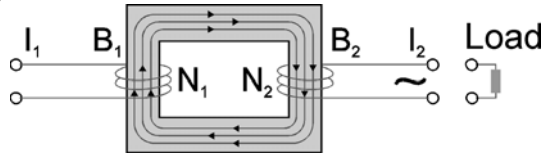


## 3.7 Electrical Transducers

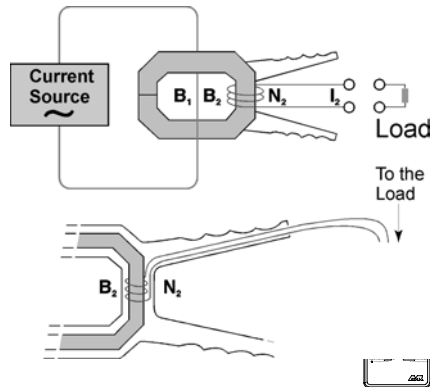
### 3.7.1 Split-Core Type Transformers

#### Measuring Principle

Current transformers are used to acquire high alternating currents without contact and without interrupting the circuit. In principle, they consist of 2 separate transformer windings ( $B_1$  = primary winding with  $N_1$  windings,  $B_2$  = secondary winding with  $N_2$  windings) on one common iron core (closed magnetic circuit).



If an alternating current  $I_1$  flows through the winding  $B_1$ , a current  $I_2$  is induced in the winding  $B_2$ , which is depending on the winding ratio  $N_1/N_2$ . In comparison with stationary-installed panel transformers, split-core type transformers must be able to embrace a conductor within a magnetic circuit that is split open. In practice, the primary winding  $B_1$  consists of only one winding of the cable that carries the current to be measured.



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

*Example:*

$$I_1 = 100\text{A}$$

$$N_1 = 1 \text{ winding}$$

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

$$N_2 = 1000 \text{ windings}$$

The transformation ratio is therefore:  $N_1/N_2 = I_1 / I_2 = 100\text{A} / 0.1\text{A} = 1000$ .

At the display of the multimeter each mA AC corresponds to 1A AC (primary current).

## ALMEMO® Split-Core Type Transformer

For the measurement of alternating currents the ALMEMO® sensor range provides the split-core type transformers FE A604 with integrated rectifying and ALMEMO® connecting cables. They are perfect for use in maintenance and monitoring of electrical systems without interrupting their current supply.

**The selection of the split-core type transformer is based on:**

- the minimum/maximum amperage.
- the dimensions of the leading conductor.
- the output signal.
- the frequency range.

## Technical Data

	FE A604 2	FE A604 MN	FE A604 4N
Measuring range:	1 A to 150 A AC *	0.5 A to 200 A AC *	2 A to 500 A AC *
	* the higher value corresponds to 120% v. maximum nominal value		
Measuring accuracy at 50 Hz:	15 to 150 A: $\pm 3\%$ 5 to 15 A: 0 to $-6\%$ 1 to 5 A: 0 to $-(10\% + 200 \text{ mA})$	$\pm 3\%$ of m.v. $\pm 0.5 \text{ A}$	$\pm 3\%$ of m.v. $\pm 0.5 \text{ A}$
Encompassing capability:	cable $\varnothing 12 \text{ mm}$	cable $\varnothing 20 \text{ mm}$ rail $20 \times 5 \text{ mm}$	cable $\varnothing 30 \text{ mm}$ rail $30 \times 63 \text{ mm}$
Transformation ratio:	100 mV DC/1 A AC	100 mV DC/1 A AC	1 mV DC/1 A AC
Output signal:	15 V DC	20 V DC	0.5 V DC
Operating frequency:	50 to 400 Hz	40 to 10 kHz	40 to 1 kHz
Safety standards:	IEC 414	IEC 1010-1	IEC 348, IEC 1010-2-032
Overvoltage protection:	yes	Category III	
Dimensions:	115 x 35 x 22 mm	135 x 50 x 30 mm	215 x 66 x 34 mm
Weight:	approx. 100 g	approx. 180 g	approx. 420 g
Nominal conditions:	25°C $\pm 3^\circ\text{C}$ /1013 mbar		
Environmental conditions:			
Operating temperature:	$-10$ to $+55^\circ\text{C}$		
Relative humidity:	0% to 90% at max. $40^\circ\text{C}$		
Storage temperature:	$-40$ to $+70^\circ\text{C}$		
Connecting cable:	1.5 m long with banana plug and ALMEMO® connector		

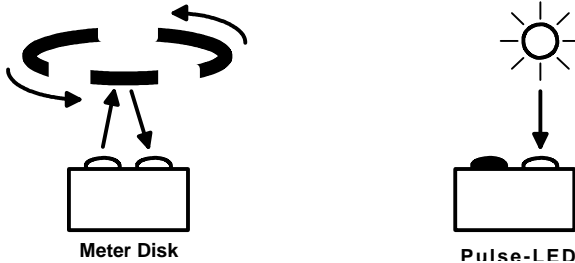


For other clip-on instruments with AC voltage output an AC module (ZA 9603-AKx see 4.2.4) is required for a connection to ALMEMO® devices.

### 3.7.2 Optical Probe for Current Meters

#### Measuring Principle

When **scanning passive optical indicators** (meter disks) the revolutions of the stroboscopic disk are converted into electrical pulses. When **scanning active optical indicators** (pulse LED) the energy-proportional pulses of electronic counters are registered. The coverage ranges from green, yellow and red LEDs up to IR emitting LEDs.



#### ALMEMO® Current Meter Scanning

For the scanning of supply meters the ALMEMO® sensor range provides self-calibrating optical probes FU A919-SZ. Existing energy meters that do not have a pulse output can be included in the energy management at low cost and with no conversion required. Furthermore, the energy-proportional pulses of electronic meters can be registered.

The probes are, therefore, suitable for various applications, for example, industrial systems, large houses with several flats, shopping centres, trade fairs and exhibitions, holiday and camping resorts, hotel and apartment installations, municipalities and authorities.

#### The three probe heads available differ in their fastening possibilities:

1. Probe head FU A919-SZB with removable adhesive tape
2. Probe head FU A919-SZC with magnetic mounting  
(only for meters with pulse LED)
3. Probe head FU A919-SZD with adjustable stand

Each probe head is equipped with a frequency meter module (see 4.2.5) and is programmed for pulse measurement, i.e. the ALMEMO® device counts the amount of revolutions or pulses for each measuring cycle. A suitable choice of the time base (print cycle) or a scaling of the measured value allows for a correct scaled display of consumption values. By the formation of sums over the print cycle or over the entire measuring period (see 6.7.1), it is also possible to determine the total consumption over longer periods.

## Installation and Start Up

### Probe Head FU A919-SZB:

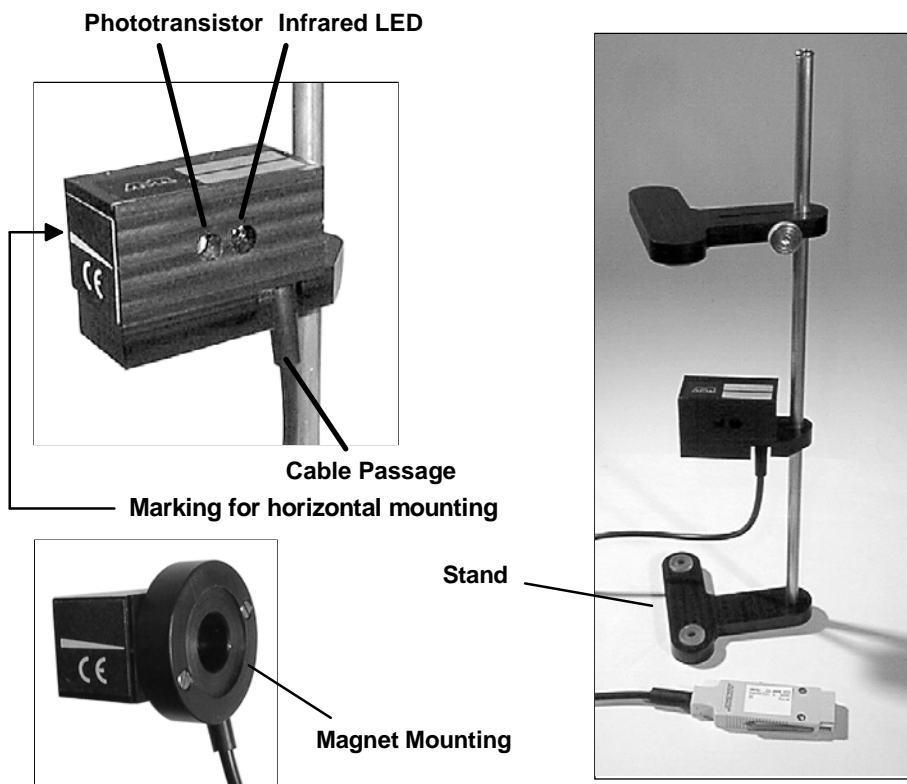
Using a self-sealing tape the probe head is fixed to the glass disk of the meter so that the stroboscopic disk is centered with respect to the sensor. Further mounting, adjustment or setting efforts are not required. The sensor performs a self-calibration with respect to the marking on the stroboscopic disk.

### Probe Head FU A919-SZC:

Using a magnet mounting the probe head is fixed in front of the meter LED and is suitable for both, measurements in test laboratories and portable operation.

### Probe Head FU A919-SZD:

Using a stand with a suction cup holding (maximum span 400mm) the probe is, in particular, suitable for mobile operation.





**Important!** First mount the probe head and then connect it to the instrument.

### 1. Scanning of Meter Disks (Reflex Light Method):

Horizontal: The marking line (see illustration) must align with the meter disk.

Vertically: The cable passage of the probe head (see illustration) must be in the center of the meter disk.

The calibration phase starts with a short flash of the control LED (duration approx. 1s). The period of the calibration phase lasts 40 seconds. During this time the probe head attempts to identify a meter indicator mark. If the control LED does not start to flash synchronously with the meter indicator mark the probe head is not properly mounted. In this case, the probe head must be re-adjusted and the calibration phase must be repeated. For this purpose, the cable must be disconnected for a short time from the ALMEMO® instrument (Power-ON Reset).

### 2. Scanning of a Meter LED (LED Method):

The probe head is capable to scan green, red and infrared meter LEDs. To allow the probe head to operate in the LED mode the integrated infrared LED must be blacked out by means of a label. The second opening (phototransistor) must be accurately positioned over the LED to be scanned. After connection to the measuring instrument, the probe head detects the absence of its own infrared light and changes to the LED mode. This mode can be identified by the double flash during start up of the probe head.

### Technical Data:

Sensor housing:	dimensions: 40 x 20 x 20 (W x H x D) operating environment: IP50 material: plastic, black
Operating voltage:	5.5 to 30V DC
Max. current consumption:	5mA
Function control:	via LED
Signal output:	transistor open collector PNP (1kohm protective resistor)
Max. sampling rate:	3 pulses/s
Temperature range:	-20 to 60°C
Connecting cable:	3m long with ALMEMO® connector
Max. distance to instrument:	15m