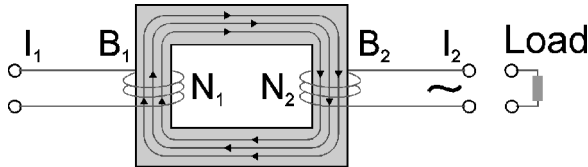


## 3.7 Electrical Transducers

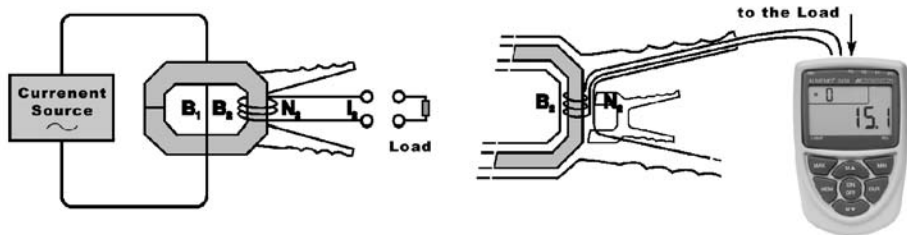
### 3.7.1 Split-Core Type Transformers

#### 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 coils ( $B_1$  = primary coil with  $N_1$  turns,  $B_2$  = secondary coil with  $N_2$  turns) on one common iron core (closed magnetic circuit).



If an alternating current  $I_1$  flows through coil  $B_1$ , a current  $I_2$  is induced in coil  $B_2$ ; its size depends on the turns ratio  $N_1:N_2$ . Unlike stationary panel transformers, a split-core transformer must also work with a conductor in a magnetic circuit that is split open. In practice, primary winding  $B_1$  comprises just one winding of the cable through which 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

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

$I_2 = (I_1 \times N_1) / N_2 = 100 \times 1 / 1000 = 0,1 \text{ A}$     $N_2 = 1000 \text{ coils}$

The transformation ratio is thus :  $N_1/N_2 = I_1 / I_2 = 100 \text{ A} / 0,1 \text{ A} = 1000$

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

#### ALMEMO® split-core transformers

For the purposes of measuring alternating currents the spectrum of ALMEMO® sensors includes split-core transformers FE A604 with integrated rectifier and ALMEMO® connecting cable. These are perfectly suitable for the maintenance and monitoring of electrical systems without interrupting their current supply.

#### Choosing a split-core transformer with the following features:

- \* Maximum / minimum current intensity
- \* Dimensions of the main conductor
- \* Output signal
- \* Frequency range

## Technical data

	<b>FE A604 9</b>	
Measuring range	1 to 150 A AC	
Measuring accuracy at 50 Hz	40 to 150 A $\pm 4\%$ 15 to 40 A $\pm 3\% \pm 0.2 \text{ A}$ 5 to 15 A $\pm 6\% \pm 0.2 \text{ A}$ 1 to 5 A $\pm 10\% \pm 0.2 \text{ A}$	
Capacity	Cable diameter 10 mm	
Transformation ratio	100 mV DC / 1 A AC	
Output signal	15 VDC	
Operating frequency	48 to 500 Hz	
Safety standards	EN 61010-2-032 (issue 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°C $\pm 3^\circ\text{C}$ / 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, 1.5 meters, with safety laboratory connectors, including safety coupling and 1.5-meter ALMEMO® connecting cable with banana plugs	
	<b>FE A604 MN</b>	<b>FE A604 4N</b>
Measuring range	0.5 to 200 A AC *	2 to 500 A AC *
	* The higher value corresponds to 120% of the maximum nominal value.	
Measuring accuracy at 50 Hz	$\pm 3\%$ of measured value $\pm 0.5 \text{ A}$	$\pm 3\%$ of measured value $\pm 0.5 \text{ A}$
Capacity	Cable diameter 20 mm	Cable diameter 30 mm
	Rail 20 x 5 mm	Rail 30 x 63 mm
Transformation ratio	100 mV DC / 1 A AC	1 mV DC / 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°C $\pm 3^\circ\text{C}$ / 1013 mbar	
Ambient conditions		
Operating temperature	-10 to +55 °C	
Relative humidity	0% to 90% at 40°C maximum	

Storage temperature	–40 to +70 °C	
Connecting cable	Integrated banana sockets	Cable, 1.5 meters, with safety laboratory connectors
		Including safety coupling
	Including 1.5-meter ALMEMO® connecting cable with banana plugs	



To connect other split-core transformers with AC output to ALMEMO® devices an AC module is required (ZA 9603-AKx see Section 4.2.7).

### 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:

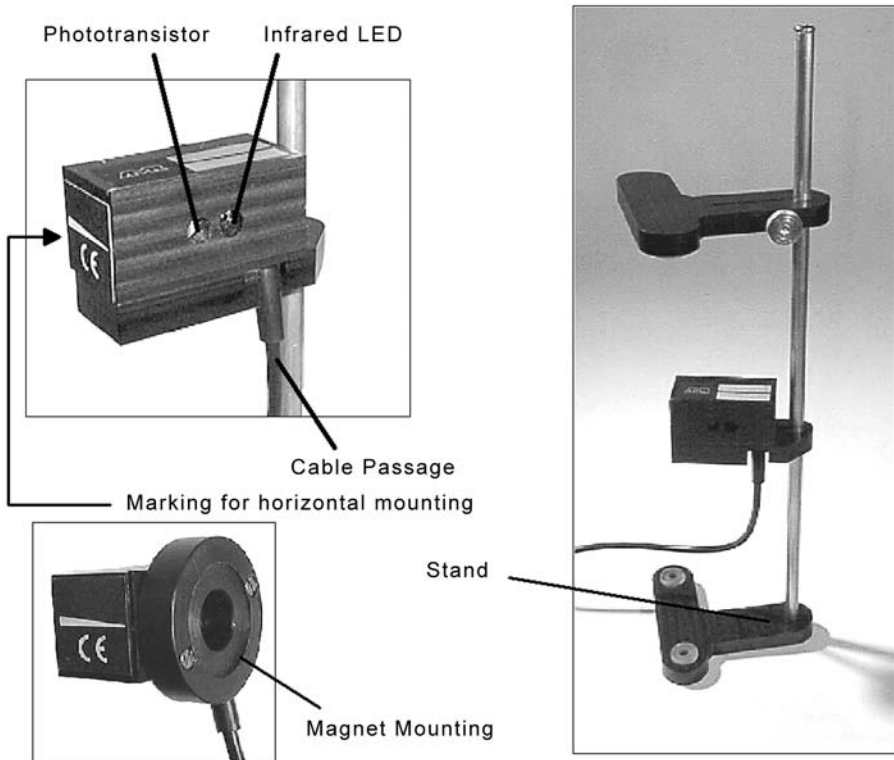
Using a self-sealing tape the probe head is fixed to the glass disk of the meter so that the stroboscopic disk is centered with respect to the sensor. Further mounting, adjustment or setting efforts are not required. The sensor performs a self-calibration with respect to the marking on the stroboscopic 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) FUA919SZB/SZD

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), FU A919 SZC

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