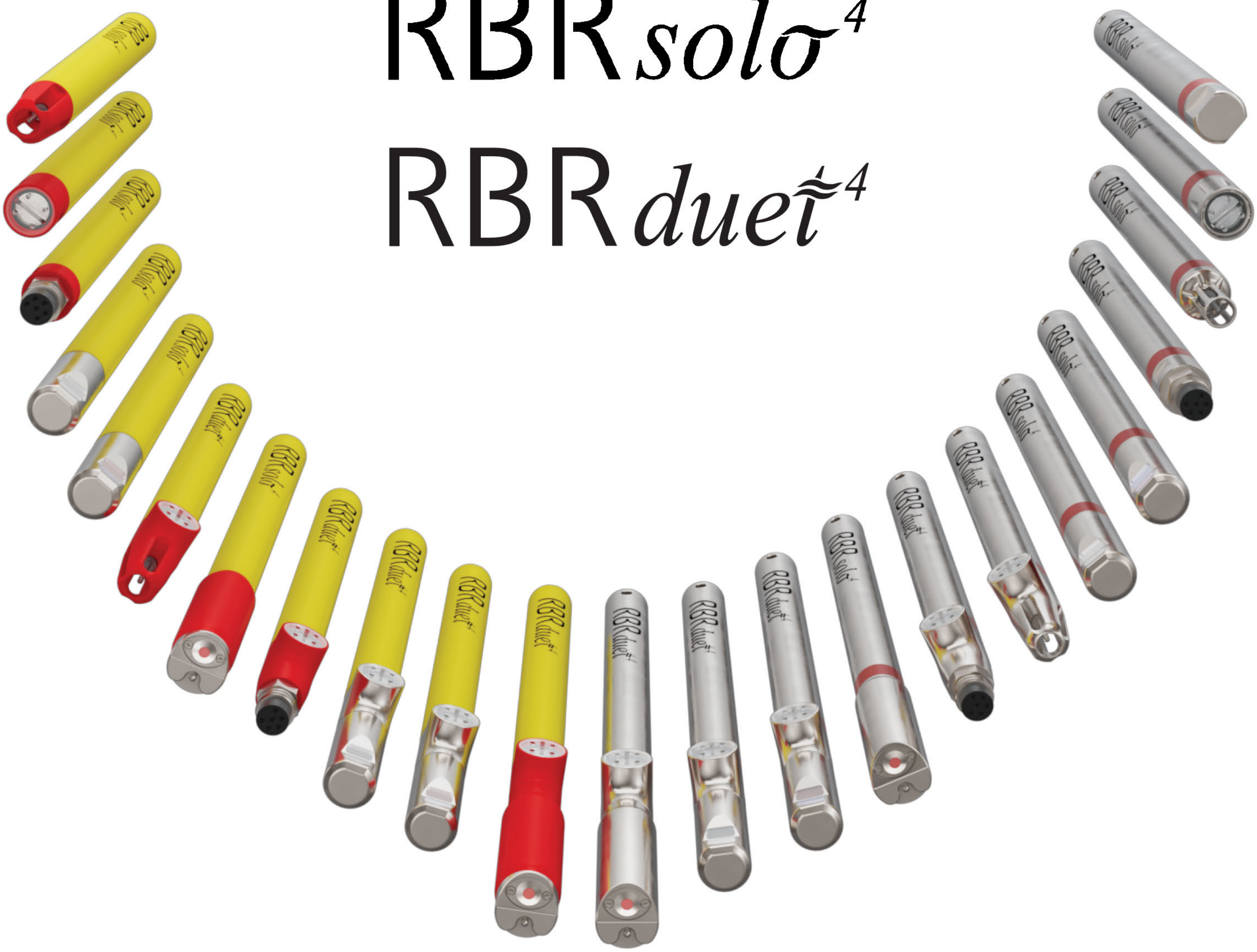
RBR COMPACT INSTRUMENTS

RBR*solo*[4]
RBR*duet*[4]



INSTRUMENT GUIDE

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1 Compact instruments

RBR manufactures two types of compact instruments, the RBR*solo*[4] and the RBR*duet*[4]. The RBR*solo*[4] is a family of single-sensor instruments and the RBR*duet*[4] instruments are dual-sensor. They are all small, lightweight, stable, and provide highly accurate measurements during long deployments. Low power consumption, large memory, and the ability to endure harsh conditions make them a perfect choice for many oceanographic applications. Only one software tool, Ruskin, is required to operate them. See Ruskin User Guide: Compact Instruments[4] for more information.

All RBR compact instruments support the following features:

- Large memory
- High accuracy
- Long deployments
- Compact and lightweight
- Any AA battery chemistry
- Multi-rate sampling up to 32Hz*
- Fast USB-C download

* Select from several |fast sampling variants, such as | fast32, | tide32, and | wave32, depending on your needs.

> In most cases, standard, | slow, and | fast sampling variants look identical. The exception is the RBR*solo*[4] T| deep| slow, which has an embedded thermistor.

Some compact instruments are also available in titanium housing, which resists all forms of marine corrosion and is suitable for deepwater applications (| deep). All RBR instruments within the |deep family provide accurate and stable measurements in the most challenging environments. Several configurations are rated for the full ocean depth, thus being deployable as deep as the bottom of the Marianas Trench.

All compact instruments are available in a longer housing that holds 2x AA cell batteries (| 2x), doubling the power available. This is especially beneficial for multi-year schedules or for D.x instruments where the x is an active optical sensor with high power consumption.

> The RBR*solo*[4] T, RBR*solo*[4] D, and the RBR*duet*[4] T.D are also available in a single cell housing.

Fig. 1 . The RBRsolo[4] and RBRduet[4] product range

1.1 RBRsolo^4

The RBR*solo*^{4} is a family of small single-sensor, long-autonomy instruments, which come in several variants:

- RBR*solo*^{4} D: depth
- RBR*solo*^{4} T: temperature
- RBR*solo*^{4} Tu: turbidity
- RBR*solo4* chl-*a*: chlorophyll-*a*
- RBR*solo*^{4} ODO: temperature and optical dissolved oxygen
- RBR*solo*^{4} x: exchangeable
  - Can connect to the following standalone RBR serial sensors: RBR*coda* Tu, RBR*coda* chl-*a*, RBR*quadrante*, RBR*coda* T.ODO, RBR*coda*^{3} T, RBR*coda*^{3} D, and RBR*coda*^{3} T.D.

For information regarding RBR sensors, please see the following guides: RBR Instrument Guide: RBR*coda* and RBR*coda*^{3} and RBR Instrument Guide: RBRtridente and RBRquadrante.

Fig. 2 . The RBRsolo^4 shallow instruments: RBRsolo^4 D | 2x, RBRsolo^4 T | 2x, RBRsolo^4 x | 2x, RBRsolo^4 chl-a | 2x, RBRsolo^4 Tu | 2x, RBRsolo^4 ODO | 2x

All configurations are available in titanium housing for deepwater applications (|deep). In most cases, standard, |slow, and |fast sampling variants of the same instrument look identical, with the exception of RBR*solo*^{4} T |deep |slow, which has an embedded thermistor. See Fig. 3 for details.

Fig. 3 . The RBRsolo^4 deep instruments: RBRsolo^4 ODO | 2x, RBRsolo^4 Tu | 2x, RBRsolo^4 chl-a| 2x, RBRsolo^4 x | 2x, RBRsolo^4 T | fast | 2x, RBRsolo^4 D | 2x, RBRsolo^4 T | 2x (Note the embedded thermistor)

1.2 RBRduet^4

The RBR*duet*^{4} is a family of small dual-sensor long-autonomy instruments, which can be configured with any of the following options:

- RBR*duet*^{4} T.D: temperature and depth
- RBR*duet*^{4} D.Tu: depth and turbidity
- RBR*duet*^{4} D.chl-*a*: depth and chlorophyll-*a*
- RBR*duet*^{4} D.ODO: depth, temperature and optical dissolved oxygen
- RBR*duet*^{4} D.x: depth and one other exchangeable sensor
  - Can connect to the following standalone RBR serial sensors: RBR*coda* Tu, RBR*coda* chl-*a*, RBR*quadrante*, RBR*coda* T.ODO, RBR*coda*^{3} T, RBR*coda*^{3} D, *and* RBR*coda*^{3} T.D.

For information regarding RBR sensors, please see the following guides: [RBR Instrument Guide: RBR*coda* and RBR*coda*^{3}] and [RBR Instrument Guide: RBRtridente and RBRquadrante].

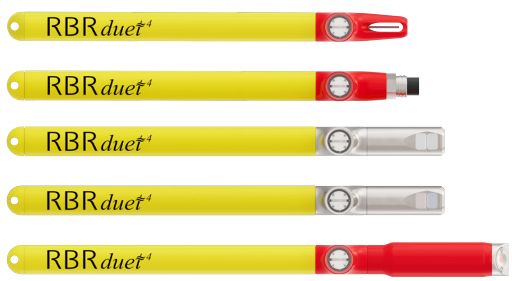

Fig. 4 . The RBRduet^4 shallow instruments: RBRduet^4 T.D | 2x, RBRduet^4 D.x | 2x, RBRduet^4 D.chl-a | 2x, RBRduet^4 D.Tu | 2x, RBRduet^4 D.ODO | 2x

All configurations are available in titanium housing for deepwater applications (|deep), designed to endure harsh conditions:

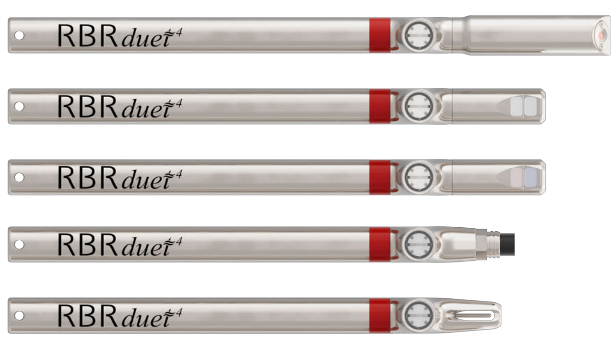

Fig. 5 . The RBRduet^4 deep instruments: RBRduet^4 D.ODO | 2x, RBRduet^4 D.Tu | 2x, RBRduet^4 D.chl-a | 2x, RBRduet^4 D.x | 2x, RBRduet^4 T.D | 2x

2 Physical specifications

RBR*solo*[4] and RBR*duet*[4] common specifications

Parameter	Value
Storage	>2 billion samples
Power[1]	Any AA-type cell
Communication	USB-C
Clock drift[2]	±60 seconds per year
Housing diameter	25.4mm (plastic), 25mm (Ti)

[1]See Ruskin User Guide: Compact Instruments[4] for suitable battery chemistries.

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

RBR*solo*[4] weight, length, and depth rating

Instrument	Weight	Total length	Depth rating
RBR*solo*[4] D RBR*solo*[4] D|2x RBR*solo*[4] D|deep RBR*solo*[4] D|deep|2x	140g in air, 25g in water 174g in air, 25g in water 310g in air, 195g in water 405g in air, 255g in water	227mm 293mm 232mm 302mm	1000m 1000m 10000m 10000m
RBR*solo*[4] T RBR*solo*[4] T|2x RBR*solo*[4] T|deep RBR*solo*[4] T|deep|2x	125g in air, 20g in water 159g in air, 20g in water 295g in air, 185g in water 390g in air, 245g in water	242mm 308mm 245mm 315mm	1700m 1700m 10000m 10000m
RBR*solo*[4] ODO|2x RBR*solo*[4] ODO|deep|2x	249g in air, 40g in water 510g in air, 310g in water	369mm 377mm	1000m 6000m
RBR*solo*[4] Tu | 2x RBR*solo*[4] Tu | deep | 2x	215g in air, 60g in water 440g in air, 270g in water	329mm 338mm	1700m 6000m
RBR*solo*[4] chl-*a*|2x RBR*solo*[4] chl-*a* | deep | 2x	215g in air, 60g in water 440g in air, 270g in water	329mm 338mm	1700m 6000m
RBR*solo*[4] *x*|2x RBR*solo*[4] *x*|deep|2x	184g in air, 35g in water 410g in air, 255g in water	305mm 319mm	1700m 6000m

RBR*duet*^{4} weight, length, and depth rating

Instrument	Weight	Total length	Depth rating
RBR*duet*^{4} T.D	170g in air, 30g in water	274mm	1000m
RBR*duet*^{4} T.D|2x	205g in air, 30g in water	340mm	1000m
RBR*duet*^{4} T.D|deep	390g in air, 255g in water	278mm	10000m
RBR*duet*^{4} T.D|deep|2x	485g in air, 315g in water	348mm	10000m
RBR*duet*^{4} D.Tu|2x	254g in air, 55g in water	374mm	1000m
RBR*duet*^{4} D.Tu|deep|2x	560g in air, 360g in water	379mm	6000m
RBR*duet*^{4} D.chl-*a*|2x	254g in air, 55g in water	374mm	1000m
RBR*duet*^{4} D.chl-*a*|deep|2x	560g in air, 360g in water	379mm	6000m
RBR*duet*^{4} D.ODO|2x	304g in air, 65g in water	425.5mm	1000m
RBR*duet*^{4} D.ODO|deep|2x	625g in air, 390g in water	425mm	6000m
RBR*duet*^{4} D.x|2x	219g in air, 40g in water	349mm	1000m
RBR*duet*^{4} D.x|deep|2x	520g in air, 340g in water	358mm	6000m

For deployment estimates, use Ruskin autonomy engine. See Ruskin User Guide: Compact Instruments[4] for details.

3 Sensor specifications

Most RBR compact instruments have only one sensor (RBR*solo*[4]), but some include two (RBR*duet*[4]). While temperature and pressure remain the most popular choices, specialised sensors are available to meet various requirements. Refer to the following subsections for more information.

Please contact the RBR sales team to discuss your needs and to select the perfect configuration for your applications.

3.1 Pressure (D)

Any RBR*solo*[4] or RBR*duet*[4] that measures pressure (D), including all variants, uses a piezoresistive pressure sensor, as shown in Fig. 6. The sensor is protected by a clear plastic guard. During deployments, always orient it downwards to reduce debris collecting on the membrane of the pressure sensor.

Fig. 6 . An RBRsolo[4] D with piezoresistive pressure sensor

| tide32 and | wave32 variants take averages of pressure readings over extended periods of time, providing accurate tide level data.

| wave32 instruments can also obtain wave characteristics and detect infrequent phenomena, like boat wakes.

Parameter	Value
Range[1]	20 / 100 / 300 / 1000dbar (plastic) 1000 / 2000 / 6000 / 10000dbar (Ti)
Initial accuracy[2]	±0.01% full scale
Resolution	<0.001% full scale
Typical stability	±0.01% full scale / year
Time constant	<10ms

[1] Recommended depth for wave measurements is less than 100m.

[2] The 20m sensor is limited to ±0.05% FS due to its physical construction.

3.2 Temperature (T)

Any RBR*solo*[4] or RBR*duet*[4] that measures temperature (T), including all variants, uses the same thermistor-type temperature sensor (see Fig. 7).

Fig. 7 . An RBRsolo[4] T with 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	<0.1s | fast, <1s standard

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

3.3 Dissolved oxygen (ODO)

RBR compact instruments with "ODO" in the name, such as the RBR*solo*^{4} ODO, and RBR*duet*^{4} D.ODO | deep, use the optical dissolved oxygen sensor (see Fig. 8). During deployments, always orient the sensor downwards to reduce debris collecting on the sensing foil and minimise direct sunlight. Store the sensor in the dedicated storage cap, included with the instrument. Rehydrate for five days before deployment. See RBR ODO sensor care and maintenance for more information.

Fig. 8 . RBRsolo^4 ODO | 2x: Optical dissolved oxygen sensor

Parameter	Value
Measurement range	0-1000µmol/L
Calibrated range Concentration Saturation Temperature	 0-500µmol/L 0-120% 1.5°C to 30°C
Initial accuracy For | fast For standard, | slow	 Maximum of ±8µmol/L or ±5% Maximum of ±2µmol/L or ±1.5%
Resolution For | fast For standard For | slow	 <1µmol/L (saturation 0.4%) <0.5µmol/L (saturation 0.2%) <0.1µmol/L (saturation 0.04%)
Time constant	<1s | fast, <8s standard, or <30s | slow

⚠ Optical dissolved oxygen measurements require pressure correction for highest accuracy. Enter the known absolute pressure value manually in the **Parameters** table under the **Calibration** tab in Ruskin.

3.4 Turbidity (Tu)

Any RBR *solo*[4] or *duet*[4] that measures turbidity uses the RBR realtime turbidity sensor, which has two independent optical channels for optimising linearity and sensitivity (see Fig. 9). During deployments, minimize direct sunlight.

Fig. 9 . RBRsolo[4] Tu | 2x: Turbidity sensor

Turbidity

Parameter	**Value**
Channel wavelength	880nm
Centroid angle	90°
Linearity, R^2	0.99
Initial accuracy	5%
Calibrated range	0 - 1000FTU
Measurement range*	0 - 1500FTU
Detection limit	0.005FTU

* Response becomes non-linear above 1000FTU.

Turbidity (optical backscatter)

Parameter	**Value**
Channel wavelength	880nm
Centroid angle	135°
Linearity, R^2	0.99
Initial accuracy	5%
Calibrated range	1000 - 4000FTU
Measurement range*	0 - 20000FTU
Detection limit	2.0FTU

* Response is linear between 500 and 15000 FTU

3.5 Chlorophyll-a (chl-a)

Any RBR*solo*[4] or RBR*duet*[4] that measures chlorophyll-*a* uses the RBR realtime chlorophyll-a sensor (see Fig. 10), designed to ensure sensitivity to low concentrations across the measurable range (0-500µg/L). During deployments, minimize direct sunlight by deploying the instrument with the detection window facing down.

Fig. 10 . RBRsolo[4] chl-a | 2x: Chlorophyll-a sensor

Optical

Parameter	Value
Linearity, R2	0.99
Initial accuracy	5%

Chlorophyll-*a*

Parameter	Value
Wavelength	470nm/695nm (excitation/emission)
Calibrated range*	0-50µg/L
Measurement range	0-500µg/L
Detection limit*	0.020µg/L

*Scaled for the in vivo fluorescence response.

4 Derived parameters

Ruskin software calculates derived parameters.

You can select alternative derivation options for some parameters in the **Calibration** tab.

See Ruskin User Guide: Compact Instruments[4] for details.

4.1 Sea pressure

Sea pressure is the difference between the pressure measured underwater by your RBR instrument and atmospheric pressure. The units of measurement are **dbar** (decibars).

$$\text{Sea pressure} = \text{absolute pressure - atmospheric pressure}$$

where pressure (in dbar) is the value measured directly by your RBR instrument.

Enter atmospheric pressure (in dbar) manually in the **Parameters** table under the **Calibration** tab in Ruskin. See Ruskin User Guide: Compact Instruments[4]. If not entered, a default value of 10.1325dbar will be used.

4.2 Depth

Depth is a function of sea pressure and seawater density. The units of measurement are **m** (meters).

$$\text{Depth} = \frac{\text{sea pressure}}{\text{density} \cdot \text{g}}$$

where seawater density is in g/cm^3 and sea pressure is in dbar, and *g* is the acceleration of gravity and equals 9.8m/s^2 .

Sea pressure is also a derived parameter:

$$\text{Sea pressure} = \text{absolute pressure} - \text{atmospheric pressure}$$

Enter atmospheric pressure in (dbar) and seawater density (in g/cm^3) manually in the **Parameters** table under the **Calibration** tab in Ruskin. See Ruskin User Guide: Compact Instruments[4]. If not entered, default values of 10.1325dbar and 1.0281g/cm^3 will be used.

4.3 Oxygen concentration

When a sensor measures oxygen saturation, we derive oxygen concentration using the Weiss equation. See The solubility of nitrogen, oxygen and argon in water and seawater by R.F. Weiss for details.

The units of measurement may be **µMol/L, mg/L,** or **mL/L**.

The Weiss equation requires values for absolute temperature (in °K) and salinity, which are derived from measured temperature and conductivity. As your instrument does not measure conductivity, a default value of 35PSU will be used. Alternatively, enter conductivity manually in the **Parameters** table under the **Calibration** tab in Ruskin. See Ruskin User Guide: Compact Instruments[4].

4.4 Oxygen saturation

The RBR*solo*[4] ODO and the RBR*duet*[4] D.ODO measure dissolved oxygen concentration.

When a sensor measures oxygen concentration, we derive oxygen saturation using the Garcia and Gordon equation. See Oxygen solubility in seawater: better fitting equations by F. H. Garcia and I. I. Gordon for details.

The units of measurement are **%**.

The Garcia and Gordon equation requires values for absolute temperature (in °K) and salinity, which are derived from measured temperature and conductivity. As your instrument does not measure conductivity, a default value of 35PSU will be used. Alternatively, enter conductivity manually in the **Parameters** table under the **Calibration** tab in Ruskin. See Ruskin User Guide: Compact Instruments[4].

5 Hardware

5.1 Open and close a compact instrument

> ⚠ RBR compact instruments have two O-rings. Remember to keep the O-rings clean and avoid scratching the O-ring mating surfaces. Carefully inspect the O-rings before deploying the instrument.

Opening the instrument

1. Hold the instrument with the sensor end-cap up.
2. Unscrew the sensor end-cap, counterclockwise.
3. Once fully unscrewed, slide the housing away from the sensor end-cap to reveal the sensor carriage. The sensor carriage contains the battery compartment, desiccant holder, and USB-C port.

Fig. 11 . An RBRsolo4 T demonstrating the sensor end-cap detaching from the sensor carriage.

Fig. 12 . Sensor carriage for standard and | 2x variants

Closing the instrument

1. Insert the sensor carriage into the housing.
2. Screw the sensor end-cap back on, clockwise.

5.2 Instrument interface

Refer to Open and close a compact instrument for details on accessing connection ports.

USB-C port

RBR compact instruments have an internal USB-C port.

Fig. 13 . USB-C port location. Note: the location is the same on all variants.

The RBR support kit includes a USB-C data cable, which can connect the instrument to your computer.

Deployment

- Connect the instrument to your computer using the USB-C cable
- Find the instrument on Ruskin
- Review the settings and click **Enable**

Data download

- Connect the instrument to your computer using the USB-C cable
- Find the instrument on Ruskin
- Select **Download**

6 Maintenance

6.1 Support kits

RBR provides one support kit per every three instruments ordered. If you need more units, contact RBR.

The RBR support kit for compact instruments contains an assortment of basic accessories and spare parts, as illustrated in Fig. 14.

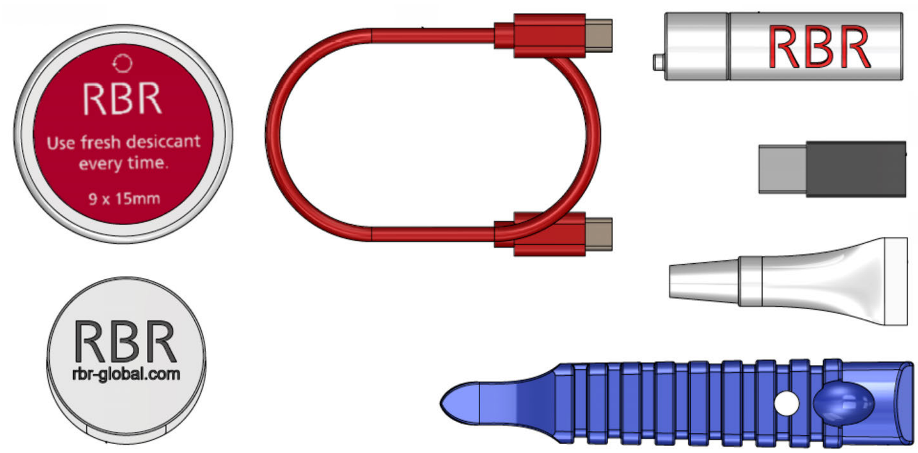

Fig. 14 . The contents of the RBR support kit for compact instruments, clockwise from top left: Replacement desiccant, USB-C to USB-C cable, USB memory stick, USB-C to USB-A adapter, silicone compound, O-ring removal tool, replacement O-rings.

The USB-C desktop cable included in the kit is used to download data from the instruments internal port to a computer.

6.2 Replace the O-rings

Refer to Open and close a compact instrument for details on accessing the O-rings.
The O-ring removal tool and silicone compound are available in the support kit.

Care for the O-rings is the single most important item of maintenance on any submersible RBR instrument. A water leak can damage the circuit board beyond repair and cause complete data loss. Every instrument's seal depends upon its O-rings; therefore, proper O-ring maintenance is crucial.

The O-rings may lose elasticity over time, even when the instrument is not deployed. RBR strongly recommends replacing the O-rings regularly.

RBR compact instruments use two O-rings (see Fig. 15). One is the main O-ring, and the other is the backup. Both are required to protect the instrument from flooding.

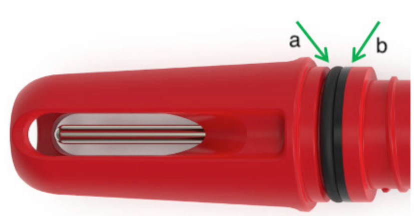

Fig. 15 . Location of the O-rings. (a) main O-ring. (b) backup O-ring.

To access the O-rings, open the instrument.

Inspecting the O-rings and mating surfaces

Visually inspect the O-rings, paying attention to the following areas:

- The surface of the O-ring itself should be smooth and free of nicks or damage.
- The mating surface on the inside of the case between the threads and the open end.
- The groove in the end-cap where the O-ring sits.

> ⚠ When handling the O-rings:
> - Avoid using any object that could scratch the O-ring or any of its mating surfaces.
> - If dirt is present in the O-ring groove, remove the O-ring as described below and thoroughly clean the groove.
> - Do not return an old O-ring to the instrument. If you remove the O-ring from the instrument for any reason, always replace it with a new one.
> - If the surfaces of the O-ring groove are scratched, pitted, or damaged, contact RBR for advice.

Replacing the O-rings

Correct placement and orientation of the two O-rings are critical to maintaining depth rating integrity.

The main O-ring has a round profile. It must be installed first.

The backup O-ring is flat on one side, and concave on the other. When installed, the concave side must face the main O-ring, as illustrated in Fig. 16.

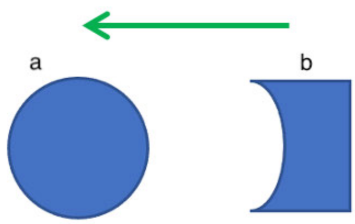

Fig. 16 . Orientation of the O-rings (a) main O-ring. (b) backup O-ring

Use the plastic O-ring tool (included with the support kit) to remove the O-rings from the groove. The O-ring may need to stretch quite a bit as it is pushed off; this requires some effort but can be done by hand.

1. Clean the groove thoroughly using a soft, lint-free cloth and compressed air if necessary.
2. Select the proper O-rings and inspect them for damage.
3. Lubricate with a very light film of silicone grease (included in the support kit).
4. Install the main O-ring by sliding it over the electronic housings and popping it into its groove.
5. Install the backup O-ring, ensuring that the concave side is facing toward the main O-ring.
6. Once in place, inspect the O-rings once more for scratches and debris, and wipe away any silicone compound deposited on the carriage.
7. Once the inspection is complete, close the instrument.

6.3 Replace batteries

Refer to Open and close a compact instrument for details on accessing the battery.

RBR ships new instruments with fresh, highest capacity batteries included. Replace the batteries before each deployment to maximise the operational time, and prevent data loss.

See Ruskin User Guide: Compact Instruments[4] for information on predicting battery life.

Replacing the battery

1. Open the instrument and pull out the sensor carriage.
2. Push the battery out of its holder using your finger or a blunt tool.
3. Insert new AA-type batteries into the holder.
4. Check for correct polarity.
5. Insert the sensor carriage into the housing and close the instrument.

Fig. 17 . An RBRsolo[4] T battery carriage. Note the direction of removal.

For the RBR*solo*[4] and RBR*duet*[4] | 2x variants, RBR recommends replacing both cells to ensure maximum performance.

Always remove the battery from your instrument during long-term storage. Doing so will prevent internal damage due to battery leakage and/or corrosion.

6.4 Replace the desiccant capsule

Refer to Open and close a compact instrument for details on accessing the desiccant.

Replace the desiccant capsule before each deployment.

Fresh desiccant will keep the instrument compartment dry and prevent malfunction. Water damage may occur if condensation forms inside the instrument.

As a preventative measure, RBR recommends servicing the instrument in a cool, dry place (when possible).

Replacing the desiccant capsule

1. Open the instrument and pull out the sensor carriage.
2. Push the desiccant capsule out of its holder using your finger or a blunt tool.
3. Insert a new desiccant capsule into the holder.
4. Insert the sensor carriage into the housing and close the instrument.

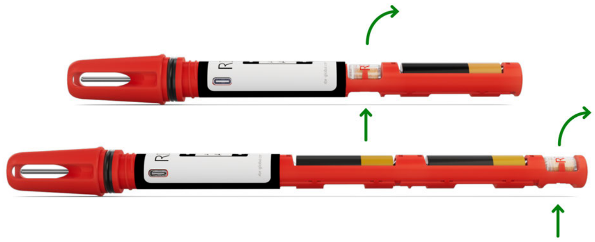

Fig. 18 . Desiccant location and removal direction in both the standard and | 2x variants.

All instruments ship with fresh reusable desiccant capsules. They use a cobalt-free colour changing indicator dye. Orange indicates fresh desiccant, while green indicates it is saturated (about 15% water by weight). Once exhausted, the capsules can be replaced with new ones (available from RBR), or refreshed.

Fig. 19 . Fresh (orange) and saturated (green) desiccant capsules

Refreshing the desiccant

Follow the steps below to refresh the desiccant.

1. Remove the saturated silica beads from their capsule.
2. Place them in the oven and heat at 120°C (250°F) for about two hours.
3. Take the refreshed beads out of the oven and return them to the capsule.
4. Wait until the silica beads cool down. Once cool, the desiccant is ready to be reused.

⚠ Always remove the beads from their capsule before refreshing. The capsule will deform if heated to 120°C.

⚠ Return the refreshed beads to the capsule immediately after reheating. If left outside the capsule, the desiccant will trap moisture and go back to green.

6.5 Couple an exchangeable sensor

RBR instruments with an “x” in the name, such as RBR*solo*[4] x | 2x, or RBR*duet*[4] D.x | 2x can connect to sensors by either direct connection and cabled connection.

⚠ Due to the weight of the RBR *quadrante,* couple it to an exchangeable instrument only via a cabled connection.

Direct connection

Connection to a direct sensor is done via a coupler. The instrument has a custom-made female connector, which fits the male connector of the sensor.

Fig. 20 . An RBRsolo⁴ x | 2x with coupler and RBRcoda chl-a.

The coupler has two flanges with opposing threads. It is important to ensure the coupler is securely tightened so the connection is watertight.

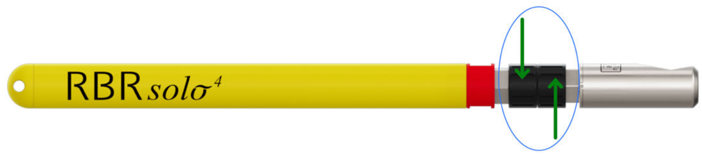

Fig. 21 . An RBRsolo⁴ x | 2x with coupler attached. Note the direction to tighten.

Instruments can be stored with the sensor connected; however, before deploying the instrument, it is important to verify that the coupler has not become loose. If that happens, you will see a small gap between the sensor and the coupler, or between the coupler and the base of the connector. Gently tighten the flanges to close the gap.

Disconnecting and connecting a sensor

1. Disconnect the sensor
    a. Take the instrument in your left hand and hold it horizontally, with the sensor oriented to the right.
    b. With your left index finger and thumb, prevent the left flange from moving.
    c. With your right hand, hold the sensor tightly.
    d. With your right index finger and thumb, twist the right flange clockwise until loose.
    e. The sensor will drop into your hand.
2. Access the female connector
    a. Twist the left flange counterclockwise.
    b. Remove the coupler.
3. Lubricate the female connector (see Cables and connectors).
4. Reconnect the sensor
    a. Place the coupler back on the instrument.
    b. Twist clockwise until tight.
    c. Very carefully mate the sensor to the instrument (the pins on the sensor must be aligned with the corresponding holes).
    d. Press the sensor into the instrument to make sure the pins are inserted.
    e. Continue to hold the instrument with your left hand.
    f. With your right hand, hold the sensor tightly.
    g. With your right index finger and thumb, twist the right flange counterclockwise while slightly pushing the sensor in with your palm.
    h. Verify the tightness of both flanges.

> ⚠ Occasionally, the left flange may begin to loosen while you are tightening the right one. It usually means that the pins did not mate properly. Carefully align the pins again and press harder. Wiggle the sensor gently to make sure the pins are inserted.

Cabled connection

1. Lubricate the female connector (see Cables and connectors).
2. Connect the cable to the sensor and the instrument.
3. Ensure both connections are snug, then slide the connector locking sleeves over each connection and tighten by hand.

6.6 Cables and connectors

The RBR*solo*[4] x and the RBR*duet*[4] D.x can connect to a compatible sensor via a customised cable. This cable has two connectors, which need to be lubricated any time when they are disconnected and reconnected.

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

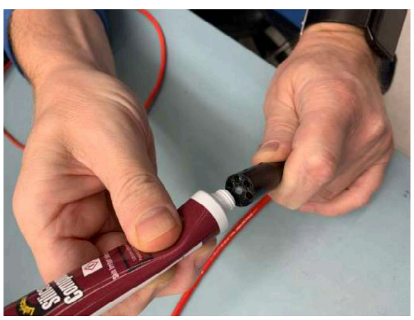

Fig. 22 . Applying silicone compound to the female connectors.

Fig. 23 . 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

6.7 RBR ODO sensor care and maintenance

Fig. 24 . RBRsolo^4 ODO | 2x with cap fitted, ready for storage.

First deployment

RBR ships the RBR*solo*^{4} ODO and the RBR*duet*^{4} D.ODO instruments with a hydrated storage cap on, so that the instrument is ready for its first deployment. However, long transportation times and low cabin pressure may cause the water to evaporate. Verify that the storage cap is still wet. If not, rehydrate the sensor for **five days** before deployment.

Calibration

Check your sensor calibration before each deployment in saturated fresh water. If the readings are not within 1% of 100% saturation, recalibrate the instrument using a one-point calibration. Typically, | fast instruments may need recalibration more often than standard or | slow. See Ruskin User Guide: Compact Instruments^4 for user calibration instructions.

6.8 Clean the instrument

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.

Cleaning ODO sensors

When dirty, carefully wipe the sensors with a soft cloth. To remove encrustation, soak in water until soft. It may take hours or days, depending on the severity.

> Do not use abrasive cloths as scratched faces can affect calibration.
> Do not use solvents or cleaners as these could affect optical properties of the window.

Cleaning turbidity sensors

Clean the optical face of the sensor with a lint-free cloth and isopropyl alcohol.

> ⚠ Ensure you are wearing gloves, oil from finger prints easily soils the windows.

Fig. 25 . Dirty

Fig. 26 . Clean

6.9 Calibrate the instrument

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 our current calibration fees.

6.10 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 authorization code (RMA) and review the detailed shipping information on the RBR website.

7 Revision history

Revision No.	Release date	Notes
A	20 February 2026	Original
B	17 April 2026	Updated pressure specs on Pressure page Added a note to the Compact Instruments page regarding single cell housing availability Updated chlorophyll-a spec table footnote