Sensor principles
A new solution for measuring currents needed for protection and monitoring in medium voltage power systems, is sensor. Sensors based on alternative principles have been introduced as successors to instrument transformers in order to obtain the size reduction, performance improvement, and better standardization. These principles are far from new, but not until now, with the introduction of versatile electronic relays, it has been possible to make use of the sensors advantageous properties.

Current sensor
The measurement of currents in KEVCR 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:

\[ u_{out} = M \frac{di}{dt} \]

In all cases, a signal reproducing the actual primary current waveform is obtained by integration of the transmitted signal.

Protection and control IEDs (Intelligent Electronic Devices)
The functions of a traditional relay, as well as new additional functions, are included in a protection and control IED. The information transmitted from the sensors to the IED is, during fault conditions, more accurate than the corresponding secondary information from an instrument transformer, hence giving the possibility for a versatile relay function. However, the IED must be able to operate at a sensor’s low input signal level with sufficient accuracy, and the signal from the Rogowski coil must be integrated. Modern IEDs (e.g. ABB’s Feeder terminals in the RE-series) are designed for sensor use, and they are also equipped with built-in integrators for Rogowski coil sensor inputs.

Sensor application
The sensor is suitable for the application with Circuit Breaker and Relay as integrated solution.
Differences between Sensor and Instrument Transformer

There are noticeable differences between Sensors and traditional Instrument Transformers:

Linearity

Due to the absence of ferromagnetic core the sensor is linear up to the highest currents. Measurement and protection can be realized with one single secondary winding with double ratings. In addition, one single standard sensor can be used for a range of rating currents.

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<th>Accuracy limits</th>
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For this sensor type, the variation of amplitude error under constant ambient temperature and same application within current range from 5% Ip (12.5 A) up to 30*Ip (7500 A) is smaller than 0.2%, that more than fulfils the accuracy class requirements within its whole range.

Example: Rated current 250 A accuracy class 1 + protection purposes up to 7500 A accuracy class 5P30. The accuracy limits are according to the picture below.

Compactness

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

Correction factor

The amplitude error of a current sensor is in practice constant and independent of the primary current. Hence, it can be corrected in the IED by using a correction factor, measured separately for every sensor.

Secondary cables

The accuracy classes of the sensor are given at the ends of its secondary cables. The cables are intended to be connected directly to the IED, and subsequently no burden calculation for the secondary wiring is needed. Therefore, every sensor is accuracy tested when equipped with its own cable.
Technical data

Standard
IEC 60044-8 (2002-07)
Instrument transformers
Part 8: Electronic current transformers

Technical parameters of Current Sensor
Type KEVCR 24 _C2
Current Sensor type KEVCR 24 _C2: Rogowski coil + 1.6 m cable

Highest voltage for equipment and test voltages
- Highest voltage for equipment, \( U_{m} \): 24 kV
- Power frequency voltage withstand test on primary terminals: 50 kV
- Power frequency voltage withstand test on secondary terminals: 0.5 kV
- Impulse voltage withstand test on secondary terminals: 1 kV

Current sensor, rated values
- Rated frequency, \( f_{r} \): 50/60 Hz
- Rated accuracy: class 1/5P30
- Rated burden, \( R_{br} \): > 4 MΩ
- Rated continuous thermal current, \( I_{cth} \):
  - type OC2: 630 A
  - type AC2: 1250 A
- Rated short-time thermal current, \( I_{th} \):
  - 21 kA, 3s
- Rated dynamic current, \( I_{dyn} \): 63 kA
- Rated primary current, \( I_{pr} \): 250 A
- Rated transformation, \( K_{ra} \):
  - 250 A/0.150 V at 50 Hz
  - 250 A/0.180 V at 60 Hz

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

Protection and control IEDs
Sensor could be connected to a protection and control IED-unit from ABB:
- IED types: RE_601

Cable
- Connector: RJ 45 shielded
- Length: 1.6 m

Dimensions and weight
- outline drawing number: type OC2 1VL5300617R0101
  - type AC2 1VL5300617R0102
- Weight: type OC2 5.7 kg
  - type AC2 6.7 kg

Ordering data
- KEVCR 24 AC2: 1VL5400050V0101
- KEVCR 24 OC2: 1VL5400051V0101
KEVCR 24

Outline drawing number:
- OC2 - 1VL5300617R0101
- AC2 - 1VL5300617R0102

Weight:
- OC2 - 5.7 kg
- AC2 - 6.7 kg

Cable length: 1.6 m

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