN 1092-1 TYPE B2 ④
E G	DN 80, PN 250	EN 1092-1 TYPE B2 ④
E H	DN 80, PN 320	EN 1092-1 TYPE B2 ④
E J	DN 80, PN 400	EN 1092-1 TYPE B2 ④
F A	DN 100, PN 16	EN 1092-1 TYPE A
F B	DN 100, PN 25/40	EN 1092-1 TYPE A
F D	DN 100, PN 63	EN 1092-1 TYPE B2
F E	DN 100, PN 100	EN 1092-1 TYPE B2
F F	DN 100, PN 160	EN 1092-1 TYPE B2 ④
F G	DN 100, PN 250	EN 1092-1 TYPE B2 ④
F H	DN 100, PN 320	EN 1092-1 TYPE B2 ④
F J	DN 100, PN 400	EN 1092-1 TYPE B2 ④

① Confirm mounting conditions/nozzle diameter to ensure sufficient clearance.
② Not available with 3rd Digit N or 8th Digit P
③ Not available with 3rd Digit M or N
④ Available only with 3rd Digit M or N



3.7.5 Single Rigid Rod Probe continued

6 | CONSTRUCTION CODES

0	Industrial
K	ASME B31.1
L	ASME B31.3
M	ASME B31.3 & NACE MR0175/MR0103 – NOT available with Carbon Steel Flange
N	NACE MR0175/MR0103 – NOT available with Carbon Steel Flange

7 | FLANGE OPTIONS

0	None

8 | MATERIAL OF CONSTRUCTION - MFG/NUT/ROD/INSULATION

A	316 SS/316L SS
B	Hastelloy C
C	Monel
E	316/316L SS Hygienic (15 Ra surface finish with CMTRs)
F	Faced Flange, PFA coated wetted surfaces — Available only with 3rd digit F
P	PFA coated rod — Available only with 3rd digit F
R	316 SS/316L SS with Carbon Steel Flange
S	Hastelloy C with Carbon Steel Flange
T	Monel with Carbon Steel Flange

9 | SPACER MATERIAL

0	None – NOT available with 3rd Digit N
2	PEEK HT (+650 °F/+345 °C) — Available only with 3rd digit N
3	Ceramic (High Temp.>+800 °F/+425 °C) — Available only with 3rd digit N
4	Duratron® CU60 PBI (+800 °F/+425 °C) — Available only with 3rd digit N

10 | O-RING MATERIALS/SEAL OPTIONS

0	Viton® GFLT — NOT available with 3rd digit M or N
1	EPDM (Ethylene Propylene Rubber) — Available only with 3rd digit H
2	Kalrez 4079 — NOT available with 3rd digit M or N
8	Aegis PF 128 (NACE) — NOT available with 3rd digit M or N
A	Kalrez 6375 — NOT available with 3rd digit M or N
D	None/Glass Ceramic Alloy Dual Seal with annunciator fitting — NOT available with 3rd digit F
N	None/Glass Ceramic Alloy Dual Seal — NOT available with 3rd digit F

11 | PROBE SIZE/ELEMENT TYPE/FLUSHING CONNECTION

0	Standard Single Rod

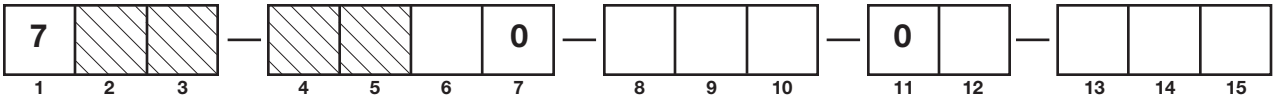
12 | SPECIAL OPTIONS

0	Non-Removable Rod Available only with (8th digit E, F or P)
1	Removable Rod NOT available with (8th Digit E, F or P)
2	Two-piece segmented probe
3	Three-piece segmented probe
4	Four-piece segmented probe
5	Five-piece segmented probe
6	Six-piece segmented probe

13 14 15 | INSERTION LENGTH

X X X	inches (012 – 288) cm (030 – 732) maximum 240 inches (610 cm) when 8th digit = E, F or P

unit of measure determined by 2nd digit of model number



3.7.6 Single Cable Flexible Probe

1 | TECHNOLOGY

7	Eclipse GWR Probes - Model 706

2 | MEASUREMENT SYSTEM

A	English (inches)
C	Metric (centimeters)

3 | SPECIALTY FLEXIBLE PROBES

1	Single Cable Flexible standard for in-tank applications (+400 °F/+200 °C)
2	Single Cable Flexible Light Duty Bulk Solids
3	Single Cable Flexible HTHP for in-tank applications (+850 °F/+450 °C)
6	Single Cable Flexible HTHP for chamber applications (+850 °F/+450 °C)

4 5 | PROCESS CONNECTION – SIZE/TYPE (consult factory for other process connections)

Threaded

4 1	2" NPT Thread (not available with the 7y6)
4 2	2" BSP (G1) Thread (not available with the 7y6)

ASME Flanges

4 3	2" 150# ASME RF ①
4 4	2" 300# ASME RF ①
4 5	2" 600# ASME RF ①
4 7	2" 900/1500# ASME RF
4 8	2" 2500# ASME RF
4 K	2" 600# ASME RTJ
4 M	2" 900/1500# ASME RTJ
4 N	2" 2500# ASME RTJ

5 3	3" 150# ASME RF
5 4	3" 300# ASME RF
5 5	3" 600# ASME RF
5 6	3" 900# ASME RF
5 7	3" 1500# ASME RF
5 8	3" 2500# ASME RF
5 K	3" 600# ASME RTJ
5 L	3" 900# ASME RTJ
5 M	3" 1500# ASME RTJ
5 N	3" 2500# ASME RTJ

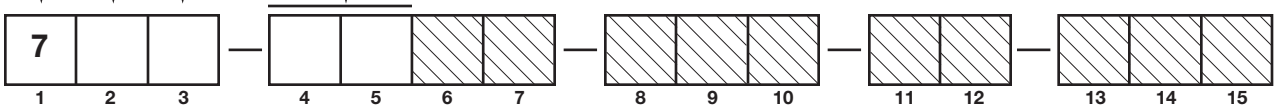
6 3	4" 150# ASME RF
6 4	4" 300# ASME RF
6 5	4" 600# ASME RF
6 6	4" 900# ASME RF ②
6 7	4" 1500# ASME RF ②
6 8	4" 2500# ASME RF ②
6 K	4" 600# ASME RTJ ②
6 L	4" 900# ASME RTJ ②
6 M	4" 1500# ASME RTJ ②
6 N	4" 2500# ASME RTJ ②

EN Flanges

D A	DN 50, PN 16	EN 1092-1 TYPE A ①
D B	DN 50, PN 25/40	EN 1092-1 TYPE A ①
D D	DN 50, PN 63	EN 1092-1 TYPE B2 ①
D E	DN 50, PN 100	EN 1092-1 TYPE B2 ①
D F	DN 50, PN 160	EN 1092-1 TYPE B2 ②
D G	DN 50, PN 250	EN 1092-1 TYPE B2 ②
D H	DN 50, PN 320	EN 1092-1 TYPE B2 ②
D J	DN 50, PN 400	EN 1092-1 TYPE B2 ②
E A	DN 80, PN 16	EN 1092-1 TYPE A ①
E B	DN 80, PN 25/40	EN 1092-1 TYPE A
E D	DN 80, PN 63	EN 1092-1 TYPE B2
E E	DN 80, PN 100	EN 1092-1 TYPE B2

E F	DN 80, PN 160	EN 1092-1 TYPE B2 ②
E G	DN 80, PN 250	EN 1092-1 TYPE B2 ②
E H	DN 80, PN 320	EN 1092-1 TYPE B2 ②
E J	DN 80, PN 400	EN 1092-1 TYPE B2 ②
F A	DN 100, PN 16	EN 1092-1 TYPE A
F B	DN 100, PN 25/40	EN 1092-1 TYPE A
F D	DN 100, PN 63	EN 1092-1 TYPE B2
F E	DN 100, PN 100	EN 1092-1 TYPE B2
F F	DN 100, PN 160	EN 1092-1 TYPE B2 ②
F G	DN 100, PN 250	EN 1092-1 TYPE B2 ②
F H	DN 100, PN 320	EN 1092-1 TYPE B2 ②
F J	DN 100, PN 400	EN 1092-1 TYPE B2 ②

① Confirm mounting conditions/nozzle diameter to ensure sufficient clearance.
② Only available with 3rd Digit 3 or 6



6 | CONSTRUCTION CODES

0	Industrial
L	ASME B31.3
M	ASME B31.3 & NACE MR0175 / ISO 15156 & MR0103 — Available when digit 8 = A, F, or P
N	NACE MR0175 / ISO 15156 & MR0103 — Available when digit 8 = A, F, or P

7 | FLANGE OPTIONS

0	None

8 | MATERIAL OF CONSTRUCTION - MFG/NUT/ROD/INSULATION

A	316 SS/316L SS
F	Faced Flange, PFA Coated Wetted Surfaces — Available only with 3rd digit 1
P	PFA Coated 316/316L SS Cable – Available only with 3rd digit 1
R	316 SS/316L SS with Carbon Steel Flange

9 | SPACER/WEIGHT MATERIAL

0	No Spacer — Not available with 3rd digit 3
1	PTFE Spacer — Available only with 3rd digit 3
4	Celazole® Spacer — Available only with 3rd digit 6
5	Metal Weight — Available only with 3rd digit 3

10 | O-RING MATERIALS/SEAL OPTIONS

0	Viton® GFLT
2	Kalrez 4079
8	Aegis PF 128 (NACE)
A	Kalrez 6375
D	Glass Ceramic Alloy Dual Seal with annunciator fitting — Available only with 3rd digit 3 or 6
N	None/Glass Ceramic Alloy Dual Seal – Available only with 3rd digit 3 or 6

11 | PROBE SIZE/ELEMENT TYPE/FLUSHING CONNECTION

3	Flexible Cable Probe

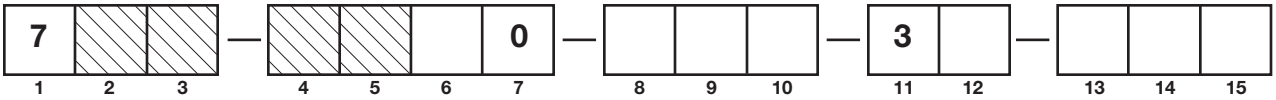
12 | SPECIAL OPTIONS

0	Non-removable Probe Cable Only available with 3rd digit 2 or 8th digit F
1	Removable Single-piece Probe Cable Available only with 3rd digit 1, 3 and 6

13 14 15 | INSERTION LENGTH

X X X	feet (003 – 100) meters (001 – 030)

unit of measure determined by 2nd digit of model number



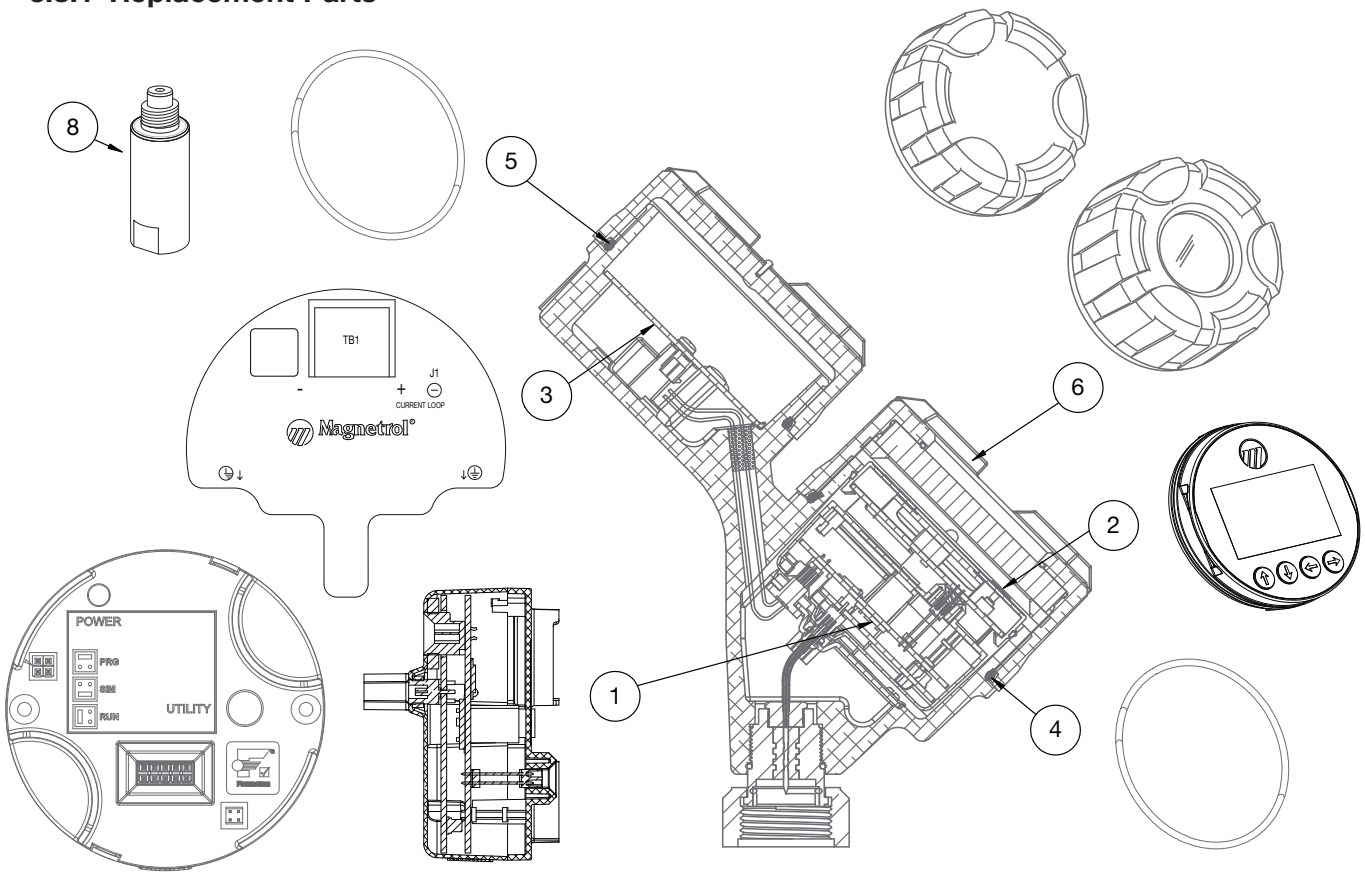
3.7.7 Segmented Probe Options
12th Digit of Model Number

Probe Model	One Segment	Two Segments	Three Segments	Four Segments	Five Segments	Six Segments
Coaxial Models 7yD, 7yP and 7yT (Enlarged versions only) (3", DN 80 Process Connections and larger)	24 – 72" (60 – 182 cm)	48 – 144" (120 – 365 cm)	72 – 216" (180 – 548 cm)	96 – 288" (240 – 731 cm)	120 – 360" (305 – 914 cm)	144 – 396" (365 – 999 cm)
Caged Models 7yG, 7yL and 7yJ	12 – 120" (30 – 305 cm)	24 – 240" (60 – 610 cm)	36 – 288" (90 – 732 cm)	48 – 288" (120 – 732 cm)	Not Available	Not Available

NOTE: Segments will be evenly divided over the length of the probe.

3.8 Parts

3.8.1 Replacement Parts



Electronics:

Digit: 1 2 3 4 5 6 7 8 9 10

Part Number: [ ] 7 0 6 — 5 [ ] [ ] [ ] — [ ] [ ] [ ] — [ ] [ ] [ ]

X = product with a non-standard customer requirement

Serial Number: [ ] [ ] [ ] [ ] [ ] [ ] — [ ] [ ] — [ ] [ ] [ ] — [ ] [ ] [ ]

See nameplate, always provide complete part number and serial number when ordering spares.

(1) Electronic Module		
Digit 5	**Digit 6**	**Replacement Part**
1	2	Z31-2849-001
2	0	Z31-2849-002
3	0	Z31-2858-001
4	0	Z31-2849-001

(2) Display Module		
Digit 5	**Digit 7**	**Replacement Part**
1, 2, 3 or 4	0, 1 or 2	N/A
	A, B or C	089-9136-001

(3) Wiring PC Board		
Digit 5	**Digit 6**	**Replacement Part**
1	2	Z30-9165-001
2 or 3	0	Z30-9166-002
4	0	Z31-2859-001

	Replacement Part
(4) and (5) O-ring	012-2201-237

(6) Housing Cover			
Digit 7	**Digit 8**	**Digit 9**	**Replacement Part**
0, 1 or 2	all	1 or A	004-9225-002
		2 or B	004-9225-003
A, B or C	0, 1 or A	1 or A	036-4413-005
	3, B, C or D		036-4413-001
	all	2 or B	036-4413-002

(7) Housing Cover	
Digit 9	**Replacement Part**
1 or A	004-9225-002
2 or B	004-9225-003

(8) 705/706 Adapter	
Digit 9	**Replacement Part**
A or B	032-6923-001

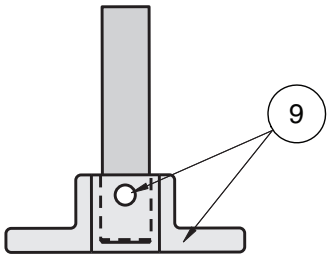
Probe:

Digit: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Part Number: 7

X = product with a non-standard customer requirement

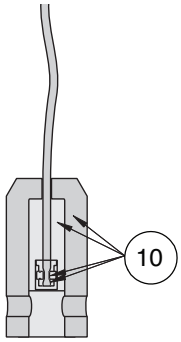
Bottom Spacer for Single Rod GWR Probe



7yF, 7yM or 7yN single rod

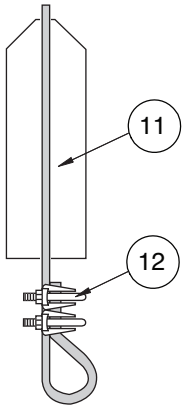
(9) Bottom Spacer + Pin Kit		
Digit 3	**Digit 8**	**Replacement Part**
F or M	A or R	089-9114-008
	B or S	089-9114-009
	C or T	089-9114-010
N	A or R	089-9114-005
	B or S	089-9114-006
	C or T	089-9114-007

Cable Weight for Flexible GWR Probe



7y1 single cable

(10) Cable Weight Assembly	
Digit 3	**Replacement Part**
1	089-9120-001



7y2 single cable

(11) Cable Weight	
Digit 3	**Replacement Part**
2	004-8778-001

(12) Cable Clamp	
Digit 3	**Replacement Part**
2	010-1731-001 (ordering quantity: 2)

4.0 Advanced Configuration/ Troubleshooting Techniques

This section contains information regarding some of the advanced configuration and troubleshooting capability contained within the Model 706 transmitter. These diagnostic options are best suited for use with PACTware and the Model 706 DTM, and should be implemented only after contacting AMETEK LMS Technical Support.

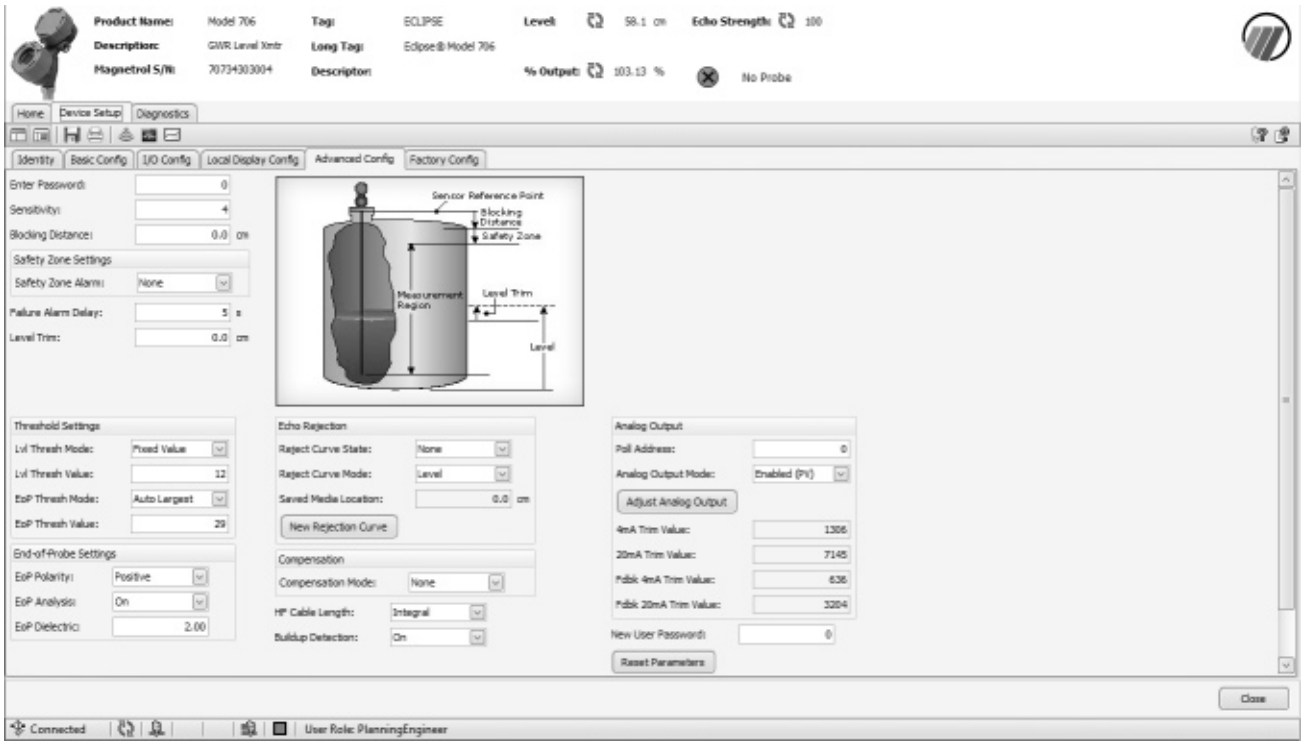
4.1 End-of-Probe Analysis (EOPA)

Note that due to the operation of this method, End of Probe Analysis cannot be applied with interface measurement, applications with a "water" bottoms, or with stratifying liquids. Therefore, EOPA will not be available when Measurement Type = Interface & Level.

When EOPA is enabled and the calculated (inferred level) is being used, a diagnostic warning shown as "Inferred Level" will be present.

4.1.1 Enable EOPA using PACT*ware*

Click on the Device Setup tab, and then select Advanced Config. In the lower left corner select the correct Polarity for the End of Probe pulse, then turn on the EoP Analysis. The Eop Dielectric box will then appear. Fill in the correct Dielectric of the process medium being measured.



4.1.2 Enable EOPA using keypad/LCD

From the MAIN MENU, select DEVICE SETUP and press Enter.



Scroll down to Advanced Config, and then press Enter.



Scroll down to END of PROBE ANALYSIS, and then press Enter.



Enter the correct polarity for EoP Polarity, turn on EoP Analysis, and then enter the correct value for EoP Dielectric. EoP Dielectric is the dielectric constant of the process medium being measured.



4.2 Sloped Threshold

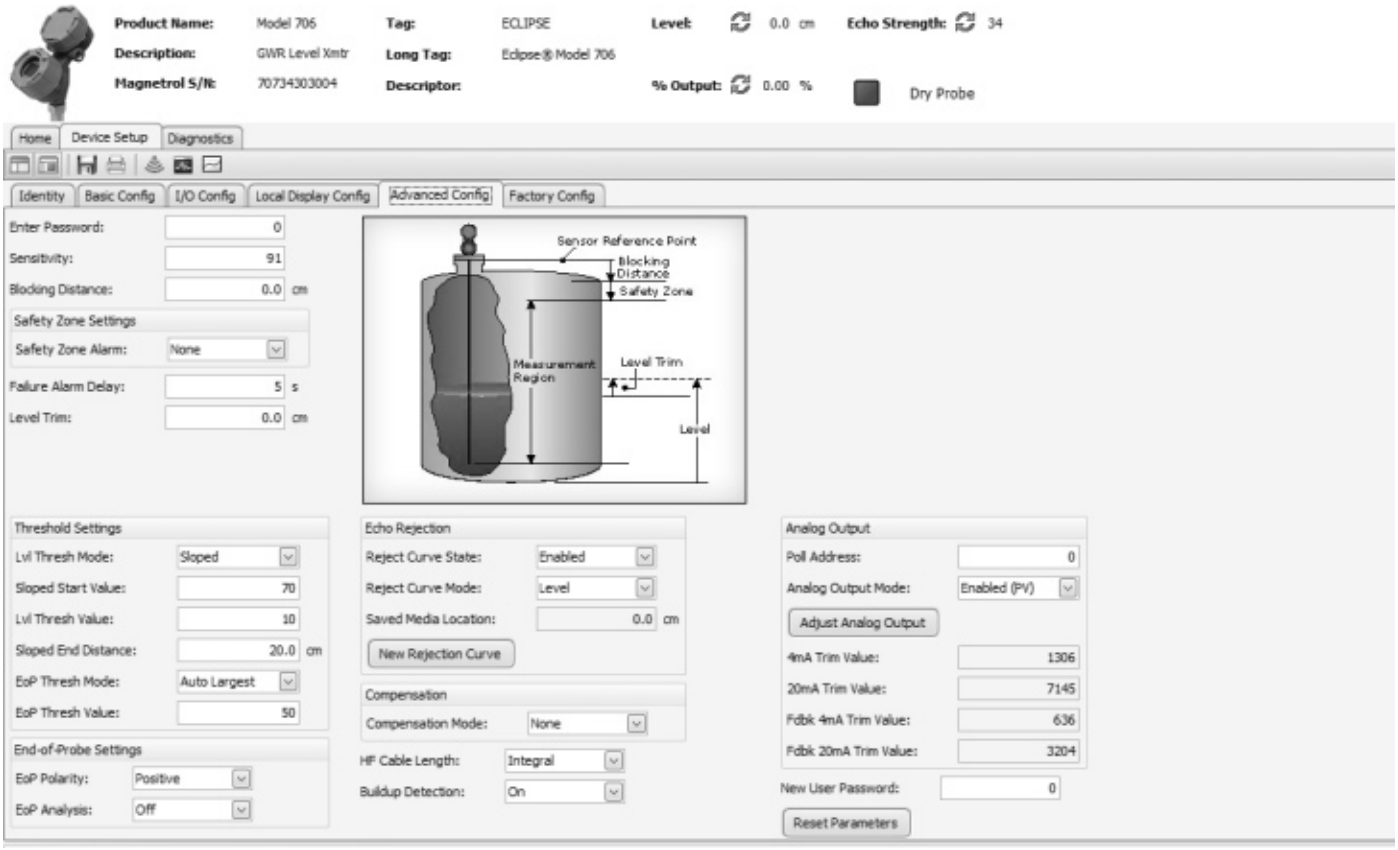
The Sloped Threshold option contained in the Model 706 allows the user additional level detection capability by allowing the threshold to be sloped (bent) around an unwanted signal. The result is a convenient way to ignore undesired signals.

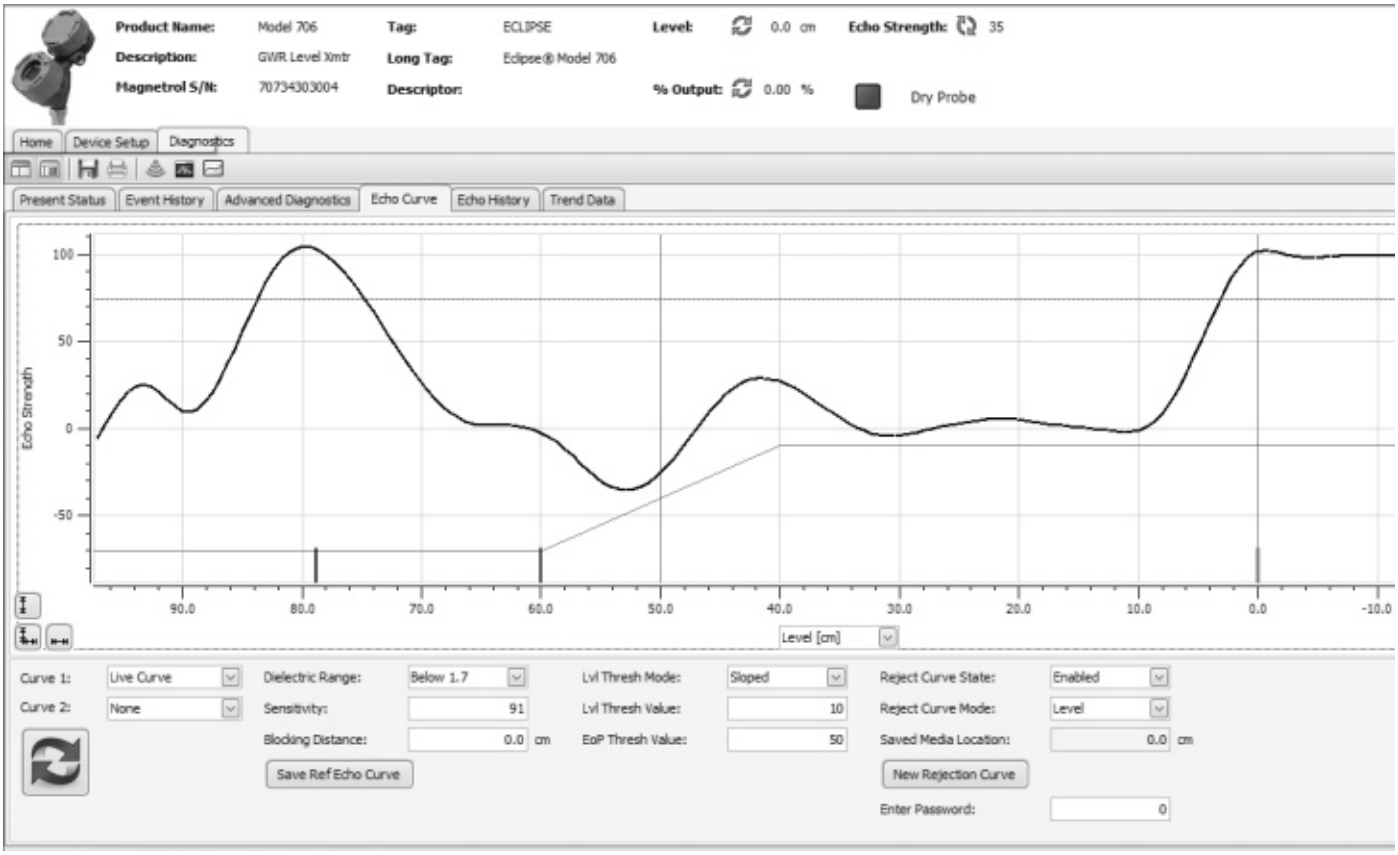
The use of PACTware and the Model 706 DTM is recommended for this option.

Using PACTware, click on the Device Setup tab, and then select Advanced Config.

In the Threshold Settings section, select “Sloped” within in the Lvl Tresh Mode dropdown box.

Then set the Sloped Start Value, Lvl Tresh Value, and Sloped End Distance.


Product Name: Model 706
Tag: ECLIPSE
Level: 0.0 cm
Echo Strength: 34
Description: GWR Level Xmtr
Long Tag: Eclipse® Model 706
Magnetrol S/N: 70734303004
Descriptor:
% Output: 0.00 %
Dry Probe
Home
Device Setup
Diagnostics
Identity
Basic Config
I/O Config
Local Display Config
Advanced Config
Factory Config
Enter Password: 0
Sensitivity: 91
Blocking Distance: 0.0 cm
Safety Zone Settings
Safety Zone Alarm: None
Failure Alarm Delay: 5 s
Level Trim: 0.0 cm
Sensor Reference Point
Blocking Distance
Safety Zone
Measurement Region
Level Trim
Level
Threshold Settings
Lvl Thresh Mode: Sloped
Sloped Start Value: 70
Lvl Thresh Value: 10
Sloped End Distance: 20.0 cm
EoP Thresh Mode: Auto Largest
EoP Thresh Value: 50
End-of-Probe Settings
EoP Polarity: Positive
EoP Analysis: Off
Echo Rejection
Reject Curve State: Enabled
Reject Curve Mode: Level
Saved Media Location: 0.0 cm
New Rejection Curve
Compensation
Compensation Mode: None
HF Cable Length: Integral
Buildup Detection: On
Analog Output
Poll Address: 0
Analog Output Mode: Enabled (PV)
Adjust Analog Output
4mA Trim Value: 1306
20mA Trim Value: 7145
Fdbk 4mA Trim Value: 636
Fdbk 20mA Trim Value: 3204
New User Password: 0
Reset Parameters

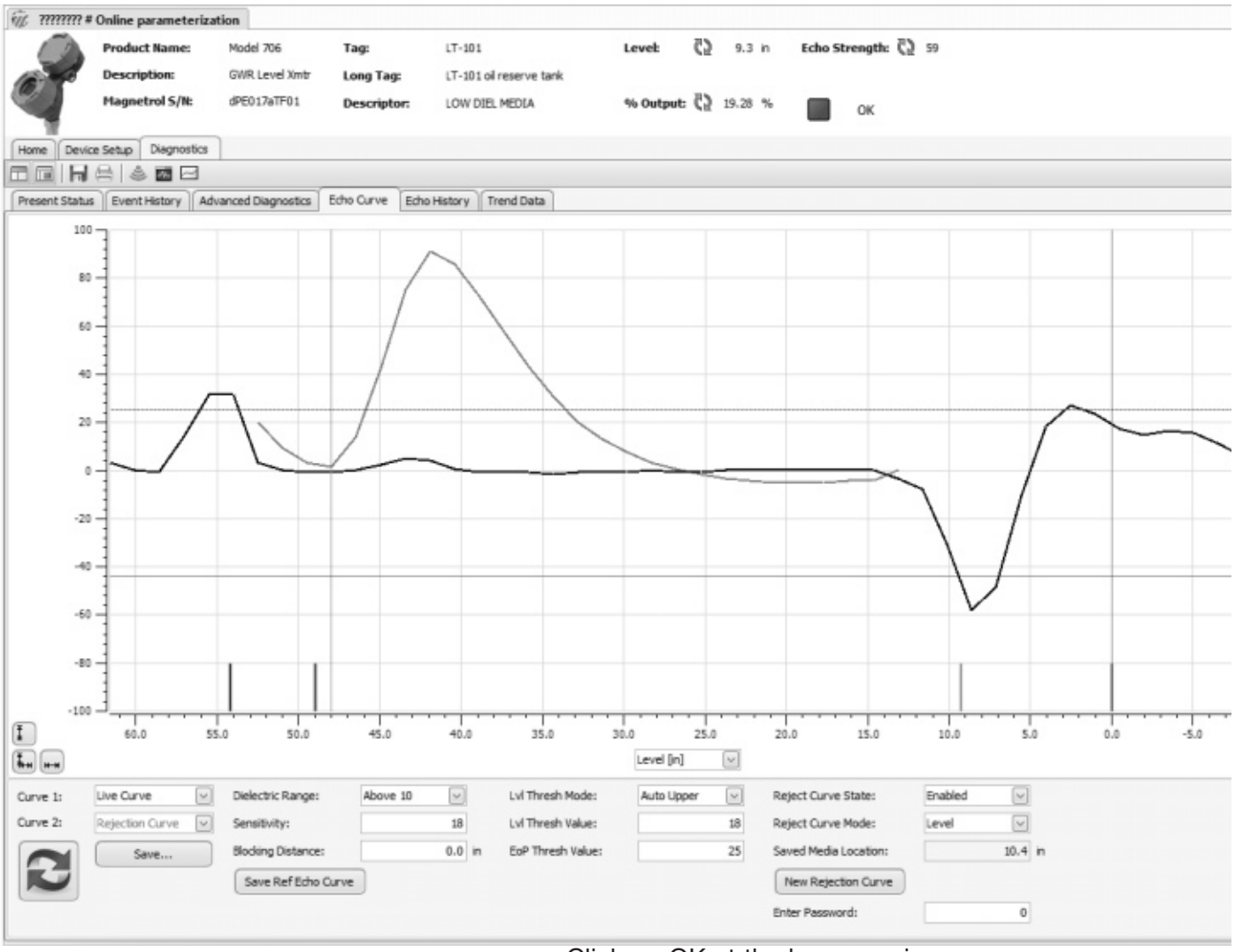

Product Name: Model 706
Tag: ECLIPSE
Level: 0.0 cm
Echo Strength: 35
Description: GWR Level Xmtr
Long Tag: Eclipse® Model 706
Magnetrol S/N: 70734303004
Descriptor:
% Output: 0.00 %
Dry Probe
Home
Device Setup
Diagnostics
Present Status
Event History
Advanced Diagnostics
Echo Curve
Echo History
Trend Data
Echo Strength
100
50
0
-50
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
Level [cm]
Curve 1: Live Curve
Curve 2: None
Dielectric Range: Below 1.7
Sensitivity: 91
Blocking Distance: 0.0 cm
Save Ref Echo Curve
Lvl Thresh Mode: Sloped
Lvl Thresh Value: 10
EoP Thresh Value: 50
Reject Curve State: Enabled
Reject Curve Mode: Level
Saved Media Location: 0.0 cm
New Rejection Curve
Enter Password: 0

4.3 Echo Rejection

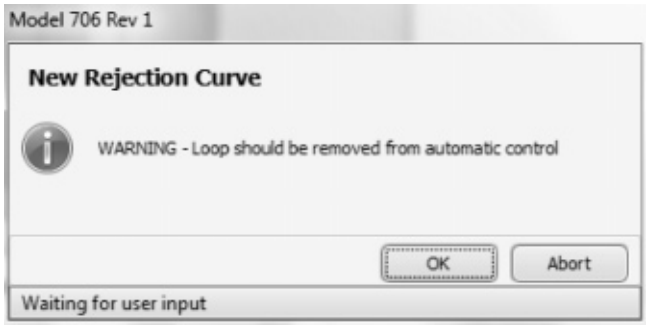
Another way to ignore unwanted signals along the length of the probe is by utilizing the Echo Rejection feature.

Setup using PACTware

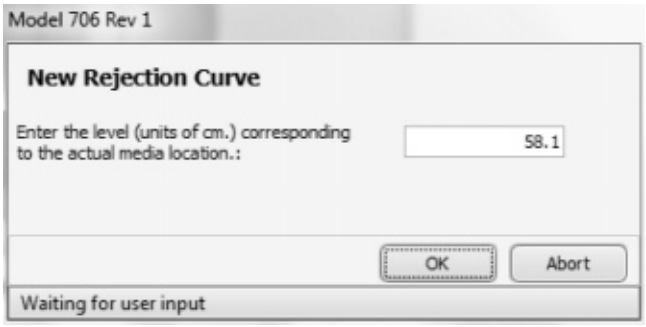
Select the Diagnostics tab and then the Echo Curve tab. Then click on New Rejection Curve



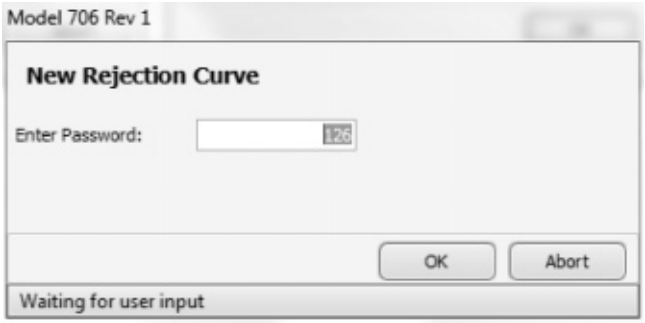
Click on OK at the loop warning message.

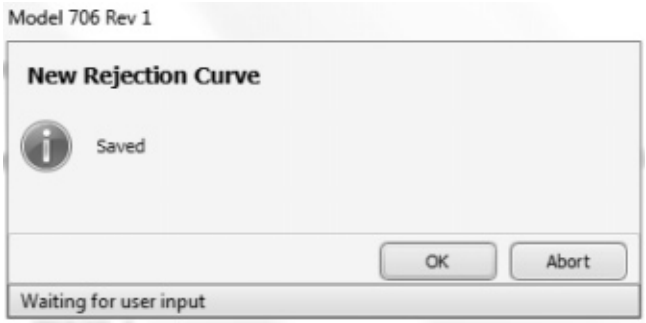


On the next screen, enter the actual process media location and then hit OK.



A password window will then appear (unless the password was previously entered). Enter the password and hit OK. Then the system calculates the curve, and then saves it. Hit OK to confirm.





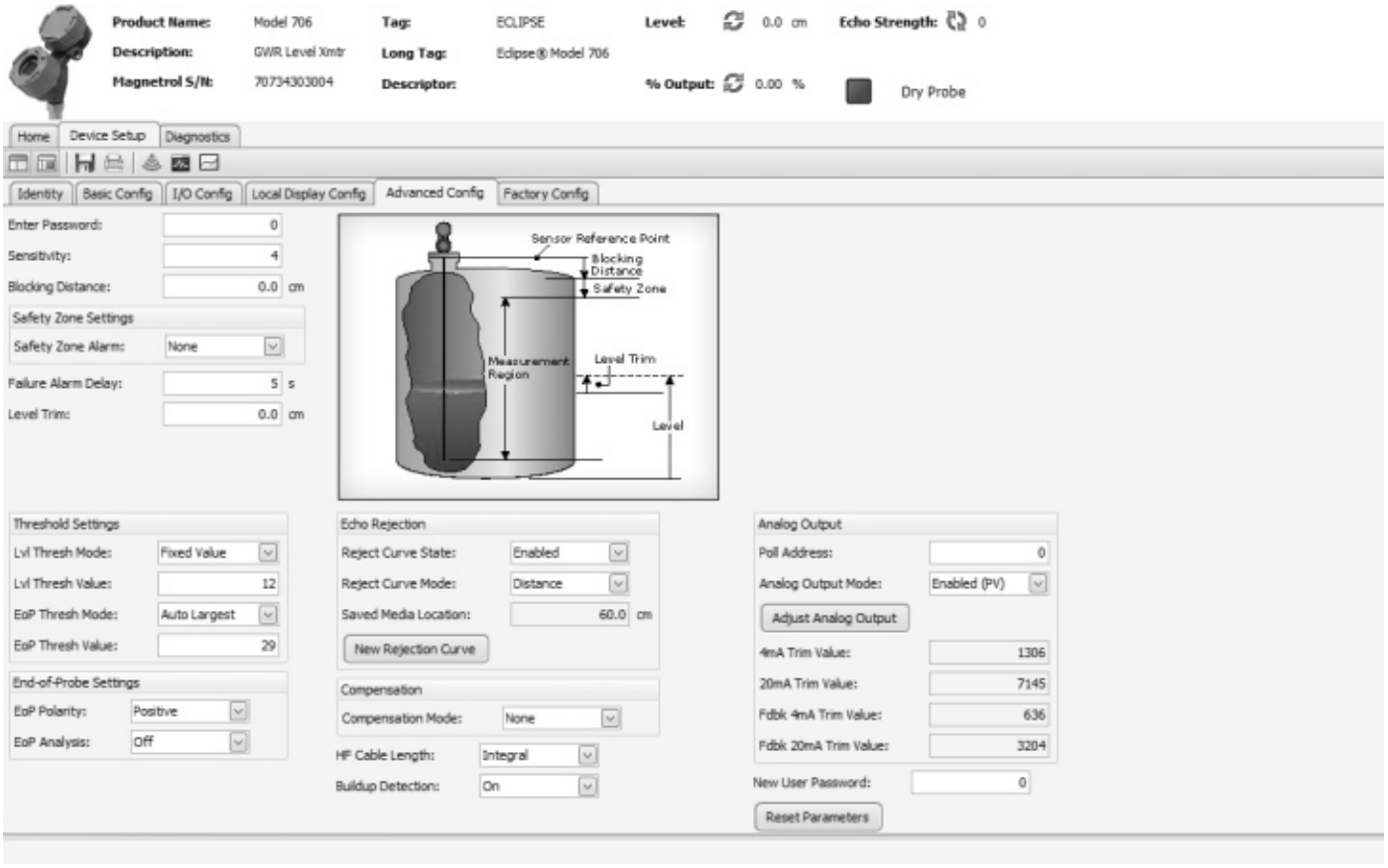
A warning screen is then shown so that the loop can be returned to automatic control.



At this point the echo rejection curve can be viewed by selecting Rejection Curve as Curve 2 in the lower left corner of the screen. The Rejection curve will then be displayed in red as shown in the screenshot above.

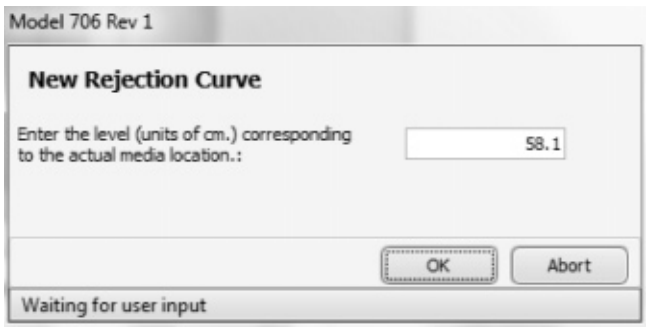
Alternatively, you can follow the procedure below:

Select the Device Setup tab, and then select the Advanced Config tab. Then click on New Rejection Curve.

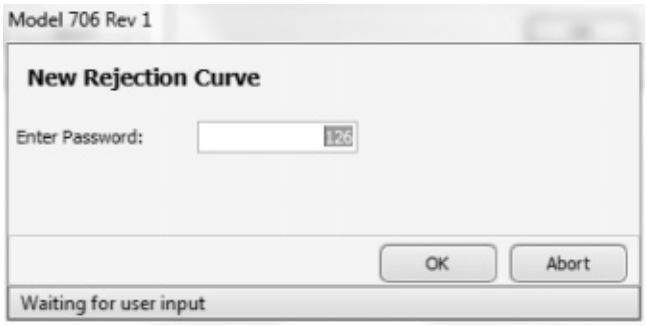


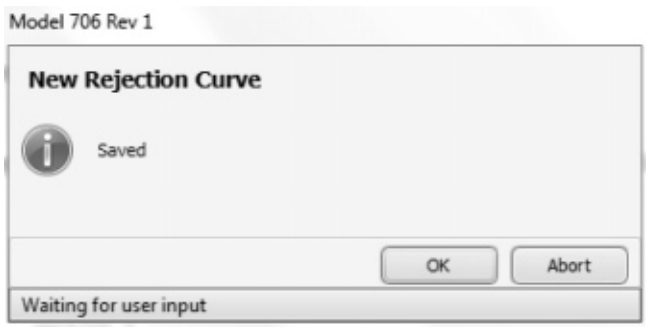
You will get a warning regarding the loop, hit OK. On the next screen you need to enter the actual media location and then hit OK.





Next a password window might appear if not already entered. Then the system calculates the curve, and then saves it. Hit OK to confirm.

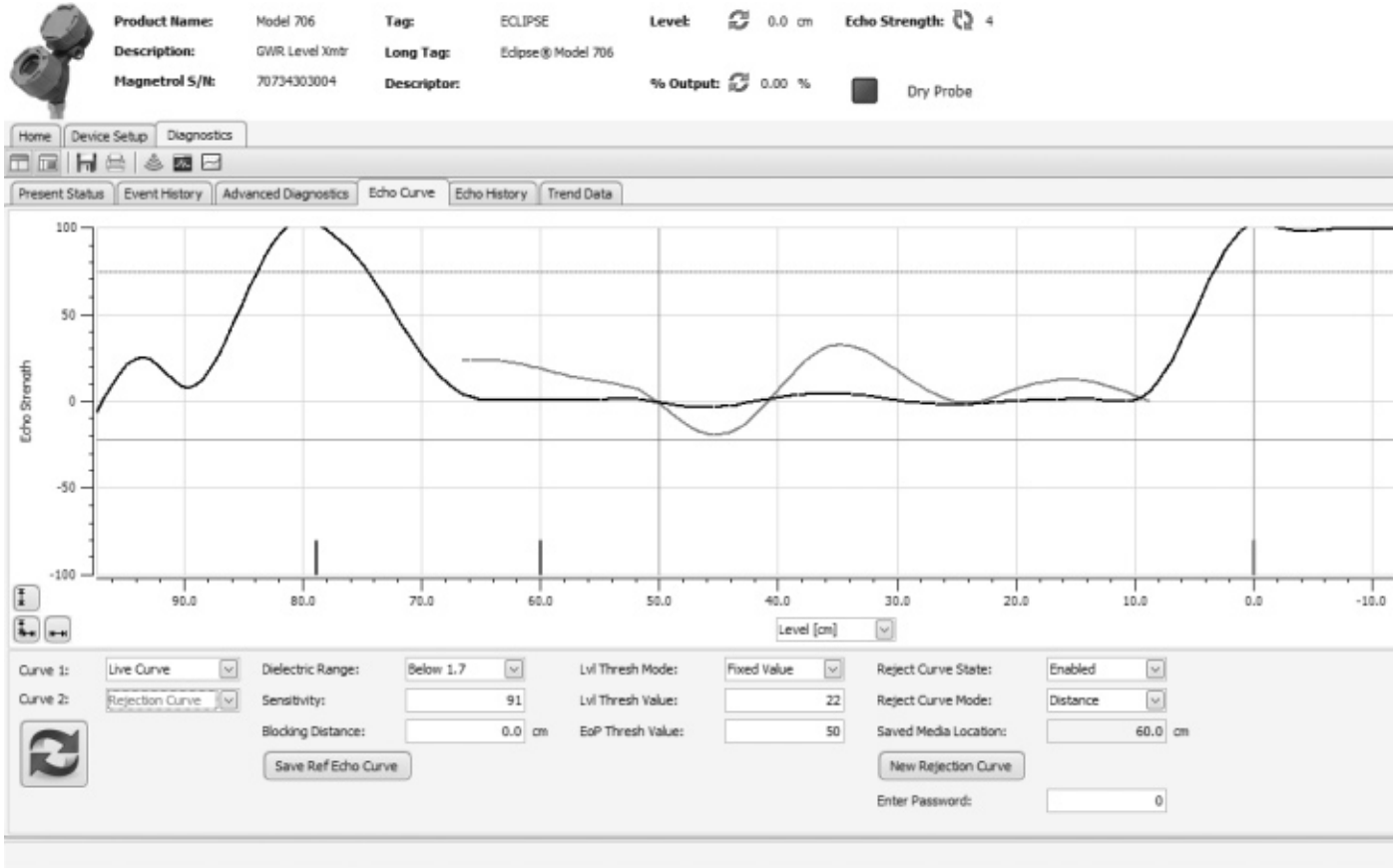




A warning screen is shown that the loop can be returned to automatic control.



At this point the echo rejection curve can be viewed by selecting Rejection Curve as Curve 2 in the lower left corner of the Echo Curve screen. The Rejection curve will then be displayed in red as shown in the screenshot below.

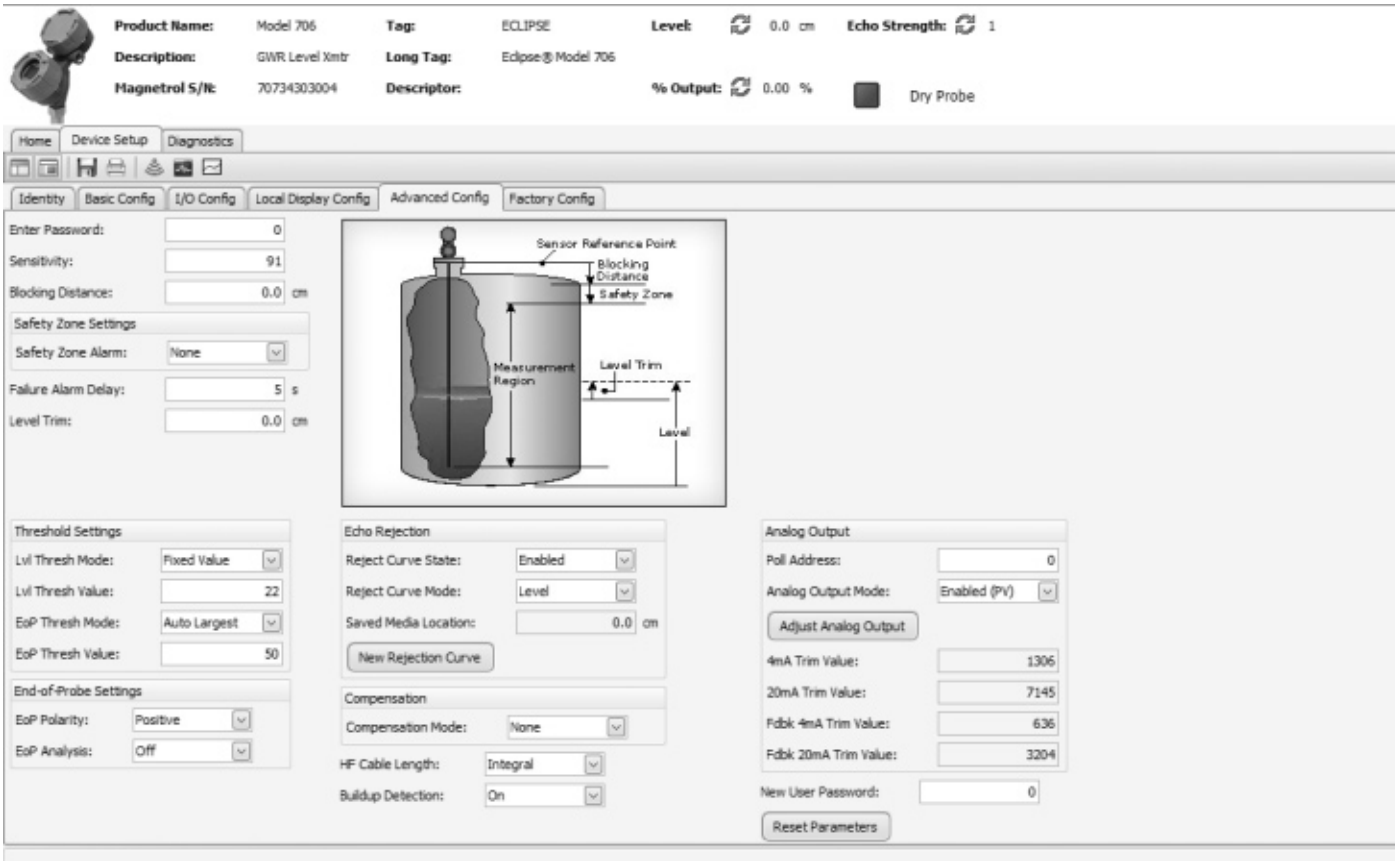


4.4 Buildup Detection

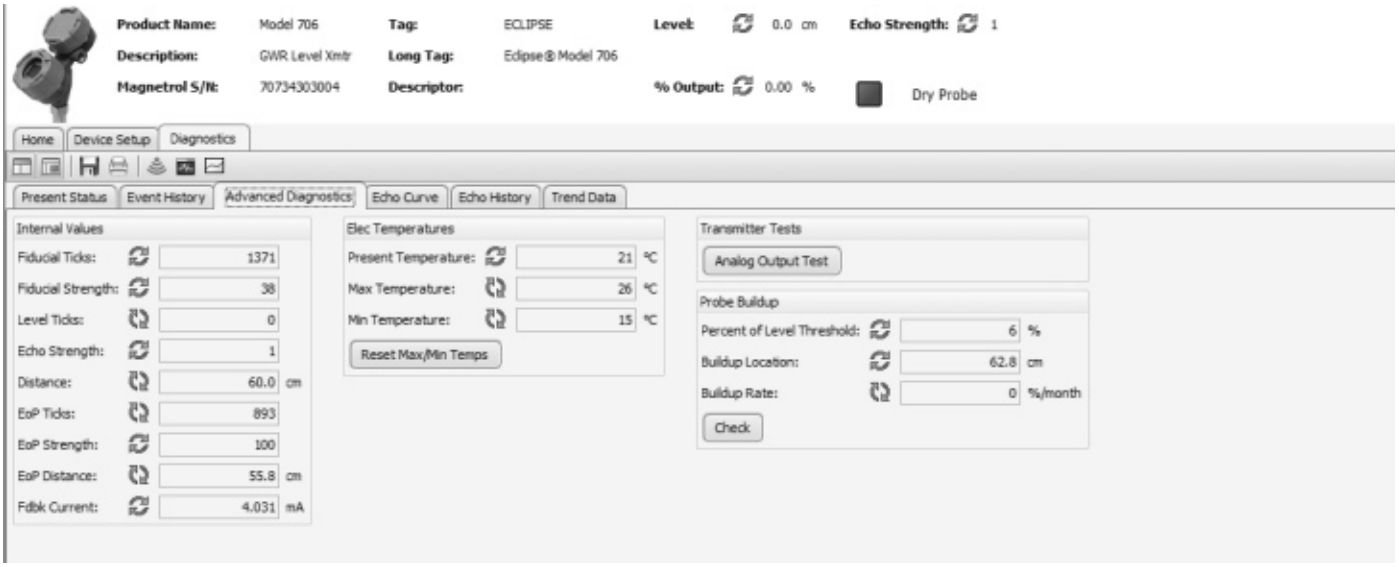
A unique feature contained within the Model 706 can be used to obtain an indication of build-up along the length of the probe. This can be set as the HART SV or TV which can be monitored in the control room. An algorithm compares the buildup echo strength as compared to the Lvl Thrsh Value, and outputs value in percent.

4.4.1 Buildup Detection Setup using PACT*ware*

Buildup detection is a feature that needs to be turned on in Advanced Config, see below.



Once turned on progress can be checked in the Advanced Diagnostics screen, see below.



4.4.2 Buildup Detection Setup using the Keypad

From the menu select DEVICE SETUP and hit Enter.





Scroll down to ADVANCED CONFIG and hit Enter; then, select On and hit Enter



Checking buildup can be done from the main display screen. First the unit must be set up to display the Buildup percentage. Go to the main menu and select DEVICE SETUP then hit Enter.



Scroll down to DISPLAY CONFIG and hit Enter.



Scroll down to Probe Buildup and hit Enter, then select View. From the main screen the Buildup percentage is now shown.



NOTES

Service Policy

Owners of AMETEK LMS controls may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by prepaid transportation.

AMETEK LMS will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a “Return Material Authorization” (RMA) number be obtained from the factory prior to the material’s return. This is available through an AMETEK LMS local representative or by contacting the factory. Provide the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

Maintenance Policy

With proper Eclipse Guided Wave Radar (GWR) probe selection, there is virtually no maintenance required for a Model 706 system. As explained in Section 3.3.5, application-related issues, such as coating or bridging on the probe can occur. Therefore, although internal diagnostics can be utilized to proactively display overall system degradation, a periodic visual inspection of he probe is recommended. Refer to Section 3.8 for replacement parts.

24/7 Technical Support assistance is available at 1-630-723-6730 or fieldservice.magnetrol@ametek.com.

Eclipse Guided Wave Radar transmitters may be protected by one or more of the following U.S. Patent Nos. US 6,062,095; US 6,247,362; US 6,588,272; US 6,626,038; US 6,640,629; US 6,642,807; US 6,690,320; US 6,750,808; US 6,801,157; US 6,867,729; US 6,879,282; 6,906,662. May depend on model. Other patents pending.

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