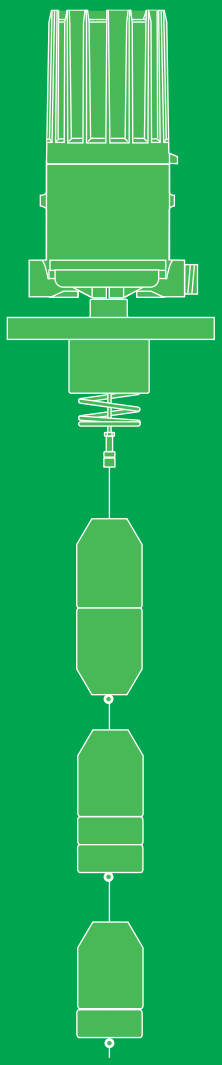
BUOYANCY PRODUCTS

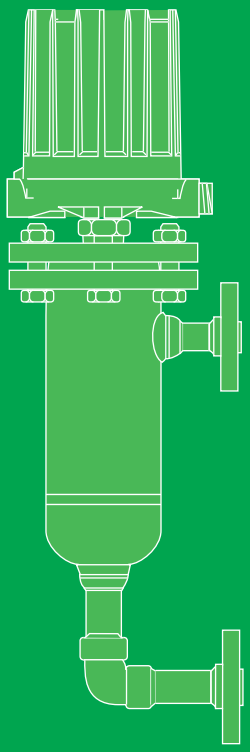
MAGNETROL® / AMETEK®
LEVEL MEASUREMENT SOLUTIONS

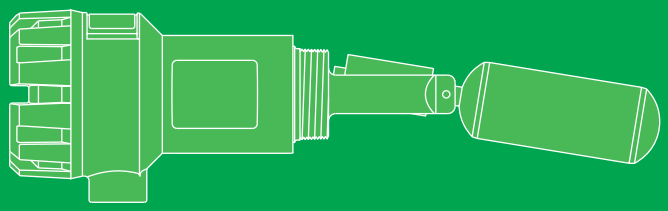
The Total Spectrum of Solutions ▶

Magnetrol® products employ many technologies for the measurement and control of level and flow. Buoyancy technology, with its utilization of float and displacer sensing elements, represents our most time-tested product group.

To this day, buoyancy technology provides optimum solutions for many of today's level control challenges.







BUOYANCY PRODUCTS

Magnetrol® —a world leader in level and flow control technology—designs, manufactures, markets and services level and flow instrumentation worldwide.

Magnetrol® product groups are based upon these technologies:

- Air Sonar
- Buoyancy
- Contact Ultrasound
- Guided Wave Radar
- Pulse Burst Radar
- RF Capacitance
- Thermal Dispersion
- Vibration
- Visual Indicators

The industries we serve include:

- Petroleum Production
- Petroleum Refining
- Power Generation
- Petrochemical
- Chemical
- Water & Wastewater
- Pulp & Paper
- Food & Beverage
- Pharmaceutical

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Buoyancy Level Controls

A Time-Tested Solution

The application of buoyancy principles to the challenges of liquid level measurement and control is one of the oldest and most reliable solutions available in the process control industry. The key to the success of buoyancy instruments is the means by which the motion of the liquid and, therefore, the float or displacer is converted into the desired level control action. Magnetrol® incorporates the optimal features into its level switches while providing repeatable, dependable performance. The result of completely isolating the process environment from the switching mechanism and keeping all magnetic components out of the process environment, is a robust, versatile instrument suitable for a wide variety of control applications.

Buoyancy Technology's Advantages:

+ Service pressures up to 5000 psig (345 bar)
+ Service temperatures to +1200° F (+649° C)
+ No calibration of switches
+ Setup of displacer switches without level change
+ Highly reliable and familiar technology
+ Multiple-stage control available
+ Narrow and/or wide differential displacer switches
+ Transmitters available for continuous output
+ Switches do not require power

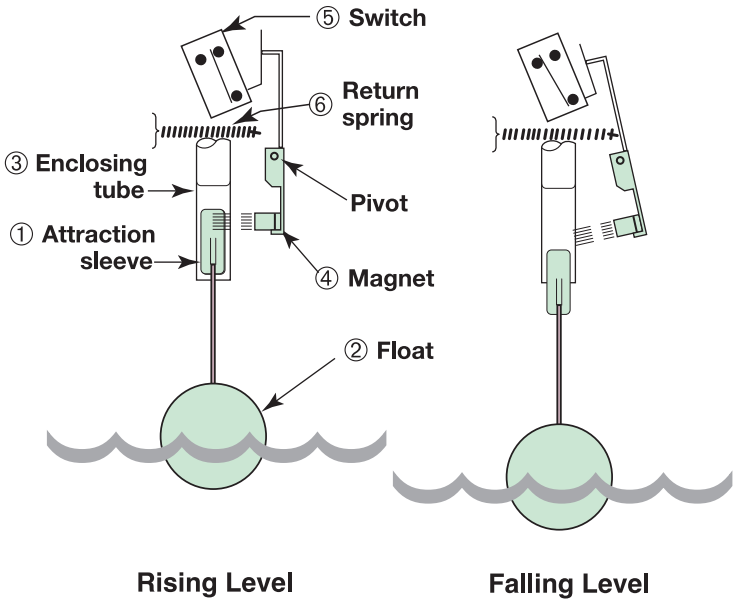
Buoyancy Technology's Limitations:

- Buildup or dirty process may impede performance.
- Switch accuracy limited to ±0.25 inches (6 mm).
- Not suitable for solids
- Moving parts in process

Vertical Float

The float orientation utilized for top mounted switches and as the primary sensing method for external cage switches is the vertical float. The principle of operation is simple and provides a practical solution to narrow level differential requirements.

A rigid stem and attraction sleeve① assembly is affixed to the top of a spherical or oblong float.② The size of the float determines the buoyancy force of the process liquid against the float, stem and sleeve assembly. This buoyancy force must be greater than the weight of the assembly and is increased by enlarging the float. Because the buoyancy force is greater, the float assembly rises directly with the liquid level. As it does so, the attraction sleeve moves within a static pressure boundary, the enclosing tube.③ A permanent magnet④ is attached to the switch assembly⑤ outside of the enclosing tube. When the attraction sleeve enters the field of the switch magnet, the magnet is pulled toward the sleeve, snapping against the enclosing tube and causing the switch to change state. As the liquid level falls, the float/stem/sleeve assembly follows it. When the attraction sleeve moves out of the field of the switch magnet, a return spring⑥ on the switch mechanism pulls the magnet away from the enclosing tube, returning the switch to its original state.

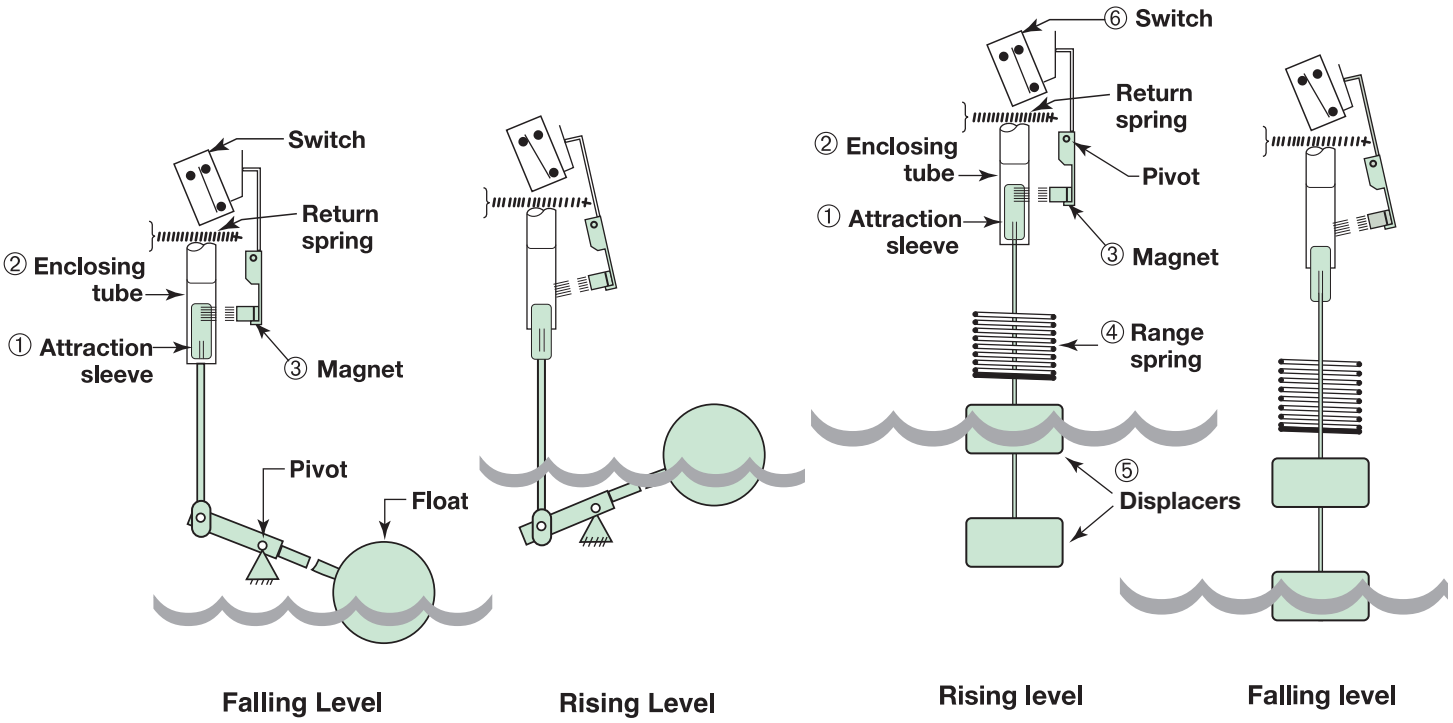


Horizontal Float

A horizontal float switch, often called a side mounted unit, operates much like a vertical float. It utilizes the same components, float, stem, sleeve,① enclosing tube,② switch magnet③ and mechanism, but functions in a slightly different manner. The lower float stem pivots on a fulcrum. This means that as the float rises, the attraction sleeve is pulled down out of the field of the switch magnet causing the magnet to be pulled away from the enclosing tube. Conversely, as the float falls, the sleeve moves upward causing the switch magnet to pull in. Side mounted controls may be used for wide level differential. By lengthening the float stem, the liquid level and float must move through a greater distance in order to change the state of the switch. Side mounted units offer the option of mounting toward the bottom of a vessel for use in low level service, something that may not be done with a top mounted vertical float.

Displacer Switches

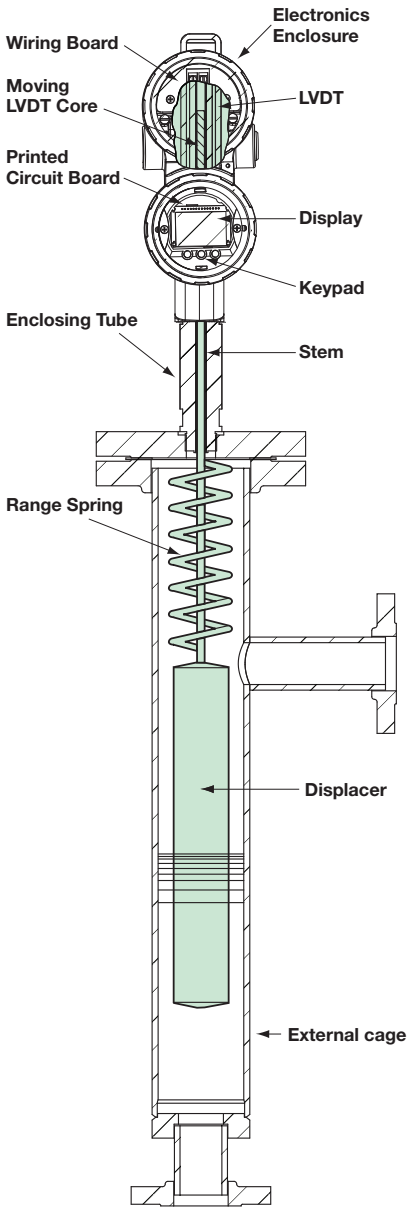
While taking advantage of the same buoyancy and magnetic coupling principles as float switches, displacer level switches utilize a precision range spring④ to convert the change in buoyancy force to movement of an attraction sleeve.① Because the displacer⑤ is weighted, it hangs into the liquid rather than floating on top. As the liquid level moves changing the volume of liquid displaced by the displacers, the buoyancy force on the displacers changes. This causes elongation or compression of the range spring which, in turn, moves the attraction sleeve into or out of the field of the switch magnet, changing the state of the switch.⑥



Buoyancy Level Controls (continued)

Displacer Transmitters

As with displacer switches, the change in buoyancy force on a range spring is converted to motion in a displacer transmitter. This motion is used to produce an output proportional to the change in liquid level. The pneumatic Modulevel® has a sleeve that attracts a follower magnet, changing the position of a nozzle lever and the output from the controller head. The E3 MODULEVEL employs a linear variable differential transformer (LVDT) to produce the proportional output. The core of the LVDT is fixed to the top of the displacer stem. As the spring compresses or elongates, the core moves within the LVDT windings, inducing currents in the secondary windings. This information is processed and output as a 4–20 mA proportional signal. In addition, the E3 superimposes a HART® compatible signal on the 4–20 mA allowing communications via the HART protocol or is available with FOUNDATION fieldbus™ protocol.



Advantages (+) and Limitations (-)

Vertical Float :

+ Highly reliable and repeatable
+ Broad product offering
+ High temperature capability
+ Many modifications and options available
- Low S.G. means a low pressure rating
- Only narrow differential standard
- External cage units are expensive when large floats (and therefore cages) are required

Horizontal Float:

+ Highly reliable and repeatable
+ Wide or narrow differentials
+ Low S.G. rating on counterweighted units
- Invasive mounting; can't be isolated without additional chamber
- Use only on very clean liquids due to pivots in the process

Displacer Switches:

+ Highly reliable and repeatable
+ Wide and narrow differentials or combinations
+ High pressure capability with low S.G.
+ Not affected by turbulence
- Temperature limited by range spring

Displacer Transmitters:

+ High pressure/temperature capabilities
+ Stable signal in turbulent applications
+ No flexure of pressure boundary parts
+ HART or FOUNDATION fieldbus compatible
- Affected by shifting S.G.

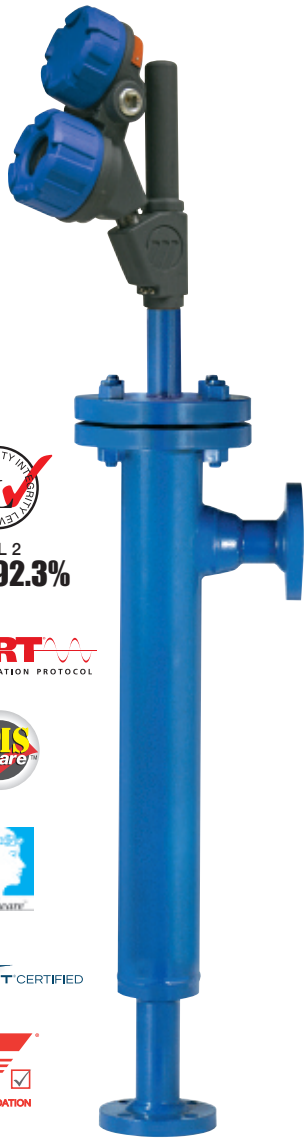
At-A-Glance: **Magnetrol® Buoyancy Products**

The chart below summarizes the principle features of the leading MAGNETROL buoyancy products. A green dot (●) indicates a standard feature; a red triangle (▲) indicates an optional feature.

		Modulevel® Digital E3	Modulevel® Pneumatic	Series 3 Switches	External Cage Float Switches	External Cage Displacer Switches	Top Mount Displacer Switches	Top Mount Float Switches	Side Mount Float Switches	Tuffy® II Switches	TK1 Switches	Flow Switches	Boiler Switches	Aurora® Level Gauge
	Page Number	**8**	**9**	**10**	**11**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Sensor Type ▶	Float			●	●			●	●	●	●		●	●
	Displacer	●	●	●		●	●							
Control Action/Output ▶	Single Switch			●	●	●	●	●	●	●	●	●	●	▲
	Multiple Switch		▲	●	●		●	●	●				●	▲
	Controller		●											
	Transmitter	●	●											▲
	Narrow Switch Differential		▲	●	●	●	●	●	●	●	●	●	●	▲
	Wide Switch Differential						●		●	●				
	Indicator	●	●											●
	HART	●												●
	FOUNDATION fieldbus	▲												▲
Configurations ▶	External Cage	●	●	●	●	●	▲				▲		●	●
	Top Mount	●	●				●	●				●		▲
	Side Mount		▲						●	●	●	●		
	Integral Mount	●	●	●	●	●	●	●	●	●	●	●	●	●
	Remote Mount	▲	▲											▲
Construction to Code ▶	NACE Construction	▲	▲	●			▲	▲	▲	▲		▲		▲
	ASME B31.1	▲	▲	●	▲									▲
	ASME B31.3	▲	▲	●	▲		▲	▲	▲	▲				▲

E3 MODULEVEL® Electronic Transmitter

Advanced Level Control



Description:

The E3 MODULEVEL level transmitter is an advanced, intrinsically-safe, two-wire instrument that converts liquid level changes into a stable output signal. It has microprocessor-based electronics with HART compatible output or FOUNDATION fieldbus™ with a PID block. E3 supports the FDT/DTM standard and PACT*ware*™ PC software package.

Features:

- Two-wire, loop-powered, transmitter for level, interface or density measurement
- No level change needed for configuration; no field calibration necessary.
- Suitable for use in Safety Integrity Level (SIL) 2 environments with an SFF of 92.3%
- 4–20 mA output signal
- Two-line, 8-character LCD and 3-button keypad
- Continuous self-test, 3.6 mA, 22 mA or HOLD fault indication and fully NAMUR NE 43 compliant
- Comprehensive diagnostics with faults, warnings & status history
- HART or FOUNDATION fieldbus digital communications
- PACTware PC program using HART communication for advanced configuration and troubleshooting (see bulletin 59-101)
- IS, XP and Non-incendive approvals from FM, CSA, ATEX, IEC
- Standard output range from 3.8 to 20.5 mA
- 11 VDC turn on voltage
- Maximum loop resistance of 620 ohms at 24 VDC

Model Selection:

- Refer to MAGNETROL Bulletin 48-135 for model numbers, options and complete specification information.

SIL 2
SFF 92.3%

HART COMMUNICATION PROTOCOL

FDT CERTIFIED

FOUNDATION

SPECIFICATIONS

FM APPROVED

Supply Voltage: 11 to 36 VDC

Ambient Temp Range: –40° to +176° F (–40° to +80° C)

Process Temp Range: Steam Applications: –20° to +500° F (–29° to +260° C)
Non-Steam Applications: –20° to +600° F (–29° to +315° C) with carbon steel chambers; stainless steel chambers available for lower process temperatures

Process Pressure: Up to 5100 psig @ +100° F (352 bar @ +38° C)

Accuracy: ±0.75 % of full span

Repeatability: ±0.20 % of full span

Linearity: ±0.50 % of full span

Temperature Effect: Max 0.017 %/° F (0.031 %/° C) from -40° F to +176° F (-40° C to +80° C)

Operator Interface: HART Handheld Communicator, PACT*ware* PC software and Field Device Tool, or 3-button menu-driven data entry and system security with 2-line × 8-character LCD display

Output: 4–20 mA (reversible) with HART; max loop resistance 620 Ω @ 24 VDC;
3.8 to 20.5 mA usable (meets NAMUR NE43) or FOUNDATION fieldbus

Specific Gravity: 0.23 to 2.20 SG

Materials of Construction: Chambers: carbon steel or 316/316L stainless steel
Wetted Components: 316/316L and Inconel® (spring)

MODULEVEL® Pneumatic Controller

High Reliability in Temperature and Pressure Extremes

Description:

The pneumatic MODULEVEL is a highly reliable liquid level controller using continuous displacement technology. The output signals are in direct proportion to changes in liquid level. The pneumatic MODULEVEL uses the MAGNETROL proven magnetic coupling design for optimum performance at extreme temperature and pressure.

Features:

- Range spring design provides stable output signal even on turbulent level, reducing valve wear.
- Head rotates 360° for ease of installation and positioning.
- NEMA 3R controller head is removable without depressurizing the process, reducing downtime and maintenance costs.
- Instrument shop calibration allows quick start-up or maintenance.
- Visual indicator is actuated by magnetic coupling which allows visual level indication even upon loss of air supply.
- Turndown, midpoint change, and specific gravity correction are all adjusted by dedicated calibrators making start-up quick and easy.
- Suitable for interface level or density measurement with modified displacer.
- Dual head, receiver/controllers are standard selection.

Model Selection:

Refer to MAGNETROL Bulletin 48-110 for model numbers, options and complete specification information.

SPECIFICATIONS

Supply Pressure: Regulated instrument quality air (clean & dry)

Air Consumption: 3 SCFH @ 9 psig output
6 SCFH @ 15 psig output

Process Temp Range: -20° to +700° F (-29° to +371° C) with carbon steel chambers
(stainless steel chambers are available for lower process temperatures)

Process Pressure: Up to 4265 psig @ +100° F (294 bar @ +38° C)

Accuracy: <±2 %

Repeatability: ±0.5 %

Linearity: ±1.0 %

Output: Proportional, proportional plus reset, and transmitter: 3–15 psig or 6–30 psig (direct or reverse acting)
Differential Gap: 0–20 psig or 0–35 psig (direct or reverse acting)

Specific Gravity: 0.23 to 2.20 SG

Materials of Construction: Chambers: carbon steel or 316/316L stainless steel
Wetted Components: 304/304L or 316/316L and Inconel® (spring)

SERIES 3 Liquid Level Switches

ASME B31.1 and B31.3 Conformance-Certified Switches

Series 3 Flanged Cage Design

Description: MAGNETROL Series 3 float- displacer-actuated external cage level switches are designed, constructed, tested and certified to ASME B31.1, Power Piping Code or ASME B31.3, Process Piping Code.

Measurement Principle: Vertical float- or displacer-actuated level switch.

Features:

- Construction to NACE MR0175 and MR0103 optional
- Sealed and flanged top external chambers
- Broad selection of switch types
- Single or multiple switch points
- Exotic materials of construction available
- Can be modified for interface service
- Available with many sizes, types and configurations of process connections, including optional weld neck, RTJ or DIN flanges.
- All switch enclosures rotate through 360° for ease of conduit entry positioning

Model Selection: For model numbers, options and specification information on Series 3 refer to MAGNETROL Bulletin 46-127.

SPECIFICATIONS

Process Temp Range: –20° to +1000° F (–29° to +538° C) with carbon steel chamber
Lower temperatures possible with stainless steel chambers

Process Pressure: Up to 1680 psig (116 bar) for ASME B31.1
Up to 2240 psig (154 bar) for ASME B31.3

Specific Gravity: Down to 0.41 for ASME B31.1
Down to 0.33 for ASME B31.3

Chamber Material: Standard is carbon steel
Options include 304/304L SS, 316/316L SS, Monel, Hastelloy C, duplex SS, etc.

Trim Parts: 300 and 400 series stainless steels

Quality Assurance: Full penetration welds done by qualified welders per ASME Section IX procedures. Certificate of Conformance on all pressure boundary materials, certified ten minute hydrostatic test, post-weld heat treatment (NACE units only) and 5% radiographic examination (ASME B31.3 only).

Switch Enclosures: NEMA 4X/7/9 aluminum for Class I, Div. 1, Groups B, C & D areas and IEC Ex Ex d IIC T6, IP66 areas. Aluminum ATEX enclosures for Ex II 2 G EEx d IIC T6.

Switch Mechanisms: Dry contact, hermetically sealed, and pneumatic.

Series 3 Sealed Cage Design

EXTERNAL CAGE Liquid Level Switches

Reliability in Sealed or Flanged Top External Chambers

Description:

The MAGNETROL external cage float- and displacer-actuated level switches have been industry standards for decades. With 28 basic models from which to choose, these self-contained instruments provide time-proven solutions to a wide range of level control applications.

Measurement Principle:

Vertical float- or displacer-actuated level switch.

Features:

- Sealed and flanged top external chambers
- Broad selection of switch types
- Single or multiple switch points
- Exotic materials of construction available
- Can be engineered for interface service
- Available with many sizes, types and configurations of process connections, including optional weld neck, RTJ or DIN flanges.
- All switch enclosures rotate through 360° for ease of conduit entry positioning.

Model Selection:

Refer to MAGNETROL bulletins 46-115, 46-116 and 46-121 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range:

–50° to +1000° F (–29° to +538° C)

Process Pressure:

Float controls up to 2240 psig (154 bar)
Displacer controls up to 5000 psig (345 bar)

Specific Gravity:

Down to 0.32

Chamber Material:

Standard is carbon steel. Sealed cage models available in stainless steel. Options include 304/304L SS, 316/316L SS, Monel, Hastelloy C, duplex SS, etc.

Float and Trim Parts:

300 and 400 series SS or all 316/316L SS

Switch Enclosures:

Polymer power coat finished aluminum NEMA 4X/7/9 for Class I, Div. 1, Group B or Groups C & D areas, IEC Ex Ex d IIC T6, IP66 areas and ATEX Ex II 2 G EEx d IIC T6.

Switch Mechanisms:

Dry contact, hermetically sealed, and pneumatic

Options:

Interface service, high and low temperature modifications, customized installation dimensions, vents and drains, customized actuation levels, special finishes, etc.

TOP MOUNT DISPLACER TYPE Level Switches

Narrow or Wide Range; for Simple or Complex Applications

Description:

The MAGNETROL displacement type level switches offer the user a wide selection of alarm and control configurations. These switches are well suited for simple or complex applications from single alarms points to overlapping three stage pump control.

Measurement Principle:

Vertical displacer-actuated level switch.

Features:

- Reliable, maintenance-free operation
- Single-, dual- or triple-stage models
- 16 standard displacer arrangements plus specials
- Field-adjustable set points and deadband
- Optional Proof-er ground checker provides means to check control function of overfill protection without climbing tank
- Optional dual detection of floating roof and liquid per requirements of API 2350, 2011 revision.
- Range spring design allows for reliable performance even in turbulent or surging applications.
- Models built to NACE MR0175 and MR0103 available
- Available with a variety of electric and pneumatic switch mechanisms

Model Selection:

Refer to MAGNETROL Bulletin 45-115 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range:

–50° to +500° F (–46° to +260° C)

Process Pressure:

Up to 800 psig (55 bar)

Specific Gravity Range:

0.40 to 2.40

Wetted Parts:

Mounting connection in carbon steel, cast iron or 316/316L SS
Displacers in 316/316L SS, porcelain, Karbate or brass
Trim in 300 and 400 series SS or, all 316/316L SS
Displacer cable and clamps in 316/316L SS, Monel or Hastelloy C

Actuation Levels:

One to three narrow and wide differential set points, field-adjustable

Switch Enclosures:

Polymer power coat finished aluminum NEMA 4X/7/9 for Class I, Div. Group B or Groups C & D areas, IEC Ex Ex d IIC T6, IP66 areas and ATEX Ex II 2 G EEx d IIC T6.

Switch Mechanisms:

Dry contact, hermetically sealed, and pneumatic

Options:

Modification per customer requirements include extended displacer interface service, low specific gravity displacers, customized displacer arrangements, etc.

TOP MOUNT Liquid Level Switches

Simple and Reliable Float-Actuated Switches for Top-Mount Installations

Description:
Top-mounted, float-actuated models T20 and T21 provide time-tested reliability in a single- or dual-stage liquid level switch. These simple vertical float switches are easy to install and require virtually no maintenance making them cost-effective process control instruments.

Measurement Principle:
Vertical float actuated level switch.

Features:

- Reliable, maintenance-free operation
- Single- or dual-stage models
- Actuating levels as low as 48" (1.2 m) below mounting connection
- Choice of floats allows application flexibility
- Threaded or flanged process connections available
- Available with a variety of electric and pneumatic switch mechanisms

Model Selection:
Refer to MAGNETROL Bulletin 44-117 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range:
–50° to +1000° F (–46° +538° C)

Process Pressure:
Up to 600 psig (41 bar)

Specific Gravity:
Down to 0.56

Wetted Parts:
Mounting connection in carbon steel, cast iron or 316/316L SS
Float and trim in 300 and 400 series SS or all 316/316L SS

Actuation Levels:
Each unit built and calibrated for customer specified actuation level(s) from 4 to 48 inches (101 mm to 1.2 m) from mounting connection. Minimum distance between trip points on dual-stage units is 8" (203 mm).

Switch Enclosures:
Polymer power coat finished aluminum NEMA 4X/7/9 for Class I, Div. 1, Group B or Groups C & D areas, IEC Ex Ex d IIC T6, IP66 areas and ATEX Ex II 2 G EEx d IIC T6.

Switch Mechanisms:
Dry contact, hermetically sealed, and pneumatic

Guide Cage:
Optional guide cage prevents damage to float or stem in turbulent installations or on long insertion length models.

Options:
Modification per customer requirements include interface service, low specific gravity floats, other process connections, etc.

SIDE MOUNT Liquid Level Switches

Reliable Float-Actuated Switches for Side-Mount Installations

Description: Single- and dual-stage side mounted float level switches are available with a wide choice of mounting connections, stem lengths, floats and switch options to provide reliable solutions to a broad range of level control applications.

Measurement Principle: Horizontal float-actuated level switch.

Features:

- Single- or dual-stage models
- Narrow to wide differential for a variety of control needs
- Choice of six float sizes and four stem lengths allows application flexibility
- Threaded or flanged process connections available
- Available with a variety of electric and pneumatic switch mechanisms.

Model Selection: Refer to MAGNETROL Bulletin 44-116 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range: –50° to +1000° F (–46° to +538° C)

Process Pressure: Up to 1200 psig (83 bar)

Specific Gravity: Down to 0.40

Wetted Parts: Body in carbon steel, 304 SS or 316 SS.
Float and trim in 300 and 400 series SS or all 316/316L SS.

Actuation Levels: Level differential from as narrow as 1.00" to as wide as 16.12" is available on single stage models.

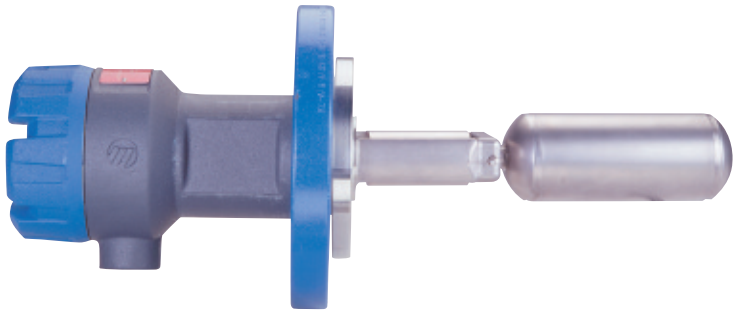
Switch Enclosures: Polymer power coat finished aluminum NEMA 4X/7/9 for Class I, Div. 1, Group B or Groups C & D areas, IEC Ex Ex d IIC T6, IP66 areas and ATEX Ex II 2 G EEx d IIC T6.

Switch Mechanisms: Dry contact, hermetically sealed, and pneumatic

Options: Modification per customer requirements include interface service, exotic materials of construction, etc.

TUFFY® II Liquid Level Switches

A Compact Horizontal Mount Float Switch



Description: A single-stage, compact float level switch for horizontal mounting into a tank or vessel through threaded or flanged pipe connections.

Measurement Principle: Horizontal float-actuated level switch.

Features:

- Enlarged switch housing for ease of wiring
- Narrow and adjustable differential models to suit any application
- Unique model for interface
- Available built to ASME B31.3, NACE or both
- Choice of cast iron or aluminum switch enclosure materials
- Selection of switch types, both gold and silver contacts
- Model available with all Hastelloy C wetted components
- Clad flange design includes 3" to 6" sizes up to 1500# ANSI

Model Selection: Refer to MAGNETROL Bulletin 44-106 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range: –65° to +750° F (–54° to +399° C)

Process Pressure: Up to 2625 psig (181 bar)

Specific Gravity: Down to 0.40

Wetted Parts: Models available with 316/316L SS or Hastelloy C wetted parts

Level Differential: Models available with narrow (0.5") to wide differential (up to 18.26")

Switch Enclosures: Polymer powder coat finished cast iron or aluminum NEMA 4X/7/9 for Class I Div. 1 Group B, C & D, and ATEX Ex II 1/2 G EEx d IIC T6 and Ex II 1G EEx ia IIC T6, IP66

Switch Mechanisms: SPDT and DPDT dry contact gold or silver, or SPDT hermetically sealed gold or silver

Interface Level: Minimum specific gravity difference of 0.10 and minimum lower liquid specific gravity of 0.81

External Cage: Optional cage in carbon steel or 316 SS for use when unit cannot be mounted directly into tank or vessel

Pneumatic Tuffy®: See MAGNETROL Bulletin 44-109 for models and specifications

MODEL TK1 Liquid Level Switches

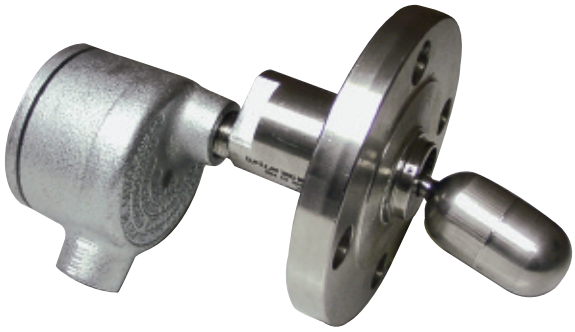
A Compact Horizontal Mount Float Switch

Description: A single-stage, compact float level switch for horizontal mounting into a tank or vessel through threaded or flanged pipe connections.

Measurement Principle: Horizontal float-actuated level switch.

Features:

- Sealed reed switches or DPDT relays available
- Choice of flying leads or junction box
- All 316 SS wetted parts
- Explosion proof with or without a junction box
- Extended stem model for deep mountings
- A selection of threaded and flanged process connections available



Model Selection: Refer to MAGNETROL Bulletin 44-108 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range: –40° to +300° F (–40° to +149° C)

Process Pressure: Up to 1500 psig (103 bar)

Specific Gravity: Down to 0.40

Wetted Parts: 316/316L SS

Switch Enclosures: 316/316L SS body and cast aluminum/iron junction box

Switch Mechanisms: SPST or SPDT reed switches and 24 VDC or 120 VAC DPDT powered relays

SPECIAL PURPOSE Liquid Level Switches

Model B40 LIQUID LEVEL SWITCH

Description: The B40 is a float-actuated liquid level switch designed for high pressure and temperature service. The sealed external cage houses a horizontally oriented float assembly for use in single-stage applications.

Measurement Principle: Horizontal float-actuated level switch.

Features:
- Chambers in carbon steel, 316 SS, 304 SS and chrome moly
- Optional construction to ASME B31.1 for use in power plants

Process Temp Range: –50° to +1200° F (–29° to +649° C)

Pressure Pressure: Up to 3700 psig (255 bar)

Model Selection: Refer to MAGNETROL Bulletin 46-120 for model numbers, options and complete specification information.

Models F10 and F50 FLOW SWITCHES

Description: The F10 and F50 are mechanical flow switches designed for use in horizontal flow lines. The F10 is a vane-actuated flow switch for use in lines 2" and greater in diameter. The F50 is a disc-actuated flow switch for use in lines 2" and smaller in diameter.

Measurement Principle: Vane- and disc-actuated flow switches.

Features:
- F10 mounting available threaded or flanged, carbon steel, 304 SS or 316 SS
- F50 body available in bronze or 316 SS
- F10 actuation flow rate is field-adjustable
- F50 requires no calibration

Process Temp Range: –50° to +450° F (–29° to +232° C) for F10
–50° to +750° F (–29° to +399° C) for F50

Process Pressure: Up to 1000 psig (69 bar) for F10
Up to 1150 psig (79 bar) for F50

Model Selection: Refer to MAGNETROL Bulletin 47-116 for model numbers, options and complete specification information.

BOILER Level Switches

Providing Reliable Boiler Controls Since 1932

Description: MAGNETROL boiler level switches are the first choice of the largest boiler manufacturers. Single-stage units provide reliable low water cut-off while multiple-stage water column style units provide boiler water level control.

Measurement Principle: Vertical float-actuated level switch.

Features:

- Reliable operation
- Single or multiple switch points
- Both fabricated and cast chambers available
- Water columns with try-cock and gauge glass connections
- Left hand and right hand water column mountings
- Pressures up to 600 pounds working steam pressure
- Available with a variety of electric and pneumatic switch mechanisms

Model Selection: Refer to MAGNETROL Bulletin 46-118 for model numbers, options and complete specification information.

SPECIFICATIONS

Process Temp Range: –20° to +750° F (–29° to +399° C)

Process Pressure: Up to 900 psig (62 bar)

Specific Gravity: Down to 0.75

Chamber Material: Cast iron or fabricated carbon steel chambers

Float and Trim Parts: Brass chamber liners
Trim in 300 and 400 series SS or all 316/316L SS

Actuation Levels: One to three narrow differential set points

Switch Enclosures: Polymer power coat finished aluminum NEMA 4X/7/9 for Class I, Div. 1, Group B or Groups C & D areas, IEC Ex Ex d IIC T6, IP66 areas and ATEX Ex II 2 G EEx d IIC T6.

Switch Mechanisms: Dry contact, hermetically sealed, and pneumatic

Aurora® Magnetic Level Indicator with Guided Wave Radar Transmitter

Achieve True Redundancy with this State-of-the-Art MLI

Description: The Orion Instruments®, a MAGNETROL company, unique marriage of magnetic level indication with guided wave radar has resulted in a truly redundant level control instrument. Clamp-on reed, dry contact and pneumatic switches are also available to augment the transmitter output.

Measurement Principle: Float and magnetic coupling and Eclipse® Guided Wave Radar

Features:

- Large selection of materials of construction
- Unique "flux ring" within the float produces a strong, consistent magnetic field for reliable magnetic coupling
- Shuttle-type or flag indicators
- Broad range of process connection types and sizes
- Optional ASME B31.1, B31.3 or NACE construction
- Choice of scale units of measure
- High temperature and cryogenic insulation available

Model Selection: Refer to ORION INSTRUMENTS Bulletin ORI-138 for model numbers, options and complete specification information.

ORION® INSTRUMENTS

Aurora®

Featuring ECLIPSE® 706GWR

SPECIFICATIONS

Process Temp Range: –320° to +106° F (–196° to +538° C)

Process Pressure: Full vacuum to 4500 psig (310 bar)

Specific Gravity: Down to 0.35

Dielectric: Down to 1.4

Chamber Material: MLI materials of construction include 304/304L SS, 316/316L SS, Monel®, Hastelloy® C, titanium, Hastelloy B, 321 SS, Alloy 20, Inconel 625, Inconel 825, 347 SS, 904L SS and other non-magnetic alloys

Measuring Range: 12 to 600 inches (0.3 to 15.2 meters)

Transmitter: 24 VDC supply, 4–20 mA output, HART, FOUNDATION fieldbus™ or LCD optional

Indicators: Shuttle-type follower or flags, visible from 100 feet

Scale: Available in units of height (inches, centimeters), volume (gallons, liters), percentage of span or other custom units

Options: Clamp-on Jupiter® magnetostrictive transmitter and switches. Remote-mounted electronics, additional materials of construction, custom span, process connections, etc.

Atlas™ Gemini™ ENHANCED Jupiter®

Additional Orion Instruments® products available include Atlas™ and Gemini MLIs and the Jupiter® magnetostrictive transmitter

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