Installation and operating instructions
Liquid level instrument

BM 51
1. **Brief description**

The BM 51 level gauge is suited specifically for measuring liquid levels in open-topped or pressurized vessels and tanks. Their use in hazardous areas is subject to special regulations.

**Scope of supply**

- Indicator housing with follower magnet and complete set of parts for connection to the mounting flange (1 gasket, 4 screw bolts, 4 washers, 4 nuts)
- Float
- Guide tube with connection flange

2. **Installation**

3. **Start-up**

4. **Maintenance**

5. **Options (ES, P, K...)**
   - Electrical signal output
   - Pneumatic signal output
   - Limit switches TG 22
   - Isolation switching amplifier WE 77

6. **Float selection**

7. **Level gauge components/versions**

8. **Changing the wire cable**

9. **Technical data**

Responsibility as to suitability and intended use of these variable-area flowmeters rests solely with the operator. Improper installation and operation of the flowmeters may render guarantee void.

In addition, the "General Conditions of Sale" which form the basis of purchase order contracts are applicable.

1.1 **Measuring principle**

A float with built-in magnet system is guided on a non-magnetic tube. It follows the liquid level in the vessel, thereby causing the magnet system to move the follower magnet inside the tube. Changes in level are transmitted via a flexible wire cable to a measuring drum. The weight of the follower magnet is balanced by a spring motor. System operation is thus non-interacting. The indicating device and teletransmission system are actuated by the measuring drum via a toothed gearing.

2. **Official approvals**

<table>
<thead>
<tr>
<th>Application</th>
<th>Approved by</th>
<th>Instrument version</th>
<th>Certification mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only with explosion protection</td>
<td>Physicalisch-</td>
<td>BM 51/.-/20</td>
<td>PTB Nr. III B3 1167</td>
</tr>
<tr>
<td>In stationary storage tanks for flammable, water-endangering liquids of dangerous-materials classes A, All and B (excl. C5), float and guide tube in Zone 0</td>
<td>Technische</td>
<td>BM 51/.-/P2D</td>
<td>PTB Nr. III B3 1902</td>
</tr>
<tr>
<td></td>
<td>Bundesanstalt</td>
<td>BM 51/.-/K5/20</td>
<td>PTB Nr. Ex-69/2014</td>
</tr>
<tr>
<td></td>
<td>PTB</td>
<td>BM 51/.-/K5/20</td>
<td>PTB Nr. Ex-69/2014</td>
</tr>
<tr>
<td>Overfill protection with explosion protection</td>
<td>PTB</td>
<td>BM 51/.-/K.-/FEx/20</td>
<td>PTB Nr. Ex-89/2072 F</td>
</tr>
<tr>
<td>In stationary storage tanks (not pressure vessels**) for flammable, water-endangering liquids of dangerous-materials classes A, All and B (excl. C5), float and guide tube in Zone 0</td>
<td></td>
<td>BM 51/.-/K5-FEx/20</td>
<td>PTB Nr. Ex-89/2072 F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BM 51/.-/P-F5/20</td>
<td>PTB Nr. Ex-89/2072 F</td>
</tr>
<tr>
<td>Overfill protection without explosion protection</td>
<td>PTB</td>
<td>BM 51/.-/K.-/F/2W</td>
<td>PTB Nr. III B3 1816 F</td>
</tr>
<tr>
<td>In stationary storage tanks (not pressure vessels**) for flammable, water-endangering liquids</td>
<td></td>
<td>BM 51/.-/K5-F/2W</td>
<td>PTB Nr. III B3 1834 F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BM 51/.-/P-FW</td>
<td>PTB Nr. III B3 1835 F</td>
</tr>
<tr>
<td>Only with explosion protection</td>
<td>BASEEFA</td>
<td>BM 51/.-/C5/Ex</td>
<td>BAS No. Ex 832330</td>
</tr>
<tr>
<td>In stationary storage vessels for flammable, water-endangering liquids; certification applicable in Europe and Federal Republic of Germany (excl. VbF zones)</td>
<td></td>
<td>BM 51/.-/K/Ex</td>
<td>BAS No. Ex 832330</td>
</tr>
<tr>
<td>Overfill protection without explosion protection</td>
<td>Institut für Bautechnik</td>
<td>BM 51/.-/K.-/FWN</td>
<td>Approval Notice FA-VI 610.13</td>
</tr>
<tr>
<td>In stationary storage tanks (not pressure vessels**) for non-flammable, water-endangering liquids</td>
<td>(IBT)</td>
<td>BM 51/.-/K5-F/2W</td>
<td>Approval Notice FA-VI 610.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BM 51/.-/P-F/2W</td>
<td>Approval Notice FA-VI 610.33</td>
</tr>
<tr>
<td>Overfill protection for cargo tanks</td>
<td>Germanischer Lloyd</td>
<td>BM 51/.-/K</td>
<td>Certification No. 88775 HH</td>
</tr>
</tbody>
</table>

* Meaning of symbols
  - K = Limit contacts
  - ES = Electrical signal output
  - P = Pneumatic signal output
  - F = Part of overfill protection system
  - Ex = Explosion-protected equipment
  - ZA = Zone 0 for water-endangering, flammable liquids
  - WN = Zone 0 for water-endangering, non-flammable liquids
  - WB = Zone 0 for water-endangering, flammable liquids AII

** max. operating pressure is 3 bar

**Note:**
Certified devices are not standard versions! Deviations in design and technical data are possible!
2. Installation

The float guide tube forms a gas-tight and pressure-resistant partition between the liquid chamber and the magnetic data transmission system.

The float is designed for a specified liquid and specified operating conditions. Its depth of immersion is determined by its weight and the density of the liquid, and is marked at the appropriate level by an inverted triangle.
- Before installation, remove stoppers and protective covers from the indicator housing flange and the guide tube connecting flange.
- If possible, do not install during rain or snowfalls.
- Use compressed air or a special pump to remove moisture (condensation).
- Position gasket on mounting flange.
- Remove limit stop.
- CrNi steel 1.4571: screwed with split pin
- PTFE: screwed to guide tube
- Polypropylene (PP): secured with hexagon socket screw
- Insert guide tube through mounting flange into the tank.
- Appropriately refit and secure limit stop, depending on type.
- On the PTFE and PP versions, the limit stop must be screwed down firmly to form a tight seal; the product should not seep into the guide tube.

**Right side up:** identification plate shows “top” and “bottom”, red triangle inverted.

On versions where the pipe diameter of the vessel flange is bigger than the float diameter, the float can then be fitted to the guide tube and then both inserted through the mounting flange into the tank.

**Tank bottom attachment for guide tube**

If the level gauge is to be installed in ships or where moving liquid levels in general are concerned, a tank bottom attachment is recommended to prevent buckling of tubes in excess of 3 m length. The bottom attachment of guide tubes longer than 3 m is officially required for level gauges used in Zone “O” categories.

Weld the tube attachment to the tank bottom in alignment with the connecting flange.

3. Start-up

- Place indicator housing on its side on a firm support on a level with the connecting flange.
- Place gasket on the connecting flange.
- Thread the wire cable through the hole in the follower magnet and knot the end.
- Attach a rope clamp to act as lift limiter approx. 200 mm above the follower magnet.
- Pay off wire cable uniformly from the measuring drum against the force of the spring motor, and lower the follower magnet down into the guide tube.
- Polarity of follower magnet: north at top, south at bottom; vice versa for float ring magnet.
- Accordingly, like poles (repelling one another) meet first.
- Lift follower magnet approx. 200 mm and let it fall freely through the repelling magnet system. It will then be held by the magnet system in the float.
- To check: greater resistance should be noticed when tugging on the wire cable, or when turning the measuring drum if the level gauge is of the built-in type. The magnetic binding force is approx. 0.9 kg.
- Do not bend or damage the wire cable in any way.
- Position the indicator housing on the guide tube flange and screw it down.

The wire cable is kept taut by the spring motor.

**Presetting dimension “V”**

The indicator system cannot indicate “0” m level in empty tanks because allowance must be made for the depth of immersion of the float and the limit stop on the guide tube.

Presetting dimension “V” is the distance between the red triangle on the float and the bottom of the tank.

\[ V = a + h \]

- \( a \) = distance between tank bottom and top edge of limit stop on guide tube
- \( h \) = float’s depth of immersion

Dimension “a” will be specified in the tank drawing or must be measured in the tank.

Immersion depth “h” is marked on the float (refer to Section 2, Installation), or can be read off from the relevant float chart (Section 6) “depth of immersion vs. product density”.

Allow for vertical and horizontal play of the guide tube.
Adjustment of the measuring system

- Make sure that the float is resting against the limit stop of the guide tube in the empty tank.
- Determine presetting dimension “V”.
- Remove the large “centimetre” hand.
- Set via slip coupling the small “metre” hand to presetting dimension “V” on the metre scale.
- Replace “centimetre” hand, set to presetting dimension, and tighten the fixing screw.
- Check movement of the hands on the scale by lifting the float.
- Remove stick-on labels from float and guide tube (contamination of liquid).
- Seal and screw down both housing covers.
- Screw down front cover – with notch at bottom.

Level gauges for low-temperature installations

For installations operating below 0°C, the air in the guide tube and indicator housing must be replaced by nitrogen, otherwise condensed moisture from the air would cause the follower magnet to freeze fast in the guide tube.

- Insert a hose down to the bottom of the guide tube.
- Flush first the tube then the housing with nitrogen.
- To absorb residual moisture, place a bag of silica gel in the indicator housing before sealing and screwing down.

When flushing the level gauge with nitrogen, make sure that the applied internal pressure of max. 0.03 bar (0.003 MPa) is not exceeded.

4. Maintenance

After approx. 1 year’s operation, lubricate the journals in the indicator system and the windings of the spring motor with resin- or acid-free oil.

If liquids are contaminated or contain solids with a settling tendency, clean the guide tube and float slide at regular intervals to ensure free movement of the float.

BM 51 measurement mechanism without auxiliary gearing

1  Measuring drum
2  Pointer gearing
3  Spindle for cable guide
4  Spring motor

5. Options (E..., P..., K...)

All level gauges can be fitted with optional equipment. Actuation is transmitted via an auxiliary gearing from the measurement mechanism to the transducer or limit switches.

5.1 Electrical signal output...ES

The KINAX 5W1 angle-of-rotation transducer (make: Camille Bauer) is built into the indicator housing to convert liquid level data into an impressed current of 0(4) to 20 mA.

The KINAX 5W1 is also suitable for use in hazardous areas if powered by an intrinsically safe circuit.

In terms of explosion protection, the KINAX 5W1 angle-of-rotation transducer functions like a passive dipole. It may be installed in hazardous areas providing the power supply is obtained from a voltage source with certified intrinsically safe circuit.

The supply power must be a DC voltage that can be drawn from an existing DC source or from power supply units (rectifier, transducer feeder unit).

All instruments powered by the measuring circuit (indicators, recorders) to be series-connected and must not exceed the maximum load of the angle-of-rotation transducer.

Connection diagrams

4 to 20 mA  0 to 20 mA  0 to 20 mA
2-wire  3-wire  4-wire
ircuit  circuit  circuit

U_s, supply voltage
R_A, external resistance

KINAX 5W1 connection terminals

KINAX 5W1

11  12  13
(1  2  3  former designations)

Adjustment of the electrical signal output

1. Instrument required: 0 to 20 mA milliammeter.
2. Set presetting dimension “V”.
3. Connect angle-of-rotation transducer as shown in the circuit diagram together with a local indicating instrument and switch on.
4. The angle-of-rotation transducer has, as ordered, been factory-set to 0—100% measuring range. These values are not identical with the full-scale range (e.g. measuring range 0 to 3.8 m, but full-scale range 6.0 m).

<table>
<thead>
<tr>
<th>at 0 to 20 mA</th>
<th>at 4 to 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% = 0 m</td>
<td>0 mA</td>
</tr>
<tr>
<td>10% = 0.38 m</td>
<td>2 mA</td>
</tr>
<tr>
<td>50% = 1.9 m</td>
<td>10 mA</td>
</tr>
<tr>
<td>100% = 3.8 m</td>
<td>20 mA</td>
</tr>
</tbody>
</table>
5. At the mounting location, the full-scale range must be adjusted to harmonize with the electrical full-scale range.

6. Remove indicator housing from the guide tube connecting flange.

7. Pull the wire cable with follower magnet out of the guide tube and slowly wind it up onto the measuring drum (thereby cancelling the magnetic bond between the two magnets).

8. At 100% measured-value indication, the output signal of the transducer must be exactly 20.0 mA. If not, loosen the two fixing screws on the angle-of-rotation transducer and turn the complete transducer until a precise 20.0 mA reading is obtained. Retighten screws.

9. Do not readjust the two potentiometers in the angle-of-rotation transducer. These have been factory set and paint-locked.

10. Electrical adjustment of the full-scale range means that the zero is automatically correct, since full-scale range and zero were set during factory calibration.

11. Lower the wire cable with magnet down through the guide tube to re-establish the magnetic bond with the float magnet system.

12. Replace indicator housing. This completes the adjustment procedure.

---

**Technical data**

**Angle-of-rotation transducer KINAX 5W1**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>12 to 36 V DC max. 22 V for hazardous-area operation</td>
</tr>
<tr>
<td>Power consumption</td>
<td>approx. 25 mA</td>
</tr>
<tr>
<td>Self-inductance</td>
<td>2 mH</td>
</tr>
<tr>
<td>Self-capacitance</td>
<td>15 nF</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-25 °C to +60 °C</td>
</tr>
<tr>
<td>3- or 4-wire connection</td>
<td>0 to 5 mA max. 2400 ohms</td>
</tr>
<tr>
<td>3- or 4-wire connection</td>
<td>0 to 10 mA max. 1700 ohms</td>
</tr>
<tr>
<td>2-wire connection</td>
<td>4 to 20 mA max. 600 ohms</td>
</tr>
<tr>
<td>Linearity</td>
<td>&lt; ± 1% at I max</td>
</tr>
<tr>
<td>Temperature effect</td>
<td>&lt; 0.5%/10 °C</td>
</tr>
<tr>
<td>Power supply effect</td>
<td>&lt; 0.2%</td>
</tr>
<tr>
<td>Dependence on external resistance</td>
<td>&lt; 0.2% at Δ R_A max,</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 0.2%</td>
</tr>
</tbody>
</table>

Max. external resistance

2-wire connection: 

\[ R_A = \frac{U_b [V] - 12 [V]}{I_A [mA]} \] [kΩ]

3- and 4-wire connection: 

\[ R_A = \frac{U_b [V] - 5.3 [V]}{I_A [mA]} - 0.339 [kΩ] \]

where:

- \( U_b \) = power supply
- \( I_A \) = max. output current

---

**5.2 Pneumatic signal output \( \ldots P \)**

The WT 80 pneumatic transmitter with VR 80 amplifier is used to convert the measured liquid level into a pneumatic signal. Activation is via cam disc.

**Start-up**

- Use only clean, oil- and moisture-free air to operate the transmitter.
- Blow out air lines before connecting up.
- Initial air feed pressure should be 1.4 bar; there must not be any noticeable drop in pressure when the measuring system is fully modulated (100% values).
- Leak-tightness: pressure test, check screw connections with leak indicator spray.

**Adjustment of the pneumatic signal output**

1. Instrument required: Class 0.2 precision pressure gauge, connected to the signal output of the unit. Connect up feed air supply.

2. Set presetting dimension "V".

3. Remove indicator housing.

4. Pull the wire cable out of the guide tube and allow it to wind up slowly on the measuring drum up to the full-scale value (thus cancelling the magnetic bond between float magnet system and follower magnet). The signal output must amount to exactly 0.1 MPa (1.0 bar) and 0.02 MPa (0.2 bar), resp. If not, undo fastening on cam disc, and align the mark on the cam disc with the adjacent bearing. Secure the cam disc. Fine adjustment by way of the zero adjusting screw.

5. Do not alter any other adjusting screws on the lever system or transmitter; these have been factory-set and paint-locked.

6. Pneumatic adjustment of the full-scale range means that the zero is automatically correct, since full-scale range and zero were set precisely during factory calibration.

7. Pay off the wire cable and lower follower magnet down through guide tube to form a bond with the float magnet system.

8. Replace indicator housing. This completes the adjustment procedure.
Technical data

Pneumatic transmitter WT 80

- Supply air pressure: 0.14 MPa ± 0.01 MPa (1.4 bar ± 0.1 bar)
- Air consumption: 480 l/h
- Air capacity: 1800 l/h
- Output: 0.02 to 0.1 MPa (0.2 to 1.0 bar [3 to 15 psi])
- Linearity: ± 0.5%
- Hysteresis: 0.25%
- Sensitivity: 0.1%
- Ambient temperature: -25 °C to +70 °C
- Temperature effect: 0.03 %/°C
- Inlet pressure dependence: 0.2 %/0.01 MPa (0.1 bar)
- Load characteristic:
  - at 0.05 MPa (0.6 bar): 1.2 % at 300 l/h
  - at 0.5 MPa: 3 % at 600 l/h
- Connections: Ermeto 6

5.3 Limit switches TG 22

Up to 4 TG 22 electrical limit switches can be installed in the BM 51 level gauge to signal specific levels.

The TG 22 is a slot initiator of the type SJ 3.5-N manufactured by Pepperl & Fuchs. These are matched for transistor amplifiers with intrinsically-safe control circuit to NAMUR and DIN 19234. Transistor amplifiers WE/Ex-1 for one and WE/Ex-2 for two control circuits are available from stock.

Adjustment

The limit values at which an electrical signal is to be initiated are freely selectable.

- Signalling is effected by slotted discs which dip into a slot initiator.
- The slotted discs can be turned relative to each other when the measuring drum is in locked position.
- Annunciators (Hima, Pepperl & Fuchs, Siemens etc.) are required for signal evaluation. WE/Ex switching relays made by Pepperl & Fuchs, control circuit in protection category (Ex)CS, 500 VA, 4 A, 230 V relay output switching capacity, are supplied as standard equipment for these and for the hazardous-duty version.
- To set the operating point, first set the operating point on the indicating system (raise the float or reel in the cable). To do this, remove indicator housing from the guide tube.

Action

TG 22 consists of a slot initiator and separately mounted transistor amplifier. Dipping of the slotted disc into the slot initiator causes damping of the electrical resonant circuit and triggering of the switching pulse.

The TG 22 is also suitable for use in conjunction with hazardous-duty systems, but the transistor amplifier must be installed outside the hazardous area; alternatively, use (Ex)3n GS type of enclosure.

BM 51,.../K4,...

Connection diagram

Limit switches

1. K 1 Terminals 1,2
2. K 2 Terminals 3,4
3. K 3 Terminals 5,6
4. K 4 Terminals 7,8

Limit switch TG 22

- Rated voltage: 8 V DC
- Power consumption
  - Active area clear: ≥ 3 mA
  - Active area obscured: ≤ 1 mA
- Self-inductance: 160 μH
- Self-capacitance: 40 nF
- Ambient temperature: -25 °C to +100 °C
  (for hazardous-duty systems max. 60 °C)

Electrical characteristics in conformity with DIN 19234 and NAMUR.
5.4 Isolation switching amplifier WE 77

**AC-version**
WE 77/Ex1
WE 77/Ex2

**DC-version**
WE 77/Ex1-G
WE 77/Ex2-G

The isolation switching amplifiers consist of a power pack, transistor switching amplifier and output stage.

---

**Electrical connection TG 24 and WE 77**

WE 77/Ex 1, WE 77/Ex 1-G feature one and WE 77/Ex2, WE 77/Ex2-G two intrinsically safe control circuits in conformity with DIN 19234 and NAMUR.

- **Connection diagrams**
  1. Sensor (Initiator)
  2. Isolation switching amplifier
  3. LED lights when "relay is active"
  4. Relay output
  5. Supply power — AC: 230 (220), 120 V AC
     DC: 15 to 70 V DC

- **Function shown**
  - High resistance operation with open-circuit monitoring
    (for changeover of mode, see table below)
  - Relay deenergized (inactive)

---

**Adjustment of WE 77**

Various modes of operation are possible by transposing the wire jumpers as specified in the Table. "Relay active" is signalled by an LED.

---

<table>
<thead>
<tr>
<th>Function</th>
<th>AC - Version</th>
<th>DC - Version</th>
<th>Input</th>
<th>Output</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WE 77/Ex1</td>
<td>WE 77/Ex1-G</td>
<td>Init.</td>
<td>mech. switch</td>
<td>Relay</td>
<td></td>
</tr>
<tr>
<td>1st function</td>
<td>Link between term. 3 &amp; 4</td>
<td>Links between term. 3 &amp; 4</td>
<td>Switch pos. 2</td>
<td>Links between term. 1 &amp; 3</td>
<td>Switch pos. 2</td>
<td>Links between term. 1 &amp; 3</td>
</tr>
<tr>
<td></td>
<td>0 - Signal</td>
<td>10 k</td>
<td>inactive</td>
<td>1 - Signal</td>
<td>active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>damped</td>
<td>10 k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>without open-circuit monitoring</td>
<td>Link between term. 4 &amp; 5</td>
<td>Links between term. 4 &amp; 5</td>
<td>Switch pos. 1</td>
<td>Links between term. 1 &amp; 3</td>
<td>Switch pos. 1</td>
<td>Links between term. 1 &amp; 3</td>
</tr>
<tr>
<td></td>
<td>0 - Signal</td>
<td>10 k</td>
<td>active</td>
<td>1 - Signal</td>
<td>inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>damped</td>
<td>10 k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd function</td>
<td>without link</td>
<td>without links</td>
<td>Switch pos. 1</td>
<td>without links</td>
<td>without links</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - Signal</td>
<td>10 k</td>
<td>active</td>
<td>1 - Signal</td>
<td>inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>damped</td>
<td>10 k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit diagram</td>
<td>with open-circuit monitoring</td>
<td>without link</td>
<td>without links</td>
<td>Switch pos. 1</td>
<td>without link</td>
<td>without links</td>
</tr>
<tr>
<td></td>
<td>0 - Signal</td>
<td>10 k</td>
<td>active</td>
<td>1 - Signal</td>
<td>inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>damped</td>
<td>10 k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>without link</td>
<td>without links</td>
<td>Switch pos. 1</td>
<td>without link</td>
<td>without links</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - Signal</td>
<td>10 k</td>
<td>active</td>
<td>1 - Signal</td>
<td>inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>damped</td>
<td>10 k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>without link</td>
<td>without links</td>
<td>Switch pos. 1</td>
<td>without link</td>
<td>without links</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - Signal</td>
<td>10 k</td>
<td>active</td>
<td>1 - Signal</td>
<td>inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>damped</td>
<td>10 k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


## Technical data

### Power supply

<table>
<thead>
<tr>
<th></th>
<th><strong>AC version</strong></th>
<th><strong>DC version</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WE 77/Ex 1</td>
<td>WE 77/Ex 1-C</td>
</tr>
<tr>
<td></td>
<td>WE 77/Ex 2</td>
<td>WE 77/Ex 2-C</td>
</tr>
</tbody>
</table>

#### Standard
- 230 V AC + 6% \(-10\%\), (220 V AC + 10% \((-15\%\))
- 120 V AC + 5% \(-10\%\)

45 to 65 Hz

#### Special versions
- 24, 42, 110, 127 V AC

#### Input

<table>
<thead>
<tr>
<th></th>
<th>DIN 19234 or NAMUR</th>
<th>DIN 19234 or NAMUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection category</td>
<td>[EEx ia] II C or [EEx ib] II C</td>
<td>[EEx ia] II C or [EEx ib] II C</td>
</tr>
<tr>
<td>PTB No.</td>
<td>Ex – 792/4043 X</td>
<td>Ex – 81/2146 X</td>
</tr>
<tr>
<td>Open-circuit voltage</td>
<td>8 V AC (13.5 V AC *)</td>
<td>8 V DC (12.7 V DC *)</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>8 mA (31 mA *)</td>
<td>8 mA (21 mA *)</td>
</tr>
</tbody>
</table>

#### Safe external inductance/capacitance*

<table>
<thead>
<tr>
<th></th>
<th>3 mH/230 nF values per circuit</th>
<th>2 mH/370 nF values per circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>[EEx ia] II C</td>
<td>31 mH/609 nF</td>
<td>70 mH/800 nF</td>
</tr>
<tr>
<td>[EEx ib] II C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Output

<table>
<thead>
<tr>
<th></th>
<th>WE 77/Ex 1: 1 changeover contact</th>
<th>WE 77/Ex 1-C: 1 changeover contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WE 77/Ex 2: 2 changeover contact</td>
<td>WE 77/Ex 2-C: 2 changeover contact</td>
</tr>
</tbody>
</table>

#### Contact rating
- AC: 4 A/250 V/500 A/cos \( \varphi = 0.7 \)
- DC: 220 V/0.1 A; 60 V/0.6 A; 24 V/4 A

#### Display “relay active”
- with LED

### Housing

<table>
<thead>
<tr>
<th></th>
<th>plastic NORYL SE 0, self extinguishing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixing</td>
<td>snap-on mounting on 35 mm (1.38&quot;) standard rail to DIN 46277 or screw fixing, dimensions to DIN 43603</td>
</tr>
<tr>
<td>Connection</td>
<td>self-opening binding posts, max. cross-section 2 * 1.5 mm² (2 * 14 AWG)</td>
</tr>
<tr>
<td>Type of protection</td>
<td>IP 20, to DIN 40050; equivalent to NEMA 1</td>
</tr>
<tr>
<td>Environment category</td>
<td>HUE, to DIN 40040</td>
</tr>
</tbody>
</table>

* max. values for operation in hazardous-duty systems

If mechanical switches are connected, connect a 10-kohm resistor across the input.

### Dimensions

#### WE/Ex-1

[Dimensions diagram]

#### WE/Ex-2

[Dimensions diagram]
6. Float selection

Select float as a function of pressure, temperature and density of the product. Also select the material of construction to suit the application in question.

<table>
<thead>
<tr>
<th>Float</th>
<th>Operating conditions</th>
<th>Stock number</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Shape</td>
<td>Dimensions (mm)</td>
</tr>
<tr>
<td>1</td>
<td>Disk</td>
<td>dia. 195 x 185</td>
</tr>
<tr>
<td>2</td>
<td>Bail</td>
<td>dia. 197 x 1.0</td>
</tr>
<tr>
<td>3</td>
<td>Cylinder</td>
<td>dia. 190 x 180</td>
</tr>
<tr>
<td>4</td>
<td>Cylinder</td>
<td>dia. 140 x 211</td>
</tr>
<tr>
<td>5</td>
<td>Cylinder</td>
<td>dia. 140 x 200</td>
</tr>
</tbody>
</table>

* If used in hazardous areas, please note data specified in the Certificate of Conformity.
** Not suitable for use in hazardous areas.

Note: The specified operating pressure applies to 20°C. Float test pressure = Operating pressure x 1.3. (Hazardous duty units = Operating pressure x 1.5).

Floats
Each float is designed and constructed for the specified liquid product and given operating conditions.

Float graphs
The graphs show the depth of immersion "h" for each float as a function of the product density "p".

Note: The float operating pressure should be equal to the vessel test pressure. If the vessel test pressure is higher than the float operating pressure, remove the float before testing the vessel. Refer to instrument nameplate for float operating pressure.
7. Level gauge components

1. Cover, rear
2. Housing
3. Spring motor
4. Measuring drum
5. Gear unit
6. Centimetre hand, large
7. Metre hand, small
8. Cable guide
9. Scale
10. Cover with window
11. Mounting flange
12. Connecting flange
13. Wire cable
14. Float
15. Magnet system
16. Follower magnet
17. Guide tube
18. Limit stop

8. Changing the wire cable

1. Disconnect flanged connection between indicator housing and guide tube.
2. Pull wire cable and magnet out of the guide tube.
   (If follower magnet has become detached; fetch wire end and magnet out with a special catching device obtainable from our Service Dept.)
   Reel in wire cable using the spring motor up to the end stop.
3. Remove both housing covers, both pointer hands, and the dial face.
   Disconnect any rear-mounted electrical/pneumatic lines.
4. Pay off wire cable from the measuring drum against the force of the spring motor up to the end stop.
5. Turn the measuring drum until the knotted end of the wire is visible through the hole in the baseplate. Secure measuring drum against turning.
6. Pull out the knot using pincers or a hook and cut it off. Remove rest of wire from measuring drum.
7. Slide the leading end of the new wire cable through the cable guide and thread it from outside through the small hole in the measuring drum. Then pull it through the hole in the baseplate, tie a knot in the end and cut off excess wire. Pull the knot back to the end stop in the measuring drum. Release the measuring drum.
8. The force of the spring motor will automatically wind the wire cable onto the measuring drum. Guide the cable by hand to avoid looping.
9. Wind an adequate length of cable onto the measuring drum (one full turn = 0.4 m).
10. When a sufficient length of cable has been wound up, pull cable through the cable guide, attach a rope clamp and cut off cable 0.5 m behind the clamp. Secure measuring gearing by tightening both screws in the indicator housing.
11. Thread the end of the cable outwards through the flange and attach the follower magnet.
12. For partially filled tanks, proceed as described in Section 3. Start-up. Measure current liquid level with a yardstick and transfer this reading to the indicator.
   For empty tanks, proceed as described under Presetting Dimension "V" and Adjustment of Measuring System.
13. Place indicator housing on guide tube and screw down.
14. Replace both indicator housing covers.

Instrument versions

<table>
<thead>
<tr>
<th>Designation</th>
<th>Guide tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM 51/RR Standard</td>
<td>St. steel 1.4571, tube dia. 28 × 2 mm</td>
</tr>
<tr>
<td></td>
<td>Flange DN 80, PN 16, St. steel 1.4571</td>
</tr>
<tr>
<td>BM 51/NR Standard</td>
<td>St. steel 1.4571, tube dia. 28 × 2 mm</td>
</tr>
<tr>
<td></td>
<td>Flange DN 80, PN 16, steel</td>
</tr>
<tr>
<td>BM 51/N-PTFE Polytetrafluorethylene</td>
<td>St. steel 1.4301, tube dia. 28 × 2 mm</td>
</tr>
<tr>
<td></td>
<td>with PTFE liner, 3 mm</td>
</tr>
<tr>
<td></td>
<td>Flange DN 80, PN 16, steel, PTFE gasket</td>
</tr>
<tr>
<td>BM 51/N-PP Polypropylene</td>
<td>St. steel 1.4301, tube dia. 28 × 2 mm</td>
</tr>
<tr>
<td></td>
<td>with PP tube, flange DN 80, PN 16, steel with PP gasket</td>
</tr>
<tr>
<td>BM 51/M Marine</td>
<td>St. steel 1.4301, tube dia. 28 × 2 mm</td>
</tr>
<tr>
<td></td>
<td>Flange DN 80, PN 16, steel</td>
</tr>
</tbody>
</table>
## 9. Technical data

<table>
<thead>
<tr>
<th>Instrument type</th>
<th>BM 51 level gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring range</strong></td>
<td>max. 6 m</td>
</tr>
<tr>
<td><strong>Product</strong></td>
<td>Liquids, incl. liquefied gases</td>
</tr>
<tr>
<td>Viscosity</td>
<td>$\leq 100 \text{ MPa} \cdot \text{s}$</td>
</tr>
<tr>
<td>Solids</td>
<td>$\leq 100 \text{ g/l}$</td>
</tr>
<tr>
<td>Particle size</td>
<td>$\leq 200 \mu \text{m}$</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>$\pm 3 \text{ mm.of measured value}$</td>
</tr>
<tr>
<td><strong>Operating data</strong>*</td>
<td></td>
</tr>
<tr>
<td>Max. pressure</td>
<td>0.6 MPa (6 bar), special version: 1.5 MPa (15 bar)</td>
</tr>
<tr>
<td>Product density</td>
<td>0.5 bis 3.0 kg/l</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>– 60 to + 120°C, PP version: max. + 60°C</td>
</tr>
<tr>
<td>Product temperature</td>
<td>– 160 to + 400°C</td>
</tr>
<tr>
<td></td>
<td>Note restrictions imposed by built-in options!</td>
</tr>
<tr>
<td><strong>Indication</strong></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>Circular scale, 160 mm dia.</td>
</tr>
<tr>
<td>Scale marks</td>
<td>(m) and (cm) marks</td>
</tr>
<tr>
<td></td>
<td>Special version: (m²) or (%) marks</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>Flange DN 80, PN 16, to DIN 2527</td>
</tr>
<tr>
<td>Special version</td>
<td>other DN, flanges to DIN 2512 and other standards</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Grey cast iron</td>
</tr>
<tr>
<td>Enclosure to DIN 40050</td>
<td>IP 56</td>
</tr>
</tbody>
</table>

* Note: Allow for operating data of floats!