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## *Level Measurement*

## Level Measurement



### *For 50 years ...*

... KSR KUEBLER has designed and manufactured measurement and control devices for liquids and bulk materials.

The foundation for the development of KSR KUEBLER was laid in 1962 by Dipl.-Ing. Heinrich Kübler with the invention of the magnetic switch – something completely new at that time, and a very simple design concept which rapidly spread across the whole world. A series of developments like the KSR Magnetic Float Switch, the KSR Level Sensor and the KSR Bypass Level Indicator followed.

Over the past decades, a strategy of steady expansion led to the forming of our branches in China, UK, Singapore and the USA, a joint venture and a global net of distributors. This makes KSR KUEBLER a global player.

Putting ourselves in the customers' position, searching with them for the best solution, working as a team, constantly striving for improvement – this is our daily goal – this is our philosophy.

**50**  
**YEARS**

# Contents



## *"In the beginning there was water",*

one could say. Indeed! However, this was just the beginning. Highly aggressive, caustic, viscous and soiled liquids have been added to simple water. The problems and requirements have become constantly more complex and demanding and our field of activity has expanded.

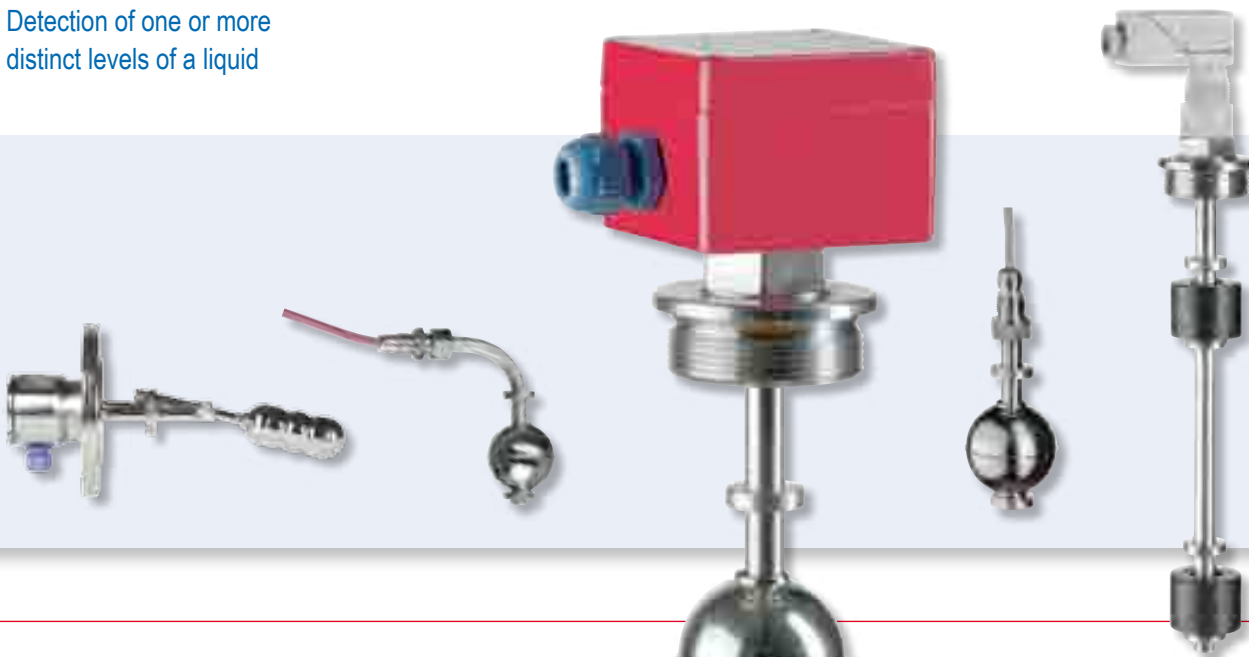
KSR KUEBLER AG today manufactures a broad range of level measurement devices covering temperatures up to 450 °C and pressures up to 40 MPa. Tailor-made solutions for chemical and pharmaceutical plants, offshore and oil industry, shipbuilding, plant construction, food and beverages industry, water purification plants and an ever growing number of applications in the environmental industry make up a big share of our new developments.

Our highly qualified members of staff are constantly engaged in customising new solutions to solve individual problems. The latest in production technology, an uncompromising commitment to quality and national and international approvals are the foundations that build up the reputation of our company.

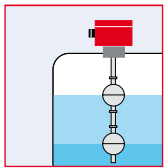
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## Magnetic Float Switches

Detection of one or more distinct levels of a liquid



### Operating Principle



Magnetic Float Switches are based on the float principle with individual reed contacts for every level to be monitored. A float with a built-in magnetic system actuates the small preset contacts through the wall of the guide tube enabling the detection of distinct levels of the liquid.

This simple and proven operating principle is suitable for a wide variety of applications.

The measurement is independent of foam, conductivity, dielectric constant, pressure, vacuum, temperature, vapour, condensation, bubbles, boiling effects and vibration.

### Technical Advantages

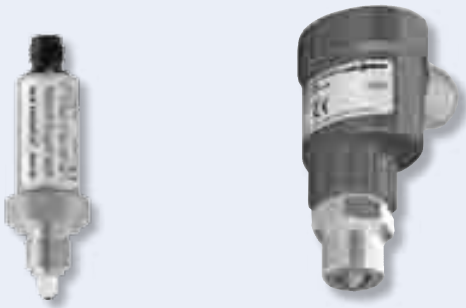
- Suitable for virtually all liquids
- Switching operation is without direct contact with the liquid, free of wear and tear and does not require any power supply
- Universal signal processing of volt-free contacts:
  - PLC
  - Initiator circuit to DIN NAMUR 60947-5-6
- Multiple switch points in one unit (up to 8)
- Explosion-proof designs
- Temperature – 196 °C to + 300 °C
- Pressure Vacuum to 100 bar, S.G.  $\geq 400 \text{ kg/m}^3$
- Interface measurement  $\Delta \geq 50 \text{ kg/m}^3$
- Application specific designs available
- Simple installation and commissioning, maintenance-free



Set Point Relay  
Pump / Solenoid Valve Control

# Opto Level Switch

Opto Level Switches are used for monitoring liquid levels



## Working principle

The level limit detection with the conic tip is independent of physical properties of the fluids such as density, dielectric constant, conductivity, color and refractive index.

The curve in the diagram level shows the switching transition. With 1.1 it is in a range that can never be reached of gases or liquids (all gases have a refractive index <math><1.05</math> and all fluids >1.25). The interface measurement, however, uses the refractive index dependence of the rounded sensor tip.

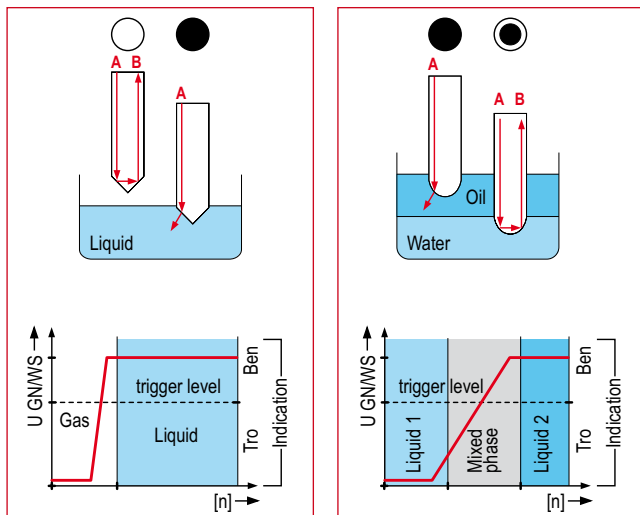
## Technical advantages

- Approvals: ATEX, WHG § 19, DGRL, SIL 1
- Level and interface
- High precision
- Range of pressure 0 ... 500 bar
- Range of temperature -269 ... +400 °C
- independent of color, density, dielectric constant, conductivity and refractive index
- small measurement volume
- small size

## Function principle

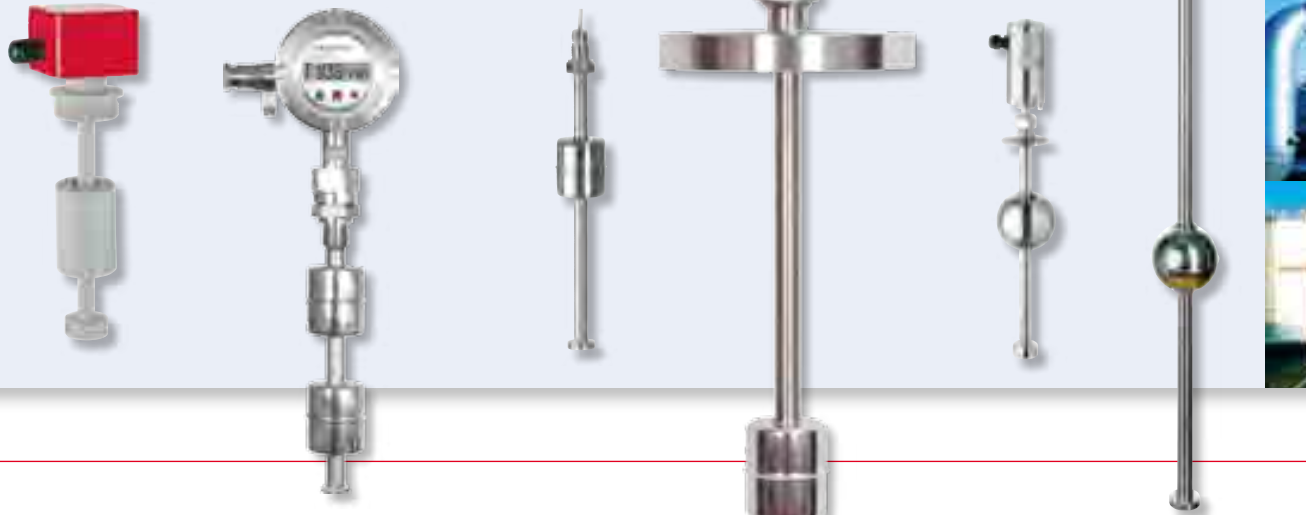
Level

Interface

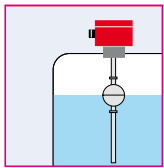


## Level Sensors

Continuous level measurement,  
interface measurement



### Operating Principle / Reed chain



Level Sensors are based on the float principle with a 3-wire potentiometer circuit.

A float with a built-in magnetic system actuates small reed contacts through the wall of the guide tube. These reed switches form a resistance measuring chain that continuously generates a voltage proportional to the height of the level.

The resistance measuring chain is closely stepped and is made up from small chips soldered onto a PCB. The chips contain the necessary reed contact-resistor combination. Due to this assembly the generated voltage is virtually continuous. Depending on requirements and design, different contact separations from 5 to 20 mm are available.

Continuous measurement of liquid levels independent of foam, conductivity, dielectric constant, pressure, vacuum, temperature, vapour, condensation, bubbles, boiling effects and vibration.

### Operating Principle Magnetostrictiv

The measuring is initiated by a current pulse. This generates a circular magnetic field along a magnetostrictive wire in the probe tube. At the measuring point (liquid level) a float with permanent magnet is used as a position sensor. This magnetic field of the float twists the wire.

The superposition of the two magnetic fields initiates a mechanical wave in the wire. This is converted into an electrical signal at the end of the wire in the sensor housing by a piezo-ceramic. The time of flight measurement allows to determine the starting point of the mechanical wave and therefore the float position with high accuracy.

### Technical Advantages

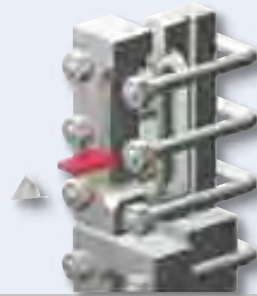
- Approvals: ATEX, SIL 2, Ex d, NEPSI
- Protocols: EDDL, DTM, HART
- Signal transmission over large distances
- Simple installation and commissioning, one-time calibration only, no re-calibration necessary
- Display proportional to the height of the level or the contents of the vessel.
- Set point relays continuously adjustable over full range
- High repeatability of set points
- Temperature range  $-80\text{ °C}$  to  $+200\text{ °C}$   
Pressure Vacuum to 100 bar  
S.G.  $\geq 400\text{ kg/m}^3$
- Interface and product level measurement simultaneously possible at S.G.  $\Delta \geq 50\text{ kg/m}^3$
- Application specific designs available

### Signal transmission

- External control units and set point relays
- 2-wire head-mounted transmitters with 4...20 mA signal
- Programmable HART®-Protocol, PROFIBUS® PA, FOUNDATION™ Fieldbus

# Glass level gauges

Level measurement with glass level gauges – reflex and transparent



## KSR Reflex glass level gauges

The principle of the reflex sight glass is the reflection of the outdoor light. In the gas or vapor phase you get a bright display, because the light in the prismatic grooves of the sight glass is reflected.

In the liquid phase, the light is absorbed, so a dark display indicates the fluid level.

KSR Reflex sight glass gauges are available with housing for the pressure range up to PN25 and cover design for the pressure range up to PN100. They are the best and cheapest indicator for steam application up to 35 bar, but can also be used in numerous applications of process industries.

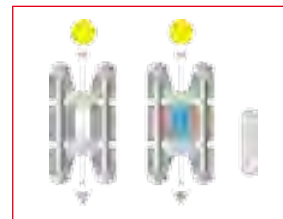


Function principle reflex

## KSR Transparent glass level gauges

In this type of sight glass indicators the liquid is included between two transparent sight glasses. This allows a sight of the fluid and therefore provides a clear indication of the level.

KSR transparent sight glass indicators are available in double-cover design for pressures up to PN100. They are the most appropriate indicator for steam application above 35 bar, where micas must be used, to protect the sight glass against corrosion of the boiler water. They can also be used in numerous applications, particular for the observation of interface or liquid paint. They also can be equipped on their backside with a lighting device in order to improve visibility.



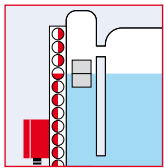
Function principle transparent

## Bypass Level Indicators

Continuous level measurement with visual indication of level without power supply



### Operating Principle



A communicating bypass chamber is connected to the side of a vessel. As the liquid level in the tank rises or falls, a float with a built-in magnetic system inside the chamber rises or falls with it.

The radial magnetic field of the permanent magnet of the float actuates the level display and sensors mounted on the outside of the bypass chamber.

### KSR Level Sensor

- Continuous level measurement with 3-wire potentiometer circuit for external control units
- 2-wire level transmitters  
Head-mounted transmitter 4–20 mA
- Programmable HART®-Protocol, PROFIBUS® PA, FOUNDATION™ Fieldbus
- High precision, magnetostrictive level sensors, accuracy < 1.0 mm

### KSR Magnetic Switch

- Detection of one or more discrete levels
- Reed contact bistable
- Reed contact NAMUR, DIN 60947-5-6
- Inductive for safety applications
- Pneumatic

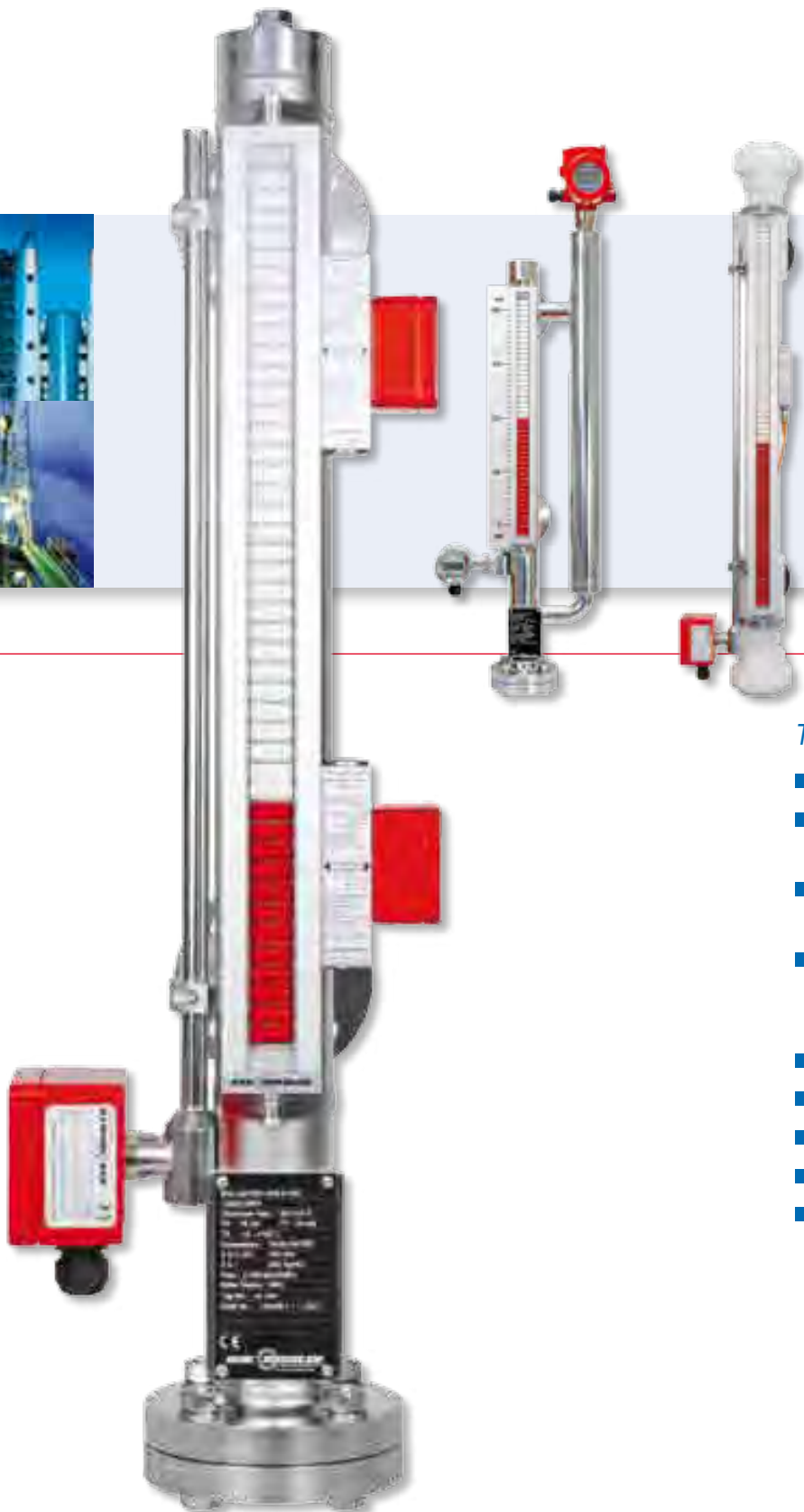
① Transmitter 4–20 mA, programmable:

HART®-protocol, PROFIBUS® PA, FOUNDATION™ Fieldbus

② KSR Magnetic Roller Display – two-color continuous visual monitoring of the actual level without auxiliary power

③ High-resolution transducers





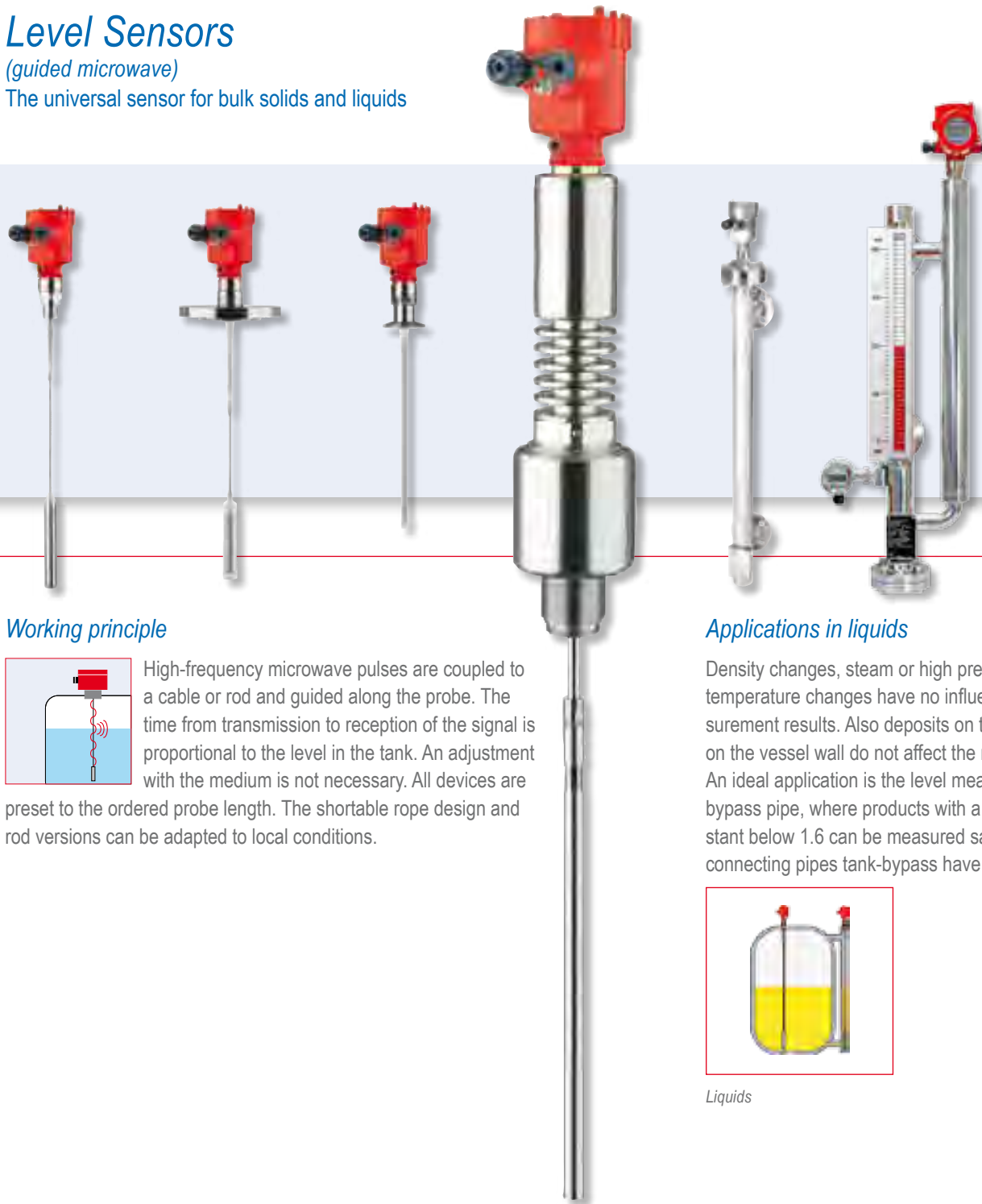
### *Technical Advantages*

- Simple, robust, and solid design
- Display proportional to the height of the level or the contents of the vessel
- Pressure- and gas-proof separation of chamber and display
- Available for applications in all areas of industry through versatile design and corrosion-resistant materials
- Pressure range to 420 bar
- Temperature range to 450 °C
- S.G.  $\geq 400 \text{ kg/m}^3$
- Explosion-proof designs
- Interface and product level measurement at S.G.  $\Delta \geq 50 \text{ kg/m}^3$

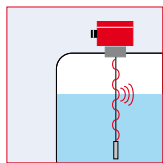
## Level Sensors

(guided microwave)

The universal sensor for bulk solids and liquids



### Working principle



High-frequency microwave pulses are coupled to a cable or rod and guided along the probe. The time from transmission to reception of the signal is proportional to the level in the tank. An adjustment with the medium is not necessary. All devices are preset to the ordered probe length. The shortable rope design and rod versions can be adapted to local conditions.

### Applications in liquids

Density changes, steam or high pressure and temperature changes have no influence on measurement results. Also deposits on the probe or on the vessel wall do not affect the measurement. An ideal application is the level measurement in a bypass pipe, where products with a dielectric constant below 1.6 can be measured safely. Also the connecting pipes tank-bypass have no influence.



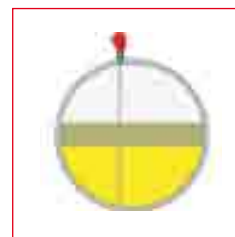
Liquids



### *Interface measurement in liquids*

The measuring principle was developed for the detection of interface layers. Typical applications are the measurements of oil or solvent on water. The microwave pulse is reflected a second time at an interface with different permittivity. This allows the detection of a second filling level.

The advantage against displacers is that the measurement principle works independent of density. No moving parts are used, so a maintenance-free operation is ensured.



*Interface*

## Solutions for level measurement from our product range



### Special solutions

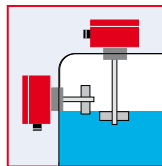


Bypass seamlessly (without welding)



Enamelled slide tube with glass float

### KSR Paddle Switch

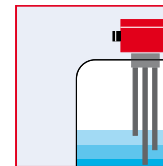


#### Measurement of bulk material

The paddle switch type DF is especially suited for powders, granules and viscous media like sand, fodder, oats, small components etc. The paddle switch can be top or side mounted on the container or silo.

- Supply voltages  
24 V AC/DC, 110 V AC, 230 V AC
- Magnetic clutch for pressurised containers
- Flat and cross paddle
- Adjustable position of paddle

### Conductive Level Controls and Electrodes



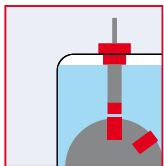
#### Level measurement of electrically conductive media

The KSR electrode relays work according to the conductivity measurement method and can be used in combination with KSR electrodes for level monitoring or control of electrically conductive fluids such as water, alkalis or acids.

- Adjustable sensitivity
- Multiple electrodes, adjustable
- Materials: stainless steel, Hastelloy, titanium, PTFE-insulated, ECTFE-coated



### KSR Magnetic Switches

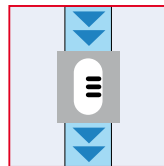


*Rotary pulse encoder, stroke position e.g. in machines and apparatus engineering etc.*

A magnetic switch consists of Reed contact which are built-in in a hermetically sealed glass tube filled with protective gas. By approximating a permanent magnet the overlapping contact tongues ends come together and touch each other suddenly. When removing the permanent magnet the contact tongues immediately go instantly back to its resting position.

- Potential free contact
- Installation independent of orientation
- Stable switching point, repeatability of switch point 0.1 mm

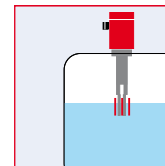
### KSR Flow Monitors



*Variable-area flow measurement at any mounting position for gases or liquids*

- High switching accuracy
- High functional safety
- Low hysteresis
- Adjustable switch point
- Wide switching range
- Viscosity compensated types available

### KSR TF Tuning Fork Level Switch



*The KSR-TF can be used as a universal level switch in liquids*

They detect levels with high precision and can be used in tanks and pipelines, regardless of the installation position.

- Setup without adjustment
- Product-independent switching point
- Very high reproducibility
- Wear- and maintenance-free
- Minimum installation dimensions

## Partnership

Individual problems require  
tailor-made solutions



To address our customers' problems on site we work through our branches and distributors in the Middle and Far East, in Africa, the USA, and of course in Germany and Europe.

Our unique solutions are as different as our customers' applications and requirements. A steadily growing customer base proves it.

ABB, Atotech, BASF, Bayer, Bitzer, BSL, Burgess-Manning, Burgmann, Chemopetrol, Deutz, DOW, Flowserve, Gasprom, GEA, Henkel, Hermetic, Infracor, KHS, Krupp-Uhde, Kvaerner, Leuna Raffinerie, Liebherr, Linde, Lurgi, MAN, Peene Werft, Roche, Ruhrgas, Schering, Siemens, Single, Statoil, Tessag, Toyo, Vatec, VA-Tech, Wacker Siltronic, Woodside, YORK

*Our products and applications  
are found worldwide  
in the following application fields:*

*Chemical and pharmaceutical plants*

*Off-Shore and oil industry*

*Shipbuilding*

*Plant construction*

*Water purification and environmental  
industry*

*Food and beverage industry*





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## Product Range



*Magnetic Float Switches*

*Level Sensors*

*Bypass Level Indicators*

*Glass Level Gauges*

*Top Mounted Level Indicators*

*Paddle Switches*

*Safety Leakage Detectors*

*Flow Monitors*

*Ultrasonic Level Sensors*

*Conductive Level Relays*

*Opto Level Switches*

*Electrodes*

*Magnetic Switches*

*Controls/Transmitters*

*Level Displays*

## Approvals



ATEX 94/9/EC



PED 97/23/EC



**Germany**  
TÜV SÜD AG,  
Industrie Service

**IBExU**

IBExU Institut für  
Sicherheitstechnik GmbH



Physikalisch Technische  
Bundesanstalt PTB



Bundesamt für Wehrtechnik  
und Beschaffung



Germanischer Lloyd



**Netherlands**  
KEMA



**France**  
Laboratoire Central des  
Industries Electriques



Bureau Veritas

**DEMKO**

**Denmark**  
DEMKO



**Norway**  
Det Norske Veritas



**Russia**  
Gosgortekhnadzor OGS  
Oil & Gas Safety



GOST Permission to use  
Pattern Approval/EX



**USA**  
Factory Mutual Research  
Corporation