Product description
- Assured detection of single, double and multiple sheet.
- Scanning of the most varied of materials – from thin Washi through to wafers.
- Double sheet and missing sheet output as pnp or npn switched outputs.
- Scanning of sheet material weights from <20 g/m² to 1,200 g/m², films, thin sheet metals and finest corrugated cards possible.
- 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 20 to 60 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 40 mm ± 3 mm (or 20 mm ± 2 mm with dbk+4/M12/...E+S).
- dbk+4 can be fitted at any position.
- Connect the transmitter to the receiver using the M8 connector.
- Connect the receiver 7 core control line in keeping with Fig. 2.

Operating Instructions
Ultrasonic double sheet detection with 2 switched outputs

dbk+4/3CDD/M18 E+S

dbk+4/3BEE/M18 E+S

dbk+4/WK/3BEE/M18 E+S

dbk+4/M18/3CDD/M18 E+S

dbk+4/M18/3BEE/M18 E+S

dbk+4/M12/3CDD/M18 E+S

dbk+4/M12/3BEE/M18 E+S

Functional principle
The function of the double sheet detection is to detect two or more sheets or other flat 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 beam 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 one sheet 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+4 voltage supply.

### Pointer
- The »Standard« sensitivity class corresponds to the setting of predecessor model dbk-4.

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+4 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+4 are delivered with the following factory settings:
- Free-run mode with 3 sensitivity classes and teach-in
- Missing sheet output on NCC
- Double sheet output on NCC
- 40 or 20 mm spacing

![Image](image-url)
Operation in the free-run mode

The dbk+4 operates in the free-run mode ex-works. In the free-run mode, the dbk+4 performs measurements cyclically.

**Pointers**
- 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-2 LinkControl adapter available as an accessory and the LinkControl software.

**Sensitivity classes**

The fact that the dbk+4 control inputs are unconnected or on logic 0 points to pre-selection of the »Standard« sensitivity class where the standard sensitivity class where the next-lower sensitivity class is to be pre-selected.

- The »Thin« setting is to be selected for extremely thin materials, such as bibles printing paper, with weight per unit area of over 50 g/m².
- The »Thick« setting is available for all materials glued to each other across their full extent (e.g. two foils bonded with a water film, a splay on a paper web) and special materials which cannot be scanned with one of the 3 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+4 can detect them.

Success with a teach-in operation is shown by a green LED. In instances where no material teach-in was possible, dbk+4 flashes in red. Then repeat the operation.

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

The material can now be scanned.

- C3 must not be on logic 1 when the supply voltage is connected.
- Function for the D2 switched output
  - Double sheet = NCC or
  - Double sheet = NOC
- Operating mode
  - Free-run mode with 3 pre-defined sensitivity classes and additional teach-in classes 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
  - Edge- or level-controlled trigger mode

**Parameterization with LinkControl**

The dbk+4 can be extensively parameterized under LinkControl. Here you need the optionally available LinkControl adapter LCA-2 and the LinkControl software for Windows®.

**Operation onto LinkControl**

- Install the LinkControl software onto your PC.
- Connect the LinkControl adapter to your PC with the USB cable.
- Connect dbk+4 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.

**Maintenance**

No maintenance is needed on the double sheet detector. We recommend cleaning the sensor surfaces at the transmitter and receiver should they become very dirty. The best thing is to apply some isopropanol 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.

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

The following settings can be undertaken:
- Numeric input of the spacing between transmitter and receiver
- Function for the D1 switched output
  - Missing sheet = NCC (single sheet = NOC)
  - Missign sheet = NOC (single sheet = NCC)
- Overmodulation = NCC or
- Operation in the trigger mode

**Fig. 8:** Trigger mode level-controlled

In the level-controlled trigger mode, dbk+4 keeps on taking measurements for as long as the trigger signal is on hand. With dbk+4 deactivated (C2 control input to logic 0), the reading of the last measurement at the switched outputs is frozen (see Fig. 8).

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

Also available is a diagrammatic representation of the readings.

**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.

- Clear the measuring section of sheet materials between transmitter and receiver.
- Place all the 3 control inputs on logic 1.
- Switch on the supply voltage: The LEDs flash alternately red and green.
- Wait at least 2 seconds.
- Place the C3 control input on logic 0.

**Pointers**
- Any failure to teach-in the set spacing results in dbk+4 flashing in red for 3 seconds.
- dbk+4 is operating normally. Finally, select the requested type of operation through the control inputs.

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

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

**Assignments**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Colour adapter cable</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Blue</td>
<td>3</td>
</tr>
<tr>
<td>Grey</td>
<td>Grey</td>
<td>5</td>
</tr>
<tr>
<td>Brown</td>
<td>Brown</td>
<td>1</td>
</tr>
<tr>
<td>C3/Com</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 5:* Connecting dbk+4 to the LCA-2

**Fig. 8:** Trigger-mode level-controlled
### Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spacing transmitter-receiver</strong></td>
<td></td>
</tr>
<tr>
<td>Optimum spacing transmitter-receiver</td>
<td></td>
</tr>
<tr>
<td>Blinds zone (in front of transmitter and receiver)</td>
<td></td>
</tr>
<tr>
<td><strong>Permissible angular deviation</strong></td>
<td>±45° from the perpendicular of the sheet</td>
</tr>
<tr>
<td><strong>Optimization</strong></td>
<td>Ultrafonic_FT: 500 kHz</td>
</tr>
<tr>
<td><strong>Working range</strong></td>
<td>up to 0.4 mm thickness, self-adhesive films, sheet metals up to 0.3 mm thickness, finest corrugated cardboard, wafer, printed circuit boards</td>
</tr>
<tr>
<td><strong>Operating voltage U&lt;sub&gt;0&lt;/sub&gt;</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>2 m PUR cable, 7 x 0.25 mm&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Preventive maintenance</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Response time Trigger-Mode</strong></td>
<td>500 μs</td>
</tr>
<tr>
<td><strong>Response time Free-Run-Mode</strong></td>
<td>5.5 ms</td>
</tr>
<tr>
<td><strong>Release delay Trigger-Mode</strong></td>
<td>until next edge</td>
</tr>
<tr>
<td><strong>Release delay Free-Run-Mode</strong></td>
<td>2,5 ms</td>
</tr>
<tr>
<td><strong>Indicator</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Max. tightening torque of nuts</strong></td>
<td>M18: 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>-20 °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>130 g</td>
</tr>
<tr>
<td><strong>Norm conformity</strong></td>
<td>EN 60947-5-2</td>
</tr>
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</table>

### Order no.

<table>
<thead>
<tr>
<th>Order no.</th>
<th>dbk4/12C/M18 E+S</th>
<th>dbk4/WK3//M18 E+S</th>
<th>dbk4/M18/3//M18 E+S</th>
<th>dbk4/M12/3//M18 E+S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double sheet output</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
</tr>
<tr>
<td>Missing sheet output</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
<td>npp, ±4 V, b&lt;sub&gt;v&lt;/sub&gt; = 80 mA, short circuit proof, switchable NOC/NC</td>
</tr>
<tr>
<td>U&lt;sub&gt;2&lt;/sub&gt; at control inputs C&lt;sub&gt;1&lt;/sub&gt;-C&lt;sub&gt;2&lt;/sub&gt;</td>
<td>±4 V logical 1</td>
<td>±4 V logical 1</td>
<td>±4 V logical 1</td>
<td>±4 V logical 1</td>
</tr>
<tr>
<td>Time delay before availability</td>
<td>≤ 300 ms</td>
<td>≤ 300 ms</td>
<td>≤ 300 ms</td>
<td>≤ 300 ms</td>
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</table>

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<td>≤ 300 ms</td>
</tr>
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</table>

**Notes:**
- Can be programmed with LinkControl
- Please consult the manufacturer’s documentation for detailed specifications.

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**References:**
- EN 60947-5-2
- IP 65
- M18: 15 Nm; M12: 8 Nm
- PUR: polyurethane, epoxy resin with glass content
- PVC: polyvinyl chloride
- Brass sleeve, nickel-plated; plastic parts: PBT, PA;
- Epoxy resin: polyurethane, epoxy resin with glass content
- Green: working/single sheet
- Red: double sheet
- Green: working/single sheet
- Red: double sheet
- Red: flashing: missing sheet
- Brass sleeve, nickel-plated; plastic parts: PBT, PA;
- Cable: PUR/PVC; ultrasonic transducer:
- Polyurethane, epoxy resin with glass content
- Polyurethane, epoxy resin with glass content
- Polyurethane, epoxy resin with glass content
- Polyurethane, epoxy resin with glass content
- Polyurethane, epoxy resin with glass content
- Polyurethane, epoxy resin with glass content
- 2 m PUR cable, 7 x 0.25 mm²
- 1 m, PUR; both with M8 connector
- Release delay Trigger-Mode: 2.5 ms
- Release delay Free-Run-Mode: 2.5 ms
- Class of protection to EN 60529: IP 65
- Norm conformity: EN 60947-5-2