Installation & Maintenance Instructions

MAGNETROL ECLIPSE 705

Guided Wave Radar Level Transmitter

Supplied by

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ECLIPSE®

Enhanced Model 705

Software v3.x

Installation and Operating Manual
for use in the Hygienic Industries

Guided Wave Radar

Level Transmitter

FOUNDATION

HART COMMUNICATION PROTOCOL

PACTware

AMS aware

FDT CERTIFIED

SIL 3 Certified — Safety • Integrity • Level

PROFI

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MAGNETROL® / AMETEK®

LEVEL MEASUREMENT
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Read this Manual Before Installing

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

Conventions Used in this Manual

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

NOTES

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

Cautions

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

WARNINGS

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

Safety Messages

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

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

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

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

Low Voltage Directive

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

Warranty

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

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

Quality Assurance

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

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.

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

Table of Contents

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.

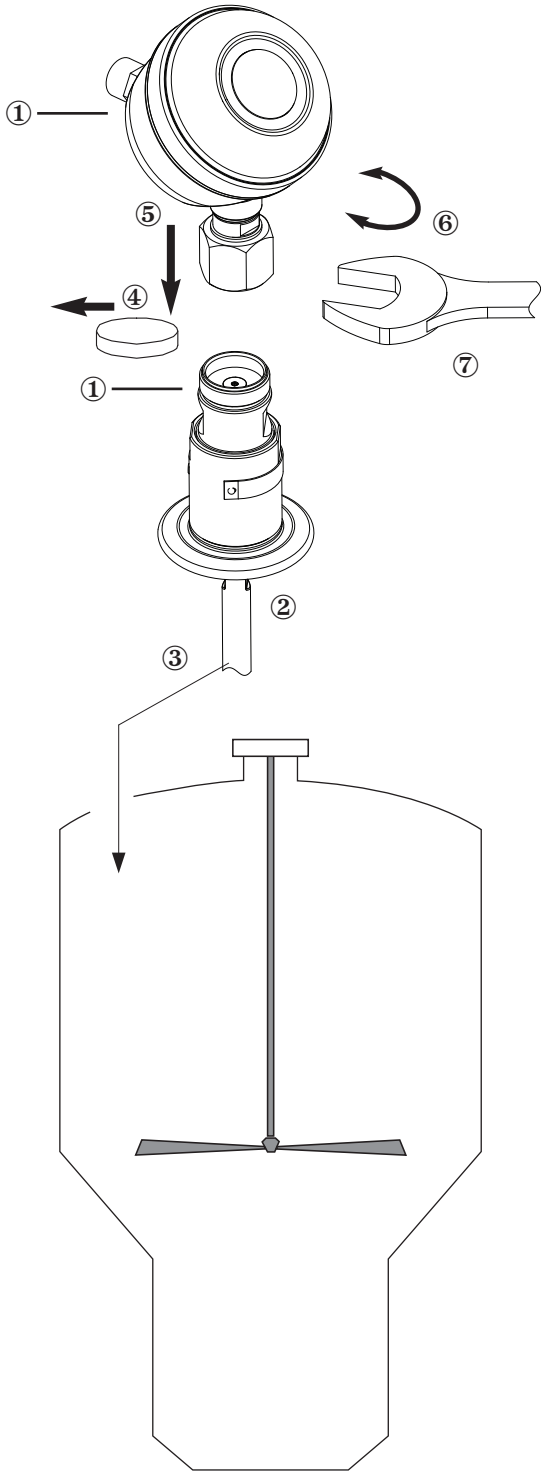
1.1 Getting Started

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

1.1.1 Equipment and Tools

- 1½" (38 mm) wrench. Proper tools to fit the process connection type.
- Flat-blade screwdriver
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA minimum
- Soft jaw wrench (to tighten electropolished rod to process connection on model 7xH probe)

NOTE: If soft jaw wrench is not available, attach a flexible polymeric or elastomeric hose over electropolished rod wrench flats to tighten or loosen.



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	Set to flange when using tri-clamp mounting	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) (AI block parameter. Not selectable at transmitter on Model 705 Fieldbus)	_____
Probe Length	What is the probe length? (Note that the original probe may have been shortened by the skid or vessel manufacturer to fit the vessel.)	_____
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? (*Upper layer dielectric for interface applications*)	_____
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) (Top 6" (152 mm) of Single Rod probes is within Blocking Distance)	_____

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 optimum performance, it is highly recommended to keep the transmitter and probe matched as a set.

1.2.1 Probe

② Attach probe rod to process connection using soft jaw wrench [tighten to 75 inch-lbs. (8.5 Nm)].

③ Carefully place the probe into the vessel. Align the probe as necessary on the vessel.

1.2.2 Transmitter

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.

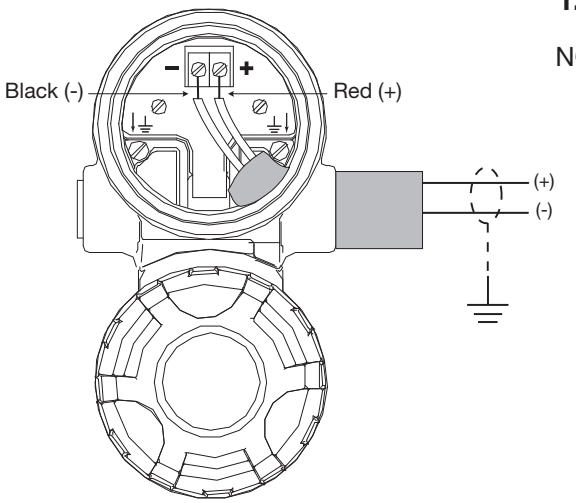
④ Remove the protective plastic cap from the top of the probe and store for future use. Make sure the top probe connector (female socket) is clean and dry. Clean with isopropyl alcohol and cotton swabs if necessary.

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 (60 Nm). 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.



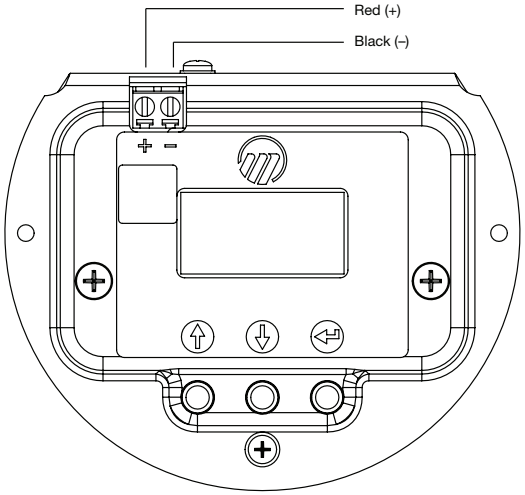
Dual Compartment Aluminum Housing

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.

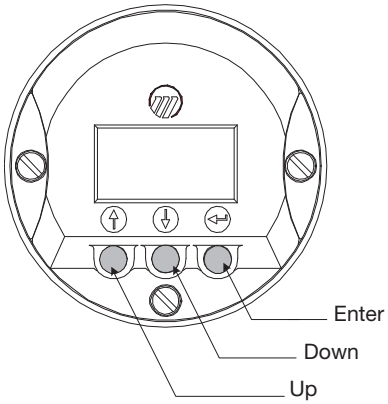
NOTE: Ensure that the electrical wiring to the Eclipse transmitter is complete and in compliance with all regulations and codes.

1. Remove the transmitter cover (the upper wiring compartment of the dual compartment aluminum version).
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.



Single Compartment 304 ss Housing

1.4 QuickStart Configuration

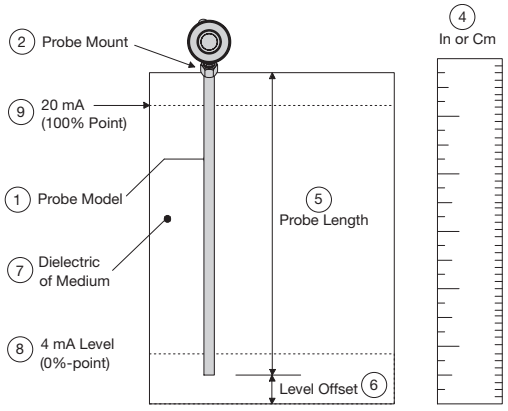


The Eclipse transmitter is configured with default values from the factory but can be reconfigured in the shop (disregard any fault messages due to unattached probe). The minimum configuration instructions required in the field follow. Use the information from the operating parameters table in Section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

1. Power-up the transmitter.

   The display changes every five seconds to show one of four values: Status, Level, %Output, and Loop current.
2. Remove the transmitter cover (the lower electronic compartment of the dual compartment aluminum version).
3. Use the Up or Down Arrow (⇧ ⇩) keys to move from one step of the configuration program to the next step.
4. Press the Enter Arrow (⇦) key. The last character in the first line of the display changes to an exclamation point (!).
5. Use the Up or Down Arrow (⇧ ⇩) keys to increase or decrease the value in the display or to scroll through the choices.
6. Press the Enter Arrow (⇦) key to accept a value and move to the next step of the configuration program (the default password is 0).
7. 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" (0–15cm)] may exist at the top and bottom of the probe. See Specifications, Section 7.4.

①	`PrbModel (select)`	Select the **Probe Model** to be used **Model 705:** 7xF-E or 7xH-X
②	`PrbMount (select)`	Select the type of **Probe Mounting** to vessel (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.**
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. (Typically 10–100 for hygienic applications)
⑧	`Set 4mA xxx.x`	Enter the level value (0%-point) for the **4 mA** point (not included on Model 705 fieldbus).
⑨	`Set 20mA xxx.x`	Enter the level value (100%-point) for the **20 mA** point (not included on Model 705 fieldbus).

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.

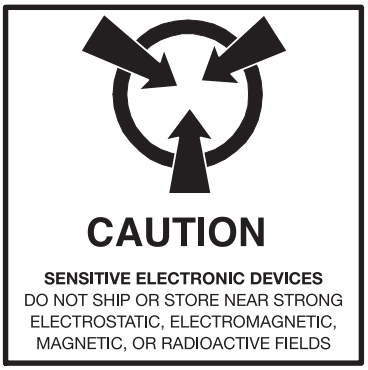
Before proceeding with the installation, do the following:

- 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 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 7.0.

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:

- 1½" (38 mm) wrench.
- Flat-blade screwdriver
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA
- Soft jaw wrench (to tighten electropolished rod to process connection on model 7xH probe)

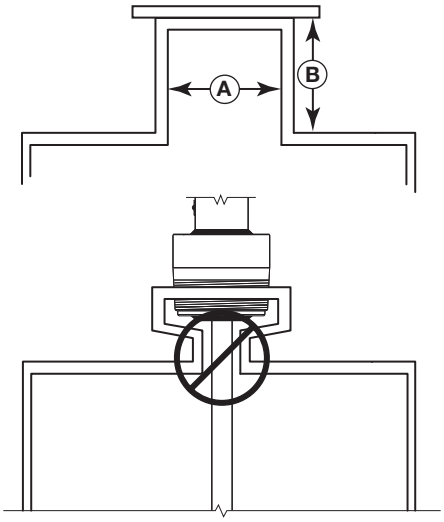
NOTE: If soft jaw wrench is not available, attach a flexible polymeric or elastomeric hose over electropolished rod wrench flats to tighten or loosen.

2.3.3 Operational Considerations

Operating specifications vary based on probe model number. See Specifications, Section 7.2.

2.4 Mounting

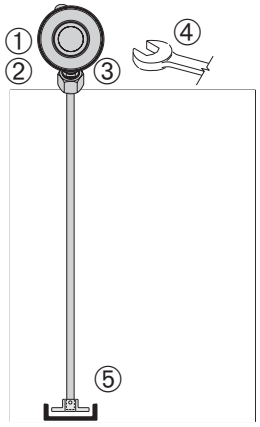
Make sure all mounting connections are properly in place on the tank before installing the probe. Compare the nameplate on the probe and transmitter with the product information; make sure the Eclipse probe is correct for the intended installation.



2.4.1 Prior to Installing a Hygienic Single Rod Probe (Models 7xF and 7xH)

Before installing, ensure the:

- 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 length does not restrict performance by ensuring the following:
  - Ratio of Diameter: Length (A:B) is 1:1 or greater; any ratio, 1:1 (e.g., a 2" × 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment
  - Probe is not in contact with conductive objects with in the vessel.



2.4.1.1 To install a Model 7xF or Model 7xH rigid single rod hygienic probe:

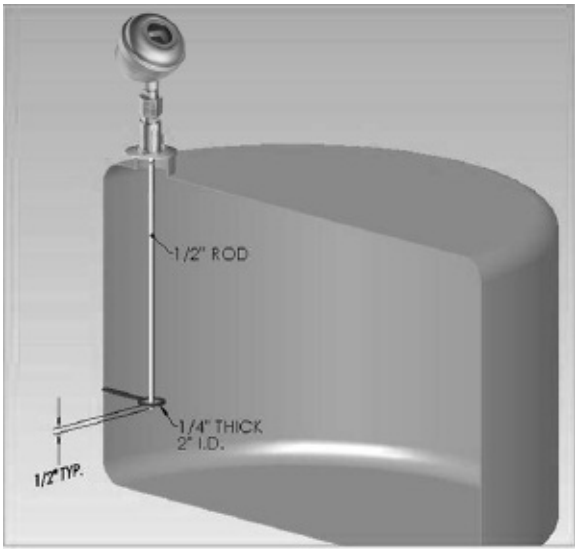
① Confirm the model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.

② Attach probe rod to process connection using soft jaw wrench [tighten to 20–25 inch-lbs. (2.25-3 Nm)].

③ Carefully place the probe into the vessel. Align the probe as necessary on the vessel.

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.

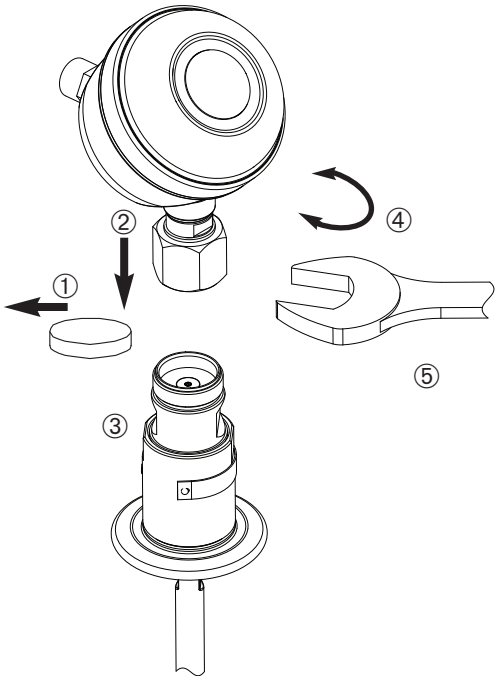
⑤ Place the transmitter on the probe. Align the universal connection at the base of the transmitter housing with the top of the probe. Tighten the connection to 45 ft–lbs.



One method for stabilizing probe within a vessel

2.4.2 Installing the Transmitter

The transmitter can be ordered for installation as an integral or remote configuration.



2.4.2.1 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 become 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.

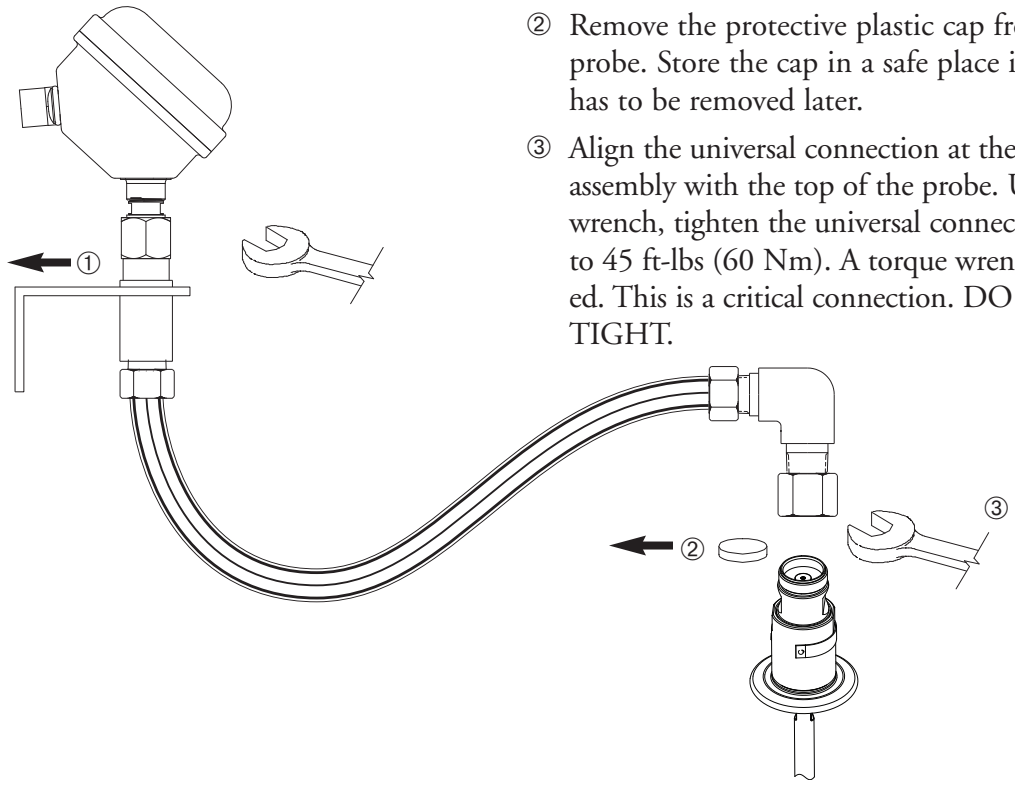
⑤ When the transmitter is facing the desired direction, use a 1½" (38 mm) wrench to tighten the universal connection on the transmitter to 45 ft-lbs (60 Nm). A torque wrench is highly recommended. This is a critical connection. DO NOT LEAVE HAND-TIGHT.

2.4.2.2 Remote Mount

① Mount the transmitter/remote bracket as an assembly within 33" or 144" (84 or 366 cm) of the probe. DO NOT REMOVE TRANSMITTER OR REMOTE CABLE FROM BRACKET.

② Remove the protective plastic cap from the top of the probe. Store the cap in a safe place in case the transmitter has to be removed later.

③ Align the universal connection at the end of the remote assembly with the top of the probe. Using a 1½" (38 mm) wrench, tighten the universal connection on the transmitter to 45 ft-lbs (60 Nm). A torque wrench is highly recommended. This is a critical connection. DO NOT LEAVE HAND-TIGHT.



2.5 Wiring

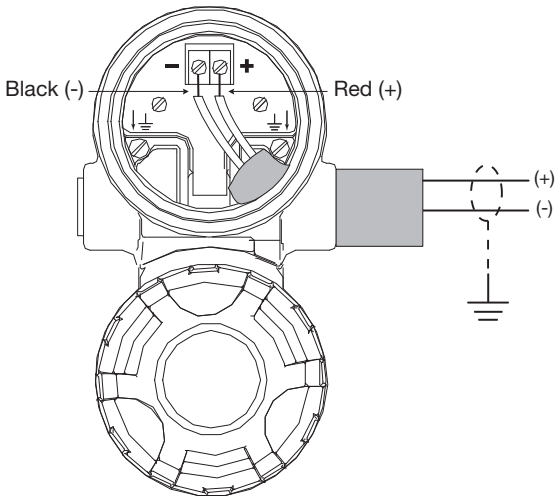
Caution: All versions of the Eclipse Model 705 transmitter operate at voltages of 11–36 VDC. Higher voltage will damage the transmitter.

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:

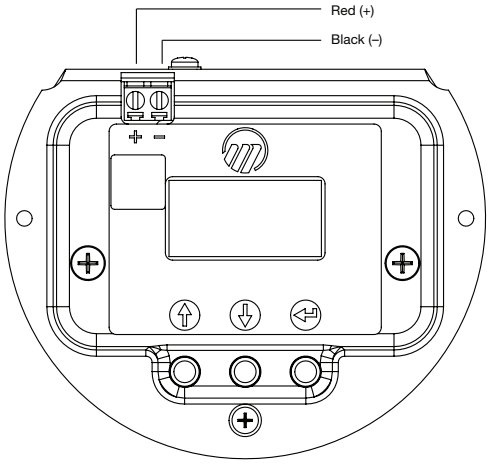
- General Purpose or Non-incendive (Cl I, Div. 2)
- Intrinsically Safe
- Explosion Proof

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

Wiring Diagram



Dual Compartment Aluminum Housing



Single Compartment 304 ss Housing

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

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

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

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 5.4.2.

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 5.3.1.

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.

2.6 Configuring the Transmitter

The Eclipse transmitter is factory-configured 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.

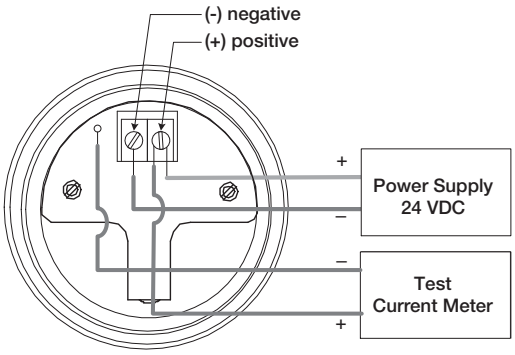
Refer to instruction manual 57-640 for detailed FOUNDATION fieldbus information.

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.

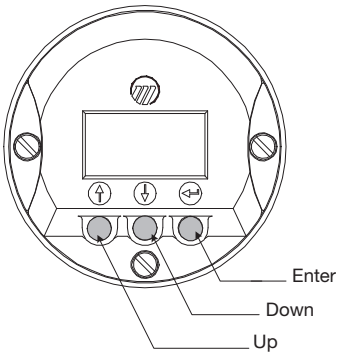


Model 705 with Test Meter

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 Ω 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 five seconds to display STATUS, LEVEL, %OUTPUT, and LOOP information (LEVEL, %OUTPUT, and STATUS for Fieldbus version). The transmitter defaults to this display after five minutes without a keystroke.

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. *NOTE: Hold arrow key for rapid scrolling.*
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

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 *Status, Level, % Output,* and *Loop* values cycles every 5 seconds

2	`Level` `xxx.x`	Transmitter Display	Transmitter displays *Level Value* in selected units
3	`% Output` `xx.x%`	Transmitter Display	Transmitter displays *% Output* measurement derived from 20 mA span
4	`Loop` `xx.xx mA`	Transmitter Display	Transmitter displays *Loop* value (mA)
5	`PrbModel` `(select)`	**Select** the type of probe used (Example: 7xR-x)	Select from **7xF-E** or **7xH-X** as shown on the probe nameplate
6	`PrbMount` `(select)`	**Select** the type of probe mounting	Select **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	Note that the original probe may have been shortened by the skid or vessel manufacturer to fit the vessel.
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 **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" [0–15cm]) may exist at the top/bottom of the probe. See *Functional Specifications Probe, Section 3.6.1*
15	Set 20mA xxx.x lu	**Enter** the PV value for the 20 mA point	A small transition zone (0–6" [0–15cm]) may exist at the top/bottom of the probe. See *Functional Specifications Probe, Section 3.6.1*
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	*Safety Zone* is a user-defined area just below the *Blocking Distance*. 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 *Blocking Distance*. Here the unit will report a *Safety Zone Fault* (#19) if the level rises into this area.
21	SZ Alarm Reset	**Press Enter** to clear a latched Safety Zone alarm	Clear a latched *Safety Zone* 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 (0-63)	Select a HART poll address (0–63). Enter 0 for a single transmitter installation. Poll address does not affect loop current.
24	Loop Mode	Enable/Disable	Determines whether the loop is fixed at 4.0 mA or controlled by the PV.
25	Trim Lvl xx.x lu	**Enter** value to adjust Level reading	-10.0 inches ≤ Lvl Trim ≤ +10.0 inches *(Requires superuser password)*
26	Trim 4 xxxx	Fine tune the 4 mA point	Adjust setting to output exactly 4.0 mA on current meter
27	Trim 20 xxxx	Fine tune the 20 mA point	Adjust setting to output exactly 20.0 mA on current meter
28	Loop Tst xx.x mA	**Enter** a mA Output value	Set mA output to any given value to perform loop test
29	LvlTicks Xxxxx	Diagnostic Display	Time of flight from fiducial to level signal
30	New Pass xxx	**Enter** new password (0-255)	Displays encrypted value of present password
31	Language (select)	**Select** from English, Spanish, French, German	Language choice for LCD display
32	Mdl705HT Ver3.0a0	Transmitter display	Product identification Firmware version

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

	Display	Action	Comment
33	DispFact (select)	**Select** Yes to display factory parameter menus	
34	History (current status)	**Press Enter** to view history of exceptions	Diagnostic Display
35	Run Time		
36	History Reset	**Press Enter** and select yes to clear history	Similar to SZ Alarm Reset
37	HF cable (select)	Superuser Parameter	Select from 3-foot or 12-foot (84 cm or 366 cm) remote
38	FidTicks xxxx	Diagnostic Display	Time of flight from start of ramp to fiducial
39	FidSprd		
40	Fid Type (select)	Superuser Parameter	Select from positive or negative (Selection only allowed for some probes)
41	Fid Gain xxx	Superuser Parameter	Amount of gain applied to the fiducial signal
42	Window xxx	Factory Parameter	
43	Conv Fct xxxx	Factory Parameter	Calibration parameter
44	Scl Ofst xxx	Factory Parameter	Calibration parameter
45	Neg Ampl xxx	Superuser Password	Diagnostic parameter
46	Pos Ampl xxx	Superuser Password	Diagnostic parameter
47	Signal xxx	Diagnostic Display	Indication of level signal amplitude
48	Compsate (select)	Superuser Password	Select from None, Manual, Auto
49	DrateFct xxxx	Diagnostic Display	Compsate = Auto. Velocity derating factor for Model 7xS Steam probe
50	Targ Ampl xxxx	Diagnostic Display	Compsate = Auto. Indication of steam reference target amplitude
51	Targ Tks xxxx	Diagnostic Display	Compsate = Auto. Measured time of flight from fiducial to steam reference target
52	Targ Cal xxxx	Diagnostic Display	Compsate = Auto. Calibrated time of flight from fiducial to target in room temperature air
53	OperMode (select)	Superuser Password	Compsate = Auto. Select from Run, Cal, Off
54	7xKCorr xxx	Superuser Password	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 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: *Status, Volume, % Output* and *Loop* values cycles every 5 seconds
2	Volume xxx vu	Transmitter Display	Transmitter displays *Volume* in selected units
3	% Output xx.x%	Transmitter Display	Transmitter displays *% Output* measurement derived from 20 mA span
4	Loop xx.xx mA	Transmitter Display	Transmitter displays *Loop* value (mA)
5	Level xxx.x lu	Transmitter Display	Transmitter displays *Level Value* in selected units
6	PrbModel (select)	**Select** the type of probe used (Example: 7xR-x)	Select from **7xF-E** or **7xH-X** as shown on the probe nameplate
7	PrbMount (select)	**Select** the type of probe mounting	Select **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	Note that the original probe may have been shortened by the skid or vessel manufacturer to fit the vessel
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 **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" [0-15 cm)) may exist at the top/bottom of the probe. See *Functional Specifications Probe, Section 3.6.1*
18	Set 20mA xxxx vu	**Enter** the PV value for the 20 mA point	A small transition zone (0–6" [0-15 cm]) 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

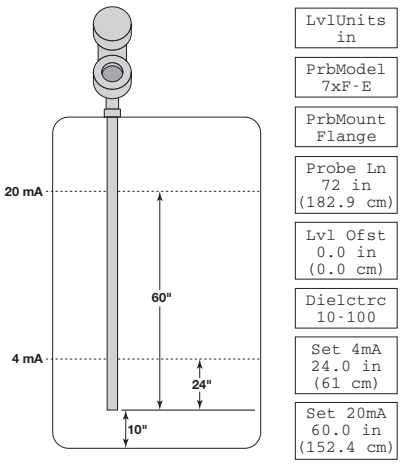
2.6.5.2 **Measurement Type: Level and Volume (Loop Control = Volume)**

	Display	Action	Comment
22	SZ Fault (select)	**Select** loop current behavior when level is sensed in safety zone	*Safety Zone* is a user-defined area just below the *Blocking Distance*. 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 *Blocking Distance*. Here the unit will report a *Safety Zone Fault* (#21) if the level rises into this area.
24	SZ Alarm Reset	**Press Enter** to clear a latched Safety Zone alarm	Clear a latched *Safety Zone* 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 (0-63)	Select a HART poll address (0–63). Enter 0 for a single transmitter installation. Poll address does not affect loop current.
27	Loop Mode	Enable/Disable	Determines whether the loop is fixed at 4.0 mA or controlled by the PV.
28	Trim Lvl xx.x lu	**Enter** value to adjust Level reading	-10.0 inches <= Lvl Trim <= +10.0 inches *(Requires superuser password)*
29	Trim 4 xxxx	Fine tune the 4 mA point	Adjust setting to output exactly 4.0 mA on current meter
30	Trim 20 xxxx	Fine tune the 20 mA point	Adjust setting to output exactly 20.0 mA on current meter
31	Loop Tst xx.x mA	**Enter** a mA Output value	Set mA output to any given value to perform loop test
32	LvlTicks xxxx	Diagnostic Display	Time of flight from fiducial to level signal
33	New Pass xxx	**Enter** new password (0-255)	Displays encrypted value of present password
34	Language (select)	**Select** from English, Spanish, French, German	Language choice for LCD display
35	Mdl705HT Ver3.0a0	Transmitter display	Product identification Firmware version
36	DispFact (select)	**Select** Yes to display factory parameter menus	Allows for viewing the factory parameters
37	History (current status)	**Press Enter** to view history of recent exceptions	Diagnostic Display
38	HF cable (select)	Superuser Parameter	Select from 3- or 12-foot (84 or 366 cm) remote
39	Run Time		
40	History Reset	**Press Enter** and select yes to clear history	Similar to SZ Alarm Reset
41	FidTicks xxxx	Diagnostic Display	Time of flight from start of ramp to fiducial
42	Fid Type (select)	Superuser Password	Select from positive or negative (Selection only allowed for some probes)
43	Fid Spread		

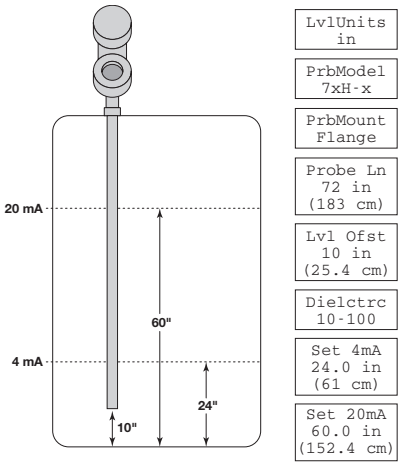
2.6.5.2 **Measurement Type: Level and Volume (Loop Control = Volume)**

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

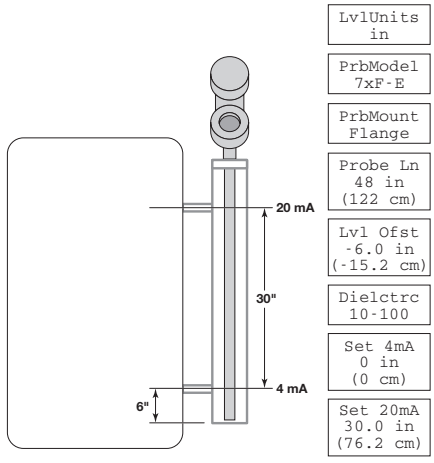
2.6.6 Offset Description



Example 1



Example 2



Example 3

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 (Lvl Ofst = 0 as shipped from factory):
Application calls for a 72-inch (183 cm) Model 7xF–E hygienic probe installed with the bottom of the probe 10 inches (25.4 cm) above the bottom of the tank. The user wants the 4 mA point at 24 inches (61 cm) and the 20 mA point at 60 inches (152.4 cm) 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:
Application calls for a 72-inch (183 cm) Model 7xH hygienic probe installed with the bottom of the probe 10 inches (25.4 cm) above the bottom of the tank. The user wants the 4 mA point at 24 inches (61 cm) and the 20 mA point at 60 inches (152.4 cm) as referenced from the bottom of the tank.

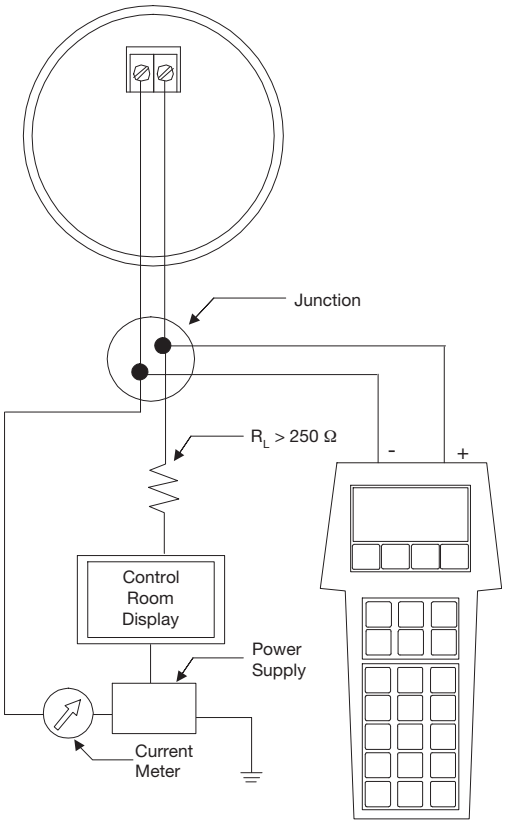
When the Eclipse transmitter is mounted in a chamber/bridle, it is usually desirable to configure the unit with the 4 mA (0%) point at the lower process connection and the 20 mA (100%) point at the upper process connection. The span is the center-to-center dimension. In this case, a negative Lvl Ofst 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:
Application calls for a 48-inch (122 cm) Model 7xF–E probe measuring water in a chamber with the bottom of the probe 6 inches (15.2) below the lower process connection. The user wants the 4 mA point to be 0 inches (0 cm) at the bottom process connection and the 20 mA point to be 30 inches (76.2 cm) at the top process connection.

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.

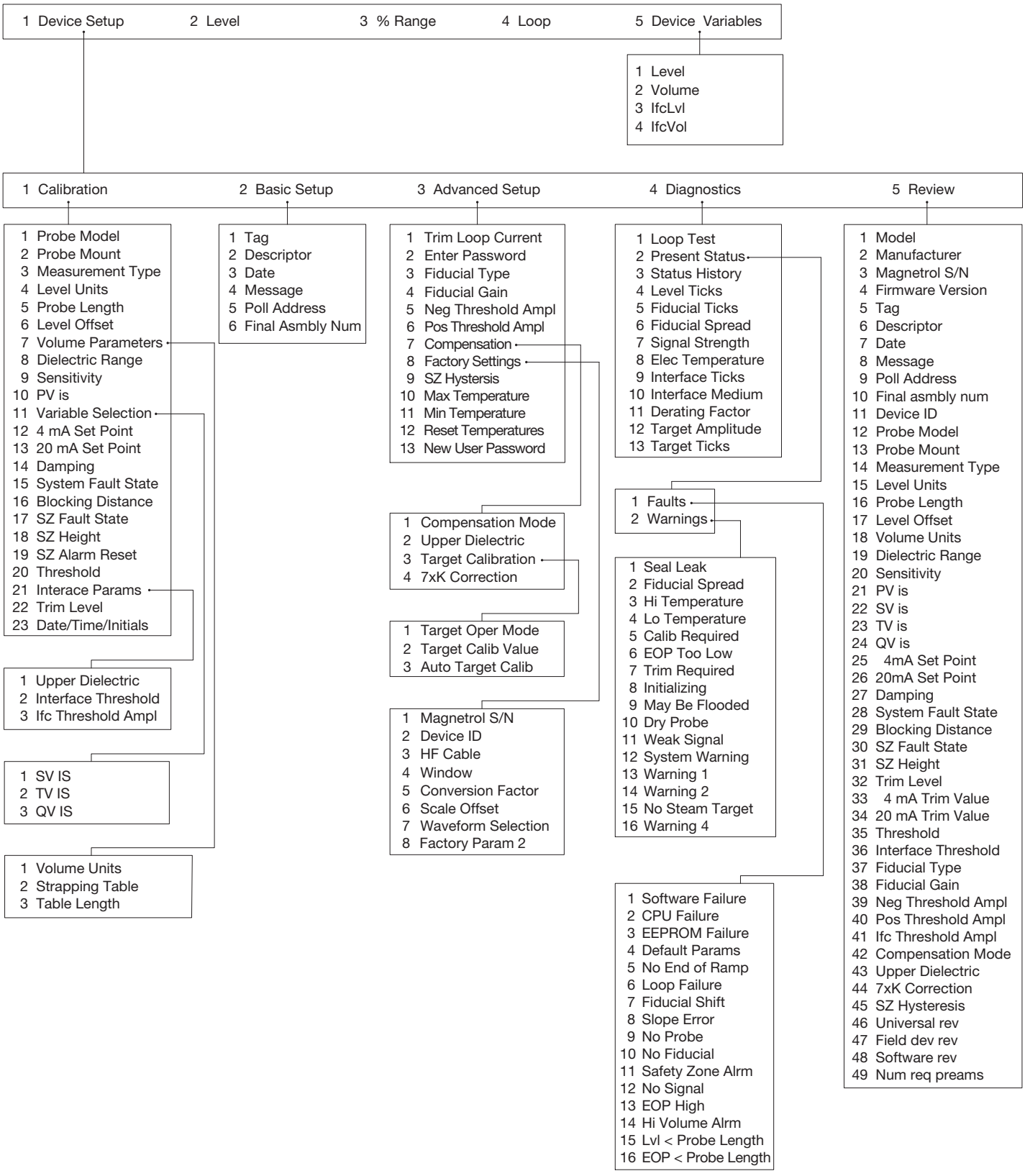
HART uses the Bell 202 frequency shift keying technique of high-frequency digital signals. It operates on the 4–20 mA loop and requires 250 Ω load resistance. A typical connection between a communicator and the Eclipse transmitter is shown at left.

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
Dev V2 DD V1	August 2011	Version 3.2A and later

3.0 Reference Information

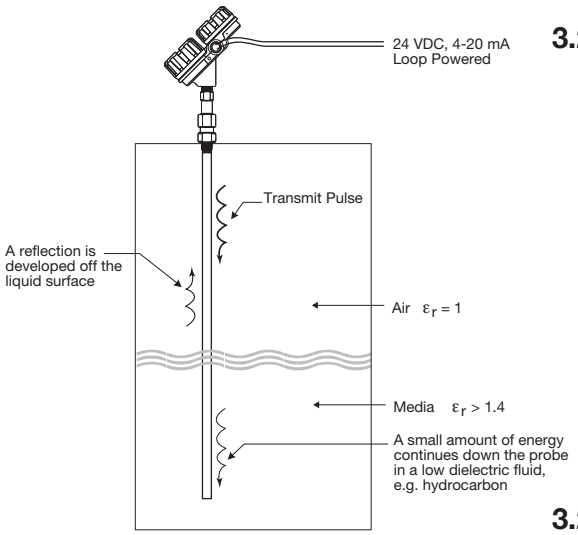
This section presents an overview of the operation of the Eclipse Guided Wave Radar Level Transmitter, information on troubleshooting common problems, listings of agency approvals, lists of replacement and recommended spare parts, and detailed physical, functional, and performance specifications.

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.

Refer to Appendix A for information concerning the extremely low level GWR emitted energy into the process.

3.2.2 Time Domain Reflectometry (TDR)

TDR uses pulses of electromagnetic (EM) energy to measure distances or levels. When a pulse reaches a dielectric discontinuity (created by 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.

3.2.3 Equivalent Time Sampling (ETS)

ETS (Equivalent Time Sampling) is used to measure the high speed, low power EM energy. ETS is a critical key in the application of TDR to vessel level measurement technology. The high speed EM energy (1000 ft/µs) 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.

4.0 Initial Start-Up

The introduction of Guided Wave Radar (GWR) technology as a method to measure level, increases performance and provides unique solutions beyond traditional level measurement methods. GWR devices have been successfully applied in the Life Sciences industry for more than a decade. There are thousands of units installed in all facets of production as well as in the utilities section of these facilities. (Please refer to the Industrial I/O manual 57-606 for additional information on non-hygienic applications.)

Based on that extensive experience, this document provides some suggested best practices for the installation and start-up of GWR devices commonly found in the Life Sciences industry.

4.1 Probe Location

The primary consideration for a new GWR installation is the location of the wave guide or probe. In comparison to other radar technologies, GWR is extremely robust and is not easily affected by typical disturbances within a vessel. However, there are opportunities to capitalize on a few best practices to reduce, if not eliminate, fine tuning at installation.

The best location for a guided wave radar unit is along the outer belt ring. Position the probe away from baffles, diptubes, and any agitation device that might damage the probe. While not imperative, the selected position for the probe should be as far as possible from spray bulbs to simplify installation, start-up, and commissioning of the device. Conversely, the distance between the probe and a vortex breaker or drain can be as close as 1 inch (2.5 cm).

The best location for a Guided Wave Radar probe is on the top head of a vessel, as close the sidewall as possible. The nozzle and probe should be marked to identify the correct orientation within the tank. **The orientation is critical to the performance of the installation.** Deviation from the correct orientation can change the characteristic non-linearity of the probe and therefore reduce measurement repeatability. The methods for correction are all reliant on the repeatability of the device. Therefore, if there is any concern regarding the probe's movement, an alignment hook

similar to those used to maintain the position of spray balls should be incorporated into the design and welded to the flange assembly of the guided wave radar unit.

NOTE: If an alignment hook is not feasible, “match-mark” the process connection on the probe to the process connection on the vessel.

4.2 Probe Bends

Often it is necessary to bend the probe to accommodate the constraints of the application. The Eclipse Model 705 utilizes a probe that can be bent to maximize yields while avoiding disturbances. Use the following guidelines for bending a probe to improve the overall performance and reliability of the installation.

NOTE: The orientation is critical to the performance of the installation.

4.2.1 Shallow Bends

The bend design should be as shallow as possible. A shallow bend is best characterized as one that is very large on the side of the probe where the bending mechanism is located. Positioning the bend as high as possible, in relation to the top of the probe, will assist in keeping this angle shallow.

Installation design should avoid placing bends in probes at critical measurement points as it relates to the process. This will ensure that the device provides the highest level of performance possible.

4.2.2 Field Bends

The Magnetrol Eclipse Guided Wave Radar probe can be modified in the field. This includes modifications in length as well as probe bending. Many times this will reduce or eliminate extra shipping cost due to irregular packaging as well as reduce delivery time by eliminating drawing approval.

When bending the probe in the field, do not apply stress (e.g., clamping) to the flange assembly. This can damage components internal to the portion of the device responsible for transferring signal and maintaining hygienic seal from the process.

NOTE: Do not apply any force to the process adaptor or transmitter as this may cause damage.

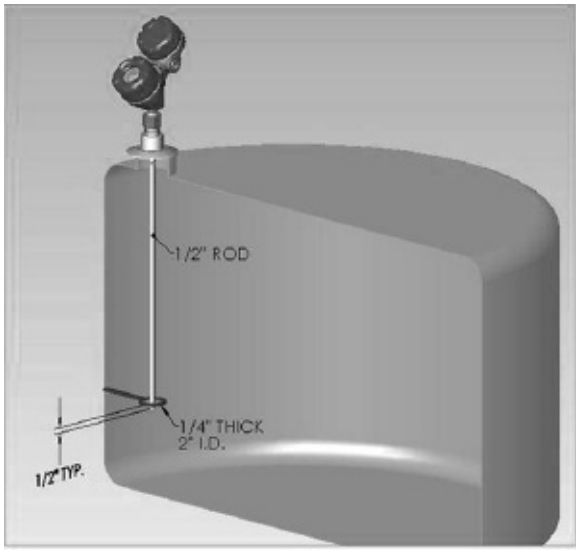
Use a ½" conduit bending device on probes that are ½" bar stock or less for simple bends. Probes constructed from bar stock grater than ½" will require considerable force. Therefore, a hand crank style bending may be ideal.

NOTE: Consider sliding a 5/16" hose over the electro polished rod to prevent damage to the probe during the bending operation.

Errors in bending can be corrected by cutting the incorrect portion of the probe and welding a new piece of material to the probe with matching specifications using a full penetration weld to maintain sterility.

After bending or modification, inspect the probe finish and polish as necessary to obtain the required surface finish.

4.2.3 Accommodating Non-Linearity



One method for stabilizing probe within a vessel

Any non-vertical portion of the probe represents non-linearity in the measurement. When designing a new installation for which a probe is going to be bent, the ideal process connection size is at least 2" for GWR probes ½" in diameter. This will allow a rigid probe to be installed through the nozzle with the highest degree of ease. For smaller diameter probes (e.g., approx. ¼" diameter), a ¾" or 1" connection is sufficient. Typically, these smaller probes are found in small vessels where the installation is not as difficult, regardless of connection size.

If the probe can potentially deflect and be caught by an agitator or other moving component within a tank, a "capture ring" should be incorporated into the installation design to prevent the probe from deflecting more than 3 inches (75 mm) per 6 feet (1.8 m) of probe length. (See figure at left for example.) Contact the manufacturer for assistance in the design and application of the capture ring.

There are no performance concerns when incorporating a capture ring. However, make sure the probe does not touch the ring when there is no liquid present. During typical operation, the liquid level should be above the ring so that all signals reflect off the liquid level rather than reflect off the capture ring.

A capture ring should be constructed from ¼" round bar stock formed into a circle at one end. A 2" diameter is ideal for the circle and should share the same centerline as the probe. A length of bar stock should be extended from this circle to the nearest portion of the tank that will allow the ring to be welded for connection.

An ideal location for a capture ring is as low as possible along the probe to minimize potential dead-band issues that may result from product hang-up on the ring. The capture ring should be installed below the lowest measuring point if possible, but high enough such that the probe will not be able to jump out of the ring during operation.

4.3 Electronics Mounting

The Eclipse Model 705 unit has a removable transmitter design.

Incorporating a unique high frequency connector, free rotation of the transmitter head is independent of the probe orientation.

4.4 Basic Start-Up

A radar signal is an electromagnetic pulse that reflects at a change in dielectric. Typical Life Sciences applications are water for injection (WFI) or high purity water based. High purity water has a very high dielectric (WFI is approximately 12–15). This is considered high dielectric from a GWR standpoint. Furthermore, adding salts or media to the water drastically increases the dielectric value of the process.

Typical applications are within a metallic vessel that provides additional benefit to the technology's signal efficiency. These factors allow very low gains to reduce the signal-to-noise ratio. The Magnetrol Eclipse unit uses parameters tagged "Dielectric Range" and "Sensitivity" to adjust the unit's gain.

4.4.1 Probe Length

The overall length of the probe should be measured after making any field modifications including bending, cutting, or adding length. When the unit's probe length has been configured in its final form, enter that exact length into the Probe Length parameter within the transmitter and then ensure a "Dry Probe" status which confirms that the end of probe signal is measured correctly.

4.4.2 Blocking Distance and Damping

Other relevant configuration parameters are Blocking Distance and Damping.

Blocking Distance is a configurable "dead-band" that can be entered into the unit. Although the Model 705 unit can typically read from the tip of the probe to the top of the flange, Life Sciences applications may require the use of blocking distance to ignore some distance from the top of the probe. It may be used when an electromagnetic pulse reverberates along an unusually long nozzle to create a phenomenon called "ringing." Ringing generates a false level signal beyond the bottom of the nozzle. In extreme cases, blocking distance also may be used to ignore spray from a nozzle that is too close to the probe and cannot be addressed by reducing sensitivity.

The Damping parameter is not typically used in Life Sciences applications. Most guided wave radar units are connected to a PLC or DCS that has the capability to perform any damping while true measurement can be received into data collection systems.

4.4.3 Strapping Tables

A bent probe creates a non-linear output relative to actual liquid level in a vessel. To account for this non-linearity, the Magnetrol Eclipse unit has a twenty-point strapping table embedded in the device that will correlate a measured level to some configurable point.

The most common method for using the strapping table in Life Sciences applications is through a calibrated flow meter (e.g., coriolis), filling the vessel to meter known volumes. Then, entering the output level value into the table along with the corresponding volume as measured by the meter. Using the strapping table will not only compensate for the non-linearity associated with bends in the probe, but also will account for the changes in volume from changes in tank geometry, disturbances such as agitator blades, and any other dynamics along the probe.

The published repeatability for the Magnetrol Eclipse guide wave radar in typical Life Sciences applications is 0.025% of volume or 0.1" (3mm), whichever is greater. It is important to note that the flow meter should be operated at the rated flow-rate to make sure that the meter does not affect the accuracy of the strapping table.

When preparing a strapping table, identify areas where there is significant non-linearity of volume with respect to level. Then, select and cluster strapping table points in quantities of 3 to 5, depending on availability, around the identified areas. For example, in a typical tulip-shaped tank, approximately fifty percent of the points should be in the non-linear portion of the tank. Then, 3-5 cluster points should be assigned to the batch heights for the process.

Finally, one point should be reserved in any application for a point at 105%-110% of the maximum operating volume. There are two philosophies regarding the first point. Most tables will perform linear interpolation between points. Therefore, anything measured between zero and the first strapping table point will be interpolated. However, some users prefer to measure the first possible point and correlate that to a known volume for repeatability.

4.4.4 Tuning/Optimization

GWR devices may require fine tuning in the field after installation. In the most basic applications, the Model 705 requires no configuration or tuning. However, as complexities such as probe bending and proximity to disturbances in the vessel are entered into design of the installation, Magnetrol suggests using the following guidelines to tune a GWR unit.

4.4.4.1 Dielectric Range/Sensitivity

Adjust the Dielectric Range and Sensitivity parameters to change the gain of the device. Dielectric range can be thought of as a “course gain adjustment,” and sensitivity as a “fine gain adjustment.” Often, there is no further configuration or tuning required beyond these adjustments.

4.4.4.2 PACT*ware* Echo Curve

A HART modem is required for a PC to communicate with the transmitter. Using the Echo Curve function provides a real-time waveform and indicates the effects of the changes made to configuration.

Threshold Adjustment Based on EchoCurve

There are cases where sensitivity adjustments will not ignore noise present in a vessel. In those cases, threshold adjustments (Positive or Negative depending on the Echo Curve) may be necessary.

4.4.4.3 Blocking Distance

If there is noise at the top of the probe that can not be ignored, such as an installation that is too close to a spray ball that has an excessive flow stream aimed at the probe, then an artificial dead-band can be introduced using the "blocking distance" parameter. This is a top-down measured portion of the probe that will be ignored.

4.4.4.4 Echo Curves in Dry and Filled States

Obtain Echo Curves in both dry and filled states to make sure that changes to configuration do not affect the unit’s ability to read the true end of probe signal as well as liquid level along the probe.

4.4.4.5 Strapping Table Configuration

The referenced configuration parameters can affect where a waveform crosses thresholds. Therefore, all strapping table information should be obtained after the configuration has been optimized.

4.4.4.6 Additional Considerations

Many Life Sciences industry applications are dynamic processes. These may require additional tuning to accommodate the differences. Specifically, applications where clean-in-place (CIP) is present may require further tuning as the recycle rates are finalized.

Caustics have a high dielectric that will respond differently than process water (i.e. reducing sensitivity addresses a majority of these fine-tuning cases). The Echo Curve function in the Eclipse PACT*ware* DTM is very effective in identifying what adjustments need to be made and whether they have been resolved.

Foaming applications are quite common in Life Sciences liquid level measurement applications and many, if not all, liquid levels can be measured using the Magnetrol Eclipse GWR. However, there is a limit that is dependent upon the dielectric value of the foam. If the value is high enough, the radar signal will not pass through the foam. Based on experience, the Eclipse is operational in most Life Sciences operation by utilizing the sensitivity and threshold adjustment built into the unit to address these situations.

5.0 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.

5.1 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.
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., foam over water	Adjust Threshold settings.
	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) Adjust sensitivity 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 52–53. Enter all data when transmitter is working CORRECTLY or INCORRECTLY.

5.2 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	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	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.	1) Set transmitter to lower dielectric range 2) Increase sensitivity
Flooded?	Loss of level signal possibly due to flooding, twin rod probes only	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	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	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	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	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	1) Transmitter may need to be moved to ensure ambient temperature is within specification 2) Change to remote mount transmitter

5.2 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.
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 watch-dog 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

PACT*ware*™ PC Program

The Eclipse Model 705 offers the ability to do Trending and Echo Curve analysis using a PACT*ware* 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.

5.3 Agency Approvals


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

Explosion Proof (with intrinsically Safe Probe)

US/Canada: FM19US0091X/FM19CA0047X:
Integral and Remote:
Class I, Div 1, Groups B, C, D T4
Class II, III, Div. 1 Groups E, F, G T4
-40ºC ≤ Ta ≤+70ºC
Type 4X, IP66

Integral:
US: Class I, Zone 0,1 AEx ia/db IIC T4 Ga/Gb
Canada: Ex ia/db IIC T4 Ga/Gb
-40ºC ≤ Ta ≤+70ºC
Type 4X, IP66

Remote:
US: Class I, Zone 1 AEx db [ia Ga] IIC T4 Gb
Canada: Ex db [ia Ga] IIC T4 Gb
-40ºC ≤ Ta ≤+70ºC
Type 4X, IP66

Flame Proof

ATEX – FM19ATEX0175X:
Integral:
II 1/2 G Ex ia/db IIC T4 Ga/Gb
Remote:
II 2(1) G Ex db [ia Ga] IIC T4 Gb
-40ºC ≤ Ta ≤+70ºC
IP66

IEC IECEx FMG19.0022X:
Integral:
Ex ia/db IIC T4 Ga/Gb

Remote:
Ex db [ia Ga] IIC T4 Gb
-40ºC ≤ Ta ≤+70ºC
IP66

Intrinsically Safe

US/Canada: FM19US0091X/FM19CA0047X:
Integral and Remote:
Class I, II, III, Div. 1 Group A, B, C, D, E, F, G T4
-40ºC ≤ Ta ≤+70ºC
Type 4X, IP66

Integral:
US: Class I, Zone 0 AEx ia IIC T4 Ga
Canada: Ex ia IIC T4 Ga
US: Class I Zone 2 AEx ia IIC T4 Gc
Canada: Ex ic IIC T4 Gc
-40ºC ≤ Ta ≤+70ºC
Type 4X, IP66

Remote:
US: Class I, Zone 2 AEx ic [ia Ga] IIC T4 Gc
Canada: Ex ic [ia Ga] IIC T4 Gc
Ta = -40ºC to +70ºC
Type 4X, IP66

ATEX – FM19ATEX0175X:
Integral:
II 1 G Ex ia IIC T4 Ga
-40ºC ≤ Ta ≤+70ºC
IP66

Remote:
II 3(1) G ic [ia Ga] IIC T4 Gc
-40ºC ≤ Ta ≤+70ºC
IP66

ATEX – FM20ATEX0013X:
Integral:
II 3 G Ex ic IIC T4 Gc
-40ºC ≤ Ta ≤+70ºC
IP66

IEC - IECEx FMG19.0022X:
Integral:
Ex ia IIC T4 Ga
Ex ic IIC T4 GC
-40ºC ≤ Ta ≤+70ºC
IP66

Remote:
Ex ic [ia Ga] IIC T4 Gc
Ta = -40ºC to+70ºC
IP66

Non-Incendive

US/Canada: FM19US0091X/FM19CA0047X:
Integral and Remote:
US: Class I Div. 2, Groups A, B, C D T4
Class II, III, Div. 2 Groups E, F, and G T4
Canada: Class I Div. 2, Groups A, B, C, D T4
Nonincendive - Class II, III Div. 2, Groups F and G T4
-40ºC ≤ Ta ≤+70ºC
IP66

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

5.3.1 Special Conditions of Use

705-5abc-Def/7gh-ijkl-m. Eclipse Level Transmitter

705-5abc-Def/7gh-AjkN-m. Eclipse Level Transmitter

705-5abc-Def/7EK-ijkA-mn. Eclipse Level Transmitter

705-5abc-4ef/7gh-ijkl-m. Eclipse Level Transmitter

705-5abc-4ef/7gh-AjkN-m. Eclipse Level Transmitter

705-5abc-4ef/7EK-ijkA-mn. Eclipse Level Transmitter

1. The Eclipse Level Transmitter is only for use with the Eclipse Level Probe
2. The flamepaths of the equipment are not intended to be repaired. Consult the manufacturer if repair of the flamepath joints is necessary.
3. Refer to the manufacturer's instructions to reduce the potential of an electrostatic charging hazard on the equipment enclosure.
4. To maintain the T4 temperature code care shall be taken to ensure the "Enclosure Temperature" does not exceed 70ºC.
5. The Transmitter shall be connected to a safety extra low-voltage circuit (SELV) with Um ≤ 30 V.

705-5abc-Fef/7gh-ijkl-m. Eclipse Level Transmitter

705-5abc-Fef/7gh-AjkN-m. Eclipse Level Transmitter

705-5abc-Fef/7EK-ijkA-mn. Eclipse Level Transmitter

705-5abc-6ef/7gh-ijkl-m. Eclipse Level Transmitter

705-5abc-6ef/7gh-AjkN-m. Eclipse Level Transmitter

705-5abc-6ef/7EK-ijkA-mn. Eclipse Level Transmitter

1. The Eclipse Level Transmitter is only for use with the Eclipse Level Probe
2. Refer to the manufacturer's instructions to reduce the potential of an electrostatic charging hazard on the equipment enclosure.
3. To maintain the T4 temperature code care shall be taken to ensure the "Enclosure Temperature" does not exceed 70ºC.

705-5abc-Cef/7gh-ijkl-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-Cef/7gh-AjkN-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-Cef/7EK-ijkA-mn. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-3ef/7gh-ijkl-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-3ef/7gh-AjkN-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-3ef/7EK-ijkA-mn. Eclipse Level Transmitter/Eclipse Level Probe.

1. The flamepaths of the equipment are not intended to be repaired. Consult the manufacturer if repair of the flamepath joints is necessary.
2. Refer to the manufacturer's instructions to reduce the potential of an electrostatic charging hazard on the equipment enclosure.
3. To maintain the T4 temperature code care shall be taken to ensure the "Enclosure Temperature" does not exceed 70ºC.
4. The Transmitter shall be connected to a safety extra low-voltage circuit (SELV) with Um ≤ 30V.

705-5abc-def/7gh-ijkl-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-def/7gh-AjkN-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-def/7EK-ijkA-mn. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-Eef/7gh-ijkl-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-Eef/7gh-AjkN-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-Eef/7EK-ijkA-mn. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-5ef/7gh-ijkl-m. Eclipse Level Transmitter/Eclipse Level Probe.

705-5abc-5ef/7gh-AjkN-m. Eclipse Level Transmitter/Eclipse Level Probe.

1. Refer to the manufacturer's instructions to reduce the potential of an electrostatic charging hazard on the equipment enclosure.
2. To maintain the T4 temperature code care shall be taken to ensure the "Enclosure Temperature" does not exceed 70ºC.

7gh-ijkl-m. Eclipse Level Probe.

7gh-AjkN-m. Eclipse Level Probe.

7EK-ijkA-mn. Eclipse Level Probe.

1. The Eclipse Level Probe is only for use with the Eclipse Level Transmitter.

The following approval standards are applicable:
FM3600:2018, FM3610:2010, FM3611:2004, FM3615:2018, FM3615:2018, FM3810:2018, ANSI/UL60079-0:2019, ANSI/UL 60079-1:2015, ANSI/UL 60079-11:2014, ANSI/UL 60079-26:2017, ANSI/UL 61010-1:2015, ANSI/ISA 60079-1:2015, ANSI/ISA 60079-11:2014, ANSI/ISA 60079-15:2012, ANSI/ISA 60079-26:2014, ANSI/NEMA 250:1991, ANSI/IEC 60529:2004, CSA-C22.2 No. 0.4:2017, CSA-C22.2 No. 0.5:2016, CSA-C22.2 No. 25:R2014, CSA-C22.2 No. 30:R2016,
CSA- C22.2 No. 94:R2011, CSA-C22.2 No. 157:2012, CSA-C22.2 No. 213:2016, CSA-C22.2 No. 61010.1:2012 CAN/CSA 60079-0:2019, CAN/CSA 60079-1:2016 CAN/CSA 60079-11:2014, C22.2 No. 60529:2005, ANSI/ISA12.27.01:2011, EN/IEC60079-0:2018, EN60079-1:2014, EN60079-11:2014, EN60079-26:2015, EN60529+A1+A2: (1991, 2000, 2013), IEC60079-0:2017, IEC60079-1:2014, IEC60079-11:2011, IEC60079-26:2014, IEC 60529:2013.

5.3.2 Agency Specifications – Intrinsically Safe Installation

HAZARDOUS LOCATION
MODEL 705 LEVEL TRANSMITTER

INTRINSICALLY SAFE FOR:
CLASS I, DIVISION I GROUPS A, B, C, D, T4
CLASS II, III, DIVISION I GROUPS E, F, G, T4
CLASS I, DIVISION 2, GROUPS A, B, C, D, T4
CLASS II, III, DIVISION 2, GROUPS E, F, G, T4
CLASS I ZONE 0 AEx/Ex ia IIC, T4 Ga
II 1 G Ex ia IIC, T4 Ga
CLASS I, ZONE 2, AEx/Ex ic IIC, T4 Gc
II 3 G Ex ic IIC, T4 Gc
CLASS I, ZONE 2, AEx/Ex ic [ia Ga] IIC T4 Gc
II 3 (1) G Ex ic IIC [ia Ga], T4 Gc

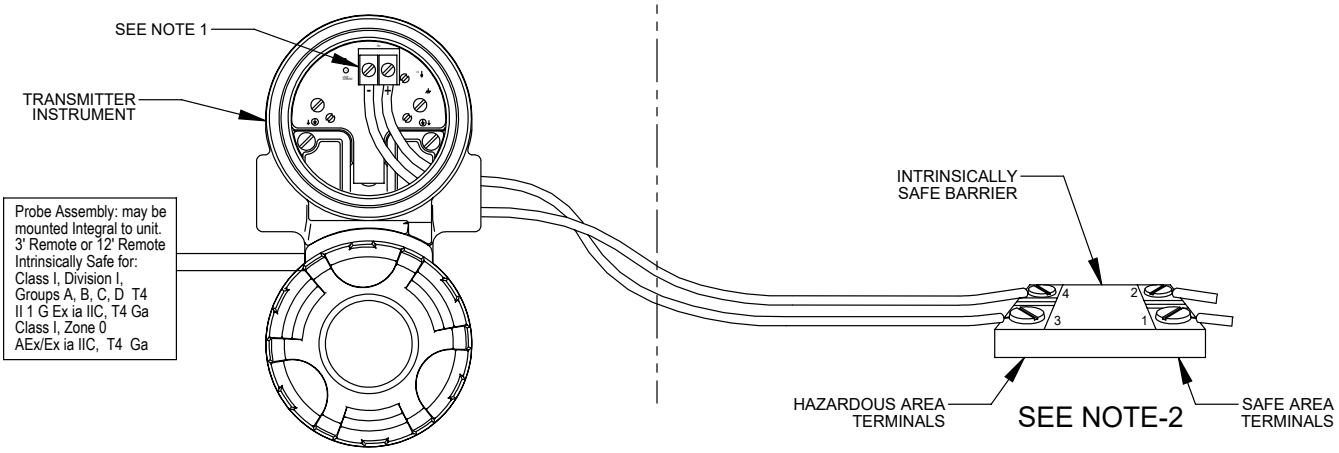
ENTITY/NIFW
Ui(Vmax) = 28.4V
Imax = 124mA
Pmax = 0.84W
Ci = 3nF
Li = 3µH

NON-HAZARDOUS LOCATION
LIMITING VALUES

Voc ≤ 28.4V Ca ≥ 3nF
Isc ≤ 124mA La ≥ 3µH

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

MODEL 705-50XX-XXX
705-51XX-XXX



NOTES:

1. FOR EXPLOSION PROOF OR DUST-IGNITION PROOF INSTALLATIONS. THE I.S. GROUND TERMINAL SHALL BE CONNECTED TO APPROPRIATE INTRINSICALLY SAFE GROUND IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE [CEC] THE NATIONAL ELECTRICAL CODE [NEC, ANSI/NFPA 70] [FOR FMC]. FOR INTRINSICALLY SAFE INSTALLATIONS. THE I.S. GROUND TERMINAL DOES NOT REQUIRE GROUNDING.
2. MANUFACTURER'S INSTALLATION INSTRUCTIONS SUPPLIED WITH THE PROTECTIVE BARRIER AND THE CEC OR THE NEC AND ANSI/ISA RP 12.6 [FOR FMC] MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT. BARRIER MUST BE FMC CERTIFIED FOR CANADIAN INSTALLATIONS & FM APPROVED FOR U.S. INSTALLATION.
3. CONTROL EQUIPMENT CONNECTED TO PROTECTIVE BARRIERS MUST NOT USE OR GENERATE MORE THAN 250 VDC OR VRMS.
4. NRTL LISTED DUST-TIGHT SEALS MUST BE USED WHEN TRANSMITTER IS INSTALLED IN CLASS II & III ENVIRONMENTS.
5. NO REVISIONS TO THIS DRAWING WITHOUT AND FMC APPROVAL.
6. FOR CANADA: Ex ia INTRINSICALLY SAFE/SECURITE INTRINSEQUE.
7. FOR CANADA: WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABLITY FOR HAZARDOUS LOCATIONS.
8. FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 70°C AMBIENT, USE WIRE WITH A MINIMUM TEMPERATURE RATING OF 75°C.
9. THE TRANSMITTER CAN ALSO BE INSTALLED IN:
   CLASS I, DIVISION 2, GROUPS A, B, C, D
   CLASS II, DIVISION 2, GROUPS E, F, G (F & G ONLY FOR FMC)
   CLASS III, DIVISION 2, AND HAZARDOUS LOCATIONS AND DOES NOT REQUIRE CONNECTION TO A PROTECTIVE BARRIER WHEN INSTALLED PER THE CEC (FOR CANADA) OR THE NEC (FOR FMC) AND WHEN CONNECTED TO A POWER SOURCE NOT EXCEEDING 28.4 VDC.
10. FOR CANADA: CERTIFIED BARRIERS WITH LINEAR OUTPUT CHARACTERISTICS MUST BE USED.

099-5055-H

SHEET 2 OF 4

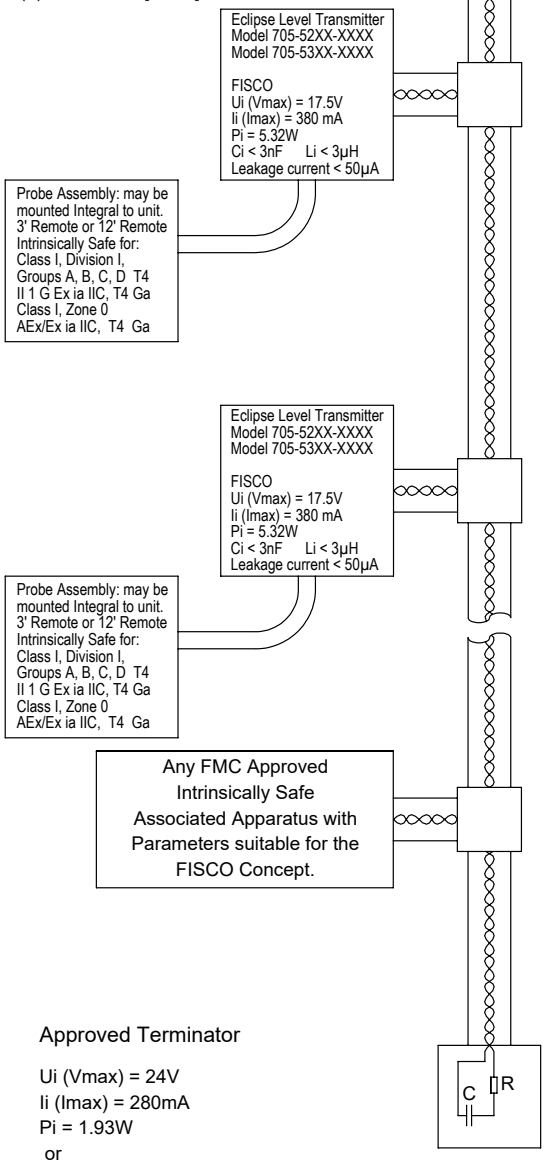
5.3.3 Agency Specifications – FOUNDATION fieldbus System

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Division 1, Groups A, B, C, D, T4
Class II, III, Division 1, Groups E, F, G, T4
Class I, Division 2, Groups A, B, C, D, T4
Class II, III, Division 2, Groups E, F, G, T4 (F & G ONLY FOR FMC)
Class I, Zone 0 AEx/Ex ia IIC, T4 Ga
II 1 G Ex ia IIC, T4 Ga
Class I, Zone 2, AEx/Ex ic IIC, T4 Gc
II 3 G Ex ic IIC, T4 Gc
Class I, Zone 2, AEx/Ex ic [ia Ga] IIC, T4 Gc
II 3 (1) G Ex ic IIC [ia Ga], T4 Gc

UNCLASSIFIED LOCATION

FISCO
Uo (Voc or Vt) =17.5V
Io (Isc or It) = 380mA
Po = 5.32W
or
Any FMC Approved Intrinsically Safe. Associated Apparatus with Parameters suitable for the FISCO Concept.



Approved Terminator

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

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

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

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

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

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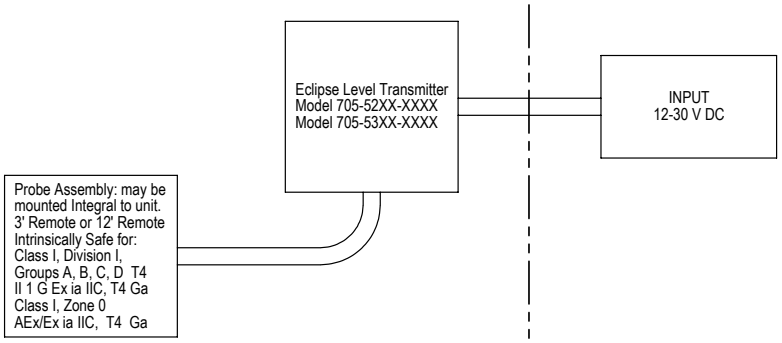
5.3.3 Agency Specifications – FOUNDATION fieldbus System

HAZARDOUS (CLASSIFIED) LOCATION

UNCLASSIFIED LOCATION

EXPLOSION PROOF / INTRINSICALLY SAFE

CL I DIV 1 GRPS B,C,D T4
CL II,III DIV 1 GRPS E,F,G T4
CL I ZONE 0,1 AEx/Ex ia/db IIC T4 Ga/Gb
CL I DIV 1 GRPS B,C,D T4
CL II,III DIV 1 GRPS E,F,G T4
CL I ZONE 1 AEx/Ex db [ia Ga] IIC T4 Gb
II 1/2 G Ex ia/db IIC T4 Ga/Gb
II 2(1) G Ex db [ia Ga] IIC T4 Gb



NOTES:

1. FOR EXPLOSION PROOF OR DUST-IGNITION PROOF INSTALLATIONS. THE I.S. GROUND TERMINAL SHALL BE CONNECTED TO APPROPRIATE INTRINSICALLY SAFE GROUND IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE [CEC] THE NATIONAL ELECTRICAL CODE [NEC, ANSI/NFPA 70] [FOR FMC]. FOR INTRINSICALLY SAFE INSTALLATIONS. THE I.S. GROUND TERMINAL DOES NOT REQUIRE GROUNDING.
2. NO REVISIONS TO THIS DRAWING WITHOUT AND FMC APPROVAL.
3. FOR CANADA: Ex ia INTRINSICALLY SAFE/SECURITE INTRINSEQUE.
4. FOR CANADA: WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABLITY FOR HAZARDOUS LOCATIONS.
5. FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR THE OPERATING TEMPERATURE. FOR 70°C AMBIENT, USE WIRE WITH A MINIMUM TEMPERATURE RATING OF 75°C.
6. THE TRANSMITTER SHALL BE CONNECTED TO A SAFETY EXTRA LOW-VOLTAGE CIRCUIT (SELV) WITH Um $\leq$= 30V.

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SHEET 4 OF 4

6.0 Parts

6.1 Replacement Parts

Item	Description	Part Number: Dual Compartment	Part Number: 304 ss Single Compartment Housing
①	Electronic module		
	HART with display (SIL 1)	Z31-2835-001	89-7254-001
	HART without display (SIL 1)	Z31-2835-002	N/A
	HART with display (SIL 2)	Z31-2835-003	89-7254-003
	HART without display (SIL 2)	Z31-2835-004	N/A
	FOUNDATION fieldbus with display	Z31-2841-001	89-7254-002
	FOUNDATION fieldbus without display	Z31-2841-002	N/A
	PROFIBUS PA with display	Z31-2846-001	89-7254-004
	PROFIBUS PA without display	Z31-2846-002	N/A
②	Terminal board		
	HART General Purpose (GP), Intrinsically Safe (IS), Explosion Proof (XP)	Z30-9151-001	N/A
	FOUNDATION fieldbus (XP)	Z30-9151-003	N/A
	FOUNDATION fieldbus (IS/Fisco)	Z30-9151-004	N/A
③	O-ring (Viton®) (Consult Factory for alternative O-ring materials)	012-2201-237	12-2201-237
④	Housing cover without glass	004-9193-003	36-5702-003
⑤	Housing cover with glass (GP, IS) (XP)	036-4410-001 036-4410-003	36-5702-002 N/A

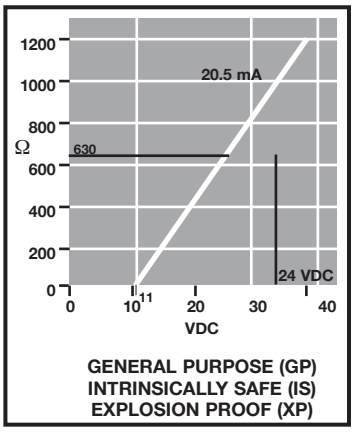
6.2 Recommended Spare Parts

Item	Description	Part Number: Dual Compartment	Part Number: 304 ss Single Compartment Housing
①	Electronic module		
	HART with display (SIL 1)	Z31-2835-001	89-7254-001
	HART without display (SIL 1)	Z31-2835-002	N/A
	HART with display (SIL 2)	Z31-2835-003	89-7254-003
	HART without display (SIL 2)	Z31-2835-004	N/A
	FOUNDATION fieldbus with display	Z31-2841-001	89-7254-002
	FOUNDATION fieldbus without display	Z31-2841-002	N/A
	PROFIBUS PA with display	Z31-2846-001	89-7254-004
	PROFIBUS PA without display	Z31-2846-002	N/A
②	Terminal board		
	HART General Purpose (GP), Intrinsically Safe (IS), Explosion Proof (XP)	Z30-9151-001	N/A
	FOUNDATION fieldbus (XP)	Z30-9151-003	N/A
	FOUNDATION fieldbus (IS/Fisco)	Z30-9151-004	N/A
③	Model 7xH Hygienic Probe Rebuild Kit 2”, 316 SS with Viton O-Ring (Contact factory for other sizes)	89-4505-003	
④	Model 7xF–E Hygienic Probe Rebuild Kit 2”, 316 SS (Contact factory for other sizes)	89-4504-003	

7.0 Specifications

7.1 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	
Span	6 inches to 24 feet (15 to 732 cm)	
Output		
Type	Analog	4 to 20 mA with HART digital signal (HART 6)
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 × 8-character display	
Digital Communication	HART Version 6.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	Deep drawn 304 ss single compartment, optional Aluminum A356T6 (<0.20% copper) or 316L dual compartment	
Cable Entry	¾" NPT and M20: for dual compartment housing ½" NPT and M20: for single compartment 304ss housing	



GENERAL PURPOSE (GP)
INTRINSICALLY SAFE (IS)
EXPLOSION PROOF (XP)

7.1.1 O-ring (Seal) Selection Chart – Model 7xH

Material	Code	Maximum Temperature①	Min. Temp.
Viton® GFLT	0	+400 °F (+200 °C)	-40 °F (-40 °C)
EPDM	1	+250 °F (+125 °C)	-60 °F (-50 °C)

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: Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement.
Mounting Affects: 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" × 6" nozzle = 1:3) may require a Blocking
	Distance and/or DIELECTRIC adjustment (see Section 2.6.5)
	No pipe reducers are used
	Obstructions: may require configuration changes
	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 3 Capable	Safe Failure Fraction (SFF) 91%

7.2 Performance - Model 705

Reference Conditions	Reflection from water at +70° F (+20° C) with 72" (183 cm) coaxial probe
	(CFD threshold)
Linearity	<0.3% of probe length or 0.3 inch (. mm) (whichever is greater)
Measured Error	±0.5% probe length or ±0.5 inch (13 mm) (whichever is greater)
Resolution	±0.1 inch (3 mm)
Repeatability	<0.1 inch (3 mm)
Hysteresis	<0.1 inch (3 mm)
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 (8 mm) within selected range
Humidity	0-99%, non-condensing

7.3 Process Conditions

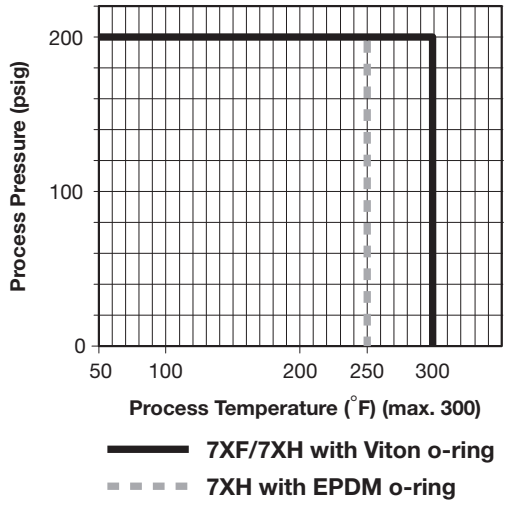
Model	Hygienic (7xF-E or 7xH-x)
Maximum Process Temperature	+300° F @ 200 psig (+150° C @ 13.7 bar)
Maximum Process Pressure	200 psig @ +300 °F (13.7 bar @ 150 °C
Maximum Viscosity	10,000 (consult factory if severe agitation/turbulence)
Dielectric Range	≥1.9
Hermeticity	N/A

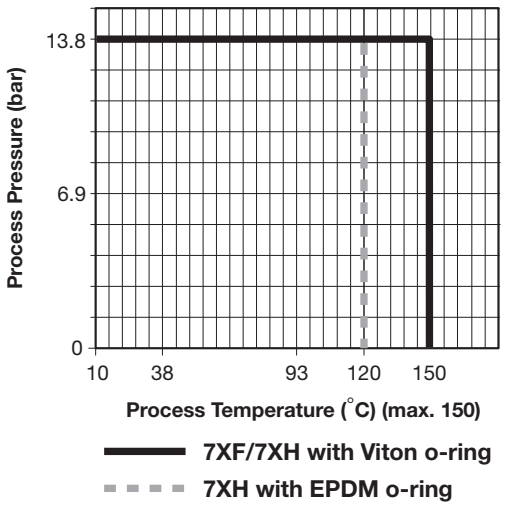
7.4 Probe Specifications

Single Rod Probes

Model	7xF–E	7xH–x
Wetted Metallic Parts	316L SS, <15 R_a max. electropolished finish (Optional: Hastelloy C, AL6XN SS)	316L SS, <15 R_a max. electropolished finish (Optional: Hastelloy C, AL6XN SS)
Elastomer and Polymeric Wetted Parts	TFE (GRAS 21CFR177-1550 and USP <88> Class VI at 121° C)	PEEK and O-ring (Viton or EPDM) (GRAS 21CFR177 and USP <88> Class VI at 121°C
Diameter	0.5" (13 mm) 0.25" (7 mm) for ¾" tri-clamp	0.5" (13 mm)
Blocking Distance – Top	0–36" (0–91 cm)–Probe length dependent (adjustable)	0–36" (0–91 cm)–Probe length dependent (adjustable)
Process Connection	¾" – 4" Tri-clamp flange	¾" – 4" Tri-clamp flange
Transition Zone (Top)	Application Dependent	Application Dependent
Transition Zone (Bottom)	1" (2.5 cm) @ ε_r >10	1" (2.5 cm) @ ε_r >10
Pull Force/Tension	N/A	N/A
Side Load	Not more than 3" deflection at end of 72" (183 cm) probe	Not more than 3" deflection at end of 72" (183 cm) probe

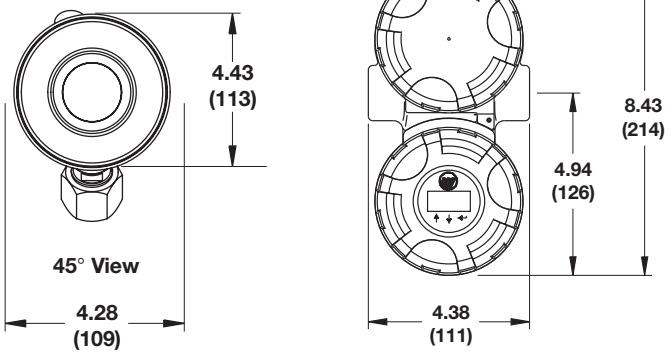
Temperature/Pressure Charts



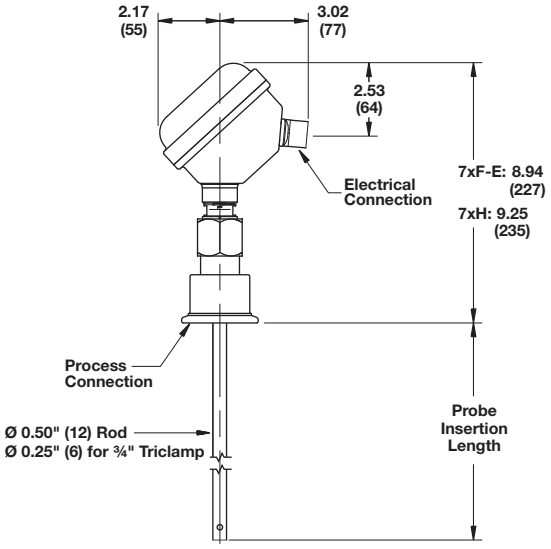


7.5 Physical

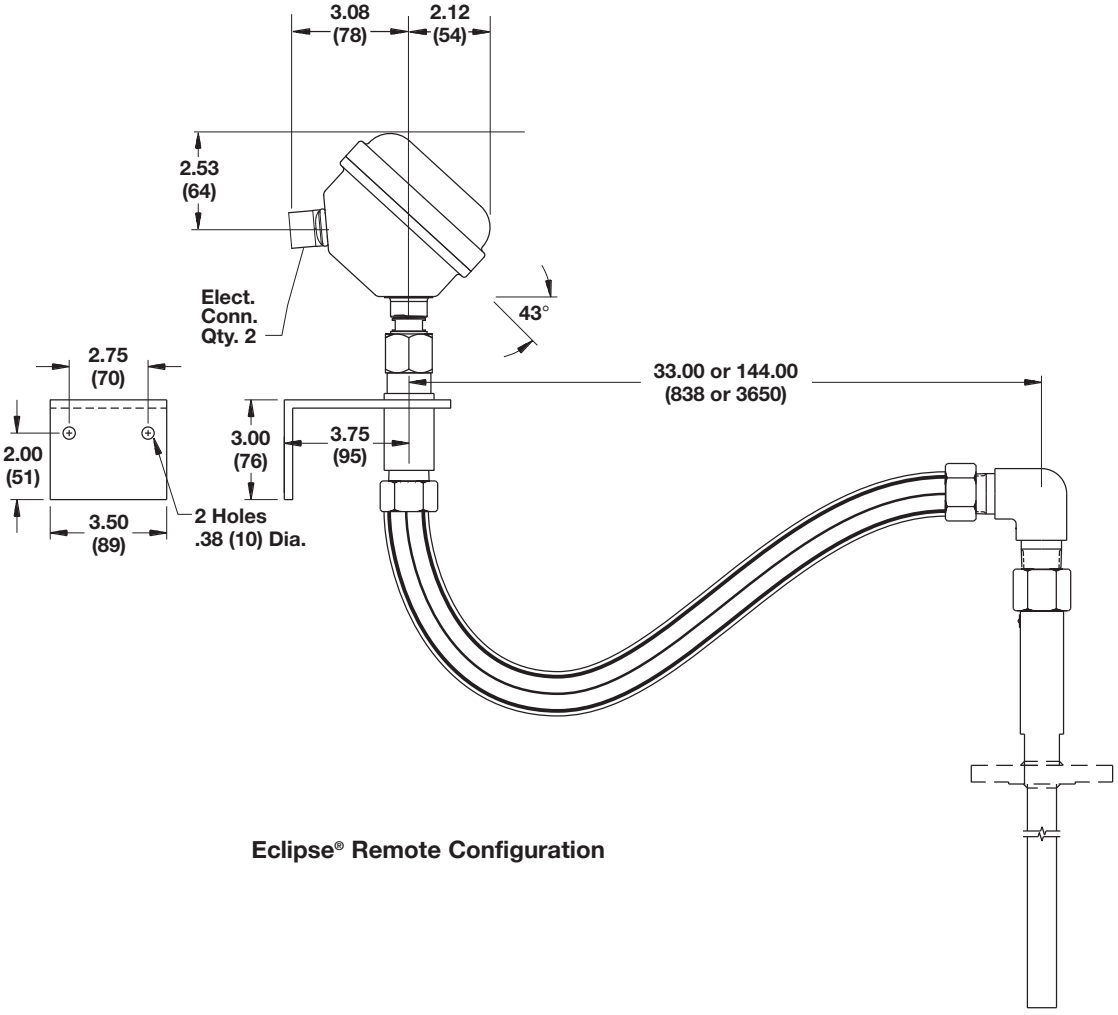
inches (mm)



Eclipse® Housing (45° View)



Eclipse® with 7xF-E Probe Hygienic Connection



Eclipse® Remote Configuration

8.0 Model Numbers

8.1 Transmitter

BASIC MODEL NUMBER

705	Eclipse Guided Wave Radar Level Transmitter

POWER

5	24 VDC, Two-wire

SIGNAL OUTPUT

1	4–20 mA with HART
2	FOUNDATION fieldbus™ Digital Communication (English only)
3	PROFIBUS PA Digital Communication (English Only)

OPTIONS

0	None – SIL 1 Standard Electronics (SFF=84.5%)
A	SIL 2 (Certified) Enhanced Electronics (SFF=91%) ①

ACCESSORIES

0	Digital display and keypad with blind cover
A	Digital display and keypad with window cover

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] IIB 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
3	304 stainless steel, single compartment ②
7	Cast aluminum, dual compartment, 12-foot remote
9	304 stainless steel, single compartment, 12-foot remote ①

CONDUIT CONNECTION

0	¾" NPT
1	M20
4	½" NPT ③

① Not available with Model 7xH Probe
② Only available with conduit connection code 4
③ Not available with explosion proof Mounting/Classification codes 3, 4, C, D.

7	0	5	—	5				—			

8.2 Probe

BASIC MODEL NUMBER

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

CONFIGURATION/STYLE

F	Hygienic Single Rod (with PTFE seal)
H	Hygienic Single Rod (with O-Ring seal)

MATERIAL OF CONSTRUCTION

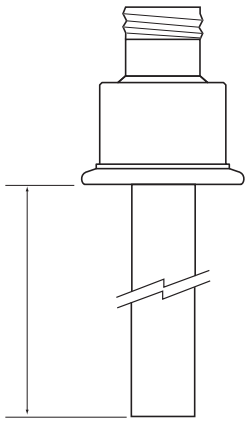
E	Hygienic, 316L stainless steel (15 R_a EP finish)
G	Hygienic, AL6XN stainless steel (15 R_a EP finish)
H	Hygienic, Hastelloy C22 (15 R_a EP finish)

PROCESS CONNECTION SIZE/TYPE
HYGIENIC FLANGE CONNECTIONS

2P	¾" Tri-Clover® type, 16 AMP Hygienic Flange (only available with 3rd digit F)
3P	1" or 1½" Tri-Clover® type, 16 AMP Hygienic Flange
4P	2" Tri-Clover® type, 16 AMP Hygienic Flange
5P	3" Tri-Clover® type, 16 AMP Hygienic Flange
6P	4" Tri-Clover® type, 16 AMP Hygienic Flange
9P	2½" Tri-Clover® type, 16 AMP Hygienic Flange

O-RINGS

1	EPDM (only available with 3rd digit H)
C	Viton® GF (only available with 3rd digit H)
N	None (only available with 3rd digit F)



Insertion Length
Hygienic Flange

LENGTH

24 to 240 inches (60 to 610 cm) ① (unit of measure is determined by second digit of Model Number)
Examples: 24 inches = 024; 60 centimeters = 060

① Contact factory for applications requiring probe lengths less than 24" (60 cm).

7			—			P		—			

9.0 Dry Calibration Procedure

9.1 Calibration Verification

9.1.1 Wet Calibration Verification of Eclipse

Calibration verification of a transmitter and probe in a vessel is very expensive and time consuming. The vessel must be taken out of service and WFI water is typically metered into the vessel through a high accuracy mass flow meter or other device such as load cells. WFI water is expensive, typically on the order of $1.00 per liter and the filling and filling/emptying of a typical processing vessel and strapping of a transmitter could take upwards of 6 to 8 hours.

9.1.2 Dry Calibration Verification of Eclipse

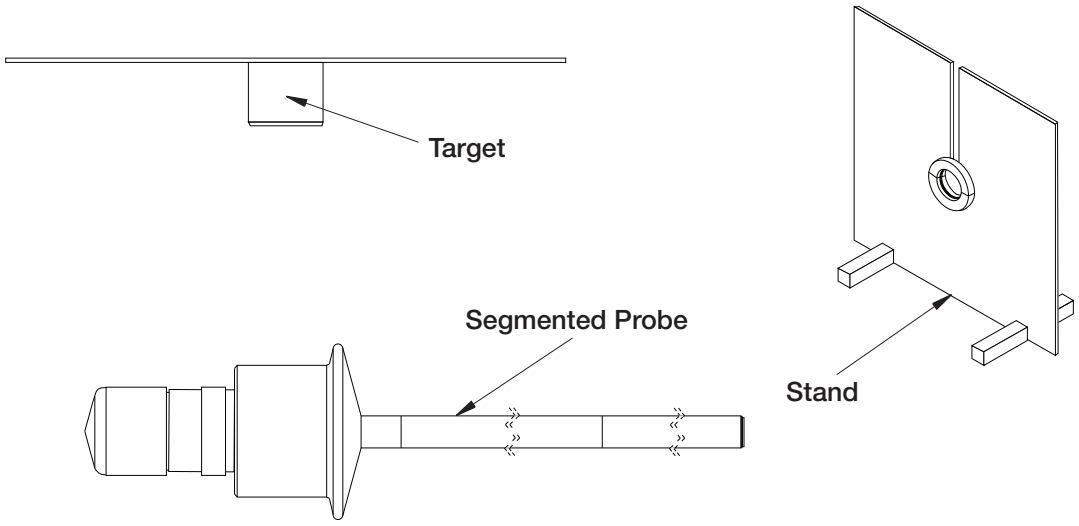
An economical alternative to wet calibration is to perform dry calibration verification on a GWR transmitter on a test bench in the metrology lab. Calibration verification is often performed by one person in less than 20 minutes.

9.1.3 Dry Calibration Verification Bench

A Dry Calibration Verification Bench can be manufactured by the user or purchased through Magnetrol. The part number for a Magnetrol Dry Calibration Verification Bench is P/N 89-7910-002.

The Magnetrol Dry Calibration Verification Bench consists of a transmitter mounting stand, sectioned probes, and movable target.

NOTE: Transmitter NOT necessary or included with the test stand. Use the existing transmitter under test.



9.2 Procedure to Verify Calibration of Eclipse

A probe is required for a test bench that is as long as the longest probe installed in the field. The probe must be of the same type as in the field.

9.2.1 Initial Baseline Verification of Eclipse

The probe and transmitter are calibrated on the actual vessel in the field. This is normally done by metering in specific volumes or mass of WFI water through a precision mass flow meter and "strapping" the transmitter and probe to that metered quantity. For example, assume that the probe and transmitter is successfully calibrated in the field to 0 to 100% equals 4 to 20 mA equals 0 to 90 cm equals 0 to 500 liters.

Immediately after that wet calibration, dismount the electronics from the probe, leave the probe in the vessel and install the transmitter electronics on the test bench probe.

Note: For any Calibration Verification, changes to the transmitter configurations (sensitivity for example) are NOT permitted!

Begin by positioning the target at specific positions on the bench probe as determined by predetermined marks on the probe or as measured by a laser. Write down the output as displayed on the transmitter. The target is then moved to the second mark or position on the test rod as measured by a laser and the reading on the transmitter is noted. This procedure is continued for the length of the rod. When the final point on the test rod is measured and documented, the electronics can be removed from the test bench and mounted back on the original vessel in the field.

9.2.2 Subsequent Calibration Verification

Periodic calibration verification is required per 21CFR211.68(a). Each licensed facility will have a frequency of calibration verification documented in their SOPs.

For subsequent calibration verifications, the transmitter is removed from the probe and the probe remains in the vessel to prevent breach of vessel sterility. The transmitter is then placed on the dry calibration verification bench probe. The Initial Calibration Verification Document is retrieved for comparison. The target is paced at the first mark, as documented on the Initial Calibration Verification sheet and the transmitter reading is taken and written down on the sheet next to the appropriate level mark. This procedure is completed for each initial level mark. The results for initial verses "today" are compared. If the accuracies are within the

required range, as determined by the User Requirement Specification (URS), the transmitter passes calibration verification and can be reinstalled on the process.

If the transmitter under test fails calibration verification, the transmitter must be installed on the vessel and the probe/transmitter must undergo a complete wet calibration. After a successful wet calibration is completed, the transmitter should be removed and taken to the dry calibration verification bench where a NEW Initial Baseline Verification must be performed. The old Initial Baseline Verification is now invalid as adjustments have been made to the transmitter during wet calibration.

9.3 Sample Calibration Verification Document

If the accuracy is inside has limits “URS” (User Requirement Specifications), the Eclipse passes.

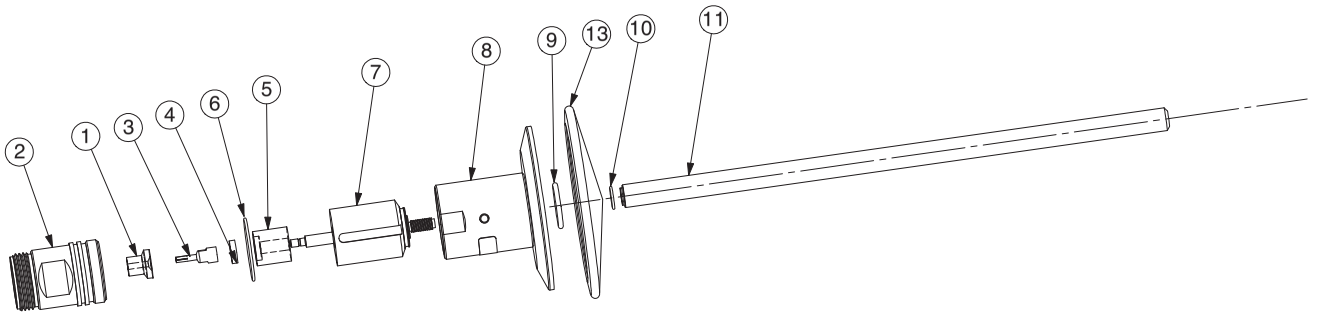
NOTE: The accuracy required is the accuracy required per the URS – NOT the standard accuracy of Eclipse.

Frequency of calibration verification is determined based on experience, process conditions, and criticalityof the measurement.

	INITIAL 2012	2013	2014
Mark1 (0 cm)	0		
Mark2 (10 cm)	0		
	0		
	0		
Mark8 (90 cm)	0		
Mark9 (110 cm)	0	0,1 liter	
Mark10 (110 cm)	25,2 liter	25,1 liter	
Mark11 (120 cm)	45,7 liter	45,8 liter	
Mark19 (180 cm)	475,3 liter	475 liter	
Mark20 (190 cm)	500,2 liter	500,0 liter	
Mark21 (200 cm)	500,2 liter	500,0 liter	
Certified	Miller	Smith	
Date	11.1.2010	15.1.2011	

10. Hygienic Probe Rebuild Procedure

10.1 Model 7xH

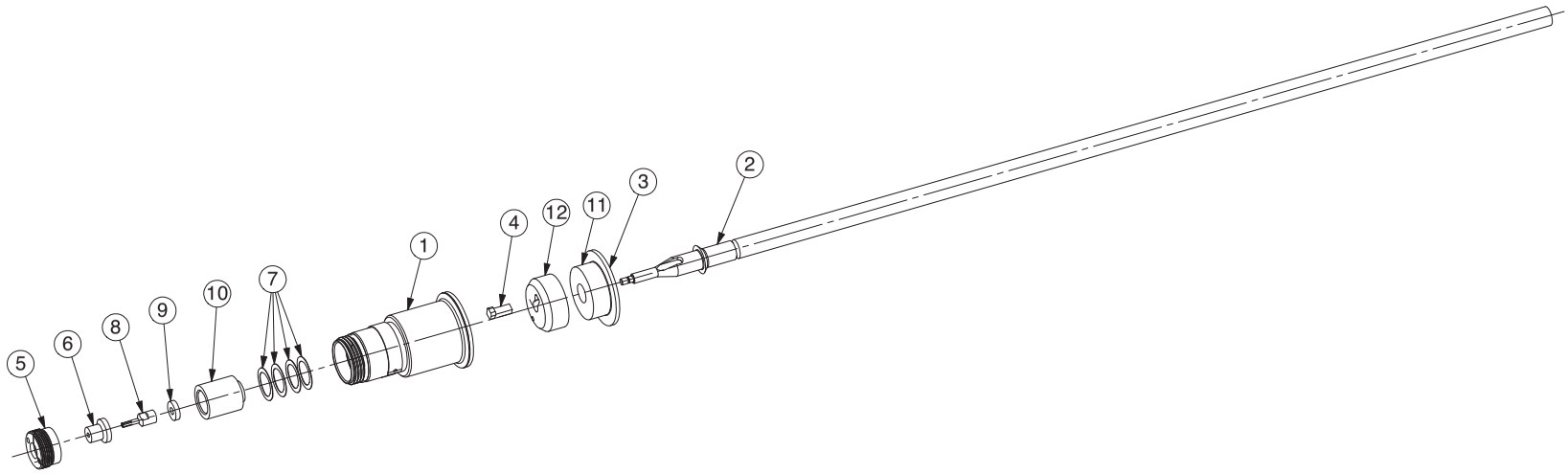


ASSEMBLY INSTRUCTIONS		
STEP	PROCEDURE	COMMENT
1	INSERT O-RING (ITEM-9) INTO GROOVE OF HOUSING SUPPORT ASSEMBLY (ITEM-7).	
2	SLIDE SPACER (ITEM-5) OVER THE SHAFT OF THE HOUSING SUPPORT ASEMBLY (ITEM-7).	
3	SLIDE WASHER (ITEM-4) OVER THE SHAFT OF THE HOUSING SUPPORT ASSEMBLY (ITEM-7).	
4	SCREW CENTER PIN (ITEM-3) ONTO HOUSING SUPPORT ASSEMBLY SHAFT (ITEM-7) USING CENTER PIN WRENCH FROM PROBE TOOL KIT P/N 089-7910-001. USE 20 IN-LBS MAX. TORQUE.	CAUTION: **OVERTIGHTENING CAN DAMAGE THE THREADED END OF THE HOUSING SUPPORT ASSEMBLY.**
5	INSERT HOUSING SUPPORT ASSEMBLY (ITEM-7) INTO FLANGE ASSEMBLY (ITEM-8).	ALIGN THE SLOTS IN THE HOUSING SUPPORT ASSEMBLY WITH THE KEYS IN THE FLANGE ASSEMBLY.
6	INSTALL INSULATING BUSHING (ITEM-1) ONTO CENTER PIN (ITEM 3).	
7	APPLY O-RING LUBE TO O-RING BEFORE INSERTING O-RING (ITEM-6) INTO GROOVE OF HF ADAPTOR (ITEM-2).	
8	APPLY ANTI-SEIZE TO THREADS OF HF ADAPTOR BEFORE SCREWING HF ADAPTER (ITEM-2) INTO FLANGE ASSEMBLY (ITEM-8). USE 45 ± 5 FT-LBS OF MAX TORQUE (Note-2).	
9	USING A DIGITAL MULTIMETER, ENSURE GREATER THAN 20 MEG-OHM RESISTANCE BETWEEN CENTER PIN (ITEM-3) AND ADAPTER ASSEMBLY (ITEM-8).	
10	INSTALL O-RING (ITEM-10) INTO GROOVE ON PROBE SHAFT (ITEM-11). SCREW PROBE SHAFT ONTO HOUSING SUPPORT ASSEMBLY (ITEM-7). USE 75 IN-LBS OF TORQUE.	CAUTION: **OVERTIGHTENING CAN DAMAGE THE THREADED END OF THE HOUSING SUPPORT ASSEMBLY.**
11	USING A DIGITAL MULTIMETER, ENSURE CONTINUITY BETWEEN CENTER PIN (ITEM-8) AND PROBE SHAFT (ITEM-2)	

DISASSEMBLY INSTRUCTIONS		
STEP	PROCEDURE	COMMENT
1	UNSCREW AND RETAIN PROBE SHAFT (ITEM-11). REMOVE AND DISCARD O-RING (ITEM-10).	
2	UNSCREW AND RETAIN HF ADAPTER (ITEM-2).	
3	REMOVE AND RETAIN INSULATING BUSHING (ITEM-1).	
4	WHILE HOLDING FLANGE ASSEMBLY (ITEM-8) TO KEEP IT FROM ROTATING, CAREFULLY UNSCREW CENTER PIN (ITEM-3). RETAIN CENTER PIN.	USE CENTER PIN WRENCH FROM PROBE TOOL KIT P/N 089-7910-001
5	PULL HOUSING SUPPORT ASSEMBLY (ITEM-7) OUT FROM THE ADAPTER ASSEMBLY.	
6	REMOVE AND RETAIN WASHER (ITEM-4) AND SPACER (ITEM-5). DISCARD THE HOUSING SUPPORT ASSEMBLY (ITEM-7) AND O-RING (ITEM-9).	
7	CLEAN PARTS.	

NOTE:
1. HANDLE PER REQUIREMENTS OF ASME BPE.
2. IF REPLACING ITEM-8 (FLANGE ASSEMBLY), THE NAMEPLATE SHOULD BE REMOVED FROM THE EXISTING FLANGE ASSEMBLY AND RE-ATTACHED TO THE NEW FLANGE ASSEMBLY.
3. FOR CUSTOMER USE

HYGIENIC PROBE PARTS		
ITEM	QTY	DESCRIPTION
1	1	INSULATOR BUSHING
2	1	HF ADAPTER
3	1	CENTER PIN
4	1	WASHER
5	1	SPACER
6	1	O-RING
7	1	HOUSING SUPPORT ASSEMBLY
8	1	FLANGE ASSEMBLY
9	1	O-RING
10	1	O-RING
11	1	PROBE SHAFT
13	1	VINYL FLANGE COVER



ASSEMBLY INSTRUCTIONS		
STEP	PROCEDURE	COMMENT
1	INSERT KEY (ITEM-4) INTO SLOT OF KEY INSERT (ITEM-12).	FOR 1-1/2" OR 2" FITTING, USE A NEW KEY INSERT (ITEM-12) AND A NEW INSERT (ITEM-11) FOR 3" AND LARGER FITTING, ORIGINAL INSERTS MAY BE USED.
2	INSERT KEY INSERT AND KEY ASSEMBLY (STEP 1) INTO ADAPTER ASSEMBLY (ITEM-1). ALONG WITH INSERT (ITEM-11)	ALIGN THE HOLE IN THE KEY INSERT (ITEM-12) WITH THE PIN IN THE ADAPTER ASSEMBLY (ITEM-1).
3	FOR 3" OR LARGER FITTING, SLIDE NEW WASHER (ITEM-3) OVER THE PROBE ROD (ITEM-2).	1-1/2" AND 2" FITTINGS DO NOT REQUIRE A SEPARATE WASHER (ITEM-3).
4	INSERT PROBE ROD (ITEM-2) INTO THE INSERT (ITEM-11) OF THE ADAPTER ASSEMBLY.	ALIGN THE SLOT ON THE PROBE ROD (ITEM-2) WITH THE KEY (ITEM-4) IN THE KEY INSERT (ITEM-12).
5	INSTALL FOUR WAVE-SPRINGS (ITEM-7) INTO ADAPTER ASSEMBLY.	ENSURE SPRINGS ARE NESTED. SPLITS IN SPRINGS SHOULD NOT BE ALIGNED AGAINST EACH OTHER.
6	INSTALL PROCESS SEAL (ITEM-10).	
7	INSTALL WASHER (ITEM-9).	
8	INSTALL CENTER PIN (ITEM-8) USING CENTER PIN WRENCH FROM PROBE TOOL KIT P/N 089-7910-001. USE 20 IN-LBS TORQUE	CAUTION: **OVERTIGHTENING CAN DAMAGE THE THREADED END OF THE PROBE SHAFT.**
9	INSTALL INSULATING BUSHING (ITEM-6) ONTO CENTER PIN (ITEM-B).	
10	SCREW LOCKNUT (ITEM-5) INTO ADAPTER ASSEMBLY (ITEM-1) USING LOCKNUT WRENCH FROM PROBE TOOL KIT P/N 089-7910-001. USE 50 IN-LBS TORQUE.	TOP SURFACE OF LOCKNUT (ITEM-5) SHOULD BE APPROXIMATELY .06" ABOVE END OF CENTER PIN (ITEM-8) INSULATING BUSHING (ITEM-6) SHOULD BE FREE TO FLOAT UP AND DOWN.
11	USING A DIGITAL MULTIMETER, ENSURE GREATER THAN 20 MEG-OHM RESISTANCE BETWEEN CENTER PIN (ITEM-8) AND ADAPTER ASSEMBLY (ITEM-1).	
12	USING A DIGITAL MULTIMETER, ENSURE CONTINUITY BETWEEN CENTER PIN (ITEM-8) AND PROBE SHAFT (ITEM-2)	

DISASSEMBLY INSTRUCTIONS		
STEP	PROCEDURE	COMMENT
1	UNSCREW AND RETAIN LOCKNUT (ITEM-5).	USE LOCKNUT WRENCH FROM PROBE TOOL KIT P/N 089-7910-001.
2	REMOVE AND RETAIN INSULATING BUSHING (ITEM-6).	
3	WHILE CLAMPING/HOLDING PROBE ROD (ITEM-2) FROM ROTATING, CAREFULLY UNSCREW AND RETAIN CENTER PIN (ITEM-8).	USE CENTER PIN WRENCH FROM PROBE TOOL KIT P/N 089-7910-001
4	PULL PROBE ROD (ITEM-2) OUT FROM THE ADAPTER ASSEMBLY (ITEM-1). RETAIN PROBE ROD (ITEM-2) AND KEY (ITEM-4).	CAUTION: PROTECT THE .75" DIAMETER LIP ON THE PROBE ROD (ITEM-2). **DENTS OR GOUGES ON THE SHARP EDGE MAY CAUSE LOSS OF SEAL.**
5	REMOVE INSERT (ITEM-11), KEY INSERT (ITEM-12) AND WASHER (ITEM-3). FOR 1-1/2" AND 2" FITTING: A SEPARATE WASHER (ITEM-3) IS NOT USED. DISCARD THE INSERT (ITEM-11) AND THE KEY INSERT (ITEM-12). FOR 3" OR LARGER FITTING: DISCARD THE WASHER (ITEM-3) AND RETAIN THE INSERT (ITEM-11) AND THE KEY INSERT (ITEM-12).	
6	REMOVE AND RETAIN WASHER (ITEM-9), PROCESS SEAL (ITEM-10) AND WAVE SPRINGS (ITEM-7) FROM ADAPTER ASSEMBLY.	
7	CLEAN PARTS.	

NOTE:
1. FOR CUSTOMER USE

HYGIENIC PROBE PARTS		
ITEM	QTY	DESCRIPTION
1	1	ADAPTER ASSEMBLY
2	1	PROBE ROD
3	1	WASHER (FOR 3" AND LARGER ONLY)
4	1	KEY
5	1	LOCKNUT
6	1	INSULATING BUSHING
7	4	WAVE SPRING
8	1	CENTER PIN
9	1	WASHER
10	1	PROCESS SEAL
11	1	INSERT
12	1	KEY INSERT

MAGNETROL® / AMETEK®
LEVEL MEASUREMENT SOLUTIONS

Model 705 Hygienic 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	
Vessel Name					
Vessel #					
Process Medium					
Tag #					
Electronics Serial #					
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					

MAGNETROL® / AMETEK®
LEVEL MEASUREMENT SOLUTIONS

Model 705 Hygienic 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					

MAGNETROL® / AMETEK®
LEVEL MEASUREMENT SOLUTIONS

Model 705 Hygienic Eclipse® Guided Wave Radar Transmitter

Configuration Data Sheet

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

Strapping Table Point	Level Reading	Volume
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Appendix A: GWR – Emitted Energy

The Eclipse Model 705 far exceeds the OSHA health and safety requirements for nonionizing radiation. OSHA Standard 29 CFR 1910.97 covers non-ionization radiation. Section (a)(2)(i) states:

"For normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz, the radiation protection guide is 10 mW/cm^2 (milliwatts per square centimeter) as averaged over any possible 0.1–hour period."

The Eclipse signal is within this frequency range. No signals are intentionally radiated away from the probe. Eclipse complies with FCC Part 15, Subpart B as an unintentional radiator. It is authorized under the verification process.

Under the authorization process, the emissions of Eclipse must be within the limits listed in the table in section 15.109(a). The highest field strength listed in the table 500 µV/m (microvolts per meter) at three meters. Eclipse has a 0.1% duty cycle. For a worst case calculation, let us assume a 100% duty cycle. This assumption correlates to the Eclipse generating a continuous signal for 0.1 hours.

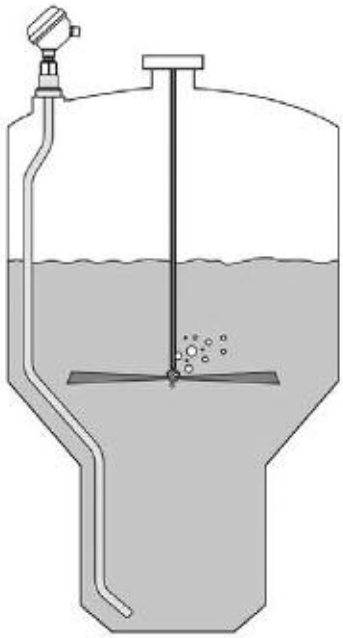
Field strength is related to power density by the equation:

Power density - (field strength^2/(the impedance of air in free space), where the impedance of air in free space is 377 ohms.

The result is power density of 0.066 pW/cm^2 (picowatts per square centimeter) at three meters or 6.4 pW/cm^2 at one foot. These values are from the one billion to ten billion times smaller than the OSHA guideline. For a 0.1% duty cycle, these numbers become even smaller by a factor of 1000.

Appendix B: Indexing Bent GWR Probes in Vessels

Eclipse hygienic GWR probes are often bent to avoid obstructions in a vessel or to position the tip of the probe at the heel of a vessel in order to measure as low in the vessel as possible. An illustration of a bent probe in a tulip tank is shown below:



When the Eclipse transmitter is configured and calibrated to measure volume, it is important to assure that, if the probe is removed from the vessel and then reinserted into the vessel, the probe is positioned exactly as it was when originally calibrated. Any rotation of the bent probe may significantly affect the calibration of the instrument. Note that rotation of a straight probe does NOT affect calibration.

We recommend either of two methods to index the bent probe in a vessel so that the calibration will be preserved: Match-Marking or Positioning Pin. Both methods are described below.

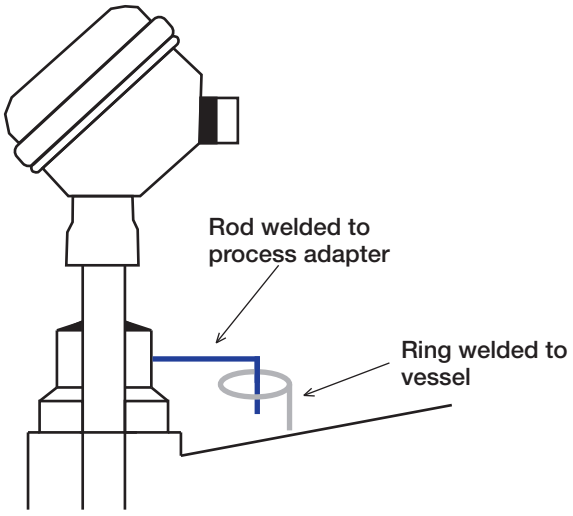
Match-Marking

Match-Marking is the marking of the GWR probe process connection in relationship to the vessel ferrule that it is mounted in. After the probe is properly bent for the specific vessel, the probe is properly positioned in the vessel. Before the clamp is placed on the ferrule/probe joint, the ferrule on the vessel and the ferule on the GWR probe process connection are match-marked.

The easiest way to achieve the match-mark is to make a vertical mark on both the vessel ferrule and the GWR probe process adapter. This mark can be something as simple as a permanent Magic Marker line or a vertical chisel mark. In either case, the indexing mark will match the alignment of the bent probe within a vessel. Should the bent GWR probe subsequently be removed or the position changed, it would be easy to realign both marks to position the probe to the original geometry.

Pin Positioning

During fabrication of the vessel, a ring is welded near the vessel ferrule. The GWR probe is then bent to the required geometry and is inserted into the vessel. After the ferrule clamp is installed, the probe is calibrated to read volume. When the calibration is complete and before removing the clamp, an indexing rod is bent to fit into the ring retainer and positioned against the process adapter of the probe. A temporary mark is then made on the probe process adapter. The probe is then removed from the vessel and disassembled to remove the parts within the probe process adapter so that these parts are not melted during the welding of the rod to the process adapter. After welding the indexing rod onto the probe process adapter, the internals of the probe are reassembled once the process adapter is cool. See sketch below:



Note that if the probe process adapter is disassembled, the parts must be reassembled correctly and torqued to specifications.

Appendix C: Segmented Probes

Stainless Steel Housing with Model 7xH Hygienic probe

Eclipse Model 705 transmitter in a 304 SS housing for use in a variety of hygienic applications. 0.5-inch diameter 316L SS probe with a 15Ra MAX surface finish is available with lengths up to 244" and with Tri-Clover® type connection sizes from 1" through 4".

In addition, a 0.25-inch diameter 316L SS probe with 15Ra MAX surface finish is available with lengths up to 72" and with a ¾" Tri-Clover® type connection.

1½" Hygienic Connection with bend

316L SS probes can be bent to avoid internal obstructions such as agitator blades and spray balls, and to ensure lowest possible level detection.

¾" Hygienic Connection without bend

0.25-inch diameter probes suitable for use in smaller vessels where space is at a premium. Available in lengths up to 72 inches.

Segmented Hygienic Probe

Segmented probes are available should the probe be inserted or removed with limited headroom above the vessel (segmented lengths are specified by the customer). Contact the factory for details.

Aluminum Dual Compartment Housing

Eclipse Model 705 transmitter is available with an industrial dual compartment aluminum housing.

NOTES

NOTES

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.

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