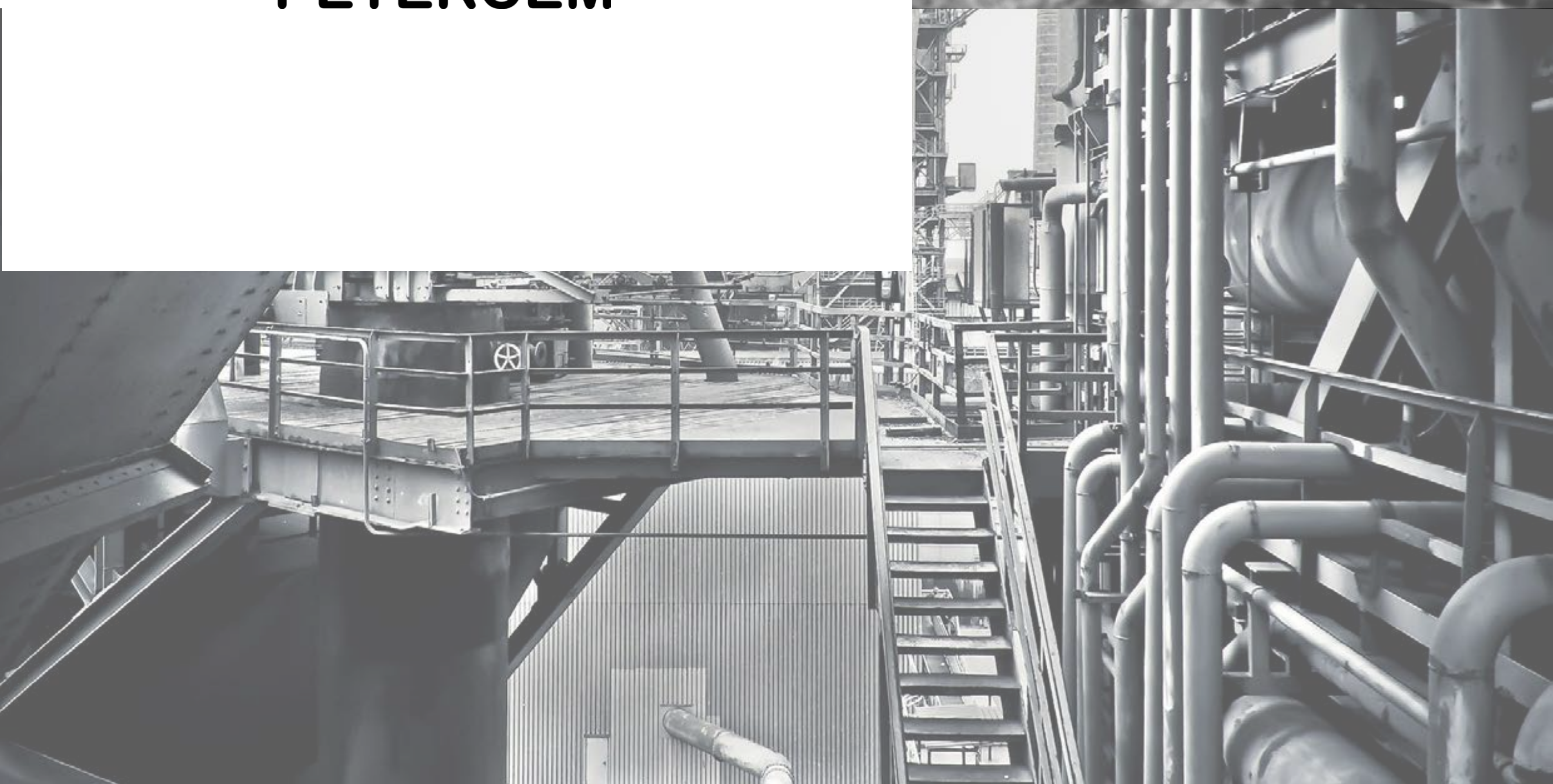
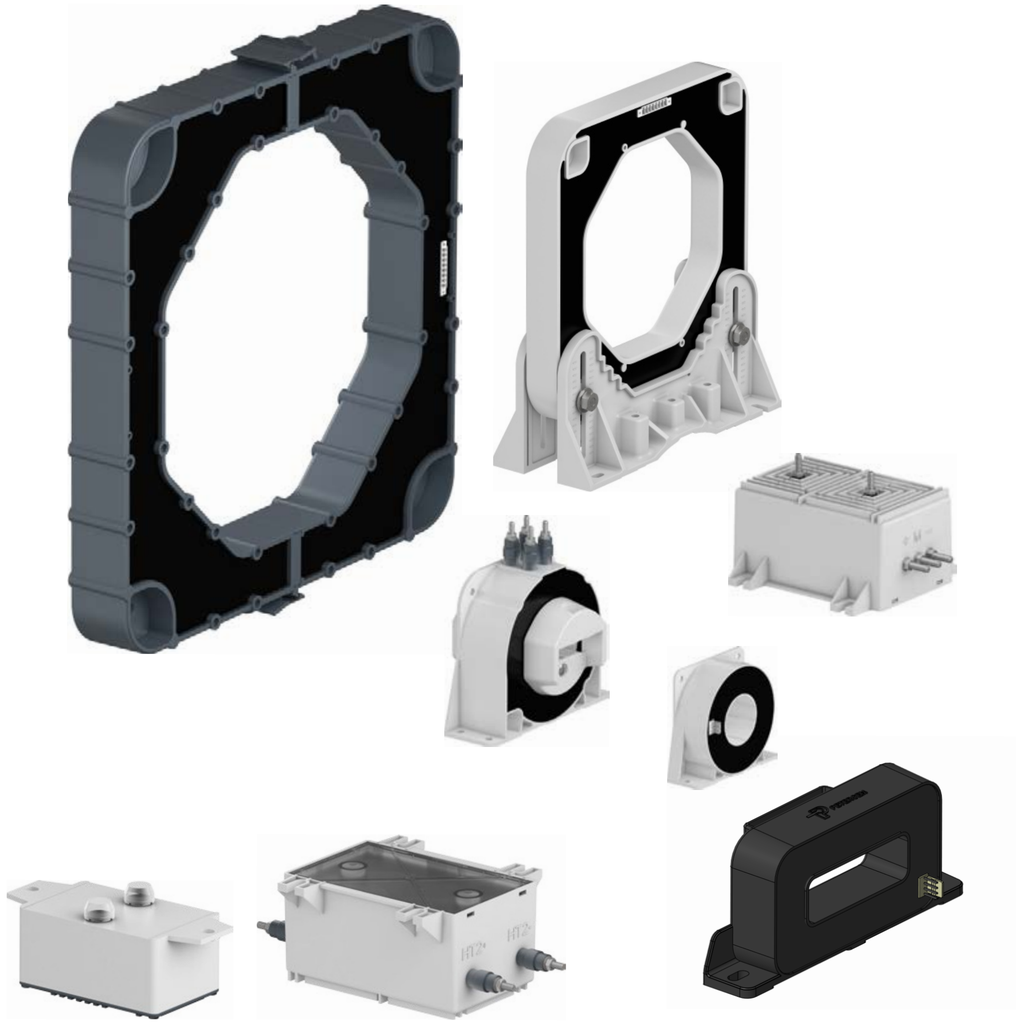
CURRENT SENSORS, VOLTAGE SENSORS AND VOLTAGE DETECTORS

PETERCEM





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01.OVERVIEW

Current and voltage measurement expertise from PETERCEM

1

Competence that you can rely on

Profit from our global network and 40 years of experience in current and voltage measurements. As an expert in electrical engineering, we offer sensors that can handle rough applications like rail, mining, offshore windmills, compact drive solutions and many more.

Reliable in extreme conditions

Years of product development and improvements allow us to offer you a product operating from -40 °C up to +85 °C.

Thanks to their specific designs, which prevents electric and magnetic perturbations, our sensors can be implemented into compact systems or next to high current or voltage bus bars.

Speed up your projects

Don't spend your time searching for another partner, select current and voltage sensors to measure DC, AC and pulsating current.

Continuous operation

For precise energy metering PETERCEM sensors guarantee very low accuracy error under 0.25% over frequencies up to 100 kHz. Allowing your installation to run in a reliable and efficient way.

Get high dynamic performances with representative outputs correctly followed up to 100 A/µs and 50 V/µs.

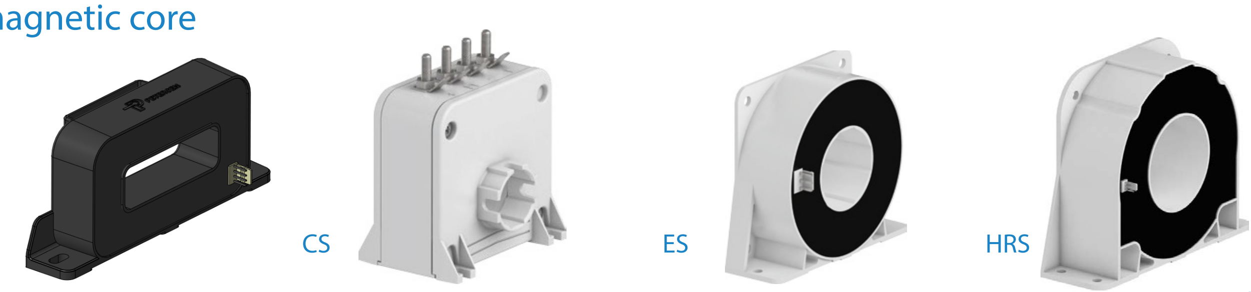
Sensors panorama

Measure DC, AC or pulsating currents and voltages
with a galvanic insulation

1

Current measurement - Hall effect technology

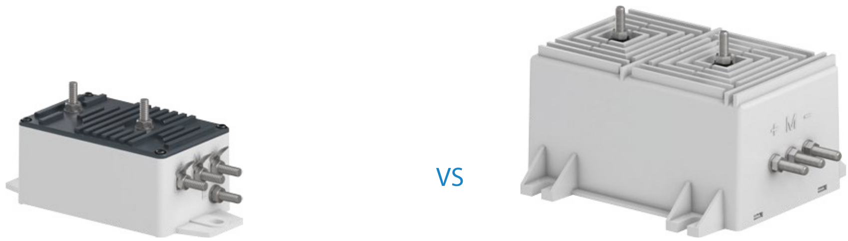
With magnetic core



100 A — 2 500 A

Voltage measurement

Electronic technology

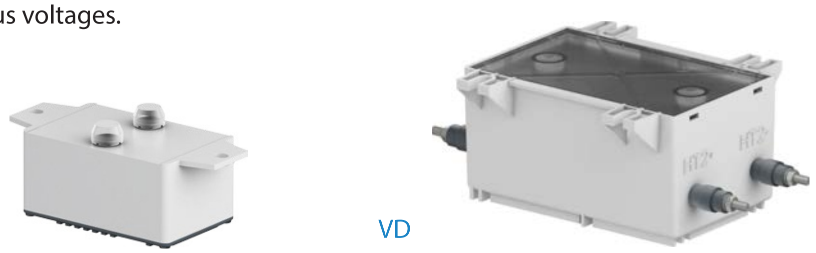


50 V — 1 500 V — 4 200 V

Voltage detection

Electronic technology

Maintenance personnel warning from dangerous voltages.
Very good visibility thanks to red colored LEDs.
Complies with main railway standards.

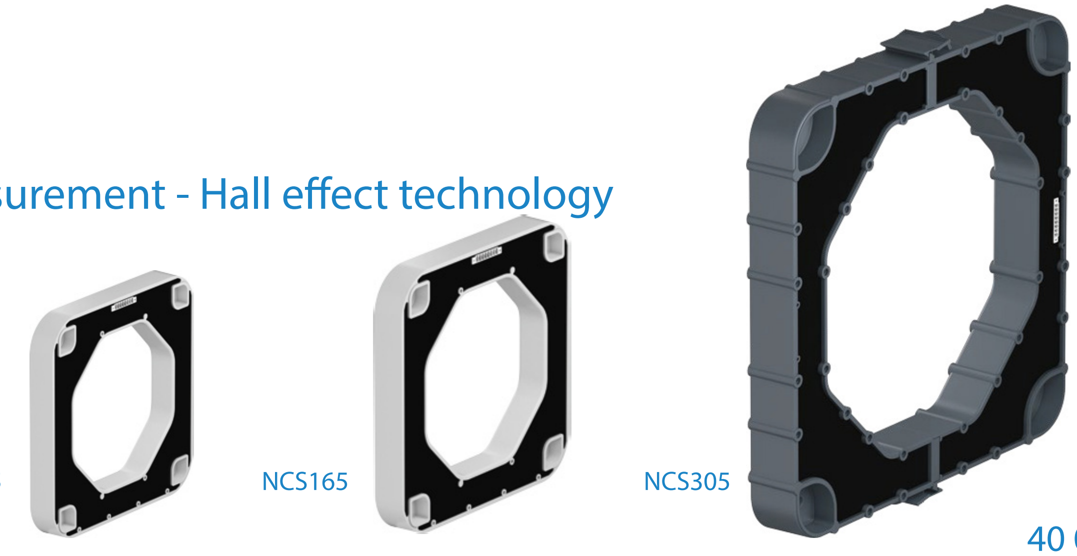


Detection level — 50 V — 1500 V — 25 V — 3000 V

1

Current measurement - Hall effect technology

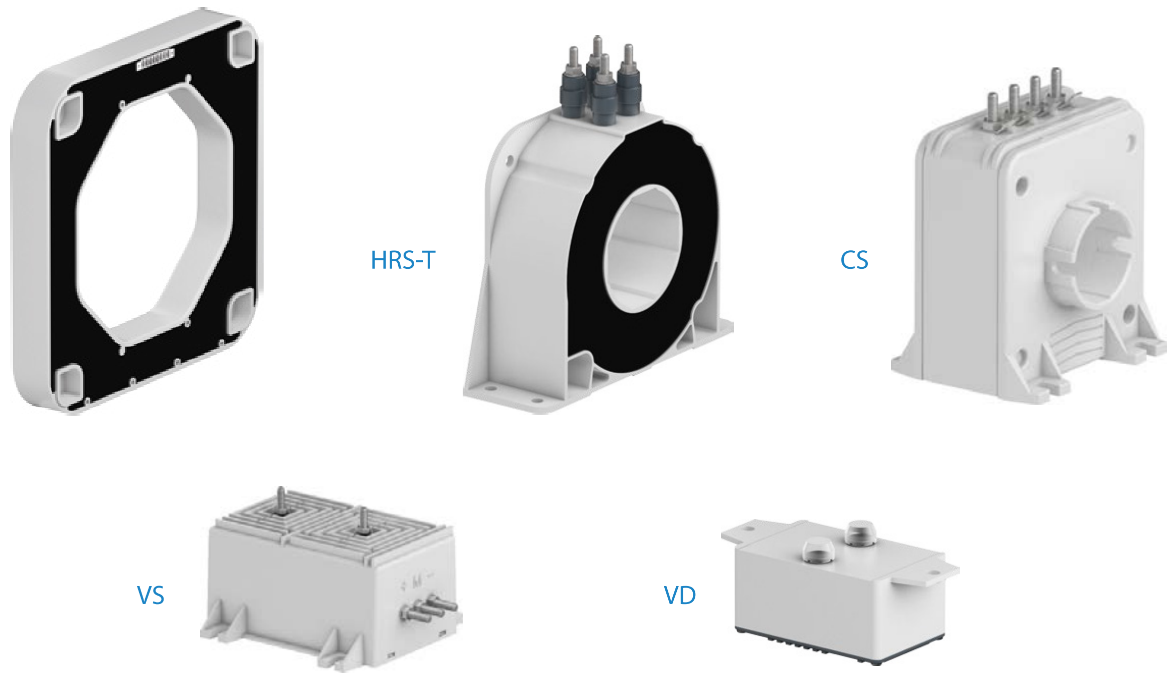
Full electronic



4 000 A — 40 000 A

Railway applications

Dedicated products meeting main railway standards.
Current measurement from 100 A to 40 000 A.
Voltage measurement from 50 V to 4 200 V.
Voltage detection



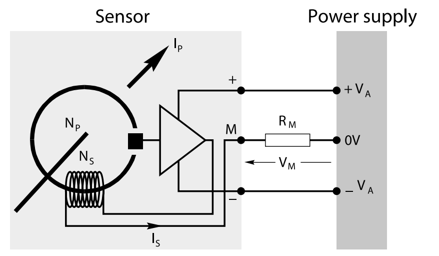
TWO TECHNOLOGIES FOR MEASURING CURRENT

1

1. Closed loop Hall effect technology

Principle

PETERCEM current sensors based on closed loop Hall effect technology are electronic transformers.
They allow for the measurement of direct, alternating and impulse currents, with galvanic insulation between the primary and secondary circuits.
The primary current I_P flowing across the sensor creates a primary magnetic flux.
The magnetic circuit channels this magnetic flux. The Hall probe placed in the air gap of the magnetic circuit provides a voltage proportional to this flux.
The electronic circuit amplifies this voltage and converts it into a secondary current I_S. This secondary current multiplied by the number of turns Ns of secondary winding cancels out the primary magnetic flux that created it (contra reaction). The formula $N_P \times I_P = N_S \times I_S$ is true at any time. The current sensor measures instantaneous values.



The secondary output current I_S is therefore exactly proportional to the primary current at any moment. It is an exact replica of the primary current multiplied by the number of turns N_P/N_S. This secondary current I_S can be passed through a measuring resistance R_M. The measuring voltage V_M at the terminals of this measuring resistance R_M is therefore also exactly proportional to the primary current I_P.

ADVANTAGES

The main advantages of this closed loop Hall effect technology are as follows:

– Galvanic insulation between the primary and secondary circuits
– Measurement of all waveforms is possible: direct current, alternating current, impulse, etc.
– High accuracy over a large frequency range (from direct to more than 100 kHz)
– High dynamic performance
– High overload capacities
– High reliability.

APPLICATIONS

Industry
Variable speed drives, Uninterruptible Power Suppliers (UPS), active harmonic filters, battery chargers, wind generators, robotics, conveyers, lifts, cranes, solar inverter, elevator, etc.

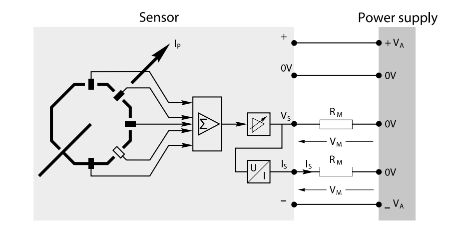
Railway
Main converters, auxiliary converters (lighting, air conditioning), battery chargers, choppers, substations, mining, etc.

2. Electronic technology

1

Principle

PETERCEM current sensors are entirely based on electronic technology. In contrast to closed or open loop Hall effect technology, no magnetic circuit is used in the sensor.
They allow for the measurement of direct, alternating and impulse currents with galvanic insulation between the primary and secondary circuits.
The primary current I_P flowing across the sensor creates a primary magnetic flux. The different Hall probes included in the sensor measure this magnetic flux. The electronic circuit treats these signals to provide two output currents I_{S1} and I_{S2} and/or two output voltages V_{S1} and V_{S2}. All the outputs are exactly proportional to the measured primary current.
The current sensor measures instantaneous values.
The first output measures from 0 Amp to Ipn and the 2nd output measures from O Amp to Ip max. This feature allows more accurate information.



ADVANTAGES

The main advantages of this electronic technology are as follows:
– Galvanic insulation between the primary and secondary circuits
– Measurement of all waveforms is possible: direct current, alternating current, impulse, etc.
– Choice of output type (current or voltage, IPN or IPMAX)
– Very large current measuring range (up to 40 kA) without overheating the sensor
– High dynamic performance
– Low power consumption
– Reduced weight and volume
– Simplified mechanical fixing

APPLICATIONS

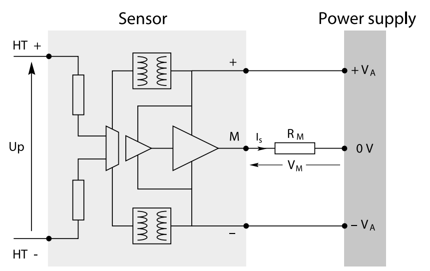
Industry
Electrolysis, rectifiers, welding, etc.

Railway
Substations in continuous voltage.

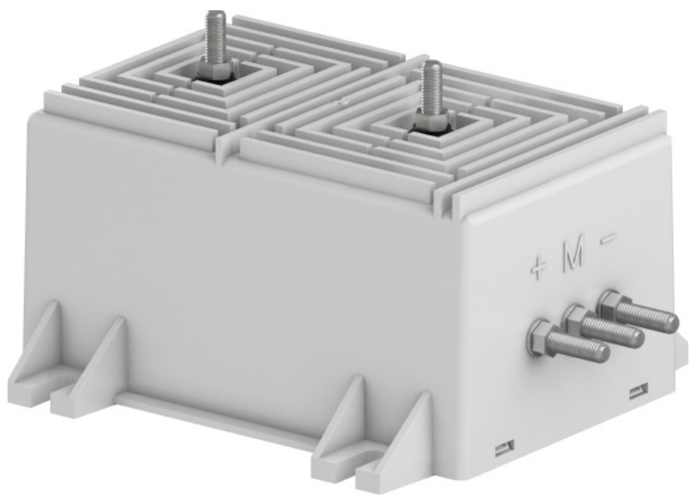
1

1. Electronic technology

Principle
PETERCEM voltage sensors based on electronic technology only use electronic components. In contrast to closed or open loop Hall effect technology, no magnetic circuits or Hall effect probes are used in the sensor.
This allows for the measurement of direct or alternating voltages with electrical insulation between the primary and secondary circuits.
The primary voltage to be measured is applied directly to the sensor terminals: HT+ (positive high voltage) and HT– (negative high voltage or earth). This voltage is passed through an insulating amplifier and is then converted to a secondary output current IS. This secondary current Is is electrically insulated from the primary voltage to which it is exactly proportional.
The voltage sensor measures instantaneous values.



In the same way as for current sensors, this secondary current I_s can be then passed through a measuring resistance R_m. The measuring voltage V_m at the terminals of this measuring resistance R_m is therefore also exactly proportional to the primary voltage U_p. The electrical supply to the sensor is also insulated from the primary voltage.



ADVANTAGES

The main advantages of this fully electronic technology are as follows:
– Electrical insulation between the primary and secondary circuits.
– Measurement of all waveforms is possible: direct voltage, alternating voltage, impulse, etc.
– Excellent immunity to electromagnetic fields.
– Excellent accuracy.
– High dynamic performance.
– Excellent reliability.

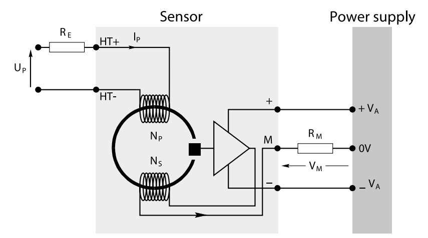
APPLICATIONS

Railway
Main converters, auxiliary converters (lighting, air conditioning), battery chargers,
choppers, substations, mining, etc.

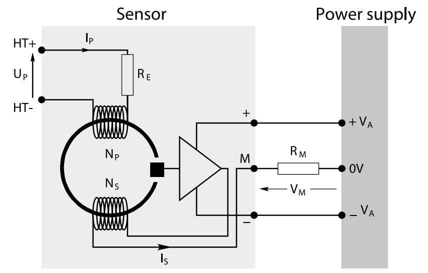
1

2. Closed loop Hall effect technology

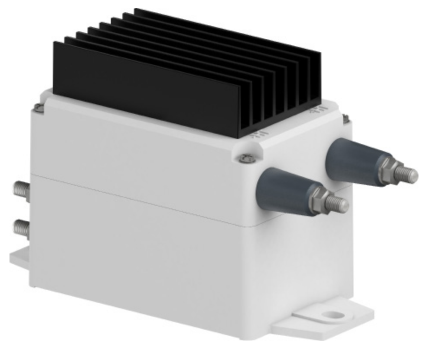
Principle
PETERCEM voltage sensors based on closed loop Hall effect technology are also electronic transformers. They allow for the measurement of direct, alternating and impulse voltages with galvanic insulation between the primary and secondary circuits.
The primary voltage U_P to be measured is applied directly to the sensor terminals: HT+ (positive high voltage) and HT– (negative high voltage). An input resistance R_E must necessarily be placed in series with the resistance R_P of the primary winding to limit the current I_P and therefore the heat dissipated from the sensor. This resistance R_E may be either integrated during the manufacturing of the product (calibrated sensor) or added externally by the user to determine the voltage rating (not calibrated sensor).
The primary current I_P flowing across the primary winding via this resistance R_E generates a primary magnetic flux. The magnetic circuit channels this magnetic flux. The Hall probe placed in the air gap of the magnetic circuit provides a voltage V_H proportional to this flux.
The electronic circuit amplifies this voltage and converts it into a secondary current I_S. This secondary current multiplied by the number of turns N_S of secondary winding cancels out the primary magnetic flux that created it (contra reaction). The formula $N_P \times I_P = N_S \times I_S$ is true at any time.
The voltage sensor measures instantaneous values.
The secondary output current I_S is therefore exactly proportional to the primary voltage at any moment. It is an exact replica of the primary voltage. This secondary current I_S is passed through a measuring resistance R_M. The measuring voltage V_M at the terminals of this measuring resistance R_M is therefore also exactly proportional to the primary voltage U_P .



Principle diagram of a not calibrated EM010 sensor



Principle diagram of a calibrated EM010 sensor



ADVANTAGES

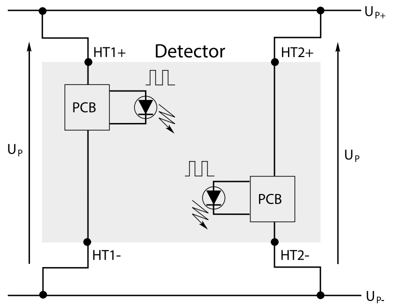
The main advantages of this closed loop Hall effect technology are as follows:
– Galvanic insulation between the primary and secondary circuits.
– Measurement of all waveforms is possible: direct voltage, alternating voltage, impulse, etc.
– High accuracy.

APPLICATIONS

Railway
Main converters, auxiliary converters (lighting, air conditioning), battery chargers,
choppers, substations, mining, etc.

1. Electronic technology

Principle
PETERCEM voltage detector is based on entirely electronic technology. It allows the detection of the presence of direct voltages. This main function is duplicated within the detector to bring redundancy.
The voltage detector converts the primary voltage UP applied to its terminals to visual information for the user. This function permits the user to carry out maintenance operations with the assurance that dangerous voltage is not present.
The primary voltage U_p to be measured is applied directly to the detector terminals: HT1+ and HT2+ (positive high voltage) and HT1– and HT2- (negative high voltage or 0 V electric). The electronic circuit (PCB) converts the primary voltage U_p to an electrical signal supplied to a light emitting diode (LED).
The information is supplied to the user visually through two flashing LEDs.
The detector does not need an external power supply in order to work.



The voltage detector indicates the presence of a voltage higher than a limit (maximum 50 V in compliance with standards) by the illumination of a LED. Inversely, the LED is extinguished when the voltage is below this limit.

ADVANTAGES

The main advantages of this electronic technology are as follows:
– Detection of direct voltages.
– Very good visual indication.
– High overload capacities.
– Excellent reliability (functional redundancy in a single product).
– Excellent immunity to magnetic fields.
– Compact product.

APPLICATIONS

Railway
Main converters, auxiliary converters (lighting, air conditioning), electronic power devices integrating capacitors banks, battery chargers, choppers, substations, etc.

02.INDUSTRY APPLICATION

Current sensors
Closed loop technology

Electronic technology

Right fit current sensors

Industry current sensors

Closed loop technology

The resin concept: a reference that has become a standard

Since 15 years we have integrated an essential concept into industrial current sensors: a determination to anticipate market requirements and genuine concern for the protection of the environment. With the introduction of recyclable resin, PETERCEM were trailblazers of an innovation that has over the years become a touchstone.

Optimized settings, waste control, minimization of losses, etc. are all factors that again ensure our pride in the field of current sensors.

Smaller

As components get smaller but more powerful, installing current sensors is becoming a real problem. With PETERCEM's industrial sensors, the whole thing is child's play. By being the first in the field to offer these smaller current sensors that maintain your high performance objectives, PETERCEM have met the challenge of giving you the space you always needed.

Horizontal or vertical mounting

Once again we lead the field by giving installers a chance to choose between two ways of fastening sensors: horizontally or vertically. This flexibility means that PETERMCEM's sensors can be installed in any position.
This major breakthrough greatly simplifies the task of systems integrators by providing the ideal way of reducing the size of equipment.

A vast range of possibilities for every type of use

Because PETERCEM is in constant touch with their customers so that we can respond and adapt to the demands of the different sectors, we hold pride in our customers partner's. PETERCEM are totally at home in the world of power electronics, a world made up of target sectors that range from power converters and auxiliary converters, inverters, windpower generators, welding, robotics and active harmonic suppressors. PETERCEM's power lies in their ability to adapt.

Unbeatable reliability

Designed using the 6 sigma approach, the ES range is a model of reliability. The choice and number of optimized components, traceability of subassemblies, individually production tests… nothing is left to chance to guarantee your peace of mind.

	Sigma	Defects (PPM)	Performance
Unacceptable	2 σ	308 537	69.2 %
Average	3 σ	66 807	93.3 %
Very good	4 σ	6 210	99.4 %
	5 σ	233	99.98 %
Outstanding	6 σ	3.4	99.9996 %

Quality that goes beyond standards

Our product line has been ISO 9001 certified for more than 25 years and our range of industrial current sensors bear the CE label in Europe and the UL label in the US.
This ongoing striving after quality has always been the hallmark of a company where excellence and safety are part of the culture, from design right through to production. This culture is the result of continuous research to make technical progress and meet our customers' demands.

Compliance of the design with standard EN 50178 and EN61010-1 is proof of their ability to comply with the most detailed constraint as well as major demands.
The fact that each individual sensor is subjected to rigorous testing is proof of the importance PETERCEM attributes to quality.

Because your needs are specific we find you the best solution

2

ES100 ... ES2000 industry current sensors
100 to 2000 A - Closed loop technology

Frame mounting
These sensors are designed to be fixed by the case.
They may be either horizontally or vertically mounted.
The secondary connection is made with a connector or cable.
For ES sensors the primary conductor may be a cable or a bar.


ES100C


ES300C


ES500C


ES1000S


ES2000C

Ordering details

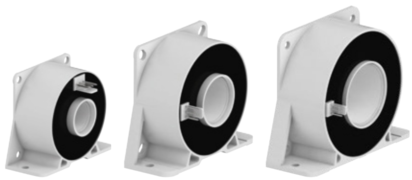
Nominal primary current A r.m.s.	Secondary current at I_{PN} mA	Supply voltage V DC	Secondary connection	Type	Order code
100	100	±12 ... ±24	Molex type 3 pins HE 14	ES100C	1SBT150100R0001
100	100	±12 ... ±24	3 wires 200 mm	ES100F	1SBT150100R0002
300	150	±12 ... ±24	Molex type 3 pins HE 14	ES300C	1SBT150300R0001
300	150	±12 ... ±24	JST 3 pins	ES300S	1SBT150300R0003
300	150	±12 ... ±24	3 wires 200 mm	ES300F	1SBT150300R0002
500	100	±12 ... ±24	Molex type 3 pins HE 14	ES500C	1SBT150500R0001
500	100	±12 ... ±24	JST 3 pins	ES500S	1SBT150500R0003
500	100	±12 ... ±24	3 wires 200 mm	ES500F	1SBT150500R0002
500	125	±12 ... ±24	Molex type 3 pins HE 14	ES500-9672	1SBT150500R9672
500	125	±12 ... ±24	JST 3 pins	ES500-9673	1SBT150500R9673
500	125	±12 ... ±24	3 wires 200 mm	ES500-9674	1SBT150500R9674
1000	200	±15... ±24	Molex type 3 pins HE 14	ES1000C	1SBT151000R0001
1000	200	±15... ±24	JST 3 pins	ES1000S	1SBT151000R0003
1000	200	±15... ±24	3 wires 200 mm	ES1000F	1SBT151000R0002
1000	250	±15... ±24	Molex type 3 pins HE 14	ES1000-9678	1SBT151000R9678
1000	250	±15... ±24	JST 3 pins	ES1000-9679	1SBT151000R9679
1000	250	±15... ±24	3 wires 200 mm	ES1000-9680	1SBT151000R9680
2000	400	±15 ... ±24	Molex type 3 pins HE 14	ES2000C	1SBT152000R0003
2000	400	±15 ... ±24	JST 3 pins	ES2000S	1SBT152000R0002
2000	400	±15 ... ±24	3 wires 200 mm	ES2000F	1SBT152000R0001

2

Technical data

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.



		Molex type HE14 connector	ES100C	ES300C	ES500C	ES500-9672
		JST connector	–	ES300S	ES500S	ES500-9673
		Cables	ES100F	ES300F	ES500F	ES500-9674
Nominal primary current		A r.m.s.	100	300	500	500
Measuring range	@ ±15 V (±5%)	A	±150	±500	±800	±800
Measuring range	@ ±24 V (±5%)	A	±150	±500	±800	±800
Not measurable overload	10 ms/hour	A	300 (1 ms/hour)	3000	5000	5000
Max. measuring resistance	@ I_{PMAX} & ±15 V (±5%)	Ω	50	20	7	13
Max. measuring resistance	@ I_{PMAX} & ±24 V (±5%)	Ω	107	54	60	56
Min. measuring resistance	@ I_{PN} & ±15 V (±5%)	Ω	12	0	0	0
Min. measuring resistance	@ I_{PN} & ±24 V (±5%)	Ω	8.9	45	0	31
Turn number			1000	2000	5000	4000
Secondary current at I_{PN}		mA	100	150	100	125
Accuracy at I_{PN}	@ +25 °C	%	≤±0.5	≤±0.5	≤±0.5	≤±0.5
Accuracy at I_{PN}	-5 … +70 °C	%	≤±1	≤±1	≤±1	≤±1
Accuracy at I_{PN}	-20 … +70 °C	%	≤±2.5	≤±1.5	≤±1	≤±1
Offset current	@ +25 °C	mA	≤±0.4	≤±0.25	≤±0.25	≤±0.25
Linearity		%	≤0.1	≤0.1	≤0.1	≤0.1
Thermal drift coefficient	-5 … +70 °C	µA/°C	≤10	≤15	≤5	≤6.25
Thermal drift coefficient	-20 … +70 °C	µA/°C	≤80	≤40	≤16	≤20
Delay time		µs	≤1	≤1	≤1	≤1
di/dt correctly followed		A / µs	≤50	≤50	≤100	≤100
Bandwidth	-1 dB	kHz	≤100	≤100	≤100	≤100
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤12	≤12	≤12	≤12
Secondary resistance	@ +70 °C	Ω	≤30	≤33	≤76	≤53
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV	3	3	3	3
Supply voltage	±5%	V DC	±12 … ±24	±12 … ±24	±12 … ±24	±12 … ±24
Voltage drop		V	≤2.5	≤1	≤1	≤1
Mass		kg	0.050	0.115	0.210	0.210
Operating temperature		°C	-20 … +70	-20 … +70	-20 … +70	-20 … +70
Storage temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85

General data

– Plastic case and insulating resin are self-extinguishing
– Fixing holes in the case moulding for two positions at right angles
– Direction of the current: A primary current flowing in the direction of the arrow results in a positive secondary output current from terminal M.

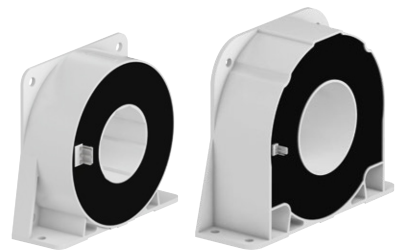
Primary connection

Hole for primary conductor.
The temperature of the primary conductor in contact with the case must not exceed 100 °C.

Secondary connection

– Molex type HE14 connector
– JST connector (ref.: B3P-VH)
– 3 x 200 mm cables (cross section 0.38 mm²).

Technical data



		Molex type HE14 connector	ES1000C	ES1000-9678	ES2000C
		JST connector	ES1000S	ES1000-9679	ES2000S
		Cables	ES1000F	ES1000-9680	ES2000F
Nominal primary current		A r.m.s.	1000	1000	2000
Measuring range	@ ±15 V (±5%)	A	±1500	±1500	±2200
Measuring range	@ ±24 V (±5%)	A	±1500	±1500	±3000
Not measurable overload	10 ms/hour	A	10000	10000	20000
Max. measuring resistance	@ I_{PMAX} & ±15 V (±5%)	Ω	2	8	5
Max. measuring resistance	@ I_{PMAX} & ±24 V (±5%)	Ω	30	30	11
Min. measuring resistance	@ I_{PN} & ±15 V (±5%)	Ω	0	0	0
Min. measuring resistance	@ I_{PN} & ±24 V (±5%)	Ω	0	0	0
Turn number			5000	4000	5000
Secondary current at I_{PN}		mA	200	250	400
Accuracy at I_{PN}	@ +25 °C	%	≤±0.5	≤±0.5	≤±0.5
Accuracy at I_{PN}	-5 … +70 °C	%	≤±1	≤±1	≤±1
Accuracy at I_{PN}	-20 … +70 °C	%	≤±1	≤±1	≤±1
Offset current	@ +25 °C	mA	≤± 0.25	≤±0.5	≤±0.25
Linearity		%	≤0.1	≤0.1	≤0.1
Thermal drift coefficient	-5 … +70 °C	µA/°C	≤5	≤6.25	≤10
Thermal drift coefficient	-20 … +70 °C	µA/°C	≤20	≤20	≤10
Delay time		µs	≤1	≤1	≤1
di/dt correctly followed		A / µs	≤100	≤100	≤100
Bandwidth	-1 dB	kHz	≤100	≤100	≤100
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤15	≤15	≤25
Secondary resistance	@ +70 °C	Ω	≤39	≤ 24	≤25
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV	3	3	4
Supply voltage	±5%	V DC	±15 … ±24	±15 … ±24	±15 … ±24
Voltage drop		V	≤ 2	≤ 2	≤1
Mass		kg	0.550	0.610	1.5
Operating temperature		°C	-20 … +70	-20 … +70	-20 … +70
Storage temperature		°C	-40 … +85	-40 … +85	-40 … +85

Accessories and options

Female Molex connector

– PETERCEM order code: **FPTN440032R0003** including 10 socket housings and 30 crimp socket contacts
– Molex order code: socket housing: 22-01-1034; crimp socket contacts: 08-70-0057.

Female JST connector

– PETERCEM order code: **FPTN440032R0002** including 10 socket housings and 30 crimp socket contacts
– JST order code: socket housing: VHR-3N; crimp socket contacts: SVH-21T-1.1.

Conformity

EN 50178
EN 61000-6-2, EN 61000-6-4

: ES sensors with cables.
File number: E166814 Vol 1
: ES sensors with connectors.
File number: E166814 Vol 2

RoHS

Frame mounting

These sensors are designed to be fixed by the case.
They may be either horizontally or vertically mounted.
The secondary connection is made with a connector or cable.

HRS1000-I-000
HRS1500-I-000

HRS2000-I-000
HRS2500-I-000

Ordering details

Nominal primary Current	Secondary current at IPN	Supply voltage	Secondary connection	Type
A r.m.s	mA	VDC		
1000	200	± 15...± 24V	Molex type 3 pins HE14	HRS1000-I-000
1000	200	± 15...± 24V	JST connector 3 pins	HRS1000-I-001
1000	200	± 15...± 24V	3 wires 200 mm	HRS1000-I-002
1000	200	± 15...± 24V	Minifit Jr 4 pins	HRS1000-I-005
1000	200	± 15...± 24V	Phoenix contact type 3 pins	HRS1000-I-006
1500	300	± 15...± 24V	Molex type 3 pins HE14	HRS1500-I-000
1500	300	± 15...± 24V	JST connector 3 pins	HRS1500-I-001
1500	300	± 15...± 24V	3 wires 200 mm	HRS1500-I-002
1500	300	± 15...± 24V	Minifit Jr 4 pins	HRS1500-I-005
1500	300	± 15...± 24V	Phoenix contact type 3 pins	HRS1500-I-006
2000	400	± 15...± 24V	Molex type 3 pins HE14	HRS2000-I-000
2000	400	± 15...± 24V	JST connector 3 pins	HRS2000-I-001
2000	400	± 15...± 24V	3 wires 200 mm	HRS2000-I-002
2000	400	± 15...± 24V	Minifit Jr 4 pins	HRS2000-I-005
2000	400	± 15...± 24V	Phoenix contact type 3 pins	HRS2000-I-006
2500	500	± 15...± 24V	Molex type 3 pins HE14	HRS2500-I-000
2500	500	± 15...± 24V	JST connector 3 pins	HRS2500-I-001
2500	500	± 15...± 24V	3 wires 200 mm	HRS2500-I-002
2500	500	± 15...± 24V	Minifit Jr 4 pins	HRS2500-I-005
2500	500	± 15...± 24V	Phoenix contact type 3 pins	HRS2500-I-006

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.

			HRS1000-I-XXX	HRS1500-I-XXX	HRS2000-I-XXX	HRS2500-I-XXX
Nominal primary current		A r.m.s	1000	1500	2000	2500
Measuring range	@± 24V (±5%), 15min/h	A	2700	3000	4000	4500
Not measurable overload	10ms/h	A	10 000	10 000	10 000	10 000
Max. measuring resistance (see datasheet for details)	@± 15V (±5%), 15min/h	Ω	0	0	0	0
Max. measuring resistance (see datasheet for details)	@± 24V (±5%), 15min/h	Ω	0	0	0	0
Min. measuring resistance (see datasheet for details)	@± 15V (±5%), 15min/h	Ω	0	0	0	0
Min. measuring resistance (see datasheet for details)	@± 24V (±5%), 15min/h	Ω	0	0	0	0
Turn number			5000	5000	5000	5000
Secondary current at INP		mA	200	300	400	500
Accuracy at IPN	@ +25°C	%	≤ ±0,25	≤ ±0,25	≤ ±0,25	≤ ±0,25
Accuracy at IPN	-40…-20°C, +70…85°C	%	≤ ±0,5	≤ ±0,5	≤ ±0,5	≤ ±0,5
Offset current	@+25°C	mA	≤ 0,2	≤ 0,2	≤ 0,2	≤ 0,2
Linearity		%	≤ 0,1	≤ 0,1	≤ 0,1	≤ 0,1
Thermal drift coefficient on offset		mA/K	≤ 0,025	≤ 0,025	≤ 0,025	≤ 0,025
Delay time		µs	≤ 1	≤ 1	≤ 1	≤ 1
Di / dt correctly followed		A/ µs	100	100	100	100
Bandwidth		kHz	≤ 100	≤ 100	≤ 100	≤ 100
Max no load consumption current		mA	≤ 25	≤ 25	≤ 25	≤ 25
Secondary resistance	@+85°C	Ω	≤ 46	≤ 46	≤ 30	≤ 30
Dielectric strength Primary/Secondary	@50Hz, 1min	kV	4	4	4	4
Supply voltage		V	±15…±24	±15…±24	±15…±24	±15…±24
Voltage drop		V	≤ 1,6	≤ 1,6	≤ 1,6	≤ 1,6
Mass		g	550	550	1500	1500
Operating temperature		°C	-40…+85	-40…+85	-40…+85	-40…+85
Storage temperature		°C	-50…+90	-50…+90	-50…+90	-50…+90

General data

– Plastic case and insulating resin are self-extinguishing
– Fixing holes in the case moulding for two positions at right angles
– Direction of the current: A primary current flowing in the direction of the arrow results in a positive secondary output current from terminal M.

Primary connection

Hole for primary conductor.
The temperature of the primary conductor in contact with the case must not exceed 100 °C.

Secondary connection

– Molex type HE14 connector
– JST connector (ref.: B3P-VH)
– 3 x 200 mm cables (cross section 0.38 mm²).
- Molex Minifit connector (ref.: JR5566)
- Phoenix Contact type connector 3pts

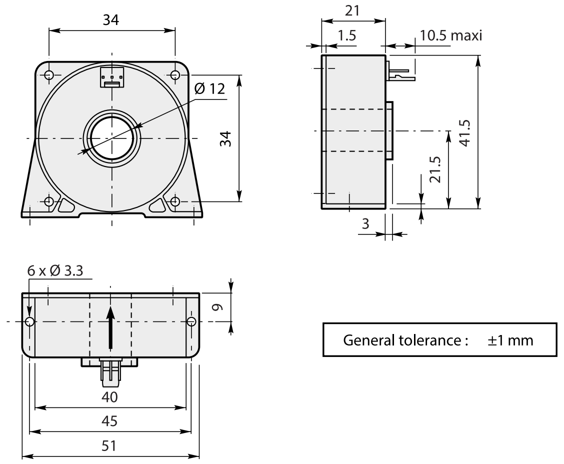
Conformity

EN 61010-1
EN 61000-6-2, EN 61000-6-4

RoHS

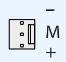
ES100 ... ES500 industry current sensors

Dimensions (mm)

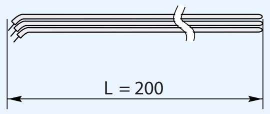


ES100C / ES100F

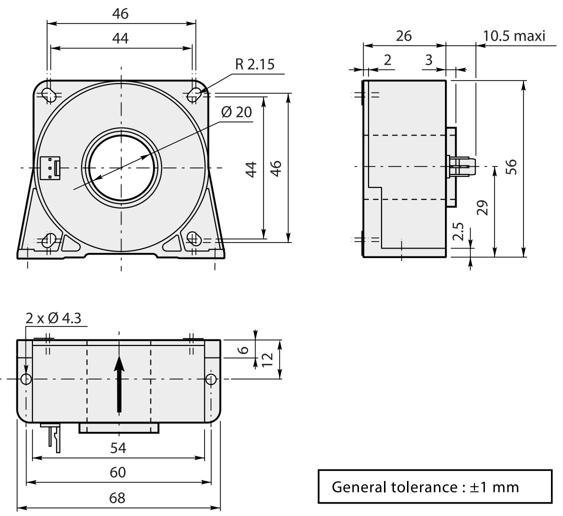
Standard ES100… sensors secondary connection



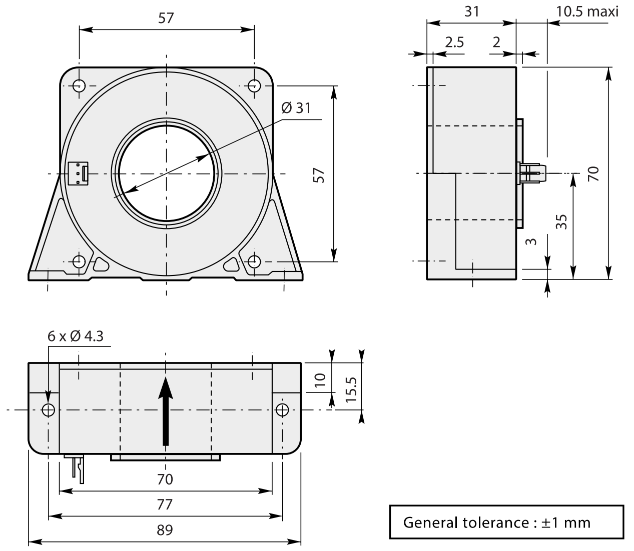
Molex type connector
(with 2.54 mm pitch)



Cable: - Red +V_A
- Green M
- Black -V_A

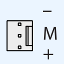


ES300C / ES300S / ES300F

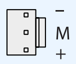


ES500C / ES500S / ES500F
ES500-9672 / ES500-9673 / ES500-9674

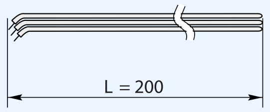
Standard ES300... and ES500… sensors secondary connection



Molex type connector
(with 2.54 mm pitch)



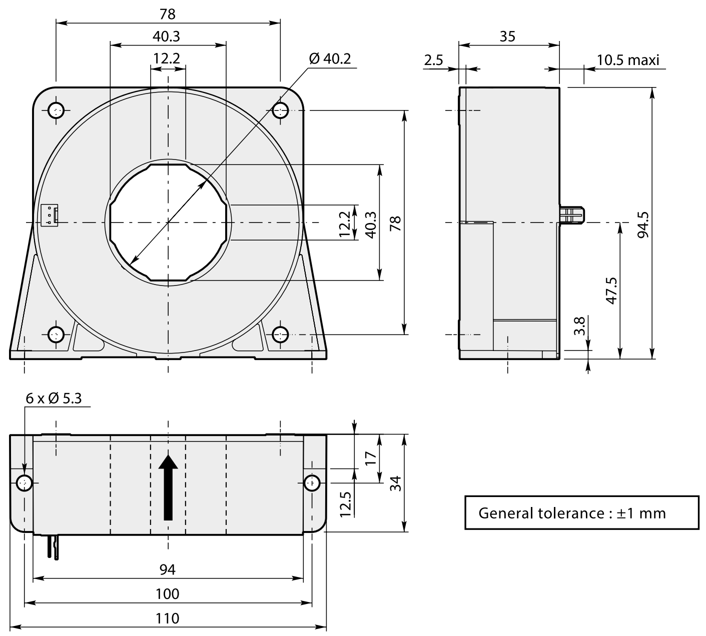
JST connector
(with 3.96 mm pitch)



Cable: - Red +V_A
- Green M
- Black -V_A

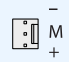
ES1000 ... ES2000, HRS1000-I ... HRS2500-I industry current sensors

Dimensions (mm)

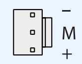


ES1000C / ES1000S / ES1000F
ES1000-9678 / ES1000-9679 / ES1000-9680
HRS1000-I / HRS1500-I

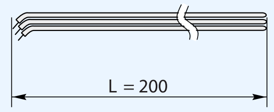
Standard ES1000... and ES2000…
sensors secondary connection



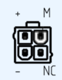
Molex type connector
(with 2.54 mm pitch)

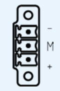


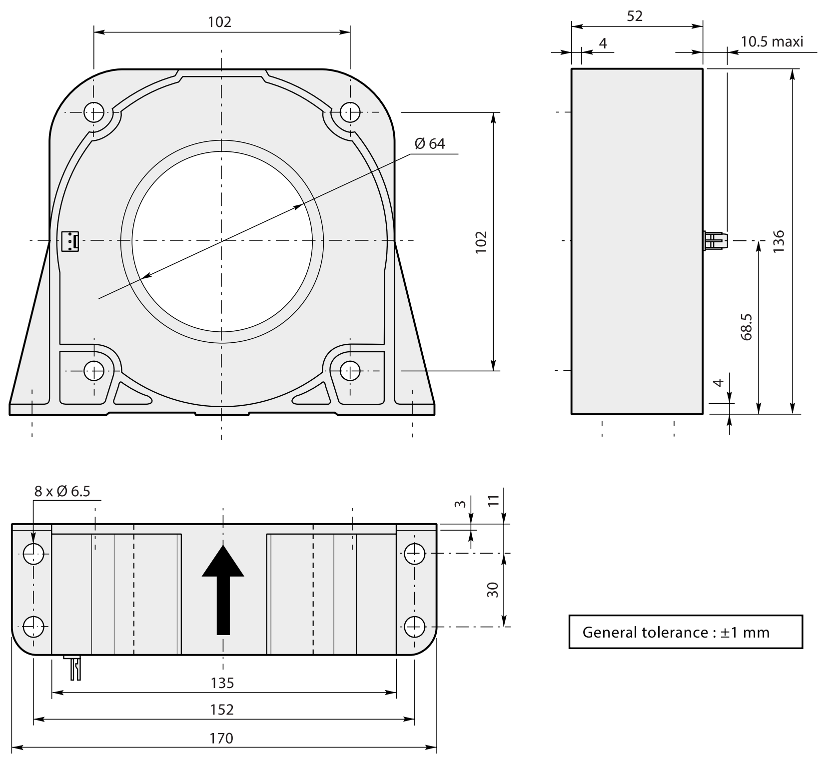
JST connector
(with 3.96 mm pitch)



Cable: - Red +V_A
- Green M
- Black -V_A


Molex Minifit Jr5566
(with 4.20 mm picth)

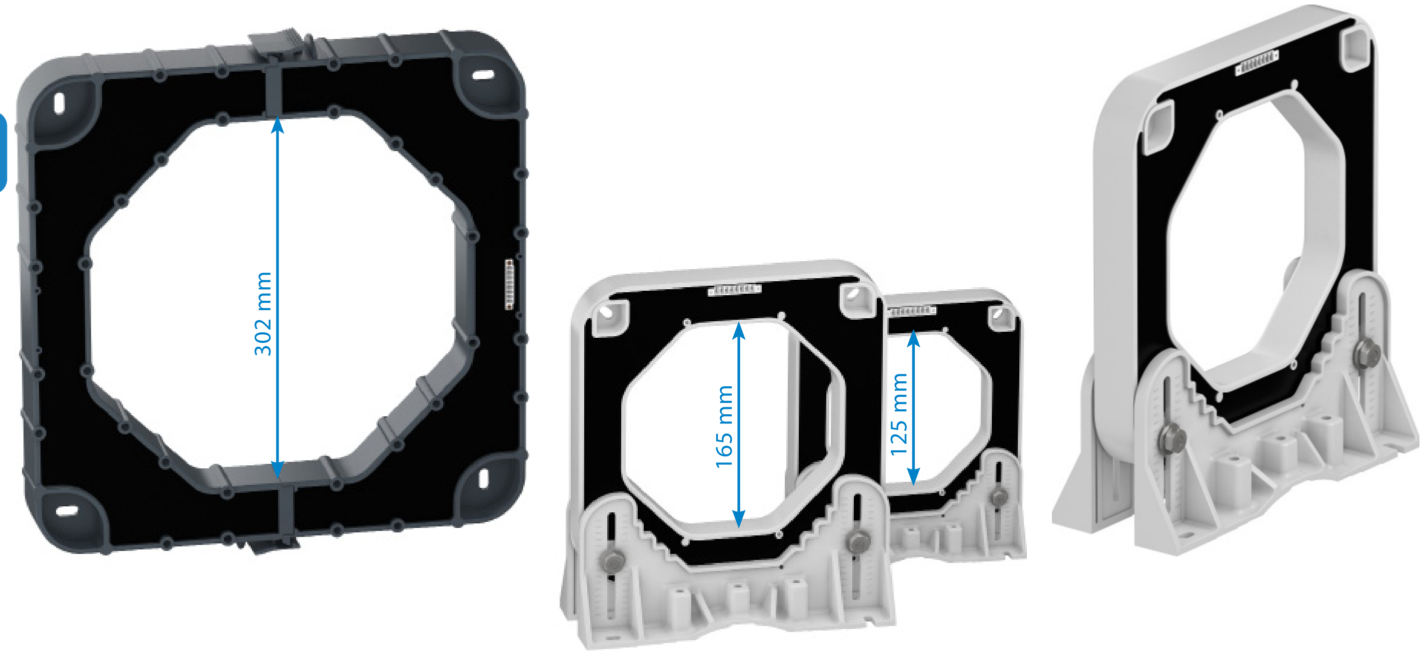

Phoenix contact type connector
(with 3.80 mm picth)



ES2000C / ES2000S /ES2000F
HRS2000-I / HRS2500-I

Industry current sensors NCS range

Electronic technology



100% electronic

The main advantage of the NCS range of sensors is that they are designed using a brand-new solution: 100% electronic technology. Unlike other currently available solutions such as shunts and CTs, this approach means that these sensors are very compact. Several patents were necessary to achieve this improvement.

Considerable energy savings

NCS sensors offer considerable savings in energy. Indeed only a few watts are required to power the NCS sensor in contrast to traditional sensors that require several hundred watts.
This reduction in wasted energy means there is no rise in temperature around the sensor.

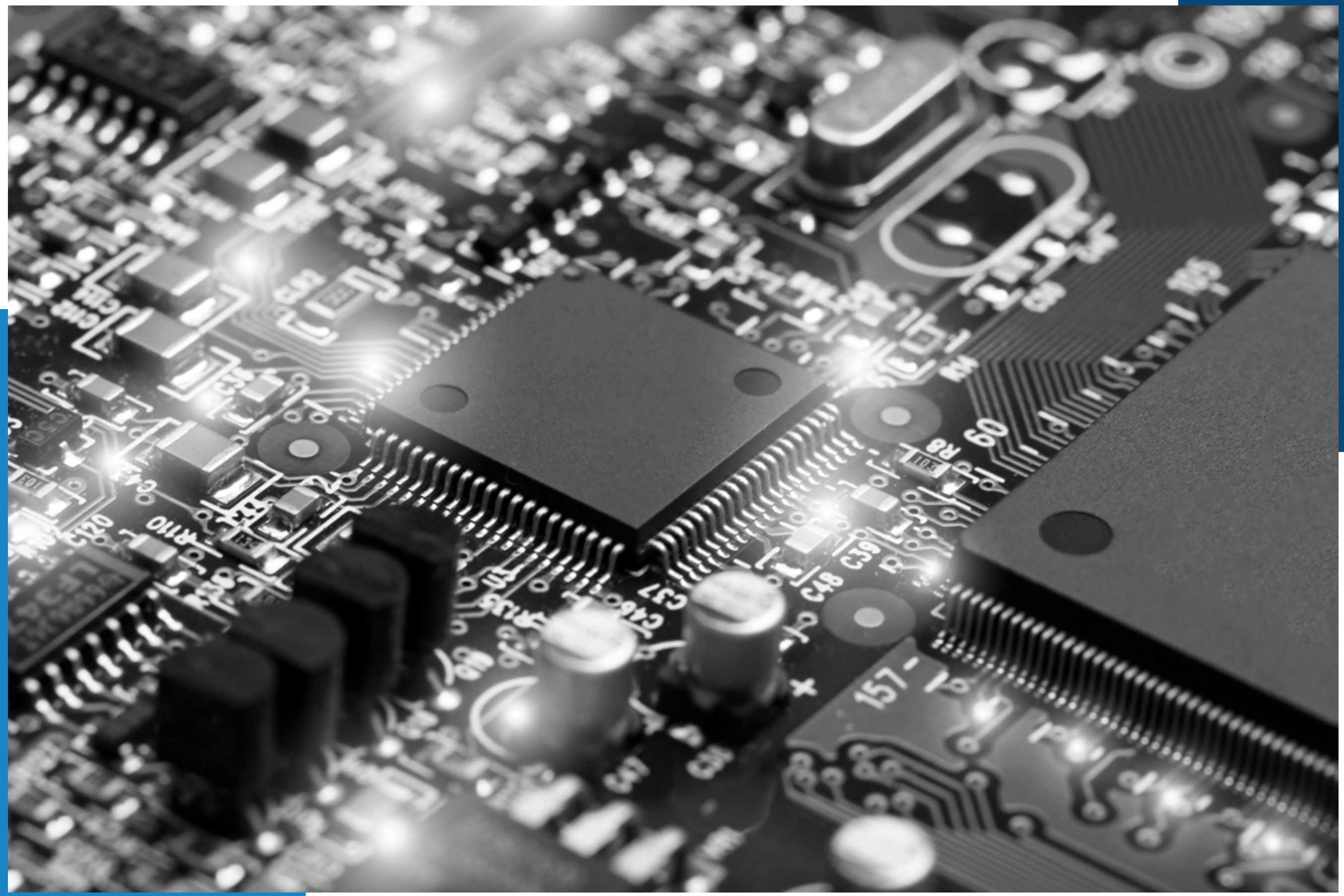
Quality that goes beyond standards

PETERCEM has been ISO 9001 certified for 25 years and our standard NCS sensors bear the CE label in Europe.
This ongoing striving after quality has always been the hallmark
of a company where excellence and safety are part of the culture, from design right through to production.
This culture is the result of continuous research to make technical progress and meet our customers' demands.

The chief selling-point of NCS sensors is their quality. Compliance of their high-tech electronic design with standard EN61010-1 is proof of their ability to comply with the most detailed constraint as well as major demands. The fact that each individual sensor is subjected to rigorous testing is proof of the
importance PETERCEM attribute to quality.

Environment-friendly

PETERCEM has long been concerned with the protection of the environment. This approach is particularly noticeable in the production of the NCS range in the reduction of the number of components, in the use of a low-energy manufacturing procedure and the use of recyclable packing. The products in use are also characterized by their reduced energy consumption.
Our NCS range is RoHS & REACH compliant.



Designed to be integrated into every situation

The NCS125/165 sensor is entirely symmetrical. Its square shape and strategically positioned oblong holes make it easy to fasten in a choice of 2 positions.
As an accessory it comes with a side plate that can be fastened on either side of the sensor giving complete fitting flexibility.
It can be fitted both horizontally and vertically.
This flexibility means that NCS125/165 sensor simplifies the work of integrators.
Additionally the pair of side plate allows the NCS125/165 sensor to be fitted to one or several bars at the same time.
The NCS305 sensor has been designed to reduce installationcosts for new and retrofit systems. Using our innovative and robust opening, the clip-on
system allows the NCS305 to be easily adapted to existing bus bars.
Thanks to its core free, patented technology, the NCS is more cost effective and faster to install than traditional Hall Effect sensor.
The NCS is a "flyweight" with only 5.5 kg (for the NCS305), this sensor offer the best rating/weight ratio.

The NCS meets all of your requirements

NCS125 ... NCS165 industry current sensors

4000 to 40000 A - Electronic technology

2

Frame mounting

These sensors are designed to be fixed by the case or by mounting brackets (page 36 to 39 for details).
They may be either vertically or horizontally mounted.
The secondary connection is made with a connector or cable.
For NCS sensors the primary conductor may be a cable, one or several bars.

NCS125-4 to NCS125-10

NCS125-4AF to NCS125-10AF
NCS125-4VF to NCS125-10VF

NCS165-4 to NCS165-20

NCS165-4AF to NCS165-20AF
NCS165-4VF to NCS165-20VF

Ordering details

Nominal primary current	Opening for the primary conductor	Secondary current I_{S1} at $\pm I_{PN}$	Secondary voltage V_{S1} at $\pm I_{PN}$	Supply voltage	Secondary connection	Type	Order code
A	mm	mA	V	V DC			
4000	125	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS125-4	1SBT200204R0001
4000	125	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS125-4AF	1SBT200204R0002
4000	125	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS125-4VF	1SBT200204R0102
4000	165	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS165-4	1SBT200604R0001
4000	165	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-4AF	1SBT200604R0002
4000	165	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-4VF	1SBT200604R0102
6000	125	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS125-6	1SBT200206R0001
6000	125	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS125-6AF	1SBT200206R0002
6000	125	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS125-6VF	1SBT200206R0102
6000	165	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS165-6	1SBT200606R0001
6000	165	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-6AF	1SBT200606R0002
6000	165	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-6VF	1SBT200606R0102
10000	125	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS125-10	1SBT200210R0001
10000	125	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS125-10AF	1SBT200210R0002
10000	125	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS125-10VF	1SBT200210R0102
10000	165	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS165-10	1SBT200610R0001
10000	165	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-10AF	1SBT200610R0002
10000	165	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-10VF	1SBT200610R0102
20000	165	±20	±10	±15 ... ±24	Straight connector 8 pin	NCS165-20	1SBT200620R0001
20000	165	±20	–	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-20AF	1SBT200620R0002
20000	165	–	±10	±15 ... ±24	Shielded cable 6 wires (2 m)	NCS165-20VF	1SBT200620R0102

NCS305 industry current sensors

6000 to 40000 A - Electronic technology

2

Frame mounting

These sensors are designed to be fixed by the case or by mounting brackets (page 40 for details).
They may be either vertically or horizontally mounted.
The secondary connection is made with a connector or cable.
For NCS sensors the primary conductor may be a cable, one or several bars.

NCS305-6 to NCS305-20

NCS305-6AF to NCS305-20AF
NCS305-6VF to NCS305-20VF

Ordering details

Nominal primary current	Opening for the primary conductor	Secondary current I_{S1} at $\pm I_{PN}$	Secondary voltage V_{S1} at $\pm I_{PN}$	Supply voltage	Secondary connection	Type	Order code
A	mm	mA	V	V DC			
6000	302	±20	±10	+15 ... +24 (±2%)	Straight connector 8 pin	NCS305-6	1SBT200306R0001
6000	302	±20	–	+15 ... +24 (±2%)	Shielded cable 6 wires (2 m)	NCS305-6AF	1SBT200306R0002
6000	302	–	±10	+15 ... +24 (±2%)	Shielded cable 6 wires (2 m)	NCS305-6VF	1SBT200306R0102
10000	302	±20	±10	+15 ... +24 (±2%)	Straight connector 8 pin	NCS305-10	1SBT200310R0001
10000	302	±20	–	+15 ... +24 (±2%)	Shielded cable 6 wires (2 m)	NCS305-10AF	1SBT200310R0002
10000	302	–	±10	+15 ... +24 (±2%)	Shielded cable 6 wires (2 m)	NCS305-10VF	1SBT200310R0102
20000	302	±20	±10	+15 ... +24 (±2%)	Straight connector 8 pin	NCS305-20	1SBT200320R0001
20000	302	±20	–	+15 ... +24 (±2%)	Shielded cable 6 wires (2 m)	NCS305-20AF	1SBT200320R0002
20000	302	–	±10	+15 ... +24 (±2%)	Shielded cable 6 wires (2 m)	NCS305-20VF	1SBT200320R0102

NCS125 industry current sensors

Technical data

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.

		ABB 8 pin connector	NCS125-4	–	–
		Output current shielded cable	–	NCS125-4AF	–
		Output voltage shielded cable	–	–	NCS125-4VF
Nominal primary current		A	4000	4000	4000
Measuring range		A	20000	20000	20000
Not measured overload	1 s/h	A peak	80000	80000	80000
Secondary current I_{S1} at I_{PN}		mA	±20	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤±250	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤±180	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤±4	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 ... 350	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤±1	≤±1	≤±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤±3	≤±3	≤±3
Gain thermal drift	-25 … +85 °C	%/°C	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 … -25 °C	%/°C	≤0.2	≤0.2	≤0.2
Linearity (typical)		%	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤3	≤3	≤3
di/dt correctly followed		A / µs	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤ 245	≤ 245	≤ 245
No load consumption current (I_{A0-})		mA	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	5	5	5
Supply voltage	± 2%	V DC	±15 … ±24	±15 … ±24	±15 … ±24
Mass		kg	1.1	1.4	1.4
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

General data

– Plastic case and insulating resin are self-extinguishing.

– Two fixing modes:

- Horizontal or vertical with fixing holes in the case moulding.
- By bar using the intermediate side plate kit (Refer to accessories and options on the following page).

– Max tightening torque for M6 screws (side plate mounting): 2 N.m

– **Direction of the current:**

- Output current (I_{S1} and I_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output current on terminals I_{S1} and I_{S2} .
- Output voltage (V_{S1} and V_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output voltage on terminals V_{S1} and V_{S2} .

– Burn-in test in accordance with FPTC 404304 cycle.

Primary connection

Hole for primary conductor.

The temperature of the primary conductor in contact with the case must not exceed 100 °C.

Secondary connection

– Male straight 8 pin connector (integrated in the sensor)

A female straight 8 pin connector is provided as standard with each product.

– Shielded cable 6 x 2000 mm (cross section 0.5 mm²).

NCS125 industry current sensors

Technical data

		ABB 8 pin connector	NCS125-6	–	–	NCS125-10	–	–
		Output current shielded cable	–	NCS125-6AF	–	–	NCS125-10AF	–
		Output voltage shielded cable	–	–	NCS125-6VF	–	–	NCS125-10VF
Nominal primary current		A	6000	6000	6000	10000	10000	10000
Measuring range		A	30000	30000	30000	30000	30000	30000
Not measured overload	1 s/h	A peak	120000	120000	120000	200000	200000	200000
Secondary current I_{S1} at I_{PN}		mA	±20	±20	–	±20	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	±20	–	±20	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤±250	≤±250	–	≤±250	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤±180	≤±180	–	≤±180	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤±4	≤±4	–	≤±4	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 ... 350	0 ... 350	–	0 ... 350	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V	±10	–	±10	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	±10	–	±10	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	≤±100	–	≤±100	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	≤±50	–	≤±50	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	≤±2	–	≤±2	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	10000 ... ∞	–	10000 ... ∞	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤±1	≤±1	≤±1	≤±1	≤±1	≤±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤±3	≤±3	≤±3	≤±3	≤±3	≤±3
Gain thermal drift	-25 … +85 °C	%/°C	≤0.03	≤0.03	≤0.03	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 … -25 °C	%/°C	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2
Linearity (typical)		%	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤3	≤3	≤3	≤3	≤3	≤3
di/dt correctly followed		A / µs	≤100	≤100	≤100	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz	0 … 10	0 … 10	0 … 10	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤ 245	≤245	≤245	≤245	≤245	≤245
No load consumption current (I_{A0-})		mA	≤35	≤35	≤35	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	5	5	5	5	5	5
Supply voltage	± 2%	V DC	±15 … ±24	±15 … ±24	±15 … ±24	±15 … ±24	±15 … ±24	±15 … ±24
Mass		kg	1.1	1.4	1.4	1.1	1.4	1.4
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

Accessories and options

PETERCEM female straight 8 pin connector

PETERCEM order code: **1SBT200000R2003** including 10 lockable connectors

Side plates (or right angle brackets)

For installation of the side plates, please refer to the mounting instructions ref. **1SBC146005M1701-1** (NCS125) or the mounting instructions ref. **1SBC146004M1701-1** (NCS165)

Side plate kit NCS125:

PETERCEM order code: **1SBT200000R2002**

Conformity

EN 61010-1

EN 61000-6-2, EN 61000-6-4

CE

RoHS

NCS165 industry current sensors

Technical data

2

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.

		8 pin connector	NCS165-4	–	–	NCS165-6	–	–
		Output current shielded cable	–	NCS165-4AF	–	–	NCS165-6AF	–
		Output voltage shielded cable	–	–	NCS165-4VF	–	–	NCS165-6VF
Nominal primary current		A	4000	4000	4000	6000	6000	6000
Measuring range		A	20000	20000	20000	30000	30000	30000
Not measured overload	1 s/h	A peak	80000	80000	80000	120000	120000	120000
Secondary current I_{S1} at I_{PN}		mA	±20	±20	–	±20	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	±20	–	±20	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤±250	≤±250	–	≤±250	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤±180	≤±180	–	≤±180	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤±4	≤±4	–	≤±4	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 ... 350	0 ... 350	–	0 ... 350	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V	±10	–	±10	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	±10	–	±10	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	≤±100	–	≤±100	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	≤±50	–	≤±50	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	≤±2	–	≤±2	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	10000 ... ∞	–	10000 ... ∞	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤±1	≤±1	≤±1	≤±1	≤±1	≤±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤±3	≤±3	≤±3	≤±3	≤±3	≤±3
Gain thermal drift	-25 ... +85 °C	%/°C	≤0.03	≤0.03	≤0.03	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 ... -25 °C	%/°C	≤0.1	≤0.1	≤0.1	≤0.1	≤0.1	≤0.1
Linearity (typical)		%	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤3	≤3	≤3	≤3	≤3	≤3
di/dt correctly followed		A / µs	≤100	≤100	≤100	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz	0 ... 10	0 ... 10	0 ... 10	0 ... 10	0 ... 10	0 ... 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤210	≤210	≤210	≤210	≤210	≤210
No load consumption current (I_{A0-})		mA	≤35	≤35	≤35	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	5	5	5	5	5	5
Supply voltage	± 2%	V DC	±15 ... ±24	±15 ... ±24	±15 ... ±24	±15 ... ±24	±15 ... ±24	±15 ... ±24
Mass		kg	1.4	1.7	1.7	1.4	1.7	1.7
Operating temperature		°C	-40 ... +85	-40 ... +85	-40 ... +85	-40 ... +85	-40 ... +85	-40 ... +85
Storage/startup temperature		°C	-50 ... +90	-50 ... +90	-50 ... +90	-50 ... +90	-50 ... +90	-50 ... +90

(1) Maximum current I generated: 5000 A r.m.s.

General data

– Plastic case and insulating resin are self-extinguishing

– Two fixing modes:

- Horizontal or vertical with fixing holes in the case moulding.
- By bar using the intermediate side plate kit (Refer to Accessories and options on the following page).

– Max tightening torque for M6 screws (side plate mounting): 2 N.m

– **Direction of the current:**

- Output current (I_{S1} and I_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output current on terminals I_{S1} and I_{S2}.
- Output voltage (V_{S1} and V_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output voltage on terminals V_{S1} and V_{S2}.

– Burn-in test in accordance with FPTC 404304 cycle

Primary connection

Hole for primary conductor.

The temperature of the primary conductor in contact with the case

must not exceed 100 °C.

Secondary connection

– Male straight 8 pin connector (integrated in the sensor)

A female straight 8 pin connector is provided as standard with each

product

– Shielded cable 6 x 2000 mm (cross section 0.5 mm²).

NCS165 industry current sensors

Technical data

2

		8 pin connector	NCS165-10	–	–	NCS165-20	–	–
		Output current shielded cable	–	NCS165-10AF	–	–	NCS165-20AF	–
		Output voltage shielded cable	–	–	NCS165-10VF	–	–	NCS165-20VF
Nominal primary current		A	10000	10000	10000	20000	20000	20000
Measuring range		A	30000	30000	30000	40000	40000	40000
Not measured overload	1 s/h	A peak	200000	200000	200000	200000	200000	200000
Secondary current I_{S1} at I_{PN}		mA	±20	±20	–	±20	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	±20	–	±20	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤±250	≤±250	–	≤±250	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤±180	≤±180	–	≤±180	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤±4	≤±4	–	≤±4	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 ... 350	0 ... 350	–	0 ... 350	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V	±10	–	±10	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	±10	–	±10	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	≤±100	–	≤±100	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	≤±50	–	≤±50	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	≤±2	–	≤±2	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	10000 ... ∞	–	10000 ... ∞	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤±1	≤±1	≤±1	≤±1	≤±1	≤±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤±3	≤±3	≤±3	≤±3	≤±3	≤±3
Gain thermal drift	-25 ... +85 °C	%/°C	≤0.03	≤0.03	≤0.03	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 ... -25 °C	%/°C	≤0.1	≤0.1	≤0.1	≤0.1	≤0.1	≤0.1
Linearity (typical)		%	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤3	≤3	≤3	≤3	≤3	≤3
di/dt correctly followed		A / µs	≤100	≤100	≤100	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz	0 ... 10	0 ... 10	0 ... 10	0 ... 10	0 ... 10	0 ... 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤210	≤210	≤210	≤210	≤210	≤210
No load consumption current (I_{A0-})		mA	≤35	≤35	≤35	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	5	5	5	5	5	5
Supply voltage	± 2%	V DC	±15 ... ±24	±15 ... ±24	±15 ... ±24	±15 ... ±24	±15 ... ±24	±15 ... ±24
Mass		kg	1.4	1.7	1.7	1.4	1.7	1.7
Operating temperature		°C	-40 ... +85	-40 ... +85	-40 ... +85	-40 ... +85	-40 ... +85	-40 ... +85
Storage/startup temperature		°C	-50 ... +90	-50 ... +90	-50 ... +90	-50 ... +90	-50 ... +90	-50 ... +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

Accessories and options

PETERCEM female straight 8 pin connector

PETERCEM order code : **1SBT200000R2003** includes 10 lockable connectors

Side plates (or right angle brackets)

For installation of the side plates, please refer to the mounting instructions ref. **1SBC146004M1701-1**

Side plate kit NCS165:

PETERCEM order code: **1SBT200000R2001**

Conformity

EN 61010-1

EN 61000-6-2, EN 61000-6-4

CE

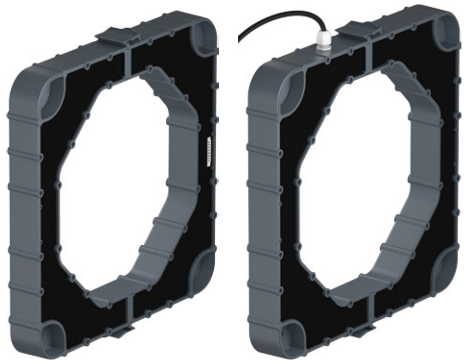
RoHS

NCS305 industry current sensors

Technical data

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.



		8 pin connector	NCS305-6	–	–	NCS305-10
		Output current shielded cable	–	NCS305-6AF	–	–
		Output voltage shielded cable	–	–	NCS305-6VF	–
Nominal primary current		A	6000	6000	6000	10000
Measuring range		A	20000	20000	20000	30000
Not measured overload	1 s/h	A peak	80000	80000	80000	120000
Secondary current I_{S1} at I_{PN}		mA	±20	±20	–	±20
Secondary current I_{S2} at I_{PMAX}		mA	±20	±20	–	±20
Residual current $I_{S1}0$	@ +25 °C	µA	≤ ±250	≤ ±250	–	≤ ±250
Residual current $I_{S2}0$	@ +25 °C	µA	≤ ±180	≤ ±180	–	≤ ±180
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤ ±4	≤ ±4	–	≤ ±4
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 … 350	0 … 350	–	0 … 350
Secondary voltage V_{S1} at I_{PN}		V	±10	–	±10	±10
Secondary voltage V_{S2} at I_{PMAX}		V	±10	–	±10	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	≤ ±100	–	≤ ±100	≤ ±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	≤ ±50	–	≤ ±50	≤ ±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	≤ ±2	–	≤ ±2	≤ ±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	10000 … ∞	–	10000 … ∞	10000 … ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤ ±1	≤ ±1	≤ ±1	≤ ±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤ ±3	≤ ±3	≤ ±3	≤ ±3
Gain thermal drift	-20 … +85 °C	%/°C	≤ ±0.01	≤ ±0.01	≤ ±0.01	≤ ±0.01
Gain thermal drift	-40 … -20 °C	%/°C	≤ ±0.04	≤ ±0.04	≤ ±0.04	≤ ±0.04
Linearity (typical)		%	±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤ 10	≤ 10	≤ 10	≤ 10
di/dt correctly followed		A / µs	≤ 100	≤ 100	≤ 100	≤ 100
Bandwidth	@ -1 dB	kHz	0 … 10	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤ 400	≤ 400	≤ 400	≤ 400
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	5	5	5	5
Supply voltage	± 2%	V DC	+15 … +24	+15 … +24	+15 … +24	+15 … +24
Mass		kg	5.5	5.8	5.8	5.5
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

General data

– Plastic case and insulating resin are self-extinguishing.
– Clip on mounting mode
– Two fixing modes:
– Horizontal with fixing holes in the case moulding.
– By bar using the intermediate side plate kit (Refer to accessories and options on the following page).
– M ax tightening torque for M6.3 screws (side plate mounting): 4.5 N.m
– Direction of the current:
  - Output current (IS1 and IS2): A primary current flowing in the direction of the arrow results in a positive secondary output current on terminals IS1 and IS2.
  - Output voltage (VS1 and VS2): A primary current flowing in the direction of the arrow results in a positive secondary output voltage on terminals VS1 and VS2.
– Burn-in test in accordance with FPTC 404304 cycle.

Primary connection

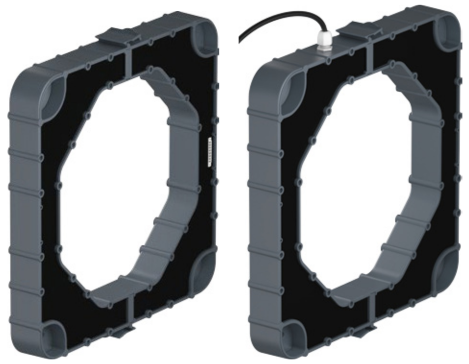
Hole for primary conductor.
The temperature of the primary conductor in contact with the case must not exceed 100 °C.

Secondary connection

– Male straight 8 pin connector (integrated in the sensor)
A female straight 8 pin connector is provided as standard with each product.
– Shielded cable 6 x 2000 mm (cross section 0.5 mm²).

NCS305 industry current sensors

Technical data



		8 pin connector	–	–	NCS305-20	–	–
		Output current shielded cable	NCS305-10AF	–	–	NCS305-20AF	–
		Output voltage shielded cable	–	NCS305-10VF	–	–	NCS305-20VF
Nominal primary current		A	10000	10000	20000	20000	20000
Measuring range		A	30000	30000	40000	40000	40000
Not measured overload	1 s/h	A peak	120000	120000	200000	200000	200000
Secondary current I_{S1} at I_{PN}		mA	±20	–	±20	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	–	±20	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤ ±250	–	≤ ±250	≤ ±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤ ±180	–	≤ ±180	≤ ±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤ ±4	–	≤ ±4	≤ ±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 … 350	–	0 … 350	0 … 350	–
Secondary voltage V_{S1} at I_{PN}		V	–	±10	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	–	±10	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	–	≤ ±100	≤ ±100	–	≤ ±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	–	≤ ±50	≤ ±50	–	≤ ±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	–	≤ ±2	≤ ±2	–	≤ ±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	–	10000 … ∞	10000 … ∞	–	10000 … ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤ ±1	≤ ±1	≤ ±1	≤ ±1	≤ ±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤ ±3	≤ ±3	≤ ±3	≤ ±3	≤ ±3
Gain thermal drift	-20 … +85 °C	%/°C	≤ ±0.01	≤ ±0.01	≤ ±0.01	≤ ±0.01	≤ ±0.01
Gain thermal drift	-40 … -20 °C	%/°C	≤ ±0.04	≤ ±0.04	≤ ±0.04	≤ ±0.04	≤ ±0.04
Linearity (typical)		%	±0.5	±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10
di/dt correctly followed		A / µs	≤ 100	≤ 100	≤ 100	≤ 100	≤ 100
Bandwidth	@ -1 dB	kHz	0 … 10	0 … 10	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤ 400	≤ 400	≤ 400	≤ 400	≤ 400
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	5	5	5	5	5
Supply voltage	± 2%	V DC	+15 … +24	+15 … +24	+15 … +24	+15 … +24	+15 … +24
Mass		kg	5.8	5.8	5.5	5.8	5.8
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

Accessories and options

PETERCEM female straight 8 pin connector
PETERCEM order code: **1SBT200000R2003** including 10 lockable connectors

Side plates
For installation of the side plates, please refer to the mounting instructions ref. **1SBC146011M1701**

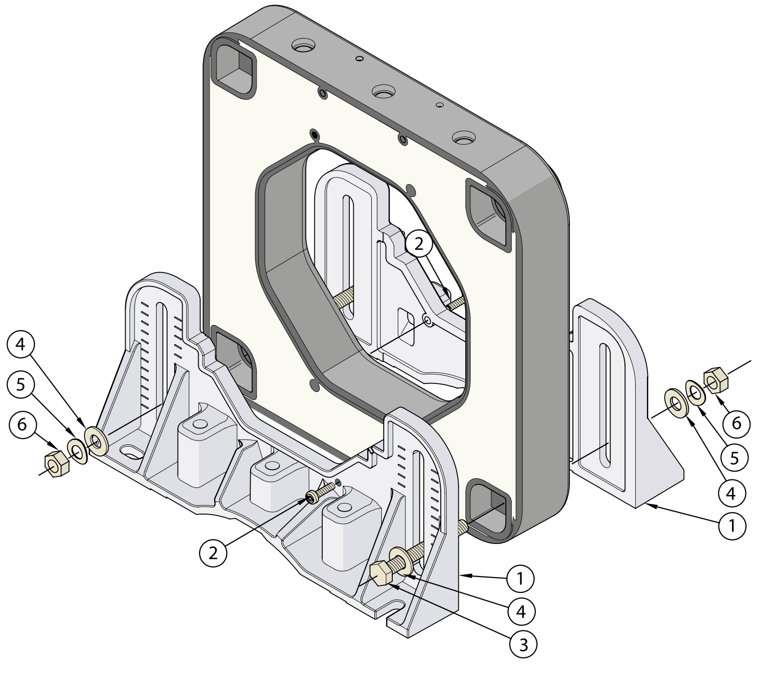
Side plate kit NCS305:
PETERCEM order code: **1SBT200000R2005**

Conformity

EN 61010-1
EN 61000-6-2, EN 61000-6-4

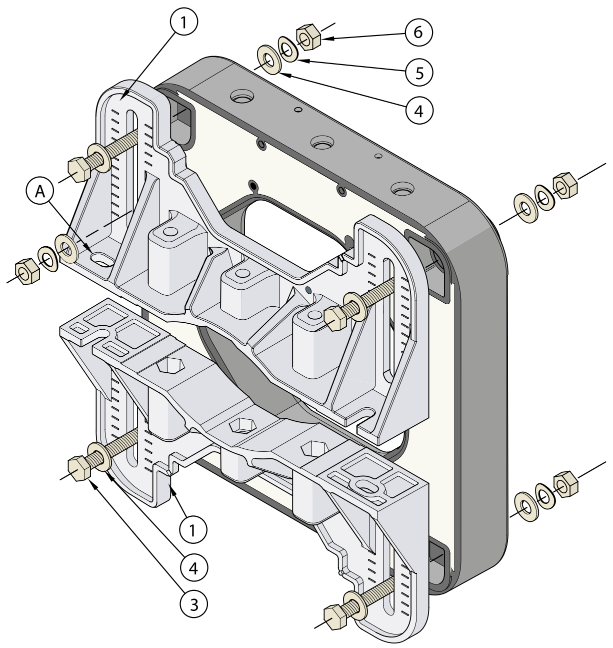
RoHS

Right angle brackets mounting on NCS125 sensors



- 1 - Side plate: x2
- 2 - Standard positioning screw: x2 (3x12)
- 3 - Side plate screw M6: x2 (6x50)
- 4 - Flat washer: x4
- 5 - Spring washer: x2
- 6 - Locknut: x2
- 7 - Not used:
  - Side plate screw M6: x4 (6x30)
  - Flat washer: x4
  - Spring washer: x2
  - Locknut: x2

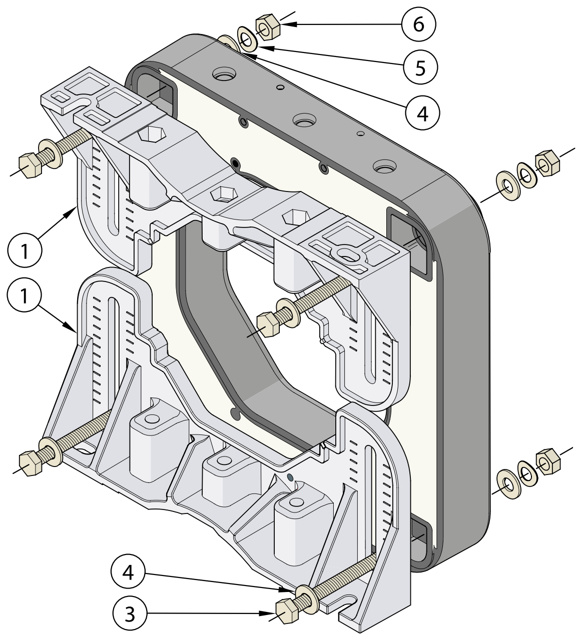
Right angle brackets mounting on NCS125 sensors



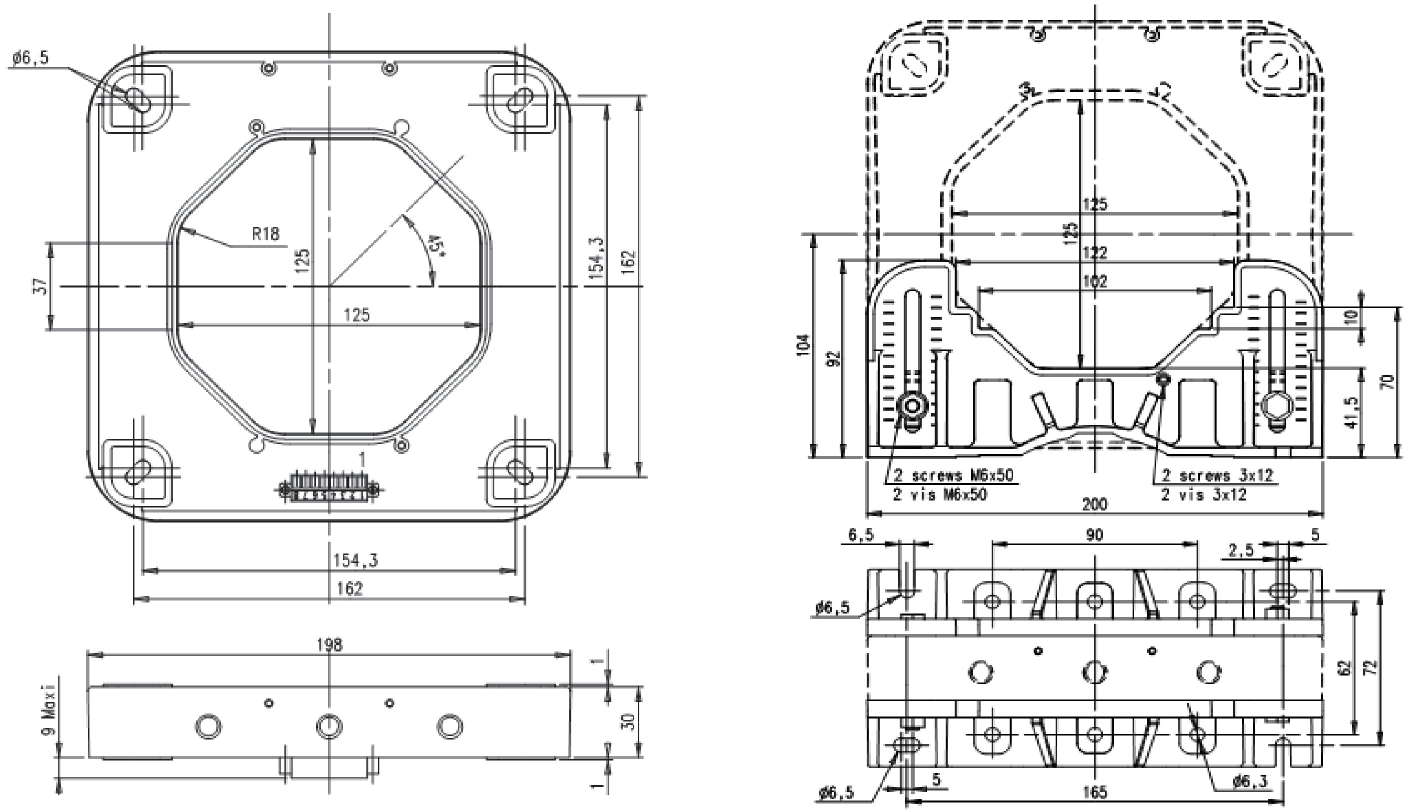
- 1 - Side plate: x2
- 3 - Side plate screw M6: x4 (6x30)
- 4 - Flat washer: x8
- 5 - Spring washer: x4
- 6 - Locknut: x4
- 7 - Not used:
  - Side plate screw M6: x2 (6x50)
  - Standard positioning screw: x2 (3x12)

A - The screws for clamping the side plates to the bar (or cable) are not supplied

Right angle brackets mounting on NCS125 sensors



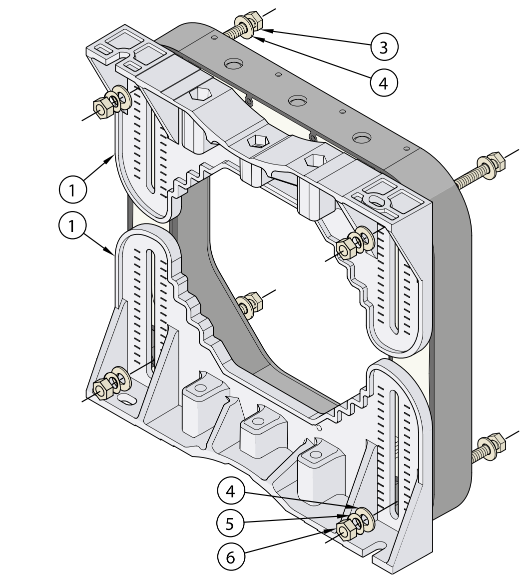
- 1 - Side plate: x2
- 3 - Side plate screw M6: x2 (6x30)
- 4 - Flat washer: x8
- 5 - Spring washer: x4
- 6 - Locknut: x4
- 7 - Not used:
  - Side plate screw M6: x4 (6x30)



NCS165 industry current sensors

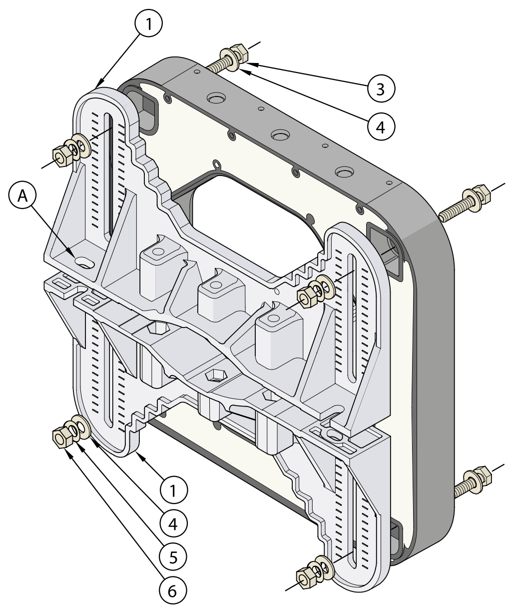
Right angle brackets mounting on NCS165 sensors

2



1 -	Side plate: x2
3 -	Side plate screw M6: x4 (6x30)
4 -	Flat washer: x8
5 -	Spring washer: x4
6 -	Locknut: x4
7 -	Not used: • Side plate screw M6: x2 (6x30) • Standard positioning screw: x2 (3x12)

Right angle brackets mounting on NCS165 sensors

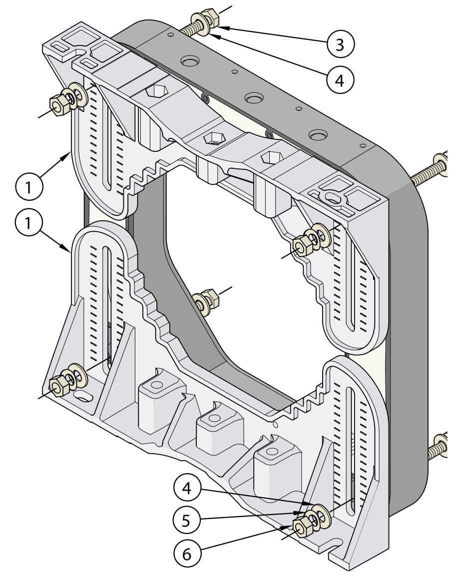


1 -	Side plate: x2
3 -	Side plate screw M6: x4 (6x30)
4 -	Flat washer: x8
5 -	Spring washer: x4
6 -	Locknut: x4
7 -	Not used: • Side plate screw M6: x2 (6x50) • Standard positioning screw: x2 (3x12)

A - The screws for clamping the side plates to the bar (or cable) are not supplied

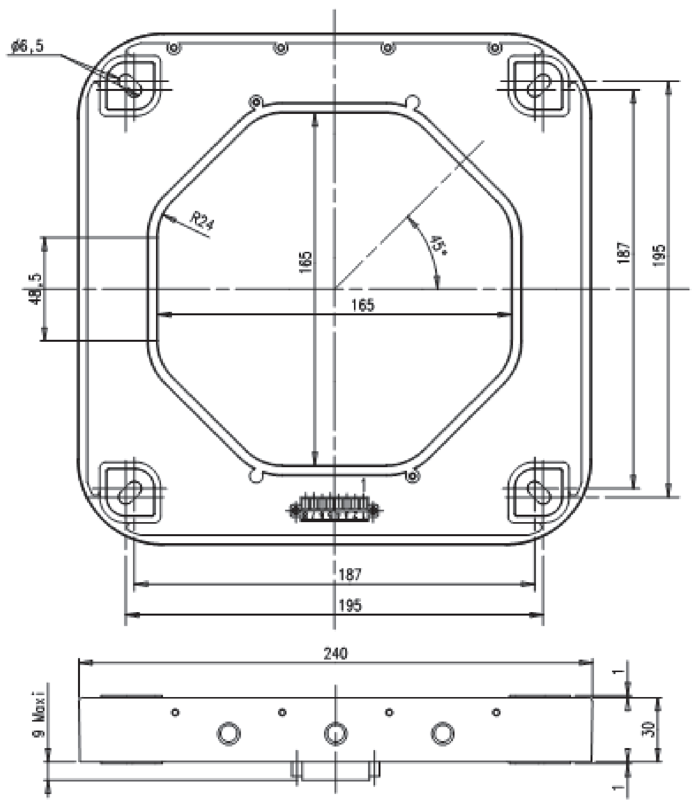
NCS165 industry current sensors

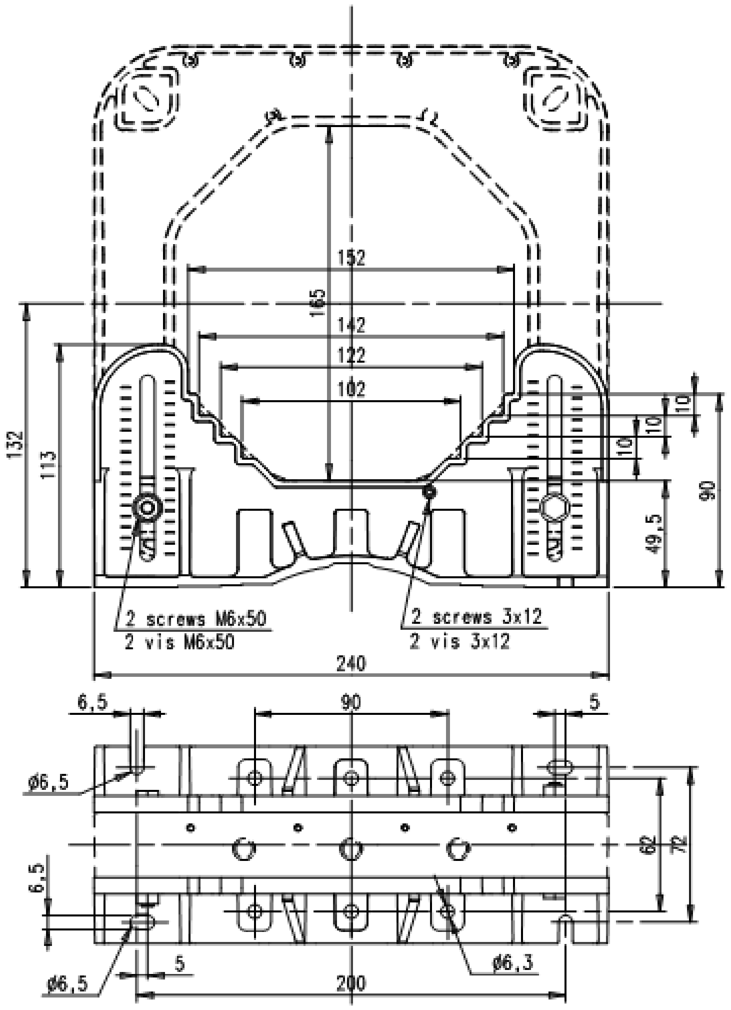
Right angle brackets mounting on NCS165 sensors



1 -	Side plate: x2
3 -	Side plate screw M6: x4 (6x30)
4 -	Flat washer: x8
5 -	Spring washer: x4
6 -	Locknut: x4
7 -	Not used: • Side plate screw M6: x2 (6x30) • Standard positioning screw: x2 (3x12)

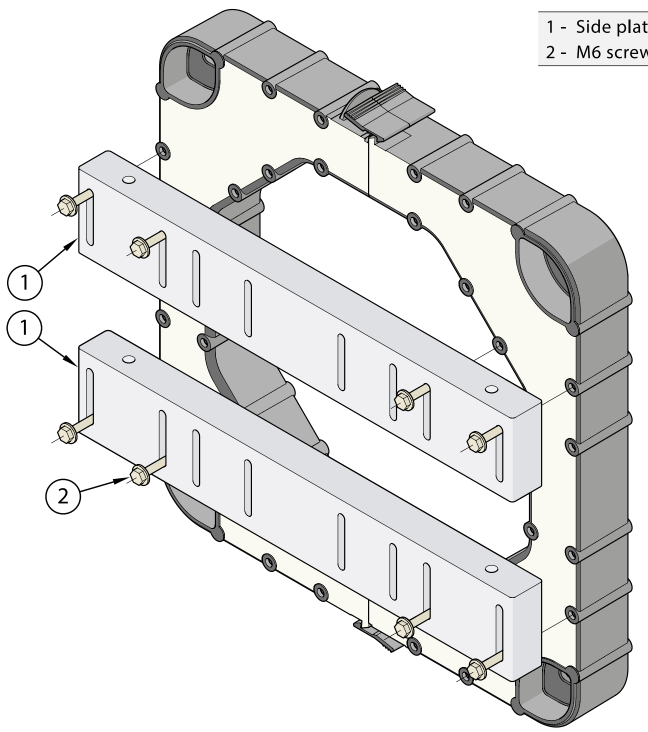
2



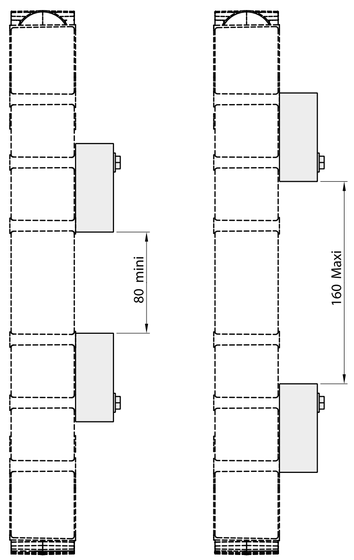


NCS305 industry current sensors

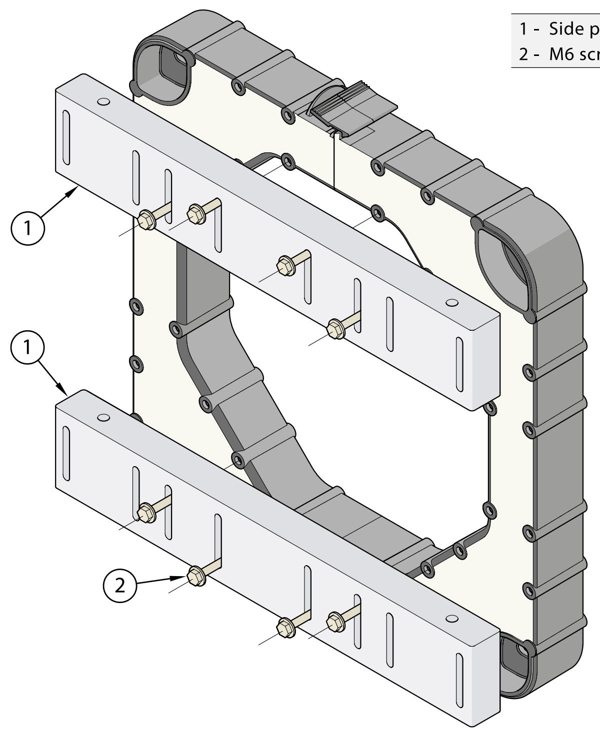
Side plate mounting on NCS305 sensors



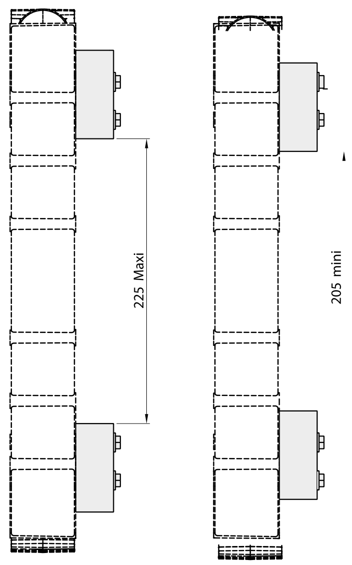
1 - Side plate: x2
2 - M6 screw: x8 (6.3x50)



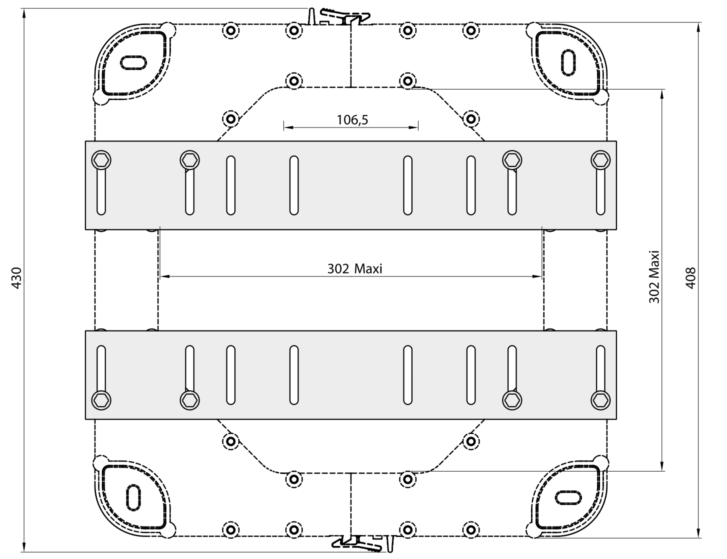
Side plate mounting on NCS305 sensors

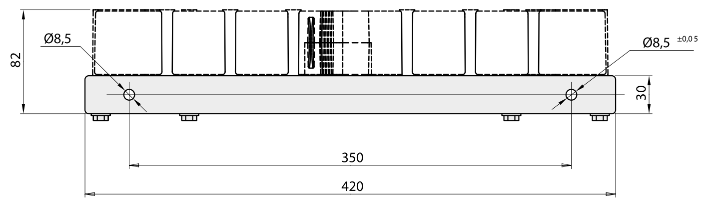


1 - Side plate: x2
2 - M6 screw: x8 (6.3x50)



Side plate mounting on NCS305 sensors

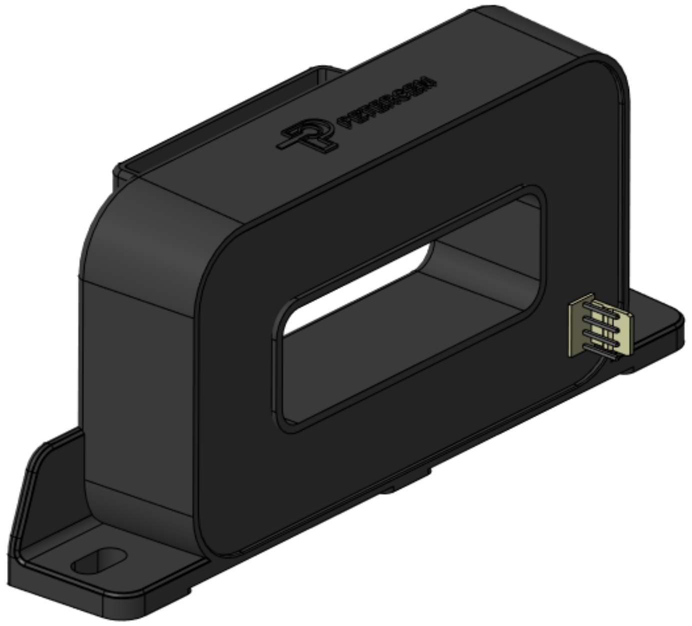




Overview

A modern and efficient current sensor to measure AC, DC and pulsating currents with a galvanic insulation between primary and secondary circuits, able to measure currents from 10A to 3000A.

2



KEY FEATURES

-Rectangular design, to facilitate integration with busbars
-Compact dimensions to save up to 30% of space and reduce overall dimensions of the equipment
-A wide measurement range, up to 3 times nominal current value
- High level of accuracy
-Good behavior on presence of magnetic disturbances

APPLICATIONS

Industrial
- Uninterruptible Power Supplies (UPS)
-Power supplies for welding applications
- Converter for DC drives
- AC variable speed drives
- Servo motor drives
-Windmill inverters
- Solar farm inverters
- Battery chargers
- Energy Storage System (ESS)

RFCS 1000

Technical data

2

Electrical details

Parameter	Unit	Value
Primary nominal current (AC and DC)	A	-1000/+1000
Measuring range (AC and DC)	A	-3000/+3000
Not measurable overload (10ms/h)	A	30 000
No load consumption current	mA	≤ 22
Supply voltage (+/- 5%)	V	+/- 15
Output voltage (@nominal current) *	V	+/- 4
Frequency bandwidth	kHz	0-25
Internal resistance	Ω	100

*Value given with measuring resistance = 10k Ω and ambient temperature = 25°C

Performances

Parameter	Unit	Value
Overall accuracy @ nominal current (cf graph 1)	%	≤ 0.5
Linearity	%	≤ 0.1
Offset value	mV	≤ 10
Temperature drift coefficient	mV/K	≤ 1
Response time	µs	≤ 3
di/dt correctly followed	A/µs	50
Frequency bandwidth	kHz	0-25
Error generated by magnetic disturbances	%	< 1

General specs

Parameter	Unit	Value
Storage temperature	°C	-25/+85
Operating temperature	°C	-25/+85
Pollution degree		2
Overvoltage category		3
Mass	g	480g

RFCS 1000

Technical data

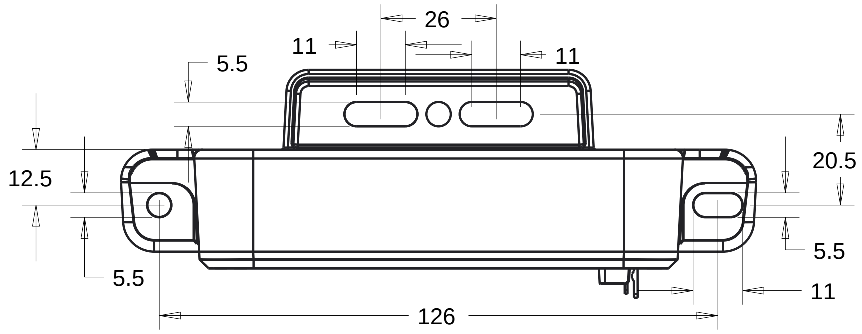
Insulation

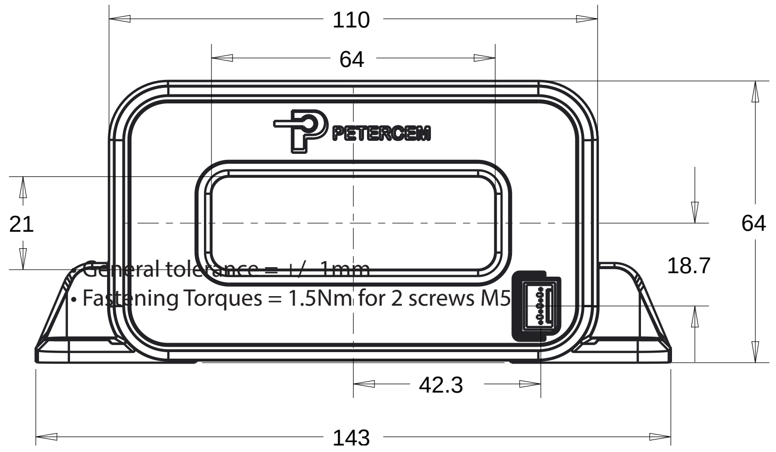
Parameter	Unit	Value
Dielectric test	kV	5.2 *50Hz, 1min*
Impulse test	kV	8.3 *50HZ, 1min*
Overvoltage category		3
Comparative Tracking Index (CTI)		600
Insulation resistance	MΩ	200
Insulation voltage, basic insulation	V	600
Insulation voltage, reinforced insulation	V	600
Clearance distance (connector to through opening)	mm	16
Creepage distance (connector to through opening	mm	20,2

Standards

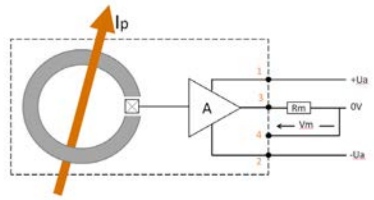
Parameter		Reference
UL		UL508
CE Low voltage directive EMC directive Product standard (industrial)		 2014/30/UE 2014/35/UE EN 61010-1
RoHS		Directive 2011/65/UE
REACH		Reglement 1907/2006
Conflict mineral		Dodd Franck Act 1502
UL		UL508
CE Low voltage directive EMC directive Product standard (industrial)		 2014/30/UE 2014/35/UE EN 61010-1
RoHS		Directive 2011/65/UE
REACH		Reglement 1907/2006

Dimensions

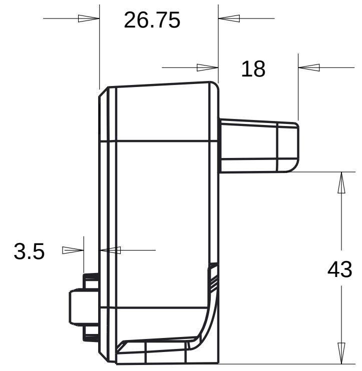




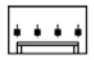
CONNECTION



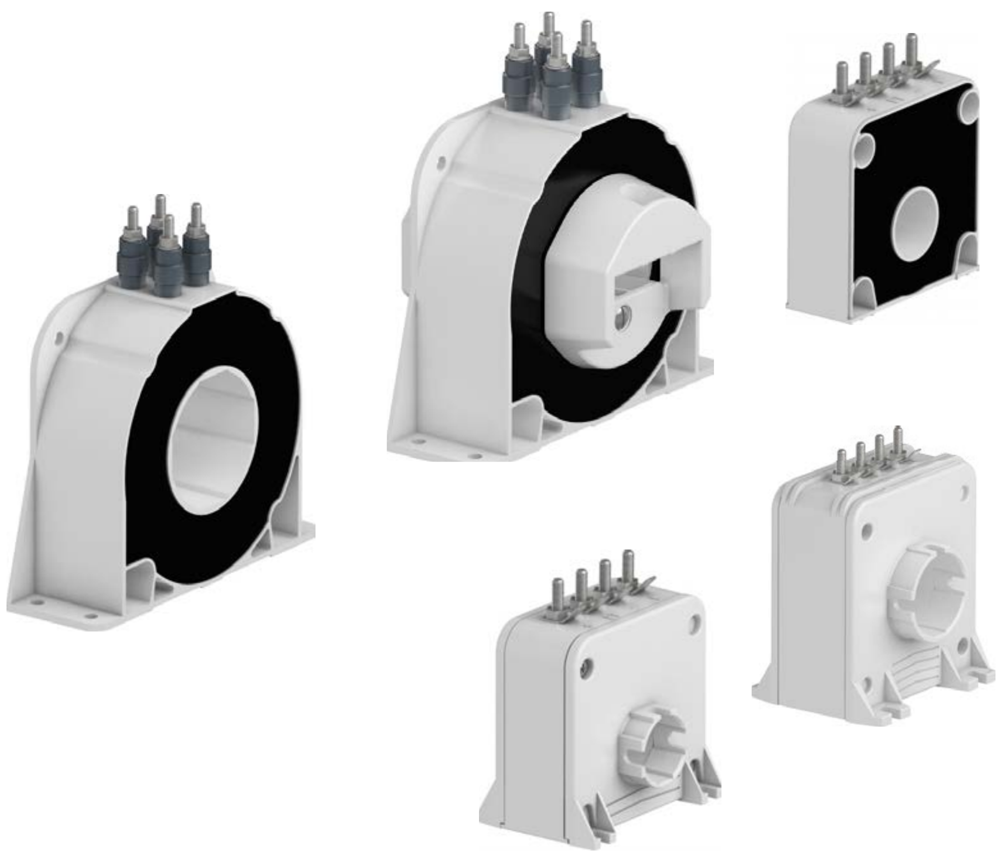
CONNECTOR
Molex réf. 5045-04/A



TERMINAL
MARKING



03.RAILWAY APPLICATION



3

Railway current sensors

Closed loop technology for rolling stock and infrastructure

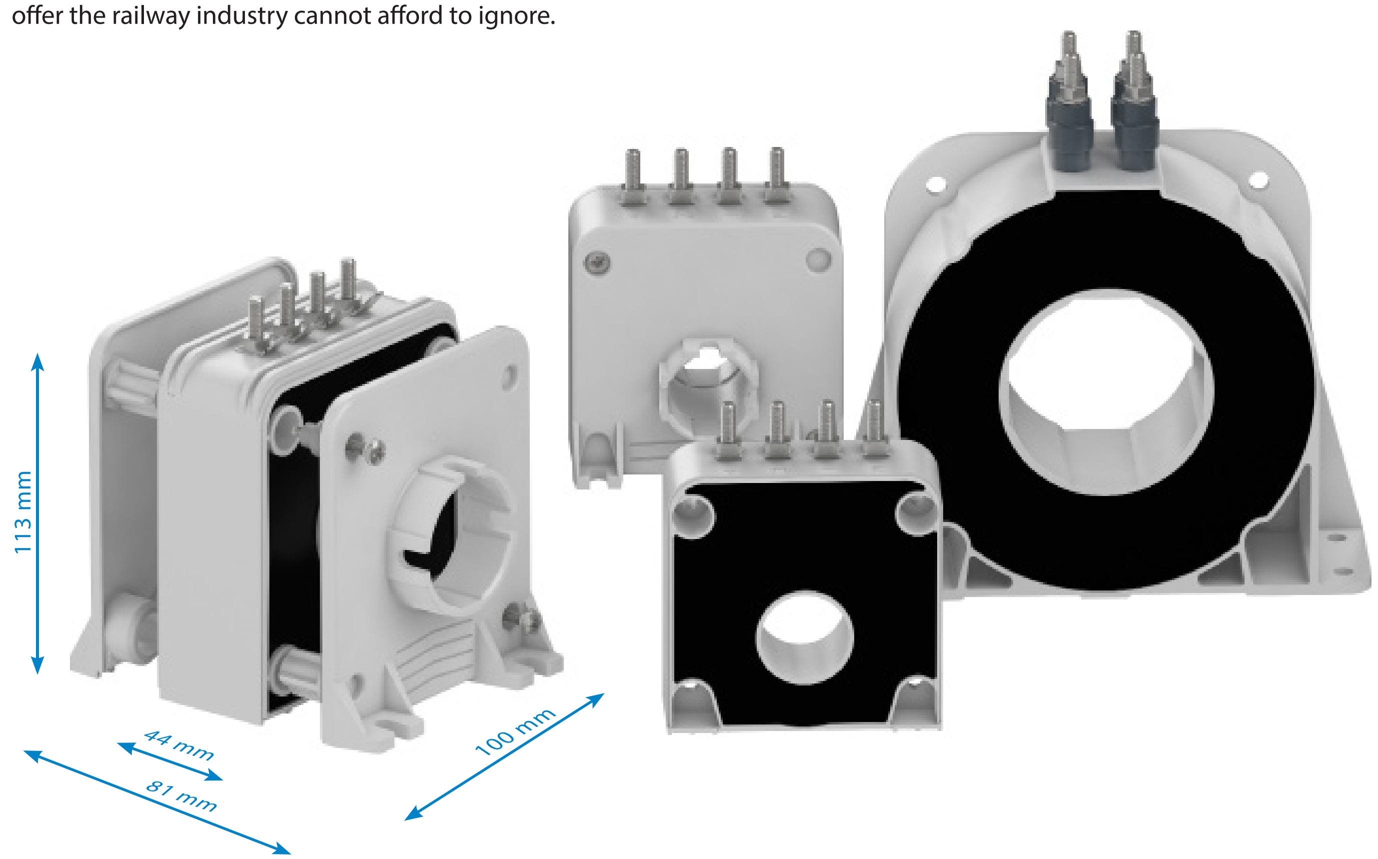
Incomparable modularity

Railway current sensors come with a complete range of options and
accessories and a wealth of preset variants that have now become standard. As well as being renowned for their incomparable modularity, they give their users the edge because
they are compact and easy to fit. They also offer a number of connection options, their simplicity and performance characteristics are unrivalled as are their magnetic immunity and mechanical resistance. They meet all the exacting demands of sectors as varied as railways, the mining industry and control in difficult environments such as ozone generators. CS/HRS-T current sensors and VS voltage sensors together constitute an offer the railway industry cannot afford to ignore.

You simply can't get any smaller!

PETERCEM current sensors contain everything needed to do the job – you don't need anything else. By integrating the philosophy of reduced size into its CS and HRS-T range, PETERCEM have brought miniaturization to a point of perfection. This miniaturization also gives great flexibility of installation as well as the best size and performance for money on the market. Small really is beautiful.

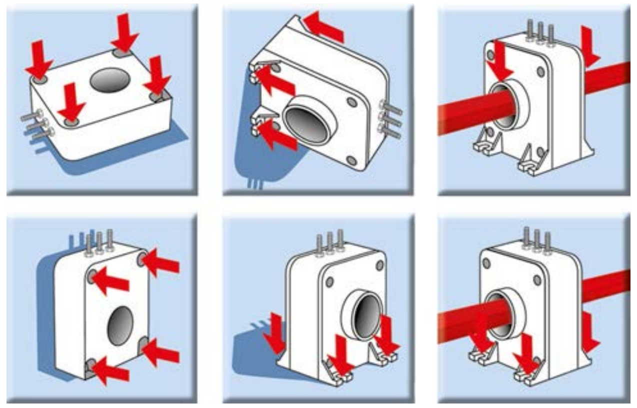
3



The efficient way

Once again PETERCEM have shown that they put all their know-how and talent for innovation into improving efficiency. Whether fitted horizontally or vertically, PETERCEM sensors fit perfectly into your system configurations and the space available. Installation is no longer a problem; in fact inserting sensors is child's play. This choice of fittings is a first in the sensors market. This ability to stay a length ahead makes PETERCEM stand out from their competitors.

The best way up is the way you want



Unbeatable lifetime

Designed using the 6 sigma approach, the PETERCEM's railway current sensor range is a model of reliability. The choice and number of optimized components, traceability of subassemblies, individually production tests… nothing is left to chance to guarantee your peace of mind.

Perfect efficiency in every environment

Both CS and HRS-T have been designed for applications in difficult environments such as on-board railway equipment (power converters, auxiliary converters for heating, ventilation and air conditioning) and the mining industry. Their robust design and excellent performances (e.g. operating range between –40° and +85 °C) make them ideal for use in other very demanding applications (marine, wind-power, ozone generators, etc.).

Quality that goes beyond standards

Our product line has been ISO 9001 certified for more than 25 years and our sensors bear the CE label. This ongoing striving after quality has always been the hallmark of a company where excellence and safety are part of the culture, from design right through to production.
This culture is the result of continuous research to make technical progress and meet our customers' demands.
The chief selling-point of CS and HRS-T sensors is their quality. Compliance with EN 50121-X for electromagnetic disturbance and EN 50155 for their high-tech electronic design is proof of their ability to comply with the most detailed constraints as well as major demands. The fact that each individual sensor is subjected to rigorous testing such as sensor burn-in is proof of the importance PETERCEM attribute to quality.

They meet the various security standards in force such as EN 50124-1 for electrical insulation and NFF 16101-NFF 16102 & EN 45 455 for fire-smoke resistance.

Incomparable protection against magnetic fields

These sensors are conceived, designed and renowned for their unrivalled immunity to ambient magnetic fields. Although they are in continuous proximity of powerful currents capable of distorting their measurements, this does not, in fact, occur.
Their accuracy is rock-solid and once set to measure a particular current, that is what they measure – that and nothing else.

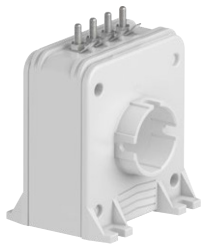
Environment-friendly

PETERCEM have long been concerned with the protection of the environment. This environmental approach is particularly noticeable in production of the CS range in the reduction of the number of components, in the use of a low-energy manufacturing procedure and the use of recyclable packing. The products in use are also characterized by their reduced energy consumption.

HRS1000-T ... HRS2500-T railway current sensors

Closed loop technology for rolling stock and infrastructure 1000 to 2500 A

3



HRS1000-T-014

HRS1500-T-004

HRS2000-T-004

HRS2500-T-014

Ordering details

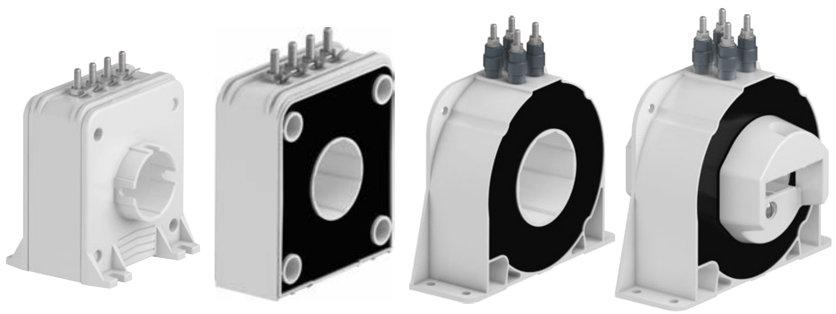
Nominal primary Current	Secondary current at IPN	Supply voltage	Secondary connection	Type
A r.m.s	mA	VDC		
1000	200	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1000-T-003
1000	200	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1000-T-013
1000	200	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1000-T-004
1000	200	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1000-T-014
1000	200	± 15...± 24V	Minifit Jr 4 pins	HRS1000-T-005
1500	300	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1500-T-003
1500	300	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1500-T-013
1500	300	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1500-T-004
1500	300	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS1500-T-014
1500	300	± 15...± 24V	Minifit Jr 4 pins	HRS1500-T-005
2000	400	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2000-T-003
2000	400	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2000-T-013
2000	400	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2000-T-004
2000	400	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2000-T-014
2000	400	± 15...± 24V	Minifit Jr 4 pins	HRS2000-T-005
2000	400	± 15...± 24V	Minifit Jr 4 pins	HRS2000-T-015
2500	500	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2500-T-003
2500	500	± 15...± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2500-T-013
2500	500	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2500-T-004
2500	500	± 15...± 24V	4 x M5 studs // 3 x 6.35 x 0.8 Faston	HRS2500-T-014
2500	500	± 15...± 24V	Minifit Jr 4 pins	HRS2500-T-005

* HRSxxxx-t/I--00xxx : without side plates
HRSxxxx-t/I--01xxx : with side plates

HRS1000-T ... HRS2500-T railway current sensors

For rolling stock and infrastructure
Technical data

Application
Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.



			HRS1000-I-XXX	HRS1500-I-XXX	HRS2000-I-XXX	HRS2500-I-XXX
Nominal primary current		A r.m.s	1000	1500	2000	2500
Measuring range	@± 24V (±5%), 15min/h	A	2700	3000	4000	4500
Not measurable overload	10ms/h	A	10 000	10 000	10 000	10 000
Max. measuring resistance (see datasheet for details)	@± 15V (±5%), 15min/h	Ω	0	0	0	0
Max. measuring resistance (see datasheet for details)	@± 24V (±5%), 15min/h	Ω	0	0	0	0
Min. measuring resistance (see datasheet for details)	@± 15V (±5%), 15min/h	Ω	0	0	0	0
Min. measuring resistance (see datasheet for details)	@± 24V (±5%), 15min/h	Ω	0	0	0	0
Turn number			5000	5000	5000	5000
Secondary current at INP		mA	200	300	400	500
Accuracy at IPN	@ +25°C	%	≤ ±0,25	≤ ±0,25	≤ ±0,25	≤ ±0,25
Accuracy at IPN	-40…-20°C, +70…85°C	%	≤ ±0,5	≤ ±0,5	≤ ±0,5	≤ ±0,5
Offset current	@+25°C	mA	≤ 0,2	≤ 0,2	≤ 0,2	≤ 0,2
Linearity		%	≤ 0,1	≤ 0,1	≤ 0,1	≤ 0,1
Thermal drift coefficient on offset		mA/K	≤ 0,025	≤ 0,025	≤ 0,025	≤ 0,025
Delay time		µs	≤ 1	≤ 1	≤ 1	≤ 1
Di / dt correctly followed		A/ µs	100	100	100	100
Bandwidth		kHz	≤ 100	≤ 100	≤ 100	≤ 100
Max no load consumption current		mA	≤ 20	≤ 20	≤ 20	≤ 20
Secondary resistance	@+85°C	Ω	≤ 42	≤ 42	≤ 30	≤ 30
Dielectric strength Primary/Secondary	@50Hz, 1min	kV	12	12	12	12
Dielectric strength Primary/Secondary	@50Hz, 1min	kV	0.5	0.5	0.5	0.5
Supply voltage		V	±15…±24	±15…±24	±15…±24	±15…±24
Voltage drop		V	≤ 1,6	≤ 1,6	≤ 1,6	≤ 1,6
Mass		g	850	850	1500	1500
Mass with side plates		g	1000	1000	1660	1660
Operating temperature		°C	-40…+85	-40…+85	-40…+85	-40…+85
Storage temperature		°C	-50…+90	-50…+90	-50…+90	-50…+90

General data

– Plastic case and insulating resin are self-extinguishing.
– Fixing holes in the case moulding for horizontal or vertical mounting, with side plates.
– Direction of the current: A primary current flowing in the direction of the arrow results in a positive secondary output current from terminal M.
– Internal electrostatic screen: All HRS-T sensors have an electrostatic screen, this is connected to the screen terminal "E". Depending on the version, when this screen terminal "E" is not provided, the screen is connected to the (–) terminal of the sensor.

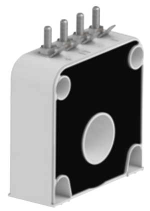
– Protections:
 - of the measuring circuit against short-circuits.
 - of the measuring circuit against opening.
 - of the power supply against polarity reversal.
– Burn-in test in accordance with FPTC 404304 cycle.

Primary connection
Hole for primary conductor. The temperature of the primary conductor
in contact with the case must not exceed 100 °C.

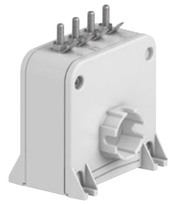
Conformity
EN 50155
EN 50121-3-2
EN 50124-1

CS300 ... CS2000 railway current sensors

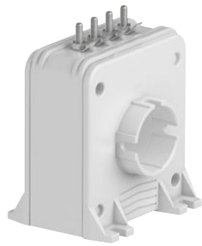
Closed loop technology for rolling stock and infrastructure
100 to 2000 A



CS300BRE



CS300BRV



CS1000BRVE

CS2000BR

CS2000BRV

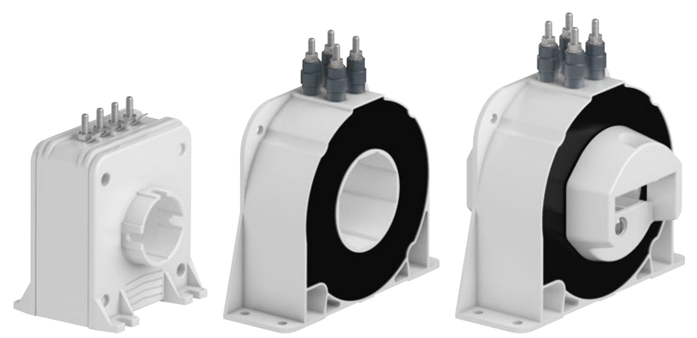
Ordering details*

Nominal primary Current A r.m.s	Secondary current I $_{s1}$ at ± I $_{PN}$ mA	Supply voltage VDC	Secondary connection	Type	Order code
100	100	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS300-9877	1SBT170300R9877
300	150	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS300BR	1SBT170300R0001
300	150	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS300BRV	1SBT170300R0002
300	150	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS300BRE	1SBT170300R0003
300	150	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS300BRVE	1SBT170300R0004
500	142,86	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS503BR	1SBT170503R0001
500	142,86	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS503BRE	1SBT170503R0003
500	100	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS500BR	1SBT170500R0001
500	100	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS500BRV	1SBT170500R0002
500	100		4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS500BRE	1SBT170500R0003
500	100	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS500BRVE	1SBT170500R0004
1000	200	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CSI000BR	1SBT171000R0001
1000	200	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CSI000BRV	1SBT171000R0002
1000	200	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CSI000BRE	1SBT171000R0003
1000	200	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CSI000BRVE	1SBT171000R0004
1000	250	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS1000-9940	1SBT171000R9940
1000	250	± 15…± 24V	3 x M5 studs // 3 x 6.35 x 0.8 Faston	CS1000-9941	1SBT171000R9941
1000	250	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS1000-9942	1SBT171000R9942
1000	250	± 15…± 24V	4 x M5 studs // 4 x 6.35 x 0.8 Faston	CS1000-9943	1SBT171000R9943
2000	400	± 15…± 24V	4 x M5 studs //	CS200BR	1SBT172000R0003
2000	400	± 15…± 24V	4 x M5 studs //	CS2000BRV	1SBT172000R0004
2000	500	± 15…± 24V	4 x M5 studs //	CS2000-9944	1SBT172000R9944
2000	500	± 15…± 24V	4 x M5 studs //	CS2000-9945	1SBT172000R9945

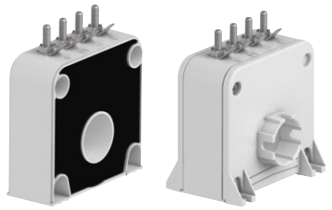
* CSxxxxBRE: with screen connection
CSxxxxBRV: with side plates and without screen connection
CSxxxxBRVE: with side plates and screen connection

CS300 ... CS2000 railway current sensors

For rolling stock and infrastructure
Technical data



Application
Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.



		Horizontal mounting	CS300BR	CS503BR	CS500BR
		Vertical mounting	CS300BRV	–	CS500BRV
		horizontal + Screen	CS300BRE	CS503BRE	CS500BRE
		vertical + Screen	CS300BRVE	–	CS500BRVE
Nominal primary current		A r.m.s.	300	500	500
Measuring range	@ ±15 V (±5%)	A peak	±600	–	–
Measuring range	@ ±24 V (±5%)	A peak	±600	±750	±1000
Not measurable overload	10 ms/hour	A peak	3000	5000	5000
Max. measuring resistance	@ I_{PMAX} & ±15 V (±5%)	Ω	12	–	–
Max. measuring resistance	@ I_{PMAX} & ±24 V (±5%)	Ω	40	6	37
Min. measuring resistance	@ I_{PN} & ±15 V (±5%)	Ω	0	–	–
Min. measuring resistance	@ I_{PN} & ±24 V (±5%)	Ω	35	0	0
Turn number			2000	3500	5000
Secondary current at I_{PN}		mA	150	142.86	100
Accuracy at I_{PN}	@ +25 °C	%	≤±0.5	≤±0.5	≤±0.5
Accuracy at I_{PN}	-40 … +85 °C	%	≤±1	≤±1	≤±1
Offset current	@ +25 °C & ±24 V (±5%)	mA	≤±0.5	≤±0.3	≤±0.25
Linearity		%	≤0.1	≤0.1	≤0.1
Thermal drift coefficient	-40 … +85 °C	µA/°C	≤7.5	≤7	≤5
Delay time		µs	≤1	≤1	≤1
di/dt correctly followed		A / µs	≤100	≤100	≤100
Bandwidth	-1 dB	kHz	≤100	≤100	≤100
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤15	≤15	≤15
Secondary resistance	@ +85 °C	Ω	≤27	≤88	≤64
Dielectric strength Primary/Secondary (or Primary/(Secondary+Screen) if relevant)	50 Hz, 1 min	kV	6.5	6.5	12
Dielectric strength Secondary/Screen (if relevant)	50 Hz, 1 min	kV	0.5	0.5	0.5
Supply voltage	±5%	V DC	±15 … ±24	±15 … ±24	±15 … ±24
Voltage drop		V	≤2.5	≤2.5	≤2.5
Mass		kg	0.36	0.36	0.78
Mass with side plates		kg	0.45	0.45	0.910
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85
Storage temperature		°C	-50 … +90	-50 … +90	-50 … +90

3

		Horizontal mounting	CS1000BR	CS1000-9940	CS2000BR*	CS2000-9944*
		Vertical mounting	CS1000BRV	CS1000-9941	CS2000BR*	CS2000-9944*
		Horizontal + Screen	CS1000BRE	CS1000-9942	CS2000BR*	CS2000-9944*
		Vertical + Screen	CS1000BRVE	CS1000-9943	CS2000BRV	CS2000-9945*
Nominal primary current		A r.m.s.	1000	1000	2000	2000
Measuring range	@ ±15 V (±5%)	A peak	–	–	–	–
Measuring range	@ ±24 V (±5%)	A peak	±2000	±2000	±3000	±3000
Not measurable overload	10 ms/hour	A peak	10000	10000	20000	20000
Max. measuring resistance	@ I_{PMAX} & ±15 V (±5%)	Ω	–	–	–	–
Max. measuring resistance	@ I_{PMAX} & ±24 V (±5%)	Ω	4	7	5	9
Min. measuring resistance	@ I_{PN} & ±15 V (±5%)	Ω	–	–	–	–
Min. measuring resistance	@ I_{PN} & ±24 V (±5%)	Ω	0	0	0	0
Turn number			5000	4000	5000	4000
Secondary current at I_{PN}		mA	200	250	400	500
Accuracy at I_{PN}	@ +25 °C	%	≤±0.5	≤±0.5	≤±0.5	≤±0.5
Accuracy at I_{PN}	-40 … +85 °C	%	≤±1	≤±1	≤±1	≤±1
Offset current	@ +25 °C & ±24 V (±5%)	mA	≤± 0.25	≤± 0.25	≤± 0.25	≤± 0.25
Linearity		%	≤0.1	≤0.1	≤0.1	≤0.1
Thermal drift coefficient	-40 … +85 °C	µA/°C	≤10	≤12.5	≤20	≤25
Delay time		µs	≤1	≤1	≤1	≤1
di/dt correctly followed		A / µs	≤100	≤100	≤100	≤100
Bandwidth	-1 dB	kHz	≤100	≤100	≤100	≤100
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤15	≤15	≤25	≤25
Secondary resistance	@ +85 °C	Ω	≤46	≤34	≤30	≤20
Dielectric strength Primary/Secondary (or Primary/(Secondary+Screen) if relevant)	50 Hz, 1 min	kV	12	12	12	12
Dielectric strength Secondary/Screen (if relevant)	50 Hz, 1 min	kV	0.5	0.5	1.5	1.5
Supply voltage	±5%	V DC	±15 … ±24	±15 … ±24	±15 … ±24	±15 … ±24
Voltage drop		V	≤2.5	≤2.5	≤1.5	≤1.5
Mass		kg	0.85	0.85	1.5	1.5
Mass with side plates		kg	1	1	1.66	1.66
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90

* Horizontal or vertical mounting is possible.

General data
– Plastic case and insulating resin are self-extinguishing.
– Fixing holes in the case moulding for horizontal or vertical mounting, with side plates.
– Direction of the current: A primary current flowing in the direction of the arrow results in a positive secondary output current from terminal M.
– Internal electrostatic screen: All CS sensors have an electrostatic screen, this is connected to the screen terminal "E". Depending on the version, when this screen terminal "E" is not provided, the screen is connected to the (–) terminal of the sensor.
– Protections:
  - of the measuring circuit against short-circuits.
  - of the measuring circuit against opening.
  - of the power supply against polarity reversal.
– Burn-in test in accordance with FPTC 404304 cycle.

Primary connection
Hole for primary conductor. The temperature of the primary conductor
in contact with the case must not exceed 100 °C.

Standard secondary connections
M5 studs and Faston 6.35 x 0.8: see "Accessories and options" for details.

Conformity
EN 50155
EN 50121-3-2
EN 50124-1

Accessories
– Side plate kits (including the fixing screws): set of 2 plates allowing for:
  - Vertical or bar mounting for CS300 to CS1000 and HRS1000-T / HRS1500-T
  - Bar mounting for CS2000, HRS2000-T and HRS2500-T (vertical mounting is possible without side plate)
– Mounting bar kits (including the fixing screws) for CS300 to CS2000 and HRS range. See "Accessories and options" for details.

Closed loop technology for rolling stock and infrastructure

Accessories

Side plates

Side plate kits include all the necessary screws for fixing the plates to the sensor.

Type	Sensor concerned	Technical description	Order code
Side plate kit CST0	CS300 / CS503	set of 2 plates	1SBT170000R2001
Side plate kit CST1	CS500 / CS1000 / HRS1000-T / HRS1500-T	set of 2 plates	1SBT170000R2002
Side plate kit CST2	CS2000 / HRS2000-T / HRS2500-T	set of 2 plates	1SBT170000R2007

Bar kits

Bar kits include all the necessary screws for mounting the bar on the sensor (the sensor must already be fitted with side plates prior to mounting the bar).

Type	Sensor concerned	Technical description of the bar	Order code
Bar kit CST0	CS300 & CS503	6x25x155 mm^2, 0.280 kg	1SBT170000R2003
Bar kit CST1-6	CS500 & CS1000 / HRS1000-T / HRS1500-T	6x40x185 mm^2, 0.510 kg	1SBT170000R2004
Bar kit CST1-10	CS500 & CS1000 / HRS1000-T / HRS1500-T	10x40x185 mm^2, 0.760 kg	1SBT170000R2005
Bar kit CST1 special	CS500 & CS1000 / HRS1000-T / HRS1500-T	10x40x210 mm^2, 0.8 kg (for compatibility with TA600, TA800 et EA1000 sensors)	1SBT170000R2010
Bar kit CST2	CS2000 / HRS2000-T / HRS2500-T	20x60x240 mm^2, 2.5 kg	1SBT170000R2008
Bar kit CST2 special	CS2000 / HRS2000-T / HRS2500-T	20x60x370 mm^2, 3.8 kg (for compatibility with EA2000 sensors)	1SBT170000R2012

Options

Number of secondary turns Ns

Sensor	CS300	CS503	CS500
Ns	1000	4000	3500
	2500	5000	

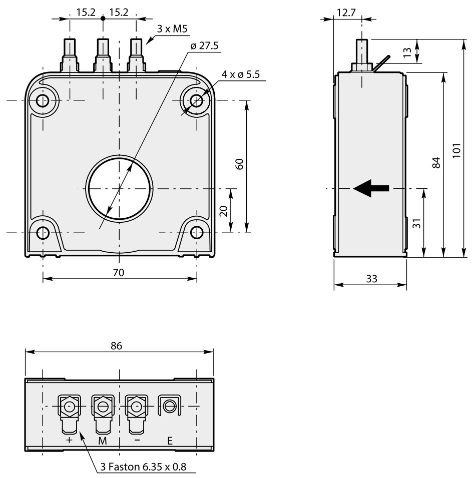
Secondary connection variants

Sensor	CS300 & CS503	CS500 & CS1000	CS2000
Secondary connection	–	–	3 M5 studs
	3 M5 inserts	3 M5 inserts	3 M5 inserts
	4 M5 inserts	4 M5 inserts	4 M5 inserts
	3 pin Lemo connector	3 pin Lemo connector	3 pin Lemo connector
	4 pin Lemo connector	4 pin Lemo connector	4 pin Lemo connector
	Shielded cable (2 m)	Shielded cable (2 m)	Shielded cable (2 m)

For rolling stock and infrastructure

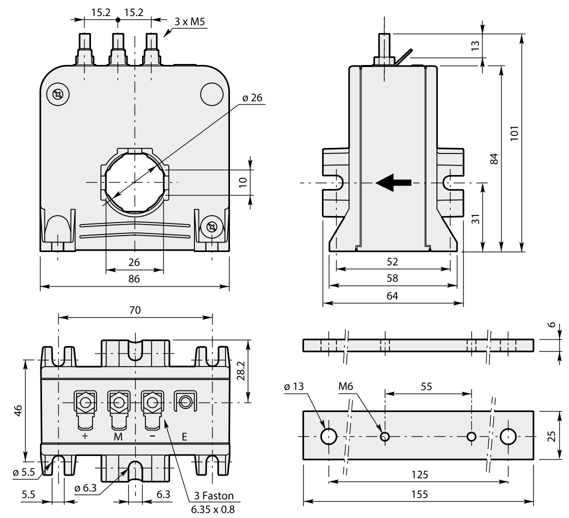
Dimensions (mm)

Horizontal mounting



Size 0 - CS300BR
and CS503BR

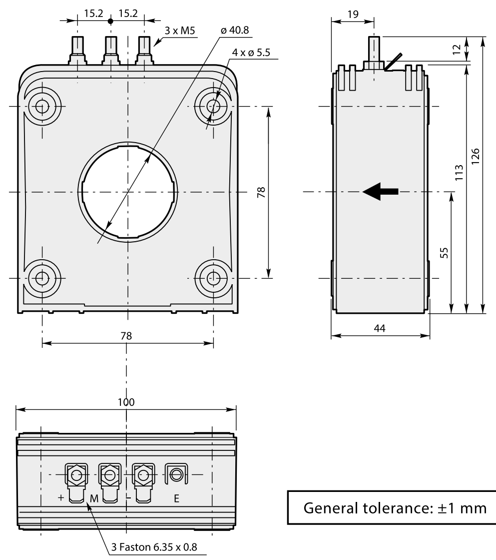
Vertical mounting



Size 0 - CS300BRV

Bar CST0

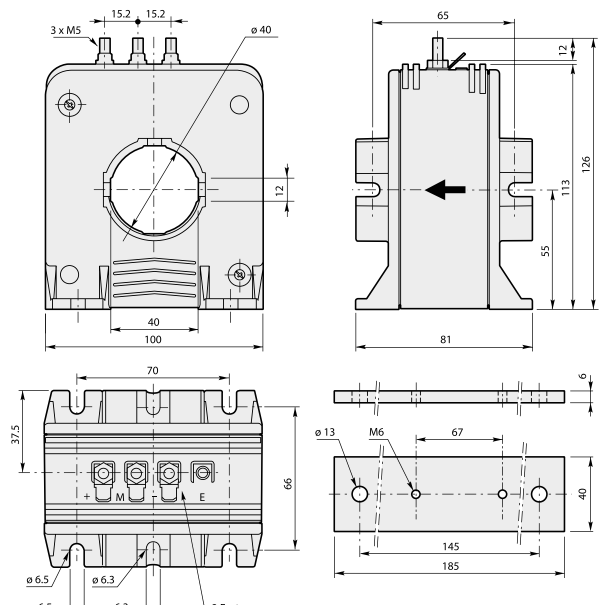
Horizontal mounting



Size 1 - CS500BR
and CS1000BR
and HRS1000-T-003/T-004
and HRS1500-T-003/T-004

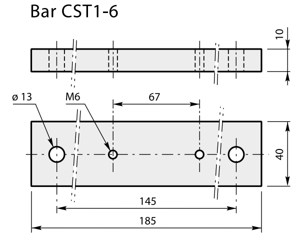
General tolerance: ±1 mm

Vertical mounting



Size 1 - CS500BRV
and CS1000BRV
and HRS1000-T-013/T-014
and HRS1500-T-013/T-014

Bar CST1-6



General tolerance: ±1 mm

Bar CST1-10

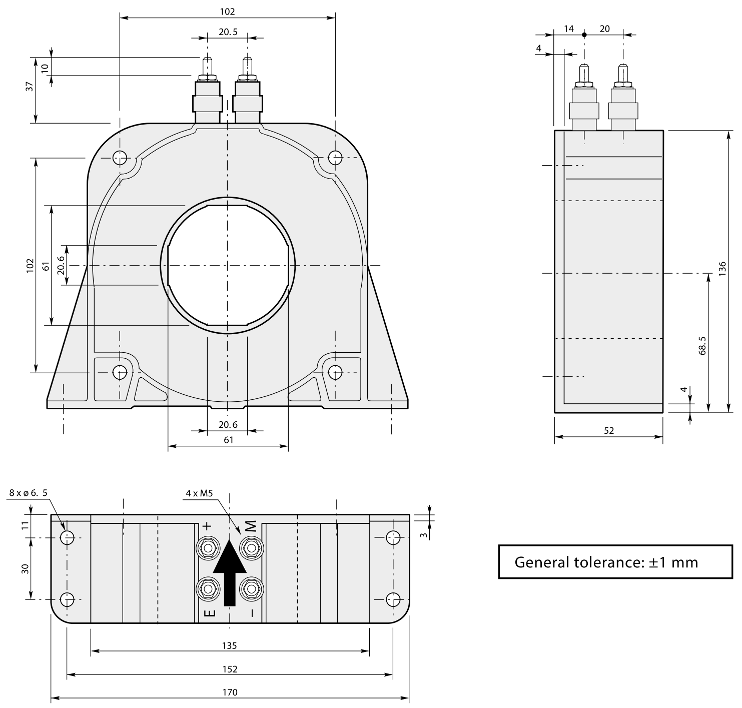
The primary bar kit is only available with the vertical mounting versions.
Tightening torque for M5 terminal studs (N.m) : 2

CS2000 railway current sensors

For rolling stock and infrastructure

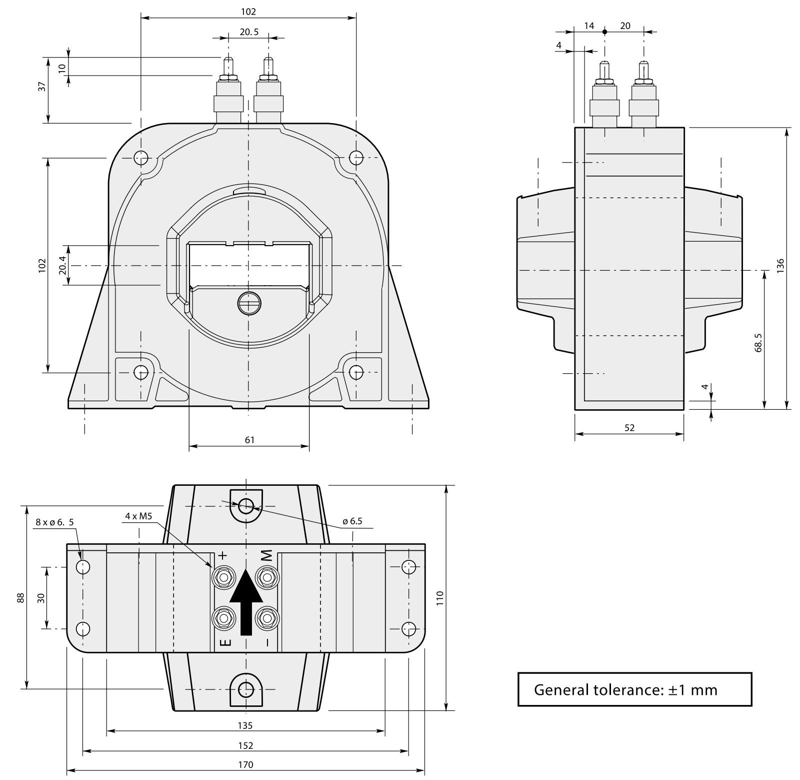
Dimensions (mm)

Horizontal and vertical mounting

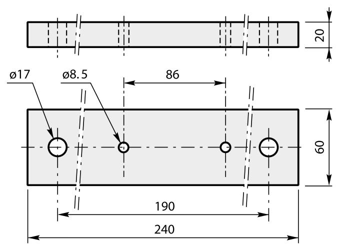


Size 2 - CS2000BR
and HRS2000-T-004 / HRS2500-T-004

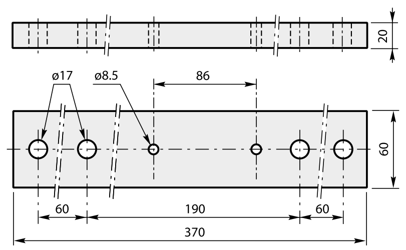
Horizontal and vertical mounting



Size 2 - CS2000BRV
and HRS2000-T-014 / HRS2500-T-014



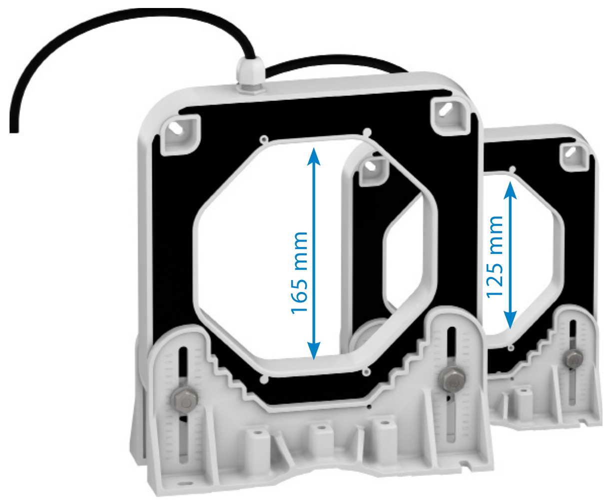
Bar CST2



Bar CST2 special

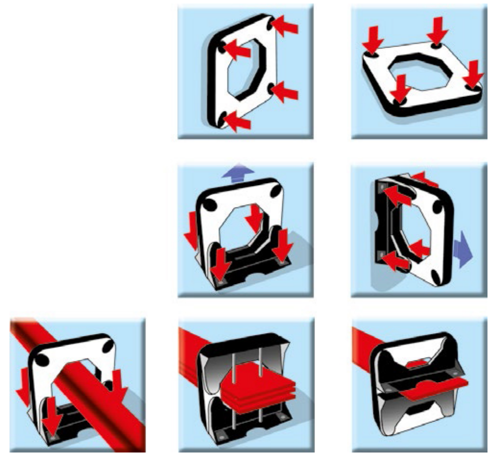
Railway current sensors NCS-T range electronic technology

Electronic technology



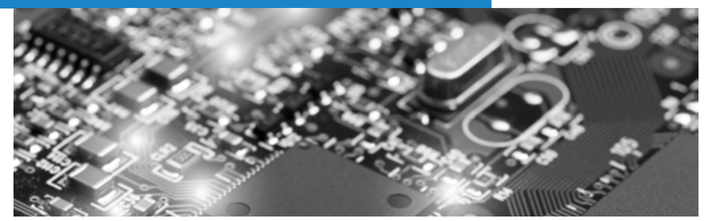
Designed to be integrated into every situation

The NCS sensor is entirely symmetrical. Its square shape and strategically positioned oblong holes make it easy to fasten in a choice of 2 positions. As an accessory it comes with a side plate that can be fastened on either side of the sensor giving complete fitting flexibility. It meets the standard design of PETERCEM current sensors. It can be fitted both horizontally and vertically. This flexibility means that NCS sensors can be fitted in any position and simplifies the work of integrators. Additionally the pair of right angle brackets allows the NCS sensor to be fitted to one or several bars at the same time.



100% electronic

The main advantage of the NCS range of sensors is that they are designed using a brand-new solution: 100% electronic technology. Unlike other currently available solutions such as shunts and CTs, this approach means that these sensors are very compact. Several patents were necessary to achieve this improvement.



Quality that goes beyond standards

Our product line has been ISO 9001 certified since 1993 and our standard NCS sensors bear the CE label in Europe.
This ongoing striving after quality has always been the hallmark of a company where excellence and safety are part of the culture, from design right through to production.
This culture is the result of continuous research to make technical progress and meet our customers' demands.

The chief selling-point of NCS sensors is their quality. Compliance of their high-tech electronic design with standard EN 50155 is proof of their ability to comply with the most detailed constraint as well as major demands. The fact that each individual sensor is subjected to rigorous testing is proof of the importance PETERCEM attribute to quality.

Considerable energy savings

NCS sensors offer considerable savings in energy. Indeed only a few watts are required to power the NCS sensor in contrast to traditional sensors that require several hundred watts.
This reduction in wasted energy means there is no rise in temperature around the sensor.

Environment-friendly

PETERCEM have long been concerned with the protection of the environment. This environmental approach is particularly noticeable in the production of the NCS range in the reduction of the number of components, in the use of a low-energy manufacturing procedure and the use of recyclable packing. The products in use are also characterized by their reduced energy consumption.
Our NCST range is RoHS compliant.

NCS Substation sensors have been designed to meet the substation standards EN 50123-1 and EN 50121-5. NCS range sensors also meet the security standard EN 50124-1.

The NCS meets all of your requirements

NCS125T ... NCS165T railway current sensors

For infrastructure only
4000 to 40000 A - Electronic technology

3

Frame mounting

These current sensors are specially designed and manufactured for Traction applications (NCS range for fixed railway applications and CS range for rolling stock).
The requirements for these sensors are generally higher than those for Industry applications (larger operating temperature range, higher level of shocks and vibrations...).
These sensors can be fixed mechanically, by the case or by the primary bar, depending on the version or option.

NCS125T-4AF to NCS125T-10AF
NCS125T-4VF to NCS125T-10VF

NCS165T-4AF to NCS165-20AF
NCS165T-4VF to NCS165-20VF

Ordering details

Nominal primary current	Secondary current I_{S1} at $\pm I_{PN}$	Secondary voltage V_{S1} at $\pm I_{PN}$	Supply voltage	Secondary connection	Type	Order code
A	mA	V	V DC			
4000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS125T-4AF	1SBT209204R0001
4000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS125T-4VF	1SBT209204R0101
4000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS165T-4AF	1SBT209604R0001
4000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS165T-4VF	1SBT209604R0101
6000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS125T-6AF	1SBT209206R0001
6000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS125T-6VF	1SBT209206R0101
6000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS165T-6AF	1SBT209606R0001
6000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS165T-6VF	1SBT209606R0101
10000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS125T-10AF	1SBT209210R0001
10000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS125T-10VF	1SBT209210R0101
10000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS165T-10AF	1SBT209610R0001
10000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS165T-10VF	1SBT209610R0101
20000	±20	–	±24	Shielded cable 6 wires (2 m)	NCS165T-20AF	1SBT209620R0001
20000	–	±10	±24	Shielded cable 6 wires (2 m)	NCS165T-20VF	1SBT209620R0101

NCS125T railway current sensors

For infrastructure only
Technical data

3

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.

	Output current shielded cable		NCS125T-4AF	–
	Output voltage shielded cable		–	NCS125T-4VF
Nominal primary current		A	4000	4000
Measuring range		A	20000	20000
Not measured overload	1 s/h	A peak	80000	80000
Secondary current I_{S1} at I_{PN}		mA	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%	≤±1	≤±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%	≤±3	≤±3
Gain thermal drift	-25 ... +85 °C	%/°C	≤0.03	≤0.03
Gain thermal drift	-40 ... -25 °C	%/°C	≤ 0.2	≤ 0.2
Linearity (typical)		%	±0.5	±0.5
Delay time (typical)		µs	≤3	≤3
di/dt correctly followed		A / µs	≤100	≤100
Bandwidth	@ -1 dB	kHz	0 ... 10	0 ... 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤ 245	≤ 245
No load consumption current (I_{A0-})		mA	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	20	20
Supply voltage	± 25%	V DC	±24	±24
Mass		kg	1.4	1.4
Operating temperature		°C	-40 ... +85	-40 ... +85
Storage/startup temperature		°C	-50 ... +90	-50 ... +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

General data

– Plastic case and insulating resin are self-extinguishing.
– Two fixing modes:
  - Horizontal or vertical with fixing holes in the case moulding
  - By bar using the intermediate side plate kit (Refer to Accessories and options on the following page)
– Max tightening torque for M6 screws (side plate mounting): 2 N.m
– **Direction of the current:**
  - Output current (I_{S1} and I_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output current on terminals I_{S1} and I_{S2}.
  - Output voltage (V_{S1} and V_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output voltage on terminals V_{S1} and V_{S2}.
– Burn-in test in accordance with FPTC 404304 cycle

Primary connection

Hole for primary conductor.
The temperature of the primary conductor in contact with the case must not exceed 100 °C.

Secondary connection

Shielded cable 6 x 2000 mm (cross section 0.5 mm²)

			Output current shielded cable	NCS125T-6AF	–	NCS125T-10AF	–
			Output voltage shielded cable	–	NCS125T-6VF	–	NCS125T-10VF
Nominal primary current		A		6000	6000	10000	10000
Measuring range		A		30000	30000	30000	30000
Not measured overload	1 s/h	A peak		120000	120000	200000	200000
Secondary current I_{S1} at I_{PN}		mA		±20	–	±20	–
Secondary current I_{S2} at I_{PMAX}		mA		±20	–	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA		≤±250	–	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA		≤±180	–	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C		≤±4	–	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω		0 ... 350	–	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V		–	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V		–	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV		–	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV		–	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C		–	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω		–	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%		≤±2	≤± 2	≤± 2	≤± 2
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%		≤±3	≤±3	≤±3	≤±3
Gain thermal drift	-25 … +85 °C	%/°C		≤0.03	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 … -25 °C	%/°C		≤0.1	≤0.1	≤0.1	≤0.1
Linearity (typical)		%		±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs		≤3	≤3	≤3	≤3
di/dt correctly followed		A / µs		≤100	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz		0 … 10	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA		≤ 245	≤ 245	≤ 245	≤ 245
No load consumption current (I_{A0-})		mA		≤35	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.		20	20	20	20
Supply voltage	± 25%	V DC		±24	±24	±24	±24
Mass		kg		1.4	1.4	1.4	1.4
Operating temperature		°C		-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C		-50 … +90	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

Accessories and options

Side plates (or right angle brackets)

For installation of the side plates, please refer to the mounting instructions ref. **1SBC146000M1703**

Side plate kit NCS125T:
PETERCEM order code: **1SBT200000R2002**

Conformity

EN 50155
EN 50121-5, EN50123-1, EN50124-1

RoHS

NCS165T railway current sensors

For infrastructure only
Technical data

Application

Sensors to measure DC, AC or pulsating currents with a galvanic insulation between primary and secondary circuits.

			Output current shielded cable	NCS165T-4AF	–	NCS165T-6AF	–
			Output voltage shielded cable	–	NCS165T-4VF	–	NCS165T-6VF
Nominal primary current		A		4000	4000	6000	6000
Measuring range		A		20000	20000	30000	30000
Not measured overload	1 s/h	A peak		80000	80000	120000	120000
Secondary current I_{S1} at I_{PN}		mA		±20	–	±20	–
Secondary current I_{S2} at I_{PMAX}		mA		±20	–	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA		≤±250	–	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA		≤±180	–	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C		≤±4	–	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω		0 ... 350	–	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V		–	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V		–	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV		–	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV		–	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C		–	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω		–	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset) (1) at I_{PN}	@ +25 °C	%		≤±1	≤±1	≤±1	≤±1
Rms accuracy 50 Hz (without offset) (1) at I_{PMAX}	@ +25 °C	%		≤±3	≤±3	≤±3	≤±3
Gain thermal drift	-25 … +85 °C	%/°C		≤0.03	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 … -25 °C	%/°C		≤0.1	≤0.1	≤0.1	≤0.1
Linearity (typical)		%		±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs		≤3	≤3	≤3	≤3
di/dt correctly followed		A / µs		≤100	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz		0 … 10	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA		≤210	≤210	≤210	≤210
No load consumption current (I_{A0-})		mA		≤35	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.		20	20	20	20
Supply voltage	± 25%	V DC		±24	±24	±24	±24
Mass		kg		1.7	1.7	1.7	1.7
Operating temperature		°C		-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C		-50 … +90	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

General data

– Plastic case and insulating resin are self-extinguishing.
– Two fixing modes:
  - Horizontal or vertical with fixing holes in the case moulding.
  - By bar using the intermediate side plate kit (Refer to accessories and options on the following page)
– Max tightening torque for M6 screws (side plate mounting): 2 N.m
– **Direction of the current:**
  - Output current (I_{S1} and I_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output current on terminals I_{S1} and I_{S2}.
  - Output voltage (V_{S1} and V_{S2}): A primary current flowing in the direction of the arrow results in a positive secondary output voltage on terminals V_{S1} and V_{S2}.
– Burn-in test in accordance with FPTC 404304 cycle

Primary connection

Hole for primary conductor.
The temperature of the primary conductor in contact with the case must not exceed 100 °C.

Secondary connection

Shielded cable 6 x 2000 mm (cross section 0.5 mm²)

			NCS165T-10AF	–	NCS165T-20AF	–
		Output current shielded cable	NCS165T-10AF	–	NCS165T-20AF	–
		Output voltage shielded cable	–	NCS165T-10VF	–	NCS165T-20VF
Nominal primary current		A	10000	10000	20000	20000
Measuring range		A	30000	30000	40000	40000
Not measured overload	1 s/h	A peak	200000	200000	200000	200000
Secondary current I_{S1} at I_{PN}		mA	±20	–	±20	–
Secondary current I_{S2} at I_{PMAX}		mA	±20	–	±20	–
Residual current $I_{S1}0$	@ +25 °C	µA	≤±250	–	≤±250	–
Residual current $I_{S2}0$	@ +25 °C	µA	≤±180	–	≤±180	–
Thermal drift coefficient (outputs I_{S1}, I_{S2})		µA/°C	≤±4	–	≤±4	–
Measuring resistance (outputs I_{S1}, I_{S2})		Ω	0 ... 350	–	0 ... 350	–
Secondary voltage V_{S1} at I_{PN}		V	–	±10	–	±10
Secondary voltage V_{S2} at I_{PMAX}		V	–	±10	–	±10
Residual voltage $V_{S1}0$	@ +25 °C	mV	–	≤±100	–	≤±100
Residual voltage $V_{S2}0$	@ +25 °C	mV	–	≤±50	–	≤±50
Thermal drift coefficient (outputs V_{S1}, V_{S2})		mV/°C	–	≤±2	–	≤±2
Measuring resistance (outputs V_{S1}, V_{S2})		Ω	–	10000 ... ∞	–	10000 ... ∞
Rms accuracy 50 Hz (without offset)1 at I_{PN}	@ +25 °C	%	≤±1	≤±1	≤±1	≤±1
Rms accuracy 50 Hz (without offset)1 at I_{PMAX}	@ +25 °C	%	≤±3	≤±3	≤±3	≤±3
Gain thermal drift	-25 … +85 °C	%/°C	≤0.03	≤0.03	≤0.03	≤0.03
Gain thermal drift	-40 … -25 °C	%/°C	≤0.1	≤0.1	≤0.1	≤0.1
Linearity (typical)		%	±0.5	±0.5	±0.5	±0.5
Delay time (typical)		µs	≤3	≤3	≤3	≤3
di/dt correctly followed		A / µs	≤100	≤100	≤100	≤100
Bandwidth	@ -1 dB	kHz	0 … 10	0 … 10	0 … 10	0 … 10
No load consumption current (I_{A0+})	@ -40 °C	mA	≤210	≤210	≤210	≤210
No load consumption current (I_{A0-})		mA	≤35	≤35	≤35	≤35
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV r.m.s.	20	20	20	20
Supply voltage	± 25%	V DC	±24	±24	±24	±24
Mass		kg	1.7	1.7	1.7	1.7
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage/startup temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90

(1) Maximum current I_{PN} generated: 5000 A r.m.s.

Accessories and options

Side plates (or right angle brackets)

For installation of the side plates, please refer to the mounting instructions ref. **1SBC146000M1703**

Side plate kit NCS165T:
PETERCEM order code: **1SBT200000R2001**

Conformity

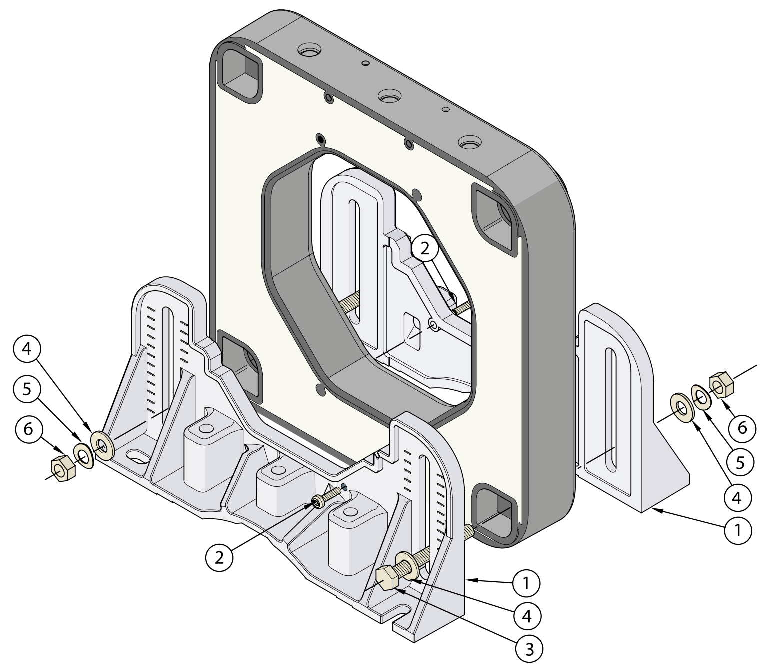
EN 50155
EN 50121-5, EN 50123-1, EN 50124-1

CE
RoHS

NCS125T railway current sensors

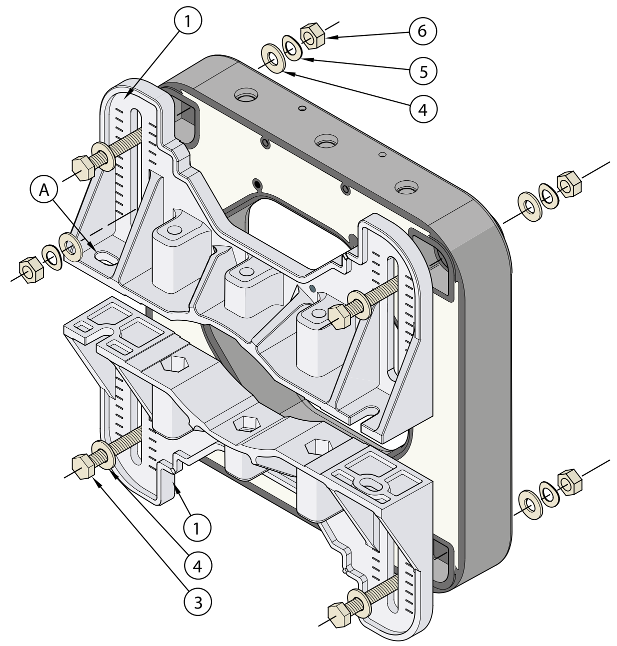
For infrastructure only

Right angle brackets mounting on NCS125T sensors



1 - Side plate: x2
2 - Standard positioning screw: x2 (3x12)
3 - Side plate screw M6: x2 (6x50)
4 - Flat washer: x4
5 - Spring washer: x2
6 - Locknut: x2
7 - Not used:
- Side plate screw M6: x4 (6x30)
- Flat washer: x4
- Spring washer: x2
- Locknut: x2

Right angle brackets mounting on NCS125T sensors



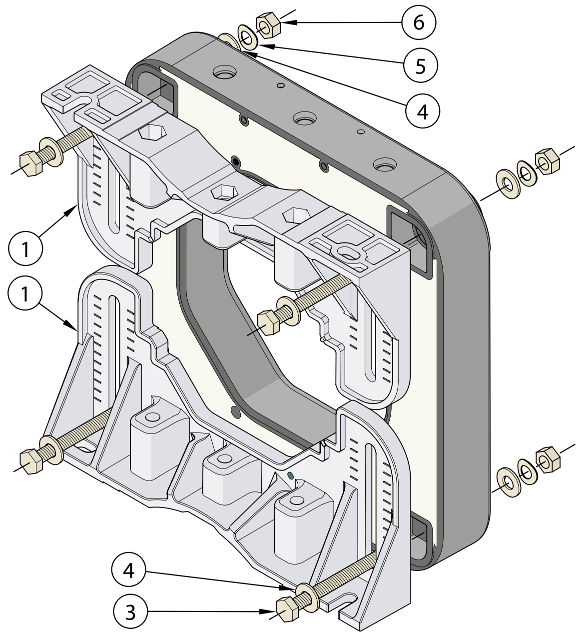
1 - Side plate: x2
3 - Side plate screw M6: x4 (6x30)
4 - Flat washer: x8
5 - Spring washer: x4
6 - Locknut: x4
7 - Not used:
- Side plate screw M6: x4 (6x50)
- Standard positioning screw: x2 (3x12)

A - The screws for clamping the side plates to the bar (or cable) are not supplied

NCS125T railway current sensors

For infrastructure only

Right angle brackets mounting on NCS125T sensors



1 - Side plate: x2
3 - Side plate screw M6: x4 (6x30)
4 - Flat washer: x8
5 - Spring washer: x4
6 - Locknut: x4
7 - Not used:
- Side plate screw M6: x2 (6x50)
- Standard positioning screw: x2 (3x12)

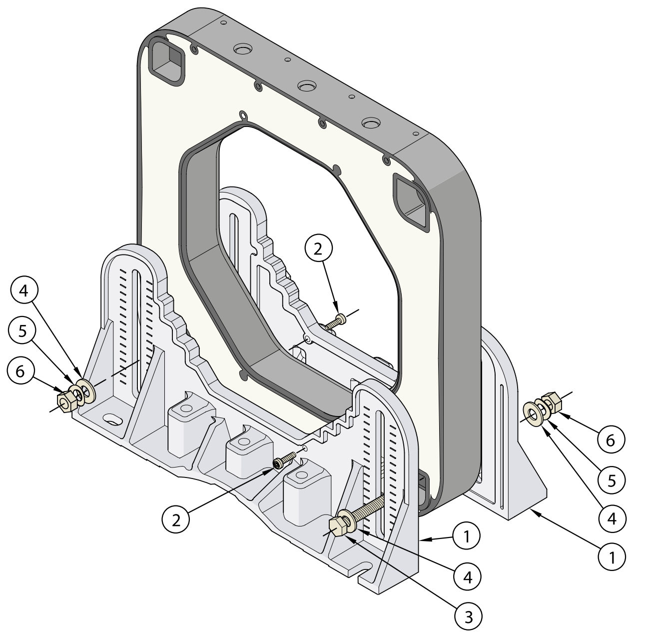
See page 36 to 40 for detailed dimensions

3

NCS165T railway current sensors

For infrastructure only

Right angle brackets mounting on NCS165T sensors



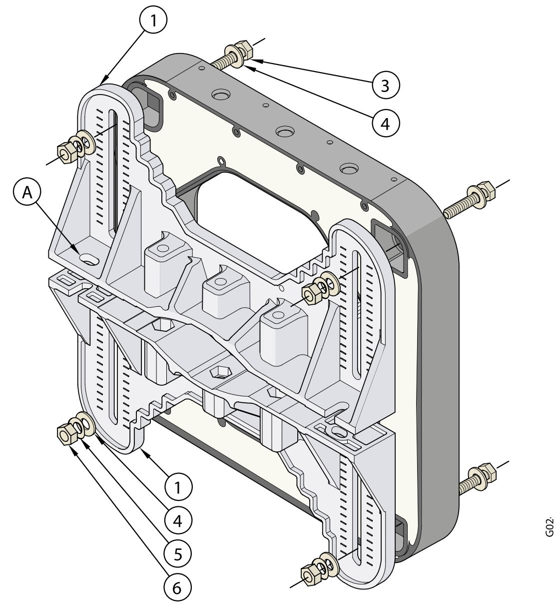
1 - Side plate: x2
2 - Standard positioning screw: x2 (3x12)
3 - Side plate screw M6: x2 (6x50)
4 - Flat washer: x4
5 - Spring washer: x2
6 - Locknut: x2
7 - Not used:
- Side plate screw M6: x4 (6x30)
- Flat washer: x4
- Spring washer: x2
- Locknut: x2

See page 36 to 40 for detailed dimensions

NCS165T railway current sensors

For infrastructure only

Right angle brackets mounting on NCS165T sensors



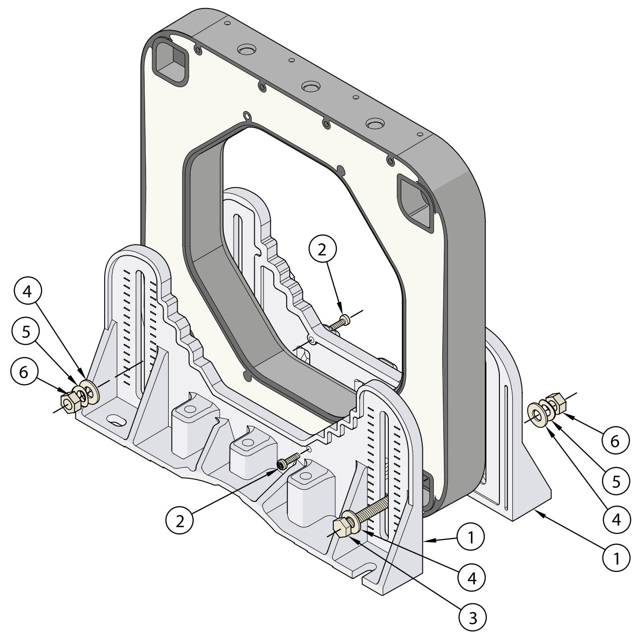
1 - Side plate: x2
3 - Side plate screw M6: x4 (6x30)
4 - Flat washer: x8
5 - Spring washer: x4
6 - Locknut: x4
7 - Not used:
- Side plate screw M6: x4 (6x50)
- Standard positioning screw: x2 (3x12)

A - The screws for clamping the side plates to the bar (or cable) are not supplied

See page 36 to 40 for detailed dimensions

3

Right angle brackets mounting on NCS165T sensors

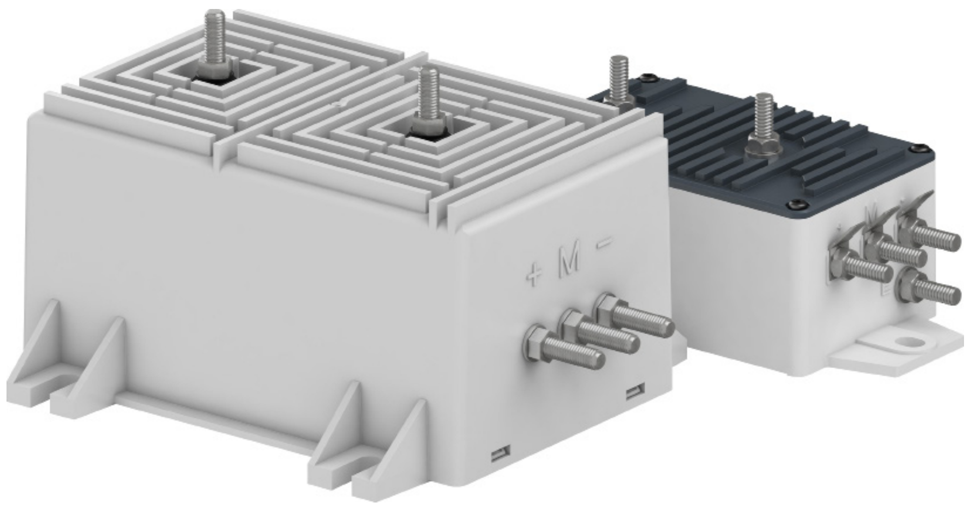


1 - Side plate: x2
2 - Standard positioning screw: x2 (3x12)
3 - Side plate screw M6: x2 (6x50)
4 - Flat washer: x4
5 - Spring washer: x2
6 - Locknut: x2
7 - Not used:
- Side plate screw M6: x4 (6x30)
- Flat washer: x4
- Spring washer: x2
- Locknut: x2

See page 36 to 40 for detailed dimensions

Railway voltage sensors VS range

Electronic technology for rolling stock and infrastructure



Perfect efficiency in every environment

The VS range has been designed for applications in difficult environments such as on-board railway equipment (power converters, auxiliary converters for heating, ventilation and air conditioning) and the mining industry. Their robust design and excellent performances (e.g. operating range between –40° and +85 °C) make VS voltage sensors ideal for use in other very demanding applications (marine, wind-power, ozone generators, etc.).

Incomparable protection against magnetic fields

VS sensors are conceived, designed and renowned for their unrivalled immunity to ambient magnetic fields. Although they are in continuous proximity of powerful currents capable of distorting their measurements, this does not, in fact, occur. Their accuracy is rock-solid and once set to measure a particular voltage, that is what they measure – that and nothing else.

100% electronic
a great leap forward

To push the performance barriers back ever further, VS sensors are made 100% electronic. Our sensors are the first ones on the market to incorporate this innovation. They prove themselves every day and give their users the edge in a broad range of applications. This guarantees you unbeatable dynamic performances that give optimal slaving of customer equipment while complying with the latest standards in force.
VS sensors are perfect for use in sectors such as railways, mining and control in hazardous environments.
VS voltage sensors and CS current sensors together constitute an offer the railway industry cannot afford to ignore.

Going beyond ordinary standards

PETERCEM have been ISO 9001 certified since 1993 and our sensors bear the CE label. This ongoing striving after quality has always been the hallmark of a company where excellence and safety are part of the culture, from design right through to production.
This culture is the result of continuous research to make technical progress and meet our customers' demands.

The chief selling-point of VS sensors is their quality. Compliance with EN 50121-X for electromagnetic disturbance and EN 50155 for their high-tech electronic design is proof of their ability to comply with the most detailed constraints as well as major demands. The fact that each individual sensor is subjected to rigorous testing such as sensor burn-in is proof of the importance PETERCEM attribute to quality.

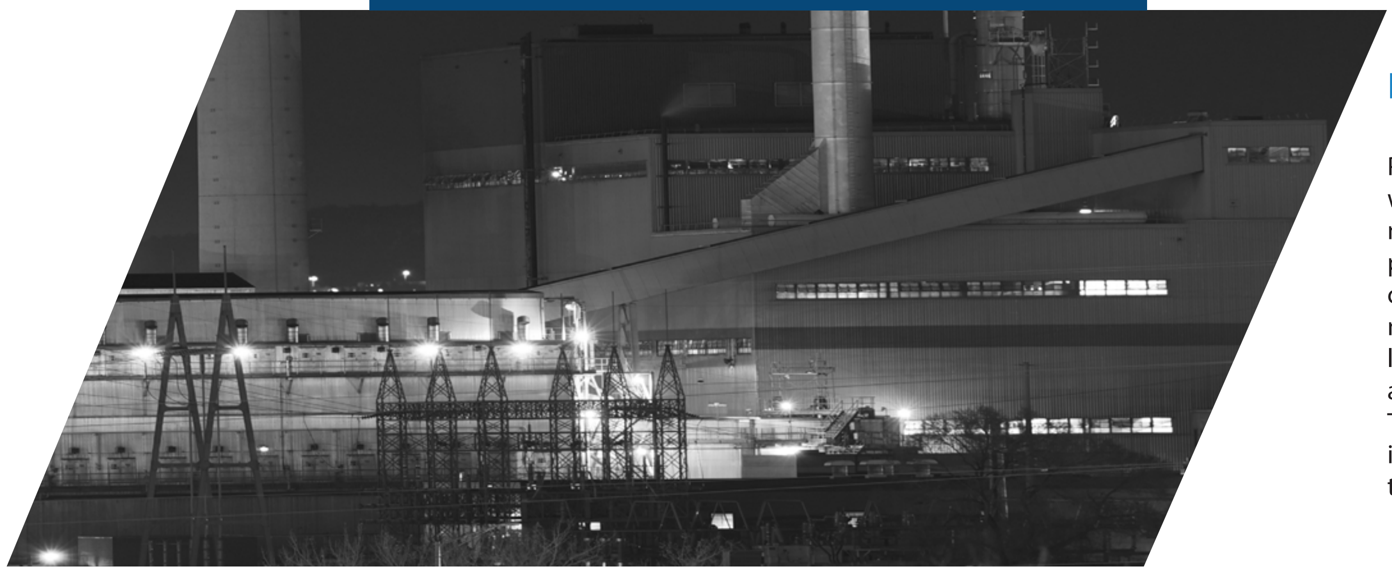
VS sensors meet the various security standards in force such as EN 50124-1 for electrical insulation, NFF 16101-NFF 16102 & EN 45 545 for fire-smoke resistance.

Flexibility of use

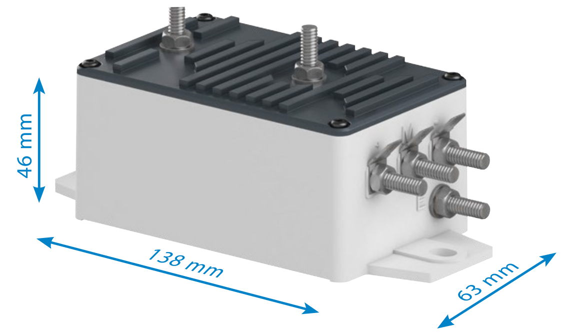
All our products have been conceived and designed so that installation and use are as simple as possible. Flexibility of installation and operation obtained using a range of connector variants mean that VS sensors are very easy to use. In fact, high-tech sensors have never been as easy to use.

Optimized electronic performance

The electrical performances of VS sensors are genuinely customized to a variety of demands and meet the severest constraints. VS sensors give the best accuracy and performance for money on the market. And their performances really come up to your expectations.



Quality that goes beyond standards



PETERCEM have applied the notion "Small is beautiful" to its products.
By integrating the notion of reduced size into their VS sensors, PETERCEM have brought miniaturization to a point of perfection.
This miniaturization gives great flexibility of installation. The great breakthrough with VS sensors is that they are 100% electronic. This makes it possible to put cutting-edge technology into the smallest possible space. Everything is integrated; in other words everything is inside to leave as much room as possible outside.

Environment-friendly

PETERCEM have long been concerned with the protection of the environment. This environmental approach is particularly noticeable in production of the VS range in the reduction of the number of components, in the use of a low-energy manufacturing procedure and the use of recyclable packing.
The products in use are also characterized by their reduced energy consumption.

PETERCEM – because your needs deserve exact science

EM010 ... EM020 railway voltage sensors

For rolling stock and infrastructure
600 to 5000 V - Closed loop technology

Closed loop Hall effect technology
Closed loop Hall effect technology also allows for voltage measurement.
For calibrated EM010 sensors, the voltage to be measured is applied directly to the primary terminals of the sensor.

3

EM10

Nominal primary voltage U_{PN} V r.m.s	Secondary current at U_{PN} mA	Supply voltage VDC	Secondary connection	Type	Order code
600	50	±15... ±24	5 x M5 studs	EM010-9239	EM010-9239
750	50	±15... ±24	5 x M5 studs	EM010-9240	EM010-9240
1000	50	±15... ±24	5 x M5 studs	EM010-9371	EM010-9371
1500	50	±15... ±24	5 x M5 studs	EM010-9317	EM010-9317
2000	50	±15... ±24	5 x M5 studs	EM020-9318	1SBT182020R9318
3000	50	±15... ±24	5 x M5 studs	EM020-9319	1SBT183020R9319
4200	50	±15... ±24	5 x M5 studs	EM010-9394	EM010-9394
5000	50	±15... ±24	5 x M5 studs	EM010-9354	EM010-9354

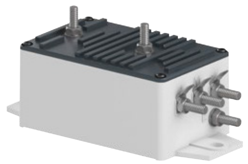
Note : technical data available on request

VS50B ... VS4200B railway voltage sensors

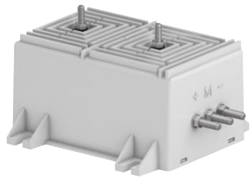
For rolling stock and infrastructure
50 to 4200 V - Electronic technology

Electronic technology
These voltage sensors use the new PETERCEM 100 % electronic technology
(the magnetic circuit and Hall probe are no longer required).
The voltage to be measured is applied directly to the primary terminals of the sensor.
They are specially designed and manufactured to meet the latest railway standards.

3



VS50B to VS1500B



VS2000B to VS4200B

Ordering details

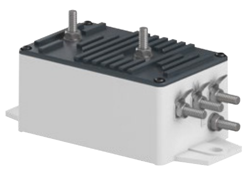
Nominal primary voltage V r.m.s.	Secondary current at U_{PN} mA	Supply voltage V DC	Secondary connection	Type	Order code
50	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS50B	1SBT160050R0001
125	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS125B	1SBT160125R0001
250	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS250B	1SBT160250R0001
500	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS500B	1SBT160500R0001
750	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS750B	1SBT160750R0001
1000	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS1000B	1SBT161000R0001
1500	50	±12 ... ±24	4 x M5 studs // 3 x 6.35 x 0.8 Faston	VS1500B	1SBT161500R0001
2000	50	±12 ... ±24	3 x M5 studs	VS2000B	1SBT162000R0001
3000	50	±12 ... ±24	3 x M5 studs	VS3000B	1SBT163000R0001
4000	50	±12 ... ±24	3 x M5 studs	VS4000B	1SBT164000R0001
4200	50	±12 ... ±24	3 x M5 studs	VS4200B	1SBT164200R0001

VS50B ... VS1500B railway voltage sensors

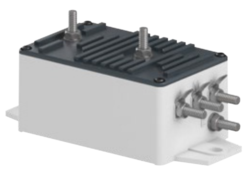
For rolling stock and infrastructure
Technical data

Application

Electronic sensors to measure DC, AC or pulsating voltages with insulation between primary and secondary circuits.



			VS50B	VS125B	VS250B	VS500B
Nominal primary voltage		V r.m.s.	50	125	250	500
Measuring range	@ ±12 V (±5%) / 1 min/h	V peak	±75	±187.5	±375	±750
Measuring range	@ ±24 V (±5%) / 1 min/h	V peak	±75	±187.5	±375	±750
Not measurable overload	1 sec/hour	V peak	≤150	≤ 375	≤750	≤1500
Max. measuring resistance	@ U_{PMAX} & ±12 V (±5%)	Ω	67	67	67	67
Max. measuring resistance	@ U_{PMAX} & ±24 V (±5%)	Ω	188	188	188	188
Min. measuring resistance	@ U_{PN} & ±24 V (±5%)	Ω	0	0	0	0
Secondary current at U_{PN}		mA	50	50	50	50
Accuracy at U_{PN}	@ +25 °C	%	≤±0.9	≤±0.9	≤±0.9	≤±0.9
Accuracy at U_{PN}	-25 … +70 °C	%	≤±1.5	≤±1.5	≤±1.5	≤±1.5
Accuracy at U_{PN}	-40 … +85 °C	%	≤±1.7	≤±1.7	≤±1.7	≤±1.7
Offset current	@ +25 °C & ±24 V (±5%)	mA	≤±0.15	≤±0.15	≤±0.15	≤±0.15
Linearity	$0.1U_{PN}$ … $1.5U_{PN}$	%	≤0.3	≤0.3	≤0.3	≤0.3
Delay time		µs	≤10	≤10	≤10	≤10
dv/dt correctly followed		V / µs	≤0.6	≤1.5	≤3	≤6
Bandwidth	-3 dB & R_M = 50 Ω	kHz	≤13	≤13	≤13	≤13
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤50	≤50	≤50	≤50
Dielectric strength Primary/(Secondary+Screen)	50 Hz, 1 min	kV	3.3	3.3	3.3	3.3
Dielectric strength Secondary/Screen	50 Hz, 1 min	kV	0.5	0.5	0.5	0.5
Partial discharges : extinction voltage	@10pC, 50 Hz	kV	≥1.1	≥1.1	≥1.1	≥1.1
Supply voltage	±5%	V DC	±12 … ±24	±12 … ±24	±12 … ±24	±12 … ±24
Mass		kg	0.333	0.333	0.333	0.333
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90



			VS750B	VS1000B	VS1500B
Nominal primary voltage		V r.m.s.	750	1000	1500
Measuring range	@ ±12 V (±5%) / 1 min/h	V peak	±1125	±1500	±2250
Measuring range	@ ±24 V (±5%) / 1 min/h	V peak	±1125	±1500	±2250
Not measurable overload	1 sec/hour	V peak	2250	3000	4500
Max. measuring resistance	@ U_{PMAX} & ±12 V (±5%)	Ω	67	67	67
Max. measuring resistance	@ U_{PMAX} & ±24 V (±5%)	Ω	188	188	188
Min. measuring resistance	@ U_{PN} & ±24 V (±5%)	Ω	0	0	0
Secondary current at U_{PN}		mA	50	50	50
Accuracy at U_{PN}	@ +25 °C	%	≤±0.9	≤±0.9	≤±0.9
Accuracy at U_{PN}	-25 … +70 °C	%	≤±1.5	≤±1.5	≤±1.5
Accuracy at U_{PN}	-40 … +85 °C	%	≤±1.7	≤±1.7	≤±1.7
Offset current	@ +25 °C & ±24 V (±5%)	mA	≤±0.15	≤±0.15	≤±0.15
Linearity	$0.1U_{PN}$ … $1.5U_{PN}$	%	≤0.3	≤0.3	≤0.3
Delay time		µs	≤10	≤10	≤10
dv/dt correctly followed		V / µs	≤9	≤12	≤18
Bandwidth	-3 dB & R_M = 50 Ω	kHz	≤13	≤13	≤13
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤50	≤50	≤50
Dielectric strength Primary/(Secondary+Screen)	50 Hz, 1 min	kV	4.3	5.5	6.5
Dielectric strength Secondary/Screen	50 Hz, 1 min	kV	0.5	0.5	0.5
Partial discharges : extinction voltage	@10pC, 50 Hz	kV	≥1.1	≥2.2	≥2.2
Supply voltage	±5%	V DC	±12 … ±24	±12 … ±24	±12 … ±24
Mass		kg	0.333	0.333	0.333
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85
Storage temperature		°C	-50 … +90	-50 … +90	-50 … +90

3

Max. common mode voltage

The following two conditions must be continuously and simultaneously respected:

1) $U_{HT+} + U_{HT-} \leq 4.2$ kV peak

and

2) $| U_{HT+} - U_{HT-} | \leq U_{PMAX}$

General data

– Coated electronic circuit.
– Plastic case and insulating resin are self-extinguishing.
– Direction of the current: A positive primary differential voltage ($U_{HT+} - U_{HT-} > 0$) results in a positive secondary output current from terminal M.
– Protections:
 - of the measuring circuit against short-circuits.
 - of the measuring circuit against opening.
 - of the power supply against polarity reversal.
– Burn-in test in accordance with FPTC 404304 cycle.
– Tightening torque for M5 terminal studs (N.m): 2 N.m.

Primary connection

– 2 M5 studs

Standard secondary connections

– 4 M5 studs and 3 Faston 6.35 x 0.8

Options

– Primary connection: 2 separated High Voltage cables.
– Secondary connection: Shielded cable (2 m), M5 inserts, Lemo connector.

Conformity

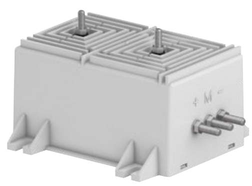
EN 50155
EN 50121-3-2
EN 50124-1

CE

VS2000B ... VS4200B railway voltage sensors

For rolling stock and infrastructure
Technical data

Application
Electronic sensors to measure DC, AC or pulsating voltages with insulation between primary and secondary circuits.



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			VS2000B	VS3000B	VS4000B	VS4200B
Nominal primary voltage		V r.m.s.	2000	3000	4000	4200
Measuring range	@ ±12 V (±5%) / 1 min/h	V peak	±3000	±4500	±6000	±6000
Measuring range	@ ±24 V (±5%) / 1 min/h	V peak	±3000	±4500	±6000	±6000
Not measurable overload	1 sec/hour	V peak	≤6000	≤9000	≤12000	≤12000
Max. measuring resistance	@ U_{PMAX} & ±12 V (±5%)	Ω	47	42	42	42
Max. measuring resistance	@ U_{PMAX} & ±24 V (±5%)	Ω	184	179	179	179
Min. measuring resistance	@ U_{PN} & ±24 V (±5%)	Ω	0	0	0	0
Secondary current at U_{PN}		mA	50	50	50	50
Accuracy at U_{PN}	@ +25 °C	%	≤±0.9	≤±0.9	≤±0.9	≤±0.9
Accuracy at U_{PN}	-25 … +70 °C	%	≤±1.5	≤±1.5	≤±1.5	≤±1.5
Accuracy at U_{PN}	-40 … +85 °C	%	≤±1.7	≤±1.7	≤±1.7	≤±1.7
Offset current	@ +25 °C & ±24 V (±5%)	mA	≤±0.15	≤±0.15	≤±0.15	≤±0.15
Linearity	$0.1U_{PN}$ … $1.5U_{PN}$	%	≤0.3	≤0.3	≤0.3	≤0.3
Delay time		µs	≤10	≤10	≤10	≤10
dv/dt correctly followed		V / µs	≤24	≤36	≤48	≤50
Bandwidth	-3 dB & R_M = 50 Ω	kHz	≤13	≤13	≤13	≤13
Max. no-load consumption current	@ ±24 V (±5%)	mA	≤50	≤50	≤50	≤50
Dielectric strength Primary/Secondary	50 Hz, 1 min	kV	8	12	12	12
Partial discharges : extinction voltage	@10pC, 50 Hz	kV	≥4.3	≥4.3	≥4.3	≥4.3
Supply voltage	±5%	V DC	±12 … ±24	±12 … ±24	±12 … ±24	±12 … ±24
Mass		kg	1.5	1.5	1.5	1.5
Operating temperature		°C	-40 … +85	-40 … +85	-40 … +85	-40 … +85
Storage temperature		°C	-50 … +90	-50 … +90	-50 … +90	-50 … +90

Max. common mode voltage
The following two conditions must be continuously and simultaneously respected:
1) $U_{HT+} + U_{HT-} \leq 10$ kV peak
and
2) $| U_{HT+} - U_{HT-} | \leq U_{PMAX}$

General data
– Coated electronic circuit.
– Plastic case and insulating resin are self-extinguishing.
– Direction of the current: A positive primary differential voltage ($U_{HT+} - U_{HT-} > 0$) results in a positive secondary output current from terminal M.
– Protections :
 - of the measuring circuit against short-circuits.
 - of the measuring circuit against opening.
 - of the power supply against polarity reversal.
– Burn-in test in accordance with FPTC 404304 cycle.
– Tightening torque for M5 terminal studs (N.m): 2 N.m.

Primary connection
– 2 M5 studs

Standard secondary connection
– 3 M5 studs

Options
– Primary connection: 2 separated High Voltage cables.
– Secondary connection: shielded cable (2 m), M5 inserts, Lemo connector.
– Nominal secondary current I_{SN} :
I_{SN} (for U_{PN})= 20 mA or I_{SN} (for U_{PN}) = 80 mA.

Conformity
EN 50155
EN 50121-3-2
EN 50124-1

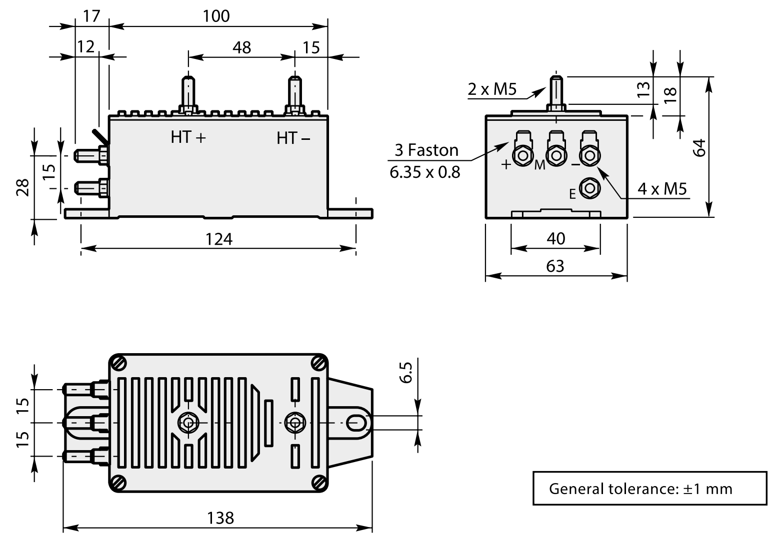
CE

VS railway voltage sensors

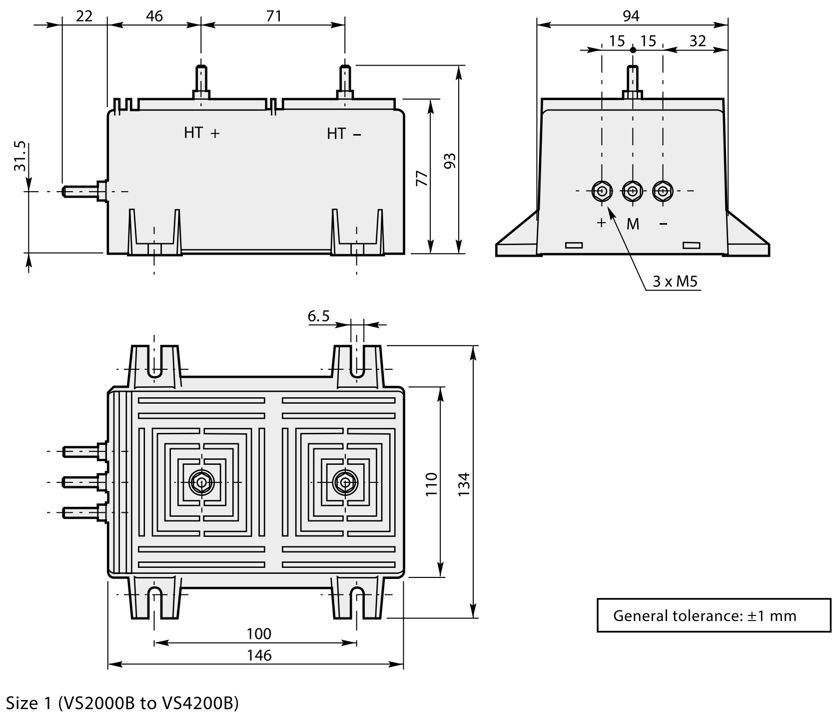
For rolling stock and infrastructure

3

Dimensions (mm)



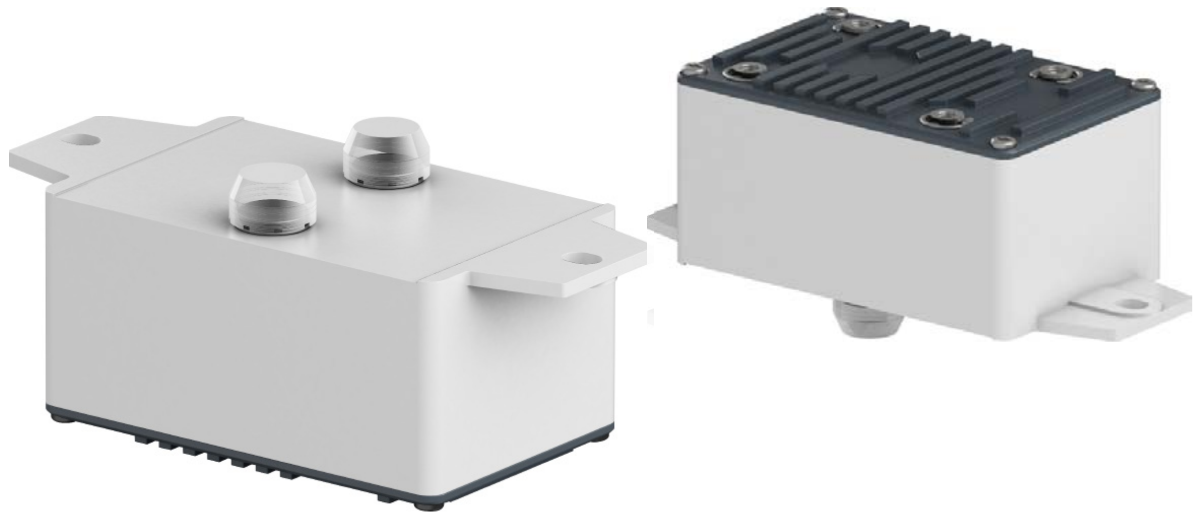
Size 0 (VS50B to VS1500B)



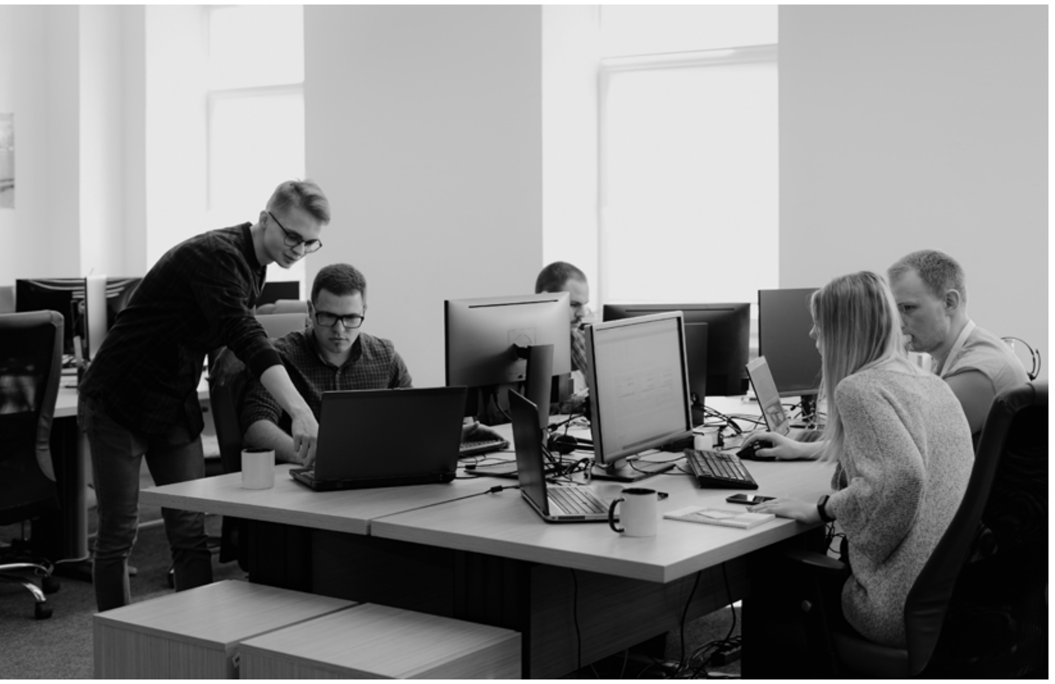
Size 1 (VS2000B to VS4200B)

Railway voltage detectors VD range

Electronic technology for rolling stock and infrastructure



Maintenance personnel warning : an PETERCEM innovation.



Faced with a current offering with insufficient reliability that doesn't meet the market standards, PETERCEM has innovated with the VD Railway voltage detector.

This 100% electronic product allows your maintenance operatives to be aware of the presence of a continuous voltage, before carrying out operations on equipment. When the diode flashes, the voltage is greater than 50 V and when it is extinguished, the voltage is below this limit. Provided with a double internal function and independent LEDs, the VD Railway voltage detector offers redundant function and a lifetime greater than 1 million hours. Guaranteed for 2 years, it allows reliable decisions to carry out operations to be made and warns personnel from dangerous high voltages.

An answer adapted to market requirements

Guaranteeing optimum reliability, the VD Railway voltage detector meets the requirements for difficult environments and is adaptable to the most demanding applications such as:
– rolling stock: main converters, auxiliary converters. Based on the SNCF CF60-100 specification, the whole French railway market imposes the presence of a voltage detector within built redundancy, to meet the drastic requirements of this sector.
– electronic power systems integrating capacitors banks: backups, wind generators, variable speed drives, electrolysis require voltage detectors of robust design and offer high reliability.

A considered and measured integrated design

Thanks to a 100% electronic technology, PETERCEM has reduced the size of the VD Railway voltage sensor to a minimum. The ultra-compact dimensions allow for simplified installation. Additionally, its self-sufficiency in energy means that it can work without an external power supply.

100% electronic

At the forefront of technological innovation at PETERCEM, the VD Railway voltage detector is 100% electronic. Other than the assurance of providing unbeatable performance, it has reduced dimensions:
smaller and more compact, it offers greater installation flexibility. Its 100% electronic technology also provides it with an excellent immunity to surrounding magnetic fields: a guarantee for accurate detection of a given voltage.

Redundancy to avoid any risks

The VD Railway voltage detector is a voltage detection system with built-in redundancy. It is equipped with two electronic circuits each connected to a light emitting diode (LED). These two parallel and independent systems guarantee a high level of functioning and improve the reliability of the detector.

Environment-friendly

PETERCEM have long been concerned with the protection of the environment, as proved by the ISO 14001 certification they received in 1998. This environmental approach is particularly noticeable in production of the VS range in the reduction of the number of components, in the use of a low-energy manufacturing procedure and the use of recyclable packing.
The products in use are also characterized by their reduced energy consumption.

Quality that goes beyond standards

The new product complies with the standard EN 50155 (high technology electronic design and testing) and EMC EN 50121-3-2 (electromagnetic compatibility: resistance to electromagnetic interference) and follows a very rigorous manufacturing process.

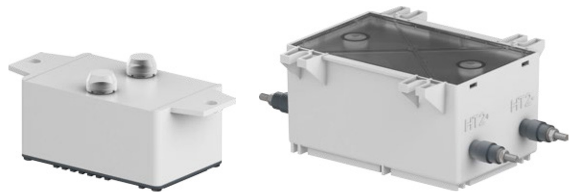
Certified ISO 9001 and CE labeled, the VD Railway voltage detector complies with the most rigorous standards and requirements.

The VD Railway voltage detector is the only product on the market that complies with rolling stock security standards such
as: EN 50124-1 (electrical isolation), EN 50163 (standardized voltage 1500 V DC) and EN 45 545 for fire-smoke resistance.

Because your security is essential

For rolling stock and infrastructure
Technical data

Application
Electronic detectors for direct voltages.
This device signals the presence of dangerous voltages via the independent flashing of two LEDs (Light emitting diodes).
A secondary supply voltage is not necessary.



3

			VD1500-48	VD3000-25
Order code			1SBT900000R0007	1SBT903000R2501
Nominal voltage (U_N)		V DC	1500	3000
Maximum voltage long duration U_{MAX2}	5 min	V DC	1950	3900
Maximum voltage overload	20 msec/h	V DC	2540	4200
Insulation voltage rating (1) (U_{NM})	50 Hz, 1 min	kV	6.5	12
Average current consumption (LED flashing)		mA	≤ 1.5	≤ 1.5
LED flashing frequency		Hz	2	2
Activating voltage (U_{ON})		V DC	> 49	> 25.5
Activating voltage (U_{OFF})		V DC	< 38	< 16.5
Mass		kg	≤ 0.5	≤ 1.5
Starting temperature		°C	-40 ... +70	-40 ... +70
Operating temperature		°C	-25 ... +70	-25 ... +70
Storage temperature		°C	-40 ... +85	-40 ... +85
Light Emitting Diode (LED) colour			red	red
Light Emitting Diode (LED) angle of vision			≥ 15°	≥ 15°

(1) Defined acc. to overload category: 3 (OV3), pollution degree: 2 (PD2)

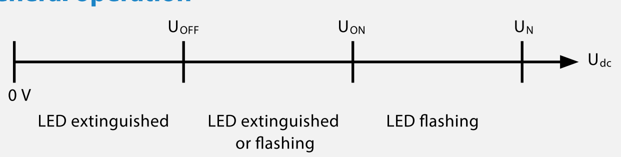
Customisation
For models with remote LEDs and/or with other colors, please contact your sales representative.

General data
– Plastic case and insulating resin are self-extinguishing.
– The casing temperature must not exceed 105 °C.
– Fixing holes in the case moulding for horizontal mounting.
– Product mounting according to the document: *VD range Mounting* Instructions.
– Product Use and Maintenance instructions according to the document: *Use of the Voltage Detector - Preventive and Curative* Maintenance VD range.
– Tightening torque: 2 Nm.

Security
Only qualified and authorised personnel may carry out any operation on the detector; without voltage applied to the terminals of the voltage detector and with the equipment (power converter) electrically isolated.

Primary connection
– Insert M5x7 for terminals.

General operation



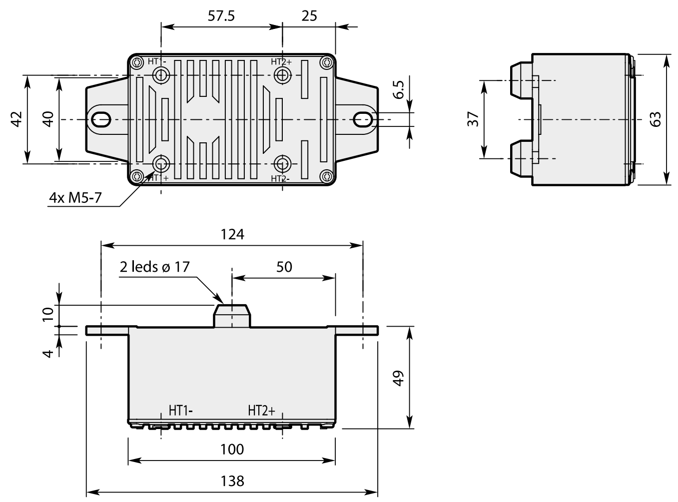
U_{OFF} : Low limit at which the LEDs extinguish when the equipment is electrically isolated.
U_{ON} : High limit at which the LEDs illuminate (flashing frequency approximately 2 Hz) when the equipment power is switched on.
Between these two limits the LEDs maybe extinguished or flashing.

Conformity
EN 50155, EN 50124-1, EN 50121-3-2, EN 50163

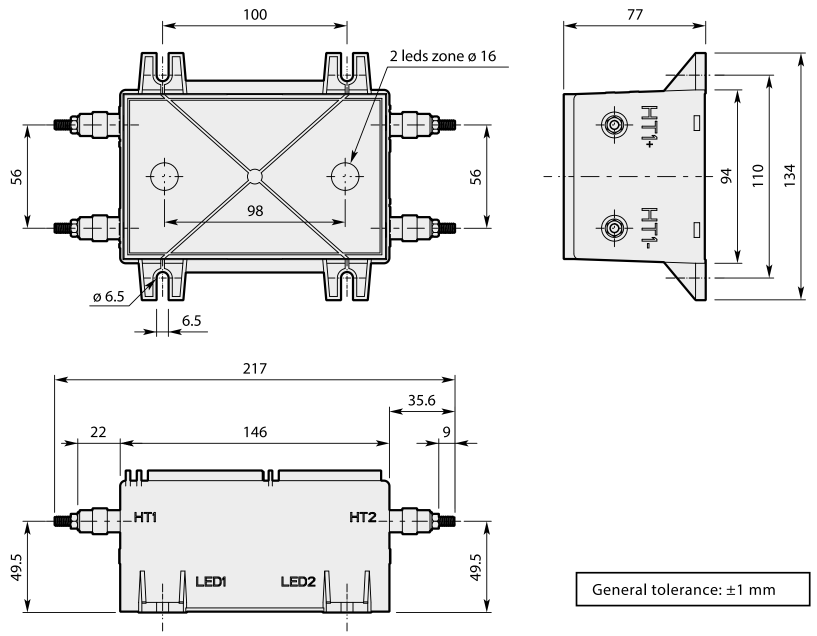
For rolling stock and infrastructure

3

Dimensions (mm)

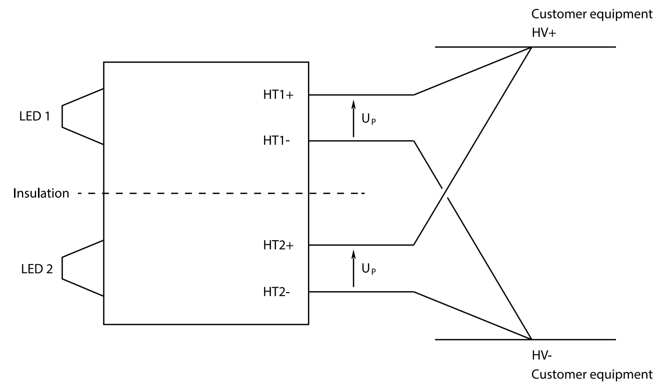


VD1500-48



VD3000-25

Wiring diagram



04.GENERAL TECHNICAL DATA

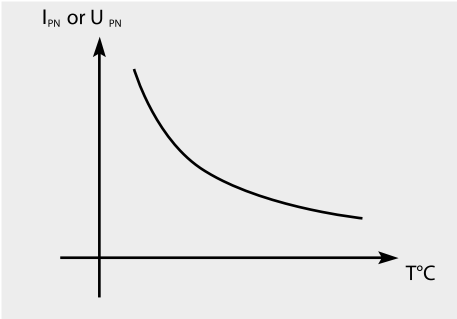
Description of the main current and voltage sensor's characteristics

Nominal primary current (I_{PN}) and nominal primary voltage (U_{PN})

This is the maximum current or voltage that the sensor can continuously withstand (i.e. without time limit).
The sensor is thermally sized to continuously withstand this value.
For alternating currents, this is the r.m.s. value of the sinusoidal current.
The value given in the catalogue or in the technical data sheet is a nominal rating value. This figure can be higher if certain conditions (temperature, supply voltage…) are less restricting.

Operating range (I_{PN}, U_{PN}) and temperature (°C)

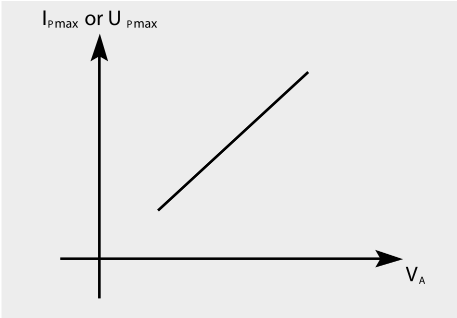
The sensor has been designed for a certain operating temperature. If this temperature is reduced, then it is possible to use the sensor with a higher thermal current or voltage.



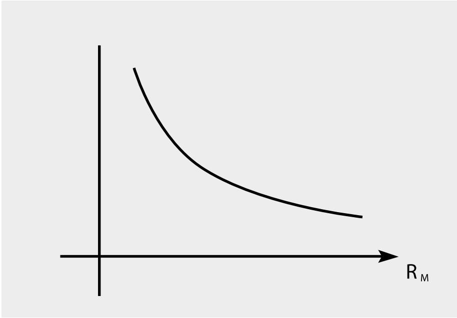
Measuring range (I_{PMAX} and U_{PMAX})

This is the maximum current or voltage that the sensor can measure with the Hall effect. In general, mainly for thermal reasons, the sensor cannot continuously measure this value for direct currents and voltages.
This measuring range is given for specific operating conditions. This can vary depending mainly on the parameters below (see calculation guide).

- **Supply voltage**
  The measuring range increases with the supply voltage.

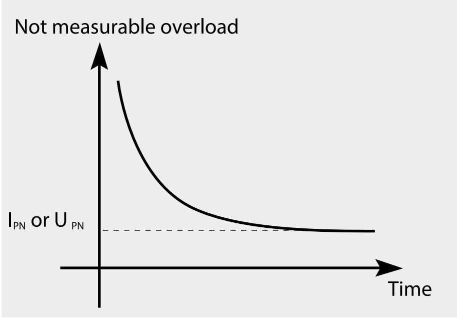


- **Measuring resistance**
  The measuring range increases when the measuring resistance is reduced.



Not measurable overload

This is the maximum instantaneous current or voltage that the sensor can withstand without being destroyed or damaged.
However the sensor is not able to measure this overload value.
This value must be limited in amplitude and duration in order to avoid magnetising the magnetic circuit, overheating or straining the electronic components. A sensor can withstand a lower value overload for longer.



Description of the main current and voltage sensor's characteristics

Secondary current I_{SN} at I_{PN} or at U_{PN}

This is the sensor's output current I_S when the input is equal to the nominal primary current I_{PN} or to the nominal primary voltage U_{PN}.

Measuring resistance R_M

This is the resistance connected in the secondary measuring circuit between terminal M of the current or voltage sensor and the 0 V of the supply. The measuring voltage V_M at the terminals of this resistance R_M is proportional to the sensor's secondary current I_S.
It is therefore the image of the sensor's primary current I_P or primary voltage U_P.

For thermal reasons, a minimum value is sometimes required in certain operating conditions in order to limit overheating of the sensor.

The maximum value for this resistance is determined by the measuring range.
(see calculation guide and the curve I_{PMAX} or U_{PMAX} = f(R_M) opposite).

Accuracy

This is the maximum error for the sensor output I_{SN} for the nominal input value (current or voltage).
This takes into account the residual current, linearity and thermal drift.

AC accuracy

This is the maximum error for the sensor's output I_{SN} for an alternating sinusoidal primary current with a frequency of 50 Hz.
The residual current is not taken into account. The linearity and thermal drift are always included.

No-load consumption current

This is the sensor's current consumption when the primary current (or primary voltage) is zero.
The total current consumption of the sensor is therefore the no-load consumption current plus the secondary current.

Closed loop Hall effect current sensors

Instructions for mounting and wiring ES, and CS sensors

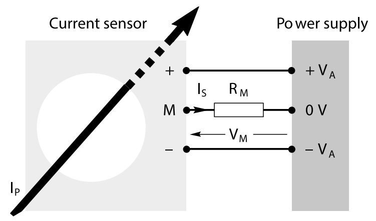
Introduction

These instructions are a non-exhaustive synthesis of the main recommendations for mounting closed loop Hall effect current sensors.
Each application configuration is different, do not hesitate to contact us for advice adapted to your particular case.
Please note that incorrect or non-judicious use of the sensor may lead to deterioration in the performance or operation of the sensor.

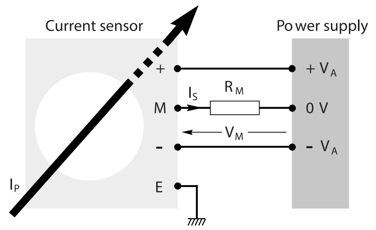
1 - Wiring diagram

– Direction of the current: A primary current IP flowing in the direction of the arrow results in a positive secondary output current Is from terminal M.
– Supply voltage: bipolar voltage -VA… 0 V … +VA
Closed loop Hall effect sensors can also operate with a unipolar supply voltage (-VA … 0 V or 0 V … +VA) under certain conditions.
Please contact your distributor for further details for this application.

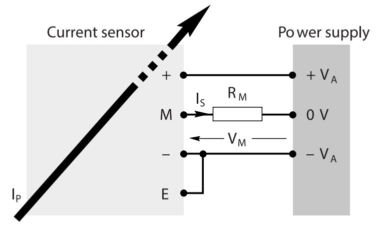
1.1 - Sensors without screen terminal



1.2 - Sensors with screen terminal



Recommended wiring



Alternative wiring

The screen terminal "E" can be connected to the secondary negative terminal (marked "-") on the sensor. However the best EMC performance is obtained by connecting the screen terminal "E" to ground by a copper braid strap as short as possible.

1.3 - Internal electrostatic screen

During very rapid variations in the primary conductor potential compared to the reference potential (high du/dt), a capacitive coupling effect can be produced between the primary conductor and the secondary winding of the sensor. This coupling can lead to measurement errors. In order to eliminate this capacitive coupling, some current sensors have an internal copper electrostatic screen between the secondary winding and the hole for the primary conductor. This screen is linked internally either to an additional terminal marked "E", or to the sensor negative secondary terminal (marked "-").

2 - Mechanical mounting

– All mounting positions are possible: horizontal, vertical, upside down etc.
– Recommended fixing: by screws and flat washers.
– **Installation with a primary bar:** in this case, the sensor must be mechanically fixed, either only by the bar, or only by the enclosure, but never by both at the same time (this type of fixing would lead to mechanical stresses that could lead to deterioration of the sensor casing).

3 - Precautions to be taken into account relative to the electromagnetic environment

Due to their operating principle (measure of magnetic field by the Hall effect probe), closed loop Hall effect current sensors can be sensitive to strong external magnetic fields. It is therefore strongly recommended to avoid positioning them too close to high current power cables. The use of a magnetic screen to protect the sensor may be advised for certain configurations with a strong magnetic influence.
The orientation of the sensor is also very important. Please contact your distributor for further information on this subject.

4 - Processing of the sensor's output signal

Standard codes of practice advise that, before the signal is processed, a low-pass filter adapted to the bandwidth of the sensor is used. Moreover, in the case of digital processing of the signal, it is also recommended that the sampling frequency is adapted to the bandwidth of both the signal to be measured and the sensor.
In the event of sensor failure, the processing of the output signal should take into account deterioration in performance (e.g. absence of signal or saturated signal) and rapidly and safely shut the system down.

Electronic current sensors

Instructions for mounting and wiring NCS sensors

Introduction

These instructions are a non-exhaustive synthesis of the main recommendations for mounting electronic current sensors. Each application configuration is different, please do not hesitate to contact us for advice adapted to your particular case. Please note that incorrect or non-judicious use of the sensor may lead to deterioration in the performance or operation of the sensor.

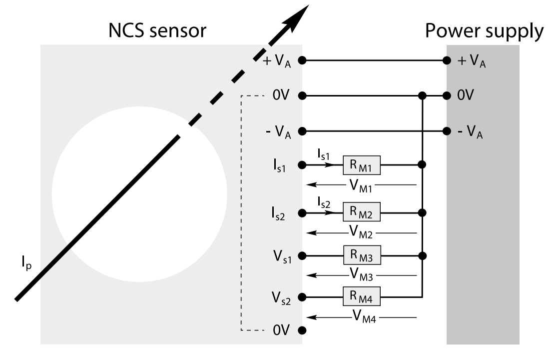
1 - Wiring diagram

– **Direction of the current:**
- **Output current (I_{S1} and I_{S2}):** A primary current flowing in the direction of the arrow results in a positive secondary output current on the terminals I_{S1} and I_{S2}.
- **Output voltage (V_{S1} and V_{S2}):** A primary current flowing in the direction of the arrow results in a positive secondary output voltage on the terminals V_{S1} and V_{S2}.

– Supply voltage: bipolar voltage $-V_A$ … 0 V … $+V_A$ (0…+VA for the NCS305).
It is possible to design electronic current sensors, upon request, that can operate with a unipolar supply voltage ($-V_A$ … 0 V ou 0 V …$+V_A$).

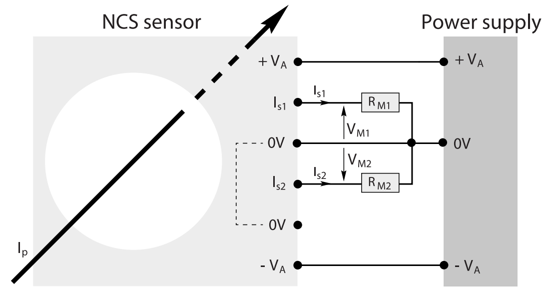
1.1 Sensors with connector output (current and voltage outputs)

Sensor internal electric connection



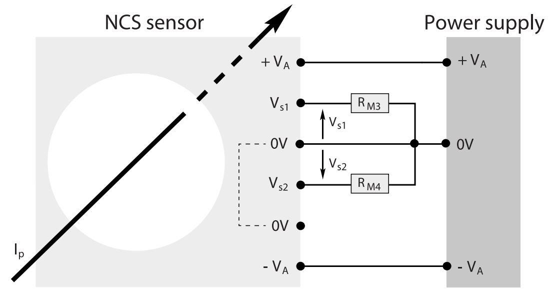
1.2 Sensors with cable output (current outputs)

NCS sensors have two current outputs as standard:
– I_{S1} that supplies ±20 mA (peak) at $\pm I_{PN}$ (peak)
– I_{S2} that supplies ±20 mA (peak) at $\pm I_{PMAX}$ (peak)
Two measured gains are thus available.
In the case of a current output, R_M is determined in the following manner:
$R_M = V_M / I_S$ where V_M = to be obtained at the terminals of R_M
$I_S = I_{S1}$ or I_{S2} (current output)
Limitation: $0\ \Omega < R_M < 350\ \Omega$ for I_S max (peak) of ±20 mA
The secondary cable passes through the white plastic enclosure (included) containing a ferrite core (NCS125 & NCS165), to reduce the interference that could affect the correct functioning of the sensor.



1.3 Sensors with cable output (voltage outputs)

The sensors have two voltage outputs as standard:
– V_{S1} that supplies ±10 V (peak) at $\pm I_{PN}$ (peak)
– V_{S2} that supplies ±10 V (peak) at $\pm I_{PMAX}$ (peak)
Two measured gains are thus available.
In the case of a voltage output, R_M is either greater than or equal to 10 kΩ.
The secondary cable passes through the white plastic enclosure (included) containing a ferrite core (NCS125 & NCS165), to reduce the interference that could affect the correct functioning of the sensor.



Instructions for mounting and wiring NCS sensors

2 - Mechanical mounting

– All mounting positions are possible: horizontal, vertical, upside down etc.
– Recommended fixing: by screws and flat washers. Oblong fixing holes in the enclosure moulding provide a large amount of mounting flexibility and allow for fully symmetrical positioning.
– Fixing by the use of side plate kits:
  - Fixing on one (or several) cable on one (or several) primary bar: in this case, the sensor should only be fixed to the primary conductor mechanically by the side plate kit. The sensor must not be mechanically fixed to the primary conductor by the enclosure and the side plate kit at the same time (this type of mounting would lead to mechanical stresses that may deteriorate the enclosure).
  - Fixing on a chassis or partition: in this case, the side plate kit offers a large amount of mounting flexibility.

See the particular mounting instructions.

Recommendations for the passage of the primary conductor

– The primary conductor may be one (or several) cable or one (or several) bar.
– In order to obtain the best measuring performance, the primary conductor must be:
  - Centred as much as possible in the opening in the sensor
  - The biggest possible with respect to the opening in the sensor
  - Fixed at an angle close to 90° with respect to a plane formed by the sensor
  - As straight as possible at the sensor in order to minimise local increases in the magnetic field caused by bends in the primary conductor.

These local increases may create a saturation of one of the sensor probes and induce measurement errors.

For further information, please refer to the "Dimensions" section of the NCS range in this catalogue or to the mounting instructions ref. **1SBC146000M1704** (NCS125 & NCS165) or ref. **1SBC146010M1701** (NCS305).

Electronic current sensors

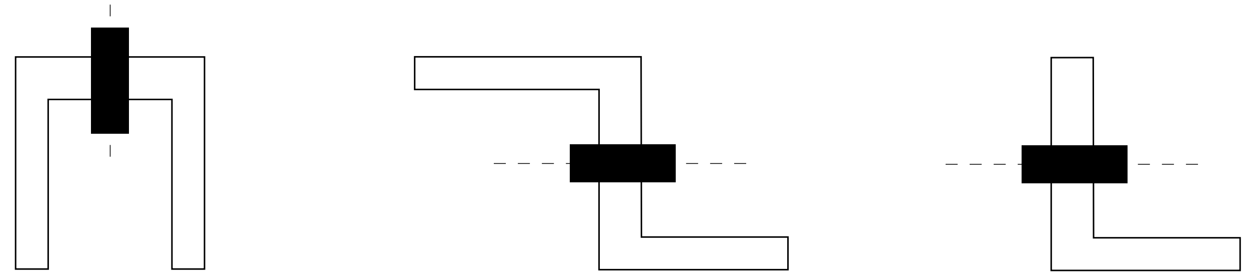
Instructions for mounting and wiring NCS sensors

3 - Precautions to be taken into account relative to the electromagnetic environment

Due to the continuous reduction in equipment volume and the increase in their power, internal system components are subject to strong electromagnetic interference. NCS sensors, based on the measure of currents by magnetic fields, (see functioning description **1SBD370024R1000**) must not be interfered by surrounding magnetic fields. They have therefore been designed in order to allow accurate measurement without interference.
Different tests carried out on NCS sensors show the rejection of the sensors to this external magnetic interference in relation to the configuration of the predefined bar arrangement.

During type testing, the sensors were subject to 3 types of tests:
– magnetic field circuits: measure the influence of the magnetic fields generated by the primary conductor on the sensor
– interference by an external set of bars: measure the influence of the magnetic fields generated by the other conductors different from the primary conductor on the sensor
– coupling of primary bars: measure the influence of the mechanical mounting of the sensor on a primary conductor

During the different tests and in each configuration, the measured results (accuracy) are recorded whilst varying the following elements:
  - distance between the sensor and the interfering current
  - rotation of the interfering current around the sensor
  - the magnitude of the interfering current
  - the current form (DC or AC)
  - inclination of the sensor on the primary conductor
  - centricity of the sensor on the primary bar
  - different primary bar configurations (rectangular simple or double, round and arrangements in "U", "S" or "L" configurations)

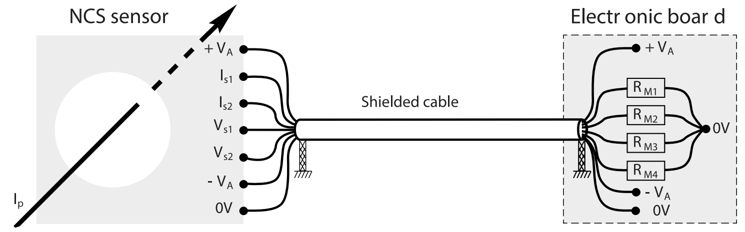


Primary bar in "U" Primary bar in "S" Primary bar in "L"

The tests were carried out with the primary bars in "U" configuration, the most restricting condition.
See mounting instructions ref. **1SBC146000M1704** (NCS125 & NCS165) or ref. **1SBC146010M1701** (NCS305) for further information.

3.1 Mounting for improved EMC performance (shielding)

In applications that require the sensor to be used with long cables exposed to interference, it is imperative that shielded cables are used, with the shielding connected to ground at both ends (see figure below).
Standard NCS sensors with cable outputs are supplied in white plastic enclosures containing a ferrite core (NCS125 & NCS165). The secondary cable passes through this white plastic enclosure to reduce the interference caused that could affect the correct functioning of the sensor.
Please contact your distributor for further information on this subject.



4 - Processing of the sensor's output signal

Standard codes of practice advise that, before the signal is processed, a low-pass filter adapted to the bandwidth of the sensor is used.
Moreover, in the case of digital processing of the signal, it is also recommended that the sampling frequency is adapted to the bandwidth of both the signal to be measured and the sensor.
In the event of sensor failure, the processing of the output signal should take into account this deterioration in performance (e.g. absence of signal or saturated signal) and rapidly and safely shut the system down.

Instructions for mounting and wiring VS sensors

Introduction

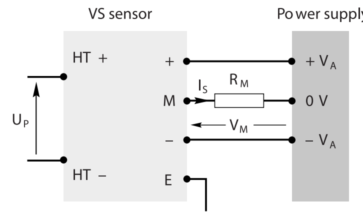
These instructions are a non-exhaustive synthesis of the main recommendations for mounting VS voltage sensors. Each application configuration is different, do not hesitate to contact us for advice adapted to your particular case.
Please note that incorrect or non-judicious use of sensors may lead to deterioration in the performance or operation of the sensor.
Please refer to the mounting instructions ref. **1SBC147000M1702** (VS050 to VS1500) and ref. **1SBC146012M1701** (VS2000 to VS4200) for further information.

1 - Wiring diagram

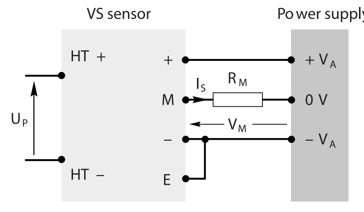
– Direction of the current: A positive primary differential voltage ($U_P = U_{HT+} - U_{HT-} > 0$) results in a positive secondary output current Is from terminal M.
– Supply voltage: bipolar voltage $-V_A \ldots 0\,V \ldots +V_A$
VS sensors can also operate with a unipolar supply voltage ($-V_A \ldots 0$ V ou 0 V … $+V_A$) under certain conditions.
Please contact your distributor for further details for this application.

1.1 - VS voltage sensors with screen

The best EMC performance is obtained by connecting the screen terminal "E" to earth by a copper braid strap as short as possible.
If the electromagnetic interference is weak the screen terminal "E" can be connected to the sensor negative secondary terminal (marked "-").

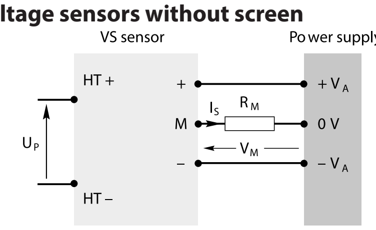


Recommended wiring



Alternative wiring

1.2 - VS voltage sensors without screen



2 - Mechanical mounting

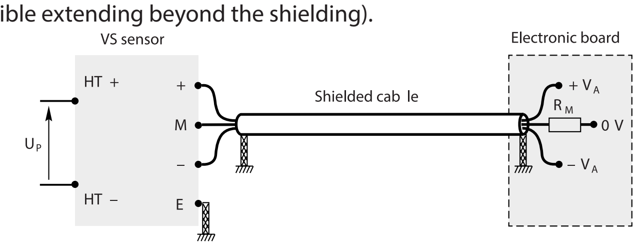
All mounting positions are possible: horizontal, vertical, upside down, on edge.
Minimum distance between 2 sensors: 1 cm.
Recommended fixing: 2 M6 screws with flat washers.

Electronic voltage sensors

Instructions for mounting and wiring VS sensors

3 - Precautions to be taken into account, relative to the electromagnetic environment

– Best performance is obtained in an environment with low electromagnetic interference.
– Electromagnetic interference is generated by the switching of strong currents (e.g.: switch relay), high voltage switchgear (e.g.: semi-conductor choppers), high intensity radio environment (e.g.: radio communication equipment).
– With the aim of minimising the effects of strong electromagnetic interference, please refer to standard rules (current working practice) and especially the following:
- It is recommended that the sensor be fixed by its enclosure to a conducting plate that is connected to a stable potential (e.g.: earth ground plate).
- It is recommended that the secondary be connected with a shielded cable (with the shielding connected to both cable ends and with a minimum length of wire as possible extending beyond the shielding).



- It is recommended that the screen terminal "E" be connected to earth with a copper braid strap as short as possible (length not to exceed five times its width).
– It is recommended that the primary and secondary cables are separated.
– It is recommended that the two primary cables are fixed together (e.g. with cable clamps).
– It is strongly recommended that the primary and secondary cables connected to the sensors, are fixed to the earth ground plates or metal frame in order to minimise the interference induced in these cables.

4 - Processing of the sensor's output signal

Standard codes of practice advise that, before the signal is processed, a low-pass filter adapted to the bandwidth of the sensor is used.
Moreover, in the case of digital processing of the signal, it is also recommended that the sampling frequency is adapted to the bandwidth of both the signal to be measured and the sensor.
In the event of sensor failure, the processing of the output signal should take into account deterioration in performance (e.g. absence of signal or saturated signal) and rapidly and safely shut the system down.

Warning: The VS voltage sensor incorporates a switched mode power supply with a chopping frequency set at around 50 kHz.

5 - Dedicated technical documentation to VS technology

Because of the need on more precise technical information on VS sensors, following documentation is available:
1SBD370318R1001 VS tests in the field. This document approaches the different possibilities to investigate, from basic to complex tests, the good operation of a VS sensor. The EMC subject is also presented.

Introduction

These instructions are a non-exhaustive synthesis of the main recommendations for mounting VD voltage detectors.
Each application configuration is different, please do not hesitate to contact us for advice adapted to your particular case.
Please note that incorrect or non-judicious use of the sensor may lead to deterioration in the performance or operation of the sensor.

1 - Wiring diagram

The VD voltage detector is a very reliable product, consequently the wiring is an important point to take into account.
The following points must be respected:

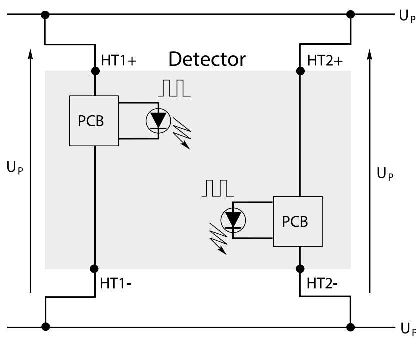
– The VD voltage detector connections wires must be dedicated to High Voltage only,
– The 4 screws used must respect the following specification:
 - M5x7 insert for connections : screw M5 with flat washer. Tightening torque: 2 Nm.

It is also recommended that the LED (Light Emitting Diode) lenses are only removed during maintenance operations by qualified personnel.

1.1 - Redundancy function

In order to ensure that the detector works correctly and permanently, it includes two times the same function as explained opposite.
In order to operate accordingly, the VD detector must be connected using the 4 primary terminals:

– The first LED operates when the terminals HT1+ and HT1- are connected,
– The second LED operates when the terminals HT2+ and HT2- are connected.



1.2 - High voltage connection

Before connecting the high voltage cable to the VD voltage detector, the operator must make sure that the identification of the terminals is clearly marked without the possibility of confusion.
The correct identification of the High Voltage terminals is shown opposite:
The detector operates correctly when the polarity of the terminals is respected as follows:

– The positive High Voltage is connected to HT1+ and HT2+ with 2 different cables coming from the 2 different connection points,
– The negative High Voltage is connected to HT1- and HT2- with 2 different cables coming from the 2 different connection points.

2 - Mechanical mounting

2.1 - Fixing by the enclosure

From the security point of view, it is very important that the VD voltage detector is fixed in the best possible mechanical conditions:

– The detector may be mounted in all positions (horizontal, vertical, upside down, on edge) but the two M6 screws must be checked that they are correctly tightened on the detector with a system to prevent nuts becoming loose
– The use of flat washers under the nuts is generally recommended
– The surface where the detector is mounted, is sufficiently flat
– The location where the detector is mounted is not subject to high vibration levels
– The maintenance personnel have easy and quick access to the device
– The 2 LEDs are easily visible to the appropriate persons

2.2 Environment around the LEDs

The recommended visual inspection distance for checking the LEDs should not exceed 2 metres between the operators eyes and the LED. The ambient light should not exceed 1000 lux. This distance may be increased if the voltage detector is placed in a location where the daylight has a small influence on the visual indication of the LED.
For normal and regular checking of the LEDs, the operators eyes should be within an angle of ±15° from the LEDs axis. For further information, please do not hesitate to contact your distributor or refer to the mounting Instructions.

3 - 1st switching on of the detector

After applying high voltage to the primary terminals of the VD voltage detector, pay attention to the following points:

– do not touch the HT terminals (high voltage) of the VD voltage detector
–do not try to remove the lenses of the LEDs

Checking correct functioning

The VD voltage detector LEDs should flash about every 0.5 seconds as soon as the dangerous voltage U_{ON} is passed. The LEDs should remain extinguished below U_{OFF}, (see the detailed characteristics of the VD1500 voltage detector). In the event that LEDs do not work when high voltage is applied:

–electrically isolate the system
– make sure that no residual voltage is present in the VD voltage detector (voltmeter or other means)
– check that the VD voltage detector wiring is correct (this may explain why the LEDs do not work)

If no faults are found in the installation, carry out a complete replacement of the voltage detector.
Please contact your distributor for further information on this subject or refer to the document *Voltage Detector usage - Preventive and Curative Maintenance*.

ES300C

4

1 - Reminder of the key elements (closed loop Hall effect)

Formulas

- $N_P \times I_P = N_S \times I_S$
- $V_A = e + V_S + V_M$
- $V_S = R_S \times I_S$
- $V_M = R_M \times I_S$

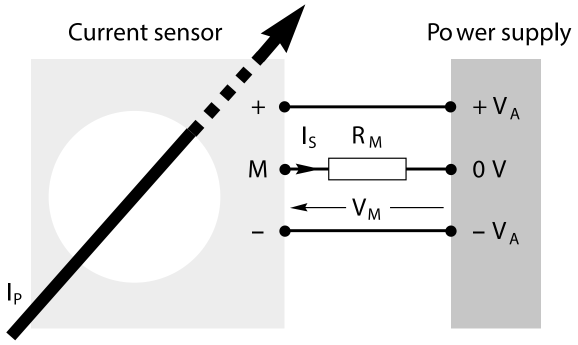
Abbreviations

- N_P : turn number of the primary winding
- I_P : primary current
- I_{PN} : nominal primary current
- N_S : turn number of the secondary winding
- I_S : output secondary current
- V_A : supply voltage
- e : voltage drop across output transistors (and in the protection diodes, if relevant)
- V_S : voltage drop across secondary winding
- V_M : measuring voltage
- R_S : resistance of the secondary winding
- R_M : measuring resistance

Values of "e" with a bipolar sensor supply

Sensor	ES100	ES300…ES2000	CS300…CS1000	CS2000	MP or EL
Voltage "e"	2.5 V	1 V	2.5 V	1.5 V	3 V

Reminder of the sensor electrical connection



2 - Measurement circuit calculation (secondary part of the sensor)

Example with ES300C sensor

N_P/N_S = 1/2000
I_{PN} = 300 A
R_S = 33 Ω (at +70 °C)
I_S = 0.15 A (at I_{PN})
e = 1 V

2.1 - What load resistance (RM) is required to obtain an 8 V measuring signal (VM = 8 V) when the IP current = 520 A peak?

$I_S = (N_P / N_S) \times I_P$ = (1 / 2000) x 520 = 0.26 A peak
$R_M = V_M / I_S$ = 8 / 0.26 = 30.77 Ω

We must check that the sensor can measure these 520 A peak, i.e.:
$V_A \geq e + V_S + V_M$
If V_A = ±15 V (±5%), then we must check that
15 x 0.95 ≥ 1 + (33 x 0.26) + 8 which is false since 14.25 V< 17.58 V

Therefore a supply greater than or equal to 17.58 V must be selected. Select a ±24 V (±5%) supply.
We verify that 24 x 0.95 ≥ 17.58 V.

Conclusion
An ES300C sensor can measure a peak of 520 A in the following conditions:
V_A = ±24 V (±5%)
R_M = 30.77 Ω
to obtain an 8 V signal at a peak of 520 A

ES300C

4

2.2 - What are the consequences, if the required signal is only 5 V?

$R_M = V_M / I_S$ = 5 / 0.26 = 19.23 Ω
We must check that the sensor can measure these 520 A peak.
$V_A \geq e + V_S + V_M$
If V_A = ±15 V (±5%), then we must check that
15 x 0.95 > 1 + (33 x 0.26) + 5 which is false since 14.25 V< 14.58 V
Therefore a supply greater than or equal to 14.58 V must be selected. Select a ±24 V (±5%) supply or a ±15 V supply with a tighter tolerance, for example ±15 V (±2%).
(since 15 V x 0.98 ≥ 14.58 V)

Conclusion
An ES300C sensor can measure a peak of 520 A in the following conditions:
V_A = ±15 V (±2%)
R_M = 19.23 Ω
to obtain a 5 V signal at a peak of 520 A.

In general, the larger the measuring signal required, the larger the load resistance and the higher the sensor supply voltage should be. The thermal aspect of the sensor should be considered.

2.3 - What is the maximum current measurable by an ES300C in specific conditions?

For example, the conditions are:
V_A = ±15 V (±5%)
R_M = 15 Ω

From the base formulas, we obtain the following formula:
$I_{SMAX} = (V_{AMIN} - e) / (R_S + R_M)$ = [(15 x 0.95) – 1] / (33 + 15) = 0.276 A peak
Now calculate the equivalent primary current:
$I_P = (N_S / N_P) \times I_S$ = (2000 / 1) x 0.276 = 552 A peak

Conclusion
An ES300C sensor can measure a peak of 552 A in the following conditions:
V_A = ±15 V (±5%)
R_M = 15 Ω
Note: the 552 A peak current must not be a continuous current. For specific requirements, contact your distributor.

2.4 - What influence does the ambient temperature have on the sensor's performance?

Taking the conditions from point 2.3 (preceding example). The calculations were made using a maximum default operating temperature of +70 °C. If this maximum temperature is +50 °C, then the measuring range can be increased as follows:

R_S = 33 Ω at +70 °C At +50 °C, R_S = 30.5 Ω then,
$I_{SMAX} = (V_{AMIN} - e) / (R_S + R_M)$ = [(15 x 0.95) – 1] / (30.5 + 15) = 0.291 A peak
Now calculate the equivalent primary current:
$I_P = (N_S / N_P) \times I_S$ = (2000 / 1) x 0.291 = 582 A peak

Conclusion
An ES300C sensor can measure a peak of 582 A in the following conditions:
V_A = ±15 V (±5%)
R_M = 15 Ω
Max. operating temperature = +50 °C
Note: the 582 A peak current must not be a continuous current. For specific requirements, contact your distributor.

In general, the lower the ambient temperature, the more important the sensor measurable current. The thermal aspect of the sensor should be considered.

Closed loop Hall effect current sensors

ES300C

2.5 - What influence does the turn ratio have on the sensor's performance?

Taking the conditions of point 2.3 again. The calculations were based on a turn ratio of 1/2000. If this ratio is 1/1500 (non standard ratio for a 300 A sensor), then the elements are determined as follows:

$I_S = (N_P / N_S) \times I_P$ = (1 / 1500) x 552 = 0.368 peak (I_P = 522 A from 2.3 above)

Now calculate the voltage obtained at the terminals of the measuring resistance:

- for a turn ratio of 1/2000:

  $V_M = R_M \times I_S$ = 15 x 0.276 = 4.14 V

- for a turn ratio of 1/1500:

  $V_M = R_M \times I_S$ = 15 x 0.368 = 5.52 V

Conclusion

An ES300C sensor can measure a peak of 552 A in the following conditions

$V_A = \pm 15$ V (±5%)

$R_M = 15\ \Omega$

V_M = 4.14 V with a turn ratio of 1/2000

V_M = 5.52 V with a turn ratio of 1/1500

In general, the lower the turn ratio, the more important the output current and the higher the measuring voltage. The thermal aspect of the sensor should be considered.

2.6 - What influence does the supply voltage have on the sensor's performance?

Taking the conditions in point 2.3 again. The calculations were based on a supply voltage of ±15 V (±5%).

Reworking the calculations with a supply of ±24 V (±5%).

From the base formulas, we obtain the following formula:

$I_{SMAX} = (V_{AMIN} - e) / (R_S + R_M)$ = [(24 x 0.95) – 1] / (33 + 15) = 0.454 A peak

Now calculate the equivalent primary current:

$I_P = (N_S / N_P) \times I_S$ = (2000 / 1) x 0.454 = 908 A peak

Conclusion

An ES300C sensor can measure a peak of 908 A in the following conditions:

$V_A = \pm 24$ V (±5%)

$R_M = 15\ \Omega$

Note: the 908 A peak current must not be a continuous current.

In general, the higher the supply voltage, the more important the measuring current and the higher the measuring voltage. The thermal aspect of the sensor should be considered.

NB: for calculations with unipolar supply (e.g. 0…+24 V), contact your distributor.

Electronic technology current sensors NCS sensors

NCS125-10

1 - Reminder of the key elements

Formulas

$V_{M1} = R_{M1} \times I_{S1}$

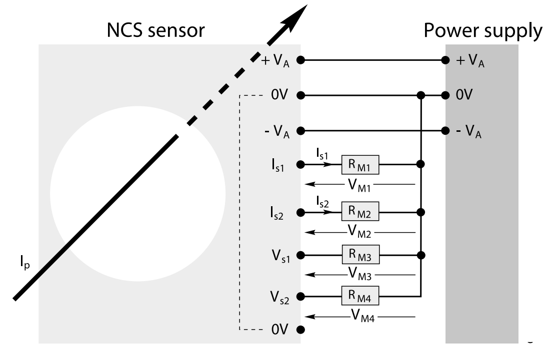
$V_{M2} = R_{M2} \times I_{S2}$

with $0\ \Omega < R_{M1}$ or $R_{M2} < 350\ \Omega$

Abbreviations

I_P	:	primary current
I_{PN}	:	nominal primary current
I_{PMAX}	:	maximum primary current
I_{S1}	:	secondary current at I_{PN}
I_{S2}	:	secondary current at I_{PMAX}
V_{S1}	:	secondary voltage at I_{PN}
V_{S2}	:	secondary voltage at I_{PMAX}
V_A	:	supply voltage
V_M	:	measuring voltage
R_M	:	measuring resistance
R_{MMIN}	:	minimum measuring resistance
R_{MMAX}	:	maximal measuring resistance

Reminder of the sensor electrical connection



2 - Measurement circuit calculation (current output)

Example with NCS125-4 sensor

I_{PN}	= 4 000 A	I_{S1} @ I_{PN}	= ±20 mA
I_{PMAX}	= 20 000 A	I_{S2} @ I_{PMAX}	= ±20 mA
R_M	= 0 - 350 Ω (I_{S1} & I_{S2})	V_{S1} @ I_{PN}	= ±10 V
R_M	≥ 10 kΩ (V_{S2} & V_{S2})	V_{S2} @ I_{PMAX}	= ±10 V
V_A	= ±15 V … ±24 V		

The design of the sensor requires that 2 operating points are respected on the outputs I_{S1} and I_{S2}:

- A maximum measuring voltage of 7 V DC ($V_{MMAX} \leq R_{MMAX} \times I_{SMAX}$)
- A maximum output current of ±20 mA DC.

The supply voltage does not have any influence on the output signals.

2.1 - What load resistance (R_M) is required to obtain a 5 V measuring (V_M = 5 V) when the current I_P = 6000 A peak?

The measured current is greater than I_{PN} (4000 A for a NCS125-4), I_{S2} is therefore used as the measuring signal.

Firstly the output current on I_{S2} must be calculated when I_{PN} = 6000 A DC

$I_{S2} = I_{PN} / I_{PMAX} \times I_{SMAX}$ = 6000 / 20000 x 20 = 6 mA (correct because I_{S2MAX} = ±20 mA DC)

Now determine the value of the resistance R_M

$R_M = V_M / I_{S2}$ = 5 / 0.006 = 833.33 Ω

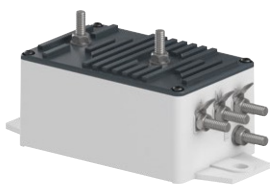
Conclusion

The NCS125-4 sensor can measure 6000 A peak on the signal output I_{S2} with a resistance of 416.67 Ω (greater than 350 Ω) because the output current is smaller than I_{SMAX} i.e. 20 mA DC

The product of $R_M \times I_{SMAX}$ must always be smaller than or equal to maximum output of 7 V DC

3 - Measurement circuit calculation (voltage output)

No special calculation needs to be made. This NCS sensor range supplies a voltage directly proportional to the primary current I_P between -10 V and +10 V. A load resistance of a value greater than or equal to 10 kΩ adapts the impedance of the measured output (V_{S1} or V_{S2}) to the acquisition system.



VS1000B

1 - Reminder of the key elements

Formulas

$$V_M = R_M \times I_S \text{ and } \frac{U_{PN}}{I_{SN}} = \frac{U_P}{I_S}$$

VS50 ... VS1500:

- $R_M = [(0.8 \times V_{AMIN}) / I_S] - 55$
- $U_{HT+} + U_{HT-} \leq 4.2$ kV peak and $|U_{HT+} - U_{HT-}| \leq U_{PMAX}$

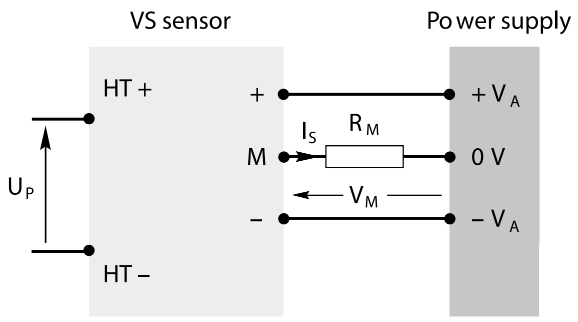
VS2000 ... VS4200 :

- $R_M = [(0.8 \times V_{AMIN}) / I_S] - 60$
- $U_{HT+} + U_{HT-} \leq 10$ kV peak and $|U_{HT+} - U_{HT-}| \leq U_{PMAX}$

Abbreviations

U_P	:	primary voltage
U_{PN}	:	nominal primary voltage
I_S	:	secondary current
I_{SN}	:	nominal secondary current
V_A	:	supply voltage
V_{AMIN}	:	V_A less lowest supply tolerance
V_M	:	measuring voltage
R_M	:	measuring resistance

Reminder of the sensor electrical connection



2 - Measurement circuit calculation (secondary part of the sensor)

Example with VS1000B sensor

U_{PN} = 1000 V

I_{SN} = 50 mA

V_A = ±24 V (±5%)

U_{PMAX} = 1500 V

2.1 - What load resistance (RM) is required to obtain a 10 V measuring signal (VM = 10 V) when the voltage U_{PMAX} = 1500 V peak?

$I_S = I_{SN} \times U_{PMAX} / U_{PN}$ = 0.050 x 1500 / 1000 i.e. I_S = 75 mA

$R_M = V_M / I_S$ = 10 / 0.075 i.e. R_M = 133.33 Ω

We must check that the sensor can measure this 1500 V with a ±24 V (±5%) supply

V_{AMIN} = 24 x 0.95 = 22.8 V

$R_M = [(0.8 \times V_{AMIN}) / I_S] - 55$ = [(0.8 x 22.8) / 0.075] – 55 i.e. R_M = 188.2 Ω

We therefore verify that the sensor can measure this 1500 V voltage since the measuring resistance with a ±24 V (±5%) supply is 188.2 Ω for 133.33 Ω required.

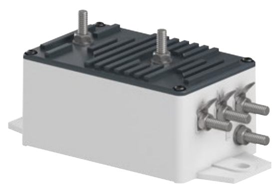
Conclusion

A VS1000B sensor can measure a peak of 1500 V in the following conditions:

V_A = ±24 V (±5%)

R_M = 133.33 Ω

to obtain a 10 V signal at 1500 V peak.



VS1000B

2.2 - What are the consequences, if the required signal is only 5 V (VM = 5 V)?

In the same way as for closed loop Hall effect current sensors, if the required measuring voltage is reduced, carefully check that the ±15 V (±5%) supply used in this example is sufficient to obtain a 5 V signal with the conditions used in the preceding point.

$R_M = V_M / I_S$ = 5 / 0.075 i.e. R_M = 66.67 Ω

$R_M = [(0.8 \times V_{AMIN}) / I_S] - 55$ = [(0.8 x 14.25) / 0.075] – 55 i.e. R_M = 97 Ω

We therefore verify that the sensor measures this 1500 V voltage since the measuring resistance with a ±15 V (±5%) supply is 97 Ω for 66.67 Ω required.

2.3 - What is the maximum measurable voltage by a VS1000B in specific conditions?

An electronic voltage sensor is also sensitive to the thermal aspect.

In general, a VS voltage sensor can withstand up to 150% of the nominal primary voltage, but only under certain conditions.

In all these cases, we recommend that you contact your distributor in order to obtain detailed information on this subject.

2.4 - What influence does the ambient temperature have on the sensor's performance?

The electronic voltage sensor design means that the maximum operating temperature influences the sensor's performance, notably the measurement accuracy. However there is no correlation between a reduction in the ambient temperature and an increase in the voltage to be measured.

2.5 - What influence does the supply voltage have on the sensor performance?

In general, the higher the supply voltage, the higher the measuring voltage. The thermal aspect of the sensor should be considered.

NB: for calculations with unipolar supply (e.g. 0…+24 V), contact your distributor.

2.6 - What influence does the temperature have on the sensor's life time?

From a general point of view, with whatever product, the more the temperature, the less the life time. With the VS sensors, the temperature also reduces the life time above 40 °C. The factor of reduction is however very much depending on the way the VS sensors are used in the application. Please contact your local supplier for further information.

3 - Sensor primary circuit calculation

Maximum common mode voltage

Can the VS1000B sensor (U_{PMAX} = 1500 V peak) be used to measure a differential voltage

$U_P = U_{HT+} - U_{HT-}$ with U_{HT+} = 3500 V DC and U_{HT-} = 2600 V DC ?

3.1 - $|U_{HT+} - U_{HT-}| = |3500 - 2600| = 900$ V DC ≤ 1500 V peak :

First condition $|U_{HT+} - U_{HT-}| \leq U_{PMAX}$ is therefore fulfilled.

3.2 - $U_{HT+} + U_{HT-}$ = 3500 + 2600 = 6100 V DC > 4.2 kV peak :

Second condition $U_{HT+} + U_{HT-} \leq 4.2$ kV peak is not therefore fulfilled.

Conclusion

The VS1000B sensor cannot therefore be used to measure this 900 V DC primary differential voltage (even though this differential voltage is lower than the nominal primary voltage of the VS1000B sensor).

For this application the VS2000B sensor can be used since:

$U_{HT+} + U_{HT-}$ = 6100 V DC ≤ 10 kV peak

The condition $U_{HT+} + U_{HT-} \leq 10$ kV peak is therefore fulfilled with the VS2000B.

Current and voltage sensor selection guide

General
The following questionnaires are used to select sensors according to the client's requirements.
The characteristics shown in the catalogue are given with respect to a defined environment (worst case conditions).
The technical requirements will not always reach these extreme limits, and it is possible, following confirmation by us, to propose higher maximum electrical or thermal values to those published, thanks to a knowledge and detailed analysis of the sensor operating environment.
A technical relationship between the client and PETERCEM will allow the proposal of the best selection of sensors, equally from the viewpoint of performance and economy.

Two principal areas are considered in the selection of a sensor:
– the electrical aspect
– the thermal aspect
The sensor performance is based on a combination of electrical and thermal conditions; any values other than those indicated in this catalogue cannot be guaranteed unless validated by us. The information below is only valid for sensors using closed loop Hall effect technology.
Contact your local supplier for other technologies.

Mission profile
Due to the design of converters with integrate more power with less volume, sensors are very constraint; leading to reduce their life time. As a matter of fact, even though the application main conditions are well within the sensors characteristics, these conditions have an impact on the sensor life time.

The main general characteristics that involves the sensors life time are the following:
– the ambient temperature above 40 °C. It is usually said that every additional 10 °C, the life time is reduced by a factor of 2. Of course, this value is a theoretical value and has to be defined in line with the concerned project.
– the ambient temperature variations also impact the sensor life time. Even small variations (like 10 °C) can change the life time of the sensor especially on the electronic part.
– the way the sensors are used also impact its duration (numbers of ON/OFF per day, average current or voltage value, power supply value, load resistor value, vibrations levels…)

The above general impacting conditions are well defined in standards like IEC 62380, UTE C 80-810 and must be consider during any new converter design.
PETERCEM can provide theoretical reliability calculation based on specific profile mission of your projects.

Electrical characteristics
The electrical characteristics values mentioned in this catalogue are given for a particular sensor operating point. These values may vary, according to the specific technical requirement, in the following way:
– The primary thermal current (voltage) (IPN or UPN) may be increased if:
- the maximum operating temperature is lower than the value shown in the technical data sheet
- the sensor supply voltage (VA) is reduced
- the load resistance value (RM) is increased
– The maximum current (voltage) measurable by the sensor may be increased if:
- the maximum operating temperature is lower than the value shown in the technical data sheet
- the sensor supply voltage (VA) is increased
- the secondary winding resistance value (RS) is reduced (e.g. by using a lower transformation ratio)
- the load resistance value (RM) is reduced

Thermal characteristics
The operating temperature values mentioned in this catalogue are given for a particular sensor operating point. These values may vary, according to the specific technical requirement, in the following way:
– The maximum operating temperature may be increased if:
- the primary thermal current (voltage) (IPN or UPN) is reduced
- the sensor supply voltage (VA) is reduced
- the load resistance value (RM) is increased
PS: The minimum operating temperature cannot be lower than that shown in the technical data sheet as this is fixed by the lower temperature limit of the components used in the sensor.

Industry current sensor selection

Company: .... Name: ....
Address: ....
Tel: .... Fax: .... Email: ....

Application
1. Application :
– Variable speed drive.......................☐
– UPS ....☐
– Wind generator.......................☐
– Active harmonic filter ....☐
– Welding machines ....☐
– Solar ....☐
– Other (description).......................
2. Quantity per year: ....

Mechanical characteristics
1. Sensor fixing:
– By soldering to the PCB ....☐
– By the enclosure.......................☐
– By the primary conductor.......................☐
2. Primary conductor:
– Cable diameter ....(mm)
– Cable connection size ....(mm)
– Bar size ....(mm)
3. Secondary connection:
– By connector.......................☐
– By cable without connector.......................☐
– Other ....☐

Sensor environmental conditions
1. Minimum operating temperature ....(°C)
2. Maximum operating temperature.......................(°C)
3. Presence of strong electromagnetic fields.......................☐
4. Max. continuous primary conductor voltage.......................(V)
5. Main reference standards ....

Electrical characteristics
1. Nominal current (I_{PN}) ....(A r.m.s.)
2. Current type (if possible, show current profile on graph):
– Direct ....☐
– Alternating ....☐
3. Bandwidth to be measured ....(Hz)
4. Current measuring range:
– Minimum current ....(A)
– Maximum current ....(A)
– Duration (of max. current) ....(sec)
– Repetition (of max. current) ....
– Measuring voltage (on R_M) at max current ....(V)
5. Overload current (not measurable):
– Not measurable overload current ....(A)
– Duration ....(sec)
– Repetition ....
6. Sensor supply voltage:
– Bipolar supply voltage ....(±V)
– Unipolar supply voltage ....(0 +V or 0 -V)
7. Output current
– Secondary current at nominal current I_{PN} ....(mA)
8. Current output (NCS range only)
– Secondary current at maximum current I_{PMAX} ....(mA)
9. Voltage output
– Secondary voltage at nominal current I_{PN} ....(V)
10. Voltage output (NCS range only)
– Secondary voltage at maximum current I_{PMAX} ....(V)

Other requirements (description)
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This document is used for selecting sensors according to the application and the clients requirements.

Questionnaire

Railway current sensor selection

Company: .... Name: ....

Address: ....

Tel: .... Fax: .... Email: ....

Application

1. Project name ....
2. Application:
   Rolling stock:
   – Power converter .... ☐
   – Auxiliary converter .... ☐
   – Other .... ☐
   Short or long distance train:
   – Power converter .... ☐
   – Auxiliary converter .... ☐
   Metro or tramway:
   – Power converter .... ☐
   – Auxiliary converter .... ☐
   Fixed installation (e.g. substtion) .... ☐
3. Quantity per year: ....
4. Total quantity for the projet ....

Mechanical characteristics

1. Sensor fixing:
   – By the enclosure .... ☐
   – By the primary conductor .... ☐
2. Primary conductor:
   – Cable diameter .... (mm)
   – Bar size .... (mm)
3. Secondary connection:
   – Screw or Faston .... ☐
   – By connector .... ☐
   – By shielded cable .... ☐
   – Other .... ☐

Electrical characteristics

1. Nominal current (I_{PN}) (A r.m.s.)
2. Current type (if possible, show current profile on graph):
   – Direct .... ☐
   – Alternating .... ☐
3. Bandwidth to be measured.......................... (Hz)
4. Current measuring range:
   – Minimum current.......................... (A)
   – Maximum current .... (A)
   – Duration (of max. current) .... (sec)
   – Repetition (of max. current) ....
   – Measuring voltage (on RM) at max current .... (V)
5. Overload current (not measurable):
   – Not measurable overload current .... (A)
   – Duration .... (sec)
   – Repetition ....
6. Sensor supply voltage:
   – Bipolar supply voltage .... (±V)
   – Unipolar supply voltage .... (0 +V or 0 -V)
7. Output current
   – Secondary current at nominal current I_{PN} .... (mA)
8. Current output (NCS125 & NCS165 only for fixed installations)
   – Secondary current at maximum current I_{PMAX} .... (mA)
9. Voltage output (NCS125 & NCS165 only for fixed installations)
   – Secondary voltage at nominal current I_{PN} .... (V)
10. Voltage output (NCS125 & NCS165 only for fixed installations)
   – Secondary voltage at maximum current I_{PMAX} .... (V)

Sensor environmental conditions

1. Minimum operating temperature .... (°C)
2. Maximum operating temperature .... (°C)
3. Average nominal operating temperature .... (°C)
4. Maximum continuous primary conductor voltage .... (V)
5. Main reference standards ....

Other requirements (description)

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This document is used for selecting sensors according to the application and the clients requirements.

Questionnaire

Railway voltage sensor selection

Company: .... Name: ....

Address: ....

Tel: .... Fax: .... Email: ....

Application

1. Project name ....
2. Application:
   Short or long distance train:
   – Power converter .... ☐
   – Auxiliary converter .... ☐
   Metro or tramway:
   – Power converter .... ☐
   – Auxiliary converter .... ☐
   Fixed installation (e.g. substation) .... ☐
3. Quantity per year: ....
4. Total quantity for the project ....

Mechanical characteristics

1. Primary connection:
   – By screw .... ☐
   – Other .... ☐
2. Secondary connection:
   – Screw or Faston .... ☐
   – By connector .... ☐
   – Other .... ☐

Sensor environmental conditions

1. Minimum operating temperature .... (°C)
2. Maximum operating temperature .... (°C)
3. Average nominal operating temperature .... (°C)
4. Main reference standards ....

Electrical characteristics

1. Nominal voltage (U_{PN}) .... (V r.m.s.)
2. Voltage type (if possible, show voltage profile on graph):
   – Direct .... ☐
   – Alternating .... ☐
3. Bandwidth to be measured .... (Hz)
4. Voltage measuring range:
   – Minimum voltage .... (V)
   – Maximum voltage .... (V)
   – Duration (at max. voltage) .... (sec)
   – Repetition (at max. voltage)..........................
   – Measuring voltage (on R_M) at max voltage .... (V)
5. Overload voltage (not measurable):
   – Not measurable overload voltage .... (V)
   – Duration .... (sec)
   – Repetition ....
   – Category (from OV1 to OV3)..........................
6. Sensor supply voltage:
   – Bipolar supply voltage .... (±V)
   – Unipolar supply voltage .... (0 +V or 0 -V)
7. Output current
   – Secondary current at nominal voltage U_{PN} .... (mA)

Other requirements (description)

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This document is used for selecting sensors according to the application and the clients requirements.

Questionnaire

Voltage detector selection

Company: .... Name: ....

Address: ....

Tel: .... Fax: .... Email: ....

Application

1. Project name ....
2. Application:
   Short or long distance train:
   – Power converter ....☐
   – Auxiliary converter ....☐
   Metro or tramway:
   – Power converter ....☐
   – Auxiliary converter ....☐
   Fixed equipment (e.g. substation) ....☐
3. Quantity per year: ....
4. Total quantity for the project..

Sensor environmental conditions

1. Minimum operating temperature ....(°C)
2. Maximum operating temperature ....(°C)
3. Average nominal operating temperature ....(°C)
4. Pollution degree..
5. Over voltage category (from OV1 to OV3)..
6. Maximum ambient light level .... (lux)
7. Main reference standards ....

Electrical characteristics

1. Nominal voltage (U_{PN}) ....(V DC)
2. Maximum voltage long duration: 5 min (U_{MAX2}) ....(V DC)
3. Maximum voltage overload: 20 ms (U_{MAX3}) ....(V DC)
4. Minimum voltage to be detected ....(V)

Other requirements (description)

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This document is used for selecting sensors according to the application and the clients requirements.

5

CONTACT US

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Voltage and current sensors

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Catalog Sensors - A3 Avril 2020