microsonic

Instruction manual

dbk-4
Ultrasonic double-sheet detection

dbk-4/CD/O/M18 E+S
dbk-4/CDD/O/M18 E+S
dbk-4/CEE/O/M18 E+S
dbk-4/BDD/S/M18 E+S
dbk-4/BEE/S/M18 E+S

Product description

- **No need for calibration to the sheet material or to the material weight (grammage)**
- **Grammages from 20 to 1,200 g/m², films, thin sheet metals and fine corrugateds can be scanned**
- **Can be mounted perpendicular to the passing sheet**
- **Special versions for use on sheet-fed printing presses and for paper gatherers**
- **Time to respond to double or missing sheets from just 0.5 ms**
- **Double-sheet and missing-sheet output**
- **pnp and npn versions available**

Operating principle

The task of double-sheet detection is to identify two or more sheets inadvertently adhering together. The sensor system consists of a transmitter and a receiver with integrated evaluation electronics.

An ultrahigh-frequency ultrasonic transmitter fires a sonic beam at the underside of the sheet. The beam generates the sheet to vibrate, which in turn causes a very small sound wave on the other side of the sheet. This sound wave is then evaluated by the ultrasonic receiver opposite. If there are two sheets one on top of the other ("double sheet"), then the signal is weakened to such an extent that it hardly reaches the receiver.

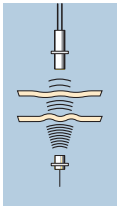

Fig. 1: Operating principle

The ultrasonic double-sheet detector is equipped with a control input that, depending on the particular model, is used to select different response times or to activate and deactivate the detector.

The detector has two operating modes:

- *Free Run Mode*
  The ultrasonic double-sheet detector operates continuously. In the event of a double sheet or missing sheet, the corresponding output is set following the response time. When the error is cleared, the output is reset after the tripping delay.
- *Trigger Mode*
  The ultrasonic double-sheet detector can be activated and deactivated via the control input. The control input is either level-triggered or edge-triggered depending on the particular model. The response time in the event of a double or missing sheet is shortest immediately after activation, typically 0.5 ms. The control states in effect at the moment of deactivation are frozen until the next activation.

Important information for installation and application

When installing, starting up or carrying out maintenance work on the detection system, always perform all measures essential to ensuring the safety of staff and the system (cf. the instruction manual for the entire system and the instructions of the system operator). The double-sheet detectors of the dbk series have been designed for industrial applications.

The sensors are not items of safety equipment and must not be used for the purposes of personnel safety and machine protection.

Installation

Install the transmitter and receiver facing each other 40 mm ± 3 mm apart (see fig. 4). Installation of the dbk is not dependent on the position.

Note!

- The distance between the transmitter/receiver and the passing sheet must never be less than 7 mm.
- The coaxiality must be ≤ 0.5 mm.
- Angular deviation between the transmitter and the receiver must be no more than 2°.
- When working with papers and thin films, we recommend you install the dbk perpendicular to the sheet (see fig. 5 a).
- When working with thin sheet metals, thicker plastic films (e.g. credit cards), install the dbk with a deviation of 27° from the perpendicular (see fig. 5 b)).
- Types of paper that lead to false triggering when the dbk is mounted perpendicular (as a rule, types with air pockets) can frequently be scanned more accurately when the dbk is installed at an angle of 45° to the sheet. If the dbk is angled towards the corrugations of corrugated, the system can even be used to scan fine corrugateds (G and F; see fig. 5 c).
- The maximum tightening torque for the nuts is 15 Nm.
- If you install the transmitter in a recessed position or position a sheet guide between the transmitter and receiver, the hole must have a minimum diameter of ≥ 12 mm, but we recommend a diameter of 18 mm (fig. 5).

Connect the transmitter to the receiver using the 2-pin plug-in connector.

Note!

- The cable between the transmitter and receiver must not be connected to an external voltage.

Connect the 4-core or 5-core control cable of the receiver as shown in fig. 2.

Starting up

Switch on the power supply of the dbk.

Check that the system is functioning properly with the aid of a test sheet.

Hold a test sheet inside the working range between the transmitter and receiver.

The LED must light up green. (If the LED lights up red, check the installation dimensions of the dbk and the test sheet you have chosen).

Hold a double test sheet (two sheets) inside the working range between the transmitter and receiver.

The LED must light up red.

For double-sheet detectors with missing-sheet output:

Remove all sheets from between the transmitter and the receiver.

The LED must flash red.

Note

- The test sheet may be either a high-grammage sheet of the material to be scanned or the test sheet available as an accessory from microsonic, which can be ordered under the article designation "dbk test sheet". This test sheet serves as threshold material at room temperature and can be used to verify correct adjustment and operation of the dbk.

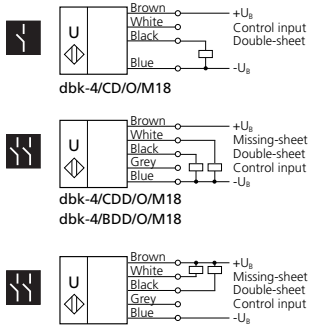

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Fig. 2: Standard symbols and terminal assignments

Housing dimensions and installation hints

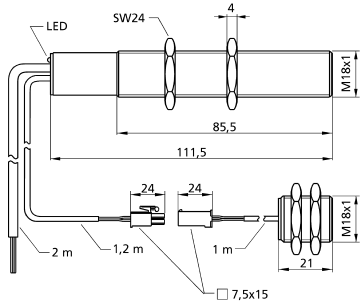

Fig. 3: Dimensions dbk-4

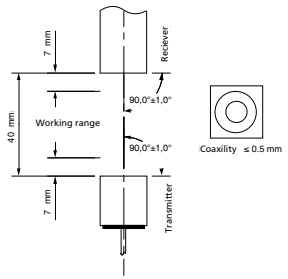

Fig. 4: Installation and working range

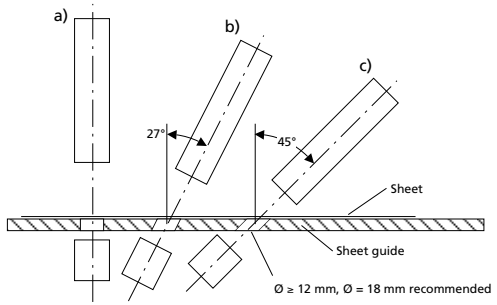

Fig. 5: Installation positions

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Time diagrams

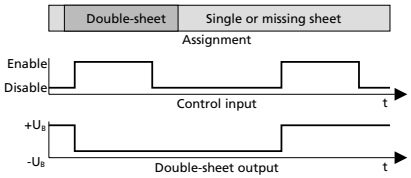

Fig. 6: dbk-4/CD/O/M18 Trigger-Mode

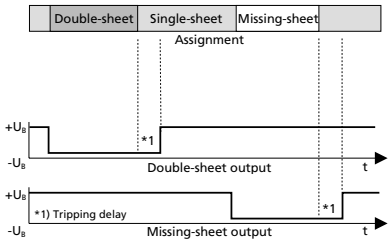

Fig. 7: dbk-4/CD/O/M18 (Double-sheet output) und dbk-4/CDD/S/M18 Free-Run-Mode

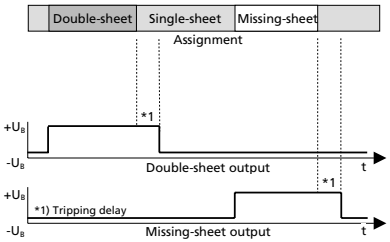

Fig. 8: dbk-4/CEE/S/M18 Free-Run-Mode

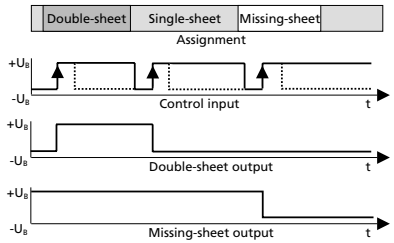

Fig. 9: dbk-4/BDD/S/M18 Trigger-Mode

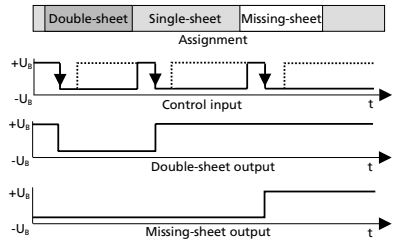

Fig. 10: dbk-4/BEE/S/M18 Trigger-Mode

Technical specification

Model name	dbk-4/CD/O/M18 E+S	dbk-4/CDD/O/M18 E+S	dbk-4/CEE/O/M18 E+S	dbk-4/BDD/O/M18 E+S	dbk-4/BEE/O/M18 E+S
Transmitter-receiver spacing	40 mm ±3 mm	40 mm ±3 mm	40 mm ±3 mm	40 mm ±3 mm	40 mm ± 3 mm
Transmitter-receiver blind zone	7 mm in front of both transmitter and receiver	7 mm in front of both transmitter and receiver	7 mm in front of both transmitter and receiver	7 mm in front of both transmitter and receiver	7 mm in front of both transmitter and receiver
Permissible angular deviation	±45° from the perpendicular to the sheet	±45° from the perpendicular to the sheet	±45° from the perpendicular to the sheet	±45° from the perpendicular to the sheet	±45° from the perpendicular to the sheet
Ultrasonic frequency	400 kHz	400 kHz	400 kHz	400 kHz	400 kHz
Resolution	2 sheets not stuck together across entire surface	2 sheets not stuck together across entire surface	2 sheets not stuck together across entire surface	2 sheets not stuck together across entire surface	2 sheets not stuck together across entire surface
Working range	Papers with grammages of 20–1,200 g/m², metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metals up to 0.3 mm thick, fine corrugateds	Papers with grammages of 20–1,200 g/m², metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metals up to 0.3 mm thick, fine corrugateds	Papers with grammages of 20–1,200 g/m², metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metals up to 0.3 mm thick, fine corrugateds	Papers with grammages of 20–1,200 g/m², metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metals up to 0.3 mm thick, fine corrugateds	Papers with grammages of 20–1,200 g/m², metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metals up to 0.3 mm thick, fine corrugateds
Operating voltage U_B	20 – 30 V DC	20 – 30 V DC	20 – 30 V DC	20 – 30 V DC	20 – 30 V DC
Residual ripple	±10 %	±10 %	±10 %	±10 %	±10%
No-load current consumption	≤35 mA	≤45 mA	≤45 mA	≤45 mA	≤ 45 mA
Type of connection	4-core cable, 2,000 mm long	5-core cable, 2,000 mm long	5-core cable, 2,000 mm long	5-core cable, 2,000 mm long	5-core cable, 2,000 mm long
Signal cable	On receiver: 1,200 mm On transmitter: 1,000 mm, With 2-pin plug-in connector, IP 20	On receiver: 1,200 mm On transmitter: 1,000 mm, With 2-pin plug-in connector, IP 20	On receiver: 1,200 mm On transmitter: 1,000 mm, With 2-pin plug-in connector, IP 20	On receiver: 1,200 mm On transmitter: 1,000 mm, With 2-pin plug-in connector, IP 20	On receiver: 1,200 mm On transmitter: 1,000 mm, With 2-pin plug-in connector, IP 20
Terminal assignment					
Brown	$+U_B$	$+U_B$	$+U_B$	$+U_B$	$+U_B$
Blue	$-U_B$ (0 V)	$-U_B$ (0 V)	$-U_B$ (0 V)	$-U_B$ (0 V)	$-U_B$ (0 V)
White	Control input	Missing sheet	Missing sheet	Missing sheet	Missing sheet
Black	Double sheet	Double sheet	Double sheet	Double sheet	Double sheet
Grey	-	Control input	Control input	Control input	Control input
Controls	None required	None required	None required	None required	None required
Programmable	No	No	No	No	No
Double-sheet output	pnp, $+U_B$-2 V, I_{max} = 500 mA, short-circuit-proof, NC contact	pnp, $+U_B$-2 V, I_{max} = 500 mA, short-circuit-proof, NC contact	npn, $-U_B$+2 V, I_{max} = 500 mA, short-circuit-proof, NC contact	pnp, $+U_B$-2 V, I_{max} = 500 mA, short-circuit-proof, NO contact	npn, $-U_B$+2 V, I_{max} = 500 mA, short-circuit-proof, NO contact
Missing-sheet output		pnp, $+U_B$-2 V, I_{max} = 500 mA, short-circuit-proof, NC contact	npn, $-U_B$+2 V, I_{max} = 500 mA, short-circuit-proof, NC contact	pnp, $+U_B$-2 V, I_{max} = 500 mA, short-circuit-proof, NC contact	npn, $-U_B$+2 V, I_{max} = 500 mA, short-circuit-proof, NC contact
Response time, Trigger Mode	4.5 ms	-	-	0,5 ms	0.5 ms
Response time, Free Run Mode	24.5 ms	2.5 ms or 6.5 ms	2.5 ms or 6.5 ms	-	–
Tripping delay, Trigger Mode	40 ms or state frozen until next enable	-	-	State frozen until next edge	State frozen until next edge
Tripping delay, Free Run Mode	160 ms	10 ms	10 ms	-	–
Indicator	Green: stand-by Red: double sheet	Green: stand-by Red: double sheet Flashing red: missing sheet	Green: stand-by Red: double sheet Flashing red: missing sheet	Green: stand-by Red: double sheet Flashing red: missing sheet	Green: stand-by Red: double sheet Flashing red: missing sheet
U_E at control input	dbk deactivated: $U_E < 0{,}1 \times U_B$ or $U_E > 0{,}9 \times U_B$ dbk activated: $0{,}3 \times U_B < U_E < 0{,}7 \times U_B$ ($I_E \leq$ 100µA or control input open) (low side or high side triggerable)	Response time 6.5 ms: $U_E > 0{,}7 \times U_B$ Response time 2.5 ms: $U_E < 0{,}3 \times U_B$ or control input open	Response time 6.5 ms: $U_E > 0{,}7 \times U_B$ Response time 2.5 ms: $U_E < 0{,}3 \times U_B$ or control input open	dbk activated for one scan: edge change from $-U_B$ to $+U_B$; edge width ≥ 1 ms	dbk activated for one scan: edge change from +UB to –UB; edge width ≥ 1 ms
Description of control input	If the control input is pulled to +UB or –UB (high- or low-active input), the dbk is deactivated; the state of the switched output before deactivation is frozen. If the control input is released, the dbk starts its scans with a response time of 4.5 ms (Trigger Mode). If the dbk is not deactivated again, it continues scanning continuously (Free Run Mode) with a response time of 6.5 ms. After 500 ms, the response time in Free Run Mode is extended to 24.5 ms and remains at this value.	Free Run Mode only. The dbk scans continuously. If the control input remains open-circuited or if it is applied to $-U_B$, the response time is 2.5 ms. If the control input is applied to $+U_B$, the response time is 6.5 ms.	Free Run Mode only. The dbk scans continuously. If the control input remains open-circuited or if it is applied to $-U_B$, the response time is 2.5 ms. If the control input is applied to $+U_B$, the response time is 6.5 ms.	Trigger Mode only. One scan is performed with a rising edge at the control input (edge change from $-U_B$ to $+U_B$). After the response time of 0.5 ms, both outputs are set in accordance with the result of the scan. The states of the two switching outputs are frozen until the next rising edge.	Trigger Mode only. One scan is performed with a falling edge at the control input (edge change from $+U_B$ to $-U_B$). After the response time of 0.5 ms, both outputs are set in accordance with the result of the scan. The states of the two switching outputs are frozen until the next falling edge.
Housing	Nickel-plated brass sleeve Plastic parts: PBT Cable: PVC sheath Ultrasonic transducer: polyurethane foam, epoxy resin with glass content	Nickel-plated brass sleeve Plastic parts: PBT Cable: PVC sheath Ultrasonic transducer: polyurethane foam, epoxy resin with glass content	Nickel-plated brass sleeve Plastic parts: PBT Cable: PVC sheath Ultrasonic transducer: polyurethane foam, epoxy resin with glass content	Nickel-plated brass sleeve Plastic parts: PBT Cable: PVC sheath Ultrasonic transducer: polyurethane foam, epoxy resin with glass content	Nickel-plated brass sleeve Plastic parts: PBT Cable: PVC sheath Ultrasonic transducer: polyurethane foam, epoxy resin with glass content
Max. tightening torque of nuts	15 Nm	15 Nm	15 Nm	15 Nm	15 Nm
Degree of protection per EN 60 529	IP 65	IP 65	IP 65	IP 65	IP 65
Operating temperature	+5°C to +60°C	+5°C to +60°C	+5°C to +60°C	+5°C to +60°C	+5°C to +60°C
Storage temperature	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Weight	270 g	280	280 g	280	280 g
Standard conformed with	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2

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