Technical argumentation

Argumentation technique

NCS Range

Gamme NCS

1SBC146156D1701 Technical Argumentation NCS range 1.1 - Version 1.1

100% electronic
current sensors

Capteurs de courant
100% électronique

SUMMARY

SOMMAIRE

AFAQ ISO 9001 VERSION 2000

AFAQ ISO 14001

Current and voltage sensors

NCS range Technical Presentation

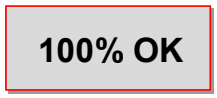
ABB

Technical presentation summary

- 1 The customer's needs
- 2 The aimed applications
- 3 The technology
- 4 The range
- 5 The main characteristics
- 6 The options and accessories
- 7 The electrical connections
- 8 The used standards
- 9 The technical documentation

1 The customers' needs

- Price



- High quality

- High performances

- Reliability

- Compactness

- Latest standards

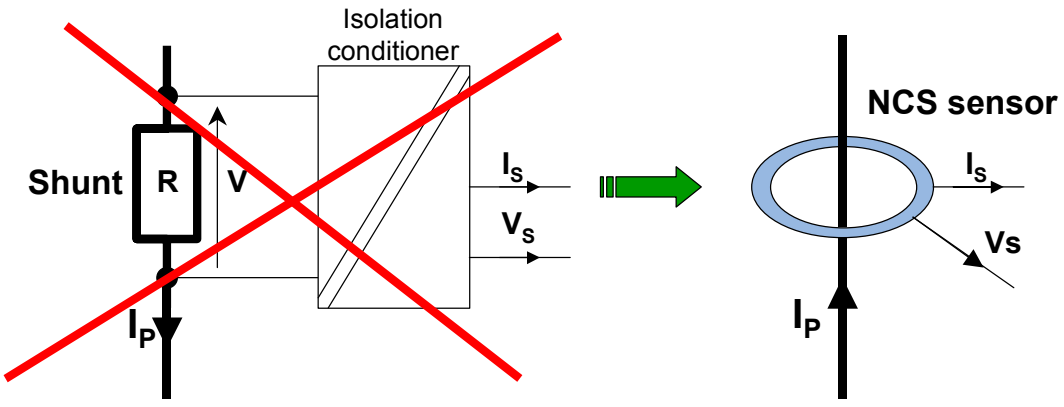
- Reliable supplier

2 The aimed applications

- Industrial applications
  - UPS, windmills, welding, electrolysis ...
- Traction applications
  - Sub-stations (mainly)…

2 The aimed applications

- First typical technology of substitution:
  - **To replace the entire function (**shunt + isolation conditioner**)**



- Ratings targeted: 2 to 20 kA (Ipn)
- Markets: Industry & Traction

2 The aimed applications

- Other technologies to replace:
  - Depending on customer application, it is possible to use NCS instead of other current measurement technologies:
    - Closed loop Hall effect sensors
    - Open loop Hall effect sensors
    - Rogowski coils
    - Current transformers

2 The aimed applications

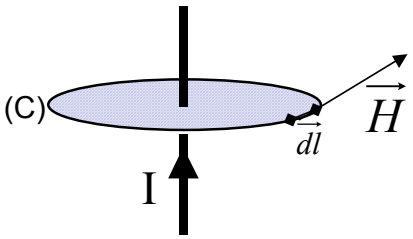
- Specific applications:
  - Need of a large hole for a low nominal primary current:
    - Conductor in Aluminium (low current density)
    - Cable with thick insulation (medium voltage)
    - Several conductors through the hole
    - Specific bus bar dimensions

3 The technology

- Functionning principle
  - Application of the Ampere's theorem:

The integration of the magnetic field vector $\vec{H}$ *on a closed contour (C) leads to the primary current I*:

$$\oint_C \vec{H} \cdot \vec{dl} = I$$

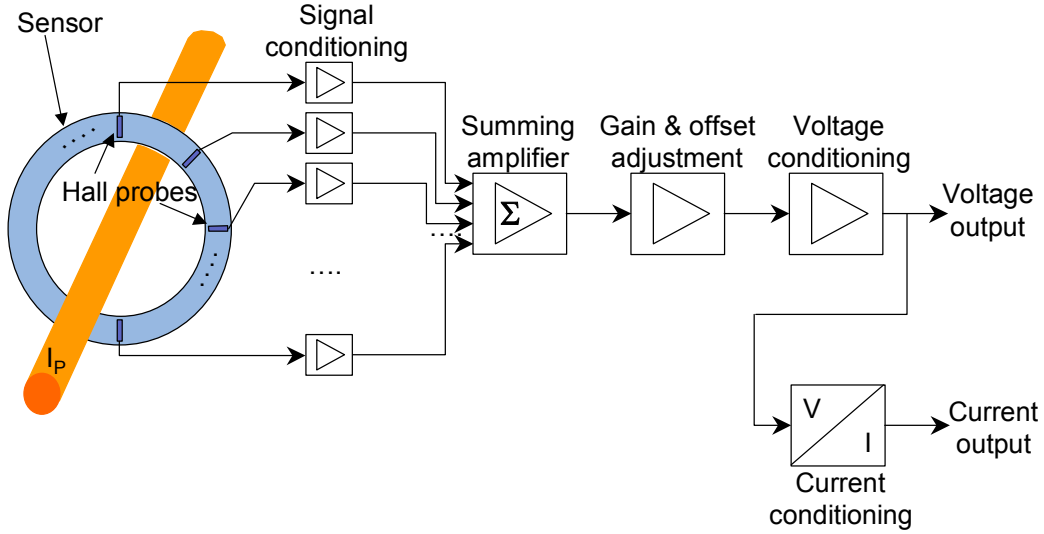


In the air: $\vec{B} = \mu_0 \cdot \vec{H}$

- Technology:
  - Detection of the magnetic field with Hall effect probes
  - Full electronic concept (no magnetic core)

3 The technology

- Functionning principle



- Major function
  - To measure ac and dc high currents (≥2kA)

3 The technology

- Technologies comparison for current sensing

	Shunt	Current Transformer	Open Loop	Closed Loop	Rogowski Coil	NCS Technology
Insulation P/S	NO	YES	YES	YES	YES	YES
Bandwidth	DC to few kHz	AC only	DC to few kHz	DC to 100 kHz	AC only	DC to few kHz
Measuring range	Low	Medium	Medium	High	Very High	Very High
Maximum overloads	Very Low	Low	Low	High	Very High	Very High
Power dissipation	High	Medium	Low	Medium	Low	Low
Output signal	Voltage	Current	Voltage	Current	Voltage	Voltage or current
Supply voltage	No need	No need	± V	± V	No need	± V or 0…+V
Accuracy	0.5 to 2%	0.5 to 2%	2 to 4%	< 1%	~1%	0.5 to 2%
Price	Low	Medium	Medium	High	Medium	medium
Comments	Need of conditioner	No DC	Low accuracy	High price	Need of conditioner	Very "flexible"

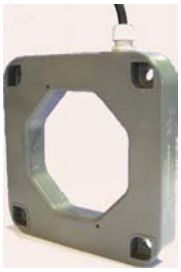
3 The technology

- Major advantages of the NCS technology
  - Galvanic isolation
  - Wide continuous measuring range
  - No power dissipation (no heating)

4 The range

- General range presentation: markets & ratings

NCS125



Traction Industry

2…10kA

NCS165

Traction Industry

4…20kA

4 The range

Current output

- NCS range: NCS125 and NCS165 (2 sizes)
  - Internal hole: 125 mm and 165 mm

	Hole (mm)	Ipn (kA peak)	Is1 at Ipn (mA peak)	Ipmax (kA peak)	Is2 at Ipmax (mA peak)
NCS125-2	125	2	±20	10	±20
NCS125-4	125	4	±20	20	±20
NCS125-6	125	6	±20	30	±20
NCS125-10	125	10	±20	30	±20
NCS165-4	165	4	±20	20	±20
NCS165-6	165	6	±20	30	±20
NCS165-10	165	10	±20	30	±20
NCS165-20	165	20	±20	40	±20

- Important note: NCS sensors withstand Ipmax **continuously**

4 The range

Voltage output

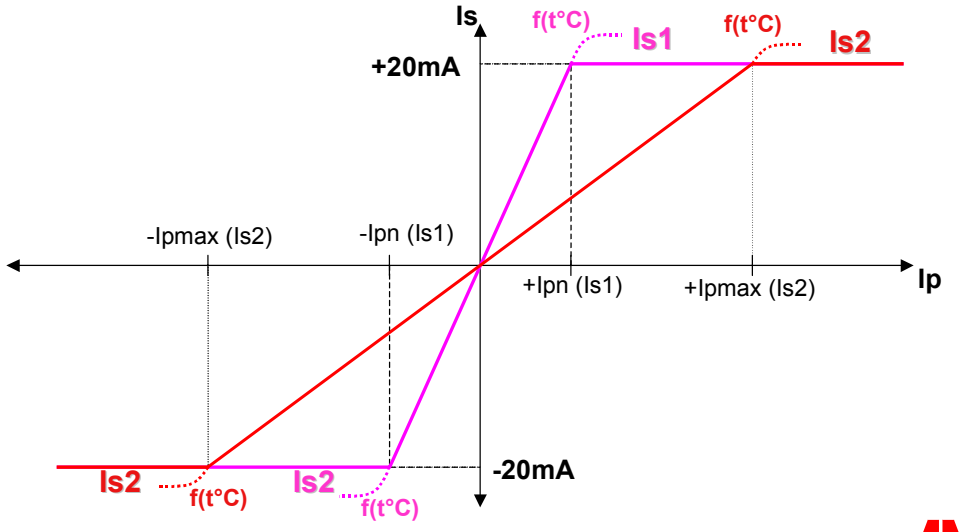
- NCS range: NCS125 and NCS165 (2 sizes)
  - Internal hole: 125 mm and 165 mm

	Hole (mm)	Ipn (kA peak)	Vs1 at Ipn (V peak)	Ipmax (kA peak)	Vs2 at Ipmax (V peak)
NCS125-2	125	2	±10	10	±10
NCS125-4	125	4	±10	20	±10
NCS125-6	125	6	±10	30	±10
NCS125-10	125	10	±10	30	±10
NCS165-4	165	4	±10	20	±10
NCS165-6	165	6	±10	30	±10
NCS165-10	165	10	±10	30	±10
NCS165-20	165	20	±10	40	±10

  - Important note: NCS sensors withstand Ipmax **continuously**

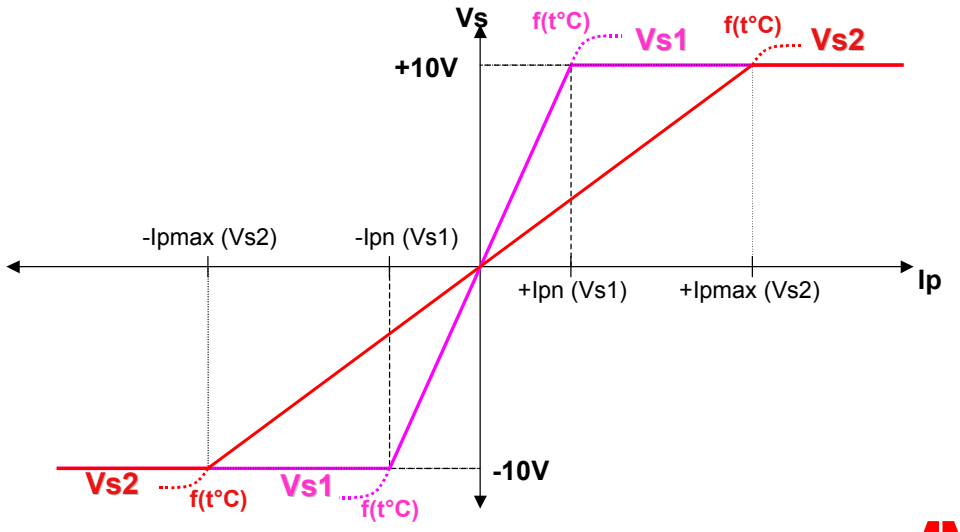
4 The range

- NCS125 and NCS165 standard current outputs:



4 The range

- NCS125 and NCS165 standard voltage outputs:



4 The range

- NCS125 and NCS165 standard secondary outputs:
  - Connector output (industrial version only):
    - Is1: ±20mA @ Ipn (peak value)
    - Is2: ±20mA @ Ipmax (peak value)
    - Vs1: ±10V @ Ipn (peak value)
    - Vs2: ±10V @ Ipmax (peak value)
  - Cable output (industrial and traction versions):
    - Is1: ±20mA @ Ipn (peak value)
    - Is2: ±20mA @ Ipmax (peak value)

    or
    - Vs1: ±10V @ Ipn (peak value)
    - Vs2: ±10V @ Ipmax (peak value)

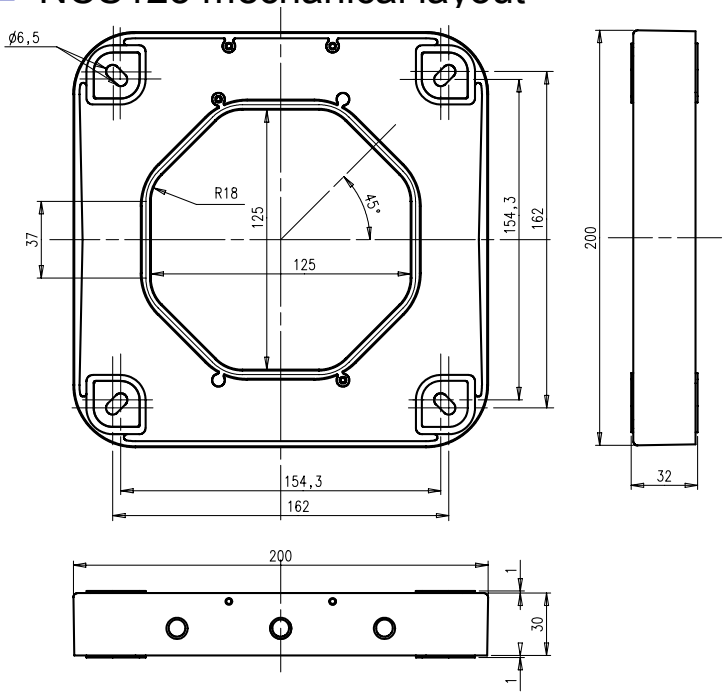
4 The range

- Industrial and Traction main differences:

	Industry	Traction
Supply voltage	±15V to ±24V (±2%)	±24V (±25%)
Test voltage	5kV	20kV
Partial discharges	1.25kV	4.3kV
Creepage distance	14mm	195mm
Clearance distance	14mm	76mm
EMC (refer to type test report)		

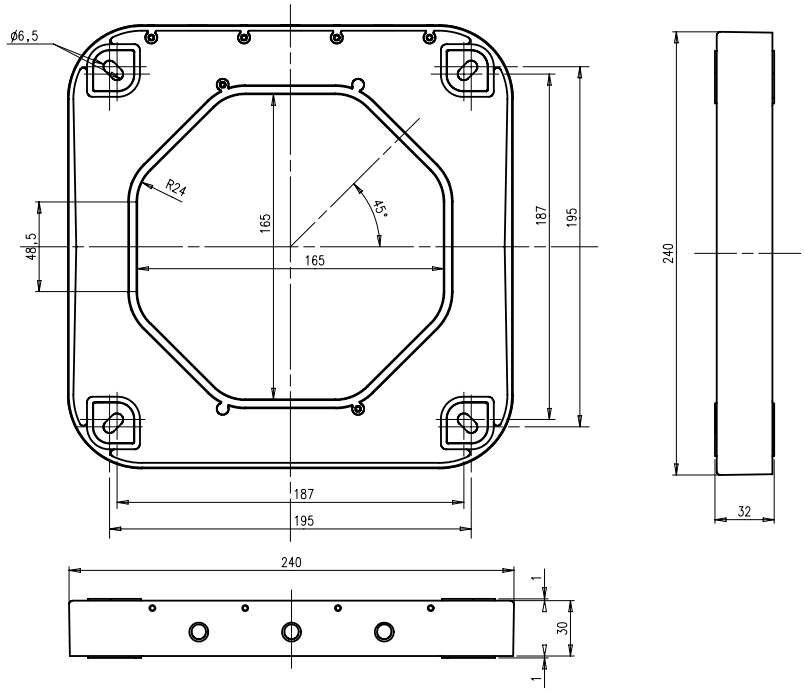
4 The range

- NCS125 mechanical layout



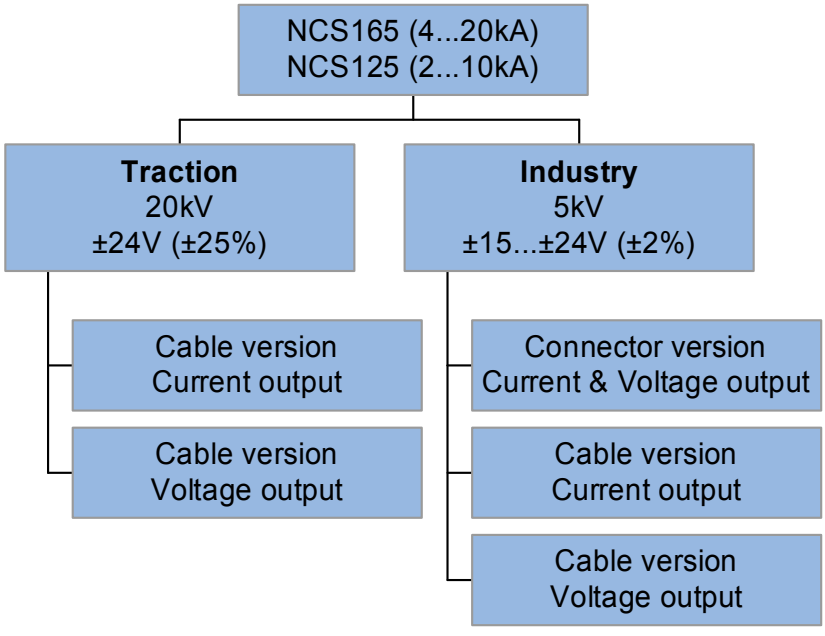
4 The range

- NCS165 mechanical layout



4 The range

- Standard NCS range synthesis



5 The main characteristics

- NCS125: main characteristics

Characteristics	Unit	NCS125-2	NCS125-4	NCS125-6	NCS125-10
Max. input current **Ipn** (continuously)	kA peak	**2**	**4**	**6**	**10**
Max. input current **Ipmax** (continuously)	kA peak	**10**	**20**	**30**	**30**
Max. not measurable overload	kA peak	40	80	120	200
Output current **Is1@Ipn**	mA peak	±20			
Output current **Is2@Ipmax**	mA peak	±20			
Output voltage **Vs1@Ipn**	V peak	±10			
Output voltage **Vs2@Ipmax**	V peak	±10			
Accuracy @**Ipn** and @+25°C	%	±1			
Delay time (typical)	µS	3			
di/dt correctly followed	A/µS	< 100			
Bandwidth (@-1dB)	kHz	0…10			
Dielectric strength	kV; 50Hz; 1min	5			
Power supply	V	±15…±24			
Operating temperature	°C	-40…+85			
Storage temperature	°C	-50…+90			

- For further requests, please contact us.

5 The main characteristics

- NCS165: main characteristics

Characteristics	Unit	NCS165-4	NCS165-6	NCS165-10	NCS165-20
Max. input current **Ipn** (continuously)	kA peak	**4**	**6**	**10**	**20**
Max. input current **Ipmax** (continuously)	kA peak	**20**	**30**	**30**	**40**
Max. not measurable overload	kA peak	80	120	200	200
Output current **Is1@Ipn**	mA peak	±20			
Output current **Is2@Ipmax**	mA peak	±20			
Output voltage **Vs1@Ipn**	V peak	±10			
Output voltage **Vs2@Ipmax**	V peak	±10			
Accuracy @**Ipn** and @+25°C	%	±1			
Delay time (typical)	µS	3			
di/dt correctly followed	A/µS	< 100			
Bandwidth (@-1dB)	kHz	0…10			
Dielectric strength	kV; 50Hz; 1min	5			
Power supply	V	±15…±24			
Operating temperature	°C	-40…+85			
Storage temperature	°C	-50…+90			

- For further requests, please contact us.

6 The options and accessories

- NCS125 & NCS165 : mechanical options
  - Brackets

For horizontal mounting

For vertical mounting

For fixing on a bus bar

  - Bus bars

6 The options and accessories

- NCS125 & NCS165 : terminals options
  - Standard output connections:
    - 6 wire shielded cable (2 m)
    - 8 pin locable connector

  - Optional output connections:
    - Other to be defined upon request

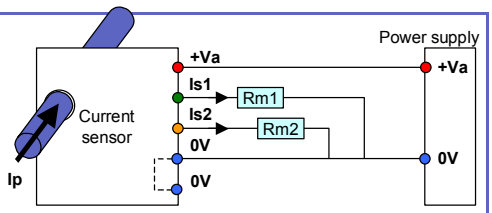
6 The options and accessories

- NCS125 & NCS165 : electrical options
  - Specific gain for the output current Is
  - Specific gain for the output voltage Vs
  - Multiple output voltage or current
  - Output current 4-20 mA: see next page

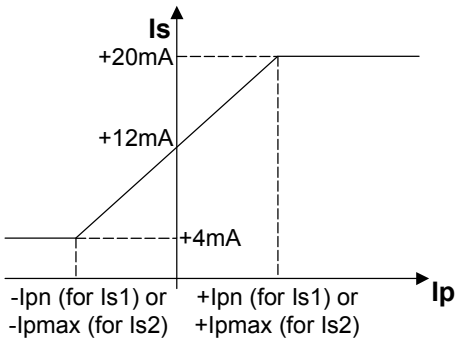
    (with unipolar supply voltage 0...+15 to +24 Vdc)

6 The options and accessories

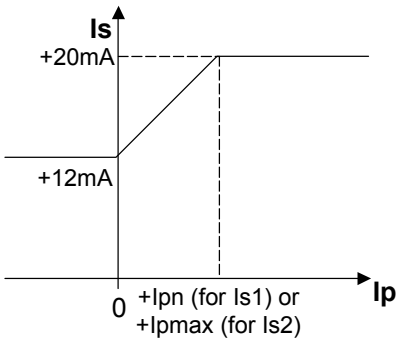
- NCS125 & NCS165
  - Optional output: current 4-20 mA



Is1 or Is2 for ac primary current



Is1 or Is2 for dc primary current

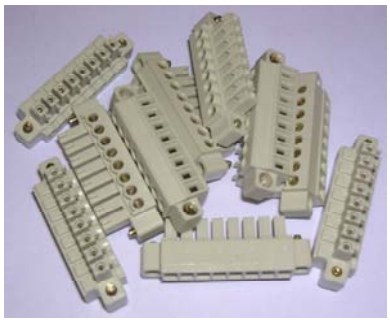


6 The options and accessories

- NCS125 & NCS165 : the accessories

Side plates kit (without bar)

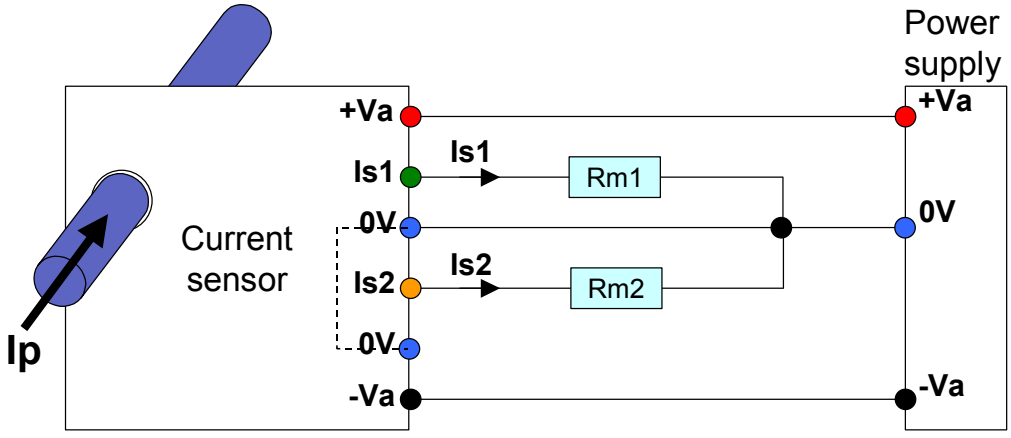
Female connector kit (set of 10 pieces)



7 The electrical connections

- NCS125 & NCS165: connection diagram

Current output

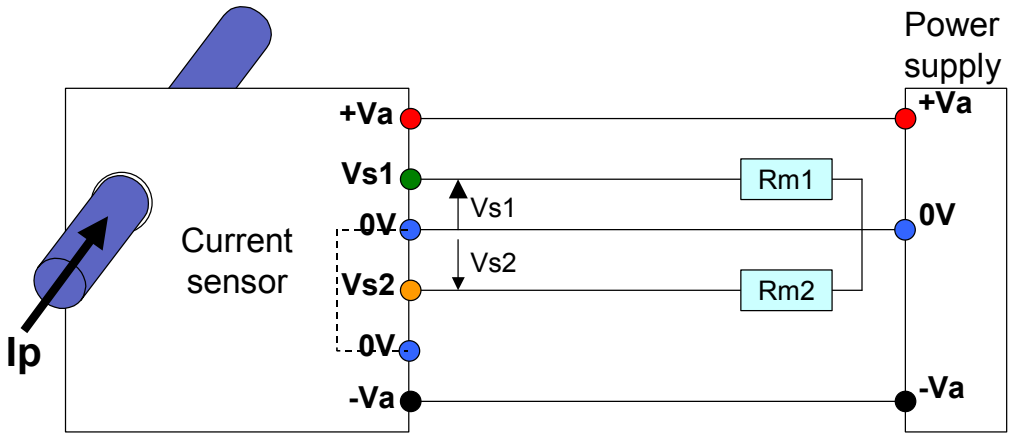


- Rm1 & Rm2 with Rmin: 0Ω and Rmax: 350Ω

7 The electrical connections

- NCS125 & NCS165 : connection diagram

Voltage output



- Rm1 & Rm2 ≥ 10kΩ

8 The used standards: Industrial applications

- EN50178 (Oct 1997)
  - Safety requirements
    - Rated voltage : 1000V rms or 1500Vdc
    - Pollution degree : PD2 (pollution normally conducting and random condensation)
    - Insulation distance : OV3 (fixed installations with requirements of reliability and disponibility
      : 14 mm air distance (reinforced insulation)
      : material group II (400≤CTI<600)
    - Creepage distance : 14.2mm (reinforced insulation) with grooves having minimum 2 mm
    - Partial discharges : 1.25kV (10pC)

8 The used standards: Industrial applications

- EN50178 (Oct 1997)….
  - Environmental requirements
    - Climatic : Tab 6, class 2K3
      : -20…+70°C
      : 95% relative humidity
      : max 60gr of water / m^3
      : 70 à 106kPa
    - EMC : design and tests in accordance with EN61000-6-2 and EN61000-6-4

8 The used standards: Industrial applications

- EN50178 (Oct 1997)….
  - Testing (see details in the concerned Type Test Report)
    - Functioning : @ +25°C, @-40°C, @+85°C
      : delay time
      : di/dt
      : bandwidth
      : overload
      : magnetic environment
    - Other climatic tests : salt mist
      : humid heat
      : storage

8 The used standards: Industrial applications

- EN50178 (Oct 1997)….
  - Testing (see details in the concerned Type Test Report)
    - Dielectric : dielectric test
      : insulation resistance
      : dielectric overload
      : partial discharges
    - EMC (immunity) : burst
      EN61000-6-2 : surges
      : electrostatic discharges
      : conducted perturbations
      : electromagnetic fields
      : network magnetic fields

8 The used standards: Industrial applications

- EN50178 (Oct 1997)….
  - Testing (see details in the concerned Type Test Report)
    - EMC (emission) : conducted
      EN61000-6-4 : radiated
    - Mechanical : vibrations
      : shocks

8 The used standards: railways applications

- EN50155 (Dec 2002)
  - Testing (see details in the concerned Type Test Report)
    - Functioning : @ +25°C, @-40°C, @+85°C
      : delay time
      : di/dt
      : bandwidth
      : overload
      : magnetic environment
      : power supply over/under voltage
    - Other climatic tests : salt mist
      : humid heat cycling
      : storage

8 The used standards: railways applications

- EN50123-1 (May 1995) for substations up to 3kVdc
  - Main requirements
    - Rated voltage (U_N) : 3000Vdc
    - Max. repetitive Voltage (U_{NM}) : 4800Vdc
    - Dielectric tests : 16.8kV (50Hz, 1min)
    - Air distance (outdoor) : 76mm
    - Over voltage category : 0V3
    - Pollution degree : PD3A

8 The used standards: railways applications

- EN50163 (Nov 1995) for substations up to 3kVdc
  - Standard rated voltages

Rated voltage (U_N)	750Vdc	1500Vdc	3000Vdc
Umax1 (permanent)	900Vdc	1800Vdc	3600Vdc
Umax2 (max. 5 min)	950Vdc	1950Vdc	3900Vdc
Umax3 (20msec)	1269Vdc	2538Vdc	5075Vdc

8 The used standards: railways applications

- EN50121-5 (Sep 2000) for substations up to 3kVdc
  - Electro-magnetic compatibility (see details in the concerned Type Test Report)
    - Immunity : burst
      : surges
      : electrostatic discharges
      : conducted perturbations
      : electromagnetic fields
      : network magnetic fields
    - Emission : conducted
      : radiated

8 The used standards: railways applications

- IEC61373 (Jan 1999) for ground mobile equipments
  - Vibrations and shocks (see details in the concerned Type Test Report)
    - Tests : random vibrations with functional sensor
      : random vibrations without functional sensor
      : shocks
    - Vibrations severity : class B

8 The used standards: railways applications

- EN50124-1 (Jan 1999)
  - Insulation coordination
    - Rated voltage : 3000Vdc
    - Pollution degree : PD3A (low conductivity and humidity with long term condensation)
    - Insulation distance : OV3 (same as OV4 with less requirements on over voltages, reliability & disponibility)
      : 76 mm air distance (reinforced insulation)
      : material group II (400≤CTI<600)
    - Creepage distance : 195mm (reinforced insulation) with grooves having minimum 2.5 mm
    - Partial discharges : 4.3kV (10pC)

8 The used standards: railways applications

- EN50121-3-2 (Sep 2000) for ground mobile equipments
  - Electro-magnetic compatibility (see details in the concerned Type Test Report)
    - Immunity & Emission : same as per EN50121-5 but with some higher levels during tests

9 The technical documentation

- Technical file
  - Technical presentation: this document
  - Mounting instructions
  - Data sheets
  - Type tests report
  - MTBF calculation
  - Fire/smoke certificate
  - Environmental certificate

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