RBR*cervello*

(firmware versions ≤1.17)

INSTRUMENT GUIDE

rbr-global.com

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1 Introduction

The RBR*cervello* is a general-purpose controller designed for use in surface installations. Typically connected to one or more RBR instruments using an inductive modem, it is responsible for archiving logged data locally onto an SD card, as well as optionally uploading that data to the RBR data hosting service via Iridium Satellite or GSM cellular modems.

The most common implementation is with the Del Mar Oceanographic (DMO) Wirewalker™, a wave-powered wire-guided profiling platform manufactured by DMO. This platform can host a variety of instruments, including the RBR*concerto*^{3} and RBR*maestro*^{3}. Longer autonomy deployments can be obtained with the RBR*fermata* underwater battery canisters, which typically extend deployment lifetimes by a factor of forty. The inductive modem uses the jacketed steel mooring line of the WireWalker to communicate to the surface.

The RBR*cervello* controllers have undergone several modifications over the years, progressing from single-modem versions to dual-modem, and eventually incorporating the deep-sleep feature.

- RBR*cervello*, single modem (GSM)
- RBR*cervello*, single modem (RUDICS)
- RBR*cervello*, dual modem (GSM/RUDICS), end-cap with two wired connectors, built-in antennas
- RBR*cervello* Antarctica, dual modem (GSM/RUDICS), deep-sleep feature, end-cap with four wired connectors, external RUDICS and GPS antennas
- RBR*cervello*, dual modem (GSM/RUDICS), deep-sleep feature, end-cap with two or four wired connectors, built-in antennas
- RBR*cervello*, dual modem (GSM/RUDICS), deep-sleep feature, end-cap with four wired connectors, built-in low-profile antennas

This documentation applies to the RBR*cervello* with firmware versions up to 1.17.

1.1 Legacy RBRcervello models

RBR supports all legacy RBR*cervello* models.

Both single-modem versions, RBR*cervello*, single modem (GSM) and RBR*cervello*, single modem (RUDICS), have an Iridium antenna and an end-cap with a solid handle.

Fig. 1. RBRcervello, single modem

1.2 RBRcervello, dual modem

The dual-modem RBR*cervello* version (pre-2023) has an Iridium antenna and an end-cap with opening tabs. It is perfect for mounting on a buoy.

Fig. 2. RBRcervello, dual modem (GSM/RUDICS)

This version supports both LTE/GSM and RUDICS, includes a deep-sleep feature, and may have two or four wired connectors.

Fig. 3. RBRcervello with two wired connectors

Fig. 4. RBRcervello with four wired connectors

1.3 RBRcervello Antarctica

The RBR*cervello* Antarctica is a dual-modem version (GSM/RUDICS). It includes the deep-sleep feature and an end-cap with locking tabs and four wired connectors. External RUDICS and GPS antennas are mounted to these connectors separately. The RBR*cervello* Antarctica is perfect for out-of-water deployments.

Fig. 5. RBRcervello Antarctica

2 Hardware

2.1 Opening and closing the legacy RBRcervello

The legacy single-modem legacy RBR*cervello* models with a simple handle include:

- RBR*cervello*, single modem (GSM)
- RBR*cervello*, single modem (RUDICS)

To open a single-modem legacy RBR*cervello* model, firmly hold the handle and pull out the end-cap.

To close, place the end-cap back on the data controller and push it back on.

Fig. 6. Opening the legacy RBRcervello

2.2 Opening and closing the RBRcervello

The following RBR*cervello* models have an end-cap with locking tabs:

- RBR*cervello* Antarctica, dual modem (GSM/RUDICS), deep-sleep feature, end-cap with four wired connectors, external RUDICS and GPS antennas
- RBR*cervello*, dual modem (GSM/RUDICS), end-cap with two or four wired connectors, built-in antennas

Opening the controller

1. Position the RBR*cervello* upright.
2. Locate and grab the locking tabs on the cap.
3. Pull the tabs to their sides.
4. Pull the internal assembly from the external handle.

Fig. 7. Opening the locking tabs (RBRcervello Antarctica)

Closing the controller

1. Position the RBR*cervello* housing upright.
2. Insert the internal assembly into the housing.
3. Align the locking tabs with the openings on the top of the housing.
4. Press firmly.
5. Lock the tabs back in place.

Fig. 8. Closing the locking tabs (RBRcervello, dual modem)

2.3 RBRcervello Antarctica crate

The RBR*cervello* Antarctica crate contains all the elements needed to deploy the RBR*cervello* controller in dry environments with a mooring line feed. It features cable feed-throughs for a mooring line, an external GPS antenna, and an external Iridium antenna, as well as staples, screws, screwdriver, hex keys, zip ties, castors, and clamps.

Fig. 9. RBRcervello Antarctica crate

Fig. 10. RBRcervello Antarctica crate, open

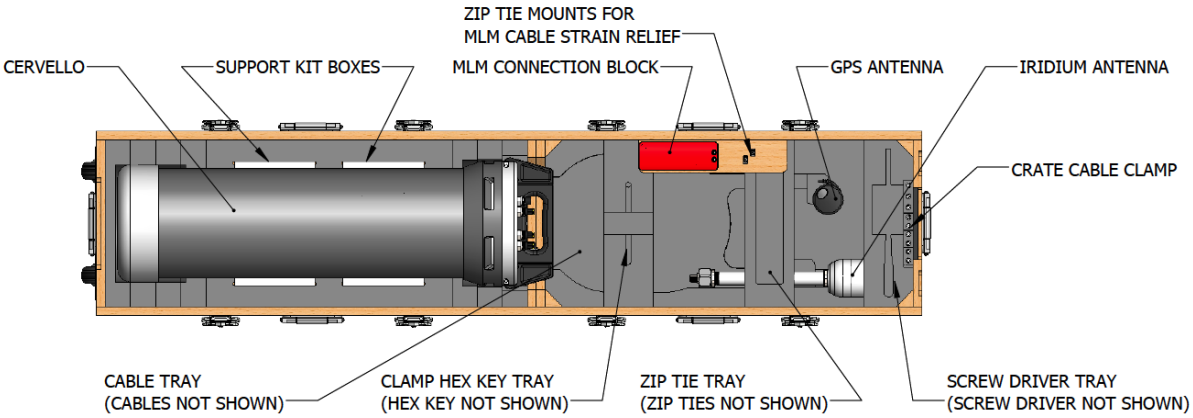

Fig. 11. Contents of the RBRcervello Antarctica crate

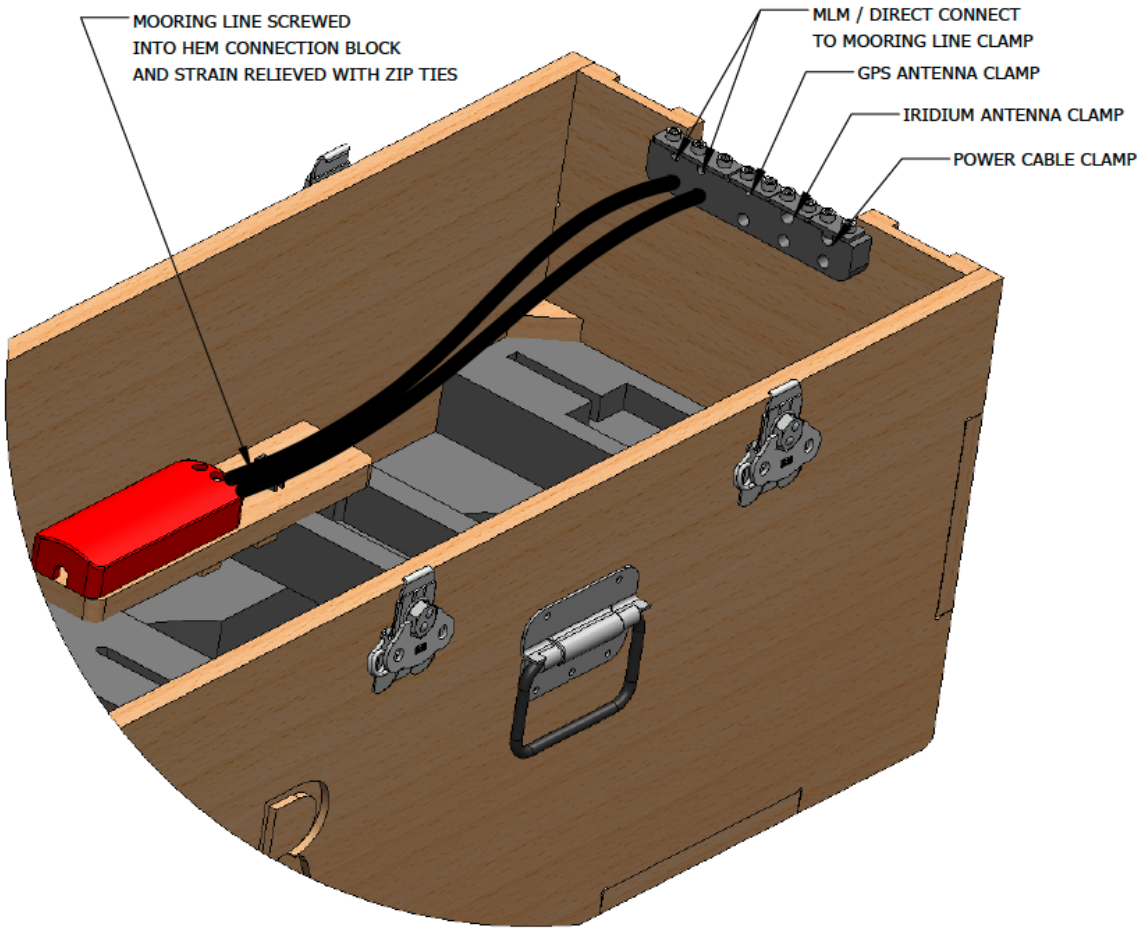

Fig. 12. Connection block for deployment of the RBRcervello Antarctica

3 General maintenance

3.1 Support kit

RBR provides one support kit and one cable kit for every RBR*cervello* ordered.

Fig. 13. RBRcervello support kit

Fig. 14. RBRcervello cable kit

The RBR*cervello* support kit contains an assortment of basic accessories and spare parts, as presented below. If you need more units, contact RBR.

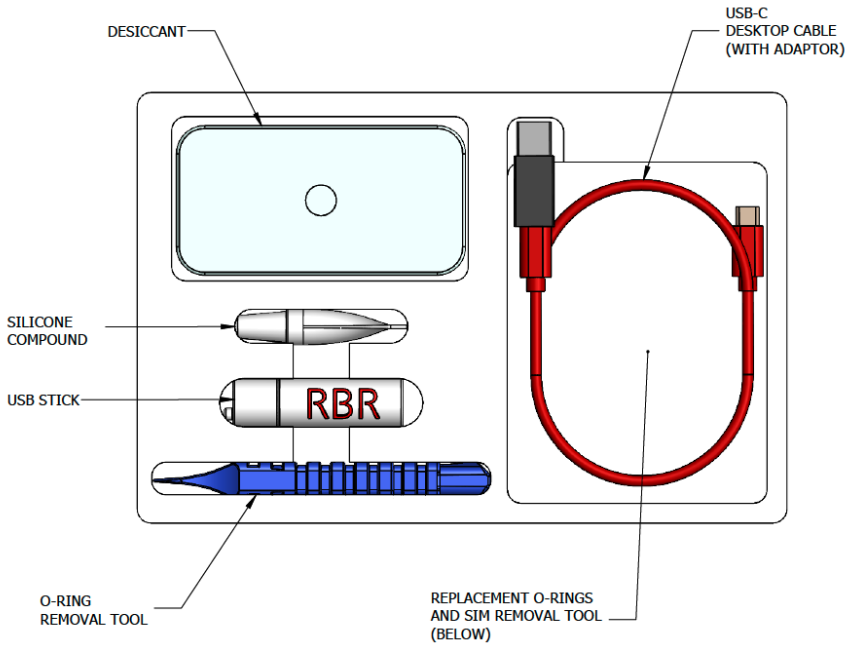

Fig. 15. RBRcervello support kit diagram

The RBR*cervello* cable kit contains the MLM inductive loop cable and MLM inductive test loop termination cable. If you need more units, contact RBR.

Fig. 16. MLM test loop cable

Fig. 17. Termination cable

3.2 Replacing batteries

RBR may ship new RBR*cervello* data controllers with or without lithium thionyl chloride batteries included, depending on your order.

When ordered without the batteries, open your RBR*cervello* and insert the batteries as shown below. Before each deployment, replace the batteries to maximise the operational time and prevent data loss.

To remove the battery pack:

1. Remove the internal assembly from the RBR*cervello*. See Opening the controller.
2. Remove the intermediate foam.
3. Press the switch to the **off** position.
4. Twist the lock counterclockwise.
5. Pull the internal battery pack out and remove it from the internal assembly.

To install a new battery pack:

1. Insert the new battery pack into the RBR*cervello* internal assembly.
2. Insert the intermediate foam on top of the battery pack.
3. Push the battery pack down, into the connector, and twist the lock clockwise.
4. Press the switch to the **on** position.
5. Insert the internal assembly back in the RBR*cervello* housing. See Closing the controller.

Fig. 18. Battery connector

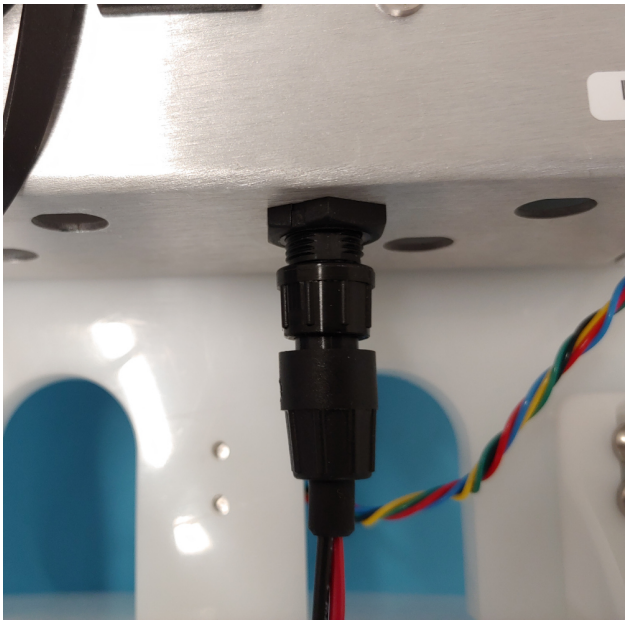

Fig. 19. Lock connector

Fig. 20. Inserted battery and foam

3.3 Replacing desiccant

Replace desiccant before each deployment. One spare desiccant canister is included in the support kit.

Fresh desiccant will keep the RBR*cervello* compartment dry and prevent malfunction. Water damage may occur if condensation forms inside the controller.

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

Replacing the desiccant canister

1. Remove the battery end-cap and pull out the internal assembly. See Opening the controller.
2. Unclip the desiccant canister from the holder.
3. Insert the new desiccant canister into the holder.
4. Insert the internal assembly into the RBR*cervello* housing. See Closing the controller.

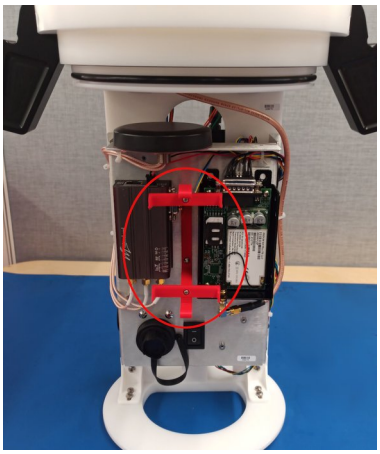

Fig. 21. Desiccant canister holder

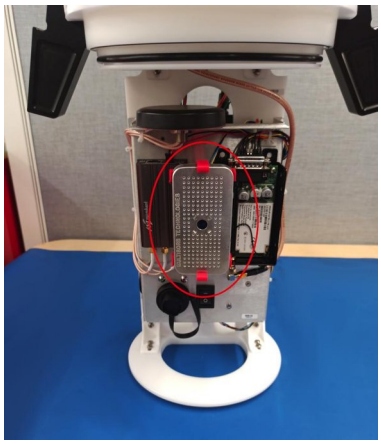

Fig. 22. Desiccant canister fully inserted

3.4 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.

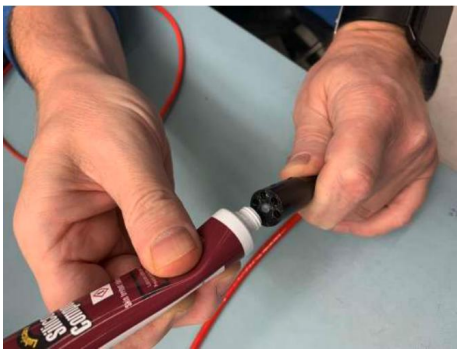

Fig. 23. Applying silicone compound to the female connectors.

Fig. 24. 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 Getting started

4.1 Using the diagnostic port

RBR*cervello* Antarctica and dual-modem

The RBR*cervello* diagnostic port consists of a six-pin bulkhead connector with power and RS-232 connections. It is meant to be used in conjunction with an RBR patch cable with RS-232 electrical connections, like the one provided in the RBR*cervello* Antarctica shipping crate.

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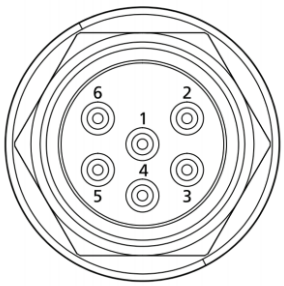
Tools needed

- USB to MCIL-6-FS cable (provided)
- Computer with a USB port
- Serial terminal

External MCBH-6-MP diagnostic connector pinout



Pin No.	RS-232
1	Ground
2	Power +9 to +22 V
3	Data output from the instrument (Tx)
4	Data input into the instrument (Rx)
5	N/C
6	N/C

Serial terminal

RBRcervello serial settings

- 115200baud
- 8bit, no parity-bit, 1 stop-bit: 8N1
- No flow control

Use a terminal emulator to communicate with the *RBRcervello* through its diagnostic/debug port.

Windows

On a Windows-based workstation, use any terminal emulator console that supports a serial port, such as Tera Term.

Tera Term

Tera Term is an open-source terminal emulator that lets you connect to hosts via serial port or the network. The default settings should work with the *RBRcervello* interface. In the unlikely event when they do not, load the configuration file provided below using the **Setup→Restore setup** menu.

Teraterm_RBRcervello.INI

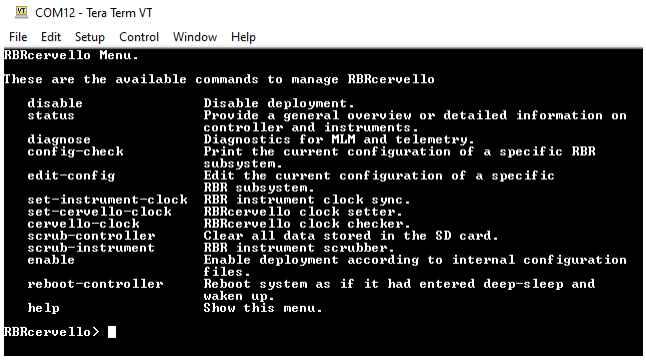
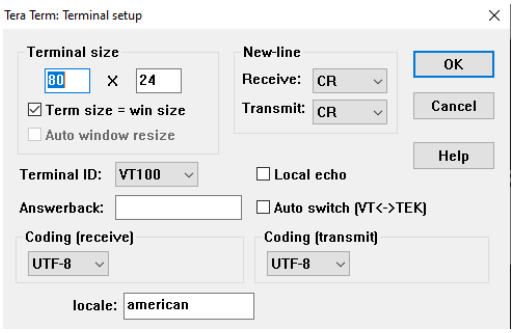


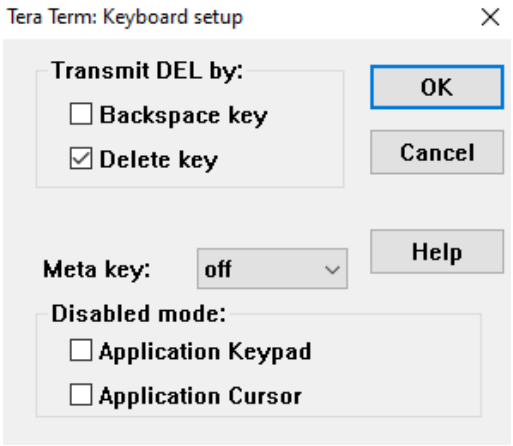
Fig. 25. Tera Term

Alternatively, configure the settings manually as follows:

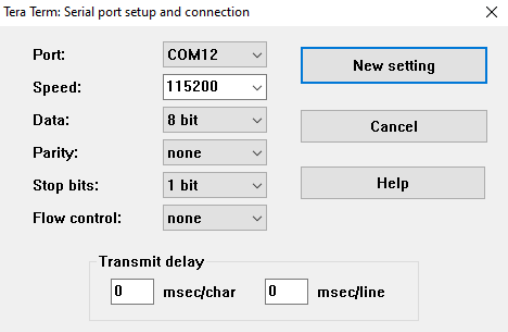
- In **Setup→Terminal setup** menu, enter the terminal size:



- In **Setup→Keyboard setup** menu, select **Delete key**:



- In **Setup→Serial port setup and connection** menu, select the correct COM port:



Highlighting text on the terminal automatically copies it to the clipboard. Right-clicking on the terminal will paste the saved text on it.

Linux

On a Linux-based workstation, use any terminal emulator console that supports a serial port, such as Minicom.

Minicom

Minicom is a serial communication program that connects to devices through a GNU/Linux serial ports. Use the `-s` command to set up the terminal with the right port and settings, or execute it with explicit settings at runtime with the correct device:

```
1 minicom -b 115200 -D /dev/ttyUSB0
```

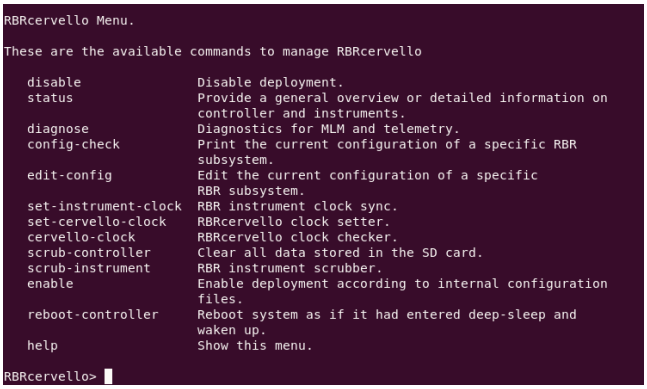


Fig. 26. Minicom

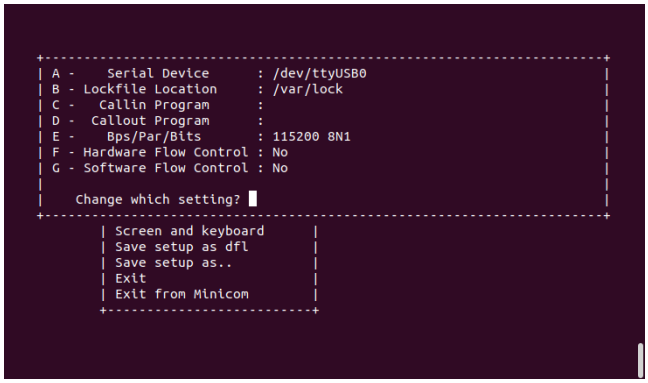


Fig. 27. Minicom serial settings

To copy and paste text from and to a Linux terminal, use Ctrl+Shift+C and Ctrl+Shift+V.

Diagnostic menu overview

Access the RBR*cervello* menu via the diagnostic port using an RS-232 interface (115200 8N1). It is a fully-featured Bash terminal (Restricted Bash) with **tab** completion. To see the list of available commands, execute the `help` command. You will find all you need to deploy the RBR*cervello* with the RBR instruments. As a quick in-menu reference, each command displays a short manual when executed with the `-h` or `--help` argument.

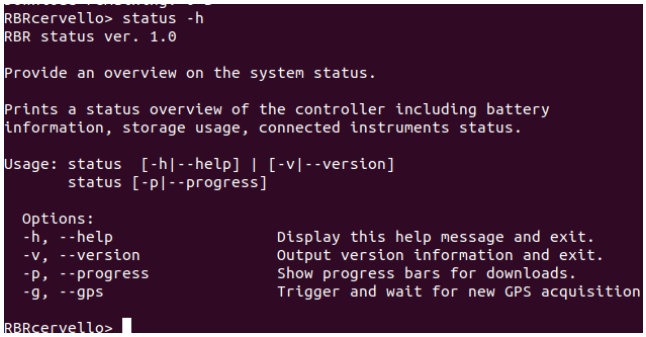


Fig. 28. `status` *help*

```
RBRcervello Menu.

These are the available commands to manage RBRcervello

   disable               Disable deployment.
   status                Provide a general overview or detailed information on
                         controller and instruments.
   diagnose              Diagnostics for MLM and telemetry.
   transparent-link      Establish a transparent link to an instrument
                         serial port.
   config-check          Print the current configuration of a specific RBR
                         subsystem.
   edit-config           Edit the current configuration of a specific
                         RBR subsystem.
   set-instrument-clock  RBR instrument clock sync.
   set-cervello-clock    RBRcervello clock setter.
   cervello-clock        RBRcervello clock checker.
   scrub-controller      Clear all data stored in the SD card.
   scrub-instrument      RBR instrument scrubber.
   enable                Enable deployment according to internal configuration
                         files.
   reboot-controller     Reboot system as if it had entered deep-sleep and
                         waken up.
   help                  Show this menu.
```

See the Diagnostic menu section for more information.

4.2 Telemetry

All new RBR*cervello* data controllers are equipped with a GSM/RUDICS dual modem.

Some legacy data controllers may only have the GSM-only modem integrated. See below for details on setting up your telemetry options, depending on your modem type.

LTE/GSM

Before LTE/GSM telemetry can function, a SIM-card equipped with a data plan must be installed into the RBR*cervello*.

> ⚠ The end-user is responsible for provisioning a SIM-card and a data plan for use with the RBR*cervello*. To determine specific data quota requirements for your deployment scenario, please contact RBR.

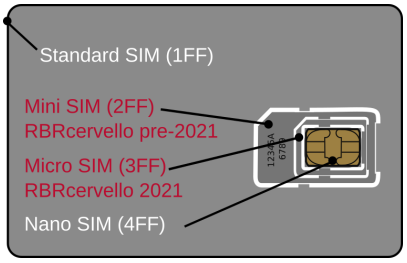


Fig. 29. SIM-card comparison (Wikipedia)

Fig. 30. Legacy GSM modem, isolated with the SIM-card slot highlighted

Fig. 31. GSM/RUDICS dual modem pre-April 2021

Fig. 32. GSM/RUDICS dual modem post-April 2021

Supported bands

Legacy GSM-only	UMTS/HSPA FDD Bands (Bands 1,2,4,5,6,8)
GSM/RUDICS dual modem, pre-202	LTE FDD (Bands 2,4,5,12,13,14,66,71) WCDMA (Bands 2,4,5)
GSM/RUDICS dual modem, 2021	LTE FDD (Bands 1,2,3,4,5,7,8,12,13,18,19,20,26,28) LTE TDD (Bands 38,39,40,41) WCDMA (Bands 1,2,4,5,6,8,19) GSM (Bands 2,3,5,8)

Accessing the LTE/GSM modem

Tools needed

For legacy, GSM-only data controllers (to open the main RBR*cervello* enclosure):

- 2.5mm hex key
- Philips #2 screwdriver

For dual modems manufactured after April 2021:

- SIM removal tool (included in the support kit)

A LTE/GSM modem is integrated into the RBR*cervello*. Its location varies based on whether you have a legacy, GSM-only RBR*cervello* data controller variant or a GSM/RUDICS dual-modem data controller.

Legacy, GSM-only

1. Pull the handle straight up and remove the internal assembly from the housing.

   Mounted in the middle section of the internal frame are two black enclosures. The smaller of these is the head-end modem (HEM) of the mooring line modem (MLM) inductive modem system. The larger contains the RBR*cervello* processor and the LTE/GSM modem.
2. Disconnect the cables from the top and bottom of each enclosure.
3. Remove the four 2.5mm hex screws holding the HEM in place.
4. Remove the HEM.
5. Remove the four Philips #2 screws from the lid of the main RBR*cervello* enclosure.
6. Remove the lid.

   The LTE/GSM modem is the topmost component in the main enclosure.

GSM/RUDICS dual modem

1. Flip the two tabs on the top handle outwards
2. Pull the handle straight up to remove the internal assembly.

3. Rest the internal assembly on the lip of the housing.
4. Disconnect the battery connector.
5. Remove the internal assembly fully and rest it on a flat work surface.
6. Orient the internal assembly with the HEM facing upwards.

   The LTE/GSM modem will be directly above the LEDs.

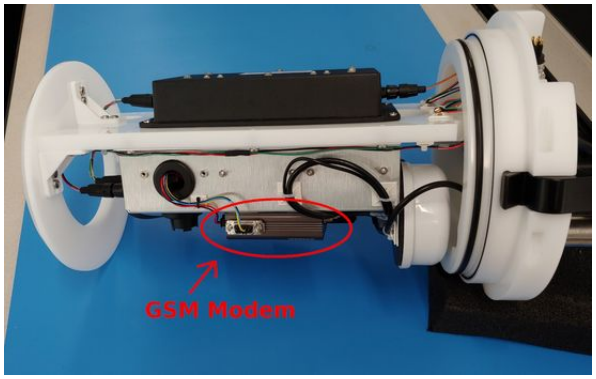


Fig. 33. RBRcervello, GSM/RUDICS dual modem, pre-April 2021

The GSM modem accepts a mini SIM-card (2FF).

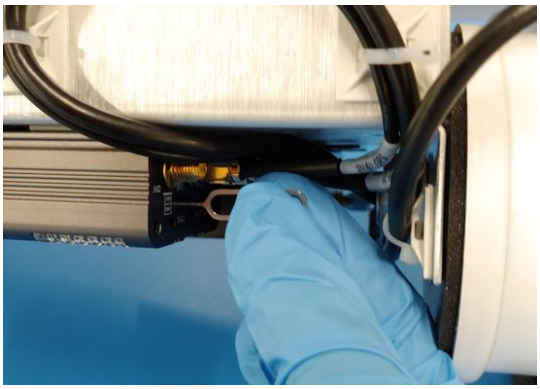
Once you have located the modem, insert the mini SIM-card into the SIM-card slot, oriented as indicated by the label on the modem.

RBRcervello, GSM/RUDICS dual modem, manufactured after April 2021

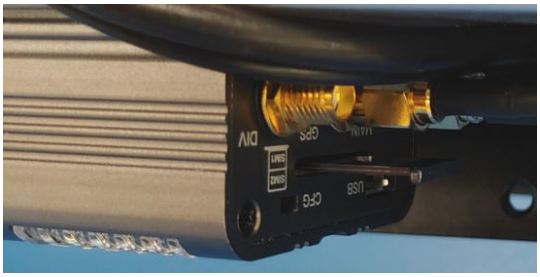
The LTE/GSM modem accepts a micro SIM-card (3FF).

1. Locate the pinhole in the SIM tray.

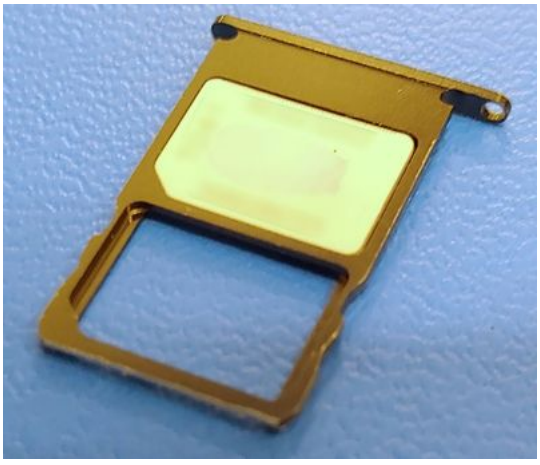
2. Insert the SIM removal tool as straight as possible into the pinhole and push. The tray will pop out.



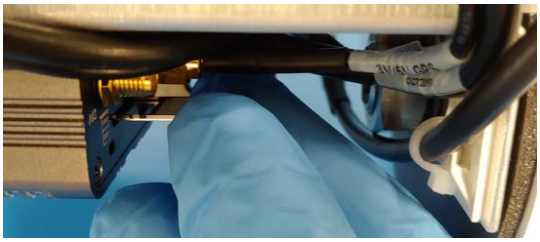
3. Pull the tray out of the modem.



4. Put the micro SIM-card into the SIM1 position, with the electrical contacts facing down.



5. Insert the tray with the SIM-card installed and its electrical contacts facing downward. Handle it with care to prevent the SIM from falling out of the tray.



6. Push the tray in until flushed with the modem's chassis. Avoid moving the RBR*cervello* until the tray is fully inserted to prevent the SIM from falling out of place.

Most cellular providers require no further configuration. If telemetry difficulties arise, or if you know your provider requires additional APN configuration, please contact RBR.

Iridium RUDICS

For RBR*cervellos* equipped with Iridium RUDICS telemetry, a fixed SIM-card is already installed. This SIM-card can be used worldwide with airtime services provided by MetOcean Telematics. If you would like to use another airtime provider, please inform RBR before ordering.

Unlike Iridium SBD, where data recipients are configured on a per-device basis, RUDICS modems are associated with a shared configuration, known as a "RUDICS group". If you subscribe to airtime services through MetOcean Telematics and are using RBR-provided data hosting, you can use RBR's RUDICS group: `JOUBEH_RBRCERVELLO_STD_PROD` for US-based data hosting (https://data.rbr-global.com) or `JOUBEH_RBRCERVELLO_2_STD_PROD` for China-based data hosting (https://data.rbr.cn). Otherwise, you will need to set up a RUDICS group through your provider of choice. A setup fee for the group will apply. To use your data controller with RBR data hosting, the RUDICS group configuration is as follows:

United States-based data hosting

RUDICS type	standard (Standard or PPP)
Mobile-originated terminating IP	34.194.96.152
Mobile-originated terminating port	9140
Mobile-terminated originating IP	34.194.96.152 (not currently used by RBR)

China-based data hosting

RUDICS type	standard (Standard or PPP)
Mobile-originated terminating IP	54.223.67.137
Mobile-originated terminating port	9140
Mobile-terminated originating IP	54.223.67.137 (not currently used by RBR)

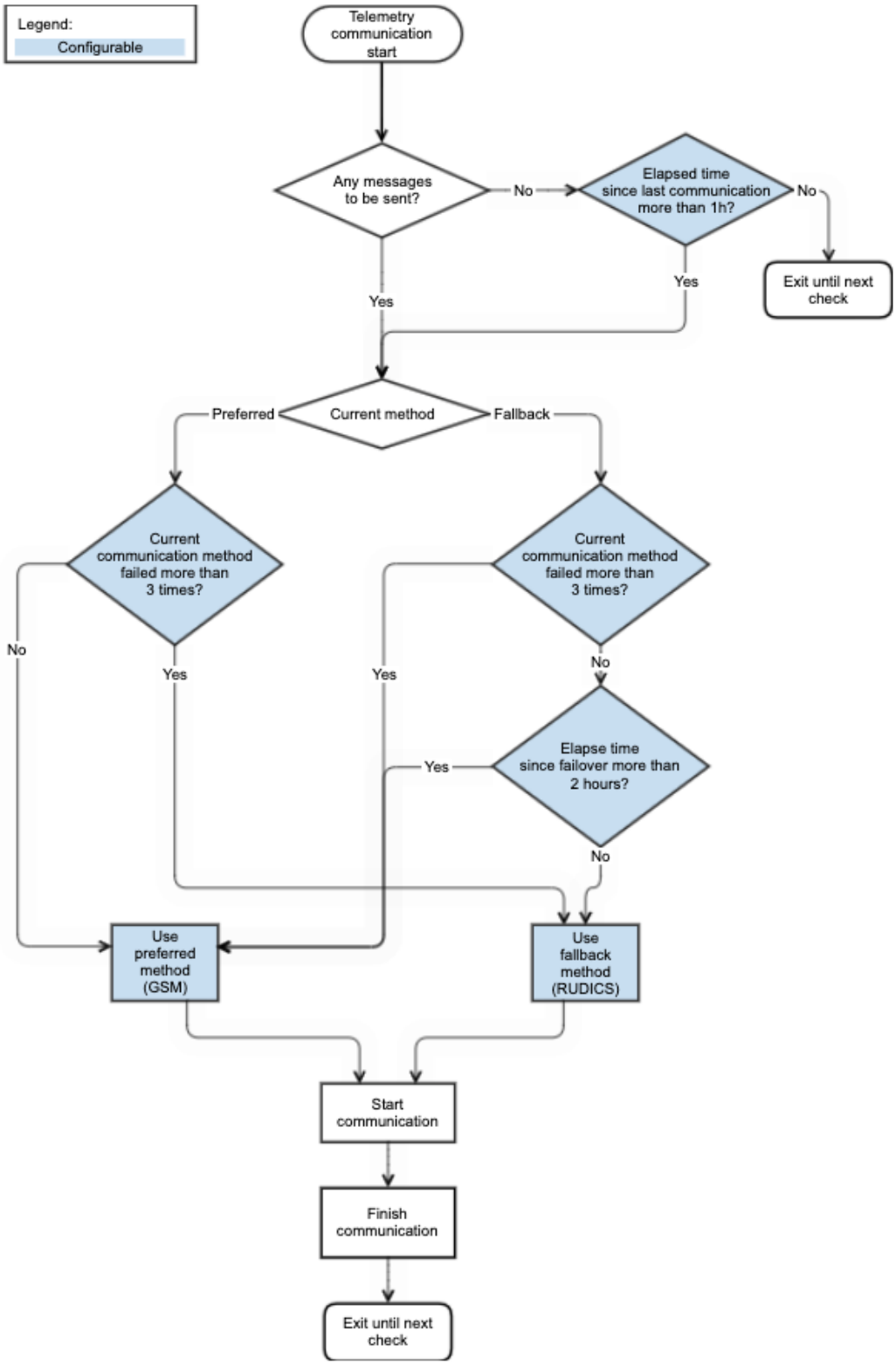
Upon setup, indicate to your airtime provider:

- the RUDICS group name to provision against
- the unique ID (ICCID) of the SIM card installed in the modem

Contact RBR support to determine the ICCID of your SIM-card. The IMEI of the modem is not required, as that is only necessary for provisioning SBD service, which is not used by the RBR*cervello*.

Failover

RBR*cervellos* equipped with a dual modem have a failover mechanism which determines its communication method. Usually the preferred method would be GSM, due to lower cost and faster speeds, and the fallback method would be Iridium RUDICS.


Legend:
Configurable
Telemetry communication start
Any messages to be sent?
No
Elapsed time since last communication more than 1h?
No
Exit until next check
Yes
Yes
Current method
Preferred
Fallback
Current communication method failed more than 3 times?
No
Yes
Current communication method failed more than 3 times?
Yes
No
Elapse time since failover more than 2 hours?
Yes
No
Use preferred method (GSM)
Use fallback method (RUDICS)
Start communication
Finish communication
Exit until next check

4.3 Deployment preparation

Configuration

Each RBR*cervello* is configured by RBR to work with a specific instrument. For details particular to your instrument or to change the configuration, please contact RBR.

To estimate power and telemetry requirements use the RBRcervello Deployment Calculator.

Use your instruments or sub-surface modems (SSM) only with a properly configured data controller.

Failure to configure the RBR*cervello* with correct deployment parameters may compromise your mission. At best, invalid data will be reported; at worst, the deployment will be unsuccessful.

Bench testing dual-modem RBR*cervello*

Tools needed

- A computer running Ruskin
- A USB cable as appropriate to connect your instrument (RBR*concerto*^{3} or RBR*maestro*^{3}) to your computer
- A test loop for the MLM
- An RS-232 patch cable

An end-to-end bench test of the system will exercise all of its individual components and confirm that:

- The RBR*cervello* telemetry modems (GSM and Iridium RUDICS) are operational
- The mooring line modem (MLM) and head-end modem (HEM) can communicate with the sub-surface modems (SSM)
- The RBR*cervello* can communicate with the instrument via the MLM

To bench-test the system, connect all of its components together:

1. Remove the internal assembly of the RBR*cervello* from the housing (optional).
2. Connect the MLM test loop cable to the RBR*cervello* (**DIRECT CONNECT** or **TO HAMMERHEAD**, depending on your model).
3. Connect the instrument to its ferrite holder.
4. Pass the test loop through the ferrite holder.
   The loop does not need to make contact with any part of the holder: passing through the middle of the ferrite is all that is required for functionality.
5. Connect the MCIL-6-FS end of the patch cable to the diagnostic port.
6. Connect the USB end of the patch cable to your computer.
7. Connect the batteries in the lower section of the internal frame of the RBR*cervello* to the connector labeled “Battery”.
8. Turn the switch on, if not done already.
   In case the RBR*cervello* was already powered, press any key while in the serial terminal to wake it up. The RBR*cervello* will boot up. This process will take up to two minutes. When booted, the data controller will search for and connect to an available instrument, and determine whether it needs to download any data from it.
9. Once in the terminal, run the three basic diagnostic tasks: MLM, GSM, and RUDICS.

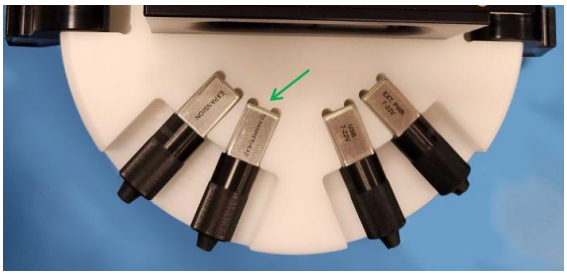


Fig. 34. TO HAMMERHEAD port

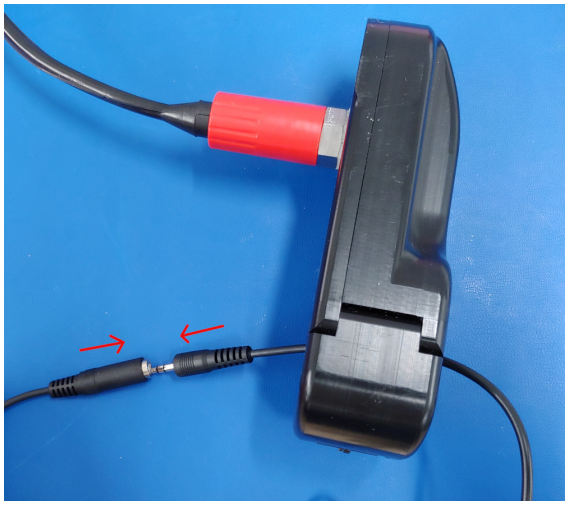


Fig. 35. MLM test loop through ferrite holder

Bench testing legacy single-modem RBR*cervello* models

Tools needed

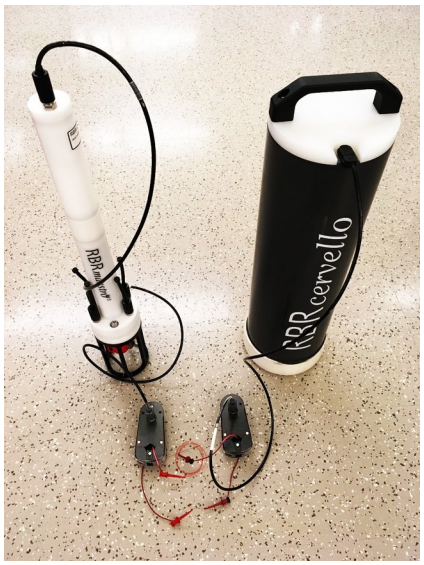
- A computer running Ruskin
- A USB cable as appropriate to connect your instrument (RBR*concerto*^{3} or RBR*maestro*^{3}) to your computer
- A test loop for the MLM

An end-to-end bench test of the system will exercise all of its individual components and confirm that:

- The RBR*cervello* telemetry modems (LTE/GSM and Iridium RUDICS) are operational
- The mooring line modem (MLM) and head-end modem (HEM) can communicate with the sub-surface modems (SSM)
- The RBR*cervello* can communicate with the instrument via the MLM

Before beginning the test, ensure that the instrument (RBR*concerto*^{3} or RBR*maestro*^{3}) has been stopped, and its memory is empty. This practice should always be followed where possible before connecting an instrument to an RBR*cervello*: if the amount of data stored in the instrument is below a configured threshold, the data controller will attempt to download it before starting a new deployment; if there is a lot of data in memory, this can cause a considerable delay.

1. Uncouple the SSM from the instrument by unscrewing them at the coupler. Unscrew from the instrument side, then carefully disconnect the umbilical cable running between the two.
2. Connect the instrument to a computer via USB and open Ruskin.
3. Go to the **Configuration** tab.
4. If the instrument is logging, click **Stop** to stop it.
5. Click the **UTC** button to synchronize the instrument clock to UTC time.
6. Click **Enable** to start a new deployment. You may need to reconfigure the deployment end time before Ruskin will allow you to enable the instrument; any end time is acceptable as this will be reconfigured by the RBR*cervello*.
7. Stop the instrument again. This ensures that only a negligibly short deployment is stored within instrument memory.
8. Disconnect the instrument from the computer, reconnect the umbilical cable to the SSM, and recouple the SSM and instrument.



To bench test the system, connect all of its component pieces together: connect the instrument and RBR*cervello* to their respective ferrite holders, and the ferrite holders to each other via a test loop consisting of a length of wire (of any length as physically convenient) or mooring line with the ends coupled and a 50Ω resistor placed inline.

- For convenience, remove the internal assembly of the RBR*cervello* from the external tube.
- Pass the test loop through the ferrite holders. The loop need not be held tightly by the anti-strumming bar, nor does it need to make contact with any part of the holder: passing through the middle of the ferrite is all that is required for functionality.

Then, connect either of the batteries in the lower section of the internal frame of the RBR*cervello* to either of the adjacent connectors labeled “Battery”. The RBR*cervello* will then boot. This process will take up to two minutes. After the data controller has booted, it will search for and connect to an available instrument, determine whether it needs to download any data from the instrument, and then start a new deployment.

- If the MLM is operating, you should hear the ferrite holders “chirping”: short bursts of low volume, medium-pitch, audible noise.
- If there are optical sensors on the instrument, you will see them light up when the data controller starts the deployment and as the instrument continues sampling.
- The data controller will send collected instrument data and its own diagnostic data (battery levels, GPS position)

every half-hour after the deployment has started. Data will appear within a few minutes of this telemetry event on the data hosting webpage for the RBR*cervello* and instrument. To determine the data hosting URLs for your data controller and instrument, please contact RBR.

Diagnosing MLM

In the terminal window, press **Enter** a couple of times and wait for the `RBRcervello>` prompt. Type `diagnose mlm` and press **Enter**. Immediately, the MLM test routine will start running. This routine will assess communication with the HEM and SSM attached to the line, check their configuration, and perform a bit-error-rate test.

Follow the instructions on the screen as sometimes it prompts for user interaction.

```
RBRcervello> diagnose mlm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting MLM test
I think the HEM is on /dev/ttyS3 at 115200 baud.
Trying to wake the HEM...
RBR HEM-1000 1.300 208882
Found HEM 208882.
HEM firmware version 1.300 >= 1.300.
commands now unlocked
Checking HEM configuration...
Checking: baud rate BAUD: 115200
Setting: baud rate BAUD: 115200.
.
.
.
Setting: ber pattern BERPAT: RAND
Checking: ber length (bytes) BERLEN: x0800
Setting: ber length (bytes) BERLEN: x0800
Ensuring there is no open SSM channel before attempting any channel activity...
No previously open channel.
Attempting SSM discovery:
Found SSM 999888
Found SSM 989989
Discovery complete
Waiting for channel cooldown...
.
.
.
MLM communication looks good.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

Diagnosing LTE/GSM modem

This test requires the RBR*cervello* to have an activated SIM-card installed in the LTE/GSM modem as described in Telemetry. If LTE/GSM is not going to be used in this deployment, this test can be omitted.

After finishing the previous test, wait for the `RBRcervello>` prompt to appear again. Type `diagnose gsm` and press enter. The LTE/GSM test will wait for any ongoing communication to finish and will diagnose the connection to the internet via the LTE/GSM modem.

```
RBRcervello> diagnose gsm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting GSM test
I think the GSM modem is on /dev/ttyS4 at 230400 baud.
Waiting for the modem to come up...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: 867698099999999
IMSI: 302720599999999
ICCID: 89302720512345678987
Waiting for the modem to connect to the GSM network....
Reconnecting for Internet access (1/2)...
Bringing PPP connection down...
Bringing PPP connection back up...
Waiting for the PPP connection to become the default route
Making sure we can access the web...
The modem connection is up.
Brought the gsm connection up successfully.
/usr/local/wirewalker-
controller/diagnostics/../publisher/modes/gsm/netpty/bin/netpty:
socket was closed
messages-read: no process found
netpty: no process found
The serial link has been brought down.
Powering off the modem.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

Diagnosing RUDICS

The RUDICS diagnostic task will test the entire communication pathway to the Iridium Satellite network. For this test to succeed, the RBR*cervello* needs to be positioned outdoors, with a clear view of the sky and with as few obstructions as possible.

After the `RBRcervello>` prompt appears again, type `diagnose rudics` and press enter. This routine will turn on the RUDICS modem and then will attempt to dial to the Iridium network as configured in Telemetry. It can identify failures in the modem, signal strength, or activation issues of the SIM-card.

```
RBRcervello> diagnose rudics
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting RUDICS test
I think the RUDICS modem is on /dev/ttyS4 at 2400 baud.
Waiting for the modem to come up...
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:26:24 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:26:24 src/teraform.c:367 [INFO ]: Dial number: "0088169999999"
2021-11-12 20:26:24 src/teraform.c:388 [INFO ]: Configuring modem...
2021-11-12 20:26:24 src/teraform.c:432 [INFO ]: Waiting for modem to be available...
```

```
2021-11-12 20:26:24 src/teraform.c:451 [INFO ]: Checking IMEI...
2021-11-12 20:26:24 src/teraform.c:451 [INFO ]: IMEI: 300125099999999
2021-11-12 20:26:24 src/teraform.c:478 [INFO ]: Checking ICCID...
2021-11-12 20:26:24 src/teraform.c:478 [INFO ]: ICCID: 8988169999999999
2021-11-12 20:26:24 src/teraform.c:488 [INFO ]: Disabling flow control...
2021-11-12 20:26:25 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:26:31 src/teraform.c:520 [INFO ]: Found signal of strength 5/5.
2021-11-12 20:26:31 src/teraform.c:530 [INFO ]: Configuring data connection...
2021-11-12 20:26:31 src/teraform.c:564 [INFO ]: Dialing data connection...
2021-11-12 20:26:40 src/teraform.c:564 [INFO ]: Connection dialed.
The modem connection is up.
Brought the rudics connection up successfully.
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:26:40 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:26:43 src/teraform.c:584 [INFO ]: Escaping from data call...
2021-11-12 20:26:44 src/teraform.c:594 [INFO ]: Disconnecting data call...
The serial link has been brought down.
Powering off the modem.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

If any of the tests result in failure, go to troubleshooting, or contact RBR support.

Clearing the controller and instruments

Before deployment, clear all data from the RBR*cervello* and the instruments that would be attached to it.

Clearing the data is also known as "scrubbing". Commands are provided in the diagnostic menu for scrubbing the instrument and the controller. Both commands require the RBR*cervello*'s deployment to be disabled.

Follow the steps below.

1. Disable the RBR*cervello* using the `disable` command.

```
RBRcervello> disable
Deployment stopped
```

2. Clear the memory in all instruments attached using the `scrub-instruments -a` command. This might take several minutes, depending on the number of instruments.

```
RBRcervello> scrub-instrument -a
Clearing memory...
Instrument 01: success
Instrument 02: success
```

3. Re-check the status of the instruments using the `status` command.

```
RBRcervello> status
RBRcervello
Serial number: 208685
Part number: 0011493
Cervello firmware version: 1.16.0
Clock: 2021-10-29 02:24:35
Cervello status: disabled
Cervello internal battery: 13.68 V
Cervello external battery: 1.31 V
```

```
Storage used : 168 MB
Storage remaining: 14355 MB
Storage size : 15299 MB
Telemetry last update: 2021-10-29 02:00:09
Telemetry last result: success
Telemetry last mode : rudics
GPS last update : 2021-10-29 02:17:59
GPS last result : fixacquired
GPS last known position: 45.349128 -75.917473
Instrument 01 last update : 2021-10-29 02:24:06
Instrument 01 : disabled
Instrument 01 internal battery: 5.11 V
Instrument 01 external battery: 0.00 V
Download remaining: 0B
```

4. Clear the data from the RBR*cervello* using the `scrub-controller` command.

```
RBRcervello> scrub-controller
Are you sure you want to scrub the controller? (y/N)y
Removing files from
/mnt/sdcard/data...
/mnt/sdcard/logs...
/mnt/sdcard/lost+found...
/mnt/sdcard/messages...
/mnt/sdcard/publisher...
/mnt/sdcard/queues...
/mnt/sdcard/responses...
/mnt/sdcard/tasks...
```

If the instrument does not seem to start, go to troubleshooting, or contact RBR support.

4.4 Deploying the RBRcervello Antarctica

Installing the RBR*cervello* Antarctica on site

Follow the steps below to set up the RBR*cervello* Antarctica on site.

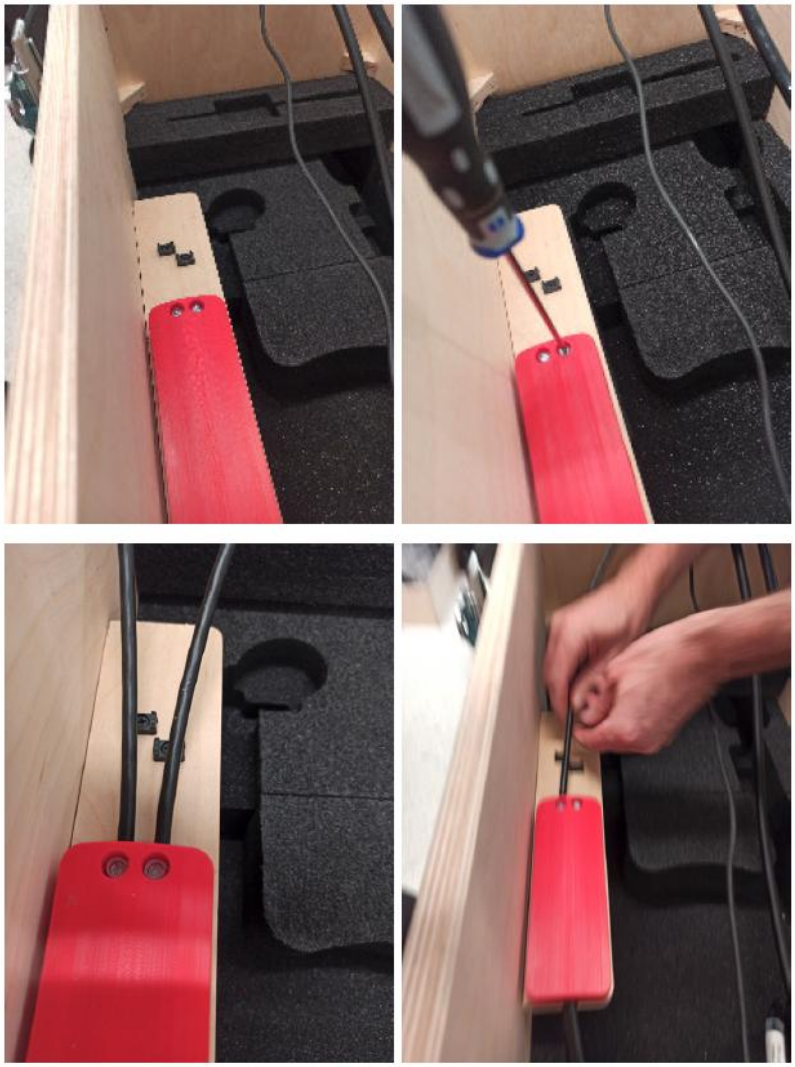
Tools needed

- 5mm hex key
- Philips #2 screwdriver
- zip ties
- cutting tool (not included!)

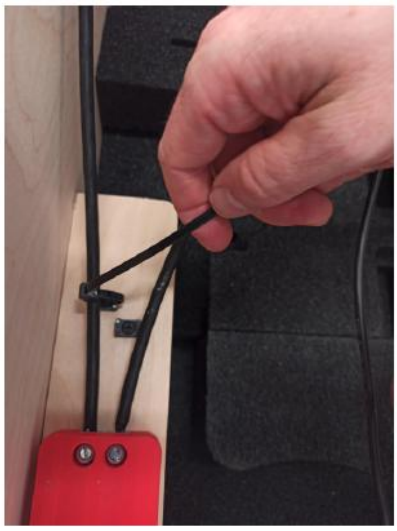
1. Open the crate.
2. Install the mooring line modem (MLM) lines.

a. Cut the mooring line to the appropriate length to fit in the crate.
b. Strip both ends of the line by approximately 1cm.

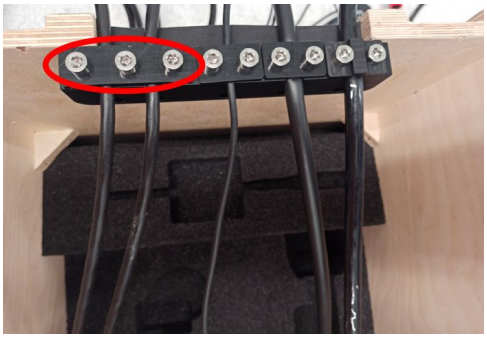
c. Attach each of the MLM lines to the MLM lines junction box. Use the screwdriver provided.



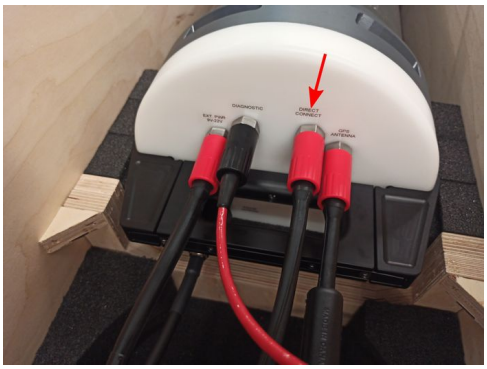
d. Secure each of the MLM lines to the crate. Use the zip ties provided.



e. Secure each of the MLM lines to the crate using their dedicated clamping slot. Use the 5mm hex key provided.



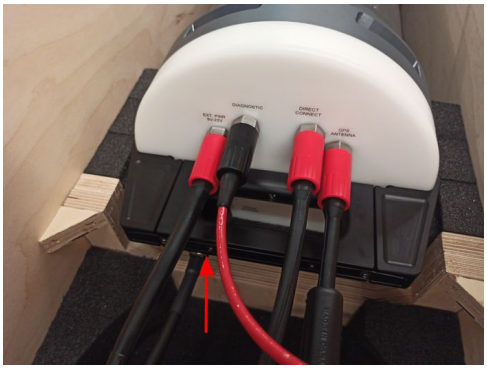
f. Attach the MLM lines junction box cable to the RBR*cervello* end-cap. Use the connector labeled "DIRECT CONNECT".



3. Install the Iridium antenna.

a. Attach the Iridium antenna to its cable.

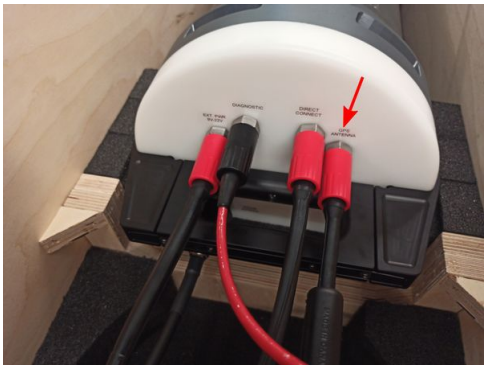
b. Attach the Iridium antenna cable to the RBR*cervello* end-cap. Use the connector labeled "IRIDIUM ANTENNA".



c. Secure the Iridium antenna cable to the crate via its dedicated clamping slot. Use the 5mm hex key provided.

4. Install the GPS antenna.

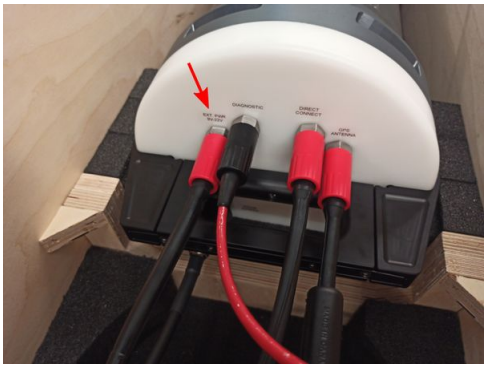
a. Attach the GPS antenna to the RBR*cervello* end-cap. Use the connector labeled "GPS ANTENNA".



b. Secure the GPS antenna cable to the crate via its dedicated clamping slot. Use the 5mm hex key provided.

5. Install the external power source (if applicable).

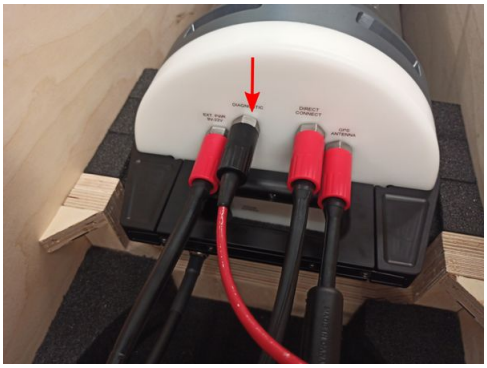
a. Attach the external power cable to the RBR*cervello* end-cap. Use the connector labeled "EXT. PWR".



b. Secure the external power cable to the crate via its dedicated clamping slot. Use the 5mm hex key provided. Note that the tab of the slot has two different sides to accommodate 6.3mm and 9.5mm cable diameters.

Enabling the RBR*cervello*

1. Attach the provided patch cable to the RBR*cervello* end-cap. Use the connector labeled "DIAGNOSTIC".



2. Follow the steps in Using the diagnostic port to set up the terminal and access the RBR*cervello*'s menu.
3. Enable the RBR*cervello* by using the `enable` command.
4. Use the `status` command to check the status of all instruments attached to the mooring line. Verify that they are all logging.

> ⚠ The instrument status updates can take up to 20 minutes, depending on the number of instruments attached to the MLM line.

```
RBRcervello> status
RBRcervello
Serial number: 208685
Part number: 0011493
Cervello firmware version: 1.16.0
Clock: 2021-10-29 02:24:35
Cervello status: logging
Cervello internal battery: 13.68 V
```

```
Cervello external battery: 1.31 V
Storage used : 168 MB
Storage remaining: 14355 MB
Storage size : 15299 MB
Telemetry last update: 2021-10-29 02:00:09
Telemetry last result: success
Telemetry last mode : rudics
GPS last update : 2021-10-29 02:17:59
GPS last result : fixacquired
GPS last known position: 45.349128 -75.917473
Instrument 01 last update : 2021-10-29 02:24:06
Instrument 01 : logging
Instrument 01 internal battery: 5.11 V
Instrument 01 external battery: 0.00 V
Instrument 02 last update : 2021-10-29 02:23:37
Instrument 02 : logging
Instrument 02 internal battery: 4.74 V
Instrument 02 external battery: 0.00 V
Instrument 03 last update : 2021-10-29 02:20:45
Instrument 03 : logging
Instrument 03 internal battery: 4.69 V
Instrument 03 external battery: 0.00 V
Instrument 04 last update : 2021-10-29 02:23:02
Instrument 04 : logging
Instrument 04 internal battery: 4.90 V
Instrument 04 external battery: 0.00 V
Download remaining: 0B
```

5 Features

5.1 Data hosting

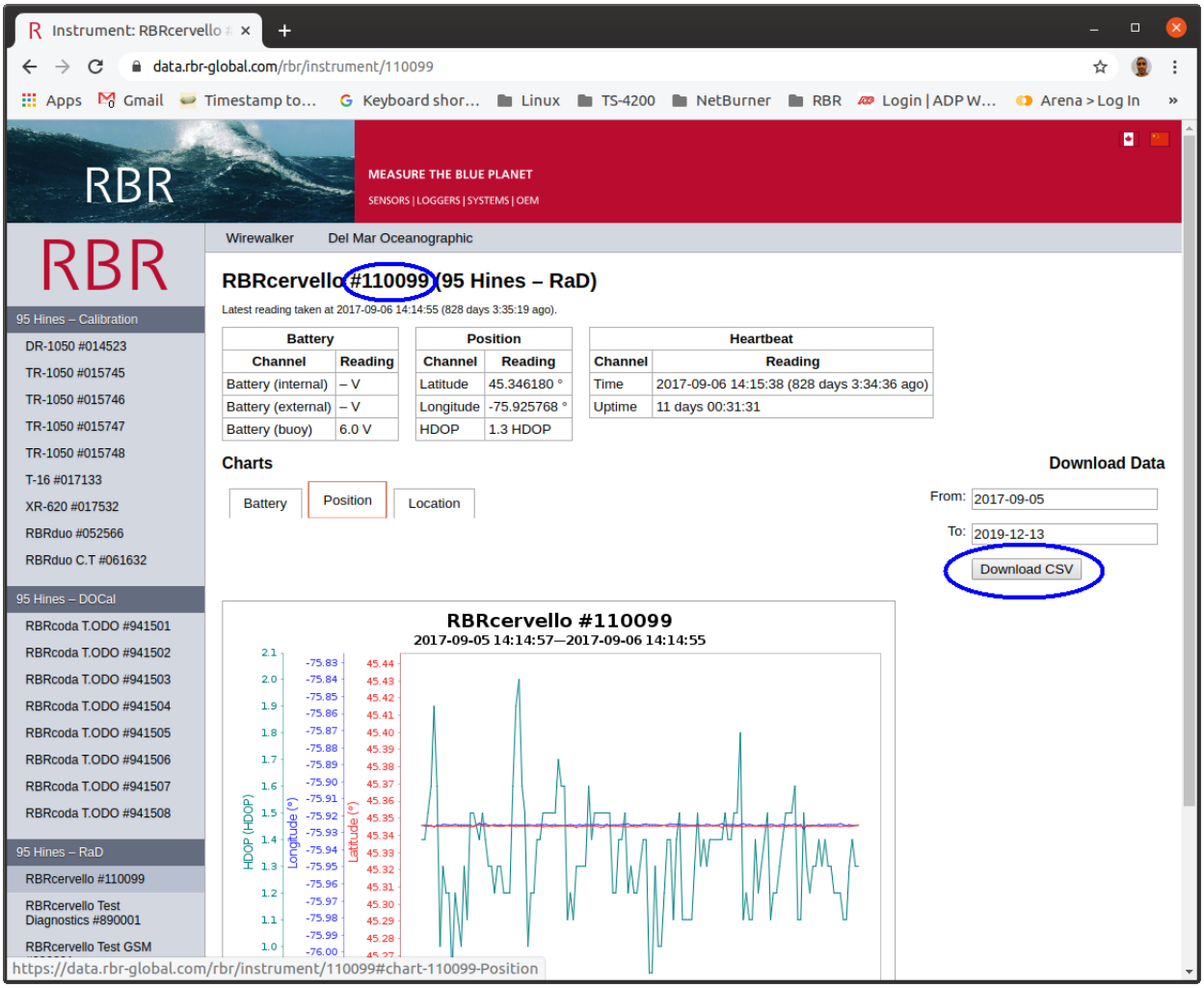
The RBR*cervello* is optionally supplied with realtime telemetry in the form of GSM cellular and Iridium Satellite modems. These send data to the RBR data hosting service, which is accessible at `https://data.rbr-global.com/ClientReference`. Each client site may be public or password protected. One year of data hosting service is included with each RBR*cervello.* After the first year, contact RBR to purchase additional years of service.

Your data is stored on the RBR data-hosting portal in the form of comma-separated value (CSV) files.

Data controllers report data under two different serial numbers: one for the attached instrument (RBR*concerto*^{3} or RBR*maestro*^{3}), and one for diagnostic information (battery levels and GPS coordinates). Remember to download from the appropriate instrument.

Obtaining data from the RBR data-hosting portal

Navigate to https://data.rbr-global.com/rbr (replacing RBR with your customer name) and click **Download CSV**.



Obtaining data using a shell script

Use the getcsvdata.sh script to poll and download data for a particular instrument.

After downloading the script, you will have to change the file permissions to enable execution. For example, to permit all users on the system to execute the script:

```
chmod +x getcsvdata.sh
```

Call the script using your customer URL slug, serial number, start date, and end date as arguments. For example, to download all data for the RBR's device "110099" from September 1, 2017 to December 31, 2020, use the script with this command:

```
./getcsvdata.sh rbr 110099 2017-09-01 2020-12-31
```

Manually downloading data files

Retrieve exports of instrument data by making HTTP GET requests via this URL pattern:

`https://data.rbr-global.com/customer/download/serial?from=A&to=B`

or

`https://data.rbr-global.com/customer/download/serial?timespan=C`

- `customer` is the customer slug; e.g. `rbr`, `csiro`.
- `serial` is the serial number of the instrument for which data should be retrieved.
- `A` and `B` are UTC dates in YYYY-MM-DD format and respect the instrument timezone. Alternatively, they can be YYYY-MM-DD**T**HH:MM:SS.
- `C` is an integer number of days.

The first format will yield a CSV of all data from dates A to B, inclusive of both. The second format will yield a CSV of all data from the last C × 24 hours (*not* the most recent C × 24 hours of data available!).

For example, use the above URL format within a `curl` command to obtain the data from RBR's instrument with serial number 080296 from September 8, 2016 to September 9, 2016:

```
curl --location --remote-name --remote-header-name --compressed 'http://data.rbr-global.com/rbr/download/080296?from=2016-09-08&to=2016-09-09'
```

It can also be more granular, from September 8, 2016, at 10:00 to 20:00:

```
curl --location --remote-name --remote-header-name --compressed 'http://data.rbr-global.com/rbr/download/080296?from=2016-09-08T10:00:00&to=2016-09-08T20:00:00'
```

Remember to enclose the URL in quotation marks, lest your shell split the command around the ampersand (`&`) character.

In general, restrict yourself to downloading around one or two days of data at a time, and later concatenating the results. An instrument sampling at 6Hz will generate almost 100MB of CSV data per day. Large transfers may time out during the download process or your connection may be unexpectedly dropped.

Manually downloading diagnostic data files

These files usually contain useful data for diagnostic purposes, such as the battery voltage of the instruments. The same HTTP GET requests can be used with the addition of the '*download-diagnostic*' attribute.

```
curl --location --remote-name --remote-header-name --compressed 'http://data.rbr-global.com/rbr/download/999916?download-diagnostic&from=2022-01-09&to=2022-01-10'
```

Low bandwidth transfers

If your computer has relatively low bandwidth, use the getcsvdata.sh script described above to acquire data and save them to a server with high bandwidth, always-on connection. Subsequently, transfer only the difference using the `rsync` command.

```
rsync --verbose --archive --partial --progress --compress myusername@my.server.address:/my/data/path/RBR-080296.csv .
```

Downloads

getcsvdata.sh

5.2 USB interface

The RBR*cervello* has a USB interface for retrieving data from the unit and for installing firmware and configuration updates. It is compatible with FAT32-formatted USB mass storage devices and can be used with flash drives. Bus-powered hard drives are not recommended as the RBR*cervello* may not provide sufficient power.

Retrieving data

Tools needed

- A blank, FAT32-formatted USB flash memory stick, at least 512MB in size

To retrieve data from the RBR*cervello*, connect a FAT32-formatted USB storage device to its USB port while it is powered on and awake. All data will be copied from the data controller to the storage device.

An RBR*cervello* Antarctica could be in a deep sleep state when the USB stick is connected. Wake it up by connecting the diagnostic port and pressing **Enter** on the serial terminal. When the `RBRcervello>` prompt appears, plug in the USB stick.

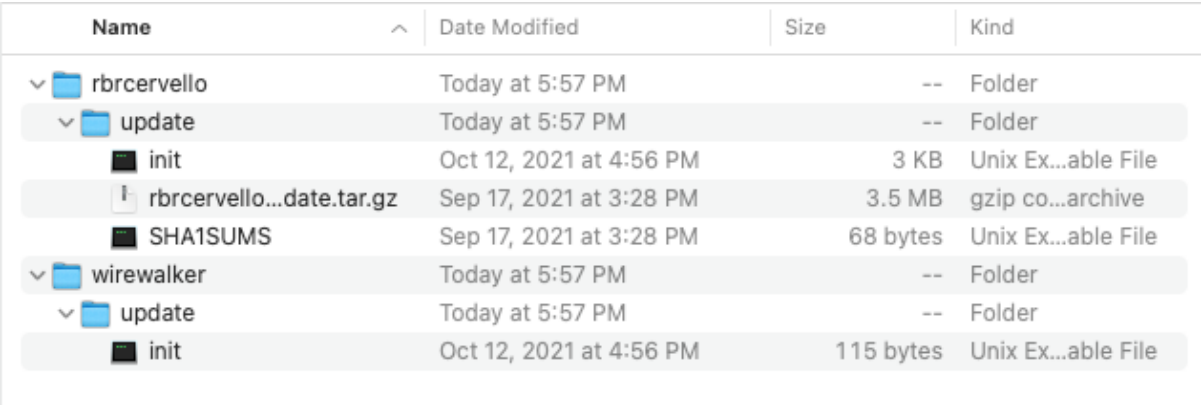
Connect only flash memory storage media (i.e., memory sticks or SSDs) to the USB port of the data controller. Attempted use of portable hard drives may damage the RBR*cervello*.

Applying updates

Tools needed

- A blank, FAT32-formatted USB flash memory stick, at least 512MB in size

Firmware and configuration updates for the data controller are delivered in the form of ZIP archives. To apply these updates, extract the archive into the root of an empty, FAT32-formatted USB storage device. The structure of all directories within the archive, including the top-level `rbrcervello` directory will be retained. After decompressing, the contents of the USB stick will resemble this structure:



Name	Date Modified	Size	Kind
rbrcervello	Today at 5:57 PM	--	Folder
update	Today at 5:57 PM	--	Folder
init	Oct 12, 2021 at 4:56 PM	3 KB	Unix Ex...able File
rbrcervello...date.tar.gz	Sep 17, 2021 at 3:28 PM	3.5 MB	gzip co...archive
SHA1SUMS	Sep 17, 2021 at 3:28 PM	68 bytes	Unix Ex...able File
wirewalker	Today at 5:57 PM	--	Folder
update	Today at 5:57 PM	--	Folder
init	Oct 12, 2021 at 4:56 PM	115 bytes	Unix Ex...able File

Some archive extraction programs, including Safari and the macOS Finder, may modify directory structures during decompression. If this happens, either recreate directories as necessary to match the structure depicted above or use a program that does not modify contents during extraction (e.g., 7-Zip on Windows or The Unarchiver on macOS).

Always retrieve the data from the RBR*cervello* and clear it completely before applying any updates.

As when retrieving data from the RBR*cervello*, connect the USB storage device to the USB port on the data controller.

Light indicator

During data transfer or applying updates, the red light on the RBR*cervello* will flash steadily. Once all data is transferred or updates installed, the red light will cease flashing and the green light will turn on. At that point, the storage device may be disconnected safely. The green light will turn off.

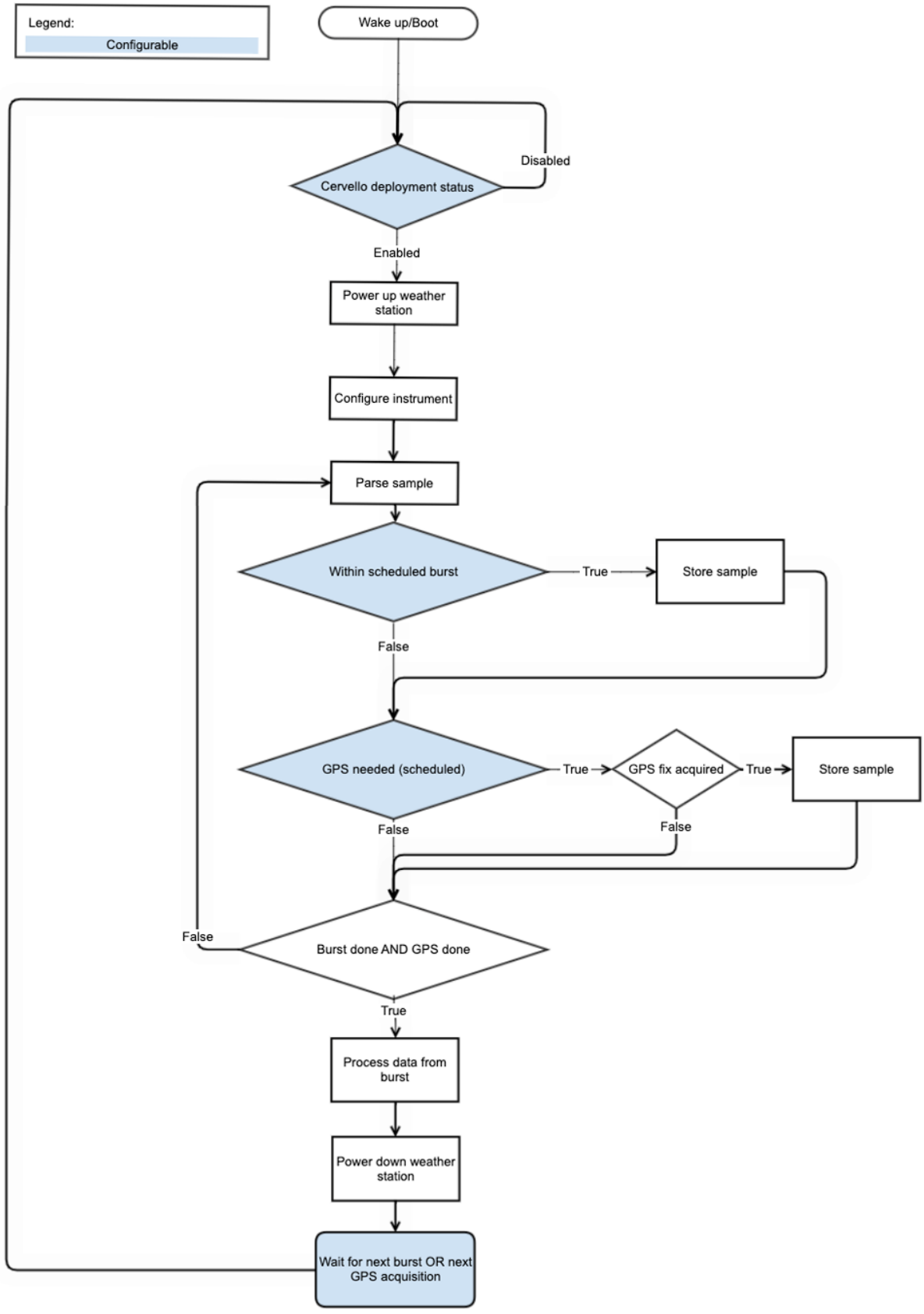
If an error occurs during the process, the red light will repeatedly flash the Morse code representation of “SOS”: three short flashes, three long flashes, and three short flashes. If this occurs, remove the storage device.

Once the red light has turned off and stays off for several seconds, reconnect the storage device and retry.

5.3 Weather station (optional)

The RBR*cervello* is optionally supplied with a weather station integration, particularly, with the Airmar 200WX WeatherStation®. It is connected to the system via the RBR*cervello* MCBH6-FS connector labelled "EXPANSION".

Deployment behaviour of the weather station depends on the configuration files of the RBR*cervello*. Contact us at support@rbr-global.com or via the RBR website to change these settings.


Legend:
Configurable
Wake up/Boot
Cervello deployment status
Disabled
Enabled
Power up weather station
Configure instrument
Parse sample
Within scheduled burst
True
Store sample
False
GPS needed (scheduled)
True
GPS fix acquired
True
Store sample
False
False
False
Burst done AND GPS done
True
Process data from burst
Power down weather station
Wait for next burst OR next GPS acquisition

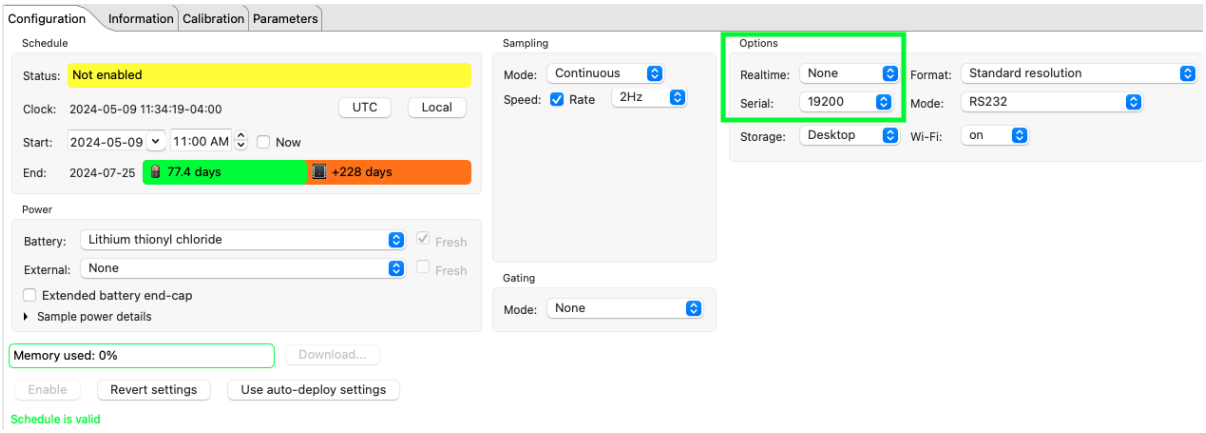
6 Troubleshooting

The RBR*cervello* system comprises multiple components, and thus troubleshooting may be a multi-stage process. There are separate procedures to verify correct functionality of each component.

Follow the steps outlined in Using the diagnostic port to open the command menu. Refer to Deployment preparation for the detailed description of how to run diagnostic tests.

Communication issues

1. Using the status command, check the status of the instrument.
2. If the instrument status is `commchannelerror`, go to MLM troubleshooting.
3. If the instrument status is `loggererror`, use Ruskin to check if your logger is communicating at 19200baud.



> If you change any settings on Ruskin, clear the data from the instrument and the data controller, as described in Deployment preparation.

Modem issues

If any of the modem diagnostic tests fails unexpectedly, refer to the specific troubleshooting section:

- LTE/GSM modem troubleshooting
- RUDICS modem troubleshooting

Weather station issues

If the system seems to receive incorrect navigation readings, refer to Airmar weather station troubleshooting.

6.1 LTE/GSM modem troubleshooting

Diagnostic task

This test requires the RBR*cervello* to have an activated SIM-card installed in the LTE/GSM modem as described in Telemetry. If LTE/GSM is not going to be used in this deployment, this test can be omitted.

After finishing the previous test, wait for the `RBRcervello>` prompt to appear again. Type `diagnose gsm` and press enter. The LTE/GSM test will wait for any ongoing communication to finish and will diagnose the connection to the internet via the LTE/GSM modem.

```
RBRcervello> diagnose gsm
Checking deployment status...
```

```
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting GSM test
I think the GSM modem is on /dev/ttyS4 at 230400 baud.
Waiting for the modem to come up...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: 867698099999999
IMSI: 302720599999999
ICCID: 89302720512345678987
Waiting for the modem to connect to the GSM network....
Reconnecting for Internet access (1/2)...
Bringing PPP connection down...
Bringing PPP connection back up...
Waiting for the PPP connection to become the default route
Making sure we can access the web...
The modem connection is up.
Brought the gsm connection up successfully.
/usr/local/wirewalker-
controller/diagnostics/../publisher/modes/gsm/netpty/bin/netpty:
socket was closed
messages-read: no process found
netpty: no process found
The serial link has been brought down.
Powering off the modem.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

Failure, bad SIM-card

```
RBRcervello> diagnose gsm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting GSM test
I think the GSM modem is on /dev/ttyS4 at 230400 baud.
Waiting for the modem to come up...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: N/A
IMSI: N/A
ICCID: N/A
Waiting for the modem to connect to the GSM
network.....................................................Hit the connection
timeout!
Giving up.
Test failure: failed to bring up connection!
/usr/bin/poff: No pppd is running. None stopped.
messages-read: no process found
netpty: no process found
The serial link has been brought down.
Powering off the modem.
```

```
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

If so, remove and re-insert the SIM card in the tray in the SIM1 position, as explained in the Telemetry section.

6.2 RUDICS modem troubleshooting

Diagnostic task

The RUDICS diagnostic task will test the entire communication pathway to the Iridium Satellite network. For this test to succeed, the RBR*cervello* needs to be positioned outdoors, with a clear view of the sky and with as few obstructions as possible.

After the `RBRcervello>` prompt appears again, type `diagnose rudics` and press enter. This routine will turn on the RUDICS modem and then will attempt to dial to the Iridium network as configured in Telemetry. It can identify failures in the modem, signal strength, or activation issues of the SIM-card.

```
RBRcervello> diagnose rudics
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting RUDICS test
I think the RUDICS modem is on /dev/ttyS4 at 2400 baud.
Waiting for the modem to come up...
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:26:24 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:26:24 src/teraform.c:367 [INFO ]: Dial number: "0088169999999"
2021-11-12 20:26:24 src/teraform.c:388 [INFO ]: Configuring modem...
2021-11-12 20:26:24 src/teraform.c:432 [INFO ]: Waiting for modem to be available...
2021-11-12 20:26:24 src/teraform.c:451 [INFO ]: Checking IMEI...
2021-11-12 20:26:24 src/teraform.c:451 [INFO ]: IMEI: 300125099999999
2021-11-12 20:26:24 src/teraform.c:478 [INFO ]: Checking ICCID...
2021-11-12 20:26:24 src/teraform.c:478 [INFO ]: ICCID: 8988169999999999
2021-11-12 20:26:24 src/teraform.c:488 [INFO ]: Disabling flow control...
2021-11-12 20:26:25 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:26:31 src/teraform.c:520 [INFO ]: Found signal of strength 5/5.
2021-11-12 20:26:31 src/teraform.c:530 [INFO ]: Configuring data connection...
2021-11-12 20:26:31 src/teraform.c:564 [INFO ]: Dialing data connection...
2021-11-12 20:26:40 src/teraform.c:564 [INFO ]: Connection dialed.
The modem connection is up.
Brought the rudics connection up successfully.
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:26:40 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:26:43 src/teraform.c:584 [INFO ]: Escaping from data call...
2021-11-12 20:26:44 src/teraform.c:594 [INFO ]: Disconnecting data call...
The serial link has been brought down.
Powering off the modem.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

Failure, no satellite signal

This error indicates there is a connection problem with the antenna, or the antenna is obstructed.

```
RBRcervello> diagnose rudics
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting RUDICS test
I think the RUDICS modem is on /dev/ttyS4 at 2400 baud.
Waiting for the modem to come up...
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:42:48 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:42:48 src/teraform.c:367 [INFO ]: Dial number: "0088160999999"
2021-11-12 20:42:48 src/teraform.c:388 [INFO ]: Configuring modem...
2021-11-12 20:42:48 src/teraform.c:432 [INFO ]: Waiting for modem to be available...
2021-11-12 20:42:48 src/teraform.c:451 [INFO ]: Checking IMEI...
2021-11-12 20:42:48 src/teraform.c:451 [INFO ]: IMEI: 3001250619999999
2021-11-12 20:42:48 src/teraform.c:478 [INFO ]: Checking ICCID...
2021-11-12 20:42:49 src/teraform.c:478 [INFO ]: ICCID: 8988169763060999999
2021-11-12 20:42:49 src/teraform.c:488 [INFO ]: Disabling flow control...
2021-11-12 20:42:49 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:42:52 src/teraform.c:520 [INFO ]: No signal found. Waiting to try
again.
2021-11-12 20:43:03 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:43:03 src/teraform.c:520 [INFO ]: No signal found. Waiting to try
again.
2021-11-12 20:43:14 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:43:18 src/teraform.c:520 [INFO ]: No signal found. Waiting to try
again.
2021-11-12 20:43:29 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:43:29 src/teraform.c:520 [INFO ]: No signal found after the final
attempt.
2021-11-12 20:43:29 src/teraform.c:520 [ERROR]: Failed after 4 attempts.
Failed to dial connection! Giving up.
Test failure: failed to bring up connection!
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:43:29 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:43:32 src/teraform.c:584 [INFO ]: Escaping from data call...
2021-11-12 20:43:35 src/teraform.c:584 [INFO ]: Escaping from data call...
2021-11-12 20:43:38 src/teraform.c:584 [ERROR]: Failed after 2 attempts.
The serial link has been brought down.
Powering off the modem.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

Failure, no carrier or activation issue

This failure usually occurs because of a bad connection with the network or when the SIM-card has not been successfully activated.

```
RBRcervello> diagnose rudics
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
```

```
Stopping periodic command scheduler: cron.
Starting RUDICS test
I think the RUDICS modem is on /dev/ttyS4 at 2400 baud.
Waiting for the modem to come up...
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:54:02 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:54:02 src/teraform.c:367 [INFO ]: Dial number: "0088160999999"
2021-11-12 20:54:02 src/teraform.c:388 [INFO ]: Configuring modem...
2021-11-12 20:54:02 src/teraform.c:432 [INFO ]: Waiting for modem to be available...
2021-11-12 20:54:02 src/teraform.c:451 [INFO ]: Checking IMEI...
2021-11-12 20:54:03 src/teraform.c:451 [INFO ]: IMEI: 300125061999999
2021-11-12 20:54:03 src/teraform.c:478 [INFO ]: Checking ICCID...
2021-11-12 20:54:03 src/teraform.c:478 [INFO ]: ICCID: 8988169234002999999
2021-11-12 20:54:03 src/teraform.c:488 [INFO ]: Disabling flow control...
2021-11-12 20:54:03 src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-11-12 20:54:12 src/teraform.c:520 [INFO ]: Found signal of strength 1/5.
2021-11-12 20:54:12 src/teraform.c:530 [INFO ]: Configuring data connection...
2021-11-12 20:54:12 src/teraform.c:564 [INFO ]: Dialing data connection...
2021-11-12 20:54:12 src/teraform.c:564 [INFO ]: Dial reported no carrier. Waiting 40s
to try again.
2021-11-12 20:54:52 src/teraform.c:564 [INFO ]: Dialing data connection...
2021-11-12 20:54:52 src/teraform.c:564 [INFO ]: Dial reported an error.
2021-11-12 20:54:52 src/teraform.c:564 [ERROR]: Failed after 2 attempts.
Failed to dial connection! Giving up.
Test failure: failed to bring up connection!
Teraform v1.1.2 (built 2021-10-12T20:17:02+0000)
2021-11-12 20:54:52 src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-11-12 20:54:55 src/teraform.c:584 [INFO ]: Escaping from data call...
2021-11-12 20:54:58 src/teraform.c:584 [INFO ]: Escaping from data call...
2021-11-12 20:55:01 src/teraform.c:584 [ERROR]: Failed after 2 attempts.
The serial link has been brought down.
Powering off the modem.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

6.3 MLM troubleshooting

Diagnostic tasks

In the terminal window, press **Enter** a couple of times and wait for the `RBRcervello>` prompt. Type `diagnose mlm` and press **Enter**. Immediately, the MLM test routine will start running. This routine will assess communication with the HEM and SSM attached to the line, check their configuration, and perform a bit-error-rate test.

Follow the instructions on the screen as sometimes it prompts for user interaction.

```
RBRcervello> diagnose mlm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting MLM test
I think the HEM is on /dev/ttyS3 at 115200 baud.
Trying to wake the HEM...
RBR HEM-1000 1.300 208882
Found HEM 208882.
```

```
HEM firmware version 1.300 >= 1.300.
commands now unlocked
Checking HEM configuration...
Checking: baud rate BAUD: 115200
Setting: baud rate BAUD: 115200.
.
.
.
Setting: ber pattern BERPAT: RAND
Checking: ber length (bytes) BERLEN: x0800
Setting: ber length (bytes) BERLEN: x0800
Ensuring there is no open SSM channel before attempting any channel activity...
No previously open channel.
Attempting SSM discovery:
Found SSM 999888
Found SSM 989989
Discovery complete
Waiting for channel cooldown...
.
.
.
MLM communication looks good.
Restarting services...
Starting periodic command scheduler: cron.
RBRcervello>
```

The RBRcervello uses the mooring line modem (“MLM”) inductive modem to communicate with the instrument mounted on the mooring line. The MLM system consists of a head-end modem (“HEM”) included within the buoy-mounted RBRcervello housing, and a sub-surface modem (“SSM”) coupled onto the instrument. The instrument needs to be configured to communicate at the baudrate as configured in the SSM which is typically 19200 bits-per-second.

The MLM diagnostic task is a useful tool that checks the connection and settings of the HEM and the SSMs attached to the mooring line. When it finds an error, it will indicate the possible cause in a human-readable form in the console.

If you wish to communicate directly with the HEM you can run the following command:

```
RBRcervello> diagnose transparent-link
```

MLM communication principles: commands

Send each command to the modem on its own line. Lines must be terminated with a carriage return and/or a linefeed character. Most terminal emulators' default handling of the **Enter** key produces acceptable behaviour.

Sleep

If the HEM receives no commands for 10 seconds, it will go to sleep. The HEM will wake up when it next receives a line termination character. This can lead to the modem “ignoring” commands upon first connection, or after having sat idle. To ensure the modem evaluates your command, it is good practice to send a line termination (hit the **Enter** key) once or twice before each command to both wakes up the modem and to cause it to stay awake while you’re typing.

The instrument also has a 10-second sleep timeout. When communicating with the instrument over the inductive modem link, the same technique of sending a line termination character before each command should also be followed. Moreover, there is a 10-second inactivity timeout for the HEM connection to the instrument; if no data passes across the inductive modem link for ten seconds, the connection is closed. To avoid having to frequently reopen the channel, periodically send a line termination character.

Initial state

If the loggercontroller service was running before the connection was opened, the HEM may still be in “transparent mode” – received commands will be passed directly to the attached instrument. To determine the state of the connection, send a line termination character once or twice to wake the HEM from sleep, then send the `a` command (by typing `a<Enter>`). The unit should respond:

```
RBR HEM-1000 1.300 999999
```

If you instead receive something to the effect of:

```
RBR RBRconcerto 1.410 999999
Ready:
```

then the modem is in “transparent mode” – it is passing everything you type through to the instrument on the other end of the inductive link. This happens when the logger controller has been interrupted. Wait up to 10 seconds for the transparent mode to time out and return you to the HEM command interface:

```
channel closed
***command mode***
```

SSM discovery

The HEM can automatically discover connected SSMs. This is a straightforward, rapid way to verify basic MLM functionality. To invoke it, send the `disc` command to the HEM:

```
disc
    discovery requested
    099999
    discovery complete OK
```

The command will take around 40 seconds to complete, and will list the serial numbers of any connected SSMs as they are discovered. If the SSM is discovered at this step, both the HEM and the SSM are functional. In this case:

- Type Ctrl+C to return to the diagnostic menu.
- Reboot the controller with reboot-controller to start all the services again.

Otherwise, continue on to checking the ferrites.

Otherwise, continue on to checking the ferrites.

Ferrites

The ferrite holders (shown at right) hold the ferrite halves and clamp them to the mooring line. If the connection between a ferrite and the modem is faulty, the modem connection will be, at best, unreliable and, at worst, nonfunctional.

The ferrite holders are the first thing to check in the event that the HEM cannot see the SSM, starting with the surface ferrite holder.

To perform a cursory check of the ferrite:

1. Disconnect and reconnect the connectors at both ends of the cable to ensure that they are well-seated.
2. Open the ferrite holder. Check visible edges of the ferrite for damage (scratches, chips). Wiggle/push the ferrite halves to confirm that they are intact, not cracked/split.
3. Clean the ferrite's mating surfaces with a small amount of isopropyl alcohol.
4. Close the ferrite holder again, ensuring that the ends of both ferrite halves are flush and line up with each other.

If other tests point back to a ferrite failure, you can remove the ferrite halves from the enclosure to check them. Do this in a workshop or another safe area where no small parts will be lost during disassembly.

1. Open the ferrite holder.
2. Using a 3mm hex key, remove the retaining screws on the anti-strumming bar on the ferrite holder clasp.
3. Remove the bar.
4. Lift the ferrite half out of the recess, being careful to not lose the T-shaped spring from the bottom of the recess.
5. Check the ferrite half for cracks or fractures.
6. Check that the two O-rings are evenly spaced around the ferrite half, approximately at thirds.
7. Remove the spring from the recess. Make note of the orientation of the spring within the recess before removal: whether the top of the "T" is facing the left or the right side of the clasp.
8. Check the spring for cracks or surface scoring.
9. Insert the spring back into the recess.
10. Push the ferrite half back into the clasp.
11. Replace the anti-strumming bar and tighten its retaining screws.
12. Carefully slide the other ferrite half from the holder body and check it for cracks or fractures. Slide it back into its recess when satisfied.

The orientation of the spring determines the elevation it affords the ferrite half. If the ferrite halves do not compress tightly against each other when the clasp is closed, reorient the spring so the top of the "T" faces the clasp hinge.

Additionally, each ferrite holder contains a coil. With an ohmmeter, check the resistance across the outer two pins of the MCBH-F on a 3-pin version, or between pin 5 and 6 on a 6-pin version connector on the ferrite holder. It should measure 3-4Ohm. Significantly more (hundreds of Ohms or an open circuit) indicates a failure of the coil or the connector.

If everything seems OK, run the MLM diagnostic task again (see above) to verify if the issue went away.

6.4 Airmar weather station troubleshooting

Diagnostic task

This calibration sequence requires the RBR*cervello* to be mounted with the Airmar station in the buoy. If the system does not have an Airmar weather station, omit this step.

After finishing the previous test, wait for the `RBRcervello>` prompt to appear again. Type `diagnose calibrate-airmar-compass -p 4` and press **Enter**. This script will request the user to do a slow circular turn of the buoy to compensate the compass for any nearby structures that might affect the compass readings.

```
RBRcervello> diagnose calibrate-airmar-compass -p 4
Stopping services...
Waiting for publisher to terminate...
```

```
Stopping periodic command scheduler: cron.
Are you sure you want to begin a compass calibration sequence on port 4? (y/N) y
Powering on port 4...
Waiting for the station to boot up
Station ready!
Temporarily stopping station streaming...
Ready to start the calibration sequence!
=====================================================
The calibration sequence requires at least one full
slow circular turn of the station within 2-3 minutes
of starting the sequence.
=====================================================
Are you ready to start the compass calibration sequence? (y/N) y
Starting the calibration sequence!
=====================================================
Please complete at least one SLOW circular turn of
the station now.
=====================================================
Waiting for the calibration to complete
Calibration successful!
RBRcervello>
```

Calibration failed

The Airmar station might reject a calibration sequence if it determines the data quality is not good enough. In such a case, repeat the process at different turning speeds to improve the quality of the calibration.

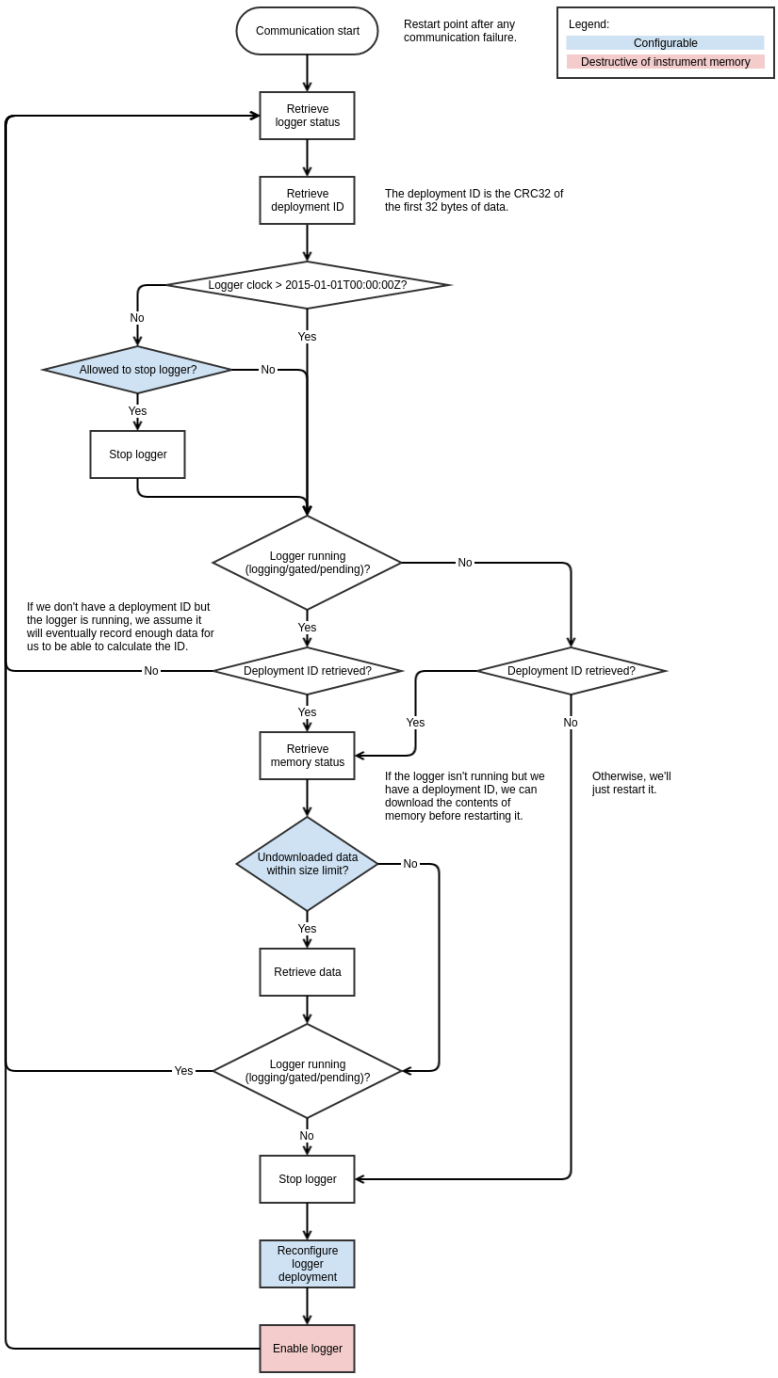
```
RBRcervello> diagnose calibrate-airmar-compass -p 4
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Are you sure you want to begin a compass calibration sequence on port 4? (y/N) y
Powering on port 4...
Waiting for the station to boot up
Station ready!
Temporarily stopping station streaming...
Ready to start the calibration sequence!
=====================================================
The calibration sequence requires at least one full
slow circular turn of the station within 2-3 minutes
of starting the sequence.
=====================================================
Are you ready to start the compass calibration sequence? (y/N) y
Starting the calibration sequence!
=====================================================
Please complete at least one SLOW circular turn of
the station now.
=====================================================
Waiting for the calibration to complete
Calibration failed! Please try again...
RBRcervello>
```

7 Reference

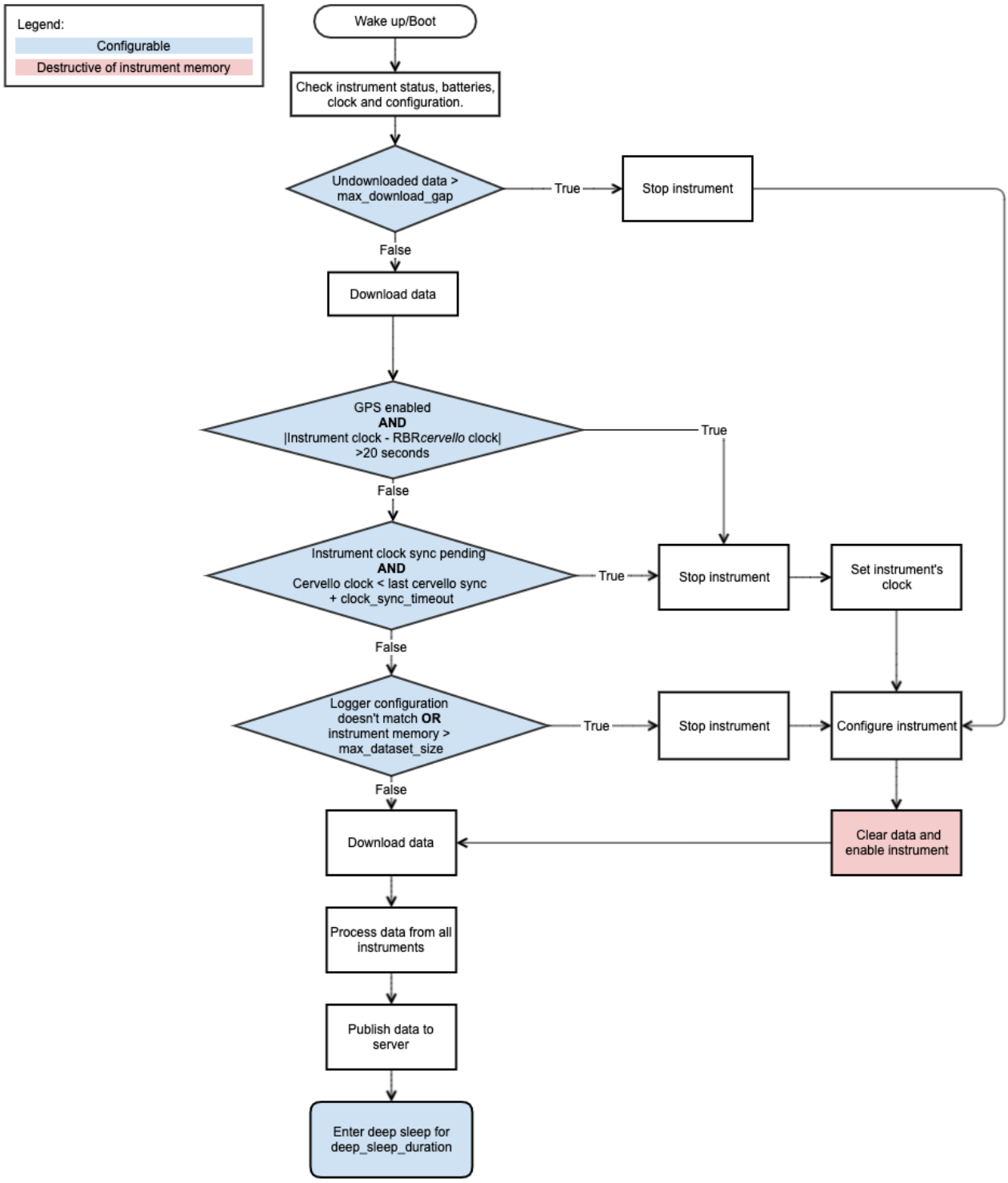
7.1 Deployment behaviour

The RBR*cervello* will oversee deployment of attached instruments, configure instrument settings, and start the logging schedule.

7.1.1 Behaviour with deep-sleep disabled



7.1.2 Behaviour with deep-sleep enabled



7.2 Diagnostic menu

The diagnostic commands use the following formatting conventions:

1. Examples of literal input and output are shown in `bold` type.
2. When an item or group of items is optional, it is enclosed in `[square brackets]`.
3. Where an item can be one of several options, options are separated by vertical bars, `|`.
4. Placeholders for variable fields are in `<italics enclosed in angle brackets>`.

7.2.1 status

Usage

`status [-h|--help] | [-v|--version]`

`status [-p|--progress]`

`status [-g|-gps]`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

`-p, --progress` Shows progress bars for downloads.

`-g, --gps` Triggers and wait for new GPS satellite fix.

Description

Prints a status overview of the controller including battery information, storage usage, connected instruments status.

General overview

- `Serial number`: serial number of the RBR*cervello*.
- `Part number`: part number of the RBR*cervello*.
- `Cervello firmware version`: firmware version of the RBR*cervello*.
- `Clock`: current clock of the RBR*cervello*.

RBRcervello status

- `Cervello status`: current status of the RBRcervello, either **disabled** or **logging**.
- `Cervello internal battery`: RBR*cervello* internal battery voltage in Volts.
- `Cervello external battery`: RBR*cervello* external battery voltage in Volts.

Storage

- `Storage used`: RBR*cervello* memory used in MB.
- `Storage remaining`: RBR*cervello* memory still available in MB.
- `Storage size`: RBR*cervello* memory total size in MB.

Telemetry

- `Telemetry last update`: date/time of the last telemetry attempt, or **N/A**.
- `Telemetry last result`: the result of the last telemetry attempt, either **success**, **failed over X times** or **N/A**.
- `Telemetry last mode`: mode of last telemetry attempt, either **gsm**, **rudics** or **N/A**.

GPS

- `GPS last update`: date/time of the last GPS acquisition attempt.
- `GPS last result`: the result of the last GPS acquisition attempt, either **fixacquired**, **fixnotacquired** or **N/A**.
- `GPS last known position`: the position of the last GPS acquisition attempt, either the latitude and longitude or **N/A**.

Instrument

- `Instrument <XX> last update`: date/time of the last status update the RBRcervello performed on the instrument **XX** or **N/A**.
- `Instrument <XX>`: the last known status of the instrument, either:
  - one of the natural statuses of an RBR instrument: `disabled, pending, logging, gated, stopped, finished, unknown`.
  - one of the natural statuses of an Aquadopp instrument: `stopped, logging, unknown`.
  - **commchannelerror:** the RBR*cervello* is unable to open the communication channel.
  - **loggererror**: the instrument has encountered an error.
  - **misconfigured**: the RBR*cervello* is unable to configure the instrument.
  - **notdiscovered:** the RBR*cervello* did not find the instrument.
  - **error**
  - **N/A**
- `Instrument <XX> internal battery`: the last known internal battery of the instrument **XX** in Volts or **N/A.**
- `Instrument <XX> external battery`: the last known external battery of the instrument **XX** in Volts or **N/A**.

Download

- `Download remaining`: the total number of bytes remaining to be downloaded over all the instruments.

If the RBR*cervello* is misconfigured, only the general overview will be displayed.

Examples

```
RBRcervello> status

RBRcervello
Serial number: 208685
Part number: 0011493
Cervello firmware version: 1.16.0

Clock: 2021-10-29 02:24:35

Cervello status: disabled
Cervello internal battery: 13.68 V
Cervello external battery: 1.31 V

Storage used     : 168 MB
Storage remaining: 14355 MB
Storage size     : 15299 MB

Telemetry last update: 2021-10-29 02:00:09
Telemetry last result: success
Telemetry last mode  : rudics

```

```
GPS last update        : 2021-10-29 02:17:59
GPS last result        : fixacquired
GPS last known position: 45.349128 -75.917473

Instrument 01 last update     : 2021-10-29 02:24:06
Instrument 01                 : disabled
Instrument 01 internal battery: 5.11 V
Instrument 01 external battery: 0.00 V

Instrument 02 last update     : 2021-10-29 02:23:37
Instrument 02                 : stopped
Instrument 02 internal battery: 4.74 V
Instrument 02 external battery: 0.00 V

Instrument 03 last update     : 2021-10-29 02:20:45
Instrument 03                 : stopped
Instrument 03 internal battery: 4.69 V
Instrument 03 external battery: 0.00 V

Instrument 04 last update     : 2021-10-29 02:23:02
Instrument 04                 : stopped
Instrument 04 internal battery: 4.90 V
Instrument 04 external battery: 0.00 V

Download remaining: 0B
```

7.2.2 disable

Usage

`disable [-h|--help] | [-v|--version]`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

Description

Disable deployment, disable instruments and download their data. The RBRcervello will remain disabled upon power cycling.

Examples

```
RBRcervello> disable
Deployment disabled
```

7.2.3 diagnose

Usage

`diagnose [-h|--help] | [-v|--version]`

`diagnose <command>`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

Commands

`mlm` Diagnoses MLM communication.

`gsm` Diagnoses GSM telemetry.

`rudics` Diagnoses Iridium RUDICS telemetry.

`calibrate-airmar-compass` Runs the compass calibration.

Description

Performs in-depth tests for telemetry and MLM links.

`mlm` Ensures correct HEM and SSM configuration on every connected device.

`gsm` Ensures connectivity through GSM to the Internet.

`rudics` Ensures connectivity through Iridium RUDICS to the Internet.

`calibrate-airmar-compass` Ensures the compass is calibrated in the current environment.

Examples

```
RBRcervello> diagnose rudics
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting RUDICS test
I think the RUDICS modem is on /dev/ttyS4 at 2400 baud.
Waiting for the modem to come up...
Teraform v1.1.2 (built 2021-10-27T13:30:04+0000)
2021-10-29 05:55:19   src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-10-29 05:55:19   src/teraform.c:367 [INFO ]: Dial number: "0088160000500"
2021-10-29 05:55:19   src/teraform.c:388 [INFO ]: Configuring modem...
2021-10-29 05:55:19   src/teraform.c:432 [INFO ]: Waiting for modem to be
available...
2021-10-29 05:55:19   src/teraform.c:451 [INFO ]: Checking IMEI...
2021-10-29 05:55:20   src/teraform.c:451 [INFO ]: IMEI: 300125061274520
2021-10-29 05:55:20   src/teraform.c:478 [INFO ]: Checking ICCID...
2021-10-29 05:55:20   src/teraform.c:478 [INFO ]: ICCID: 8988169763060305628
2021-10-29 05:55:20   src/teraform.c:488 [INFO ]: Disabling flow control...
2021-10-29 05:55:20   src/teraform.c:520 [INFO ]: Waiting for satellite signal...
2021-10-29 05:55:26   src/teraform.c:520 [INFO ]: Found signal of strength 5/5.
2021-10-29 05:55:26   src/teraform.c:530 [INFO ]: Configuring data connection...
2021-10-29 05:55:26   src/teraform.c:564 [INFO ]: Dialing data connection...
2021-10-29 05:55:34   src/teraform.c:564 [INFO ]: Connection dialed.
The modem connection is up.
Brought the rudics connection up successfully.
Teraform v1.1.2 (built 2021-10-27T13:30:04+0000)
2021-10-29 05:55:34   src/teraform.c:364 [INFO ]: Modem: "/dev/ttyS4"
2021-10-29 05:55:37   src/teraform.c:584 [INFO ]: Escaping from data call...
2021-10-29 05:55:38   src/teraform.c:594 [INFO ]: Disconnecting data call...
The serial link has been brought down.
Powering off the modem.
```

```
Starting periodic command scheduler: cron.
RBRcervello>
```

```
RBRcervello> diagnose gsm
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting GSM test
I think the GSM modem is on /dev/ttyS4 at 230400 baud.
Waiting for the modem to come up...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: 867698040840616
IMSI: 302720511124309
ICCID: 89302720523086286725
Waiting for the modem to connect to the GSM network..
Reconnecting for Internet access (1/2)...
    Bringing PPP connection down...
    Bringing PPP connection back up...
    Waiting for the PPP connection to become the default route
Making sure we can access the web...
The modem connection is up.
Brought the gsm connection up successfully.
/usr/local/wirewalker-
controller/diagnostics/../publisher/modes/gsm/netpty/bin/netpty: error waiting for
fds: Interruptl
messages-read: no process found
The serial link has been brought down.
Powering off the modem.
Starting periodic command scheduler: cron.
RBRcervello>
```

```
RBRcervello> diagnose mlm
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Starting MLM test
I think the HEM is on /dev/ttyS3 at 115200 baud.
Trying to wake the HEM...
***command mode***
        RBR HEM-1000 1.300 208882
Found HEM 208882.
HEM firmware version 1.300 >= 1.300.
        commands now locked
Checking HEM configuration...
Checking:       commands now unlocked
        baud rate BAUD: 115200
Setting:        baud rate BAUD: 115200
Checking:       sleep timeout (10ms) ZTO: 1000
Setting:        sleep timeout (10ms) ZTO: 1000
Checking:       hardware flow control enable HWF: 0
Setting:        hardware flow control enable HWF: 0
Checking:       poll enable PEN: 0
Setting:        poll enable PEN: 0
Checking:       poll interval time (min) PINT: 5
```

```
Setting:        poll interval time (min) PINT: 5
Checking:       poll delay time (10ms) PDEL: 500
Setting:        poll delay time (10ms) PDEL: 500
Checking:       poll display enable PDISP: 0
Setting:        poll display enable PDISP: 0
Checking:       poll cmd string PCMD: x46,x30,x30
Setting:        poll cmd string PCMD: x46,x30,x30
Checking:       poll wakeup char enable PWUPEN: 1
Setting:        poll wakeup char enable PWUPEN: 1
Checking:       poll wakeup char PWUPCHAR: x0F
Setting:        poll wakeup char PWUPCHAR: x0F
Checking:       poll sleep enable (zzz) PSLPEN: 1
Setting:        poll sleep enable (zzz) PSLPEN: 1
Checking:       poll address PADD: 00
Setting:        poll address PADD: 00
Checking:       modem open channel timeout (10ms) MDOCDUR: 1000
Setting:        modem open channel timeout (10ms) MDOCDUR: 1000
Checking:       modem open channel permanent MDOCPERM: 0
Setting:        modem open channel permanent MDOCPERM: 0
Checking:       modem maximum retry count MDRTRY: 1
Setting:        modem maximum retry count MDRTRY: 1
Checking:       transparent max chars before send TPMXC: 256
Setting:        transparent max chars before send TPMXC: 256
Checking:       transparent send char TPSNDC: x0A
Setting:        transparent send char TPSNDC: x0A
Checking:       transparent send char enable TPSNDEN: 1
Setting:        transparent send char enable TPSNDEN: 1
Checking:       transparent send char as well enable TPSNDC2: 1
Setting:        transparent send char as well enable TPSNDC2: 1
Checking:       transparent char timeout (10ms) TPCTO: 20
Setting:        transparent char timeout (10ms) TPCTO: 20
Checking:       transparent char timeout enable TPCTOEN: 1
Setting:        transparent char timeout enable TPCTOEN: 1
Checking:       transparent escape timeout (10ms) TPESCTO: 75
Setting:        transparent escape timeout (10ms) TPESCTO: 75
Checking:       transparent escape timeout enable TPESCTOEN: 1
Setting:        transparent escape timeout enable TPESCTOEN: 1
Checking:       transparent request ack enable TPACK: 0
Setting:        transparent request ack enable TPACK: 0
Checking:       transparent display ack enable TPACKDSP: 0
Setting:        transparent display ack enable TPACKDSP: 0
Checking:       transparent display nak enable TPNAKDSP: 0
Setting:        transparent display nak enable TPNAKDSP: 0
Checking:       ber pattern BERPAT: RAND
Setting:        ber pattern BERPAT: RAND
Checking:       ber length (bytes) BERLEN: x0800
Setting:        ber length (bytes) BERLEN: x0800
Ensuring there is no open SSM channel before attempting any channel activity...
        channel closed
Channel closed successfully.
Attempting SSM discovery:
        discovery requested
        208088
Found SSM 208088.
        208090
Found SSM 208090.
        discovery complete OK
Waiting for channel cooldown...
```

```
Opening a channel to the SSM...
        channel requested (with ssm 208088)...GRANTED
.       RBR SSM-1000 1.300 208088
Opened channel to SSM 208088.
SSM firmware version 1.300 >= 1.300.
.       commands now unlocked
Checking SSM configuration...
Checking: .     baud rate BAUD: 19200
Setting:  .     baud rate BAUD: 19200
Checking: .     sleep timeout (10ms) ZTO: 1000
Setting:  .     sleep timeout (10ms) ZTO: 1000
Checking: .     RBR logger id retrieval enable LIDEN: 0
Setting:  .     RBR logger id retrieval enable LIDEN: 0
Checking: .     transparent max chars before send TPMXC: 512
Setting:  .     transparent max chars before send TPMXC: 512
Checking: .     transparent send char TPSNDC: x0A
Setting:  .     transparent send char TPSNDC: x0A
Checking: .     transparent send char enable TPSNDEN: 0
Setting:  .     transparent send char enable TPSNDEN: 0
Checking: .     transparent send char as well enable TPSNDC2: 1
Setting:  .     transparent send char as well enable TPSNDC2: 1
Checking: .     transparent char timeout (10ms) TPCTO: 20
Setting:  .     transparent char timeout (10ms) TPCTO: 20
Checking: .     transparent char timeout enable TPCTOEN: 1
Setting:  .     transparent char timeout enable TPCTOEN: 1
Checking: .     transparent escape timeout (10ms) TPESCTO: 75
Setting:  .     transparent escape timeout (10ms) TPESCTO: 75
Checking: .     transparent escape timeout enable TPESCTOEN: 1
Setting:  .     transparent escape timeout enable TPESCTOEN: 1
Checking: .     transparent request ack enable TPACK: 0
Setting:  .     transparent request ack enable TPACK: 0
Checking: .     transparent display ack enable TPACKDSP: 0
Setting:  .     transparent display ack enable TPACKDSP: 0
Checking: .     transparent display nak enable TPNAKDSP: 0
Setting:  .     transparent display nak enable TPNAKDSP: 0
Checking: .     ber pattern BERPAT: RAND
Setting:  .     ber pattern BERPAT: RAND
Checking: .     ber length (bytes) BERLEN: x0800
Setting:  .     ber length (bytes) BERLEN: x0800
Performing a bit error test to assess loop quality...
        (tx) sending ber msg...
.ber : x00000000 / 00004000
Bit error test passed.
.       commands now locked
        channel closed
Waiting for channel cooldown...
Opening a channel to the SSM...
        channel requested (with ssm 208090)...GRANTED
.       RBR SSM-1000 1.300 208090
Opened channel to SSM 208090.
SSM firmware version 1.300 >= 1.300.
.       commands now unlocked
Checking SSM configuration...
Checking: .     baud rate BAUD: 19200
Setting:  .     baud rate BAUD: 19200
Checking: .     sleep timeout (10ms) ZTO: 1000
Setting:  .     sleep timeout (10ms) ZTO: 1000
Checking: .     RBR logger id retrieval enable LIDEN: 0
```

```
Setting:  .     RBR logger id retrieval enable LIDEN: 0
Checking: .     transparent max chars before send TPMXC: 512
Setting:  .     transparent max chars before send TPMXC: 512
Checking: .     transparent send char TPSNDC: x0A
Setting:  .     transparent send char TPSNDC: x0A
Checking: .     transparent send char enable TPSNDEN: 0
Setting:  .     transparent send char enable TPSNDEN: 0
Checking: .     transparent send char as well enable TPSNDC2: 1
Setting:  .     transparent send char as well enable TPSNDC2: 1
Checking: .     transparent char timeout (10ms) TPCTO: 20
Setting:  .     transparent char timeout (10ms) TPCTO: 20
Checking: .     transparent char timeout enable TPCTOEN: 1
Setting:  .     transparent char timeout enable TPCTOEN: 1
Checking: .     transparent escape timeout (10ms) TPESCTO: 75
Setting:  .     transparent escape timeout (10ms) TPESCTO: 75
Checking: .     transparent escape timeout enable TPESCTOEN: 1
Setting:  .     transparent escape timeout enable TPESCTOEN: 1
Checking: .     transparent request ack enable TPACK: 0
Setting:  .     transparent request ack enable TPACK: 0
Checking: .     transparent display ack enable TPACKDSP: 0
Setting:  .     transparent display ack enable TPACKDSP: 0
Checking: .     transparent display nak enable TPNAKDSP: 0
Setting:  .     transparent display nak enable TPNAKDSP: 0
Checking: .     ber pattern BERPAT: RAND
Setting:  .     ber pattern BERPAT: RAND
Checking: .     ber length (bytes) BERLEN: x0800
Setting:  .     ber length (bytes) BERLEN: x0800
Performing a bit error test to assess loop quality...
        (tx) sending ber msg...
.ber : x00000000 / 00004000
Bit error test passed.
.       commands now locked
        channel closed
Waiting for channel cooldown... commands now locked
MLM communication looks good.
Starting periodic command scheduler: cron.
RBRcervello>
```

```
RBRcervello> diagnose calibrate-airmar-compass 2
Stopping services...
Waiting for publisher to terminate...
Stopping periodic command scheduler: cron.
Are you sure you want to begin a compass calibration sequence on port 2? (y/N) y
Powering on port 2...
Waiting for the station to boot up
Station ready!
Temporarily stopping station streaming...
Ready to start the calibration sequence!
=====================================================
The calibration sequence requires at least one full
slow circular turn of the station within 2-3 minutes
of starting the sequence.
=====================================================
Are you ready to start the compass calibration sequence? (y/N) y
Starting the calibration sequence!
=====================================================
Please complete at least one SLOW circular turn of
```

```
the station now.
==================================================
Waiting for the calibration to complete
Calibration successful!
RBRcervello>
```

7.2.4 config-check

Usage

`config-check [-h|--help] | [-v|-version]`

`config-check [-c|--config-file <device>]`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

`-c, --config-file <device>` Shows configuration file for a supported device.

The supported devices are the following:

- `instrument<XX>` displays the corresponding deployment.json configuration file of an instrument, where **XX** is the instrument number.
- `cervello` displays the user configuration of the RBR*cervello*.

Description

Checks RBR configuration. Displays in an interactive manner the current configuration of the RBR*cervello* or one of the configured instruments. Uses arrow keys to scroll the configuration; **Q** to exit.

Examples

```
RBRcervello> config-check -c cervello
Showing configuration file of cervello.
{
    "file": {
        "date": "20210814000000",
        "version": "3.0.0",
        "schema": "0011713",
        "customer": "RBR"
     },
    "controller": {
        "battery_period": 600,
        "deep_sleep": {
            "enabled": false,
            "deep_sleep_duration": 3600
        },
        "clock_sync_timeout": 43200
    },
    "gps": {
        "enabled": true,
        "period": 600,
        "fix_timeout": 60,
        "hdop_threshold": 1.5
    ...
    "telemetry": {
```

```
        "enabled": true,
        "force_period": 3600,
        "mode": ["gsm", "rudics"],
        "gsm": {
            "failures_before_unavailable": 3,
            "retry_period": 7200,
            "apn": "auto",
            "destination": "dataincoming.rbr-global.com:9140"
        },
        "rudics": {
            "failures_before_unavailable": 3,
            "retry_period": 7200,
            "dial": "00881600005385"
        }
    }
}
```

7.2.5 edit-config

Usage

`edit-config [-h|--help] | [-v|--version]`

`edit-config [-n|-new-file] | [-c|--config-file <device>]`

Options

`-h, --help` Displays this help message and exit.

`-v, --version` Outputs version information and exit.

`-n, --new-file` Starts editing from an empty file.

`-c, --config-file <device>` Shows configuration for a supported device.

The supported devices are the following:

- `instrument<XX>` allows editing the deployment configuration file of an instrument, where **XX** is the instrument number.
- `cervello` allows editing the RBRcervello user configuration file.

Description

Interactively edits the current configuration of a specific instrument or the RBR*cervello* with GNU nano.

Examples

```
RBRcervello>edit-config -c instrument01
```

7.2.6 set-cervello-clock

Usage

`set-cervello-clock [-h|--help] | [-v|--version]`

`set-cervello-clock <string-formatted-date>`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

Commands

`string-formatted-date` Inputs new internal clock time, saves it, and exits. Format: *yyyy-mm-ddThh:mm:ss.*

Description

Sets the RBR*cervello* internal clock and saves the previous and new times in every RSK file involved, the RBR*cervello*, and the instrument.

This command is intended to be used on units with no GPS.

Examples

```
RBRcervello> set-cervello-clock '2023-12-25T12:34:56'
Previous internal time: '2014-12-25T10:12:00'
New internal time: '2023-12-25T12:34:56'
```

7.2.7 cervello-clock

Usage

`cervello-clock [-h|--help] | [-v|-version]`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

Description

Displays the current clock of the RBR*cervello* and its last manually triggered clock synchronization.

- `Last time sync:` displays the last manually triggered clock synchronization date/time. This does not reflect GPS clock resynchronization time.
- `Current internal time:` displays the current clock of the RBR*cervello*.

  Examples

  ```
  RBRcervello> cervello-clock
  Last time sync: '2023-06-28 15:31:00'
  Current internal time: '2023-06-29 11:54:24'
  ```

7.2.8 reboot-controller

Usage

`reboot-controller [-h|--help] | [-v|-version]`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

Description

Stops all internal services and reboots the RBR*cervello* as if it entered deep sleep and woke up. Useful for testing deployment behaviour.

Examples

```
RBRcervello> reboot-controller
...
The system is going down for reboot NOW!
...
```

7.2.9 scrub-controller

Usage

`scrub-controller [-h|--help] | [-v|-version]`

`scrub-controller [-f|-format]`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

`-f, --format` Formats the SD card in the proper ext4 filesystem and initializes the folder structure.

Description

Clears all data stored in the RBR*cervello* storage. This command is unavailable if the RBR*cervello* status is `logging`.

Examples

```
RBRcervello> scrub-controller
Are you sure you want to scrub the controller? (y/N)y

Removing files from
    /mnt/sdcard/data...
    /mnt/sdcard/logs...
    /mnt/sdcard/lost+found...
    /mnt/sdcard/messages...
    /mnt/sdcard/publisher...
    /mnt/sdcard/queues...
    /mnt/sdcard/responses...
    /mnt/sdcard/tasks...
```

7.2.10 scrub-instrument

Usage

`scrub-instrument [-h|--help] | [-v|-version]`

`scrub-instrument [-a|-all]`

`scrub-instrument <command>`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

`-a, -all` Erases all instruments.

Commands

`instrument<XX>` Erases instrument XX.

Description

Clears the internal memory of an instrument connected to the system. This command is unavailable if the RBR*cervello* status is logging. By default, it erases all instruments.

Examples

```
RBRcervello> scrub-instrument
Are you sure you want to scrub instrument01? (y/N) y
Checking deployment status...
Clearing memory...
Instrument 01: success
```

When the instrument number is not entered, the command defaults to instrument 01.

```
RBRcervello> scrub-instrument instrument02
Are you sure you want to scrub instrument02? (y/N) y
Checking deployment status...
Clearing memory...
Instrument 02: success
```

```
RBRcervello> scrub-instrument -a
Are you sure you want to scrub ALL instruments? (y/N) y
Checking deployment status...
Clearing memory...
Instrument 01: success
Instrument 02: success
```

7.2.11 enable

Usage

`enable [-h|--help] | [-v|-version]`

Options

`-h, --help` Displays this help message and exits.
`-v, --version` Outputs version information and exits.

Description

Enables deployments according to internal configuration files. Configures instruments and sets them up to start logging. Deletes any stopping flag for the deployment; whenever the system reboots, the deployment behaviour will continue.

Examples

```
RBRcervello> enable
Deployment enabled
```

7.2.12 help

Usage

`help`

Description

Displays the RBR*cervello* diagnostic **Help** menu as shown on wake up.

Examples

```
RBRcervello> help
RBRcervello Menu.

These are the available commands to manage RBRcervello

   disable               Disable deployment.
   status                Provide a general overview or detailed information on
                         controller and instruments.
   diagnose              Diagnostics for MLM and telemetry.
   transparent-link      Establish a transparent link to an instrument
                         serial port.
   config-check          Print the current configuration of a specific RBR
                         subsystem.
   edit-config           Edit the current configuration of a specific
                         RBR subsystem.
   set-instrument-clock  RBR instrument clock sync.
   set-cervello-clock    RBRcervello clock setter.
   cervello-clock        RBRcervello clock checker.
   scrub-controller      Clear all data stored in the SD card.
   scrub-instrument      RBR instrument scrubber.
   enable                Enable deployment according to internal configuration
                         files.
   reboot-controller     Reboot system as if it had entered deep-sleep and
                         waken up.
   help                  Show this menu.
```

7.2.13 transparent-link

Usage

`transparent-link [-h|--help] | [-v|-version]`

`transparent-link [-p|--port] <port>`

Options

`-h, --help` Displays this help message and exits.

`-v, --version` Outputs version information and exits.

`-p, --port <port>` Selects a specific port number to interact with. Defaults to 1.

Description

Stops all services permanently and open a transparent link with the chosen serial port.

Examples

```
BRcervello> transparent-link
Checking deployment status...
Stopping services...
Stopping periodic command scheduler: cron.
Waiting for publisher to terminate...
Connected. Press CTRL-C to exit when done.
```

When the port number is not entered, the command defaults to Port 1.

```
RBRcervello> transparent-link -p 2
Checking deployment status...
Stopping services...
Stopping periodic command scheduler: cron failed!
Waiting for publisher to terminate...
Connected. Press CTRL-C to exit when done.
```

8 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.

9 Revision history

Revision No.	Release date	Notes
A	21 May 2024	Initial release.
B	27 September 2026	Migrated. Reformatted and reviewed; no technical changes.