RBR*quartz*^{3} Q|plus

INSTRUMENT GUIDE

rbr-global.com

Table of Contents

1 Introduction

This document introduces you to your RBR instrument and will provide the information to deploy and maintain it. It is written specifically for the RBR*quartz*^{3} Q|plus. The RBR instrument guide can be accessed on the USB data stick provided with the instrument, from the Help menu in Ruskin, and on the RBR web site, at www.rbr-global.com.

2 Revision history

Revision No.	Release Date	Notes
A	17-March-2021	Original

CE

3 Warranty statement

All instruments manufactured by RBR Ltd. are warranted against defects in workmanship or original parts and materials for one year. Third-party sensors (not manufactured by RBR) are limited to the warranty provided by the original manufacturer.

Units suffering from such defects will be repaired or replaced at the discretion of RBR Ltd., provided that the problem has appeared during normal use of the instrument for the purpose intended by us. The liability of RBR Ltd. extends only to the replacement cost of the instrument. The customer will bear all shipping costs to us for repair; all other costs, including return shipment, will be borne by RBR Ltd.

This warranty does not cover consumables or normal wear and tear, nor does it cover damage caused by negligent use or mishandling. Attempted modification or repair of any unit without the prior consent of RBR Ltd. will immediately void any warranty in force.

Users are expected to maintain a regular program of calibration.

We reserve the right to grant or refuse warranty repairs at our discretion if we consider reasonable grounds for doing so.

4 RBRquartz^3 Q|plus - Overview

The RBRquartz^3 Q|plus tide and wave logger integrates the proven Paroscientific Digiquartz® pressure sensor for the best-in-class initial accuracy and low drift performance. Intended for long-term autonomous or realtime observations of water level, tides and waves, the incredibly stable pressure sensor in the RBRquartz^3 Q|plus can resolve small changes over long deployments. Flexible measurement schedules, burst sampling, and configurable integration times permit applications for tide, wave, and sea-level measurements. The RBRquartz^3 Q|plus has a large battery and memory capacity for extended autonomous deployments and USB, RS-232, or RS-485 connectivity for realtime applications.

RBR*quartz*^{3} Q |plus

5 Specifications

5.1 Instrument

Specification	Description
Storage	240M readings
Power	24 D cells
External power	4.5V to 30V
Communications	USB and RS-232 or RS-485
Clock drift	±60 second/year
Absolute maximum pressure*	Maximum pressure sensor range plus 20%
Housing material	Plastic
Dimensions	532mm x Ø100mm
Weight (in air)	11kg
Weight (in water)	2.5kg

*Exceeding the absolute maximum pressure will damage the instrument.

ⓘ For a complete mechanical drawing of the instrument, see Appendix A.

5.1.1 Deployment estimates

Deployment times are based on both memory and internal battery capacity.

Speed	Alkaline (recommended: Energizer E95)		Lithium thionyl chloride (recommended: SAFT LS33600)	
	Time (days)	Number of samples	Time (days)	Number of samples
16Hz	60	90M	60	90M
8Hz	125	90M	125	90M
4Hz	250	90M	250	90M
2Hz	300	52M	500	90M
1Hz	300	26M	980	90M

Order of power draw

When an external power supply is present, the instrument will preferentially draw power from this source and not consume the internal batteries. For an instrument powered by an external source, the internal batteries serve as backup power if the external source fails.

The instrument is powered by the external power source as long as the voltage is greater than 4.5V. If the external voltage drops below 4.5V, the system switches on the internal batteries.

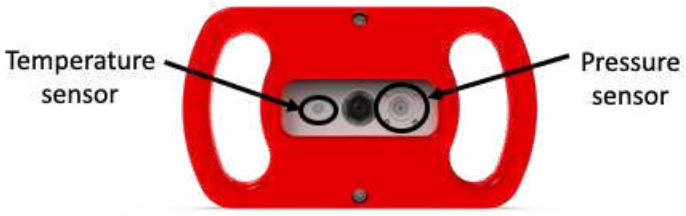
USB Power

When connected, USB preferentially powers the instrument during configuration or data download; however, if sampling occurs while connected via USB, the internal batteries are used during the sample.

5.2 Orientation and Datum Location

The datum of the RBR*quartz*³ Q|plus is located at the centre of the pressure port. An offset adjustment is done at RBR with the sensors facing downwards, as shown in the first image. It is recommended that the instrument is deployed sensor end cap down or on the instrument's side to reduce the possibility of sediment affecting the pressure sensor.

RBR's offer adjustment orientation



Sensor location

6 Hardware

6.1 Interfacing to the RBRquartz Q|plus

The RBR*quartz*³ Q|plus provides three communication ports, an internal USB-C port, plus two external MCBH connectors. The external MCBH connector configuration is one USB connector, with the other being either an RS-232 or RS-485 (selected at the time of order). These external MCBH connectors can be used for configuring, data download, provide real-time data access, and provide external power. See Appendix B for MCBH pinout.

6.1.1 USB-C connection

A USB-C desktop cable is supplied in the instrument support kit. Use this cable to download data from the instrument's internal port.

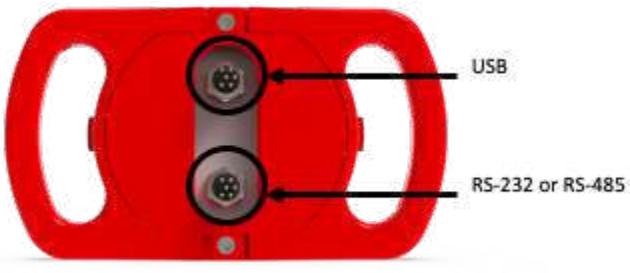
To access the USB-C port located inside the instrument body, perform the following:

1. Remove the battery carriage.
2. Connect the computer to the instrument through the USB-C port located mid-way down the body.
3. Start the Ruskin application.

RBR*quartz*^{3} Q |plus USB-C port location

6.1.2 MCBH connectors

The MCBH interface provides both data and power connections and is located on the battery endcap. The MCBH data and power connection allow for extended deployments by providing external power and real-time data access.



RBR*quartz*^{3} Q |plus MCBH port location

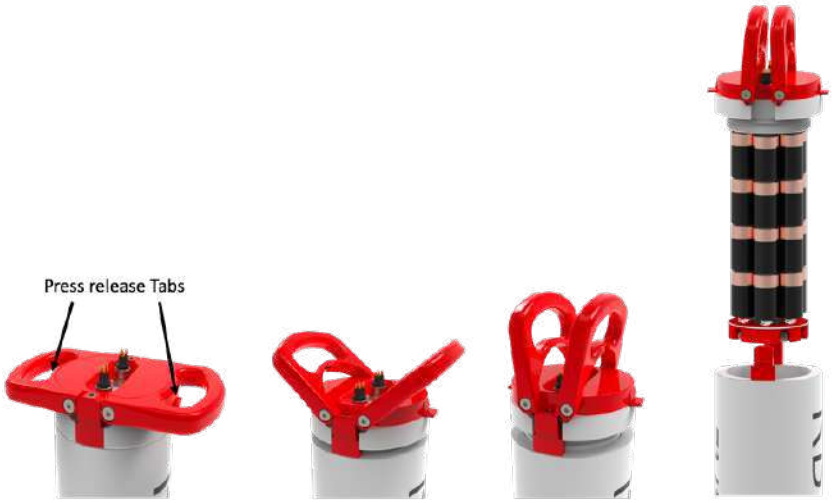
RBR can provide patch cables to connect the computer to the instruments via the MCBH ports for deployments where data and power connections are required for extended deployments or realtime data access. To increase the distance between the instrument and the computer, RBR can also provide underwater extension cables.

These ports allow data downloads without jeopardising the watertight seal. This port is useful for situations where data downloads need to occurs in less than ideal conditions. These ports also allow for real-time data access through underwater extension cable (sold separately).

6.2 Opening / Closing

6.2.1 Opening the instrument

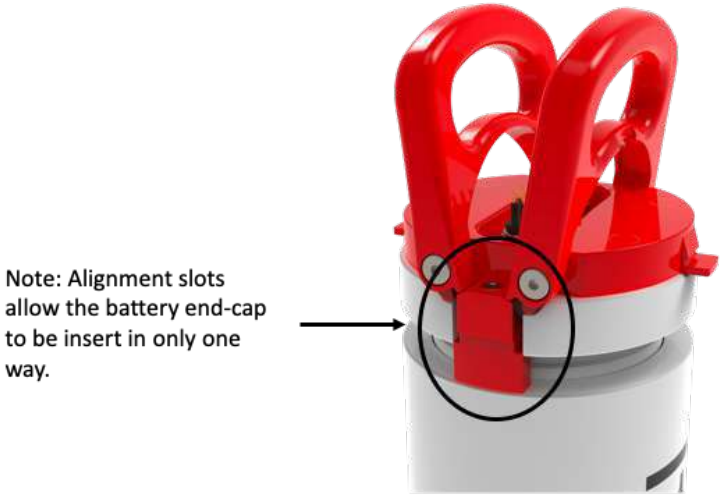
1. Push down on the release tabs located on each side of the battery end-cap.
2. Grip the battery end-cap handles firmly and pull up until the battery carriage is fully ejected.



Opening the instrument

6.2.2 Closing

1. Align the tabs on the instrument housing and battery end-cap. The battery end-cap can only be inserted one way.
2. Grip the battery end-cap handles firmly and push down until the battery end-cap locks into place.
3. Ensure that both release tabs click into place, indicating the handles are locked into the closed position.



Alignment slots

6.3 Batteries

Replace the batteries before each deployment to maximize the operational time. Ruskin, the software that manages RBR instruments, allows users to estimate the instruments battery life (assuming fresh batteries) and track the remaining battery life during deployment. See Ruskin User Guide: Standard Instruments[3] for more information about predicting battery life.

To change the batteries:

1. Remove the battery end-cap from the instrument.
2. Replace the 24 D cell batteries.
3. Check for correct battery polarity.
4. Insert the battery end-cap.

Battery carriage with 24 D cell batteries

6.4 Desiccant

Replacing the desiccants is recommended before each deployment. The use of fresh desiccants will keep the instrument compartment dry and prevent the electronics from being damaged due to condensation inside the instrument. As a preventative measure, RBR recommends always use fresh desiccant packs and, when possible, service the instrument in a cool, dry place.

6.4.1 Changing desiccants

1. Remove the battery end-cap from the instrument.
2. Locate the desiccants holder at the bottom of the battery end-cap.
3. Remove the used desiccant capsules from their sockets.
4. Insert fresh desiccants into their sockets.
5. Place the battery end-cap in the instrument.

Location of the desiccant holder

All instruments ship with fresh reusable desiccant. These capsules use a cobalt-free colour changing indicator dye. The colour of the desiccant indicated the amount of moisture that has been absorbed. Orange indicated fresh desiccant, while green indicated it is saturated (about 17% water by weight). Once exhausted, the desiccant can be replaced with fresh desiccant (available from RBR) or refreshed.

6.4.2 Refreshing desiccant

To refresh the desiccant, the beads must be removed from the capsule and heated to 120°C for about two hours. Once cool, the silica beads can be returned to the capsule and reused.

> The plastic capsule will deform if heated to 120°C.

7 Maintenance

7.1 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 scrubbed the instrument with a soft brush.	Avoid scratching the plastic (this make future cleaning more difficult).
Calcification	Soak in vinegar for no more than 24 hrs, *th en 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.
Sensor anti-fouling mesh	Scrub the anti-fouling mesh with a soft brush. Replace the anti-fouling mesh if needed.	See removing the anti-fouling mesh for more information.

7.2 O-rings

Care of the O-ring is the single most important item of maintenance on any RBR submersible instrument. A water leak can damage the electronics board beyond repair and cause complete data loss. Every instrument's seal depends upon its O-ring, not the end-cap tightness. Therefore, proper O-ring maintenance is crucial.

ⓘ O-ring may lose elasticity over time due to pressure, even when the instrument is not deployed. RBR strongly suggest that the O-ring be replaced regularly.

O-ring location

7.2.1 Inspecting O-rings

Visually inspect the O-ring, 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 surface should be smooth and debris-free.
- The groove in the end-cap where the O-ring sits, the surface should be smooth and debris-free.

⚠ Never use materials that can scratch the O-ring or any of its mating surfaces. If any dirt is present in the groove, remove the O-ring as described below, then thoroughly clean the groove with a soft, lint-free cloth. If the O-ring is removed for any reason, it should be replaced. If the surfaces of the groove are scratched, pitted, or damaged. Please contact RBR for advice at support@rbr-global.com.

7.2.2 Replacing an O-ring

1. Use the plastic O-ring tool (included with the instrument support kit) to remove the O-ring from its 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.
2. Clean the groove thoroughly using a soft, lint-free cloth and compressed air if necessary.
3. Select the proper O-ring and inspect it for damage.
4. Lubricate the new O-ring with a very light film of silicone grease (included with the support kit).

5. Install the new O-ring by pushing it into place and popping it into its groove.
6. Once the new O-ring is in place, inspect it once more for scratches and debris, and wipe away any silicone grease deposited on the end-cap.
7. Close the logger.

Do not use a metal screwdriver or any other tool that may scratch the O-ring groove; doing so may damage the end-cap.

7.3 Support kits

Along with the RBR*quartz*^{3} Q|plus, the user will receive a support kit (shown in the picture below and outlined in the following table).

RBR*quartz*^{3} Q|plus support kit

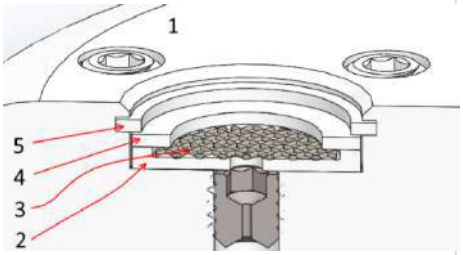
Item	Part name
1	Refill adapter
2	Pressure adaptor
3	Replacement antifouling mesh
4	Refill / Pressure adapter
5	M6x20mm Cap screws
6	Buffer fluid
7	USB-C desktop cable
8	USB stick
9	3mm and 5mm hex key
10	Retaining ring removal tool
11	Syringe with a stopper
12	5cm needle
13	Syringe kickstand
14	O-ring removal tool
15	Cleaning swabs
16	Replacement O-rings
17	Silicon grease
18	Desiccant

7.4 Pressure Paroscientific Digiquartz® maintenance

7.4.1 Removing the antifouling mesh

1. Remove the retaining ring using the pick provided with the maintenance kit. Hook the split in the retaining ring at the opening and pull it out of the sensor end-cap recess.
2. Remove the upper mesh insulator disk, nickel-copper mesh, and the lower mesh insulator disk.

Antifouling mesh assembly

Item No.	Description	Part image	Assembled antifouling mesh	Buffer tube interface assembly
1	Sensor end-cap	N/A		
2	Lower mesh insulator disk			
3	Nickel-copper mesh			
4	Upper mesh insulator disk			
5	Retaining ring			

7.4.2 Filling the syringe and degassing the buffer oil

It is important to remove all gases within the system as they can coalesce into bubbles causing anomalies in the data. If the system is ever cleaned or has had an oil leak out for any reason it is important to refil the system with degassed oil.

Materials

Item no.	Description	Image
1	Dow Corning FS 1265 Fluid 300 cst	
2	Needle ~5cm long	
3	Syringe with stopper	
4	Syringe kickstand	

Filling the syringe

1. Remove the stopper from the syringe.
2. Install the needle.
3. Draw 1-2ml of the oil into the syringe.

Safety precautions

The buffer oil is not a hazardous substance, but it is recommended to practice good industrial hygiene and safety practice and to use the material in a well-ventilated space.

Recommended handling materials

1. Latex or nitrile gloves
2. Lint-free tissues
3. Protective coat

Degassing the buffer oil

1. Invert the syringe so that the needle is facing up and draw any remaining oil out of the needle.
2. Remove the needle.
3. Purge the air from the syringe.
4. Install the stopper.
5. Reverse the syringe so that the stopper is facing down.
6. Draw the plunger of the syringe past the 10ml point. Install the syringe kickstand so that it cups the plunger and supports it in the drawn position by bracing against the flange on the plunger and the barrel.
7. Leave the syringe in the reverse position for ~1hour.
8. Remove the kickstand.
9. Invert the syringe so that the tip is facing up.
10. Remove the stopper.
11. Purge any air from the syringe.

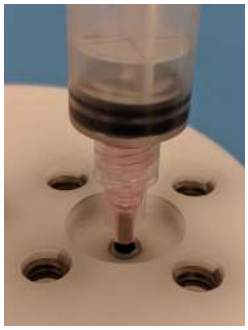
7.4.3 Cleaning the buffer tube

Materials

Item no.	Part name	Image
1	Foam stand	
2	Syringe	
3	18 gauge needle ~5cm long Needle storage tube	
4	Syringe kickstand	

Cleaning the buffer tube by aspirating the buffer oil

Step	Description	Notes
1	Prepare the instrument • Set the RBR*quartz* Q|plus into the foam stand with the MCBH ports slotted into the cutout in the stand. • Remove the antifouling mesh assembly (see: Removing the antifouling mesh assembly).	

Step	Description	Notes
2	Clean the buffer tube assembly • Insert the syringe needle into the buffer tube assembly until the needle's metal barrel is no longer visible. • Draw the plunger of the syringe past the 10ml point and install the syringe kickstand so that it cups the plunger and supports it in the drawn position by bracing against the flange on the plunger and the barrel. • The oil and any particles will be drawn into the syringe, and once the assembly is empty, it will draw air.	 
3	Refill the buffer tube assembly as described in the Refilling the buffer oil section.	

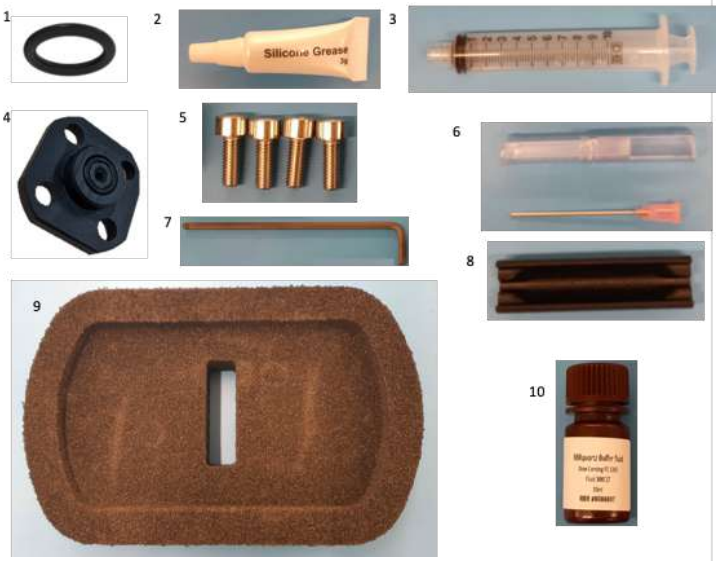
Cleaning the buffer tube by displacement with buffer oil

Debris can be removed from the buffer tube assembly by purging the assembly with buffer oil. This route will consume more oil; however, it may be more effective in some situations.

Step	Description
1	Prepare the instrument and the syringe • Set the RBR*quartz* Q|plus into the foam stand with the MCBH ports slotted into the cutout in the stand(see: above). • Remove the antifouling mesh assembly (see: Removing the antifouling mesh assembly). • Remove the instrument from the foam stand and lay it on its side. • Fill the syringe and degas the buffer oil (see: Filling the syringe and degassing the buffer oil)
2	Clean the buffer tube assembly • Insert the syringe needle into the buffer tube assembly until the needle's metal barrel is no longer visible. • Depress the plunger and flush the buffer tube assembly. • With the syringe still in the pressure port, stand the instrument so the port points up. • While depressing the plunger, remove the syringe.
3	Refill the buffer tube assembly as described in the Refilling the buffer tube assembly section.

7.4.4 Refilling the buffer oil

Materials

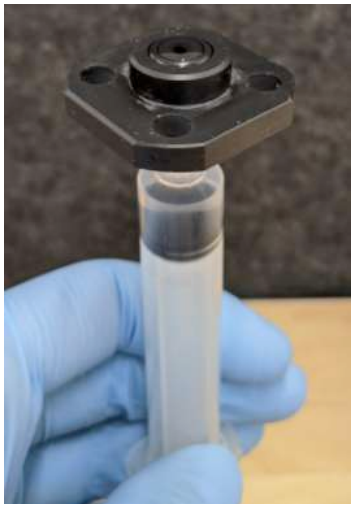
Part name	Image
1. O-ring 2. Silicone grease 3. Syringe 4. Refill adapter 5. M 6 socket head screws (qty 4) 6. Needle ~5cm long 7. 5mm hex 8. Syringe Kickstand 9. Foam stand 10. Dow Corning FS 1265 Fluid 300 cst	

Refilling the buffer oil

Step	Description	
1	Set the RBR*quartz* Q|plus into the foam stand with the MCBH ports slotted into the cutout in the stand.	

Step	Description	
2	Prepare the instrument and refill adapter • Apply a thin film of silicone grease to the O-ring of the refill adapter. • Install the O-ring into the refill adapter as shown in the image of the adapter. • Remove the antifouling mesh assembly (see: Removing the antifouling mesh assembly). • Remove the 4 set screws around the pressure port using the 3mm hex tool	 

3	Fill the buffer tube
	
	• Prepare the syringe by:
	  • Remove the stopper from the syringe.
	  • Install the needle.
	  • Invert the syringe so that the needle is point up.
	  • Purge the air from the needle by depressing the plunger until a drop of oil comes out.
	• Insert the needle into the buffer tube assembly fill it with oil to the top of the set screw.
	• When extracting the needle, continue to apply pressure to the plunger to maintain the oil level.
	  • Note: Ideally, the meniscus at the air-oil interface would be convex to minimize the air in the final assembly.
	• Draw the oil out of the needle and remove the needle.
		

4	Refilling the oil • Install the refill adapter to the syringe. • Invert the syringe so that the refill adapter is pointing up. • Purge the air from the refill adapter by depressing the plunger until a drop of oil sits on the adapter opening. • Note: Ideally, the meniscus at the air-oil interface would be convex to minimize the air in the final assembly.	

Step	Description	
5	Install the refill adapter • Mate the refill adapter to the pressure port. • Install the 4 socket head screws with the 5mm hex tool. Do not apply pressure to the plunger when it is installed on the pressure port, as this can exceed the pressure rating of the sensor.	
6	Degas the system • Draw the plunger of the syringe just past the 10ml mark and install the kickstand onto the plunger. See the image of the complete assembly. Note: The rate of bubbles coming out of the assembly should quickly start to reduce, if not tighten the syringe to the refill adapter and the socket head screws. • Let sit for ~1hr. • Remove the kickstand. • Draw the plunger to the 10ml mark and let it drop. • Repeat this action until no bubbles come out of the assembly after drawing (approximately 10 times).	

Step	Description	
7	Clean up and reassemble • Remove the refill adapter. • Clean any excess oil from the pressure port. • Reinstall the antifouling mesh assembly.	

7.4.5 Installing the calibration adaptor

A calibration adaptor is required when the pressure sensor needs calibration. The following steps provide instruction to install the calibration adapter:

1. Remove the antifouling mesh.
2. Apply a thin layer of grease to the O-ring.
3. Install O-ring into the O-ring groove of the External Pressure Adapter, as shown below.
4. Position the External Pressure Adapter over the instrument's exposed pressure port, as shown in the table below.
5. Install the four screws with a 5mm hex key and hand tighten.

Calibration adaptor parts and assembly (part number: 0008746)

Item No.	Description	Qty	Adaptor	Installation of adaptor
1	External pressure adaptor screws	4		
2	RBR external pressure adapter	1		
3	O-ring	1		

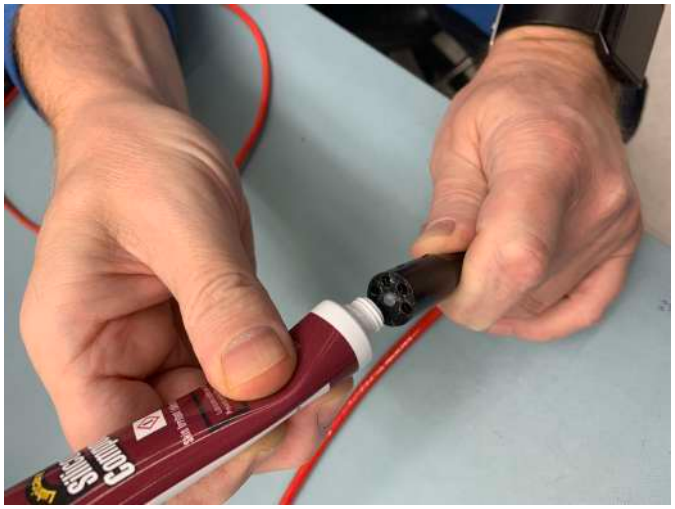
7.5 Cable and connector

7.5.1 Cable bend radius

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

7.5.2 Connector Maintenance

RBR recommends that the female MCBH connector be greased every time a cable or plug is removed and reconnected. This helps prevent connector corrosion and provide easier removal of the cable or plug, reducing the chances of damaging the connection due to mechanical manipulation. The recommend silicon grease is provided in the instrument support kit. When applying, ensure each connector hole is filled with approximately 10% grease.



Greasing the connector

7.6 Calibration

We recommend that you verify the calibration of your instrument before any critical deployment, periodically once a year, or if you suspect the calibration to be out of specifications. Discuss your calibration needs with RBR. In some cases, you will be recommended to return the instrument to RBR to have it checked and re-calibrated. Please contact us for our current calibration fees.

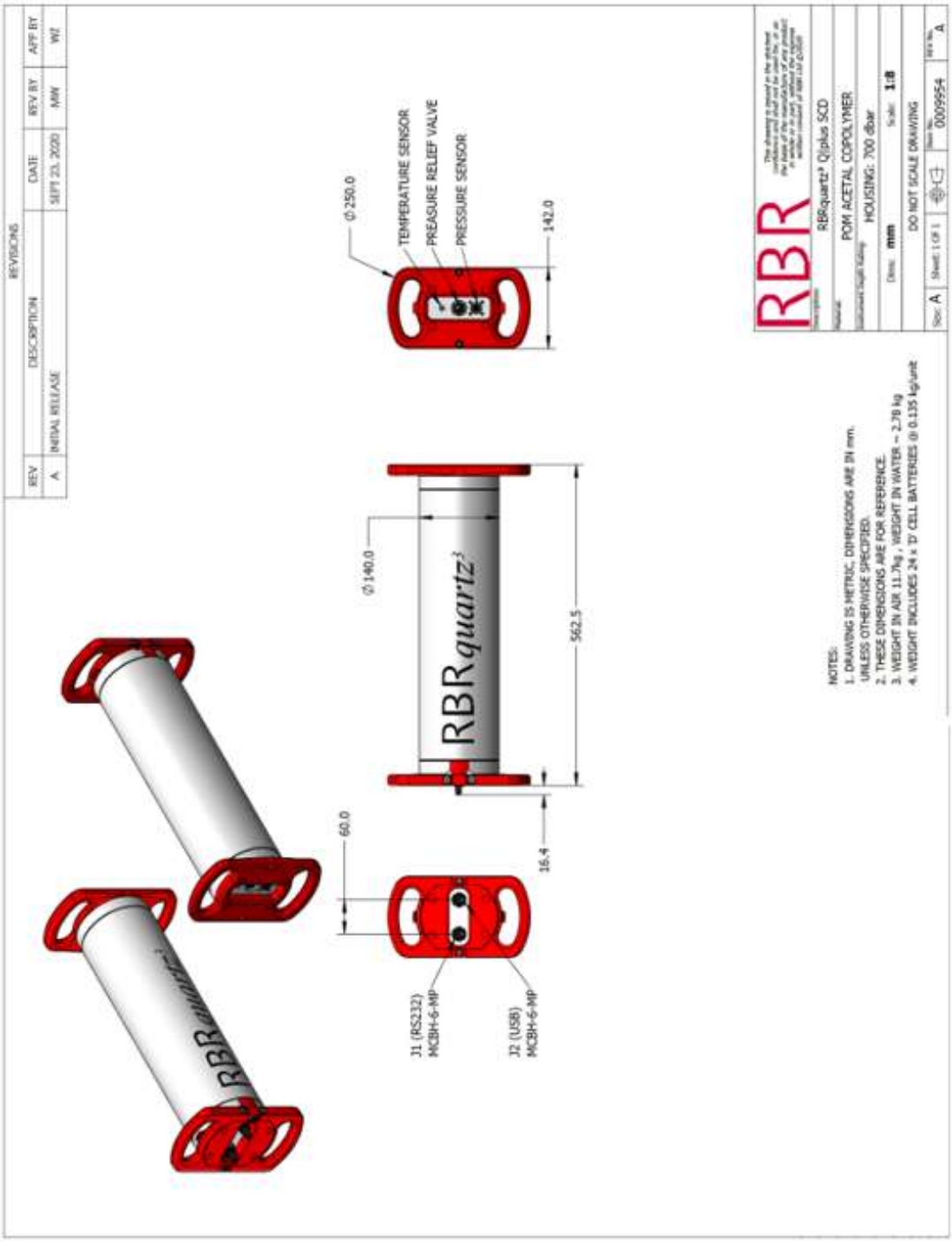
7.7 Repairs

RBR supports all instruments and software manufactured by RBR. Please contact RBR immediately if there are any issues with an RBR supplied product. The RBR support team will work to resolve the issue remotely, if not the instruments can be returned to RBR for further servicing. Please have the model and the serial number of the unit ready when contacting RBR at support@rbr-global.com.

There are no user-repairable parts of the instrument. Whether successful or not, any attempt to repair without prior authorization from RBR will void the warranty. If it is necessary to return the product to RBR for an upgrade, repair, or calibration, please contact support to obtain an RMA and review the detailed shipping information on our website www.rbr-global.com.

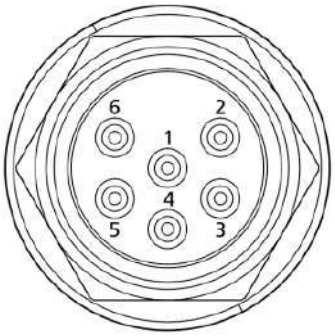
8 Appendices

8.1 Appendix A- Product drawing



8.2 Appendix B- Connector pinouts

8.2.1 MCBH-6-MP connector pinout



MCBH-6-MP

Pin #	USB	RS-232	RS-485
1	Ground	Ground	Ground
2	Power in +4.5 to +30 V	Power in +4.5 to +30 V	Power in +4.5 to +30 V
3	N/C	Tx	Rx-
4	VUSB +5V	Rx	Tx+
5	D-	N/C	Rx-
6	D+	N/C	Tx+