Baumer Explosion Protection Guideline

Scope

This document contains recommendations for ATEX installations of suitable Baumer sensors. The information given must not be understood as a specification and Baumer does not assume any responsibility for the information provided.
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1 Protection concepts used by Baumer

Note: BU Motion and pressure transmitter X9 are excluded.

1.1 Intrinsic safety (Ex i)

- Zones 0, 1, 2 (gas) [Class I Division 1/2 (gases)] and zones 20, 21, 22 (dust) [Class II Division 1/2 (dusts)]
- Limit the energy of sparks and surface temperatures
- Ex i safety barrier or isolator required (associated apparatus)
- No IO-Link via barrier or isolator possible

Figure 1: Schematic for a gas “ia” installation of a CleverLevel (LBFH/I) (ATEX II 1 G Ex ia IIC T4 Ga)

Figure 2: Examples of Ex i associated apparatus (“barriers”)
1.2 Tight enclosure (Ex t)
- Zones 20, 21, 22 (dust) [Class II Division 1/2 (dusts)]
- Standard protection for dusts
- Rugged and tight enclosure, no hot surfaces
- Ingression protection required (e.g. IP6x)
- Use insulated cables to IP6x
- Must not be unplugged in operation (only for defined maintenance)

Zones 20, 21, 22

Safe area

Figure 3: Schematic for a dust “ta” installation of a CleverLevel (ATEX II 1 D Ex ta IIIC T100 °C)

1.3 Non-sparking (Ex nA)
- Zone 2 (gas) only [Class I Division 2 (gases)]
- No arcs, sparks or hot surfaces
- Enclosure ingression protection min. IP54
- “Ex nA” moved to “Ex ec” by regulations, but is still valid

Zone 2

Safe area

Figure 4: Schematic for a gas zone 2 “nA” installation of a CleverLevel (ATEX II 3 G Ex nA IIC T4 Gc)
2 Product specifics

2.1 General

All Baumer Ex-certified products are only applicable for surface installation (ATEX group II), i.e. not for mining (ATEX group I).

Any dual stamping for gas and dust (like LBFS-4xxxx.x) does not mean that the unit can be used in an atmosphere which is hazardous for both gas and dust (hybrid mixture). In this case, a dedicated assessment has to be made by the operator which we cannot support. Once such a unit has been connected to any other than an intrinsically safe circuit, it must not be used in an intrinsically safe installation again.

2.2 Temperature sensors

2.2.1 Passive Pt100 sensors (simple apparatus)

There are dedicated three-channel Zener barriers available, however, they aren’t recommended, because of accuracy loss and difficulties to match intrinsic safety limit values. Also most Ex i isolators with integrated Pt100 to 4-20-mA converter do not match the limit values of our “simple apparatus” specification. Temperature sensors with integrated Baumer FlexTop head transmitters are recommended instead.

2.2.2 Temperature transmitters

All FlexTop transmitters have ATEX certification, either as single module or mounted in a thermometer, like TFRx or TCR6. The interface is an analog 2-wire current loop with HART protocol as option. It’s ideal for being transferred through a Zener barrier, because current loop signals are tolerant to loop resistance without degrading performance.

2.3 Pressure sensors

Ex-certified pressure sensors are PBMx, PFMx, and Y91-3. ATEX compatibility is restricted to 4-20-mA interface with exception of Y91-2, which is also available with voltage output, however no application is given in this document for it. There is also a constraint for cable output connection of PBMx, which has been discontinued for gas due to risk of carryover gas through the cable between different zones.

For PBMx: The pressure transmitters can be mounted in boundary walls, which separates the areas according to category 1 (EPL Ga) - requirements (zone 0) from areas according to category 2 (EPL Gb) - requirements (zone 1). In this case, the process connection must be sufficiently sealed according to EN 60079-26, art. 4.6, e.g. the protection class IP67 according to EN 60529. Please refer to the appropriate installation instructions for more details.

2.4 Point level switches

2.4.1 General CleverLevel installation constraints

For all CleverLevel, no barrier is required for dust (ta) and non-sparking (nA, zone 2) applications. When using a standard barrier, there are some boundary conditions. The supply voltage comes to a borderline level when anticipating all worst case conditions. For that reason the output load resistance should be greater than 10 kOhm. The max. output voltage is limited to the actual supply voltage arriving after the barrier’s resistor, which is not within the threshold range of a standard digital PLC input. For that reason the output signal has to be evaluated with an analog input type.

If a digital input type should be used in the PLC, the Ex i isolator PROFSI3 is recommended.
2.4.2 LFFS

2.4.2.1 Versions
There are separate versions for gas (ia), dust (tD, new: ta) and non-sparking (nA, zone 2).

2.4.2.2 Intrinsic safety installation constraints for LFFS
For gas (ia) only Ex i isolator PROFSI3 can be used.

2.4.3 LBFS

2.4.3.1 Versions
For legacy reasons, there are two separate versions for gas (ia) and dust (ta) available (LBFS-1xxxx.x and LBFS-2xxxx.x). If there is no mandatory requirement to order these legacy versions, please chose the combined version for ia and ta (LBFS-4xxxx.x). (LBFS-3xxxx.x) is the version for non-sparking applications (nA, zone 2).

2.4.3.2 Intrinsic safety installation constraints for LBFS
For gas (ia) applications only Ex i isolator PROFSI3 can be used. Only PNP-output configuration (at ordering choice) can be used. Please refer to section 3.2.3 for details.

2.4.4 LBFH/I

2.4.4.1 Versions
There are two versions: combined gas/dust (ia/ta) and non-sparking (nA, zone 2). Both versions are approved to ATEX and IECEx, however, there is currently no UL certificate.

2.4.4.2 Intrinsic safety installation constraints for LBFH/I
PNP and push-pull output configuration can be used, however push-pull is preferred due to lower leakage current for the IO-Link capable output in particular. Please refer to section 3.2.4 for details.

The LED current consumption is slightly higher when showing yellow, rather than green or blue color. In factory default setting, both outputs are switching antivalent with equal switching windows; with this configuration there will never be a yellow LED indication. Nevertheless, both outputs can be used simultaneously with some restrictions, if there is a requirement for different sensor thresholds using different demanding media. In this case the proper function has to be evaluated and tested with respect to min. supply voltage and PLC input level. Please refer to section 3.2.5 for more information.

LBFH/I have a quite big inductance integrated which supports the qTeach feature; therefore only gas group IIIB can be accepted (EN 60079, 50-%-rule), please see section 3.4 for details.

2.5 Inductive proximity switches IFRM ##X...

All Baumer Ex i inductive proximity switches are connected by a 2-wire NAMUR interface. In addition there are Ex t versions with transistor switching outputs and tight enclosure for Ex dust applications in zone 22.
2.6 FlexProgrammer 9701

FlexProgrammer 9701 must not be used in hazardous areas. It can be connected in the safe area if terminals are available there and if:

- It is not an intrinsically safe installation, because
  - Serial resistance caused by a barrier is too high for a proper function
  - Lines are cut by a switching repeater (e.g. PROFSI3)
- The capacitance caused by the cable is within a moderate range (max. cable length app. 20 m)

3 Barrier and isolator selection for intrinsic safety (Ex i) installations

3.1 Quick application finder

<table>
<thead>
<tr>
<th>Temperature sensors and transmitters TFRx, TCR6, 2xxx</th>
<th>Analog 2-wire current loop sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure sensors PBMx, PFMx, Y913</td>
<td>Analog 2-wire current loop sensors</td>
</tr>
<tr>
<td>CombiSeries with DFON relays TFRx, PFMx</td>
<td>Analog 2-wire current loop sensor with relays</td>
</tr>
<tr>
<td>Point level switches LFFS, LBFS, (LBFH, LBFI) with PROFSI3</td>
<td>Switching sensor with single PNP output</td>
</tr>
<tr>
<td>Point level switches LBH, LBFI with one output with Zener barrier</td>
<td>Switching sensor with single push-pull output</td>
</tr>
<tr>
<td>Point level switches LBH, LBFI with two outputs with PROFSI3 or Zener barrier</td>
<td>Switching sensor with two PNP outputs</td>
</tr>
<tr>
<td>Inductive proximity switches IFRM ##X..., IFR 10.82E05 with NAMUR isolator</td>
<td>Switching sensor with two push-pull outputs</td>
</tr>
<tr>
<td>Inductive proximity switches IFRM ##X..., IFR 10.82E05 with NAMUR isolator</td>
<td>Switching sensor with NAMUR interface</td>
</tr>
</tbody>
</table>

3.2 Intrinsic safety installation concepts

3.2.1 Analog 2-wire current loop sensor

- Applicable for all Baumer Ex i 4-20-mA current loop sensors, e.g. PBMx, PFMx, TFRx, TCR6
- Voltage drop of app. 10 V due to series resistor (up to 360 Ohm) and return diode (2 V)
- HART compatible

Figure 5: Analog 2-wire 4-20-mA current loop sensor installation
3.2.2 Analog 2-wire current loop sensor with relays

- Applicable in combination with relays contacts like integrated in TFRx and PFMx with DFON display
- Same points than in 3.2.1

![Diagram of Analog 2-wire 4-20-mA current loop sensor installation with relay contacts]

B28RD100 B30RS075

Figure 6: Analog 2-wire 4-20-mA current loop sensor installation with relay contacts
3.2.3 Switching sensor with single PNP output

- Applicable for CleverLevel switches, LFFS and LBFS in particular or LBFH/I with only one output used
- An active Ex i isolator is capable to drive directly a digital PLC input.
- Normally open or normally closed (NO/NC) logic can be chosen by wiring or programming. Please check up appendix 4.2 for fail-safe operation considerations.
- For LBFH/I higher cost than Zener barrier (without taking PLC input into account)

**Graphical Diagram:**

```
Switching sensor with Ex i isolator
Baumer code: BISOSW1

Hazardous area

Safe area

Control equipment
```

Figure 7: PNP switching output installation with dedicated Ex i isolator

3.2.4 Switching sensor with single push-pull output

- Applicable for LBFH/I
- Push-pull outputs are the preferred choice, because there is no leakage current in off-state. This applies especially for IO-Link capable outputs which have usually a higher leakage in PNP output mode. If possible, such switching sensors should be ordered or programmed with push-pull output.
- High voltage drop of power supply due to series resistor of Zener barrier (up to 360 Ohm)
- Analog input in PLC is required, because of low high-side voltage and additional voltage drop from diode in return channel. The switching threshold should be set to 5 V and RI is preferable 10 kOhm.
- IO-Link is not applicable in intrinsically safe ATEX installations. It can be used for programming with direct connection in maintenance conditions without risk of explosive atmosphere presence.

**Graphical Diagram:**

```
Switching sensor with push-pull output
Safety barrier
Baumer code: B28RD100

Hazardous area

Safe area

Control equipment
```

Figure 8: Push-pull switching output installation
3.2.5 Switching sensor with two PNP outputs

- Applicable for LBFH/I for transmitting two switching outputs with different switching window settings
- Same points as in 3.2.3 if applicable
- The switching input of the second isolator must be taken into account to prove intrinsic safety.
- According to EN 60079-14, the protection level must be reduced to "ib" (zone 1) when associated apparatus are interconnected.

![Diagram of two PNP switching outputs with interconnection of two Ex i isolators](image)

Figure 9: Two PNP switching outputs with interconnection of two Ex i isolators
3.2.6 Switching sensor with two push-pull outputs

- Same points than in 3.2.4
- Second barrier with only the return diode path used must be taken into account to prove intrinsic safety.
- According to EN 60079-14, the protection level must be reduced to "ib" (zone 1) when associated apparatus are interconnected (please refer also to section 3.4.1).

![Diagram of two-channel push-pull switching output installation with equal barrier types](image)

**Figure 10**: Two-channel push-pull switching output installation with equal barrier types

3.2.7 Switching sensor with NAMUR interface

- Applicable for Ex i Baumer proximity switches, like IFRM ##X...
- The most efficient solution proposed is using an active Ex i isolator with NAMUR input.

![Diagram of 2-wire NAMUR interface installation with Ex i isolator with NAMUR input](image)

**Figure 11**: 2-wire NAMUR interface installation with Ex i isolator with NAMUR input
## 3.3 Reference for barrier and isolator models

<table>
<thead>
<tr>
<th>Baumer code</th>
<th>Baumer accessories</th>
</tr>
</thead>
</table>
| **B28RD100** | Dual-channel safety barrier (with diode return channel)  
  ZEX-ALL.B28RD100  
  (11217062) |
| ![Diagram](image) | Placement in zone 2 or safe area |
| **B30RS075** | Single-channel safety barrier (for potential-free contacts)  
  ZEX-ALL.B30RS075  
  (11217063) |
| ![Diagram](image) | Placement in zone 2 or safe area |
| **BNAMUR1** | Switching repeater (NAMUR Ex i field circuit)  
  ZEX-ALL.BNAMUR1  
  (11217065) |
<p>| <img src="image" alt="Diagram" /> | Placement in zone 2 or safe area |</p>
<table>
<thead>
<tr>
<th>Baumer code</th>
<th>Baumer</th>
</tr>
</thead>
</table>
| **BISOSW1** | Ex i isolator  
Baumer code: BISOSW1 |
|             | Switching repeater (CleverLevel Ex i)  
**PROFSI3**  
(11049888) |

Placement in safe area or for dust in zones 21, 22 with IP6x protection
3.4 Intrinsic safety check

Note: The statements given here do not replace proof of intrinsic safety. They only serve as support to select the suitable components. All information is given without guarantee.

3.4.1 B28RD100

- Two-channel safety barrier
- Resistor for power supply
- Diode as return channel

All Ex i Baumer sensors with analog 2-wire 4-20 mA current loop signal

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors¹</th>
<th>ZEX-ALL.B28RD100 (I + II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 28 V</td>
<td>28 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 100 mA</td>
<td>93 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 700 mW</td>
<td>651 mW</td>
</tr>
<tr>
<td>Gas group</td>
<td>IIC</td>
<td>IIB</td>
</tr>
<tr>
<td>Co</td>
<td>≥ 60 nF</td>
<td>83 nF</td>
</tr>
<tr>
<td>Lo</td>
<td>≥ 1.5 mH **</td>
<td>2.2 mH</td>
</tr>
</tbody>
</table>

** Multiplied by 100 from actual max. value to exclude 50-%-rule

Result: suitable for gas group IIC

Baumer LBFH, LBFI (one output)

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors¹</th>
<th>ZEX-ALL.B28RD100 (I + II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 30 V</td>
<td>28 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 100 mA</td>
<td>93 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 750 mW</td>
<td>651 mW</td>
</tr>
<tr>
<td>Gas group</td>
<td>IIC</td>
<td>IIB</td>
</tr>
<tr>
<td>Co</td>
<td>≥ 63 nF</td>
<td>83 nF / 2 *</td>
</tr>
<tr>
<td>Lo</td>
<td>≥ 617 µH</td>
<td>2.2 mH / 2 *</td>
</tr>
</tbody>
</table>

* 50-%-rule has to be applied, because Lo = 617 µH > 1 % · 2.2 mH = 22 µH

Result: suitable for gas group IIB

¹ Limit values: smallest for Ui, II, Pi, greatest for Ci, Li; Cc and Lc for cables are not considered
Baumer LBFH, LBFI (two outputs)

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors²</th>
<th>ZEX-ALL.B28RD100 (I + II)</th>
<th>ZEX-ALL.B28RD100 (II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 30 V</td>
<td>28 V</td>
<td>28 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 100 mA</td>
<td>93 mA</td>
<td>3 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 750 mW</td>
<td>651 mW</td>
<td>21 mW</td>
</tr>
</tbody>
</table>

Interconnection of two barriers with Co and Lo calculated

<table>
<thead>
<tr>
<th>Gas group</th>
<th>Co</th>
<th>Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIC</td>
<td>≥ 63 nF</td>
<td>≥ 617 µH</td>
</tr>
<tr>
<td>IIB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Values Co and Lo calculated with PTB software “ispark” V 6.2 with Uo = 28 V and Io = 96 mA, safety factor 1.5 (zones 0/1):

<table>
<thead>
<tr>
<th>IIC</th>
<th>Co</th>
<th>Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55 nF</td>
<td>67 nF</td>
</tr>
<tr>
<td>IIB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Co</th>
<th>Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>240 nF</td>
<td>13 mH</td>
</tr>
<tr>
<td>290 nF</td>
<td>2 mH</td>
</tr>
<tr>
<td>350 nF</td>
<td>1 mH</td>
</tr>
<tr>
<td>430 nF</td>
<td>500 µH</td>
</tr>
<tr>
<td>570 nF</td>
<td>200 µH</td>
</tr>
<tr>
<td>650 nF</td>
<td>100 µH</td>
</tr>
</tbody>
</table>

Result: suitable for gas group IIB; according to EN 60079-14 restriction to “ib” and therefore zone 1

² Limit values: smallest for Ui, li, Pi, greatest for Ci, Li; Cc and Lc for cables are not considered
3.4.2 BISOSW1

- Galvanically isolated switching repeater
- Dedicated design to CleverLevel
- Relay output

![Diagram of Ex i isolator Baumer code: BISOSW1](image)

### Baumer LFFS, LBFS

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors³</th>
<th>PROFSI3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 30 V</td>
<td>25.2 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 100 mA</td>
<td>99 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 750 mW</td>
<td>623 mW</td>
</tr>
<tr>
<td>Gas group</td>
<td></td>
<td>IIC</td>
</tr>
<tr>
<td>Co</td>
<td>≥ 43 nF</td>
<td>107 nF</td>
</tr>
<tr>
<td>Lo</td>
<td>≥ 1 mH</td>
<td>3 mH</td>
</tr>
</tbody>
</table>

** Multipled by 100 from actual max. value to exclude 50-%-rule

Result: suitable for gas group IIC

### Baumer LBFH, LBFI (one output)

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors³</th>
<th>PROFSI3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 30 V</td>
<td>25.2 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 100 mA</td>
<td>99 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 750 mW</td>
<td>623 mW</td>
</tr>
<tr>
<td>Gas group</td>
<td>IIC</td>
<td>IIB</td>
</tr>
<tr>
<td>Co</td>
<td>≥ 63 nF</td>
<td>107 nF / 2 *</td>
</tr>
<tr>
<td>Lo</td>
<td>≥ 617 μH</td>
<td>3 mH / 2 *</td>
</tr>
</tbody>
</table>

* 50-%-rule has to be applied, because Lo = 617 μH > 1 % · 3 mH = 30 μH

Result: suitable for gas group IIB

³ Limit values: smallest for Ui, li, Pi, greatest for Ci, Li; Cc and Lc for cables are not considered
3.4.3 **B30RS075**
- Single-channel safety barrier
- Dedicated to contact evaluation
- Integrated active current limiter controlling a switching output

![Safety barrier diagram](image)

---

### Baumer DFON Relay outputs (TFRx, PFMx)

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors</th>
<th>ZEX-ALL.B30RS075</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 30 V</td>
<td>25.2 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 75 mA</td>
<td>60 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 750 mW</td>
<td>378 mW</td>
</tr>
<tr>
<td>Gas group</td>
<td></td>
<td>IIC</td>
</tr>
<tr>
<td>Co</td>
<td>≥ 10 nF</td>
<td>107 nF</td>
</tr>
<tr>
<td>Lo</td>
<td>≥ 1 mH **</td>
<td>6.2 mH</td>
</tr>
</tbody>
</table>

** Multiplied by 100 from actual max. value to exclude 50-%-rule

Result: suitable for gas group IIC

---

4 Limit values: smallest for Ui, li, Pi, greatest for Ci, Li; Cc and Lc for cables are not considered
3.4.4 BNAMUR1
- Galvanically isolated switching repeater
- Dedicated to inductive proximity switches with NAMUR interface

Ex i isolator
Baumer code: BNAMUR1

Baumer IFRM ##X..., IFR 10.82E05, IFRM 05X95/509348

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensors</th>
<th>ZEX-ALL.BNAMUR1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uo</td>
<td>≤ 13 V</td>
<td>9.6 V</td>
</tr>
<tr>
<td>Io</td>
<td>≤ 20 mA</td>
<td>10 mA</td>
</tr>
<tr>
<td>Po</td>
<td>≤ 65 mW</td>
<td>25 mW</td>
</tr>
<tr>
<td>Gas group</td>
<td>IIC</td>
<td>IIB</td>
</tr>
<tr>
<td>Co</td>
<td>≥ 100 nF</td>
<td>3600 nF</td>
</tr>
<tr>
<td>Lo</td>
<td>≥ 20 mH</td>
<td>300 mH</td>
</tr>
</tbody>
</table>

** Multiplied by 100 from actual max. value to exclude 50%-rule

Result: suitable for gas group IIC

---

5 Limit values: smallest for Ui, li, Pi, greatest for Ci, Li; Cc and Lc for cables are not considered
4 Appendix

4.1 Flowchart for associated apparatus selection

4.1.1 Point level switches

1) No solution with NPN output available
2) Push-pull output has less leakage current in off-state and is therefore preferred
3) Low voltage level of switching signal; threshold of PLC input should be set to 5 Volt.
4.1.2 Temperature sensors

TFRx, TCR6

FlexTop

Yes

Substance

Gas

Dust

No solution

Zener barrier B28RD100
ZEX-ALL.B28RD100
(11217062)

DFON Relay

Yes

Zener barrier B30RS075
ZEX-ALL.B30RS075
(11217063)

Done

1) One barrier per relay contact
4.1.3 Pressure sensors

PBMx, PFMx
Y913

Zener barrier B28RD100
ZEX-ALL.B28RD100
(11217062)

DFON
Relay

Yes

Zener barrier B30RS075 \(^1\)
ZEX-ALL.B30RS075
(11217063)

Done

No

1) One barrier per relay contact
4.1.4 Inductive proximity switches

Inductive proximity switch

Zone → Gas → Ex ia (NAMUR)

Ex ia (NAMUR)
IFR 10.82E05

Ex i isolator BNAMUR1
ZEX-ALL.BNAMUR1
(11217065)

Done

Substance → Dust → Ex ic (NAMUR)

Ex ic (NAMUR)
IFR 10.82E05

No barrier/isolator required

Zone → Ex tb

Ex tb
IWRM 12I9704/S14X

Ex tc
IWRM 12##X...
IFR 12.82.05/K630
IFFM 20P15/103735
MDRM 18I95/126018

Zone → No solution

Zone → 20 → No solution
4.2 Considerations for fail-safe operation

It depends on the fail-safe position of the application whether NO or NC is the choice for CleverLevel output. The operator should consider that in case of any wire break or power loss the safe switching status should be entered. I.e. in case of an overfill protection the contact should open when medium is detected, but in case of a dry run protection the contact should also open when no medium is detected.

**NO and NC choice for CleverLevel product family**

<table>
<thead>
<tr>
<th>CleverLevel</th>
<th>Programming by FlexProgram</th>
<th>Two antivalent outputs NO/NC with factory setting</th>
<th>Selection by power supply polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFFS</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LBFS</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>LBFH/I</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Note: In all cases PNP output has been considered, however digital (push-pull) will work as well.
There is an internal switch in the PROFSI3 (accessible after removing the front cover), where its relay logic can be inverted.

![PROFSI3 front cover and its reversal side](image)

**Figure 12: PROFSI3 front cover and its reversal side**

<table>
<thead>
<tr>
<th>Application</th>
<th>Medium detected</th>
<th>CleverLevel</th>
<th>PROFSI3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PNP output NO</td>
<td>PNP output NC</td>
</tr>
<tr>
<td>Overfill protection</td>
<td>No</td>
<td>active</td>
<td>closed</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>inactive</td>
<td>open</td>
</tr>
<tr>
<td>Dry run detection</td>
<td>No</td>
<td>inactive</td>
<td>open</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>active</td>
<td>closed</td>
</tr>
</tbody>
</table>

In case of power down or wire break of CleverLevel, it should enter the critical status (marked in red). For all fail-safe applications the used relay output contact of PROFSI3 is always normally open (NO), because it is the defined status in case of power down. In addition no inversion of the PROFSI3 relay’s switching logic has to be chosen (internal switch always set to “NORMAL”).
Configuration vs. application

<table>
<thead>
<tr>
<th>Application</th>
<th>CleverLevel PNP output</th>
<th>PROFSI3 relay output contact</th>
<th>PROFSI3 Switch “Fail Safe”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overfill protection</td>
<td>NC</td>
<td>NO</td>
<td>NORMAL</td>
</tr>
<tr>
<td>Dry run detection</td>
<td>NO</td>
<td>NO</td>
<td>NORMAL</td>
</tr>
</tbody>
</table>

Please note that the relay contact “NO” of PROFSI3 is open (not closed) for both critical status “overfill” and “dry run” of the appropriate application. If wired according to the schematic above you will read “zero” or “low” in these cases.

Conclusion

Dependent on the application “overfill protection” or “dry run detection”, only the CleverLevel output logic NO/NC has to be selected appropriately. There are no choices for PROFSI3, neither switch “Fail Safe”, nor wiring in such cases. However, related to other goals the available choices of PROFSI3 can be selected, of course.

4.3 Marking overview for ATEX and IECEx used for Baumer products

The overview contains all protection concepts covered in this document and shows them with one example each for ATEX and IECEx.
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4.5 Documentation history

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<th>Date</th>
<th>Reviewed by</th>
<th>Amendment / Supplement / Description</th>
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<tr>
<td>V1.00</td>
<td>19.03.2019</td>
<td>fep</td>
<td>First release</td>
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<tr>
<td>V1.10</td>
<td>25.03.2019</td>
<td>fep</td>
<td>Minor revisions, removed “increased safety”, IP67-&gt;IP6x</td>
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<td>V1.11</td>
<td>03.04.2019</td>
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<td>LBFS/LFFS w/o standard barrier (missing max. Is reduction)</td>
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<td>12.04.2019</td>
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<td>Flowchart added, minor revisions</td>
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<tr>
<td>V1.21</td>
<td>16.04.2019</td>
<td>fep</td>
<td>Headline changed, “General” in 2.1 added dual use of gas/dust</td>
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<tr>
<td>V1.22</td>
<td>10.05.2019</td>
<td>fep</td>
<td>Minor changes, intrinsic not in general in chapter 2</td>
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<tr>
<td>V1.31</td>
<td>26.07.2019</td>
<td>fep</td>
<td>Application pictures changed, accessories references, minor changes</td>
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<tr>
<td>V1.32</td>
<td>03.10.2019</td>
<td>fep</td>
<td>Threshold changed to 5 V, added boundary for pressure sensors, flowchart: “Switch” renamed to “Digital”, minor changes</td>
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<tr>
<td>V1.40</td>
<td>27.07.2020</td>
<td>fep</td>
<td>Inter-connected PROFSI3 for two switching outputs added, marking overview and list of figures included, minor corrections</td>
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