# RBR*centauro*$^3$
# INSTRUMENT GUIDE

rbr-global.com

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# 1 RBRcentauro$^3$ C.T.D

The RBR*centauro*$^3$ is a small CTD instrument optimised for gliders and autonomous underwater vehicles. It incorporates conductivity, temperature, and pressure/depth sensors (CTD) and can derive salinity, density, and sound velocity. The instrument ensures totally silent operation for passive acoustic listening and turbulence measurements, and has an additional advantage of a transverse conductivity cell, optimised for natural hydrodynamic flow. The RBR*centauro*$^3$ C.T.D is unaffected by surface contaminants or freezing conditions, comes pre-calibrated to account for static conductive elements, and is rated to 2000m.

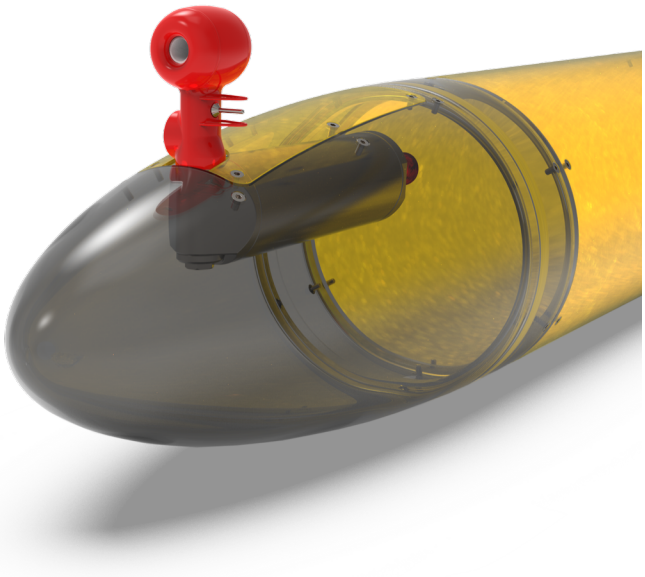


*Fig. 1. RBRcentauro$^3$ C.T.D, integrated*

Key features of the RBR*centauro*$^3$ C.T.D are:

- High accuracy
  - Unaffected by surface contaminants
  - Pre-calibrated to account for static elements[1]
  - Sampling rate up to 16Hz
- Low power
  - 90% less power than pumped CTD
  - Longer mission and more samples
- Silent operation
  - No pump or moving parts
  - Reduced noise for acoustic measurements
  - Reduced vibration for turbulence studies

[1] Accuracy of conductivity measurements is affected by objects within 15cm of the sensor, especially if they are conductive. Metal deployment frames are a good example. This proximity effect decreases with distance. Calibration procedure uses the predetermined k-factor to take into account static elements, such as other sensors or glider body.

The RBR CTD instruments are uniquely designed to determine salinity by measuring the conductivity and temperature of the water. Their rugged inductive cell is not affected by surface contaminants or freezing conditions. The co-located thermistor improves data accuracy and reduces salinity spikes. Equipped with a piezoresistive pressure channel, the CTD instruments provide more accurate salinity data when the instrument is sampling at varying depths.

*Fig. 2. RBRcentauro³ C.T.D. Left: temperature sensor, middle: conductivity sensor, right: pressure sensor*

The RBR*centauro*³ C.T.D facilitates optimal measurement schedules. Power consumption is 90% lower than that of traditional pumped CTD sensors and allows for substantially longer deployments. The calibration coefficients are stored on the instrument. With serial output, stream your data to your underwater vehicle or use Ruskin to download the RSK file. Datasets can be read directly in Matlab, or exported to Excel, OceanDataView®, or text files. See Ruskin User Guide: Standard Instruments³ and Logger³ Command Reference.

In addition to the RBR*centauro*³, RBR offers other options for vehicle integration applications. Explore the capabilities of the RBR*legato*³, an exceptionally small CTD instrument, whose unique shape is optimised for flow dynamics. Refer to the RBR*legato*³ Instrument Guide.

# 2 Physical specifications

Instrument

| Specification | Description |
|---|---|
| Max number of readings[1] | 240 million |
| External power | 4.5 to 30V |
| Communications | RS-232 |
| Clock drift[2] | ±60 seconds/year |
| Housing | Titanium |
| Diameter | 60.3mm |
| Length | ~206mm (instrument only)<br>~254mm (with connector) |
| Weight | ~1600g in air, ~950g in water |
| Depth rating | 2000m |
| Sampling rate | 2Hz |

[1] Each sample can include multiple readings.

[2] The realtime clock is not maintained when there is no power.

**Power consumption at 12V**

| Specification | Description |
|---|---|
| ≤1Hz sampling | 22.8mJ per sample |
| 2Hz sampling | 46mW |
| Sleep power | 180µW |

**Startup time**

Generally, there is no need to power off RBR instruments. The RBR*centauro*[3] will go to sleep after inactivity, consume virtually no power while on standby, and then wake up instantly when required.

If you turn off the instrument, there will be a delay starting up. Furthermore, you will have to wait for at least two minutes before turning it back on.

- Elapsed startup time from fully discharged state to functional command interpreter: 4s maximum
- Elapsed power downtime to complete discharge: 120s minimum

Ensure that the instrument is fully discharged before resuming the measurements. Power-cycling the unit for less than 120s may leave the board in an unknown state. In addition, the realtime clock may not be maintained over a power cycle.

**External port**

The RBR*centauro*$^3$ uses an external MCBH-6-MP connector. It can be used for connecting to an RS-232 underwater extension cable.

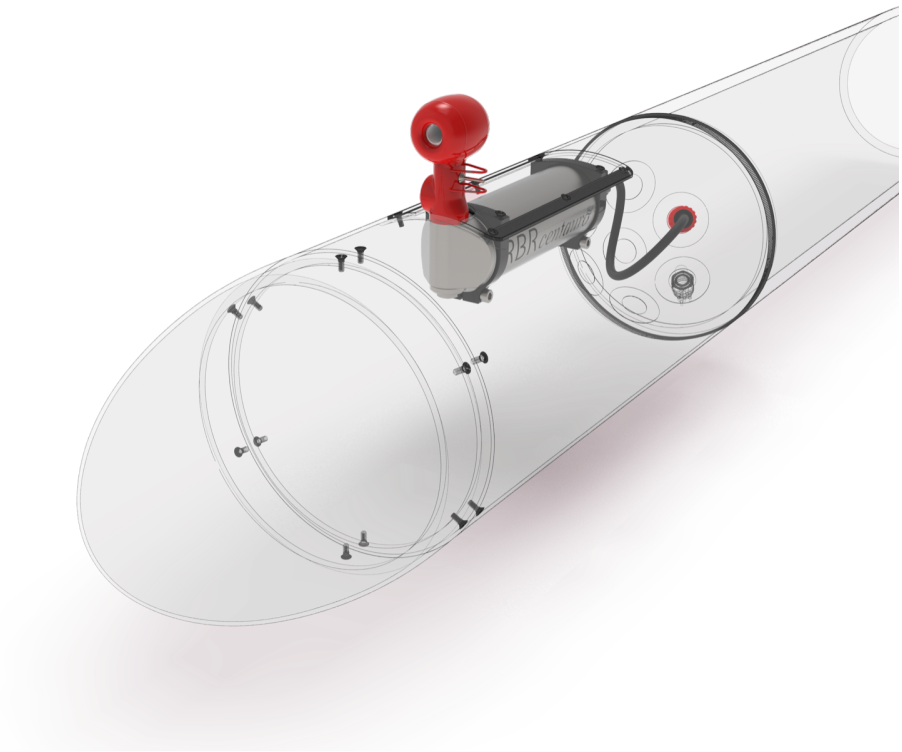
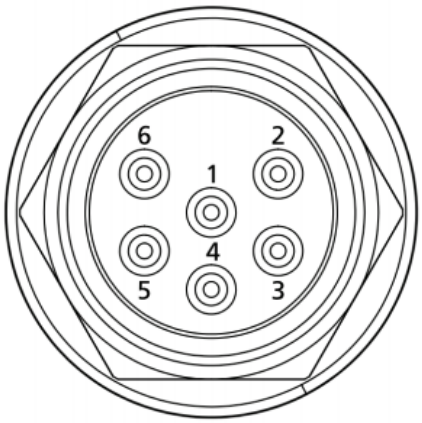


*Fig. 3. RBRcentauro$^3$ C.T.D, connected via RS-232*

**External MCBH-6-MP connector pinout**

| Pin No. | RS-232 |
|---|---|
| 1 | Ground |
| 2 | Power in 4.5V to 30V |
| 3 | Data output from the instrument (Tx) |
| 4 | Data input into the instrument (Rx) |
| 5 | N/C |
| 6 | N/C |



# 3 Sensor specifications

The RBR*centauro*$^3$ has conductivity, temperature, and pressure sensors.

## 3.1 Conductivity (C)

The RBR*centauro*$^3$ C.T.D uses an integrated inductive conductivity sensor which measures the ability of seawater to conduct electric current.

| Parameter | Value |
|---|---|
| Range | 0 to 85mS/cm |
| Initial accuracy[1] | ±0.003mS/cm |
| Resolution | <0.0001mS/cm |
| Typical stability | 0.010mS/cm/year |

[1] Vehicle dynamics and geometry may affect measurement accuracy.

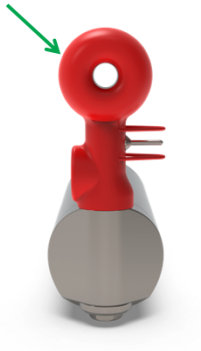


*Fig. 4. Conductivity sensor*

Conductivity measurements are performed using a rugged inductive cell that can be frozen into ice. RBR used computational fluid dynamics (CFD) to optimise its design. The conductivity sensor is streamlined for hydrodynamic flushing through and around it, and does not require a pump, thus ensuring totally silent operation.

While 80% of its volumetric measurements happens inside the cell, they also extend up to 15 cm away and thus may be affected by conductive and non-conductive objects within this distance. RBR calibrates conductivity sensors to account for static objects, such as other sensors or glider body. Conductivity measurements are also temperature compensated.

## 3.2 Temperature (T)

The RBR*centauro*$^3$ C.T.D uses a thermistor-type temperature sensor.

| Parameter | Value |
|---|---|
| Range[1] | -5°C to 35°C |
| Initial accuracy | ±0.002°C |
| Resolution | <0.00005°C |
| Typical stability | ±0.002°C / year |
| Time constant | ~1s |

[1] A wider temperature range is available upon request. Contact RBR for more information.

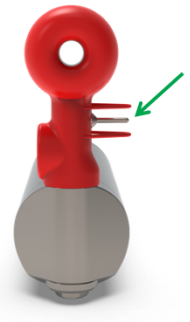


*Fig. 5. Temperature sensor*

## 3.3 Pressure (D)

The RBR*centauro*$^3$ C.T.D uses a piezoresistive pressure (depth) sensor.

The sensor is protected by a clear plastic guard. During deployments, always orient it downwards to reduce debris collecting on the housing.

| Parameter | Value |
|---|---|
| Range | 2000dbar |
| Initial accuracy | ±0.05% full scale |
| Resolution | <0.001% full scale |
| Typical stability | ±0.05% full scale / year |
| Time constant | <10ms |

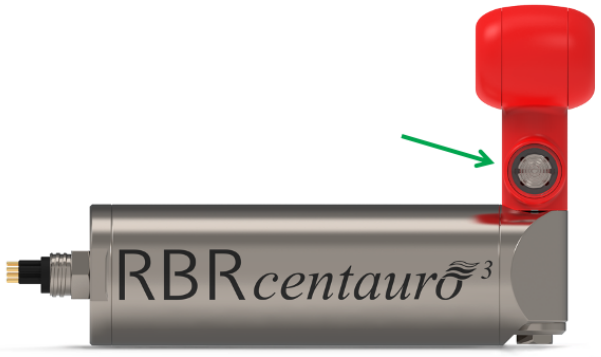



*Fig. 6. Pressure sensor*

# 4 Maintenance

The RBR*centauro*$^3$ requires minimal maintenance. Refer to sections below for instructions on cleaning your instrument and caring for its cables and connectors.

Do not attempt to open your RBR*centauro*$^3$. The instrument has no user-serviceable parts. See Repairs.

## 4.1 Cleaning

Clean the instrument after each extended deployment to remove deposits that may have accumulated.

Do not use an ultrasonic bath to clean your instruments. Ultrasonic vibrations can break the wire bonding inside the transducers.

| Type | Procedure | Notes |
|---|---|---|
| General/biofouling | To clean the exterior, soak in a mild detergent, then scrub the instrument with a soft brush. | Avoid scratching the plastic (scratches make future cleaning more difficult). |
| Calcification, encrustation | Soak in vinegar for six hours, then scrub the surface using a soft brush. | Soaking in vinegar for more than 24 hours may damage the O-ring and increase the risk of a leak. |

**Cleaning the pressure sensor**

Avoid touching the diaphragm when cleaning the sensor. Any deformation will permanently affect performance.

1. Unscrew the sensor guard using a coin or a large flathead screwdriver. Do not apply excessive force, especially when using the screwdriver.
2. Rinse the area under running water. If this fails to remove the deposits, try soaking in vinegar.
3. If unsuccessful, contact RBR.

## 4.2 Cables and connectors

**Cable bend radius**

The smallest bend radius for RBR supplied cables is 15cm.

**Lubricating the connectors**

Lubrication improves watertight sealing, prevents corrosion, and reduces the force required to de-mate the connector. Use the silicone compound provided with your instrument:

- Apply the silicone compound to all female connectors before every mating.
- Ensure each connector hole is filled with approximately 30% lubricant.

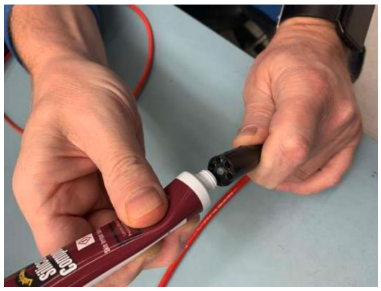


*Fig. 7. Applying silicone compound to the female connectors.*

*Fig. 8. Cross-sectional view of a connector with 30% lubricant fill.*

**Reducing mechanical stress**

- Do not pull on the cable.
- Hold onto the connector to pull out the cable.
- Disconnect by pulling straight out, not at an angle.
- Avoid sharp bends at the point where the cable enters the connector.
- Avoid angular loads on the connector.

## 4.3 Calibration

Factory calibration coefficients are calculated for each sensor, and the coefficients are stored on the instrument.

RBR calibration certificates contain calibration equations, coefficients, and residuals for each sensor.

Calibration certificates are available for download:

- If using Ruskin, connect your instrument and go to **Information**, then select **Download**.
- For OEM instruments, go to https://oem-lookup.rbr-global.com, select **OEM lookup by serial number**, and search by the serial number and authorisation key.

RBR recommends calibrating your instrument before any critical deployment, periodically once a year, or if you suspect the readings to be out of specifications.

Discuss your calibration requirements with RBR. In some cases, the instrument will need to be returned to RBR to have it checked and recalibrated.

Please contact RBR for current calibration fees.

## 4.4 Repairs

RBR supports all our products. Contact us immediately at support@rbr-global.com or via the RBR website if there are any issues with your instrument. Please have the model and the serial number of the unit ready. Our support team will work to resolve the issue remotely. In some cases, you may have to return your instrument to RBR for further servicing.

There are no user-repairable parts of the instrument. Any attempt to repair without prior authorisation from RBR will void the warranty. Refer to the RBR warranty statement.

To return a product to RBR for an upgrade, repair, or calibration, please contact our support team to obtain a return merchandise authorisation code (RMA) and review the detailed shipping information on the RBR website.

# 5 Revision history

| Revision No. | Release date | Notes |
|---|---|---|
| A | 30 November 2022 | Original |
| B | 15 June 2024 | Updated the Sensor specifications sections for conductivity specifications (resolution).<br>Added a warning against using the ultrasonic bath to the Cleaning section. |
| C | 27 September 2026 | Migrated. Reformatted and reviewed; no technical changes. |