VISION STATEMENT

To be the customers’ preferred partner in the global supply of level and flow control solutions
COMPANY
Magnetrol® International Incorporated is based near Chicago, U.S.A. The story started in 1932 with the production of level measurement devices, based on the buoyancy principle, in steam boilers. Nowadays Magnetrol® is a worldwide group, specialized in the production of devices for level and flow measurement and using a variety of technologies such as radar, thermal dispersion, ultrasound, etc… Through a worldwide network of direct sales offices, distributors and representatives our devices are reaching the final place of application.

Magnetrol® International NV is based in Zele, Belgium and acts as the headquarters for Europe, Middle East, Africa and India (EMEA-region). Next to the production facility there is an engineering team able to support customers during start-up and commissioning, trouble shooting and/or problem solving.

By far our biggest market is the oil & gas sector as a whole. Other markets include chemical industry, power generation and energy sector. More recently we have added a product line specifically targeting the food & beverage, pharmaceutical and cosmetic industries. Next to these identified industries we are also supplying a number of OEM sectors such as skidbuilders, pump installations, etc…
OUR PRODUCTS

The majority of the devices manufactured by Magnetrol International NV are designed and tailor-made to the specifications and requests of our customers. Over the years a great expertise has been gained in different fields.

Below is a list, not limitative and depending on the device type, of metals with which we have gained experience:

- 321 stainless steel
- 304/304L stainless steel
- 316/316L stainless steel
- (Low temperature) Carbon steel and carbon steel
- Chrome Molybdenium steel
- (Super) Duplex stainless steel
- Monel
- Hastelloy
- Incoloy and Inconel types
- …

Working with these metals and the need to join them has resulted in over 130 welding procedures being established in house.

A similar experience has been gained on possible process connections:

- ANSI flanges
- EN (DIN) flanges
- Tri-clamp connections
- Proprietary flanges enabling compatibility with existing connections
- Threaded connections such as NPT and BSP
- …

Although our standard colors are blue (up to 240 °C) and a grey type (temperatures higher than 240 °C) we can supply nearly any color upon customer request.

So, if you have any specific request please do not hesitate to contact us.
Magnetrol® level and flow controls use state-of-the-art technology and are produced under strict quality procedures of ISO 9001 - PED 97/23/EC. Magnetrol® quality is achieved by using fully traceable materials, ASME IX qualified welders and the capability to work with standard as well as exotic materials. Magnetrol® builds standard and custom-built equipment for all industries. The integration of SIL philosophy into the basic concept design results in safer-to-use controls that self-ensure their correct operation and report any possible malfunctions. Magnetrol®'s entire R&D budget is devoted to optimizing the design of level controls for minimal cost of ownership by durability.

Full details on Magnetrol®'s products can be found on our website www.magnetrol.com and in our respective sales bulletins.

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>PRODUCT FAMILY</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided Wave Radar</td>
<td>Eclipse® – Horizon™</td>
<td>6</td>
</tr>
<tr>
<td>Pulse Burst Radar</td>
<td>Pulsar® R05 - Model R82</td>
<td>16</td>
</tr>
<tr>
<td>Magnetostrictive</td>
<td>Jupiter®</td>
<td>20</td>
</tr>
<tr>
<td>Ultrasonic Contact</td>
<td>Echotel® 9XX</td>
<td>22</td>
</tr>
<tr>
<td>Ultrasonic Non Contact</td>
<td>Echotel® 3X5</td>
<td>28</td>
</tr>
<tr>
<td>Acoustic Mapping</td>
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<td>32</td>
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<tr>
<td>Thermal Dispersion</td>
<td>Thermatel®</td>
<td>34</td>
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<tr>
<td>RF Capacitance</td>
<td>Kotron®</td>
<td>40</td>
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<tr>
<td>Magnetic Level Indicator</td>
<td>Vector™ – Atlas™ - Gemini™</td>
<td>44</td>
</tr>
<tr>
<td>Displacer Transmitter</td>
<td>Modulevel®</td>
<td>48</td>
</tr>
<tr>
<td>Buoyancy</td>
<td>Mechanicals</td>
<td>52</td>
</tr>
<tr>
<td>Mechanical Flow</td>
<td>Mechanicals</td>
<td>60</td>
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</table>
Guided Wave Radar is based upon the technology of Time Domain Reflectometry (TDR). TDR utilises pulses of electromagnetic energy, which are transmitted down a probe. When a pulse reaches a liquid surface that has a higher dielectric than the air/vapour in which it is traveling, the pulse is reflected.

An ultra high-speed timing circuit precisely measures the transit time and provides an accurate measurement of the liquid level or the liquid-liquid interface. All these devices are overfill safe due to the fact that the reference signal is generated above the process seal.
ECLIPSE® 706
Guided wave radar level transmitter

DESCRIPTION
The Eclipse® Model 706 is an advanced two wire loop powered, 24 V DC guided wave radar transmitter with a superior signal strength to take on a broad range of challenging high pressure high temperature applications. An extensive line of dedicated coaxial, caged coaxial, single and twin rod probes delivers accurate and reliable level control. The innovative dual compartment enclosure positions wiring and electronics in the same plane, and angled to maximise ease of wiring, configuration, set-up and data display.

FEATURES
"Real Level", measurement not affected by media variables eg. dielectrics, pressure, density, pH, viscosity, ....
Easy bench configuration - no need for level movement.
2-wire loop powered intrinsically safe level transmitter.
360° rotatable housing can be dismantled without depressurising the vessel via "Quick connect/disconnect" probe coupling.
Probe designs: up to +450 °C / 430 bar (+842 °F / 6250 psi).
Saturated steam applications up to 155 bar @ +345 °C (2250 psi @ +650 °F).
Cryogenic applications down to -196 °C (-320 °F).
Integral or remote electronics.
Suited for SIL 2 or SIL 3 Loops (full FMEDA report available).
Internal reference signal physically and electrically separated from tank and media.
Improved pulse amplitude and superior signal-to-noise ratio.
4-button user interface and graphical LCD display provide enhanced depth of data, indicating on-screen waveforms and troubleshooting tips.

APPLICATIONS
MEDIA: Liquids or slurries; hydrocarbons to water-based media (dielectric 1,4 - 100) and solids (dielectric 1,9 - 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 vapours, foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media or specific gravity.

AGENCY APPROVALS
ATEX
II 1 G Ex ia IIC T4 Ga
II 3 G Ex nA [ia Ga] IIC T4 Gc
II 2 G Ex d [ia Ga] IIC T6 Gb
II 2 D Ex t[b] [ia Ga] IIIC T85°C Db

IEC
Ex ia IIC T4 Ga
Ex nA [ia Ga] IIC T4 Gc
Ex d [ia Ga] IIC T6 Gb
Ex t[b] [ia Ga] IIIC T85°C Db
# ECLIPSE® 706 PROBE OFFERING OVERVIEW

## OVERVIEW

**GUIDED WAVE RADAR**

### Overfill Capable/Interface Probes

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coaxial</td>
<td>Standard Model 7CT</td>
<td>Standard general purpose coaxial probe for clean applications</td>
</tr>
<tr>
<td></td>
<td>High Pressure Model 7CP</td>
<td>Coaxial probe for high pressure applications</td>
</tr>
<tr>
<td></td>
<td>High Temperature High Pressure Model 7CD</td>
<td>Coaxial probe for high temperature applications</td>
</tr>
<tr>
<td></td>
<td>Saturated Steam Model 7CS</td>
<td>Coaxial probe for saturated steam applications</td>
</tr>
<tr>
<td>Caged Coaxial Rod</td>
<td>Standard Model 7CG</td>
<td>Standard general purpose single rod probe for external chamber applications</td>
</tr>
<tr>
<td></td>
<td>High Pressure Model 7CL</td>
<td>Single rod probe for high pressure external chamber applications</td>
</tr>
<tr>
<td></td>
<td>High Temperature High Pressure Model 7CJ</td>
<td>Single rod probe for high temperature external chamber applications</td>
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</table>

### Standard Probes

<table>
<thead>
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<th>Type</th>
<th>Model</th>
<th>Application</th>
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</thead>
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<tr>
<td>Single Rod Bare – Rigid</td>
<td>Standard Model 7CF</td>
<td>Standard general purpose single rod probe for tank applications</td>
</tr>
<tr>
<td></td>
<td>High Pressure Model 7CM</td>
<td>Single rod probe for high pressure tank mounted applications</td>
</tr>
<tr>
<td></td>
<td>High Temperature High Pressure Model 7CN</td>
<td>Single rod probe for high temperature tank mounted applications</td>
</tr>
<tr>
<td>Single Rod Coated – Rigid</td>
<td>PFA Coated Model 7CF-4</td>
<td>PFA coated probe for viscous applications</td>
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<td></td>
<td>Corrosion Resistant Model 7CF-F</td>
<td>PFA faced flange probe for corrosive applications</td>
</tr>
<tr>
<td>Flexible (Direct Insertion into Tanks)</td>
<td>Single Cable Standard Model 7C1</td>
<td>Standard single cable probe for extended range applications</td>
</tr>
<tr>
<td></td>
<td>Single Cable High Temperature High Pressure Model 7C3</td>
<td>High temperature single cable probe for extended range applications — Future</td>
</tr>
<tr>
<td></td>
<td>Twin Cable Standard Model 7C7</td>
<td>Standard twin cable probe for extended range applications</td>
</tr>
<tr>
<td>Flexible (In Side-Mounted Chambers) – Future</td>
<td>Single Cable Standard Model 7C4</td>
<td>Standard single cable probe for external chamber applications</td>
</tr>
<tr>
<td></td>
<td>Single Cable High Temperature High Pressure Model 7C6</td>
<td>High temperature single cable probe for external chamber applications</td>
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</tbody>
</table>

### Bulk Solids

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Application</th>
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<tbody>
<tr>
<td>Single Cable</td>
<td>Model 7C2</td>
<td>Single cable probe for bulk solids applications</td>
</tr>
<tr>
<td>Twin Cable</td>
<td>Model 7C5</td>
<td>Twin cable probe for bulk solids applications</td>
</tr>
</tbody>
</table>
DESCRIPTION
The Eclipse® 705 Transmitter is a loop-powered, 24 V DC liquid-level transmitter based on the revolutionary Guided Wave Radar (GWR) technology. Encompassing a number of significant engineering accomplishments, this leading edge level transmitter is designed to provide measurement performance well beyond that of many traditional technologies, as well as “through-air” radars.

The innovative enclosure is a first in the industry, orienting dual compartments (wiring and electronics) in the same plane, and angled to maximise ease of wiring, configuration, set-up and data display.

This single transmitter can be used with all probe types and offers enhanced reliability, for use in SIL 2 / SIL 3 loops.

FEATURES
“Real Level”, measurement not affected by media variables eg. dielectrics, pressure, density, pH, viscosity, ...

Easy bench configuration - no need for level simulation.

2-wire loop powered intrinsically safe level transmitter.

20-point custom strapping table for volumetric output.

360° rotatable housing can be dismantled without depressurising the vessel via “Quick connect/disconnect” probe coupling.

2-line x 8-characters display and 3-button keypad.

Probe designs: up to +425 °C / 430 bar (+800 °F / 6250 psi).

Saturated steam applications up to 155 bar @ +345 °C (2250 psi @ +650 °F).

Cryogenic applications down to -196 °C (-320 °F).

Integral or remote electronics.

Suited for SIL 1 or SIL 2 Loops (full FMEDA report available).

Suited for SIL 3 Loops (EXIDA Certificate available).

APPLICATIONS
MEDIA: Liquids or slurries; hydrocarbons to water-based media (dielectric 1,4 - 100) and solids (dielectric 1,9 - 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 vapours, foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media or specific gravity.

AGENCY APPROVALS

ATEX
II 3 (1) G EEx nA [ia] IIC T6, non sparking
II 3 (1) G EEx nA [N] [ia] IIC T6, FNIICO – non incendive
II 1 G Ex ia IIC T4 Ga, Intrinsically safe
II 1 G Ex ia IIC T4 Ga, FISCO – Intrinsically safe
II 1 / 2 G D EEx c[ia] IIC T6 Gb
II 1 / 2 D Ex t[ia Da] IIC T85 °C Db IP66

IEC
Ex d [ia Ga] IIC T6 Gb
Ex t[ia Da] IIC T85 °C Db IP66
Ex ic [ia Ga] IIC T4

Lloyds
Primary level safety device for steamdrums conform to
- EN 12952-11 (water tube boilers)
- EN 12953-9 (shell boilers)

TÜV
WHG § 63, overfill prevention

AIB
VLAREM II – 5.17.7

FM/CSA
Non Incendive / Intrinsically safe / Explosion proof

LRS
Lloyds Register of Shipping (marine applications)

Russian Authorisation Standards
Other approvals are available, consult factory for more details.
ECLIPSE® 705 HEAVY DUTY
Guided wave radar probes for heavy duty applications

DESCRIPTION
The Eclipse® 705 Transmitter is a loop-powered, 24 V DC liquid-level transmitter based on the revolutionary Guided Wave Radar (GWR) technology. Encompassing a number of significant engineering accomplishments, this leading edge level transmitter is designed to provide measurement performance well beyond that of many traditional technologies, as well as “through-air” radars.

The innovative enclosure is a first in the industry, orienting dual compartments (wiring and electronics) in the same plane, and angled to maximise ease of wiring, configuration, set-up and data display.

This single transmitter can be used with all probe types and offers enhanced reliability, for use in SIL 2 / SIL 3 loops.

FEATURES
“Real Level”, measurement not affected by media variables eg. dielectrics, pressure, density, pH, viscosity, ...

Easy bench configuration - no need for level simulation.

2-wire loop powered intrinsically safe level transmitter.

20-point custom strapping table for volumetric output.

360° rotatable housing can be removed without depressurising the vessel via “Quick connect/disconnect” probe coupling.

2-line x 8 characters display and 3-button keypad.

Probe designs: up to +245 °C / 430 bar (+800 °F / 6250 psi).

Saturated steam applications up to 155 bar @ +345 °C (2250 psi @ +650 °F).

Cryogenic applications down to -196 °C (-320 °F).

Integral or remote electronics.

Suited for SIL 1 or SIL 2 Loops (full FMEDA report available).

Suited for SIL 3 Loops (EXIDA Certificate available).

APPLICATIONS

MEDIA: Liquids or slurries; hydrocarbons to water-based media (dielectric 1.4 - 100), up to 10,000 cP.

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 vapours, foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media or specific gravity.

AGENCY APPROVALS

ATEX
II 3 (1) G Ex ee nA [ia] IIC T6, non sparking
II 3 (1) G Ex ee nA [il] [ia] IIC T6, FISCO – non incendive
II 1 G Ex ia IIC T4 Ga, intrinsically safe
II 1 G Ex ia IIC T4 Ga, FISCO – intrinsically safe
II 1 / 2 G D Ex e d[ia] IIC T6 Gb
II 1 / 2 D Ex t[Da] IIIC T85 °C Db IP66

IEC
Ex d [ia Ga] IIC T6 Gb
Ex t[Da] IIIC T85 °C Db IP66
Ex ic [ia Ga] IIC T4

Lloyds
Primary level safety device for steamdrums conform to:
- EN 12952-11 (water tube boilers)
- EN 12953-9 (shell boilers)

TÜV
WHG § 63, overfill prevention

AIB
VLAREM II – 5.17.7

FM/CSA
Non Incendive / Intrinsically safe / Explosion proof

LRS
Lloyds Register of Shipping (marine applications)

Russian Authorisation Standards
Other approvals are available, consult factory for more details.
**DESCRIPTION**

The Eclipse® 705 Transmitter is a loop-powered, 24 V DC liquid-level transmitter based on the revolutionary Guided Wave Radar (GWR) technology. Encompassing a number of significant engineering accomplishments, this leading edge level transmitter is designed to provide measurement performance well beyond that of many traditional technologies, including "through-air" radar.

Typical for these devices is that the probe can be bended (upon request) to follow the shape of the vessel. This way mixing blades can be avoided and measurement can be carried out to the last drop present.

The Eclipse® 705 offers enhanced reliability, as demonstrated by a Safe Failure Fraction of 91 %.

**FEATURES**

- "Real Level", measurement not affected by media variables eg. dielectrics, pressure, density, pH, viscosity, ...
- 2-wire loop powered intrinsically safe level transmitter.
- 20-point custom strapping table for volumetric output.
- Housing can be removed without depressurising the vessel.
- 2-line x 8 characters display and 3-button keypad.
- Suitable design for CIP/SIP cleaning.
- Integral or remote electronics.
- Suited for SIL 1 or SIL 2 Loops (full FMEDA report available).

**APPLICATIONS**

**MEDIA:** From non-conductive liquids up to water-based media (dielectric 1.9 - 100).
**VESSELS:** Most process or storage vessels.
**CONDITIONS:** All level measurement and control applications including process conditions exhibiting visible vapours, foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media or specific gravity.

**AGENCY APPROVALS**

- **ATEX**  II 1 G Ex ia IIC T4 Ga, intrinsically safe
  II 1 G Ex ia IIC T4 Ga, FISCO – intrinsically safe
- **TNO** Hygienic Machinery Directive 98/37/EC annex 1, section 2.1
  EN 1672 part 2, Hygienic requirements
  EHEDG doc. 2 (second edit. March 2000) and doc. 8 (July 1993)
- **FM/CSA**
- **Russian Authorisation Standards**
  Other approvals are available, consult factory for more details.
ECLIPSE® AURORA®
Guided wave radar level transmitter and magnetic level indicator

DESCRIPTION
Aurora® combines the operation of a conventional float operated magnetic level indicator with the leading edge technology of Guided Wave Radar. The result is a true level measurement redundancy in a single 3” or 4” chamber design. The Eclipse® Guided Wave Radar is a 2-wire loop powered 24 V DC liquid level transmitter utilising Time Domain Reflectometry technology (TDR) to perform level measurement independent from media characteristics and process conditions. The Aurora® is a completely self-contained unit for side mounting to a tank or vessel with threaded or flanged pipe connections.

FEATURES
- Complete redundant system whereby the measuring results of the Eclipse can be continuously checked against the level indication of the Magnetic Level Indicator.
- Pro-active maintenance can be planned ahead of time based upon the comparison of the measuring results of the two systems.
- No calibration required on either measuring system.
- 2-wire loop powered intrinsically safe level transmitter.
- HART®, AMS®, Foundation Fieldbus™ and PACTware™ communication protocol.
- Up to 5,7 m (224”) measuring range.
- Up to 103 bar (1500 psi) – optional up to 310 bar (4500 psi).
- Up to +400 °C (+750 °F) process temperature for non-condensing applications.
- Up to 155 bar @ +345 °C (2250 psi @ +650 °F) for saturated steam applications.
- Suited for SIL 1 and SIL 2 loops (full FMEDA report available for Eclipse transmitter) – optional SIL 2/3.
- Eclipse transmitter SIL 3 certified (EXIDA certificate available).
- Several cage designs are available, consult factory for more details.

APPLICATIONS
- MEDIA: Clean liquids; hydrocarbons to water-based media (dielectric 1.4-100).
- INTERFACE: Consult factory.
- 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 vapours, foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media.

AGENCY APPROVALS
- ATEX II 3 (1) G Ex nA [ia] IIC T6, non sparking
  II 3 (1) G Ex nA [nL] [ia] IIC T6, FNICO – non incendive
  II 1 G Ex ia IIC T4 Ga, intrinsically safe
  II 1 G Ex ia IIC T4 Ga, FISCO – intrinsically safe
  II 1 / 2 G D Ex d [ia] IIC T6 Gb
  II 1 / 2 D Ex t [ia Da] IIC T65 °C Db IP66
- ATEX Constructional safety applicable on MLI parts only
  II 1 G C T6
- IEC Ex d [ia Ga] IIC T6 Gb
  Ex t[ia Da] IIC T65 °C Db IP66
- Lloyds Primary level safety device for steamdrums conform to
  - EN 12952-11 (water tube boilers)
  - EN 12953-9 (shell boilers)
- TÜV WHG § 63, overfill prevention
- AIB VLAREM II – 5.17.7
- FM/CSA Non Incendive / Intrinsically safe / Explosion proof
- LRS Lloyds Register of Shipping (marine applications)
- Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
**HORIZON™ 704**
Guided wave radar level transmitter

**DESCRIPTION**
The Horizon™ 704 is a loop-powered, 24 V DC liquid-level transmitter based on the revolutionary Guided Wave Radar (GWR) technology. The electronics of the Horizon™ 704 is integral mount on the GWR probe and allows local configuration via a 3-button keypad / display. The Horizon™ 704 electronics are compatible with different types of GWR probes each encompassing different application challenges (coaxial or twin rod types). The aluminium or Lexan® housing can be removed for service under process conditions.

**FEATURES**
- “Real Level”, measurement not affected by changing media variables eg. dielectrics, pressure, density, pH, viscosity, ...
- Easy bench configuration - no need for level simulation.
- 2-line x 8 characters display / 3-button keypad or blind transmitter.
- 2-wire loop powered intrinsically safe level transmitter.
- Housing can be easily removed without depressurising the vessel.
- HART®/AMS® digital communication.
- Max process temperature: +205 °C (+400 °F).
- Max process pressure: 70 bar (1000 psi).
- 4-20 mA output (meets NAMUR NE 43).
- Integral mount electronics.

**APPLICATIONS**
- **MEDIA**: Liquids or slurries; hydrocarbons to water-based media (dielectric 1.7 - 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 vapours, foam, coating / build up, surface agitation, turbulence and varying dielectric media or specific gravity.

**AGENCY APPROVALS**
- ATEX II 1 G Ex ia IIC T4, intrinsically safe
- FM/CSA
- Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
### ECLIPSE® 705 PROBE SELECTION
Coaxial style GWR probes

<table>
<thead>
<tr>
<th>Application/Type</th>
<th>7MR-7MM (coax)</th>
<th>7MD-7ML (coax)</th>
<th>7MS (coax)</th>
<th>7MT-7MN (coax)</th>
<th>7MG (single rod)</th>
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<tbody>
<tr>
<td><strong>Function</strong></td>
<td>Level</td>
<td>HTHP&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>Steam</td>
<td>Level - Interface</td>
<td>Level - Interface</td>
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<tr>
<td><strong>Temperature</strong></td>
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<tr>
<td>-40 °C / +150 °C</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>-40 °C / +200 °C</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>-196 °C / +430 °C</td>
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<td>Yes</td>
<td>No</td>
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<td>saturated steam +345 °C</td>
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<td><strong>Pressure</strong></td>
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<td>0 to 50 bar</td>
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<td><strong>Wetted materials</strong></td>
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</tr>
<tr>
<td>316/316L</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hastelloy® C</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Monel®</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Seal type</strong></td>
<td><em>O</em> ring type with various materials</td>
<td>Borosilicate seal (Full vacuum)</td>
<td>Dynamic steam seal with HT PEEK / Aegis</td>
<td><em>O</em> ring type with various materials</td>
<td><em>O</em> ring type with various materials</td>
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<tr>
<td><strong>Liquid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Film coating</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Weak build up</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Strong build up</td>
<td>Use Ø 45 mm (7MM)</td>
<td>Use Ø 45 mm (7ML)</td>
<td>No</td>
<td>Use Ø 45 mm (7MN)</td>
<td>Yes</td>
</tr>
<tr>
<td>aggressive</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Probe Ø/section</strong></td>
<td>Ø 22.5 (7MR) - 45 (7MM) mm</td>
<td>Ø 22.5 (7MD) - 45 (7ML) mm</td>
<td>Ø 22.5 mm</td>
<td>Ø 22.5 (7MT) - 45 (7MN) mm</td>
<td>Ø 13, 19 or 25 mm</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> High Temperature / High Pressure (HTHP) GWR probes with multi venting holes are suitable for level and liquid-liquid interface measurement.

<sup>(2)</sup> Caged single rod probe with the same performance as a coax set up.
# ECLIPSE® 705
## PROBE SELECTION
Single and dual lead GWR probes

<table>
<thead>
<tr>
<th>Application/Type</th>
<th>7MF-A (single rod)</th>
<th>7MF-F (single rod)</th>
<th>7MJ (single rod)</th>
<th>7M1/7M2 (single cable)</th>
<th>7MB (twin rod)</th>
<th>7M7/7M5 (twin flex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Level liquids</td>
<td>PFA coated</td>
<td>HTHP</td>
<td>Liquids / Solids</td>
<td>Level - Interface</td>
<td>Liquids / Solids</td>
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<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-40 °C / +150 °C</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>-40 °C / +200 °C</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes (7M1 only)</td>
<td>No</td>
<td>Yes (7M7) - ambient (7M5)</td>
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<td>-40 °C / +315 °C</td>
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<td>No</td>
<td>Yes</td>
<td>As “X”(1)</td>
<td>No</td>
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<tr>
<td>Pressure</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>0 to 70 bar</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>max 50 bar</td>
<td>Yes</td>
</tr>
<tr>
<td>0 to 207 bar</td>
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<td>No</td>
<td>Yes</td>
<td>As “X”(1)</td>
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<td>No</td>
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<tr>
<td>Min. dielectrics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1.4</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>7M1: ≥ 1.9</td>
<td>No</td>
<td>No</td>
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<tr>
<td>≥ 1.9</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>7M2: ≥ 4.0</td>
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<td>≥ 10</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Measuring range</td>
<td>6,1 m</td>
<td>6,1 m</td>
<td>6,1 m</td>
<td>23 m</td>
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<td>23 m</td>
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<td>Wetted materials</td>
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<td>316/316L</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes - PFA coated</td>
</tr>
<tr>
<td>Hastelloy® C</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Monel®</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Seal type</td>
<td>“O”ring type with Viton®/EPDM/Kalrez® 4079/PEEK materials (not for use with ammonia, use only 7MD)</td>
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<td></td>
<td></td>
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<tr>
<td>Liquid</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Clean</td>
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<td>Yes</td>
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<tr>
<td>Film coating</td>
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<td>Weak build up</td>
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<td>Strong build up</td>
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<td>aggressive</td>
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<td>No</td>
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<tr>
<td>Probe Ø/section</td>
<td>Ø 13 mm</td>
<td>Ø 16 mm</td>
<td>Ø 13 mm</td>
<td>Ø 5 mm</td>
<td>2 x Ø 13 mm</td>
<td>2 x Ø 6 mm</td>
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</tbody>
</table>

Remote transmitter head available as an option

(1) As “X” = optionally available.
Pulse Burst Radar emits short bursts of energy to a liquid surface. An ultra-high-speed timing circuitry measures the time of the signal reflected off the liquid surface. Sophisticated signal processing filters out false reflections and other background noises. The exact level is then calculated, by factoring tank height and sensor offset information. The circuitry is extremely energy efficient so no duty cycling is needed like with likewise radars. This allows to track high rates of level changes up to 4.5 m/minute (180°/min).
PULSAR® R05
Pulse burst radar level transmitter

DESCRIPTION
The Pulsar® Radar transmitter is the latest generation of loop-powered, 24 V DC, level transmitters. It has low power consumption, fast response time and is easy to use.
The Pulsar® is designed to provide unparalleled performance and ease of use. Pulsar® non-contact radar is the perfect complement to the Magnetrol Eclipse® Guided Wave Radar. These transmitters offer the ultimate solution to the vast majority of process level applications.

FEATURES
- 6 GHz operating frequency offers superior performance in the tougher applications of turbulence, foam, and heavy vapours.
- 2-wire loop powered intrinsically safe level transmitter.
- 360° rotatable housing can be dismantled without depressurising the vessel via “Quick connect/disconnect” probe coupling.
- 2-line x 8 characters display and 3-button keypad.
- 2 antenna styles up to +200 °C / 51.7 bar (+400 °F / 750 psi):
  - horn antenna: 3”, 4” and 6”
  - dielectric rod antenna: PP and TFE.
- Measuring range up to 20 m.
- False target setup is simple, intuitive and effective.
- Will reliably track extremely rapid rate of change up to 4,5 m (180”) / minute.
- Suited for SIL 1 and SIL 2 loops (full FMEDA report available).

APPLICATIONS
MEDIA: Liquids or slurries; hydrocarbons to water-based media (dielectric 1.7 - 100).
VESSELS: Most process or storage vessels up to rated probe temperature and pressure. Pits and non metallic tanks.
CONDITIONS: Virtually all level measurement and control applications including process conditions exhibiting visible vapours, some foam, surface agitation, bubbling or boiling, high fill/empty rates, low level and varying dielectric media or specific gravity.

AGENCY APPROvals
- ATEX II 1 G Ex ia IIC T4 Ga, intrinsically safe
  II 1/2 G EEx d IIC T6, flameproof enclosure
- IEC Ex ia IIC T4 Ga, intrinsically safe
- LRS Lloyds Register of Shipping (marine applications)
- FM/CSA
- Russian Authorisation Standards
Other approvals are available, consult factory for more details.
MODEL R82
Non contact radar level transmitter for level, volume and open channel flow applications

DESCRIPTION
The Model R82 is an economical, loop powered radar transmitter bringing radar to everyday applications. Ultrasonic devices, frequently used in daily applications, can now be replaced using radar technology with its superior performance.

The electronics are housed in a single compartment cast aluminium or Lexan® housing. The R82 measures effectively even when atmospheres above the liquid are saturated with vapour. Pulse Burst technology and advanced signal processing manage common disturbances such as false echoes caused by obstructions, multi-path reflections from tank sidewalls or turbulence caused by agitators, aggressive chemicals, or aerators.

FEATURES
- 2-wire loop powered intrinsically safe transmitter.
- 26 GHz frequency.
- Fast and easy configuration via 2-line x 16 characters display and 4-button keypad.
- Intuitive false target profiling.
- Rotatable microwave beam for optimised operation.
- Encapsulated PP or Tefzel® antennas in lengths of 50 mm (2") and 200 mm (8").
- Process temperature: -40 °C to +93 °C (-40 °F to +200 °F)
  pressure: vacuum to 13.8 bar (200 psi)
  dielectric: 1.7 – 100.

Suited for SIL 1 loops (full FMEDA report available).

APPLICATIONS
- Open channel flow flumes and weirs.
- Paint, ink and solvent tanks.
- Chemical storage.
- Thick and viscous media.
- Batch and day tanks.

AGENCY APPROVALS
- ATEX II 1 G Ex ia IIC T4, intrinsically safe
- cFMus
- Russian Authorisation Standards

Other approvals are available, consult factory for more details.
The Enhanced Jupiter® transmitter utilises the effect of a magnetic field on a magnetostrictive wire as the basis for operation of the instrument. The primary components are the probe assembly containing the wire and the electronics assembly.

1. A low energy pulse which is generated by the electronics travels the length of the magnetostrictive wire.

2. A return signal is generated from the precise location where the magnetic field of the float intersects the wire.

3. Interaction between the magnetic field, electrical pulse and magnetostrictive wire cause a slight mechanical disturbance in the wire that travels back up the probe at the speed of sound.

4. A timer precisely measures the elapsed time between the generation of the pulse and the return of the mechanical or acoustic signal. This is detected by the acoustic sensor located below the electronics housing. The software is set up to measure the time-of-flight data and to display and convert to level and/or liquid-liquid interface measurement.
DESCRIPTION

The Jupiter® liquid level transmitter is a loop-powered 24 V DC liquid-level transmitter and is available as a direct insertion transmitter or as an external mounted transmitter onto a Magnetic Level Indicator. The unit can be designed for liquid level and/or liquid-liquid interface measurement.

The innovative enclosure is a first in the industry, orienting dual compartments (wiring and electronics) in the same plane and angled to maximize ease of wiring, configuration, set-up and data display.

The high safety level of the Jupiter is demonstrated by a Safe Failure Fraction > 90%.

FEATURES

- High precision and repeatable level measurement:
  - accuracy up to ± 0.4 mm (0.015”)
  - repeatability of ± 0.13 mm (0.005”).
- Easy bench configuration – no need for level simulation.
- 2-wire loop powered intrinsically safe level transmitter.
- Dual compartment with separate housing for wiring and electronics.
- 2-line x 8 characters display and 3-button keypad.
- Process temperature up to +450 °C (+850 °F) (external mount) / +260 °C (+500 °F) (direct insertion).
- Process pressure up to 26.2 bar (380 psi) – custom floats up to 117 bar (1700 psi).
- Probe lengths up to 5.70 m (19 ft).
- Float failure reporting.
- Suited for SIL 1 or SIL 2 loops (full FMEDA report available).

APPLICATIONS

- MEDIA: Highly recommended for use in liquids with enhanced foam development.
- Interface measurement where the upper liquid layer has a higher dielectric than the lower liquid layer.
- CONDITIONS: Suited for use in a turbulent liquid environment as the float remains in contact with the liquid surface whilst emitting its signal.

AGENCY APPROVALS

- ATEX
  - II 1 G Ex ia IIC T4 Ga, intrinsically safe
  - II 1 G Ex ia IIC T4 Ga, FISCO – intrinsically safe
  - II 1/2 G Ex d IIC T6 Ga/Gb, flameproof enclosure
- ATEX
  - Constructional safety applicable on MLI parts only
  - II 1 G C T6
- IEC
  - Ex ia IIC T4 Ga, intrinsically safe
  - Ex ia IIC T4 Ga, FISCO – intrinsically safe
  - Ex d IIC T6, flameproof enclosure
- LRS
  - Lloyds Register of Shipping (marine applications) (pending)
- FM/CSA
  - Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
The Echotel® ultrasonic contact operates on a two crystal pulsed or “transmit-receive” principle which applies a high frequency electronic burst to the transmit crystal. The signal is then converted into ultrasonic energy and transmitted across the sensing gap towards the receiver crystal. When there is air in the gap, the high frequency ultrasonic energy will be attenuated, thereby not allowing the energy to be received. When there is liquid in the gap, the ultrasonic energy will propagate across the gap and the current shift or relay output will indicate a reception of the signal.
**DESCRIPTION**

The Echotel® 961/962 series are used to detect high or low level alarm(s) in a broad range of viscous to light liquids. Pulsed signal technology provides superior performance in applications suffering from foam, aeration, heavy turbulence and suspensions containing solids.

The Echotel® 961 has a tip sensitive setpoint and is ideally used as high or low level alarm.

The Echotel® 962 offers 2 setpoints on the same transducer, a tip sensitive setpoint and a second setpoint via a flow-through upper gap. The unit is used for level alarm or to control a pump in an auto fill/empty mode.

The Echotel® 961/962 is equipped with advanced diagnostics that continuously check the transducer and electronics. The diagnostics also alarm for electrical noise interference from external sources.

**FEATURES**

- No calibration required.
- 2-wire loop powered with mA output or AC/DC line powered with integrated relay(s).
- Continuous selftest with selectable error output.
- LED identification for:
  - process alarm
  - error of transducer, electronics or electrical noise interference
  - wet/dry status of transducer.
- Push buttons for manual testing of alarm and error signals.
- Adjustable time delay up to 45 s.
- Process temperature from -80 °C to +165 °C (-110 °F to +325 °F) depending on used materials.
- Process pressure up to 138 bar (2000 psi).
- Metal and plastic transducers.
- Suited for SIL 1 and SIL 2 loops (full FMEDA report available).

**APPLICATIONS**

**VESSELS:** Any mounting position.

**CONDITIONS:** Unaffected by

- shifting dielectric, density or pH
- presence of foam, turbulence, visible vapours
- fast drain/fill rates
- transducer coating and air bubbles
- vacuum conditions.

**AGENCY APPROVALS**

- **ATEX**
  II 1 G Ex ia IIC T5 Ga, intrinsically safe
  II 1/2 G Ex d IIC T6 Ga/Gb, flameproof enclosure
- **IEC**
  Ex d IIC T6 Ga/Gb
- **TÜV**
  WHG §19
- **AIB**
  VLAREM II - 5.17.7
- **FM/CSA**
  Russian Authorisation Standards
  Other approvals are available, consult factory for more details.
ECHOTEL® 960/961
Ultrasonic level switch for hygienic use

DESCRIPTION
Echotel® 960/961 ultrasonic level switches require no calibration to detect the presence of any liquid in less than 1s. Foam is ignored by this technology, so that the unit only detects the presence or absence of liquid. The pulsed wave technology permits the unit to resist turbulence, aeration, suspended solids and build up.
The Echotel® series have both 3A and EHEDG approval for use in hygienic applications.
Model 960 is equipped with AS-i bus communication.
Model 961 offers either current shift or relay output.

FEATURES
- No calibration required.
- 2-wire loop powered with mA output, AC/DC line powered with integrated relays or 2-wire AS-i bus communication.
- Continuous selftest with selectable error output.
- Process temperature from -40 °C to +165 °C (-40 °F to +325 °F).
- Process pressure up to 103 bar (1500 psi).
- LED identification for:
  - process alarm
  - error of transducer, electronics or electrical noise interference
  - wet/dry status of transducer.
- Push buttons for manual testing of alarm and error signals.
- Adjustable time delay up to 45 s.
- Suitable sensor design for CIP/SIP cleaning.
- Model 961 suited for SIL 1 and SIL 2 loops (full FMEDA report available).

APPLICATIONS
- MEDIA: Any liquid
- VESSELS: Any mounting position
- CONDITIONS: Unaffected by
  - shifting dielectric, density or pH
  - presence of foam, turbulence, visible vapours
  - fast drain/fill rates
  - vacuum conditions.

AGENCY APPROVALS
- TNO Hygienic Machinery Directive 98/37/EC annex 1, section 2.1
- EN 1672 part 2, Hygienic requirements
- EHEDG doc. 2 (second edit. March 2000) and doc. 8 (July 1993)
- AS-i Tested to EN 50295/IEC 62026-2 test certificate # 76401
- Other approvals are available, consult factory for more details.
**DESCRIPTION**

Echotel® 910 is an integral mounted ultrasonic tip sensitive level switch with integrated DPDT relay. The Echotel® 910 is ideally suited for pump protection (also for vacuum), overflow prevention, high or low level alarm in clean liquid applications with or without foam.

**FEATURES**

- No calibration required.
- Dual electrical entries and various housings are standard available.
- A built-in averaging circuit ensures no false alarms due to most effervescence or turbulences.
- Actuation is determined by the length of the transducer and is available in lengths between 3 cm (1.20") and 254 cm (100").
- Process pressure/temperature: 55.2 bar at -40 °C to +120 °C (800 psi at -40°F to +250 °F).
- All materials exposed to process in 316/316L SST (1.4401/1.4404).
- Field selectable high/low level failsafe.

**APPLICATIONS**

**LIQUIDS:** Any clean liquids.

**VESSELS:** Any mounting position.

**PROCESS CONDITIONS:** Unaffected by

- shifting dielectric, density or pH
- presence of foam, turbulence, visible vapours
- fast drain/fill rates
- transducer coating and air bubbles
- vacuum conditions.

**AGENCY APPROVALS**

<table>
<thead>
<tr>
<th>ATEX</th>
<th>II 1/2 G Ex d+e/d IIIC T6 Ga/Gb, flameproof enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM/CSA</td>
<td>Russian Authorisation Standards</td>
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<tr>
<td>Other approvals are available, consult factory for more details.</td>
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</tbody>
</table>
**DESCRIPTION**

Echotel® 940/941 ultrasonic level controls are compact integral units which utilise pulsed wave technology to detect high or low level alarm in a broad range of viscous to light liquids. The unit is available in two versions:
- with integrated relay: Echotel® 940
- with 8/16 mA current shift: Echotel® 941.

**FEATURES**

- No calibration required.
- Electronics potted in sensor.
- Compact and easy to install design.
- High or low level detection.
- Max +85 °C @ 138 bar (+185 °F @ 2000 psi).
- IP66, watertight, with flying leads.
- Horseshoe shaped transducer gap.

**APPLICATIONS**

**VESSELS:** Any mounting position, ideally suited for filters.

**CONDITIONS:** Unaffected by
- shifting dielectric, density or pH
- presence of foam, turbulence, visible vapours
- fast drain/fill rates
- vacuum conditions.

**AGENCY APPROVALS**

- FM/CSA
- Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
The level measurement is accomplished by emitting an ultrasonic pulse from the transducer face and measuring the elapsed time between sending this pulse and its reflected echo from the liquid surface. Since the speed of sound is temperature dependant, the transducer also measures ambient temperature to compensate for the changing velocity.
**DESCRIPTION**

The Echotel® 355 is an integral mount, high performance ultrasonic non contact transmitter for liquid level, volume and open channel flow measurement.

The electronics are housed in a single compartment cast aluminium or Lexan® housing. The intelligent electronics analyse the ultrasonic echo profile, apply temperature compensation, reject echoes from false targets, and then processes the true echo from the liquid surface. This results in an extremely reliable measurement even when application difficulties like turbulence and false echoes exist.

**FEATURES**

- 2-wire loop powered intrinsically safe transmitter.
- Fast and easy configuration via 2-line x 16 characters display and 4-button keypad.
- False target rejection identifies true echo from liquid surface.
- Common tank shapes and 20-point custom table for volume calculations.
- Flume/weir primary elements and generic equation for open channel flow.
- Process temperature from -40 °C to +80 °C (-40 °F to +175 °F).
- Process pressure max 3 bar (43,5 psi).
- Two 7-digit totalizers for flow:
  - resettable
  - continuous totalizer.
- Suited for SIL 1 loops (full FMEDA report available).

**APPLICATIONS**

- Open channel flow flumes and weirs.
- Paint, ink and solvent tanks.
- Chemical storage.
- Thick and viscous media.
- Batch and day tanks.

**AGENCY APPROVALS**

- **ATEX**
  - II 1 G Ex ia IIC T4, intrinsically safe
  - II 1/2 G Ex ma / d IIC T6 Ga/Gb, flameproof enclosure

- **cFMus**

Other approvals are available, consult factory for more details.
**ECHOTEL® 335**
Ultrasonic non contact transmitter for level, volume or open channel flow

**DESCRIPTION**
The Echotel® 335 is an integral mount, high performance ultrasonic non-contact transmitter for liquid level, volume and open channel flow measurement. The electronics are housed in a dual compartment housing separating field wiring from user interface electronics. Advanced digital signal processing routines enable the 335 to perform in applications involving in-tank obstructions, light foam and agitation.

**FEATURES**
- Fast and easy calibration via 4 and 20 mA magnetic touch points.
- LED indication for:
  - echo validity
  - relay status (energised/de-energised).
- Plug in custom / 6 digit display module (optional)
  - for easy set up
  - with bar graph display for liquid level % or echo strength.
- Process temperature from -30 °C to +90 °C (-22 °F to +195 °F).
- IP 67, dual compartment (field wiring / user interface electronics) in cast aluminium.
- Signal output: linearised 4-20 mA and separate relay for level alarm or echo loss tracking.
- 2 separate totalisers for flow:
  - daily resettable
  - continuous totaliser.
- Max level range: 8 m (26 ft).

**APPLICATIONS**
- Water and waste water: tank - open channel flow measurement.
- Paper and pulp.
- Paint, ink and solvent tanks.
- General industry.
- Oil and chemical storage.
- Thick and viscous media.
- Food and beverage.
- Batch and day tanks.
Acoustic Mapping Technology uses an array of three antennas to transmit low frequency pulses and to receive echoes of the pulses from the contents of the silo, bin or other container. Using three antennas the unit measures not only the time/distance of each echo, but also the direction each echo comes from. The device’s digital signal processor samples and analyzes the received signals to provide very accurate measurement of the level, volume and mass of the stored contents and generates a 3D image of actual allocation of product within the container for display on remote computer screens.
**DESCRIPTION**

The Contour uses acoustic mapping technology for accurately measuring bulk solids and powders stored in different types of silos, vessels or even open areas. The advanced technology allows a surface mapping to be carried out and calculates the respective volume present in the silo or vessel. Because of the low frequency used, dust or moisture present in the space above the solids will have no influence on the measurement at all.

**FEATURES**

- Measures level and volume of solids and powders independent of dielectric constant.
- Measures minimum, maximum, and average level with a range of 70 m (230 feet).
- Operates in dusty and moisture rich environments.
- Profiles of adhesions to vessel walls.
- Acoustic energy vibration provides for self-cleaning of antenna.
- Mapping visualization tool allows 3D view of materials in bin/vessel.
- PC software provides assistance for location of unit, and remote configuration.
- Emitting frequency of 2 to 10 kHz+
- Process temperature: -40 to +85 °C (-40 to +185 °F).
- Process pressure: -0.5 to 3 bar (-7.25 to 43.5 psi).
- Operator interface: 4-line X 20 character LCD and 4-button keypad.

**APPLICATIONS**

All types of solids such as: ores, powders, plastic pellets, fertilizers, fly ash etc…

**AGENCY APPROVALS**

- ATEX II 1/2D, Ex ibD/iaD 20/21 T110°C
- II 2G Ex ia/ib IIB T4
- IEC EEx ia IIC T6 (pending)
- cFMus Intrinsically safe Class I, II, Division I, Groups C,D,E,F & G
- EMC EN 61326-1: 2006
- NSR EN 61010-1: 2001
- Protection IP67 per IEC 60529.
Two Resistance Temperature Detectors (RTD) sensors are fixed at the end of a probe. One sensor measures the ambient temperature; the second sensor is heated to a given temperature. For level applications the cooling effect of the contacting media reduces the temperature difference between the two sensors (TD and TG product series) and will activate a switch. In flow applications the change in flow will create a temperature difference depending on the amount of gas passing through the pipe.
**THERMATEL® TG1/TG2**

Thermal dispersion switch

**DESCRIPTION**

Thermatel® TG1/TG2 switches consist of electronics in a DIN rail housing and a remote sensor with aluminium or stainless steel sensor housing (max 500 m (1640 ft) away from electronics).

TG1/TG2 switches can easily be adjusted to detect flow (gases and liquids), level or liquid-liquid interface. Both units are 2-wire 24 V DC powered and intrinsically safe approved.

The TG1 offers standard LED flow indication, the TG2 offers LED flow indication per NAMUR NE 44.

**FEATURES**

- Temperature compensation
- Easy field calibration – pre-calibration from factory on request.
- Variable flow or flow / no flow detection of gases and liquids.
- Excellent low flow sensitivity.
- Automatic temperature compensation for repeatable alarm under varying process temperatures.
- Continuous diagnostics detect sensor fault.
- Continuous monitoring of flow rate versus setpoint via LED.
- mA output provides repeatable indication of flow rate and fault detection.
- Optional retractable fitting for dismantling under process conditions.
- Process conditions up to +450 °C (+850 °F) and 413 bar (6000 psi).
- Suited for SIL1 and SIL2 loops (full FMEDA report available).

**APPLICATIONS**

**MEDIA:** All types of gases and liquids.

**VESSELS:** Pipe sizes down to 1/4". Max sensor length up to 3,3 m. Can be installed at any angle vertically/horizontally.

**CONDITIONS:** Can be used on conductive and non conductive media, very light density to heavy viscous media (up to 10.000 cP). Can be set to ignore foam, aeration, turbulence, and cavitation.

**AGENCY APPROVALS**

- ATEX II (I) / 1 G Ex ia IIIB T5 Ga
- Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
**THERMATEL® TD1/TD2**

**Thermal dispersion switch**

**DESCRIPTION**
Thermatel® TD1/TD2 switches can easily be adjusted to detect flow (gases and liquids), level or liquid-liquid interface. The TD1 is a line powered 24 V DC unit with integral electronics and a built-in DPDT relay. The TD2 is either V DC or V AC line powered, has integral or remote electronics and offers additionally LED indication, time delay and mA output for diagnostics and trending.

With continuous diagnostics, automatic temperature compensation, narrow hysteresis and fast response time, TD1/TD2 bring you the latest in thermal dispersion technology.

**FEATURES**
- Easy field calibration – pre-calibration from factory on request.
- Variable flow or flow / no flow detection of gases and liquids.
- Excellent low flow sensitivity.
- Automatic temperature compensation for repeatable alarm under varying process temperatures.
- Continuous diagnostics detect sensor fault.
- Continuous monitoring of flow rate versus setpoint via LED (TD2).
- mA output provides repeatable indication of flow rate and fault detection (TD2).
- Flow can be measured over test points (TD2).
- Optional retractable fitting for dismantling under process conditions.
- Process conditions up to +450 °C (+850 °F) and 413 bar (6000 psi).
- Integral or remote electronics up to 150 m (500 ft).
- Suited for SIL1 and SIL2 loops (full FMEDA report available).

**APPLICATIONS**
- **MEDIA:** All types of gases and liquids.
- **VESSELS:** Pipe sizes down to 1/4”. Max sensor length up to 3.3 m. Can be installed at any angle vertically/horizontally, flanged, threaded or with compression fitting with or without hot or cold tap.
- **CONDITIONS:** Can be used on conductive and non conductive media, very light density to heavy viscous media (up to 10,000 cP). Can be set to ignore foam, aeration, turbulence, and cavitation.

**AGENCY APPROVALS**
- **ATEX**
  - For TD1 & TD2: II 1/2 G Ex e IIC T5/T4, flameproof enclosure with intrinsically safe probe circuitry (not valid for hermetically sealed relay option)
  - For TD2 only: II 2 G Ex d IIC T5/T4, flameproof enclosure (zone 1)

- **IEC**
  - For TD1 & TD2: Ex d [ib] / d + ib IIC T5/T4 Gb/Ga, flameproof enclosure with intrinsically safe probe circuitry (not valid for hermetically sealed relay option)
  - For TD2 only: Ex d IIC T5/T4 Gb, flameproof enclosure (zone 1)

- **FM/CSA**
  - Russian Authorisation Standards
  - Other approvals are available, consult factory for more details.
**THERMATEL® TD2**
Thermal dispersion switch for hygienic use

**DESCRIPTION**
Thermatel® TD2 switches can easily be adjusted to detect flow (gases and liquids), level or liquid-liquid interface. The TD2 is either V DC or V AC line powered and offers additional LED indication, time delay and mA output for diagnostics and trending.

The unit has both 3A and EHEDG approval for use in hygienic applications.

**FEATURES**
- Easy field calibration – pre-calibration from factory on request.
- Variable flow or flow / no flow detection of gases and liquids.
- Excellent low flow sensitivity.
- Automatic temperature compensation for repeatable alarm under varying process temperatures.
- Continuous diagnostics detect sensor fault.
- Continuous monitoring of flow rate versus setpoint via LED.
- mA output provides repeatable indication of flow rate and fault detection.
- Flow can be measured over test points.
- Suited for SIL1 loops (full FMEDA report available).

**APPLICATIONS**
- **MEDIA:** All types of gases and liquids.
- **VESSELS:** Max sensor length up to 3,3 m. Can be installed at any angle vertically/horizontally.
- **CONDITIONS:** Can be used on conductive and non conductive media, very light density to heavy viscous media (up to 10,000 cP). Can be set to ignore foam, aeration, turbulence, and cavitation.

**AGENCY APPROVALS**
- TNO - Hygienic Machinery Directive 98/37/EC annex 1, section 2.1
- EN 1672 part 2, Hygienic requirements
- EHEDG doc. 2 (second edit. March 2000) and doc. 8 (July 1999)

Other approvals are available, consult factory for more details.
Similar to our thermal dispersion switches also here two resistance temperature detectors (RTD) are fixed at the end of a probe. Specific for this device is that the sensors are protected to prevent damage if inserted into a pipe/channel.

One sensor measures the ambient temperature; the second sensor will vary in temperature to make sure that the temperature difference between the two sensors remains constant. The energy needed to do this is measured and recalculated to a mass flow of the known gas passing through the pipe/channel.
THERMATEL®
ENHANCED MODEL TA2
Thermal mass flow meter

DESCRIPTION
The Enhanced Model TA2 Thermal Mass Flow Meter provides reliable mass measurement for air and gas flow applications. The powerful, yet easy to use, electronics are contained in a compact flameproof enclosure. The TA2 is available with both insertion probes as well as flow body design for smaller pipe sizes. The TA2 offers excellent performance at an exceptional value.

FEATURES
- Direct mass flow measurement of air and gases.
- No need for temperature/pressure correction.
- High turndown ratio 100:1.
- Excellent low flow sensitivity.
- Low pressure drop.
- NIST traceable calibrations.
- Flow, temperature and totalised flow available over HART®.
- Advanced diagnostics check condition of probe, electronics, and wiring.
- Rotatable plug-in display module provides display of flow rate, temperature, totalised flow, plus diagnostic messages.
- Process temperatures up to +205 °C (+400 °F).
- Pressure rating up to 103 bar (1500 psi) dependent upon process connections.
- Probe can be field replaced.
  - Optional:
    - retractable probe assembly or valve with compression fitting
    - flow body for ½” to 4” pipe sizes
    - flow conditioning plate for flow bodies 1½” and higher.
  - Accepts both AC and DC power input.
- Optional pulse output plus second mA output which can be used for temperature or different flow range (passive output only).
- 2-line x 16 characters backlit display with 4-button keypad for ease of configuration.
- Calibration for two different gases.
- Language selections of English, German, French, Spanish and Russian.
- Rotatable housing.
- Suited for SIL 1 and SIL 2 loops (full FMEDA report available).

APPLICATIONS
- Combustion air.
- Digester/bio-gas.
- Compressed air/gas.
- Vent lines/tare headers.
- Natural gas.
- Hydrogen piping.
- Aeration lines.

AGENCY APPROVALS
- ATEX
  - II 2 G Ex d IIC T6 Gb, flameproof enclosure
  - II 1 / 2 G Ex d IIB / d [ib] II C T4 Ga/Gb
- cFMus
- Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
The liquid acts as an isolator between two conductors (probe and tank wall). When level rises, there is more gain of capacity into an analog or digital signal.
**KOTRON® 805**  
Smart RF level transmitter

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**DESCRIPTION**  
The Kotron® series 805 is a budget minded but “full function” 2-wire loop-powered 24 V DC, smart RF transmitter. The microprocessor based electronics allow the user to calibrate the 805 with only one small level change. The electronics are housed in an ergonomic dual compartment housing which is directly mounted on top of the probe.  
The Kotron® 805 comes in 2 versions:  
- blind transmitter  
- transmitter with local Magnecal™ system (display and keypad).

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**FEATURES**  
**Blind Transmitter:**  
- Password protected.  
- Calibration using HART® communication.  
- One small level change needed for initial calibration.  
- Full diagnostics using HART® communication.  
- Analog output: 3.8 mA to 20.5 per Namur NE 43.  
**Transmitter with local keypad/display:**  
- Calibration using HART®, or locally via a 2-line x 8 characters display and a 3-button keypad.  
- Continuous local display of level, % and loop signal.  
- Fault identification via FAULT message on display.  
**Other Features:**  
- Ergonomic - 45° angle, dual compartment housing isolates terminal board from electronics.  
- Transmitter head can be removed from probe without depressurising the vessel.  
- Process temperature max +540 °C @ 35 bar (+1000 °F @ 500 psi).  
- Process pressure max 345 bar @ +40 °C (5000 psi @ +100 °F).  
- Compatible with over 50 application oriented KOTRON® probes (see bulletin BE 50-125).

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**APPLICATIONS**  
Hydrocarbons & solvents.  
Corrosives, acids and caustics.  
Powders & granulars.  
High temperature/pressure liquids.

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**AGENCY APPROVALS**  
**ATEX**  
II 1G EEx ia IIC T4 (ambient -40 °C to +80 °C)  
II 1G EEx ia IIC T6 (ambient -40 °C to +40 °C)  
**FM/CSA**  
Other approvals are available, consult factory for more details.
**KOTRON® RF 2-WIRE**  
Level transmitter

**DESCRIPTION**

The Kotron® 2-wire RF capacitance transmitter is one of the most cost effective level transmitters available today. Compact in size, it employs state of the art technology for a stable, accurate signal in a wide range of materials.

**FEATURES**

- Uses state of the art technology to provide a stable, more accurate signal.
- 4-20 mA isolated output signal.
- Utilises a 24 V DC current loop for power source and signal transmission.
- Input voltage of 14 to 40 V DC at transmitter terminals.
- Potted electronics are vibration resistant, protect electronics from the environment and allow easy wiring.
- Has integral metering points to allow the local measurement of 4-20 mA loop current without breaking the two-wire circuit loop.
- Power indicator LED varies in brightness with level changes.
- Available with a full range of rigid and flexible sensing probes to 345 bar (5000 psi) and +540 °C (+1000 °F).

**APPLICATIONS**

- Clean or dirty liquids.
- Viscous liquids.
- Light slurries.
- Corrosive liquids.
- High temperature liquids.
- Chemicals.
- Hydrocarbons & solvents.
- Food & beverage.
- Powders & granulars.

**AGENCY APPROVALS**

- ATEX  
  II 1G EEx ia IIC T6, intrinsically safe

- FM/CSA

Other approvals are available, consult factory for more details.
RF CAPACITANCE
The Magnetic Level Indicator (MLI) consists of a sealed bypass cage, a float containing a magnet and a visual indicator rail with bi-coloured flags that individually contain a magnet. The indicator rail is external mount on the cage and its flags are magnetically coupled/aligned with the magnet of the float. As the level changes, the float will follow and its magnet will attract the magnets in the flags. This will cause the flags to rotate showing their opposite coloured side. The same electro-magnetic coupling will activate/deactivate switches or change the output of an externally clamped on magnetostrictive transmitter.
**DESCRIPTION**

Vector™ is a rugged, reliable and cost-effective Magnetic Level Indicator (MLI). Suitable for a variety of installations, Vector™ has many basic features and is precision-engineered and manufactured to ensure a long service life.

MLIs are widely used to replace high-maintenance sight and gauge class indicators and are increasingly used in new applications. Optional switches and transmitters are available to provide various output signals for level control.

**FEATURES**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rugged, industrial grade construction</td>
<td></td>
</tr>
<tr>
<td>Rail can be rotated to obtain better viewing position</td>
<td></td>
</tr>
<tr>
<td>Immediate and accurate response to level changes</td>
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<tr>
<td>Max process pressure of the float 85 bar (1230 psi)</td>
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<tr>
<td>Max process temp. +260 °C (+320 °F)</td>
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<tr>
<td>Min process temp. -40 °C (-40 °F)</td>
<td></td>
</tr>
<tr>
<td>Measuring range up to 5.5 m (18 ft)</td>
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<tr>
<td>Standard S.G. range from 0.54 - 1.50 kg/dm³</td>
<td></td>
</tr>
<tr>
<td>Floats are not vented nor gas filled</td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td></td>
</tr>
<tr>
<td>- scale in cm or tailor made</td>
<td></td>
</tr>
<tr>
<td>- reed type bi-stable switches</td>
<td></td>
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<tr>
<td>- reed chain transmitter with 4-20 mA output (HART® optional)</td>
<td></td>
</tr>
</tbody>
</table>

**APPLICATIONS**

**MEDIA:** Clean liquids.

**VESSELS:** Most process and storage tanks up to rated operating pressure and process temperature.

**FUNCTION:** Continuous liquid level or liquid-liquid interface indication.
**DESCRIPTION**

The Atlas is our standard high-performance magnetic level indicator. Atlas is a single chamber design with either a 2", 2 1/2", or 3" chamber diameter, as required by the application. There are twelve basic configuration styles including top mount models.

Atlas MLIs are produced in a wide range of materials, including exotic alloys and plastics. We also offer the most complete selection of process connection types and sizes in the industry.

Atlas can be equipped with a variety of level transmitters and switches as well as flag and shuttle indicators with or without stainless steel scales. This enables the Atlas to be a complete level and monitoring control.

Atlas™ may be equipped with the external mount Jupiter®, magnetostrictive transmitter, or with an Eclipse® Guided Wave radar in an enlarged cage.

**FEATURES**

- Precision manufactured float with multiple magnets and flux ring for an optimum Gauss rating.
- Indication rail filled with inert gas for elimination of condensation and a clear read off under all conditions.
- Rubber seal protects the glass of the indicator against heavy vibration and handling.
- Flags are designed with mechanical stop for stable indication of fast varying level changes.
- Shuttle followers for level and interface indication.
- Stainless steel flags in aluminium or stainless steel (optional) indication rail.
- 1/2" NPT vent and drain.
- Max hydrotest pressure of the float: 62 bar (900 psi) - higher pressure on request.
- Min operating process temperature: -50 °C (-60 °F) standard, down to -196 °C (-320 °F) on request.
- Max operating process temperature up to + 540 °C (up to +1000 °F) with factory supplied insulation.
- S.G. range as low as 0, 49 kg/dm³ (lower S.G. on request).
- Bottom and top spring protection of the float avoids float damage during transport, maintenance and surging/ flashing conditions.

Options:
- high and low temperature options
- stainless steel scale for level or volume
- Jupiter® magnetostrictive transmitter.

Several cage designs are available, consult factory for more details.

**APPLICATIONS**

**MEDIA:** Clean liquids with a S.G. ≥ 0,49 kg/dm³ incl. aggressive, toxic and flammable liquids / liquified gases.

**VESSELS:** Most process and storage tanks up to rated operating pressure and process temperature.

**FUNCTION:** Continuous liquid level or liquid-liquid interface indication.

**AGENCY APPROVALS**

**ATEX**
- II 1 G Ex ia IIC T4 Ga, Intrinsically safe
- II 1 G Ex ia IIC T4 Ga, FISCO – intrinsically safe
- II/2 G Ex d IIC T6 Ga/Gb, flameproof enclosure

**ATEX**
- Constructional safety: II 1 G C T6

**IEC**
- Ex ia IIC T4 Ga, Intrinsically safe
- Ex ia IIC T4 Ga, FISCO – intrinsically safe
- Ex d IIC T6 Ga/Gb, flameproof enclosure

**LRS**
- Lloyds Register of Shipping (marine applications) (pending)

**FM/CSA**
- Russian Authorisation Standards

Other approvals are available, consult factory for more details.
DESCRIPTION
This twin chamber design is unique to the Magnetic level gauge industry. Countless unique configuration styles are available with Gemini™. It can be produced in the same metal material selections as Atlas™.

The second chamber facilitates the installation of any of a wide selection of transmitters to provide continuous level monitoring in addition to the indication provided by the primary chamber. Eclipse® guided wave radar or direct insertion Jupiter® magnetostrictive level transmitters can be mounted in the secondary chamber to provide totally redundant indication with continuous level output. The primary chamber, which houses the float, can be fitted with clamp-on switches or transmitters for additional level control.

FEATURES
Precision manufactured float with multiple magnets and flux ring for an optimum Gauss rating.
Indication rail filled with inert gas for elimination of condensation and a clear read off under all conditions.
Rubber seal protects the glass of the indicator against heavy vibration and handling.
Flags are designed with mechanical stop for stable indication of fast varying level changes.
Shuttle followers for level and interface indication.
Stainless steel flags in aluminium or stainless steel (optional) indication rail.
1/2” NPT vent and drain.
Max hydrotest pressure of the float: 62 bar (900 psi) - higher pressure on request.
Min operating process temperature: -50 °C (-60 °F) standard, down to -196 °C (-320 °F) on request.
Max operating process temperature up to + 540 °C (up to +1000 °F) with factory supplied insulation.
S.G. range as low as 0, 49 kg/dm³ (lower S.G. on request).
Bottom and top spring protection of the float avoids float damage during transport, maintenance and surging/ flashing conditions.
Options:
- high and low temperature options
- stainless steel scale for level or volume
- Jupiter® magnetostrictive transmitter.
Several cage designs are available, consult factory for more details.

APPLICATIONS
MEDIA: Clean liquids with a S.G. ≥ 0.49 kg/dm³ incl. aggressive, toxic and flammable liquids / liquified gases.
VESSELS: Most process and storage tanks up to rated operating pressure and process temperature.
FUNCTION: Continuous liquid level or liquid-liquid interface indication.

AGENCY APPROVALS
ATEX
II 1 G Ex ia IIC T4 Ga, intrinsically safe
II 1 G Ex ia IIC T4 Ga, RISCO – intrinsically safe
II 1/2 G Ex d IIC T6 Ga/Gb, flameproof enclosure

ATEX Constructional safety: II 1 G C T6

IEC
Ex ia IIC T4 Ga, intrinsically safe
Ex ia IIC T4 Ga, RISCO – intrinsically safe
Ex d IIC T6 Ga/Gb, flameproof enclosure

LRS
Lloyds Register of Shipping (marine applications) (pending)

FM/CSA
Russian Authorisation Standards
Other approvals are available, consult factory for more details.
The buoyancy force works on the displacer which will vertically move in (increasing liquid level) and out (decreasing liquid level) the linear differential transformer (LVDT). Due to this movement voltages are induced in the secondary windings of the LVDT. These signals are then processed in the electronic circuitry and used to control the output signal.
DESCRIPTION

E3 Modulevels® are 2-wire, loop-powered level transmitters utilising the buoyancy principle to detect and convert liquid level changes into a stable output signal.

The linkage between the level sensing element and output electronics greatly simplifies mechanical design and construction. The in-line vertical design of the transmitter reduces instrument weight and the effects of process vibration on electronic circuitry components while simplifying installation.

FEATURES

Operation functions include:
- interface measurement and detection
- continuous level measurement
- density measurement.

2-line x 8 characters display LCD and 3-button keypad.

Easy bench configuration. No need for level simulation.

2-wire loop powered intrinsically safe level transmitter.

360° rotatable housing can be dismantled without depressurising the vessel.

Special options, materials and custom engineered features.

Suited for SIL 1 and SIL 2 loops. SFF of 92.3% (full FMEDA report available).

Several cage designs are available, consult factory for more details.

APPLICATIONS

MEDIA: Liquids with a S.G. as low as 0.23 and up to 2.2 kg/dm³ and interfaces with a minimum density difference of 0.10 kg/dm³.

VESSELS: Most process vessels up to +315 °C (+600 °F) process temperature and pressures up to 355 bar (5150 psi) or storage vessels e.g:
  - feedwater heaters
  - condensate drip pots
  - scrubbers
  - separators
  - receivers
  - flash tanks
  - knock out drums
  - boilers.

AGENCY APPROVALS

ATEX

II 1G Ex ia IIC T4, intrinsically safe
II 1/2G Ex d IIC T6, explosion proof

IEC

Ex ia IIC T4 Ga
Ex d IIC T6 Ga/Gb

FM explosion proof

Class I Div.1, Groups B,C,D
Class II Div.1, Groups E,F,G
Class III, Type 4X T5, IP66

FM intrinsically safe

Class I Div.1, Groups A,B,C,D
Class II Div.1, Groups E,F,G
Class III, Type 4X T4, IP66

LRS

Lloyds Register of Shipping (marine applications)

Russian Authorisation Standards

Other approvals are available, consult factory for more details.
PNEUMATIC MODULEVEL®  
Liquid level control

DESCRIPTION
Pneumatic Modulevel® controls are displacement actuated level sensors. They provide output signals in direct proportion to changes in liquid level.
Simple, modular design and proven magnetic coupling make Modulevel controls versatile, highly stable, vibration resistant and adaptable to extremes of temperature and pressure.

FEATURES
Standard models handle service temperatures from -100 °C to +370 °C (-150 °F to +700 °F) and pressure to 294 bar (4265 psi).
Stable output signal is unaffected by surface turbulence. Prevents control valve "hunting" and extends valve life.
Controller head may be removed and bench calibrated without dismantling or even depressurising the tank.
Accurate output signal provided over a wide specific gravity range.
316 SS displacer and trim.
Easy field calibration without moving tank liquid level, reducing installation time and cost.
Controller head rotates 360°, simplifies pneumatic piping hookup.
Pilot relay provides a 4 to 1 amplification of pilot pressure signal to speed valve response.
Built-in visual level indicator is independent of air supply.
Optional pneumatic to current interface transducer for use in electronic control applications.
Optional proportional plus integral control.
Optional differential gap (on-off) control.
Optional Hi-Lo electronic alarm signal provides inexpensive backup alarm.

APPLICATIONS
Pneumatic Modulevel® liquid level controls are widely used in utility power generation, chemical and petroleum processing operations, such as:
- steam generator feedwater heater regulation
- fractionating column level transmitter
- ethanamine level transmitter
- vent gas scrubber level control
- drip pot condensate level control
- flash tank level transmitter.
Several devices such as Eclipse, Modulevel,... are mounted in (custom designed) external cages. Depending on process connection, process condition, customer specification,... several possibilities are possible. Below are some typical examples. Many other designs are possible, consult the factory for more details.
A permanent magnet is attached to a pivoted switch actuator. As the float/displacer rises following the liquid level, it raises the attraction sleeve into the field of the magnet, which then snaps against the non-magnetic enclosing tube, actuating the switch. The enclosing tube provides a static pressure boundary between the switch mechanism and the process. On a falling level, the float/displacer deactivates the switch.
**T20 - T21**
Liquid float level switch

**DESCRIPTION**
T20 and T21 units are user friendly, reliable float switches designed for top mounting to tanks or vessels. T20 units utilise a single switch mechanism and float. T21 units utilise two switch mechanisms and two separate floats when widely spaced actuating levels are required. T20 and T21 models are available for any type of open or closed vessel with either threaded or flanged type mounting and actuating depths up to 1219 mm (48 inches).

**FEATURES**
Carbon or stainless steel process connection materials (other materials available on request).
Flanged and threaded process connections.
Process temperature up to +400 °C (+750 °F).
Up to 2 switch levels (T21).
S.G. as low as 0.60 kg/dm$^3$.
Process pressure up to 41.3 bar (600 psi).
Standard anti-corrosive protection.
Optional:
- NACE construction (MR-01-75)
- interface calibration
- special actuating levels
- special tank connections
- extreme temperature modifications
- class 1, Group B explosion proof electrical enclosure
- special exterior surface preparation and finish.
Suitable for SIL 2 loops (DPDT switch) (full FMEDA report available).

**APPLICATIONS**
Day tanks.
Condensate receivers.
Fuel storage tanks.
Cooling towers.
Flash tanks.
Interface.

**AGENCY APPROVALS**
ATEX
II 2G Ex d IIC T6 Gb, explosion proof
II 1G Ex ia IIC T6, intrinsically safe

IEC
Ex d IIC T6

CCE
explosion proof and intrinsically safe

FM
Class I, Div. 1, Groups C & D
Class II, Div. 1, Groups E, F & G, Type NEMA 7/9

FM/CSA
Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9

LRS
Lloyd’s Register of Shipping (marine applications)

Russian Authorisation Standards

Other approvals are available, consult factory for more details.
**A10/15 - B10/15 - C10/15**
Liquid displacer level switch

**DESCRIPTION**
Magnetrol’s displacement type level switches offer the industrial user a wide choice of alarm and control configurations. Each unit utilises a simple buoyancy principle and is well suited for simple or complex applications, such as foaming or surging liquids or agitated fluids, and usually costs less than other types of level switches.

**FEATURES**
- Narrow or wide level ranges achieved through multiple switch mechanism capability.
- Maximum process temperature: +260 °C (500 °F).
- Maximum process pressure: 55.1 bar (800 psi).
- S.G. as low as 0.4 kg/dm³.
- Displacers adjustable at any point along the suspension cable.
- Anti-surge design eliminates the possibility of switch short cycling.
- Standard 3 m (10 ft) of suspension cable, included for all models.
- Field adjustable set point and switch differential.
- Wide choice of displacer materials.
- Wide choice of housings and switch mechanisms.
- Standard anti-corrosive protection.
- Optional:
  - NACE construction (MR-01-75)
  - proof-er® ground check
  - floating roof models
  - high pressure models
  - models for interface.
- Suited for SIL 2 loops (DPDT switch) (full FMEDA report available).

**APPLICATIONS**
- Foaming or surging liquids.
- Paints.
- Agitated fluids.
- Varnishes.
- Sewage handling.
- Heavy oils.
- Dirty liquids.
- Liquids with solids.

**AGENCY APPROVALS**
- ATEX
  - II 2G Ex d IIC T6 Gb, explosion proof
  - II 1G Ex ia IIC T6, intrinsically safe
- IEC
  - Ex d IIC T6
- CCE
  - explosion proof and intrinsically safe
- FM
  - Class I, Div. 1, Groups C & D
  - Class II, Div. 1, Groups E, F & G, Type NEMA 7/9
- FM/CSA
  - Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9
- LRS
  - Lloyds Register of Shipping (marine applications)
- Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
### TUFFY® T3
Side mounting level control

#### DESCRIPTION
Tuffy liquid level switches are float actuated devices designed for horizontal mounting in a tank or vessel through threaded or flanged pipe connections. The compact size allows for installation in small vessels, while its many features provide a variety of application uses. The single switch mechanism is available in SPDT or DPDT forms on units designed for adjustable, narrow or wide differential and interface service.

#### FEATURES
- **Maximum process temperature:** +400 °C (+750 °F).
- **Minimum process temperature:** -55 °C (-65 °F).
- **Maximum process pressure:** 150 bar (2160 psi).
- **S.G.** as low as 0.4 kg/dm$^3$.
- Wetted parts in 316/316L (1.4401/1.4404) or Hastelloy C (2.4819).
- Available as:
  - flanged
  - threaded
  - flanged or sealed cage mounted.
- Suited for SIL 2 loops (DPDT switch) (full FMEDA report available).

#### MODELS
- Narrow differential switch (for alarm functions):
  - standard pressure (up to 50 bar (720 psi))
  - high pressure (up to 150 bar (2160 psi)).
- Wide adjustable differential switch (for control functions).
- Interface switch (detection of interface level between liquids).
- External cages.
- Compact versions:
  - pneumatic narrow differential switch
  - electric narrow differential switch.

#### APPLICATIONS
- Sour service (NACE).
- High/low alarm.
- Single pump control.
- Day storage tanks.
- Corrosive processes.
- Process vessels.
- Boiler low water cut off.
- Interface level.
- Installations in hazardous area.

#### AGENCY APPROVALS
- **ATEX**
  - II 1/2G Ex d IIC T6 Ga/Gb, explosion proof
  - II 1G Ex ia IIC T6, intrinsically safe
- **FM/CSA**
  - Explosion proof
- Other approvals are available, consult factory for more details.
T62 - T64 - T67
Side mounting liquid float level switch

DESCRIPTION
Side mounting controls mount horizontally to any tank or vessel through a threaded or flanged pipe connection. Standard models are normally equipped with a single switch mechanism for high or low level alarm or control applications. Tandem models with two switch mechanisms are available for two level stage applications, providing the operating functions of two separate instruments such as high and low level alarm.

FEATURES
- Carbon or stainless steel body materials (other materials available on request).
- Flanged and threaded process connections.
- Process temperature up to +400 °C (+750 °F).
- Up to 2 switch levels (T67).
- S.G. as low as 0.40 kg/dm³.
- Process pressure up to 82.7 bar (1200 psi).
- Field adjustable level differentials from 32 mm (1.25”) up to 409 mm (16.12”).
- Standard anti-corrosive protection.
- Optional:
  - NACE construction (MR-01-75)
  - interface calibration
  - special actuating levels
  - code compliance construction
  - special tank connections
  - extreme temperature modifications
  - Class 1, Group B explosion proof electrical enclosure
  - special exterior surface preparation and finish.

APPLICATIONS
- Foaming or surging liquids.
- Varnishes.
- Sewage handling.
- Heavy oils.
- Paints.
- Liquids with solids.

AGENCY APPROVALS
- ATEX
  - II 2G Ex d IIC T6 Gb, explosion proof
  - II 1G EE x ia IIC T6, intrinsically safe
- IEC
  - Ex d IIC T6
- CCE
  - explosion proof and intrinsically safe
- FM
  - Class I, Div. 1, Groups C & D
  - Class II, Div. 1, Groups E, F & G, Type NEMA 7/9
- FM/CSA
  - Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9
- LRS
  - Lloyds Register of Shipping (marine applications)

Russian Authorisation Standards
Other approvals are available, consult factory for more details.
### Description
The B40 liquid level switch is specifically designed and constructed for high pressure, high temperature service conditions. These type level switches are completely self-contained units designed for side mounting to a tank or vessel with welded or flanged pipe connections.

### Features
- Cr Mo (Chrome - molybdenum), carbon steel or stainless steel welded float cages.
- Process temperature up to +540 °C (+1000 °F).
- Single switch level.
- S.G. as low as 0.65 kg/dm³.
- Process pressure up to 207 bar @ +370 °C (3000 psi @ +700 °F).
- Standard anti-corrosive protection.
- Optional:
  - special tank connections
  - extreme temperature modifications
  - Class 1, Group B explosion proof electrical enclosure.
- Suited for SIL 2 loops (DPDT switch) (full FMEDA report available).

### Applications
- Accumulators.
- Flash tanks.
- Receivers.
- Knock out drums.
- Flare pots.
- Storage tanks.
- Scrubbers.
- Separators.

### Agency Approvals
- ATEX II 2G Ex d IIC T6 Gb, explosion proof
- IEC Ex d IIC T6
- CCE Explosion proof
- FM Class I, Div. 1, Groups C & D
  - Class II, Div. 1, Groups E, F & G, Type NEMA 7/9
- FM/CSA Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9
- LRS Lloyds Register of Shipping (marine applications)
- Russian Authorisation Standards
  - Other approvals are available, consult factory for more details.
EXTERNAL CAGE
Liquid float / displacer level switch

DESCRIPTION
External cage type level switches are completely self-contained units designed for side mounting to a tank or vessel with threaded or flanged pipe connections. These switches are engineered to customer specifications.

FEATURES
- Carbon or stainless steel welded float cages (other materials available on request).
- Process temperature up to +400 °C (+750 °F).
- Up to 3 switch levels.
- Standard anti-corrosive protection.
- Sealed/Flanged cages:
  - S.G. as low as 0.34 kg/dm³
  - Process pressure up to 138 bar (2000 psi) for floats
  - Process pressure up to 345 bar (5000 psi) for displacers.
- Optional:
  - NACE construction (MR-01-75)
  - Interface calibration
  - Customised installation dimensions
  - Special actuating levels
  - Code compliance construction
  - Special tank connections
  - Extreme temperature modifications
  - Class 1, Group B explosion proof electrical enclosure
  - Special exterior surface preparation and finish.
- Suited for SIL 2 loops (DPDT switch) (full FMEDA report available).

APPLICATIONS
- Foaming or surging liquids.
- Paints.
- Agitated fluids.
- Varnishes.
- Sewage handling.
- Heavy oils.
- Dirty liquids.
- Liquids with solids.

AGENCY APPROVALS
- ATEX
  II 2G Ex e IIC T6 Gb, explosion proof
  II 1G Ex ia IIC T6, intrinsically safe
- IEC
  Ex d IIC T6
- CCE
  Explosion proof and intrinsically safe
- FM
  Class I, Div. 1, Groups C & D
  Class II, Div. 1, Groups E, F & G, Type NEMA 7/9
- FM/CSA
  Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9
- LRS
  Lloyds Register of Shipping (marine applications)

Russian Authorisation Standards
- Other approvals are available, consult factory for more details.
As with our electronic products our buoyancy products can also be mounted in (custom designed) external cages. It will again depend on process connection, process condition, customer specification, … how the external cage will be designed. Below are some typical examples. Many other designs are possible, consult the factory for more details.
F10
The actuating vane is magnetically linked to a pivoted electric (or pneumatic) switch, which is isolated from the process by a non-magnetic barrier tube. As the actuating vane moves with an increase in flow, it drives a magnetic sleeve into the field of a permanent magnet located outside the barrier tube which trips the switch. As flow decreases, the actuating vane returns to a vertical position, allowing the magnet and switch assembly to return to the “No Flow” position.

F50
The rate of flow through the valve body raises or lowers the disc. This in turn raises or lowers the magnetic sleeve, within its sealed non-magnetic barrier tube. On an increasing flow rate, the magnetic sleeve rises into the field of the permanent magnet, located outside the barrier tube, actuating the attached switch mechanism. When the flow rate drops, below the rate for which the flow disc is calibrated, a reversal of this action occurs.
**F10 - F50**

**Flow switch**

**DESCRIPTION**

Flow switches are highly reliable devices sensing the start or stop of flow in horizontal pipelines containing oil and petroleum derivatives, chemicals, water, or air.

Vane actuated model F10 switches are used on gas or liquid flow applications in 2” or larger pipe sizes.

Disc actuated model F50 switches are in-line type sensing clean liquids in 2” or smaller pipe sizes.

**FEATURES**

- Actuation on increasing or decreasing flow.
- Special sensing elements for non-standard or high flow applications.
- Designed for horizontal pipe applications.
- Standard anti-corrosive protection.

Model F10:

- field adjustable
- low pressure drop
- process temperature up to +230 °C (+450 °F)
- process pressure up to 69 bar (1000 psi)
- standard flow vanes for 2” thru 10” flow lines.

Model F50:

- no calibration required
- bronze or stainless steel construction
- process temperature up to +400 °C (+750 °F)
- process pressure up to 79.3 bar (1150 psi)
- bodies for flow lines from 3/4” to 2”.

**APPLICATIONS**

- Pump staging or failure.
- Pipeline flow detection.
- Valve failure.
- Loss of pipeline flow.
- Pipe blockage/rupture.
- Pump inlet flow protection.
- Check valve blockage/leakage.
- Alarm on eyewash or shower safety station.

**AGENCY APPROVALS**

- ATEX  II 2G Ex d IIC T6 Gb, explosion proof
- IEC Ex d IIC T6
- CCE explosion proof and intrinsically safe
- FM Class I, Div. 1, Groups C & D
- FM/CSA Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9
- LRS Lloyds Register of Shipping (marine applications)
- Russian Authorisation Standards

Other approvals are available, consult factory for more details.
MECHANICAL FLOW
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Ex</strong></td>
<td>Is the EU symbol for explosive atmospheres. It indicates that the concerned device can be used in a well specified explosive atmosphere.</td>
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<tr>
<td><strong>ATEX</strong></td>
<td>Stands for &quot;Atmosphères Explosives&quot; (Explosive Atmospheres) and is the name for the respective directive giving the legal requirements for controlling explosive atmospheres and the suitability of equipment and protective systems used in these environments.</td>
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<tr>
<td><strong>IEC</strong></td>
<td>The International Electrotechnical Commission is the leading global organization that publishes consensus-based International Standards and manages conformity assessment systems for electric and electronic products, systems and services, collectively known as electrotechnology.</td>
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<tr>
<td><strong>PED</strong></td>
<td>The purpose of the Pressure Equipment Directive is to harmonise national laws of Member States regarding the design, manufacture, testing and conformity assessment of pressure equipment and assemblies of pressure equipment. More in particular the Directive concerns items such as vessels, pressurised storage containers, heat exchangers, steam generators, boilers, industrial piping, safety devices and pressure accessories.</td>
</tr>
<tr>
<td><strong>SIL</strong></td>
<td>Safety Integrity Level is a measure of the safety risk of a given process. The higher the SIL level, the greater the impact of failure and the lower the failure rate that is acceptable.</td>
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<tr>
<td><strong>HART</strong></td>
<td>The HART® (Highway Addressable Remote Transducer) Protocol is the global standard for sending and receiving digital information across analog wires between smart devices and control or monitoring system.</td>
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<tr>
<td><strong>FDT</strong></td>
<td>Field Device Tool standardizes the communication and configuration interface between all field devices and host systems. FDT provides a common environment for accessing the devices’ most sophisticated features. Any device can be configured, operated, and maintained through the standardized user interface – regardless of supplier, type or communication protocol.</td>
</tr>
<tr>
<td><strong>PACTware®</strong></td>
<td>PACTware® (Process Automation Configuration Tool) is a frame program that operates on a PC or control system. It is a device-independent software program that communicates with all approved DTMs.</td>
</tr>
<tr>
<td><strong>DTM</strong></td>
<td>DTM (Device Type Manager) is not a stand-alone program but a device-specific software driver designed to operate within a frame program such as PACTware. It includes all special information needed to communicate with a specific device. There are two basic categories of DTMs—Communication (e.g., HART, Fieldbus, Profibus) and Field Device.</td>
</tr>
<tr>
<td><strong>EHEDG</strong></td>
<td>European Hygienic Engineering &amp; Design Group is a consortium of equipment manufacturers, food industries, research institutes as well as public health authorities developing guidelines for equipment used throughout the hygienic industries.</td>
</tr>
<tr>
<td><strong>IP</strong></td>
<td>Ingress Protection (IP) ratings are developed by the European Committee for Electro Technical Standardization (CENELEC), specifying the environmental protection the enclosure of a device provides.</td>
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