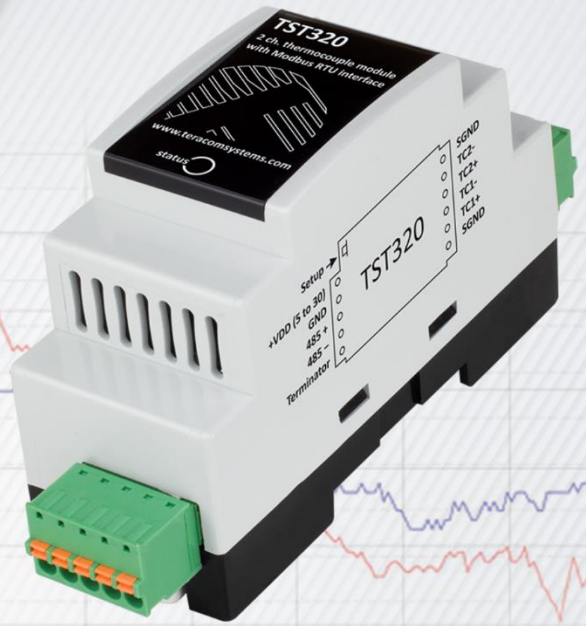
control solutions
TERACOM



TST320

2 channel thermocouple module with Modbus RTU interface

Version 1.3 / November 2023

USER MANUAL

www.teracomsystems.com

1. **Short description**

   TST320 is a versatile and reliable solution for temperature monitoring and control, supporting two thermocouples. With its MODBUS RTU interface, it seamlessly integrates into industrial systems, enabling easy communication and data exchange with other devices. It offers precise temperature readings for various applications and industries, ensuring accurate process control and optimization. Its compact design and user-friendly interface make it a practical choice for industrial automation and monitoring needs.

2. **Features**

   - 24-bit ADC with DSP processing
   - RS-485 interface supporting up to 63 nodes
   - LED indicator displaying communication status
   - Compatibility with all types of thermocouples
   - Integrated 120-ohm termination resistor
   - Firmware update capability via the interface

3. **Applications**

   - Industrial temperature monitoring - Enables accurate temperature measurement in industrial processes, catering to diverse applications with various thermocouple types.
   - HVAC system control - Integrates precise temperature regulation for efficient heating and cooling in residential, commercial, and industrial HVAC systems.
   - Laboratory and research applications - Facilitates stable and accurate temperature monitoring in scientific experiments and research, including chemical reactions and material testing.

4. **Specifications**

   - Physical characteristics
     Dimensions: 35x86x59mm (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: IP40 (connections IP20)
   - Power supply
     Operating voltage range (including -15/+20% according to IEC 62368-1): 5 to 30VDC
     Current consumption: 15mA@12V
   - Thermocouples
     Thermocouple types supported: J, K, T, N, E, B, R, and S
     Temperature resolution: 0.01°
     ADC conversation accuracy (max): ±0.1%
     CJC accuracy (max): ±0.19%
     Input conversion rate for both channels: 1 sample per second
       With DSP (Digital Signal Processing) over 76865 samples for low-pass filtering and 50/60Hz notch filtering
     Thermocouple break detection: Available
   - Interface
     Protocol: Modbus RTU
     Physical layer: RS-485 serial line
     Number of bus transceivers: up to 63
     Bus cable: Twisted, shielded, 2×0.5mm²
     Response time ≤ 50ms
       Master response time-out ≥ Response time + Answer time
       The answer time depends on the number of bits and the baud rate.
     Connectors
     Type: 3.81mm pitch screwless pluggable for 28 to 16 (AWG) / 0.081 to 1.31 (mm²) wires
   - Isolation
     Maximum working isolation voltage: 1500Vrms
   - Warranty
     Warranty period: 3 years

5. **Status indicator**

The device status is indicated through a single LED positioned behind the semitransparent front panel:

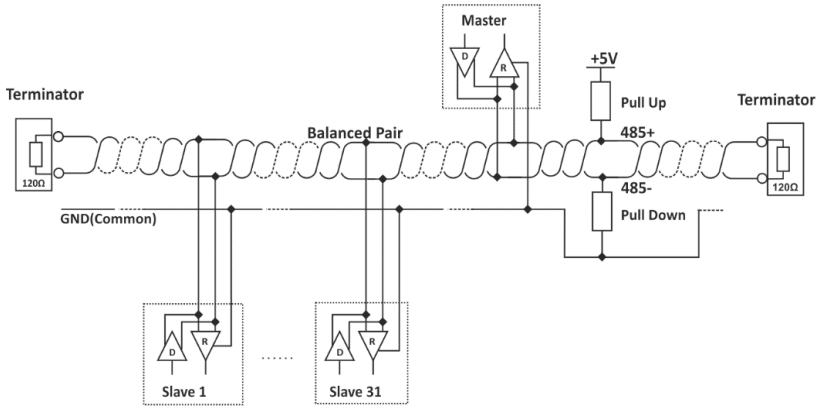
- Steady blinking of the LED for 1 second indicates proper sensor functionality.
- A 3-second blink pattern signals a lack of communication with the controller.
- If the LED remains off, it indicates a lack of power supply to the device.

6. **Pinout**

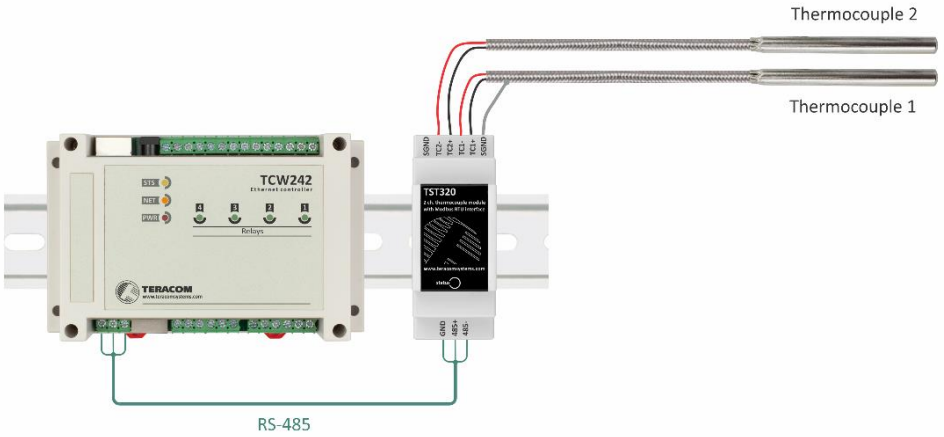
- 5-pins connector
  1 – +VDD (5 to 30)
  2 – GND
  3 – RS485+
  4 – RS485-
  5 – Terminator
- 6-pins connector
  1 – SGND (Shield)
  2 – TC2-
  3 – TC2+
  4 – TC1-
  5 – TC1+
  6 – SGND (Shield)

7. **Installation**

Two-Wire MODBUS definition according to modbus.org:
“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.”



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. The device comes equipped with a built-in 120-ohm resistor, and for bus termination, the terminals "485-" and "Term" should be shortened.



8. Factory default settings

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

- Disconnect the power supply.
- Press and hold the "Setup" 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.

9. 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 "Setup" 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.

10. Modbus address table

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	40853	32-bit uns. integer		99999(0x0001869F)
TC1 temperature °C	R	3	100	40101	32-bit float		
TC2 temperature °C	R	3	102	40103	32-bit float		
TC1 min. temperature °C	R	3	120	40121	32-bit float		
TC2 min. temperature °C	R	3	122	40123	32-bit float		
TC1 max. temperature °C	R	3	140	40141	32-bit float		
TC2 max. temperature °C	R	3	142	40143	32-bit float		
TC1 temperature °F	R	3	200	40201	32-bit float		
TC2 temperature °F	R	3	202	40203	32-bit float		
TC1 min. temperature °F	R	3	220	40221	32-bit float		

TC2 min. temperature °F	R	3	222	40223	32-bit float		
TC1 max. temperature °F	R	3	240	40241	32-bit float		
TC2 max. temperature °F	R	3	242	40243	32-bit float		
TC1 temperature °C x 10	R	3	400	40401	16-bit sig. integer		
TC2 temperature °C x 10	R	3	401	40402	16-bit sig. integer		
TC1 min. temperature °C x 10	R	3	420	40421	16-bit sig. integer		
TC2 min. temperature °C x 10	R	3	421	40422	16-bit sig. integer		
TC1 max. temperature °C x 10	R	3	440	40441	16-bit sig. integer		
TC2 max. temperature °C x 10	R	3	441	40442	16-bit sig. integer		
TC1 temperature °F x 10	R	3	500	40501	16-bit sig. integer		
TC2 temperature °F x 10	R	3	501	40502	16-bit sig. integer		
TC1 min. temperature °F x 10	R	3	520	40521	16-bit sig. integer		
TC2 min. temperature °F x 10	R	3	521	40522	16-bit sig. integer		
TC1 max. temperature °F x 10	R	3	540	40541	16-bit sig. integer		
TC2 max. temperature °F x 10	R	3	541	40542	16-bit sig. integer		
TC1 temperature °C x 100	R	3	600	40601	16-bit sig. integer		
TC2 temperature °C x 100	R	3	602	40603	16-bit sig. integer		
TC1 min. temperature °C x 100	R	3	620	40621	32-bit sig. integer		
TC2 min. temperature °C x 100	R	3	622	40623	32-bit sig. integer		
TC1 max. temperature °C x 100	R	3	640	40641	32-bit sig. integer		
TC2 max. temperature °C x 100	R	3	642	40643	32-bit sig. integer		
TC1 temperature °F x 100	R	3	700	40701	32-bit sig. integer		
TC2 temperature °F x 100	R	3	702	40703	32-bit sig. integer		
TC1 min. temperature °F x 100	R	3	720	40721	32-bit sig. integer		
TC2 min. temperature °F x 100	R	3	722	40723	32-bit sig. integer		
TC1 max. temperature °F x 100	R	3	740	40741	32-bit sig. integer		
TC2 max. temperature °F x 100	R	3	742	40743	32-bit sig. integer		
Reset min and max values	R/W	3,6	1000	41001	16-bit uns. integer		
TC1 type	R/W	3,6	2100	42001	16-bit uns. integer	0	0=J type,1=K type,2=T type, 3=N type, 4=E type, 5=B type, 6=R type, 7=S type
TC1 multiplier	R/W	3,16	2101	42002	32-bit float	1.000	
TC1 offset	R/W	3,16	2103	42004	32-bit float	0.000	
TC2 type	R/W	3,6	2110	42011	16-bit uns. integer	0	0=J type,1=K type,2=T type, 3=N type, 4=E type, 5=B type, 6=R type, 7=S type
TC2 multiplier	R/W	3,16	2111	42012	32-bit float	1.000	
TC2 offset	R/W	3,16	2113	42014	32-bit float	0.000	

* The settings will take effect after restarting the device by power off, power on.

The shown logic decimal addresses are calculated with offsets 10001 (discrete inputs) and 40001 (holding registers).
MSW - Most significant word first - (bits 31 … 16), (bits 15 … 0);
LSW - Least significant word first - (bits 15 … 0), (bits 31 … 16);
PDU address - Actual address bytes used in a Modbus Protocol Data unit;
When TC is not available or in case of measurement error, for:

- a floating-point, the returned value is “NaN”;
- a 16-bit signed integer, the returned value is “-32768”(0x8000);
- a 32-bit signed integer, the returned value is “-2147483648”(0x80000000).

11. Recycling

Recycle all applicable material.

Do not dispose of in the regular household refuse.