Operating manual

Ultrasound double sheet detection with 2 switched outputs

**dbk+5/3CDD/M18 E+S**

**dbk+5/3BEE/M18 E+S**

**Functional principle**

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.

**Product description**

- Assured detection of single, double and multiple sheet.
- Scanning of sheet materials, 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 wafer 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 recomended 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.

**Point**

- If required, spacing between transmitter and receiver can be adjusted to the local range in the 30 to 70 mm range; see under «Teach-in spacing between transmitter and receiver».
- The coaxiality of transmitter and receiver must be ≤ 0.5 mm.
- Transmitter and receiver are not to be inclined to each other in excess of 2°.
- Vertical mounting to the sheet is recommended for papers (Fig 1a).
- In case of vertical mounting to the sheet, the spacing between transmitter and/or receiver and the sheet running through is not to be under 7 mm.
- In case of certain sheet metals or thicker plastic films, the dbk has to be mounted at an inclination to sheet normal depending on the material (Fig 1b). If necessary the optimum mounting position has to be determined in a test.
- Thick papers and paperboard responsible for faulty switching in case of vertical mounting can often be scanned at a 27° to 45° mounting angle to sheet normal. Corrugated cards have to be measured obliquely to the waves (Fig 1c).
- Other materials may make a special fitting position necessary. Do contact microscopic when you work with these special materials.
- The max. torque of the nuts is 15 Nm for the M18 sleeves.
- The drill hole must be ≥ 12 mm given that the transmitter is recess-mounted or a sheet feed is envisaged between transmitter and receiver. The recommendation is for a 18 mm diameter (see Fig 1).
- The line between transmitter and receiver is not to be bridged with an external potential.

**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.

**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

**Point**

- You can use a material of a high sheet weight as the test sheet or the test sheet itself obtainable as an accessory with the «dbk test sheet» article name. This test sheet works as critical material at the ambient temperature in the «Standard» sensitivity class and can be used to examine the correct adjustment and function.

**Check 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».

**Parameters**

- All parameters can also be adjusted externally setting of sensitivity for transmitter and receiver.
- Defined parameter values are saved and can be retrieved at a later point in time.
- Free-run mode with 3 sensitivity classes and teach-in.
- Missing sheet output on NCI
- Double sheet output on NCI
- 50 mm spacing

**Control input C1**

- Single/missing sheet output
- Control input C1
- Control input C2
- Control input C3/Com

**Colour**

- Brown
- Blue
- White
- Black
- Pink
- Grey

**Condition**

- single sheet
- single sheet overmodulation
- double sheet
- missing sheet
- Teach-in activated
- Teach-in dismissed
- Teach-in spacing transmitter-receiver

**LED 1**

- Green
- Red
- Orange

**LED 2**

- Green
- Red
- Flashing

**Coefficient**

- + Red = Green
- Orange = Green

**Triggering**

- The LED must light up green for «Missing sheet detected».
- The LED must light up red for «Missing sheet detected».
- The LED must flash red for «Missing sheet detected».

**Coefficient**

- Green
- Orange
- Flashing

**Fig. 1: Mounting and installation positions**

**Fig. 2: Colour coding of the control line**

**Fig. 9: LED displays**
Operation in the free-run mode

The dbk+5 operates in the free-run mode ex-works. In the free-run mode, the dbk+5 performs measurements cyclically.

Teach-in

The teach-in mode is also available for materials glued to each other across their full extent (e.g. two wafers bonded with a water film, a spline 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 detector.
- 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+5 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+5 flashes in red. Then repeat the operation:
- On finishing the teach-in operation, either place the C3 control input on logic 0 or leave it unconnected.
- The material can now be scanned.

Parameterization with Link-Control

The double sheet software is parameterized with the help of the LCA-2 LinkControl adapter available as an accessory and the LinkControl software.

- Available for materials teach-in (C2 control input 0).
- On finishing the teach-in operation, either place the C3 control input on logic 0 or leave it unconnected.
- The material can now be scanned.

Function for the D2 switched output

Double sheet = NCO or Overmodulation = NCO

Operating 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 Edge- or level-controlled trigger mode

Also available is a diagrammatic representation of the readings.

Operation in the trigger mode

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

In 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«, »Thick«, »Thin« and »Teach-in« sensitivity classes 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 transmitter and receiver.
### Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>dbk+5/3CDD/M18 E+S</th>
<th>dbk+5/3BEE/M18 E+S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spacing</strong></td>
<td>30 to 70 mm</td>
<td>30 to 70 mm</td>
</tr>
<tr>
<td><strong>Optimum spacing</strong></td>
<td>50 mm ± 3 mm</td>
<td>50 mm ± 3 mm</td>
</tr>
<tr>
<td><strong>Blind zone</strong></td>
<td>7 mm</td>
<td>7 mm</td>
</tr>
<tr>
<td><strong>Permissible angular deviation</strong></td>
<td>±45° from the perpendicular of the sheet</td>
<td>±45° from the perpendicular of the sheet</td>
</tr>
<tr>
<td><strong>Ultrasound frequency</strong></td>
<td>200 kHz</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>
<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</strong> $U_{op}$</td>
<td>20 V to 30 V DC</td>
<td>20 V to 30 V DC</td>
</tr>
<tr>
<td><strong>Voltage ripple</strong></td>
<td>± 5 mA</td>
<td>± 5 mA</td>
</tr>
<tr>
<td><strong>No-load current consumption</strong></td>
<td>5 mA</td>
<td>5 mA</td>
</tr>
<tr>
<td><strong>Type of connection</strong></td>
<td>2 m PUR cable, 7 x 0.25 mm²</td>
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</tr>
<tr>
<td><strong>At transmitter:</strong></td>
<td>PUR, 1.2 m; transmitter: 1 m, PUR, both with 3-pin M8 plug</td>
<td>PUR, 1.2 m; transmitter: 1 m, PUR, both with 3-pin M8 plug</td>
</tr>
<tr>
<td><strong>At receiver:</strong></td>
<td>PUR, 1.2 m; receiver: 1 m, PUR, both with 3-pin M8 plug</td>
<td>PUR, 1.2 m; receiver: 1 m, PUR, both with 3-pin M8 plug</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td>3 control inputs: C1 to C3</td>
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</tr>
<tr>
<td><strong>Programmable</strong></td>
<td>selection of sensitivity classes, Teach-in, LinkControl</td>
<td>selection of sensitivity classes, Teach-in, LinkControl</td>
</tr>
<tr>
<td><strong>Release delay</strong></td>
<td>≤ 500 µs</td>
<td>≤ 500 µs</td>
</tr>
<tr>
<td><strong>Trigger-Mode</strong></td>
<td>5.5 ms</td>
<td>5.5 ms</td>
</tr>
<tr>
<td><strong>Indicator</strong></td>
<td>green: working/single sheet</td>
<td>green: working/single sheet</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>
<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>
<td>15 Nm</td>
</tr>
<tr>
<td><strong>Class of protection to EN 60529</strong></td>
<td>IP 65</td>
<td>IP 65</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>+5 °C to +60 °C</td>
<td>+5 °C to +60 °C</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-40 °C to +85 °C</td>
<td>-40 °C to +85 °C</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>150 g</td>
<td>150 g</td>
</tr>
<tr>
<td><strong>Norm conformity</strong></td>
<td>EN 60947-5-2</td>
<td>EN 60947-5-2</td>
</tr>
</tbody>
</table>

**Double sheet output**
- $U_{op}$, $U_{in}$: short circuit proof, switchable NC ON/NCI

**Missing sheet output**
- $U_{pp}$, $U_{in}$: short circuit proof, switchable NC ON/NCI

**$U_{op}$ at control inputs $C_1$ to $C_3$**
- $U_{op}$ > $U_{pp}$ + 18 V: logical 1
- $U_{op}$ ≤ $U_{pp}$ + 13 V or control input open: logical 0

**Time delay before availability**
- ≤ 300 ms

**Pin assignment**
- Brown: Missing sheet
- White: Double sheet
- Black: C1
- Violet: C2
- Blue: C3
- Pink: -UB
- Grey: +UB

### Notes

1. Can be programmed with LinkControl

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*The content of this document is subject to technical changes. Specifications in this document are presented in a descriptive way only. They do not warrant any product features.*