



EQUIPMENT CATALOG

**AVR – VOLTAGE REGULATOR
RELAY**



AVR – Voltage Regulator Relay



In an increasingly demanding market in terms of quality of electric energy, the rules for parameter definition and acceptable supply limits are becoming more stringent. There is a growing need for tools capable of meeting this reality and affording adequate voltage regulation.

Within this context, TreeTech's New Voltage Regulator Relay AVR offers a solution that goes beyond the traditional and well-known “90” relays. The AVR is fitted with unprecedented resources in order to afford better control of load voltage limits, allowing the most stringent requirements to be addressed and met.



Main Features

- ✓ Applicable to Power Transformers with load tap changers (OLTC) and Single Phase Voltage Regulators;
- ✓ IED (Intelligent Electronic Device), suited for integration in supervision or monitoring systems through RS485 and RS232 ports (Modbus standard, DNP optional).
- ✓ Six independent sets of voltage regulation parameters, activated by way of hour programming (internal clock) or external dry contacts;
- ✓ Internal clock with hour, minute and second, day, month and year, plus day of the week;
- ✓ Independent activation times for voltage above or below the range adjusted;
- ✓ Defined timer types (constant time) or Inverse Curve;
- ✓ Linear timer with independent adjustments by ranges of voltage deviation;
- ✓ Compensation for line drop by adjustments to Resistance and Reactance or by the simplified voltage drop percentage method (compensation Z);
- ✓ Five signal relays with programmable functions and operation types (NO/NC);
- ✓ Analog output for remote reading of voltage, current or tap position (optional). Configurable output range: 0...1, -1...1, 0...5, -5...5, 0...10, -10...10, 0...20, -20...20, or 4...20mA;
- ✓ Multi-measurement function: voltage readings for transformer and load, deviation of voltage, current, active, reactive and apparent power, load %, power factor and frequency;
- ✓ PT/ CT phase difference adjustable from 0 to 330°, allowing any type of PT/CT connection;
- ✓ Blocking of OLTC in case of over-current or under-voltage. Selectable activation in case of over-voltage: block of OLTC or quick voltage reduction;
- ✓ High luminosity VFD (Vacuum Fluorescent Display) display type, readable under any lighting or temperature conditions;
- ✓ Operating temperature -40...+85°C, allowing the device to be installed in outdoor panels;
- ✓ Universal power input, from 38 to 265Vdc/Vac 50/60Hz;
- ✓ User password protected programming menus;
- ✓ Communication by optical fiber, using external electrical-optical converter.



Optional Features

Optional item 1 – DNP3 Protocol

User selected communication protocol between Modbus RTU and DNP3.0 level 1.

Optional item 2 – Mass Memory

Non-volatile memory for storage of readings, operations of the OLTC and alarm event data. User selects the variables to be stored (maximum of 30 variables) and defines whether storage is for instant, average, minimum or maximum values for the interval.

Optional item 3 – Position Reading

Input for reading OLTC position by potentiometric sensor, with compensation for resistance of cables and detection of errors. Associated functions:

- ✓ Current output programming for remote tap reading;
- ✓ Manual command of OLTC, local (front panel) and by serial communication;
- ✓ Limitation of OLTC excursion range (minimum and maximum tap positions allowed) and memorizing maximum and minimum positions reached since last reset;
- ✓ Protection against undue tap operations: blockage of switch in case of operations not initiated by AVR.

Optional item 4 – OLTC Checking:

It works by algorithms that identify voltage levels corresponding to the sensitivity of the circuit, identifying activity or not of the switching, signaling the fault (Alarm). It does not require potentiometric transmitter information.

Optional item 6 – Parallelism by Circulating Current

Parallelism control for up to 6 transformers using the Minimum Circulating Current Method, with block for excess circulating current.

Optional item 7 – OLTC Maintenance

Same as for Optional item 3, adding:

- ✓ OLTC operation counter, with notice for high number of operations;
- ✓ Integration of current switched squared, with notice for high I^2 sum.

Technical Data

VERSÃO BÁSICA

Condition	Interval / Description
Supply Voltage	38 to 265 Vca/Vcc – 50/60 Hz
Consumption	8 W
Operating Temperature	- 40 to + 85°C
Protection Degree	IP20
Wire size except PT and CT inputs	0,3 to 2,5 mm ² , 22 to 12 AWG
Wire size - PT and CT inputs	one or two 16 to 12 AWG, 1.5 to 2.5mm ² using appropriate ring-type terminal lug
Mounting	Built into panel
Measuring Ranges	
Voltage	0...160 V
Current	0...10 A
Maximum Error	
Voltage	0,5 % of full scale in 0...160 V range
Current	1 % of full scale
Dry Contacts	
Dry Contacts	3
Relays outputs	7 NO + 1 NC (self-diagnosis)
Maximum switching power	70 W (dc) / 220 VA (ac)
Maximum switching voltage	250 Vdc / 250 Vac
Maximum conduction current	5 A
Analog outputs	
Analog outputs	1 current loop
Variable	Programmable
Output range:	Programmable: 0...1, -1...1, 0...5, -5...5, 0...10, -10...10, 0...20, -20...20, 4...20 mA
Maximum error	0,5 % of full scale
Maximum load	10 V
Serial communication ports	1 RS485/RS232 (for supervision system)

OPTIONAL ITEMS

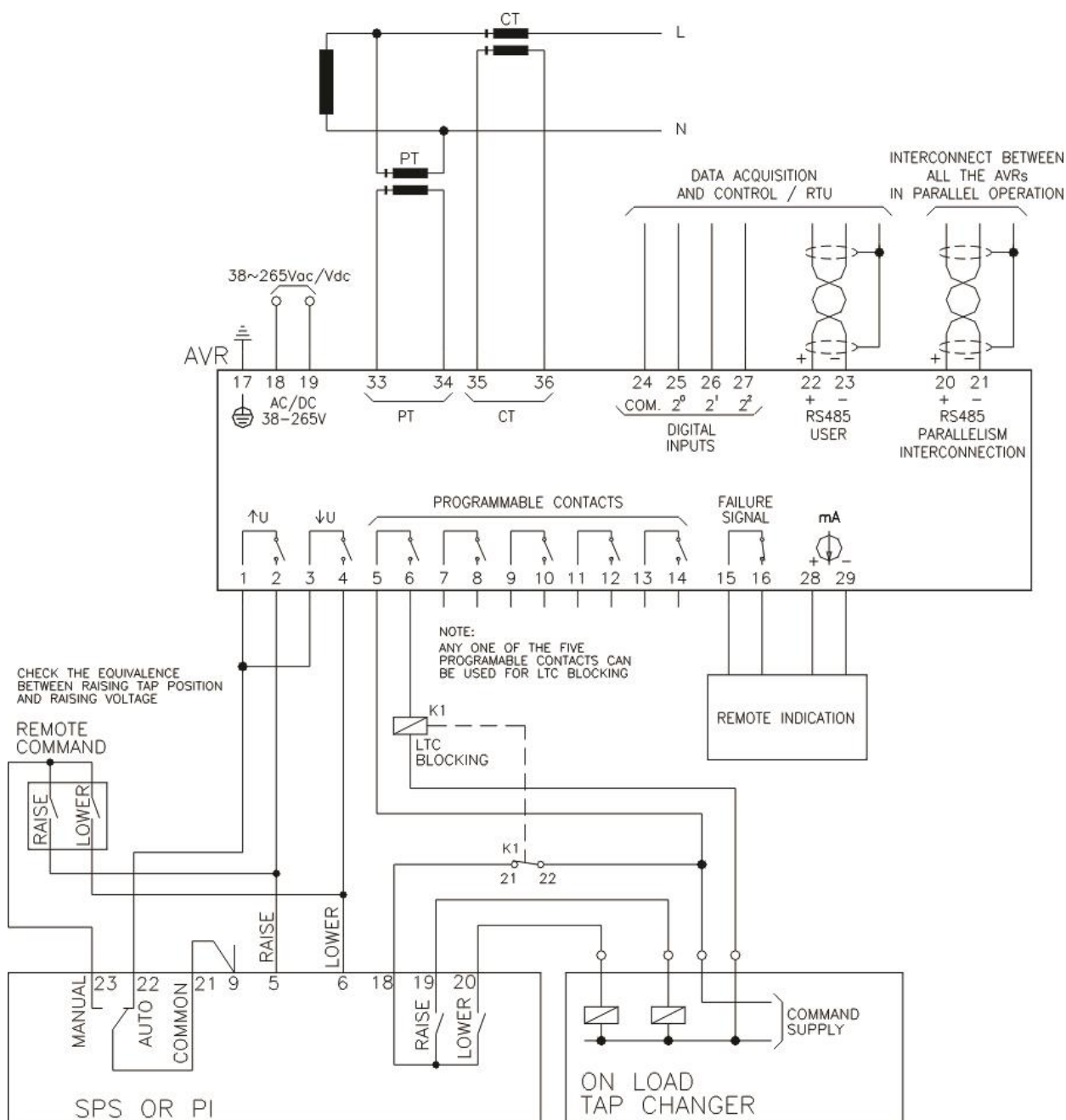
Condition	Interval / Description
Tap position measurement input	Potentiometer sensor (resistors precision 1% or better), 3 wires
Number of OLTC positions	2 to 50
Total resistance of potentiometric transmitter	9,4 to 1000 Ω
Step resistance of potentiometric transmitter	4,7 to 20 Ω
Serial communication port	1 RS485 (for interconnection between AVRs for the optional parallel operation functions)
Mass memory	Non-volatile type FIFO (First In First Out)
Recording interval	1 to 120 minutes
Capacity	406 to 1928 registers (according to the number of variables programmed by the user for recording, from 30 to 0 respectively)

Adjustment Ranges (MAIN SETTINGS):

Condition	Interval / Description
Rated Voltage (Un)	50 to 140 V, 0,1 V step
Dead band	0 to 10 %, 0,1 % step
Timer for operations	0 to 180 s, 1 s step
R-X Line drop compensation	-25 V to 25 V, 0,1 V step
Z Line drop compensation	0 to 15 %, 0,1 % step
Blocking by $U <$	10 to 99 % of Un, 1% step
Blocking by $U >$	101 to 199 % of Un, 1 % step
Blocking by $I >$	10 to 200 % of In, 1 % step
Display Languages	Portuguese, English, Spanish

Connection Diagrams

APPLICATION WITH POSITION INDICATOR PI OR PARALLELISM SUPERVISOR SPS

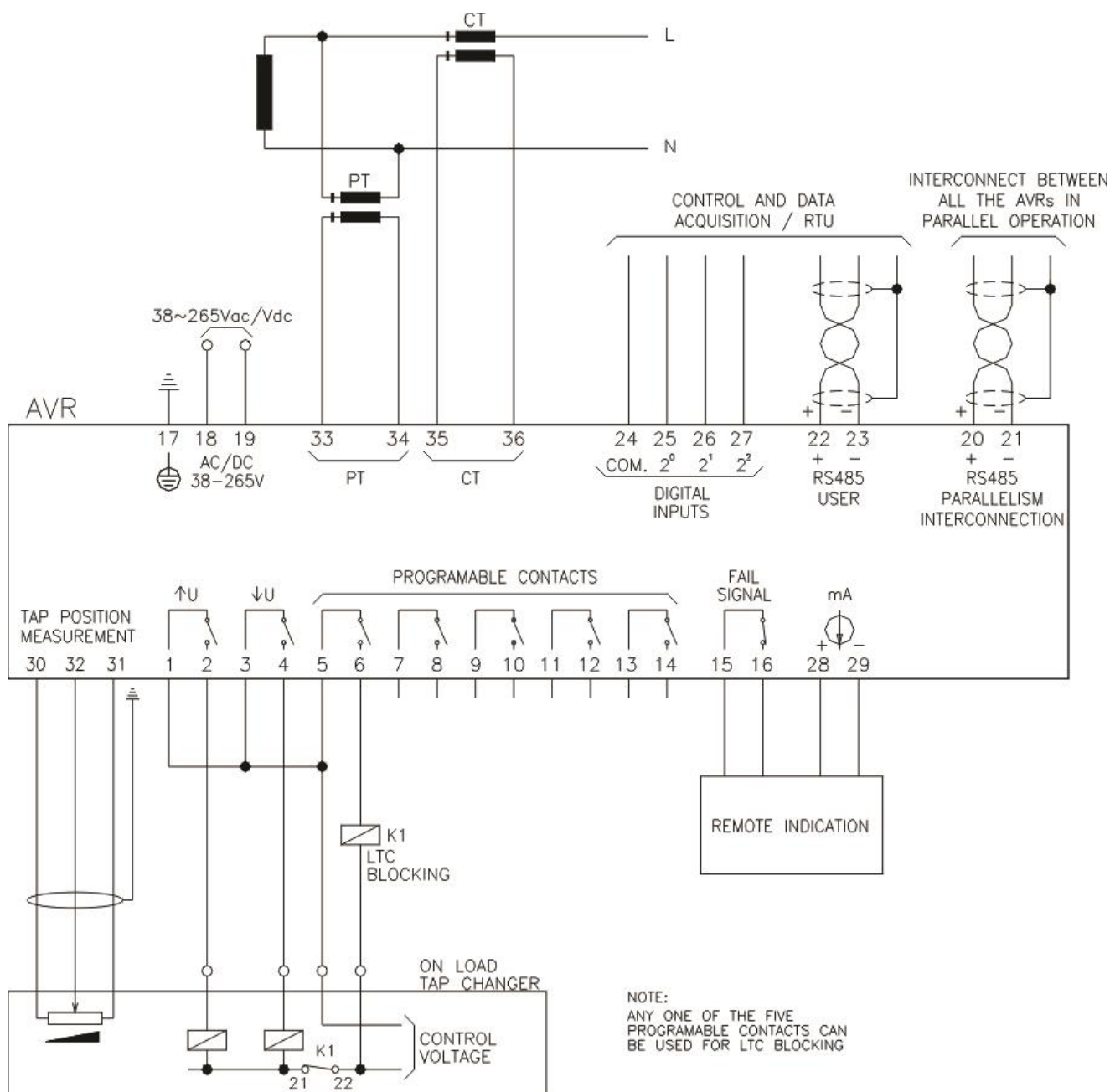


Notes:

- 1) Any one of the five programmable contacts can be used for OLTC blocking;
- 2) All contacts shown with AVR, SPS and PI de-energized;
- 3) Connection of terminals 20 and 21 is only necessary if AVR has the optional function Parallelism by Circulating Current.

Connection Diagram

AVR WITH TAP POSITION MEASUREMENT (OPTIONAL 3)

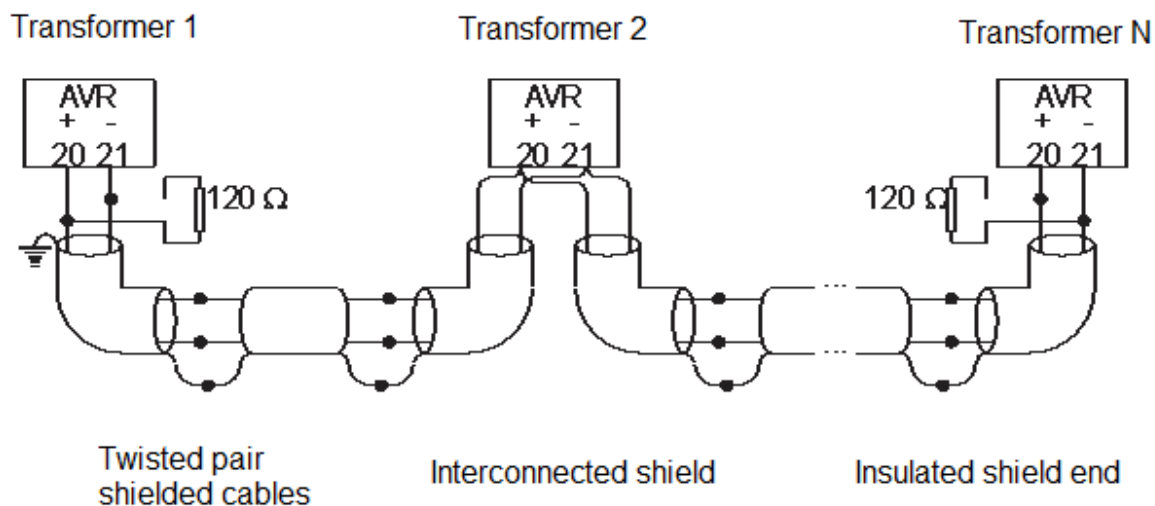


Notes:

- 1) Any one of the five programmable output contacts can be used for OLTC blocking;
- 2) The resistors in the tap-changer for remote position indication must have precision of 1% or better
- 3) All contacts shown with AVR de-energized;
- 4) Connection of terminals 20 and 21 is only necessary if AVR has the optional function Parallelism by Circulating Current.

Connection Diagram

AVR COM PARALELISMO POR CORRENTE CIRCULANTE (OPCIONAL 6)

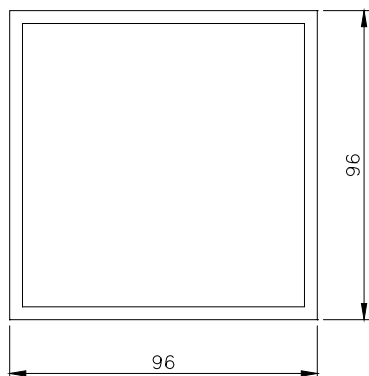


Notes:

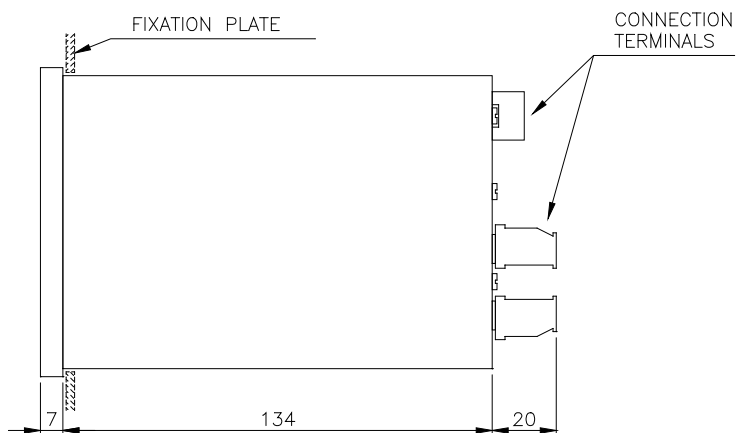
- 1) The RS-485 communication port for interconnection of AVRs is only connected if the Circulating Current Parallelism function is used (optional 6);
- 2) The RS-485 ports for interconnection already have pull-up and pull-down resistors built into the AVRs, eliminating the use of external resistors. The maximum distance of 1200 meters between the ends of the communication network must be respected;
- 3) Use shielded twisted pair cables and interconnect shields in case of splice. Ground one end of the cord and keep the other cord;
- 4) At the ends of the communication network, connect a 120 Ω resistor in parallel, as shown in the figure above.



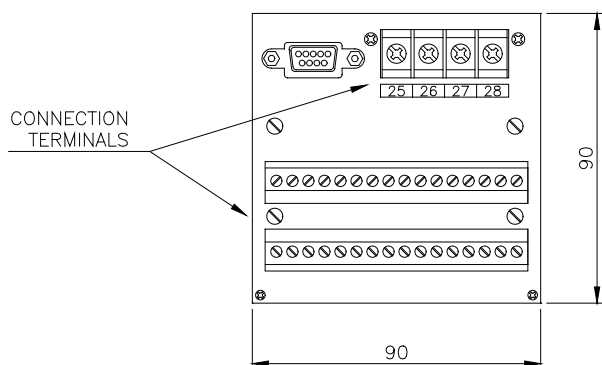
Dimensions



FRONT VIEW



SIDE VIEW



REAR VIEW

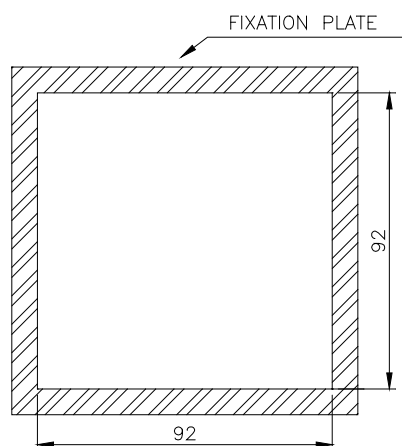


PLATE CUT OFF FOR ASSEMBLY

ALL DIMENSIONS IN mm

Order Specification

The Voltage Regulator Relay AVR is universal, with the operating characteristics being selected by way of program menus. These adjustments can be made directly on its front panel or by way of specific configuration software, using the RS232 or RS485 serial communication ports. Power input is universal (38 to 265 Vdc/Vac 50/60Hz).

Therefore, in ordering the device all that needs to be specified is:

- ✓ Voltage Regulator Relay AVR;
- ✓ Number of devices;
- ✓ Optional functions desired. More than one optional item can be specified for the same device, taking into account the possible combination of optional items shown on table below.

OPTIONAL ITEM	COMBINATION 1	COMBINATION 2
1) DNP3 Protocol		
2) Mass Memory		
3) Position Reading		
4) OLTC Checking		
6) Circulating Current Parallelism		
7) OLTC Maintenance		

SUBTITLE:

	Allowed
	Not allowed

Type Testing

Surge Immunity (IEC 60255-22-5 e IEC 61000-4-5)	
Differential Mode	1kV, 5 per polarity (+/-)
Common Mode	2kV, 5 per polarity (+/-)
Electrical transients immunity (IEC 60255-22-1, IEC 61000-4-12 e IEEE C37-90-1)	
1 st cycle peak, frequency, time and repetition rate, decay to 50 %	2,5 kV common mode, 1.1 MHz, 2 s, 400 surges/s, 5 cycles
Voltage Impulse (IEC 60255-5)	
Wave form, Amplitude, Number of pulses	1,2/50 µs, 5 kV, 3 negative and 3 positive, 5 s interval
Applied Voltage (IEC 60255-5)	
Industrial frequency applied voltage	2 kV, 60 Hz, 1 min. to ground
Irradiated electromagnetic field immunity (IEC 60255-22-3 e IEC 61000-4-3)	
Frequency, field intensity	26 MHz a 1 GHz, 10 V/m
Conducted electromagnetic perturbations immunity (IEC 60255-22-6 e IEC 61000-4-6)	
Frequency, field intensity	0,15 a 80 MHz, 10 V/m
Electrostatic discharges (IEC 60255-22-2, IEC 61000-4-2 e IEEE C37.90.3)	
Intensity and repetitions	Air mode: 8kV, ten discharges per polarity; Contact mode: 6kV ten discharges per polarity
Fast electrical transient immunity (IEC 60255-22-4, IEC 61000-4-4 e IEEE C37-90-1)	
Power supply - inputs and outputs, serial communication port	4 kV, 2 kV
Climatic test (IEC 60068-2-14)	
Temperature range, total test time	-40 a +85°C, 96 hours
Vibration response (IEC 60255-21-1)	
Application mode, amplitude, duration	3 axis (X, Y and Z), sinusoidal, 0,075mm from 10 to 58 Hz, 1G of 58 to 150 Hz, 8 min/axis
Vibration resistance (IEC 60255-21-1)	
Application mode, frequency, amplitude, duration	3 axis (X, Y and Z), sinusoidal, 10 to 150 Hz, 2G, 160 min/axis



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