KSR Magnetostrictive Level Transmitters (High Accuracy)
KSR Magnetostrictive Level Transmitters

**Approvals**

- ATEX 94/9/EC
- PED 97/23/EC

**Germany**

- Technischer Überwachungsverein Südwestdeutschland e.V.
- IBExU Institut für Sicherheitstechnik GmbH
- Physikalisch Technische Bundesanstalt PTB
- Bundesamt für Wehrtechnik und Beschaffung
- Germanischer Lloyd

**Netherlands**

- KEMA
- Nederlands Laboratorium voor Elektrotechniek (KEMA)

**France**

- Laboratoire Central des Industries Électriques (LCIE)
- Bureau Veritas

**Denmark**

- DEMKO
- Det Norske Veritas

**Norway**

- Det Norske Veritas

**Russia**

- Gosgortechnadzor OGS Oil & Gas Safety
- GOST Permission to use Pattern Approval/EX

**USA**

- Factory Mutual Research Corporation

**Contents**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSR Magnetostrictive Level Transmitters</td>
<td>4</td>
</tr>
<tr>
<td>Description</td>
<td>4</td>
</tr>
<tr>
<td>Type code</td>
<td>5</td>
</tr>
<tr>
<td>Stainless steel 1.4571 (316Ti)</td>
<td>6</td>
</tr>
<tr>
<td>Food Industry - Design</td>
<td>7</td>
</tr>
<tr>
<td>Pharmaceutical Design</td>
<td>8</td>
</tr>
<tr>
<td>PVC, Polypropylene, PVDF</td>
<td>9</td>
</tr>
<tr>
<td>Stainless steel E-CTFE-coated</td>
<td>10</td>
</tr>
<tr>
<td>Stainless steel PTFE-lined</td>
<td>10</td>
</tr>
<tr>
<td>Magnetic Level Gauge / Bypass - Design</td>
<td>11</td>
</tr>
<tr>
<td>Float designs</td>
<td>12</td>
</tr>
<tr>
<td>Length limitations for FFG-...-Ex</td>
<td>13</td>
</tr>
<tr>
<td>KSR KUEBLER Quality</td>
<td>14</td>
</tr>
</tbody>
</table>
KSR Magnetostrictive Level Transmitters

KSR Magnetostrictive Level Transmitters Type FFG-T-... are used for continuous, remote liquid level measurement and based on position monitoring of a magnetic float following the magnetostrictive principle.

The measuring process is initiated by a current impulse. This current generates an axial magnetic field (3) along the length of a wire (1) made of magnetostrictive material, which is held under tension inside the guide tube. The float, which sits on the liquid surface, is fitted with permanent magnets (4). When the pulse reaches the float the two magnetic fields interact and a torsional force results.

A torsional stress wave (5) is induced in the wire. A piezoceramic converter in the transmitter housing (2) at the end of the wire converts this into an electrical signal. By measuring the elapsed transit time, it is possible to determine the start point of the torsional stress wave and therefore the float position with a high degree of accuracy.

Technical advantages

The simple and effective principle of operation makes these devices ideally suited for a plethora of applications.

Constant measurement of liquid levels, independent of physical and chemical changes of the medium, such as: foaming, conductivity, dielectric constant, pressure, vacuum, temperature, vapours, condensation, bubbles, boiling effects, S.G. changes.

Signal transmission over long distances.

Simple installation and commissioning - one-off initial calibration adjustment, no further calibration necessary.

Interface and total level measurement at $\Delta$-S.G. $\geq$ 50 kg / m$^3$.

Application limits:

$T = -200^\circ\text{C}$ to $+200^\circ\text{C}$

$P = \text{vacuum to 100 bar}$

$\rho \geq 400 \text{ kg/m}^3$

Availability of many corrosion resistant materials facilitates use in applications in all industry sectors: chemical, petrochemical, oil and gas, pharmaceutical, off-shore, ship building, power plants, manufacturing, water treatment, food and beverages.

Application specific designs and solutions available.

Explosion-proof designs.
# Type code

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic type</td>
<td>FFG</td>
<td>Transmitter Housing</td>
</tr>
<tr>
<td>2</td>
<td>Transmitter housing stainless steel</td>
<td>T</td>
<td>Process connection</td>
</tr>
<tr>
<td>3</td>
<td>R</td>
<td>Stainless steel 1.4571 (316Ti)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NPT</td>
<td>Stainless steel electropolished</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MR</td>
<td>Stainless steel E-CTFE-coated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Stainless steel PTFE-lined</td>
<td></td>
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<td></td>
<td>FC</td>
<td>Titanium</td>
<td></td>
</tr>
<tr>
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<td>IS</td>
<td>Hastelloy B</td>
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</tr>
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<td>PVDF</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Flange nominal size</td>
<td>DN 50 - DN 150</td>
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</tr>
<tr>
<td></td>
<td>Flange pressure rating</td>
<td>Class 150 - 600</td>
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<tr>
<td></td>
<td>Flange face</td>
<td>Standard Form C optional E.A.F.N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guide tube (sensor tube) material</td>
<td>Stainless steel 1.4571 (316Ti)</td>
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<td></td>
<td>PVDF</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Guide tube length</td>
<td>Measuring range</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diameter</td>
<td>Tube OD</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>L</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float design (Page 12)</td>
<td>Float OD</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Material (Code 5)</td>
<td>Float OD</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Approvals</td>
<td>Ex-Design</td>
<td></td>
</tr>
</tbody>
</table>

## Type code example:

<table>
<thead>
<tr>
<th>Code</th>
<th>Basic Type</th>
<th>Transmitter Housing</th>
<th>Connection Material</th>
<th>Connection Size</th>
<th>Guide tube Material</th>
<th>Guide tube length Measuring range</th>
<th>Float</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FFG</td>
<td>T</td>
<td>FV</td>
<td>50/60/12</td>
<td>V</td>
<td>L950/M850/12</td>
<td>V44A</td>
<td>Ex</td>
</tr>
</tbody>
</table>
KSR Magnetostrictive Level Transmitters
Stainless steel 1.4571 (316Ti)

Type code Ex only:
II 1G Ex ia IIC T6-T3
ExeU 02 ATEX 1124 X

Electrical connection
Transmitter housing stainless steel 1.4301, Ingress protection IP68

Process connection
Mounting thread
BSP 1½" or BSP 2"

Guide tube OD
12 mm
18 mm

Guide tube length max.
3000 mm
6000 mm

Float
V44A, V52A, V62A, V83A
V80A, V98A, V105A, V120A

Limit S.G. 85%
Nominal S.G. 50%
see page 12 (float designs)

Nominal pressure
see page 12 (float designs)

Temperature range
Liquid -45°C ... +125°C
Liquid -200°C ... +200°C
Transmitter housing -40°C ... +85°C

Ex-Design
Category 1/2
T6 -25°C ... +85°C
T5 -25°C ... +100°C
T4 -25°C ... +135°C
T3 -25°C ... +150°C

Connection 2-wire
Supply voltage 10 ... 30 VDC
Output signal 4 ... 20 mA

Permissible circuit values
Type of protection intrinsically safe Ex ib IIC
Uj < 30 V ; I < 200 mA ; L < 250 µF ; C < 5 nF

Error signal Adjustable to 3.6 mA or 21.5 mA

Accuracy / linearity Better ±0.5 mm

Resolution < 0.1 mm

Analogue section ± 0.1 % (20°C) + 0.005 % / K

Load 900 Ohm at Uj = 30V DC ; 650 Ohm at Uj = 24V DC ; 100 Ohm at Uj = 12V DC
KSR Magnetostrictive Level Transmitters

Food Industry Design
Stainless steel 1.4404, 1.4435 (316L)

Type code Ex only:
II 1/2G EEx ia IIC T6-T3
IEExU 02 ATEX 1124 X

Electrical connection
Transmitter housing stainless steel 1.4301, Ingress protection IP68

Process connection
Dairy pipe fitting to DIN 11851
DN50 - DN150
Clamp-connection to DIN 32676 (Triclamp)
DN25 - DN100 or 1" - 4"

Guide tube OD
12 mm
18 mm

Guide tube length max.
3000 mm
6000 mm

Float
V44A, V52A, V62A, V83A
V80A, V98A, V105A, V120A

Limit S.G. 85%
Nominal S.G. 50%
Nominal pressure see page 12 (float designs)

Temperature range
Liquid -45° C ... +125° C
Standard design
Liquid -20° C ... +200° C
HT design
Transmitter housing -40° C ... +85° C

Ex-Design
Category 1/2
Transmitter housing
T6 -25° C ... +85° C
-40° C ... +100° C
T5 -25° C ... +150° C
-40° C ... +200° C
T4 -25° C ... +150° C
-40° C ... +135° C
T3 -25° C ... +150° C
-40° C ... +100° C

Connection
2-wire

Supply voltage
10 ... 30 VDC

Output signal
4 ... 20 mA

Permissible circuit values
Type of protection intrinsically safe EEx ia IIC
U, < 30 V ; I, < 200 mA ; L, < 250 µH ; C, < 5 nF

Error signal
Adjustable to 3.6 mA or 21.5 mA

Accuracy / linearity
Better ±0.5 mm

Resolution
< 0.1 mm

Analogue section
± 0.1 % (20° C) + 0.005 % / K

Load
900 Ohm at U, = 30V DC ; 650 Ohm at U, = 24V DC ; 100 Ohm at U, = 12V DC
**KSR Magnetostrictive Level Transmitters**

**Pharmaceutical Design**

**Stainless steel 1.4435 (316L) and 1.4539**

Type code Ex only:

II 1/2G Ex ia IIC T6-T3

IBExU 02 ATEX 1124 X

Electrical connection Transmitter housing stainless steel 1.4301, Ingress protection IP68

Process connection

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS</td>
<td>Sanitary nozzle (Ingold nozzle)</td>
</tr>
<tr>
<td>FC</td>
<td>Clamp-connection (Triclamp)</td>
</tr>
<tr>
<td>MR</td>
<td>Dairy pipe fitting DIN 11851 or other sanitary fittings</td>
</tr>
<tr>
<td>F</td>
<td>Flange (DIN, ANSI, JIS)</td>
</tr>
</tbody>
</table>

Guide tube OD 17.2 mm Stainless steel 1.4435 or 1.4539, ground and polished, R\(^a\) < 0.4

Guide tube length max. 6000 mm

Float

- **V80/88R4/3A/35**: Stainless steel 1.4435, ground and polished, R\(^a\) < 0.4
- **V80R/4V/39**: Stainless steel 1.4539, electropolished

Limit S.G. 85% 715 kg/m\(^3\)

Nominal S.G. 50% 1220 kg/m\(^3\)

Nominal pressure 10 bar

Temperature range

- Liquid: -45°C ... +125°C Standard design
- Liquid: -200°C ... +200°C HT design
- Transmitter housing: -40°C ... +85°C

Ex-Design

<table>
<thead>
<tr>
<th>Category</th>
<th>Liquid Temperature</th>
<th>Transmitter Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-25°C ... +85°C</td>
<td>-40°C ... +40°C</td>
</tr>
<tr>
<td>T5</td>
<td>-25°C ... +100°C</td>
<td>-40°C ... +55°C</td>
</tr>
<tr>
<td>T4</td>
<td>-25°C ... +135°C</td>
<td>-40°C ... +85°C</td>
</tr>
<tr>
<td>T3</td>
<td>-25°C ... +150°C</td>
<td>-40°C ... +85°C</td>
</tr>
</tbody>
</table>

Connection 2-wire

Supply voltage 10 ... 30 VDC

Output signal 4 ... 20 mA

Permissible circuit values Type of protection intrinsically safe EEx lb IIC U\(_1\) < 30 V ; I < 200 mA ; L < 250 μH ; C < 5 nF

Error signal Adjustable to 3.6 mA or 21.5 mA

Accuracy / Linearity Better ±0.5 mm

Resolution < 0.1 mm

Analogue section ±0.1 % (20°C) + 0.005 % / K

Load 900 Ohm at U\(_2\) = 30V DC ; 650 Ohm at U\(_2\) = 24V DC ; 100 Ohm at U\(_2\) = 12V DC
KSR Magnetostrictive Level Transmitters

PVC, Polypropylene, PVDF

**PVC**
- **Material:** FFG-T-RP,...-P-L.../M.../..-P..A
- **Electrical connection:** Transmitter housing stainless steel 1.4301, Ingress protection IP68
- **Process connection Mounting thread Mounting flange:** BSP 2" to DIN: DN 65 - DN 125, PN 10 Form to ANSI: 21/2" - 5", Class 150 FF
- **Guide tube OD:** 20 mm
- **Guide tube length max.:** 5000 mm
- **Float PVC** P55A/26 or P80A
- **Polypropylene** PP55A/26 or PP80A
- **PVDF** PFS5A/26 or PFS80A
- **Limit S.G. 85%** see page 12 (float designs)
- **Nominal S.G. 50%**
- **Nominal pressure max.:** 3 bar
- **Temperature range Liquid:** 0°C ... +60°C PVC
- **-10°C ... +80°C Polypropylene**
- **-10°C ... +100°C PVDF**
- **Transmitter housing:** -40°C ... +85°C
- **Connection:** 2-wire
- **Supply voltage:** 10 ... 30 VDC
- **Output signal:** 4 ... 20 mA
- **Error signal:** Adjustable to 3.6 mA or 21.5 mA
- **Accuracy / linearity:** Better ±0.5 mm
- **Resolution:** < 0.1 mm
- **Analogue section:** ± 0.1 % (20°C) + 0.005 % / K
- **Load 900 Ohm at **U** = 30 V DC ; 650 Ohm at **U** = 24 V DC ; 100 Ohm at **U** = 12 V DC

**Polypropylene**
- **Material:** FFG-T-RPP,...-PP-L.../M.../..-PP..A
- **Electrical connection:** Transmitter housing stainless steel 1.4301, Ingress protection IP68
- **Process connection Mounting thread Mounting flange:**
- **Guide tube OD:** 20 mm
- **Guide tube length max.:** 5000 mm
- **Float Polypropylene** PP55A/26 or PP80A
- **Limit S.G. 85%** see page 12 (float designs)
- **Nominal S.G. 50%**
- **Nominal pressure max.:** 3 bar
- **Temperature range Liquid:** 0°C ... +60°C PVC
- **-10°C ... +80°C Polypropylene**
- **-10°C ... +100°C PVDF**
- **Transmitter housing:** -40°C ... +85°C
- **Connection:** 2-wire
- **Supply voltage:** 10 ... 30 VDC
- **Output signal:** 4 ... 20 mA
- **Error signal:** Adjustable to 3.6 mA or 21.5 mA
- **Accuracy / linearity:** Better ±0.5 mm
- **Resolution:** < 0.1 mm
- **Analogue section:** ± 0.1 % (20°C) + 0.005 % / K
- **Load 900 Ohm at **U** = 30 V DC ; 650 Ohm at **U** = 24 V DC ; 100 Ohm at **U** = 12 V DC

**PVDF**
- **Material:** FFG-T-RPF,...-PF-L.../M.../..-PF..A
- **Electrical connection:** Transmitter housing stainless steel 1.4301, Ingress protection IP68
- **Process connection Mounting thread Mounting flange:**
- **Guide tube OD:** 20 mm
- **Guide tube length max.:** 5000 mm
- **Float PVDF** PF55A/26 or PF80A
- **Limit S.G. 85%** see page 12 (float designs)
- **Nominal S.G. 50%**
- **Nominal pressure max.:** 3 bar
- **Temperature range Liquid:** 0°C ... +60°C PVC
- **-10°C ... +80°C Polypropylene**
- **-10°C ... +100°C PVDF**
- **Transmitter housing:** -40°C ... +85°C
- **Connection:** 2-wire
- **Supply voltage:** 10 ... 30 VDC
- **Output signal:** 4 ... 20 mA
- **Error signal:** Adjustable to 3.6 mA or 21.5 mA
- **Accuracy / linearity:** Better ±0.5 mm
- **Resolution:** < 0.1 mm
- **Analogue section:** ± 0.1 % (20°C) + 0.005 % / K
- **Load 900 Ohm at **U** = 30 V DC ; 650 Ohm at **U** = 24 V DC ; 100 Ohm at **U** = 12 V DC
KSR Magnetostrictive Level Transmitters

Stainless steel ECTFE-coated and PTFE-lined

Option: anti-static

Electrical connection
Transmitter housing stainless steel 1.4301, Ingress protection IP68

Process connection
Mounting flange to DIN DN50 - DN200, PN6 - PN100 or to ANSI 2" - 8", Class 150 - 600

Guide tube OD
18 mm, 25 mm, PTFE-Sleeve = 3.5 mm thick

Guide tube length max.
4000 mm, 5000 mm

Float
VEC81A, VEC99A, VEC106A, VEC121A, TF80A, TF90A

Limit S.G. 85% see page 12 (float designs)
Nominal S.G. 50% see page 12 (float designs)
Nominal pressure max. 3 bar

Temperature range
Process dep. on liquid Transmitter housing -40°C ... +85°C

Connection 2-wire
Supply voltage 10 ... 30 VDC
Output signal 4 ... 20 mA
Error signal Adjustable to 3.6 mA or 21.5 mA
Accuracy / linearity Better ±0.5 mm
Resolution < 0.1 mm
Analogue section ± 0.1 % (20°C) + 0.005 % / K
Load 900 Ohm at U = 30V DC ; 650 Ohm at U = 24V DC ; 100 Ohm at U = 12V DC
**KSR Magnetostrictive Level Transmitters**

**Magnetic Level Gauge / Bypass Design**

**Type code Ex only**

II 2G EEx ib IIC T6-T3  
IBExU 02 ATEX 1124 X

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**FFG-BT-V-L.../M.../12 (-Ex)**

**Electrical connection**

Transmitter housing stainless steel 1.4301, Ingress protection IP68

**Sensor tube OD**

OD 12 mm

**Sensor length**

200 mm ... 6000 mm

**Permissible ambient temperature**

<table>
<thead>
<tr>
<th>Sensor tube</th>
<th>Transmitter housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45°C ... +125°C</td>
<td>-40°C ... +65°C</td>
</tr>
<tr>
<td>-200°C ... +200°C</td>
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</tbody>
</table>

Standard design

HT design

**Ex-Design Category**

<table>
<thead>
<tr>
<th>Category 2</th>
<th>Sensor tube</th>
<th>Transmitter housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-25°C ... +85°C</td>
<td>-40°C ... +60°C</td>
</tr>
<tr>
<td>T5</td>
<td>-25°C ... +100°C</td>
<td>-40°C ... +55°C</td>
</tr>
<tr>
<td>T4</td>
<td>-25°C ... +135°C</td>
<td>-40°C ... +85°C</td>
</tr>
<tr>
<td>T3</td>
<td>-25°C ... +150°C</td>
<td>-40°C ... +85°C</td>
</tr>
</tbody>
</table>

**Connection**

2-wire

**Supply voltage**

10 ... 30 VDC

**Output signal**

4 ... 20 mA

**Permissible circuit values**

Type of protection intrinsically safe EEx ib IIC  
U < 30 V ; I < 200 mA ; L < 250 µH ; C < 5 nF

Error signal

Adjustable to 3.6 mA or 21.5 mA

**Accuracy / linearity**

Better ±0.5 mm

**Resolution**

< 0.1 mm

**Analogue section**

± 0.1 % (20°C) + 0.005 % / K

**Load**

900 Ohm at U_a = 30V DC ; 650 Ohm at U_a = 24V DC ; 100 Ohm at U_a = 12V DC

---

Type code Ex only
## Spherical floats (S)

<table>
<thead>
<tr>
<th>Material</th>
<th>Type Code 6</th>
<th>Shape</th>
<th>A OD [mm]</th>
<th>B OD [mm]</th>
<th>C OD [mm]</th>
<th>Max. operating pressure [bar]</th>
<th>Max. operating temp. [°C]</th>
<th>Weight [g]</th>
<th>Volume [cm³]</th>
<th>Limit S.G. 85% [kg/m³]</th>
<th>Nominal S.G. 50% [kg/m³]</th>
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<tbody>
<tr>
<td>Stainless Steel</td>
<td>V44A</td>
<td>C</td>
<td>44</td>
<td>52</td>
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<td>V52A</td>
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Limitation of guide tube length for KSR Magnetostrictive Level Transmitters FFG-...-Ex

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