MEDIUM VOLTAGE PRODUCT

KEVCD B
Indoor combined sensor;
Indoor current sensor
Parameters for Application | Value
--- | ---
Rated primary current of application | 1 250 up to 3 200 A
Rated primary voltage of application | 6 up to 24 kV

Sensor Parameters | Value
--- | ---
Rated primary voltage, $U_{pn}$ | $11/\sqrt{3}; 15/\sqrt{3}; 22/\sqrt{3}$ kV
Highest voltage for equipment, $U_m$ | 12; 17.5; 24 kV
Rated power frequency withstand voltage | 28; 38; 50 kV
Rated lightning impulse withstand voltage | 75; 95; 125 kV
Rated primary current, $I_{pr}$ | 1 600 A
Rated continuous thermal current, $I_{cth}$ | 3 200 A
Rated transformation ratio, $K_{ra}$ for current measurement | 1 600 A/150 mV at 50 Hz
| | 180 mV at 60 Hz
Rated transformation ratio, $K_n$ for voltage measurement | 10 000 : 1
Current accuracy class | 1
Voltage accuracy class | 1 / 3P
Length of cable | 5.0; 6.5; 7.5 m

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 and voltage 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.

Current sensor
Current measurement in KEVCD B 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:

$$I_p(t) = \int_{0}^{t} \frac{dU_p(t)}{M}$$

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

Voltage sensor
Voltage measurement in KEVCD B sensors is based on the resistive divider principle. The output voltage is directly proportional to the input voltage:

$$U_s(t) = \frac{U_p(t)}{R}$$
In all cases, the transmitted output signal reproduces the actual waveform of the primary voltage 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 615 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 and voltage sensing realized by the single sensor with double the accuracy class designation (e.g.: voltage sensing with combined accuracy class 1/3P).

**Sensor design**

KEVCD B is a block type sensor designed according to the DIN 42600 size requirements. Two versions could be selected: one providing current measurement together with voltage indication capability, or a second one, providing, in addition to these, also the possibility of voltage measurement.

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Functions included</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voltage sensor</td>
</tr>
<tr>
<td>KEVCD 12 BE2</td>
<td>■</td>
</tr>
<tr>
<td>KEVCD 12 BG2</td>
<td>■</td>
</tr>
<tr>
<td>KEVCD 17.5 BE2</td>
<td>■</td>
</tr>
<tr>
<td>KEVCD 17.5 BG2</td>
<td>■</td>
</tr>
<tr>
<td>KEVCD 24 BE2</td>
<td>■</td>
</tr>
<tr>
<td>KEVCD 24 BG2</td>
<td>■</td>
</tr>
</tbody>
</table>

Tab. 1. Sensor variants

**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. 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.

**Compactness**

Since the sensing elements are particularly small, and the same elements are used for both measurement and protection, the current and voltage sensors can easily be combined in one device – the Combined Sensor, which is still smaller and far lighter than the conventional Instrument Transformer. The weight of the combined KEVCD B sensor designed for 24 kV is only 24 kg and designs for lower voltage levels are even lighter. This enables much easier handling without the need for special lifting devices.
Rated parameters
Because the sensors are highly linear within a very wide range of currents and voltages, the same single sensor can be used for the various rated currents and voltages 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 and voltage, 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, KEVCD B sensors exhibit extremely low energy consumption that is just a fraction of that transferred to heat in conventional CTs/VTs. This fact contributes to huge energy savings during its entire operating life, supporting the world-wide effort to reduce energy consumption. Furthermore, the temperature rise caused by internal heating up due to current flowing through the sensor is very low and creates a further possibility of upgrading current ratings of the switchgear, or the other applications, and/or reduces the need for artificial ventilation.

Correction factors
The amplitude and phase error of a current and a voltage 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 (aU) and phase error correction factor (pU) of a voltage sensor; amplitude correction factor (aI) and phase error correction factor (pI) of a current sensor.

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. These cables are 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. Standard cable lengths: 5.0; 6.5 and 7.5 m

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEVCD_B2</td>
<td>5 m</td>
</tr>
<tr>
<td>KEVCD_B2</td>
<td>6.5 m</td>
</tr>
<tr>
<td>KEVCD_B2</td>
<td>7.5 m</td>
</tr>
</tbody>
</table>

Tab. 2. Types of secondary cables
Connector adapters
To provide connectivity between a sensor with a RJ-45 cable connector and IEDs with Twin-BNC connectors a group of adapters were designed. The use of an adapter has no influence on the current and/or voltage signal and accuracy of the sensor with the cable.

For more information about connector adapters refer to Doc. No. 1VLC000710 - Sensor accessories.

Coupling electrode for voltage detection system
Intended to be used in:

- Voltage detection system (VDS) according to IEC 61243-5;
- Voltage presence indication system (VPIS) according to IEC 62271-206

If there is no connection of the coupling electrode to the coupling system the electrode must be earthed. The sensor is delivered with an earthed coupling electrode.

<table>
<thead>
<tr>
<th>Electrode</th>
<th>Sensor Capacitance</th>
<th>Highest voltage of equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>23 – 40 pF</td>
<td>12 and 17.5 kV</td>
</tr>
<tr>
<td>C2</td>
<td>≤25 pF</td>
<td>24 kV</td>
</tr>
</tbody>
</table>

Tab. 3. Capacitance values

**Standards**

**Voltage sensors:** IEC 60044-7 (1999-12)
Instrument transformers – Part 7: Electronic voltage transformers

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

**Sensor name code**

<table>
<thead>
<tr>
<th>KEVCD</th>
<th>12</th>
<th>B</th>
<th>E</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design number</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sensor function:**

E = voltage and current sensors and coupling electrode

G = current sensor and coupling electrode

**Use of sensors and current range:**

B: \( I_{\text{th}} = 3200 \text{ A} \)

**Highest voltage for equipment:**

Voltage rating: 12kV, 17.5kV and 24kV

**Cast resin insulated combisensor:**

KE = sensors

V = voltage

C = current

D = block type sensor according to the DIN 42600 size requirements

<table>
<thead>
<tr>
<th>Type</th>
<th>Highest voltage for equipment ( U_{\text{m}} )</th>
<th>Rated power frequency test voltage</th>
<th>Rated lightning impulse test voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEVCD 12</td>
<td>12 kV</td>
<td>28 kV</td>
<td>75 kV</td>
</tr>
<tr>
<td>KEVCD 17.5</td>
<td>17.5 kV</td>
<td>38 kV</td>
<td>95 kV</td>
</tr>
<tr>
<td>KEVCD 24</td>
<td>24 kV</td>
<td>50 kV</td>
<td>125 kV</td>
</tr>
</tbody>
</table>

Tab. 4. Highest voltage for equipment and test voltages
Voltage sensor, rated values

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated primary voltage U_{pn} (kV)</th>
<th>Maximum rated primary voltage U_{pnmax} (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEVCD 12</td>
<td>11/√3</td>
<td>12/√3</td>
</tr>
<tr>
<td>KEVCD 17.5</td>
<td>15/√3</td>
<td>17.5/√3</td>
</tr>
<tr>
<td>KEVCD 24</td>
<td>22/√3</td>
<td>24/√3</td>
</tr>
</tbody>
</table>

Tab. 6. Rated primary voltage

- Rated frequency, f_{n}: 50/60 Hz
- Accuracy class: 1/3P
- Rated burden, R_{br}: 10 MΩ
- Rated transformation ratio, K_{n}: 10 000:1
- Rated voltage factor, k_{u}: 1.9/8 h

Current sensor, rated values

- Rated primary current, I_{pr}: 1 600 A
- Rated transformation ratio, K_{ra}:
  - 1 600 A/0.150 V at 50 Hz
  - 1 600 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_{ct}: 3 200 A
- Rated short-time thermal current, I_{th}:
  - 50 kA/3 s (KEVCD 12; KEVCD 17.5)
  - 40 kA/3 s (KEVCD 24)
- Rated dynamic current, I_{dyn}:
  - 125 kA (KEVCD 12; KEVCD 17.5)
  - 100 kA (KEVCD 24)
- Rated frequency, f_{r}: 50/60 Hz
- Rated extended primary current factor, K_{pcr}: 1.2
- Accuracy class: 1
- Rated burden, R_{br}: 10 MΩ

Temperature category

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

Cables

- Length: 5.0; 6.5; 7.5 m
- Connector: RJ-45 (CAT-6)

Ordering data / specification of sensor

- Sensor name code
- Used IED
- Polarity
- Cable length
- Accessories (Connector adapter)
Dimensional Drawings

KEVCD B

KEVCD 12_; KEVCD 17.5_

Outline drawing number: 1VL5300805R0101
Weight: 20 kg

<table>
<thead>
<tr>
<th>TYPE</th>
<th>A</th>
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<tbody>
<tr>
<td>KEVCD 12 BE 2</td>
<td>5000</td>
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<tr>
<td>KEVCD 17.5 BE 2</td>
<td>6500</td>
</tr>
<tr>
<td>KEVCD 12 BG 2</td>
<td>7500</td>
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<tr>
<td>KEVCD 17.5 BG 2</td>
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ONLY FOR BE2 TYPE
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