FOCS – Fiber-Optic Current Sensor
Make light work of DC current measurement
FOCS – Fiber-Optic Current Sensor
Use light, the best choice for precision high-current measurements

Do you want maximum availability and top accuracy in your process control and measurements? Do you require a reliable and easy-to-install precision high-current measurement device?

Then FOCS – the Fiber-Optic Current Sensor from ABB – is your choice. FOCS combines highest performance based on pure fiber-optic measurement with a stunning and slender design that is specially suited to harsh industrial environments.

No bulky structures, no tedious tuning – simply install the lightweight frame at almost any location in next to no time. What’s more, FOCS is immune to magnetic interference.

Optical technology solves magnetic problems
Compared to magnetic systems, this well-proven, field-tested optical technology brings radical benefits. The result is exceptional accuracy and reliability. Based on the magneto-optic effect, FOCS can measure uni- or bidirectional DC currents of up to 600 kA with an accuracy of +/- 0.1 % of the measured value.

FOCS can be positioned anywhere along the busbar, with no need for recalibration – neither after installation nor at any time during its lifetime.

FOCS offers the highest metering signal disturbance immunity available for complex industrial processes. It is unaffected by stray magnetic fields at the plant, so time-consuming magnetic centering of the sensor head is a thing of the past. And thanks to purely optical signal acquisition, the saturation of magnetic elements in the sensor electronics and sensor head is completely eliminated.
FOCS – Fiber-Optic Current Sensor
Depend on light, and benefit from unmatched performance

As the world’s leading supplier of state-of-the-art solutions, we have a unique insight into the requirements of process technology. We have designed FOCS specifically to meet the needs of industrial control in adverse locations.

Highly dependable, exceptionally accurate
FOCS offers an accuracy of ±0.1 % and a linearity of ±0.1 % of the measured value from 1 to 120 % of the rated current, combined with ±0.02 % repeatability. With no drop in accuracy, the DC current can easily be regulated through the entire range of a running production process.

DC measurement and integrated protection
The measurement range up to ±600 kA is combined with DC current protection. FOCS features instantaneous or inverse time overcurrent protection to maintain a safe production process at all times. Reverse current protection is a further option.

Much simpler installation and commissioning
FOCS is really quick and simple to install. With a sensor head weighing less than 15 kg that comes in seven standard sizes as well as customized solutions, FOCS is easy to fit around any busbar. And with only a single fiber-optic cable between the sensor head and the sensor electronics, cable routing is kept to a minimum.

− No need for special on-site modifications.
− No need for on-site calibration.
− And no need for re-calibration when relocating FOCS in the case of a plant redesign.

Easy integration into external control systems
Any control system can be used to process the sensor signals.

FOCS comes with two unidirectional or bidirectional analog outputs as standard. Three status relays with changeover contacts are provided for signaling purposes.

ABB PowerLINK is used to create a straightforward digital interface between the sensor electronics and ABB’s AC 800PEC controller. Other digital interfaces are available as options in order to connect FOCS to any third-party system.

Designed for the harshest environments
An IP 67 protection class for the optical fiber ensures unbiased signal transmission in the harsh environment of electrochemical and other industrial processes. Additionally, the electronics boards are coated to protect them from dirt and dust from the production environment. The rugged and lightweight design of the sensor head housing protects the optical fiber from mechanical damage.
FOCS – Fiber-Optic Current Sensor
Technical data

Sensor performance

- Full-scale rated current (Ir): 0 to ± 500 kA
- Overcurrent capacity: 20 %
- Max. measurable current: ± 600 kA (including overcurrent)
- Sampling rate: 4 kHz
- Accuracy (1 % to 120 % of Ir): ± 0.1 % of measured value
- Linearity (1 % to 120 % of Ir): ± 0.1 %
- Repeatability: ± 0.02 %
- Temperature sensitivity: < ± 0.002 %/° C

Sensor outputs

- Analog outputs of Ir (unidirectional): 0 to 1 V and 0 to 20 mA or 0.2 to 1 V and 4 to 20 mA
- Analog outputs of Ir (bidirectional): ± 1 V and ± 20 mA
- Bus communication: ABB PowerLINK (standard)
- PROFIBUS DP slave (optional)
- Relays: Changeover contacts for alarm/trip signaling

Ambient conditions

- Sensor head: -40° C to +80° C
- Sensor electronics (with forced air cooling): -25° C to 65° C
- Sensor electronics (w/o forced air cooling): -25° C to 55° C
- Temperature sensor head and electronics (storage): -40° C to 70° C

Min. temp for PROFIBUS DP slave module in use: 0° C to 55° C/65° C

Humidity (EN 61131-2): RH= 5 – 95 %

Pollution degree (compliant with IEC 60664): Degree 2

Altitude (compliant with IEC 60068-2-13): < 4000 m

Protection class

Sensor electronics: IP 00, always to be mounted in a control cubicle

Optics and fiber cable: IP 67

Models and ratings

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<th>Main type code</th>
<th>Current rating (kA)</th>
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Power supply

- Standard input: 24 VDC, -15 % to +20 %
- Power consumption: < 60 W

Physical dimensions

- Sensor electronics dimensions: 450 mm x 101 mm x 136 mm
- Sensor electronics weight: < 5 kg
- Sensor head weight: 7 standard sizes or on request
- Sensor fiber cable: 15 m to 70 m

Selectable protection features

- Instantaneous overcurrent detection
- Inverse time overcurrent detection
- Instantaneous reverse current detection

Additional features

- Optional process panel PP820
- Current indication and setting changes
- Ah and kAh counter pulses over PROFIBUS DP and PowerLINK

Sensor head type code

- Standard sensor head dimensions
- (other sizes may be available)

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ABB FOCS – Fiber-Optic Current Sensors
FOCS – Fiber-Optic Current Sensor
Based on light. The science behind FOCS

The right physics for highest accuracy
The FOCS system utilizes the Faraday effect to measure current. A simple loop of optical fiber is wound around the busbar in place of the complicated and bulky sensor head of conventional transducers.

The Faraday effect can be observed when polarized light waves are exposed to a magnetic field. As a result, the waves accumulate a phase difference.

In the FOCS system, the right and left circularly polarized light waves travel through the coil of the sensing fiber. At the end of the fiber, they are reflected (and their polarization direction is swapped) and then retrace their optical path to the sensor electronics. If a DC current is flowing, they accumulate a phase difference which is proportional to the line integral of the magnetic field along the sensing fiber. This difference is therefore a direct and highly precise measure for the current.

\[ \Delta \Phi_F = 4VI \]

\[ I = \int H ds \]

\( V \) = material constant (Verdet constant)
\( H \) = magnetic field
\( s \) = length of sensing fiber

Straightforward design for easy application
The sensor electronics contain the light source, optical phase detection circuit and digital signal processor. The sensor’s technology has been proven in highly demanding applications such as navigation systems in the air, on land and at sea. The digital signal processor within the module converts the optical phase difference directly into a digital signal, which can then be transmitted for analysis wherever required.

The sensor head is connected to the sensor electronics via a non-detachable fiber-optic cable.

FOCS is delivered ready to use with standard firmware installed. All data-conditioning and monitoring functions provided by ABB FOCS, including scaling and calibration, have been preset and tested at the ABB factory. No software engineering is necessary on site.
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