MICROSONIC

Operating manual

Ultrasonic label and splice sensor with two switching outputs with IO-Link interface

esf+1/CFF/Pro
esf+1/CFF/Exp

Functional principle

The fork houses a transmitter-receiver measuring section. The transmitter is located in the lower leg, and the receiver in the upper leg. The web material to be scanned is guided through the fork. The ultrasonic transmitter in the lower leg emits a fast sequence of pulses that causes the web material to vibrate, resulting in a significantly attenuated sound wave being emitted on the opposite side. The receiver in the upper leg of the fork receives these sound pulses and evaluates them.

The web material can be a carrier material with labels that need to be detected individually, or a continuous material with a splice that needs to be located.

The signal difference between the backing material and the labels, or between the web material and the splice, can be very small. To ensure reliable detection, the esf+1 sensor must therefore initially learn the signal level for the backing or web material.
A simple Teach-in method is available for both label sensor and splice sensor operation. In addition, labels can be programmed statically if necessary.

Product description

- Reliable detection of labels made of paper, metal or (transparent) plastic
- Detection of splices of paper, plastic or metal webs
- Detection of materials with grammages from <20 g/m² to >600 g/m²; sheet metals and plastic films up to 0.3 mm thickness
- A simple Teach-in method for label/splice detection
- Additional static Teach-in for labels
- Configurable via LinkControl and IO-Link
- Measurement cycle time starting at 150 µs; automatically adjusts to the web material

IO-Link

The esf+1 sensor is IO-Link-capable in accordance with IO-Link specification V1.1 and supports the Smart Sensor Profile »Digital Measuring Sensor«. The sensor can be monitored and parameterized via IO-Link.
The latest IODD file and informations about start-up and configuration of esf+1 sensors via IO-Link, you will find online at:

- www.microsonic.de/en/esf+1.

Safety Notes

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

Proper Use

esf+1 ultrasonic sensors are used for non-contact detection of labels and splices.

esf+1/CFF/Pro or esf+1/CFF/Exp

The **esf+1/CFF/Pro** operates at an ultrasonic frequency of 500 kHz, whereas the **esf+1/CFF/Exp** operates at 200 kHz.
With a measurement cycle time of 150 µs, the **esf+1/CFF/Pro** is the faster option and should always be the starting point for label detection.
For labels where Teach-in is not possible with the Pro version, the **esf+1/CFF/Exp** is used.

For splice detection on web materials with basis weights of 250 g/m² or higher or thicknesses up to 0.3 mm, the **esf+1/CFF/Exp** is used.

Depending on the sound attenuation in the track material, the esf+1 automatically adjusts its transmission power and thus its measurement cycle time. If the transmission power needs to be increased, the measurement time increases accordingly. This can vary from 150 µs to 2 ms (Pro) or 300 µs to 3.9 ms (Exp).

Installation

➔ Attach the mounting adapter to the fork so that the fork is tilted 13° against the web direction (see Fig. 4).
➔ Mount the sensor using two screws.
➔ Connect the connection cable using the 5-pin M12 connector as shown in Fig. 1.

- Always mount the sensor so that it is angled away from the dispensing edge (see Fig. 4).
- To change the fork's angle from –13° to +13° (or vice versa), remove the mounting adapter, rotate it 180°, and reattach it (see Fig. 5).

		colour
1	$+U_B$	brown
3	$-U_B$	blue
2	F1 (web break output)	white
4	F2 (label/splice output)	black
5	Teach-in/Com	grey

Fig. 1: Pin assignment and colour coding for microsonic connection lines

Note

- Via IO-Link and LinkControl, the functions assigned to F1 and F2 can be changed.

Start-up

➔ Connect the power supply.
➔ Insert web material into the fork without the material touching the fork.
➔ Perform a Teach-in.

Teach-in via push-button and Teach-in input

The Teach-in procedure can be carried out via the push-button on the top leg of the fork or with the Teach-in input on pin 5 on the M12 connector.
➔ Depending on whether the sensor is used as a label sensor or a splice sensor, perform the corresponding Teach-in as shown in Diagram 1.

Notes

- If you change materials, perform the Teach-in again.
- The IO-Link interface includes a recipe management function that allows you to store up to 20 programmed materials and retrieve them as needed. This eliminates the need to repeat the teach-in process for the same material. For more information, see the IO-Link accompanying document.
- Applying $+U_B$ to the Teach-in input is equivalent to pressing the push-button.
- A failed Teach-in is indicated by the red LED flashing.
- If the Teach-in according to Diagram 1 fails for labels, the static label Teach-in can be used as an alternative (see Diagram 2).
- If Teach-in has been locked via IO-Link, all 3 LEDs will flash for 3 s when attempting a Teach-in.

Operation

The esf+1 continually performs measurements and sets the switching outputs based on its results. An overview of the operating modes with the associated LED displays is shown in Fig. 2.

	LED		
operation status	pow (green)	out (yellow)	err (red)
ready for use	on	–	–
IO-Link operation	flash	–	–
backing material	on/flash	off	off
label/splice	on/flash	on	off
web break	on/flash	off	on
Teach-in error	off	off	flash

Fig. 2: LED display

Factory setting

The esf+1 sensor is delivered factory made with the following settings:

- Output F2 to label/splice output, high-active
- Output F1 to web break, high-active
- Teach-in: push-button active, Teach-in input active

The sensor can be reset to its factory setting (see Diagram 3).

Configuration via LinkControl

Using the LinkControl adapter (optional accessory) and the LinkControl software for Windows®, all Teach-in and additional sensor parameter settings can be optionally adjusted.

Operation with LinkControl

➔ Install LinkControl-software at your PC.
➔ Connect the adapter to your PC using the usb cable.
➔ Connect the power supply cable at the T-connector of the LCA-2.
➔ Start the LinkControl-Software and follow the instructions on the screen.

	pin (esf+1)	colour adapter cable	pin (LCA-2)
$+U_B$	1	brown	1
$-U_B$	3	blue	3
Com	5	grey	5

Fig. 3: Connection of the esf+1 to the LCA-2

You can make the following settings:

- Switching logic of the output terminals (high active/low active)
- Function of the output terminals
- Operating mode
- Switching logic of the Teach-in input
- Teach-in procedures
- and much more

Maintenance

The esf+1 is maintenance-free. If dirt accumulates on the ultrasonic transducers, we recommend cleaning them with a clean cloth or gently blowing them off with oil-free compressed air.

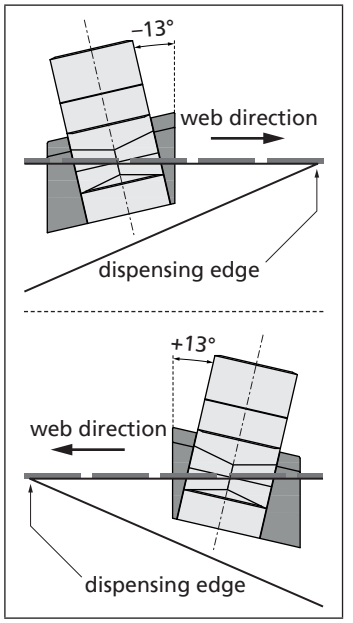


Fig. 4: Proper installation on the dispensing edge

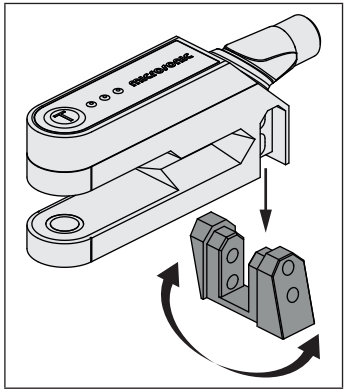
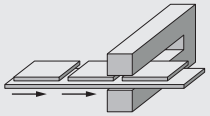
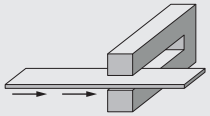


Fig. 5: Adjust the angle by rotating the mounting adapter

Diagram 1: Standard Teach-in





Dynamic Teach-in of labels

Insert the backing material with label into the fork.

Briefly tap the push-button[1].

LED red:	off
LED green:	flashes
LED yellow:	on

Move the backing material with label through the fork at a constant speed.

Wait until the LED stops flashing.

Teach-in only for web material (splice sensor)

Insert web material into the fork.

Press and hold the push-button[1].

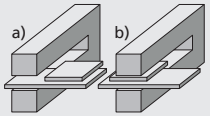
LED red:	off
LED green:	flashes
LED yellow:	on

Move web material (without splice) through the fork.

Release push-button[1].

Normal operating mode

Diagram 2: Static Teach-in



Static Teach-in of labels

a) Only insert backing material into the fork.

Press and hold the push-button[1].

LED red:	off
LED green:	flashes
LED yellow:	on

Move some backing material through the fork.

Release push-button[1] and press it briefly within 1 s.

LED red:	off
LED green:	flashes
LED yellow:	off

b) Place backing material with label into the fork.

Press and hold the push-button[1].

LED red:	off
LED green:	flashes
LED yellow:	on

Move the backing material with the label slightly in the fork, only the label should be detected.

Release push-button[1].

Normal operating mode

Diagram 3: Factory setting

Reset to factory setting

Turn off operating voltage.

Press push-button[1].

Turn on operating voltage.

LED red:	off
LED green:	off
LED yellow:	flashes

Press push-button[1] for about 10 s, until all LEDs are off.

Release push-button[1].

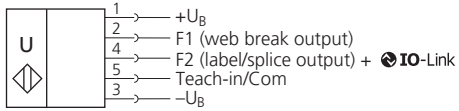
Normal operating mode

[1] Settings via push-button can alternatively be made by connecting the Teach-in/Com input to $+U_B$.

Technical data

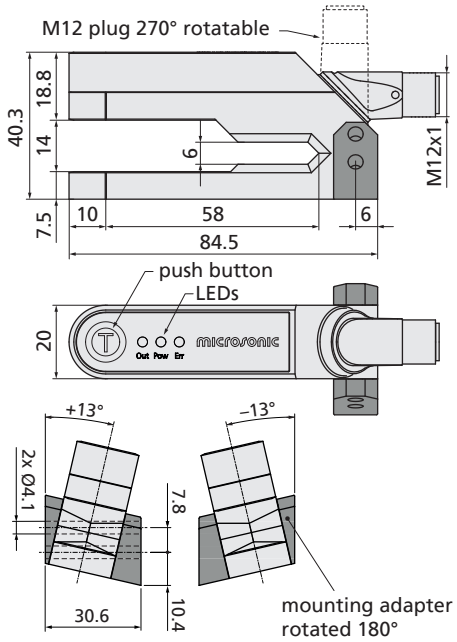
	esf+1/CFF/Pro	esf+1/CFF/Exp
fork width	6 mm	6 mm
fork depth	68 mm	68 mm
transducer frequency	500 kHz	200 kHz
recommended applications	labels on backing material	labels on backing material
	web material with grammages of <20 g/m² to 400 g/m²,	web material with grammages of 250 g/m² to >600 g/m²,
	metal-laminated paper and films up to 0.2 mm thick, self-adhesive films	metal-laminated paper and films up to 0.3 mm thick, self-adhesive films
operating voltage U_B	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)
operating voltage ripple	±10 %	±10 %
no-load current consumption	≤50 mA	≤50 mA
type of connection	5-pin M12 initiator plug	5-pin M12 initiator plug
controls	Teach-in push-button, Teach-in input (pin 5)	Teach-in push-button, Teach-in input (pin 5)
scope of settings	Teach-in, IO-Link, LinkControl	Teach-in, IO-Link, LinkControl
measurement cycle time	150 µs to 2 ms (depending on the material)	300 µs to 3.9 ms (depending on the material)
response time	≥260 µs	≥425 µs
indicators	3 LEDs: Pow (green), Out (yellow), Err (red)	3 LEDs: Pow (green), Out (yellow), Err (red)
IO-Link	V1.1	V1.1
housing	PA-GF50; ultrasonic transducer: polyurethane,	PA-GF50; ultrasonic transducer: polyurethane,
	epoxy resin with glass content	epoxy resin with glass content
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	60 g	60 g
norm conformity	EN 60947-5-2	EN 60947-5-2
time delay before availibility	<300 ms	<300 ms
order no.	**esf+1/CFF/Pro**	**esf+1/CFF/Exp**
label/splice output	Push-Pull, $+U_B$–1 V, $–U_B$+1 V, $I_{max.}$ = 100 mA,	Push-Pull, $+U_B$–1 V, $–U_B$+1 V, $I_{max.}$ = 100 mA,
	short-circuit-proof, switchable NOC/NCC	short-circuit-proof, switchable NOC/NCC
web break output	Push-Pull, $+U_B$–1 V, $–U_B$+1 V, $I_{max.}$ = 100 mA,	Push-Pull, $+U_B$–1 V, $–U_B$+1 V, $I_{max.}$ = 100 mA,
	short-circuit-proof, switchable NOC/NCC	short-circuit-proof, switchable NOC/NCC

Wiring diagram



2 Push-Pull switching outputs

Scale drawing (dimensions in mm)



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