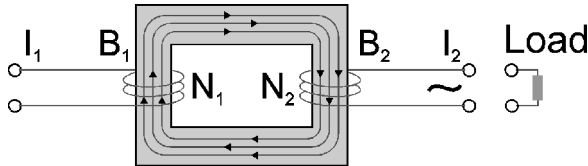


3.7 Electrical converters

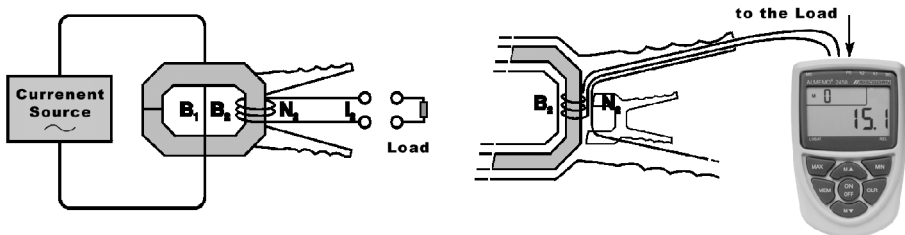
3.7.1 Current clamp, a split-core transformer

Measuring Principle

Current transformers can be used to measure high alternating currents without contact and without interrupting the circuit. Basically a current transformer comprises 2 separate transformer coils (B_1 = primary winding with N_1 turns, B_2 = secondary winding with N_2 turns) on one common iron core (closed magnetic circuit).



If an alternating current I_1 flows through winding B_1 , a current I_2 is induced in winding B_2 ; the size of B_2 depends on the turns ratio $N_1 : N_2$. Unlike stationary control panel transformers a current clamp is a split-core transformer with a split magnetic circuit and can thus be used to measure the properties of an electrical conductor. In practice primary winding B_1 comprises just one turn of the cable; it is through this that the current to be measured flows.



The transformation ratio of a current transformer is: $I_1 \times N_1 = I_2 \times N_2$

Example

$I_1 = 100 \text{ A}$ $N_1 = 1 \text{ winding}$

$I_2 = (I_1 \times N_1) / N_2 = 100 \times 1 / 1000 = 0.1 \text{ A}$ $N_2 = 1000 \text{ coils}$

In the multimeter display each mA AC thus represents 1 A AC (primary current).

ALMEMO® current clamps

For the purpose of measuring alternating currents the ALMEMO® range of sensors includes current clamps FE A604 with an integrated rectifier and an ALMEMO® connecting cable. These are ideal for monitoring and maintaining various electrical systems without having to interrupt the power supply.

Maximum / minimum current strength	Output signal
Dimensions of the conductor	Frequency range

Technical data

	FE A604 9
Measuring range	1 to 150 A AC
Measuring accuracy at 50 Hz	40 to 150 A $\pm 4\%$ 15 to 40 A $\pm 3\% \pm 0.2$ A 5 to 15 A $\pm 6\% \pm 0.2$ A 1 to 5 A $\pm 10\% \pm 0.2$ A
Clamping size	Cable diameter 10 mm
Transformation ratio	100 mVDC / 1 A AC
Output signal	15 VDC
Operating frequency	48 to 500 Hz
Safety standards	EN 61010-2-032 (Version 2/2003)
Admissible voltage	300 V category IV or 600 V category III
Dimensions	130 x 37 x 25 mm
Weight	approx. 180 g
Nominal conditions	+25 ± 3 °C, 1013 mbar, 20 to 75 % RH
Ambient conditions	
Operating temperature	-10 to +50 °C
Relative humidity	10 to 85 % RH
Storage temperature	-40 to +80 °C
Connecting cable	Cable length 1.5 meters with laboratory-standard safety connectors including safety coupling including 1.5-meter ALMEMO® connecting cable with banana plugs

	FE A604 MN	FE A604 4N
Measuring range	0.5 to 200 A AC *	2 to 500 A AC *
	* The higher value corresponds to 120% of the maximum nominal value.	
Meas. accuracy at 50 Hz	$\pm 3\%$ of measured value ± 0.5 A	$\pm 3\%$ of measured value ± 0.5 A
Clamping size	Cable diameter 20 mm	Cable diameter 30 mm
	Rail 20 x 5 mm	Rail 30 x 63 mm
Transformation ratio	100 mVDC / 1 A AC	1 mVDC / 1 A AC
Output signal	20 VDC	0.5 VDC
Operating frequency	40 to 10 kHz	40 to 1 kHz
Safety standards	IEC 1010-1	IEC 348 , IEC 1010-2-032
Overvoltage protection	Category III	no
Dimensions	135 x 50 x 30 mm	215 x 66 x 34 mm
Weight	approx. 180 g	approx. 420 g
Nominal conditions	+25 ± 3 °C 1013 mbar	

Ambient conditions		
Operating temperature	-10 to +55 °C	
Relative humidity	0% to 90% RH at 40°C maximum	
Storage temperature	-40 to +70 °C	
Connecting cable	Integrated banana sockets including 1.5-meter ALMEMO® connecting cable with banana plugs	Cable length 1.5 meters with laboratory-standard safety connectors including safety coupling including 1.5-meter ALMEMO® connecting cable with banana plugs



To connect other current clamps with an AC output to ALMEMO® devices an AC module is required (ZA 9603-AKx). (see 4.2.7)

3.7.2 Optical Probe for Current Meters

Measuring Principle

Sampling a passive optical indicator (e.g. meter disc) involves converting the revolutions of a rotating disc into electrical pulses.

Sampling an active optical indicator (e.g. pulsed LED) involves registering the energy-proportional pulses from electronic counters. The LEDs covered range from green, yellow, red LEDs right through to IR emitting LEDs.



ALMEMO® electricity meter samplers

For the purpose of sampling electricity meters the ALMEMO® range of sensors includes self-calibrating optical probes FU A919-SZ. Existing meters without a pulsed output can thus be incorporated in an energy management system at reasonable cost and without major conversion work. The energy-proportional pulses from electronic meters can also be registered.

Uses

- *Industrial systems, Multiple apartment houses, Shopping centers, Trade fairs and exhibitions, Holiday resorts and camping sites, Hotel and apartment installations, Municipalities and authorities*

The 3 probes differ in terms of their possible fixtures.

- 1 Probe FU A919-SZB → Recommended method - transparent self-adhesive tape
- 2 Probe FUA919-SZ4B → Recommended method - transparent self-adhesive tape (only for meters with pulsed LED)
- 3 Probe FU A919-SZD With adjustable stand

Each probe is equipped with a frequency measuring module (see 4.2.5) and is programmed for pulse measurement; i.e. the ALMEMO® device counts the number of revolutions or pulses per measuring cycle. However, by suitably adjusting either the time base (output cycle) or the measured value scaling, it is possible to have consumption values displayed correctly. By summing over such output cycles or over the full measuring period (see 6.7.1) it is also possible to determine total consumption over longer periods..

Assembly and putting into service**Probe FU A919-SZB**

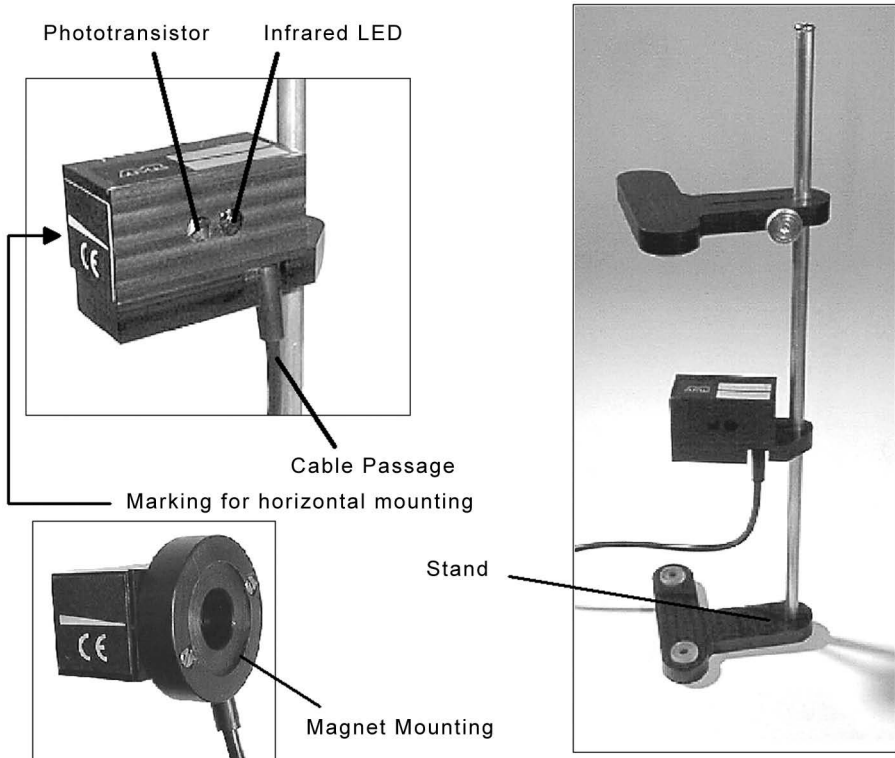
The probe is attached to the meter's glass window by means of transparent self-adhesive tape in such a way that the sensor is aligned with the center of the rotating disc. There is no need for any further assembly, adjustment, or setting operations. The sensor calibrates itself automatically with the marker on the rotating disc.

Probe FU A919-SZ4B

The probe is attached to the meter's housing by means of transparent self-adhesive tape in such a way that its central aperture (phototransistor) is positioned exactly above the LED to be sampled. There is no need to adjust the sensitivity setting because the probe adapts automatically to each particular meter.

Probe FU A919-SZD

The probe is placed on its stand and this is attached by means of a suction cup fixture (maximum span 400 mm); it is thus especially suitable for mobile use.



Important! The probe must first be fitted in position - before connecting it to the measuring instrument.

Sampling a meter disc (reflected light method) FU A919 SZB/SZD

Horizontal : The reference line must be flush with the meter disc. (see Figure)

Vertical : The cable for the probe must be led via the center of the meter disc. (see Figure)

The self-calibration phase begins when the status LED lights up briefly (duration approx. 1 second). The self-calibration phase takes 40 seconds. During this time the probe will look for a meter marker. If the status LED does not start flashing in synchrony with the meter marker the probe must be wrongly positioned. In this event the probe must be readjusted and the self-calibration phase must be repeated. For this purpose the cable should be unplugged briefly from the ALMEMO® measuring instrument (power ON reset)..

Technical Data FU A919 SZB/SZD

Sensor housing, dimensions in mm	40 x 20 x 20 (WxHxD)
IP enclosure	IP 50
Sensor housing, material	Plastic, black
Operating voltage	5.5 to 30 VDC
Maximum current consumption 5 mA	5 mA
Function monitoring	LED
Signal output	Transistor open collector PNP (1K protective resistor)
Maximum sampling rate	3 pulses / second
Temperature range	-20 to +60 °C
Connecting cable	Length 3 meters with ALMEMO® plug
Maximum distance from measuring instrument	15 meters

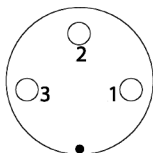
Sampling a meter LED (LED method) FU A919 SZ4B

This probe can be used to sample green, red, and infrared meter LEDs. To ensure that the probe is working in LED mode the integrated infrared LED must be blacked out with a piece of adhesive tape. The second aperture (phototransistor) must be positioned exactly above the LED to be sampled. As soon as the probe is connected to the measuring instrument it detects the absence of its own integrated infrared and changes over to LED mode. That the probe is in LED mode is indicated by two flashes when it is first operated.

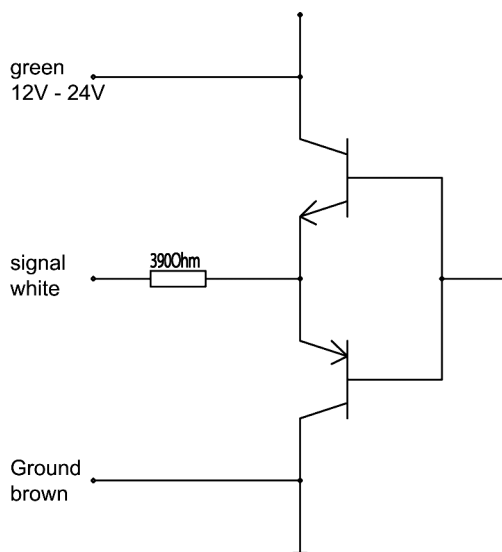
As soon as the probe is connected to the power supply it starts detecting the flashes from the meter's pulsed LED. The red status indicator on the front panel of the FU A919 SZ4B should flash in the same rhythm as the meter's pulsed LED.

Electrical connections FU A919 SZ4B

DIN connector
(Front view)



1 brown (Ground)
2 white (signal)
3 (5,5 - 24V)



Technical data FU A919 SZ4B

Sensor housing, dimensions in mm	44 x 29 x 24 (WxHxD)
IP enclosure	IP 50
Sensor housing, material	Plastic, black
Operating voltage	5.5 to 30 VDC
Maximum current consumption 5 mA	5 mA
Function monitoring	LED
Signal output	Transistor active +/- switching (390 Ω), maximum 20 mA
Maximum sampling rate	30 Hz
Temperature range	-20 to +60 °C
Connecting cable	Length 3 meters with ALMEMO® plug
Maximum distance from measuring instrument	15 meters