



dbk⁺4

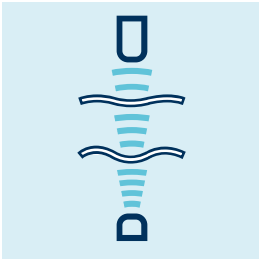
The ultrasonic double-sheet control dbk⁺4 combines multiple variants of its predecessor into a single unit, opening up entirely new possibilities for use.

HIGHLIGHTS

- › 3 control inputs › for trigger, Teach-in and external sensitivity settings for the material
- › Teach-in option › e.g. for probing wafers stuck together by a water film
- › Variant with 90° angled head › for individual installation situations
- › Variant with external M18 receiving transducer
- › Variant with very compact transmitter and receiver in the M12 threaded sleeve

BASICS

- › Reliable detection of single and double sheets
- › No Teach-in needed (plug and play)
- › Double-sheet and missing-sheet output
- › Working distance between the transmitter and the receiver selectable from 20 mm to 60 mm
- › Trigger option › for applications in warehouse flow
- › LinkControl › for configuration of sensors from a PC



Functional principle

The task

of double-sheet control is to identify two or more pieces or sheets inadvertently adhering together.

The functional principle

A high-frequency ultrasonic transmitter beams against the sheet from the underside. The beamed signal induces the material to vibrate. The effect of these vibrations is a very small sonic wave on the other side of the sheet being spread. This wave is evaluated by the ultrasonic receiver on the opposite side. The signal from the stacked sheet ("double sheet") is so weak that it hardly gets to the receiver.

The working ranges

The dbk+4 has three control inputs by means of which three working ranges can be preselected. The standard working ranges covers the sheet material weight range from 20 g/m² to 1,200 g/m². Extremely thin materials such as Bible printing paper with a weight per unit area of less than 20 g/m² are scanned with the use of the "Thin" setting. The "Thick" setting is available for paperboard containers and fine-corrugated card.

Changes between the working ranges can be undertaken under on-going operations. A Teach-in for the material to be scanned is not necessary.

If the three control inputs stay unconnected, then the dbk+4 operates in the standard working range. As such, a very broad material spectrum can be scanned.

Teach-in

The Teach-in function is additionally available for materials which cannot be scanned with one of the three working ranges.

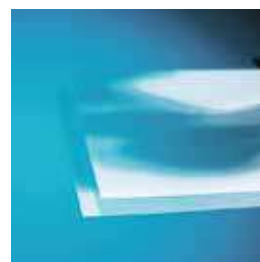
A material Teach-in is done by inserting a single sheet into the double-sheet control. The C3 control input is then applied to logic 1 level for at least 3 seconds. Materials with non-homogeneous elements must be moved during the Teach-in phase so that the dbk+4 can detect them. Success with a Teach-in operation is shown by a green LED. The material can now be detected. The Teach-in makes it possible to scan materials from thin Washi to wafers glued with a water film.

Range of uses of dbk+4:

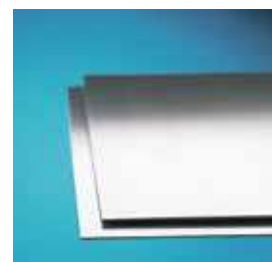
- › Sheet-printing machines
- › Assembly machines
- › Folding machines
- › Paper-processing machines
- › Manufacturing of solar cells and silicon wafers
- › Labelling
- › PCB manufacturing



Paper



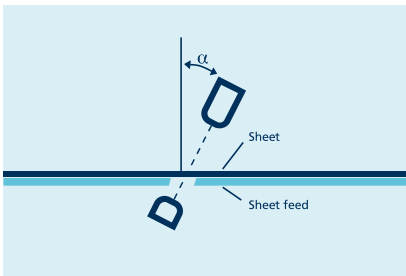
Film



Sheet metal



Double-sheet control



Fine-corrugated card can be optimally detected at an inclination of $\alpha \geq 35^\circ$, thin sheet metal or thicker plastic films at 27° and wafers at an angle of 11°

The mounting

The recommended spacing between transmitter and receiver is 40 mm (or 20 mm with dbk+4/M12/3CDD/M18 E+S).

If needed, this spacing can be adapted to the local conditions in the 20 mm to 60 mm range. For the matter of commissioning, this can be done by means of a simple Teach-in or with the LinkControl parameterisation software.

Material-conditioned fitting position

With papers and thin films, the double-sheet control is operated perpendicularly to the material; flapping does not impair the function.

In the case of fine-corrugated card, thin sheet metal, wafers or thicker plastic films (e. g. credit cards), the dbk+4 should be mounted at a specific angle of inclination to the material running through.

The free-run mode

The dbk+4 operates as standard in the free-run mode. This means that the dbk+4 cyclically carries out measurements at a high measuring rate.

Under ongoing operations, the working range can be changed and a Teach-in carried out by means of the C1 to C3 control inputs.

	C1	C2	C3
Standard	0	0	0
Thick	0	1	0
Thin	1	0	0
Teach mode	1	1	0
Teach-in	1	1	1

Free-run mode – selection of the working range

The trigger mode

Should, on the other hand, measurements be undertaken in applications with continuous feed, then an external trigger signal can trigger a measurement.

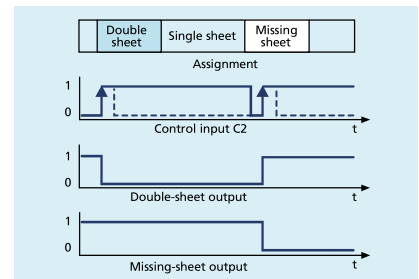
This function is parameterised with the aid of the LinkControl software. A choice can be made between edge trigger and level trigger.

The C2 control input then assumes the function of the trigger input (tr).

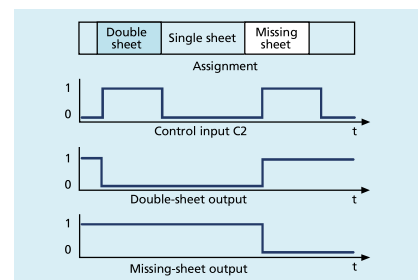
	C1	C2	C3
Standard	0	tr	0
Thin	0	tr	1
Teach mode	1	tr	0
Teach-in	1	tr	1

Trigger mode – selection of the working range

Under ongoing operations, the working range can be changed by means of the C3 control input.



Trigger mode – edge-controlled



Trigger mode – level-controlled

Support through LinkControl

dbk+4 can be comprehensively parameterised with the aid of the LinkControl software. To this end, the dbk+4 is connected to the LCA-2 LinkControl adapter. Using the LinkControl software, a USB cable connects the LCA-2 to the PC.

The following parameters can be individually adapted:

- › Spacing between transmitter and receiver
- › Double sheet: NOC/NCC
- › Single sheet or missing sheet: NOC/NCC
- › Trigger mode: on/off
- › Edge-controlled trigger: falling/rising edge
- › Level-controlled trigger: high/low active
- › Switch-on delay for detecting double sheet
- › Switch-off delay for detecting double sheet
- › Threshold values for the working ranges

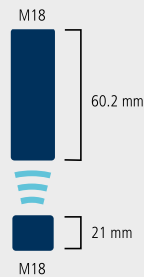


The LinkControl adapter LCA-2

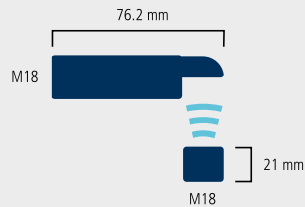
The four variants

Four housing variants cover all imaginable fitting positions.

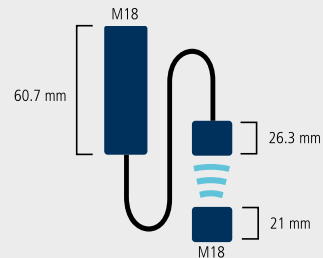
a) Standard



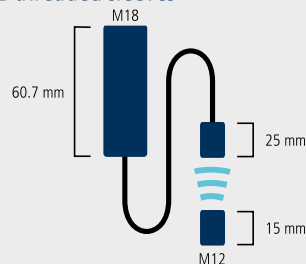
b) Receiver with 90° angular head



c) External receiver with M18 threaded sleeve



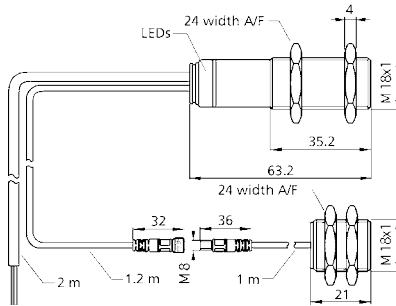
d) Transmitter and receiver with M12 threaded sleeves



dbk⁺4

dbk+4/3CDD/M18 E+S

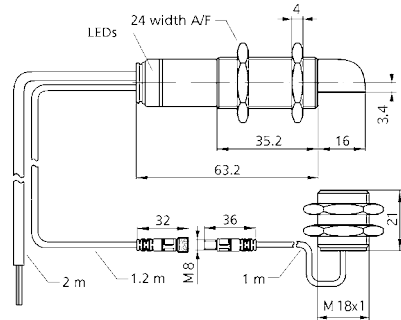
dbk+4/3BEE/M18 E+S



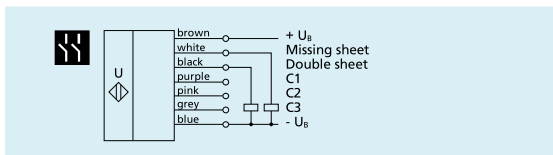
dbk⁺4

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

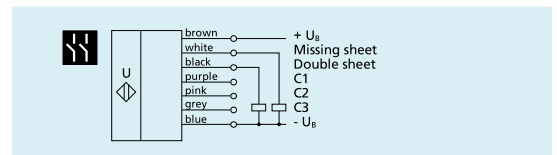
dbk+4/WK/3BEE/M18 E+S



transmitter/receiver spacing	20–60 mm; optimal: 40 mm ± 3 mm	20–60 mm; optimal: 40 mm ± 3 mm
blind zone	7 mm in front of transmitter and receiver	7 mm in front of transmitter and receiver
permissible angular deviation	± 45° from the perpendicular to the sheet	± 45° from the perpendicular to the sheet
transducer frequency	400 kHz	400 kHz
working range	papers with weights of 20 g/m ² to 2,000 g/m ² ; Washi, metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metal up to 0.3 mm thick, fine-corrugated card, wafers, PCBs	papers with weights of 20 g/m ² to 2,000 g/m ² ; Washi, metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metal up to 0.3 mm thick, fine-corrugated card, wafers, PCBs
operating voltage U _B	20 V to 30 V DC	20 V to 30 V DC
no-load current consumption	≤ 50 mA	≤ 50 mA
type of connection	2 m PUR cable, 7 × 0.25 mm ²	2 m PUR cable, 7 × 0.25 mm ²
transmitter cable	at the receiver: 1.2 m PUR cable, at the transmitter: 1 m PUR cable with M8 plug	at the receiver: 1.2 m PUR cable, at the transmitter: 1 m PUR cable with M8 plug
controls	3 control inputs: C1 to C3	3 control inputs: C1 to C3
scope for settings	<ul style="list-style-type: none"> working range selection via control inputs Teach-in via control inputs LCA-2 with LinkControl 	<ul style="list-style-type: none"> working range selection via control inputs Teach-in via control inputs LCA-2 with LinkControl
indicators	duo-LED; green: working, red: double sheet, flashing red: missing sheet	duo-LED; green: working, red: double sheet, flashing red: missing sheet
housing	brass sleeve, nickel-plated, plastic parts: PBT, PA; ultrasonic transducer: polyurethane foam, epoxy resin with glass content	brass sleeve, nickel-plated, plastic parts: PBT, PA; ultrasonic transducer: polyurethane foam, epoxy resin with glass content
class of protect. acc. to EN 60529	IP 65	IP 65
operating temperature	+5°C to +60°C	+5°C to +60°C
storage temperature	-40°C to +85°C	-40°C to +85°C
weight	130 g	130 g
response time	< 500 μs in trigger mode, 2.5 ms in free-run mode	< 500 μs in trigger mode, 2.5 ms in free-run mode
release delay	until next edge in trigger mode, 2.5 ms in free-run mode	until next edge in trigger mode, 2.5 ms in free-run mode
order number	dbk+4/3CDD/M18 E+S	dbk+4/WK/3CDD/M18 E+S
double-sheet output	pnp, U _B -2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof	pnp, U _B -2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
missing-sheet output	pnp, U _B -2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof	pnp, U _B -2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
delay prior to availability	< 300 ms	< 300 ms

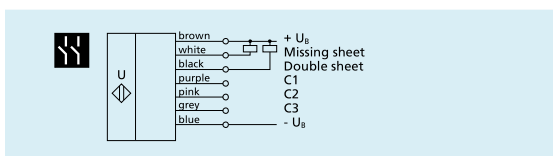


2 pnp switching outputs

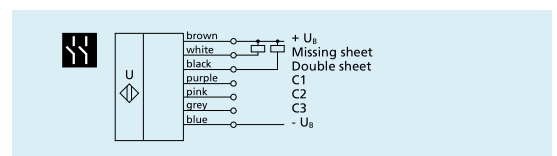


2 pnp switching outputs

order number	dbk+4/3BEE/M18 E+S	dbk+4/WK/3BEE/M18 E+S
double-sheet output	npn, -U _B +2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof	npn, -U _B +2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
missing-sheet output	npn, -U _B +2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof	npn, -U _B +2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
delay prior to availability	< 750 ms	< 750 ms



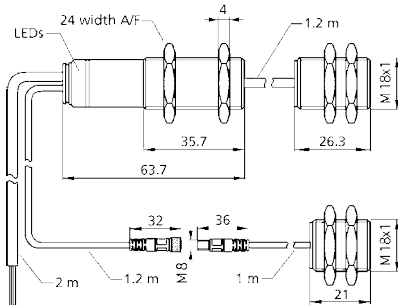
2 npn switching outputs



2 npn switching outputs

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

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



20–60 mm; optimal: 40 mm ± 3 mm

7 mm in front of transmitter and receiver

± 45° from the perpendicular to the sheet

400 kHz

papers with weights of 20 g/m² to 2,000 g/m², Washi, metal-laminated sheets and films up to 0.4 mm thick, self-adhesive films, sheet metal up to 0.3 mm thick, fine-corrugated card, wafers, PCBs

20 V to 30 V DC

≤ 50 mA

2 m PUR cable, 7 × 0.25 mm²

at the receiver: 1.2 m PUR cable,

at the transmitter: 1 m PUR cable with M8 plug;

to the swapped out receiving transducer: 1.2 m PVC cable

3 control inputs: C1 to C3

- working range selection via control inputs
- Teach-in via control inputs
- LCA-2 with LinkControl

duo-LED; green: working, red: double sheet, flashing red: missing sheet

brass sleeve, nickel-plated, plastic parts: PBT, PA; ultrasonic

transducer: polyurethane foam, epoxy resin with glass content

IP 65

+5°C to +60°C

-40°C to +85°C

165 g

< 500 μs in trigger mode, 2.5 ms in free-run mode

until next edge in trigger mode, 2.5 ms in free-run mode

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

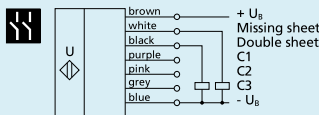
pnp, $U_B = 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

pnp, $U_B = 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

< 300 ms



2 pnp switching outputs

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

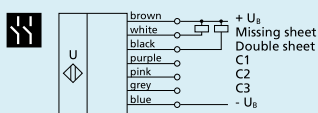
nnp, $-U_B + 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

nnp, $-U_B + 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

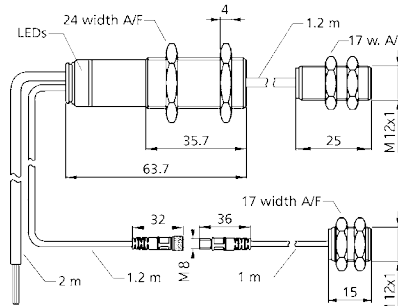
< 750 ms



2 npn switching outputs

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

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



20–40 mm; optimal: 20 mm ± 2 mm

5 mm in front of transmitter and receiver

± 45° from the perpendicular to the sheet

500 kHz

papers with weights of 20 g/m² to 600 g/m², Washi,

metal-laminated sheets and films up to 0.2 mm thick, self-adhesive films

20 V to 30 V DC

≤ 50 mA

2 m PUR cable, 7 × 0.25 mm²

at the receiver: 1.2 m PUR cable,

at the transmitter: 1 m PUR cable with M8 plug;

to the swapped out receiving transducer: 1.2 m PVC cable

3 control inputs: C1 to C3

- working range selection via control inputs
- Teach-in via control inputs
- LCA-2 with LinkControl

duo-LED; green: working, red: double sheet, flashing red: missing sheet

brass sleeve, nickel-plated, plastic parts: PBT, PA; ultrasonic

transducer: polyurethane foam, epoxy resin with glass content

IP 65

+5°C to +60°C

-40°C to +85°C

160 g

< 500 μs in trigger mode, 2.5 ms in free-run mode

until next edge in trigger mode, 2.5 ms in free-run mode

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

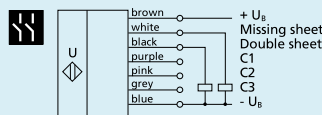
pnp, $U_B = 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

pnp, $U_B = 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

< 300 ms



2 pnp switching outputs

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

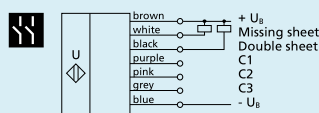
nnp, $-U_B + 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

nnp, $-U_B + 2\text{ V}$, $I_{\max} = 200\text{ mA}$

NOC/NCC adjustable, short-circuit-proof

< 750 ms



2 npn switching outputs



dbk⁺5

Extends the area of application of double-sheet controls to heavy carton, corrugated cardboard and plastic sheets.

HIGHLIGHTS

- › High-performance ultrasonic double-sheet control › especially for the probing of corrugated cardboard as well as plastic plates several mm thick
- › 3 control inputs › for trigger, Teach-in, and external sensitivity settings for the material
- › Teach-in option › e.g. for probing plates stuck together with an oil film
- › Compact design in M18 x 1 threaded tube

BASICS

- › Reliable detection of single and double sheets
- › No Teach-in needed (plug and play)
- › Double-sheet and missing-sheet output
- › Working distance between the transmitter and the receiver selectable from 30 mm to 70 mm
- › Trigger option › for applications in warehouse flow
- › LinkControl › for configuration of sensors from a PC

The dbk⁺5 ultrasonic double-sheet control

is designed for scanning thin sheet metal, plastic sheets and corrugated cardboard with thicknesses exceeding the working range of the dbk⁺4 sensors. The principle behind the operation is the same as for the dbk⁺4 sensors. The main difference between the systems lies in the materials to be detected. (For further information, see dbk⁺4.)

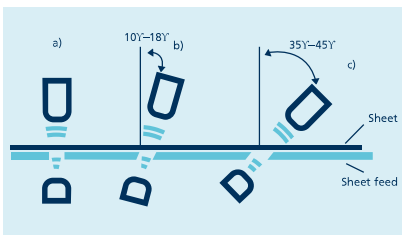
Typical materials

in the range of applications of the dbk⁺5 are sheet metal up to approx. 2 mm thick (depending on the type of metal), plastic sheets and boards for printed circuits up to a thickness of several millimetres, and coarse, corrugated card.

Papers require the sensors to be mounted perpendicular to the passing sheets. But in the case of sheet metal, plastic sheets and boards for printed circuits, it is preferable to mount the dbk⁺5 at an angle of 10–18° to the passing sheets. The optimum angle should be determined by way of trials. Corrugated cards should be scanned at an angle of 35–45° to the corrugations.

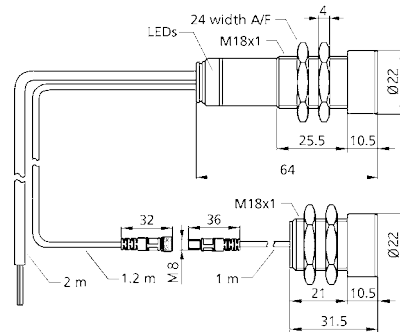
Transmitter and receiver

are housed in M18 x 1 mm threaded sleeves which should be mounted from 30 mm to 70 mm apart.

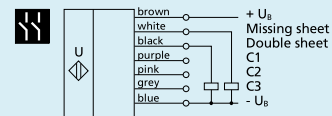


dbk+5/3CDD/M18 E+S

dbk+5/3BEE/M18 E+S

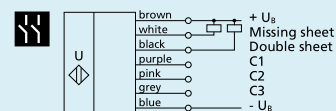


transmitter/receiver spacing	30–70 mm; optimal: 50 mm ± 3 mm
blind zone	7 mm in front of transmitter and receiver
permissible angular deviation	± 45° from the perpendicular to the sheet
transducer frequency	200 kHz
working range	papers with weights of 100 g/m ² to 2,000 g/m ² , plastic sheets and films up to 5 mm thick*, self-adhesive films, sheet metal up to 2 mm thick*, corrugated cardboard, wafers, PCBs (*: material-dependent)
operating voltage U _B	20 V to 30 V DC
no-load current consumption	≤ 50 mA
type of connection	2 m PUR cable, 7 x 0.25 mm ²
transmitter cable	at the receiver: 1.2 m PUR cable, at the transmitter: 1 m PUR cable with M8 plug
controls	3 control inputs: C1 to C3
scope for settings	<ul style="list-style-type: none"> working range selection via control inputs Teach-in via control inputs LCA-2 with LinkControl
indicators	duo-LED; green: working, red: double sheet
housing	brass sleeve, nickel-plated, plastic parts: PBT, PA; ultrasonic transducer: polyurethane foam, epoxy resin with glass content
class of protection according to EN 60529	IP 65
operating temperature	+5°C to +60°C
storage temperature	-40°C to +85°C
weight	150 g
response time	< 500 µs in trigger mode, 5.5 ms in free-run mode
release delay	until next edge in trigger mode, 5.5 ms in free-run mode
order number	dbk+5/3CDD/M18 E+S
double-sheet output	pnp, U _B -2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
missing-sheet output	pnp, U _B -2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
delay prior to availability	< 300 ms



2 pnp switching outputs

order number	dbk+5/3BEE/M18 E+S
double-sheet output	npn, -U _B +2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
missing-sheet output	npn, -U _B +2 V, I _{max} = 200 mA NOC/NCC adjustable, short-circuit-proof
delay prior to availability	< 750 ms



2 npn switching outputs