Product description
- Assured detection of single, double and multiple sheets.
- Scanning of sheet material weights from 100 g/m² to 2,000 g/m², corrugated cards, sheet metals, printed circuit boards, films and plastic sheets up to several mm thickness possible.
- Double sheet and missing sheet output as pnp or npn switched outputs.
- Vertical mounting to the sheet running through permitted.
- Three control inputs allow for an external setting of sensitivity for the material to be scanned.
- Changes to sensitivity classes under ongoing operations can be undertaken.
- Additional teach-in mode e.g. for scanning wafers glued with a water film.
- Optional trigger operation mode e.g. for applications in the shingled stream.
- Parameterization via LinkControl.
- 0.5 ms response time until a double or missing sheet in the trigger mode is detected.
- Transmitter - receiver spacing can be selected from 30 to 70 mm

Safety tips
- Read the operating instructions before start-up.
- Only qualified personnel are to undertake connection, mounting and settings.
- Not a safety component in keeping with the EC Machinery Directive.

Mounting
- Mount transmitter and receiver in keeping with Fig 1 at the recommended spacing of 50 mm ± 3 mm.
- dbk±5 can be fitted at any position.
- Connect the transmitter to the receiver using the M8 connector.
- Connect the receiver 7-strand control line in keeping with Fig 2.

Operating Instructions

Ultrasonic double sheet detection with 2 switched outputs

The function of the double sheet detection is to detect two or more sheets or other laminary materials lying one on top of the other. The sensor system consists of a transmitter and a receiver complete with integrated evaluation electronics.

A high-frequency ultrasonic transmitter beams from the underside against the sheet material. The emitted ultrasonic pulse excites the sheet material into vibrations. The effect of these vibrations is for a very small sonic wave on the other side of the sheet to spread. This wave is received by the ultrasonic receiver located there. In the case of sheet one on top of the other (double sheet), the receiver detects the difference in signal and sets its outputs accordingly.

Start-up
- Select the »Standard« sensitivity class by placing all the 3 control inputs onto logic 0 (see Figs 3 and 4) or leave them unconnected.
- Switch on the dbk+5 voltage supply.

The »Standard« sensitivity class corresponds to the setting of predecessor model dbk-5.

Check the function with a test sheet.
- Hold a single test sheet within the working range between transmitter and receiver.
- The LED must light up green for "Single sheet detected«. (Should the LED light up red, then check on the dbk+5 fitting dimension and the selected test sheet.)
- Hold a double test sheet within the working range between transmitter and receiver.
- The LED must light up red for "Double sheet detected«.
- Remove all the sheets between transmitter and receiver.
- The LED must flash red for "Missing sheet detected«.

Factory setting

The dbk+5 are delivered with the following factory settings:
- Free-run mode with 3 sensitivity classes and teach-in
- Missing sheet output on NCI
- Double sheet output on NCI
- 50 mm spacing

FT9: LED displays

Condition | LED 1 | LED 2
---|---|---
single sheet | Green | Green
single sheet overmodulation | Green | Red + Orange
double sheet | Red | Red
missing sheet | Red | Red
Teach-in activated | Green | Green
Teach-in dismissed | Red | Red
Teach-in spacing transmitter-receiver | Red | Green
Teach-in dismissed | Red | Red

Fig. 2: Colour coding of the control line

Fig. 1: Mounting and installation positions
Operation in the free-run mode

The dbk+s operates in the free-run mode ex-works. In the free-run mode, the dbk+s performs measurements cyclically.

**Pointer**
- If measurements should be taken in the shingled stream, then an external trigger signal can individually trigger each measurement. To this end, the trigger mode can be parameterized with the help of the LCA LinkControl adapter available as an accessory and the LinkControl software.

### Sensitivity classes

The fact that the dbk+s control inputs are unconnected or on logic 0 points to pre-selection of the »Standard« sensitivity class where the range of sheet material weights from a typical 100 g/m² up to 2,000 g/m² can be scanned.

- The 3 control inputs allow the sensitivity classes to be pre-selected in keeping with the Fig 4 table.
- The »Thin« setting has to be selected for thin materials.
- The working range can be enlarged to thicker materials by choosing the setting »Thick«.
- Changes between sensitivity classes can be undertaken on-going operations.
- Pre-selecting an over-low sensitivity class can result – even with a single sheet – in a double sheet signal appearing. In such an instance, the next-higher sensitivity class is to be pre-selected.
- Pre-selecting an over-high sensitivity class results – given a single sheet – in the double-sheet detection indicating overmodulation at the LEDs: one LED lights up green and the other green-orange (ange blend). In such an instance, the next-lower sensitivity class is to be pre-selected.

**C3 must not be on logic 1 when the supply voltage is connected.**

**Operator mode**

Free-run mode with 3 pre-defined sensitivity classes and additional teach-in mode or Free-run mode with 4 independent teach-in classes or Trigger mode with 2 pre-defined sensitivity classes and additional teach-in mode or

### Operation onto LinkControl

- Install the LinkControl software onto your PC.
- Connect the LinkControl adapter to your PC with the USB cable.
- Connect dbk+s to the LCA-2 in keeping with the Fig 5 table. For this, use the adapter cable in the LCA-2 case.
- Connect the voltage supply cable to the LCA-2 on the other side of the T connector.
- Start the LinkControl software and follow the instructions on the screen.

### Parameterization with LinkControl

The dbk+s can be extensively parameterized under LinkControl. Here you need the optionally available LinkControl adapter LCA-2 and the LinkControl software for Windows®.

### Sensitivity classes

- Select the teach-in mode (C1 and C2 on logic 1) in keeping with the table in Fig 4.
- This is the way to teach-in a material:
  - Place a single sheet of the material in the working range of the double sheet detection.
  - Place the C3 control input on logic 1 for a minimum of 3 seconds. Materials with inhomogeneities must be moved during the teaching phase so that dbk+s can detect them.

Success with a teach-in operation is shown by a green LED. In instances of where no material teach-in was possible, dbk+s flashes in red. Then repeat the operation.

- On finishing the teaching-in operation, either place the C3 control input on logic 0 or leave it unconnected.

The material can now be scanned.

Maintenance

No maintenance is needed on the double sheet detection. We would recommend cleaning the sensor surfaces at the transmitter and receiver should they become very dirty. The best thing is to apply some isopropyl alcohol onto a cotton cloth and then wipe the surface clean. Make sure that the reaction time of the cleaner is kept down. That means quickly wiping dry the transducer surfaces.

In the level-controlled trigger mode, dbk+s keeps on taking measurements for as long as the trigger signal is on hand. With dbk+s deactivated (C2 control input to logic 0), the reading of the last measurement at the switched outputs is frozen (see Fig 8).

### Free-run mode with 4 independent teach-in classes

Parameterization with the aid of LinkControl of the free-run mode with 4 independent teach-in classes makes teach-in possible for up to 4 different materials. As a result, the »Standard«, »Thin«, »Thick« and »Edge« sensitivity classes and additional teach-in mode can be individually adjusted (see online help in LinkControl).

Teach-in spacing between transmitter and receiver

- Teach-in of the selected spacing between transmitter and receiver must be undertaken should you not have mounted transmitter and receiver at the recommended 40 mm or 30 mm spacing.
- Clear the measuring section of sheet materials between transmitters and receivers.

### Operation in the trigger mode

If LinkControl was used to parameterize the trigger mode, then the external trigger signal is to be placed on the C2 control input.

Available in the trigger mode are sensitivity classes »Standard«, »Thin« and the teach-in mode in keeping with the Fig 6 table.

In the edge-controlled trigger setting (see Fig 7), the double-sheet detection takes a measurement with every edge from 0 to 1. The finding is then stored until the next trigger edge.

### Fig. 4: Free-run mode: selection of the sensitivity class and Teach-in

<table>
<thead>
<tr>
<th>Voltage level</th>
<th>Logical state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage level</td>
<td>0</td>
</tr>
<tr>
<td>Voltage level</td>
<td>1</td>
</tr>
</tbody>
</table>

**Fig. 3: Voltage level of the logic states at the control inputs**

**Table 1**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Colour adapter cable</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Blue</td>
<td>1</td>
</tr>
<tr>
<td>Blue</td>
<td>Grey</td>
<td>3</td>
</tr>
</tbody>
</table>

**Fig. 5: Connecting dbk+s to the LCA-2**

<table>
<thead>
<tr>
<th>C1</th>
<th>C2</th>
<th>C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Fig. 6: Trigger mode: selection of the sensitivity class and teach-in mode**

**Fig. 7: Trigger mode edge-controlled**

**Fig. 8: Trigger mode level-controlled**
<table>
<thead>
<tr>
<th>Technical data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spacing transmitter-receiver</strong></td>
<td>30 to 70 mm</td>
</tr>
<tr>
<td><strong>Optimum spacing transmitter-receiver</strong></td>
<td>50 mm ± 3 mm</td>
</tr>
<tr>
<td><strong>Blind zone (in front of transmitter and receiver)</strong></td>
<td>7 mm</td>
</tr>
<tr>
<td><strong>Permissible angular deviation</strong></td>
<td>±45° from the perpendicular of the sheet</td>
</tr>
<tr>
<td><strong>Ultrasonic frequency</strong></td>
<td>200 kHz</td>
</tr>
<tr>
<td><strong>Working range</strong></td>
<td>Papers with grammages of 100 g/m² to 2,000 g/m², metal-laminated sheets and films up to 5 mm thickness, self-adhesive films, sheet metals up to 2 mm thickness, corrugated cardboard, wafer, printed circuit boards</td>
</tr>
<tr>
<td><strong>Operating voltage U₀</strong></td>
<td>20 V to 30 V DC</td>
</tr>
<tr>
<td><strong>Voltage ripple</strong></td>
<td>≤ 10 %</td>
</tr>
<tr>
<td><strong>No-load current consumption</strong></td>
<td>≤ 50 mA</td>
</tr>
<tr>
<td><strong>Type of connection</strong></td>
<td>7 m PUR cable, 7 x 0.25 mm²</td>
</tr>
<tr>
<td><strong>Transmitter-receiver connection</strong></td>
<td>At receiver: PUR, 2.3 m, at transmitter: 1 m, PUR, both with 3-pin MB plug</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td>3 Control inputs: C1 to C3</td>
</tr>
<tr>
<td><strong>Programmable</strong></td>
<td>Selection of sensitivity classes, Teach-in, LinkControl</td>
</tr>
<tr>
<td><strong>Release delay Trigger-Mode</strong></td>
<td>≤ 5.5 ms</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td>Brass sleeve, nickel-plated, plastic parts: PBT, PA; Cable: PUR, ultrasonic transducer: Polyurethane, epoxy resin with glass content</td>
</tr>
<tr>
<td><strong>Max. tightening torque of nuts</strong></td>
<td>≤ 15 Nm</td>
</tr>
<tr>
<td><strong>Class of protection to EN 60529</strong></td>
<td>IP 65</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>-5 °C to +60 °C</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-40 °C to +85 °C</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>150 g</td>
</tr>
<tr>
<td><strong>Norm conformity</strong></td>
<td>EN 60947-5-2</td>
</tr>
</tbody>
</table>

Order no.:
- dbk-5/Empf/3CDD/M18/ K7K2
- dbk-5/Sender/M18/K1

**Double sheet output**
- npn, +U₀ = 2 V, \( I_{max} = 200 \text{ mA} \), short circuit proof, switchable NCD/NCH

**Missing sheet output**
- npn, +U₀ = 2 V, \( I_{max} = 200 \text{ mA} \), short circuit proof, switchable NCD/NCH

\( U_{0} \) at control inputs \( C_{1} - C_{3} \):
- \( U_{0} = 18 \text{ V} \), logical 1
- \( -U_{0} = 13 \text{ V} \) or control input open: logical 0

**Time delay before availability**
- \( 300 \text{ ms} \)

**Pin assignment**

1) Can be programmed with LinkControl.