

ECLIPSE[®]

Enhanced Model 705

Software v3.x

Installation and Operating Manual

Guided Wave Radar Level Transmitter



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.

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Warranty

All Magnetrol electronic level and flow controls are warranted free of defects in materials or workmanship for one full year 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, Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

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The Magnetrol quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.



Eclipse Guided Wave Radar Transmitter

Table of Contents

1.0 QuickStart Installation	
1.1 Getting Started.....4	
1.1.1 Equipment and Tools.....4	
1.1.2 Configuration Information.....5	
1.2 QuickStart Mounting.....5	
1.2.1 Probe.....5	
1.2.2 Transmitter.....6	
1.3 QuickStart Wiring.....6	
1.4 QuickStart Configuration.....7	
2.0 Complete Installation	
2.1 Unpacking.....8	
2.2 Electrostatic Discharge (ESD) Handling Procedure.....8	
2.3 Before You Begin.....9	
2.3.1 Site Preparation.....9	
2.3.2 Equipment and Tools.....9	
2.3.3 Operational Considerations.....9	
2.4 Mounting.....9	
2.4.1 Installing a Coaxial Probe.....10	
2.4.1.1 To install a coaxial probe.....10	
2.4.2 Installing a Twin Rod Probe.....11	
2.4.2.1 To install a rigid twin rod probe.....11	
2.4.2.2 To install a Model 7x7 standard flexible twin rod probe.....12	
2.4.3 Installing a Single Rod Probe.....12	
2.4.3.1 Installing a rigid probe.....13	
2.4.3.2 Installing a flexible probe.....13	
2.4.4 Installation Guidelines—Models 7x2/7x5 Bulk Solids Probes.....14	
2.4.4.1 Applications.....14	
2.4.4.2 Mounting recommendations.....14	
2.4.4.3 To install a bulk solids twin rod probe..14	
2.4.4.4 To install a bulk solids single rod probe 15	
2.4.5 Installing the Transmitter.....16	
2.4.5.1 Integral Mount.....16	
2.4.5.2 Remote Mount.....16	
2.5 Wiring.....17	
2.5.1 General Purpose or Non-Incendive (CI I, Div 2).....17	
2.5.2 Intrinsically Safe.....18	
2.5.3 Explosion Proof.....18	
2.6 Configuring the Transmitter.....19	
2.6.1 Operating Parameters.....19	
2.6.2 Setting Up for Bench Configuration.....19	
2.6.3 Transmitter Display and Keypad.....20	
2.6.4 Password Protection (Default = 0).....20	
2.6.5 Model 705 Menu: Step-By-Step Procedure..21	
2.6.5.1 Measurement Type: Level Only.....21	
2.6.5.2 Measurement Type: Level and Volume..24	
2.6.5.3 Measurement Type: Interface Level.....27	
2.6.5.4 Measurement Type: Interface and Volume.30	
2.6.6 Offset Description.....33	
2.6.7 Strapping Table Description.....34	
2.7 Configuration Using HART®.....35	
2.7.1 Connections.....35	
2.7.2 Display Menu.....35	
2.7.3 HART Menu – Model 705 3.x.....36	
2.7.4 HART Revision Table.....37	
2.8 FOUNDATION fieldbus™ Digital Communications...37	
2.8.1 Description.....37	
2.8.2 Benefits.....38	
2.8.3 Device Configuration.....39	
2.8.4 Intrinsically Safe.....39	
3.0 Reference Information	
3.1 Description.....40	
3.2 Theory of Operation.....40	
3.2.1 Micropower Impulse Radar.....40	
3.2.2 Interface Detection.....41	
3.2.3 Time Domain Reflectometry (TDR).....42	
3.2.4 Equivalent Time Sampling (ETS).....42	
3.3 Troubleshooting.....43	
3.3.1 Troubleshooting System Problems.....43	
3.3.2 Status Messages.....44	
3.3.3 Troubleshooting Applications.....46	
3.3.3.1 Model 705 (Level Application).....46	
3.3.3.2 Model 705 (Interface Application).....46	
3.3.3.3 Model 705 (Single Rod Application).....47	
3.4 Agency Approvals.....48	
3.4.1 Agency Specifications (XP Installation).....48	
3.4.2 Agency Specifications (IS Installation).....49	
3.4.3 Agency Specifications (FOUNDATION fieldbus) 50	
3.5 Parts.....51	
3.5.1 Replacement Parts.....51	
3.5.2 Recommended Spare Parts.....51	
3.6 Specifications.....52	
3.6.1 Functional.....52	
3.6.1.1 O-ring (Seal) Selection Chart.....52	
3.6.2 Performance (Model 705).....53	
3.6.3 Performance (Model 705 Interface).....54	
3.6.4 Process Conditions.....54	
3.6.5 Probe Specifications.....55	
3.6.6 Physical.....56	
3.7 Model Numbers.....60	
3.7.1 Transmitter.....60	
3.7.2 Probe.....61	
Glossary64	
Model 705 Configuration Data Sheet66	

1.0 QuickStart Installation

The QuickStart Installation procedures provide the key steps for mounting, wiring, and configuring the Eclipse level transmitter. These procedures are intended for experienced installers of electronic level measurement instruments. See Complete Installation, Section 2.0, for detailed installation instructions.

WARNING: The Model 7xD, 7xG, 7xR or 7xT overfill probes should be used for Safety Shutdown/Overfill applications. All other Guided Wave Radar probes should be installed so the maximum overfill level is a minimum of 6" (150 mm) below the process connection. This may include utilizing a nozzle or spool piece to raise the probe. Consult factory to ensure proper installation.

1.1 Getting Started

Before beginning the QuickStart Installation procedures, have the proper equipment, tools, and information available.

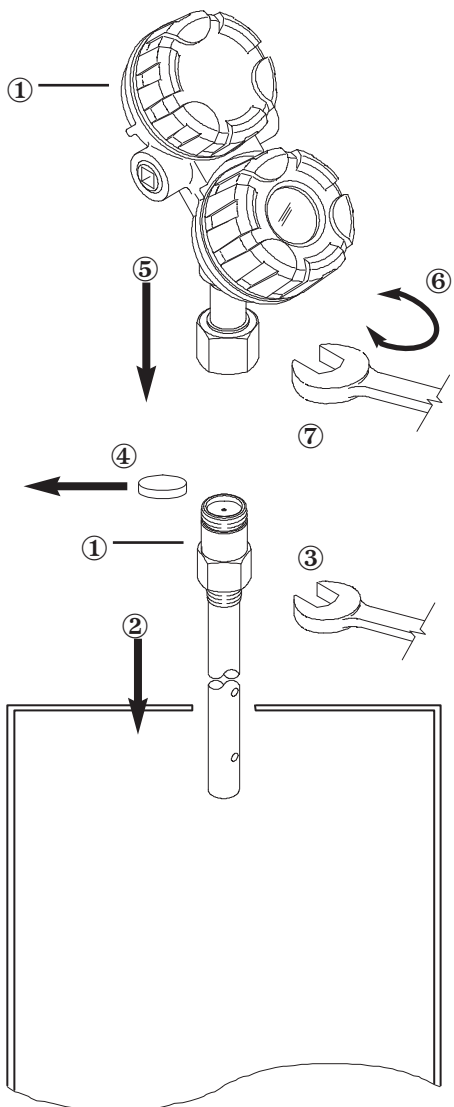
1.1.1 Equipment and Tools

- Open-end wrenches or adjustable wrench to fit the process connection size and type. Coaxial probe 1½" (38 mm), twin rod probe 1⅞" (47 mm), transmitter 1½" (38 mm). A torque wrench is highly desirable.
- Flat-blade screwdriver
- Cable cutter and ⅜" (2.5 mm) hex wrench (Flexible probes only)
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA minimum

1.1.2 Configuration Information

Some key information is needed to configure the Eclipse transmitter. Complete the following operating parameters table before beginning configuration.

Display	Question	Answer
Probe Model	What probe model is listed on the model information? (first four digits of probe model number)	_____
Probe Mount	Is the probe mounted NPT, BSP, or flange?	_____
Measurement Type	What is the desired measurement? Choices are: Level only, volume, interface level or interface level and volume.	_____
Level Units	What units of measurement will be used? (inches, centimeters, feet or meters) <small>(All block parameter. Not selectable at transmitter on Model 705 Fieldbus)</small>	_____
Probe Length	What probe length is listed on the model information?	_____
Level Offset	The desired level reading when the liquid is at the end of the probe.	_____
Dielectric	What is the dielectric constant range of the process medium? (<i>Upper layer dielectric for interface applications</i>)	_____
Loop Control	Is the output current to be controlled by level or volume?	_____
Set 4.0 mA	What is the 0% reference point for the 4.0 mA value? (EU_0 value for FOUNDATION Fieldbus)	_____
Set 20.0 mA	What is the 100% reference point for the 20.0 mA value? (EU_100 value for FOUNDATION Fieldbus) <small>(Top 6" (152 mm) of Single Rod probes is within Blocking Distance)</small>	_____



1.2 QuickStart Mounting

NOTE: Confirm the configuration style and process connection size/type of the Eclipse transmitter. Ensure it matches the requirements of the installation before continuing with the QuickStart installation.

- ① Confirm the model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.

NOTE: For applications using the Model 7xS steam probe, it is mandatory to keep the transmitter and probe matched as a set.

1.2.1 Probe

- ② Carefully place the probe into the vessel. Align the probe process connection with the threaded or flanged mounting on the vessel.

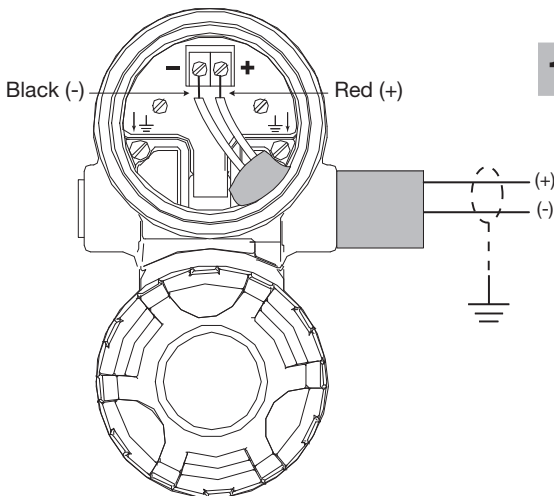
1.2.2 Transmitter

- ③ Tighten the hex nut of the probe process connection or flange bolts.

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

- ④ Remove the protective plastic cap from the top of the probe and store for future use. Make sure the top probe connector (female socket) is clean and dry. Clean with isopropyl alcohol and cotton swabs if necessary.
- ⑤ Place the transmitter on the probe. Align the universal connection at the base of the transmitter housing with the top of the probe. Hand-tighten the connection.
- ⑥ Rotate the transmitter so that it is in the most convenient position for wiring, configuring, and viewing.
- ⑦ Using a 1½" (38 mm) wrench, tighten the universal connection on the transmitter ¼ to ½ turn beyond hand-tight. A torque wrench is highly recommended to obtain 45 ft-lbs. This is a critical connection. **DO NOT LEAVE HAND-TIGHT.**

NOTE: Universal connector can be supplied with lock screws for applications with significant vibration. Contact factory for additional information.



1.3 QuickStart Wiring

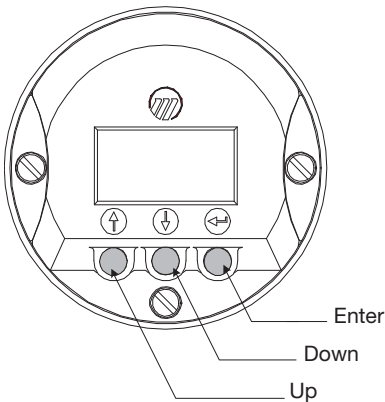
WARNING! Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

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

1. Remove the cover of the upper wiring compartment of the 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. Connect shield to an earth ground at 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 the cover and tighten.

1.4 QuickStart Configuration

The Eclipse transmitter comes configured with default values from the factory but can be reconfigured in the shop (disregard any fault messages due to unattached probe). The minimum configuration instructions required in the field follow. Use the information from the operating parameters table in Section 1.1.2 before beginning configuration.

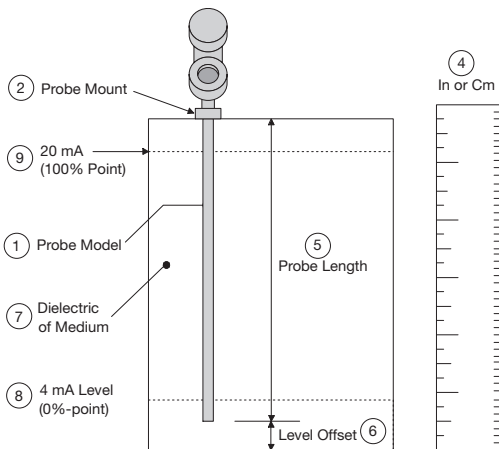


- Power up the transmitter.
The display changes every 5 seconds to show one of four values: Status, Level, %Output, and Loop current.
- Remove the cover of the lower electronic compartment.
- Use the Up or Down Arrow () keys to move from one step of the configuration program to the next step.
- Press the Enter Arrow () key. The last character in the first line of the display changes to an exclamation point (!).

LvlUnits! xxx

- Use the Up or Down Arrow () keys to increase or decrease the value in the display or to scroll through the choices.
- Press the Enter Arrow () key to accept a value and move to the next step of the configuration program (the default password is 0).
- After entering the last value, allow 10 seconds before removing power from the transmitter.

The following configuration entries are the minimum required for configuration (the default password is 0 from the LCD/keypad).



NOTE: A small transition zone (0–6") may exist at the top and bottom of the probe. See Specifications, Section 3.6.

- | | | |
|---|----------------------|--|
| ① | PrbModel
(select) | Select the Probe Model to be used
Model 705: 7xA-x, 7xB-x, 7xD-x, 7xE-x, 7xF-F, 7xF-P, 7xF-4, 7xF-x, 7xJ-x, 7xK-x, 7xP-x, 7xR-x, 7xS-x, 7xT-x, 7x1-x, 7x2-x, 7x5-x, 7x7-x |
| ② | PrbMount
(select) | Select the type of Probe Mounting to vessel (NPT, BSP, or flange). |
| ③ | MeasType
(select) | Select from Level Only, Level and Volume, Interface Level or Interface Level and Volume. |
| ④ | Lvl Units
xxx | Select the Units of measurement for the level readout (inches, cm, feet or meters). Not included on Model 705 Fieldbus. |
| ⑤ | Probe Ln
xxx.x | Enter the exact Probe Length as printed on the probe nameplate. |
| ⑥ | LvlOfst
xxx.x | Enter the Level Offset value. Refer to Section 2.6.6 for further information. (The unit is shipped from the factory with offset = 0; i.e., all measurements are referenced to the bottom of the probe). |
| ⑦ | Dielctrc
(select) | Enter the Dielectric range for the material to be measured. |
| ⑧ | Set 4mA
xxx.x | Enter the level value (0%-point) for the 4 mA point. |
| ⑨ | Set 20mA
xxx.x | Enter the level value (100%-point) for the 20 mA point. |

2.0 Complete Installation

This section provides detailed procedures for properly installing and configuring the Eclipse 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

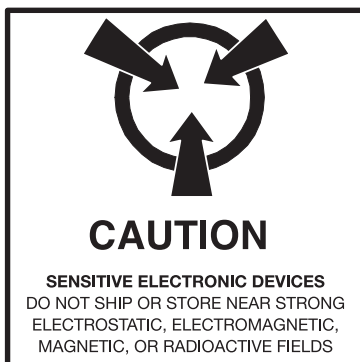
Serial Number

2.2 Electrostatic Discharge (ESD) Handling Procedure

Magnetrol 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 anti-static 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 transmitter is built to match the specific physical specifications of the required installation. Make sure the probe connection is correct for the threaded or flanged mounting on the vessel or tank where the transmitter will be placed. See Mounting, Section 2.4.

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

When installing the Eclipse transmitter in a general purpose or hazardous area, all local, state, and federal regulations and guidelines must be observed. See Wiring, Section 2.5.

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), twin rod probe 1⅞" (47 mm), transmitter 1½" (38 mm). A torque wrench is highly desirable.
- Flat-blade screwdriver
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA

2.3.3 Operational Considerations

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

2.4 Mounting

The Eclipse transmitter can be mounted 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.

NOTE: Do not place insulating material around any part of the Eclipse transmitter including the probe flange as this may cause excessive heat buildup.

Make sure 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; make sure the Eclipse probe is correct for the intended installation.

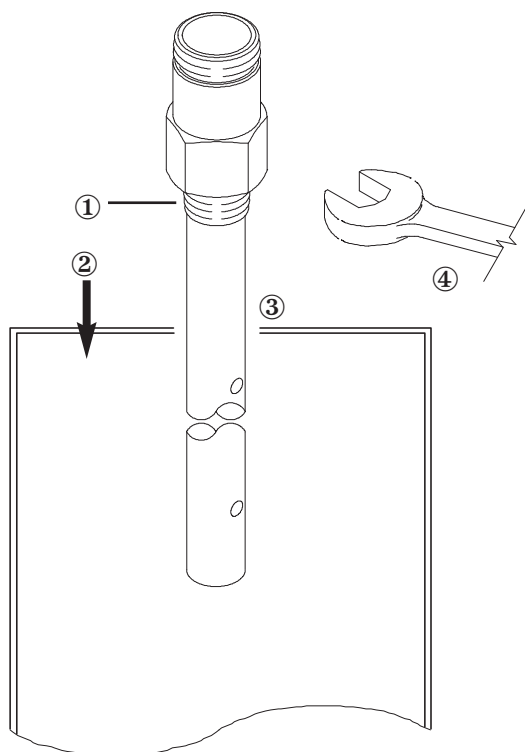
WARNING! The Model 7xD, 7xR or 7xT overfill probes should be used for Safety Shutdown/Overfill applications. All other Guided Wave Radar probes should be installed so the maximum overfill level is a minimum of 6" (150 mm) below the process connection. This may include utilizing a nozzle or spool piece to raise the probe. Consult factory to ensure proper installation.

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

2.4.1 Installing a Coaxial Probe (Models 7xA, 7xD, 7xG, 7xP, 7xR, 7xS, and 7xT)

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate room for installation and has unobstructed entry to the bottom of the vessel. The Model 7xD (High Temp./High Pressure) probe, Model 7xP (High Pressure) probe, Model 7xR (Overfill) probe, Model 7xS (Steam) probe and Model 7xT (Interface) probe require added clearance. See Physical Specifications, Section 3.6.6.
- Process temperature, pressure, dielectric, and viscosity are within the probe specifications for the installation. See Specifications, Section 3.6.
- Model 7xD (High Temp./High Pressure) probes should be handled with extra care due to the ceramic spacers used throughout their length.
- **Model 7xG (caged GWR) probes should be handled with extra care. Only handle these probes by the flanges.**



2.4.1.1 To install a coaxial probe:

- ① Make sure the process connection is at least $\frac{3}{4}$ " 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.

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.

NOTE: For applications using the Model 7xS steam probe, it is mandatory to keep the transmitter and probe matched as a set.

2.4.2 Installing a Twin Rod Probe (Models 7xB, 7x5, and 7x7)

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate headroom for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, viscosity, and media buildup are within the probe specifications for the installation. See Specifications, Section 3.6.

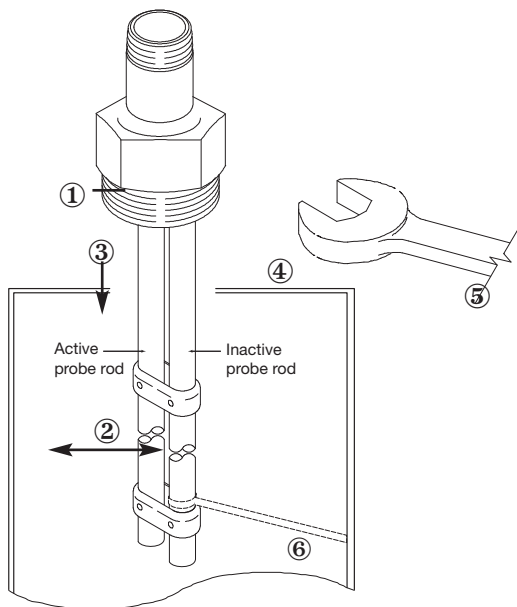
Nozzles:

The 7xB/7x5/7x7 Twin Rod probes may be susceptible to objects that are in close proximity. The following rules should be followed for proper application:

1. Nozzles should be 3" (80 mm) diameter or larger.
2. 7xB/7x5/7x7 Twin Rod probes should be installed such that the active rod is >1" (25 mm) from metallic objects such as pipes, ladders, etc., (a bare tank wall parallel to the probe is acceptable).

2.4.2.1 To install a rigid twin rod probe:

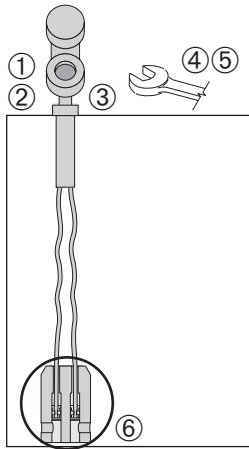
- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".
- ③ Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ④ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ⑤ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑥ Probe can be stabilized by attaching the inactive probe rod to vessel.



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.

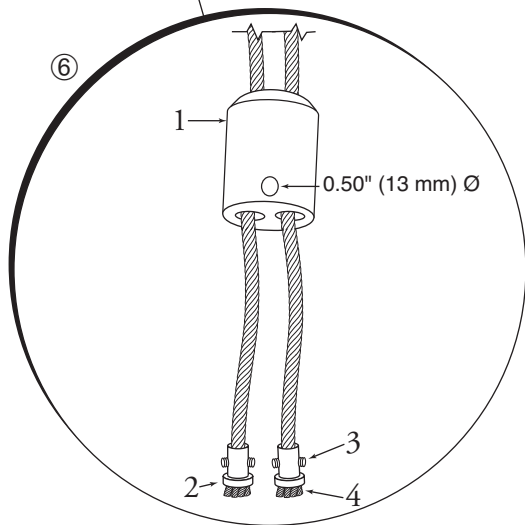
2.4.2.2 To install a Model 7x7 standard flexible twin rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".
- ③ Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ④ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ⑤ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.



Probe can be shortened in the field:

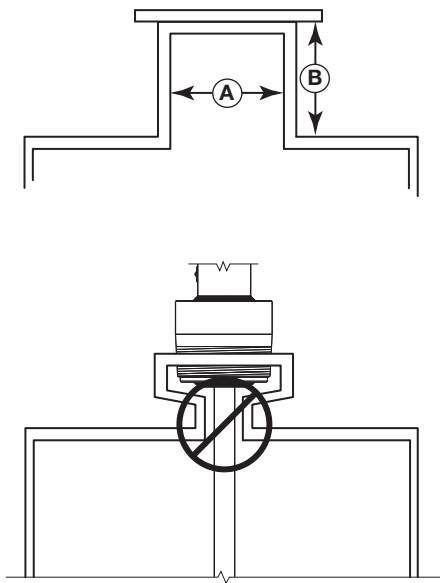
- ⑥ a. Raise the weight (1) to expose the two securing devices (2).
- b. Loosen the two #10-32 set screws (3) on both securing devices using a $\frac{3}{32}$ " (2.5 mm) hex wrench and slide the securing devices off of the probe.
- c. Slide the TFE weight off of the probe.
- d. Cut and remove the required cable (4) length.
- e. Remove $3\frac{1}{2}$ " of the rib between the two cables.
- f. Strip $\frac{5}{8}$ " (16 mm) of coating from the two cables.
- g. Slide the TFE weight back on to the probe.
- h. Reattach securing device and tighten screws.
- i. Enter new probe length (inches or cm) in software.



2.4.3 Installing a Single Rod Probe (Models 7x1, 7x2, 7xF, 7xJ)

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate headroom for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, viscosity, and media buildup are within the probe specifications for the installation. See Specifications, Section 3.6.
- Nozzle does not restrict performance by ensuring the following:
 1. No nozzle is <2" (50mm) diameter.



2. Ratio of Diameter: Length (A:B) is 1:1 or greater; any ratio <1:1 (e.g., a 2" x 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment (see Section 2.6.5.2 Measurement Type: Level and Volume).

3. No pipe reducers (restrictions) are used.

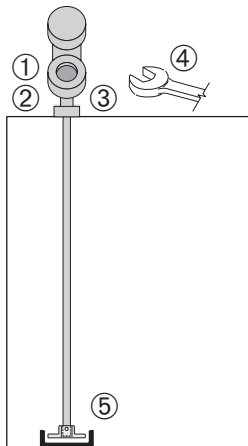
- Probe is kept away from conductive objects to ensure proper performance. See Probe Clearance Table below. A lower gain (increase in DIELECTRIC setting) may be necessary to ignore certain objects (see Section 2.6.5.4 Measurement Type: Interface and Volume).

PROBE CLEARANCE TABLE

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

2.4.3.1 To install a Model 7xF rigid single rod probe:

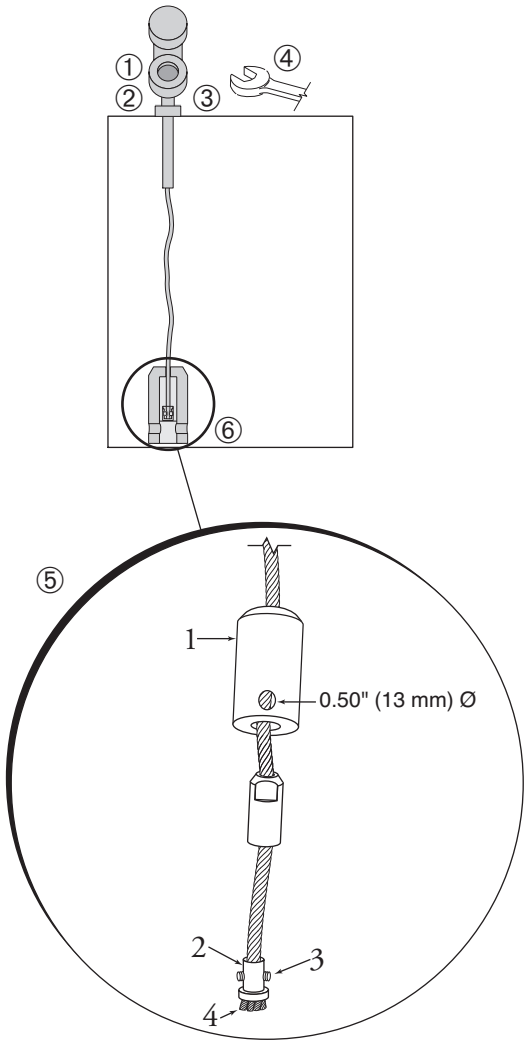
- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑤ Probe can be stabilized by placing into a non-metallic cup or bracket at the bottom of the probe. A TFE bottom spacer (P/N 89-9114-001) is optional for mounting into a metallic cup or bracket.



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.

2.4.3.2 To install a Model 7x1 flexible single rod probe:

- ① Make sure 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:
 - a. Raise TFE weight (1) exposing securing device (2).
 - b. Loosen both #10–32 set screws (3) using $\frac{3}{32}$ " (2.5 mm) 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 (inches or cm) in software.
- ⑥ Probe can be attached to the tank bottom using the 0.50" (13 mm) \varnothing hole provided in the TFE weight. Cable tension should not exceed 20 lbs.

2.4.4 Installation Guidelines **Models 7x2/7x5 Bulk Solids Probes**

The Model 7x2 and 7x5 Bulk Solids probes are 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 75-foot (22-meter) probe length.

Model 7x2 Single Rod — dielectric ≥ 4

Model 7x5 Twin Rod — dielectric ≥ 1.9

NOTE: Avoid cement, heavy gravel, etc.

2.4.4.1 Applications

1. Plastic pellets, sugar: Dielectric constant 1.9-2.0
2. Grain, seeds, sand: Dielectric constant 2.0-3.0
3. Salts: Dielectric constant 4.0-7.0
4. Metallic powder, coal dust: Dielectric constant >7

2.4.4.2 Mounting recommendations

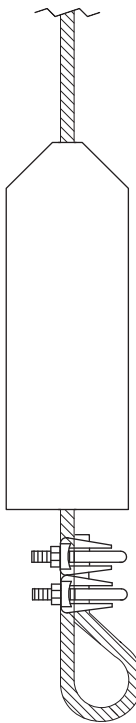
1. Use a weight instead of securing the probe to the vessel.
2. Mount probe at least 12 inches from the wall. Ideal location is $\frac{1}{4}$ to $\frac{1}{6}$ the diameter to average the angle of repose.
3. A metal flange must be used when mounting on plastic vessels.

2.4.4.3 To install a Model 7x5 bulk solids flexible twin rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.



**Model 7x5 Dual Rod
Bulk Solids Probe**



**Model 7x2 Single Rod
Bulk Solids Probe**

- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".
- ③ Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ④ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ⑤ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.

Refer to Bulk Solid Guidelines, Section 2.4.4.

Probe can be shortened in the 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.
- d. Remove 12 inches of the rib between the two cables.
- e. Strip 6 inches of coating from the two cables.
- f. Slide the weight back on to the probe.
- g. Reinstall the two cable clamps and tighten.
- h. Enter the new probe length (inches or cm) in software.

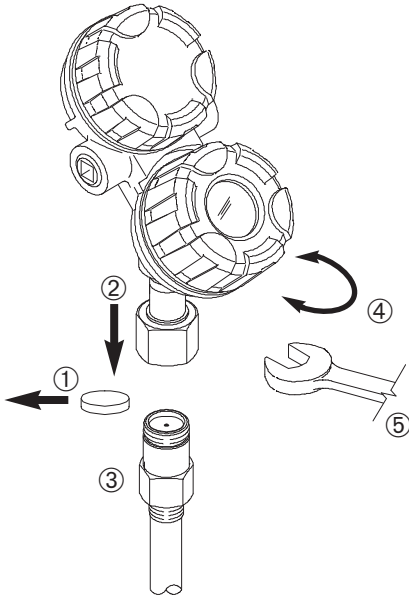
2.4.4.4 To install a Model 7x2 bulk solids flexible single rod probe:

- ① Make sure 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 6.38".
- d. Slide the weight back on to the probe.
- e. Reinstall the two cable clamps and tighten.
- f. Enter the new probe length (inches or cm) in software.

2.4.5 Installing the Transmitter

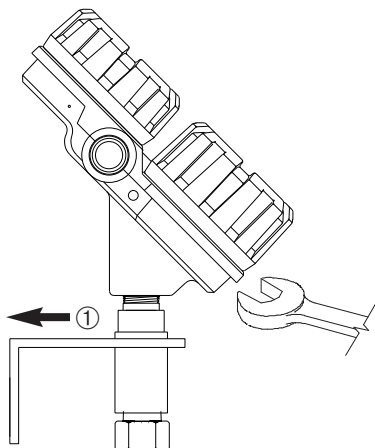
The transmitter can be ordered for installation as an Integral or Remote configuration.

2.4.5.1 Integral Mount

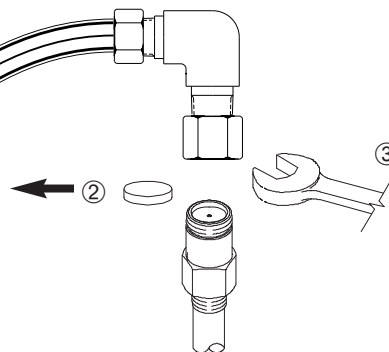


- ① Remove the protective plastic cap from the top of the probe. Store the cap in a safe place in case the transmitter has to be removed later.
- ② Place the transmitter on the probe. Be careful not to bend probe. Do not allow the gold, high frequency (male) connector to get dirty.
- ③ Align the universal connection at the base of the transmitter housing with the top of the probe. Hand-tighten the connection.
- 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 1/2" (38 mm) wrench to tighten the universal connection on the transmitter to 45 ft-lbs. A torque wrench is highly recommended. This is a critical connection. **DO NOT LEAVE HAND-TIGHT.**

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 FROM 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 1/2" (38 mm) wrench, tighten the universal connection on the transmitter to 45 ft-lbs. A torque wrench is highly recommended. This is a critical connection. **DO NOT LEAVE HAND-TIGHT.**



NOTE: Remote mounting is recommended for all cast 316 SS enclosures due to their extra weight.

2.5 Wiring

Caution: All HART versions of the Eclipse Model 705 transmitter operate at voltages of 11–36 VDC. Higher voltage will damage the transmitter.

Wiring between the power supply and the Eclipse transmitter should be made using 18–22 AWG shielded twisted pair instrument cable. Within the transmitter enclosure, connections are made to the terminal strip and the ground connections. The directions for wiring the Eclipse transmitter depend on the application:

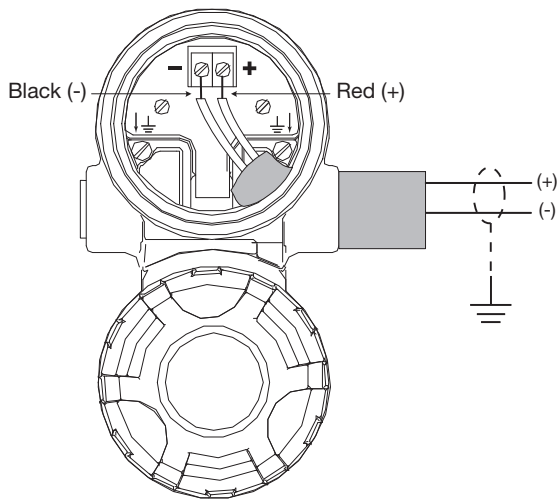
- General Purpose or Non-incendive (CI I, Div. 2)
- Intrinsically Safe
- Explosion Proof

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 (CI I, Div. 2)

A general purpose installation does not have flammable media present. Areas rated non-incendive (CI I, Div. 2) have flammable media present only under abnormal conditions. No special electrical connections are required.

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



Wiring Diagram

To install General Purpose or Non-Incendive wiring:

1. Remove the cover to the wiring compartment of the transmitter. Install the conduit plug in the unused opening. 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.
6. Replace the cover to the wiring compartment of the transmitter.

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. See Agency Drawing – Intrinsically Safe Installation, Section 3.4.2.

To install Intrinsically Safe wiring:

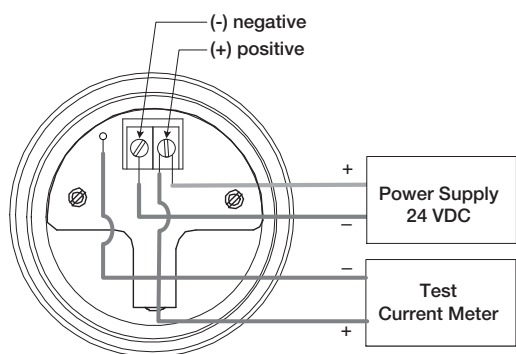
1. Make sure the IS barrier is properly installed in the safe area (refer to local plant or facility procedures). Complete the wiring from the barrier to the Eclipse transmitter.
2. Remove the cover to the wiring compartment of the transmitter. Install the conduit plug in the unused opening. Use PTFE 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.
7. Replace the cover to the wiring compartment of the transmitter.

2.5.3 Explosion Proof

Explosion Proof (XP) is a method of designing equipment for installation in 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" of the transmitter. An Explosion Proof conduit fitting (EY seal) is required between the hazardous and safe areas. See Agency Specifications, Section 3.4.1.

To install Explosion Proof wiring:

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 to 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.
6. Replace the cover to the wiring compartment of the transmitter before applying power.



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

2.6 Configuring the Transmitter

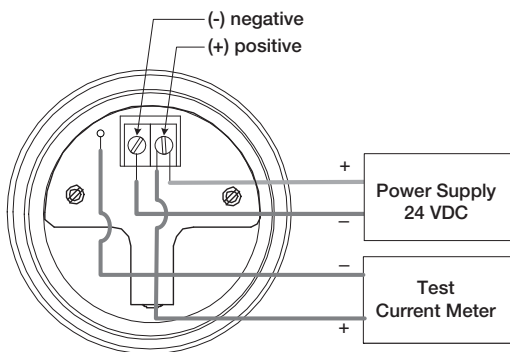
The Eclipse transmitter comes configured from the factory but can be reconfigured easily in the shop (disregard error message due to unattached probe). Bench configuration provides a convenient and efficient way to set up the transmitter before going to the tank site to complete the installation.

Before configuring the transmitter, collect the operating parameters information (refer to Section 1.1.2). Power up the transmitter on the bench and follow through the step-by-step procedures for the menu-driven transmitter display.

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

Information on configuring the transmitter using FOUNDATION fieldbus is given in Section 2.8.

Refer to instruction manual 57-640 for detailed FOUNDATION fieldbus information.



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

2.6.1 Operating Parameters

Some key information is needed to calibrate the Eclipse transmitter. Complete the configuration information table in Section 1.1.2.

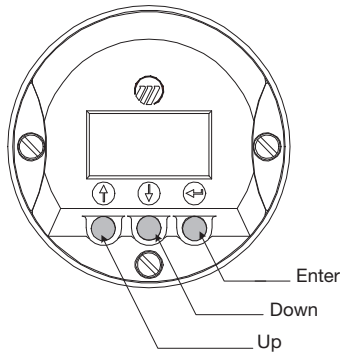
2.6.2 Setting Up for Bench Configuration

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

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

1. When using a HART communicator for configuration, a minimum $250\ \Omega$ line load resistance is required. See the HART communicator manual for more information.
2. The transmitter can be configured without the probe. (Disregard the error message due to the unattached probe.)
3. After entering the last value, allow 10 seconds before removing power from the transmitter. This allows the transmitter to store values.

2.6.3 Transmitter Display and Keypad



The Eclipse transmitter has an optional liquid crystal display (LCD) capable of showing two lines of 8 characters each. Transmitter measurements and configuration menu screens are shown on the LCD.

The transmitter default display is the measurement screen. It cycles every 5 seconds to display STATUS, LEVEL, %OUTPUT, and LOOP information (LEVEL, %OUTPUT, and STATUS for Fieldbus version). The transmitter defaults to this display after 5 minutes if no keystrokes are sensed.

The keypad has three arrows used to scroll through the displays and to calibrate the transmitter. The Up and Down Arrow (↕) keys and the Enter (↵) key.

Arrows	Function in Display Mode	Function in Configuration Mode
Up and Down ↕	Moves forward and backward in the configuration program from one display to another.	Increases or decreases the value displayed or moves to another choice. <i>NOTE: Hold arrow key for rapid scrolling.</i>
Enter ↵	Enters the configuration mode (noted by an exclamation point as the last character in the top display line).	Accepts a value and moves to the next step of the configuration program.

2.6.4 Password Protection (Default = 0)

The Eclipse transmitter is password protected to restrict access to certain portions of the menu structure that affect the operation of the system. When the proper password is entered, an exclamation point (!) appears as the last character of the first line of the display. The password can be changed to any numerical value up to 255. The password is required whenever configuration values are changed.

The default user password installed in the transmitter at the factory is 0. The last step in the configuration menu provides the option to enter a new password. With a password of 0, the transmitter is no longer password protected and any value in the menu can be adjusted without entering a confirming password, except diagnostic values.

NOTE: If the password is not known, the menu item New Password displays an encrypted value representing the present password. Call the factory with this encrypted value to determine the present password.

2.6.5 Model 705 Menu: Step-By-Step Procedure

The following tables provide a complete explanation of the software menus displayed by the Eclipse transmitter. Use these tables as a step-by-step guide to configure the transmitter based on a desired measurement type of:

- Level Only, Section 2.6.5.1
- Level and Volume, Section 2.6.5.2
- Interface Level, Section 2.6.5.3
- Interface Level and Volume, Section 2.6.5.4

The tables are separated to display the parameters based on the measurement type. The second column presents the menus shown on the transmitter display. The displays are in the order they would appear if the arrow keys were used to scroll through the menu. The numbers in the first column are not shown on the display. They are only provided as a reference.

The third column provides the actions to take when configuring the transmitter. Additional information or an explanation of an action is given in the fourth column. (Shaded sections are factory menu items).

2.6.5.1 Measurement Type: Level Only (Loop Control = Level)

	Display	Action	Comment
1	*Status* *Level* *% Out* * Loop *	Transmitter Display	LoopCtrl = Level. Transmitter default display showing <i>Status</i> , <i>Level</i> , <i>% Output</i> , and <i>Loop</i> values cycles every 5 seconds
2	Level xxx.x	Transmitter Display	Transmitter displays <i>Level Value</i> in selected units
3	% Output xx.x%	Transmitter Display	Transmitter displays <i>% Output</i> measurement derived from 20 mA span
4	Loop xx.xx mA	Transmitter Display	Transmitter displays <i>Loop</i> value (mA)
5	PrbModel (select)	Select the type of probe used (Example: 7xR-x)	Select from 7xA-x, 7xB-x, 7xD-x, 7xE-x, 7xF-x, 7xF-E, 7xF-F, 7xF-4, 7xG-x, 7xF-P, 7xG, 7xJ-x, 7xK-x, 7xL, 7xM, 7xN, 7xP-x, 7xR-x, 7xS-x, 7xT-x, 7x1-x, 7x2-x, 7x5-x, 7x7-x as shown on the probe nameplate
6	PrbMount (select)	Select the type of probe mounting	Select from NPT, BSP, or Flange
7	MeasType (select)	Select type of measurement	Select Lvl Only
8	LvlUnits (select)	Select level units	Select from cm, inches, feet or meters
9	Probe Ln xxx.x	Enter the exact length of probe	Probe length is printed on the nameplate and order information and is the last three digits of the probe model number
10	Lvl Ofst xxx.x	Enter the desired reading when probe is dry	Level Offset is the distance from the probe tip to the desired 0 level point (-90 to 300"). Refer to Section 2.6.6
11	Dielctrc (select)	Select range bounding the dielectric constant of the media	Select from 1.4-1.7; 1.7-3; 3-10; 10-100

2.6.5.1 Measurement Type: Level Only (Loop Control = Level)

	Display	Action	Comment
12	Senstvty xxx	Enter value upward or downward to sense liquid surface	Allows fine gain adjustment for single rod probes (this parameter is password protected for coaxial and twin rod probes).
13	LoopCtrl (select)	Select variable to control loop current	Select Level
14	Set 4mA xxx.x lu	Enter the PV value for the 4 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe. See <i>Functional Specifications Probe, Section 3.6.1</i>
15	Set 20mA xxx.x lu	Enter the PV value for the 20 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe. Top 4" (100 mm) of 7xB Twin Rod Probe is inactive. See <i>Functional Specifications Probe, Section 3.6.1</i>
16	Damping xx s	Enter time constant of desired damping	A Damping factor (0–10 seconds) may be added to smooth the output due to turbulence
17	Fault (select)	Select the loop current value in presence of a fault	Select from 3.6 mA, 22 mA or HOLD
18	BlockDis xx.x lu	Enter distance below reference point where level is not sensed	Allows user to ignore level measurements near the top of the probe
19	SZ Fault (select)	Select loop current behavior when level is sensed in safety zone	<i>Safety Zone</i> is a user-defined area just below the <i>Blocking Distance</i> . Enable Fault if necessary to ensure safe, reliable high-level readings in critical applications. Choices are None, 3.6 mA, 22 mA, Latch 3.6 or Latch 22 . If Latch 3.6 or Latch 22 is selected, the loop current will remain in alarm until it is manually cleared with the SZ Alarm Reset below (#21)
20	SZ Height (xx.x lu)	Enter distance below BlockDis where SZ Fault will be asserted	Enter a distance value that develops a safety zone just below the <i>Blocking Distance</i> . Here the unit will report a <i>Safety Zone Fault</i> (#19) if the level rises into this area.
21	SZ Alarm Reset	Press Enter to clear a latched Safety Zone alarm	Clear a latched <i>Safety Zone</i> alarm
22	Threshld (select)	Select the type of threshold	Unit default CFD . Only select Fixed in application with low dielectric material over higher dielectric material and unit is reading incorrect level. Example: Oil over water. (Adjustment of Trim Level may be necessary when threshold is changed)
23	Poll Adr xx	Enter HART polling address number (0-15)	Select a HART poll address (0–15). Enter 0 for a single transmitter installation
24	Trim Lvl xx.x lu	Enter value to adjust Level reading	-10.0 inches ≤ Lvl Trim ≤ +10.0 inches (Requires superuser password)
25	Trim 4 xxxx	Fine tune the 4 mA point	Adjust setting to output exactly 4.0 mA on current meter
26	Trim 20 xxxx	Fine tune the 20 mA point	Adjust setting to output exactly 20.0 mA on current meter
27	Loop Tst xx.x mA	Enter a mA Output value	Set mA output to any given value to perform loop test
28	LvlTicks XXXXX	Diagnostic Display	Time of flight from fiducial to level signal
29	New Pass xxx	Enter new password (0-255)	Displays encrypted value of present password
30	Language (select)	Select from English, Spanish, French, German	Language choice for LCD display
31	Mdl705HT Ver3.0a0	Transmitter display	Product identification Firmware version

2.6.5.1 Measurement Type: Level Only (Loop Control = Level)

	Display	Action	Comment
32	DispFact (select)	Select Yes to display factory parameter menus	
33	History (current status)	Press Enter to view history of exceptions	Diagnostic Display
34	Run Time		
35	History Reset	Press Enter and select yes to clear history	Similar to SZ Alarm Reset
36	HF cable (select)	Superuser Parameter	Select from 3-foot or 12-foot remote
37	FidTicks xxxx	Diagnostic Display	Time of flight from start of ramp to fiducial
38	FidSprd		
39	Fid Type (select)	Superuser Parameter	Select from positive or negative (Selection only allowed for some probes)
40	Fid Gain xxx	Superuser Parameter	Amount of gain applied to the fiducial signal
41	Window xxx	Factory Parameter	
42	Conv Fct xxxx	Factory Parameter	Calibration parameter
43	Scl Ofst xxx	Factory Parameter	Calibration parameter
44	Neg Ampl xxx	Superuser Password	Diagnostic parameter
45	Pos Ampl xxx	Superuser Password	Diagnostic parameter
46	Signal xxx	Diagnostic Display	Indication of level signal amplitude
47	Compsate (select)	Superuser Password	Select from None, Manual, Auto
48	DrateFct xxxx	Diagnostic Display	Compsate = Auto. Velocity derating factor for Model 7xS Steam probe
49	Targ Ampl xxxx	Diagnostic Display	Compsate = Auto. Indication of steam reference target amplitude
50	Targ Tks xxxx	Diagnostic Display	Compsate = Auto. Measured time of flight from fiducial to steam reference target
51	Targ Cal xxxx	Diagnostic Display	Compsate = Auto. Calibrated time of flight from fiducial to target in room temperature air
52	OperMode (select)	Superuser Password	Compsate = Auto. Select from Run, Cal, Off
53	7xKCorr xxx	Superuser Password	Distance in mm from fiducial to user reference point (7xK probe characteristic)
54	ElecTemp xxx C	Diagnostic Display	Present temperature in electronics compartment (degrees Celsius)
55	Max Temp xxx C	Superuser Password	Maximum electronics temperature recorded
56	Min Temp xxx C	Superuser Password	Minimum electronics temperature recorded
57	SZ Hyst xx.x lu	Superuser Password	

2.6.5.2 Measurement Type: Level and Volume (Loop Control = Volume)

	Display	Action	Comment
1	*Status* *Volume* *% Out * * Loop *	Transmitter Display	LoopCtrl = Volume Transmitter default display showing: <i>Status, Volume, % Output</i> and <i>Loop</i> values cycles every 5 seconds
2	Volume xxx vu	Transmitter Display	Transmitter displays <i>Volume</i> in selected units
3	% Output xx.x%	Transmitter Display	Transmitter displays <i>% Output</i> measurement derived from 20 mA span
4	Loop xx.xx mA	Transmitter Display	Transmitter displays <i>Loop</i> value (mA)
5	Level xxx.x lu	Transmitter Display	Transmitter displays <i>Level Value</i> in selected units
6	PrbModel (select)	Select the type of probe used (Example: 7xR-x)	Select from 7xA-x, 7xB-x, 7xD-x, 7xE-x, 7xF-x, 7xF-E, 7xF-F, 7xF-4, 7xF-P, 7xG-x, 7xJ-x, 7xK-x, 7xL, 7xM, 7xN, 7xP-x, 7xR-x, 7xS-x, 7xT-x, 7x1-x, 7x2-x, 7x5-x, 7x7-x as shown on the probe nameplate
7	PrbMount (select)	Select the type of probe mounting	Select from NPT, BSP, or Flange
8	MeasType (select)	Select type of measurement	Select from Lvl&Vol
9	LvlUnits (select)	Select level units	Select from cm, inches, feet or meters
10	Probe Ln xxx.x lu	Enter the exact length of probe	Probe length is printed on the nameplate and order information and is the last three digits of the probe model number
11	Lvl Ofst xxx.x lu	Enter desired Level reading when probe is dry	Level Offset is the distance from the probe tip to the desired 0 level point (-90 to 300"). Refer to Section 2.6.6
12	VolUnits (select)	Select the volume units	Select from liters or gallons
13	StrapTbl nn pnts	Enter to access strapping table	20-point strapping table enables conversion from level to volume (Refer to Section 2.6.7 for more information)
14	Dielctrc (select)	Select range bounding the dielectric constant of the media	Select from 1.4–1.7; 1.7–3; 3–10; 10–100
15	Senstvty xxx	Enter value upward or downward to sense liquid surface	Allows fine gain adjustment for single rod probes (this parameter is password protected for coaxial and twin rod probes)
16	LoopCtrl (select)	Select variable to control loop current	Select from Level or Volume
17	Set 4mA xxxx vu	Enter the PV value for the 4 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe. See <i>Functional Specifications Probe, Section 3.6.1</i>
18	Set 20mA xxxx vu	Enter the PV value for the 20 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe
19	Damping xx s	Enter time constant of desired damping	A Damping factor (0–10 seconds) may be added to smooth the output due to turbulence
20	Fault (select)	Select the loop current value in presence of a fault	Select from 3.6 mA, 22 mA or HOLD
21	BlockDis xx.x lu	Enter distance below reference point where level is not sensed	Allows user to ignore level measurements near the top of the probe

2.6.5.2 Measurement Type: Level and Volume (Loop Control = Volume)

	Display	Action	Comment
22	SZ Fault (select)	Select loop current behavior when level is sensed in safety zone	<i>Safety Zone</i> is a user-defined area just below the <i>Blocking Distance</i> . Enable Fault if necessary to ensure safe, reliable high-level readings in critical applications. Choices are None , 3.6 mA , 22 mA , Latch 3.6 or Latch 22 . If Latch 3.6 or Latch 22 is selected, the loop current will remain in alarm until it is manually cleared with the SZ Alarm Reset below (#23)
23	SZHeight xx.x lu	Enter distance below BlockDis where SZ Fault will be asserted	Enter a distance value that develops a safety zone just below the <i>Blocking Distance</i> . Here the unit will report a <i>Safety Zone Fault</i> (#21) if the level rises into this area.
24	SZ Alarm Reset	Press Enter to clear a latched Safety Zone alarm	Clear a latched <i>Safety Zone</i> alarm
25	Threshld (select)	Select the type of threshold	Unit default CFD . Only select Fixed in application with low dielectric material over higher dielectric material and unit is reading incorrect level. Example: Oil over water. (Adjustment of Trim Level may be necessary when threshold is changed)
26	Poll Adr xx	Enter HART polling address number (0-15)	Select a HART poll address (0–15). Enter 0 for a single transmitter installation
27	Trim Lvl xx.x lu	Enter value to adjust Level reading	-10.0 inches <= Lvl Trim <= +10.0 inches (Requires superuser password)
28	Trim 4 xxxx	Fine tune the 4 mA point	Adjust setting to output exactly 4.0 mA on current meter
29	Trim 20 xxxx	Fine tune the 20 mA point	Adjust setting to output exactly 20.0 mA on current meter
30	Loop Tst xx.x mA	Enter a mA Output value	Set mA output to any given value to perform loop test
31	LvlTicks xxxx	Diagnostic Display	Time of flight from fiducial to level signal
32	New Pass xxx	Enter new password (0-255)	Displays encrypted value of present password
33	Language (select)	Select from English, Spanish, French, German	Language choice for LCD display
34	Mdl705HT Ver3.0a0	Transmitter display	Product identification Firmware version
35	DispFact (select)	Select Yes to display factory parameter menus	Allows for viewing the factory parameters
36	History (current status)	Press Enter to view history of recent exceptions	Diagnostic Display
37	HF cable (select)	Superuser Parameter	Select from 3-foot or 12-foot remote
38	Run Time		
39	History Reset	Press Enter and select yes to clear history	Similar to SZ Alarm Reset
40	FidTicks xxxx	Diagnostic Display	Time of flight from start of ramp to fiducial
41	Fid Type (select)	Superuser Password	Select from positive or negative (Selection only allowed for some probes)
42	Fid Spread		

2.6.5.2 Measurement Type: Level and Volume (Loop Control = Volume)

	Display	Action	Comment
43	Fid Gain xxx	Superuser Password	
44	Window xxx	Factory Parameter	
45	Conv Fct xxxx	Factory Parameter	Calibration parameter
46	Scl Ofst xxx	Factory Parameter	Calibration parameter
47	Neg Ampl xxx	Superuser Password	Diagnostic factory setting
48	Pos Ampl xxx	Superuser Password	Diagnostic factory setting
49	Signal xxx	Diagnostic Display	Indication of level signal amplitude
50	Compsate (select)	Superuser Parameter	Select from None, Manual, Auto
51	7xKCorr xxx	Superuser Parameter	Distance in mm from fiducial to user reference point (7xK probe characteristic)
52	ElecTemp xxx C	Diagnostic Display	Present temperature in electronics compartment (degrees Celsius)
53	Max Temp xxx C	Diagnostic Display	Maximum electronics temperature recorded
54	Min Temp xxx C	Diagnostic Display	Minimum electronics temperature recorded
55	SZ Hyst xx.x lu	Diagnostic Display	Diagnostic factory setting

2.6.5.3 Measurement Type: Interface Level (Loop Control = Interface Level)

	Display	Action	Comment
1	*Status* *IfcLvl* *% Out * * Loop *	Transmitter Display	LoopCtrl = IfcLevel Transmitter default display showing <i>Status</i> , <i>IfcLevel</i> , <i>% Output</i> , and <i>Loop</i> values cycles every 5 seconds
2	IfcLvl xxxx vu	Transmitter Display	Transmitter displays interface level in selected units
3	% Output xx.x%	Transmitter Display	Transmitter displays <i>% Output</i> measurement derived from 20 mA span
4	Loop xx.xx mA	Transmitter Display	Transmitter displays <i>Loop</i> value (mA)
5	Level		
6	PrbModel (select)	Select the type of probe used (Example: 7xT-x)	Select from 7xB-x , 7xD-x , 7xF-x , 7xG , 7xL , 7xM , 7xN , 7xT-x , 7x7-x as shown on the probe nameplate
7	PrbMount (select)	Select the type of probe mounting	Select from NPT , BSP , or Flange
8	MeasType (select)	Select type of measurement	Select from Intrface
9	LvlUnits (select)	Select level units	Select from cm , inches , feet or meters
10	Probe Ln xxx.x	Enter the exact length of probe	Probe length is printed on the nameplate and order information and is the last three digits of the probe model number
11	Lvl Ofst x.xx	Enter the desired reading when probe is dry	Level Offset is the distance from the probe tip to the desired 0% level point (-90 to 300"). Refer to Section 2.6.6
12	Upr Diel (select)	Enter the dielectric constant of the upper liquid	Interface mode or Manual compensation mode
13	Dielctrc (select)	Select range bounding the dielectric constant of the lower liquid	Select 10–100
14	Senstvtv xxx	Enter value upward or downward to sense liquid surface	Allows fine gain adjustment for single rod probes (this parameter is password protected for coaxial and twin rod probes)
15	LoopCtrl (select)	Select variable to control loop current	Select from Level or IfcLvl
16	Set 4mA xxx.x lu	Enter the PV value for the 4 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe. See <i>Functional Specifications Probe</i> , Section 3.6.1
17	Set 20mA xxx.x lu	Enter the PV value for the 20 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe
18	Damping xx s	Enter time constant of desired damping	A Damping factor (0–10 seconds) may be added to smooth the output due to turbulence
19	Fault (select)	Select the loop current value in presence of a fault	Select from 3.6 mA , 22 mA or HOLD
20	BlockDis xx.x lu	Enter distance below reference point where level is not sensed	Allows user to ignore level measurements near the top of probe

2.6.5.3 Measurement Type: Interface Level (Loop Control = Interface Level)

	Display	Action	Comment
21	SZ Fault (select)	Select loop current behavior when level is sensed in safety zone	<i>Safety Zone</i> is a user-defined area just below the <i>Blocking Distance</i> . Enable Fault if necessary to ensure safe, reliable high-level readings in critical applications. Choices are None , 3.6 mA , 22 mA , Latch 3.6 or Latch 22 . If Latch 3.6 or Latch 22 is selected, the loop current will remain in alarm until it is manually cleared with the SZ Alarm Reset below (#23)
22	SZ Height xx.x lu	Enter distance below BlockDis where SZ Fault will be asserted	Enter a distance value that develops a safety zone just below the <i>Blocking Distance</i> . Here the unit will report a <i>Safety Zone Fault</i> (#21) if the level rises into this area.
23	SZ Alarm Reset	Press Enter to clear a latched Safety Zone alarm	Clear a latched <i>Safety Zone</i> alarm
24	Threshld (select)	Select from CFD, Fixed	For interface, refers to threshold for upper level pulse. (Set to Fixed for most common applications.)
25	IfcThrsh (select)	Select from CFD, Fixed	Interface mode only. Threshold for interface level pulse. (Set to CFD for most common applications.)
26	Poll Adr xx	Enter HART polling address number (0-15)	
27	Trim Lvl xx.x lu	Enter value to adjust Level reading	-10.0 inches <= Lvl Trim <= +10.0 inches (Requires superuser password)
28	Trim 4 xxxx	Fine tune the 4 mA point	Adjust setting to output exactly 4.0 mA on current meter
29	Trim 20 xxxx	Fine tune the 20 mA point	Adjust setting to output exactly 20.0 mA on current meter
30	Loop Tst xx.x mA	Enter a mA Output value	Set mA output to any given value to perform loop test
31	LvlTicks xxxx	Diagnostic Display	Time of flight from fiducial to interface signal
32	IfcTicks xxxx	Diagnostic Display	Interface mode only. Time of flight through upper liquid
33	Medium	Diagnostic Display	Interface mode only. Displayed messages are: Unknown, Oil Only, Thin Oil, Thick Oil, Dry Probe
34	New Pass xxx	Enter new password (0-255)	Displays encrypted value of present password
35	Language (select)	Select from English, Spanish, French, German	Language choice for LCD display. (no HART counterpart)
36	Mdl1705HT Ver3.0a0	Transmitter display	Product identification. Firmware version
37	DispFact (select)	Select Yes to display factory parameter menus	Access for viewing the factory parameter
38	History (current status)	Press Enter to view history of recent exceptions	Diagnostic Display
39	Run Time		
40	History Reset	Press Enter and select yes to clear history	Similar to SZ Alarm Reset
41	HF cable (select)	Superuser Parameter	Select from 3-foot or 12-foot remote
42	FidTicks xxxx	Diagnostic Display	Time of flight from start of ramp to fiducial

2.6.5.3 Measurement Type: Interface Level (Loop Control = Interface Level)

	Display	Action	Comment
43	Fid Sprd xxx	Diagnostic Display	Spread in fiducial ticks readings
44	Fid Type (select)	Superuser Parameter	Select from positive or negative (Selection only allowed for some probes)
45	Fid Gain xxx	Superuser Parameter	Amount of gain applied to fiducial signal
46	Window xxx	Factory Parameter	
47	Conv Fct xxxx	Factory Parameter	Calibration parameter
48	Scl Ofst xxx	Factory Parameter	Calibration parameter
49	Neg Ampl xxx	Superuser Password	
50	Ifc Ampl	Superuser Password	
51	Pos Ampl xxx	Superuser Password	
52	Signal xxx	Diagnostic Display	Indication of level signal amplitude
53	Compsate	Superuser Parameter	Select from None, Manual, Auto
54	7xKCorr xxx	Superuser Parameter	Distance in mm from fiducial to user reference point (7xK probe characteristic)
55	ElecTemp xxx C	Diagnostic Display	Present temperature in electronics compartment (degrees Celsius)
56	Max Temp xxx C	Superuser Password	Maximum electronics temperature recorded
57	Min Temp xxx C	Superuser Password	Minimum electronics temperature recorded
58	SZ Hyst xx.x lu	Superuser Parameter	Safety Zone hysteresis height

2.6.5.4 Measurement Type: Interface and Volume

	Display	Action	Comment
1	*Status* *IfcLvl* *% Out * * Loop *	Transmitter Display	LoopCtrl = IfcLevel and Volume Transmitter default display showing <i>Status</i> , <i>Interface Level</i> , <i>Volume</i> , <i>% Output</i> , and <i>Loop</i> values cycles every 5 seconds
2	IfcLevel xxx.x lu	Transmitter Display	LoopCtrl = IfcLevel
3	Ifc Vol xxxx vu	Transmitter Display	LoopCtrl = Ifc Vol
4	% Output xx.x%	Transmitter Display	Transmitter displays <i>% Output</i> measurement derived from 20 mA span
5	Loop xx.xx mA	Transmitter Display	Transmitter displays <i>Loop</i> value (mA)
6	Level		
7	Volume		
8	PrbModel (select)	Select the type of probe used (Example: 7xT-x)	Select from 7xB-x , 7xD-x , 7xF-x , 7xG , 7xL , 7xM , 7xN , 7xT-x , 7x7-x as shown on the probe nameplate
9	PrbMount (select)	Select the type of probe mounting	Select from NPT , BSP , or Flange
10	MeasType (select)	Select type of measurement	Select from Ifc&Vol
11	LvlUnits (select)	Select level units	Select from cm , inches , feet or meters
12	Probe Ln xxx.x lu	Enter the exact length of probe	Probe length is printed on the nameplate and order information and is the last three digits of the probe model number
13	Lvl Ofst xxx.x lu	Enter the desired reading when probe is dry	Offset is the distance from the probe tip to the desired 0 level point (-90 to 300"). Refer to Section 2.6.6
14	VolUnits (select)	Select the volume units	Select from liters or gallons Measure type = Lvl&Vol or Ifc&Vol
15	StrapTbl nn pnts	Enter to access strapping table	Measure type = Lvl&Vol or Ifc&Vol
16	Upr Diel (select)	Enter the dielectric constant of the upper liquid	Interface mode
17	Dielctrc (select)	Select range bounding the dielectric constant of the lower liquid	Select 10–100
18	Senstvtly xxx	Enter value upward or downward to sense liquid surface	Allows fine gain adjustment for single rod probes (this parameter is password protected for coaxial and twin rod probes)
19	LoopCtrl (select)	Select variable to control loop current	Select from Level, Volume, IfcLvl or IfcVol
20	Set 4mA xxx.x lu	Enter the PV value for the 4 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe. See <i>Functional Specifications Probe</i> , Section 3.6.1
21	Set 20mA xxx.x lu	Enter the PV value for the 20 mA point	A small transition zone (0–6") may exist at the top/bottom of the probe
22	Damping xx s	Enter time constant of desired damping	A Damping factor (0–10 seconds) may be added to smooth the output due to turbulence
23	Fault (select)	Select the loop current value in presence of a fault	Select from 3.6 mA , 22 mA or HOLD

2.6.5.4 Measurement Type: Interface and Volume

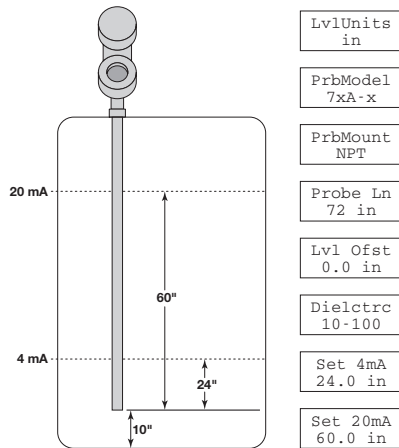
	Display	Action	Comment
24	BlockDis xx.x lu	Enter distance below reference point where level is not sensed	Allows user to ignore level measurements near the top of the probe
25	SZ Fault (select)	Select lop current behavior when level is sensed in safety zone	<i>Safety Zone</i> is a user-defined area just below the <i>Blocking Distance</i> . Enable Fault if necessary to ensure safe, reliable high-level readings in critical applications. Choices are None , 3.6 mA , 22 mA , Latch 3.6 or Latch 22 . If Latch 3.6 or Latch 22 is selected, the loop current will remain in alarm until it is manually cleared with the SZ Alarm Reset below (#27)
26	SZ Height xx.x lu	Enter distance below BlockDis where SZ Fault will be asserted	Enter a distance value that develops a safety zone just below the <i>Blocking Distance</i> . Here the unit will report a <i>Safety Zone Fault</i> (#25) if the level rises into this area.
27	SZ Alarm Reset	Press Enter to clear a latched Safety Zone alarm	Clear a latched <i>Safety Zone</i> alarm
28	Threshld (select)	Select from CFD, Fixed	For interface, refers to threshold for upper level pulse. (Set to Fixed for most common applications.)
29	IfcThrsh (select)	Select from CFD, Fixed	Interface mode only. Threshold for interface level pulse. (Set to CFD for most common applications.)
30	Poll Adr xx	Enter HART polling address number (0-15)	
31	Trim Lvl xx.x lu	Enter value to adjust Level reading	-10.0 inches <= Lvl Trim <= +10.0 inches (Requires superuser password)
32	Trim 4 xxxx	Fine tune the 4 mA point	Adjust setting to output exactly 4.0 mA on current meter
33	Trim 20 xxxx	Fine tune the 20 mA point	Adjust setting to output exactly 20.0 mA on current meter
34	Loop Tst xx.x mA	Enter a mA Output value	Set mA output to any given value to perform loop test
35	LvlTicks Xxxxx	Diagnostic Display	Time of flight from fiducial to interface signal
36	IfcTicks Xxxxx	Diagnostic Display	Interface mode only Time of flight through upper liquid
37	Medium	Diagnostic Display	Interface mode only Displayed messages are: Unknown, Oil Only, Thin Oil, Thick Oil
38	New Pass Xxx	Enter new password (0-255)	Displays encrypted value of present password
39	Language (select)	Select from English, Spanish, French, German	Language choice for LCD display. (no HART counterpart)
40	Md1705HT Ver3.0a0	Transmitter display	Product identification. Firmware version
41	DispFact (select)	Select Yes to display factory parameter menus	Allows for viewing the factory parameters
42	History (current status)	Press Enter to view history of recent exceptions	Diagnostic Display
43	HF cable (select)	Superuser Parameter	Select from 3-foot or 12-foot remote
44	Run Time		

2.6.5.4 Measurement Type: Interface and Volume

	Display	Action	Comment
45	Hist Rst	Press Enter and select yes to clear history	Similar to SZ Alarm Reset
46	FidTicks xxxx	Diagnostic Display	Time of flight from start of ramp to fiducial
47	Fid Sprd		
48	Fid Type (select)	Superuser Parameter	Select from positive or negative (Selection only allowed for some probes, fixed for others)
49	Fid Gain xxx	Superuser Parameter	
50	Window xxx	Factory Parameter	
51	Conv Fct xxxx	Factory Parameter	Calibration parameter
52	Scl Ofst xxx	Factory Parameter	Calibration parameter
53	Neg Ampl xxx	Superuser Parameter	
54	Ifc Ampl	Superuser Parameter	
55	Pos Ampl xxx	Superuser Parameter	
56	Signal xxx	Diagnostic Display	Indication of level signal amplitude
57	Compsate (select0	Superuser Parameter	Select from None, Manual, Auto
58	7xKCorr xxx	Superuser Parameter	Distance in mm from fiducial to user reference point (7xK probe characteristic)
59	ElecTemp xxx C	Diagnostic Display	Present temperature in electronics compartment (degrees Celsius)
60	Max Temp xxx C	Superuser Password	Maximum electronics temperature recorded
61	Min Temp xxx C	Superuser Password	Minimum electronics temperature recorded
62	SZ Hyst xx.x lu	Superuser Password	Diagnostic factory setting

2.6.6 Offset Description

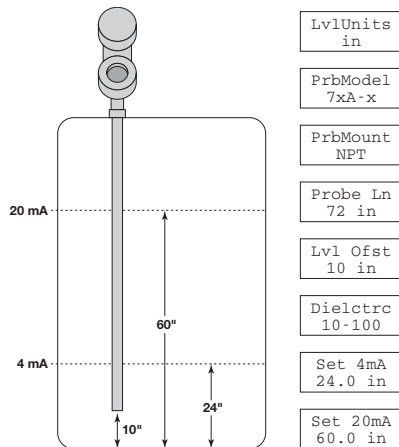
The parameter referred to as Lvl Ofst in the Eclipse menu is the desired level reading when liquid surface is at the end of the probe. The Eclipse transmitter is shipped from the factory with Lvl Ofst set to 0. With this configuration, all measurements are referenced from the bottom of the probe. See Example 1.



Example 1

Example 1 (Lvl Ofst = 0 as shipped from factory): Application calls for a 72-inch NPT Coaxial probe in water with the bottom of the probe 10 inches above the bottom of the tank. The user wants the 4 mA point at 24 inches and the 20 mA point at 60 inches as referenced from the bottom of the probe.

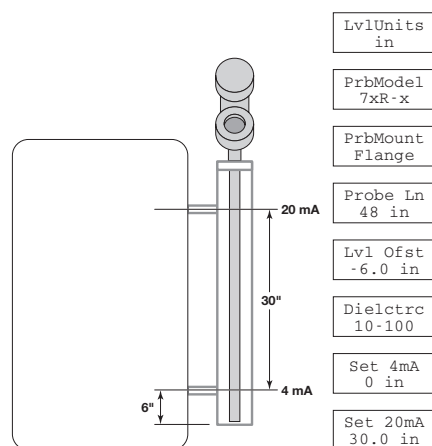
In those applications in which it is desired to reference all measurements from the bottom of the vessel, the value of Lvl Ofst should be changed to the distance between the bottom of the probe and the bottom of the vessel as shown in Example 2.



Example 2

Example 2: Application calls for a 72-inch NPT coaxial probe in water with the bottom of the probe 10 inches above the bottom of the tank. The user wants the 4 mA point at 24 inches and the 20 mA point 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 (0%) point at the lower process connection and the 20 mA (100%) point at the upper process connection. The span is the center-to-center dimension. In this case, a negative Lvl Ofst 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 cage-coaxial flanged probe measuring water in a chamber with the bottom of the probe 6 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.

2.6.7 Strapping Table Description

The Model 705 is available with a 20-point custom strapping table. Up to 20 pairs of Level—Volume points can be entered to linearize the 4-20 mA output for odd-shaped vessels.

There are two ways to enter data into the strapping table.

Procedure 1 (this method is the most common):

1. Ensure that “Level and Volume” is selected as the Measurement Type (parameter 8 in table 2.6.5.2).
2. Ensure that the correct Level Units and Volume Units are chosen. (Parameters 9 and 12 in table 2.6.5.2).
3. Scroll down to the StrapTbl (parameter 13 in table 2.6.5.2), press enter. Pt01Lvl is displayed.
4. Press Enter, then enter the desired level for Point 1 in the strapping table and press enter.
5. Enter corresponding volume for Point 1 in the strapping table (shown as Pt01Vol on the LCD) and then press enter.
6. Repeat steps 4 and 5 for remaining points.

- NOTES:
1. All twenty strapping table points do not have to be used (unused points should be left at “0”).
 2. Strapping table point values can be entered or changed in any order.
 3. All strapping table points must be monotonic and sequential. In other words, each point must be larger than the one before. If a non-monotonic entry is made, the strapping length will stop at that entry.

Procedure 2:

The Eclipse Model 705 transmitter also allows the level points to be entered automatically.

As above, a twenty-point table is available. However, with this procedure, the user can allow the Model 705 to use the present level as the strapping table entry.

1. Scroll down to the Strapping Table parameter and press enter, Pt01Lvl is displayed.
2. Press and hold the ENTER button, then press the UP arrow at the same time. (The present level reading is now captured and entered into the strapping table.) Press enter and the display shows Pt01Vol.
3. Enter the corresponding volume and press enter.
4. Add a known liquid volume to the vessel.
5. For the remaining points, add a known liquid volume to vessel and repeat steps 2 to 3.

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 transmitter. When connected to the control loop, the same system measurement readings shown on the transmitter are 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 software (Device Descriptions). Contact your local HART Service Center for additional information.

2.7.1 Connections

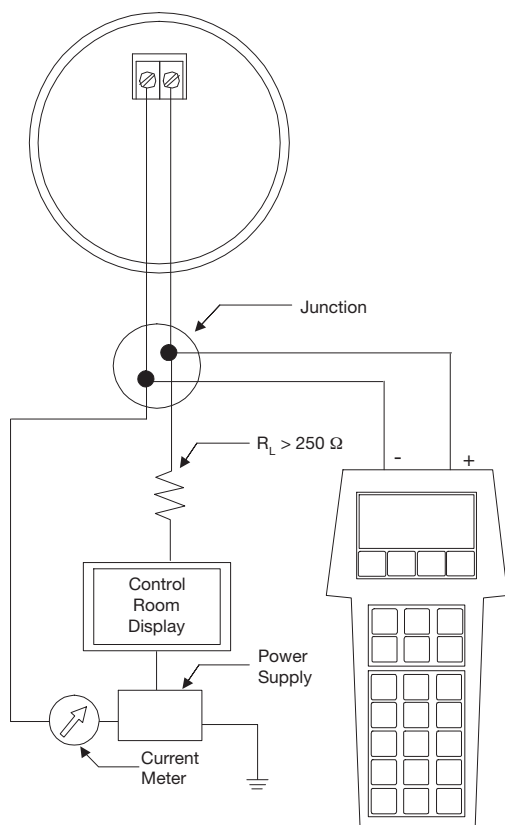
A HART communicator can be operated from a remote location by connecting it to a remote junction or by connecting it directly to the terminal block in the electronics housing of the Eclipse transmitter.

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.

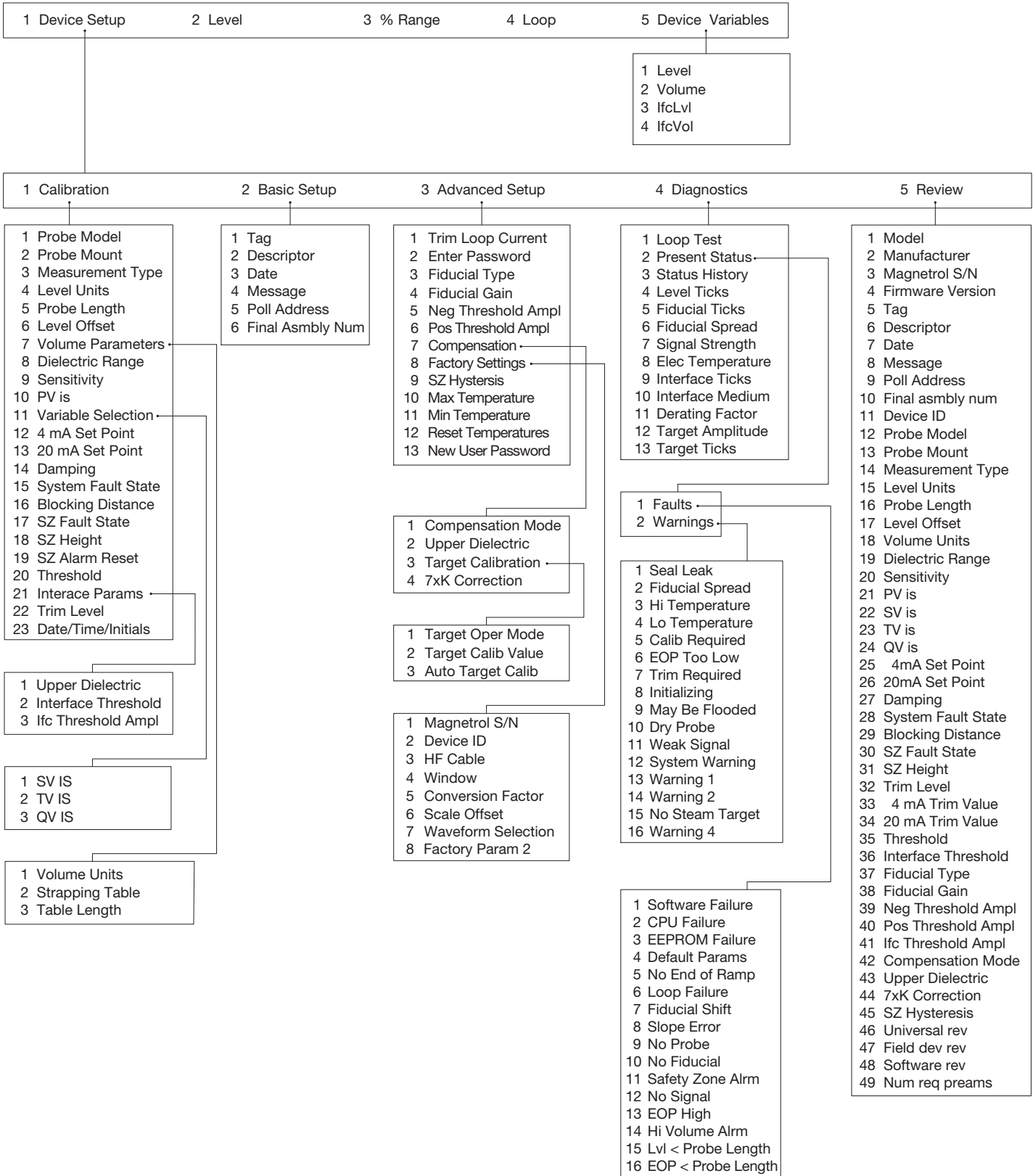
2.7.2 Display Menu

A typical communicator display is an 8-line by 21-character LCD. When connected, the top line of each menu displays the model (Model 705 3.x) and its tag number or address. Usually the bottom line of each menu is reserved for software-defined function keys (F1–F4). For detailed operating information, refer to the instruction manual provided with the HART communicator.

The Eclipse transmitter online menu trees are shown in the following illustration. Open the menu by pressing the alphanumeric key 1, Device Setup, to display the second-level menu.



2.7.3 HART Menu – Model 705 3.x



2.7.4 HART Revision Table

Model 705

HART Version	HCF Release Date	Compatible with 705 Software
Dev V1 DD V1	July 1998	Version 1.2B and earlier
Dev V1 DD V2	November 1998	Version 1.2C through 1.3D
Dev V3 DD V1	April 1999	Version 1.4A through 1.4C
Dev V4 DD V1	October 1999	Version 1.5 and later

Model 705 2.x

HART Version	HCF Release Date	Compatible with 705 Software
Dev V1 DD V1	June 2000	Version 2.0A through 2.2C
Dev V2 DD V1	September 2001	Version 2.3A through 2.3E
Dev V3 DD V1	September 2003	Version 2.4A through 2.4B
Dev V4 DD V1	April 2004	Version 2.5A and later

Model 705 3.x

HART Version	HCF Release Date	Compatible with 705 Software
Dev V1 DD V2	September 2008	Version 3.0A and later

2.8 FOUNDATION fieldbus™ Digital Communications

2.8.1 Description

FOUNDATION fieldbus is a digital communications system that serially interconnects devices in the field. A Fieldbus system is similar to a Distributed Control System (DCS) with two exceptions:

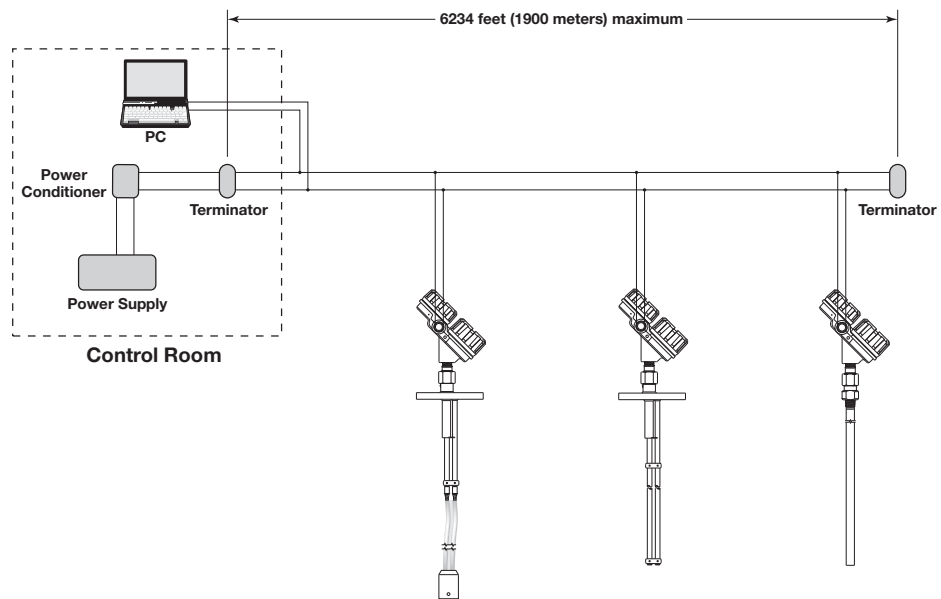
- Although a Fieldbus system can use the same physical wiring as an existing 4–20 mA device, Fieldbus devices are not connected point-to-point, but rather are multidropped on a single pair of wires (referred to as a segment).
- Fieldbus is a system that allows the user to distribute control across a network. Fieldbus devices are smart and actually maintain control over the system.

Unlike 4–20 mA analog installations in which the two wires carry a single variable (the varying 4–20 mA current), a digital communications scheme such as Fieldbus considers the two wires as a network. The network can carry many process variables as well as other information. The Eclipse Model 705FF transmitter is a FOUNDATION fieldbus registered device that communicates with the H1 Foundation Fieldbus protocol operating at 31.25 kbits/sec. The H1 physical layer is an approved IEC 61158 standard. The figure on page 38 shows a typical Fieldbus installation.

An IEC61158 shielded twisted pair wire segment can be as long as 6234 feet (1900 meters) without a repeater. Up to 4 repeaters per segment can be used to extend the distance. The maximum number of devices allowed on a Fieldbus segment is 32 although this depends on the current draw of the devices on any given segment.



Details regarding cable specifications, grounding, termination, and other network information can be found in IEC 61158 or at www.fieldbus.org.



Typical Fieldbus Installation

2.8.2 Benefits

The benefits of Fieldbus can be found throughout all phases of an installation:

1. **Design/Installation:** Connecting multiple devices to a single pair of wires means less wire and fewer I/O equipment. Initial Engineering costs are also reduced because the Fieldbus Foundation™ requires interoperability, defined as “the ability to operate multiple devices in the same system, regardless of manufacturer, without a loss of functionality.” All FOUNDATION fieldbus devices must be tested for interoperability by the Fieldbus Foundation. Magnetrol Model 705FF device registration information can be found at www.fieldbus.org.
2. **Operation:** With control now taking place within the devices in the field, better loop performance and control are the result. A Fieldbus system allows for multiple variables to be brought back from each device to the control room for additional trending and reporting.
3. **Maintenance:** The self-diagnostics residing in the smart field devices minimizes the need to send maintenance personnel to the field.

2.8.3 Device Configuration

Device Descriptions

The function of a Fieldbus device is determined by the arrangement of a system of blocks defined by the Fieldbus Foundation. The types of blocks used in a typical User Application are described as follows:

Resource Block describes the characteristics of the Fieldbus device such as the device name, manufacturer, and serial number.

Transducer Blocks contain information such as calibration date and sensor type. They are used to connect the sensor to the input function blocks.

Function Blocks are built into the Fieldbus devices as needed to provide the desired control system behavior. The input and output parameters of function blocks can be linked over the Fieldbus. There can be numerous function blocks in a single User Application.

An important requirement of Fieldbus devices is the interoperability concept mentioned above. Device Description (DD) technology is used to achieve this interoperability. The DD provides extended descriptions for each object and provides pertinent information needed by the host system.

DDs are similar to the drivers that your personal computer (PC) uses to operate peripheral devices connected to it. Any Fieldbus host system can operate with a device if it has the proper DDs for that device.

The most recent DD and Common File Format (CFF) files can be found on the Magnetrol web site at magnetrol.com or fieldbus.org.

2.8.4 Intrinsically Safe

H1 supports Intrinsic Safety (IS) applications with bus powered devices. To accomplish this, an IS barrier is placed between the power supply in the safe area and the device in the hazardous area.

H1 also supports the Fieldbus Intrinsically Safe Concept (FISCO) model which allows more field devices in a network. The FISCO model considers the capacitance and inductance of the wiring to be distributed along its entire length. The stored energy during a fault will be less and more devices are permitted on a pair of wires. Instead of the conservative entity model, which only allows about 90 mA of current, the FISCO model allows a maximum of 110 mA for Class II C installations and 240 mA for Class II B installations.

FISCO certifying agencies have limited the maximum segment length to 1000 meters because the FISCO model does not rely on standardized ignition curves.

The Eclipse Model 705 is available with an entity IS, FISCO IS, and explosion proof approvals.

3.0 Reference Information

This section presents an overview of the operation of the Eclipse 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 Description

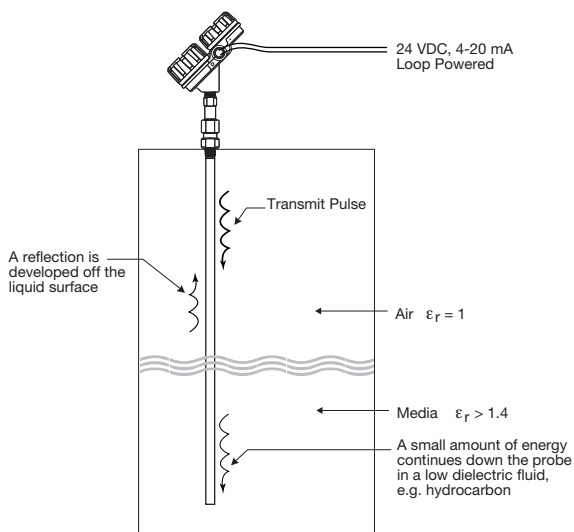
Eclipse is a loop-powered two-wire, 24 VDC, level transmitter based on the concept of Guided Wave Radar. Guided Wave Radar, or Micropower Impulse Radar (MIR), is a revolutionary, new level measurement technology.

The Eclipse 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 an explosion proof and watertight feed-through.

3.2 Theory of Operation

3.2.1 Micropower Impulse Radar

MIR (Micropower Impulse Radar) combines TDR (time domain reflectometry), ETS (equivalent time sampling) and modern low power circuitry. This synthesis of technologies brings to the level market a high-speed radar circuit (speed of light transmission) at a small fraction of the cost of conventional radar. The electromagnetic pulses are propagated via a waveguide that yields a system many times more efficient than through-air radar.



3.2.2 Interface Detection

The Eclipse Model 705, when used with the Model 7xT coaxial probe, 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 5 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.*

Eclipse Guided Wave Radar is based upon the technology of TDR (Time Domain Reflectometry). TDR utilizes pulses of electromagnetic energy transmitted down a wave guide (probe). When a 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 the pulse is reflected from the upper surface, some of the 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 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.

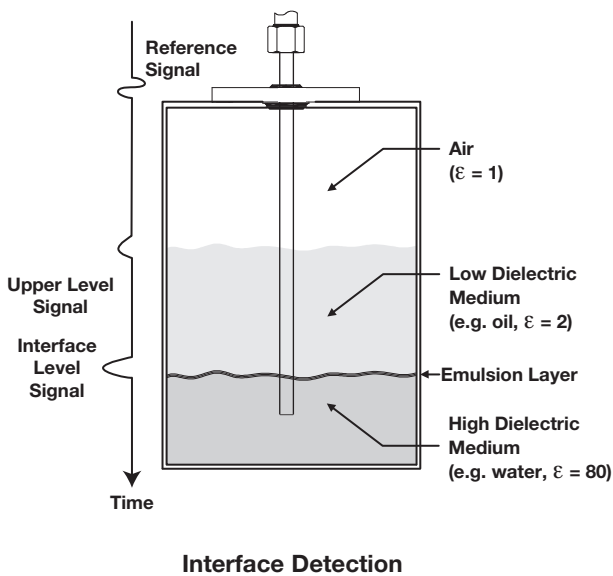
Knowing the time between the first and second reflections, along with knowing the upper layer dielectric constant, the thickness of the upper layer can be determined.

In order to properly process the reflected signals, the Model 705 is specified for those applications where the thickness of the upper layer is greater than 2 inches. The maximum upper layer is limited to the length of the Model 7xT probe, which is available in lengths up to 20 feet.

The Model 7x7 twin rod flexible probe allows interface operation up to 40 feet.

Emulsion Layers

As emulsion (rag) layers can decrease the strength of the reflected signal, the Eclipse Model 705 should only be utilized in applications that have clean, distinct layers. Contact the factory for application assistance.



3.2.3 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 media surface), part of the energy is reflected. The greater the dielectric difference, the greater the amplitude (strength) of the reflection.

Although TDR is new to the industrial level measurement industry, it has been used in the telephone, computer, and power transmission industries for years. In these industries, it is used to successfully find wire or cable breaks and shorts. An EM pulse is sent through the wire, traveling unimpeded until it finds a line break or short. A reflection is then returned from the break 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 increase in the dielectric. When an EM pulse is sent down the probe and meets the dielectric discontinuity, a reflection is generated.

3.2.4 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/ μ 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 8 scans are taken per second; each scan gathers more than 30,000 samples.

3.3 Troubleshooting

The Eclipse transmitter is designed and engineered for trouble-free operation over a wide range of operating conditions. Common transmitter problems are discussed in terms of their symptoms and recommended corrective actions. Information on how to handle material buildup on the probe is also provided in this section.

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

3.3.1 Troubleshooting System Problems — Model 705

Symptom	Problem	Solution
LEVEL, % OUTPUT and LOOP values are all inaccurate.	Basic configuration data is questionable.	Reconfigure the Probe Model and/or Probe Mount, Probe Length or Level Offset. 1) Ensure the Level is accurate. 2) Verify 4 mA and 20 mA Loop values.
	Interface level has significant emulsion.	Examine process to reduce/eliminate emulsion layer.
LEVEL readings are repeatable but consistently high or low from actual by a fixed amount.	Configuration data does not accurately match probe length or tank height.	Ensure proper Probe Model and probe length. Adjust trim level value by the amount of noted inaccuracy.
LEVEL, % OUTPUT and LOOP values fluctuate.	Turbulence	Increase the Damping factor until the readings stabilize.
	High Frequency connection	Check Fid Spread (should be stable within ± 10 counts).
LEVEL, % OUTPUT and LOOP values all reading low vs. actual.	Lower dielectric material over higher dielectric material, e.g., oil over water	Select Fixed Threshold option.
	Coating, clumping or buildup on probe	These may be expected inaccuracies due to affect on pulse propagation.
	Dense, water based foam	These may be expected inaccuracies due to affect on pulse propagation.
LEVEL reading on Display is correct but LOOP is stuck on 4 mA.	Basic configuration data is questionable.	Set POLL ADR to 0 if not using HART multi-drop.
HART device only: handheld will only read Universal Commands.	Most current Device Descriptors (DDs) are not installed in handheld.	Contact local HART service center for the latest DDs.
Level Reading on Display is stuck at full scale, loop is stuck at 20.5 mA.	Software believes probe is flooded (level near very top of probe).	Check actual level. If probe is not flooded, Check for buildup or obstructions near top of probe. Select higher dielectric range. Check for condensation in probe connection. Add Blocking Distance.
LEVEL, % OUTPUT and LOOP values all at maximum level.	Possible configuration issue with single rod probe	1) Increase Blocking Distance 2) Increase Dielectric Range
LEVEL, % OUTPUT and LOOP values all reading high vs. actual.	Possible obstruction in tank affecting single rod probe	1) Increase Dielectric Range until obstruction is ignored 2) Relocate probe away from obstruction
LEVEL value reading high when should be zero.	Transmitter loose or disconnected from probe	Ensure transmitter connected securely to probe.

NOTE: When consulting the factory concerning improper operation, use proper tables on Pages 66-67. Enter all data when transmitter is working CORRECTLY or INCORRECTLY.

3.3.2 Status Messages

Display Message	Action	Comment
OK	None	Normal operating mode
Initial	None	Program is Initializing, level reading held at 4 mA set point. This is a transient condition.
DryProbe	None	Normal message for a dry probe. End of probe signal is being detected.
EOP < Probe Length	End of Probe signal from a dry probe is out of range	<ol style="list-style-type: none"> 1) Ensure probe length is entered correctly 2) Set transmitter to a lower dielectric range 3) Consult factory 4) Ensure proper blocking distance
EOP High	End of Probe signal is out of range	<ol style="list-style-type: none"> 1) Ensure probe length is entered correctly 2) Consult factory (old twin rod probe being used with enhanced 705)
WeakSgnl	None. Signal amplitude is lower than desired.	<ol style="list-style-type: none"> 1) Set transmitter to lower dielectric range 2) Increase sensitivity
Flooded?	Loss of level signal possibly due to flooding, twin rod probes only	<ol style="list-style-type: none"> 1) Decrease level in vessel 2) Set transmitter to lower dielectric range 3) Replace with Model 7xR Overfill probe
NoSignal	No level signal being detected	<ol style="list-style-type: none"> 1) Ensure dielectric setting is correct for measured medium 2) Increase sensitivity 3) Confirm that the probe type is proper for the dielectric of the medium 4) Consult factory
No Fid	Fiducial signal is not being detected	<ol style="list-style-type: none"> 1) Check connection between probe and transmitter 2) Check for moisture on top of probe 3) Check for damaged gold pin on the high frequency connector 4) Consult factory
FidShift	FidTicks shifted from expected value	<ol style="list-style-type: none"> 1) Check connection between probe and transmitter 2) Check for moisture on top of probe 3) Check for damaged gold pin on the high frequency connector 4) Consult factory
Fid Sprd*	Fiducial Ticks variation is excessive	<ol style="list-style-type: none"> 1) Check connection between probe and transmitter 2) Check for moisture on top of probe 3) Consult factory
SZ Alarm	Safety Zone alarm has been tripped, loop current fixed at SZ Fault	Decrease level in vessel
Hi Temp	Present temperature in electronics compartment is above +80° C	<ol style="list-style-type: none"> 1) Transmitter may need to be moved to ensure ambient temperature is within specification 2) Change to remote mount transmitter

3.3.2 Status Messages

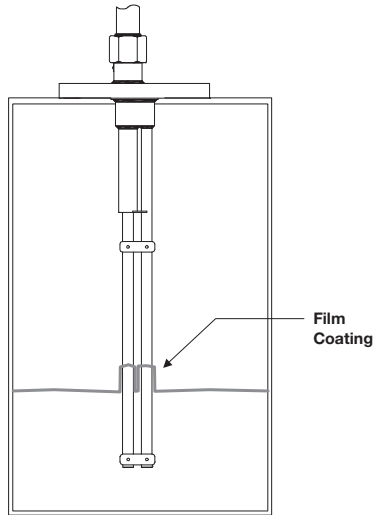
Display Message	Action	Comment
Lo Temp	Present temperature in electronics compartment is below -40° C	1) Transmitter may need to be moved to ensure ambient temperature is within specification 2) Change to remote mount transmitter
HiVolAlm	Level more than 5% above highest point in strapping table	Verify strapping table is entered correctly. None. Signal amplitude is lower than desired.
Sys Warn	Unexpected but non-fatal software event	Consult factory
TrimReqd	Factory set Loop values are defaults, loop output may be inaccurate	Consult factory
Cal Reqd	Factory set default calibration parameters are in use, level reading may be inaccurate	Consult factory
SlopeErr	Ramp circuit generating improper voltage	Consult factory
LoopFail	Loop current differs from expected value	Consult factory
No Ramp	No End-of-Ramp signal detected	Consult factory
DfltParm	Internal non-volatile parameters have been defaulted	Consult factory
LVL < Probe Length	Apparent position of the upper level pulse is beyond the end of probe.	1) Check entered probe length 2) Change threshold to fixed
EE Fail	EEPROM error allowing watchdog timer to expire	Consult factory
CPU Fail	A-D converter time out allowing watchdog timer to expire	Consult factory
SfwrFail	A fatal software error allowing watchdog timer to expire	Consult factory

PACTware™ PC Program

The Eclipse Model 705 offers the ability to do Trending and Echo Curve analysis using a PACTware DTM. This is a powerful troubleshooting tool that can aid in the resolution of some of the Error Messages shown above. Refer to Bulletins 59-101 and 59-601 for more information.

3.3.3 Troubleshooting Applications

There are numerous causes for application problems. Media buildup on the probe and stratification are covered here. Media buildup on the probe is not a problem in most cases—Eclipse circuitry typically works very effectively. Media buildup should be viewed as two types—Film Coating and Bridging. A twin rod probe can be utilized when minor film coating is a possibility. For more extreme buildup, utilize the Model 7xF or 7x1 Single Rod Probes.



3.3.3.1 Model 705 (Level Application)

- **Continuous Film Coating**

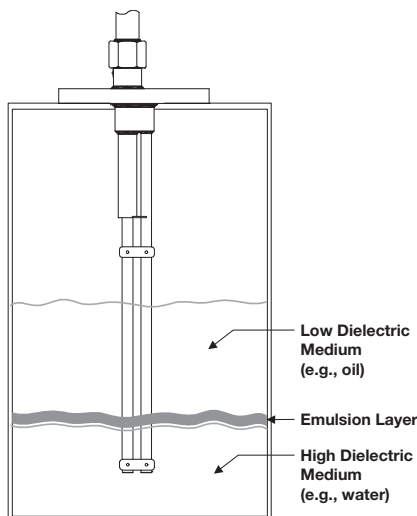
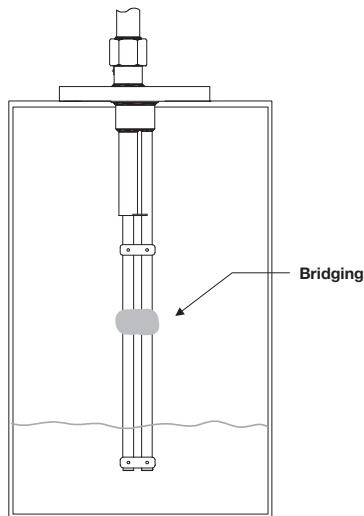
The most typical of coating problems where the media forms a continuous coating on the probe. Eclipse will continue to measure effectively with some small degradation in performance. A problem can develop if the product begins to build up on the spacers that separate the probe elements. High dielectric media (e.g., water-based) will cause the greatest error.

- **Bridging**

Media that is viscous or solid enough to form a clog, or bridge, between the elements causes the greatest degradation in performance. High dielectric media (e.g., water-based) will show as level at the location of the bridging.

- **Stratification/Interface**

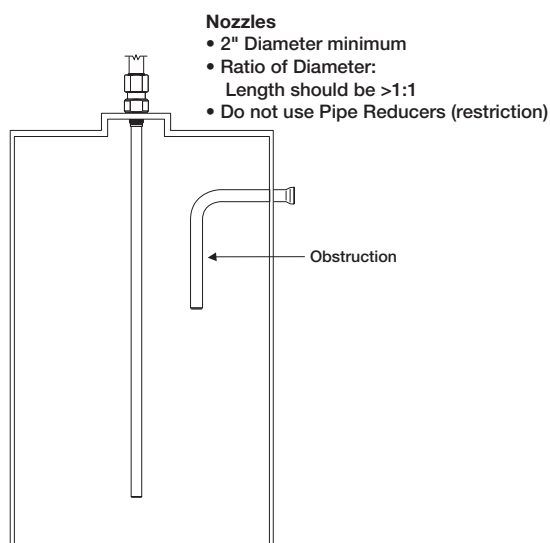
The standard Model 705 Eclipse transmitter is designed to measure the first air/media interface it detects. However, a low dielectric over a high dielectric application can cause a measurement problem and cause the electronics to trigger on the high dielectric medium that lies beneath the low dielectric medium. Select the Fixed Threshold option to read the upper medium. Example: Oil over water.



3.3.3.2 Model 705 (Interface Application)

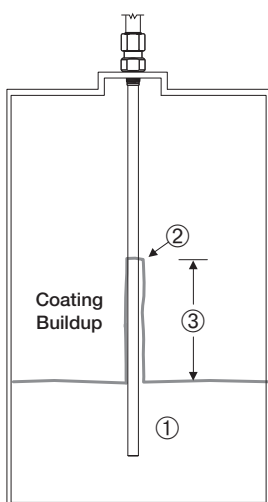
It is not uncommon for interface applications to have an emulsion layer form between the two media. This emulsion layer may pose problems for Guided Wave Radar as it may decrease the strength of the reflected signal. Since the properties of this emulsion layer are difficult to quantify, applications with emulsion layer should be avoided with Eclipse.

3.3.3.3 Model 705 (Single Rod Application)



PROBE CLEARANCE TABLE

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



• Nozzles

Nozzles can create false echoes that can cause diagnostic messages and/or errors in measurement. If EOP HIGH or EOP LOW is displayed when first configuring the instrument:

1. Ensure the PROBE LENGTH as entered in the software is equal to the actual probe length as noted on the nameplate. This value must be changed if the probe is cut shorter from the original length.
2. Increase the Blocking Distance value until the message is eliminated; 20mA point may need to be lowered.
3. Increase the DIELECTRIC RANGE a small amount to aid in reducing echoes in nozzle. Increasing the DIELECTRIC setting reduces the gain, which may cause instrument to lose level of lower dielectric media; consult factory.

• Obstructions

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.

1. Refer to the Probe Clearance Table
2. Increase the DIELECTRIC RANGE a small amount to aid in reducing echoes in nozzle. Increasing the DIELECTRIC setting reduces the gain, which may cause instrument to lose level of lower dielectric media; consult factory.

• Coating/Buildup

The Model 705 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 Length of the coating above the present level

• Stratification/Interface

The Model 705 and Single Rod probe should not be used in applications where media can separate and stratify creating an interface application (e.g., water over oil). The circuitry will detect the lower level—the higher dielectric medium (e.g., the water level).

3.4 Agency Approvals

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
	705-5XXX-1XX 705-5XXX-2XX	Intrinsically Safe	Class I, Div. 1; Groups A, B, C, & D Class II, Div. 1; Groups E, F, & G T4 Class III, Type 4X, IP66 Entity
	705-5XXX-3XX 705-5XXX-4XX	Explosion Proof ① (with Intrinsically Safe probe)	Class I, Div. 1; Groups B, C & D Class II, Div. 1; Groups E, F, & G T4 Class III, Type 4X, IP66
	705-5XXX-XXX 705-5XXX-XXX	Non-Incendive Suitable for: ②	Class I, Div. 2; Groups A, B, C, & D Class II, Div. 2; Groups F & G T4 Class III, Type 4X, IP66
	705-5XXX-1XX 705-5XXX-2XX	Intrinsically Safe	Class I, Div. 1; Groups A, B, C, & D Class II, Div. 1; Group E, F & G T4 Class III, Type 4X Entity
	705-5XXX-3XX 705-5XXX-4XX	Explosion Proof ① (with Intrinsically Safe probe)	Class I, Div. 1; Groups B, C, & D Class II, Div. 1; Group E, F & G T4 Class III, Type 4X
	705-5XXX-XXX 705-5XXX-XXX	Non-Incendive Suitable for: ②	Class I, Div. 2; Groups A, B, C, & D Class II, Div. 2; Group E, F & G T4 Class III, Type 4X
	705-5XXX-AXX 705-5XXX-BXX	Intrinsically Safe ③	Zone 0 Ex ia IIC T4
	705-5XXX-AXX 705-5XXX-BXX	Intrinsically Safe ③	Ⓜ II 1G, EEx ia IIC T4
	705-5XXX-CXX 705-5XXX-DXX	Flame Proof	Ⓜ II 1/2G, EEx d [ia] IIC T6
	705-51XX-EXX 705-51XX-FXX 705-52XX-EXX 705-52XX-FXX	Non-sparking	Ⓜ II 3(1)G, EEx nA [ia] IIC T4..T6 with probe II 1 G EEx ia IIC T6 II 3(1)G, EEx nA [nL] [ia] IIC T4..T6 with probe II 1 G EEx ia IIC T6



These units are in conformity of:

1. The EMC Directive: 2004/108/EC. The units have been tested to EN 61326.
2. Directive 94/9/EC for equipment or protective system for use in potentially explosive atmospheres.

Note: Single and twin rod probes must be used in metallic vessel or stillwell to maintain CE compliance.

- ① **Factory Sealed:** This product has been approved by Factory Mutual Research (FM), and Canadian Standards Association (CSA), as a Factory Sealed device.
- ② **IMPORTANT:** Measured media inside vessel must be non-flammable only. If media inside vessel is flammable, then the explosion proof version (which contains an internal barrier making the probe Intrinsically Safe) is required.
- ③ **Special conditions for safe use**
Because the enclosure of the Guided Wave Radar Level Transmitter Eclipse Model 705-5____-1_ and/or Probe Eclipse Model 7____-____ is made of aluminum, if it is mounted in an area where the use of category 1 G (Zone 0) apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

For applications in explosive atmospheres caused by gases, vapors or mists and where category 1G (Zone 0) apparatus is required, electrostatic charges on the non-metallic parts of the Probe Eclipse Model 7x5-____-____, Model 7x7-____-____ and Model 7_F-____-____ shall be avoided.

3.4.1 Agency Specifications – Explosion Proof Installation

Factory Sealed: This product has been approved by Factory Mutual Research (FM), and, Canadian Standards Association (CSA), 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.

Caution: Grounding (+) will cause faulty operation, but will not cause permanent damage.

3.4.2 Agency Specifications – Intrinsically Safe Installation

SW#	RELEASED	DESCRIPTION	BY & DATE	CHANGE NO.
A		CSG0 SAVITILES "C": WAS 1.3µF & "L" WAS 0.0µF	DF 05-98	3177-002
B		0 µF; LIMITING VALUES "Voc" WAS 1.5µF & "Isc" WAS 0.4µA	DF 05-98	3177-003
C		4.4 µF WAS 2.1µF; .440 µH WAS 37.5 µH	RC 05-26-02	3177-032
D		ADDED -50XX & -51XX TO TITLE; REVISED NOTE 10; ADDED -NON TO LINEAR TYPE BARRIER OUTPUT IN CHART;	RC 11-18-03	3177-300
E		ADDED SHEET 2 Pmax WAS Pmax = 1 W (FM ONLY) CI WAS CI = 4.4µF; LI WAS LI = 440µH	RC 05-04-05	3177-379

NON-HAZARDOUS LOCATION LIMITING VALUES

Voc = 10 or less than 28.6V Ca = 10 or greater than 5.5 nF
 Isc = 10 or less than 1.40 µA La = 10 or greater than 440µH
 (C) IS THE MINIMUM CAPACITANCE OF THE TRANSMITTER 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 INTERCONNECTING WIRING. (C) AND CAPACITANCE (Ca) OF THE LOAD AND THE INDUCTANCE (Li) OF THE LOAD AND THE INTERCONNECTING WIRING, MUST BE EQUAL TO LESS THAN THE CAPACITANCE (Ca) OR THE INDUCTANCE (Li), WHICH CAN BE DRIVEN BY THE SOURCE DEVICE.

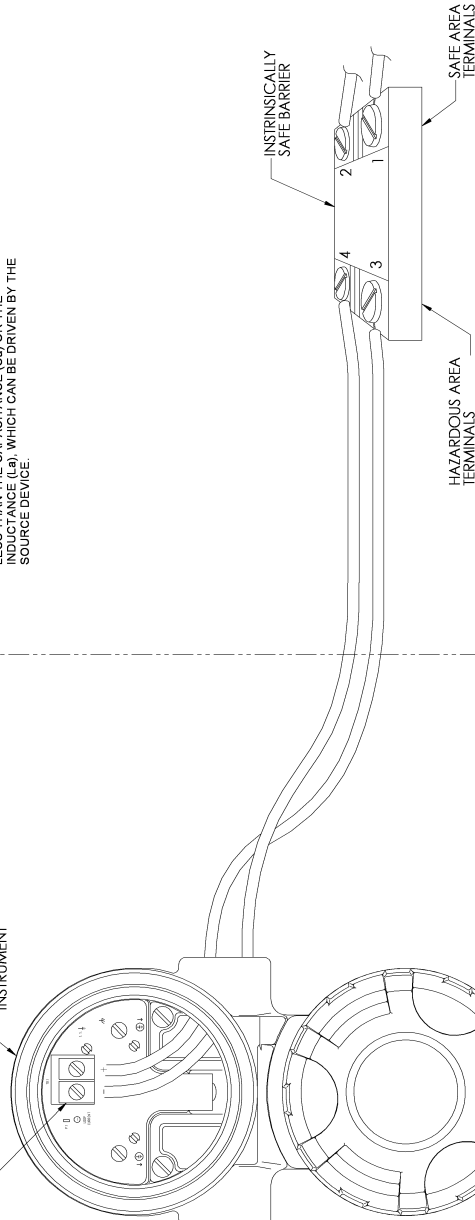
HAZARDOUS LOCATION MODEL 70X-50XX TRANSMITTER

C.S.II DIV I GROUPS A, B, C & D
 C.S.II, DIV I GROUPS E, F & G (G ONLY FOR CSA)
 C.S.III

ENTITY
 Vmax = 28.6 V
 Pmax = 1 W
 Pavg = 11 W
 Ci = 5.5µF
 Li = 94 µH

MODEL 70X-50XX-XXX
 70X-51XX-XXX

SEE NOTE 1
 TRANSMITTER INSTRUMENT



- FOR EXPLOSIONPROOF OR DUST-IGNITIONPROOF INSTALLATIONS, THE IS, GROUND TERMINAL SHALL BE CONNECTED TO APPROPRIATE INTRINSICALLY SAFE GROUND (ACCORDANCE WITH ANSIPAPA 70) (FOR FMRC) FOR INTRINSICALLY SAFE INSTALLATIONS. THE IS GROUND TERMINAL DOES NOT REQUIRE GROUNDING.
- THE CEC (FOR CSA OR THE NEC AND ANSI/ISA RP 2.6 (FOR FMRC)) MUST BE FOLLOWED WHEN INSTALLING THIS TRANSMITTER. THIS TRANSMITTER MUST BE CSA CERTIFIED FOR CANADIAN INSTALLATIONS AND APPROVED FOR U.S. INSTALLATION.
- CONTROL EQUIPMENT CONNECTED TO PROTECTIVE BARRIERS MUST NOT USE OR GENERATE 115V AC.
- INTRINSICALLY SAFE BARRIERS MUST BE USED WHEN TRANSMITTER IS INSTALLED IN CLASS II & III ENVIRONMENTS. THIS DRAWING WITHOUT CSA AND FMRC APPROVAL.
- FOR CSA EXIA INTRINSICALLY SAFE/SECURITE INTRINSEQUE.
- FOR CSA EXIA INTRINSICALLY SAFE/SECURITE INTRINSEQUE.
- FOR CSA EXIA INTRINSICALLY SAFE/SECURITE INTRINSEQUE.
- FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 71°C AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 94 Vdc.
- THE TRANSMITTER CAN ALSO BE INSTALLED IN:
 CLASS I, DIVISION 2, GROUPS A, B, C & D (C ONLY FOR FMRC)
 CLASS II, DIVISION 2, AND HAZARDOUS LOCATIONS AND DOES NOT REQUIRE CONNECTION TO A PROTECTIVE BARRIER WHEN INSTALLED PER THE CEC (FOR CSA) OR THE NEC (FOR FMRC).
- FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 71°C AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 94 Vdc.
- FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 71°C AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 94 Vdc.
- FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 71°C AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 94 Vdc.
- FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 71°C AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 94 Vdc.

BARRIER OUTPUT CURRENT (ISC)	LINEAR TYPE BARRIER OUTPUT		NON-LINEAR TYPE BARRIER OUTPUT	
	VOC	Ca	VOC	Ca
80mA	35V	0.12µF	4.0mH	1.4µF
100mA	28V	0.13µF	3.0mH	0.15µF
120mA	28V	0.12µF	2.9mH	0.15µF
140mA	24V	0.21µF	1.7mH	0.15µF

THE OUTPUT POWER OF A LINEAR OUTPUT BARRIER MAY BE CALCULATED AS FOLLOWS:
 $P_{out} = V_{oc} I_{sc}$ OR $P_{out} = I_{sc}^2 R_L$
 THE OUTPUT POWER OF A NON-LINEAR OUTPUT BARRIER MAY BE CALCULATED AS FOLLOWS:
 $P_{out} = V_{oc} I_{sc}$ OR $P_{out} = I_{sc}^2 R_L$

AGENCY LISTED DRAWING
 ALL REVISIONS TO THIS DRAWING REQUIRE QA APPROVAL

Magnetrol
 5300 BELMONT ROAD, DOWNERS GROVE ILLINOIS 60515, AREA CODE 630/668-4000
 SCALE: 1:1 SHEET 1 OF 2
 DATE: 04-22-98
 PROJECT NO: 5177-002
 DRAWN: D.FRANCOEUR
 CHECKED: T.HOFRICHTER
 APPROVED: M.TADDLE
 DATE: 04-22-98
 SIZE: C
099-5055

Drawing Last Modified: Tuesday, June 28, 2005 12:47:38 PM

3.4.3 Agency Specifications – FOUNDATION fieldbus System

REVISIONS		BY & DATE	CHANGE NO.
SYM	DESCRIPTION		
E	SEE SHEET ONE, FOR REVISIONS	RC 05-04-05	3177-379

UNCLASSIFIED LOCATION

Uo (Voc or Vt) = 30V
Io (Isc or Ib) = 500mA
Po = 1.0W

Any FM/CSA Approved Intrinsically Safe Associated Apparatus with Parameters suitable for the FISCO Concept.

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Division 1, Groups A, B, C, D
Class II, Division 1, Groups E, F, G
Class III, Division 1

Eclipse Level Transmitter
Model 705-52xx-xxx
Ui (Vmax) = 30V
Ii (Imax) = 500 mA
Pi = 5.5W
Ci ≤ 5nF
Li ≤ 10µH
Leakage current ≤ 50µA

Eclipse Level Transmitter
Model 705-52xx-xxx
Ui (Vmax) = 30V
Ii (Imax) = 500 mA
Pi = 5.5W
Ci ≤ 5nF
Li ≤ 10µH
Leakage current ≤ 50µA

Any FM/CSA Approved Intrinsically Safe Associated Apparatus with Parameters suitable for the FISCO Concept.

Approved Terminator
Ui (Vmax) = 24V
Ii (Imax) = 280 mA
Pi = 1.93W
or
Any approved termination with
R = 90 ... 100Ω
C = 0 ... 2.2µF

FISCO Concept:

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

- Loop resistance R: 15 ... 150Ω/km
- Loop inductance L: 0.4 ... 1.0µH/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 splices = 0.3m (with connections with no energy storage capability)
- Length of spur cable: ≤ 30m
- Length of trunk cable: ≤ 1km

Note:

At each end of the trunk cable an approved fail-safe termination with the following parameters is required: 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 100m (sum of the length of the trunk cable and all spur cables), the total loop inductance of the cable will not impact the intrinsic safety of the installation.

FOR PROPER INSTALLATION REFERENCE ALL APPLICABLE NOTES FROM PAGE 1 – 99-5055-001

Magnetrol®

5300 BELMONT ROAD, DOWNERS GROVE
ILLINOIS 60515, AREA CODE 630/665-4000

SCALE: 1:1 SHEET 2 OF 2

SIZE: **C** 099-5055

SYSTEM DRAWING MODEL 705-52XX TRANSMITTER	
DRAWN: D.FRANCOEUR	DATE: 01-01-98
CHECKED: T.HOFRICHTER	DATE: 04-22-98
APPROVED: M.TADDLE	DATE: 04-22-98
PROJECT NO. 5177-002	SKETCH NO.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
[] OR mm DIMENSIONS ARE IN MILLIMETERS
MAX. ALLOWED .002 (0.051)
INSIDE RADIUS .002 (0.051)

REMOVE ALL BURRS AND SHARP EDGES

ALL FINISHES: 12% OR BETTER

TOLERANCES: ±.005 (0.127) INCHES (0.254mm) MINUS
±.003 (0.076) INCHES (0.127mm) MINUS
2 PL. DECIMAL (0.005 IN, 0.127mm)
ANGULAR ±2°

MATERIAL	HEAT FINISH
RAW MATERIAL PART NO.	FINISH

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Drawing Last Modified: Tuesday, June 28, 2005 12:47:38 PM

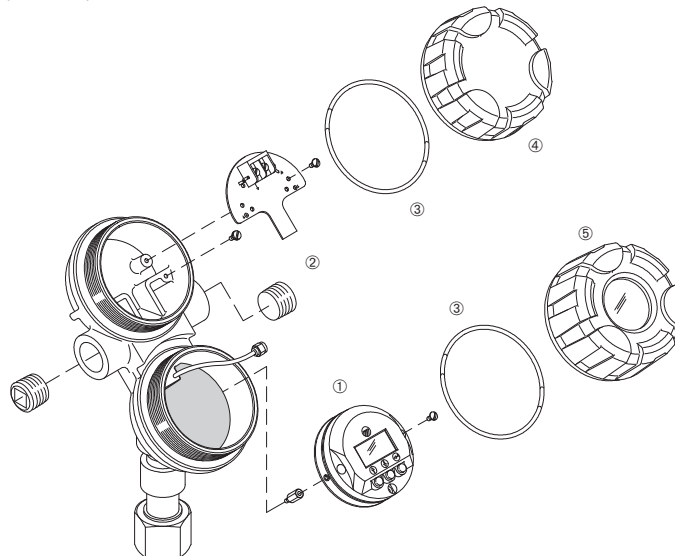
3.5 Parts

3.5.1 Replacement Parts

Item	Description	Part Number
①	Electronic module	
	HART with display (SIL 1)	Z31-2835-001
	HART without display (SIL 1)	Z31-2835-002
	HART with display (SIL 2)	Z31-2835-003
	HART without display (SIL 2)	Z31-2835-004
	FOUNDATION fieldbus with display	Z31-2841-001
	FOUNDATION fieldbus without display	Z31-2841-002
	PROFIBUS PA with display	Z31-2846-001
	PROFIBUS PA without display	Z31-2846-002
	Hygienic HART with display (SIL 1)	89-7254-001
	Hygienic FOUNDATION fieldbus with display	89-7254-002
Hygienic PROFIBUS PA with display	89-7254-004	
②	Terminal board	
	HART General Purpose (GP), Intrinsically Safe (IS), Explosion Proof (XP)	Z30-9151-001
	FOUNDATION fieldbus (XP)	Z30-9151-003
	FOUNDATION fieldbus (IS/Fisco)	Z30-9151-004
③	O-ring (Viton®) (Consult Factory for alternative O-ring materials)	012-2201-237
④	Housing cover without glass	004-9193-003
⑤	Housing cover with glass (GP, IS)	036-4410-001
	(XP)	036-4410-003
	7xB Twin Rod Probe Shortening Kit (consult factory)	089-9112-XXX
	7x7 Twin Rod Flexible Probe Weight	089-9121-001
	7xF Single Rod Rigid Probe – Spacer Kit (Spacer & Pin)	089-9114-001
	7x1 Single Rod Flexible Probe Weight	089-9120-001

3.5.2 Recommended Spare Parts

Item	Description	Part Number
①	Electronic module	
	HART with display (SIL 1)	Z31-2835-001
	HART without display (SIL 1)	Z31-2835-002
	HART with display (SIL 2)	Z31-2835-003
	HART without display (SIL 2)	Z31-2835-004
	FOUNDATION fieldbus with display	Z31-2841-001
FOUNDATION fieldbus without display	Z31-2841-002	
②	Terminal board	
	HART General Purpose (GP), Intrinsically Safe (IS), Explosion Proof (XP)	Z30-9151-001
	FOUNDATION fieldbus (XP)	Z30-9151-003
FOUNDATION fieldbus (IS/Fisco)	Z30-9151-004	



3.6 Specifications

3.6.1 Functional

System Design

Measurement Principle Guided time-of-flight via time domain reflectometry

Input

Measured Variable Level, determined by the time-of-flight of a guided radar pulse from transmitter to product surface and back

Zero and Span 6 inches to 75 feet (15 to 2286 cm)

Output

Type Analog 4 to 20 mA with HART digital signal

Range Analog 3.8 to 20.5 mA useable

Digital 0 to 999" (0 to 999 cm)

Resolution Analog 0.01 mA

Digital 0.1"

Loop Resistance (maximum) GP/IS/XP- 620 Ω @24 VDC

Diagnostic Alarm Adjustable 3.6 mA, 22 mA, HOLD

Damping Adjustable 0-10 seconds

User Interface

Keypad 3-button menu-driven data entry & system security

Indication 2-line x 8-character display

Digital Communication HART Version 5.x compatible

FOUNDATION fieldbus H1 (ITK 4.6)

Power (Measured at instrument terminals)

General Purpose/Intrinsically Safe/Explosion Proof/FM/CSA/ATEX 11 to 36 VDC

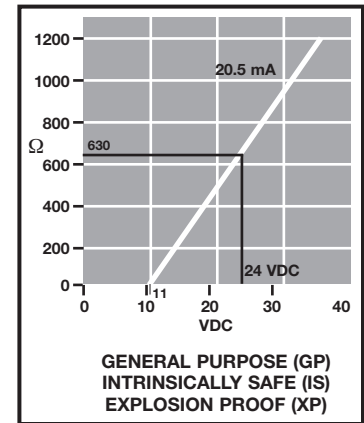
Fieldbus General Purpose/XP/IS/FISCO 9–32 VDC (17 mA current draw) (Refer to instruction manual 57-640

for additional information on FOUNDATION fieldbus version)

Housing

Material Aluminum A356T6 (<0.20% copper), optional 316 stainless steel

Cable Entry $\frac{3}{4}$ " NPT and M20



3.6.1.1 O-ring (Seal) Selection Chart

Material	Code	Maximum Temperature ^①	Min. Temp.	Recommended For Use In	Not Recommended For Use In
Viton® GFLT	0	+400° F (+200° C)	-40° F (-40° C)	General purpose, steam, ethylene	Ketones (MEK, acetone), skydrol fluids, amines, anhydrous ammonia, low molecular weight esters and ethers, hot hydro-fluoric or chlorosulfuric acids, sour HCs
EPDM	1	+250° F (+125° C)	-60° F (-50° C)	Acetone, MEK, skydrol fluids	Petroleum oils, di-ester base lubricants, propane, steam, anhydrous ammonia
Kalrez® (4079)	2	+400° F (+200° C)	-40° F (-40° C)	Inorganic and organic acids (including HF and nitric) aldehydes, ethylene, glycols, organic oils, silicone oils, vinegar, sour HCs	Black liquor, hot water/steam, hot aliphatic amines, ethylene oxide, propylene oxide, molten sodium, molten potassium, anhydrous ammonia
Aegis PF128	8	+400° F (+200° C)	-4° F (-20° C)	Inorganic and organic acids (including HF and nitric) aldehydes, ethylene, glycols, organic oils, silicone oils, vinegar, sour HCs, steam, amines, ethylene oxide, propylene oxide	Black liquor, Freon 43, Freon 75, Galden, KEL-F liquid, molten sodium, molten potassium, anhydrous ammonia
Borosilicate	N	+800° F (+430° C)	-320° F (-195° C)	General high temperature/high pressure applications, hydrocarbons, full vacuum (hermetic), ammonia, chlorine	Steam, hot alkaline solutions HF acid, media with pH>12

^① Maximum temperature of O-ring (not necessarily maximum process temperature)

Environment

Operating Temperature	-40 to +175° F (-40 to +80° C)
Display Function Operating Temperature	-5 to +160° F (-20 to +70° C)
Storage Temperature	-50 to +175° F (-46 to +80° C)
Humidity	0-99%, non-condensing
Electromagnetic Compatibility	Meets CE Requirements: EN 61326
	Note: Twin Rod and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement.
Mounting Affects: Twin Rod	Active rod must be mounted at least 1" (25 mm) from any surface or obstruction. Minimum stillwell diameter for Twin Rod probe is 3".
Single Rod	Nozzles do not restrict performance by ensuring the following: No nozzle is <2" (50 mm) diameter Ratio of Diameter: Length is 1:1 or greater; any ratio <1:1 (e.g., a 2" x 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment (see Section 2.6.5) No pipe reducers are used Obstructions (See Probe Clearance Table, page 47) Keep conductive objects away from probe to ensure proper performance
Shock Class	ANSI/ISA-S71.03 Class SA1
Vibration Class	ANSI/ISA-S71.03 Class VC2
SIL 2	Safe Failure Fraction (SFF) 91%

3.6.2 Performance - Model 705

Reference Conditions ②	Reflection from water at +70° F (+20° C) with 72" coaxial probe (CFD threshold)
Linearity ③	Coaxial/Twin Rod Probes: <0.1% of probe length or 0.1 inch (whichever is greater) Single Rod Probes: <0.3% of probe length or 0.3 inch (whichever is greater)
Measured Error	Coaxial/Twin Rod Probes: ±0.1% probe length or ±0.1 inch (whichever is greater) Single Rod Probes: ±0.5% probe length or ±0.5 inch (whichever is greater)
Resolution	±0.1 inch
Repeatability	<0.1 inch
Hysteresis	<0.1 inch
Response Time	<1 second
Warm-up Time	<5 seconds
Operating Temp. Range	-40° to +175° F (-40° to +80° C)
LCD Temp. Range	-5° to +160° F (-20° to +70° C)
Ambient Temp. Effect	Approximately +0.02% of probe length/ ° C
Process Dielectric Effect	<0.3 inch within selected range
Humidity	0-99%, non-condensing
Electromagnetic Compatibility	Meets CE requirements: EN 61326 (Twin and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement)

② Specifications will degrade with Model 7xB, 7xD, and 7xP probes and/or Fixed threshold configuration.

③ Top 24 inches of Model 7xB probe: 1.2 inches (30 mm). Specification for top 48 inches of single rod will be application dependent.

3.6.3 Performance - Model 705 Interface

Reference Conditions	Reflection from liquid of selected dielectric at +70° F (+20° C) with 72" probe
Linearity	<0.5 inch
Measured Error	Upper layer ±1 inch Interface layer ±1 inch (clean distinct interface required)
Upper Layer Dielectric	1.4–5.0
Interface Layer Dielectric	>15
Resolution	±0.1 inch
Repeatability	<0.5 inch
Hysteresis	<0.5 inch
Response Time	<1 second
Warm-up Time	<5 seconds
Operating Temp. Range	-40° to +175° F (-40° to +80° C)
LCD Temp. Range	-5° to +160° F (-20° to +70° C)
Ambient Temp. Effect	Approximately ±0.02% of probe length/ ° C
Humidity	0-99%, non-condensing
Electromagnetic Compatibility	Meets CE requirements: EN 61326

3.6.4 Process Conditions

Model	Coaxial (7xA, 7xG, 7xT, 7xR)	Twin Rod (7xB)	HTHP Coaxial (7xD)	HP Coaxial (7xP)	Steam ① (7xS)
Maximum Process Temperature	7xA: +300° F @ 400 psig (+150° C @ 27 bar) 7xG, 7xT & 7xR: +400° F @ 270 psig (+200° C @ 18 bar)	+400° F @ 275 psig (+200° C @ 19 bar)	+800° F @ 1500 psig (+427° C @ 103 bar)	+400° F @ 5500 psig (+200° C @ 380 bar)	+650° F @ 2400 psig (+340° C @ 165 bar)
Maximum Process Pressure	1000 psig @ +70° F (70 bar @ +20° C)	1000 psig @ +70° F (70 bar @ +20° C)	6250 psig @ +70° F (430 bar @ +20° C)	6250 psig @ +70° F (430 bar @ +20° C)	3000 psig @ +100° F (207 bar @ +38° C)
Maximum Viscosity	500 cp (Standard) 1500 cp (Enlarged) 10,000 Caged Coaxial	1500 cp	500 cp (Standard) 1500 cp (Enlarged)	500 cp (Standard) 1500 cp (Enlarged)	500 cp
Dielectric Range	≥1.4	≥1.9	≥1.4	≥1.4	>10
Hermeticity	N/A	N/A	Helium leak rate <10 ⁻⁸ cc/sec @ 1 atmosphere vacuum		N/A

① Not for direct insertion into boilers.

Model	Rigid (7xF)	Rigid (7xJ)	Flexible (7x1)	Flexible (7x2, 7x5)	Hygienic (7xF-E)	Paint (7xF-P)
Maximum Process Temperature	+300° F @ 400 psig (+150° C @ 27 bar)	+605° F @ 1600 psig (+320° C @ 110 bar)	+300° F @ 400 psig (+150° C @ 27 bar)	+150° F @ 50 psig (+66° C @ 3.4 bar)	+300° F @ 75 psig (+150° C @ 27 bar)	160° F (71° C)
Maximum Process Pressure	1000 psig @ +70° F (70 bar @ +20° C)	3000 psig @ +70° F (207 bar @ +20° C)	N/A		75 psig @ +300° F	Atmospheric
Maximum Viscosity	10,000 (consult factory if severe agitation/turbulence)					2000
Dielectric Range	≥1.9					
Hermeticity	N/A					

3.6.5 Probe Specifications

Dual-element Probes

Model	Coaxial (7xA, 7xR, 7xT)	Rigid Twin Rod (7xB)	Flexible Twin Rod (7x5, 7x7)	HTHP Coaxial (7xD)	HP Coaxial (7xP)	Steam (7xS)
Materials	316/316L SS (Hastelloy C and Monel opt.) TFE spacers, Viton® O-rings		316/316L SS FEP Coating Viton® O-rings	316/316L SS, Inconel® X750, Borosilicate seal, TFE or Peek™ spacers	316/316L SS, Inconel® X750, Borosilicate seal, TFE spacers	316/316L SS, Peek™, Aegis PF 128 O-ring
Diameter	.3125" (8mm) dia. rod .875" (10mm) dia. tube .6" (15mm) dia. rod 1.75" (44mm) dia. tube	Two .5" (13 mm) dia. Rods, .375" clearance between rods	Two .25" (6 mm) dia. cables; .875" (22 mm) C _L to C _L	.3125" (8 mm) diameter rod .875" (10 mm) diameter tube .6" (15 mm) diameter rod 1.75" (44 mm) diameter tube		
Process Connection	¾" NPT, 1" BSP ANSI or DIN flanges	2" NPT ANSI or DIN flanges		¾" NPT, 1" BSP ANSI or DIN flanges		¾" NPT, 1" BSP ANSI or DIN flanges
Transition Zone (Top)	7xA: 1" (25mm) @ $\epsilon_r = 1.4$ 6"(150mm) @ $\epsilon_r = 80.0$ 7xR: None	1" (25 mm) +4" inactive $\epsilon_r > 20$		1" (25 mm)	1" (25 mm) @ $\epsilon_r = 2.0$ 6"(150 mm) @ $\epsilon_r = 80.0$	8" (200 mm) @ $\epsilon_r = 80$
Transition Zone (Bottom)	6" (150 mm) @ $\epsilon_r = 1.4$ 1" (25 mm) @ $\epsilon_r = 80.0$		12" (305 mm)	6" (150 mm) @ $\epsilon_r = 1.4$ 1" (25 mm) @ $\epsilon_r = 80.0$		1" (25 mm) @ $\epsilon_r = 80$
Pull Force/Tension	N/A		7x5: 3000 lbs. 7x7: 100 lbs.	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.

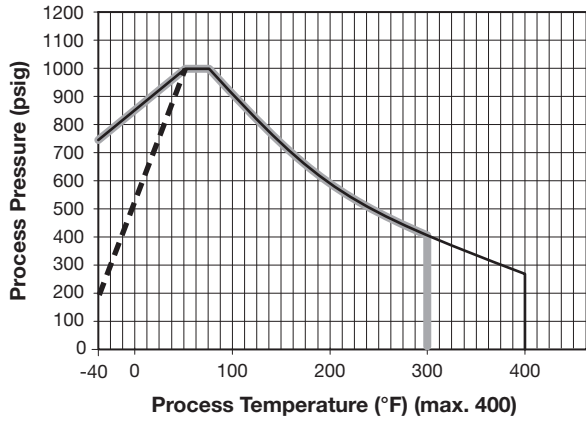
Single Rod Probes

Model	7xF, 7xJ Rigid	7x1 Flexible	7x2 Flexible
Materials	316/316L SS (Hastelloy® C and Monel optional) Viton®/PEEK™ O-rings		316/316L SS, Viton® O-rings
Diameter	0.5" (13 mm)	0.1875" (5 mm)	.25" (6 mm)
Blocking Distance - Top	0–36" (0–91 cm)–Probe length dependent (adjustable)		
Process Connection	2" NPT ANSI or DIN flange		
Transition Zone (Top)	Application Dependent	12" (305 mm) minimum	
Transition Zone (Bottom)	1" @ $\epsilon_r > 10$	12" (305 mm) minimum	
Pull Force/Tension	N/A	20 lbs.	3000 lbs.
Side Load	Not more than 3" deflection at end of 120" (305 cm) probe	Cable not to exceed 5° from vertical	

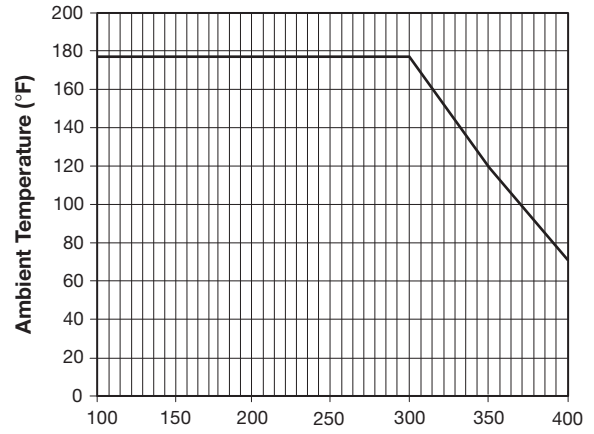
SINGLE ROD PROBE CLEARANCE GUIDELINES TABLE

Distance to Probe	Acceptable Objects
<6"	Continuous, smooth, parallel conductive surface; e.g., tank wall. Important that probe does not touch wall.
<6"	<1" (25 mm) diameter pipe and beams, ladder rungs
<12"	<1" (75 mm) diameter pipe and beams, concrete walls
<18"	All remaining objects

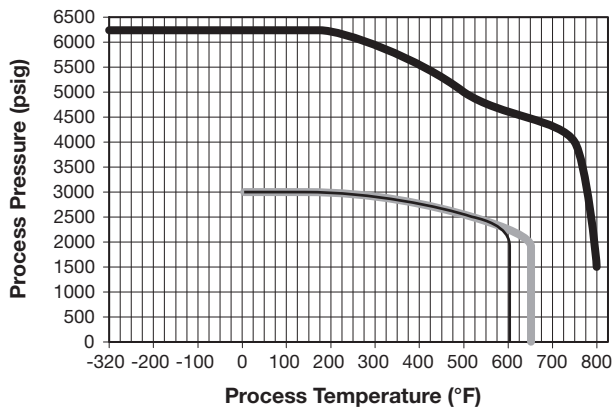
Temperature/Pressure Charts



— 7X1, 7X7, 7XA, 7XB, 7XF
 — 7XG, 7XM, 7XN, 7XR, 7XT
 - - - 7XF-F



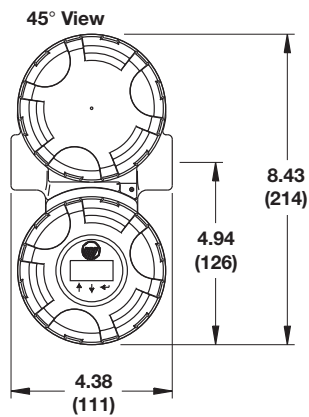
Ambient Temperature vs Process Temperature
7XB, 7XF, 7X7



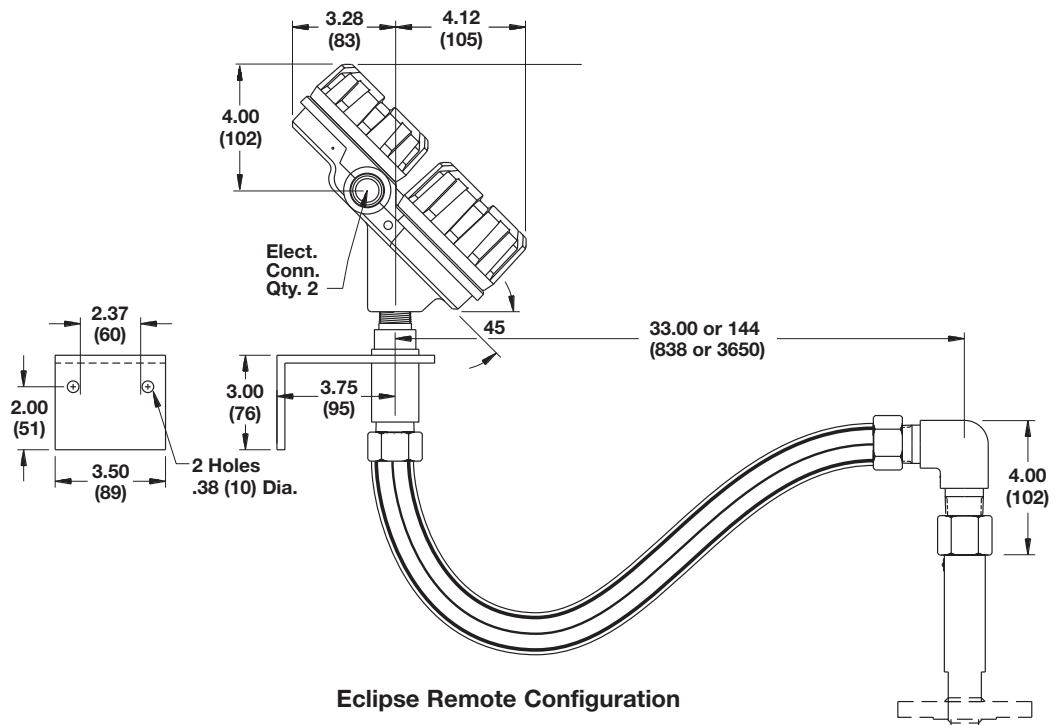
— 7XD, 7XL HTHP (max. +800° F)
 — 7XS (max. +650°)
 — 7XJ (max. +605°)

3.6.6 Physical

inches (mm)



Eclipse Housing
(45° View)



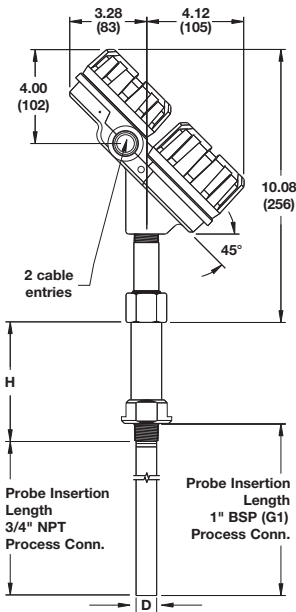
Eclipse Remote Configuration

3.6.6 Physical – Coaxial Probes

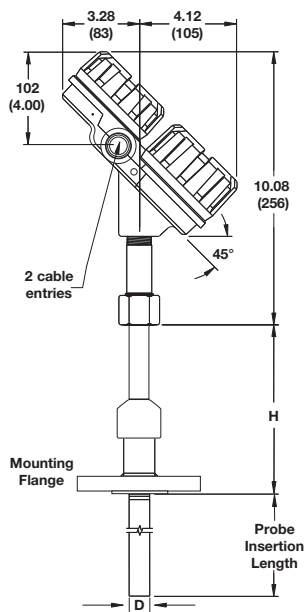
inches (mm)

COAXIAL PROBES

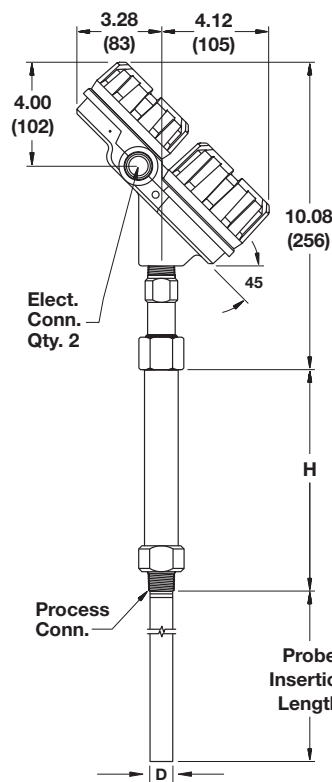
Probe	D Dimension		H Dimension	
	Standard	Enlarged	NPT	Flanged
7xA	.875 (22)	1.75 (44)	2.32 (59)	2.91 (74)
7xD	.875 (22)	1.75 (44)	8.55 (217)	10.91 (277)
7xP	.875 (22)	1.75 (44)	4.18 (106)	6.54 (166)
7xR, 7xT	.875 (22)	1.75 (44)	5.89 (150)	6.57 (167)
7xS	.875 (22)	—	7.10 (180)	9.52 (242)



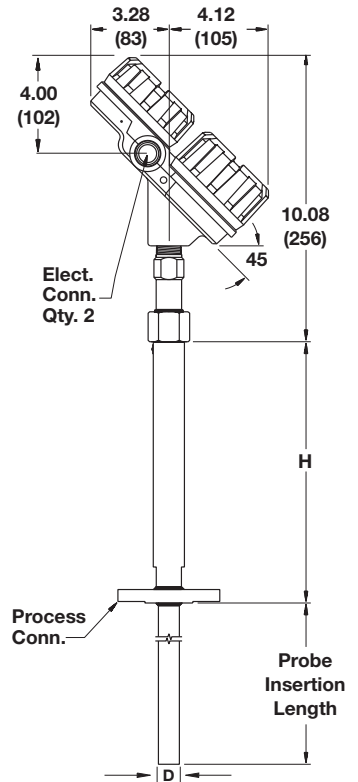
Eclipse with 7XS Probe Threaded Connection



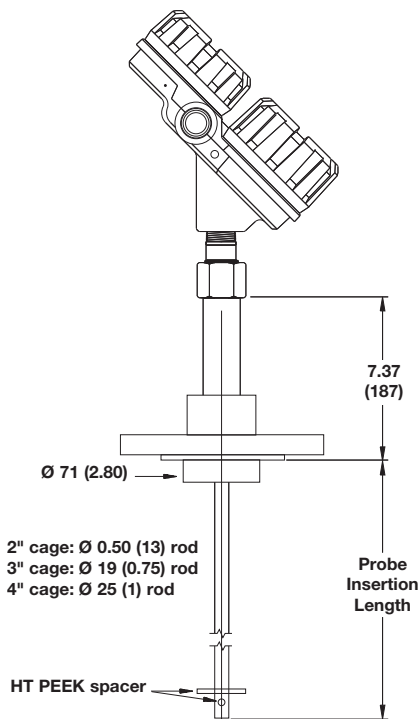
Eclipse with 7XS Probe Flanged Connection



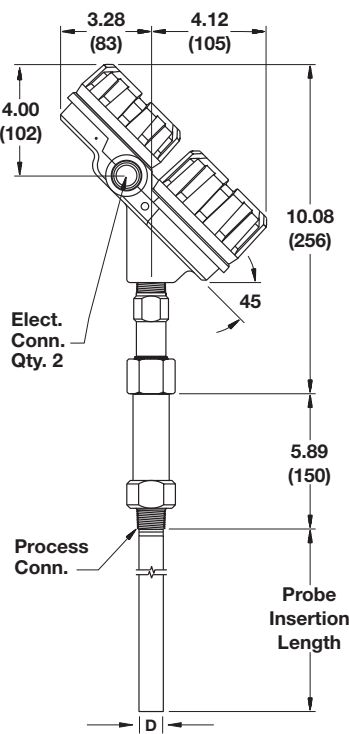
Eclipse with 7xD Probe Threaded Connection



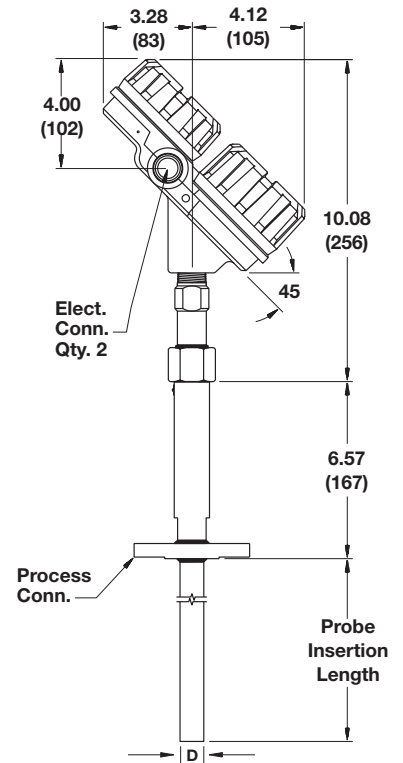
Eclipse with 7xD Probe Flanged Connection



Eclipse with 7xG Probe max 240" (6.1 m)



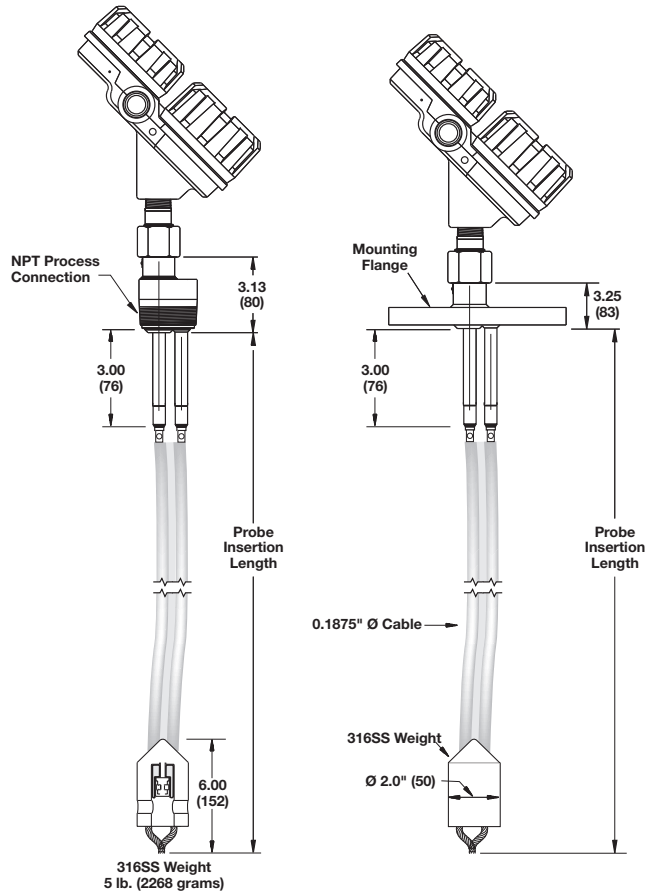
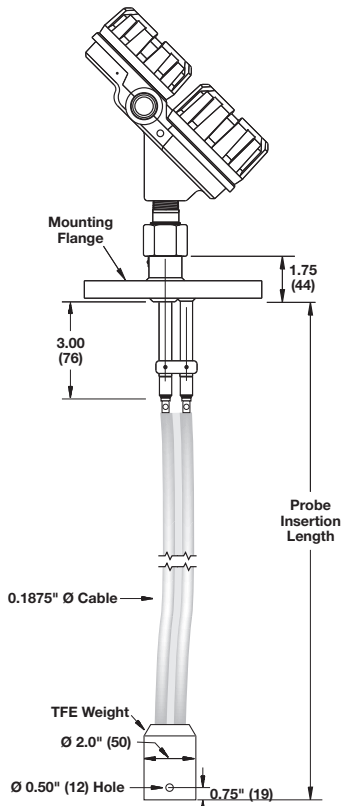
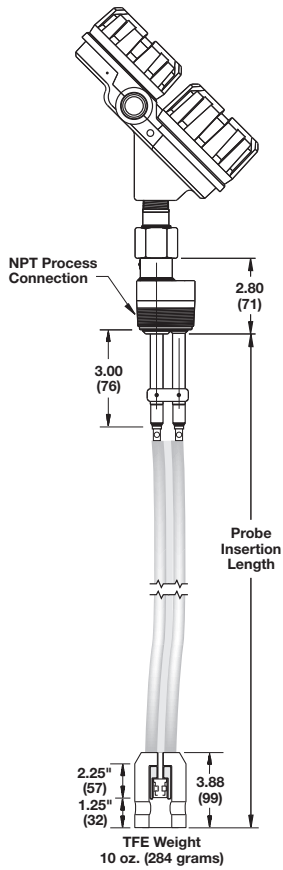
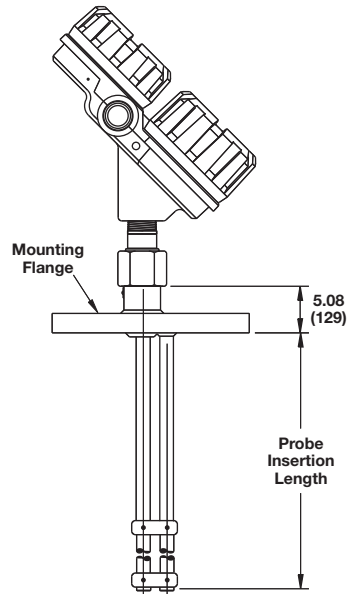
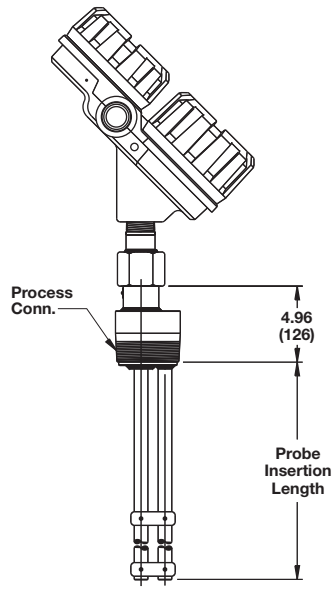
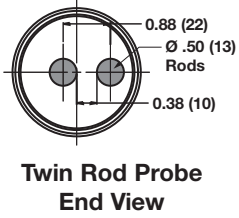
Eclipse with 7xR or 7xT Probe Threaded Connection



Eclipse with 7xR or 7xT Probe Flanged Connection

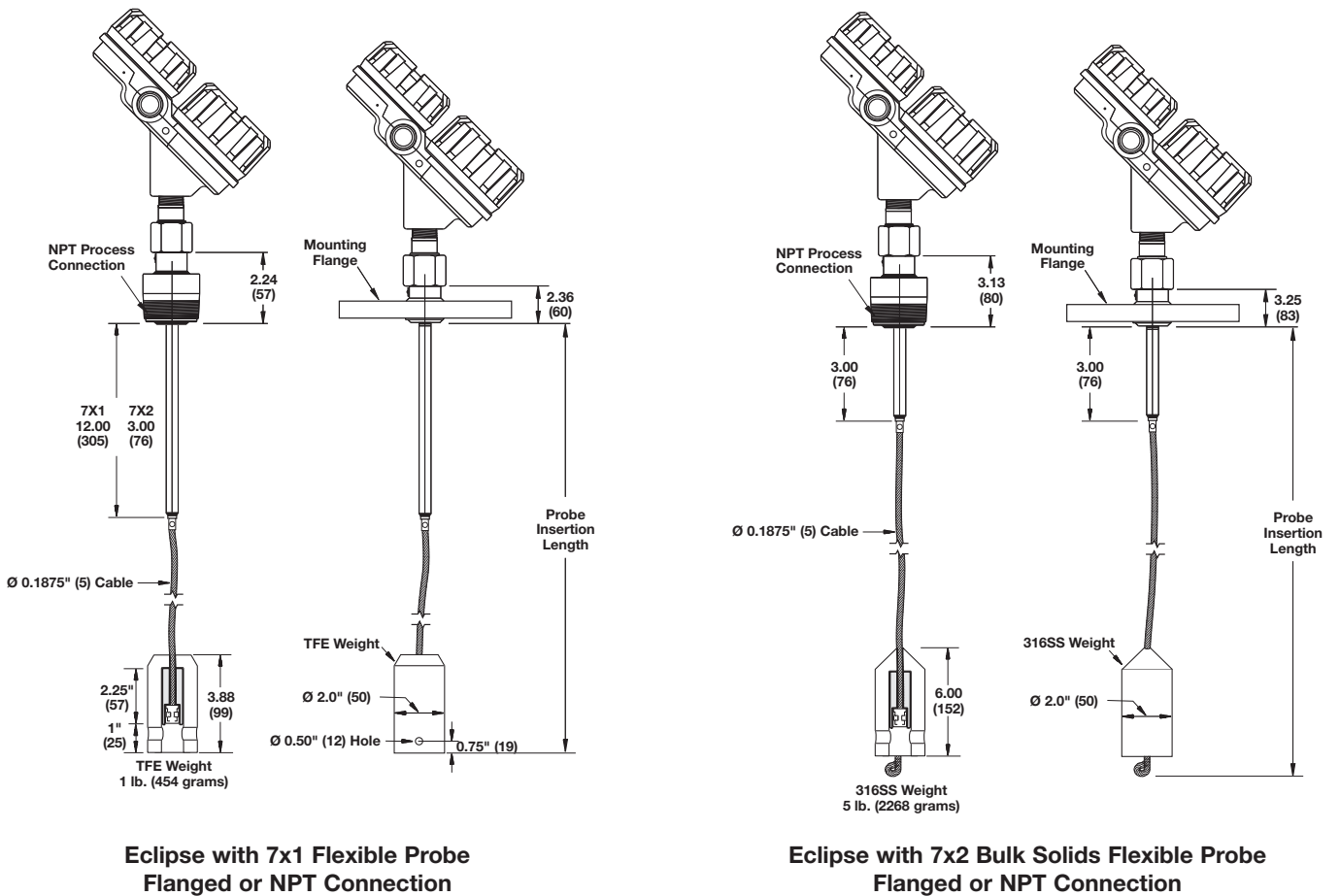
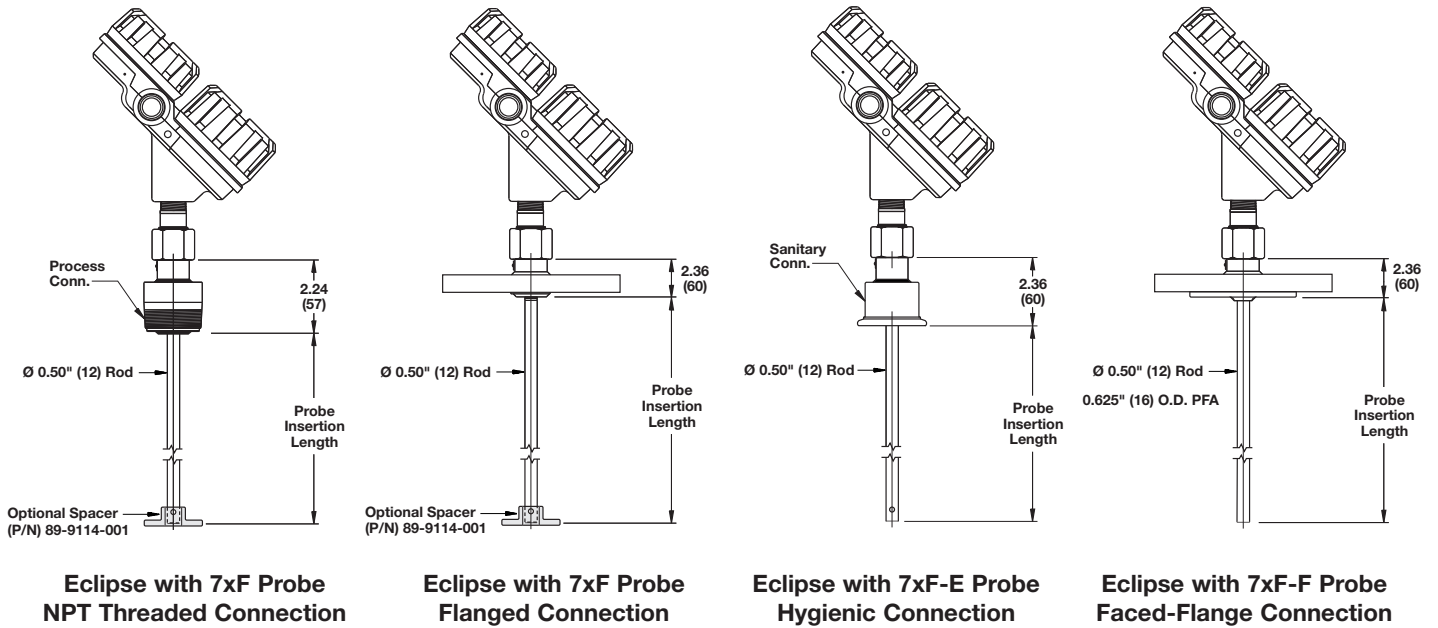
3.6.6 Physical – Twin Rod Probes

inches (mm)



3.6.6 Physical – Single Rod Probes

inches (mm)



3.7 Model Numbers

3.7.1 Transmitter

BASIC MODEL NUMBER

705	Eclipse Guided Wave Radar Level Transmitter
-----	---

POWER

5	24 VDC, Two-wire
---	------------------

SIGNAL OUTPUT AND ELECTRONICS

1 0	4–20 mA with HART – SIL 1 standard electronics (SFF of 85.4%)
1 A	4–20 mA with HART – SIL 2 enhanced electronics (SFF of 91%)
2 0	FOUNDATION fieldbus™ Communication
3 0	PROFIBUS PA™ Communication

ACCESSORIES

0	No digital display and keypad
A	Digital display and keypad

MOUNTING/CLASSIFICATION

1	Integral, General Purpose & Intrinsically Safe (FM & CSA), Non-incendive (Class I, Div. 2)
2	Remote, General Purpose & Intrinsically Safe (FM & CSA), Non-incendive (Class I, Div. 2)
3	Integral, Explosion Proof (FM & CSA) & Non-incendive
4	Remote, Explosion Proof (FM & CSA) & Non-incendive
A	Integral, General Purpose & Intrinsically Safe (ATEX & JIS EEx ia IIC T4)
B	Remote, General Purpose & Intrinsically Safe (ATEX & JIS EEx ia IIC T4)
C	Integral, Explosion Proof (ATEX EEx d [ia] IIC T6) (must be ordered with Conduit Connection Codes 0 and 1)
D	Remote, Explosion Proof (ATEX EEx d [ia] IIC T6) (must be ordered with Conduit Connection Codes 0 and 1)
E	Integral, Non-incendive (ATEX EEx n II T4..6)
F	Remote, Non-incendive (ATEX EEx n II T4..6)

HOUSING

1	Cast aluminum, dual compartment, 45° angle
2	316 stainless steel, dual compartment, 45° angle ①
7	Cast aluminum, dual compartment, 45° angle, 12-ft remote
8	316 SS, dual compartment, 45° angle, 12-ft remote ①

CONDUIT CONNECTION

0	¾" NPT
1	M20

① To reduce the possibility of probe damage due to vibration, it is recommended to use a remote mount transmitter (Mounting/Classification codes 2, 4, B, C or F) when ordering the heavier 316 SS version.



3.7.2 Probe

BASIC MODEL NUMBER

7E	Eclipse GWR probe, English unit of measure
7M	Eclipse GWR probe, Metric unit of measure

CONFIGURATION/STYLE

D	Coaxial	High Temp./High Pressure	¾" process connection or larger	Dielectric range ≥1.4
R	Coaxial	High Pressure		
L	Coaxial	High Temp./High Pressure w/Flushing Conn.		
M	Coaxial	Overfill Probe w/Flushing Conn.		
N	Coaxial	Interface Probe w/Flushing Conn.		
S	Coaxial	Hot Water/Steam		
T	Coaxial	Interface		
B	Twin Rod	Standard	2" process connection or larger (hygienic ¾" or larger)	Dielectric range ≥1.9
7	Twin Rod	Flexible		
5	Twin Rod	Flexible Bulk Solid		
F	Single Rod	Standard		
G	Caged	Overfill 2", 3" or 4"		
J	Single Rod	High Temp./High Pressure Flexible Bulk Solid		
1	Single Rod	Flexible		
2	Single Rod	Flexible Bulk Solid		

MATERIAL OF CONSTRUCTION

A	316/316L stainless steel
B	Hastelloy C, Configuration/Style codes A, B, D, F, J, P, R and T only
C	Monel, Configuration/Style codes A, B, D, F, J, P, R and T only
E	Hygienic, 316/316L stainless steel (20 R _a finish), Configuration/Style code F only, Process connections codes 2P, 3P, 4P, 5P, 6P, and 9P only
F	PFA faced flange, 2" to 4", 150# to 300#, Configuration/Style code F only, Process connection codes 43, 44, 53, 54, 63, 64, DA, DB, EA, EB, FA, and FB only
G	Hygienic, AL6XN stainless steel (20 R _a finish), Configuration/Style code F only, Process connections codes 2P, 3P, 4P, 5P, 6P, and 9P only
H	Hygienic, Hastelloy C22, Configuration/Style code F only, Process connections codes 2P, 3P, 4P, 5P, 6P, and 9P only
K	316/316L stainless steel probe and process connection, ASME B31.1 specifications (model 7xS only)
N	Enlarged coaxial probe, 316/316L stainless steel probe, 2" minimum process connection
P	Enlarged coaxial probe, Hastelloy C, 2" minimum process connection
R	Enlarged coaxial probe, Monel probe, 2" minimum process connection
V	Optional PEEK™ spacers (for Model 7xD probe only)
W	Optional Teflon® spacers (for Model 7xD probe only)
4	PFA insulated rod, 2" NPT process connection or larger, Configuration/Style code F only

PROCESS CONNECTION SIZE/TYPE

Refer to pages 59 and 60 for selections

O-RINGS

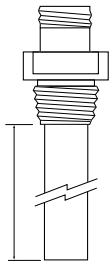
0	Viton® GFLT
1	EPDM (Ethylene Propylene Rubber)
2	Kalrez® 4079
8	Aegis PF128
N	None (Use with probes 7xD, 7xP, 7xF-E, 7xF-F, 7xF-G)

LENGTH

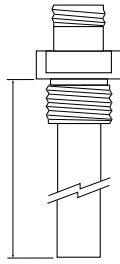
Refer to page 63 for selections



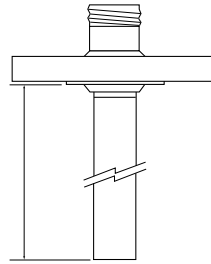
3.7.2 Probe



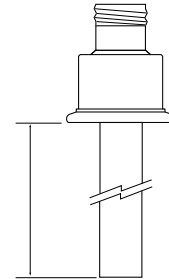
Insertion Length
NPT Process Connection



Insertion Length
BSP Process Connection



Insertion Length
ANSI or DIN Welded Flange



Insertion Length
Hygienic Flange

PROCESS CONNECTION SIZE/TYPE

THREADED CONNECTIONS

11	¾" NPT Thread ①
22	1" BSP Thread ①
41	2" NPT Thread ③
42	2" BSP Thread ③

2P	¾" Triclover® type, 16 AMP Hygienic Flange
3P	1" or 1½" Triclover® type, 16 AMP Hygienic Flange
4P	2" Triclover® type, 16 AMP Hygienic Flange
5P	3" Triclover® type, 16 AMP Hygienic Flange
6P	4" Triclover® type, 16 AMP Hygienic Flange
9P	2½" Triclover® type, 16 AMP Hygienic Flange

ANSI RAISED FACE FLANGE CONNECTIONS

23	1" 150#	ANSI Raised Face Flange ①
24	1" 300#	ANSI Raised Face Flange ①
25	1" 600#	ANSI Raised Face Flange ②
27	1" 900/1500#	ANSI Raised Face Flange ②
28	1" 2500#	ANSI Raised Face Flange ②
33	1½" 150#	ANSI Raised Face Flange ①
34	1½" 300#	ANSI Raised Face Flange ①
35	1½" 600#	ANSI Raised Face Flange ②
37	1½" 900/1500#	ANSI Raised Face Flange ②
38	1½" 2500#	ANSI Raised Face Flange ②
43	2" 150#	ANSI Raised Face Flange ①
44	2" 300#	ANSI Raised Face Flange ①
45	2" 600#	ANSI Raised Face Flange ②
47	2" 900/1500#	ANSI Raised Face Flange ②

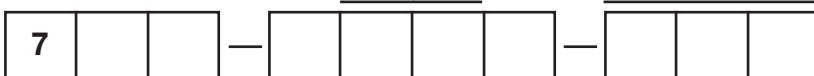
48	2" 2500#	ANSI Raised Face Flange ②
53	3" 150#	ANSI Raised Face Flange
54	3" 300#	ANSI Raised Face Flange
55	3" 600#	ANSI Raised Face Flange ②
56	3" 900#	ANSI Raised Face Flange ②
57	3" 1500#	ANSI Raised Face Flange ②
58	3" 2500#	ANSI Raised Face Flange ②
63	4" 150#	ANSI Raised Face Flange
64	4" 300#	ANSI Raised Face Flange
65	4" 600#	ANSI Raised Face Flange ②
66	4" 900#	ANSI Raised Face Flange ②
67	4" 1500#	ANSI Raised Face Flange ②
68	4" 2500#	ANSI Raised Face Flange ②

ANSI RING JOINT FLANGE CONNECTIONS

3K	1½" 600#	ANSI Ring Joint Flange ②
3M	1½" 900/1500#	ANSI Ring Joint Flange ②
3N	1½" 2500#	ANSI Ring Joint Flange ②
4K	2" 600#	ANSI Ring Joint Flange ②
4M	2" 900/1500#	ANSI Ring Joint Flange ②
4N	2" 2500#	ANSI Ring Joint Flange ②
5K	3" 600#	ANSI Ring Joint Flange ②

5L	3" 900#	ANSI Ring Joint Flange ②
5M	3" 1500#	ANSI Ring Joint Flange ②
5N	3" 2500#	ANSI Ring Joint Flange ②
6K	4" 600#	ANSI Ring Joint Flange ②
6L	4" 900#	ANSI Ring Joint Flange ②
6M	4" 1500#	ANSI Ring Joint Flange ②
6N	4" 2500#	ANSI Ring Joint Flange ②

- ① Configuration/Style Codes A, D, P, R, S & T only
- ② Configuration/Style Codes D, J, P & S only
- ③ Configuration/Style Codes B, F, J, 1, 2, 5 & 7 only



PROPRIETARY AND SPECIALTY FLANGE CONNECTIONS

TT	3½" 600#	Fisher® - Proprietary Carbon Steel (249B) Torque Tube Flange
TU	3½" 600#	Fisher - Proprietary 316 Stainless Steel (249C) Torque Tube Flange
UT	3½" 600#	Masoneilan® - Proprietary Carbon Steel Torque Tube Flange
UU	3½" 600#	Masoneilan - Proprietary 316 Stainless Steel Torque Tube Flange

DIN FLANGE CONNECTIONS

BA	DN 25, PN 16	DIN 2527 Form B Flange ①	EA	DN 80, PN 16	DIN 2527 Form B Flange
BB	DN 25, PN 25/40	DIN 2527 Form B Flange ①	EB	DN 80, PN 25/40	DIN 2527 Form B Flange
BC	DN 25, PN 64/100	DIN 2527 Form E Flange ①	ED	DN 80, PN 64	DIN 2527 Form E Flange ①
BF	DN 25, PN 160	DIN 2527 Form E Flange ②	EE	DN 80, PN 100	DIN 2527 Form E Flange ①
CA	DN 40, PN 16	DIN 2527 Form B Flange ①	EF	DN 80, PN 160	DIN 2527 Form E Flange ②
CB	DN 40, PN 25/40	DIN 2527 Form B Flange ①	EG	DN 80, PN 250	DIN 2527 Form E Flange ②
CC	DN 40, PN 64/100	DIN 2527 Form E Flange ①	EH	DN 80, PN 320	DIN 2527 Form E Flange ②
CF	DN 40, PN 160	DIN 2527 Form E Flange ②	EJ	DN 80, PN 400	DIN 2527 Form E Flange ②
CG	DN 40, PN 250	DIN 2527 Form E Flange ②	FA	DN 100, PN 16	DIN 2527 Form B Flange
CH	DN 40, PN 320	DIN 2527 Form E Flange ②	FB	DN 100, PN 25/40	DIN 2527 Form B Flange
CJ	DN 40, PN 400	DIN 2527 Form E Flange ②	FD	DN 100, PN 64	DIN 2527 Form E Flange ①
DA	DN 50, PN 16	DIN 2527 Form B Flange	FE	DN 100, PN 100	DIN 2527 Form E Flange ①
DB	DN 50, PN 25/40	DIN 2527 Form B Flange	FF	DN 100, PN 160	DIN 2527 Form E Flange ②
DD	DN 50, PN 64	DIN 2527 Form E Flange ①	FG	DN 100, PN 250	DIN 2527 Form E Flange ②
DE	DN 50, PN 100	DIN 2527 Form E Flange ①	FH	DN 100, PN 320	DIN 2527 Form E Flange ②
DF	DN 50, PN 160	DIN 2527 Form E Flange ②	FJ	DN 100, PN 400	DIN 2527 Form E Flange ②
DG	DN 50, PN 250	DIN 2527 Form E Flange ②			
DH	DN 50, PN 320	DIN 2527 Form E Flange ②			
DJ	DN 50, PN 400	DIN 2527 Form E Flange			

- ① Configuration/Style Codes A, D, P, R & S only
- ② Configuration/Style Codes D & P only

LENGTH – RIGID PROBE MODELS

24" to 240" (60 cm to 610 cm) (7xS only: 180" (457 cm) maximum)
 (unit of measure is determined by second digit of Model Number)
 Examples: 24 inches = 024; 60 centimeters = 060

LENGTH – FLEXIBLE PROBE MODEL

6' to 75' (1 to 22 m)
 (unit of measure is determined by second digit of Model Number)
 Examples: 30 feet = 030; 10 meters = 010



Glossary

Accuracy The maximum positive and negative % deviation over the total span.

ANSI *American National Standards Institute.*

ATEX *ATmospheric EXplosive* European regulations governing the use in hazardous areas.

Blocking Distance The distance between the top of the probe (fiducial) and the point at which meaningful measurement can be expected.

CE *Conformité Européene* Standards and performance criteria for the new European Union.

CENELEC *Comité Européen de Normalisation Electrotechnique* European organization that sets standards for electrical equipment.

Coaxial Probe The most sensitive waveguide in the TDR family. The concentric design (rod inside a tube) is useful in very low dielectric media that are clean and have low viscosity.

CSA *Canadian Standards Association* Canadian third-party agency that qualifies the safety of electrical equipment.

Damping Amount of time required to reach 99% of actual level change.

Default Screens The main position of the menu structure that displays the primary measurement values of LEVEL, % OUTPUT, and LOOP. The transmitter returns to this position after 5 minutes of inactivity.

Dielectric Constant (ϵ) The electrical permittivity of a material. The units are farad/meter.

DVM/DMM Digital Volt Meter/Digital Multimeter.

Electromagnetic Energy The radiation that travels through space as electric and magnetic fields varying with position and time. Examples in increasing frequency: radio waves, microwave, infrared light, visible light, ultraviolet light, x-rays, gamma waves, and cosmic waves.

EM *See Electromagnetic Energy.*

EMI *Electromagnetic Interference* Electrical noise caused by electromagnetic fields that may affect electrical circuits, particularly low-power electronic devices.

EN *European Normal* Committee guidelines in EC countries that take precedence over local, country guidelines.

ENV Preliminary EN guidelines, or pre-standards.

Ergonomic A mechanism that considers human capability in its design or function.

ETS *Equivalent Time Sampling* Process that captures high speed electromagnetic events in real time (nanoseconds) and reconstructs them into an equivalent time (milliseconds).

Explosion Proof Enclosure An enclosure designed to withstand an explosion of gas or vapor within it and prevent the explosion from spreading outside the enclosure.

Factory Sealed A third-party-approved Explosion Proof seal installed in the unit during manufacturing. This alleviates the end user from installing an external XP seal adjacent (within 18") to the device.

Fault A defect or failure in a circuit. The current (mA) value unit defaults to 3.6, 22, or Hold when a diagnostic condition occurs.

Feedthrough A small connecting cavity between the main housing compartments, carrying the cable that supplies the operating energy to the measurement circuitry and returns the output value proportional to level. This cavity is potted to maintain the environmental isolation between the two compartments.

Fid Gain *Fiducial Gain* Amount of amplification added to Fiducial (baseline) area of measurement.

Fiducial The reference signal at the top of the probe.

Fiducial Tick A value related to baseline timing that adjusts the timing window, which enhances resolution. (Factory setting).

FM *Factory Mutual* American third party agency that qualifies the safety of electrical equipment.

Four Wire An electronic instrument design that uses one set of wires to supply power (120/240 VAC, 24 VDC) and another set to carry the process measurement signal (4–20 mA). Also called *Line-powered*.

FSK Frequency Shift Keying. *See HART.*

Gain Amplification adjustment to attain optimum performance in various product dielectric ranges. (Factory setting).

Ground An electrical connection to the Earth's potential that is used as a reference for the system and electrical safety.

Grounded A state where no electrical potential exists between the ground (green) connection on the transmitter and the Earth or system ground.

Guided Wave Radar *See TDR.*

HART *Highway Addressable Remote Transducer.* Protocol that uses the Bell 202 frequency shift keying (FSK) method to superimpose low level frequencies (1200/2000 Hz) on top of the standard 4–20 mA loop to provide digital communication.

HART ID *See Poll Address.*

Hazardous Area An area where flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

IEC *International Electrotechnical Commission* Organization that sets international standards for electrical devices.

Increased Safety Designs and procedures that minimize sparks, arcs, and excessive temperatures in hazardous areas. Defined by the IEC as Zone 1 environments (Ex e).

Interface: Electrical A boundary between two related electronic circuits.

Interface: Process A boundary between two immiscible liquids.

Intrinsically Safe Ground A very low resistance connection to a ground; in accordance with the National Electrical Code (NEC, ANSI/NFPA 70 for FMRC), the Canadian Electrical Code (CEC for CSA) or the local inspector.

Intrinsic Safety A design or installation approach that limits the amount of energy that enters a hazardous area to eliminate the potential of creating an ignition source.

Level The present reading of the height of material in a vessel.

Linearity The worst case error calculated as a deviation from a perfect straight line drawn between two calibration points.

Line-Powered See *Four Wire*.

Loop The present reading of the 4-20 mA current output.

Loop-Powered See *Two Wire*.

Low Voltage Directive A European Community requirement for electrical safety and related issues of devices using 50–1000 VDC or 75–1500 VAC.

Measured Value The typical level measurement values used to track the level of a process: Level, % Output, and Loop.

Medium The liquid material being measured by the level transmitter.

MIR *Micropower Impulse Radar*. Distance or level measurement technique that combines Time Domain Reflectometry, Equivalent Time Sampling, and high speed/low power circuitry.

Multidrop The ability to install, wire, or communicate with multiple devices over one cable. Each device is given a unique address and ID.

Non-hazardous Area An area where no volatile mixtures of vapors/gas and oxygen will be found at any time. Also called *General Purpose Area*.

Non-incendive A circuit in which any arc or thermal effect produced under intended operating conditions of the equipment is incapable, under specific test conditions, of igniting the flammable gas, vapor, or dust-air mixture.

Offset The distance from the bottom of the tank to the bottom of the probe.

Password A numerical value between 0 and 255 that protects stored configuration data from unauthorized manipulation.

Percent (%) Output The present reading as a fraction of the 16 mA scale (4–20 mA).

Poll Address (HART ID) A number between 1 and 15 which sets an address or location of a device in a multi-drop loop. Poll address for single device configuration is 0.

Probe A waveguide that propagates an electromagnetic pulse from the top of the tank into the process fluid.

Probe Ln *Probe Length* Exact measurement from the bottom of the process thread connection (where the rod exits the mounting gland) to the very bottom of the probe.

Prb Model *Probe Model* Particular waveguide configuration or design. Each probe type is designed to accomplish specific objectives in an application.

Prb Mount *Probe Mount* The type of process mounting (NPT, BSP or Flange) utilized in the installation. This aids in establishing exact zero point for Guided Wave Radar propagation and measurement.

QuickStart The essential information needed for the Eclipse transmitter and probe to be installed, wired, and calibrated.

Radar *Radio Detection And Ranging* Uses EM energy and high speed timing circuits to determine distance. Original Radar devices used energy in the radio frequency range (MHz), many current devices use much higher frequencies (GHz).

Range A value related to probe length (factory setting).

Relative Dielectric (ϵ_r) A unitless number that indicates the relative permittivity of a material.

Repeatability The maximum error between two or more output readings of the same process condition.

RFI *Radio Frequency Interference* Electrical noise that can have an adverse affect on electrical circuits, particularly low-power devices.

Single Rod Probe A probe that uses one active rod and a launch plate (mounting nut, flange, and tank top) to achieve propagation. This configuration is the least efficient wave-guide, but most forgiving of coating and buildup.

Span The difference between the upper and lower limits of the range.

Specific Gravity (SG) The ratio of the density of a material to the density of water at the same conditions.

Sensitivity The amount of amplification applied to the Level signal; a higher value aids in measuring low dielectric media; a lower number assists in ignoring nearby objects.

TDR *Time Domain Reflectometry* Uses a waveguide to carry EM energy to and from the surface of the media to measure distance; similar to conventional through-air Radar but much more efficient. Also called *Guided Wave Radar*.

Threshold Method in which unit chooses correct level signal. CFD factory default. Select Fixed Threshold when low dielectric material is over higher dielectric material and unit is reading incorrect level. Example: oil over water. Adjustment of scale offset may be necessary.

Tick The smallest digital increment of time utilized in the level measurement.

Tst Loop *Test Loop* Built-in system capability to test/calibrate a loop (or separate loop device) by driving the transmitter output to a particular value.

Trim 4/Trim 20 Built-in system capability to fine tune the 4 mA and 20 mA points so the transmitter output corresponds exactly to user's meter, DCS input, etc.

Twin Rod Probe A probe that uses two parallel rods to propagate the EM pulse to the level surface and back. This design is less efficient and less sensitive than the coaxial probe and is typically used for higher dielectric media and coating problems.

Two Wire An electrical instrument design that uses one set of wires to provide both the supply power and process measurement signal. The process measurement is achieved by varying the current of the loop. Also called *Loop-powered*.

Units The engineering units used to measure level in the system. The choices are in (inches) and cm (centimeters).

Waveguide See *Probe*.

<Window> A time slice variable that enhances system resolution. (Factory setting).



705 Eclipse Guided Wave Radar Transmitter Configuration Data Sheet

Copy blank page and store calibration data for future reference and troubleshooting.

Item	Value	Value	Value		
Vessel Name					
Vessel #					
Process Medium					
Tag #					
Electronics Serial #				TROUBLESHOOTING	
Probe Serial #				Working Value	Non-Working Value
Level					
Volume (optional)					
Interface (optional)					
Interface Volume (opt.)					
Probe Model					
Probe Mount					
Measurement Type					
Level Units					
Probe Length					
Level Offset					
Volume Units (opt.)					
Strapping Table (opt.)					
Dielectric					
Sensitivity					
Loop Control					
4mA point					
20mA point					
Damping					
Blocking Distance					
Safety Zone Fault					
Safety Zone Height					
Safety Zone Alarm					
Fault Choice					
Threshold					
Interface Threshold					
HART Poll Address					
Level Trim					
Trim 4mA					
Trim 20mA					
Level Ticks					
Interface Ticks (opt.)					
<Software Version>					
HF cable					



705 Eclipse Guided Wave Radar Transmitter

Configuration Data Sheet

Copy blank page and store calibration data for future reference and troubleshooting.

Item	Value	Value	Value	TROUBLESHOOTING	
				Working Value	Non-Working Value
FidTicks					
FidSprd					
Fid Type					
Fid Gain					
Window					
Conv Fct					
Scl Ofst					
Neg Ampl					
Pos Ampl					
Signal					
Compsate					
DrateFct					
Targ Ampl					
Targ Tks					
Targ Cal					
OperMode					
7xKCorr					
ElecTemp					
Max Temp					
Min Temp					
SZ Hyst					
Name					
Date					
Time					

Service Policy

Owners of Magnetrol 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. Magnetrol 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 a Magnetrol local representative or by contacting the factory. Please supply 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.

Eclipse Guided Wave Radar transmitters may be protected by one or more of the following U.S. Patent Nos. US 6,626,038; US 6,640,629; US 6,642,807. May depend on model.



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