Technical argumentation

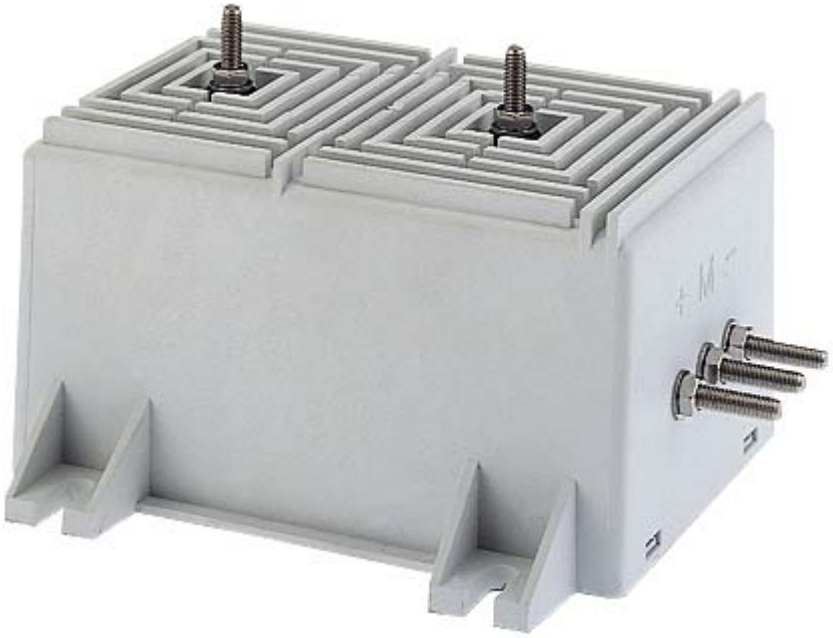
Argumentation technique

VS Range
Gamme VS

1SBC146011C1701 Technical Presentation VS range 1.0 - Version 1.0

100% electronic
voltage sensors

Capteurs de tension
100% électronique



SUMMARY

SOMMAIRE

Current and voltage sensors

VS range Technical Presentation

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
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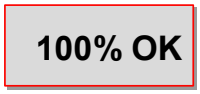
1 The customers' needs

- Price



- High quality

- High performances

- Reliability

- Compactness

- Latest standards

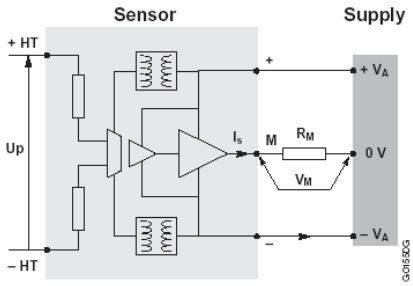
- Reliable supplier

2 The aimed applications

- Traction applications
  - Power converters
    - Catenaries d.c. voltage
    - Motor phase voltages, etc...
  - Battery voltages
  - Auxiliary voltages

3 The technology

- Functioning principle



In contrast to closed loop Hall effect technology, this fully electronic technology does not use magnetic circuits or Hall probes. This allows 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 into a secondary output current I_S. This secondary current I_S 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. The electrical supply to the sensor is also insulated from the primary voltage.

3 The technology

- Technologies comparison for voltage sensing

	VS	Other
Measuring range	1.5 U_{PN} (continuously)	1.5 U_{PN} (50 sec/hr)
Bandwidth	13 kHz	1 kHz
Response time	< 15µsec	20 to 200µsec
Accuracy (-40 to +85°C)	±1.7% at U_{PN}	±3% to ±5% at U_{PN}
High current influence	Very low	Yes
Partial discharges	High (EN50207)	Low

3 The technology

- Technologies comparison for voltage sensing

	VS	Other
Calibrated sensors	Low power primary resistors No heat sink Low power primary resistors included (no power to dissipate)	Primary resistors Heat sink Primary resistor included (about 10W to dissipate)
Not calibrated sensors	All the VS sensors are calibrated	1 external primary resistor of about 100 W to 200 W (additional cost and higher power to dissipate)
Overall dimensions	138 x 63 x 64 (size 0) 168 x 134 x 93 (size 1)	152 x 63 x 89 (EM type) 196 x 135 x 105 (TM type)
Weight	450g (size 0) 1500g (size 1)	550g (EM type) 1600g (TM type)

3 The technology

- Major advantages of the VS technology (electronic technology)
  - Electrical isolation
  - High accuracy
  - Fast response time
  - Excellent immunity to electromagnetic fields
  - Excellent linearity
  - Wide continuous measuring range
  - Low power dissipation (no heating)

4 The range

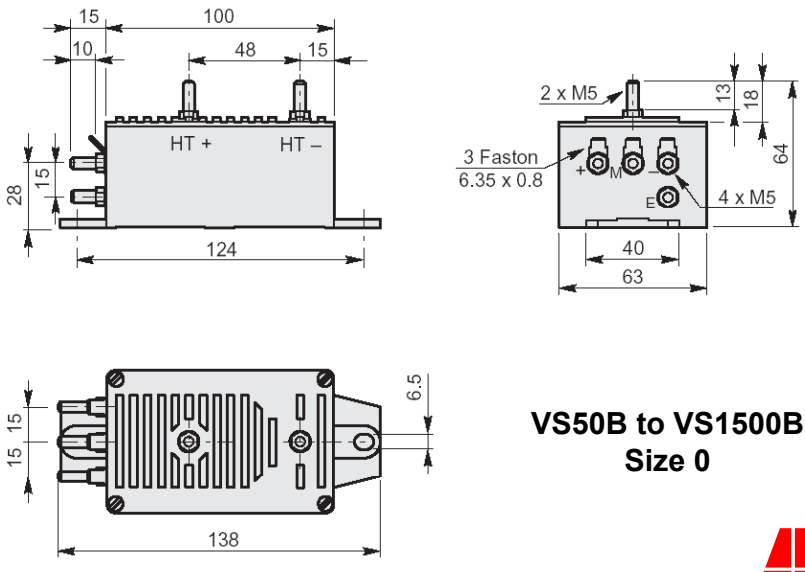
- General range presentation:
  - 50V r.m.s. up to 4200V r.m.s.
    - 50V r.m.s. => VS50B
    - 125V r.m.s. => VS125B
    - 250V r.m.s. => VS250B
    - 500V r.m.s. => VS500B
    - 750V r.m.s. => VS750B
    - 1000V r.m.s. => VS1000B
    - 1500V r.m.s. => VS1500B
    - 2000V r.m.s. => VS2000B
    - 3000V r.m.s. => VS3000B
    - 4000V r.m.s. => VS4000B
    - 4200V r.m.s. => VS4200B

4 The range

- VS range:
  - Technology: 100% electronic
  - Measuring range: ± 1.5 x U_{PN} (continuously)
  - Temperature: -40°C to +85°C
  - Supply voltage: ±12V…±24V
  - Bandwidth: 0 to 13kHz
  - Global accuracy: ±1.7% (-40°C to +85°C)
  - Dielectric strength: EN50124-1 (from 3.3kV up to 12kV)
  - Options: primary & secondary terminals, output current (size 1)

4 The range

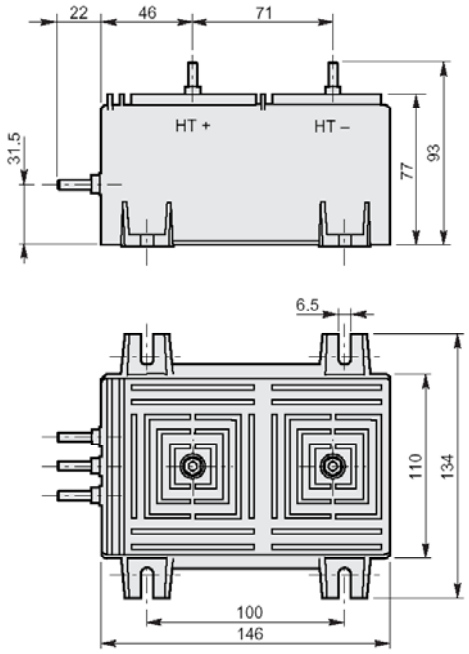
- VS range mechanical layout

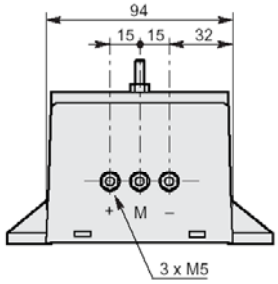


VS50B to VS1500B
Size 0

4 The range

- VS range mechanical layout





VS2000B to VS4200B
Size 1

5 The main characteristics

- VS range main standard characteristics

				VS50B	VS125B	VS250B	VS500B	VS750B
Nominal primary voltage	U_{PN}		V r.m.s.	50	125	250	500	750
Measuring range	U_{PMAX}	@ ±12V...±24V ±5%	V peak	±75	±187.5	±375	±750	±1125
Secondary current at U_{PN}	I_S		mA	50				
Accuracy at U_{PN}	Err%	@ +25°C	%	<=±0.9				
Linearity	Lin	$0.1U_{PN}$ … $1.5U_{PN}$	%	<=0.3				
Delay time	dt		µs	<=10				
dv/dt correctly followed	dv/dt		V/µs	<=0.6	<=1.5	<=3	<=6	<=9
Bandwidth	BW	-3dB & R_M=50Ω	kHz	<=13				
Max. no-load consumption current	Iao	@ ±24V±5%	mA	<=50				
Dielectric strength Primary/Secondary	Ud_p/s	50 Hz, 1 min	kV	3.3	3.3	3.3	3.3	4.3
Supply voltage	V_A	±5%	V dc	±12 … ±24				
Operating temperature	T°op		°C	-40 …+85				
Storage temperature	T°st		°C	-50 … +90				

5 The main characteristics

- VS range main standard characteristics

				VS1000B	VS1500B	VS2000B	VS3000B	VS4000B	VS4200B
Nominal primary voltage	U_{PN}		V r.m.s.	1000	1500	2000	3000	4000	4200
Measuring range	U_{PMAX}	@±12V...±24V ±5%	V peak	±1500	±2250	±3000	±4500	±6000	±6000
Secondary current at U_{PN}	I_S		mA	50					
Accuracy at U_{PN}	Err%	@+25°C	%	<=±0.9					
Linearity	Lin	$0.1U_{PN}$ … $1.5U_{PN}$	%	<=0.3					
Delay time	dt		µs	<=10					
dv/dt correctly followed	dv/dt		V/µs	<=12	<=18	<=24	<=36	<=48	<=50
Bandwidth	BW	-3dB & R_M=50Ω	kHz	<=13					
Max. no-load consumption current	Iao	@±24V±5%	mA	<=50					
Dielectric strength Primary/Secondary	Ud_p/s	50 Hz, 1 min	kV	5.5	6.5	8	12	12	12
Supply voltage	V_A	±5%	V dc	±12 …±24					
Operating temperature	T°op		°C	-40 …+85					
Storage temperature	T°st		°C	-50 …+90					

6 The options and accessories

- VS range : electrical options
  - Nominal secondary current I_{SN}:
    - I_{SN} for (U_{PN})= 20mA
    - I_{SN} for (U_{PN})= 80mA

  } for size1 only (2000V ≤ U_{PN} ≤ 4200V)

- VS range : terminals options
  - Standard output connections:

3 x M5 studs
3 x 6.35 x 0.8 Faston

6 The options and accessories

- Optional output connections:
  - Shielded cable

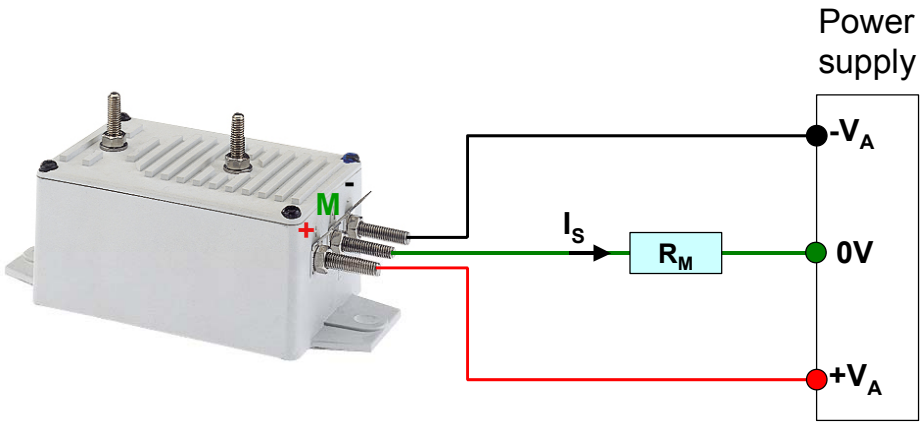
  - 3 or 4 inserts

  - LEMO Connector

  - Others on request...

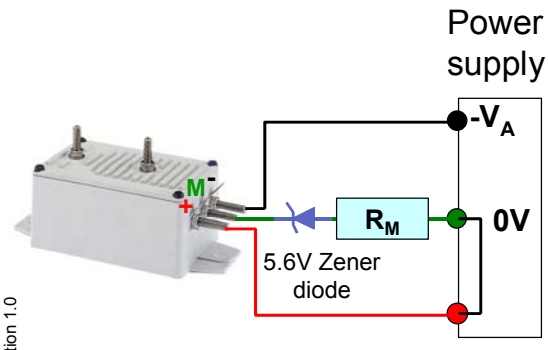
7 The electrical connections

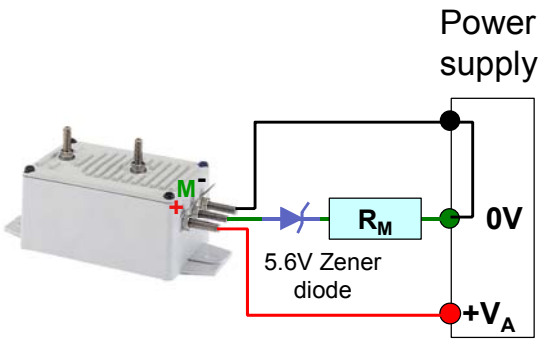
- VS range: connection diagram
  - Bi-directionnal power supply



7 The electrical connections

- Uni-directionnal power supply





0…-V_A **+V_A…0**

8 The advantages

- Construction
  - The first and most compact product since 1997
  - High performance
    - High external magnetic fields rejection
    - High measuring capabilities
  - A traction voltage sensor 100% resin potted
    - Electronic board protected
    - Withstand high vibration constraints
    - High thermal capacities
  - The best compromise: performance/volume/price
  - Recyclable packaging

8 The advantages

- Set-up flexibility
  - Accurate customer's needs optimise sensor selection knowing:
    - Max. permanent operating temperature
    - Max. measurable voltage with duration
    - Max. over voltage (not measurable) with duration
    - Max. voltage on burden resistance at U_{PMAX}
    - Min. supply voltage
  - Mechanical flexibility due to compact sensor design

9 The used standards: railways applications

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

9 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

9 The used standards: railways applications

- EN50124-1
  - Insulation coordination
    - Rated voltage : 1500Vdc (VS50…VS1500)
    - Pollution degree : PD3 (low conductivity and humidity with short term condensation)
    - Insulation distance : OV2 (same as OV1 with higher require-ments on over voltages, reliability & disponibility)
      : 22 mm air distance (reinforced insulation)
      : material group II (400≤CTI<600)
    - Creepage distance : 59 mm (reinforced insulation) with grooves having minimum 1 mm
    - Partial discharges : up to 2.2kV (10pC) following sensor

9 The used standards: railways applications

- EN50124-1
  - Insulation coordination
    - Rated voltage : 3000Vdc (VS2000…VS4200)
    - Pollution degree : PD3 (low conductivity and humidity with short term condensation)
    - Insulation distance : OV2 (same as OV1 with higher requirements on over voltages, reliability & disponibility)
      : 40 mm air distance (reinforced insulation)
      : material group II (400≤CTI<600)
    - Creepage distance : 118 mm (reinforced insulation) with grooves having minimum 1.5 mm
    - Partial discharges : up to 4.3kV (10pC) following sensor

9 The used standards: railways applications

- EN50121-3-2 for ground mobile equipments
  - Electro-magnetic compatibility (see details in the concerned Type Test Report)
    - Emission : Conducted emission (tab 5)
      : Radiated emission (tab 6)

9 The used standards: railways applications

- EN50121-3-2 for ground mobile equipments
  - Electro-magnetic compatibility (see details in the concerned Type Test Report)
    - Immunity : Electrical fast transients burst
      : Electrostatic discharge
      : Conducted perturbations
      : Radiated electromagnetic fields

10 The technical documentation

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

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ABB Entrelec
Control Division
10, rue Ampère Z.I. - B.P. 114
F-69685 Chassieu cedex / France
Telephone: +(33) (0) 4 7222 1722
Fax: +(33) (0) 4 7222 1969

http://www.abb.com/lowvoltage
E-mail : sensors.sales@fr.abb.com