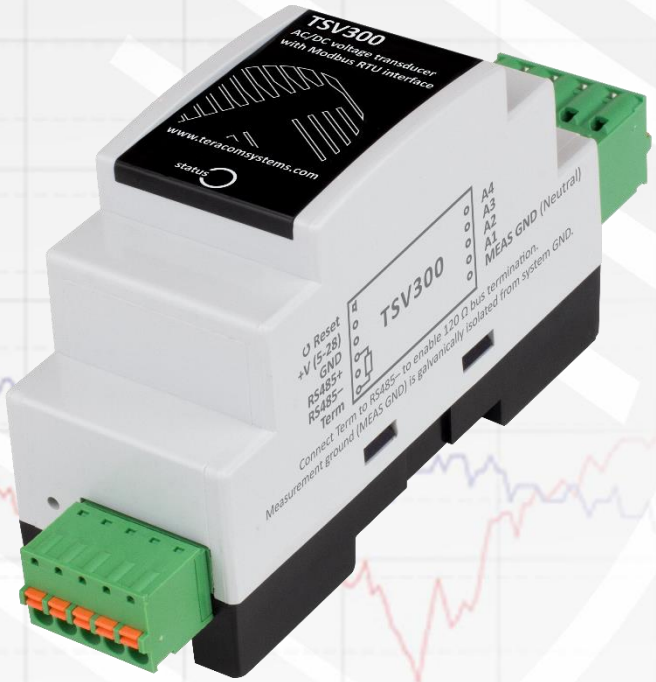
control solutions
TERACOM



TSV300
AC/DC voltage transducer with Modbus RTU interface

USER MANUAL

1. **Short description**

   TSV300 is an AC voltage transducer engineered for precise voltage measurements. Equipped with true RMS functionality, it seamlessly accommodates 50 and 60Hz nets. The transducer can also be used for DC voltage measurement and monitoring.

   With an impressive 24-bit resolution and accuracy surpassing 0.5%, this transducer ensures reliable data acquisition. The design includes a robust 1500Vrms working isolation voltage, prioritizing safety.

   Supporting MODBUS RTU communication, it provides data in 32-bit floating and 32-bit signed integer formats. TSV300 provides accurate and versatile AC/DC voltage measurements.

2. **Features**

   - 24-bit ADC with DSP processing
   - RS-485 interface supporting up to 63 nodes
   - LED indicator displaying communication status
   - Robust 1500Vrms working isolation
   - Integrated 120-ohm termination resistor
   - Screwless pluggable connectors

3. **Applications**

   - Power monitoring systems: TSV300 is ideal for monitoring AC and DC voltage in power distribution systems, ensuring efficient and reliable power supply.
   - Renewable energy systems: In solar or wind power installations, the transducer can be used to measure AC voltages accurately, contributing to the optimization of energy production.
   - Industrial automation: The module can play a vital role in industrial automation systems, providing accurate voltage measurements for equipment monitoring and control.
   - Smart grids: TSV300 can be integrated into smart grid systems to monitor and manage AC voltage levels, contributing to the stability and reliability of the grid.

4. **Specifications**

   - Physical characteristics
     Dimensions (w/o connectors): 35 x 96 x 59mm (DIN 43880 2-module enclosure)
     Weight: 75g
     Mounting: On 35 mm DIN top-hat rail
   - Environmental limits
     Operating temperature range: -20 to 60 °C
     Operating relative humidity range: 10 to 90 % (non-condensing)
     Storage temperature range: -25 to 65 °C
     Storage relative humidity range: 5 to 95 % (non-condensing)
     Ingress protection: IP20
   - Power supply
     Operating voltage range (including -15/+20 % according to IEC 62368-1): 5 to 28 VDC
     Current consumption: 15 mA @ 12 V
   - Inputs
     Input voltage range: 0 to 264 VAC or 0 to ±370 VDC
     Input frequency: 0 to 60 Hz
     Input resistance: >2.4 MOhm
   - Accuracy
     Accuracy: ±0.5 %
   - Measurement cycle
     Measurement cycle for all channels: 500±50 ms
   - Interface
     Protocol: Modbus RTU
     Physical layer: RS-485 serial line
     Number of nodes on the bus: up to 63
     Bus cable: Twisted, shielded, 2 × 0.5 mm²
     Response time ≤ 50 ms
     Master response time-out ≥ Response time + Answer time
     The answer time depends on the number of bits and the baud rate.
   - Connectors
     Power & communication: 3.81mm pitch screwless pluggable for 28 to 16 (AWG) / 0.081 to 1.31 (mm²) wires
     Measurement: 5mm pitch screwless pluggable for 28 to 16 (AWG) / 0.081 to 1.31 (mm²) wires

- Isolation
  Maximum working isolation voltage: 1500Vrms

5. LED indicator

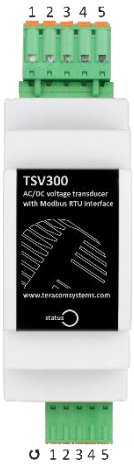
The device status is shown by a single LED indicator located behind the semitransparent front panel:

- Steady blinking of the LED for 1 second indicates proper sensor functionality.
- A 3-second blink pattern signals a lack of communication with the controller.
- If the LED remains off, it indicates a lack of power supply to the device or an inactive state.

6. Pinout

The device has two connectors: one for power and communication, and another for measurement:

- 5-pin connector – measurement side
  1 – Analog input 4
  2 – Analog input 3
  3 – Analog input 2
  4 – Analog input 1
  5 – MEAS GND (Neutral)



- 5-pins connector - power & communication side
  1 – +V (5 to 28)
  2 – GND
  3 – RS485+
  4 – RS485-
  5 – Term

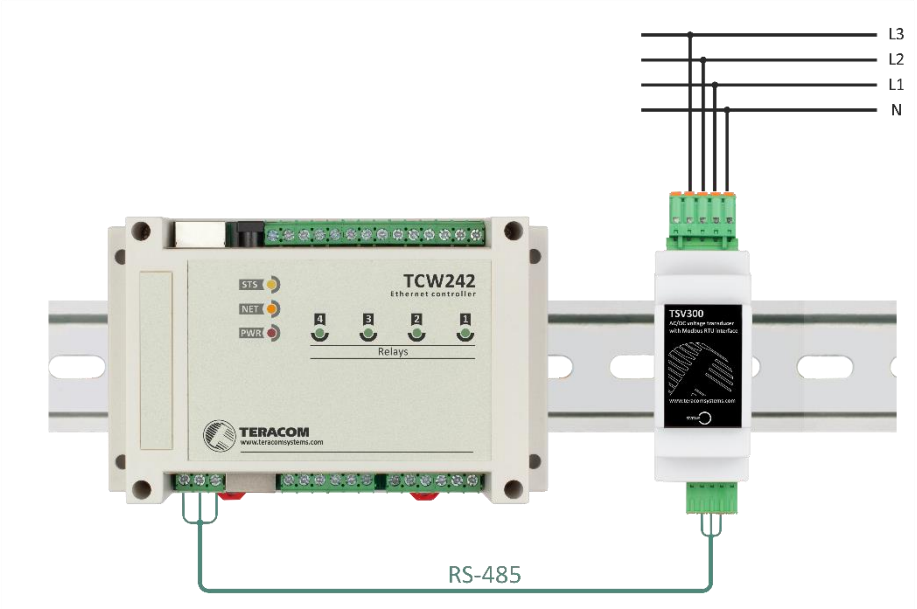
  Inside the device, a 120 Ω resistor is connected with one end to RS485+ and the other end to Term.
  To enable 120 Ω bus termination, connect Term to RS485– externally with a wire.
  Measurement ground (MEAS GND) is galvanically isolated from system GND.

7. Installation

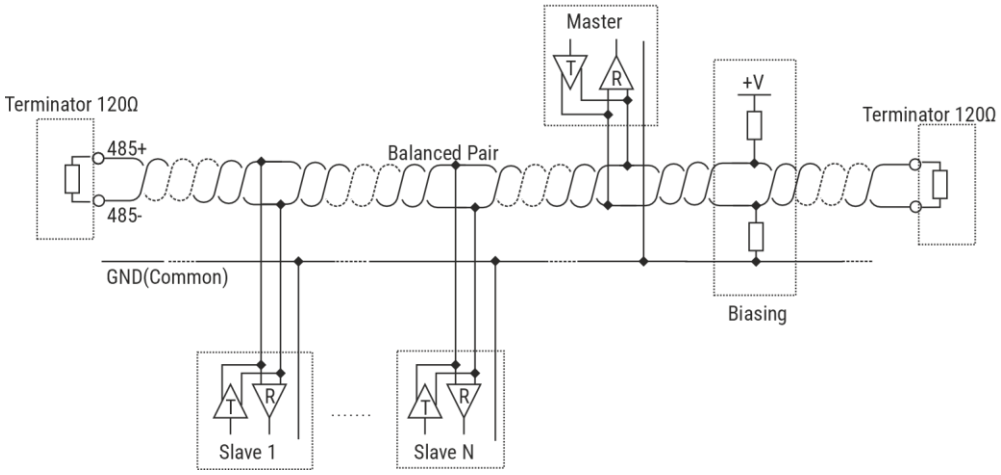
The device must be installed by qualified personnel. It must not be installed outdoors without proper protection.
The installation process involves mounting the device, connecting it to the RS-485 bus, attaching inputs, supplying power, and configuring it through the master.

Warning! Disconnect power before wiring.

Ensure that wires are securely attached to terminals and tightened. Improper wiring or configuration can cause permanent damage to TSV300 or connected equipment.



According to modbus.org, the two-Wire MODBUS definition is:
“A MODBUS solution over a serial line should implement a “Two-Wire” electrical interface in accordance with EIA/TIA-485 standard. On such a “Two-Wire” topology, at any time one driver only has the right for transmitting. In fact, a third conductor must also interconnect all the devices of the bus - the common (ground).”



It is highly advisable to use a daisy-chain (linear) topology along with UTP/FTP cables when connecting multiple sensors. To ensure the interface functions correctly, terminators (120-ohm resistors) must be installed at both ends of the bus.

8. **Peak detection**

The device supports dedicated registers for storing the minimum and maximum measured values of each channel. These registers can be used as peak value indicators for every channel.
After a reset, these registers are initialized with NaN.
The first valid reading after the reset is stored as both the minimum and maximum value.
Each subsequent reading is compared to the stored values - if the new reading is lower than the current minimum or higher than the current maximum, the corresponding register is overwritten.
During operation, the minimum and maximum registers can be reset by writing the value 1 to register 1000.

9. **Calibration**

The device applies a Multiplier and an Offset to each AC or DC measurement.
These parameter values can be adjusted if system calibration is required.
The Multiplier and Offset modify the raw input readings according to the following formula:

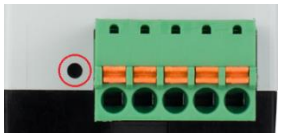
Value = (Raw_Value x Multiplier) + Offset.

By default, Multiplier = 1 and Offset = 0, meaning the input readings remain unchanged.

10. **Factory default settings**

To reset the device to its factory default settings, follow these steps:

- Disconnect the power supply.
- Press and hold the "Reset" button.
- While holding the button, reconnect the power supply.
- The status LED will remain ON for 3 seconds, then flash for 7 seconds, and finally turn ON again.
- Release the button. The device will restart with the factory default settings.



11. **Firmware update**

The device's firmware can be updated either by a Teracom controller with MODBUS RTU support or through MBRTU-Update software.

To activate the sensor's update mode, follow these steps:

- Disconnect the sensor from the bus and disconnect the power supply.
- Press and hold the "Reset" button.
- While holding the button, reconnect the power supply without releasing the button.
- The status LED will be ON for 3 seconds. If, within these 3 seconds, the button is released and pressed 3 times, the device will enter update mode.
- In update mode, the status LED will remain ON continuously.

Important: The sensor can only be updated when it is the only device on the bus.

12.Modbus address table

The following table lists all Modbus holding registers supported by TSV300.

Register name	R/W	FC	PDU decimal address	Logical decimal address	Data size	Default	Valid values
Holding registers							
RS-485 address	R/W	3,6,16	10	40011	16-bit uns. integer	1	1 to 247
Baud rate *	R/W	3,6,16	11	40012	16-bit uns. integer	19200	2400, 4800, 9600, 19200, 38400, 57600
Parity, data, stop bits *	R/W	3,6,16	12	40013	16-bit uns. integer	1	1=E81, 2=O81, 3=N81
Data order	R/W	3,6,16	13	40014	16-bit uns. integer	1	1=MSWF (MSW, LSW) 2=LSWF (LSW, MSW)
Device code	R	3	14	40015	16-bit uns. integer		0x0101
FW version	R	3	15	40016	16-bit uns. integer		
Vendor URL	R	3	18	40019	64 bytes UTF-8		teracomsystems.com
Float test value (MSW)	R	3	82	40083	32-bit float		-9.9(0xC11E6666)
Float test value (LSW)	R	3	84	40085	32-bit float		-9.9(0xC11E6666)
Signed integer test value	R	3	86	40087	16-bit sig. integer		-999(0xFC19)
Signed integer test value (MSW)	R	3	87	40088	32-bit sig. integer		-99999(0xFFFE7961)
Signed integer test value (LSW)	R	3	89	40090	32-bit sig. integer		-99999(0xFFFE7961)
Unsigned integer test value	R	3	91	40092	16-bit uns. integer		999(0x03E7)
Unsigned integer test value (MSW)	R	3	92	40093	32-bit uns. integer		99999(0x0001869F)
Unsigned integer test value (LSW)	R	3	94	40095	32-bit uns. integer		99999(0x0001869F)
Input AC voltage 1	R	3	100	40101	32-bit float		
Input AC voltage 2	R	3	102	40103	32-bit float		
Input AC voltage 3	R	3	104	40105	32-bit float		
Input AC voltage 4	R	3	106	40107	32-bit float		
Input AC voltage 1 min.	R	3	120	40121	32-bit float		
Input AC voltage 2 min.	R	3	122	40123	32-bit float		
Input AC voltage 3 min.	R	3	124	40125	32-bit float		
Input AC voltage 4 min.	R	3	126	40127	32-bit float		
Input AC voltage 1 max.	R	3	140	40141	32-bit float		
Input AC voltage 2 max.	R	3	142	40143	32-bit float		
Input AC voltage 3 max.	R	3	144	40145	32-bit float		
Input AC voltage 4 max.	R	3	146	40147	32-bit float		
Input AC voltage 1 x 1000	R	3	150	40151	32-bit signed integer		
Input AC voltage 2 x 1000	R	3	152	40153	32-bit signed integer		
Input AC voltage 3 x 1000	R	3	154	40155	32-bit signed integer		

Input AC voltage 4 x 1000	R	3	156	40157	32-bit signed integer		
Input AC voltage 1 min. x 1000	R	3	160	40161	32-bit signed integer		
Input AC voltage 2 min. x 1000	R	3	162	40163	32-bit signed integer		
Input AC voltage 3 min. x 1000	R	3	164	40165	32-bit signed integer		
Input AC voltage 4 min. x 1000	R	3	166	40167	32-bit signed integer		
Input AC voltage 1 max. x 1000	R	3	170	40171	32-bit signed integer		
Input AC voltage 2 max. x 1000	R	3	172	40173	32-bit signed integer		
Input AC voltage 3 max. x 1000	R	3	174	40175	32-bit signed integer		
Input AC voltage 4 max. x 1000	R	3	176	40177	32-bit signed integer		
Input DC voltage 1	R	3	500	40501	32-bit float		
Input DC voltage 2	R	3	502	40503	32-bit float		
Input DC voltage 3	R	3	504	40505	32-bit float		
Input DC voltage 4	R	3	506	40507	32-bit float		
Input DC voltage 1 min.	R	3	520	40521	32-bit float		
Input DC voltage 2 min.	R	3	522	40523	32-bit float		
Input DC voltage 3 min.	R	3	524	40525	32-bit float		
Input DC voltage 4 min.	R	3	526	40527	32-bit float		
Input DC voltage 1 max.	R	3	540	40541	32-bit float		
Input DC voltage 2 max.	R	3	542	40543	32-bit float		
Input DC voltage 3 max.	R	3	544	40545	32-bit float		
Input DC voltage 4 max.	R	3	546	40547	32-bit float		
Input DC voltage 1 x 1000	R	3	550	40551	32-bit signed integer		
Input DC voltage 2 x 1000	R	3	552	40553	32-bit signed integer		
Input DC voltage 3 x 1000	R	3	554	40555	32-bit signed integer		
Input DC voltage 4 x 1000	R	3	556	40557	32-bit signed integer		
Input DC voltage 1 min. x 1000	R	3	560	40561	32-bit signed integer		
Input DC voltage 2 min. x 1000	R	3	562	40563	32-bit signed integer		
Input DC voltage 3 min. x 1000	R	3	564	40565	32-bit signed integer		
Input DC voltage 4 min. x 1000	R	3	566	40567	32-bit signed integer		
Input DC voltage 1 max. x 1000	R	3	570	40571	32-bit signed integer		
Input DC voltage 2 max. x 1000	R	3	572	40573	32-bit signed integer		
Input DC voltage 3 max. x 1000	R	3	574	40575	32-bit signed integer		
Input DC voltage 4 max. x 1000	R	3	576	40577	32-bit signed integer		
Reset min and max values	R/W	3,6	1000	41001	16-bit uns. integer		1
Input AC voltage 1 multiplier	R/W	3,6	2101	42102	32-bit float	1.000	
Input AC voltage 1 offset	R/W	3,6	2103	42104	32-bit float	0.000	
Input AC voltage 2 multiplier	R/W	3,6	2111	42112	32-bit float	1.000	
Input AC voltage 2 offset	R/W	3,6	2113	42114	32-bit float	0.000	
Input AC voltage 3 multiplier	R/W	3,6	2121	42122	32-bit float	1.000	
Input AC voltage 3 offset	R/W	3,6	2123	42124	32-bit float	0.000	
Input AC voltage 4 multiplier	R/W	3,6	2131	42132	32-bit float	1.000	
Input AC voltage 4 offset	R/W	3,6	2133	42134	32-bit float	0.000	
Input DC voltage 1 multiplier	R/W	3,6	2201	42202	32-bit float	1.000	
Input DC voltage 1 offset	R/W	3,6	2203	42204	32-bit float	0.000	
Input DC voltage 2 multiplier	R/W	3,6	2211	42212	32-bit float	1.000	
Input DC voltage 2 offset	R/W	3,6	2213	42214	32-bit float	0.000	

Input DC voltage 3 multiplier	R/W	3,6	2221	42222	32-bit float	1.000	
Input DC voltage 3 offset	R/W	3,6	2223	42224	32-bit float	0.000	
Input DC voltage 4 multiplier	R/W	3,6	2231	42232	32-bit float	1.000	
Input DC voltage 4 offset	R/W	3,6	2233	42234	32-bit float	0.000	

* The settings will take effect after restarting the device by power-off, power-on.
PDU address: Actual address bytes used in a Modbus Protocol Data unit
The shown logic decimal addresses are calculated with offsets 40001 (holding registers).
MSWF: Most significant word first - (bits 31 … 16), (bits 15 … 0).
LSWF: Least significant word first - (bits 15 … 0), (bits 31 … 16).
When a floating-point value is not available, the returned value is “NaN” (e.g. in case of measurement error).
When a 32-bit signed integer value is not available, the returned value is “-2147483648” (e.g. in case of measurement error).

13.Recycling

Please recycle all applicable materials in accordance with local regulations.



Do not dispose of the device as regular household waste.

Electronic components should be properly recycled to minimize environmental impact.

