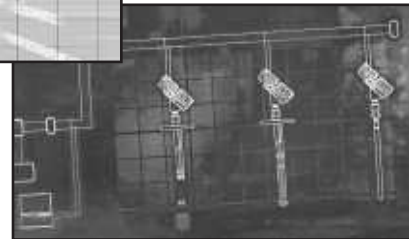


ECLIPSE[®]

Enhanced Model 705 with
FOUNDATION Fieldbus[™] Digital Output
705 software v3.x

FOUNDATION Fieldbus[™] Operating Manual

*Guided Wave Radar
Level Transmitter*



Read this Manual Before Installing

This manual provides information on the Enhanced Eclipse Model 705 transmitter with FOUNDATION fieldbus™ Output and should be used in conjunction with Eclipse I&O manual 57-600. It is important that all instructions are read and followed carefully.

Safety Messages

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

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

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

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

Low Voltage Directive

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

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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.

Warranty

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

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FOUNDATION fieldbus™ Enhanced Eclipse Model 705 Guided Wave Radar Transmitter

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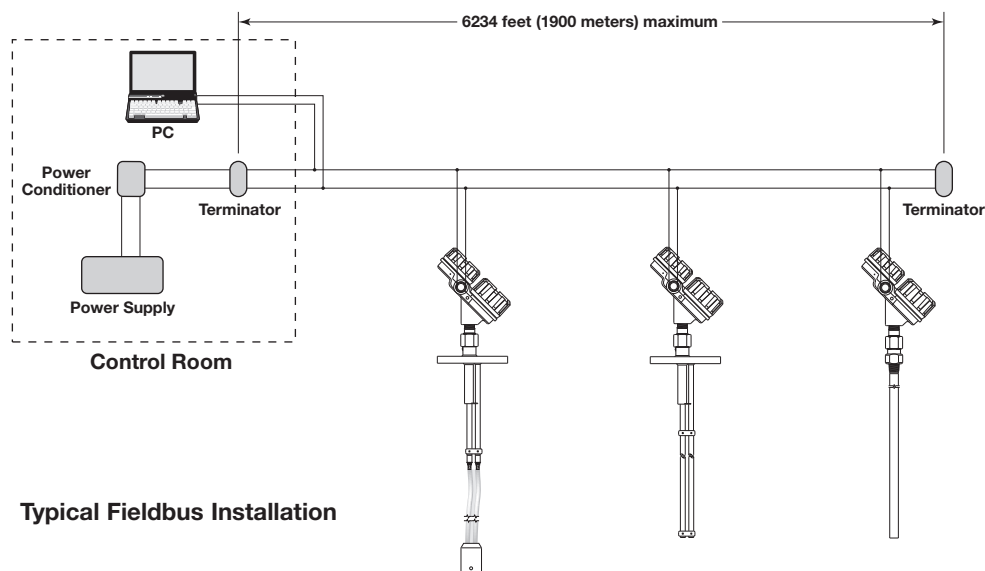
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1.0 FOUNDATION Fieldbus™ Overview

1.1 Description

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

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



Typical Fieldbus Installation

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

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

Details regarding cable specifications, grounding, termination, and other network information can be found in IEC 61158 or the wiring installation application guide AG-140 at www.fieldbus.org.

1.2 Benefits

The benefits of FOUNDATION fieldbus™ can be found throughout all phases of an installation:

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

1.3 Device Configuration

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

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

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

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

Device Descriptions

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

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

The most recent DD and CFF files can be found on the FOUNDATION fieldbus™ web site at www.fieldbus.org.

NOTE: Please consult your host system vendor for any host-specific files that may be needed.

1.3.1 FOUNDATION fieldbus™ Revision Table

Model 705 3.x

| FOUNDATION fieldbus™ Version | FOUNDATION fieldbus™ Release Date | Compatible with 705 Software |
|---------------------------------|--------------------------------------|--------------------------------------|
| Dev V1 DD V1 | June 2005 | Version 3.0A through Version 3.0K |
| Dev V2 DD V1 | June 2008 | Version 3.1A and later |

1.4 Intrinsic Safety

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

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

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

The Enhanced Eclipse Model 705 is available with entity IS, FISCO IS, FNICO non-incendive, or explosion proof approvals.

1.5 Link Active Scheduler (LAS)

The default operating class of the Enhanced Eclipse Model 705 with FOUNDATION fieldbus™ is a basic device. However, it is capable of being a Link Active Scheduler (LAS). The LAS controls all communication on a FOUNDATION fieldbus™ segment. It maintains the “Live List” of all devices on a segment, coordinates both the cyclic and acyclic timing and, at any given time, controls which device publishes data via Compel data (CD) and Pass Token (PT).

The primary LAS is usually maintained in the host system, but in the event of a failure, all associated control can be transferred to a backup LAS in a field device such as the Enhanced Eclipse Model 705. The operating class can be changed from basic to LAS using a FOUNDATION fieldbus™ configuration tool.

NOTE: The Enhanced Eclipse Model 705 is shipped from the factory with Device Class set to Basic.

2.0 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 3.0, for detailed installation instructions.

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

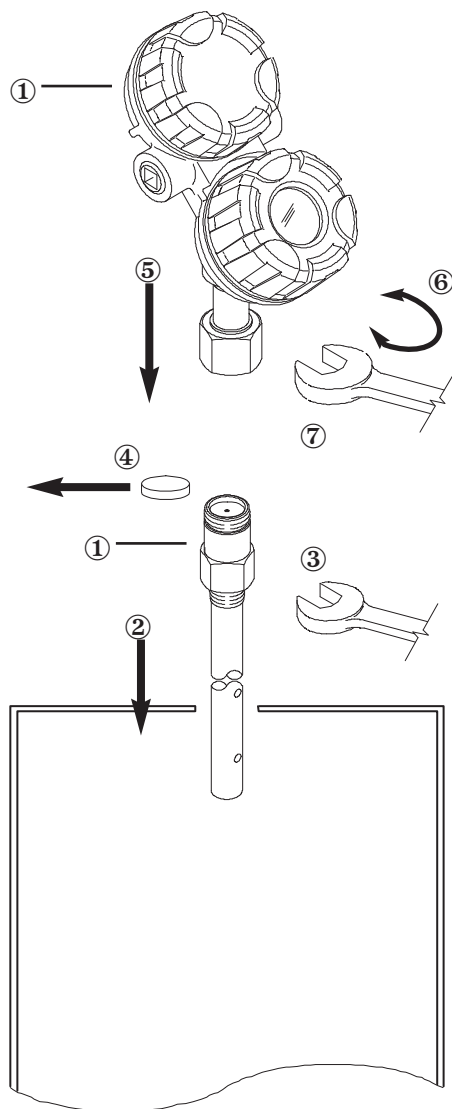
2.1 Getting Started

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

2.1.1 Equipment and Tools

- Open-end wrenches or adjustable wrench to fit the process connection size and type. Coaxial probe 1½" (38 mm), twin rod probe 1⅞" (47 mm), transmitter 1½" (38 mm). A torque wrench is highly desirable.
- Flat-blade screwdriver
- Cable cutter and ⅜" (2.5 mm) hex wrench (Flexible probes only)
- Fieldbus compatible power supply with proper termination

2.2 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.

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

2.2.1 Probe

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

2.2.2 Transmitter

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

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

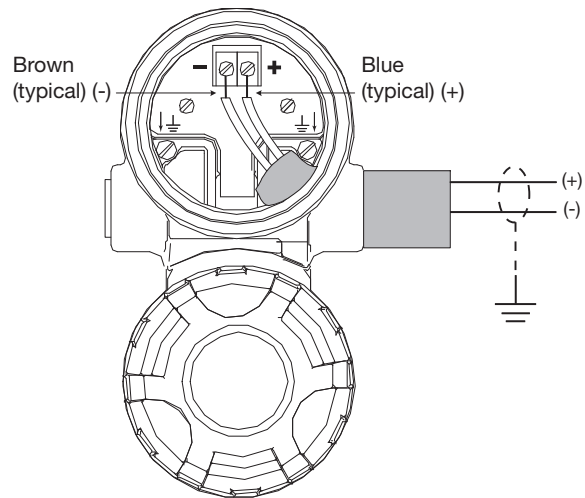
- ④ Remove the protective plastic cap from the top of the probe and store for future use. Make sure the top probe connector (female socket) is clean and dry. Clean with isopropyl alcohol and cotton swabs if necessary.
- ⑤ Place the transmitter on the probe. Align the universal connection at the base of the transmitter housing with the top of the probe. Hand tighten the connection.
- ⑥ Rotate the transmitter so that it is in the most convenient position for wiring, configuring, and viewing.
- ⑦ Using a 1½" (38 mm) wrench, tighten the universal connection on the transmitter ¼ to ½ turn beyond hand tight. A torque wrench is highly recommended to obtain 15 ft-lbs. This is a critical connection. **DO NOT LEAVE HAND TIGHT.**

2.3 QuickStart Wiring

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

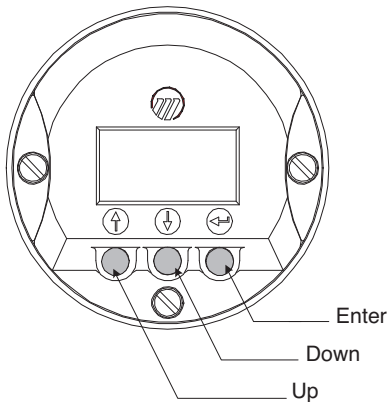
NOTE: Ensure that the electrical wiring to the Eclipse transmitter is complete and in compliance with all regulations and codes.

1. Remove the cover of the upper wiring compartment of the transmitter.
2. Attach a conduit fitting and mount the conduit plug in the spare opening. Pull the power supply wire through the conduit fitting.
3. Connect shield to an earth ground at power supply.
4. Connect 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 of I/O manual 57-600.
5. Replace the cover and tighten.



2.4 QuickStart Configuration

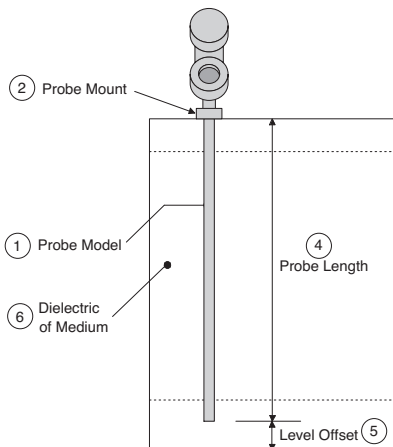
The Eclipse transmitter comes partially configured from the factory but can be reconfigured in the shop (disregard fault message due to unattached probe). The minimum configuration instructions required in the field follow.



1. Power up the transmitter.
The display changes every 5 seconds alternating between showing the Status, Level and Analog Input Block values.
2. Remove the cover of the lower electronic compartment.
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 (!).

| |
|-----------------|
| PrbModel xxx |
|-----------------|
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 1).
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 1 from the LCD/keypad).



- | | | |
|---|----------------------|--|
| ① | PrbModel (select) | Select the Probe Model to be used Model 705: 7xA-x, 7xB-x, 7xD-x, 7xE-x, 7xF-F, 7xF-P, 7xF-4, 7xF-x, 7xJ-x, 7xK-x, 7xP-x, 7xR-x, 7xS-x, 7xT-x, 7x1-x, 7x2-x, 7x5-x, 7x7-x |
| ② | PrbMount (select) | Select the type of Probe Mounting to vessel (NPT, BSP, or flange). |
| ③ | MeasType (select) | Select from Level Only, Level and Volume, Interface Level or Interface Level and Volume. |
| ④ | Probe Ln xxx.x | Enter the exact Probe Length as printed on the probe nameplate. |
| ⑤ | LvlOfst xxx.x | Enter the Level Offset value. Refer to Section 4.3.4 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). |
| ⑥ | Dielctrc (select) | Enter the Dielectric range for the material to be measured. |

3.0 Complete Installation

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

3.1 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

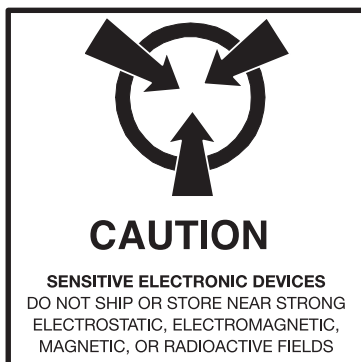
Serial Number

3.2 Electrostatic Discharge (ESD) Handling Procedure

Magnetrol's 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.



3.3 Before You Begin

3.3.1 Site Preparation

Each Eclipse transmitter is built to match the specific physical specifications of the required installation. Make sure the probe connection is correct for the threaded or flanged mounting on the vessel or tank where the transmitter will be placed. See Mounting, Section 3.4.

Make sure that the wiring between the power supply and Eclipse transmitter are complete and correct for the type of installation.

When installing the Eclipse transmitter in a general purpose or hazardous area, all local, state, and federal regulations and guidelines must be observed. See Eclipse Installation & Operating Manual 57-600, Wiring, Section 2.5.

3.3.2 Equipment and Tools

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

- Open-end wrenches or adjustable wrench to fit the process connection size and type. Coaxial probe 1½" (38 mm), twin rod probe 1⅞" (47 mm), transmitter 1½" (38 mm). A torque wrench is highly desirable.
- Flat-blade screwdriver
- Fieldbus compatible power supply with proper termination

3.3.3 Operational Considerations

Operating specifications vary based on Probe model number.

3.4 Mounting

The Eclipse transmitter can be mounted to a tank using a variety of process connections. Generally, either a threaded or flanged connection is used. For information about the sizes and types of connections available, see Probe Model Numbers, Section 7.5.2.

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

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

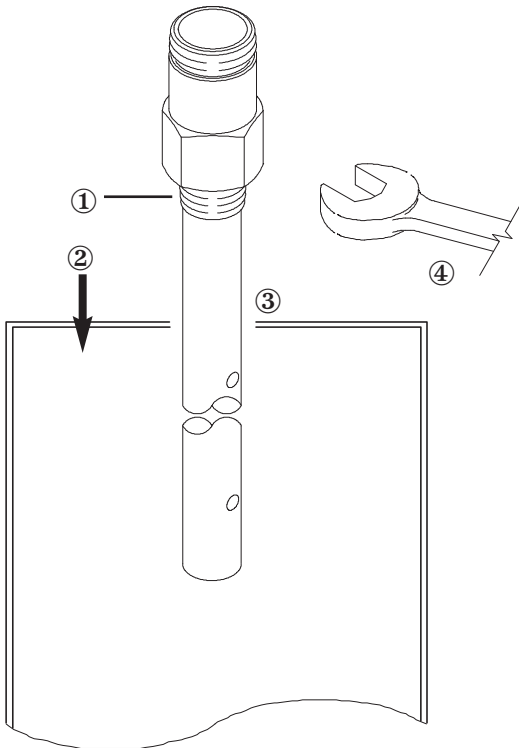
WARNING! The Model 7xD, 7xR or 7xT overfill probes should be used for Safety Shutdown/Overfill applications. All other Guided Wave Radar probes should be installed so the maximum overfill level is a minimum of 6" (150 mm) below the process connection. This may include utilizing a nozzle or spool piece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

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

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

Before installing, make sure the:

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



3.4.1.1 To install a coaxial probe:

- ① Make sure the process connection is at least $\frac{3}{4}$ " NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.

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

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

Before installing, make sure the:

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

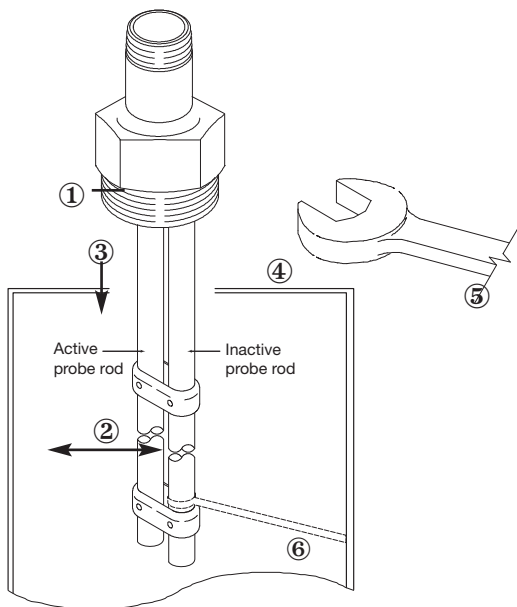
Nozzles:

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

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

3.4.2.1 To install a rigid twin rod probe:

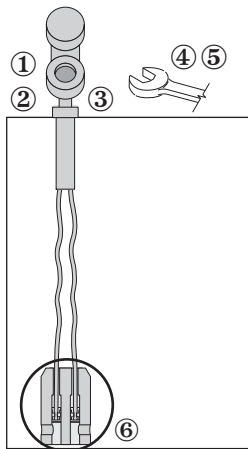
- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".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



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

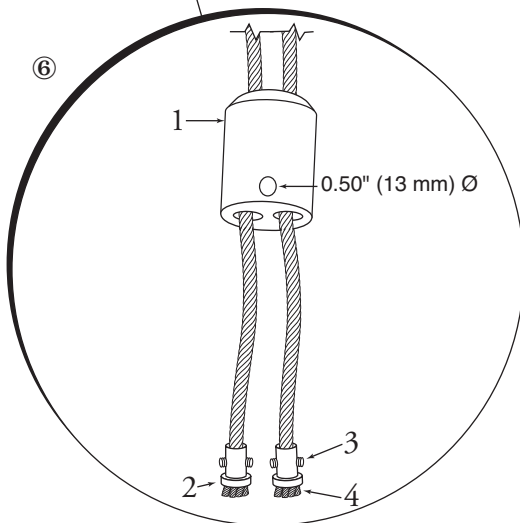
3.4.2.2 To install a Model 7x7 standard flexible twin rod probe:

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



Probe can be shortened in the field:

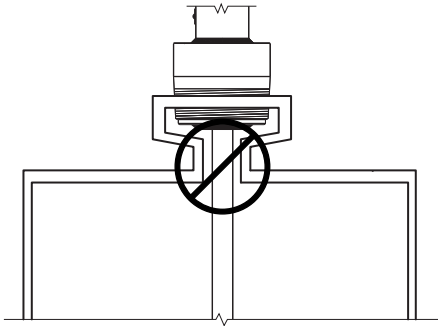
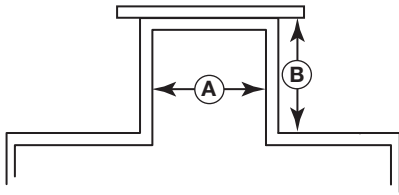
- ⑥ a. Raise the weight (1) to expose the two securing devices (2).
- b. Loosen the two #10-32 set screws (3) on both securing devices using a $\frac{3}{32}$ " (2.5 mm) hex wrench and slide the securing devices off of the probe.
- c. Slide the TFE weight off of the probe.
- d. Cut and remove the required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



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

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate headroom for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, viscosity, and media buildup are within the probe specifications for the installation.
- Nozzle does not restrict performance by ensuring the following:
 1. Nozzle is <2" (50mm) diameter.



2. Ratio of Diameter: Length (A:B) is 1:1 or greater; any ratio <1:1 (e.g., a 2" x 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment (see Eclipse Installation & Operating Manual 57-600, Section 2.6.5.2, Measurement Type: Level and Volume).

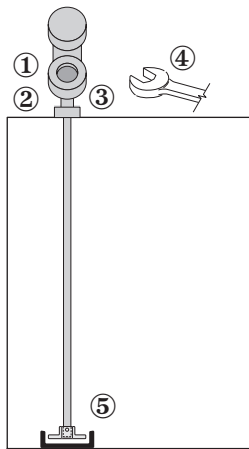
3. No pipe reducers (restrictions) are used.

- Probe is kept away from conductive objects to ensure proper performance. See Probe Clearance Table below. A lower gain (increase in DIELECTRIC setting) may be necessary to ignore certain objects.

PROBE CLEARANCE GUIDELINES

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

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

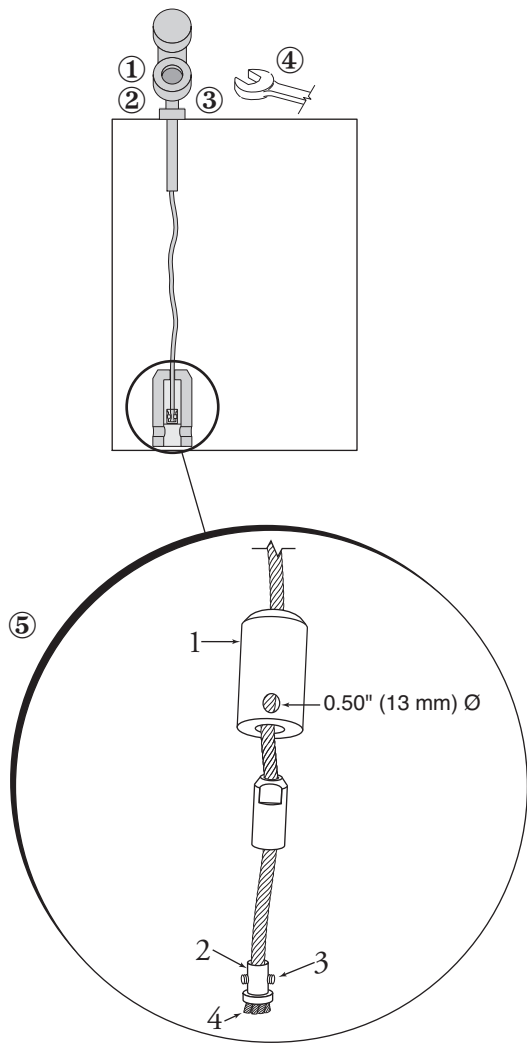


- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the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

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

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

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.



- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑤ Probe can be shortened in field:
 - a. Raise TFE weight (1) exposing securing device (2).
 - b. Loosen both #10–32 set screws (3) using $\frac{3}{32}$ " (2.5 mm) hex wrench and remove securing device.
 - c. Cut and remove needed cable (4) length.
 - d. Reattach securing device and tighten screws.
 - e. Enter new probe length (inches or cm) in software.
- ⑥ Probe can be attached to the tank bottom using the 0.50" (13 mm) \varnothing hole provided in the TFE weight. Cable tension should not exceed 20 lbs.

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

The Model 7x2 and 7x5 Bulk Solids probes are designed for a 3000 lb. (1360 kg) pull-down force for use in applications such as sand, plastic pellets and grains. It is offered with a maximum 75-foot (22 meter) probe length.

Model 7x2 Single Rod — dielectric ≥ 4

Model 7x5 Twin Rod — dielectric ≥ 1.9

NOTE: Avoid cement, heavy gravel, etc.

3.4.4.1 Applications

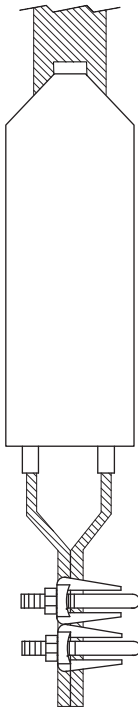
1. Plastic pellets, sugar: Dielectric constant 1.9-2.0
2. Grain, seeds, sand: Dielectric constant 2.0-3.0
3. Salts: Dielectric constant 4.0-7.0
4. Metallic powder, coal dust: Dielectric constant >7

3.4.4.2 Mounting recommendations

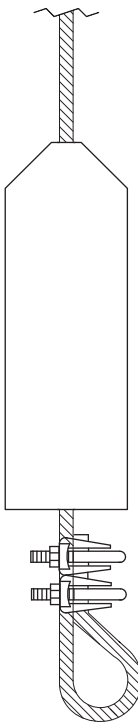
1. Use a weight instead of securing the probe to the vessel.
2. Mount probe at least 12 inches from the wall. Ideal location is $\frac{1}{4}$ to $\frac{1}{2}$ the diameter to average the angle of repose.
3. A metal flange must be used when mounting on plastic vessels.

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

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



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



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

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

Probe can be shortened in the field:

- ⑥ a. Loosen and remove the two cable clamps.
- b. Slide the weight off of the probe.
- c. Cut the cable to the required length.
- d. Remove 12 inches of the rib between the two cables.
- e. Strip 6 inches of coating from the two cables.
- f. Slide the weight back on to the probe.
- g. Reinstall the two cable clamps and tighten.
- h. Enter the new probe length (inches or cm) in software.

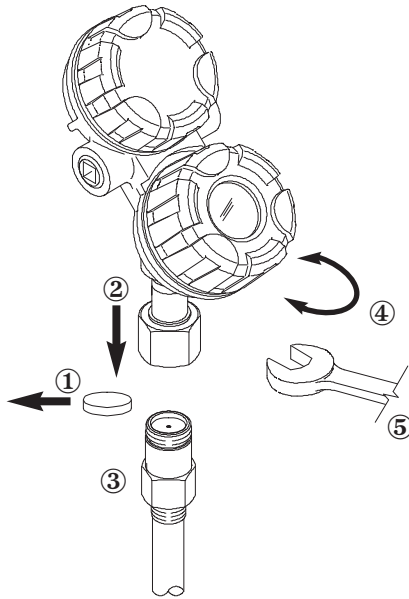
3.4.4.4 To install a Model 7x2 bulk solids flexible single rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑤ Probe can be shortened in field:
- ⑥ a. Loosen and remove the two cable clamps.
- b. Slide the weight off of the probe.
- c. Cut the cable to the required length plus 6.38".
- d. Slide the weight back on to the probe.
- e. Reinstall the two cable clamps and tighten.
- f. Enter the new probe length (inches or cm) in software.

3.4.5 Installing the Transmitter

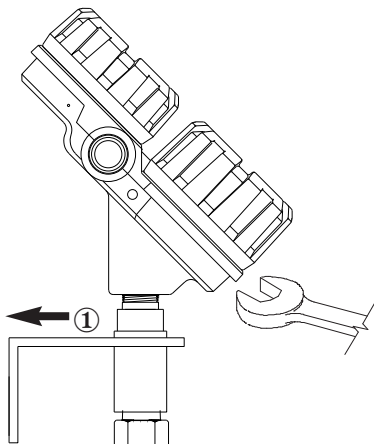
The transmitter can be ordered for installation as an Integral or Remote configuration.

3.4.5.1 Integral Mount

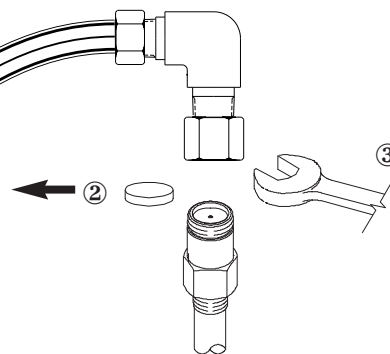


- ① Remove the protective plastic cap from the top of the probe. Put the cap in a safe place in case the transmitter has to be removed later.
- ② Place the transmitter on the probe. Be careful not to bend or dirty the gold, high frequency (male) connector.
- ③ Align the universal connection at the base of the transmitter housing with the top of the probe. Hand tighten the connection.
- ④ Rotate the transmitter to face the most convenient direction for wiring, configuration, and viewing.
- ⑤ When the transmitter is facing the desired direction, use a $1\frac{1}{2}$ " (38 mm) wrench to tighten the universal connection on the transmitter to 15 ft-lbs. A torque wrench is highly recommended. This is a critical connection. **DO NOT LEAVE HAND TIGHT.**

3.4.5.2 Remote Mount



- ① Mount the transmitter/remote bracket as an assembly within 33" (84 cm) of the probe. **DO NOT REMOVE TRANSMITTER FROM BRACKET.**
- ② Remove the protective plastic cap from the top of the probe. Put the cap in a safe place in case the transmitter has to be removed later.
- ③ Align the universal connection at the end of the remote assembly with the top of the probe. Using a $1\frac{1}{2}$ " (38 mm) wrench, tighten the universal connection on the transmitter to 15 ft-lbs. A torque wrench is highly recommended. This is a critical connection. **DO NOT LEAVE HAND TIGHT.**



4.0 Function Blocks

4.1 Overview

The Enhanced Eclipse Model 705 Guided Wave Radar Level Transmitter operates on the principle of Time Domain Reflectometry (TDR). Refer to Bulletins 57-101 and 57-600 for more detailed information on the Eclipse product family.

The Enhanced Eclipse Model 705FF is a Guided Wave Radar (GWR) level transmitter with seven FOUNDATION fieldbus™ Function Blocks (one Resource Block, one Transducer Block, four Analog Input Blocks, and one PID Block). The idea of Function Blocks, which a user can customize for a particular application, is a key concept of Fieldbus topology. Function Blocks consist of an algorithm, inputs and outputs, and a user-defined name.

The TRANSDUCER block output is available to the network through the ANALOG INPUT blocks.

- The ANALOG INPUT blocks (AI) take the TRANSDUCER block level or volume values and makes them available as an analog value to other function blocks. The AI blocks have scaling conversion, filtering, and alarm functions.

4.1.1 Universal Fieldbus Block Parameters

The following are general descriptions of the parameters common to all blocks. Additional information for a given parameter is described later in that specific block section.

ST_REV (static data revision): a read only parameter that gives the revision level of the static data associated with the block. This parameter will be incremented each time a static parameter attribute value is written and is a vehicle for tracking changes in static parameter attributes.

TAG_DESC (tag descriptor): a user assigned parameter that describes the intended application of any given block.

STRATEGY: a user assigned parameter that identifies groupings of blocks associated with a given network connection or control scheme.

ALERT_KEY: a user assigned parameter which may be used in sorting alarms or events generated by a block.

MODE_BLK: a structured parameter composed of the actual mode, the target mode, the permitted mode(s), and the normal mode of operation of a block.

- The actual mode is set by the block during its execution to reflect the mode used during execution.
- The target mode may be set and monitored through the mode parameter.

-
- The permitted modes are listed for each block.
 - The block must be in an automatic mode for normal operation.

NOTE: The `MODE_BLK` target parameter must be OOS (out of service) to change configuration and calibration parameters in that function block (when in OOS, the normal algorithm is no longer executed and any outstanding alarms are cleared).

All blocks must be in an operating mode for the device to operate. This requires the Resource Block to be in “AUTO” and the Transducer Block to be in “AUTO” before the Function Blocks can be placed in a mode other than OOS (out of service).

BLOCK_ERR: a parameter that reflects the error status of hardware or software components associated with, and directly affecting, the correct operation of a block.

NOTE: A `BLOCK_ERR` of “Simulation Active” in the Resource Block does not mean simulation is active—it merely indicates that the simulation (hardware) enabling jumper is present.

4.2 Resource Block

The `RESOURCE` block contains data specific to the Enhanced Model 705 transmitter, along with some information about the firmware.

NOTE: The Resource Block has no control function.

MODE_BLK: Must be in AUTO in order for the remaining blocks in the transmitter to operate.

NOTE: A Resource Block in “out of service” will stop all function block execution in the transmitter.

RS_STATE (Resource State): identifies the state of the `RESOURCE` block state machine. Under normal operating conditions, it should be “On-Line.”

DD_RESOURCE: a string identifying the tag of the resource that contains the Device Description for this device.

MANUFAC_ID: contains Magnetrol International’s FOUNDATION fieldbus™ manufacturer’s ID number, which is 0x000156.

DEV_TYPE: the model number of the Enhanced Eclipse Model 705 transmitter (0x0001). It is used by interface devices to locate the Device Descriptor (DD) file for this product.

DEV_REV: contains the firmware revision of the Enhanced Eclipse Model 705 transmitter. It is used by interface devices to correctly select the associated DD.

DD_REV: contains the revision of the DD associated with the version of firmware in the Enhanced Eclipse Model 705 transmitter. It is used by interface devices to correctly select the associated DD.

RESTART: Default and Processor selections are available. Default will reset the Model 705 to the established block configuration.

NOTE: As RESTART DEFAULT will set **most** configuration parameters to their default values. Devices need to be reconfigured following activation of this function

FEATURES: a list of the features available in the transmitter. The Model 705 features include Reports, and Soft Write Lock.

FEATURES_SEL: allows the user to turn Features on or off.

CYCLE_TYPE: identifies the block execution methods that are available.

CYCLE_SEL: allows the user to select the block execution method.

MIN_CYCLE_T: the time duration of the shortest cycle interval. It puts a lower limit on the scheduling of the resource.

NV_CYCLE_T: the minimum time interval between copies of non-volatile (NV) parameters to NV memory. NV memory is only updated if there has been a significant change in the dynamic value and the last value saved will be available for the restart procedure. A value of "0" means it will never be automatically copied. Entries made by human interface devices to NV parameters are copied to non-volatile memory at the time of entry.

NOTE: After completing a large copy, allow several seconds before removing power from the Eclipse Model 705 transmitter to ensure that all data has been saved.

FREE_SPACE: shows the amount of available memory for further configuration. The value is zero percent in a pre-configured device.

FREE_TIME: the amount of the block processing time that is free to process additional blocks.

SHED_RCAS: the time duration at which to give up computer writes to function block RCas locations. Shed from RCas will never happen when SHED_RCAS = 0.

SHED_ROUT: the time duration at which to give up computer writes to function block ROut locations. Shed from ROut will never happen when SHED_ROUT = 0.

FAULT_STATE, SET_FSTATE, CLR_FSTATE: these only apply to output function blocks. (The Model 705 has no output function blocks).

MAX_NOTIFY: the maximum number of alert reports that the transmitter can send without getting a confirmation.

The user can set the number low, to control alert flooding, by adjusting the LIM_NOTIFY parameter value.

LIM_NOTIFY: the maximum numbers of unconfirmed alert notify messages allowed. No alerts are reported if set to zero.

CONFIRM_TIME: the time that the transmitter will wait for confirmation of receipt of a report before trying again. Retry will not occur if CONFIRM_TIME = 0.

WRITE_LOCK: When set to LOCKED, will prevent any external change to the static or non-volatile data base in the Function Block Application of the transmitter. Block connections and calculation results will proceed normally, but the configuration will be locked.

UPDATE_EVT (Update Event): is an alert generated by a write to the static data in the block.

BLOCK_ALM (Block Alarm): is used for configuration, hardware, connection, or system problems in the block. The cause of any specific alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.

ALARM_SUM (Alarm Summary): contains the current alert status, the unacknowledged states, the unreported states, and the disabled states of the alarms associated with the block.

ACK_OPTION (Acknowledge Option): selects whether alarms associated with the block will be automatically acknowledged.

WRITE_PRI (Write Priority): the priority of the alarm generated by clearing the write lock.

WRITE_ALM (Write Alarm): the alert generated if the write lock parameter is cleared.

ITK_VER (ITK Version): contains the version of the Interoperability Test Kit (ITK) used by the Fieldbus Foundation during their interoperability testing.

4.3 Transducer Block

The TRANSDUCER block is a custom block containing parameters that support the Enhanced Eclipse Model 705 level transmitter. It contains the GWR probe configuration, diagnostics, and calibration data, and outputs level with status information.

The TRANSDUCER block parameters are grouped in a useful configuration. There are both read-only parameters and read-write parameters within the TRANSDUCER block.

- The read-only parameters report the block status and operation modes.
- The read-write parameters affect the function block basic operation, level transmitter operation, and calibration.

The Transducer Block will automatically be changed to “Out of Service” when the local interface (keypad) is used to change a parameter online. The Transducer Block must be placed back in service from the Host system.

4.3.1 Transducer Block Parameters

The first six parameters in the TRANSDUCER block are the universal parameters discussed in section 4.1.1. The universal parameters are followed by these additional required parameters:

UPDATE_EVT (Update Event): an alert generated by a write to the static data in the TRANSDUCER block.

Another important parameter found later in the TRANSDUCER block list is **DEVICE_STATUS**, which displays the status of the device. If more than one message exists, then the messages are displayed in priority order.

If **DEVICE_STATUS** indicates a problem, refer to Section 7.1, Troubleshooting (those parameters which are shaded are password-protected).

For a complete list of Transducer Block Parameters, refer to table in the Appendix.

4.3.2 Password Parameters

To change a parameter at the local user interface, a value matching the user password must be entered (Default=1). If the user password is entered, the instrument is in the user mode. After 5 minutes with no keypad activity, the entered password expires.

Factory password is for use by trained factory personnel only.

From the Host system network, the instrument always behaves as if it is in the user mode by default. In other words, it is not necessary to enter the user password in order to write parameters from the Host system.

4.3.3 Eclipse Model 705 Configuration Parameters

This set of parameters within the Transducer Block is important and required to configure every Eclipse Model 705 transmitter.

PROBE_MODEL: Select the choice that corresponds to the first four digits of the model number of the probe. An “x” in the selection means that character is variable (the probe model number is shown on the nameplates attached to both the transmitter and probe). For example, 7xA-x should be chosen for probe models beginning with 7EA or 7MA.

PROBE_MOUNT: Select the type of mounting on the probe. The choices are NPT, BSP, and Flange.

MEASUREMENT_TYPE: Select from LEVEL ONLY, LEVEL AND VOLUME, INTERFACE, or INTERFACE AND VOLUME.

PROBE_LENGTH: Enter the exact length of the probe. The probe length is shown as the last three digits of the probe model number printed on the nameplates attached to the transmitter and probe. PROBE_LENGTH is shown in SENSOR_UNITS.

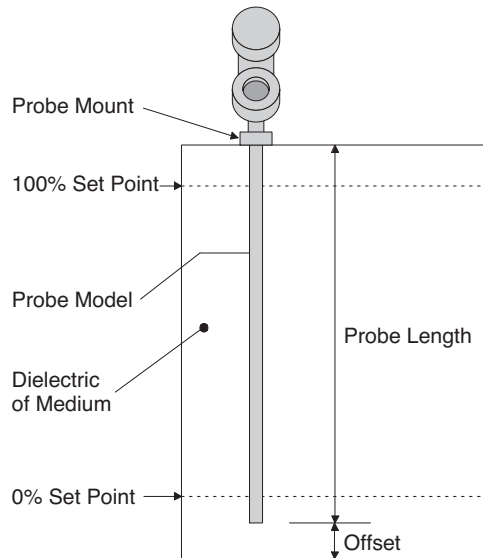
LEVEL_OFFSET: Enter the distance from the probe tip to the desired 0% reference in PROBE_UNITS. The acceptable range is from -300 inches to 600 inches. Refer to Section 4.3.4 for additional information.

DIELECTRIC_RANGE: Select from 10–100, 3–10, 1.7–3.0, or 1.7–1.4

NOTE: All dielectric ranges are not available with all probes.

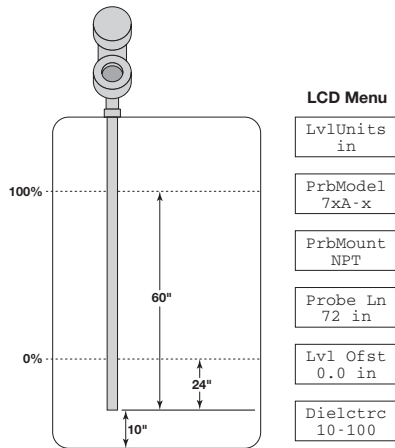
If an unsupported dielectric range is selected, the transmitter will give a negative response and the value displayed will revert to its previous value.

THRESHOLD: The threshold can be set as either FIXED or CFD. This parameter should be set to FIXED in those applications measuring total level having a lower dielectric material over a higher dielectric material. (A typical example for FIXED Threshold is a hydrocarbon application having water bottoms.)



4.3.4 Offset Description

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

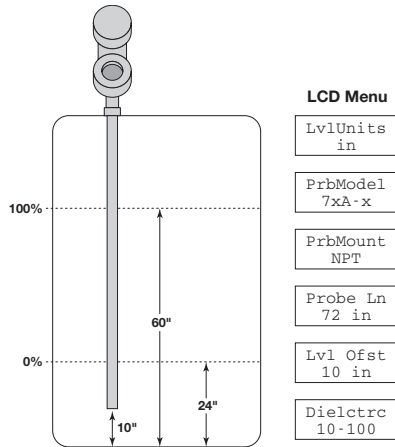


Example 1

Example 1 (LEVEL_OFFSET = 0 as shipped from factory):

Application calls for a 72-inch NPT Coaxial probe in water with the bottom of the probe 10 inches above the bottom of the tank. The user wants the 0% point at 24 inches and the 100% point at 60 inches as referenced from the bottom of the probe.

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

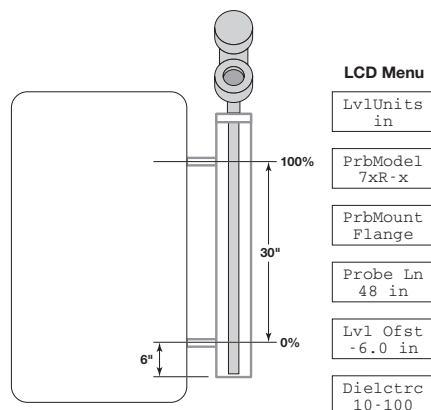


Example 2

Example 2:

Application calls for a 72-inch NPT coaxial probe in water with the bottom of the probe 10 inches above the bottom of the tank. The user wants the 0% point at 24 inches and the 100% point at 60 inches as referenced from the bottom of the tank.

When the Eclipse transmitter is mounted in a chamber/bridle, it is usually desirable to configure the unit with the 0% point at the lower process connection and the 100% point at the upper process connection. The span is the center-to-center dimension. In this case, a negative LEVEL_OFFSET needs to be entered. In doing so, all measurements are then referenced at a point up on the probe as shown in Example 3.



Example 3

Example 3:

Application calls for a 48-inch cage-coaxial flanged probe measuring water in a chamber with the bottom of the probe 6 inches below the lower process connection. The user wants the 0% point to be 0 inches at the bottom process connection and the 100% point to be 30 inches at the top process connection.

4.4 User-Calibration Parameters

One of the main advantages of the Enhanced Eclipse Model 705 GWR transmitter is that the device does not need to be calibrated in the field. Every Enhanced Eclipse Model 705 transmitter is shipped precisely calibrated from the factory.

On the other hand, part of the advantage of FOUNDATION fieldbus™ is to provide the ability to monitor changes and make adjustments to a transmitter. The Fieldbus™ concept allows a user to make calibration adjustments if deemed necessary.

NOTE: The original factory calibration settings are restored when a new probe length value is assigned.

It is highly recommended that factory calibration be used for optimum performance.

Contact the factory for information on how to perform a User Calibration.

4.4.1 Factory Parameters

The factory-adjustable calibrated parameters are WINDOW, CONVERSION_FACTOR, and SCALE_OFFSET.

WINDOW is used to adjust for the variations in the analog section of the Eclipse TDR measurement engine. CONVERSION_FACTOR and SCALE_OFFSET are the main factory calibration settings.

The following parameters are used for either troubleshooting or are parameters adjusted at the factory. They should never be changed in the field.

WINDOW: determines the amount of delay between the generation of the transmitted signal pulse and the start of the measurement cycle.

FID_TICKS: a measure of the time to the fiducial (reference) pulse.

FID_TICKS_SPREAD: provides an indication of the stability of the FID_TICKS measurement.

LEVEL_TICKS: a measure of the time to the level of the product being measured.

LEVEL_TICKS_SPREAD: provides an indication of the stability of the LEVEL_TICKS measurement.

CONVERSION_FACTOR: the slope of the factory-set calibration line.

SCALE_OFFSET: the intercept of the calibration line.

4.4.2 Firmware Version

The last parameter in the TRANSDUCER block gives the firmware version of the transmitter.

FIRMWARE_VERSION: displays the version of the firmware.

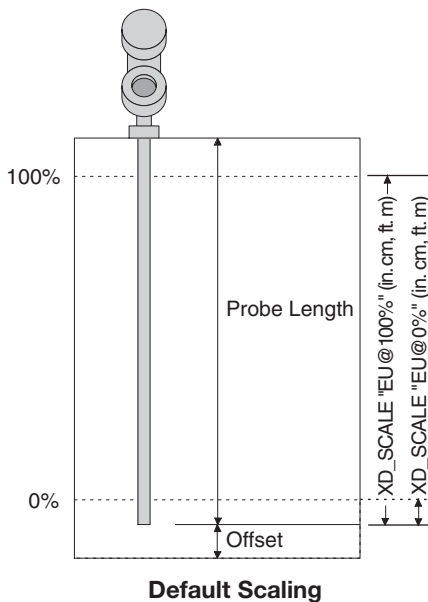
NOTE: The user should compare the DD file and revision number of the device with the HOST system to ensure they are at the same revision level.

Refer to the table on page 6.

4.5 Analog Input Block

The ANALOG INPUT (AI) block takes the Eclipse Model 705 input data, selected by channel number, and makes it available to other function blocks at its output:

| Channel | Process Value |
|---------|------------------|
| 1 | Level |
| 2 | Volume |
| 3 | Interface |
| 4 | Interface Volume |



4.5.1 AI Block Parameters

PV: Either the primary analog value for use in executing the function, or a process value associated with it.

OUT: The primary analog value calculated as a result of executing the function block.

SIMULATE: Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status

XD_SCALE: The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.

OUT_SCALE: The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter.

GRANT_DENY: Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.

IO_OPTS: Option which the user may select to alter input and output block processing.

STATUS_OPTS: Options which the user may select in the block processing of status.

CHANNEL: The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.

L_TYPE: Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect), or with square root (Ind Sqr Root), using the input range defined for the transducer and the associated output range.

LOW_CUT: Limit used in square root processing.

PV_FTIME: Time constant of a single exponential filter for the PV, in seconds.

FIELD_VAL: Raw value of the field device in % of PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).

UPDATE_EVT: This alert is generated by any change to the static data.

BLOCK_ALM: The block alarm is used for all configuration, hardware, connection failure or system problems in the block.

ALARM_SUM: The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.

ACK_OPTION: Selection of whether alarms associated with the function block will be automatically acknowledged.

ALARM_HYS: Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.

HI_HI_PRI: Priority of the high high alarm.

HI_HI_LIM: The setting for high high alarm in engineering units.

HI_PRI: Priority of the high alarm.

HI_LIM: The setting for high alarm in engineering units

LO_PRI: Priority of the low alarm.

LO_LIM: The setting for low alarm in engineering units.

LO_LO_PRI: Priority of the low low alarm.

LO_LO_LIM: The setting for low low alarm in engineering units.

HI_HI_ALM: The status for high high alarm and its associated time stamp.

HI_ALM: Status for high alarm and associated time stamp.

LO_ALM: Status for low alarm and associated time stamp.

LO_LO_ALM: The status for low low alarm and its associated time stamp.

The TRANSDUCER and AI block's MODE_BLK parameter must be set to AUTO to pass the PV Value through the AI to the network.

Transducer scaling, called XD_SCALE, is applied to the PV from the CHANNEL to produce the FIELD_VAL in percent. Valid XD_SCALE engineering units is limited to the five allowable codes of meters (m), centimeters (cm), feet (ft), inches (in), and percent (%) for the Level channels, or gallons, liters, % for the volume channels.

The AI blocks can have a BLOCK_ERR when:

1. Channel is not set correctly.
2. XD_SCALE does not have suitable engineering units or has range incompatibility.
3. SIMULATE parameter is active
4. AI block MODE is O/S (out of service).

NOTE: This can be caused by the Resource Block being OOS or the AI Block not scheduled for execution.

5. L-TYPE not set or set to Direct with improper OUT_SCALE.

The AI block uses the STATUS_OPTS setting and the TRANSDUCER PV LIMIT value to modify the AI PV and OUT QUALITY.

Damping Filter is a feature of the AI block. The PV_FTIME parameter is a time constant of a single exponential filter for the PV, in seconds. This parameter can be used to dampen out fluctuation in level due to excessive turbulence.

The AI block has multiple ALARM functions that monitor the OUT parameter for out of bound conditions.

4.5.2 Local Display of Analog Input Transducer Block Output

The Model 705 3x FOUNDATION fieldbus™ Device Revision 2 transmitter incorporates a feature that allows the device's Analog Input [AI] block Out values to be displayed on the local LCD.

NOTE: There are many reasons that AI block Out values can deviate from the measurement value originating in the Transducer block, and because the keypad and local display will only provide access to Transducer block parameters, there is no way to explore or change the other fieldbus configuration items affecting the AI block output using the keypad and LCD.

4.5.2 Local Display of Analog Input Transducer Block Output

These screens should only be considered as measured value indicators for configured transmitters.

- The screens are not used for commissioning or diagnostic / troubleshooting purposes.
- Prior to full fieldbus configuration (transmitter assigned a permanent address, AI block(s) configured and scheduled for execution, etc.), the value displayed will not reflect the transducer measurement. (Pre-configuration values will typically be 0).

4.5.2.1 AI Out Display Screens

The Analog Input Out values will be conditionally displayed as part of the “rotating” home menu screens.

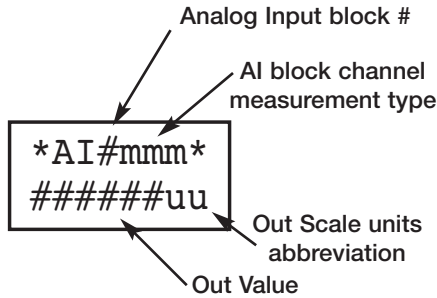
The screens will be formatted as shown where # in the title is the number of the AI block (1, 2, 3, or 4) and mmm is one of: “Lvl”, “Vol”, “Ifc”, “IfV”, “---” depending on the value of the associated AI block’s Channel parameter.

- For example, “AI1Lvl” would be the most commonly used AI Out screen.
- “AI2---” would be displayed when the channel value is 0 [uninitialized] for AI block 2.

The Out value will be displayed subject to limitations necessary for a 6-character display [999999 > Value > -99999].

Representative examples are shown below:

| | | |
|----------|----------|----------|
| *AI1Lvl* | *AI3Ifc* | *AI1Vol* |
| 99.5 cm | 0.0 % | 999999 L |



Analog Input Out Display

- Local AI Display
- AI1 Out
 - AI2 Out
 - AI3 Out
 - AI4 Out

| None | AI4 |
|---------|---------|
| AI1 | AI1+AI4 |
| AI2 | AI2+AI4 |
| AI1+AI2 | AI1,2,4 |
| AI3 | AI3+AI4 |
| AI1+AI3 | AI1,3,4 |
| AI2+AI3 | AI2,3,4 |
| AI1,2,3 | All AIs |

Analog Input Out Values To Be Displayed

Because the Model 705 transmitter has four Analog Input blocks any or all of which may be used in particular applications, a Transducer block parameter controls which AI block Out values will be displayed.

The fieldbus presentation of this parameter will be similar to that shown at left (host system dependent).

Any or all (or none) of the AI block Out values can be selected for display on the LCD.

The local LCD version of this parameter is shown differently due to the limitations of the LCD:

LCD label: “AI Disp”

The default value of the Local AI Display parameter will be such that AI 1 Out is selected.

4.6 PID Block

The PID Function Block contains the logic necessary to perform Proportional/Integral/Derivative (PID) control. The block provides filtering, set point limits and rate limits, feedforward support, output limits, error alarms, and mode shedding.

Although most other function blocks perform functions specific to the associated device, the PID block may reside in any device on the network. This includes a valve, a transmitter, or the host itself.

The Enhanced Model 705 3X PID Block implementation follows the specifications documented by the Fieldbus Foundation.

4.6.1 PID Block Parameters

ACK_OPTION: Used to set auto acknowledgement of alarms.

ALARM_HYS: The amount the alarm value must return to before the associated active alarm condition clears.

ALARM_SUM: The summary alarm is used for all process alarms in the block.

ALERT_KEY: The identification number of the plant unit.

ALG_TYPE: Selects filtering algorithm as Backward or Bi-linear.

BAL_TIME: The specified time for the internal working value of bias to return to the operator set bias.

BKCAL_IN: The analog input value and status for another blocks BKCAL_OUT output.

BKCAL_HYS: The amount the output must change away from its output limit before the limit status is turned off, expressed as a percent of the span of the output.

BKCAL_OUT: The value and status required by the BKCAL_IN input for another block.

BLOCK_ALM: Used for all configuration, hardware, connection failure, or system problems in the block.

BLOCK_ERR: Reflects the error status associated with the hardware or software components associated with a block.

BYPASS: Used to override the calculation of the block.

CAS_IN: The remote setpoint value from another block.

CONTROL_OPTS: Allows one to specify control strategy options.

DV_HI_ALM: The DV HI alarm data.

DV_HI_LIM: The setting for the alarm limit used to detect the deviation high alarm condition.

DV_HI_PRI: The priority of the deviation high alarm.

DV_LO_ALM: The DV LO alarm data.

4.6.1 PID Block Parameters (cont.)

DV_LO_LIM: The setting for the alarm limit used to detect the deviation low alarm condition.

DV_LO_PRI: The priority of the deviation low alarm.

FF_GAIN: The feedforward gain value.

FF_SCALE: The high and low scale values associated with FF_VAL.

FF_VAL: The feedforward control input value and status.

GAIN: The proportional gain value. This value cannot equal zero.

GRANT_DENY: Options for controlling access of host computers to alarm parameters of the block.

HI_ALM: The HI alarm data

HI_HI_ALM: The HI HI alarm data

HI_HI_LIM: The setting for the alarm limit used to detect the HI HI alarm condition.

HI_HI_PRI: The priority of the HI HI Alarm.

HI_LIM: The setting for the alarm limit used to detect the HI alarm condition.

HI_PRI: The priority of the HI alarm.

IN: The connection for the PV input from another block.

LO_ALM: The LO alarm data.

LO_LIM: The setting for the alarm limit used to detect the LO alarm condition.

LO_LO_ALM: The LO LO alarm data.

LO_LO_PRI: The priority of the LO LO alarm.

LO_PRI: The priority of the LO alarm.

MATH_FORM: Selects equation form (series or standard).

MODE_BLK: The actual, target, permitted, and normal modes of the block.

OUT: The block input value and status.

OUT_HI_LIM: The maximum output value allowed.

OUT_LO_LIM: The minimum output value allowed.

OUT_SCALE: The high and low scale values associated with OUT.

PV: The process variable use in block execution.

PV_FTIME: The time constant of the first order PV filter.

PV_SCALE: The high and low scale values associated with PV.

4.6.1 PID Block Parameters (cont.)

RATE: The derivative action time constant.

RCAS_IN: Target setpoint and status that is provided by a supervisory host.

RCAS_OUT: Block setpoint and status that is provided to a supervisory host.

RESET: The integral action time constant.

ROUT_IN: Block output that is provided by a supervisory host.

ROUT_OUT: Block output that is provided to a supervisory host.

SHED_OPT: Defines action to be taken on remote control device timeout.

SP: The target block setpoint value.

SP_HI_LIM: The highest SP value allowed.

SP_LO_LIM: The lowest SP value allowed.

SP_RATE_DN: Ramp rate for downward SP changes.

SP_RATE_UP: Ramp rate for upward SP changes.

STATUS_OPTS: Allows one to select options for status handling and processing.

STRATEGY: Can be used to identify grouping of blocks.

ST_REV: The revision level of the static data associated with the function block.

TAG_DESC: The user description of the intended application of the block.

TRK_IN_D: Discrete input that initiates external tracking.

TRK_SCALE: The high and low scale values associated with TRK_VAL.

TRK_VAL: The value applied to OUT in LO mode.

UPDATE_EVT: This alert is generated by any changes to the static data.

5.0 Model 705 Menu: Step by Step Procedures

The following table describes the software menu displayed by the Eclipse FOUNDATION fieldbus™ transmitter for “Level Only” measurement. Use this table as a step by step guide to configure the transmitter.

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 on the first column are not shown in the display. They are only provided as reference.

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

5.1 Measurement Type: Level Only

| | Display | Password | Action | Comment |
|----|---------------------------------|-------------------|---|--|
| 1 | *Status* *Level* *AllLvl* | None | Transmitter Display | MeasType = Lvl Only |
| 2 | Level xxx.x lu | None | Transmitter Display | All MeasType selections |
| 3 | All Lvl xx.x lu | None | Transmitter Display | All MeasType selections |
| 4 | PrbModel (select) | User | Select the type of probe used | Select from 7xA-x, 7xB-x, 7xD-x, 7xG-x, 7xK-x, 7xP-x, 7xR-x, 7xE-x, 7xF-x, 7xF-E, 7xF-F, 7x1-x, 7x2-x, 7x5-x, 7x7-x, 7xF-4, 7xF-P, 7xJ-x, 7xL-x, 7xM-x, 7xN-x, 7xS-x, 7xT-x |
| 5 | PrbMount (select) | User | Select the type of probe mounting | Select from NPT, BSP or Flange |
| 6 | MeasType (select) | User | Select type of measurement | Select from Lvl Only, Lvl&Vol, Infrface, lfc&Vol |
| 7 | SnsrUnit (select) | User | Select the Sensor units | Select from cm, inches, feet, meters |
| 8 | Probe Ln xxx.x su | User | Enter the exact length of the probe | 11.8 to 900 in (30 to 2286 cm) |
| 9 | Lvl Ofst xxx.x plu | User | Enter desired Level reading when probe is dry | -90 to 300 in (-228.6 to 762 cm) |
| 10 | Senstvty xxx | Superuser or user | Adjust gain value upward or downward to sense liquid surface | (Superuser password required for dual element probes.) |
| 11 | BlockDis xx.x su | User | Enter distance below reference point where level is not sensed | -99.9 to 2286 cm (-39.3 to 900 in) |
| 12 | SftyZone (select) | User | Select behavior when level is sensed in safety zone | Off, On, Latch |

| | Display | Password | Action | Comment |
|----|----------------------|----------------------|--|---|
| 13 | SZHeight xx.x su | User | Enter distance below BlockDis where SZ Fault will be asserted | 5.1 to 2286 cm (2 to 900 in) |
| 14 | SZ Latch Reset | User | Press Enter to clear a Safety Zone latch | |
| 15 | Threshld (select) | User | Select from CFD, Fixed | For interface, refers to threshold for upper level pulse |
| 16 | Trim Lvl xx.x su | Superuser or user | Enter value to adjust Level reading | -20.0 inches <= Lvl Trim <= +20.0 inches (Superuser password required if negative fiducial.) |
| 17 | AI Disp | User | Transmitter Display | AI Block Display |
| 18 | LvlTicks xxxxx | User | Diagnostic Display | Time of flight from fiducial to level signal |
| 19 | New Pass xxx | User | Enter new password (0-255) | Displays encrypted value of present password |
| 20 | Language (select) | User | Select from English, Spanish, French, German | Language choice for LCD display |
| 21 | Mdl705FF Ver 3.xx | None | Transmitter Display | Product identification Firmware version |
| 22 | DispFact (select) | None | Select Yes to display factory parameter menus | |
| 23 | History Status | None | Diagnostic Display to view present status and recent exceptions | |
| 24 | Run Time xxxx.x h | None | Diagnostic Display showing elapsed time since power on | Cleared to zero with History Reset |
| 25 | History Reset | Superuser | Press Enter and select yes to clear history | Reset History Data |
| 26 | HF Cable Select | Superuser | Select length of remote extension cable | Select from integral, 3-foot, 12-foot |
| 27 | FidTicks xxxx | None | Diagnostic Display | Time of flight from start of ramp to fiducial |
| 28 | Fid Sprd xxx | None | Diagnostic Display | Spread in fiducial ticks readings |
| 29 | Fid Type (select) | Superuser | Superuser parameter | Select from Positive, Negative. Selection only allowed for some probes, fixed for others |
| 30 | Fid Gain xxx | Superuser | Superuser parameter | |
| 31 | Window xxx | Factory | Factory Parameter | Calibration parameter |
| 32 | Conv Fct xxxx | Factory | Factory Parameter | Calibration parameter |
| 33 | Scl Ofst xxx | Factory | Factory Parameter | Calibration parameter |

| | Display | Password | Action | Comment |
|----|-----------------------|-----------|---|--|
| 34 | Neg Ampl xxx | Superuser | Superuser parameter | Diagnostic parameter |
| 35 | Pos Ampl xxx | Superuser | Superuser parameter | Diagnostic parameter |
| 36 | Signal xxx | None | Diagnostic Display | Indication of level signal amplitude |
| 37 | Compsate | Superuser | Superuser Parameter | Select from None, Manual, Auto |
| 38 | DrateFct xxxx | None | Diagnostic Display | Compsate = Auto, velocity derating factor |
| 39 | TargAmpl xxxx | None | Diagnostic Display | Compsate = Auto, target negative threshold amplitude |
| 40 | Targ Tks xxxx | None | Diagnostic Display | Compsate = Auto, measured time of flight from fiducial to target |
| 41 | Targ Cal xxxx | Superuser | Diagnostic Display | Compsate = Auto, calibrated time of flight from fiducial to target in room temperature air |
| 42 | OperMode (select) | Superuser | Superuser parameter | Compsate = Auto, select from Run, Cal, Off |
| 43 | 7xK Corr xxx | Superuser | Superuser parameter | Probe Model = 7xK, Distance in mm from fiducial to user reference point |
| 44 | Snsr Val xxx.x su | None | Distance to the target relative to the sensor reference point. | |
| 45 | CalPtLo xxx.x su | Superuser | The lower calibrated point of Sensor Value. It refers to PrLvl Lo. | In Sensor Units (Do Not Adjust) |
| 46 | CalPtHi xxx.x su | Superuser | The higher calibrated point of Sensor Value. It refers to PrLvl Hi. | In Sensor Units (Do Not Adjust) |
| 47 | ProbeLvl xxx.x plu | None | Level on the probe relative to the end of the probe. | |
| 48 | PrLvl Lo xxx.x plu | Superuser | Value of PrLvl at SnrCalLo. | In Probe Level Units |
| 49 | PrLvl Hi xxx.x plu | Superuser | Value of PrLvl at SnrCalHi. | In Probe Level Units |
| 50 | ElecTemp xxx C | None | Diagnostic Display | Present temperature in electronics compartment (degrees Celsius) |
| 51 | Max Temp xxx C | Superuser | Diagnostic Display | Maximum electronics temperature recorded |
| 52 | Min Temp xxx C | Superuser | Diagnostic Display | Minimum electronics temperature recorded |
| 53 | SZ Hyst xx.x su | Superuser | Superuser Parameter | Safety Zone hysteresis height |

6.0 Diagnostic Parameters

The Eclipse Model 705 measurement engine runs through a series of self-tests and will detect and report faulty operation. The TRANSDUCER BLOCK displays these faults in the DEVICE_STATUS parameter. Refer to Section 7.1.2 for more information on specific faults and warnings.

BLOCK_ERROR is not used except for indicating Out of Service (OOS).

When the Model 705 transmitter is initially powered on, the measurement engine does not have enough valid measurement cycles to make a decision about the output level. For the first few seconds after power is applied, the LEVEL_STATUS/QUALITY is “Uncertain,” the SUB_STATUS is “Initial value,” and the LIMIT attribute is “Constant.”

When the Model 705 is operating properly, the LEVEL_STATUS/QUALITY is shown as “GOOD,” and the SUB_STATUS is “Non-Specific.”

While changing the transmitter operational parameters using the local display or through the system configuration tool (with the MODE_BLK in OOS), the output might be inaccurate because of the changing parameters. When the device is set to OOS, the TRANSDUCER BLOCK will still output level but the QUALITY will be shown as “Bad” and the SUB_STATUS is “Out of Service.”

When the Enhanced Model 705 measurement cycle fails to find a valid output level, the transmitter maintains the last good value as the output and flags the failure. The LIMIT attribute is the same as the last good measurement.

When the Enhanced Model 705 detects a level above the highest measurement point of the probe the operational mode is shown as “May Be Flooded.” This is due to the fact that, since the actual level location above the top of some probes is not known, the output may not be accurate.

The Model 705 operational mode is DRY_PROBE when the level is below the end of the probe. Again, the output may not be accurate, since the location of the level below the end of the probe is not known. The TRANSDUCER BLOCK output is calculated as LEVEL_OFFSET.

When in the dry probe condition, the Model 705 compares the measured length of the probe to the value entered into the PROBE_LENGTH parameter. If the measured value does not match PROBE_LENGTH, a fault is reported. The QUALITY will be shown as “Bad,” and the SUB_STATUS is “Configuration error.”

If the Model 705 fails to find a measurable level, either due to an actual loss of a level signal or the loss of a proper Fiducial (reference) signal, the TRANSDUCER BLOCK maintains the last good value as the output and flags the failure. The QUALITY is “Bad,” the SUB_STATUS is “Sensor failure” for no level (or “Device failure” for loss of the Fiducial), and the LIMIT attribute is “Constant.”

Refer to Section 7.1.2 for additional information.

6.1 Simulation Feature

The Eclipse Model 705 with FOUNDATION fieldbus™ supports the Simulate feature in the Analog Input block. The Simulate feature is typically used to exercise the operation of an AI block by simulating a TRANSDUCER block input.

This feature can not be activated without the placement of a hardware jumper. This jumper is installed as standard on the Eclipse Model 705, and is placed in an inconvenient location to avoid inadvertent disabling of this feature.

NOTE: A BLOCK_ERR of “Simulation Active” in the Resource Block does not mean simulation is active—it merely indicates that the simulation (hardware) enabling jumper is present.

Contact the factory for instructions on how to remove this jumper and, if necessary, permanently disable the Simulate feature.

7.0 Reference Information

7.1 Troubleshooting

WARNING!

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

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.

7.1.1 Troubleshooting System Problems

| Symptom | Problem | Solution |
|---|---|--|
| LEVEL and AI OUTPUT values are 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 EU_0% and EU_100% values. |
| | Interface level has significant emulsion. | Examine process to reduce/eliminate emulsion layer. |
| LEVEL readings are repeatable but consistently high or low from actual by a fixed amount. | Configuration data does not accurately match probe length or tank height. | Ensure proper Probe Model and probe length. Adjust trim level value by the amount of noted inaccuracy. |
| LEVEL and AI OUTPUT values fluctuate. | Turbulence | Increase the AI Block process value filter time until the readings stabilize. |
| | High Frequency connection | Check Fid Spread (should be stable within ± 10 counts). |
| LEVEL and AI OUTPUT values all reading low vs. actual. | Lower dielectric material over higher dielectric material, e.g., oil over water | Select Fixed Threshold option. |
| | Coating, clumping or buildup on probe | These may be expected inaccuracies due to affect on pulse propagation. |
| | Dense, water based foam | These may be expected inaccuracies due to affect on pulse propagation. |
| Level Reading on Display is stuck at full scale. | 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 and AI OUTPUT values values all at maximum level. | Possible configuration issue with single rod probe | 1) Increase Blocking Distance 2) Increase Dielectric Range |
| LEVEL and AI OUTPUT values reading high vs. actual. | Possible obstruction in tank affecting single rod probe | 1) Increase Dielectric Range until obstruction is ignored 2) Relocate probe away from obstruction |
| LEVEL value reading high when should be zero. | Transmitter loose or disconnected from probe | Ensure transmitter connected securely to probe. |

NOTE: When consulting the factory concerning improper operation, use proper tables on Pages 54-55. Enter all data when transmitter is working CORRECTLY or INCORRECTLY.

7.1.2 Device Status Parameter in the Transducer Block

The following table lists the conditions indicated in the Device Status parameter. It also shows the affect the condition has on PV status, Sub-Status and Limit, XD ERROR and BLOCK ALARM are not affected by these conditions directly.

| Device Status | | | | PV Status Quality | PV Sub Status | Limit |
|---------------|------------------|-------|------------|-------------------|---------------------|------------------|
| Type | Label | Bit # | Value | | | |
| Mode | OK | 15 | 0x00008000 | Good | Non-Specific | Not Limited |
| Mode | User Access | 7 | 0x00000080 | Bad | OOS | Not Limited |
| Mode | Factory Access | 5 | 0x00000020 | Bad | OOS | Not Limited |
| Fault | Default Params | 28 | 0x10000000 | Bad | Configuration Error | Not Limited |
| Fault | No End of Ramp | 27 | 0x08000000 | Bad | Device Failure | Constant Limited |
| Fault | Lvl<Probe Length | 23 | 0x00800000 | Bad | Sensor Failure | Constant Limited |
| Fault | No Fiducial | 21 | 0x00200000 | Bad | Device Failure | Constant Limited |
| Fault | Safety Zone FLT | 20 | 0x00100000 | Bad | Non-Specific | Not Limited |
| Fault | No Signal | 19 | 0x00080000 | Bad | Sensor Failure | Constant Limited |
| Fault | EOP<Probe Length | 18 | 0x00040000 | Bad | Sensor Failure | Constant Limited |
| Fault | EOP High | 17 | 0x00020000 | Bad | Configuration Error | Not Limited |
| Fault | High Volume Fit | 16 | 0x00010000 | Bad | Configuration Error | High Limited |
| Warning | Hi Temperature | 11 | 0x00000800 | No Effect | No Effect | No Effect |
| Warning | Lo Temperature | 10 | 0x00000400 | No Effect | No Effect | No Effect |
| Warning | Default Cal | 9 | 0x00000200 | No Effect | No Effect | No Effect |
| Warning | Initializing | 4 | 0x00000010 | No Effect | Initial Value | Constant Limited |
| Warning | May be Flooded | 3 | 0x00000008 | No Effect | No Effect | High Limited |
| Warning | Dry Probe | 2 | 0x00000004 | No Effect | No Effect | Low Limited |
| Warning | Weak Signal | 1 | 0x00000002 | No Effect | No Effect | No Effect |
| Warning | No Steam Target | 6 | 0x00000040 | No Effect | No Effect | No Effect |

The first three conditions are Type Mode. If everything is running normally and there are no Faults or Warnings, then the device indicates it is “OK” on the local display and in Device Status. If a password is entered through the local display, the Transducer Block is taken Out of Service if it is not already and the User Access or Factory Access will be indicated in Device Status. This will indicate to the operator that an attempt is being made to modify a parameter value. No indication is given on the Fieldbus network if someone is only viewing parameters on the local display.

The next set of conditions is device faults. The device will most likely not be able to measure level correctly if one or more of these conditions occur. The condition will be indicated in Device Status and will affect PV Status, Sub-Status and Limit as indicated.

7.1.2 Device Status Parameter in the Transducer Block

The next set of conditions is the device warnings. The condition will not jeopardize the level measurement. However, knowledge of the condition may be useful in troubleshooting the device.

The following table describes the conditions that can be seen in Device Status:

| Display Message | Action | Comment |
|------------------|---|--|
| OK | None | Normal operating mode. |
| User Access | Password at the local display. | Parameter values are being changed through the local interface. Make sure Transducer Block is taken out of service. |
| Factory Access | Password at the local display. | Parameter values are being changed through the local interface. Make sure Transducer Block is taken out of service. |
| Default Params | Internal non-volatile parameters have been defaulted. | Consult factory. |
| No End of Ramp | No End-of Ramp signal detected. | Consult factory. |
| Lvl<Probe Length | Apparent position of the upper level pulse is beyond the end of the probe. | 1) Check entered Probe Length. 2) Change Threshold to Fixed. |
| No Fiducial | 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 in the high frequency connector. 4) Consult factory. |
| Safety Zone Flt | Safety Zone Alarm has been tripped. | Decrease level in vessel. |
| No Signal | No level signal being detected. | 1) Ensure Dielectric setting is correct for the measured medium. 2) Increase Sensitivity 3) Confirm Probe Model is proper for the dielectric of the medium. 4) Consult factory. |
| EOP<Probe Length | End of Probe signal from a dry probe is out of range. | 1) Ensure the Probe Length is entered correctly. 2) Set Dielectric 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. |
| High Volume Flt | Level more than 5% above highest point in strapping table. | 1) Verify strapping table is entered correctly. 2) Signal amplitude may be lower than desired. |
| Hi Temperature | 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. |
| Lo Temperature | 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 transmitter. |
| Default Cal | Factory set default calibration parameters are in use. Level reading may be inaccurate. | Consult factory. |
| Initializing | None | Program is initializing. This is a transient condition. |
| May be Flooded | Loss of level signal possibly due to flooding. Twin Rod probes only. | 1) Decrease level in vessel. 2) Set Dielectric to lower range value. 3) Replace with Model 7xR Overfill probe. |
| Dry Probe | None | Normal message for a dry probe. End of Probe signal is being detected in correct location. |
| Weak Signal | None. Signal amplitude is lower than desired. | 1) Set Dielectric to a lower range value. 2) Increase Sensitivity. |

7.1.3 FF Segment Checklist

There can be several reasons for a FOUNDATION fieldbus™ installation to be in a faulty condition. In order to ensure that communication can be established, the following requirements must be met.

- Device supply voltage must be higher than 9 VDC with a maximum of 32 VDC.
- Total current draw of a given segment cannot exceed the rating shown on the power conditioner and/or barrier.
- Device polarity must be correct.
- Two 100 Ω, 1 μF terminators must be connected to the network—one at each end of the segment.
- Cable length plus spur length must not exceed the following values:

| Number of Spurs | 1 Device | 2 Devices | 3 Devices | 4 Devices |
|-----------------|-----------------|----------------|----------------|----------------|
| 25–32 | — | — | — | — |
| 19–24 | 100 ft. (30 m) | — | — | — |
| 15–18 | 200 ft. (60 m) | 100 ft. (30 m) | — | — |
| 13–14 | 300 ft. (90 m) | 200 ft. (60 m) | 100 ft. (30 m) | — |
| 1–12 | 400 ft. (120 m) | 300 ft. (90 m) | 200 ft. (60 m) | 100 ft. (30 m) |

| Pair | Shield | Twisted | Size | Length | Type |
|--------|--------|---------|--------------------------------|---------------------|------|
| Single | Yes | Yes | AWG 18 (0.8 mm ²) | 6,200 ft. (1,900 m) | A |
| Multi | Yes | Yes | AWG 22 (0.32 mm ²) | 3,900 ft. (1,200 m) | B |
| Multi | No | Yes | AWG 26 (0.13 mm ²) | 1,300 ft. (400 m) | C |
| Multi | Yes | No | AWG 16 (1.25 mm ²) | 650 ft. (200 m) | D |

- The cable shield is to be hard grounded only at one point close to the DCS. In addition, the cable shield can be capacitively grounded in multiple places to improve EMC protection.
- Ensure all devices are on the “live list,” and the schedule has been downloaded.
- Ensure that the Resource Block, then the Transducer Block, and lastly the Function Block(s) are in “Auto” mode rather than Out of Service (OOS).

If all of these requirements are met, stable communication should be established.

7.2 Agency Approvals

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

① Factory Sealed: This product has been approved by Factory Mutual Research (FM), and Canadian Standards Association (CSA), as a Factory Sealed device.

② Measured media inside vessel must be non-flammable only.

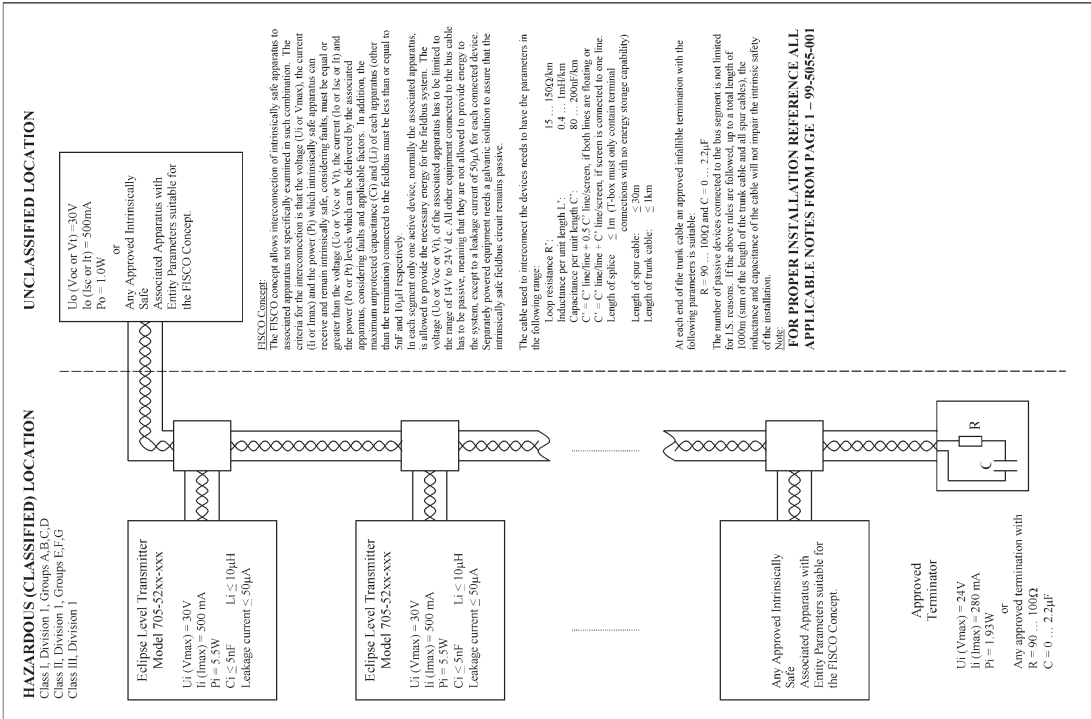


These units are in conformity of:

1. The EMC Directive: 89/336/EEC. The units have been tested to EN 61000-6-2/2001 and EN 61000-6-4/2001.
2. Directive 94/9/EC for equipment or protective system for use in potentially explosive atmospheres.

7.2.1 Agency Specifications – FOUNDATION fieldbus™ System

| REVISONS | | |
|----------|-----------------------------|---------------------|
| SYMA | DESCRIPTION | BY & DATE |
| D | SEE SHEET ONE FOR REVISIONS | RC 11-18-03 |
| | | CHANGE NO. 3177/300 |



| | | | |
|--|--|---|------------------------|
| MATERIAL | | TITLE | |
| RAW MATERIAL PART NO. | | SYSTEM DRAWING MODEL 705-53XX TRANSMITTER | |
| FINISH | | DRINK: D FRANCOEUR | DATE: 01-01-98 |
| FINISH | | CHECKED: T HOFRICHTER | DATE: 04-22-98 |
| | | APPROVED: MITADDE | DATE: 04-22-98 |
| | | PROJECT NO: 5177-002 | SHEET NO: SHEET 2 OF 2 |
| UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES (1) OR IN MILLIMETERS REMOVE ALL BURRS AND SHARP EDGES NEW DIMENSIONS IN PARENTHESES INSIDE RADI (R) (R) | | SCALE: 1:1 | |
| ALL FINISHES: 125 | | OR BETTER | |
| TOLERANCES: ±0.015 IN (0.4mm) | | | |
| 3 P.L. DECIMAL: ±0.005 IN (0.2mm) | | | |
| ANGULAR: ±2° | | | |

Magnetrol
5300 BELMONT ROAD, DOWNERS GROVE
ILLINOIS 60515, AREA CODE 630/969-4000

C 099-5055

Drawing Last Modified: Tuesday, November 18, 2003 2:57:26 PM

7.3 Specifications

7.3.1 Functional

System Design

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

Input

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

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

User Interface

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

Indication 2-line × 8-character display

Digital Communication FOUNDATION fieldbus™, H1 (31.25 kbits/sec)

Interoperability test kit (ITK Revision) ITK 5.01

LAS capable Yes, Device type: Linkmaster

Minimum Operating Voltage 9 VDC

Quiescent Current Draw 17 mA

DEV Revision 0X02

Available Blocks RB_1, TB_1, AI_1, AI_2, AI_3, AI_4, PID_1

Polarity Sensitive No

AI Block Execution Time 15 msec

Power (Measured at instrument terminals)

Fieldbus General Purpose/Explosion Proof 9 to 32 VDC (17 mA maximum current draw)

IS/FISCO/FNICO 9–32 VDC (17 mA maximum current draw)

Housing

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

Cable Entry ¾" NPT and M20

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 (-40 to +80° C)

Humidity 0-99%, non-condensing

Electromagnetic Compatibility Meets CE Requirements: EN 50081-2, EN 50082-2

Note: Twin Rod and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement.

Mounting Affects: Twin Rod Active rod must be mounted at least 1" (25 mm) from any surface or obstruction. Minimum stillwell diameter for Twin Rod probe is 3".

Single Rod Nozzles do not restrict performance by ensuring the following:

No nozzle is <2" (50 mm) diameter

Ratio of Diameter: Length is 1:1 or greater;

any ratio <1:1 (e.g., a 2" × 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment (see Section 2.6.5)

No pipe reducers are used

Obstructions (See Probe Clearance Table, page 16)

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

7.3.2 Performance - Model 705

| | |
|-------------------------------|---|
| Reference Conditions ① | Reflection from water at +70° F (+20° C) with 72" coaxial probe (CFD threshold) |
| Linearity ② | Coaxial/Twin Rod Probes: <0.1% of probe length or 0.1 inch (whichever is greater) |
| | Single Rod Probes: <0.3% of probe length or 0.3 inch (whichever is greater) |
| Measured Error | Coaxial/Twin Rod Probes: ±0.1% probe length or 0.1 inch (whichever is greater) |
| | Single Rod Probes ±0.5% probe length or 0.5 inch (whichever is greater) |
| Resolution | ±0.1 inch |
| Repeatability | <0.1 inch |
| Hysteresis | <0.1 inch |
| Response Time | <1 second |
| Warm-up Time | <5 seconds |
| Operating Temp. Range | -40° to +175° F (-40° to +80° C) |
| LCD Temp. Range | -5° to +160° F (-20° to +70° C) |
| Ambient Temp. Effect | Approximately +0.02% of probe length/ ° C |
| Process Dielectric Effect | <0.3 inch within selected range |
| Humidity | 0-99%, non-condensing |
| Electromagnetic Compatibility | Meets CE requirements (EN-61000-6-2/2001, 61000-6-4/2001) (Twin and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement) |

① Specifications will degrade with Model 7xB, 7xD, and 7xP probes and/or fixed threshold configuration.

② Top 24 inches of Model 7xB probe: 1.2 inches (30 mm). Specification for top 48 inches of single rod will be application dependent.

7.3.3 Performance - Model 705 Interface

| | |
|-------------------------------|--|
| Reference Conditions | Reflection from liquid of selected dielectric at +70° F (+20° C) with 72" probe |
| Linearity | <0.5 inch |
| Measured Error | Upper layer ±1 inch |
| | Interface layer ±1 inch (clean distinct interface required) |
| Upper Layer Dielectric | 1.4–5.0 |
| Interface Layer Dielectric | >15 |
| Resolution | ±0.1 inch |
| Repeatability | <0.5 inch |
| Hysteresis | <0.5 inch |
| Response Time | <1 second |
| Warm-up Time | <5 seconds |
| Operating Temp. Range | -40° to +175° F (-40° to +80° C) |
| LCD Temp. Range | -5° to +160° F (-20° to +70° C) |
| Ambient Temp. Effect | Approximately ±0.02% of probe length/ ° C |
| Humidity | 0-99%, non-condensing |
| Electromagnetic Compatibility | Meets CE requirements (EN-61000-6-2/2001, EN 61000-6-4/2001) (Twin and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement) |

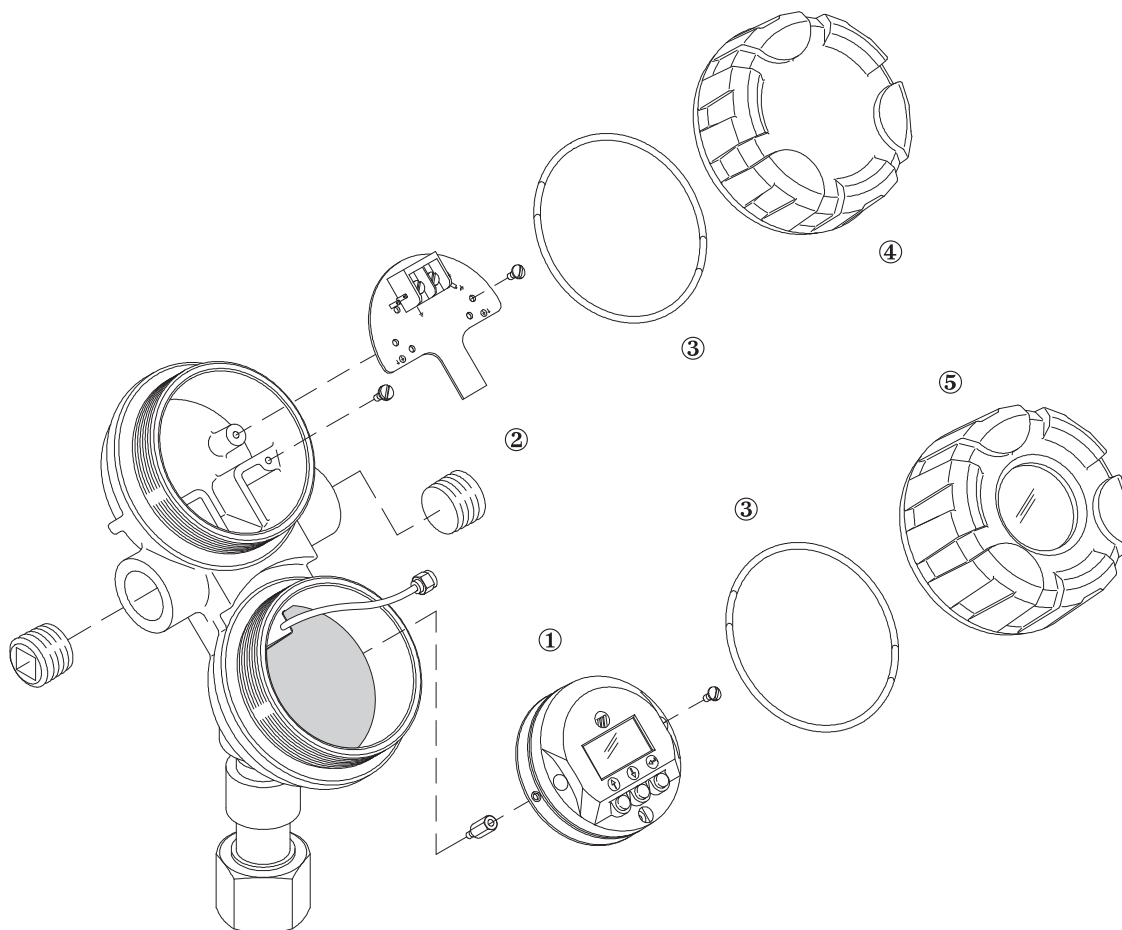
7.4 Parts

7.4.1 Replacement Parts

| Item | Description | Part Number | |
|------|--|-----------------|---------------|
| ① | Electronic module | | |
| | FOUNDATION fieldbus™ with display | Z031-2841-001 | |
| | FOUNDATION fieldbus™ without display | Z031-2841-002 | |
| ② | Terminal board FOUNDATION fieldbus™ | Explosion Proof | Z030-9151-003 |
| | | FISCO | Z030-9151-004 |
| ③ | O-ring (Viton) (Consult Factory for alternative O-ring materials) | 012-2201-237 | |
| ④ | Housing cover without glass | 004-9193-003 | |
| ⑤ | Housing cover with glass (GP, IS) (XP) | 036-4410-001 | |
| | | 036-4410-003 | |

7.4.2 Recommended Spare Parts

| Item | Description | Part Number | |
|------|--|-----------------|---------------|
| ① | Electronic module | | |
| | FOUNDATION fieldbus™ with display | Z031-2841-001 | |
| | FOUNDATION fieldbus™ without display | Z031-2841-002 | |
| ② | Terminal board FOUNDATION fieldbus™ | Explosion Proof | Z030-9151-003 |
| | | FISCO | Z030-9151-004 |



7.5 Model Numbers

7.5.1 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 Communications (English only) |
| 3 | PROFIBUS PA™ Digital Communications (English only) |

OPTIONS

| | |
|---|------|
| 0 | None |
|---|------|

ACCESSORIES

| | |
|---|-------------------------------|
| 0 | No digital display and keypad |
| A | Digital display and keypad |

MOUNTING/CLASSIFICATION

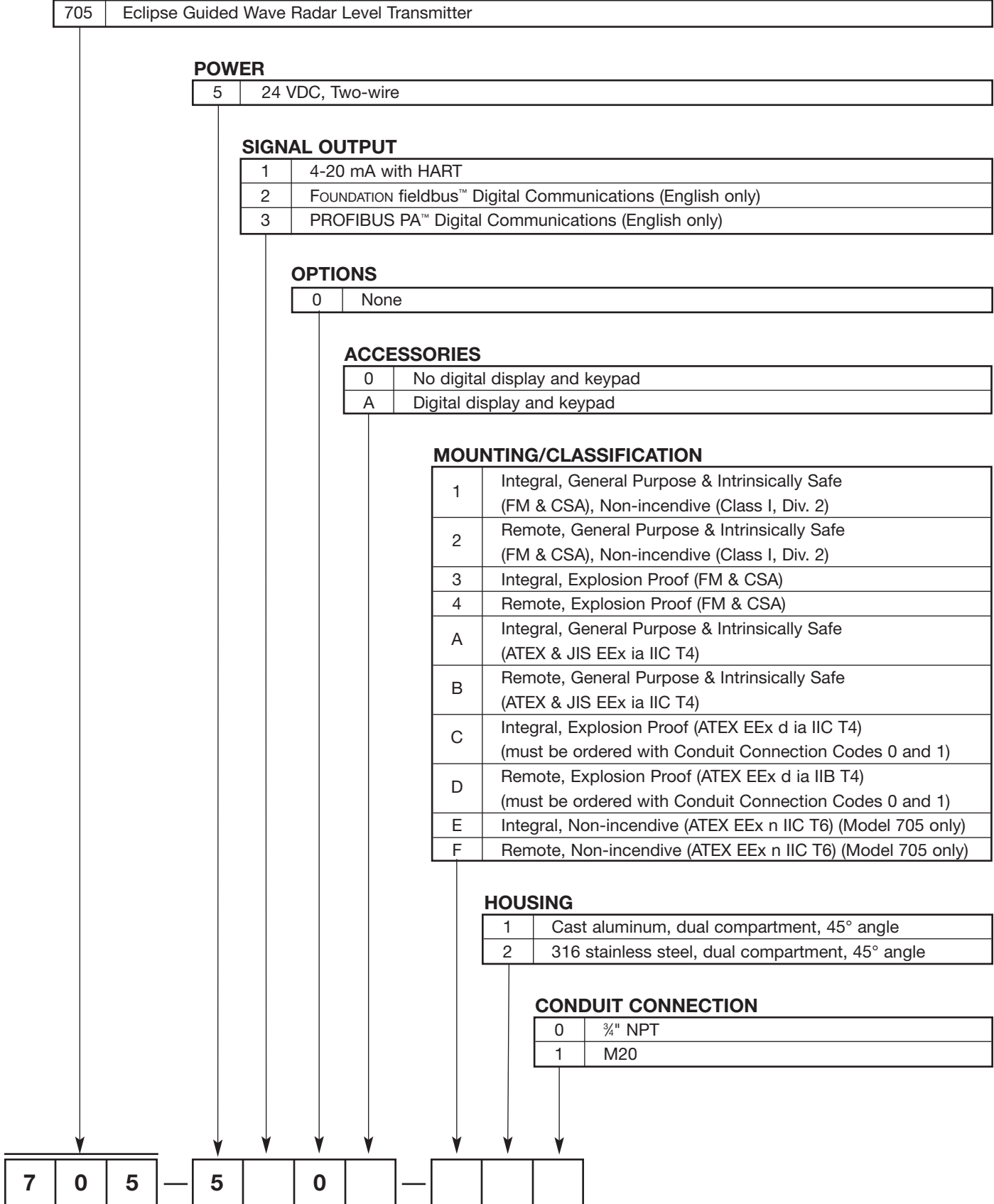
| | |
|---|--|
| 1 | Integral, General Purpose & Intrinsically Safe (FM & CSA), Non-incendive (Class I, Div. 2) |
| 2 | Remote, General Purpose & Intrinsically Safe (FM & CSA), Non-incendive (Class I, Div. 2) |
| 3 | Integral, Explosion Proof (FM & CSA) |
| 4 | Remote, Explosion Proof (FM & CSA) |
| 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 T4) (must be ordered with Conduit Connection Codes 0 and 1) |
| D | Remote, Explosion Proof (ATEX EEx d ia IIB T4) (must be ordered with Conduit Connection Codes 0 and 1) |
| E | Integral, Non-incendive (ATEX EEx n IIC T6) (Model 705 only) |
| F | Remote, Non-incendive (ATEX EEx n IIC T6) (Model 705 only) |

HOUSING

| | |
|---|--|
| 1 | Cast aluminum, dual compartment, 45° angle |
| 2 | 316 stainless steel, dual compartment, 45° angle |

CONDUIT CONNECTION

| | |
|---|--------|
| 0 | ¾" NPT |
| 1 | M20 |



7.5.2 Probe

BASIC MODEL NUMBER

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

CONFIGURATION/STYLE

| | | | | |
|---|------------|--------------------------|---------------------------------|---|
| A | Coaxial | Standard | ¾" process connection or larger | Dielectric range ≥1.4 (2.0 with ceramic spacers) |
| D | Coaxial | High Temp./High Pressure | | |
| P | Coaxial | High Pressure | | |
| R | Coaxial | Overfill | | |
| S | Coaxial | Hot Water/Steam | | |
| T | Coaxial | Interface | | |
| B | Twin Rod | Standard | 2" process connection or larger | Dielectric range ≥1.9 |
| 7 | Twin Rod | Flexible | | |
| 5 | Twin Rod | Flexible Bulk Solid | | |
| F | Single Rod | Standard | | |
| J | Single Rod | High Temp./High Pressure | | |
| 1 | Single Rod | Flexible | | |
| 2 | Single Rod | Flexible Bulk Solid | | Dielectric range ≥4.0 |

MATERIAL OF CONSTRUCTION

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

PROCESS CONNECTION SIZE/TYPE

Refer to pages 51 and 52 for selections

O-RINGS

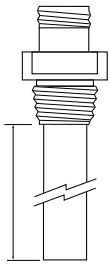
| | |
|---|---|
| 0 | Viton® GFLT |
| 1 | EPDM (Ethylene Propylene Rubber) |
| 2 | Kalrez® 4079 |
| 8 | Aegis PF128 |
| N | None (Use with probes 7xD, 7xP, 7xF-E, 7xF-F) |

LENGTH – PROBE

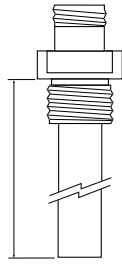
Refer to page 52 for selections



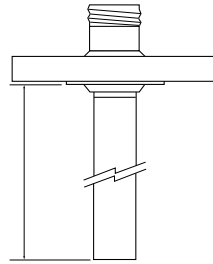
7.5.2 Probe



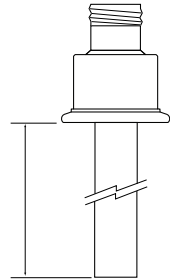
Insertion Length
NPT Process Connection



Insertion Length
BSP Process Connection



Insertion Length
ANSI or DIN Welded Flange



Insertion Length
Hygienic Flange

PROCESS CONNECTION SIZE/TYPE

THREADED CONNECTIONS

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

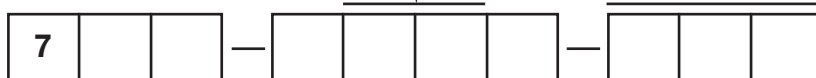
ANSI RAISED FACE FLANGE CONNECTIONS

| | | | | | |
|----|---------------|---------------------------|----|----------|---------------------------|
| 23 | 1" 150# | ANSI Raised Face Flange ① | 48 | 2" 2500# | ANSI Raised Face Flange ② |
| 24 | 1" 300# | ANSI Raised Face Flange ① | 53 | 3" 150# | ANSI Raised Face Flange |
| 25 | 1" 600# | ANSI Raised Face Flange ② | 54 | 3" 300# | ANSI Raised Face Flange |
| 27 | 1" 900/1500# | ANSI Raised Face Flange ② | 55 | 3" 600# | ANSI Raised Face Flange ② |
| 28 | 1" 2500# | ANSI Raised Face Flange ② | 56 | 3" 900# | ANSI Raised Face Flange ② |
| 33 | 1½" 150# | ANSI Raised Face Flange ① | 57 | 3" 1500# | ANSI Raised Face Flange ② |
| 34 | 1½" 300# | ANSI Raised Face Flange ① | 58 | 3" 2500# | ANSI Raised Face Flange ② |
| 35 | 1½" 600# | ANSI Raised Face Flange ② | 63 | 4" 150# | ANSI Raised Face Flange |
| 37 | 1½" 900/1500# | ANSI Raised Face Flange ② | 64 | 4" 300# | ANSI Raised Face Flange |
| 38 | 1½" 2500# | ANSI Raised Face Flange ② | 65 | 4" 600# | ANSI Raised Face Flange ② |
| 43 | 2" 150# | ANSI Raised Face Flange ① | 66 | 4" 900# | ANSI Raised Face Flange ② |
| 44 | 2" 300# | ANSI Raised Face Flange ① | 67 | 4" 1500# | ANSI Raised Face Flange ② |
| 45 | 2" 600# | ANSI Raised Face Flange ② | 68 | 4" 2500# | ANSI Raised Face Flange ② |
| 47 | 2" 900/1500# | ANSI Raised Face Flange ② | | | |

ANSI RING JOINT FLANGE CONNECTIONS

| | | | | | |
|----|---------------|--------------------------|----|----------|--------------------------|
| 3K | 1½" 600# | ANSI Ring Joint Flange ② | 5L | 3" 900# | ANSI Ring Joint Flange ② |
| 3M | 1½" 900/1500# | ANSI Ring Joint Flange ② | 5M | 3" 1500# | ANSI Ring Joint Flange ② |
| 3N | 1½" 2500# | ANSI Ring Joint Flange ② | 5N | 3" 2500# | ANSI Ring Joint Flange ② |
| 4K | 2" 600# | ANSI Ring Joint Flange ② | 6K | 4" 600# | ANSI Ring Joint Flange ② |
| 4M | 2" 900/1500# | ANSI Ring Joint Flange ② | 6L | 4" 900# | ANSI Ring Joint Flange ② |
| 4N | 2" 2500# | ANSI Ring Joint Flange ② | 6M | 4" 1500# | ANSI Ring Joint Flange ② |
| 5K | 3" 600# | ANSI Ring Joint Flange ② | 6N | 4" 2500# | ANSI Ring Joint Flange ② |

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



7.5.2 Probe

HYGIENIC FLANGE CONNECTIONS

| | |
|----|---|
| 2P | ¾" Tri-clover® type, 16 AMP Hygienic Flange |
| 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 |

PROPRIETARY AND SPECIALTY FLANGE CONNECTIONS

| | | |
|----|-------------|--|
| 4R | 2" 150# | ANSI Raised Face Carbon Steel Flange with Top Hat |
| 4S | 2" 300/600# | ANSI Raised Face Carbon Steel Flange with Top Hat |
| 5R | 3" 150# | ANSI Raised Face Carbon Steel Flange with Top Hat |
| 5S | 3" 300/600# | ANSI Raised Face Carbon Steel Flange with Top Hat |
| TT | 3½" 600# | Fisher® - Proprietary Carbon Steel (249B) Torque Tube Flange |
| TU | 3½" 600# | Fisher - Proprietary 316 Stainless Steel (249C) Torque Tube Flange |
| UT | 3½" 600# | Masoneilan® - Proprietary Carbon Steel Torque Tube Flange |
| UU | 3½" 600# | Masoneilan - Proprietary 316 Stainless Steel Torque Tube Flange |
| UV | 3½" 600# | Masoneilan - Proprietary Carbon Steel Torque Tube Flange with Top Hat |
| UW | 3½" 600# | Masoneilan - Proprietary 316 Stainless Steel Torque Tube Flange with Top Hat |

DIN FLANGE CONNECTIONS

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

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

LENGTH – PROBE MODELS 7xA, 7xB, 7xD, 7xF, 7XJ, 7xP, 7xR & 7xS

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

LENGTH – PROBE MODEL 7x1, 7x2, 7x5 & 7x7

3' to 75' (1 to 22 m) – (7x2, 7x5 & 7x7 only: 5' (1.5 m) minimum)
 (unit of measure is determined by second digit of Model Number)
 Examples: 30 feet = 030; 10 meters = 010



7.6 References

1. FOUNDATION fieldbus™, A Pocket Guide Ian Verhappen, Augusto Pereira
2. FOUNDATION fieldbus™—System Engineering Guidelines, AG–181

Appendix – Transducer Block Parameters

| ITEM | PARAMETER NAME | PARAMETER LABEL |
|------|-------------------------|--------------------|
| 0 | BLOCK_STRUCTURE | BLOCK STRUCT |
| 1 | ST_REV | ST REV |
| 2 | TAG_DESC | TAG DESC |
| 3 | STRATEGY | STRATEGY |
| 4 | ALERT_KEY | ALERT KEY |
| 5 | MODE_BLK | MODE BLK |
| 6 | BLOCK_ERR | BLOCK ERR |
| 7 | UPDATE_EVT | UPDATE EVT |
| 8 | BLOCK_ALM | BLOCK ALM |
| 9 | TRANSDUCER_DIRECTORY | XD DIRECTORY |
| 10 | TRANSDUCER_TYPE | XD TYPE |
| 11 | XD_ERROR | XD ERROR |
| 12 | COLLECTION_DIRECTORY | COLLECT DIR |
| 13 | LEVEL | Level |
| 14 | LEVEL_UNIT | Level Unit |
| 15 | PROBE_LEVEL | Probe Level |
| 16 | PROBE_LEVEL_UNIT | Probe Level Unit |
| 17 | SENSOR_VALUE | Sensor Value |
| 18 | SENSOR_UNIT | Sensor Unit |
| 19 | SENSOR_OFFSET | Sensor Offset |
| 20 | CAL_TYPE | Cal Type |
| 21 | CAL_POINT_LO | Cal Point Lo |
| 22 | CAL_POINT_HI | Cal Point Hi |
| 23 | PROBE_LEVEL_LO | Probe Lvl Lo |
| 24 | PROBE_LEVEL_HI | Probe Lvl Hi |
| 25 | LEVEL_OFFSET | Level Offset |
| 26 | SENSOR_HIGH_LIMIT | Sensor Hi Lmt |
| 27 | SENSOR_LOW_LIMIT | Sensor Lo Lmt |
| 28 | PROBE_MODEL | Probe Model |
| 29 | PROBE_MOUNT | Probe Mount |
| 30 | MEASUREMENT_TYPE | Measurement Type |
| 31 | PROBE_LENGTH | Probe Length |
| 32 | DIELECTRIC_RANGE | Dielctric Rng |
| 33 | SENSITIVITY | Sensitivity |
| 34 | BLOCKING_DISTANCE | Blocking Distance |
| 35 | SAFETY_ZONE_MODE | SafeZone Mode |
| 36 | SAFETY_ZONE_HEIGHT | SafeZone Ht |
| 37 | SAFETY_ZONE_LATCH_RESET | SZ Latch Rst |
| 38 | THRESHOLD | Threshold |
| 39 | TRIM_LEVEL | Trim Level |
| 40 | VOLUME | Volume |
| 41 | VOLUME_UNIT | Volume Unit |
| 42 | INTERFACE | Interface |
| 43 | INTERFACE_UNIT | Ifc Unit |
| 44 | UPPER_LIQUID_DIELECTRIC | Upr Liq Diel |
| 45 | INTERFACE_THRESHOLD | Ifc Threshld |
| 46 | INTERFACE_VOLUME | Ifc Vol |
| 47 | INTERFACE_VOLUME_UNIT | Ifc Vol Unit |
| 48 | STRAP_TABLE_LENGTH | Strap Table Length |
| 49 | TABLE_VOLUME_UNIT | Table Volume Unit |
| 50 | STRAPPING_TABLE_POINT01 | StrapTbl Pt01 |
| 51 | STRAPPING_TABLE_POINT02 | StrapTbl Pt02 |
| 52 | STRAPPING_TABLE_POINT03 | StrapTbl Pt03 |
| 53 | STRAPPING_TABLE_POINT04 | StrapTbl Pt04 |
| 54 | STRAPPING_TABLE_POINT05 | StrapTbl Pt05 |
| 55 | STRAPPING_TABLE_POINT06 | StrapTbl Pt06 |
| 56 | STRAPPING_TABLE_POINT07 | StrapTbl Pt07 |

| ITEM | PARAMETER NAME | PARAMETER LABEL |
|------|-------------------------------|--------------------|
| 57 | STRAPPING_TABLE_POINT08 | StrapTbl Pt08 |
| 58 | STRAPPING_TABLE_POINT09 | StrapTbl Pt09 |
| 59 | STRAPPING_TABLE_POINT10 | StrapTbl Pt10 |
| 60 | STRAPPING_TABLE_POINT11 | StrapTbl Pt11 |
| 61 | STRAPPING_TABLE_POINT12 | StrapTbl Pt12 |
| 62 | STRAPPING_TABLE_POINT13 | StrapTbl Pt13 |
| 63 | STRAPPING_TABLE_POINT14 | StrapTbl Pt14 |
| 64 | STRAPPING_TABLE_POINT15 | StrapTbl Pt15 |
| 65 | STRAPPING_TABLE_POINT16 | StrapTbl Pt16 |
| 66 | STRAPPING_TABLE_POINT17 | StrapTbl Pt17 |
| 67 | STRAPPING_TABLE_POINT18 | StrapTbl Pt18 |
| 68 | STRAPPING_TABLE_POINT19 | StrapTbl Pt19 |
| 69 | STRAPPING_TABLE_POINT20 | StrapTbl Pt20 |
| 70 | FID_TICKS | Fid Ticks |
| 71 | FID_SPREAD | Fid Spread |
| 72 | LEVEL_TICKS | Lvl Ticks |
| 73 | INTERFACE_TICKS | Ifc Ticks |
| 74 | INTERFACE_MEDIUM | Ifc Medium |
| 75 | ENTER_PASSWORD | Enter Password |
| 76 | NEW_PASSWORD | New User Password |
| 77 | DEVICE_STATUS | Device Status |
| 78 | HISTORY_MESSAGE | History Message |
| 79 | HISTORY_CONTROL | History Control |
| 80 | RESET_HISTORY | Reset History |
| 81 | FID_TYPE | Fid Type |
| 82 | FID_GAIN | Fid Gain |
| 83 | WINDOW | Window |
| 84 | CONVERSION_FACTOR | Conv Factor |
| 85 | SCALE_OFFSET | Scale Offset |
| 86 | NEGATIVE_THRESHOLD_AMPLITUDE | NegThrsh Ampl |
| 87 | INTERFACE_THRESHOLD_AMPLITUDE | IfcThrsh Ampl |
| 88 | POSITIVE_THRESHOLD_AMPLITUDE | PosThrsh Ampl |
| 89 | SIGNAL | Signal |
| 90 | COMPENSATION | Compensation |
| 91 | DERATE_FACTOR | Derate Factor |
| 92 | TARGET_AMPLITUDE | Target Amplitude |
| 93 | TARGET_TICKS | Target Ticks |
| 94 | TARGET_CAL | Target Cal |
| 95 | TARGET_OPERATING_MODE | Target OperMode |
| 96 | 7XK_DISTANCE_CORRECTION | 7XK Dist Corr |
| 97 | ELECTRONICS_TEMPERATURE | Elec Temp |
| 98 | MAX_ELECTRONICS_TEMPERATURE | Max Elec Temp |
| 99 | MIN_ELECTRONICS_TEMPERATURE | Min Elec Temp |
| 100 | RESET_ELECTRONICS_TEMPERATURE | Reset Elect Temp |
| 101 | SAFETY_ZONE_HYSTERESIS | SafeZone Hyst |
| 102 | ECHO_SUMMARY | Echo Summary |
| 103 | ECHO_DATA | Echo Data |
| 104 | ECHO_DATA_INDEX | EchoData Indx |
| 105 | WAVEFORM_SELECTION | Waveform Selection |
| 106 | STEAM_CAL_MOUNT | Steam Cal Mount |
| 107 | NON_VOL_STAT | Non Vol Stat |
| 108 | DATE_CODE | Date Code |
| 109 | MAGNETROL_SERIAL_NUMBER | Magnetrol S/N |
| 110 | FIRMWARE_VERSION | Firmware Ver |
| 111 | LOCAL_AI_DISPLAY | Local AI Display |
| 112 | HF_CABLE | HF Cable |



Enhanced Model 705 Eclipse Guided Wave Radar Transmitter FOUNDATION Fieldbus™ Configuration Data Sheet

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

| Item | Value | Value | Value | | |
|-------------------------|-------|-------|-------|------------------------|--------------------------|
| Vessel Name | | | | | |
| Vessel # | | | | | |
| Process Medium | | | | | |
| Tag # | | | | | |
| Electronics Serial # | | | | TROUBLESHOOTING | |
| Probe Serial # | | | | Working Value | Non-Working Value |
| Level | | | | | |
| Volume (optional) | | | | | |
| Interface (optional) | | | | | |
| Interface Volume (opt.) | | | | | |
| Probe Model | | | | | |
| Probe Mount | | | | | |
| Measurement Type | | | | | |
| Sensor Units | | | | | |
| Probe Length | | | | | |
| Level Offset | | | | | |
| Volume Units (opt.) | | | | | |
| Strapping Table (opt.) | | | | | |
| Dielectric | | | | | |
| Sensitivity | | | | | |
| Blocking Distance | | | | | |
| Safety Zone Fault | | | | | |
| Safety Zone Height | | | | | |
| Safety Zone Alarm | | | | | |
| Threshold | | | | | |
| Interface Threshold | | | | | |
| Level Trim | | | | | |
| Level Ticks | | | | | |
| A. I. Disp | | | | | |
| Dev Addr | | | | | |
| Interface Ticks (opt.) | | | | | |
| Fid Ticks | | | | | |
| <Software Version> | | | | | |



Enhanced Model 705 Eclipse Guided Wave Radar Transmitter

FOUNDATION Fieldbus™ 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 | | | | | |
| HF Cable | | | | | |
| Fid Gain | | | | | |
| Window | | | | | |
| Conv Fct | | | | | |
| Scl Ofst | | | | | |
| Neg Ampl | | | | | |
| Pos Ampl | | | | | |
| Signal | | | | | |
| Compsate | | | | | |
| DrateFct | | | | | |
| Targ Ampl | | | | | |
| Targ Tks | | | | | |
| Targ Cal | | | | | |
| OperMode | | | | | |
| 7xKCorr | | | | | |
| ElecTemp | | | | | |
| Max Temp | | | | | |
| Min Temp | | | | | |
| SZ Hyst | | | | | |
| Name | | | | | |
| Date | | | | | |
| Time | | | | | |

Service Policy

Owners of Magnetrol 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.

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

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 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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