RBR*centauro*^{3}
INSTRUMENT GUIDE

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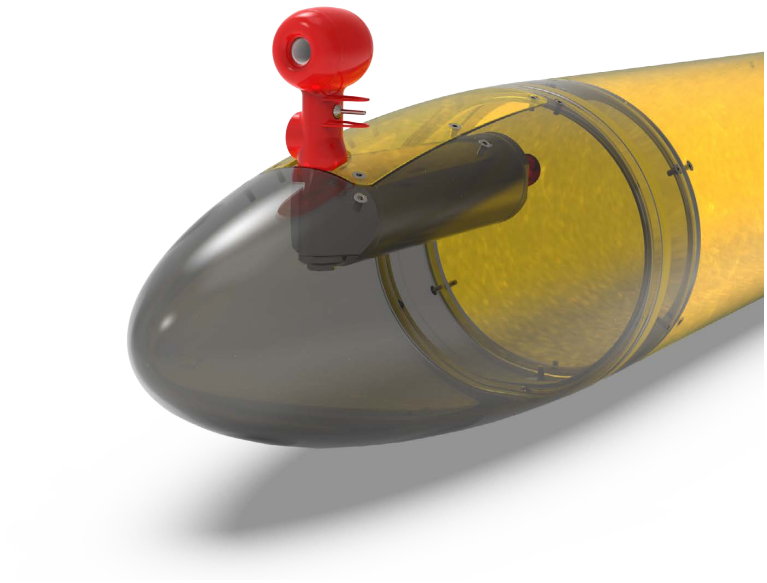
1 RBR*centauro*^{3} C.T.D

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.



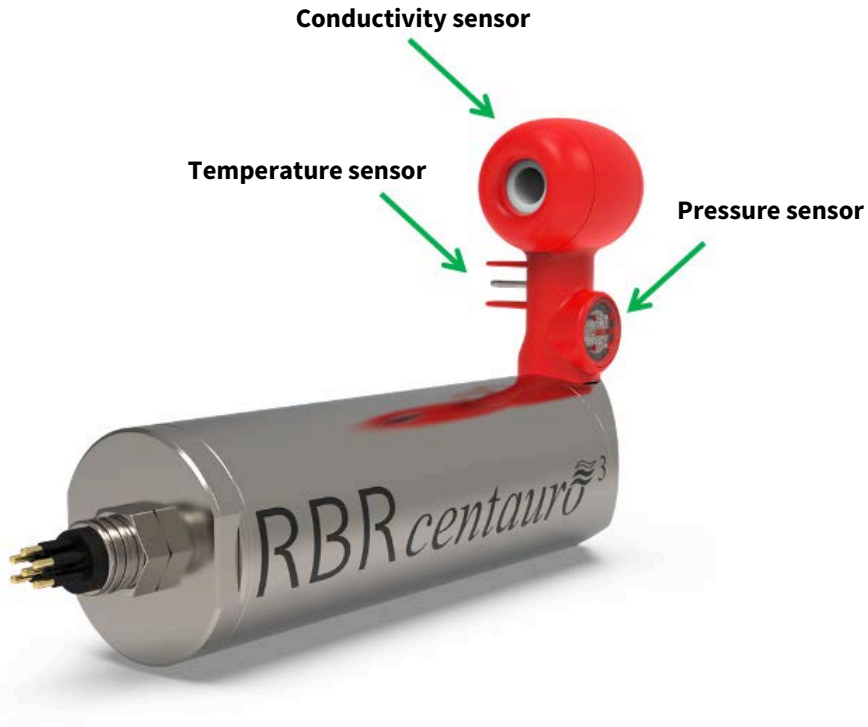
RBR*centauro*^{3} C.T.D, integrated

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

- High accuracy
  - Unaffected by surface contaminants
  - Pre-calibrated to account for static elements*
  - 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

*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.



RBR*centauro*^{3} C.T.D

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 Instruments^3 and Logger^3 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 the RBR*legato*^{3} Instrument Guide.

2 Physical specifications

Instrument

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

*Each sample can include multiple readings.
**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.

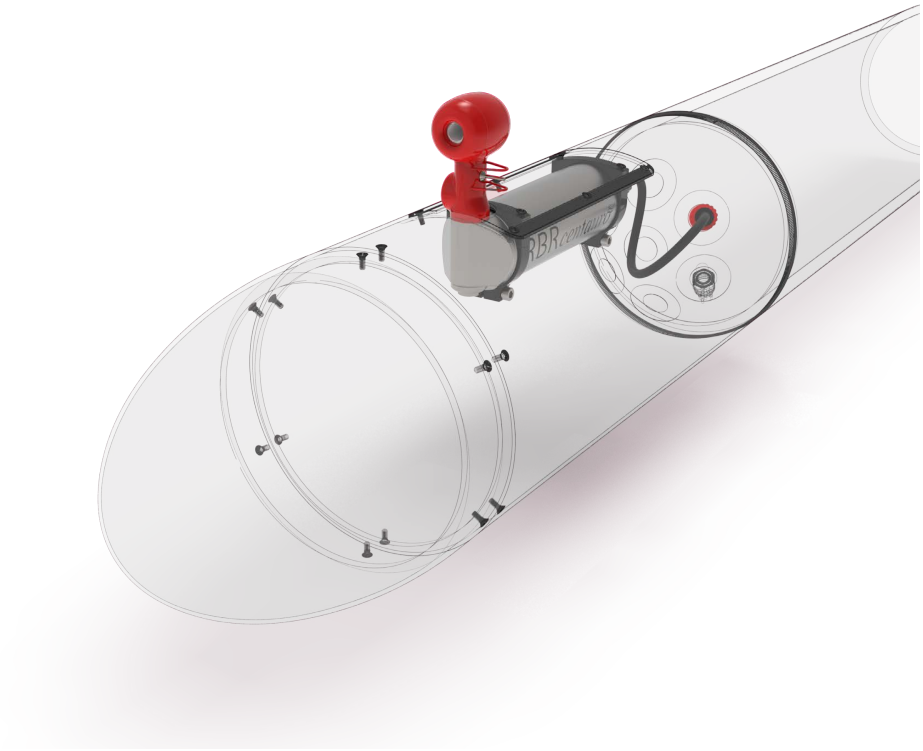
If you turn off the instrument, there will be a delay starting up. Furthermore, you will have to wait for at least two minutes before turning it back on.

- 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

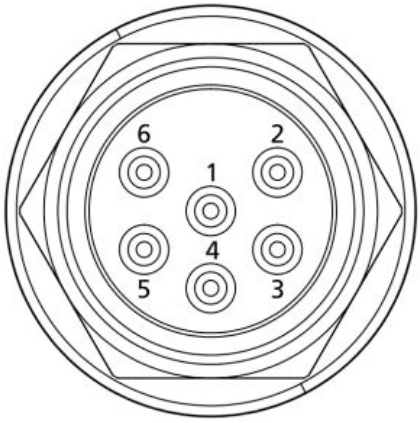
The RBR*centauro*^{3} uses an external MCBH-6-MP connector. It can be used for connecting to an RS-232 underwater extension cable.



RBR*centauro*^{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*	±0.003mS/cm
Resolution	<0.001mS/cm
Typical stability	0.010mS/cm/year

* Vehicle dynamics and geometry may affect measurement accuracy.

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.

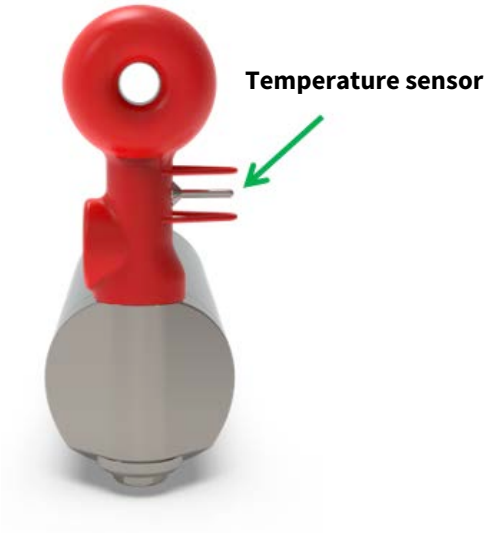
While 80% of its volumetric measurements happens inside the cell, they also extend up to 15 cm away and thus may be affected by conductive and non-conductive objects within this distance. RBR calibrates conductivity sensors to account for static objects, such as other sensors or glider body. Conductivity 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*	-5°C to 35°C
Initial accuracy	±0.002°C
Resolution	<0.00005°C
Typical stability	±0.002°C / year
Time constant	~1s

*A wider temperature range is available upon request. Contact RBR for more information.

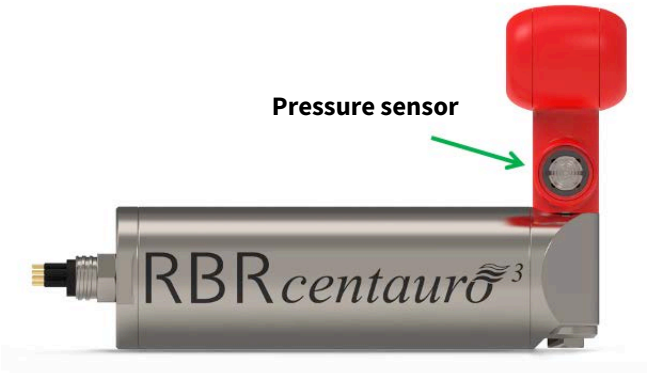


3.3 Pressure (D)

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



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.

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	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 chances of a leak.
Encrustation	Ultrasound bath	Do not use ultrasound on pressure transducers <50dbar.

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 flat head 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 or immersing in an ultrasound bath. Do not use ultrasound on pressure transducers <50dbar.
3. If unsuccessful, contact RBR.

4.2 Cables and connectors

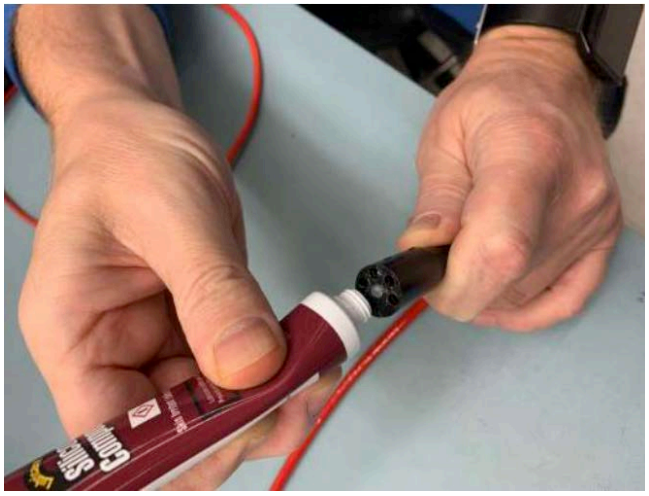
Cable bend radius

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



Lubricating a connector

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. Hard copies are provided with each shipment. RBR can replace lost or misplaced calibration certificates upon request.

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 re-calibrated.

Please contact RBR for our 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