



ORION
INSTRUMENTS

AMETEK
SENSORS, TEST & CALIBRATION

Aurora® Magnetic Level Indicator

PREMIUM MODEL

Designed as an alternative and upgrade to traditional gauge devices, Magnetic Level Indicators (MLI) from Orion Instruments® are manufactured to provide accurate and reliable liquid level in a wide range of applications. Our MLI product line—manufactured globally at multiple facilities—requires minimum maintenance and eliminates common sight glass problems like vapor and liquid emission. Orion Instruments specializes in precision-engineered excellence and offers highly customized configurations and options for process environments, including those with extreme temperatures and pressures.

True Redundancy in a Single Chamber

The Aurora® MLI combines Eclipse® Guided Wave Radar (GWR) and a float-actuated visual indicator to simultaneously provide both continuous and local level indication. So unique is the Orion Instruments® dual redundancy within a single chambered MLI that Aurora® has been granted a U.S. patent.

APPLICATIONS

- Alkylation Tanks
- Blowdown Tanks
- Boiler Drums
- Condensation Tanks
- Deaerators
- Feedwater Heaters
- Flash Drums
- Gas Chillers
- Hot Wells
- Industrial Boilers
- Oil-Water Separators
- Propane Vessels
- Storage Tanks
- Surge Tanks
- Vacuum Towers

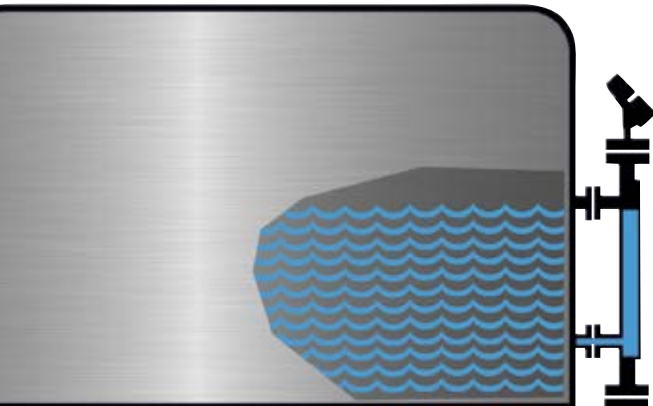


FEATURES

Introduced in 1998, Eclipse® Guided Wave Radar (GWR) quickly ascended to its leading role in process level measurement. GWR is still favored throughout the industry for its easy setup, trouble-free operation, measurement accuracy, and immunity to changing process conditions.

The Aurora® single chamber houses both the Eclipse® GWR probe and buoyancy float, with the former providing continuous measurement and the latter magnetically coupled to a visual indicator to provide local level indication.

A flag-type indicator (or a moving shuttle) visually indicates liquid level. A variety of measurement scales and indicator flag colors are available.



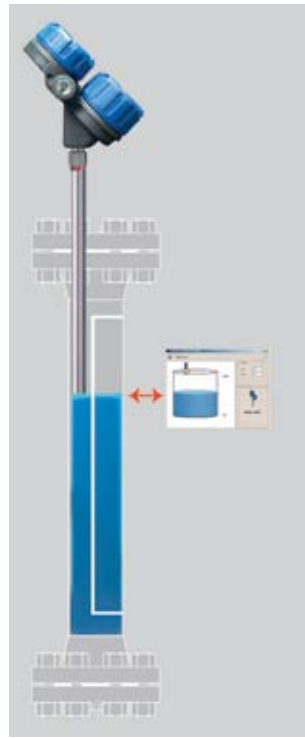
TECHNOLOGY

Radar Transmitter

The Eclipse® transmitter continuously emits electromagnetic radar pulses directly off the liquid surface. The on-board electronics provide a real-time level output, in addition to the external visual indicator operated by the Aurora® internal float.

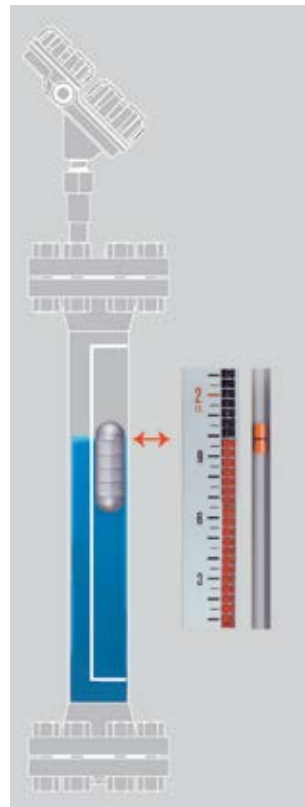
Baffle Plate

The GWR probe area is separated from the free-moving float by a baffle plate.



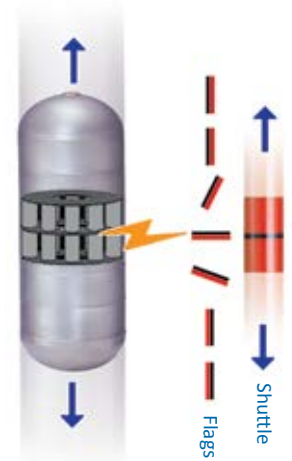
Vertical Float

The custom float located inside the chamber is magnetically coupled to the visual indicator. The float rotates flags or moves a shuttle to visually indicate liquid tank level (as explained in more detail at right).



Visual Indication

The float positioned within the Aurora® chamber rises and falls according to level changes. The float contains an internal group of magnets that are “coupled” with magnets in the flags of the visual indicator. As the float moves, the flags rotate to expose the color of their opposite side. The position where the flag’s color changes corresponds to a point on the measuring scale indicating true level. (The optional shuttle indicator moves parallel with the float to indicate level on the scale).



Optimum Float Performance

Orion Instruments® floats are engineered to provide the world’s best MLI performance.

The 360-degree vertical placement of the magnets assures proper coupling with the flag or shuttle of the indicator, even if the float is spinning in its chamber.



Float Section

The magnetic assembly creates a constant Gauss rating optimized to ensure reliable performance.

Float magnets are designed to function at temperatures up to +537° C (+1000° F) for years of reliable service. Special float alloys are available.

Baffle Plate

The superb float performance within the Aurora® is due in part to an angled baffle plate mounted inside the chamber. The baffle plate ① partitions the GWR probe area ② from the float area ③ and serves as a guide to ensure both smooth float travel and proper indicator operation. Perforations along the baffle plate equalize pressure and allow free media flow within the chamber. The probe area ② also acts as a gas-bypass zone when flashing occurs. This helps in preventing damage to the float.



Chamber Section

ECLIPSE® MODEL 706 GUIDED WAVE RADAR TRANSMITTER

DESCRIPTION

The Eclipse® Model 706 High Performance Transmitter is a loop-powered, 24 VDC level transmitter that is based upon the proven and accepted technology of Guided Wave Radar (GWR). Encompassing a number of significant engineering accomplishments, this leading edge level transmitter is designed to provide measurement performance well beyond that of many of the more traditional technologies.

Utilizing patented “diode switching” technology, along with the most comprehensive probe offering on the market, this single transmitter can be used in a wide variety of applications ranging from very light hydrocarbons to water-based media.

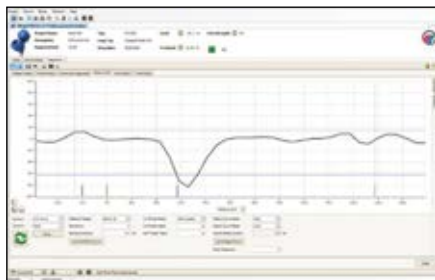
The innovative dual-compartment enclosure is now a common sight in the industry. This enclosure, first brought to the industry by Magnetrol® in 1998, is angled to maximize ease of wiring, configuration, and viewing of the versatile graphic LCD display.

One universal Model 706 transmitter can be used and interchanged with all probe types, and offers enhanced reliability as it is SIL certified for use in critical SIL 2/3 safety loops. With the use of a unique adapter, the model 706 transmitter can even operate with presently installed Model 705 probes.

The ECLIPSE Model 706 supports both the FDT/DTM and Enhanced DD (EDDL) standards, which allow viewing of valuable configuration and diagnostic information such as the echo curve in tools such as PACTware™, AMS Device Manager, and various HART® Field Communicators.



ECLIPSE® 706GWR



Eclipse® Model 706 DTM

APPLICATIONS

Media

Liquids, hydrocarbons to water-based media (Dielectric Constant $\epsilon_r = 1.2-100$)

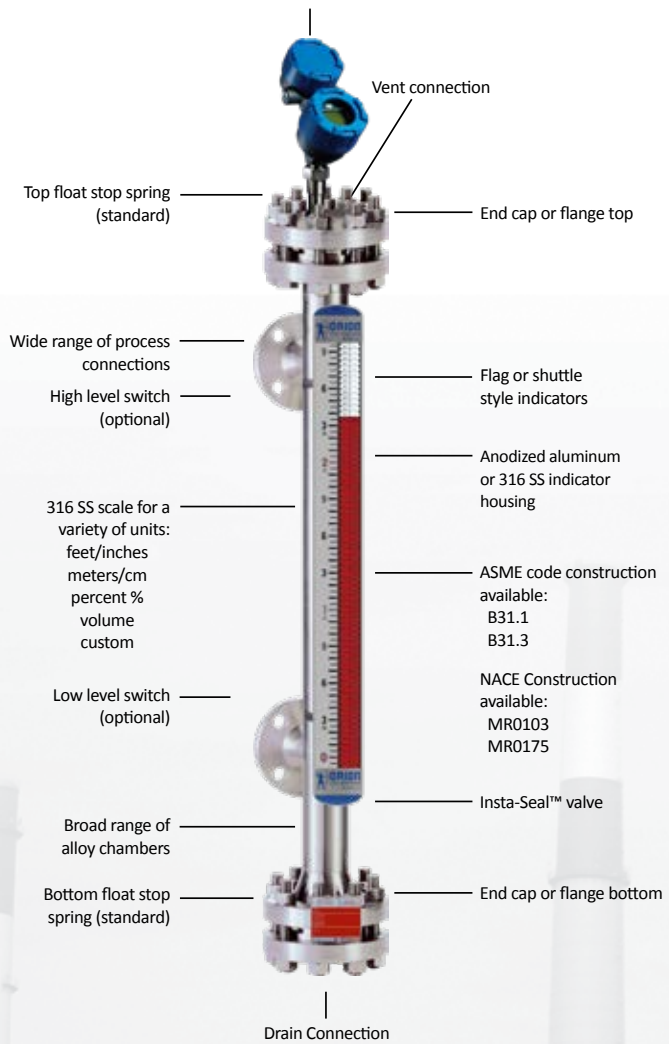
Vessels

Most process or storage vessels up to rated probe temperature and pressure.

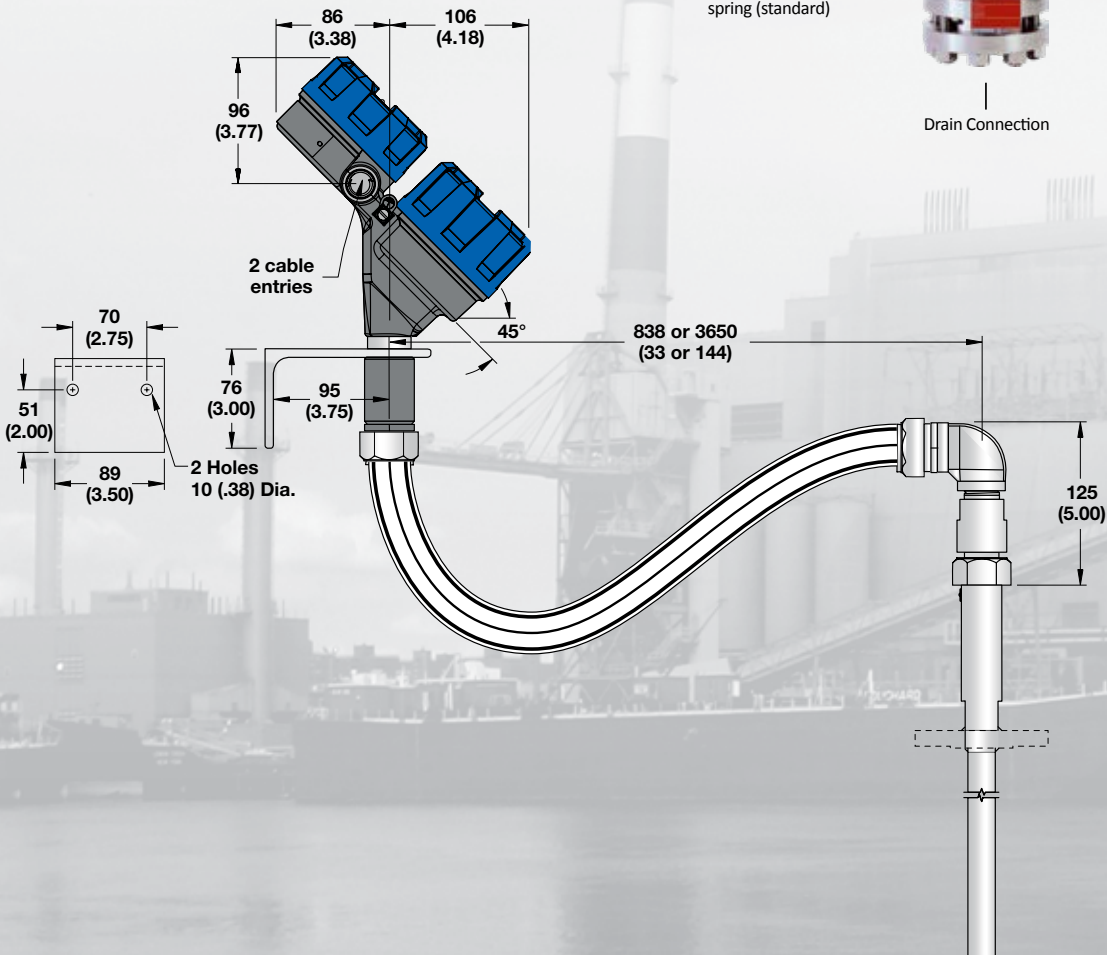
Conditions

All level measurement and control applications including process conditions exhibiting visible vapors, foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media or specific gravity.

Aurora® MLI

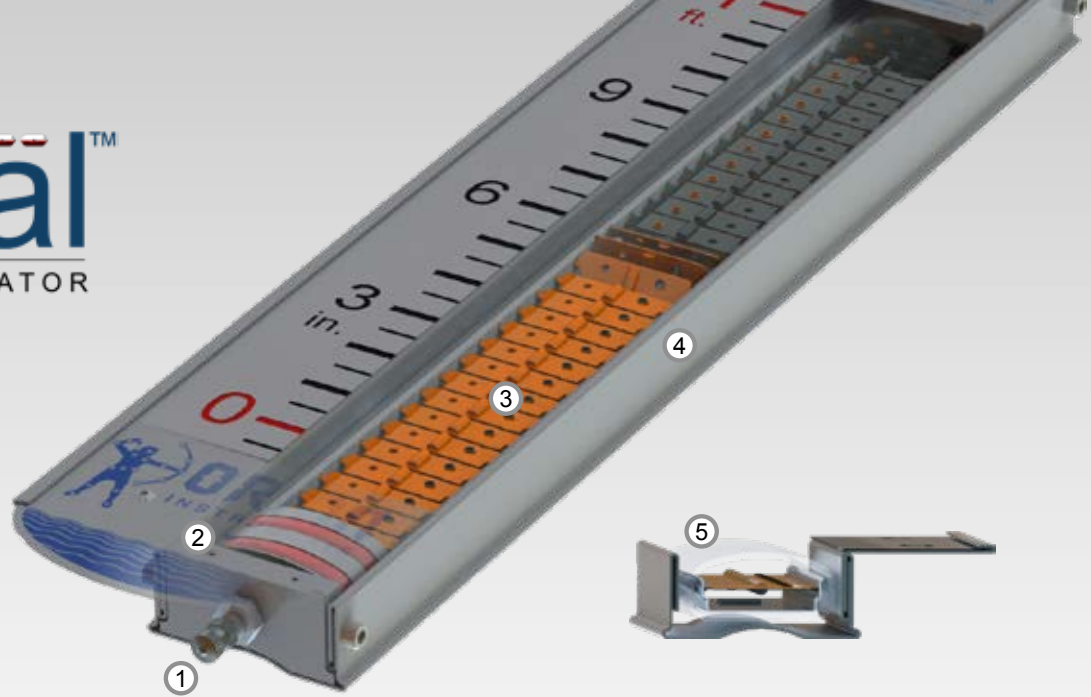


Remote Eclipse® Transmitter Configuration
mm (inches)

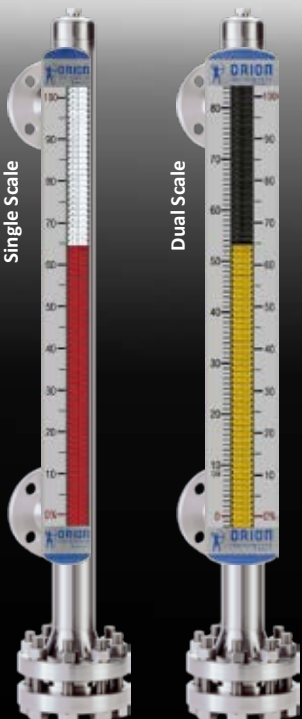
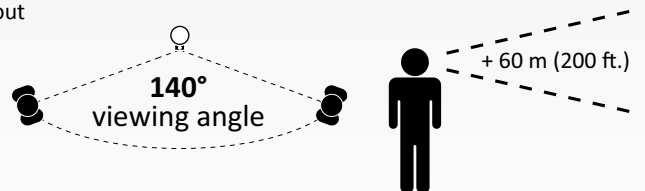


reveal™

WIDE VIEW INDICATOR



- ① InstaSeal™ valve allows for an effective vacuum seal
- ② Double custom D-ring end plug ensures a reliable seal that keeps moisture out
- ③ All-metal high contrast powder coated or anodized flags are wider to enhance overall visibility
- ④ Robust 316 stainless steel enclosure designed to face the elements
- ⑤ Extruded shatter-resistant viewing window enhances visibility and allows the flags to position closely to the float, enhancing the magnetic coupling



- Scale Options:**
- Inches / Feet
 - Running Inches
 - Millimeters / Meters
 - Centimeters / Meters
 - Percent (5% increments)
 - Gallons
 - Liters

The patented REVEAL™ indicator incorporates a *positive-stop* design which limits the rotation of each flag to a half-turn. This eliminates “over-flipping” which commonly occurs on other indicator designs.



Each flag contains a high-strength magnet



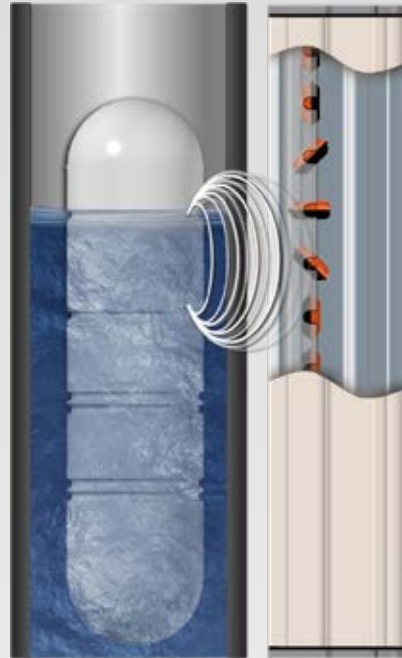
Standard flag and shuttle offering. Custom colors available.



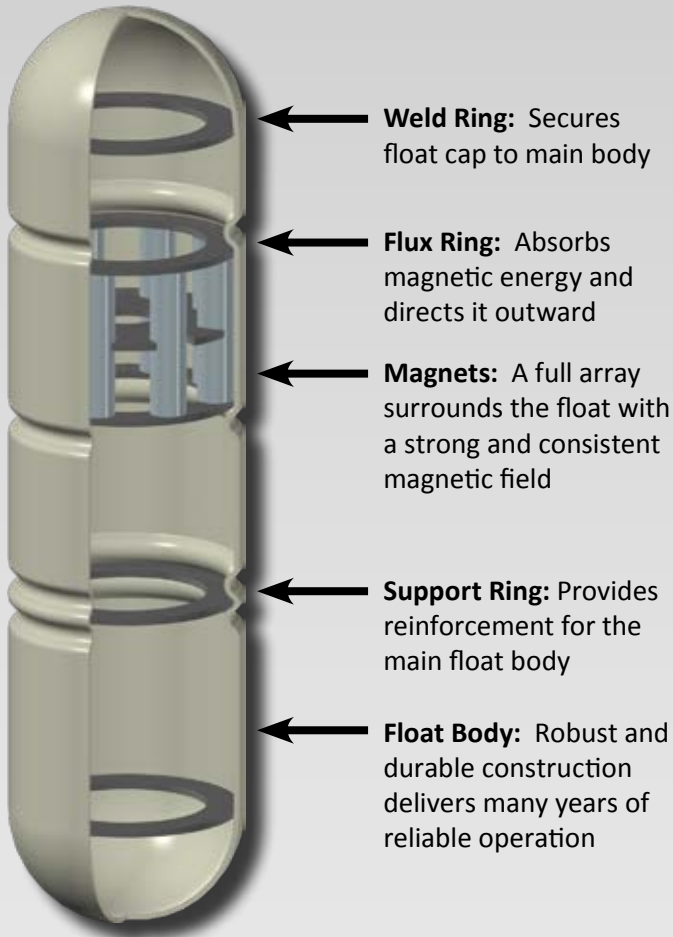
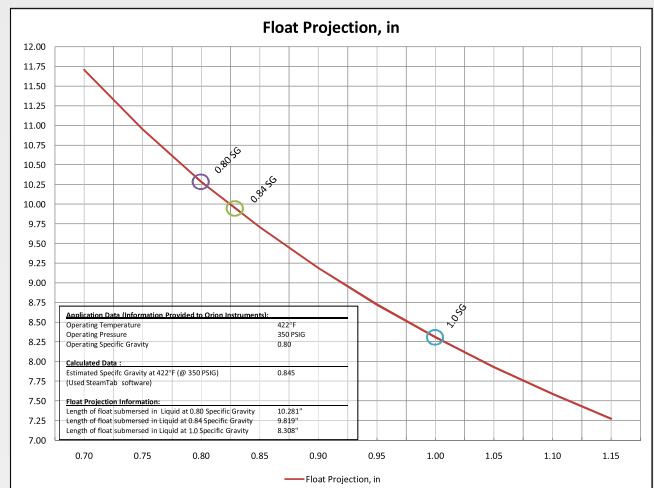
ORION FLOAT TECHNOLOGY

The float contained within the magnetic level indicator is perhaps the most important element of the instrument. Its structural design, volume displacement, weight, and buoyancy force are all carefully considered when a float is specified for a particular application.

Orion engineers have designed and tested hundreds of floats to gather the most accurate data available. We have designs for thousands of unique applications around the world, including high pressure, high temperature, and interface.



The float's 360° magnet assembly produces a strong and consistent flux array allowing visual indication through chambers as thick as schedule 160.



← **Weld Ring:** Secures float cap to main body

← **Flux Ring:** Absorbs magnetic energy and directs it outward

← **Magnets:** A full array surrounds the float with a strong and consistent magnetic field

← **Support Ring:** Provides reinforcement for the main float body

← **Float Body:** Robust and durable construction delivers many years of reliable operation

CAPABILITIES

Process pressures up to 310+ bar (4500+ psig) ①

Process Temperatures up to 538 °C (1000 °F) ①

Total level specific gravities as low as 0.30 ①

Interface float designs available for liquid specific gravity differentials as little as 0.1

Adequate buoyancy to operate effectively and freely in many viscous liquids, including crude oil

① Maximum capabilities can vary depending on combination of pressure, temperature, and media specific gravity.

OPTIONS

Teflon-S® PTFE and PFA slip-assistant coating

Special coatings for abrasion and chemical resistance

Float retrieval hook

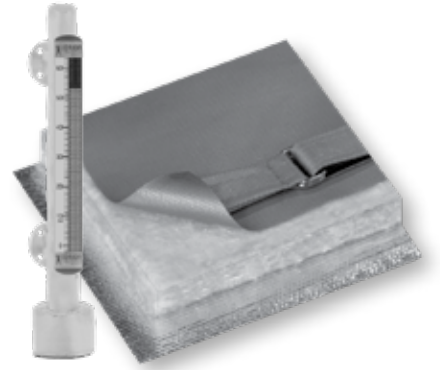
Float Projection Curve: If the liquid density changes, a float curve will reveal the offset

MAGNETIC LEVEL INDICATOR SPECIFICATIONS

Design	Single chamber
Materials of construction – Chamber	Metal alloys: see selection table digit 5
– Rail & window	316 stainless steel (Reveal™) rail with polycarbonate window Aluminum rail with polycarbonate or glass window
– Float	316 stainless steel and titanium (exotic alloys available); varies depending on process conditions
Construction options	ASME B31.1, ASME B31.3, ASME code Stamp [U,Um,S] and NACE
Approvals	Industrial, Industrial PED: ATEX II 1 G c T6 (non-electrical equipment)
Certified material test report (CMTR)	Available upon request
Pressure class ratings	ASME 150#, 300#, 600#, 900#, 1500#, 2500# EN PN16, PN25, PN40, PN63, PN100, PN160, PN250, PN320
Process connection sizes	½" to 6" DN 15 to DN 150
Process connection types	Refer to process connection section table for detail
Measuring range	30 to 1524 cm (12 to 600 inches)
Temperature range	-196 to +538 °C (-320 to +1000 °F)
Pressure range	Full vacuum to 310 bar (4500 psi)
Specific gravity range	Min. 0.30
Visual Indicators	Magnetically actuated flag assembly in contrasting orange/black, yellow/black, red/white colors, or high visibility shuttle follower (custom colors available)
REVEAL™ flag assembly seal	Inert gas filled and sealed with double D-ring & InstaSeal™ valve
REVEAL™ visual indicator	Visible from 60 m (200')
Ratings of REVEAL visual indicator	IP 68
Aluminum visual indicator	Visible from 30 m (100')
Scale options	Etched stainless steel with either height or percentage units (custom markings available)
Switch options	Electric microswitch Electric reed switch
Transmitter options	Model JM4 Jupiter magnetostrictive (refer to Orion bulletin ORI-150) Analog reed chain transmitter
High temperature options	Electric or steam tracing with or without special high temperature insulation
High temperature insulation	Fiberglass material
Low temperature options	Cryogenic insulation with special polymeric frost extension

HIGH-TEMPERATURE INSULATION

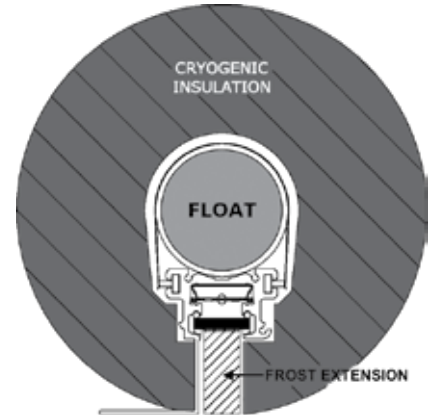
Orion specializes in custom fiberglass insulation blankets for MLIs of all shapes and sizes. They are constructed with high-quality materials capable of constant contact with temperatures up to 538 °C (1000 °F). This insulation is available as personnel protection or with heat tracing options for freeze protection or process temperature maintenance.



CRYOGENIC INSULATION & FROST EXTENSION

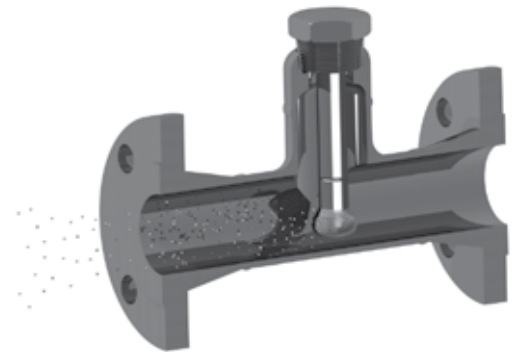
To facilitate operation where the product is kept cold via chillers, refrigerants, and condensers, cryogenic insulation is provided. By insulating the MLI with a specialized cryogenic jacket, process temperatures can be maintained in the liquid state down to -196 °C (-320 °F).

A frost extension option is available to prevent ice from collecting on the visual indicator, thereby decreasing the visibility. The extension is constructed of durable acrylic plastic and is provided standard with all cryogenic insulation.



MAGNETIC PARTICLE TRAP

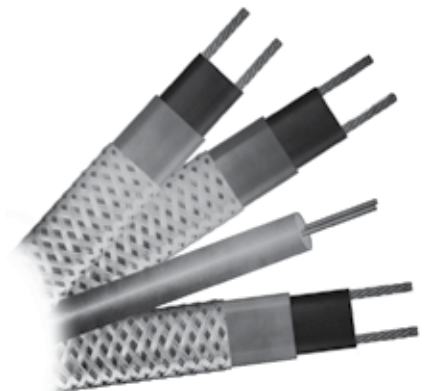
Magnetic Particle Traps, also known as Magtraps, provide additional protection for Orion's line of Magnetic Level Indicators. Particles composed mostly of ferrite, often from carbon steel piping, are widespread throughout process piping. These particles enter the MLI via the process connections during normal fill and drain operations. The magnetic float located inside the MLI attracts these particles over time. Eventually, the buildup will be enough to cause the float to become stuck inside the chamber. This results in the MLI either reading inaccurately or not at all. The trap collects the particles which can be cleaned periodically to ensure continued operation of the magnetic level indicator.



HEAT TRACING: ELECTRIC & STEAM

For applications where process freeze protection or temperature maintenance is required, heat tracing will allow the MLI to operate uninterrupted throughout harsh, cold conditions.

Electric Heat Tracing is available in self-regulating, constant wattage, and mineral insulated varieties. Contact the factory for more information.



JUPITER MODEL JM4 MAGNETOSTRICTIVE TRANSMITTER SPECIFICATIONS

Measuring Range:	15 to 999 cm (6 to 400 inches)
Resolution:	.4 mm (.014")
Repeatability:	±0.005% of full span or 0.356 mm (0.014 inches) (whichever is greater)
Linearity:	0.8 mm (0.030 inches) or 0.01% of probe length (whichever is greater)
Upper Dead Zone:	less than 7.6 cm (3 inches) when bottom mounted electronics
Lower Dead Zone:	less than 7.6 cm (3 inches) when top mounted electronics
Damping:	0 – 10 seconds; adjustable
Power (at terminals) 2-wire:	HART®: 16 to 36 VDC FOUNDATION fieldbus™ Explosion Proof: 9 to 17.5 VDC FISCO/FNICO: 9 to 32 VDC
Signal Output:	4-20 mA with HART®: 3.8 to 20.5 mA usable FOUNDATION fieldbus™: H1 (ITK Ver. 6.1.1)
Display:	Graphic liquid crystal display
Housing Material:	IP67/die-cast aluminum A413 (<0.4% copper); optional stainless steel
Area Classifications:	USA/Canada/ATEX/IECEx/INMETRO/Korea XP, IS, NI, DIP (see specific product literature for more detail)
Safety Integrity Level:	SIL rating pending
Process Temperature:	External Mount: -195 to +454 °C (-320 to +850 °F) No insulation -40 to +79 °C (-40 to +175 °F) Requiring insulation up to +454 °C (+850 °F)
Ambient Temperature at Electronics:	-40 to +80 °C (-40 to +175 °F) LCD: -20 to +70 °C (-5 to +160 °F)



Jupiter™
Model JM4
on Aurora®

OCT REED CHAIN TRANSMITTER SPECIFICATIONS

Measuring Range:	15 to 503 cm (6 to 198 inches)
Resolution:	13 mm (±0.50 inches)
Repeatability:	6 mm (< 0.25 inches)
Non-Linearity:	<0.4% full span averaged over span
Upper Transition Zone:	10.2 cm (4 inches)
Lower Transition Zone:	10.2 cm (4 inches)
Power Input:	12 to 36 VDC (2-wire)
Signal Output:	4 to 20 mA
Housing Type:	NEMA 4X, IP66
Housing Material:	Cast Aluminum or 316 SS
Area Classifications:	FM/CSA EP
Process Temperature:	No insulation: -40 to +93 °C (-40 to +200 °F) Requiring insulation: up to +260 °C (+500 °F)
Ambient Temperature at Electronics:	-40 to +70 °C (-40 to +158 °F)
Mounting Arrangement:	External mount probe with integral top or bottom mounted electronics



OCT Reed Chain Transmitter
on Aurora®

ELECTRONIC SWITCH SPECIFICATIONS

Model:	OES	ORS
Description:	DPDT magnetically actuated, bi-stable cam drive snap action switch	Hermetically sealed bi-stable reed switch
Supply Voltage:	10.1 amp; 125-250 VAC	250VAC/150VDC max
Maximum Dead Band:	±0.75" float travel	±0.50" float travel
Temperature Range:	No insulation -58 to +250 °F (-50 to +121 °C) Requiring insulation up to 500 °F (260 °C)	No insulation -58 to +250 °F (-50 to +121 °C) Requiring insulation up to 500 °F (260 °C)
Enclosure Rating:	Weatherproof IP66	Weatherproof IP66
Enclosure Material:	Cast aluminum (standard)	Stainless steel



Model OES








Model ORS

PNEUMATIC SWITCH SPECIFICATIONS

Consult factory for more information regarding pneumatic switches.

AGENCY APPROVALS – POINT SWITCH & REED CHAIN TRANSMITTER

Agency	Model	Area Classification
FM 	OES-xxxx-001	Class I, II, III, Div. 1, Groups B,C,D,E,F,G; T6 @ 80°C; Type 4X
	ORS-xxxx-001	Class I, II, III, Div. 1, Groups B,C,D,E,F,G; T6 @ 80°C; Type 4X Class I, Div. 2, Groups A, B, C, & D; T6 @ 80°C
	OCT-xxxx-xxx	Class I, II, III, Div. 1, Groups B,C,D,E,F,G; T6 @ 80°C; Type 4X Class I, Div. 2, Groups A, B, C, & D; T6 @ 80°C
CSA 	OES-x1xx-001	Class I, Div. 1/2, Groups B, C, & D; T6 @ 80°C; Type 4X Class II, Groups E, F, & G; T6 @ 80°C; Type 4X Class III
	ORS-x1xx-001	Class I, Div. 1, Groups B, C, & D; T6 @ 80°C; Type 4X
	OCT-xxxx-001	Class I, Div. 2, Groups A, B, C, & D; T6 @ 80°C; Type 4X Class II, Groups E, F, & G; T6 @ 80°C; Type 4X Class III
ATEX 	ORS-xAxx-001	ATEX II 2 G Ex d IIC T6 Ta = -40 to +70 °C
IEC 	ORS-xAxx-001	IECEx d IIC T6 Ta = -40 to +70 °C
CE 	OES-xxxx-001	Low Voltage Directives, 2006/95/EC
	ORS-xxxx-001	Installation Category II, Pollution Degree 2
	OCT-xxxx-xxxx	

3 | MOUNTING CONFIGURATION & CHAMBER CONSTRUCTION – Digit 1 = 2 (see drawings on next page)

Connection orientation		Chamber top	Chamber bottom
1	Side / Side	Welded cap with threaded Eclipse probe	Flanged (including mating blind flange)
2	Side / Side	Flanged with threaded Eclipse probe	Welded end cap
3	Side / Side	Flanged with threaded Eclipse probe	Flanged (including mating blind flange)
4	Side / Side	Flanged with seal welded Eclipse probe	Welded end cap
5	Side / Side	Flanged with seal welded Eclipse probe	Flanged (including mating blind flange)
A	Side / Bottom	Welded cap with threaded Eclipse probe	Flanged with process connection
B	Side / Bottom	Flanged with threaded Eclipse probe	Welded end cap with process connection
C	Side / Bottom	Flanged with threaded Eclipse probe	Flanged with process connection
D	Side / Bottom	Flanged with seal welded Eclipse probe	Welded end cap with process connection
F	Side / Bottom	Flanged with seal welded Eclipse probe	Flanged with process connection

EXTERNAL CAGE FOR TRANSMITTERS - CHAMBER CONFIGURATION

Process Connection Orientation		Chamber Top	Chamber Bottom
2	Side / Side	Flanged (with threaded transmitter)	Dome Cap
3	Side / Side	Flanged (with threaded transmitter)	Flanged (including blind flange)
8	Side / Bottom	Flanged (with threaded transmitter)	Flanged
9	Side / Bottom	Flanged (with threaded transmitter)	Dome Cap with Spool Piece
B	Side / Side	Flanged (with seal welded transmitter)	Dome Cap
C	Side / Side	Flanged (with seal welded transmitter)	Flanged (including blind flange)
H	Side / Bottom	Flanged (with seal welded transmitter)	Flanged
J	Side / Bottom	Flanged (with seal welded transmitter)	Dome Cap with process connection

4 | CHAMBER/FLANGE RATING

ASME	
A	150#
B	300#
C	600#
D	900#
E	1500#
F	2500#

EN 1092-1	
1	PN 16
2	PN 25
3	PN 40
4	PN 63
5	PN 100
6	PN 160
7	PN 250
8	PN 320

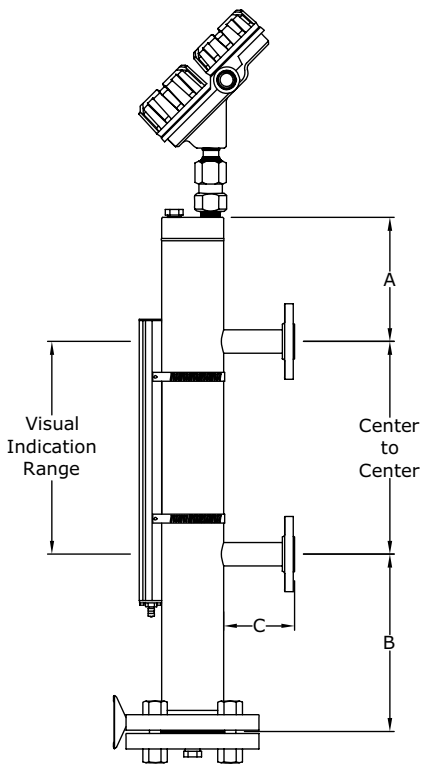
5 | MATERIAL OF CONSTRUCTION

Metallic	
A	316/316L stainless steel chamber
B	316/316L stainless steel chamber with carbon steel fittings & flanges
C	304/304L stainless steel chamber
D	304/304L stainless steel chamber with carbon steel fittings & flanges
G	321 stainless steel
H	347 stainless steel
J	904L stainless steel
N	Titanium
P	Monel®
Q	Hastelloy C-276
R	Alloy 20
S	Inconel® 625
T	Incoloy® 825
U	254 SMO

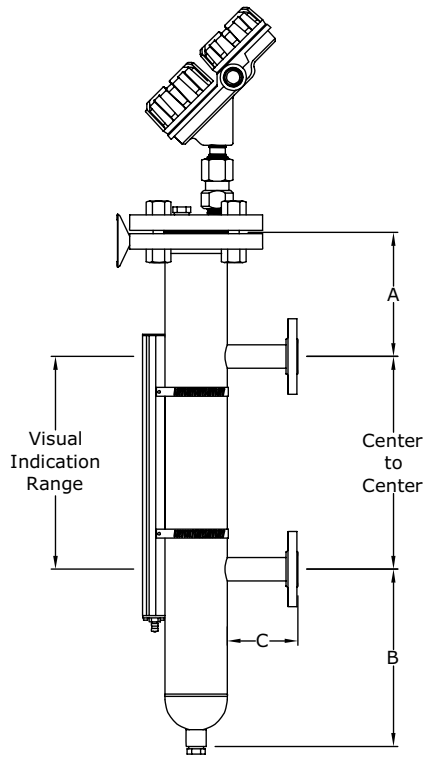
6 | CONSTRUCTION GRADE

Metallic construction – PED	
D	NACE MR0175/MR0103
E	ASME B31.3 & NACE MR0175/MR0103
J	Industrial
Z	ASME B31.3

Metallic construction – Non-PED	
1	Industrial Grade (std.)
2	ASME B31.1 for Power Piping Standard
3	ASME B31.3 for Process Piping Standard
4	Industrial Grade with NACE MR0175/0103
6	ASME B31.3 for Process Piping Standard and NACE MR0103/0175
8	Industrial Grade (extruded outlet)
9	ASME B31.3 (extruded outlet)

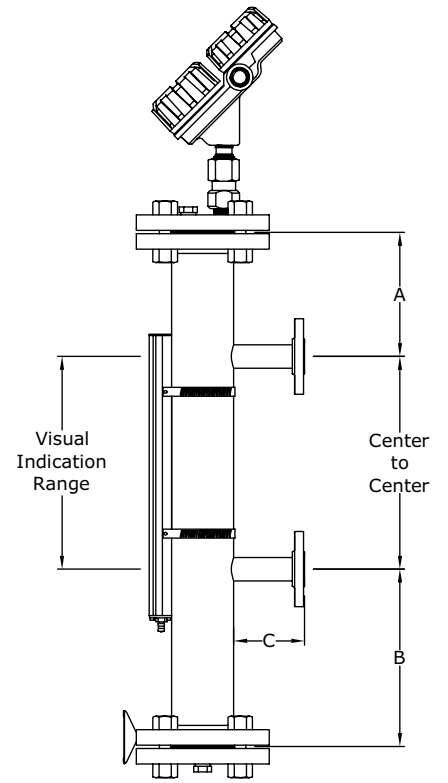


Configuration 1

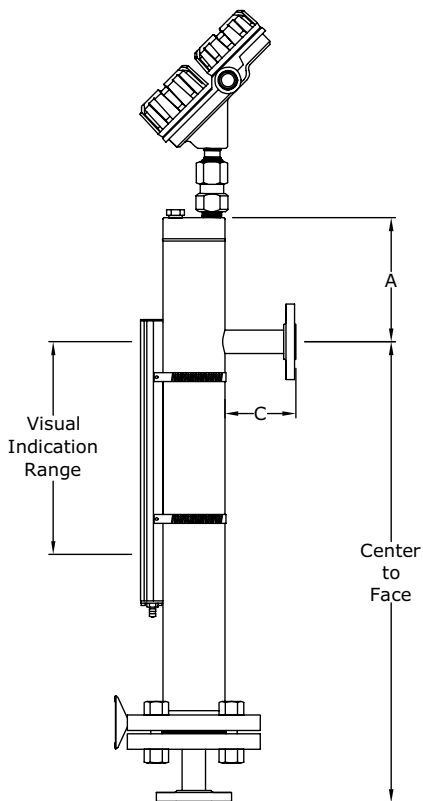


Configurations 2 & 4

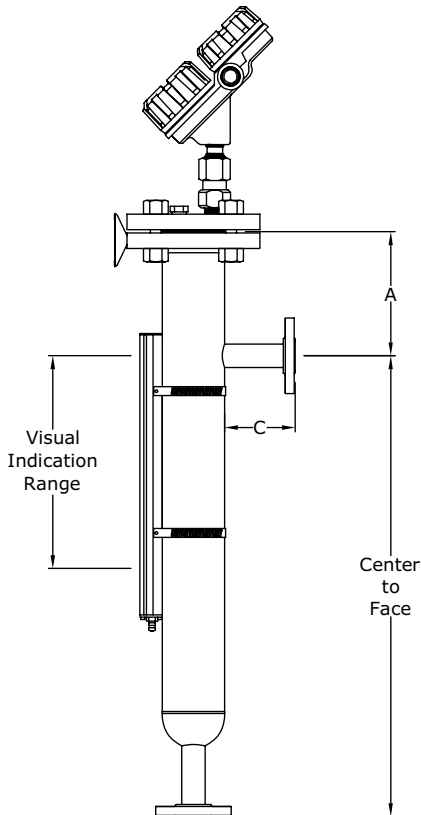
Single rod caged or flexible probes not available with bottom cap



Configurations 3 & 5

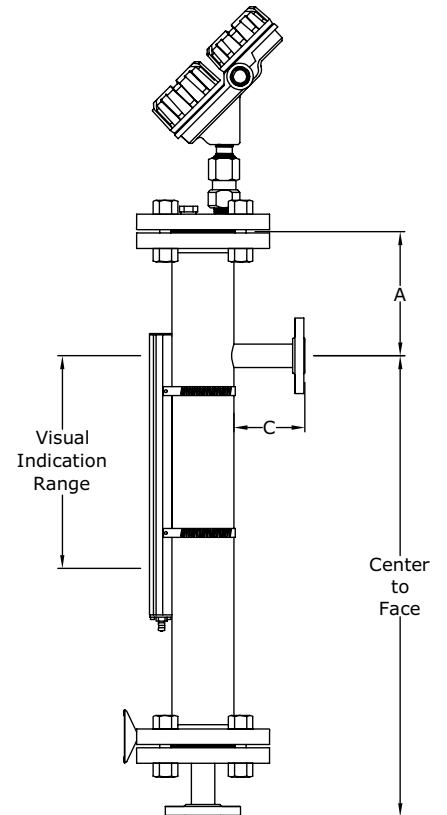


Configuration A

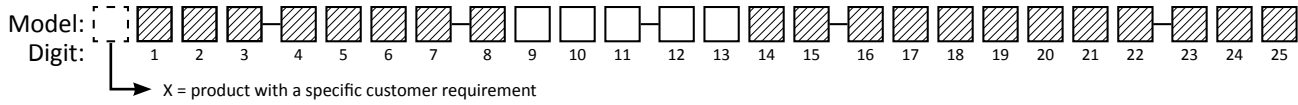


Configurations B & D

Single rod caged or flexible probes not available with bottom cap



Configurations C & F



9 | PROCESS CONNECTION SIZE

ASME		EN 1092-1	
A	1/2"	1	DN 15
B	3/4"	2	DN 20
C	1"	3	DN 25
D	1 1/2"	4	DN 40
E	2"	5	DN 50
F	2 1/2"	6	DN 65
G	3"	7	DN 80
H	4"	8	DN 100
J	6"	9	DN 150

10 | GASKET STYLE FOR CHAMBER FLANGE(S)

Gaskets for metallic flanges	
A	Flexible graphite/fiber ①
B	Spiral wound with graphite filler ②
C	Spiral wound with graphite filler, inner ring matching chamber material ③ and carbon steel outer ring
D	RTJ oval ring ③ ④
E	RTJ octagonal ring ④
N	None (if mating flanges are not supplied)

① Standard gasket for RF flanges with rating up to 300# / PN 63.

② Standard gasket for RF flanges with rating > 300# / PN 63. Winding material matches chamber material.

③ Standard ring joint for RJ ANSI flanges (digit 7 = J).

④ Ring joint material matches flange material.

11 | CHAMBER BOLTING MATERIAL

Stainless steel		
A	304 Stainless steel class 2	A193 Gr. B8 Class 2 / A194 Gr. 8
C	316 stainless steel class 2	A-193 Gr B8M class 2 / A-194 Gr 8M
D	316 stainless steel class 2 with PTFE coating	A-193 Gr B8M class 2 / A-194 Gr 8M
G	316 stainless steel class 2 + NACE	A-193 Gr B8M class 2 / A-194 Gr 8MA

Alloy		
S	Alloy steel with zinc plating (+210 °C (+390 °F) is maximum temp for zinc-plated bolting)	A-193 Gr B7 / A-194 Gr 2H
T	Alloy steel with zinc plating + NACE (+210 °C (+390 °F) is maximum temp for zinc-plated bolting)	A-193 Gr B7M / A-194 Gr 2HM
M	Alloy steel ①	A-193 Gr B7 / A-194 Gr 2H
P	Alloy steel + NACE ①	A-193 Gr B7M / A-194 Gr 2HM

N	None (if mating flanges are not supplied)
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① Available only in combination with digit 5 = B or D.

12 | VENT SIZE

N	None
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ASME	
1	1/2"
2	3/4"
3	1"
4	1 1/2"
5	2"

EN 1092-1	
A	DN 15
B	DN 20
C	DN 25
D	DN 40
E	DN 50

13 | VENT TYPE

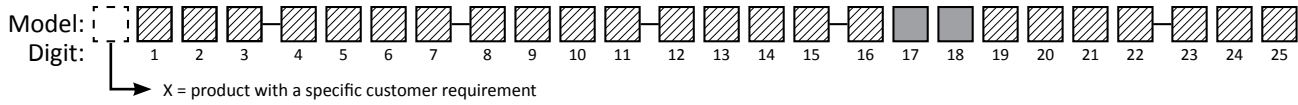
N	None
---	------

ASME	
1	Threaded NPT-F (female) with plug
2	Socket weld
3	Threaded NPT-M (male)
4	Pipe nipple plain end
5	Pipe nipple butt weld end
6	RF slip-on flange ①
7	RF weld neck flange ①
9	RJ weld neck flange ①

Valves	
A	Ball Valve, FNPT x FNPT
B	Ball Valve, SW x SW
C	Ball Valve, SW x FNPT
D	Gate Valve, FNPT x FNPT
E	Gate Valve, SW x SW
F	Gate Valve, SW x FNPT
G	RF Flange Ball Valve w/spool
H	RF Flange Gate Valve w/spool

EN 1092-1	
R	Weld neck (Type 11) EN 1092-1 Type A ①
S	Weld neck (Type 11) EN 1092-1 Type B2 ①
T	Weld neck (Type 11) EN 1092-1 Type B1 ①

① Pressure class of vent flange is as selected in digit 4.



17 | INSULATION OPTIONS

N	None	Indicator: max. 121 °C (250 °F) OCT transmitter: max. 93 °C (200 °F) Jupiter transmitter: max. 79 °C (175 °F)
---	------	---

Insulation pads for indicator, transmitter and switches			
E	Indicator only	digit 16 = N, Y	121 °C (250 °F) < T ≤ 260 °C (500 °F)
F	Indicator only	digit 16 = N	261 °C (501 °F) < T ≤ 537 °C (1000 °F)
K	Jupiter ①	digit 16 = 8, 9	261 °C (501 °F) < T ≤ 454 °C (850 °F)
R	Indicator & Jupiter ②	digit 16 = 8, 9	121 °C (250 °F) < T ≤ 260 °C (500 °F)
U	Transmitter	digit 16 = 8, 9	93 °C (200 °F) < T ≤ 260 °C (500 °F)
V	Indicator & Jupiter ②	digit 16 = 8, 9	261 °C (501 °F) < T ≤ 454 °C (850 °F)

Insulation blanket for personnel protection		
A	Chamber pipe only	up to 260 °C (500 °F)
B	Chamber pipe only	261 to 538 °C (501 to 1000 °F)
C	Chamber and flanges	up to 260 °C (500 °F)
D	Chamber and flanges	261 to 538 °C (501 to 1000 °F)

- ① Matches external mount Jupiter with digit 5 = E, F, H
- ② Matches external mount Jupiter with digit 5 = G, J
- ③ With maximum temperature up to 260 °C (500 °F); consult factory for application temperature higher than 260 °C (500 °F).

Cryogenic insulation	
L	Process temperature down to -100 °C (-150 °F)
P	Process temperature down to -196 °C (-320 °F)

Other options for temperature maintenance or freeze protection	
H	Electric heat tracing (blanket included) ③
S	Steam tracing (3/8" tubing) (blanket included) ③
J	Steam jacket (1/2" NPT inlet/outlet) ③

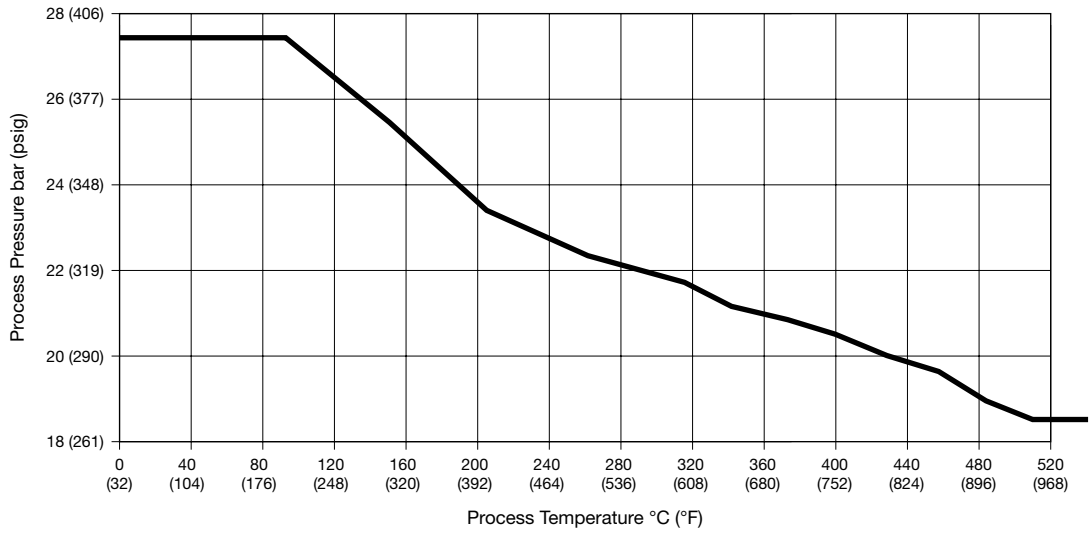
18 | MEASUREMENT TYPE & INDICATION STYLE

Total level		
1	Orange / black metal flags	
2	Yellow / black metal flags	
3	Red / white metal flags (standard)	
4	Red / silver metal flags	+371 °C (+700 °F) and above
A	Orange / black metal flags with yellow float diagnostics ①	
B	Yellow / black metal flags with orange float diagnostics ①	
C	Red / white metal flags with yellow float diagnostics ①	
D	Red / silver metal flags with black float diagnostics ①	+371 °C (+700 °F) and above
S	Fluorescent orange shuttle / follower ②	Maximum Temperature +120 °C (+249 °F)
Interface level ③		
5	Orange / black metal flags	
6	Yellow / black metal flags	
7	Red / white metal flags (standard)	
8	Red / silver metal flags	+371 °C (+700 °F) and above
F	Orange / black metal flags with yellow float diagnostics ①	
G	Yellow / black metal flags with orange float diagnostics ①	
H	Red / white metal flags with yellow float diagnostics ①	
J	Red / silver metal flags with black float diagnostics ①	+371 °C (+700 °F) and above
T	Fluorescent orange shuttle / follower ②	Maximum Temperature +120 °C (+249 °F)
N	No indicator (For external use of external Jupiter mount only)	

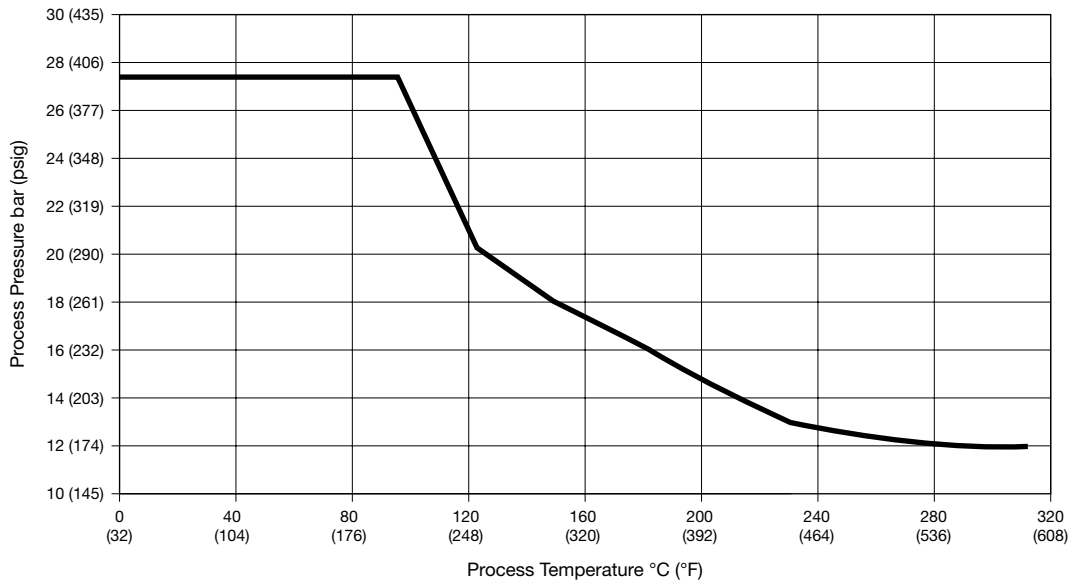
① Float diagnostics is a safety feature which indicates a contrasting color on the visual indicator when the float has fallen below the lowest measurable point on the scale. This can occur when the specific gravity of the liquid drastically decreases or the float collapses due to a pressure spike.

② Available only with stainless steel indicator, refer to digit 19.

FLOAT PRESSURE RATINGS

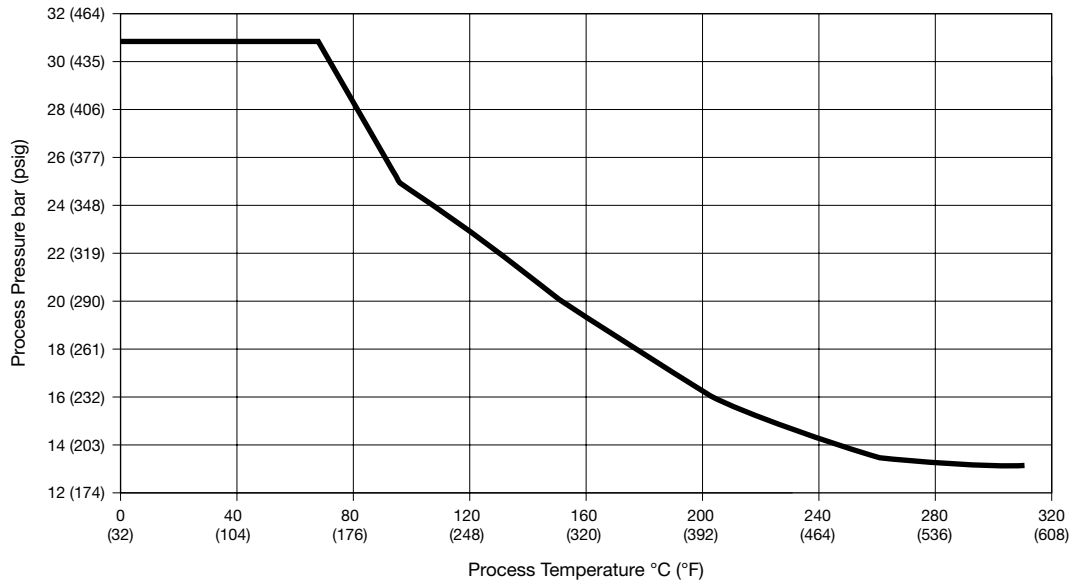


Float Type 4

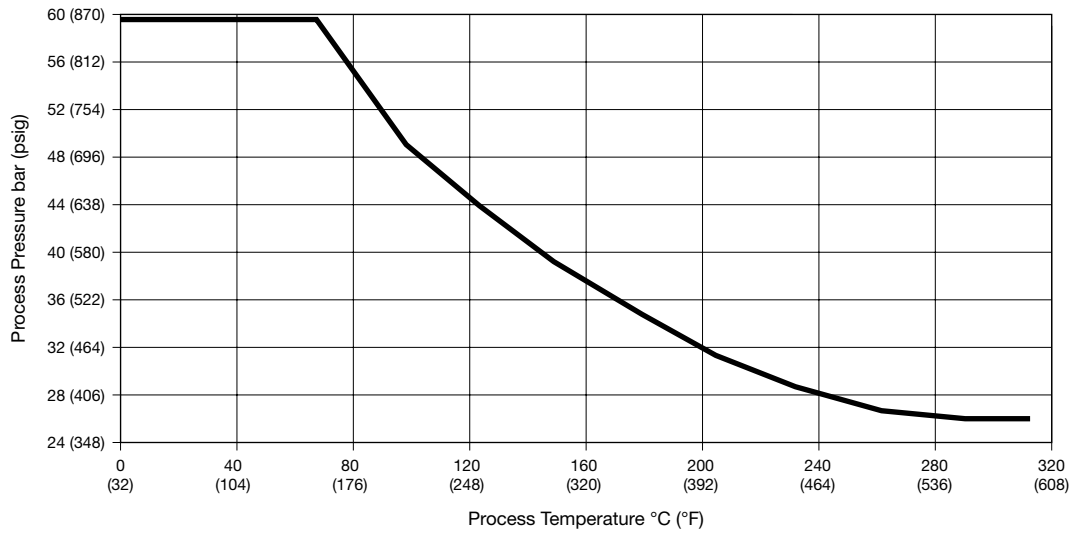


Float Type E

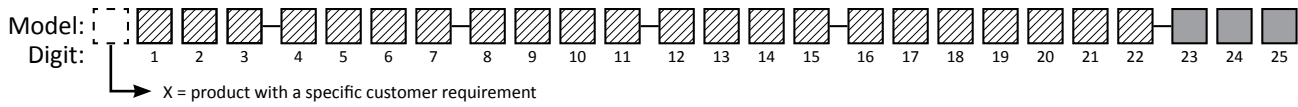
FLOAT PRESSURE RATINGS



Float Type G



Float Type K



23-25 | VISUAL INDICATION LENGTH

X X X	Specify in INCHES (maximum = 212) when model code 2 is E
	Specify in CENTIMETERS (maximum = 538) when model code 2 is M
	Example #1: Center-to-Center is 84 inches. Enter as 084. (model digit 2 must be "E")
	Example #2: Center-to-Center is 124 centimeters. Enter as 124. (model digit 2 must be "M")
	Example #3: Center-to-Center is 124.25 inches. Enter as 124 inches and X the model for 124.25 inches. Consult factory for assistance.
	Example #4: Center-to-Center is 724 millimeters. Enter as 072 centimeters and X the model for 724 millimeters. Consult factory for assistance.

OPTIONAL EXTERNAL MOUNT LEVEL TRANSMITTERS

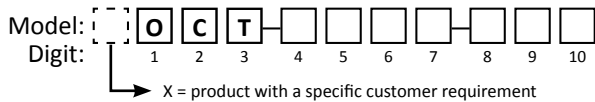
The Jupiter transmitter is a magnetostrictive level transmitter while the OCT transmitter is a reed chain level transmitter. Both types are mounted to the MLI via clamps.

Jupiter magnetostrictive transmitter Refer to bulletin ORI-150, external mount section.

OCT reed chain transmitter

The OCT analog transmitter mounts directly to the side of the MLI and provides a continuous 4–20 mA output signal proportional to the liquid level. Using simple and reliable reed switches surface mounted to a printed circuit board, the unit provides a resolution of ± 13 mm (0.50"). Activated by the magnetic field of the float, the transmitter is totally non-invasive.

SELECTION DATA



1-3 | BASIC MODEL NUMBER

OCT	Reed chain transmitter (FM/CSA explosion proof)
-----	---

4 | HOUSING / CABLE ENTRY

A	IP 66, cast aluminum, 1/2" NPT-F cable entry
S	IP 66, 316 stainless steel, 3/4" NPT-F cable entry

5 | MOUNTING POSITION

A	Top mount, right hand
B	Top mount, left hand
C	Bottom mount, right hand
D	Bottom mount, left hand

6 | CHAMBER MOUNTING CODE

No insulation present on MLI (MLI model code digit 17 = N)	
3	MLI model code digit 20 = A, B MLI model code digit 3 <> T
4	MLI model code digit 20 = E, F, G
MLI with high temperature insulation (MLI model code digit 17 = A, C, R, U)	
G	MLI model code digit 20 = A, B MLI model code digit 3 <> T
H	MLI model code digit 20 = E, F, G

7 | UNIT OF MEASUREMENT

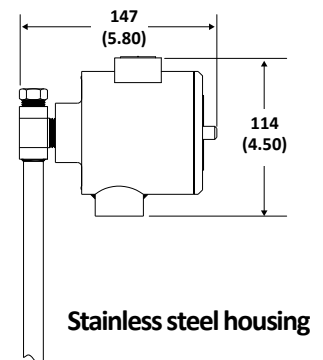
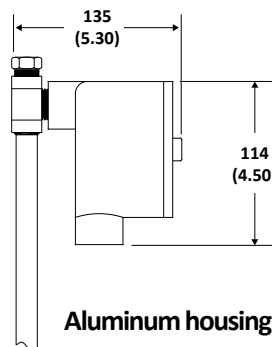
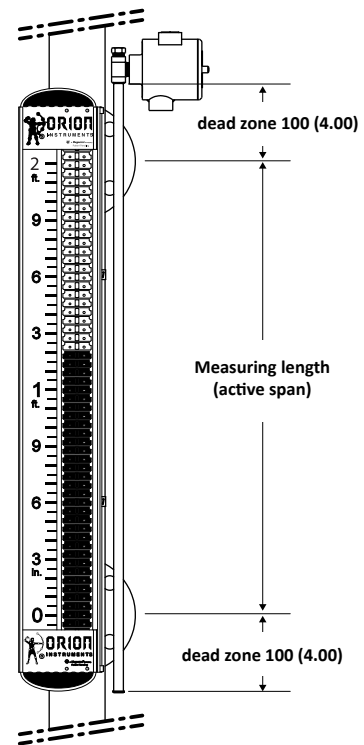
M	Metric (cm)
E	English (inches)

8-10 | MEASURING LENGTH

X X X	15 to 503 cm (6" to 198") (same as MLI center-to-center dimension)
	<i>example:</i> 6 (inches or cm) = 0 0 6

Match measuring length with visual indication length of MLI.
Sensor length = measuring length + 20 cm (8").

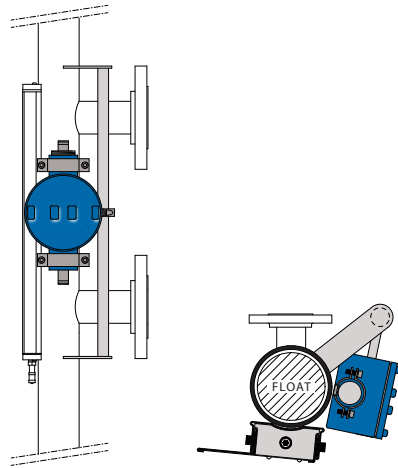
DIMENSIONS mm (inches)



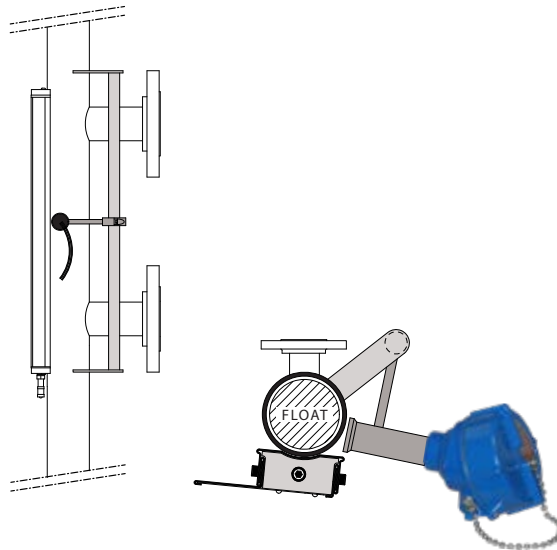
OPTIONAL POINT LEVEL SWITCHES

The OES level switch is a cam-operated microswitch while the ORS level switch is a hermetically sealed reed switch. Both types can be mounted to the MLI either via clamps or attached to a switch mount rod and are field adjustable. Simply loosen the mounting clamps and position at the desired location. Ensure that the switch always remains in close proximity to the internal float.

A switch mount rod is an available alternative method for mounting the switch to an MLI when chamber insulation blanket is present. The rod assembly, which is welded to the MLI chamber, allows the switch to slide along the full length. When the desired position is selected, simply tighten it in place.



OES switch attached to switch mount rod

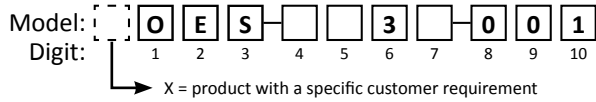


ORS switch attached to switch mount rod

OES bi-stable DPDT microswitch

The OES level switch is actuated by simple magnetic coupling. As the liquid level moves, the MLI float (with its internal magnets and flux rings) follows. When the float moves into the proximity of the microswitch, the switch magnet interacts with the float's magnetic field actuating the switch. The bi-stable design of the switch ensures that it will not reset until the float passes the switch in the opposite direction.

SELECTION DATA



1-3 | BASIC MODEL NUMBER

OES	DPDT microswitch
-----	------------------

4 | HOUSING / CABLE ENTRY

A	IP 65, cast aluminum, 3/4" NPT-F cable entry (2 entries - 1 plugged)
S	IP 65, 316 stainless steel, 3/4" NPT-F cable entry (2 entries - 1 plugged)

5 | APPROVAL

N	Weatherproof
1	FM/CSA explosion proof

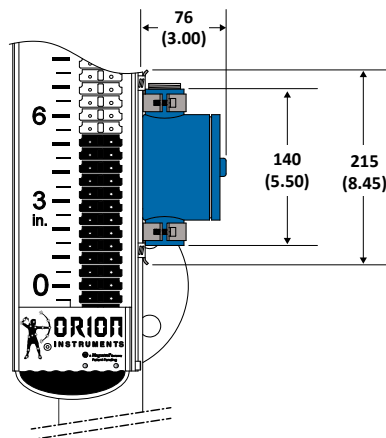
6 | CHAMBER MOUNTING CODE

N	No mounting clamps
3	MLI model code digit 20 = A, B
4	MLI model code digit 20 = E, F, G

7 | MOUNTING

C	Clamp mounted to chamber	$T \leq 121\text{ }^{\circ}\text{C}$ (250 °F)
P	Clamp mounted to chamber with insulation pad	$121\text{ }^{\circ}\text{C}$ (250 °F) < $T \leq 260\text{ }^{\circ}\text{C}$ (500 °F)
R	Attached to switch mount rod Digit 6 = N	$T \leq 260\text{ }^{\circ}\text{C}$ (500 °F)

DIMENSIONS mm (inches)



ORS hermetically sealed bi-stable SPDT reed switch

The ORS level switch is actuated by the magnetic field produced by the MLI float. As the liquid level moves, the MLI float (with its internal magnets and flux rings) follows. When the float moves into the proximity of the reed switch, the switch is actuated. The bi-stable design of the switch ensures that it will not reset until the float passes the switch in the opposite direction.

SELECTION DATA

Model:

O	R	S					0	0	1
---	---	---	--	--	--	--	---	---	---

 Digit:

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

 X = product with a specific customer requirement

1-3 | BASIC MODEL NUMBER

ORS	Hermetically sealed SPDT reed switch
-----	--------------------------------------

4 | HOUSING / CABLE ENTRY

1	Stainless body without junction box
A	Stainless body with cast aluminum junction box, IP 66, 3/4" NPT-F cable entry
S	Stainless body with stainless steel junction box, IP 66, 3/4" NPT-F cable entry

5 | APPROVAL

1	FM/CSA
2	FM/CSA: 24 volt maximum
A	ATEX
N	General Purpose

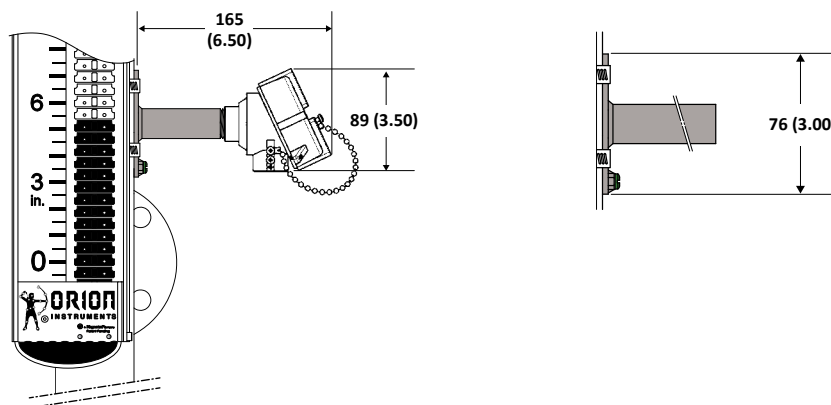
6 | CHAMBER MOUNTING CODE

3	MLI model code digit 20 is A, B
4	MLI model code digit 20 is E, F, G, H
N	No mounting clamps

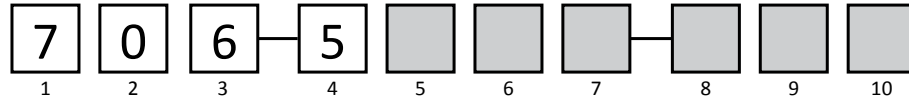
7 | MOUNTING

C	Clamp mounted on MLI (standard)	$T \leq 121\text{ }^{\circ}\text{C}$ (250 °F)
P	Clamp mounted on MLI with insulation pad	$121\text{ }^{\circ}\text{C}$ (250 °F) < $T \leq 260\text{ }^{\circ}\text{C}$ (500 °F)
R	Switch rod mount Digit 6 = N	$T \leq 260\text{ }^{\circ}\text{C}$ (500 °F)

DIMENSIONS mm (inches)



ECLIPSE® MODEL 706 GWR FOR AURORA® | TRANSMITTER MODEL NUMBER



1, 2, 3 | BASIC MODEL

706	Eclipse 4th Generation Guided Wave Radar (GWR) Level Transmitter
-----	--

4 | POWER

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

5 | SIGNAL OUTPUT & ELECTRONICS

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

6 | SAFETY OPTIONS

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

7 | ACCESSORIES / MOUNTING

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

8 | CLASSIFICATION

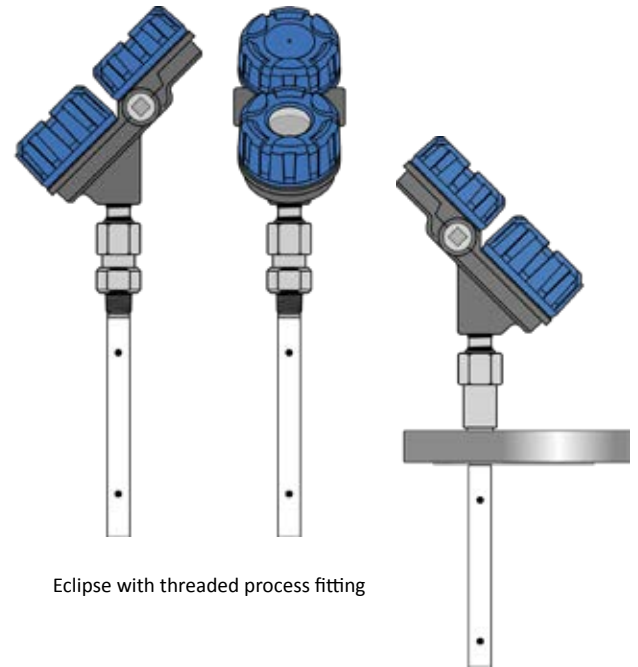
0	General Purpose, Weatherproof (IP 67)
1	Intrinsically Safe (FM & CSA CL 1 Div 1, Grps A, B, C, D) (5th digit = 1 or 2)
3	Explosion-proof (FM & CSA CL 1 Div 1, Grps B, C, D)
A	Intrinsically Safe (ATEX/IEC Ex ia IIC T4) (5th digit = 1 or 2)
B	Flame-proof (ATEX/IEC Ex d ia IIC T6) (5th digit = 1 or 2)
C	Non-sparking (ATEX Ex n IIC T6) / Non-incendive (FM & CSA, CL 1 Div 2) (5th digit = 1 or 2)
D	Dust Ex (ATEX II) (5th digit = 1 or 2)

9 | HOUSING

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

10 | CONDUIT CONNECTION

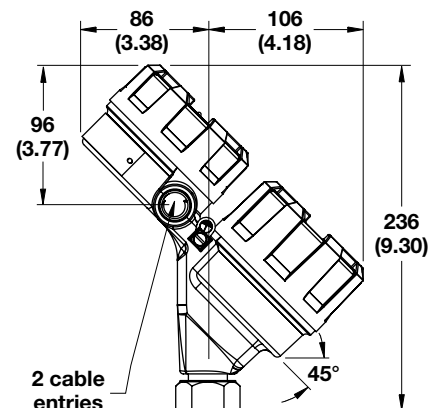
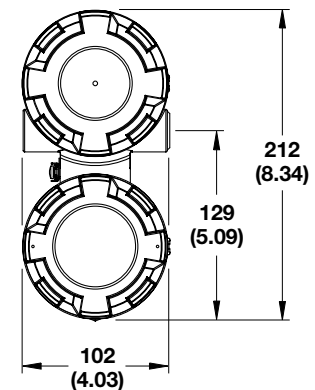
0	½" NPT
1	M20
2	½" NPT with sunshade
3	M20 with sunshade



Eclipse with threaded process fitting

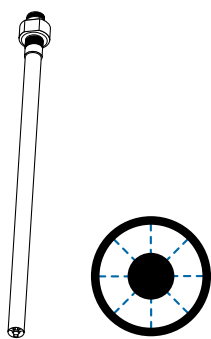
Eclipse transmitter with probe offset for Aurora MLI

DIMENSIONS mm (inches)

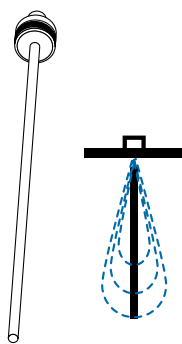


ECLIPSE PROBE SPECIFICATIONS									
GWR Probe ①	Description	Application	Dielectric Range ②③	Temperature Range ④	Maximum Pressure	Vacuum ⑤	Overfill Safe	Viscosity cP (mPa.s)	Length ⑥
7 y T	Standard Temperature Coaxial	Level/Interface	ϵ_r 1.4–100	-40 to +200 °C (-40 to +400 °F)	70 bar (1000 psi)	Yes	Yes	500	60 to 610 cm (24" to 240")
7 y P	High Pressure Coaxial	Level/Interface	ϵ_r 1.4–100	-196 to +200 °C (-320 to +400 °F)	431 bar (6250 psi)	Full	Yes	500	60 to 610 cm (24" to 240")
7 y D	High Temp. / High Pressure Coaxial	Level/Interface	ϵ_r 1.4–100	-196 to +450 °C (-320 to +850 °F)	431 bar (6250 psi)	Full	Yes	500	60 to 610 cm (24" to 240")
7 y S	Steam Coaxial	Saturated Steam	ϵ_r 10–100	-40 to +425 °C (-40 to +800 °F) ⑦	207 bar (3000 psi)	Full	No ⑦	500	60 to 455 cm (24" to 180")
7 y G	Standard Temperature Caged	Level/Interface	ϵ_r 1.4–100	-40 to +200 °C (-40 to +400 °F)	70 bar (1000 psi)	Yes	Yes	10000	60 to 610 cm (24" to 240")
7 y J	High Temp. / High Pressure Caged	Level/Interface	ϵ_r 1.4–100	-196 to +450 °C (-320 to +850 °F)	431 bar (6250 psi)	Full	Yes	10000	60 to 610 cm (24" to 240")
7 y 6	High Temp. / High Pressure Flexible	Level/Interface	ϵ_r 1.4–100	-196 to +450 °C (-320 to +850 °F)	431 bar (6250 psi)	Full	Yes ⑧	10000	91 cm to 30 m (3' to 100')

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



Coaxial Probe

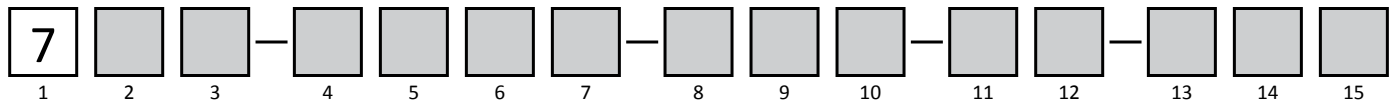


Single Rod Probe



See Magnetrol bulletin 57-106 for additional information regarding Eclipse guided wave radar specifications.

ECLIPSE® MODEL 706 GWR FOR AURORA® | PROBE MODEL NUMBER



1, 2 | BASIC MODEL

7A	Eclipse GWR probe, English unit of measure
7C	Eclipse GWR probe, Metric unit of measure

The Aurora® MLI utilizes the Magnetrol® Eclipse® GWR level transmitter. All probes specified for an Aurora® should be selected from this model number. Consult factory for special requests.

3 | PROBE TYPE

D	Coaxial	High-Temp/Hi-Pressure – Available only with 10th digit N or D	Media dielectric range ≥ 1.4 (2.0 with ceramic spacers)
P	Coaxial	High Pressure – Available only with 10th digit N or D	
S	Coaxial	Saturated steam service – Available only with 10th digit N	
T	Coaxial	Overfill/Interface – Not available with 10th digit N or D	
G	Single Rod	Caged Probe	
J	Single Rod	High-Temp/High-Pressure Caged Probe	
6	Single Rod	High-Temp/High Pressure Flexible probe	

4, 5 | CHAMBER CONNECTION - SIZE / TYPE

Threaded	
11	¾" NPT threaded connection

4" ANSI Flanges	
53	3" 150# RF Flange
54	3" 300# RF Flange
63	4" 150# RF ANSI Flange
64	4" 300# RF ANSI Flange
65	4" 600# RF ANSI Flange
66	4" 900# RF ANSI Flange
67	4" 1500# RF ANSI Flange
68	4" 2500# RF ANSI Flange

6 | CONSTRUCTION CODES

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

7 | FLANGE OPTIONS

1	Offset
2	Offset with ½" NPT Vent
3	Offset with ¾" NPT Vent

8 | MATERIAL OF CONSTRUCTION

Seal Welded Probe & Flange Material	
A	316 SS/316L SS
B	Hastelloy C
C	Monel
R	316 SS/316L SS with Carbon Steel Flange
S	Hastelloy C with Carbon Steel Flange
T	Monel with Carbon Steel Flange

9 | SPACER/WEIGHT MATERIAL

0	None
1	PTFE Spacer
2	PEEK HT
3	Ceramic – Available only with 3rd digit J
5	Metal Short Circuit – Available only with 11th digit = A

10 | PROCESS SEAL - O-RING MATERIAL

0	Viton® GFLT – Available only with 3rd digit G, T or 1
2	Kalrez® 4079 – Available only with 3rd digit G, T or 1
8	Aegis PF128 (NACE) – Available only with 3rd digit G, T or 1
A	Kalrez 6375 – Available only with 3rd digit G, T or 1
B	HF Acid Probe – Available only with 3rd digit G or T and 8th digit C
D	None/Glass Ceramic Alloy (Dual Seal Design with annunciator fitting) – Available only with 3rd digit D, P or S
N	None/Glass Ceramic Alloy – Available only with 3rd digit D, P or S

11 | PROBE SIZE

0	Caged Probe
2	Small Coaxial
3	Flexible Cable Probe
A	Medium Coaxial – Available only with 3rd digit = S

12 | SPECIAL OPTIONS

0	Single Length Probe
1	Removable Single Length Cable Probe

13, 14, 15 | INSERTION LENGTH

XXX	60 to 610 cm (24 to 240 inches) ①
	Example: 160 centimeters = 160; 24 inches = 024

① Consult factory for insertion lengths less than 60 cm (24") or greater than 610 cm (240").



Orion Instruments is dedicated to reducing product lead times through ongoing efficiency initiatives and strategic inventory management. *OrionXpress* is available for select product configurations and will allow your product to ship within 5 weeks of placing the order.

See bulletin ORI-402 for models qualifying for OrionXpress delivery.

some restrictions apply



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AMETEK[®]
SENSORS, TEST & CALIBRATION

Orion Instruments Manufacturing Facility

2105 Oak Villa Boulevard • Baton Rouge, Louisiana 70815 USA
225-906-2343 • Toll Free 866-55-ORION (866-556-7466)
orioninstruments.com

Magnetrol Aurora, IL USA Manufacturing Facility

705 Enterprise Street • Aurora, Illinois 60504 USA
630-969-4000 • e-mail: info.magnetrol@ametek.com
magnetrol.com

Magnetrol European Manufacturing Facility

Heikensstraat 6 • 9240 Zele, Belgium
+32-(0)52-45.11.11 • e-mail: info.magnetrolbe@ametek.com

Magnetrol Shanghai Manufacturing Facility

Plant 6, No. 191, Huajin Road Minhang District, Shanghai, China
+86-21-6249-1350 • e-mail: il-aur-rfqchina@ametek.com

Magnetrol Dubai, UAE Manufacturing Facility

P.O. Box 261454 – LIU FZS1-BA03, Jebel Ali Free Zone (JAFZA)
Dubai, United Arab Emirates
+971 4 8806345 • e-mail: MUAInfo@ametek.com