



ENERGY AUTOMATION PRODUCTS

SICAM FSI V2.0 B-Sensor Guardian for your Overhead Line Distribution Grids

[siemens.com/sicam-fsi](https://www.siemens.com/sicam-fsi)

Effective fault management in overhead line distribution network requires reliable locating and signaling of short circuits and earth faults.

With SICAM FSI (Fault Sensor Indicator), Siemens offers reliable fault detection for MV overhead line grids.

SICAM FSI V2.0 (Basic Sensor) B-Sensor offers indication of fault at the device with visual LED indications.

SICAM FSI V2.0 B-Sensors are available in 2 versions:

- 6MD2314-2BC20
Fault indication visibility:
100 m during daytime, 500 m during nighttime
- 6MD2314-2BC30
Fault indication visibility:
400 m during daytime, 800 m during nighttime

Benefits

- Higher availability and reduced downtime – With fast localization of faults
- Ease of Use – With single switch activation and auto threshold function, it takes not more than 5 min from unboxing to be ready for installation / service
- Suitable for outdoor application – Robust design with IP68 rated and UV resistant housing. Conformal coating of electronic modules increases protection against harmful environmental influences
- Higher degree of sensitivity – Reliable detection of faults from 10 A
- Maintenance free design – With 10 years of battery life with 1500 hours of flashing, the SICAM FSI is maintenance free
- Long Visibility – Fault localization becomes easy when the visual LED indication is visible up to 400 m day and 800 m night (distance)
- Short term current withstand –
As high as at 40 kA RMS for 1s

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Device Characteristics

Application Area

- Medium voltage overhead line networks from 6.6 kV to 69 kV
- Supports application on solidly grounded or resistive star point grounded systems
- Applicable for both 50 Hz and 60 Hz
- Supports installation on insulated and bare conductors
- Fault detection based on configured settings of Trip threshold and di/dt
- Settable time delays for inrush conditions or auto reclose sequences to avoid wrong indications.
- Comply to IEC 62689-1

Fault Detection

- Trip threshold setting range 10 A to 1500 A
10 A to 100 A (steps of 10 A)
100 A to 300 A (steps of 25 A)
300 A to 800 A (steps of 50 A)
800 A to 1500 A (steps of 100 A)
- Auto threshold Feature – Self-adjustment of trip threshold based on phase current
- ΔI trigger setting 5 A to 160 A – di/dt setting is user configurable in steps of 5 A up to 80 A, 120 A, 160 A
- Presence/absence of voltage detection for permanent fault confirmation

Configuration

- The SICAM FSI V2.0 B-Sensor can be parameterized using “FSI Configurator” software in case required
- Ease of Use – Can be used without configuration taking advantage of the default auto threshold function. With single switch activation, it takes not more than 5 min from unboxing to be ready for installation / service (Applicable for 11 kV and cable diameter ranging from 12-25 mm with reasonable amount of fault accuracy)
- Can modify voltage level or cable diameter using SICAM FSI Configurator for other use cases with auto threshold
- Manual configuration set threshold and detailed configuration of all parameters possible using SICAM FSI Configurator tool

Reset mechanisms

User configurable:

- Manual reset with a magnet
- Automatically at system voltage restoration
- Automatically over a specified time (user configurable time)

Power Source

- Lithium Thionyl Chloride Batteries (3.6 V) - Service life approx. 10 years

Environment Condition

- Operating temperature: -40 °C to +75 °C
- Maximum altitude: 5000 m
- Wind speed withstand up to 200 km/h
- Rainfall withstands: Avg rainfall 3500 mm
- Exposure to solar radiation: 1000 W/m²

Housing

- Polycarbonate, UV-resistant
- Protection class: IP68 IK09

Mounting

- The SICAM FSI is clamped onto the overhead line using hot stick



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For the U.S. published by
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Alpharetta, GA 30005, United States



SICAM

Fault Sensor Indicator (FSI) V2.0 Basic Sensor (B-Sensor)

Catalog, Edition 1.0

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SICAM Fault Sensor Indicator (FSI) V2.0 Basic Sensor (B-Sensor)

Catalog

SICAM FSI V2.0 B-Sensor	1
Description and Functions	1.1
Technical Documentation	2
Technical Data	2.1
Type Test Specifications	2.2
Case Dimensions	2.3
Ordering Information	3
Ordering Information - SICAM FSI V2.0 B-Sensor	3.1

SICAM FSI V2.0 B-Sensor

Description and Functions

Description

SICAM Fault Sensor Indicator (FSI) is developed using the latest generation of hardware technology and is a member of the Siemens SICAM short-circuit indicator product family.

The device is used to improve the reliability and to reduce the downtime on the MV overhead distribution grid.

The device measures the phase current continuously and detects the phase fault and ground fault when it is mounted on the MV overhead line network.

The device indicates both the temporary fault and the permanent fault via optical indication (LED flashing).

The device can be mounted in junction points/branching points and areas of frequent fault.

Applications

- This device is suitable for outdoor applications on MV overhead line.
- Supports application on solidly grounded or resistive star-point grounded systems.
- The device is to be configured in close coordination with the protection systems in the MV network. This results in improved fault detection and localization.
- The device can be mounted in groups of 3, one device on each phase.
- To facilitate fault identification, a distinct LED flashing sequence is generated by the device providing a clear indication of whether the fault is temporary or permanent.

Functions

Multiple settings available for fault detection

- Threshold settings, auto-threshold, and di/dt settings.

Auto threshold algorithm

- Self-Adjustment of trip threshold based on phase current.

Inrush restraint

- Avoids false fault detection due to transformer magnetization during the voltage restoration on the MV overhead line.

Auto reclosure restraint

- Blocks the redundant fault detection during the auto-reclosure retries which are made to restore the MV overhead line.

Multiple fault indication reset functionalities

- Voltage restoration in MV overhead line, auto timer reset and magnetic reset

Self-Test

- Self-test by magnetic reset to verify the battery health of the device. The success/failure of self-test is indicated by a specific LED flashing pattern.

Low temperature cutoff

- Built-in with an automatic cutoff feature when the temperature falls below -40°C.¹



[sc_fsi_v2_devicephoto1, 1, --]

Figure 1.1/1 SICAM FSI V2.0 B-Sensor

Benefits

Higher availability of overhead line networks

- Quick fault detection and localization, reduced downtime.

Ease of use

- The device is effortlessly powered ON/OFF for installation, storage and transportation using a single switch activation.
- The device is ready to install with factory configuration of 11 kV and 18 mm cable diameter. Additionally, it includes an auto threshold feature for convenient adjustment of fault thresholds in dynamic load conditions.

Installation

- Supports installation on both insulated and non-insulated overhead lines

Simple configuration

- Easy configuration of device parameters using SICAM FSI Configurator

Safe mounting

- Safely mountable on the MV overhead line by using a hot stick with shotgun or hot stick (telescopic) with device adaptor.

Long range fault indication visibility

- Fault localization becomes easier with the device's fault LED, which offers visibility for up to 400 m during the day and 800 m at night.¹

Long battery life

- 10 years of battery life, under standard operating conditions.
- Configurable blinking interval of LEDs for optimal battery life.

Maintenance free

- The device housing is weatherproof, UV stabilized, and flame retardant with an IP68 rating for durability.

Conformal coating

- The conformal coating on device electronic modules increases protection against harmful environmental influences such as extreme moisture, corrosive gases and aggressive dust.

¹ Only applicable for B-Sensor Type 2. Refer to [Ordering Information – SICAM FSI V2.0 B-Sensor, Page 10](#) for information on B-Sensor Type 1 and Type 2.

Indication of Conformity



This product complies with the directive of the Council of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU) as well as restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU).

This conformity has been proved by tests conducted by Siemens AG in accordance of the Council Directive in accordance with the product standard IEC/EN 61326-1 for the EMC directives, and with the standard IEC/EN 61010-1 for the low-voltage directive. RoHS directive 2011/65/EU is met using the standard IEC/EN 63000. The device has been designed and produced for industrial use.

Application Data

Rated voltage (V_{rated})	6.6 kV, 11 kV, 12.5 kV, 13.8 kV, 22 kV, 25 kV, 33 kV, 34.5 kV, 44 kV, 45 kV, 66 kV, and 69 kV
Maximum operating voltage	83 kV
Maximum operating current	1500 A
Maximum continuous operating current	800 A
Operating current range	0 A to 1500 A
System frequency	50 Hz or 60 Hz network as per IEC 62689-1
Grounding type	Solidly grounded system or resistive star-point grounded systems
Voltage presence	> 70% of V_{rated}
Voltage absence	< 45% of V_{rated}
Fault detection time	2 cycles \pm 1 cycle
Current measurement accuracy	\pm 10 % or \pm 5 A whichever is greater from 0 A to 800 A
Power source	Lithium-thionyl chloride batteries
Total fault-indication time	B-Sensor Type 1: 1500 h of LED flashing B-Sensor Type 2: 400 h of LED flashing
Cable overall diameter	5 mm to 40 mm (non-insulated) 15 mm to 40 mm (insulated)
Non-insulated conductor type	Aluminum Conductor Steel Reinforced (ACSR), All Aluminum Alloy Conductor (AAAC)
Insulated conductor type	Single core, aluminum conductor steel reinforced with/without waterblocking, XLPE insulated
Temperature withstand of clamping material	230°C continuous

Fault-Detection Parameters

Fault current threshold (I_{set})	10 A to 1500 A <ul style="list-style-type: none"> 10 A to 100 A (steps of 10 A) 100 A to 300 A (steps of 25 A) 300 A to 800 A (steps of 50 A) 800 A to 1500 A (steps of 100 A)
Auto threshold fault factor	2X to 4X (steps of 1X)
Range change monitoring time (T1)	20 s to 120 s (steps of 10 s)
Range change memorize time (T2)	0 s to 120 s (steps of 30 s)
DI current	5 A to 80 A (steps of 5 A), 120 A, 160 A Starting from 10 A phase current
Fault-indication time	B-Sensor Type 1: 2 h to 16 h (steps of 1 h) B-Sensor Type 2: 2 h to 4 h (steps of 1 h)
Permanent-fault verification time	3 s, 35 s, and 70 s
Inrush restraint time	3 s, 30 s, and 60 s
Auto reclosure time	0.1 s to 99.9 s

2.1

Reset Device

Voltage restoration reset	$V_{rated} > 70\%$
Magnet reset	Using magnetic adaptor
Auto timer reset	B-Sensor Type 1: 2 h to 16 h (steps of 1 h) B-Sensor Type 2: 2 h to 4 h (steps of 1 h)

Fault Indication – LEDs

Indication	6 red LEDs
Luminous flux	40 lm
Visibility angle	360° (from ground level)
Visibility range (for fault indication only)	B-Sensor Type 1: 100 m at day time, 500 m at night time B-Sensor Type 2: 400 m at day time, 800 m at night time ²
MTBF of LEDs	45000 h

Mechanical Data

Weight	B-Sensor Type 1: approximately 1.04 kg B-Sensor Type 2: approximately 1.15 kg	
Dimensions	Diameter	Height
	116.8 mm	241.4 mm

Environmental Conditions

Outdoor applications as per IEC 61010-1	
Degree of pollution	Category 2
Maximum altitude above sea level	5000 m

² B-Sensor Type 2 to have fault indication visibility range of 400 m at day time and 800 m at night time with 2 s blinking interval only.

Technical Documentation

Type Test Specifications

This section describes about the type testing performed on SICAM FSI V2.0 B-Sensor according to IEC 61326-1, IEC 62689-1, and IEC 61010-1.

EMI/EMC Tests

Test	Reference Standard	Test Requirement
Electrostatic discharge test	IEC 62689-1, Table 16	Severity class 3
	IEC 61000-4-2	6 kV contact discharge, 8 kV air discharge
	IEC 61326-1	
Power frequency magnetic field immunity 50 Hz/60 Hz	IEC 62689-1, Table 16	Severity class 4
	IEC 61000-4-8	30 A/m continuous, 300 A/m for 1 s to 3 s
	IEC 61326-1	As per IEC 61326; 30 A/m 50 Hz, 60 Hz (magnetically sensitive equipment)
Pulse magnetic field immunity	IEC 62689-1, Table 16	Severity class 4
	IEC 61000-4-9	300 A/m peak value; 20 positive and 20 negative
	IEC 61326-1	
Radiated emission test	CISPR 32	Class A
	EN 55032	30 MHz to 1000 MHz (30 MHz to 230 MHz): 40 dB (µV/m) QP (at 10 m)
	IEC 61326-1	(230 MHz to 1000 MHz): 47 dB (µV/m) QP (at 10 m) 1 GHz to 6 GHz (1 GHz to 3 GHz): 56 dB (µV/m) AV, 76 dB (µV/m) PK (at 3 m) (3 GHz to 6 GHz): 60 dB (µV/m) AV, 80 dB (µV/m) PK (at 3 m)
Damped oscillatory magnetic field test	IEC 62689-1	Severity class 4,
	IEC 61000-4-10	30-A/m peak value Oscillation frequency: 0.1 MHz and 1 MHz, ± 10% Orientation: XYZ Test duration: 2 s or continuous for 1 min
Radio frequency, electromagnetic field immunity	IEC 62689-1	Severity class 3
	IEC 61000-4-3	0.08 GHz to 1 GHz 10 V/m, 80% AM 1 kHz, 1 % step
	IEC 61326-1	1 GHz to 6 GHz 3 V/m, 80 % AM 1 kHz, 1 % step Dwell time: 2.85 s

Environmental Tests

Test	Reference Standard	Test Requirement
Dry heat test	IEC 62689-1	+75 °C
	IEC 60068-2-2	Duration: 16 h with device turned OFF 16 h with device turned ON
Dry heat test (storage) ³	IEC 60068-2-2	(+85 ±2) °C Duration: 16 h
Cold test	IEC 62689-1	-40 °C ⁴
	IEC 60068-2-1	Duration: 16 h with device turned OFF 16 h with device turned ON
Cold test (Storage) ³	IEC 60068-2-1	(-40 ±2) °C ⁴ Duration: 16 h
Damp heat steady state test	IEC 60068-2-78	(-40 ±2) °C, (95 ±3)% Duration: 4 days
Damp heat cyclic test (12 h + 12 h)	IEC 60068-2-30	Lower temperature: 25 °C Upper temperature: 55 °C Relative humidity: 95 %, ± 3 % No of cycles: 6 cycles
Change of temperature test	IEC 62689-1	(-40 ±2) °C, (+75 ±2) °C
	IEC 60068-2-14	Rate of change: (1 ± 0.2) K/min Dwell at upper and lower temperatures 3 h + 3 h 50 h 25 min OFF + 50 h 25 min ON
Salt mist test	ASTM B117 IEC 60068-2-11	Salt solution: 95 parts distilled water by weight & 5 parts sodium chloride by weight Duration of exposure: 168 h
Exposure to solar radiation	IEC 62689-1 IEC 60068-2-5	1000 W/m ² Duration: 8 h
Exposure to direct sunlight (UV)	ASTM G155-13	Exposure cycle 1 Irradiance for wave lengths: 340 nm/W (m ² · nm) Duration of light: 102 min Total exposure time: 14 days
Wind pressure test		Withstand wind speed of 200 km/h

³ For optimum battery capacity, it is recommended to store the device below 30°C; 30% RH

⁴ Only applicable for B-Sensor Type 2. -25 °C applicable for B-Sensor Type 1.

Mechanical Tests

Test	Reference Standard	Test Requirement
Vibration response test (sinusoidal)	IEC 62689-1 IEC 60068-2-6	Frequency: 10 Hz to 500 Hz 10 m/s ² amplitude 0.075 mm, 23 min Sweep rate: 1 oct./min Number of sweep cycles: 2/axis in 3 directions
Vibration endurance (Sinusoidal)	IEC 60255-21-1 IEC 60068-2-6	Class 1 Frequency: 10 Hz to 150 Hz Amplitude: 1 g (10 m/s ²) Number of sweep cycles: 20/axis in 3 directions Sweep rate: 1 oct./min
Shock response test	IEC 60068-2-27 IEC 60255-21-2	Class 1, 5 g, 11 ms, 6 pulses in each X, Y, Z axis
Shock withstand test	IEC 60068-2-27 IEC 60255-21-2	Class 1, 15 g, 11 ms, 6 pulses in each X, Y, Z axis
Bump test	IEC 60068-2-27/IEC 60068-2-29	400 m/s ² , 40 g Duration of pulse: 6 ms Number of sweeps: 2000 positive and 2000 negative shocks Number of axes: 3 (X, Y, and Z) Number of bumps: 1000 per direction Number of directions: 2 per axis Total number of bumps: 6000 shocks in 3 axes
Seismic test	IEC 60068-3-3 IEC 60255-21-3 IEC TR 62271-300	Class 1 Frequency: 5 Hz to 35 Hz Sweep rate: 1 octave/min 10 min for test cycle Frequency: 5 Hz to 8 Hz (horizontal), 3.5 mm amplitude Frequency: 5 Hz to 8 Hz (vertical), 1.5 mm amplitude Frequency: 8 Hz to 35 Hz (horizontal), 1 g (10 m/s ²) acceleration Frequency: 8 Hz to 35 Hz (vertical), 0.5 g (5 m/s ²) acceleration
Ingress of protection test	IEC 62689-1 IEC 60529	IP68 category 1
Mechanical impact test	IEC 62689-1 IEC 62262	IK09, Impact energy: 10 J

Safety Test

Test	Reference Standard	Test Requirement
Product safety test	EN/IEC 61010-1	Tests as per clause no. 4 Marking and documentation as per clause no. 5 Protection against electric shock as per clause no. 6 Protection against mechanical hazard as per clause no. 7 Resistance to mechanical stresses (shock and impact) as per clause no. 8 Protection against the spread of fire as per clause no. 9 Equipment temperature limits and resistance to heat as per clause no. 10 Protection against liberated gases and substances, explosion, and implosion as per clause no. 13 Components and subassemblies as per clause no. 14 Hazards resulting from application as per clause no. 16 Risk assessment as per clause no. 17

2.2

Electrical Test

Test	Reference Standard	Test Requirement
Dielectric withstand	IEC/EN 61010-1	125 kV with the help of hotstick
Overvoltage	IEC/EN 61010-1	Category IV
Degree of pollution	IEC/EN 61010-1	Category 2
Maximum altitude above sea level	IEC/EN 61010-1	5000 m
Short-circuit current withstand test	IEC 62689-1	12.5 kA @ 1 s 25 kA @ 170 ms
Short time current/ Dynamic test	IEC62689-1	25 kA RMS for 3 s and 62.5 kA peak 40 kA RMS for 1 s and 100 kA peak
Switching impulse test	IEC 60060-1	33 kV/175 kV, and 66 kV/250 kV 250 μs/2500 μs, no of shots: 5 Line voltage 33 kV, switching impulse voltage 175 kV Line voltage 66 kV, switching impulse voltage 250 kV

Technical Documentation

Type Test Specifications

Test	Reference Standard	Test Requirement
Lightning impulse test	IEC 60060-1	33 kV/200 kV, and 66 kV/350 kV 1.2 μ s/50 μ s, no of shots: 5 Line voltage 33 kV, switching impulse voltage 200 kV Line voltage 66 kV, switching impulse voltage 350 kV
Average rainfall test	—	Average rainfall per year: 3500 mm

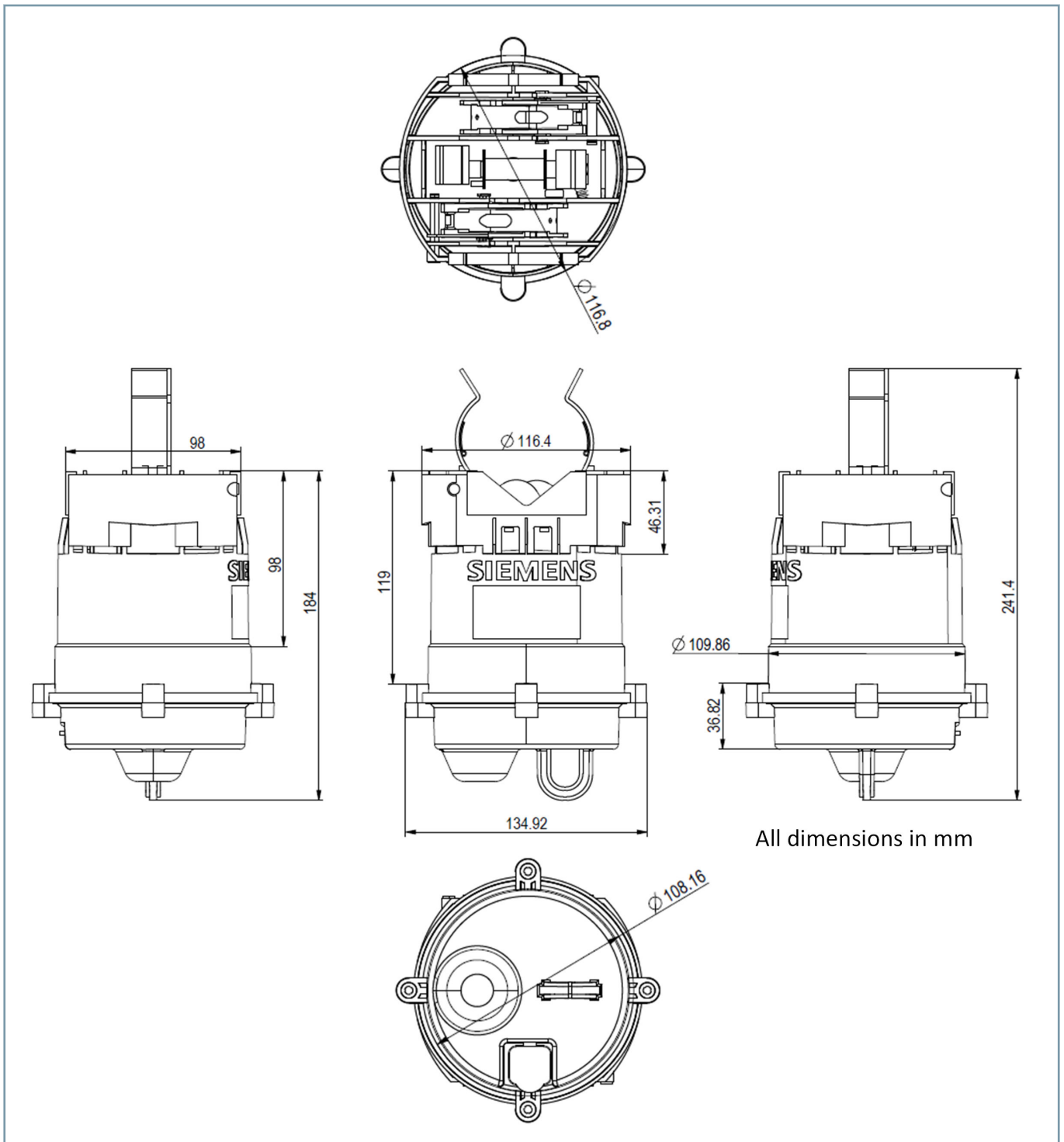
2.2

Optical Tests

Test	Reference Standard	Test Requirement
Lumens test	LM 79	40 lumens
Goniometry test	LM79	360° visibility

Device Dimensions

2.3



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Figure 2.3/1 Device Dimensions

Ordering Information

Ordering Information - SICAM FSI V2.0 B-Sensor

Ordering Information – SICAM FSI V2.0 B-Sensor

Description	Versions	Order no.												
		1	2	3	4	5	6	7	8	9	10	11	12	
		6	M	D	2	3	1	4	-	2	B	C	□	0
													▲	
SICAM FSI V2.0 B-Sensor														
B-Sensor Type 1	<ul style="list-style-type: none"> Phase-fault detection Ground-fault (di/dt) detection UV stabilized polycarbonate IP68 rated housing Operating temperature range: -25°C to +75°C Fault indication visibility: 100 m during daytime, 500 m during night time 													2
B-Sensor Type 2	<ul style="list-style-type: none"> Phase-fault detection Ground-fault (di/dt) detection UV stabilized polycarbonate IP68 rated housing Operating temperature range: -40°C to +75°C Fault indication visibility: 400 m during daytime, 800 m during night time 													3
Spare parts and accessories		6	M	D	2	3	1	8	-	4	□	□	0	□
Spare part											▲	▲		▲
	SICAM FSI V2.0 B-Sensor Lithium-thionyl chloride battery set (pack of 6)										B	B		1
Accessories														
	Magnet adaptor for device reset, accessory for hot stick with shotgun										M	A		4
	Device adaptor for SICAM FSI V2.0 mounting via hot stick (telescopic)										M	A		6
Accessory Description														
Hot stick with shotgun for SICAM FSI V2.0 B-Sensor mounting, 4 m	Recommended brand: Terex hot stick with shotgun, Ritz, catalog number: RC403-0295 For more detailed information visit: http://www.terexutilities.com.br													
	Recommended brand: Hubbell hot stick with shotgun, catalog number: C4030295 For more detailed information visit: https://www.hubbell.com/hubbellpowersystems/en/													
Hot stick (telescopic) for SICAM FSI V2.0 B-Sensor mounting, 12 m	Recommended brand: Terex Ritz, catalog no.: VTT-1/9 For more detailed information visit: http://www.terexutilities.com.br													
	Standard off-the-shelf USB Type C cable for device configuration using FSI configurator.													

Table 3.1/1 SICAM FSI V2.0 B-Sensor Selection and Ordering Data

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Article No: E50417-X8940-C657-A1

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The requested performance features are binding only when they are expressly agreed upon in the concluded contract.