microsonic

Operating Instructions

Ultrasonic label and splice sensor with 2 switched outputs

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

Functional principle

With a rapid pulse sequence, an ultrasonic transmitter beams upwards against the backing material. The effect of the sound pulses inducing the backing material to vibrate is for a markedly weakened sonic wave to be emitted on the opposite side. The receiver receives this sonic wave and analyses it.

The backing material signal level is different to that of the label or splice. And this difference in signal is analysed by the esp-4. The difference between backing material and label and/or between sheeting and splice can be very slight indeed. To ensure certainty with the difference, teach-in for the esp-4 sensor must firstly revolver around the signal level for the backing material/sheeting.

The esp-4 sensors can be used as a label and splice sensor. The 3 teach-in methods permit the esp-4 sensor to be optimally set for each and every assignment.

Product description

- Assured detection of labels made of paper, metal or (transparent) plastic.
- Detection of splices of paper web, plastic web or metal web.
- Label/splice and web break output as pnp or npn switched outputs.
- Scanning of material weights from <20 g/m^2 to >>600 g/m^2; sheet metals and plastic films up to 0,6 mm thickness.
- 3 Teach-in modes.
- Synchronisation.
- Parametrization via LinkControl.
- Response time of 300 μs until lable/splice is detected.
- Transmitter - receiver spacing can be selected from 20 to 40 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 recommended spacing of 40 mm ± 3 mm (or 20 mm ± 2 mm with esp-4/M12/...E+S).
esp-4 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.

Fig. 2: Colour coding of the control line

	Colour
+U$_B$	Brown
-U$_B$	Blue
lable/splice output D1	White
web break output D2	Black
control input C1	Violet
control input C2	Pink
control input C3	Grey

Pointer

- 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°.
- In case of thicker plastic films the esp-4 is to be mounted at a 27° inclination to sheet normal (Fig. 1b).
- Other materials may make a special fitting position necessary. Do contact microsonic when you work with these special materials.
- The max. torque of the nuts is 15 Nm for the M18 and 8 Nm for the M12 sleeves respectively.
- 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 line between transmitter and receiver is not to be bridged with an external potential.

Start-up

▸ For normal opperation mode leave all the 3 control inputs unconnected (see Figs 3 and 4).
▸ Switch on the esp-4 voltage supply.

Input	Function
C1	Teach-in
C2	Automatic tracking on/off
C3	Synchronization/communication

Fig. 3: Function of control inputs

Mode	C1	C2	C3
normal operation	open or -U$_B$	open or -U$_B$	open[1]
Teach-in	See »Teach-in modes«	open or -U$_B$	open[1]
automatic tracking	open or -U$_B$	+U$_B$	open[1]
sychro-nization	open or -U$_B$	open or -U$_B$	C3 connected with each other
automatic tracking and synchronizati-on	open or -U$_B$	+U$_B$	C3 connected with each other

1) C3 must not be connected to -U$_B$
Fig. 4: Assignment of control inputs

Teach-in

Teach-in is carried out via contol input C1.
There are 3 Teach-in methods:
- Dynamic teach-in of backing material and label
- Separate teach-in for backing material and labels
- Teach-in only for sheeting
▸ Place the web material between transmitter and receiver of the esp-4 and carry out one of the 3 Teach-in methods.

Pointer

- During Teach-in the control input C2 has to be left unconnected or connected to -U$_B$ and C3 has to be unconnected.
- 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 dismissed Teach-in is shown by a red flashing LED after the last step of the procedure until a power on or a successful Teach-in is performed. Meanwhile the sensor works in normal operation mode with the former settings.

Operation

The esp-4 performs measurements cyclically and depending on the measurement result it sets the two switched outputs.
The automatic tracking can be put on/off during runnig operation.

The conditions of LED 1 and 2 are shown in Fig. 6.

Logical state	Voltage level	
	pnp	npn
0	-U$_B$	+U$_B$
1	+U$_B$	-U$_B$

Fig. 5: Voltage level of the logic states at the control inputs

Condition	LED 1	LED 2
operation	Green	Green
backing material	Green	Green
label/splice	Red	Green
web break	Green	Red flashing
Teach-in	See »Teach-in methods«	
Teach-in dismissed	Green	Red flashing

Fig. 6: LED displays

Factory setting

The esp-4 are delivered with the following factory settings:
- Output label/splice output D1 on NOC.
- Output D2 on fuction web break.
- Ouput web break on NOC.
- 40 or 20 mm spacing.
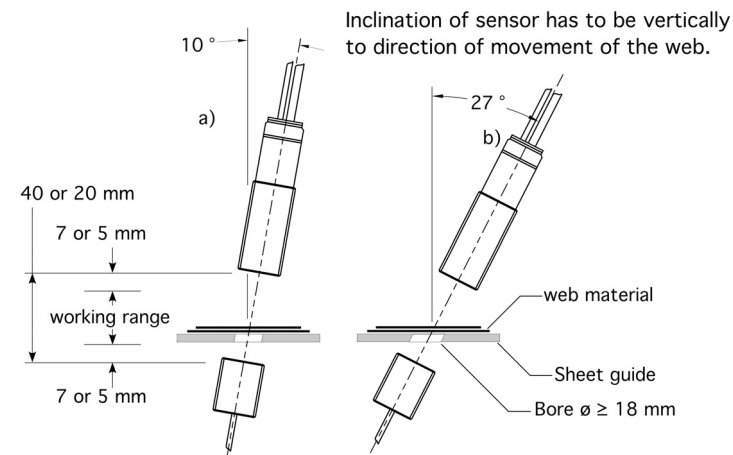- Operation mode on automatic tracking on/off via input C2.

Automatic tracking

After a Teach-in the esp-4 can track the working point automatically. In this way variations in the material to be scanned and fluctuation in the ambient temperature can be compensated.
Via control input C2 the automatic tracking can be put on and off.

Synchronization

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

Inclination of sensor has to be vertically to direction of movement of the web.

10°
a)
27°
b)
40 or 20 mm
7 or 5 mm
working range
7 or 5 mm
web material
Sheet guide
Bore ø ≥ 18 mm

Fig. 1: Mounting and installation positions

Teach-in label dynamic	Teach-in label static	Teach-in only for sheeting (splice sensor)
Place backing material with label between transmitter and receiver.	a) Place only backing material between transmitter and receiver.	Place web material between transmitter and receiver.
Place control input C1 on logic 1 for 3 s until both LED flash mutualy.	Place control input C1 on logic 1 for 6 s until one LED turns off and one LED is on.	Place control input C1 on logic 1 for 9 s until both LEDs turn off.
both LED flash green simultaneously	one LED flashes green, one LED is static green	one LED flashes green briefly, one LED is static green
Pull backing material with labels among transmitter and receiver with constant speed.	Pull only backing material among transmitter and receiver.	Pull web material among transmitter and receiver.
one LED flashes green briefly, one LED is static green	one LED flashes green briefly, one LED is static green	one LED flashes green briefly, one LED is static green
Place control input C1 on logic 1 for 1 s.	Place control input C1 on logic 1 for 1 s.	Place control input C1 on logic 1 for 1 s.
one LED is static green, one LED flashes green	one LED is static green, one LED flashes green	one LED is static green, one LED flashes green
	b) Place backing material with label between transmitter and receiver.	
	one LED flashes green briefly, one LED is static red	
	Place control input C1 on logic 1 for 1 s.	
	one LED flashes green, one LED is static green	
	Move backing material with label between transmitter and receiver.	
	one LED flashes green briefly, one LED is static green	
	Place control input C1 on logic 1 for 1 s.	
	one LED flashes green, one LED is static green	

Normal operation

Parameterization with LinkControl

The esp-4 can be extensively parameterized under LinkControl. Here you need the optionally available LinkControl adapter LCA-2 and the LinkControl software for Windows©.

Operation onto LinkControl

‣ Install the LinkControl software onto your PC.

Connect the LinkControl adapter to your PC with the USB cable.
‣ Connect esp-4 to the LCA-2 in keeping with the Fig 7 table. 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.
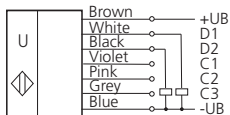‣ Start the LinkControl software and follow the instructions on the screen.

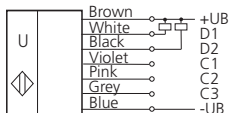|	Colour esp4	Colour adapter cable	Pin
+U_B	Brown	Brown	1
-U_B	Blue	Blue	3
C3/Com	Grey	Grey	5

Fig. 7: Connecting esp-4 to the LCA-2

The following settings can be undertaken:
- Teach-in of web or label material.
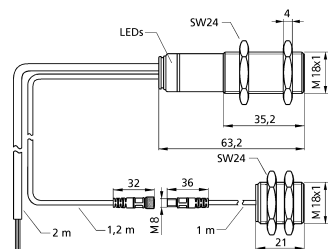- Spacing between transmitter and receiver.
- NOC/NCC function of the switched outputs.
- Function of switched output D2.
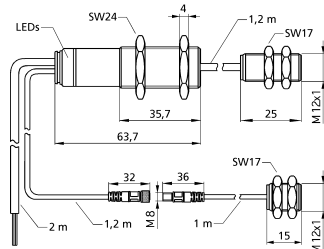
Also available is a diagrammatic representation of the readings.

Maintenance

No maintenance is need on the esp-4. We would recommend cleaning the sensor surfaces at the transmitter and receiver should they become very dirty. The best thing is to apply some isopropanol onto a cotton cloth and then wipe the surface clean. Make sure that the reaction time of the cleaner is kept down. That means quickly wiping dry the transducer surfaces.

Technical data

	esp-4/3.../M18 E+S	**esp-4/M12/3.../M18 E+S**
	2 pnp switched outputs / 2 npn switched outputs (wiring: Brown +UB, White D1, Black D2, Violet C1, Pink C2, Grey C3, Blue -UB)	
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°-27° from the perpendicular of the sheet	10°-27° from the perpendicular of the sheet
ultrasonic frequency	400 kHz	500 kHz
working range	web material with grammages of < 20 g/m^2 to >> 600 g/m^2; paper, metal, plastic	web material with grammages of < 20 g/m^2 to >> 400 g/m^2; paper, metal, plastic
operating voltage U_B	20 V to 30 V DC	20 V 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 mm^2	2 m PUR cable, 7 x 0,25 mm^2
transmitter-receiver connection	At receiver: PUR, 1,2 m; at transmitter: 1 m, PUR; both with M8 connector	At receiver: PUR, 1,2 m; at transmitter: 1 m, PUR; both 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	Teach-in, LinkControl
response time	300 µs - 2,25 ms, depending on the grammages	300 µs - 2,25 ms, depending on the grammages
indicator	Green: working/backing material; Red: label/splice; Red flashing: web break	Green: working/single sheet; Red: double sheet; Red flashing: missing sheet
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/PVC; 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 °C to +60 °C	+5 °C to +60 °C
storage temperature	-40 °C to +85 °C	-40 °C 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
double sheet output	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
missing sheet output	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 C_1-C_3	> -U_B+18 V: logical 1; < -U_B+13 V or control input open: logical 0	> -U_B+18 V: logical 1; < -U_B+13 V or control input open: logical 0
time delay before availibility	< 300 ms	< 300 ms
order no.	esp-4/3BEE/M18 E+S	esp-4/M12/3BEE/M18 E+S
label/splice output	npn, -U_B+2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC	npn, -U_B+2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC
missing sheet output	npn, -U_B+2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC	npn, -U_B+2 V, $I_{max.}$ = 200 mA, short circuit proof, switchable NOC/NCC
U_E at control inputs C_1-C_3	< -UB+6 V: logical 1; > -U_B+10 V or control input open: logical 0	< -UB+6 V: logical 1; > -U_B+10 V or control input open: logical 0
time delay before availibility	< 750 ms	< 750 ms

[1] Can be programmed with LinkControl