



ALTEA technical specifications

CVS-24-I-HI


	Customer : N/A	Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI	REV. 0	Page 2/20

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1. SCOPE OF THE DOCUMENT

The scope of the present document is the definition of technical characteristics of the Electronic Current and Voltage transformer (ECT+EVT) Altea CVS-24-I-HI in accordance with reference documents listed in Chapter 3.


2. CVS-24-I-HI DESCRIPTION

The device is a combined MV ECT + EVT for INDOOR use. The main electrical and mechanical characteristics are reported in the table below, where * marks parameters to be defined according to customer requirements. The dimensions of the device are shown in Fig. 1.

Auxiliary Supply voltage	$\pm 12 V_{dc}$
Creepage	350 mm
Nominal frequency	50 / 60 Hz
Primary terminal capacity	1 pF
Weight	3,5 kg
Bending strength P_0	2200 N
Voltage transformer features	
Rated insulation level	24/50/125 kV
Rated primary voltage, U_{pn} *	(U_p to) $20/\sqrt{3}$ kV
Maximum voltage, U_m	24 kV
Rated secondary voltage, U_{sn} *	(up to) 1 V
Rated voltage factor, K_u	1,9 for 8h
Nominal transformation ratio, K_n *	$20/\sqrt{3}$ kV / 1 V
Accuracy class *	0.2
Bandwidth (-3 dB)	30 Hz – 20 kHz
Current transformer features	
Rated primary current, I_{pr} *	50 A

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Rated continuous thermal current, I_{cth}	720 A
Rated primary time constant for transient performance, τ_{pr}	25 ms
Rated short time withstand thermal current, I_{th}	16 kA / 3s
Dynamic nominal current, I_{dyn}	31,5 kA
Nominal transformation ratio, K_{ra} *	50 A / 0,2 V
Bandwidth (-3 dB)	30 Hz – 5 kHz
Accuracy class *	0.5

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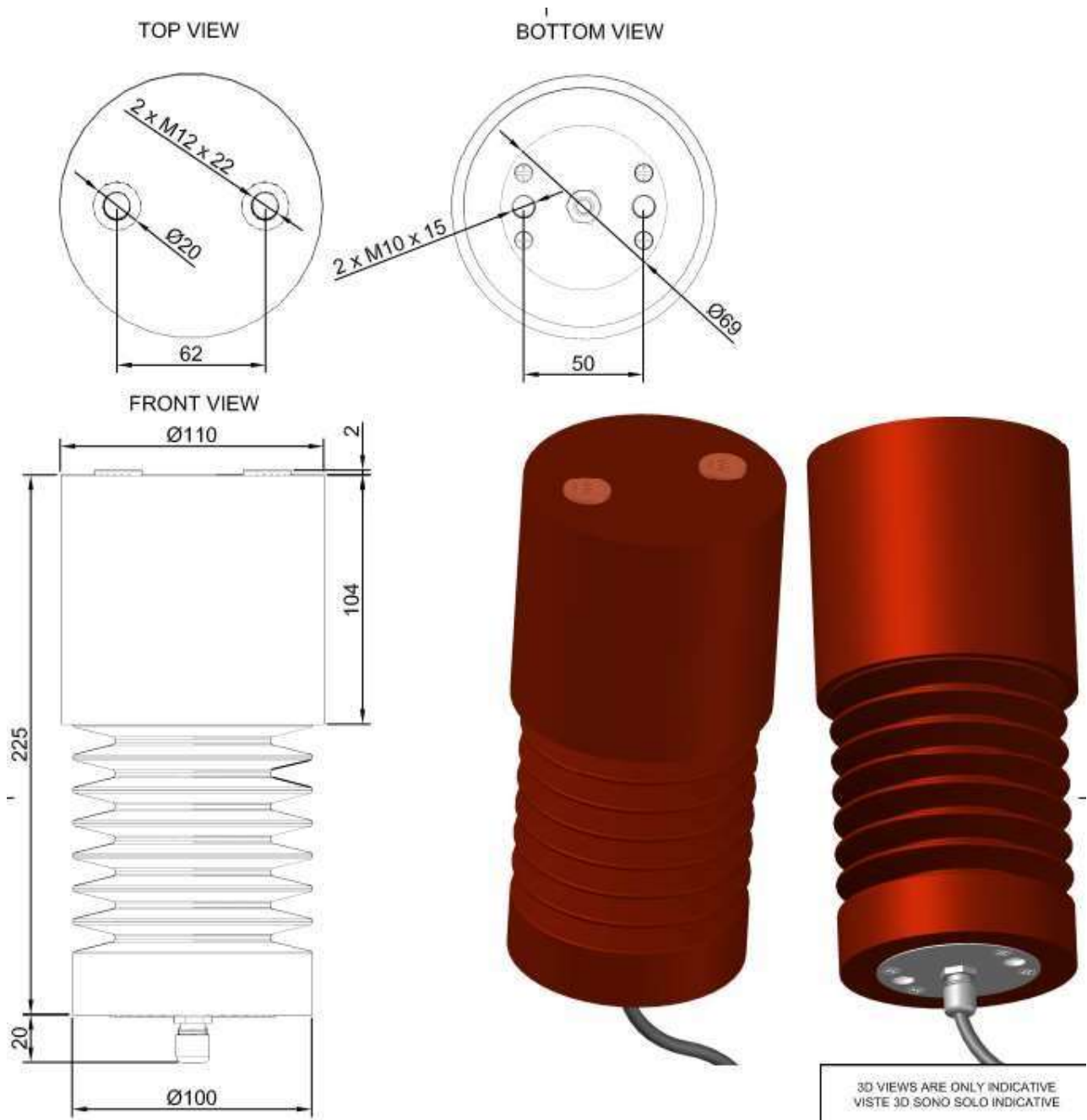



Fig.1 – Electronic indoor combined current voltage sensor CVS-24-I-HI

3. REFERENCE DOCUMENTS

The following reference documents were considered for the definition of Altea CVS-24-I-HI operational characteristics:

	Customer : N/A	Ref. No. N/A	
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1. IEC 60044-7 (1999-12) "Instrument transformers - Part 7: Electronic voltage transformers";
2. IEC 60044-8 (2002) "Instrument transformers - Part 8: Electronic current transformers";
3. IEC 60060-1 (2010) "High test voltage techniques – Part 1: General definitions and test requirements";
4. IEC 60815 (1986) "Guide for the selection of insulator in respect of polluted conditions"
5. IEC 60071-2 (1996) "Insulation co-ordination - Part 2: Application guide"
6. IEC 60660: "Insulators – Tests on indoor post insulators of organic material for Systems with Nominal Voltage greater than 1000 V up to but not including 300 kV".

4. SERVICE CONDITIONS OF THE ALTEA CVS-24-I-HI

According to [1 and 2] the electronic voltage and current sensor Altea CVS-24-I-HI is suitable for both measuring and protection purposes. The high accuracy class of the voltage sensor is suitable for smart grid applications like PMU measurements.

4.1 Service conditions

4.1.1 Ambient Air Temperature

The ambient air temperature belongs to the standard range [-5 °C; + 40 °C]. The accuracy class 0,1 of the voltage sensor is granted in a smaller temperature range, that has to be declared by the customer.

4.1.2 Altitude

For installations at an altitude higher than 1000 m, the arcing distance under the standardized reference atmospheric conditions is determined by multiplying the withstand voltages required at the service location by a factor k in accordance with Figure 3 of [1].

4.1.3 Vibrations or earth tremors


Typical vibrations to the electronic sensor due to external causes or earth tremors do not affect the operation of CVS-24-I-HI.

4.1.4 Service conditions for the indoor ALTEA CVS-24-I-HI

Altea CVS-24-I-HI is in compliance with the requirements of [2, 4.2.5] regarding the service conditions for indoor use:

Table 4.1

Solar radiation	Negligible
-----------------	------------

	Customer : N/A	Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI	REV. 0	Page 8/20

Humidity and water vapour	1) the average value of the relative humidity, measured during a period of 24 h does not exceed 95 %;
	2) the average value of the relative humidity for a period of one month does not exceed 90 %; 3) the average value of the water vapour pressure for a period of 24 h does not exceed 2,2 kPa; 4) the average value of the water vapour pressure for a period of one month does not exceed 1,8 kPa.

4.2 Earthing system [1, 4.3 and 2, 4.3]

The Altea CVS-24-I-HI is an earthed electronic voltage - current sensor. The output voltages of the Altea CVS-24-I-HI are representative of the primary current and the phase to ground primary voltage. The base-plate of the sensor (see Fig. 1) has to be connected to ground.


4.3 Safety

The Electronic voltage – current sensor Altea CVS-24-I-HI has an intrinsically safe failure mode. In case of failure, avoids explosive shattering of the housing. The Supplier is able to provide sufficient service experience evidence to support that the design adopted is not associated with brittle fracture problems.

4.4 Material


The Altea CVS-24-I-HI is in epoxy resin named EA-24.06.1670/NA whose features are reported in Table 4.2.

Table 4.2

	Customer : N/A		Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI		REV. 0	Page 9/20

	TEST SPECIFICATION	UNIT	condition or ambient test	VALUE			Note	
				indicative	nominal	Tolerance		
MECHANICAL	Shrink	ASTM D-2566 ISO 2577	%	0,8 + 1,5			Variable working temperature and mass of piece	
	Post-shrink				inappreciable			
	Specific weight	ASTM D-792 DIN 53479 UNI 7092	g/cm ³	≈ 1,8				
	Water absorption	ASTM D-570 UNI ISO 62	%		0,1	+0,05		
	Tensile strength	ASTM D-638 DIN 53455 UNI EN ISO 527	MPa		≥ 70			
	Compressive strength	ASTM D-695 UNI 4279			≥ 200			
	Flexural strength	ASTM D-790 DIN 53452 UNI EN ISO 178			130	- 30		
	Elastic modulus in tension			12000 + 14000				
	Impact strength Charpy	without intaglio with intaglio	ASTM D-256 DIN 53453 UNI EN ISO 179	KJ/m ²		10	- 2	distance support 70 mm
	Hardness (HRM)	ASTM D-785 UNI 4278	Rockwell scale M		100	- 5		
ELECTRICAL	Volume resistivity	ASTM D-257 IEC 60093	Ω * cm	≥ 10 ¹⁴				
	Surface resistivity	UNI 4288	Ω	≥ 10 ¹³			≥ 10 ¹² after 24 h in H ₂ O distilled	
	Electric strength	ASTM D-149 IEC 60243 UNI 4291	kV/mm		≥ 20			
	Arc resistance	ASTM D-495	s		≥ 190			
	Tracking resistance	IEC 60112 (CTI)	V		> 600			
		ASTM D-2303 "Time to Track "(2500 V)	min		> 200			
	Dielectric constant	ASTM D-150 IEC 60250			4 + 4,5			
Dissipation factor	UNI 4289			1+2 * 10 ⁻²				

	TEST SPECIFICATION	UNIT		VALUE	Note
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	Customer : N/A		Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI		REV. 0	Page 10/20


				condition for supplying or ambient test	indicative	nominal	** Tolerance	
THERMIC	Specific heat		j	condition for supplying or ambient test				
			kg * °C					
	Thermal conductivity	ASTM D-2303 DIN 53612 UNI 4289	W			0,6 ÷ 0,9		
			m * °C					
	Coefficient of linear thermal expansion	ASTM D-696 UNI 6061	° C-1			≈ 4 * 10 ⁻⁵		
	Index of temperature (50% flexural resistance 20000 h)	IEC 60216 DIN 53446					130	-6
COMBUSTION	Glass transition temperature	IEC 61006		condition for supplying or ambient test		110	+10 -5	
	Heat deformation resistance according to Martens	DIN 53458 UNI 4281	° C			100	+15 -0	
	Flammability temperature	DIN 51584				> 250		
	of sample	ASTM igniz.						
	Glow resistance	D-229 Met. II IEC 60695	s				positive result	
	finished piece							
emissions smokes	Optical density max	ASTM E 662						
	Acid alogenidric gaseous	CEI 20-37 Parte I	mg/g			absent		
	index of toxicity	CEI 20-37 Parte II						
VARIED	Action resistance of micro-organisms	ASTM G21-G22				good		
	Resistance of oils, solvents, detergents, hot and cold water					good		

5. RATING OF THE ALTEA CVS-24-I-HI

5.1 Standard value of rated current [2, 5 and 1, 5]

5.1.1 Rated primary current

The Altea-CVS-24-I-HI operates with rated primary current 50 A. Different values available.

	Customer : N/A	Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI	REV. 0	Page 11/20

5.1.2 Rated secondary voltage

The output of the ECT of Altea-CVS-24-I-HI is a voltage signal with 0.2 V rated value.

5.2 Standard value of rated voltage [1, 5.1]

5.2.1 Rated primary voltage

The Altea-CVS-24-I-HI operates with rated primary voltage value $20/\sqrt{3}$ kV. Lower values available.

5.2.2 Rated secondary voltage

The output of the EVT of Altea-CVS-24-I-HI is a voltage signal with rated value 1 V. Different values available.

5.3 Standard values of rated output

The accuracy class of the Altea CVS-24-I-HI is assured for load impedances greater than 100 k Ω .

5.4 Standard values of auxiliary power supply

Power supply voltage value for the Altea CVS-24-I-HI is ± 12 Vdc.

5.5 Standard reference values of other influencing parameters

5.5.1 Standard reference range of frequency

The accuracy class of the Altea CVS-24-I-HI is assured for frequencies ranging from 95 % to 105 % of the rated frequency.


5.5.2 Standard reference range of auxiliary power supply voltage

The accuracy class of the Altea CVS-24-I-HI is assured for auxiliary power supply ranging from 90 % to 110 % of the rated auxiliary power supply voltage.

5.5.3 Standard reference range of temperature

Unless otherwise specified, the standard reference range of ambient air temperature is [-5; +40 °C].

6. DESIGN FEATURES OF THE ELECTRONIC VOLTAGE - CURRENT SENSOR CVS-24-I-HI

	Customer : N/A	Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI	REV. 0	Page 12/20

6.1 Insulation requirements for primary voltage of CVS [2, 6.1 and 1 ,6.1]

6.1.1 Rated insulation levels for primary terminals

The maximum rated insulation level of the primary voltage of Altea CVS-24-I-HI is 24 kV.

6.1.2 Power-frequency withstand voltage

Power-frequency withstand voltage is 50 kV in wet conditions.

6.1.3 Lightning impulse capability

The lightning impulse capability is 125 kV in dry conditions.

6.1.4 Partial discharges

The Altea CVS-24-I-HI features partial discharge levels lower than 50 pC at 28,8 kV (equal to 1,2 24 kV) and lower than 20 pC at 16,6 kV (equal to 1,2 24/√3 kV).

6.2 Insulation of low-voltage components [1, 6.2]

6.2.1 Power-frequency voltage withstand capability: 2.8 kV RMS for 60s.

6.2.2 Impulse voltage withstand capability: 5 kV peak.


6.3 Limits of temperature rise [1, 6.4]

Altea CVS-24-I-HI withstands the thermal effects caused by the following conditions:

- maximum specified ambient air temperature (+ 40 °C);
- rated frequency (50/60 Hz);
- Rated continuous thermal current (720 A)
- 1,2 times the rated primary voltage [1,2 20/√3 = 13,9 kV];
- the combination of auxiliary power supply voltage and 5 kΩ secondary burden, which causes the maximum internal power dissipation of the secondary converter.

6.4 Transmitted overvoltage requirements [1, 6.]

Alta CVS-24-I-HI is protected against the transmission of overvoltage from the primary side to the secondary output or to the auxiliary power supply connections.

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6.5 Electromagnetic compatibility requirements [1, 6.7]

Altea CVS-24-I-HI is in compliance with all the requirements reported in [1] concerning either immunity and emission of Electromagnetic disturbances. The following tests have been passed.

6.5.1 Emission requirements

6.5.2 Immunity requirements

- Harmonic and interharmonic disturbance
- Slow voltage variation
- Voltage dips and short interruptions
- Surge immunity
- Electrical fast transient / burst
- Oscillatory wave immunity
- Electrostatic discharge
- Power frequency magnetic field immunity
- Pulse magnetic field immunity
- Damped oscillatory magnetic field immunity
- Radiated radio-frequency electromagnetic field immunity.

6.6 Reliability [1, 6.8]

The estimated MTTF of the Altea CVS-24-I-HI is 250.000 h.


6.7 Earthing terminals [1, 6.12]

6.7.1 Earthing of the primary voltage and primary converter

Altea CVS-24-I-HI is connected to ground potential trough two clamping screws M10 (see Fig. 1).

7 TESTS FOR CVS-24-I-HI

Altea CVS-24-I-HI is in compliance with Standard IEC 60044-7 and IEC 60044-8. In the following the Type tests and Routine tests performed for Altea CVS-24-I-HI are listed.

	Customer : N/A	Ref. No. N/A	
	Device Under Test: ALTEA CVS-24-I-HI	REV. 0	Page 14/20

7.1 Type tests for the current transformer [2, 7.2]

- a) short-time current tests [2, 8.1];
- b) temperature-rise test [2, 8.2];
- c) lightning-impulse test [2, 8.3.2];
- d) switching-impulse test [2, 8.3.3];
- e) wet test for outdoor type electronic current transformers [2, 8.4];
- f) RIV test [2, 8.5];
- g) transmitted overvoltage test [2, 8.6];
- h) low-voltage components voltage withstand test [2, 8.7];
- i) EMC tests: emission [2, 8.8.3];
- j) EMC tests: immunity [2, 8.8.4];
- k) accuracy test [2, 8.9];
- l) additional accuracy tests for protective electronic current transformer [2, 8.10];
- m) verification of the protection [2, 8.11];
- n) tightness tests [2, 8.12];
- o) vibration test [2, 8.13].

7.2 Routine tests for the current transformer [2, 7.3]


- a) verification of terminal markings [2, 9.1];
- b) power-frequency withstand test on primary terminals [2, 9.2];
- c) partial discharge measurement [2, 9.2.2];
- d) power-frequency withstand test for low-voltage components [2, 9.3];
- e) accuracy tests [2, 9.4];
- f) tightness tests [2, 9.5].

7.2.1 Additional routine tests for analogue output [2, 9.7]

- a) measurement of secondary direct voltage offset (U_{sd0}).
- b) if applicable (ECT powered by line current), measurement of the minimum primary current needed to ensure nominal performance of the ECT.

7.3 Special tests for the current transformer [2, 7.4]

- a) chopped lightning impulse test [2, 10.1]; N/A for Altea CVS-24-I-HI.
- b) measurement of capacitance and dielectric dissipation factor [2, 10.2]; N/A for Altea CVS-24-I-HI.

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- c) multiple chopped impulse test on primary terminals [8]; N/A for Altea CVS-24-I-HI.
- d) mechanical tests [2, 10.3];
N/A for Altea CVS-24-I-HI.
- e) accuracy test versus harmonics [2, 10.4];

7.4 Type tests for the voltage transformer [1, 7.1]


- a) lightning impulse test [1, 8.1.2];
- b) switching impulse test [1, 8.1.3];
- c) wet test for outdoor type electronic voltage transformers [1, 8.2]; N/A for Altea CVS-24-I-HI.
- d) tests for accuracy [1, 8.3];
- e) abnormal conditions withstand capability test [1, 8.4];
- f) radio interference voltage test [1, 8.5];
- g) transmitted overvoltage test [1, 8.6];
- h) electromagnetic compatibility tests: emission [1, 8.7.1]
- i) electromagnetic compatibility tests: immunity [1, 8.7.2]
- j) impulse voltage withstand test for low-voltage components [1, 8.8]
- k) transient performance test [1, 8.9]:
 - primary short-circuit [1, 8.9.1];
 - reclosing on a line with trapped charges [1, 8.9.2]; N/A for Altea CVS-24-I-HI.

7.5 Routine tests for the voltage transformer [1, 7.2]

- a) verification of terminal markings [1, 9.1]
- b) power-frequency withstand tests on primary voltage terminals [1, 9.2]
- c) partial discharge measurement [1, 9.2.4];
- d) power-frequency voltage withstand test for low-voltage components [1, 9.3]
- e) tests for accuracy [1, 9.4]

7.6 Special tests for the voltage transformer [1, 7.3]

- a) chopped lightning-impulse test on primary voltage terminals [1, 10.1]; N/A for Altea CVS-24-I-HI.

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- b) measurement of capacitance and dielectric dissipation factor [1, 10.2]; N/A for Altea CVS-24-I-HI.
- c) mechanical strength tests [1, 10.3]; N/A for Altea CVS-24-I-HI.

In addition, for post insulators of organic material for indoor service in electrical installations or equipment operating in air at atmospheric pressure on alternating current with a nominal voltage greater than 1 000 V up to, but lower than 300 kV, test foreseen by the standard [2] apply.

7.7 Type tests for indoor post insulator installation [6, 3]

- a) water absorption test [6, 3.10];
- b) flammability test [6, 3.12];
- c) ageing and humidity test [6, 3.11].
- d) test for mechanical bending strength as a function of temperature [6, 3.9];
- e) dry lightning impulse withstand voltage test [6, 3.3] (see test *a*) of Type tests);
- f) dry power-frequency withstand voltage test [6, 3.4];
- g) lightning impulse puncture test [6, 3.6];
- h) temperature cycle test [6, 3.13];
- i) partial discharge extinction voltage test [6, 3.5];
- j) test for deflection under load at normal ambient temperature conditions [6, 3.8];
- k) mechanical failing load test (bending test, tensile test, torsion test, compres. test) [6, 3.7].


7.8 Sample tests for indoor post insulator installation [6, 4]

The samples shall then be subjected to the following tests in the order given: a) verification of dimensions [6, see 4.2];

- b) water absorption test for materials other than cast epoxy resin or PUR resin only [6, 3.10];
- c) partial discharge extinction voltage test [6, 3.5] (see by test *c*) of Routine tests);

7.9 Routine tests for indoor installation [6, 5]

- a) visual examination [6, 5.2];
- b) electrical routine test and partial discharge measurement for post insulators of design category B [6, 5.4] (see test *c*) of Routine tests);

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8 MARKINGS

8.1 Terminal markings

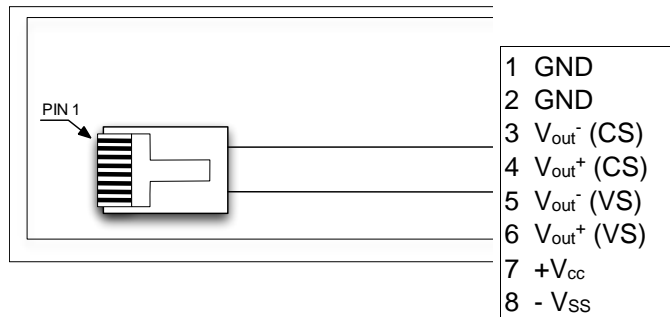


Figure 2 – RJ45 connector for auxiliary power supply, EVT output, ECT output

The connector is RJ45 type. Refer to Fig. 2 for the connections pin-out.

8.2 Rating plate markings

The rating plate of the electronic combined transformer is reported in Fig. 3.




		
Designation Electronic Voltage and Current Transformer (EVT+ECT) 		
Type CVS-24-I	Made in EU	Serial number YYMMNNNN
Electrical Characteristics 24/50/125 kV fn=50 Hz	Auxiliary Power Supply Uan= ± 12 Vdc Ian=10 mA	
EVT Characteristics Kn=20/√3 kV/1 V; Ku=1.9 Cl.: 0,5 Ref. Std.: IEC 60044-7	ECT Characteristics Kra=630 A/0.2 V; lth=16 kA Cl.: 0,5 - 5P30 Ref. Std.: IEC 60044-8	

Figure 3 Rating Plate of Altea CVS-24-I-HI

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8.3 Record of the CVS

Altea B.V. maintains records of all produced devices for a minimum of 10 years. Records contain the information listed below:

- product code;
- year of manufacture;
- Serial number/s;
- type tests, date and results;
- routine tests, date and results.

8.4 Maintenance requirement

Altea Electronic voltage – current sensor CVS-24-I-HI is a disposable device. No sub-parts can be replaced.


9. ACCURACY FOR SINGLE-PHASE ALTEA CVS-24-I-HI ELECTRONIC VOLTAGE – CURRENT SENSOR [2, 12]

The Altea CVS-24-I-HI belongs to the Accuracy class 0,5 for the ECT in the operating temperature range [-40; + 60 °C]. Lower class values available.

The Altea CVS-24-I-HI belongs to the Accuracy class 0,1 for the EVT in an ambient-air temperature range of 35 °C. The average value of the operating temperature has to be declared by the customer.

As far as specific accuracy requirements for power metering are concerned, the performances of the electronic voltage and current sensors at harmonic frequencies are reported in the following tables:

Accuracy class	Percentage ratio error (\pm) at harmonics shown below				Phase displacement (\pm) at harmonics shown below							
					Degree				Centiradians			
	2 nd to 4 th harmonic	5 th to 6 th harmonic	7 th to 9 th harmonic	10 th to 13 th harmonic	2 nd to 4 th	5 th to 6 th	7 th to 9 th	10 th to 13 th	2 nd to 4 th	5 th to 6 th	7 th to 9 th	10 th to 13 th
0,1	1 %	2 %	4 %	8 %	1	2	4	8	1,8	3,5	7	14

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Accuracy class	Percentage ratio error (\pm) at the harmonics shown below		Phase error (\pm) at harmonics shown below			
			Degree		Centiradians	
	1 st to 2 nd harmonic	3 rd to 50 th harmonic	1 st to 2 nd	3 rd to 50 th	1 st to 2 nd	3 rd to 50 th
Special quality metering	1 %	5 %	1	5	1,8	9

END OF DOCUMENT



Rev. D	ate	Revision Description	Prepared by	Checked by A	pproved by
0	26/06/14 F	irst Issue E	. Scala		

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