SMART
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DB 112 B

Double sheet monitoring

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SAFE IMPLEMENTATION AND OPERATION

Original operating instructions

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1 General information

1.1 Explanation of symbols

The symbols used in this technical description are explained below.

Attention!

This symbol precedes text messages which must strictly be observed. Failure to observe the provided instructions can lead to personal injury or damage to equipment.

Note!

This symbol indicates text passages containing important information.

1.2 Declaration of Conformity

The DB 112 B double sheet monitoring sensor system has been developed and manufactured in accordance with the applicable European standards and directives.

Note!

The corresponding declaration of conformity can be requested from the manufacturer.

The manufacturer of the product, Leuze electronic GmbH & Co. KG in D-73277 Owen, possesses a certified quality assurance system in accordance with DIN EN ISO 9001.

For UL applications:
Use is permitted exclusively in Class 2 circuits according to NEC.

2 Safety notices

2.1 Safety standards

The DB 112 B double sheet monitoring unit was developed in accordance with the applicable safety standard EN 60947-5-2 (IEC 60947-5-2).

2.2 Approved purpose

The DB 112 B double sheet monitoring unit is designed as a monitoring device primarily for paper-processing machines. It monitors incoming paper sheets on machines that process single sheets. It is used to detect and signal double sheets in the sheet feeder during operation.

Attention!

The DB 112 B double sheet monitoring unit is not a safety module acc. to the EU machinery directive.

The protection of the machine and the device cannot be guaranteed if the device is operated in a manner not complying with its intended use.

Access to or changes on the device, except where expressly described in this operating manual, is not authorized.

2.3 Areas of application

Double sheets of the following materials can be reliably detected by the DB 112 B:

- Paper
- Plastic
- Metal films

The measurement range for paper is from 20 g/m^2 (airmail paper) to 800 g/m^2 (homogeneous carton).

2.4 Organizing measures

All information provided in this technical description, especially sections "Safety notices" and "Commissioning," must be observed.

Keep this technical description in a safe place. It should be available at all times.

Safety regulations

Observe the locally applicable legal safety regulations.

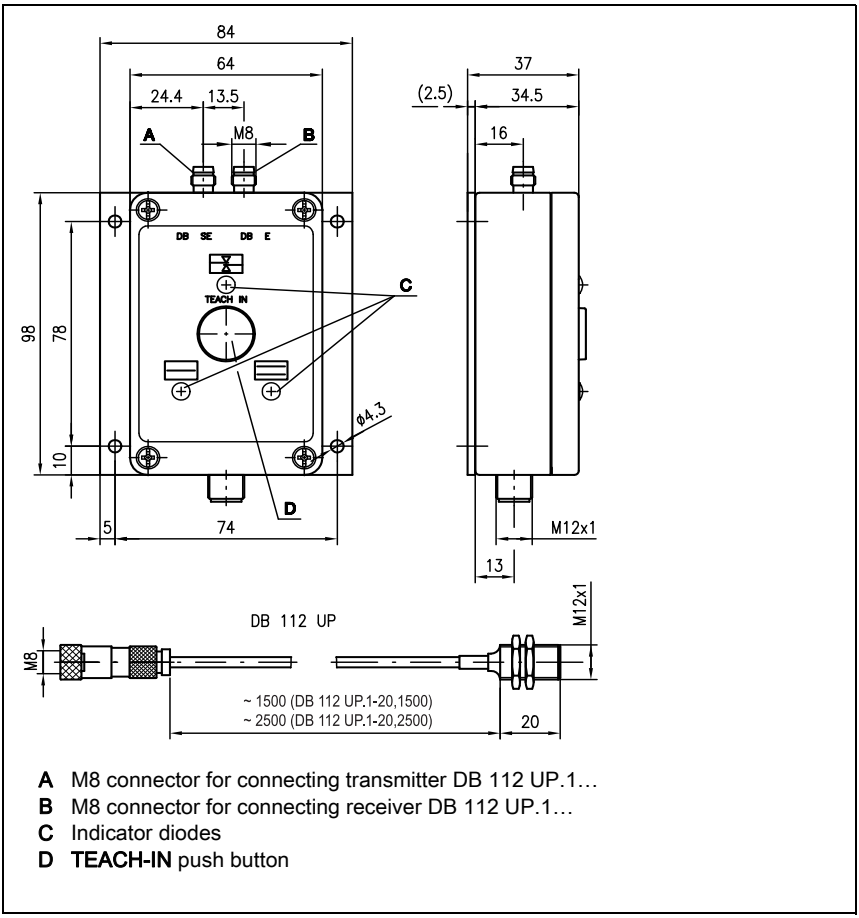
Qualified personnel

Mounting, commissioning and maintenance of the device must only be carried out by qualified personnel.

3 Device overview

The ultrasonic double sheet monitoring system consists of a VDB 112 B... analysis amplifier and a DB 112 UP ultrasonic sensor pair.

It detects and monitors primarily paper, plastic and metal films, which are usually fed in by feeders. The device functions as a presence control by constantly applying a signal at the **single sheet** output when an object is located between the sensors. It functions as a double sheet monitoring unit by comparing each sheet with the stored reference value. A detected double sheet is signaled at the **double sheet** output.



A M8 connector for connecting transmitter DB 112 UP.1…
B M8 connector for connecting receiver DB 112 UP.1…
C Indicator diodes
D **TEACH-IN** push button

Figure 3.1: Device overview – dimensions

Controls and indicators

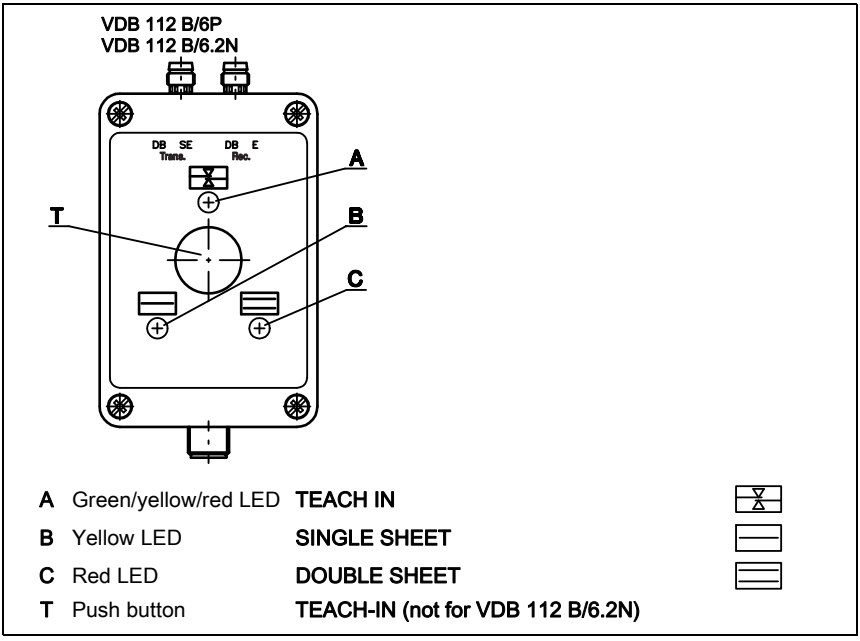


Figure 3.2: Controls and indicators

Order guide

Designation	Type	Part no.
Sensor pair M12 x 21 mm, cable length 1.5 m	DB 112 UP.1-20,1500	501 08999
Sensor pair M12 x 21 mm, cable length 2.5 m	DB 112 UP.1-20,2500	501 09000
Amplifier (positive logic)	VDB 112 B/6P	501 07002

Accessories

Designation	Type	Part no.
5 m cable, PVC, 5-pin, with M12 connectors	KD U-M12-5A-V1-050	50132079

4 Technical data

Technical data for sensor DB 112 UP

Sensor data

Operating range	15 … 30 mm
Converter frequency	300 kHz ±5 %
Sound cone	Approx. 12°

Mechanical data

Housing	Nickel-plated brass
Weight	30 g
Connection type	1.5/2.5 m cable with M8 connector, 3-pin, bending radius r > 25 mm

Technical data for analysis amplifier VDB 112 B/…

Time behavior

Switching frequency	200 Hz
Input pulse	Min. 5 ms
Readiness delay	≤ 300 ms

Electrical data

Operating voltage U_B [1]	18 ... 30 V DC (incl. residual ripple)
Residual ripple	≤ 15 % of U_B
Open-circuit current	≤ 75 mA
Switching output	2 push-pull switching outputs [2]
Function	Single sheet detected, or ≥ 1 sheet Double sheet detected, or ≥ 2 sheets
Signal voltage high/low	≥ (U_B - 2 V) / ≤ 2 V
Output current	Max. 100 mA per output
TEACH input	R_{in} = 10 kΩ
TEACH-IN active/not active [3]	…/…P (PNP): ≥ 10 V / ≤ 2 V or not connected …/…N (NPN): ≤ 2 V / ≥ 10 V or not connected
TEACH-IN duration	Max. 100 ms
TEACH-IN delay [4]	Approx. 300 ms

Indicators

Green LED A	Double sheet monitoring unit ready
Yellow LED A	TEACH-IN event
Red LED, flashing, A	Error (see Chapter 9)
Yellow LED B	Single sheet detected
Red LED C	Double sheet detected

Mechanical data

Housing	Aluminum, with powder coating, black
Weight	400 g
Connection type	M12 connector, 5-pin

Environmental data

Ambient temp. (operation/storage)	0 °C … +50 °C / -40 °C … +70 °C
Protective circuit [5]	1,2,3
VDE protection class	III
Degree of protection	IP65
Standards applied	EN 60947-5-2
Certifications	UL 508, C22.2 No.14-13 [1] [6]

1) For UL applications: use is permitted exclusively in Class 2 circuits according to NEC
2) Function: …/…P = active high (+24V); inactive low (0V),
…/…N = active low (0V); inactive high (+24V).
The push-pull switching outputs must not be connected in parallel
3) Setting the Teach-IN input disables the TEACH-IN button (see Page 10)
4) Only applies for automatic calibration during sheet movement (automatic teach)
5) 1=transient protection, 2=polarity reversal protection, 3=short circuit protection
6) These proximity switches shall be used with UL Listed Cable assemblies rated 30 V, 0.5A min, in the field installation, or equivalent (categories: CYJV/CYJV7 or PVVA/PVVA7)

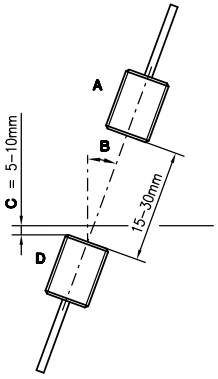
5 Mounting transmitter and receiver

Transmitter and receiver (DB 112 UP) are identical in construction and are to be mounted according to the table in Figure 5.1 at an angle which varies depending on the sheet material. A larger angle of inclination increases the flutter range; e.g., with a 35° pitch, flutter is permissible within 50% of the measurement field. The distance between transmitter and receiver must be at least 15 mm and can be max. 30 mm.

Take care to ensure exact alignment (± 1°). If the alignment does not run along the axis, the working range is reduced.

Note!

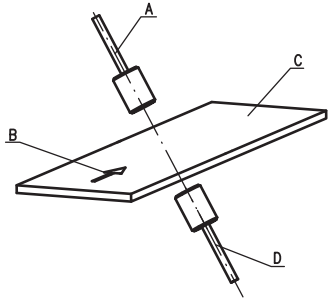
When aligning the transmitter and receiver, take care to ensure the most exact alignment possible. See "Alignment mode" on page 9. *To ensure proper function, the sensors must be inclined by the angle "B" towards the vertical.*



A Receiver
B Angle of inclination
C Sheet material
D Transmitter

Sheet material	Recommended angle of inclination B		
	0°	15° ... 25°	25° ... 35°
Standard papers to 150 g/m²	X	X	X
Carton		X	X
Plastics			X

Figure 5.1: Mounting transmitter and receiver



A Receiver
B Direction of movement
C Sheet material
D Transmitter

Figure 5.2: Recommended arrangement for maximum functionality

6 Electrical connection

Connect transmitter and receiver to the corresponding M8 connectors of the VDB 112 B/… analysis amplifier.

Connect analysis amplifier acc. to connection diagram (Figure 6.1).

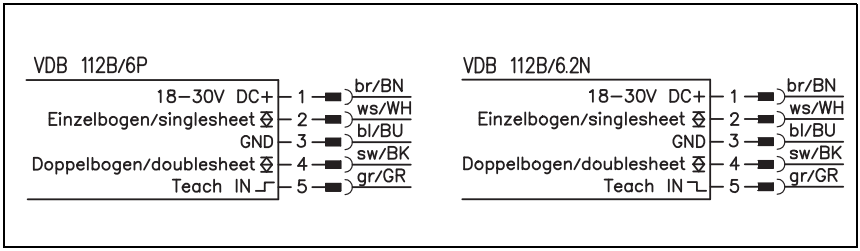


Figure 6.1: Connection diagram for VDB 112 B/…

Circuit logic

VDB 112 B/…P -> positive logic

VDB 112 B/…N -> negative logic

7 Commissioning

Note!

If the indicators flash during the initial commissioning, a calibration must first be performed on a single sheet.

First apply operating voltage. An **alignment mode** is available for commissioning. This can be used to check the alignment of the transmitter and receiver.

Alignment mode

Actuate the **TEACH-IN** button for > 5 s and	The ▭ and ▭ LEDs flash simultaneously at	
↓		
Green ▭ LED:	Alignment ok	Exiting: Actuate the **TEACH-IN** button < 5 s ↥
Yellow ▭ LED:	Alignment critical	Align transmitter and receiver until ▭ LED lights up green. Can only then be exited! Exceptional exiting only possible by means of Power OFF! ↥
Red ▭ LED:	Alignment bad	Align transmitter and receiver until LED ▭ lights up green. Can only then be exited! Exceptional exiting only possible by means of Power OFF! ↥

Note!

After exiting alignment mode, **it is absolutely necessary to perform a calibration**.

Calibration of the material to be detected

For reliable detection of double layers of the medium being processed, it is always necessary to perform a calibration on a single sheet of the medium.

Calibration of the material to be detected can be performed by either pressing the **TEACH-IN** button on the analysis amplifier for 0.3 s to 5 s or by means of a control command on the **Teach-IN** input (pin 5).

Note!

*Setting the **Teach-IN** input (pin 5) disables the **TEACH-IN** button. As soon as a signal is applied once via the **Teach-IN** input for the purpose of calibration, the **TEACH-IN** button remains inactive (disabled) until the next Power On.*

The LED illuminates yellow during the calibration process.

If calibration was successful, the LED illuminates green and the LED illuminates yellow. The **single sheet** output is activated. The reference value remains stored until the next calibration process.

If the calibration process was not successful, the LED flashes red and the LED illuminates red. The **double sheet** output is activated.

Note!

Reasons for an unsuccessful calibration could be, e.g:

- *more than 1 sheet between the sensors.*
- *Sheet material unsuitable because, e.g., laminated, coated, too thin, too thick or air inclusions present.*
- *Insufficient inclination of the sensors.*

The VDB 112 B analysis amplifier can be operated in 3 different operating modes (teach modes):

1. **Standard mode:**
   Teach with intelligent transmitter/receiver control for covering a wide range of material.
2. **Automatic teach:**
   A teach-in is performed automatically 300 ms after sheet detection by the ultrasonic sensors. In this operating mode, no manual or external teaching is necessary. Another automatic teach-in is performed if the ultrasonic path is free for ≥ 2 s.
3. **Fixed switching threshold:**
   This operating mode is recommended if the process does not permit manual or external teaching. In this operating mode, the range of material to be detected is limited.

Selection of operating mode (teach mode)

Actuate the **TEACH-IN** button for > 10 s and	The ▭ and ▭ LEDs flash alternately at 3 Hz		
1.	Green ▭ LED:	Manual teach (standard mode)	Selecting and exiting: Actuate the **TEACH-IN** button > 3s (yellow ▭ LED) Advance: Actuate the **TEACH-IN** button < 3s
2.	Red ▭ LED:	Automatic teach on first sheet	Selecting and exiting: Actuate the **TEACH-IN** button > 3s (yellow ▭ LED) Advance: Actuate the **TEACH-IN** button < 3s
3.	▭ LED off:	Permanently stored switching threshold	Selecting and exiting: Actuate the **TEACH-IN** button > 3s (yellow ▭ LED) Advance: Actuate the **TEACH-IN** button < 3s

Attention!

After selecting the operating mode (teach mode), it is absolutely necessary to perform a calibration!

8 Operation – inputs and outputs

The VDB 112 B/… evaluation unit constantly signals the situation between the sensors at two outputs.

The **single sheet output** (pin 2) is activated as long as **one or more sheets** are located in the measurement field.

The **double sheet output** (pin 4) is activated as long as **two or more sheets** are located in the measurement field.

Note!

*For reliable operation, it is **absolutely necessary to perform a calibration** on the material that is to be detected. See "Calibration of the material to be detected" on page 10.*

9 Diagnosis in the case of failure

The device LEDs signal the following error states:

LED 	LED 	LED 	Meaning	Cause	Remedy
Red flashing (6 Hz)	**Yellow flashing (6 Hz)**		Double sheet monitoring not calibrated		Perform calibration
Red flashing (6 Hz)		**Red**	No single sheet detected during calibration	No sheet inserted or double sheet inserted	Calibrate on single sheet
Red flashing (6 Hz)		**Red flashing (6 Hz)**	Amplifier detects an excessively high noise level when switching on	Extreme interfering noise	Quiet the interfering noise, e.g., with foam
	Yellow, flashing fast	**Red, flashing fast**	Current at output too high	Short-circuit	Switch off voltage, check wiring
Red flashing (3 Hz)		**Red**	Fatal memory error	Defective	Have repaired by Leuze electronic

10 Application-specific extension types

The amplifier models described in the following are used for adapting to specific applications. They are used instead of the standard amplifier models.

10.1 VDB 112 B/6.2N – fixed switching threshold

With respect to the technical and electrical data, this amplifier corresponds to the VDB 112 B/6P. The software is adapted to a specific customer application.

No calibration to the material to be detected is necessary, since a fixed switching threshold for double sheet detection is implemented in the amplifier.

The detection range includes papers from 40 g/m² to 450 g/m².

Designation	Type	Part no.
Amplifier (negative logic) – fixed switching threshold	VDB 112 B/6.2N	501 07003

Note!

The VDB 112 B/6.2N does not have a TEACH-IN button. Should it be necessary to enter alignment mode, the 2-pin pin strip on the circuit board can be bridged for >5 s. Alignment can then be performed as described under "Alignment mode" in Chapter 7.

The device LEDs signal the following error states:

LED 	LED 	LED 	Meaning	Cause	Remedy
Red flashing (6 Hz)		**Red flashing (6 Hz)**	Amplifier detects insufficient input signal when switched on	Sheet between the sensors or sensors not connected	Remove sheet
Red flashing (6 Hz)		**Red flashing (6 Hz)**	Amplifier detects an excessively high noise level when switching on	Extreme interfering noise	Quiet the interfering noise, e.g., with foam
	Yellow, flashing fast	**Red, flashing fast**	Current at output too high	Short-circuit	Switch off voltage, check wiring
Red flashing (3 Hz)		**Red**	Fatal memory error	Defective	Have repaired by Leuze electronic

With the VDB 112 B/6.2N, the operating voltage must be briefly interrupted to reset the error message.