microsonic

Operating Manual

Ultrasonic label and splice sensor with 2 switching outputs

esp-4/3CDD/M18 E+S
esp-4/M12/3CDD/M18 E+S
esp-4/3BEE/M18 E+S

Functional principle

With a rapid pulse sequence, an ultrasonic transmitter beams upwards against the backing material. The sound pulses causes the backing material to vibrate, so that a greatly weakened sonic wave is emitted on the opposite side. The receiver receives this sonic wave and analyzes it.
The backing material signal level is different to that of the label or splice. And this difference in signal is analyzed by the esp-4. The difference between backing material and label and/or between sheeting and splice can be very slight. In order to ensure reliable detection, the esp-4 sensor has to learn first the signal level of the backing material/sheeting.
The esp-4 sensors can be used as a label and splice sensor. The 3 Teach-in methods and QuickTeach allow the esp-4 sensor to be optimally set for each and every assignment.

Product description

- Reliable detection of labels made of paper, metal or (transparent) plastic
- Reliable detection of splices of paper web, plastic web or metal web
- Detection of web break
- Detection of material weights from <20 g/m² to >>600 g/m²; sheet metals and plastic films up to 0.6 mm thickness
- 3 Teach-in methods and QuickTeach
- Synchronisation
- Parametrisation via LinkControl
- Response time of 300 µs until label/splice is detected
- Transmitter–receiver spacing can be selected from 20 to 40 mm (or 30 mm with esp-4/M12/...E+S)

Safety Notes

- **Read the operating manual prior to start-up.**
- **Connection, installation and adjustment works should be carried out by expert personnel only.**
- **No safety component in accordance with the EU Machine Directive, use in the area of personal and machine protection not permitted**

Proper use

The esp-4 sensors are used for non-contact detection of labels and splice as well as web break.

Installation

➔ Mount the transmitter and receiver as shown in Fig. 5, with the recommended distance of 40 mm ±3 mm (or 20 mm ±2 mm for esp-4/M12/...E+S) from each other and an inclination >10° from the arc normal.
➔ Connect the transmitter to the receiver using the M8 connector.
➔ Connect the receiver 7-strand control line as shown in Fig. 1.

colour	
brown	operating voltage $+U_B$
blue	operating voltage $-U_B$
white	label/splice output D1
black	web break output D2
violet	control input C1
pink	control input C2
grey	control input C3

Fig. 1: Colour coding of the connection line

Notes

- The coaxiality of transmitter and receiver must be ≤ 0.5 mm.
- Transmitter and receiver should not incline more than 2° to each other.
- In case of thicker plastic films the esp-4 has to be mounted at a 27° inclination to sheet normal (see Fig. 5b).
- Other materials may need a special fitting position. If you work with these special materials, please contact the technical support team of microsonic.
- The max. torque of the nuts is 15 Nm for the M18 and 8 Nm for the M12 sleeves respectively.
- If the transmitter is recessed or a track guide is provided between the transmitter and receiver, the hole in the track guide must have a diameter of ≥18 mm.

Start-up

➔ For normal operating mode, leave control inputs C1 to C3 unconnected (see Fig. 1).
➔ Switch on the esp-4 voltage supply.

Input	Function	Setting procedure
C1	Teach-in	see »Teach-in« and »QuickTeach«
C2	Automatic tracking	Logic level 1
C3	Synchronisation/communication	**Sync**: connect C3 together **Com**: connect with LCA-2 [1]

[1] C3 must not be connected to $-U_B$ or $+U_B$.

Fig. 2: Function of control inputs

esp-4/3CDD/M18 E+S esp-4/M12/3CDD/M18 E+S	
Logic level	**Voltage level**
0	< $-U_B$ +13 V
1	> $-U_B$ +18 V
esp-4/3BEE/M18 E+S	
Logic level	**Voltage level**
0	> $-U_B$ +10 V
1	< $-U_B$ +6 V

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

Teach-in

Teach-in is carried out via control input C1. There are 3 Teach-in methods:

- Dynamic Teach-in of labels
- Static Teach-in of labels
- Splice sensor

➔ Place the web material between transmitter and receiver and carry out one of the three Teach-in methods (see Diagram 1).

QuickTeach

With QuickTeach, you have a simplified Teach-in process that you have to activate once via LinkControl before initial commissioning. You can teach-in the material via control input C1.

➔ Set in LinkControl software, whether the esp-4 should work as label or splice sensor.
➔ Place the web material between transmitter and receiver. Run QuickTeach via control input C1 according to Diagram 2.

Notes

- Every Teach-in should be performed with at least 0.5 m of label or web material to ensure that the sensor is able to detect the whole range of the material inhomogeneities.
- A failed Teach-in is indicated by the red flashing of both LEDs. Meanwhile the sensor keeps former settings in normal operating mode.

Operation

The esp-4 continually performs measurements and sets the switching outputs based on its results.
The automatic tracking can be activated/deactivated via control input C2 during normal operating mode. The conditions of LED 1 and 2 are shown in Fig. 4.

	LED 1	LED 2
Normal operating mode	green	green
backing material	green	green
label/splice	red	green
web break	green	flashing red
Teach-in	see »Teach-in«	
Teach-in dismissed	flashing red	flashing red

Fig. 4: LED displays

Factory setting

The esp-4 is delivered with the following factory settings:

- Output label/splice D1 on NOC
- Output D2 on function web break
- Output web break on NOC
- 40 or 20 mm spacing
- Operating mode automatic tracking on/off via control input C2
- QuickTeach is deactivated

Automatic tracking

After a Teach-in the esp-4 can track the switching threshold automatically. In this way variations in the material to be scanned and fluctuation in the ambient temperature can be compensated.

➔ With the start of moving material change control input C2 on logic level 1, see Fig. 2 and Fig. 3.
➔ With stop of moving material change control input C2 on logic level 0, see Fig. 2 and Fig. 3.

Notes

➔ If the material movement stops, it is mandatory to deactivate the automatic tracking via control input C2.
➔ During Teach-in procedure, the automatic tracking must be deactivated via control intput C2.

Synchronisation

If two or more esp-4 shall work close together they may influence one another. To avoid this the esp-4 can be synchronised. To do this all contol inputs C3 have to be connected with each other.

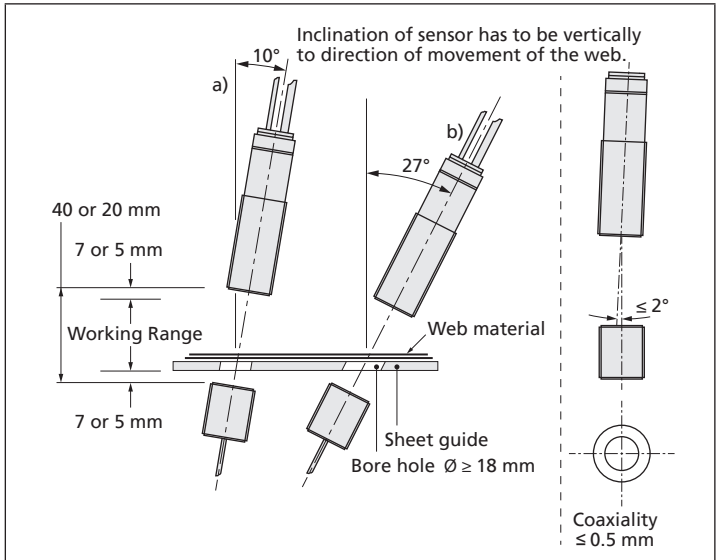
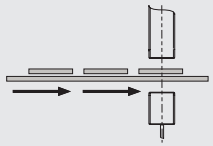


Fig. 5: Mounting and installation positions

Diagram 1: Teach-in



Teach-in label dynamic

Place backing material with label between transmitter and receiver.

Place control input C1 on logic level 1 for 3 s until both LEDs flash green alternately.

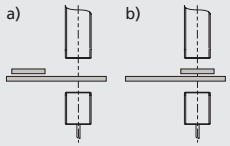
one LED flashes green, one LED is static green

Pull the backing material with labels through transmitter and receiver at a constant speed.

one LED flashes green, one LED is static green

Place control input C1 on logic level 1 for 1 s.

one LED is static green, one LED flashes green



Teach-in label static

a) Place only backing material between transmitter and receiver.

Place control input C1 on logic level 1 for 6 s until one LED turns off and one LED flashes green.

one LED flashes green, one LED is static green

Pull only backing material through transmitter and receiver.

one LED flashes green, one LED is static green

Place control input C1 on logic level 1 for 1 s.

one LED is static green, one LED flashes green

b) Place backing material with label between transmitter and receiver.

one LED flashes green, one LED is static green

Place control input C1 on logic level 1 for 1 s.

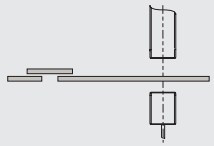
one LED is static green, one LED flashes green

Move backing material with label between transmitter and receiver.

one LED flashes green, one LED is static green

Place control input C1 on logic level 1 for 1 s.

one LED is static green, one LED flashes green



Teach-in only for sheeting (splice sensor)

Place web material between transmitter and receiver.

Place control input C1 on logic level 1 for 9 s until both LEDs turn off.

one LED flashes green, one LED is static green

Pull some web material through transmitter and receiver.

one LED flashes green, one LED is static green

Place control input C1 on logic level 1 for 1 s.

one LED is static green, one LED flashes green

Normal operating mode

Diagram 2: QuickTeach

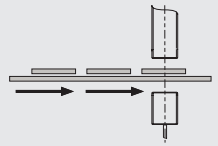
Activate QuickTeach

Connect esp-4 to the LCA-2 and via USB cable to PC. Start LinkControl software.

Read all parameters from esp-4 via LinkControl software.

Activate QuickTeach and select label or splice sensor in the QuickTeach menu.

Write all parameters to esp-4 via LinkControl software.



QuickTeach label sensor

Place backing material with labels between transmitter and receiver.

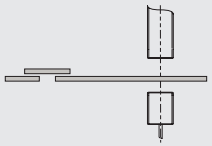
Place control input C1 on logic level 1.

one LED flashes green, one LED is static green

Pull the backing material with labels through transmitter and receiver at a constant speed.

one LED flashes green, one LED is static green

Place control input C1 on logic level 0.



QuickTeach splice sensor

Place web material between transmitter and receiver.

Place control input C1 on logic level 1.

one LED flashes green, one LED is static green

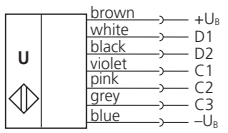
Pull web material without splice through transmitter and receiver.

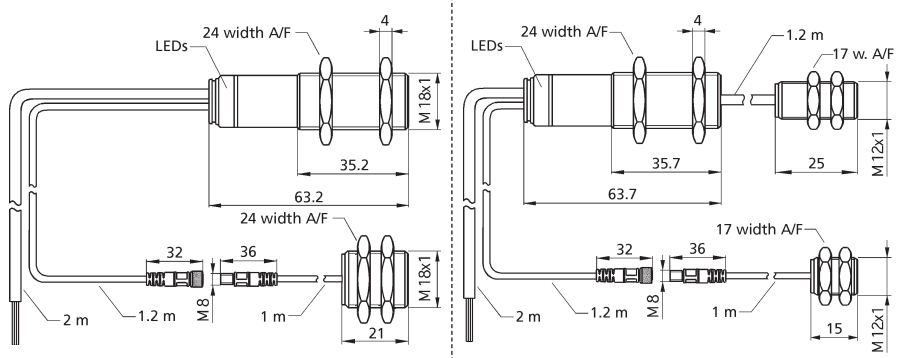
one LED flashes green, one LED is static green

Place control input C1 on logic level 0.

Normal operating mode

Technical data





	esp-4/3CDD/M18 E+S esp-4/3BEE/M18 E+S	esp-4/M12/3CDD/M18 E+S
spacing transmitter-receiver	20 to 40 mm	20 to 30 mm
optimum spacing transmitter-receiver	40 mm ± 3 mm	20 mm ± 3 mm
blind zone (in front of transmitter and receiver)	7 mm	5 mm
permissible angular deviation	10° to 27° from the perpendicular of the sheet	10° to 27° from the perpendicular of the sheet
ultrasonic frequency	400 kHz	500 kHz
working range	web material with grammages of <20 g/m² to >>600 g/m²; paper, metal, plastic	web material with grammages of <20 g/m² to >>600 g/m²; paper, metal, plastic
operating voltage U_B	20 to 30 V DC	20 to 30 V DC
voltage ripple	±10 %	±10 %
no-load current consumption	≤50 mA	≤50 mA
type of connection	2 m PUR cable, 7 x 0.25 mm²	2 m PUR cable, 7 x 0.25 mm²
transmitter-receiver connection	at receiver: PUR, 1.2 m; at transmitter: PUR, 1 m; with M8 connector	at receiver: PUR, 1.2 m; at transmitter: PUR, 1 m; with M8 connector connection cable to external ultrasonic transducer: PVC, 1.2 m
controls	3 control inputs: C1 to C3	3 control inputs: C1 to C3
programmable	Teach-in, LinkControl, QuickTeach	Teach-in, LinkControl, QuickTeach
response time	300 µs to 2.25 ms depending on the grammages	300 µs to 2.25 ms depending on the grammages
indicator	green: working/backing material red: label/splice red flashing: web break	green: working/backing material red: label/splice red flashing: web break
housing	brass sleeve, nickel-plated; plastic parts: PBT, PA; cable: PUR; ultrasonic transducer: Polyurethane, epoxy resin with glass content	brass sleeve, nickel-plated; plastic parts: PBT, PA; cable: PUR; ultrasonic transducer: Polyurethane, epoxy resin with glass content
max. tightening torque of nuts	M18: 15 Nm	M18: 15 Nm; M12: 8 Nm
class of protection to EN 60529	IP 65	IP 65
operating temperature	+5 to +60 °C	+5 to +60 °C
storage temperature	–40 to +85 °C	–40 to +85 °C
weight	130 g	160 g
norm conformity	EN 60947-5-2	EN 60947-5-2
order no.	**esp-4/3CDD/M18 E+S**	**esp-4/M12/3CDD/M18 E+S**
label/splice output D1 [1]	pnp, +U_B–2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC	pnp, +U_B–2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC
web break outout D2 [1]	pnp, +U_B–2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC	pnp, +U_B–2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC
U_E at control inputs C1 to C3	> –U_B+18 V: logic level 1 < –U_B+13 V or control input open: logic level 0	> –U_B+18 V: logic level 1 < –U_B+13 V or control input open: logic level 0
time delay before availability	<300 ms	<300 ms
order no.	**esp-4/3BEE/M18 E+S**	
label/splice output D1 [1]	npn, –U_B+2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC	
web break outout D2 [1]	npn, –U_B+2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC	
U_E at control inputs C1 to C3	< –U_B+6 V: logic level 1 > –U_B+10 V or control input open: logic level 0	
time delay before availability	<300 ms	

[1] Can be programmed via LinkControl

Parameterisation via LinkControl

The esp-4 can be extensively parameterised using the LinkControl adapter (optional accessory) and the LinkControl software for Windows®.

Operation with LinkControl

➔ Install the LinkControl software on the PC.
➔ Connect the LinkControl adapter to the PC with the USB cable.
➔ Connect esp-4 to the LCA-2 as shown in Fig. 6. 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.

	Colour esp-4	Colour adapter cable	Pin (LCA-2)
+U_B	brown	brown	1
–U_B	blue	blue	3
C3	grey	grey	5

Fig. 6: Connecting esp-4 to the LCA-2

The following settings can be adjusted:

- Teach-in of web or label material
- Spacing between transmitter and receiver
- NOC/NCC function of the switching outputs
- Function of switching output D2
- Activate QuickTeach

Zusätzlich steht eine grafische Darstellung der Messwerte zur Verfügung.

Maintenance

The esp-4 is maintenance-free. Small amounts of dirt on the sensor surface do not affect its function. Thick layers of dirt or caked-on dirt affect sensor function and must therefore be removed.

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