KEVA 24 A
Indoor voltage sensor

Sensor parameters

<table>
<thead>
<tr>
<th>Parameters for Application</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated primary voltage of application</td>
<td>kV</td>
<td>up to 24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor parameters</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated primary voltage, $U_{in}$</td>
<td>kV</td>
<td>$22/\sqrt{3}$</td>
</tr>
<tr>
<td>Highest voltage for equipment, $U_m$</td>
<td>kV</td>
<td>24</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage</td>
<td>kV</td>
<td>50</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>kV</td>
<td>125</td>
</tr>
<tr>
<td>Rated transformation ratio, $K_n$ for voltage measurement</td>
<td>-</td>
<td>10,000 : 1</td>
</tr>
<tr>
<td>Voltage accuracy class</td>
<td>-</td>
<td>0.5/3P</td>
</tr>
<tr>
<td>Length of cable</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>- KEVA 24 A1; KEVA 24 A3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>- KEVA 24 A2</td>
<td></td>
<td>3.4</td>
</tr>
</tbody>
</table>

Sensor principles

Electronic Instrument Transformers (Sensors) offer an alternative way of making the voltage measurement 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 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. A linear and highly accurate sensor characteristic in the full operating range enables the combination of metering and protection classes in one device.
Voltage sensor
Voltage measurement in KEVA A sensors is based on the resistive divider principle. The output voltage is directly proportional to the input voltage:

\[ U_s = \frac{R_2}{R_1 + R_2} U_p \]

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. Modern IEDs (such as ABB’s 615 series relays) are designed for such sensor use.

Modern digital apparatuses (microprocessor based relays) allow protection and measurement functions to be combined. They fully support voltage sensing realized by the single sensor with double the accuracy class designation (e.g.: voltage sensing with combined accuracy class 0.5/3P).

Sensor application
The voltage sensor type KEVA 24 A is intended for use in voltage measurement in air insulated medium voltage switchgear.

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 voltage range.

Example of voltage measurement range for metering accuracy class 0.5 and protection accuracy class 3P:

The accuracy limits are described on the graph below.

Rated parameters
Because the sensors are highly linear within a very wide range of voltages, the same single sensor can be used for the various rated 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 etc. since they are standard over the defined range. To achieve the correct function of the protection and control IED, the selected rated voltage as well as the rated transformation ratio must be properly set into the IED.

Correction factors
The amplitude and phase error of a voltage sensor is, in practice, constant and independent of the primary voltage. 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 voltage sensor are mentioned on the sensor label (for more information on 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 both correction factors (Cfs): amplitude correction factor (\(aU\)) and phase error correction factor (\(pU\)) of a voltage sensor.
Example of a sensor label

<table>
<thead>
<tr>
<th>ABB</th>
<th>Voltage Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEVA 24 A1</td>
<td>S/N: 1VT5413000001</td>
</tr>
<tr>
<td>KEVA 24 A3</td>
<td>S/N: 1VT5413000002</td>
</tr>
<tr>
<td>KEVA 24 A2</td>
<td>S/N: 1VT5413000003</td>
</tr>
</tbody>
</table>

Ordering data
- KEVA 24 A1: 1VLT5400008V0101
- KEVA 24 A2: 1VLT5400009V0101
- KEVA 24 A3: 1VLT54000070V0101

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

Example: Connection of connectors between a sensor and IED which requires a connector adapter

For more information about connector adapters refer to Doc. No. 1VL000710 - Sensor accessories.

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

Highest voltage for equipment and test voltages
- Highest voltage for equipment, $U_{\text{eq}}$: 24 kV
- Rated power frequency test voltage: 50 kV
- Rated lightning impulse test voltage: 125 kV

Voltage sensor, rated values
- Rated primary voltage $U_{\text{pr}}$: 22/√3 kV
- Rated frequency, $f$: 50/60 Hz
- Accuracy class: 0.5/3P
- Rated burden, $R_{\text{bur}}$: 10 MΩ
- Rated transformation ratio, $K_{\text{tur}}$: 10 000:1
- Rated voltage factor, $k_{\text{v}}$: 1.9/8h

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

Secondary cables
The sensor is equipped with a cable for connection with the IED. The cable connectors are type RJ-45 for KEVA 24 A3 sensor or type Twin-BNC for KEVA 24 A1 and KEVA 24 A2 sensors. The sensor accuracy classes are verified up to the 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:
- KEVA 24 A1; KEVA 24 A3: 5 m
- KEVA 24 A2: 3.4 m

Connector RJ-45

Example: Direct connection of connectors between the KEVA 24 A3 sensor and new IED family without the need for an adapter

Connector Twin-BNC

Example: Direct connection of connectors between the KEVA 24 A1 sensor and IED without the need for an adapter

Cable
Dimensions and weights

- Outline drawing number: KEVA 24 A1
- Weight: 4kg

![Diagram showing dimensions and weights](image-url)
Outline drawing number: KEVA 24 A2
Weight: 4kg

Twin-BNC
Length 3400mm
The data and illustrations in this catalogue are not binding. We reserve the right to make changes of the content, in the course of technical development of the product.