

# KECA 250 B1

## Indoor current sensor

Parameters for Application	Unit	Value
Rated primary current of application	A	up to 2000

Sensor Parameters	Unit	Value
Highest voltage for equipment, $U_m$	kV	0.72
Rated power frequency withstand voltage	kV	3
Rated primary current, $I_{pr}$	A	250
Rated continuous thermal current, $I_{cth}$	A	2000
Rated transformation ratio, $K_{ra}$ for current measurement	-	250 A / 150 mV at 50 Hz 180 mV at 60 Hz
Current accuracy class	-	0.5/5P125
Length of cable	m	5.0

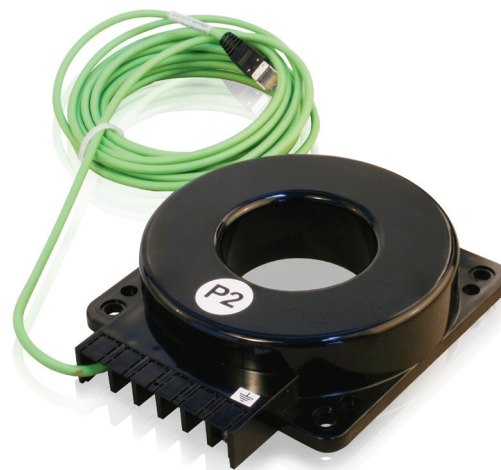
### Sensor principles

Electronic Instrument Transformers (Sensors) offer an alternative way of making the current and voltage measurements needed for the protection and monitoring of medium voltage power systems. Sensors based on alternative principles have been introduced as successors to conventional instrument transformers in order to significantly reduce size, increase safety, and to provide greater rating standardization and a wider functionality range. These well known principles can only be fully utilized in combination with versatile electronic relays.

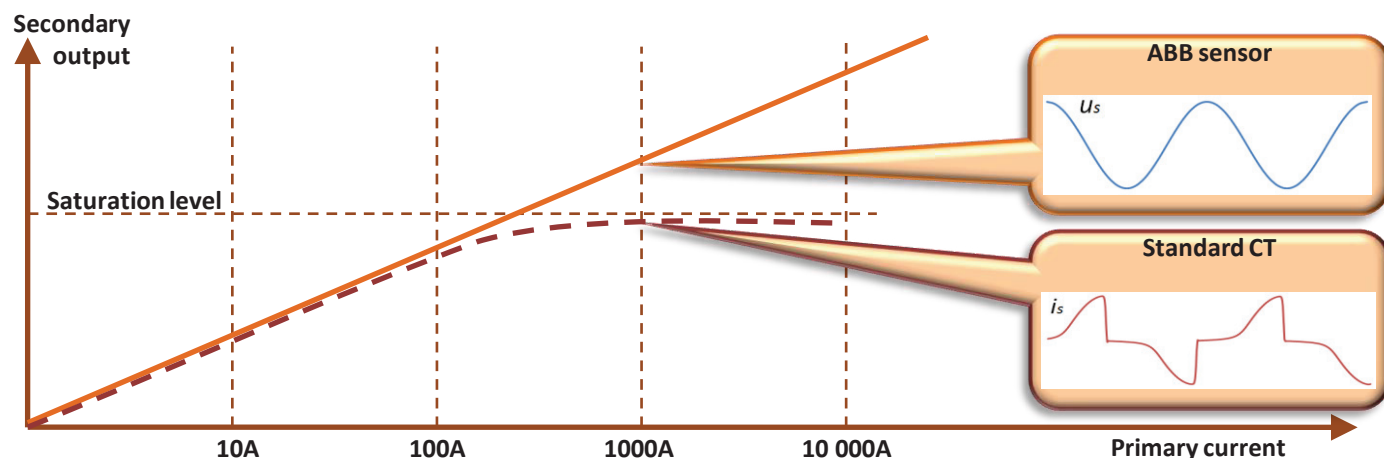
### Sensor characteristics

Construction of ABB's current sensors is done without the use of a ferromagnetic core.

This fact results in several important benefits for the user and the application. The main benefit is that the behavior of the sensor is not influenced by non-linearity and width of hysteresis curve, which results in a highly accurate and linear response over a wide dynamic range of measured quantities.

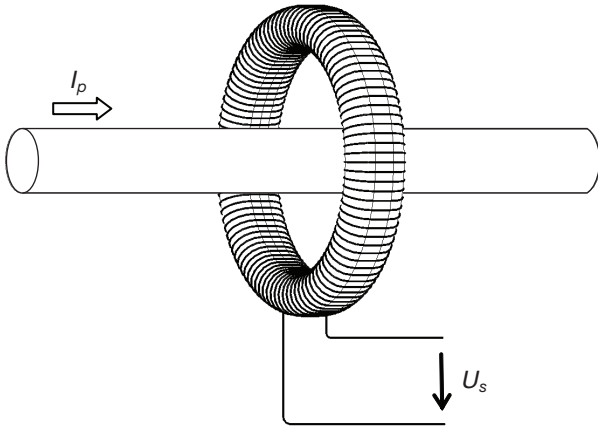


A linear and highly accurate sensor characteristic in the full operating range enables the combination of metering and protection classes in one winding. With KECA 250 B1 sensor measuring **class 0.5** is reached for continuous current measurement in the extended accuracy range from 5% of the rated primary current  $I_{pr}$  **not only up to 120% of  $I_{pr}$**  (as being common for conventional current transformers), **but even up to the rated continuous thermal current  $I_{cth}$** . For dynamic current measurement (protection purposes) the ABB sensor KECA 250 B1 fulfills requirements of protection class **5P up to an impressive value reaching the rated short-time thermal current  $I_{th}$** . That provides the possibility to designate the corresponding accuracy class as **5P125**, proving excellent linearity and accuracy measurements.



### Current sensor

Current measurement in KECA 250 B1 sensors is based on the Rogowski coil principle. A Rogowski coil is a toroidal coil, without an iron core, placed around the primary conductor in the same way as the secondary winding in a current transformer. However, the output signal from a Rogowski coil is not a current, but a voltage:



$$u_s(t) = M \frac{di_p(t)}{dt}$$

In all cases, a signal that represents the actual primary current waveform is easily obtained by integrating the transmitted output signal.

### Protection and control IEDs (Intelligent Electronic Devices)

Protection and control IEDs incorporate the functions of a traditional relay, as well as allow new additional functions. The information transmitted from the sensors to the IED is very accurate, providing the possibility of versatile relay functionality.

However, the IED must be able to operate with sufficient accuracy at a sensor's low input signal level, and the signal from the Rogowski coil must be integrated. Modern IEDs (such as ABB's 601 series relays) are designed for such sensor use, and they are also equipped with built-in integrators for Rogowski coil sensor inputs. Modern digital apparatuses (microprocessor based relays) allow protection and measurement functions to be combined. They fully support current sensing realized by the single sensor with double the accuracy class designation (e.g.: current sensing with combined accuracy class 0.5/5P125).



### Sensor applications

The current sensor type KECA 250 B1 is intended for use in current measurement in low voltage or medium voltage switchgear.

In case of medium voltage switchgear the current sensor should be installed over a bushing insulator, insulated cable or any other type of insulated conductor.

### Differences between Sensors and Instrument Transformers

There are some noticeable differences between Sensors and conventional Instrument Transformers:

#### Linearity

Due to the absence of a ferromagnetic core the sensor has a linear response over a very wide primary current range, far exceeding the typical CT range. Thus, current sensing for both measurement and protection purposes could be realized with single secondary winding with a double rating. In addition, one standard sensor can be used for a broad range of rated currents and is also capable of precisely transferring signals containing frequencies different from rated ones.

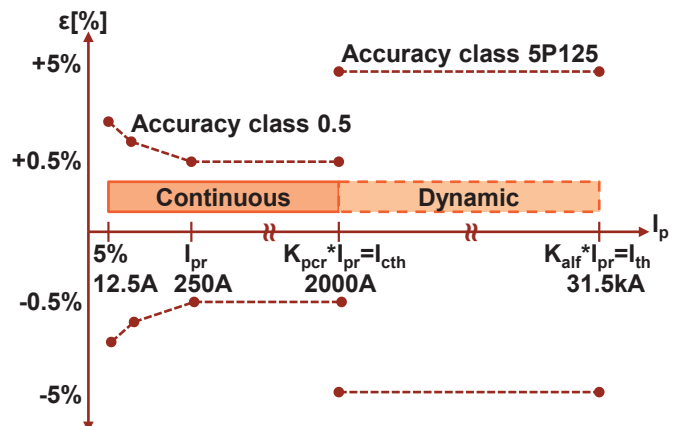
For this type of sensor, the variation of amplitude and phase error or composite error in a current range from 5% of rated primary current  $I_{pr}$  up to the rated short-time thermal current  $I_{th}$  is within the limits specified by IEC 60044-8.

*Example of current measurement range with rated current 250 A and accuracy class 0.5/5P125:*

Metering accuracy class 0.5 is, according to the IEC 60044-8 standard, guaranteed from 5% of  $I_{pr}$  up to  $K_{pcr} \times I_{pr}$ , where  $K_{pcr}$  is rated extended primary current factor and  $I_{pr}$  is rated primary current. Factor  $K_{pcr}$  is in the case of conventional CTs usually just 1.2, but in the case of the KECA 250 B1 sensor the  $K_{pcr}$  factor is several times higher and equals 8.

Protection accuracy 5P125 is guaranteed, for the advanced KECA 250 B1 sensor, from the current equal to  $K_{pcr} \times I_{pr}$  up to the current corresponding to  $K_{alf} \times I_{pr}$  value, where  $K_{alf}$  is, according to IEC 60044-8, the accuracy limit factor. For this type of sensor the value of  $K_{pcr} \times I_{pr}$  is equal to the rated continuous thermal current  $I_{cth}$  (2000 A) and the value of  $K_{alf} \times I_{pr}$  is equal to the rated short-time thermal current  $I_{th}$  (31.5 kA).

The accuracy limits are described on the graph below.



### Compactness

Since the sensing elements are particularly small, and the same elements are used for both measurement and protection, the current sensors can be easily integrated into other equipment.

### Rated parameters

Because the sensors are highly linear within a very wide range of currents, the same single sensor can be used for the various rated currents associated with each specific application up to the specified maximum voltage for equipment. There is no need to specify other parameters such as burden, safety factor, etc. since they are standard over the defined range. To achieve the correct function of the protection and control IED, the selected rated current, as well as the rated transformation ratio, must be properly set into the IED.

### Energy savings concept


As there is no iron core, no necessity for high burden values and thus a possibility for low current losses and only one secondary winding needed, KECA 250 B1 sensors exhibit extremely low energy consumption that is just a fraction of that transferred to heat in conventional CTs. This fact contributes to huge energy savings during its entire operating life, supporting the world-wide effort to reduce energy consumption.

### Correction factors

The amplitude and phase error of a current sensor is, in practice, constant and independent of the primary current. Due to this fact it is an inherent and constant property of each sensor and it is not considered as unpredictable and influenced error. Hence, it can be easily corrected in the IED by using appropriate correction factors, stated separately for every sensor.

Values of the correction factors for the amplitude and phase error of a current sensor are mentioned on the sensor label (for more information please refer to Instructions for installation, use and maintenance) and should be uploaded without any modification into the IED before the sensors are put into operation (please check available correction in the IED manual). To achieve required accuracy classes it is recommended to use all correction factors (Cfs): amplitude correction factor (al) and phase error correction factor (pl) of a current sensor.

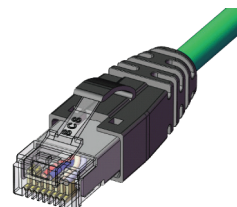
### Example of a sensor label

<b>ABB</b>		<b>s.n. 1VLT5411001545</b>	
<b>KECA 250B1</b>			
lpr: 250 A	Usr: 0.150/0.180 V	cl: 0.5/5P125	
Kpcr: 8	Cfs.: al: 1.0020	pl: +0.003°	
fr: 50/60 Hz	lth/ldyn: 31.5(3s)/100 kA	1kg E	
IEC 60044-8	Made by ABB	19 Jul 2011	

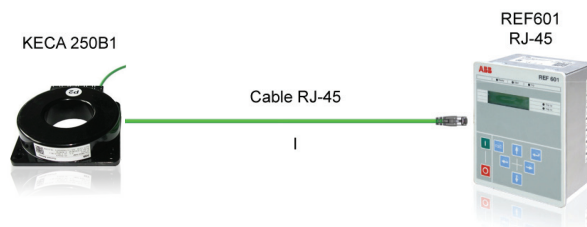
### Secondary cables

The sensor is equipped with a cable for connection with the IED. The cable connector is type RJ-45. The sensor accuracy classes are verified up to the RJ-45 connector, i.e. considering also its secondary cable. This cable is intended to be connected directly to the IED, and subsequently neither burden calculation nor secondary wiring is needed. Every sensor is therefore accuracy tested when equipped with its own cable and connector.

### Connector RJ-45



*Example: Direct connection of connectors between the sensor and new IED family*



### Standards

Current sensors: IEC 60044-8 (2002-07)  
Instrument transformers –  
Part 8: Electronic current transformers

### Highest voltage for equipment and test voltages

- Highest voltage for equipment,  $U_m$ : 0.72 kV
- Power frequency voltage withstand test on primary terminals: 3 kV

### Current sensor, rated values

- Rated primary current,  $I_{pr}$ : 250 A
- Rated transformation ratio,  $K_{ra}$ : 250 A/0.150 V at 50 Hz  
250 A/0.180 V at 60 Hz
- Rated secondary output,  $U_{sr}$ : 3 mV/Hz  
i.e. 150 mV at 50 Hz  
or 180 mV at 60 Hz
- Rated continuous thermal current,  $I_{cth}$ : 2000 A
- Rated short-time thermal current,  $I_{th}$ : 31.5 kA/3 s
- Rated dynamic current,  $I_{dyn}$ : 100 kA
- Rated frequency,  $f_r$ : 50/60 Hz
- Rated extended primary current factor,  $K_{pr}$ : 8
- Accuracy limit factor,  $K_{alf}$ : 125
- Accuracy class: 0.5/5P125
- Rated burden,  $R_{br}$ : 10 M $\Omega$

### Temperature category

- Operation: - 5°C / + 40°C
- Transport and storage: -40°C / + 70°C

### Cable

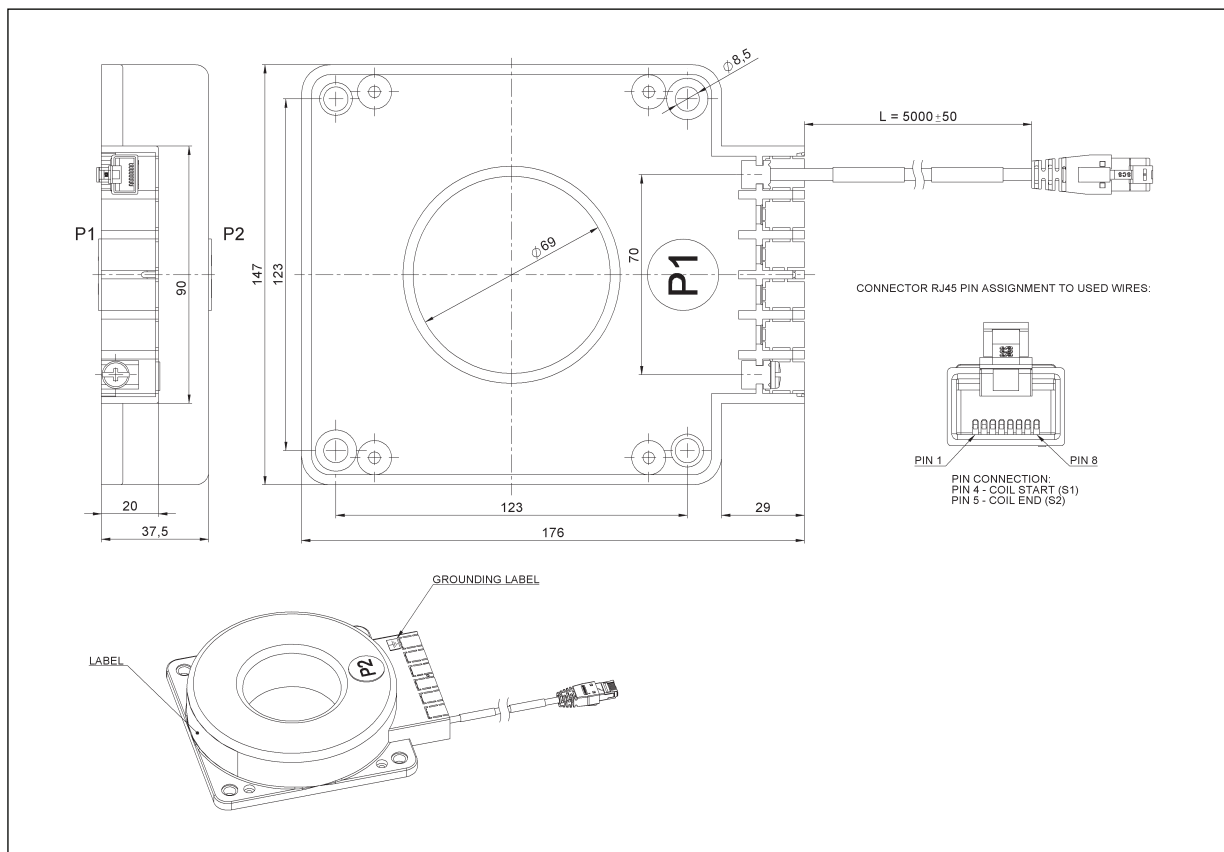
- Length: 5.0 m
- Connector: RJ-45 (CAT-6)

### Ordering data

- KECA 250 B1 1VL5400052V0101

### Dimensions and weight

- Outline drawing number: 1VL5300632R0101
- Weight: 1 kg



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