



PKP Prozessmesstechnik GmbH

Borsigstrasse 24

D-65205 Wiesbaden-Nordenstadt

Tel: 06122 / 7055 - 0

Fax: 06122 / 7055 – 50

Operating Instructions

FB01 / FB04

Bypass Level Indicator

INSTALLATION AND OPERATING INSTRUCTIONS

BYPASS- LEVEL INDICATOR TYPE FB01 / FB04

1.	FUNCTIONAL DESCRIPTION: _____	2
2.	APPLICATION: _____	2
3.	ASSEMBLY: _____	2
4.	HAZARD NOTICE: _____	2
5.	NOTICES: _____	3
6.	NOTICES FOR EX-INSTRUMENTS: _____	3
7.	COMMISSIONING: _____	3
8.	MAGNETIC SWITCH / LIMITING VALUE: _____	5
9.	ELECTRICAL CONNECTION OF THE MAGNETIC SWITCH: _____	5
10.	CAUTION: _____	5
11.	MAINTENANCE OF THE MAGNETIC SWITCH: _____	5
12.	FUNCTIONAL TEST OF THE MAGNETIC SWITCH: _____	5
13.	NOTES FOR MAGNETIC SWITCHES: _____	6
14.	NOMINAL DATA FOR EX-MAGNETIC SWITCHES: _____	6
15.	INFORMATIONS FOR EX-MAGNETIC SWITCHES: _____	7
16.	LEVEL SENSOR: _____	8
17.	ELECTRICAL CONNECTION OF THE LEVEL SENSOR _____	8
18.	CAUTION: _____	8
19.	MAINTENANCE OF THE LEVEL SENSOR: _____	8
20.	FUNCTIONAL TEST OF THE LEVEL SENSOR _____	8
21.	NOTES FOR LEVEL SENSOR: _____	9
22.	NOMINAL DATA FOR EX-LEVEL SENSOR: _____	9
23.	INFORMATION FOR EX-LEVEL SENSOR: _____	10

PKP Prozessmesstechnik
GmbH
Siemensstrasse 7
65205 Wiesbaden, Germany
Tel. ++49-6122-9937-23
Fax ++49-6122-9937-25

1. FUNCTIONAL DESCRIPTION:

The bypass level indicator forms an integral part of a pressure vessel. A chamber is mounted on the side of a tank or container by means of two process connections. This direct connection ensures that the level in the chamber corresponds precisely to the level of the liquid in the tank or container (communicating pipes). Inside the bypass chamber is a cylindrical float with a built-in magnetic system. The concentrated magnetic field produced by the permanent magnet gives a precise reading for the level of liquid in the chamber. A signal is transmitted by the magnetic field through the wall of the chamber to an externally mounted display, as well as to recording and switchgear elements.

2. APPLICATION:

The bypass level indicator is only to be exposed to liquids that allow the float to function reliably and to which the materials used are resistant. Furthermore, the system should only be used for the specified parameters such as pressure, temperature and density. In addition, no contamination, coarse particles and crystallization should be present. Excluded from these requirements are units that are specifically suited for such applications and marked accordingly.

3. ASSEMBLY:

The bypass level indicator (acc. to page 4) is bolted onto the side of the container using a process flange (1) and a suitable seal (2). The raised and flat faces as well as the gaskets have to be mechanically perfectly matched. The correct gasket material has to be used for sealing according to the medium, pressure and temperature.

Remove the base flange (3) and insert the cylindrical float (4) into the bypass chamber with the inscription "oben" ("top") at the top. Fit the seal (5) and seal the base flange again, tightening the bolts (6) firmly to secure it. Screw in the vent and drain plugs (11), if existing.

If not installed by the factory, the magnetic roller display (7) will be mounted with two clamps onto the chamber (9). Further the level sensor will be mounted onto the chamber or MRA-profile. The magnetic switches (10), depending on type, will be mounted onto the MRA-profile or chamber at the required switching level.

4. HAZARD NOTICE:

- It is not allowed to make a temporary installation if components or whole instruments are faulty or wrong, particularly when components are missing.
- Instruments and their accessory parts should not be used to secure lifting gear, to act as foot rests or any other mechanical aids that could damage the installation.
- Where there is a hazard or danger present, warning signs have to be displayed according to the local and national standards. Any isolation device fitted must also comply with these standards.
- The operators have to wear protection clothes according to the local circumstances and regulations. The operators have to be trained and given instructions as well as to be in possession of the technical data.
- The operator is responsible, to ensure that unauthorized persons do not have access to the installations or instruments and these operations.
- If passing the instruments and installations on to a third party, all documentation has to be included indicating the correct mounting procedures, operational details and hazards.

Precautions are necessary for:

- heat radiation from outside on to the instruments.
- heat radiation from the instruments to the surroundings.
- electrical heating systems.
- exposure to medium, gas, mist or steam.

5. NOTICES:

- The bypass level indicator must not be subjected to any mechanical loads, vibrations or shock influences. If these loads are existing, supporting or protecting elements have to be used.
- Mechanical shocks transmitted through the medium to the instrument is not allowed.
- For flammable or explosive mediums, instruments with 94/9/EG ATEX approvals have to be used.
- Disposal of instruments should be according to regional and national directions and guidelines. By disposal it is possible that residues of the medium remain within the instrument.
- The conditions of the environment have to be optimised so that all indicating instruments on-site can be read correctly and positioned so that they may be seen in a normal field of view.

TRANSPORTATION SPECIFICATIONS:

These instruments should be packed with respect to the delicate nature of some of the parts. Outer packing such as wooden cases should be marked with fragile or similar signs to help protect the instrument.

6. NOTICES FOR EX-INSTRUMENTS:

- The bypass level indicator may be used in accordance with 94/9/EG ATEX approvals in Zones 1 and 2 and in gas groups IIA, IIB and IIC, which are subject to explosion hazards as a result of combustible substances in the range of temperature classes T1 to T6 or of the values specified in the separate certificates for the integral level sensors and magnetic switches.
(This prescription applies to the surrounding of the electrical components mounted onto, namely for the level sensor and the magnetic switch).
- If temperatures in excess of 70°C occur at the cable gland or above 80°C at the wire terminations, only a verified heat-resistant cable for the relevant temperature may be used. The cable gland must be suitable for this temperature.
- The metal enclosures of bypass level indicators must be electrically bonded to the equipment's earth bonding system.
- Modifications to the unit may only be carried out by the manufacturer.

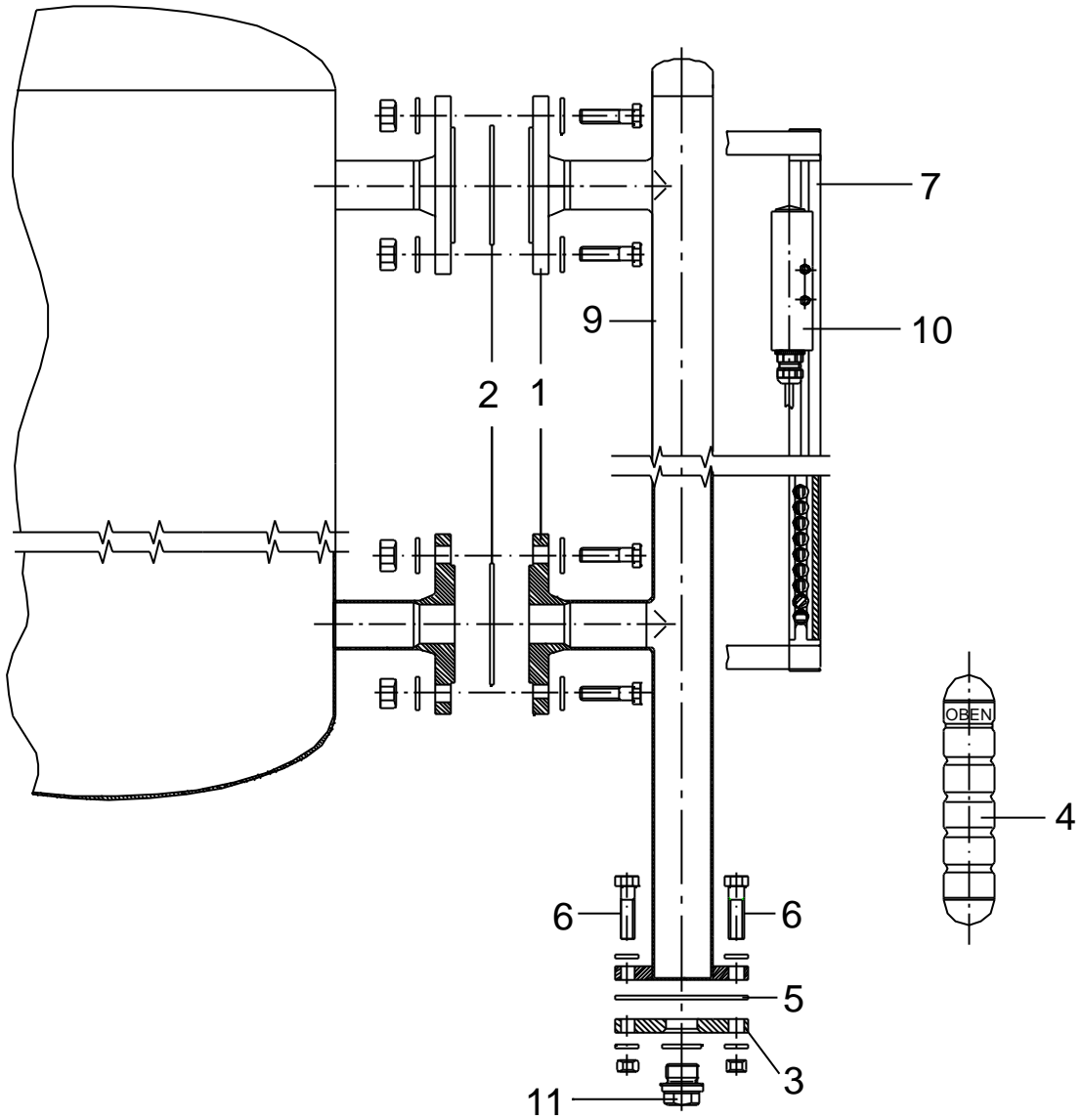
NOTES FOR THE AREA OF USE

- No electrical components may be fitted inside the parts of the bypass level indicator that are in contact with the medium. Therefore they have to be according to CEN-Norm EN 1127-1:1997. The requests for this norm, in particular also the requests of the figures 6.2.3.2 will be met: the mentioned internal areas are to be kept free of leaks and they must not contain any hot components that produce sparks.
- According to the present state of knowledge, no reservations exist concerning safety regulations to use the internal areas of the bypass chambers within explosion endangered area of zone 0.

7. COMMISSIONING:

Fill the container and switch on the electrical control, where provided. Check the magnetic roller display and check the switching function of the magnetic switches to make sure that they are operating properly. Use a connecting cable for the level sensor of at least 3 x 0.5 mm². Route cable from measuring transducer (switchgear cabinet) to the bypass level sensor and insert into the terminal box using a cable gland and seal it.

The level indicator is ready for operation.



MAGNETIC SWITCH FOR FB01 / FB04

8. MAGNETIC SWITCH / LIMITING VALUE:

Limit levels are activated by magnetic switches.

The magnetic switches will be differentiated after different types corresponding to the range of applications and the technical requirements.

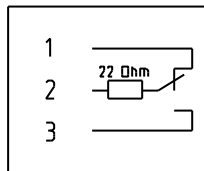
All magnetic switches are bistable, i.e. they are switched over by the float's magnetic system as the level rises and falls.

9. ELECTRICAL CONNECTION OF THE MAGNETIC SWITCH:

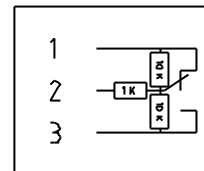
The electrical connection must comply with the safety regulations for installing electrical systems and equipment that apply in the country where the unit is installed and this work may only be undertaken by qualified personnel. The service life of the switch can be increased considerably through the use of a contact protection relay.

As options, the magnetic switches can be provided with the following configurations:

Circuit for the operation
on SPS with 22Ω resistance



Namur circuit acc. to EN 60947



10. CAUTION:

If the switch is connected to an inductive load, it may be damaged beyond repair. A protective circuit with an RC element or a freewheeling diode should be provided.

If connected to a capacitive load, a protective resistor is to be connected in series to limit the peak current.

Electrical overloading may result in the switch being damaged irreparably. This may cause the control connected in the outgoing circuit to malfunction and result in damage to property and injury to persons. Maximum electrical switching capacities must be complied with.

If a fault is present on units with metal enclosures and connecting cables without a ground terminal, the units may be live and thus cause damage to property or injury to persons. These units may only be operated on extra-low voltage or they must have an additional ground connection. (> 50 V / max. 1A)

It is important that an adequate and correct power supply is used.

11. MAINTENANCE OF THE MAGNETIC SWITCH:

The units must be installed and commissioned in accordance with the generally accepted rules of engineering practice. When in service the units do not require any maintenance, provided that the magnetic switch is designed for the ambient conditions such as the temperature, protection rating and medium.

12. FUNCTIONAL TEST OF THE MAGNETIC SWITCH:

With the electrical connection between the switch and the control disconnected, a continuity tester is then connected and the functionality of the switch is tested using a magnet. Bistable switches should be switched twice so that they are returned to their initial position. Reconnect the electrical connection after the test has been completed.

MAGNETIC SWITCH FOR FB01 / FB04

13. NOTES FOR MAGNETIC SWITCHES:

- Do not operate magnetic switches in close proximity to powerful electro-magnetic fields. Minimum clearance: 1 m.
- The magnetic switches must not be subjected to any mechanical loads, vibrations or shock influences. If these loads are existing, support or protecting elements have to be used.
- Mechanical shocks transmitted through the medium to the instrument is not allowed.
- For flammable or explosive mediums, instruments with 94/9/EG ATEX approvals have to be used.
- Disposal of instruments should be in accordance with regional and national directions and guidelines. By disposal it is possible that residues of the medium remain within the instrument.
- The conditions of the environment have to be optimised so that all indicating instruments on-site can be read correctly and be positioned to be in a normal field of view.

TRANSPORTATION SPECIFICATIONS:

These instruments should be packed with respect to the delicate nature of some of the parts. Outer packing, such as wooden cases should be marked with fragile or similar signs to help protect the instrument.

14. NOMINAL DATA FOR EX-MAGNETIC SWITCHES:

VERSION WITH "INTRINSIC SAFETY" PROTECTION RATING

Supply circuit:

- For protection rating EEx ia IIC
- only for connection to a certified intrinsically safe circuit.
- Maximum current: $I_i \leq 100 \text{ mA}$
- The effective self inductance and capacitance are negligible.

VERSION WITH OPTION /N (NAMUR CIRCUIT) WITH "INTRINSIC SECURITY" PROTECTION RATING

Supply circuit:

- For protection rating EEx ia IIC.
- only for connection to a certified intrinsically safe circuit.
- Maximum current:
 $U_i \leq 15 \text{ V}$
 $I_i \leq 60 \text{ mA}$
- The effective self inductance and capacitance are negligible.

VERSION WITH "EXPLOSION PROOF" PROTECTION RATING RESP. "ENCAPSULATION" PROTECTION RATING

Supply circuit:

- Only for connection to a circuit with safe limitation of the electrical parameters to the following values:

Rated voltage: $U_N = 250 \text{ VDC/AC}$
Switching capacity: $P_N = 50 \text{ W/VA}$

VERSION WITH OPTION /N (NAMUR CIRCUIT) WITH "FLAMEPROOF ENCLOSURE" PROTECTION RATING

Supply circuit:

- Only for connection to a circuit with safe limitation of the electrical parameters to the following values:

Rated voltage: $U_N = 15 \text{ VDC}$
Switching capacity: $I_N = 60 \text{ mA}$

MAGNETIC SWITCH FOR FB01 / FB04

VERSION WITH OPTION /R (PROTECTIVE RESISTOR) WITH "FLAMEPROOF ENCLOSURE" PROTECTION RATING

Supply circuit:

- Only for connection to a circuit with safe limitation of the electrical parameters to the following values:
Rated voltage: $U_N = 250 \text{ VDC/AC}$
Switching capacity: $I_N = 100 \text{ mA}$

If the instrument will be supplied without cable gland, it is only allowed to mount a cable gland which is according to norm EN 50018 (pressure die-cast EExd).

15. INFORMATIONS FOR EX-MAGNETIC SWITCHES:

- Magnetic switches in accordance with 94/9/EG ATEX approvals may only be used in Zones 1 and 2 and in gas groups IIA, IIB and IIC, which are subject to explosion hazards as a result of combustible substances in the range of temperature classes T1 to T6.
- The assignment between the temperature classes and the maximum ambient temperature has to be taken from the following table.

Temperature Class	Ambient temperature					
	EEx ia IIC		EEx d IIC			Eex m II
	Basis	Option / N	Basis	Option / N	Option / R	
T6	80°C	75°C	80°C	75°C	75°C	80°C
T5	95°C	90°C	95°C	90°C	90°C	95°C
T4	130°C	125°C	120°C	115°C	115°C	----
T3	190°C	185°C	----	----	----	----
T2	290°C	285°C	----	----	----	----
T1	300°C	----	----	----	----	----

- If temperatures in excess of 70°C occur at the cable lead-in or above 80°C at the wire terminations, only a verified heat-resistant cable for the relevant temperature may be connected.
- The magnetic switch (type according to type key) in the version with „explosion proof“ protection rating resp. „compound-filled encapsulation“ is only for connection to an electric circuit with safe (external) delimitation of the electrical parameters to the given values.
- Magnetic switches with metal enclosures must be electrically bonded to the equipment's earth bonding system.
- Equipment for use in hazardous locations is identified with a special rating plate containing all data relevant to explosion protection

LEVEL SENSOR FOR FB01 / FB04

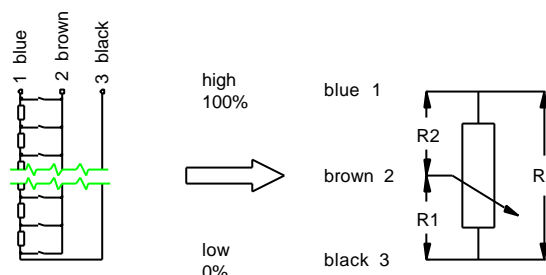
16. LEVEL SENSOR:

Level sensors are used for the electrical continuous remote display of levels. The resistance measuring chain, which is mounted outside the chamber, transmits the current level through the wall of the chamber using the magnetic system of the float. The resistance is converted into a (0)4 - 20 mA analog signal by means of a transducer and the reading is output on a digital or analog display.

17. ELECTRICAL CONNECTION OF THE LEVEL SENSOR

The electrical connection must comply with the safety regulations for installing electrical systems and equipment that apply in the country where the unit is installed and this work may only be undertaken by qualified personnel.

The level sensor is to be connected in the junction box in accordance with the connection plan. The level sensor is to be wired with the electronic transmitter connected in the outgoing circuit.



The cable gland is to be sealed and the lid of the junction box is to be properly sealed.

Control unit:

Level sensors with integral head measuring transducers are to be connected in accordance with the connection plan in the junction box. Information on terminal assignment can be found in the relevant connection plan. The connection data can be found in the appropriate operating instructions.

18. CAUTION:

- The operator has to guarantee that instruments that have an earth, will be earthed.
- Instruments with a connection cable are not earthed and can be alive in case of error.
- These instruments are only allowed to be operated with extra-low voltage.
- Instrument cables must not be run in trunking or close proximity with power lines that have heavy switching functions. Such power cables may cause switch damage from high-voltage spikes. Shielded connecting lines have to be used. These lines have to be earthed one-side.
- It is important that an adequate and correct power supply is used

19. MAINTENANCE OF THE LEVEL SENSOR:

The units must be installed and commissioned in accordance with the generally accepted rules of engineering practice. When in service, the units do not require any maintenance providing that parameters such as the type of medium, density, temperature and pressure are complied with.

20. FUNCTIONAL TEST OF THE LEVEL SENSOR

The user is responsible for periodically carrying out a functional test or, at the very least, a visual check.

A functional test can be performed on the measuring chain with the sensor either removed or in situ. If the units are in situ, it must be possible to fill the system.

1. Remove connecting cable.
2. Connect ohmmeter to two cores.
3. Move float manually or by filling the system from the min. to max. points.
4. The resistance reading displayed changes continuously as a function of the core colors connected.

LEVEL SENSOR FOR FB01 / FB04

BLACK-BROWN (R1)	BLUE-BROWN (R2)	BLACK-BLUE (Ri)
Resistance increases in proportion to the height of the float	Resistance falls from the value of the overall resistance in inverse proportion to the height of the float	Display of overall resistance (Ri)

21. NOTES FOR LEVEL SENSOR:

- Do not operate level sensors in close proximity to powerful electromagnetic fields. (Minimum clearance: 1 m.)
- Only use in conjunction with a suitable measuring transducer.
- When used on safety barriers, the overall resistance of the reed measuring chain (Ri) must be between 1 k to 100 k Ohms.
- The level sensor must not be subjected to any mechanical loads, vibrations or shocks. If these loads are existing, support or protecting elements have to be used.
- Mechanical shocks transmitted through the medium on to the instrument is not allowed.
- For flammable or explosive mediums, instruments with 94/9/EG ATEX approvals have to be used.
- Disposal of the instruments must be in accordance with the regional and national directions and guidelines. By disposal it is possible that residues of the medium remain within the instrument.
- The conditions of the environment have to be optimised so that all indicating instruments on-site can be read correctly and be positioned within a normal field of view.

TRANSPORTATION SPECIFICATIONS:

These instruments should be packed with respect to the delicate nature of some of the parts. Outer packing, such as wooden cases should be marked with fragile or similar signs to help protect the instruments.

22. NOMINAL DATA FOR EX-LEVEL SENSOR:

VERSIONS WITH «INTRINSIC SAFETY» PROTECTION RATING

Supply circuit as a passive n-terminal circuit:

- For protection rating EEx ia IIC
- only for connection to a certified intrinsically safe circuit
- Maximum values:
 $U_i \leq 30 \text{ V}$
 $I_i \leq 150 \text{ mA}$
- The effective self inductance and capacitance are negligible.

Supply circuit with separately certified integral measuring transducer:

- For intrinsically safe protection rating EEx ia IIC / EEx ib IIC
- only for connection to a certified intrinsically safe circuit.
- Maximum current:
In accordance with the nominal data of the separately certified measuring transducer.

VERSION WITH "EXPLOSION PROOF" PROTECTION RATING

Supply circuit as a passive n-terminal circuit:

- Only for connection to a circuit with safe limitation of the electrical parameters to the following values:
Rated voltage $U_N = 30 \text{ VDC/AC}$
Rated current $I_N = 150 \text{ mA}$

If the instrument is delivered without the cable gland, it is only allowed to mount a cable gland in accordance to the norm EN 50018 (pressure-proof encapsulation EExd).

LEVEL SENSOR FOR FB01 / FB04

23. INFORMATION FOR EX-LEVEL SENSOR:

- The level sensor may be used in accordance with 94/9/EG ATEX approvals in Zones 1 and 2 and in gas groups IIA, IIB and IIC, which are subject to explosion hazards as a result of combustible substances in the range of temperature classes T1 to T6 T6 respectively the listed values in the below mentioned table.
- The assignment between the temperature classes and the maximum ambient temperature has to be taken from the following table.

Temperature class	Ambient temperature	
	EEx ia/ib IIC	EEx d (ia/ib) IIC
T6	80°C	80°C
T5	95°C	95°C
T4	130°C	120°C
T3	180°C	

Separate certified control units, when installed, also have operational ambient temperature limits that have to be observed.

- If temperatures in excess of 70°C occur at the cable gland or above 80°C at the wire terminations, only a verified heat-resistant cable for the relevant temperature may be used. The cable gland must be suitable for this temperature.
- Metallic or electrically conductive housings on level sensor must be earthed to the main equipment.
- Equipment for use in hazardous locations is identified with a special rating plate containing all data relevant to explosion protection.