TRODEKS

T5690

CTD MULTI-PARAMETER SENSOR

Conductivity • Temperature • Depth / Level

RS-485	IP68	3-in-1
Modbus RTU	Immersion	EC + T + Depth

USER MANUAL

01 PRODUCT OVERVIEW

Application environment and functional summary

The TRODEKS T5690 is an immersion-type CTD multi-parameter sensor intended for water monitoring applications. It combines electrical conductivity, temperature and hydrostatic depth/level sensing in one probe, with digital RS-485 Modbus RTU communication for integration with industrial control and data acquisition systems.

Application areas

Drinking water • Surface water • Water supply systems • Hydrological research • Marine research • Marine environment monitoring

- Simultaneous measurement of conductivity, temperature and depth/level.
- Selectable conductivity-derived modes: conductivity, resistivity, TDS and salinity.
- RS-485 output using Modbus RTU protocol.
- Suitable for PLC, DCS, industrial computer, general controller, recorder and HMI/touch-screen integration.
- Dual high-impedance differential amplification for strong interference rejection and fast response.
- Immersion installation with IP68 protection.

System concept

Parameter	Specification
Sensing	EC / Temperature / Pressure-derived depth
Signal processing	Integrated digital processing and compensation
Communication	RS-485 / Modbus RTU
Host integration	PLC • DCS • SCADA • HMI • Recorder

02 TECHNICAL SPECIFICATIONS

Nominal performance and configurable parameters

Parameter	Specification
Model	T5690
Conductivity range	0 to 400 mS/cm (customizable)
Depth / level range	0 to 1000 m (customizable)
Temperature range	0 to 60 °C
Conductivity accuracy	2% or ±10 µS/cm
Depth / level accuracy	0.5% or ±5 mm
Temperature accuracy	±0.5 °C
Conductivity resolution	1 µS/cm
Depth / level resolution	1 mm
Temperature resolution	0.1 °C
Pressure reference	Gauge pressure / Absolute pressure
Temperature compensation	Automatic (ATC)
Power supply	5 VDC or 12 to 24 VDC
Signal output	RS-485 (Modbus RTU)
Housing material	Stainless steel + POM (customizable)
Installation	Immersion
Cable length	10 m default; other lengths customizable
Power consumption	< 3 W
Protection	IP68

Mechanical dimension verification

The supplied source contains a dimensional discrepancy: the specification table states 35 × 280 mm, while the dimensional drawing shows Ø35 × 290 mm overall length. Confirm the final mechanical drawing before commercial release or fabrication.

03 MECHANICAL DESIGN

Probe construction and sensing zones

Sensor body

- Stainless-steel main body
- POM protective lower section
- EC sensing zone
- Temperature sensing element
- Pressure/depth sensing port
- Immersion cable with shielded signal conductors

Installation orientation

Install the probe vertically and ensure the sensing end remains fully immersed during measurement. Avoid impact with tank walls, channel structures or the bottom.

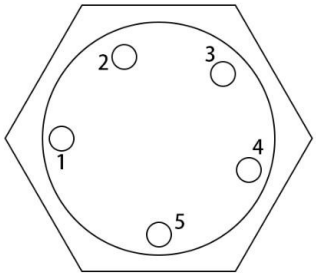
Important

For depth/level measurement, the reported value refers to the height from the pressure sensing point to the liquid surface and does not include the protective cap height (approximately 30 mm in the source drawing).

04 ELECTRICAL CONNECTIONS

Power and RS-485 wiring

Parameter	Specification
Pin / conductor	Signal
1 / Red	5 VDC or 12-24 VDC
4 / Black	GND
2 / Blue	RS485A
3 / White	RS485B
5	Reserved / not defined in source manual



Cable requirement

Use the specified shielded twisted-pair cable with air tube. All underwater or long-term exposed cable joints must be waterproof and corrosion-resistant, including seawater service.

Power-up check

Complete and verify all wiring before energizing the sensor. Incorrect polarity or RS-485 wiring can damage the equipment or prevent communication.

05 SAFETY AND COMMISSIONING

Personnel, installation and start-up requirements

Personnel requirements

- Installation, commissioning, operation and maintenance must be carried out by trained technical personnel.
- Electrical connection work must be performed by qualified electrical personnel.
- Local installation, electrical and explosion-protection requirements must be followed where applicable.
- Do not attempt repairs that are not described in the operating manual.

Commissioning sequence

1	Inspect probe, cable and connectors for damage.
2	Complete electrical wiring and verify supply voltage.
3	Power the sensor and allow approximately 10 minutes warm-up before calibration work.
4	Immerse the probe and allow 3-5 minutes for temperature stabilization.
5	Record surface zero / pressure reference before depth observations where required.
6	Lower the probe at a stable rate; source guidance suggests about 1.0 m/s and not more than 1.5 m/s in deep-water operation.

06 MAINTENANCE & CALIBRATION

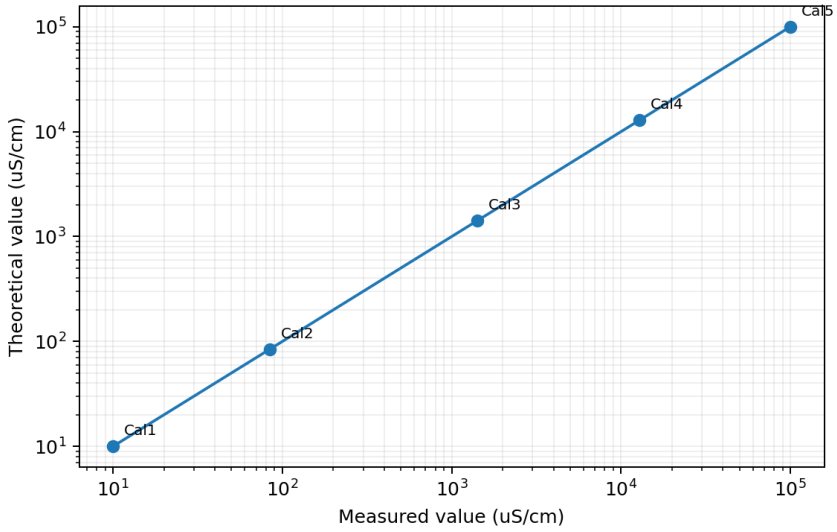
Routine care and calibration principles

Routine maintenance

- Keep the sensor clean and free from biological growth, salt crystals, sediment and other deposits.
- After each observation, rinse the probe thoroughly with clean water; for seawater service, remove all salt residue.
- Store the probe in a cool, protected location and avoid unnecessary direct sunlight exposure.
- Prevent impacts when entering or leaving the water and avoid contact with the bottom in shallow stations.

Calibration guidance

- The source manual states that the sensor is calibrated before shipment and should not be recalibrated unless measurement error exceeds the required tolerance.
- Conductivity: zero calibration in clean/dry air, then slope calibration using a known standard solution.
- Conductivity supports single-point or up to 5-point slope calibration.
- Depth/level: zero calibration in air, followed by slope calibration using a known liquid level.
- Temperature offset can be corrected using a known stable temperature reference through Modbus.



Factory conductivity calibration points

Cal1 10 µS/cm • Cal2 84 µS/cm • Cal3 1413 µS/cm • Cal4 12880 µS/cm • Cal5 100000 µS/cm

07 MODBUS RTU COMMUNICATION

Default serial settings and frame structure

Parameter	Specification
Interface	RS-485
Protocol	Modbus RTU
Default baud rate	9600 bps
Data bits	8
Parity	None
Stop bits	1
Default address	1
Address range	1 to 127
Broadcast address	255
Byte order	High byte first for default integer data
Read function	03
Write single register	06

Measurement read block

Starting at register 0x0000, six consecutive Modbus registers return conductivity, temperature and liquid-level/depth data according to the data definition in the source protocol.

Typical read request

```
Request: 01 03 00 00 00 06 C5 C8

Example reply: 01 03 0C 00 0F 42 40 00 FA 03 02 00 00 27 10 08 79
```

08 MODBUS REGISTER MAP

Measurement, calibration and conversion registers

Register	Function	Description	Access
0x0000	Measurement data	Conductivity + temperature + liquid level; 6 registers / 12 bytes.	Read
0x222C	Conductivity mode	0 Conductivity; 1 Resistivity; 2 TDS; 3 Salinity.	R/W
0x1000	Conductivity zero	Calibrate in air and write 0.	Write
0x1004	Conductivity slope Cal1	Known standard solution; 0-100000 µS/cm.	Write
0x1008	Conductivity slope Cal2	Known standard solution; 0-100000 µS/cm.	Write
0x100C	Conductivity slope Cal3	Known standard solution; 0-100000 µS/cm.	Write
0x1010	Conductivity slope Cal4	Known standard solution; 0-100000 µS/cm.	Write
0x1014	Conductivity slope Cal5	Known standard solution; 0-100000 µS/cm.	Write
0x1100	Level zero	Calibrate in air and write 0.	Write
0x1104	Level slope	Known liquid level; range 0-100000 mm.	Write
0x2100	Conductivity offset	Offset register, µS/cm ×100; -30000 to 30000.	Write
0x2104	Temperature offset	Temperature offset, °C ×10; -1000 to 1000.	Read*
0x2108	Level offset	Level offset in mm; -30000 to 30000.	Read*

** The source register table marks 0x2104 and 0x2108 as Read, while surrounding explanatory text describes reading or setting these values. Confirm firmware permissions before implementation.*

09 MODBUS REGISTER MAP

System coefficients, addressing and diagnostics

Register	Function	Description	Access
0x2214	TDS coefficient	Range 0.4-1.5; default 0.50.	R/W
0x2218	Salinity coefficient	Range 0.4-1.5; default 1.00.	R/W
0x221C	Gravity coefficient	g ×100; range 0-2000; default 980.	R/W
0x2220	Liquid density	kg/m³; range 0-2000; default 1000.	R/W
0x2800	Sensor address	Address 1-127; default 1; broadcast 255.	R/W
0x2000	Reset calibration	Restore listed calibration values to defaults; recalibration required.	Write
0x8058	Hardware version	Returns hardware version string.	Read
0x805C	Software version	Returns software version string.	Read

Derived measurement modes

- Resistivity, TDS and salinity are converted from conductivity.
- Changing measurement mode changes the reported conversion/output mode; calibration operations remain based on conductivity.

Engineering verification note

The source manual contains a level-calibration register inconsistency: its register list and command examples use 0x1100 / 0x1104, while a narrative section references 0x1030 / 0x1034. This branded draft uses 0x1100 / 0x1104 because those addresses are supported by the register table and command examples, but firmware confirmation is recommended before commissioning.

10 COMMISSIONING COMMANDS

Examples from the supplied protocol

Read measurement block

```
01 03 00 00 00 06 C5 C8
```

Temperature offset example (-2.0 °C)

```
01 06 21 04 FF EC 82 4A
```

Conductivity zero calibration

```
01 10 10 00 00 02 04 00 00 00 00 3E 6F
```

Conductivity slope example (1413 µS/cm)

```
01 10 10 0C 00 02 04 00 15 8F 88 4B A8
```

Level zero calibration

```
01 10 11 00 00 02 04 00 00 00 00 33 FF
```

Level slope example (1000 mm)

```
01 10 11 04 00 02 04 00 00 27 10 28 30
```

Set address example (destination 16)

```
01 06 28 00 00 10 81 A6
```

Switch to TDS mode

```
01 06 22 2C 00 02 C3 BA
```

CRC and response validation

Use standard Modbus CRC16 with low byte first. For calibration commands, the source manual states that matching request/response content indicates successful execution; some calibration actions may require up to approximately 30 seconds.

11 DEPTH / LEVEL CALCULATION

Pressure, density and gravity compensation

The sensor derives liquid level from hydrostatic pressure. The source manual identifies the relationship between liquid pressure, atmospheric pressure, liquid density, local gravitational acceleration and measured height.

$$h = (p - p0) / (\rho \cdot g)$$

p: measured liquid pressure • p0: atmospheric pressure • ρ: liquid density • g: gravitational acceleration

Integration notes

- For best depth/level accuracy, set the correct liquid density and local gravity coefficient where required.
- Perform zero calibration at the actual site when the pressure reference or atmospheric condition requires compensation.
- Use a known level reference for slope verification when installation geometry or process conditions demand higher confidence.
- Maintain the protective cap and sensing ports clean and unobstructed.

Final release checklist

Before publishing this manual as a commercial product document, confirm (1) final overall length, (2) level-calibration register addresses for the target firmware, and (3) read/write permissions for offset registers. All other technical content in this draft is based directly on the supplied CTD manual.

TRODEKS

T5690 | CTD SENSOR

Conductivity • Temperature • Depth / Level

RS-485 / Modbus RTU • IP68 • Immersion installation

Technical documentation based on the supplied CTD sensor manual. Specifications subject to final order and firmware confirmation.