

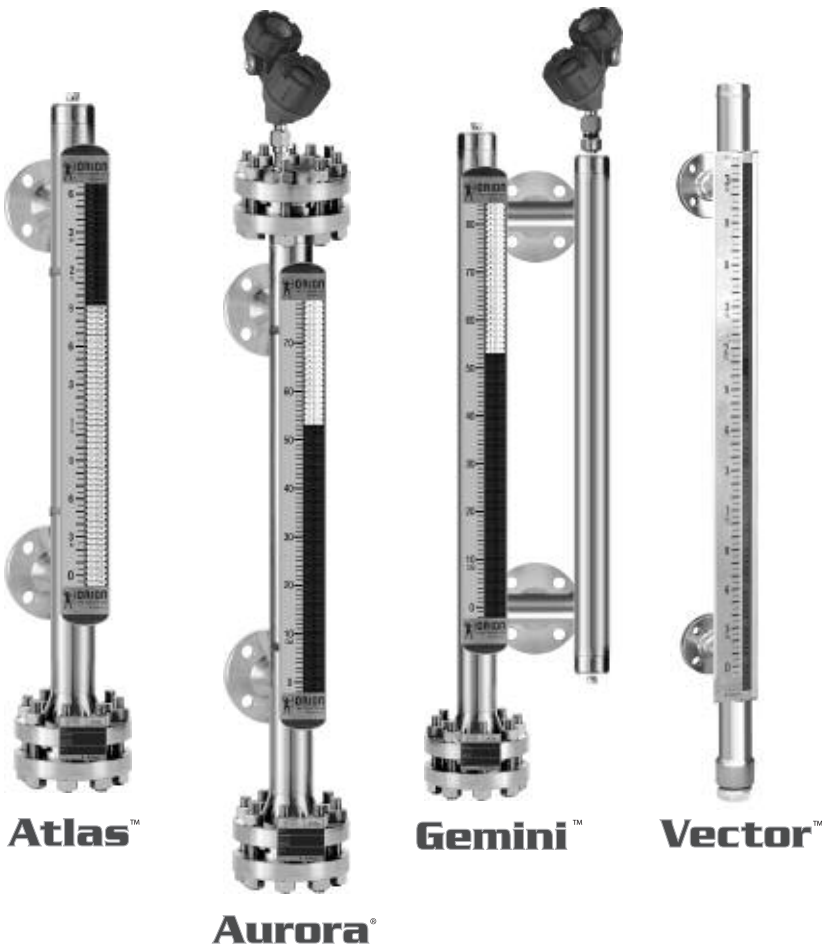
Magnetic Liquid Level Indicators

Installation and Operating Manual

Gauges

Switches

Transmitters



Read this Manual Before Installing

This manual provides information on Magnetic Liquid Level Indicators. It is important that all instructions are read carefully and followed in sequence.

Conventions Used in this Manual

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

Notes

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

Cautions

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

Warnings

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

Safety Messages

Follow all standard industry procedures for servicing electrical equipment when working with or around high voltage. Always shut off the power supply before touching any components.

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

Low Voltage Directive

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

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Warranty

All Magnetrol/Orion mechanical level controls are warranted free of defects in materials or workmanship for five full years from the date of original factory shipment.

All Magnetrol/Orion electronic level controls are warranted free of defects in materials or workmanship for eighteen months from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol/Orion will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

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





ORION
INSTRUMENTS

Magnetic Liquid Level Indicators

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1.0 Installation

Caution: If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

1.1 Unpacking

Unpack the instrument carefully. Inspect all units for damage. Report any concealed damage to carrier within 24 hours. Check the contents of the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

Caution: Do not discard the shipping container until all parts are checked.

1.2 Pre-installation Checklist

1. Manually move the float from 0% to 100% to 0% prior to start up/check out in order to reinitialize accessory products, if so equipped. Accessories may inadvertently change state due to rough handling in shipment.
2. Remove float prior to pressure testing tank.

Caution: Float damage will occur if not removed from chamber prior to pressure testing the tank.

3. Verify the MLI's center to center distance equals the vessel's center to center.

1.3 Equipment and Tools

- Open-end wrenches or adjustable wrench to fit the process studs and nuts. A torque wrench is highly desirable.
- Flat-blade screwdriver
- Digital multimeter or digital volt/ammeter if transmitters or switches are attached
- Level
- Gasket for mating flanges
- Teflon tape & "never seize" for threaded units
- Pipe wrench for threaded units

1.4 Side Mount Installation

Caution: This instrument is intended for use in Installation Category II, Pollution Degree 2 locations.

NOTE: Top of gauge nameplates are available as an option.

The MLI nameplate can be used as bottom reference of the external cage. Install the cage to the vessel with nameplate at bottom. Isolation valves are recommended for installation between vessel and external cage. Check to ensure the external cage is vertical. All piping should be straight and free of “low spots” or “pockets” so that the lower liquid connection will drain toward the external cage. Adjust piping as required.

It is recommended a drain valve be installed in the bottom flange to allow cleaning and checking level. Close the isolation valves until start up.

Initial installation of the Magnetic Level Indicator is simple. Unless otherwise specified, MLIs will be shipped from the factory fully assembled. All flanges will be torqued to ANSI specifications. Make sure all process connections attached to the vessel which the gauge will be mounted to are vertically level, and flanges, if any are level.

Carefully unpack the MLI and stand it up vertically.

NOTE: Longer units require support of the entire length of the chamber while being lifted in place vertically. This will prevent bowing of the chamber, that could result in glass breakage. Once the gauge is mounted to the vessel and the liquid level rises inside the vessel, the gauge will become operational

Isolation valves are recommended, but not required. If isolation valves are used, care must be used when opening the valves to prevent a surge of fluid or gases through the chamber. A surge can cause the float to be propelled to the far end of the chamber, and float damage could result.

Caution: If for any reason the MLI is pressurized higher than the maximum pressure indicated on the name tag, the float inside the chamber is subject to collapsing and causing float failure.

NOTE: Float is shipped in chamber.

1.5 Top Mount Installation

Caution: This instrument is intended for use in Installation Category II, Pollution Degree 2 locations.

The top mount gauge can be installed as one complete unit or disassembled to allow access from inside the tank.

Correct vertical installation is required to assure proper float movement.

To disassemble you need only to unscrew the threaded cap at the bottom mounting flange or connection.

Caution: Proper precautions should be taken to prevent the bending of the guide rod.

1.6 Top/Bottom Connection Installation

Caution: This instrument is intended for use in Installation Category II, Pollution Degree 2 locations.

Carefully unpack the MLI and stand the unit up vertically. Note the float stop disc at the bottom flange. Note the float stop bar (welded in place) at the top of the gauge. This always indicates the top of gauge.

The float is shipped in the chamber.

Caution: Overall length should be $\pm \frac{1}{6}$ ". Smooth float travel must be assured by no bending of the chamber pipe.

1.7 Start-up

Increase system pressure slowly while commissioning the instrument. Thoroughly check for leaks, and verify that the local indicator device accurately tracks the liquid level. Verify external accessory devices (switches, transmitter, etc.) are functional and properly calibrated.

Caution: Do not open the bottom isolation valve quickly. Allow the level to rise until the MLI displays the correct level in the vessel.

1.8 Special Accessory Installation

1.8.1 Insulation or Blanket Installation

Factory recommended high temperature insulation specifications:

Temperature	Thickness	Liner	Jacket
0 to +250 °F (-18 to +121 °C)	½"	Weather resistant silicone cloth	Weather resistant silicone cloth
+251 to +500 °F (+122 to +260 °C)	1"		
+501 to +1000 °F (+261 to +538 °C)	2"	Weather resistant aluminized silicone cloth	

- Thickness is ½" when the MLI has switches or a transmitter.
- Insulation used is 8 lb. density ceramic blanket
- All removable insulated blankets are fastened to the MLI by velcro and straps. Quilting pins available as an option.
- All removable insulation blankets are sewn with fire retardant teflon thread.
- High temperature guide for the level flow gauge side mount:
Consult factory for specific temperature guide lines.



Figure 1
Low Temperature
Insulated Magnetic
Level Indicator

Factory recommended cryogenic insulation specifications:

Temperature	Thickness	Liner	Jacket
+32 to -100 °F (0 to -73 °C)	2"	Outdoor .016 smooth aluminum jacket with vapor barrier	Polyurethane with all service jacket vapor barrier
-101 to -320 °F (-74 to -196 °C)	4"		

- Purpose: To maintain the required low temperature of the service fluid to be measured.
- All insulation joints will be staggered.
- All insulation joints will be sealed with a non-breathing moisture resistant mastic.
- All weather resisting jacketing seams will be sealed with a weather resistant caulk.
- The weather resistant jacket will be sealed to the 2" or 4" plexiglass frost extension, with weather resistant caulk.
- The face of the frost extension must always be exposed.
- Cryogenic units will be flipper style indicators.

1.8.2 Steam Heat Tracing Installation

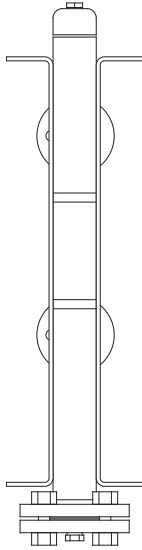


Figure 2

Steam Heat Tracing is available as a factory installed option. Steam traced units are generally supplied with a factory installed insulation blanket (also optional).

Two steam connections (typically $\frac{3}{8}$ " \times 0.035" tubing) protrude from the unit. See Figure 2. The following installation procedure is suggested:

- Remove factory installed plastic caps from the tube ends.
- Inspect tube ends for dents and burrs. Tubing length may be adjusted (cut), if required.
- Compressed air may be applied to either end to verify that no foreign material exists in the tube tracing assembly.
- A suitable saturated steam source and drain should be connected. Do not exceed applicable pressure ratings for the particular tubing size. Standard compression fittings may be used to make the connections, and either connection may be used as inlet or outlet.
- Apply steam to the unit and check for leaks.
- Contact factory or local representative for assistance, if required.

1.8.3 Electric Heat Tracing Installation

Electric Heat Tracing is available as a factory installed option. Electric traced units are generally supplied with a factory installed insulation blanket (also optional).

Electrical connections are supplied, based on specific customer requirements. Operating voltage and power consumption will vary for each particular configuration. More specific information is supplied with each unit, and is also available from the factory (unit serial number is required).

The two most common configurations are units with a fixed-point thermostatic switch or units with an adjustable "bulb-type" thermostatic switch.

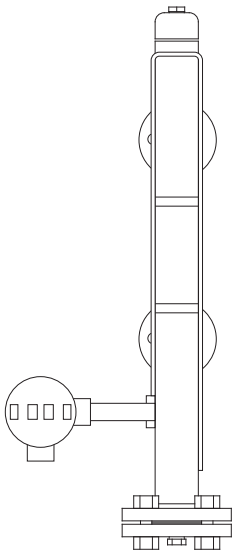


Figure 3

1.8.3.1 Units with a fixed-point thermostatic switch

With a fixed-point thermostatic switch (customer specified temperature set point), a wiring harness, or optional junction box with terminal strip will be available to accommodate field wiring. See Figure 3 (typical).

NOTE: It is the responsibility of the customer to comply with applicable installation codes and practices. Installation should be performed by qualified personnel.

-
1. Locate specific power specification and wiring diagram supplied with unit.
 2. Provide appropriate conduit and wiring to the unit.
 3. Apply sufficient operating power.
 4. Verify that unit will generate sufficient heat and maintain proper temperature.

NOTE: Wiring diagrams are supplied with units manufactured with this option.

1.8.3.2 Units with an adjustable “bulb-type” thermostatic switch

With an adjustable “bulb-type” thermostatic switch, the temperature may be preset at the factory, however field personnel should verify this setting during installation. A wiring harness, or optional junction box with terminal strip will be available to accommodate field wiring.

NOTE: For supply connections, use wire with a minimum rating of +167 °F (+75 °C) as required by process conditions. Use a minimum of 14 AWG wire for power and ground field wires.

NOTE: Housing must be grounded via protective ground screw in the base of the housing.

NOTE: It is the responsibility of the customer to comply with applicable installation codes and practices. Class I, Division 1 locations may contain explosive gas mixtures. Appropriate precautions must be taken. Installation should be performed by qualified personnel.

1. Locate specific power specification and wiring diagram supplied with unit.
2. Provide appropriate conduit and wiring to the unit.
3. Verify thermostat setting. Adjust, if necessary.
4. Apply sufficient operating power. Circuit breaker should be a GFI (ground fault interrupter) type with maximum 30 mA ground leakage current trip setting. GFI should be sized at 125% of rated load.
5. Verify that unit will generate sufficient heat and maintain proper temperature.

NOTE: Wiring diagrams are supplied with units manufactured with this option.

Caution: In hazardous areas, do not power the unit until the conduit is sealed and the enclosure cover is screwed down securely.

inches (mm)

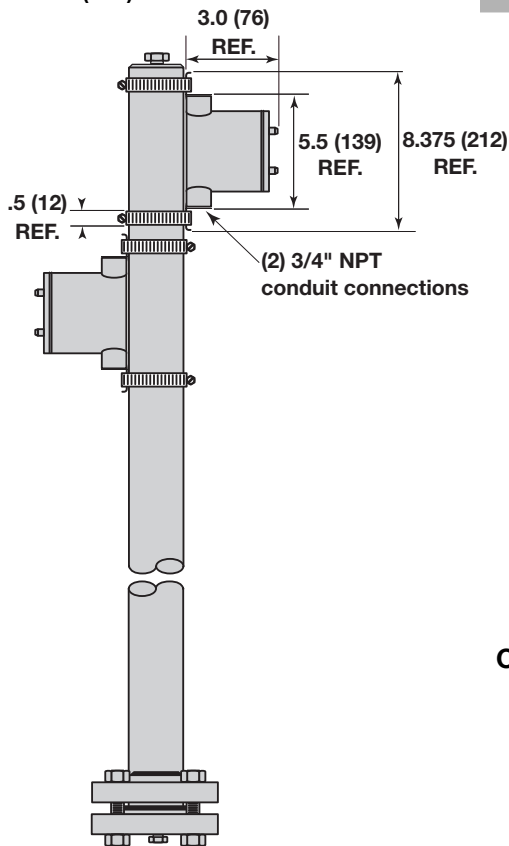


Figure 4

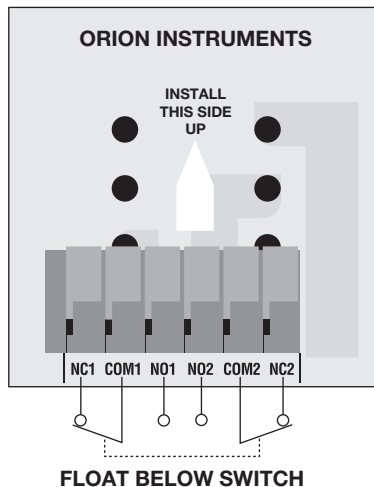


Figure 5

**Wiring of OES
cam operated switch**

Contact closure is shown with the magnetic float below the switch

1.9 Switch Installation

1.9.1 OES Cam Operated Switch

The Model OES snap switch is utilized to expand the control capabilities of Orion's extensive line of magnetic level indicators. This cam-operated double pole double throw mechanism is clamp-mounted to the outside of the MLI. This mounting style allows easy addition or repositioning of switches without disruption of the process.

The OES switch(es) are pre-installed, calibrated, and checked for proper orientation at the factory. Your unit may be equipped with one or more switches for alarming or control. To change the location of the switch in the field, simply unscrew the clamp and slide the switch to a new location. See Figure 4.

1.9.1.1 Mounting to an Atlas™ or Gemini™ MLI

Caution: If equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.

Remove the cover of the enclosure. Position the OES cam-operated snap switch on the MLI body so that the center-line of the switch enclosure is at the desired switch point level. Ensure that the switch is oriented so that the arrow on the switch mechanism is pointing toward the top of the MLI. Install the clamps around the MLI and over the mounting brackets on the top and bottom of the switch housing. Tighten the clamps so that the switch is secured to the MLI. Replace housing cover. If required, place the insulation between the MLI body and the switch before tightening the clamps.

1.9.1.2 Mounting to an Aurora® MLI

The Aurora may be ordered with one or more OES clamp-on switches. During assembly Orion can ensure proper function of the switches. Special care must be taken when adding OES switches to an Aurora after initial purchase. For proper function, the switch must be located as close to the internal float magnet as possible. This is achieved by marking the location of the indicator on the Aurora body. The indicator must be rotated on the chamber so that the switch can be positioned closest to the float. Loosen the indicator clamps, rotate the indicator 90 degrees around the chamber and retighten the clamps. Mount the OES switch where the indicator was originally located. Move the float, or move level, to verify proper operation of the switch.

1.9.1.3 Wiring

The lower conduit opening is protected with a plastic shipping plug. The upper opening is sealed with a steel plug. If it is preferable to wire through the upper conduit entry, the steel plug may be moved to the lower opening.

NOTE: For supply connections, use wire with a minimum rating of +167° F (+75° C) as required by the process conditions. Use a minimum of 14 AWG wire for power and ground field wires.

NOTE: Housing must be grounded via protective ground screw in base of housing.

Caution: In hazardous areas, do not power the unit until the conduit is sealed and the enclosure is screwed down securely.

The DPDT switch has two sets of contacts. See Figure 5 on page 10 and label on mechanism. To wire switch, strip about ½" of insulation from end of wire. Using a flat head screwdriver or pliers, push orange tab away from the wire opening on the terminal block. **DO NOT** pry up on the orange tab as damage to the terminal block may result. Insert wire into opening and release tab. Check that the wire is securely fastened within the terminal block. Repeat for balance of connections.

1.9.2 ORS Electric Reed Switch

The Model ORS reed switch is available to augment the control capabilities of Orion's extensive line of magnetic level indicators. Housed in an explosion proof stainless steel enclosure, the ORS mounts to the outside of the MLI via clamps. This mounting style allows addition or repositioning of switches at any time, without disruption of the process.

The ORS switch(es) are pre-installed, calibrated, and checked for proper orientation at the factory. Your unit may be equipped with one or more switches for alarming or control. To change the location of the switch in the field, simply unscrew the clamp and slide the switch to a new location.

1.9.2.1 Mounting to an Atlas or Gemini MLI

Caution: If equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.

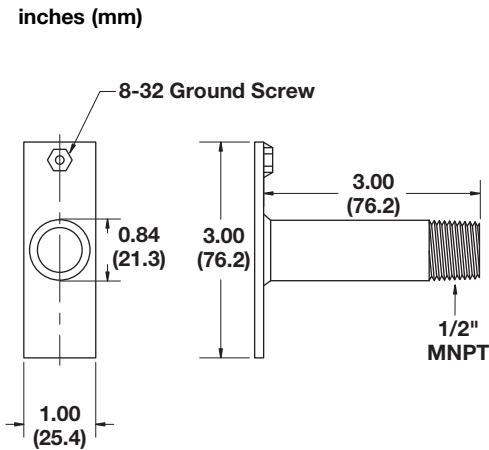


Figure 6

With mounting clamps loosened, position ORS reed switch on the MLI body so that the centerline of the stainless steel tube which houses the switch is at the desired switch point level. The switch should be oriented so that the green ground screw is closest to the top of the MLI. See Figure 6. Tighten the clamps so that the switch is secured to the MLI. If required, place the insulation between the MLI body and the switch before tightening the clamps.

1.9.2.2 Mounting to an Aurora MLI

Follow procedure for mounting to Atlas or Gemini, but ensure that the switch is positioned on the circumference of the Aurora body as close to the indicator as possible.

1.9.2.3 Wiring

The leads protruding from the potted end of the switch housing are color coded as follows:

- White = Common
- Black = Normally Closed
- Red = Normally Open

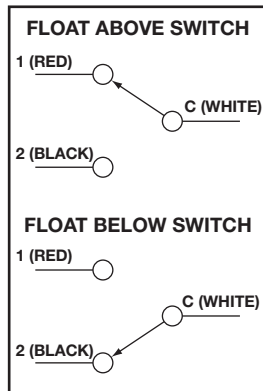


Figure 7
Wiring of ORS
Reed Switch

Contact closure shown for both conditions of the switch relative to the magnetic float

NOTE: For supply connections, use wire with a minimum rating of +167° F (+75° C) as required by the process conditions. Use a minimum of 14 AWG wire for power and ground field wires.

NOTE: Housing must be grounded via protective ground screw on upper mounting tab.

inches (mm)

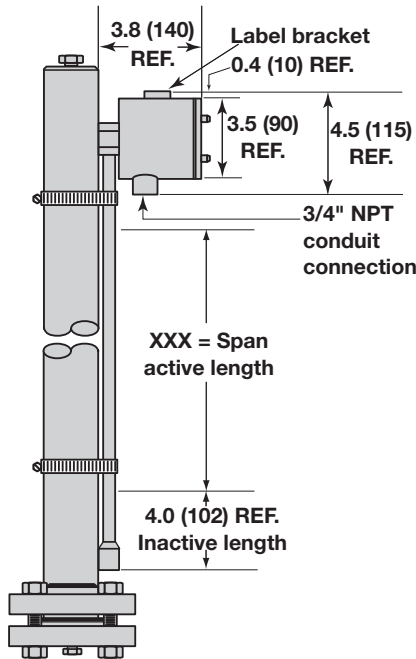


Figure 8

1.10 Analog Transmitter Installation

1.10.1 OCT Reed Transmitter

The OCT analog transmitter mounts directly to the side of the Atlas or Gemini chamber, providing a continuous 4–20 mA output signal proportional to liquid level. Using simple and reliable reed switches surface mounted to a printed circuit board, the unit provides level accuracy of ± 0.50 " (13 mm).

The OCT reed transmitter is shipped attached to the MLI gauge and is precalibrated to the customer specified span. See Figure 8. Refer to Figure 9 for wire terminations for the OCT.

Installation is simplified by utilizing gear clamps that can be repositioned with a screw driver.

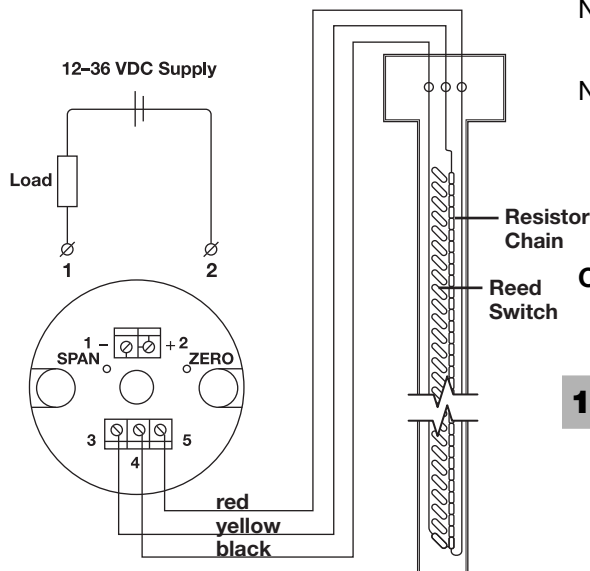
Caution: If the MLI is insulated, the analog transmitter probe must be located outside of the insulation blanket.

NOTE: For supply connections, use wire with a minimum rating of $+167$ °F ($+75$ °C) as required by process conditions. Use a minimum of 14 AWG wire for power and ground field wires.

NOTE: Housing must be grounded via protective ground screw in the base of the housing.

NOTE: It is the responsibility of the customer to comply with applicable installation codes and practices. Class I, Division 1 locations may contain explosive gas mixtures. Appropriate precautions must be taken. Installation should be performed by qualified personnel.

Caution: In hazardous areas, do not power the unit until the conduit is sealed and the enclosure cover is screwed down securely.



black: common connection of reed contacts
yellow: upper end of the resistor chain
red: lower end of the resistor chain

Figure 9

1.11 Internal Electronic Transmitter Installation

The Gemini Model enables the customer to install several different types of either continuous measuring instruments (transmitters) or point level control devices (switches). The electronic instrument is installed in the 2" or 3" secondary chamber of the Gemini MLI. The factory should be consulted for these applications to review operating parameters and to ensure that the desired instrument is properly applied.

As the electronic instrument is supplied separately from the Gemini MLI, the instruction manual for the electronic unit should be carefully reviewed prior to installation in the chamber. The instruction manual will be shipped with the instrument.

1.12 Internal Eclipse Transmitter Installation

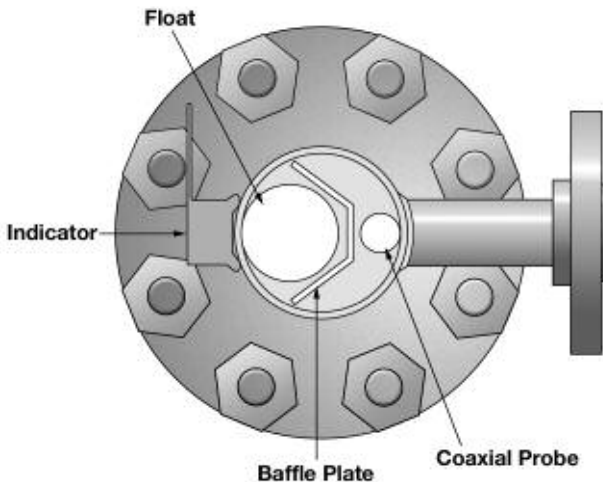


Figure 10

The Eclipse Guided Wave Radar Transmitter can be mounted in either the Gemini or the Aurora MLIs. The Aurora is designed to support operation of the Eclipse in the same chamber as the float. Due to this, the coaxial type probe must be used. With the dual chamber Gemini design, either the twin rod, coaxial, or single rod types may be used. Caution should be exercised in probe selection to take into account, media dielectric, viscosity, temperature, pressure, transition zone distances and overflow requirements. Each Eclipse will be supplied complete with an instruction manual. A review of the manual is recommended prior to installation of the Eclipse transmitter in the Gemini or Aurora MLI.

NOTE: Flag or shuttle indicator can be designed for mounting at any angle. Do not rotate indicator after gauge is manufactured, due to inability to rotate baffle plate once welding has been completed.

2.0 Reference Information

2.1 Description

Magnetic Level Indicators (MLIs) are suitable for installation on process applications that will not restrict float travel in the piping column. It is a magnetic coupled, local level indicator which is isolated from the process in a sealed non-magnetic external cage. Bi-color flags provide visual indication of level up to 100 feet. Field-adjustable level switches and transmitters are available as options.

The Atlas is a magnetically coupled local level indicator isolated from the process via a sealed non-magnetic external chamber. A fluorescent orange shuttle or series of bi-colored flags provide visual indication of liquid level from distances of up to 100 feet. Available switches for point alarms include electronic DPDT, reed and pneumatic technologies. Transmitter technologies for continuous 4–20 mA outputs include reed and guided wave radar.

Atlas is suitable for installation on process applications including corrosive services that do not impede the movement of the float in the piping column.

Aurora and Gemini incorporate a combination of the Atlas magnetic level gauge and Magnetrol's Eclipse Guided Wave Radar. This represents the industries first totally redundant mag gauge/transmitter combination.

Local indication, 4–20 mA output, HART and Fieldbus protocols are available. Float damage will not result in loss of the 4–20 mA signal

Aurora: The Eclipse Guided Wave Radar probe is mounted directly inside of the Gemini chamber. a minimum 3" chamber is utilized to accommodate the Eclipse probe and allow unobstructed float travel. Patent pending.

Gemini: The dual chamber approach also accomplishes total redundancy but increases the ease of gauge or transmitter isolation. The Atlas gauge provides local indication while the Eclipse is mounted directly inside a connected second chamber. The units perform independently of each other.

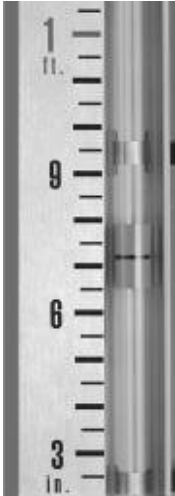


Figure 11

2.2 Theory of Operation

2.2.1 Side Mount

A float equipped with a strong magnet assembly inside and weighted to the specific gravity of the fluid to be measured, moves up and down in a non-magnetic chamber, as the fluid inside rises and falls with the level of the liquid in the vessel.

Attached to the external wall of the non-magnetic chamber is a non-porous glass tube. Inside this hermetically sealed glass tube is a highly visible fluorescent orange indicator or flags with a strong magnetic assembly inside. See Figures 11 and 12.

The indicator is always coupled to the float magnetically, to indicate the exact measurement of the fluid.

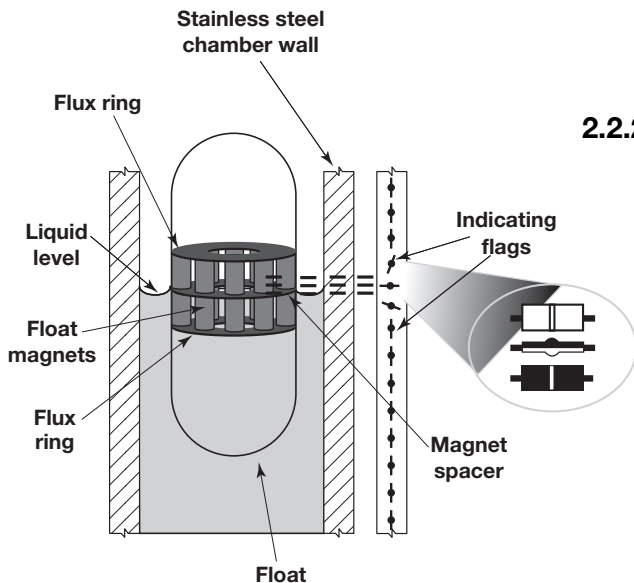


Figure 12

2.2.2 Top Mount

A top mounted float assembly consisting of a magnet assembly at the top, a guide rod in the middle, and a float at the bottom. The float at the bottom is submerged in the liquid inside the vessel. The entire guide rod assembly is weighted to the specific gravity of the fluid to be measured.

Attached to the external wall of the non-magnetic chamber is a non-porous glass tube. Inside this hermetically sealed glass tube is a highly visible fluorescent orange indicator or flags with a strong magnetic assembly inside. See Figures 11 and 12.

The indicator or flags are always coupled to the magnetic assembly, to indicate the exact measurement of the fluid.

2.3 Troubleshooting

2.3.1 Side Mount

Problem	Solution
Flags do not rotate with level change.	Test flags with a magnet from bottom to top (magnet not included). If flags test okay, check for float obstruction. (See Section 2.5, <i>Maintenance</i> on page 16)
Flags rotate at different height than actual level.	Float selected for different specific gravity. Replace float with a float with correct specific gravity rating. Confirm correctness of float orientation. Top is up.
Float inside the level gauge is moving slow or not at all.	Make sure the MLI is level vertically. The process fluid being measured may be too viscous and heat tracing may be required to make the material more fluid. Heat tracing can be purchased from the factory. The specific gravity of the process fluid and the float weight may need to be reverified. The liquid being measured may contain magnetic particles collecting on the magnetic section of the float causing drag. If this happens, magnetic trap assemblies can be purchased from the factory. Visual inspection of the float may be required to see if the float has collapsed.
Switch does not actuate with level change.	Check micro switch for continuity. Replace if damaged. If okay, remove switch from piping column and test switch magnet assembly with re-alignment magnet, by moving magnet over the housing face. If the switch magnet assembly fails to respond, replace the switch. If the switch tests okay, check float travel.
Reed transmitter does not track level.	Remove transmitter assembly from piping column and test with re-alignment magnet. Run magnet from bottom to top of reed chain. Check zero and span calibration. If no change in output, replace.
Scale is at zero to the center of the bottom process connection, but the indicator is above or below zero.	The scale assembly is mounted to the chamber using stainless steel gear clamps. It can be easily adjusted in the field using a screwdriver. Make sure the scale zero is in line with the center of the process connection. The float stop spring at each end of the chamber is there to cushion as well as position the float assembly to the center of the process connection. Make sure top or bottom float stop springs are not bent or broken.
Shuttle indicator has uncoupled and fallen to the bottom of the glass tube.	In some “flashing” applications, the float may rise or fall quickly. Consult factory for suggestions to help avoid this. To re-couple the indicator to the float, simply use a small magnet and run it along the length of the chamber to locate the float. Mark the location of the float on the outside chamber. Use the small magnet to couple with the indicator and pull the indicator up to meet and couple with the float. Make sure all stainless steel gear clamps are tight. The scale channel must be tight against the chamber.

NOTE: *Ensure unit installation is level.*

2.3.2 Top Mount

Problem

The float assembly or visual indicator is moving slowly or not at all.

Solution

Make sure the vessel opening or flange connection that the top mount flange connects to is level.

The top mount guide rod assembly may be bent. Visual inspection is required.

The process fluid in the vessel may be too viscous, Heating the vessel to make the process fluid more liquid may be required.

The specific gravity of the process fluid and the float may need to be reverified.

Visual inspection of the float inside the process fluid may be required to see if the float has collapsed.

My scale is at the center of the zero mark on the outside of the top mount chamber but the indicator is above or below zero.

The scale assembly is mounted to the chamber using stainless steel gear clamps. It can be easily adjusted in the field using a screwdriver. Make sure the scale zero is in line with the zero mark on the outside of the top mount chamber.

The float stop spring at the top of the chamber is there to cushion the magnet assembly. Make sure the bottom float stop tube is not bent or broken

The float stop tube is at the bottom inside the chamber. It is there to stop the magnet assembly at the zero mark on the outside of the chamber

2.4 Spare Parts

Spare parts are available for Magnetrol/Orion MLIs and certain switches and transmitters. Please consult the factory. Have the unit model number and serial number available for reference.

2.5 Maintenance

Periodic inspections are a necessary means to keep your level control in good working order. This control is a safety device to protect the valuable equipment it serves.

If the process liquid is clean (no solids or deposits), the MLI should require minimum maintenance. If the process liquid is dirty (solids and deposits), it is recommended the external cage be isolated from the process and flushed periodically. For complete cleaning, after draining the unit, remove the bottom flange and float, inspect cage and float for buildup and clean if required.

Magnetic traps are available to prevent magnetic particulate travel from the vessel to the chamber.

2.6 Specifications

2.6.1 Magnetic Level Indicator

Design	Atlas and Aurora – single chamber Gemini – dual chamber
Materials of construction – MLI	Metal alloys 316/316L or 304/304L stainless steel, 321 stainless steel, 347 stainless steel, Titanium, Monel, Hastelloy B, Hastelloy C-276, Inconel 625, Inconel 825, Alloy 20, Electropolished 316 stainless steel, 904L stainless steel and other non-magnetic alloys
	Plastics Fiberglass, PVC, CPVC, kynar, polypropylene
Materials of construction – Float	Same as chamber materials, 316 SS or titanium standard
Construction options	Conformance to ASME B31.1, ASME B31.3 or NACE MR0175 available
Certified material test reports (CMTR)	Available upon request
Pressure class ratings	ANSI 150#, 300#, 600#, 900#, 1500#, 2500# DIN PN16, PN25/40, PN64, PN100, PN160, PN250, PN320
Process connection sizes	½" to 8" DN 20 to DN 150
Process connection types	MNPT, FNPT, weldolet®, sockolet®, threaded couplings, threaded nipples, butt weld nipples, plain-end nipples, slip-on flanges, weldneck flanges, lap joint flanges, tri-clamp fitting, Van Stone flanges
Measuring range	12 to 600 inch (30 to 1524 centimeters) standard Consult factory for lengths over 600 inch (50 feet)
Temperature range	-320 to +1000 °F (-196 to +538 °C)
Pressure range	Full vacuum to 4500 psig (310 bar)
Specific gravity range	As low as 0.35 S.G.U.
Indicators	Magnetically actuated flag assembly in contrasting orange/black, yellow/black, red/white colors, or high visibility shuttle follower
Flag assembly seal	Inert gas filled and hermetically sealed with Insta-seal valve
Visual indication	Easily visible from 75 to 100 feet (23 to 30 meters)
Scale options	Etched stainless steel with either height, volume, or percentage units
Switch options	Model OES electric cam operated snap action Model ORS electric reed type
Transmitter options	Model 705 Eclipse Guided Wave Radar Model 2xx Jupiter Magnetostrictive Model OCT analog reed chain
High temperature options	Electric or steam tracing with or without special high temperature insulation
Low temperature options	Cryogenic insulation with special polymeric frost extension

2.6.2 Model OES Switch

- Electric snap action switch
- 10 amp DPDT
- ± 0.75 " (19 mm) float travel
- -58 to +392 °F (-50 to +200 °C)
- Cast aluminum enclosure, (2) $\frac{1}{2}$ " NPT conduit entries

See bulletin OES-100 for further information

2.6.3 Model ORS Switch

- Electric reed switch, hermetically sealed
- 1 amp SPDT
- Stainless steel enclosure with mounting tabs
- ± 0.5 " (13 mm) float travel
- -58 to +482 °F (-50 to +250 °C)
- Stainless steel enclosure with mounting tabs

See bulletin ORS-300 for further information

2.6.4 Model OCT Analog Transmitter

Power:	24 VDC
Maximum Range:	Up to 20 feet standard (Consult factory for longer lengths)
Accuracy:	± 0.5 " (13 mm)
Output:	4–20 mA
Temperature range:	-40 to +500 °F (-40 to +260 °C)

See bulletin OCT-400 for further information

2.6.5 Model JM4 Jupiter® Magnetostrictive Transmitter

Power:	16–36 VDC
Maximum Range:	Up to 400" (999 cm)
Accuracy:	$\pm 0.01\%$ full scale or ± 0.05 " (1.3 mm), whichever is greater
Output:	4–20 mA (HART optional), FOUNDATION fieldbus™
Temperature range:	-40 to +176 °F (-40 to +80 °C)

See bulletin ORI-150 for further information

2.6.6 Model 706 Eclipse® Transmitter

See bulletin 57-106 for details

Service Policy

Owners of Magnetrol/Orion Instruments controls may request the return of a or any part of an instrument for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Instruments 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 instrument, 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 instrument to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

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

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol's 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.



705 Enterprise Street • Aurora, Illinois 60504-8149 • 630-969-4000 • Fax 630-969-9489 • www.magnetrol.com
Heikensstraat 6 • B 9240 Zele, Belgium • 052 45.11.11 • Fax 052 45.09.93



2105 Oak Villa Boulevard • Baton Rouge, Louisiana 70815 • 225-906-2343 • Fax 225-906-2344 • www.orioninstruments.com

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BULLETIN: 46-638.6
EFFECTIVE: July 2016
SUPERSEDES: August 2010