



Synchronous parallelism supervisor

The Synchronous Parallelism Supervisor SPS is a device developed by Treotech for control and supervision of parallel operation of power transformers equipped with load tap changer. The SPS incorporates functions of a range of equipment that, in the past, were used to control parallelism of transformers, such as position indicators, auxiliary relays for electro-mechanical logic, selector switches Master/Follower/Individual, Manual/Automatic, Local/Remote and Raise/Lower, among others.

The SPS significantly reduces command wiring needs as well as the number of components. The result is a considerably increase in the overall reliability and reduced labor times for installation and testing, in addition to simplifying maintenance.

The device's operation philosophy is based on the Master-Follower method, in which one of the transformers is chosen as the Master, and the remaining units are Follower or Individual, out of parallelism. Due to the digital techniques of the SPS all the commuting performed by the master transformer is also initiated simultaneously in the follower equipment, thus preserving the same position in all transformers and avoiding current circulating among the windings in parallel. In case of discrepancy between taps of transformers in parallel, as well as the occurrence of any other error (invalid programming, failure in serial communication, etc.), the operation of tap changers is blocked.

The SPS can control up to six three-phase transformers in parallel, or up to six banks of single-phase transformers, that is, 18 transformers in total. The IED also allows parallel operation of a three-phase transformers and banks of single-phase transformers combination.

Main Features:

- IED (Intelligent Electronic Device) designed specifically for substation yard conditions (electromagnetic interference, extreme temperatures), suited for integration of supervision or monitoring systems by way of port RS485 (Modbus standard, DNP3.0 optional);
- Modular system that can be enhanced in accordance with application needs. Configurable transformer type: three-phase or bank of single-phase transformers;
- Selections Master/Follower/Individual, Local/Remote, Manual/Automatic and Raise/Lower commands performed directly on the front panel or through external dry contacts;
- Intelligent Position Measuring: compensation for resistance of measuring cables, failure detection and alarm for failed position measuring, due, for example, to bad contacts on the potentiometer sensor or connection cables. Option for position measurement input by current loop;
- Selectable position indication type on the display: simple numeric (ex.: 1...33), bilateral numeric (ex: -8...0...+8) or alpha-numeric (ex.: 8L...N...8R). Programmable total number of positions and resistance of the potentiometer sensor allows adaptation to all models and manufacturers of LTCs. Easy to visualize LED display;
- Analog output for remote position reading. User selectable output range: 0...1, -1...1, 0...5, -5...5, 0...10, -10...10, 0...20, -20...20 or 4...20mA);
- Four output relays for indication of alarms and states;
- Self-diagnosis: two micro-controllers with reciprocal supervision for detection of failures. Total absence of mechanical parts for parameter definition and calibration.

Technical Specifications

Parallelism Supervisor SPS

Conditions	Interval / Description
Power Supply Voltage:	38~265 Vac/Vdc, 50/60Hz
Maximum Consumption:	< 5 W
Operating Temperature:	-10 a +70 °C
Degree of Protection:	0,3 a 2,5 mm ² , 22 a 12 AWG
Connections:	IP20
Mounting:	Built in panel
Tap measurement input:	Potentiometric, 3 wires or current mA
Number of Taps of OLTC:	2 to 50
Potentiometric input – step resistance:	0...1mA, 0...5mA, 0...10mA, 0...20mA, or 4...20 mA
Analog Outputs:	One
Maximum error	0,5% of full scale
Options (selections) and maximum load:	0...1mA, -1...1mA, 12kW 0...5mA, -5...5mA, 2,4kW 0...10mA, -10...10mA, 1,2kW 0...20mA, -20...20mA, 600W 4...20 mA, 600W
Relay outputs:	Potential free contacts
Maximum switching power:	70 W / 250 VA
Maximum switching voltage:	250 Vdc / 250 Vac
Maximum conduction current:	5 A
Serial Communication Port:	1 RS 485 for interconnection to the Communication Module COMM-04

Communication Module COMM-04

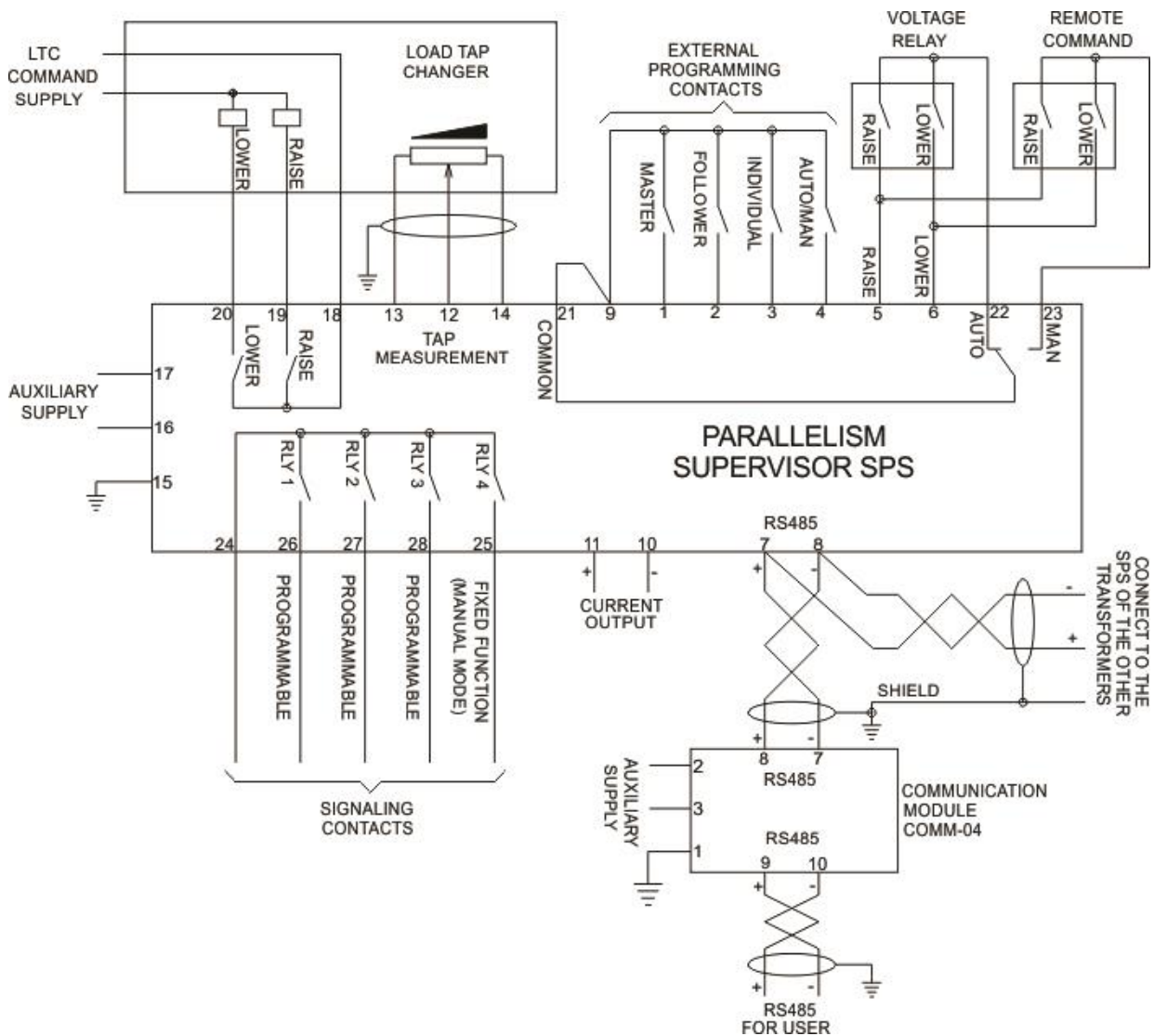
Conditions	Interval / Description
Input Tension:	38 to 265 Vac/Vdc 50/60Hz
Maximum Consumption:	< 5W
Operating Temperature:	-10 to +70°C
Protection level:	IP20
Wire size:	22 to 12 AWG, 0.3 to 2.5mm ²
Fixation:	DIN rail 35mm
Communication protocols with supervisory system (user):	Modbus RTU (standard) DNP3.0 level 1 (optional)
Serial Communication Ports:	1 RS 485 for interconnection with SPS 1 RS 485 for user (supervisory system)

Connection Diagrams

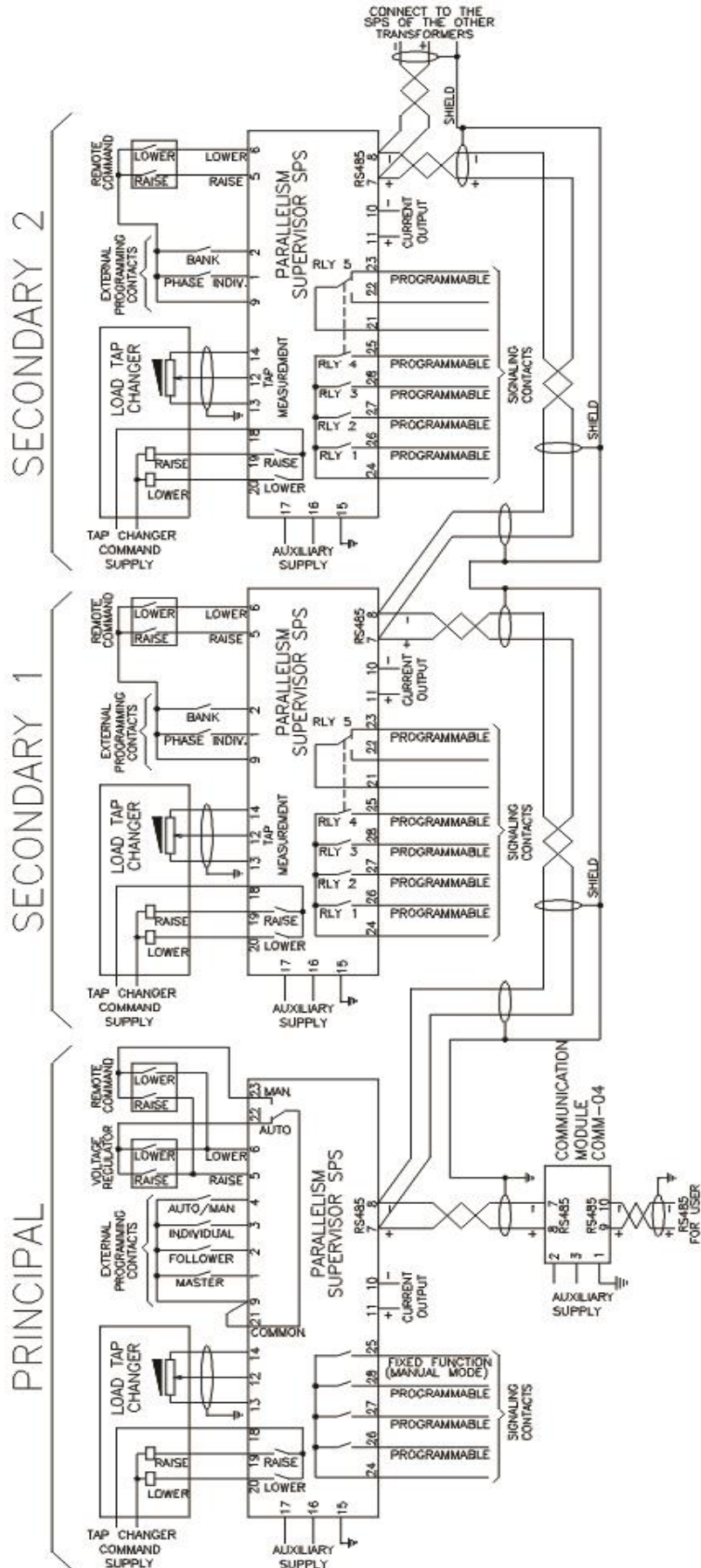
Notes:

1. One SPS should be used for each load tap changer controlled, and a single COMM-04 for all SPS.
2. The resistors in the Load Tap Changer for remote position indication must have 1% precision or better.
3. All contacts shown with SPS de-energized.

Three-phase transformer application:



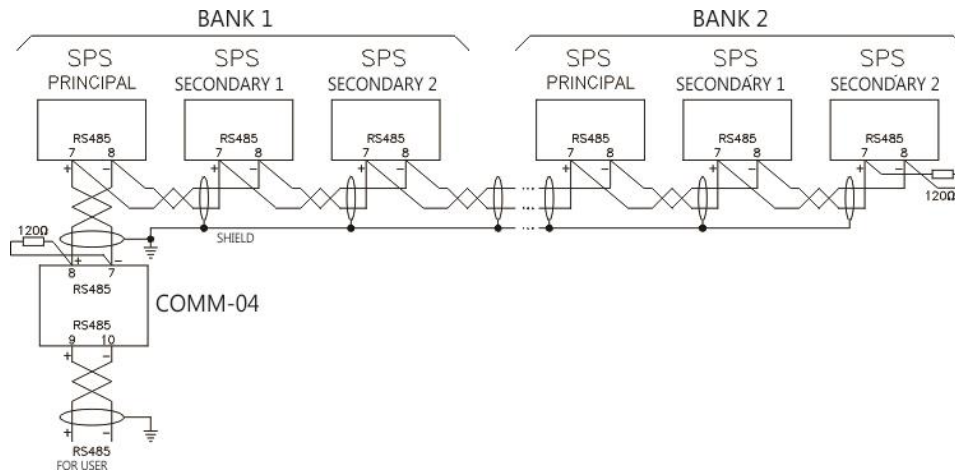
Bank of single-phase transformer:



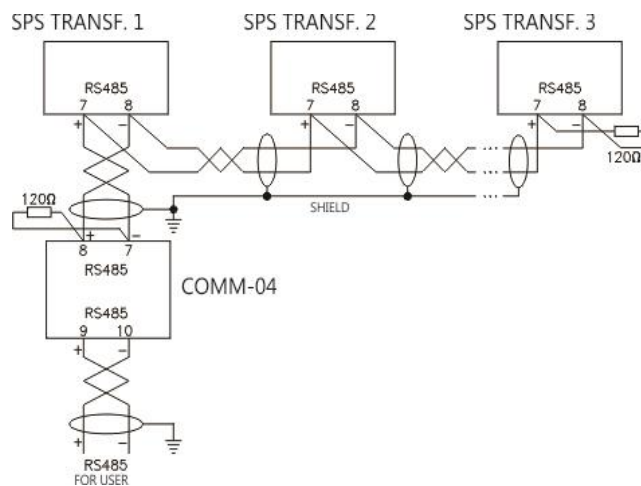
Connection Diagrams

Interconnection of serial communication ports RS485:

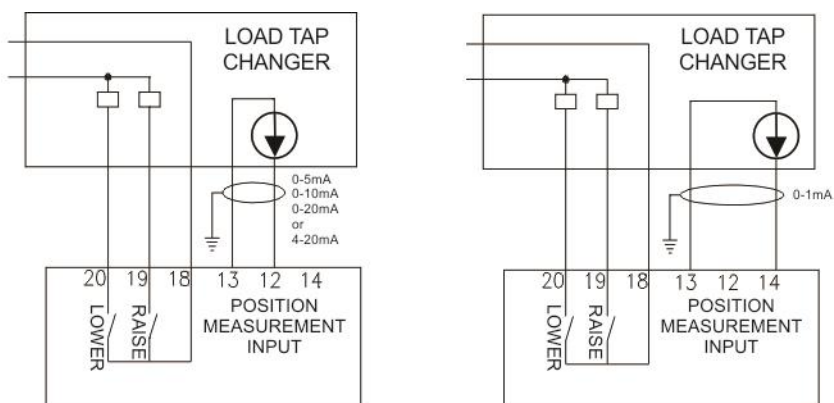
Single-phase transformer bank:



Three-phase transformer:



Detail for Current Loop Input (mA):

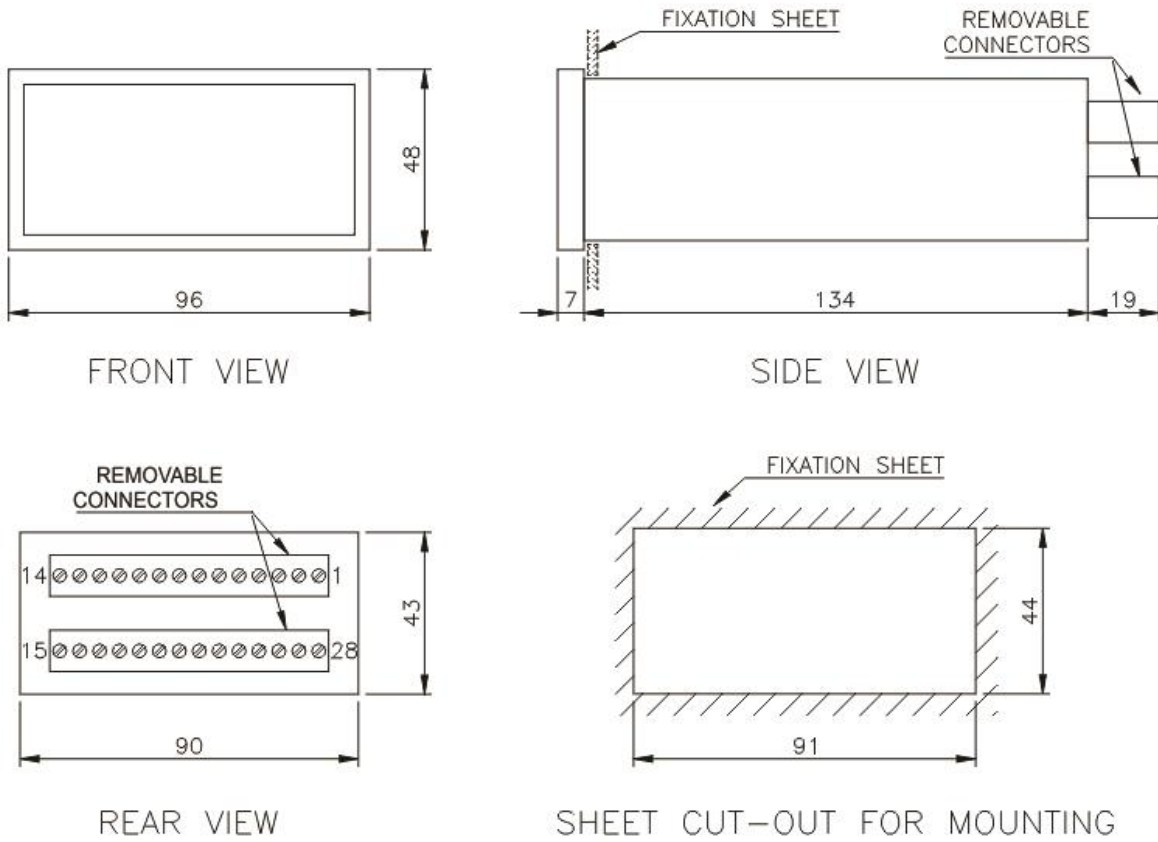


Connections for 0-5mA,
0-10mA, 0-20mA or 4-20mA

Connections for
0-1mA signal

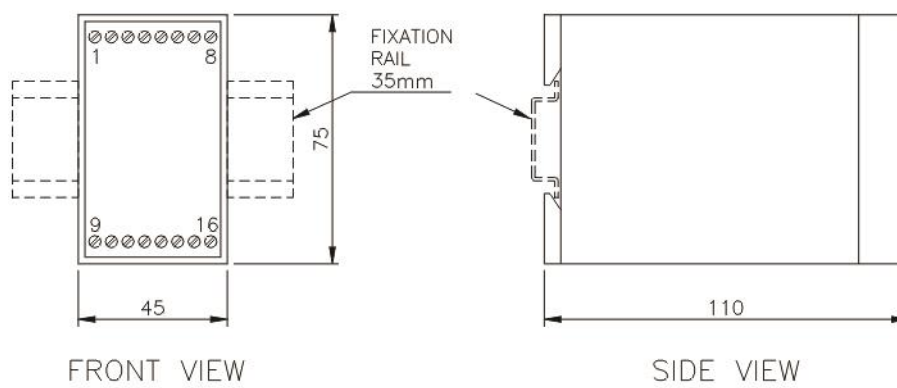
Dimensions

Parallelism Supervisor SPS:



ALL DIMENSIONS IN mm

Communication Module COMM-04



ALL DIMENSIONS IN mm

Order Specifications

The Parallelism Supervisors SPS are universal devices. The SPS features are selected by using the programming menus. These adjustments can be made directly on the device's front panel or by way of the serial communication port RS485. The power feed input is universal (38 to 265 Vdc/Vac 50/60Hz).

Therefore, in purchase orders for the equipment only the following need to be informed:

- Parallelism Supervisor SPS
 - ✓ Type of tap measurement input:
 - Standard - Potentiometric input - inform the code SPS;
 - Optional - Current mA input - inform the code SPS-I.
 - ✓ Quantity (one SPS for each LTC);

- Communication Module COMM-04
 - ✓ Quantity (a single COMM-04 for all the SPS in the same communication network);
 - ✓ Communication protocol: Modbus RTU (standard) or DNP3.0 (optional).

Optional Accessories

- **Signaling Contacts Expansion:**

If it is necessary, it is possible to expand the number of signaling contacts of the parallelism system using the Control Module DM3 in its special version named DM3-SP2. The expansion of the signaling contacts can be especially useful when the SPS is used with three-phase transformer, because in this case only 4 signaling contacts are available per three-phase unity.

The DM3-SP2 module has 8 Normally Open output contacts grouped in two 4-contact sets. Each set of contacts attends to one three-phase transformer or to one bank, in such manner that each DM3-SP2 module attends up to 2 transformers or banks. Each 4-contact set has the following fixed signaling functions: Master, Follower, Individual and Remote modes.

Detailed information can be found in the specific MD3-SP2 documentation.



Type Testing

Immunity to Surges (IEC 60255-22-5 and IEC 61000-4-5):	
Differential mode:	1kV, 5 per polarity (+/-)
Common Mode:	2kV, 5 per polarity (+/-)
Immunity to Electric Transients (IEC 60255-22-1, IEC 61000-4-12 and IEEE C37-90-1):	
Peak value of 1st cycle, Frequency, Time and repetition rate, Decay to 50%:	2.5 kV common mode, 1 kV dif. mode, 1 MHz, 2 sec; 400 surge/s, 5 cycles
Voltage pulse (IEC 60255-5):	
Waveform, Amplitude, Pulse Number:	1.2/50 μ s, 5 kV, 3 negative and 3 positive, 5s interval
Applied Voltage (IEC 60255-5):	
Bearable voltage at the industrial frequency:	2 kV 60Hz 1 min. against ground
Immunity to Irradiated Electromagnetic Fields (IEC 60255-22-3 and IEC 61000-4-3):	
Frequency, field intensity:	26 a1000 Mhz, 10V/m
Immunity to conducted electromagnetic disturbances (IEC 60255-22-6 and IEC 61000-4-6):	
Frequency, field intensity:	0,15 a 80 MHz, 10V/m
Electrostatic Discharges (IEC 60255-22-2, IEC 61000-4-2 and IEEE C37-90-3):	
Air mode:	8 kV, ten discharges per polarity
Contact mode:	6 kV, ten discharges per polarity
Fast electrical transient immunity (IEC60255-22-4):	
Power supply, inputs and outputs:	4 kV
Serial communication port:	2 kV
Climatic test: (IEC 60068-2-14):	
Temperature range:	-40 to 85°C
Total test time:	96 hours
Vibration response: (IEC 60255-21-1):	
Application mode:	3 axis (X, Y e Z), sinusoidal
Amplitude:	0,075mm from 10 to 58 Hz
Duration:	1G from 58 to 150 Hz
	8 min/axis
Vibration resistance: (IEC 60255-21-1):	
Application mode:	3 axis (X, Y e Z), sinusoidal
Frequency:	10 to 150 Hz
Amplitude:	2G
Duration:	160 min/axis



Treotech

Treotech Tecnologia
Rua José Alvim, 112, Centro
CEP 12940-750 - Atibaia/SP
+ 55 11 2410-1190

www.treotech.com.br