RBR*oregano*
INSTRUMENT GUIDE

rbr-global.com

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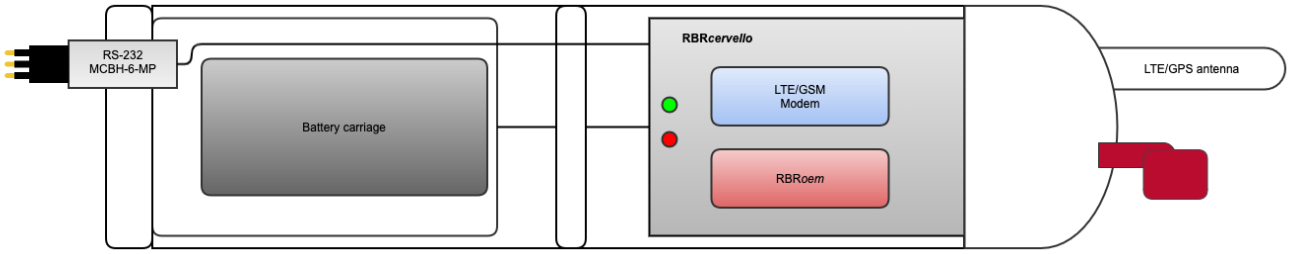
1 Getting started

1.1 Block diagram



1.2 Telemetry

GSM/LTE

Before 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. 1. GSM/LTE modem

Supported bands

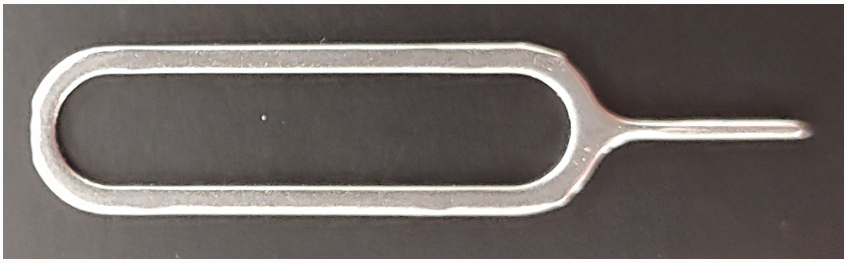
GSM/LTE modem	LTE FDD (Bands 1,2,3,4,5,7,8,12,13,18,19,20,26,28) LTE TDD (Bands 38,39,40,41) WCDMA (Bands 1,2,4,5,6,8,19) GSM (Bands 2,3,5,8)

Accessing the GSM/LTE modem SIM card tray

The GSM/LTE modem can be found in the sensor endcap of the profiler. Please follow Opening the instrument to open the instrument from the sensor endcap.

For dual modems manufactured after April 2021:

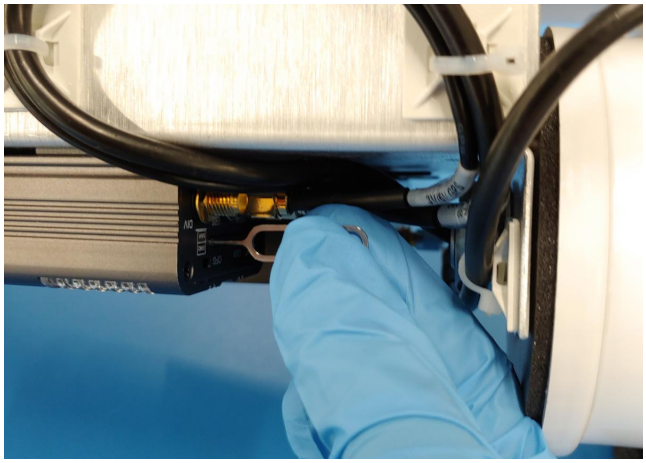
- SIM removal tool (included in the support kit)



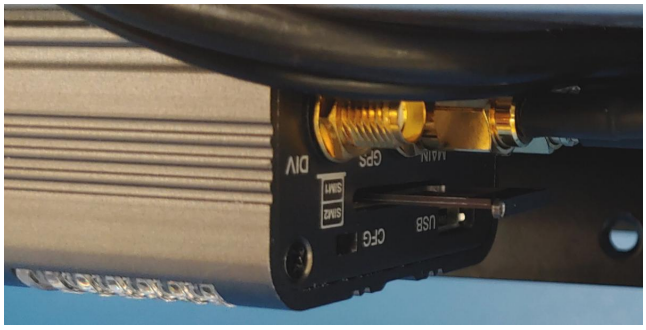
The GSM modem accepts a nano SIM-card (4FF).

1. Locate the pinhole in the SIM tray.

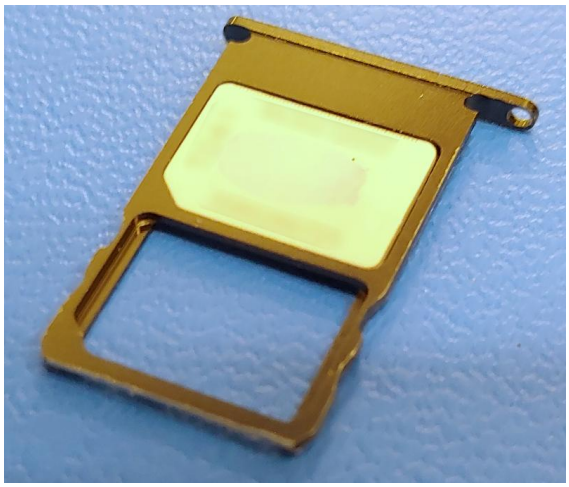
2. Insert the SIM removal tool as straight as possible into the pinhole and push. The tray will pop out.



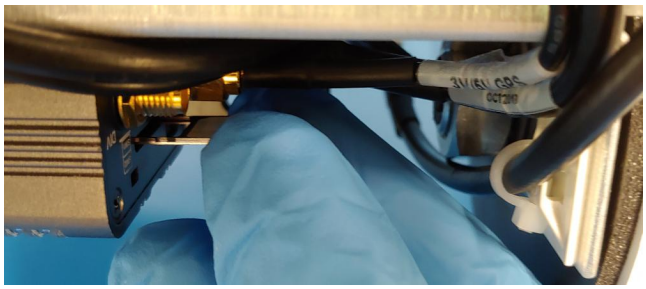
3. Pull the tray out of the modem.



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 flush 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.

1.3 Using the internal USB port

- Male USB-C to male USB-A or USB-C cable
- Computer with a USB port
- Serial terminal

If the instrument is not connected to a charged internal battery, an external power supply is needed.

Connecting to the internal USB port

The internal USB port should only be used in a raised, dry, covered area, such as an indoor lab bench, the back of a hatched vehicle, or an outdoor table covered by an awning.

Intended uses

- Configuring or updating the instrument.
- Retrieving data from the instrument.
- Performing detailed diagnostics on the instrument.

To use the internal USB port

1. Follow the steps in Opening the instrument to access the internal.
2. Connect your computer to the USB-C port shown to the right.
3. If the instrument is not connected to a charged internal battery:
   a. Connect the MCIL-6-FS RS-232 to USB-C cable to the MCBH-6-MP RS-232 connector on the instrument's endcap.
   b. Connect the terminal block on the MCIL-6-FS RS-232 to USB-C cable to an external power supply set to 12V and ideally limited to 1A.
   c. Power on the external power supply.
   d. Wait ~15s for the instrument to boot. Current will drop from ~150-200mA to ~50mA.
4. Enumerate USB devices (in Device Manager on Windows, in "/dev" on Linux) to check that your computer recognizes the instrument.

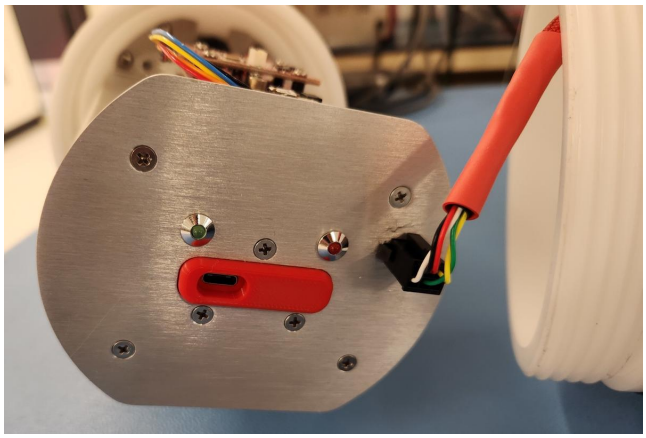


Fig. 2. USB-C port on the internal RBRcervello faceplate

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

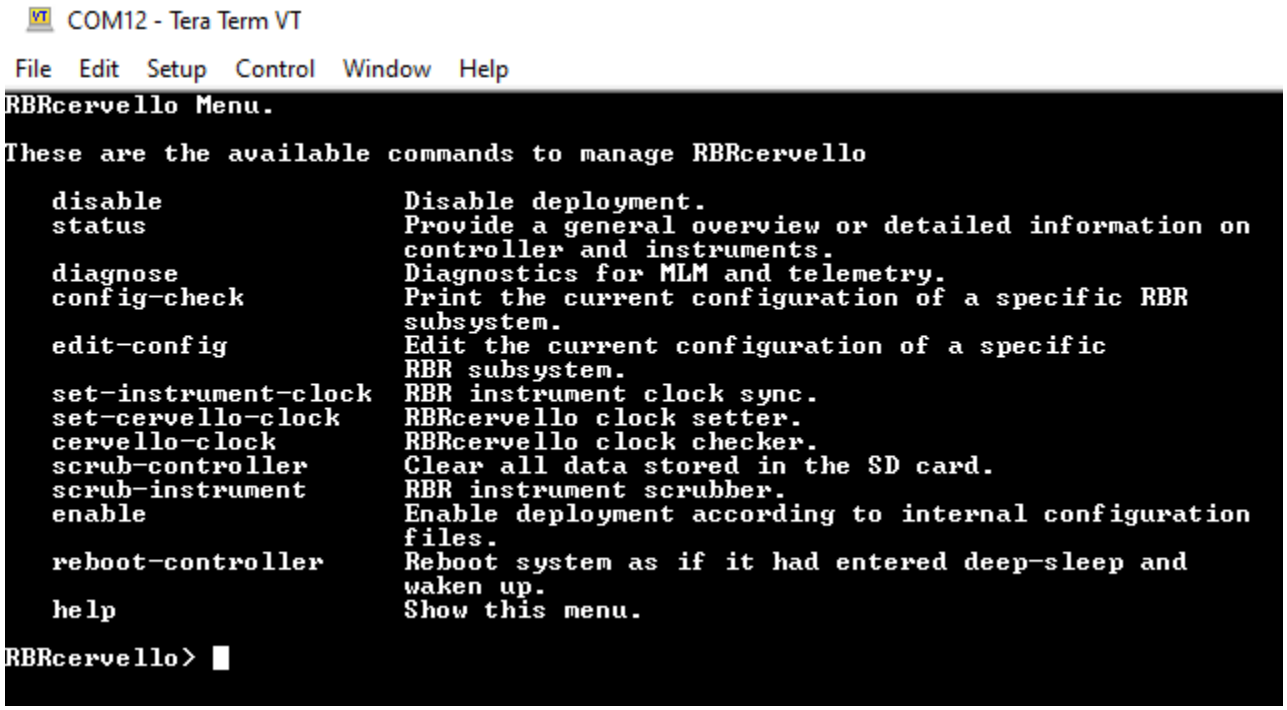
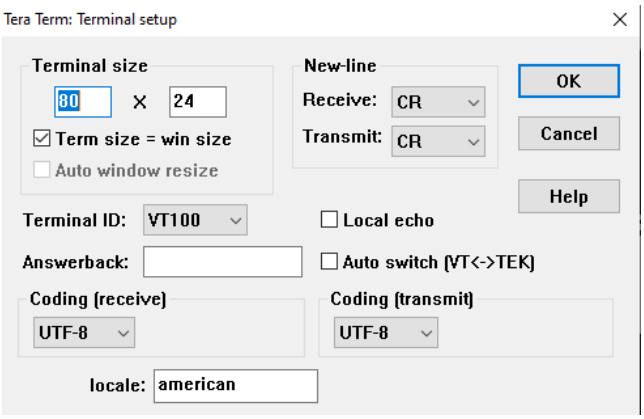


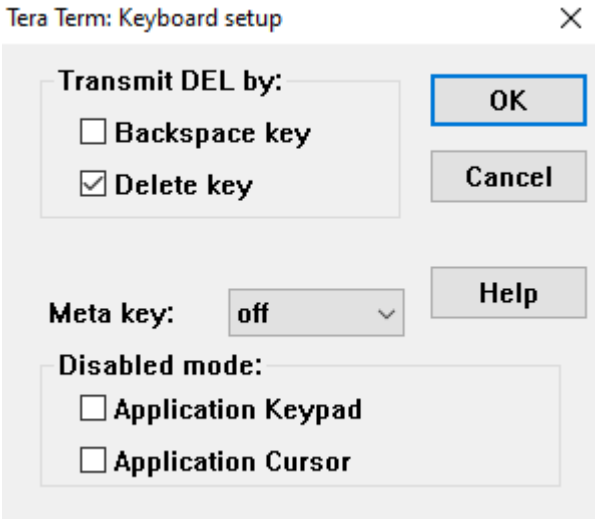
Fig. 3. Tera Term

Alternatively, configure the settings manually as follows:

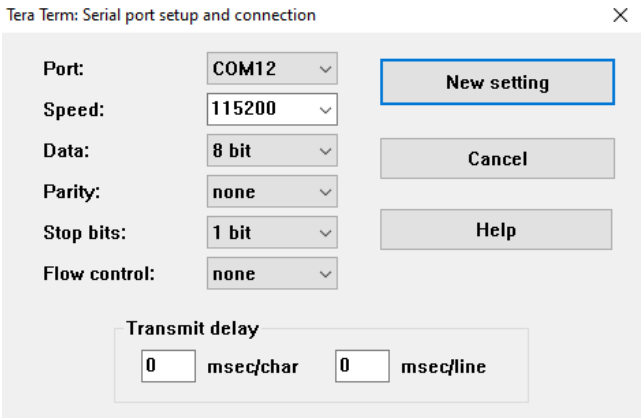
- In "Setup→Terminal setup" menu, enter the terminal size:



- 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:

```
minicom -D /dev/ttyACM0
```

```
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.
   mount-storage         Mount the data to the host computer.
   unmount-storage       Unmount the data to the host computer.
   diagnose              Diagnostics for MLM and telemetry.
   transparent-link      Establish a transparent link to an instrument
                         serial port.
   config-check          Print the configuration of a specific RBR subsystem.
   edit-config           Edit the 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 the controller.
   help                  Show this menu.

RBRcervello>
```

Fig. 4. Minicom

```
+-----------------------------------------------------------------------+
| A -    Serial Device      : /dev/ttyACM0                              |
| B - Lockfile Location     : /var/lock                                 |
| C -   Callin Program      :                                           |
| D -  Callout Program      :                                           |
| E -    Bps/Par/Bits       : 115200 8N1                                |
| F - Hardware Flow Control : No                                        |
| G - Software Flow Control : No                                        |
|                                                                       |
|    Change which setting?                                              |
+-----------------------------------------------------------------------+
        | Screen and keyboard      |
        | Save setup as dfl        |
        | Save setup as..          |
        | Exit                     |
        | Exit from Minicom        |
        +--------------------------+
```

Fig. 5. Minicom serial settings

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

Due to the nature of virtual serial ports, the baudrate is unimportant and can be set to an arbitrary value.

Diagnostic menu overview

Access the RBR*cervello* menu via the diagnostic port. 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.

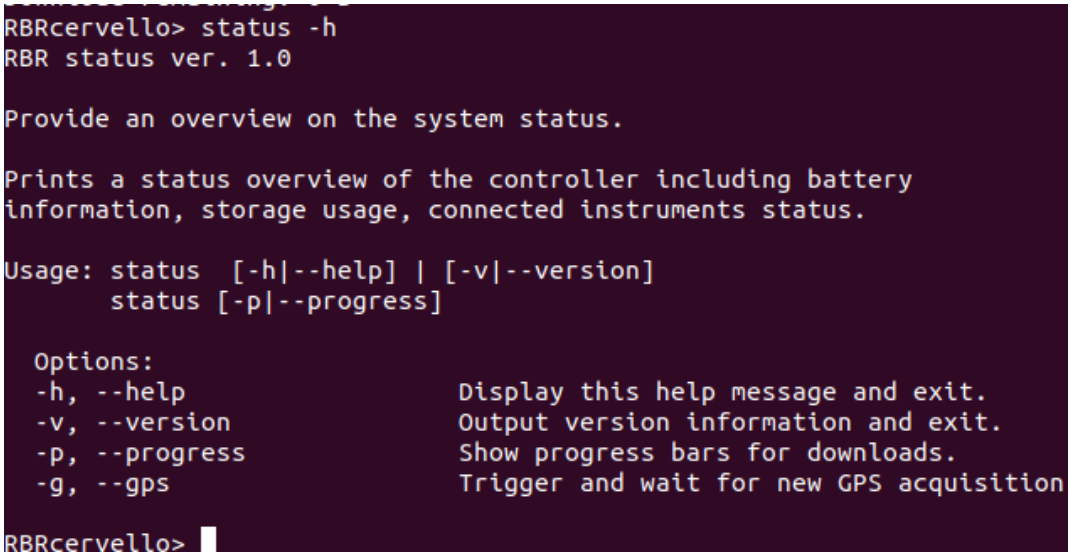


Fig. 6. "status" help

```
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   enable                Enable deployment according to internal configuration
                         files.
   reboot-controller     Reboot the controller.
   help                  Show this menu.
```
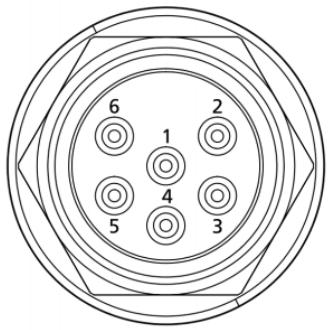

See the Diagnostic menu section for more information.

1.4 Using the RS-232 port

- USB-C to RS-232 MCIL-6-FS cable (provided)
- Computer with a USB-C port
- Serial terminal

External MCBH-6-MP RS-232 connector pinout



Pin No.	USB
1	Ground
2	Power +9 to +22 V
3	RX
4	TX
5	N/C
6	N/C

USB Patch cable

Part No.	2-metre patch cable	Notes
0009379	RS-232 - MCIL-6-FS to USB-C	For instruments with RS-232 output. Includes a power terminal block.

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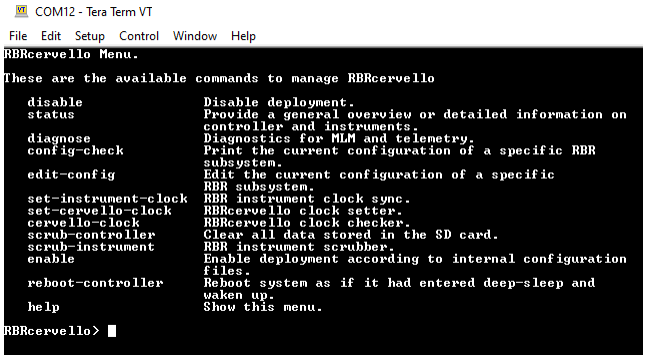

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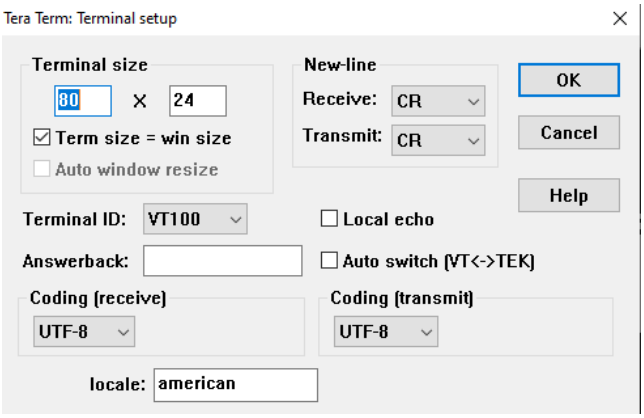

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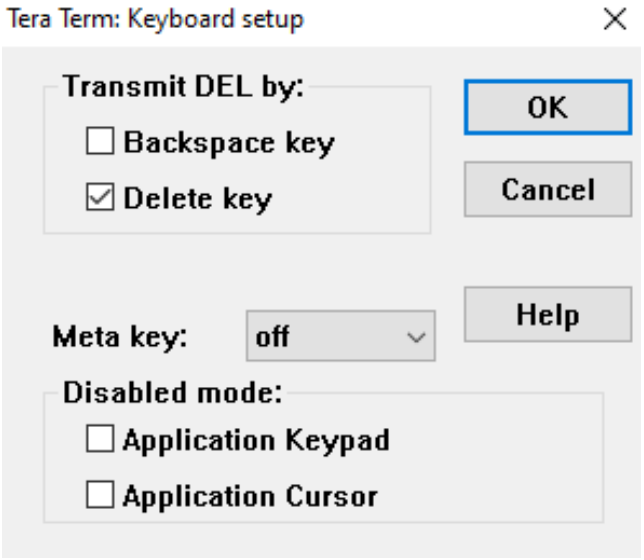

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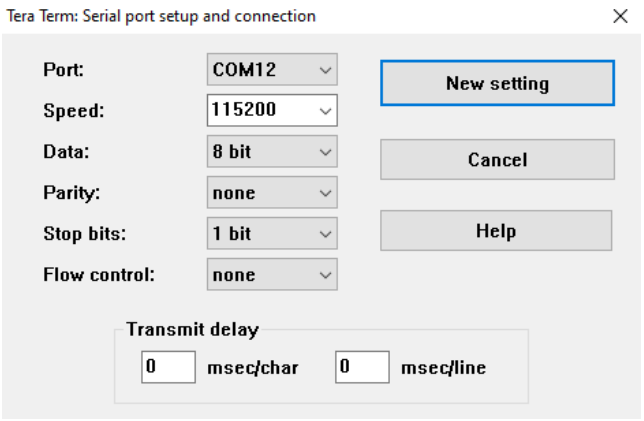

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```
1 minicom -D /dev/ttyUSB0
```

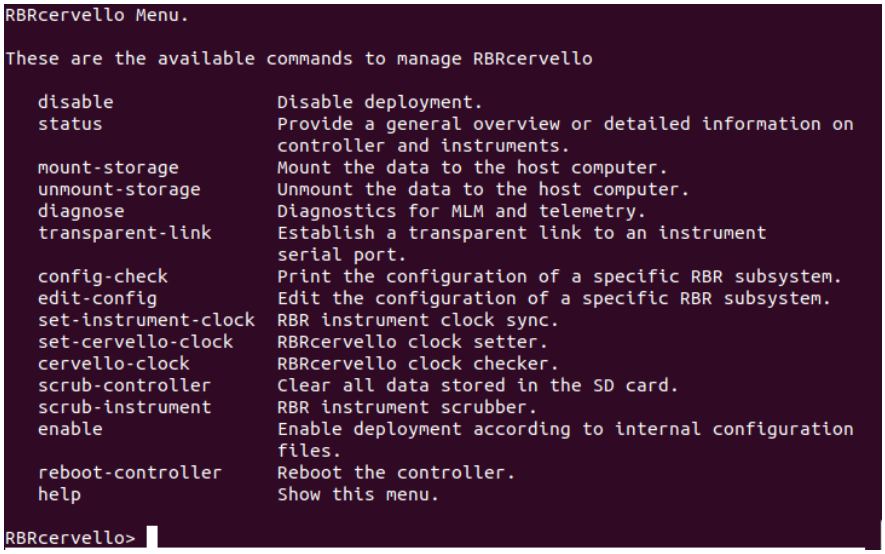

Fig. 8. Minicom

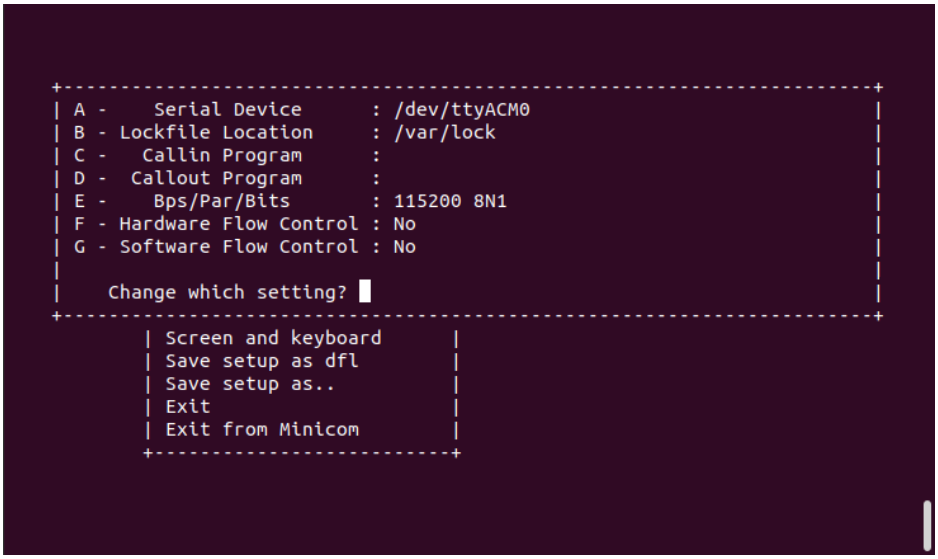

Fig. 9. Minicom serial settings

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```
RBRcervello> status -h
RBR status ver. 1.0

Provide an overview on the system status.

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

Usage: status  [-h|--help] | [-v|--version]
       status [-p|--progress]

  Options:
  -h, --help                  Display this help message and exit.
  -v, --version               Output version information and exit.
  -p, --progress              Show progress bars for downloads.
  -g, --gps                   Trigger and wait for new GPS acquisition

RBRcervello>
```

Fig. 10. "status" help

```
RBRcervello Menu.

These are the available commands to manage RBRcervello

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   status                Provide a general overview or detailed information on
                         controller and instruments.
   mount-storage         Mount the data to the host computer.
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   diagnose              Diagnostics for MLM and telemetry.
   transparent-link      Establish a transparent link to an instrument
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   config-check          Print the configuration of a specific RBR subsystem.
   edit-config           Edit the 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 the controller.
   help                  Show this menu.
```

See the Diagnostic menu section for more information.

1.5 Prepare for deployment

1.5.1 Bench testing

- USB-C to RS-232 MCIL-6-FS cable (provided)
- Computer with a USB-C port.
- Serial terminal

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

- The RBR*cervello* can communicate with the instrument
- The RBR*cervello* telemetry modem (GSM/LTE) is operational
- The RBR*cervello* can communicate with the GPS

Setting up the instrument for testing

1. Ensure that the instrument's batteries are charged.
2. Close the instrument, if it is open, as described in Opening the instrument.
3. Move the instrument outside or near a large window, where its antenna can receive a GPS signal.
4. Connect a computer to the external MCBH-6-MP RS-232 connector on the instrument's endcap.
5. Open a serial connection to the instrument by following the instructions at Using the RS-232 port.
6. Check the internal voltage on the instrument using the "status" command.

Instrument troubleshooting

First, disable the RBR*cervello* using the "disable" command.

```
RBRcervello> disable
Deployment stopped
```

Check the status using the "status" command to verify that the instrument doesn't report any errors.

GSM/LTE modem troubleshooting

This test requires the RBR*cervello* to have an activated SIM-card installed in the GSM modem as described in Telemetry. If 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 GSM test will wait for any ongoing communication to finish and will diagnose the connection to the internet via the GSM modem.

```
RBRcervello> diagnose gsm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Starting GSM test
I think the GSM modem is on /dev/ttymxc1 at 230400 baud.
Waiting for the modem to come up for 68 seconds...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: 860195999999999
IMSI: 302729999999999
ICCID: 89302720533999999999
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.
The serial link has been brought down.
Powering off the modem.
```

```
23 Brought the gsm connection up successfully.
```

GPS troubleshooting

Use the "diagnose gps" command.

```
RBRcervello> diagnose gps
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
I think the GPS is on /dev/ttyMAX3 at 9600 baud.
Waiting for the GPS to power up...
$GNRMC,,V,,,,,,,,,,N*4D
$GNVTG,,,,,,,,,N*2E
$GNGGA,
Saw a fix information sentence (GGA).
,,,,,0,00,99.99,,,,,,*56
$GNGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99*2E
$GNGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99*2E
$GPGSV,1,1,00*79
$GLGSV,1,1,00*65
$GNGLL,,,,,,V,N*7A
$GNTXT,01,01,02,ANTSTATUS=OK*25
$GNRMC,,V,,,,,,,,,,N*4D
$GNVTG,,,,,,,,,N*2E
```

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

1.5.2 Preparing the instrument

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" command.

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

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

   ```
   RBRcervello> status

   RBRcervello
   Serial number: 213821
   Part number: 0013327
   Cervello firmware version: 1.18.0
   ```

```
Clock: 2023-02-01 16:12:27

Cervello status: disabled
Cervello internal battery: 14.22 V
Cervello external battery: 0.00 V

Storage used     : 14 MB
Storage remaining: 13763 MB
Storage size     : 13776 MB

Telemetry last update: 2023-02-01 14:01:29
Telemetry last result: success
Telemetry last mode  : gsm

GPS last update        : N/A
GPS last result        : N/A
GPS last known position: N/A

Instrument 01 last update     : 2023-02-01 16:12:23
Instrument 01 status          : stopped
Instrument 01 internal battery: 0.00 V
Instrument 01 external battery: 13.92 V

Download remaining: 0 B
```

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...
```

5. Reboot the RBR*cervello* using the "reboot-controller" command. The USB interface might need a reconnection after rebooting the controller.

1.5.3 Enabling the instrument

After preparing the instrument the last step left is to enable the system so that it starts the deployment.

1. Enable the RBR*cervello* using the "enable" command.

```
RBRcervello> enable
Deployment started
```

2. Re-check the status of the instruments using the "status" command to verify that they in the "logging" state.

```
RBRcervello> status

```

```
RBRcervello
Serial number: 213821
Part number: 0013327
Cervello firmware version: 1.18.0

Clock: 2023-02-01 16:13:29

Cervello status: logging
Cervello internal battery: 14.22 V
Cervello external battery: 0.00 V

Storage used     : 14 MB
Storage remaining: 13763 MB
Storage size     : 13776 MB

Telemetry last update: 2023-02-01 14:01:29
Telemetry last result: success
Telemetry last mode  : gsm

GPS last update        : N/A
GPS last result        : N/A
GPS last known position: N/A

Instrument 01 last update     : 2023-02-01 16:13:23
Instrument 01 status          : logging
Instrument 01 internal battery: 0.00 V
Instrument 01 external battery: 13.92 V

Download remaining: 0 B
```

1.6 Predeployment checklist

- Inspect O-rings. See Replacing the O-rings.
- Replace the desiccant.
- Replace the batteries with LiSOCL2 D-cells. See Replacing batteries.
- Update the configuration with the correct parameters for the deployment. See Configuration files reference and Updating the instrument.
- Perform a bench test with the instrument fully assembled. See Prepare for deployment.
- Enable the instrument right before deploying. See enable.
- Check that the instruments are logging. See status.

1.7 Retrieving data

- Male USB-C to male USB-A or USB-C cable
- Computer with a USB port
- Serial terminal

In order to retrieve data from the RBR*cervello* you need to use the diagnostic menu.

1. Open the instrument as described in Opening the instrument.
2. Make sure the unit is powered.

3. Connect the provided USB patch cable to the instrument and computer.

> Make sure that Ruskin isn't running when you connect the instrument.

4. Open a serial terminal as described in Using the internal USB port.
5. Disable the instrument using the "disable" command.
6. Check that all the instruments are disabled using the "status" command.
7. Use the "mount-storage" command to expose the data to the host computer.

```
RBRcervello> mount-storage
Checking deployment status...
Stopping services...
Mounting data partition as read-only
```

> In MacOS the USB cable needs to be unplugged and replugged to the laptop in order for the drive to be detected.

1. Copy the data from the "RBRcervello" drive that is shown on the computer.
2. Use the "unmount-storage" command to cleanly disconnect the drive.
3. Securely close the instrument.

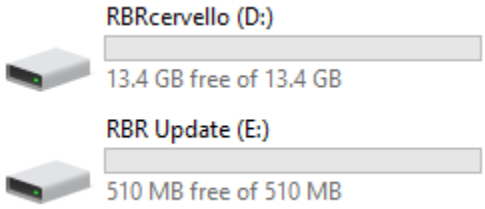


Fig. 11. Drives after using mount-storage

1.8 Updating the instrument

The RBR*cervello* has a USB interface for retrieving data from the unit and for installing firmware and configuration updates.

> An RBR*cervello* could be in a deep sleep state when the USB cable is connected. It might take up to 15 seconds to get registered on the computer

> - Male USB-C to male USB-A or USB-C cable
> - Computer with a USB port
> - Serial terminal

1.8.1 Initial steps

In order to retrieve data from the RBR*cervello* you need to use the diagnostic menu.

1. Open the instrument as described in Opening the instrument.
2. Make sure the unit is powered.
3. Connect the provided USB patch cable to the instrument and computer.

Make sure that Ruskin isn't running when you connect the instrument.

4. Open a serial terminal as described in Using the USB port.
5. Disable the instrument using the "disable" command.
6. Check that all the instruments are disabled using the "status" command.
7. Use the "mount-storage" command to expose the data to the host computer.

```
RBRcervello> mount-storage
Checking deployment status...
Stopping services...
Mounting data partition as read-only
```

In MacOS the USB cable needs to be unplugged and replugged to the laptop in order for the drive to be detected.

1. Uncompress the update-package provided in the root directory of the "RBR Update". Alternatively, open the zip file, then drag-and-drop the "rbrcervello" folder into the "RBR Update" drive. The folder structure should look like the screenshots on the right depending on what would be updated, the configuration files or the firmware.

The configuration files can be tweaked by the end user according to the Configuration files reference.

2. Eject the "RBR Update" drive from the computer before proceeding.

Failing to eject the drive before disconnecting the cable or executing the unmount-storage command could result in a failed update.

3. Use the "unmount-storage" command to cleanly disconnect the drive.

It might take up to 5 minutes for the update to finish.

4. Once the update process is finished, the instrument will reconnect again to the computer. If it doesn't, try unplugging the USB cable and replugging it.
5. Securely close the instrument.

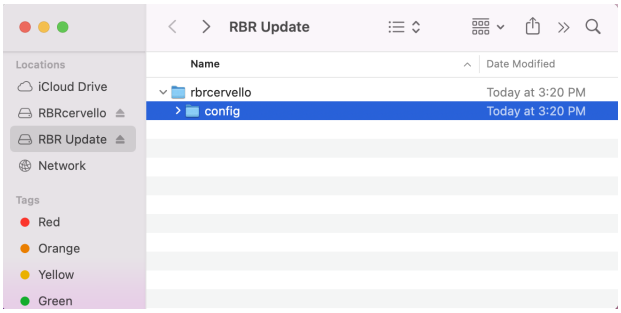


Fig. 12. Configuration update

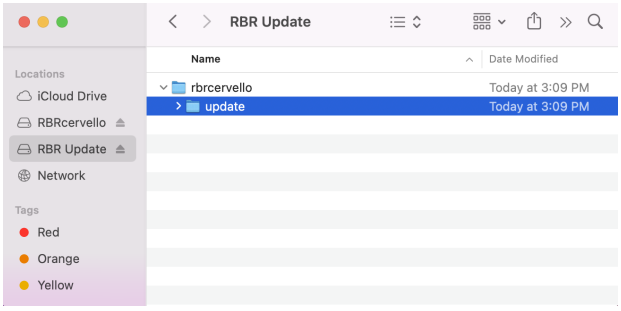


Fig. 13. Firmware update

Light indicator

While applying updates, the red light on the RBR*cervello* will flash steadily. Once all updates are installed, the red light will cease flashing and the green light will turn on. At that point, the RBR*cervello* will reboot itself within 5 seconds. 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 cContact us immediately at support@rbr-global.com or via the RBR website if there are any issues with your instrument.

Once the red light has turned off and stays off for several seconds, reconnect the instrument.

2 Maintenance

2.1 Opening the instrument

- 5 mm hex key
- 10 mm wrench
- 2 tightening clamps (provided)

2.1.1 Opening the instrument

1. Position the instrument on a bench table.
2. Locate the 2 provided clamps.
3. Put one of the clamps on the body within the half that has the MCBH connector and the other clamp right on the bottom cap of the instrument as shown in the picture.
4. Tighten the clamps to the instrument.
5. Unscrew the cap using the leverage of the clamps.
6. Disconnect the cable from the battery carriage.

2.1.2 Closing the instrument

1. Installed the provided clamps as shown in the pictures.
2. Connect the internal cable.
3. Spin the cap around counter-clockwise at least twice to prevent over-twisting the internal cable.
4. Screw the cap.
5. Remove the clamps.

Fig. 14. Installed clamps

Fig. 15. Battery carriage

2.2 Replacing batteries

RBR ships new instruments with lithium thionyl chloride batteries included. Replace batteries before each deployment to maximise the operational time and prevent data loss.

To replace the batteries:

1. Remove the battery end-cap and pull out the battery carriage. See Opening the instrument.
2. Remove the 24 old D-type cell batteries.
3. Insert 24 new LiSOCl2 D-type cell batteries.
4. Check for correct battery polarity.
5. Connect the internal cable.
6. Insert the battery carriage in the logger and return the end-cap back in its place. See Closing the instrument.

2.3 Replacing the O-rings

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

The O-ring may lose elasticity over time due to pressure, even when the logger is not deployed. RBR strongly recommends to replace the O-ring regularly.

There are three O-rings in the instrument. One at each end of the instrument, and another one in the middle of the body.

Inspecting the O-ring

Visually inspect the new O-ring for nicks and scratches before installing it. Pay attention to the following areas:

- The surface of the O-ring itself
- The mating surface on the inside of the case between the threads and the open end
- The groove in the end-cap where the O-ring sits

Avoid using any object that could scratch the O-ring or any of its mating surfaces.

If dirt is present in the O-ring groove, remove the O-ring as described below and thoroughly clean the groove.

Do not return this old O-ring to the instrument! If you remove the O-ring from the logger for any reason, always replace it with a new one.

If the surfaces of the O-ring groove are scratched, pitted, or damaged, contact RBR for advice at support@rbr-global.com.

Replacing the O-ring

> Do not use metal screwdrivers or any other metal tool! They may scratch the O-ring groove and render the end-cap useless.

1. Use the plastic O-ring tool (included with the logger) to remove the O-ring from its groove.

   > The O-ring may need to stretch quite a bit as it is pushed off. This requires some effort, but can be done by hand.

2. Clean the groove thoroughly with a soft, lint-free cloth and compressed air, if necessary.
3. Select the proper O-ring and inspect it for damage.
4. Lubricate the new O-ring with a very light film of silicone grease (included with the logger).
5. Install the new O-ring by pushing it into place and popping it into its groove.
6. Once the new O-ring is in place, inspect it once more for scratches and debris, and wipe away any silicone grease deposited on the end-cap.
7. Once the inspection is complete, close the logger.

3 Reference

3.1 Configuration files reference

3.1.1 Prepare a configuration file update package

In order to update the configuration files on the RBR*cervello* you will need to put the updated files inside the config folder using the following folder structure:

```
rbrcervello
└── config
    ├── environment.json
    ├── deployment01.json
    └── user.json
```

3.1.2 RBRcervello configuration file

The user.json file defines user-adjustable settings, such as sampling rates for batteries, deep sleep periods, and general behaviours of the controller.

> Note that when using the config-check or edit-config commands in the RBRcervello, the correct argument to open this file is "**cervello**".

3.1.2.1 user.json reference manual

3.1.2.2 Example

```
{
 "file": {
 "date": "20230209000000",
 "version": "3.2.0",
 "schema": "0011713",
 "customer": "OSU"
     },
 "controller": {
 "battery_period": 600,
 "deep_sleep": {
 "enabled": true,
 "schedule_period": 15
        },
 "clock_sync_timeout": 43200
    },
 "gps": {
 "enabled": true,
 "period": 7200,
 "fix_timeout": 300,
 "hdop_threshold": 4.1
    },
 "instrument": [
        {
 "enabled": true,
 "label": "UWP CTD|tilt",
```

```
"type": "RBR",
"config_file": "deployment01.json",
"port": 1,
"ssm": 0,
"battery_period": 600,
"can_be_stopped": true,
"max_stopped_download_gap": 1382400,
"enforce_max_dataset_size": true,
"max_dataset_size": 1000000000,
"processing": [
                {
"subset": "raw",
"channel": [
                        {
"key": "cond19",
"transmit": true,
"min": 0.0,
"max": 150.0,
"res": 0.0001
                        },
                        {
"key": "temp14",
"transmit": true,
"min": 0.0,
"max": 150.0,
"res": 0.0001
                        },
                        {
"key": "pres24",
"transmit": true,
"min": 0.0,
"max": 150.0,
"res": 0.0001
                        },
                        {
"key": "acc_00",
"transmit": true,
"min": -2.0,
"max": 2.0,
"res": 0.0001
                        },
                        {
"key": "acc_00",
"transmit": true,
"min": -2.0,
"max": 2.0,
"res": 0.0001
                        },
                        {
"key": "acc_00",
"transmit": true,
"min": -2.0,
"max": 2.0,
"res": 0.0001
                        }
                    ]
                }
            ]
```

```
        }
    ],
 "streaming": {
 "enabled": false
    },
 "processing": {
 "enabled": true,
 "period": 1800,
 "time_series": true,
 "differential_encoding": true,
 "diagnostics": true

    },
 "telemetry": {
 "enabled": true,
 "force_period": 3600,
 "preheat_timeout" : 300,
 "telemetry_timeout" : 360,
 "controller_trigger_enabled" : false,
 "schedule_trigger" : {
 "enabled" : false,
 "period" : 1800
       },
 "pressure_trigger" : {
 "enabled" : true,
 "arming_pressure" : 24,
 "engage_pressure" : 20,
 "telemetry_pressure" : 12
       },
 "no_attempt_window" : 100,
 "mode": ["gsm"],
 "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"
       }

    }
}
```

3.1.3 Logger configuration file

The deployment01.json file contains instrument deployment settings and is used by the controller to reset and configure the instrument to a known state before starting the deployment. The most important parameter found in it is the sampling regime of the logger.

> Note that when using the config-check or edit-config commands in the RBRcervello, the correct argument to open this file is "**instrument01**".

3.1.3.1 deployment01.json reference manual

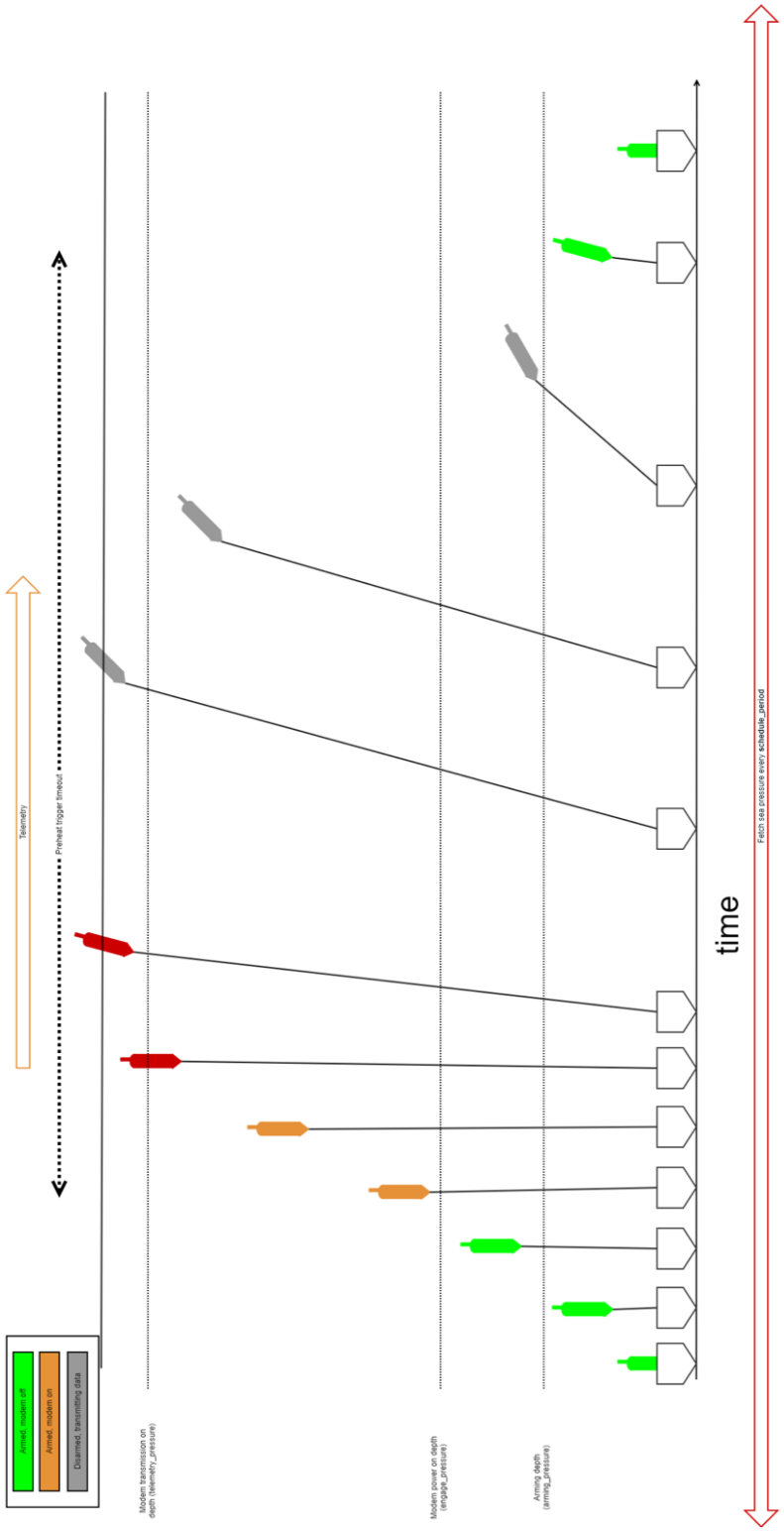
3.1.3.2 Example

```
{
 "file": {
 "date": "20230209000000",
 "version": "3.1.0",
 "schema": "0011711",
 "customer": "OSU"
     },
 "id": {
 "fwtype": 104
     },
 "part": {
 "bomnumber": "0013326",
 "description": "UWP CTD|tilt"
     },
 "deployment": {
 "channel 1": {
 "status": "on"
          },
 "channel 2": {
 "status": "on"
          },
 "channel 3": {
 "status": "on"
          },
 "channel 4": {
 "status": "on"
          },
 "channel 5": {
 "status": "on"
          },
 "channel 6": {
 "status": "on"
          },
 "channel 7": {
 "status": "off"
          },
 "channel 8": {
 "status": "off"
          },
 "channel 9": {
 "status": "off"
          },
 "channel 10": {
 "status": "off"
          },
 "channel 11": {
 "status": "off"
          },
 "sampling": {
 "mode": "continuous",
 "period": 63,
 "burstlength": 10,
 "burstinterval": 300000
```

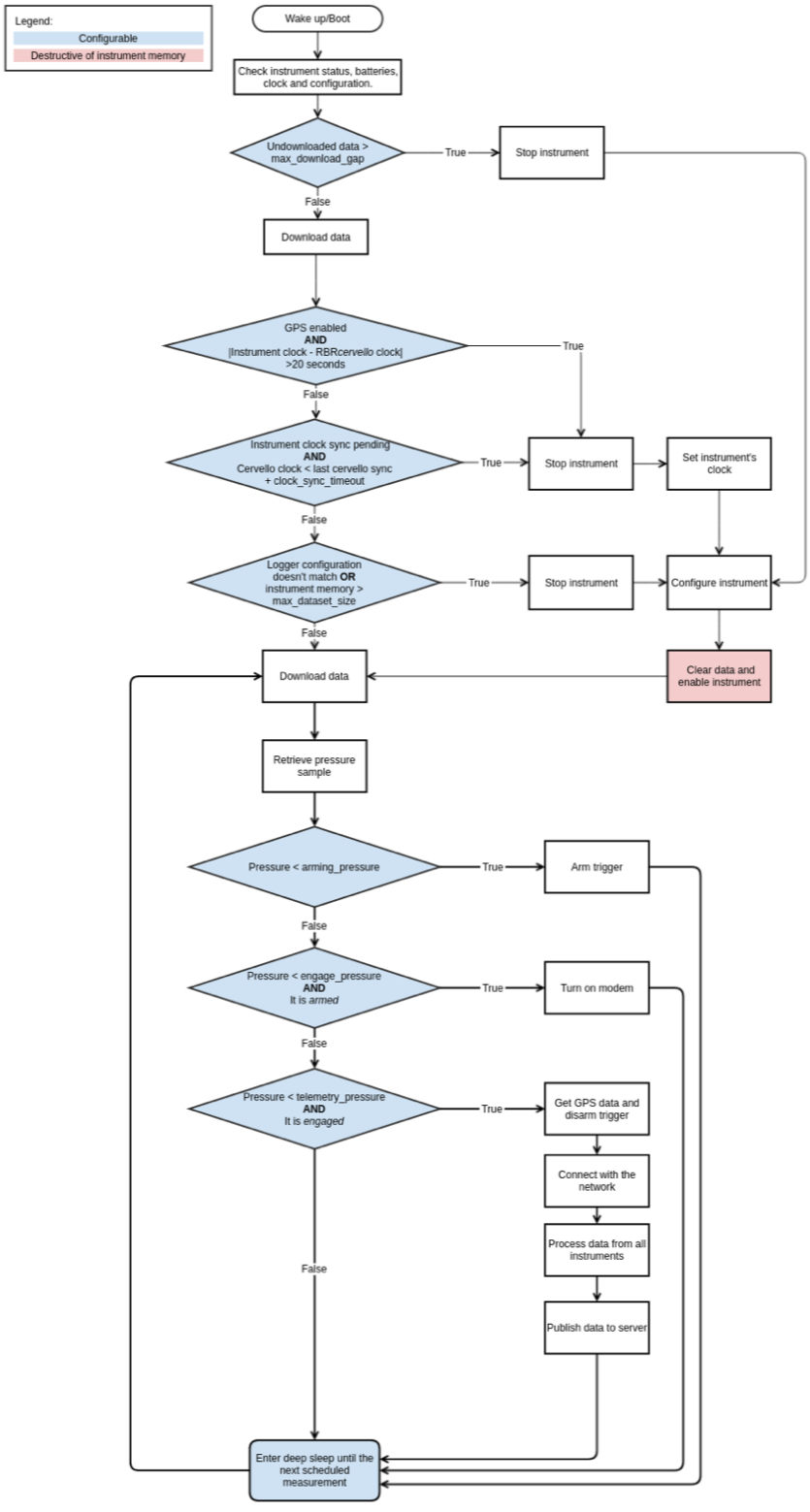
```
        },
 "ddsampling": {
 "direction": "ascending",
 "fastperiod": 63,
 "slowperiod": 10000,
 "fastthreshold": 15,
 "slowthreshold": 12
        },
 "deployment": {
 "starttime": 20000101000000,
 "endtime": 20380101000000
        },
 "streamserial": {
 "state": "off"
        },
 "streamusb": {
 "state": "off"
        },
 "settings": {
 "fetchpoweroffdelay": 20000,
 "sensorpoweralwayson": "off",
 "temperature": 15.0000,
 "atmosphere": 10.1325010,
 "pressure": 10.1325,
 "density": 1.0260209,
 "speccondtempco": 0.0191,
 "salinity": 35.0000,
 "avgsoundspeed": 1506.8000,
 "altitude": 0.0000,
 "castdetection": "on",
 "inputtimeout": 10000
        },
 "thresholding": {
 "enabled": false,
 "interval": 1000,
 "channelindex": 3,
 "condition": "below",
 "value": 90
        },
 "memformat": {
 "newtype": "calbin00"
        },
 "outputformat": {
 "type": "caltext01"
        },
 "confirmation": {
 "state": "on"
        },
 "prompt": {
 "state": "on"
        }
    }
}
```

3.2 Deployment behaviour

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



3.2.1 Behaviour with pressure trigger enabled and deep-sleep enabled



3.3 Diagnostic menu

3.3.1 config-check

3.3.1.1 Name

config-check - prints the configuration of a specific RBR subsystem.

3.3.1.2 Synopsis

RBR configuration checker.

3.3.1.3 Usage

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

config-check [-c|--config-file] [device]

3.3.1.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

-c, --config-file [device]

Show configuration file.

Where "device" is the device of which configuration will be shown.

The supported devices are the following:

instrumentXX displays the corresponding deployment configuration of instrument **XX**.

cervello displays the user configuration of the RBR*cervello*.

Note that "**instrument01**" usually maps to the "deployment01.json" file, and "**cervello**" to "user.json". However, the correct argument for this command is "**instrument01**" and "**cervello**".

3.3.1.5 Description

Display in an interactive manner the current configuration of the RBR*cervello* or one of the configured instruments. Use arrow keys to scroll the configuration. Key **Q** to exit.

3.3.1.6 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"
        }

    }
}
```

```
RBRcervello> config-check -c instrument01
Showing configuration file of instrument01.
{
     "file": {
          "date": "20230209000000",
          "version": "3.1.0",
          "schema": "0011711",
          "customer": "OSU"
     },
     "id": {
          "fwtype": 104
     },
     "part": {
        "bomnumber": "0013326",
        "description": "UWP CTD|tilt"
     },
     "deployment": {
          "channel 1": {
               "status": "on"
          },
          "channel 2": {
               "status": "on"
          },
          "channel 3": {
```

```
            "status": "on"
        },
        "channel 4": {
            "status": "on"
        },
        "channel 5": {
            "status": "on"
        },
        "channel 6": {
            "status": "on"
        },
        "channel 7": {
            "status": "off"
        },
        "channel 8": {
            "status": "off"
        },
        "channel 9": {
            "status": "off"
        },
        "channel 10": {
            "status": "off"
        },
        "channel 11": {
            "status": "off"
        },
        "sampling": {
            "mode": "continuous",
            "period": 63,
            "burstlength": 10,
            "burstinterval": 300000
        },
        "ddsampling": {
            "direction": "ascending",
            "fastperiod": 63,
            "slowperiod": 10000,
            "fastthreshold": 15,
            "slowthreshold": 12
        },
        "deployment": {
            "starttime": 20000101000000,
            "endtime": 20380101000000
        },
        "streamserial": {
            "state": "off"
        },
        "streamusb": {
            "state": "off"
        },
        "settings": {
            "fetchpoweroffdelay": 20000,
            "sensorpoweralwayson": "off",
            "temperature": 15.0000,
            "atmosphere": 10.1325010,
            "pressure": 10.1325,
            "density": 1.0260209,
            "speccondtempco": 0.0191,
            "salinity": 35.0000,
```

```
                "avgsoundspeed": 1506.8000,
                "altitude": 0.0000,
                "castdetection": "on",
                "inputtimeout": 10000
           },
           "thresholding": {
                "enabled": false,
                "interval": 1000,
                "channelindex": 3,
                "condition": "below",
                "value": 90
           },
           "memformat": {
                "newtype": "calbin00"
           },
           "outputformat": {
                "type": "caltext01"
           },
           "confirmation": {
                "state": "on"
           },
           "prompt": {
                "state": "on"
           }
      }
}
```

3.3.2 diagnose

3.3.2.1 Name

diagnose

3.3.2.2 Synopsis

Perform in-depth tests for telemetry and MLM links

3.3.2.3 Usage

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

3.3.2.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

gsm diagnose GSM telemetry

3.3.2.5 Description

gsm: Ensures connectivity through GSM to the Internet.

3.3.2.6 Examples

```
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.
messages-read: no process found
The serial link has been brought down.
Powering off the modem.
Starting periodic command scheduler: cron.
RBRcervello>
```

3.3.3 disable

3.3.3.1 Name

disable

3.3.3.2 Synopsis

Disable deployment.

3.3.3.3 Usage

disable [-h]

3.3.3.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

3.3.3.5 Description

Disable deployment, disable instruments, and generate a persistent flag to prevent reenabling instruments in future boot cycles.

3.3.3.6 Examples

```
RBRcervello> disable
Deployment disabled
```

3.3.4 edit-config

3.3.4.1 Name

edit-config

3.3.4.2 Synopsis

Edit the current configuration of an instrument or the RBRcervello.

3.3.4.3 Usage

edit-config [-n|–new-file] | [-c|--config-file] device

edit-config [-h]

3.3.4.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

-c, --config-file [device]

Where 'device' is the device of which configuration will be shown.

The supported devices are the following:

- **instrumentXX** allows editing the deployment configuration file of instrument **XX**
- **cervello** allows editing the RBRcervello user configuration file

-n, --new-file

Start editing from an empty file

Note that "**instrument01**" usually maps to the "deployment01.json" file, and "**cervello**" to "user.json". However, the correct argument for this command is "**instrument01**" and "**cervello**".

3.3.4.5 Description

Edit interactively the configuration of a specific instrument or the RBRcervello configuration. This relies on the nano editor.

3.3.4.6 Examples

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

3.3.5 enable

3.3.5.1 Name

enable

3.3.5.2 Synopsis

Enable deployment according to internal configuration files.

3.3.5.3 Usage

enable [-h]

3.3.5.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

3.3.5.5 Description

Enable deployment, configure instruments, and enable them to start logging. Deletes any stopping flag for the deployment, whenever the system reboots, the deployment behaviour will continue.

3.3.5.6 Examples

```
1 RBRcervello> enable
2 Deployment enabled
```

3.3.6 help

3.3.6.1 Name

help

3.3.6.2 Synopsis

Display the RBR*cervello* diagnostic menu help.

3.3.6.3 Usage

help

3.3.6.4 Options

-h, --help

Description

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

3.3.6.5 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.
   mount-storage         Mount the data to the host computer.
   unmount-storage       Unmount the data to the host computer.
   diagnose              Diagnostics for MLM and telemetry.
   transparent-link      Establish a transparent link to an instrument
                         serial port.
   config-check          Print the configuration of a specific RBR subsystem.
   edit-config           Edit the 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 the controller.
   help                  Show this menu.
```

3.3.7 mount-storage

3.3.7.1 Name

mount-storage

3.3.7.2 Synopsis

Mounts the data storage on the computer host.

3.3.7.3 Usage

mount-storage [-h|--help] | [-v|–version]

3.3.7.4 Options

-h, --help Display this help message and exit.

-v, --version Output version information and exit.

3.3.7.5 Description

Stops all services and exposes the internal drives to the host computer.

3.3.7.6 Examples

```
BRcervello> RBRcervello> mount-storage
Checking deployment status...
Stopping services...
Mounting data partition as read-only
```

3.3.8 reboot-controller

3.3.8.1 Name

reboot-controller - gracefully reboot the system.

3.3.8.2 Synopsis

Reboot system as if it had entered deep sleep and waken up.

3.3.8.3 Usage

reboot-controller [-h]

3.3.8.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

3.3.8.5 Description

Stop all internal services and reboot the RBR*cervello*. Useful for testing deployment behaviour.

3.3.8.6 Examples

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

3.3.9 scrub-controller

3.3.9.1 Name

scrub-controller - clears the system's storage.

3.3.9.2 Synopsis

Clear all data stored in the RBR*cervello* storage.

3.3.9.3 Usage

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

3.3.9.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

-f| --format

Formats the SD card in the proper ext4 filesystem and initializes the folder structure.

3.3.9.5 Description

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

3.3.9.6 Examples

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

Checking deployment status...
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...
```

3.3.10 scrub-instrument

3.3.10.1 Name

scrub-instrument - memory eraser for instruments

3.3.10.2 Synopsis

RBR instrument scrubber.

3.3.10.3 Usage

scrub-instrument [-h|--help] | [-v|–version]
scrub-instrument [-a|–all]
scrub-instrument [instrumentXX]

3.3.10.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

instrumentXX

Erase instrument XX.

-a

Erase all instruments.

3.3.10.5 Description

Clear the internal memory of an instrument connected to the system. This command is unavailable if the RBR*cervello* status is logging.

3.3.10.6 Examples

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

3.3.11 status

3.3.11.1 Name

status

3.3.11.2 Synopsis

Provide an overview of the system status.

3.3.11.3 Usage

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

status [-p|--progress]

status [-g|–gps]

3.3.11.4 Options

-h, --help

Display this help message and exit.

-v, --version

Output version information and exit.

-p, --progress

Show progress bars for downloads after displaying system overview. It will update indefinitely update the progress unless program is exited.

-g, --gps

Trigger and wait for a GPS acquisition before displaying the remaining of the system overview

3.3.11.5 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.

3.3.11.6 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
```

3.3.12 transparent-link

3.3.12.1 Name

transparent-link

3.3.12.2 Synopsis

Establish a transparent link to an instrument serial port.

3.3.12.3 Usage

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

transparent-link [-p|--port] [port]

3.3.12.4 Options

-h, --help Display this help message and exit.

-v, --version Output version information and exit.

-p, --port port Select a specific port number to interact with. Defaults to 1.

3.3.12.5 Description

Stops all services permanently and opens a transparent link with the chosen port. By default, it will open a transparent-link with port 1, which is connected to the MLM's head-end modem (HEM).

3.3.12.6 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.
```

```
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.
```

3.3.13 unmount-storage

3.3.13.1 Name

unmount-storage

3.3.13.2 Synopsis

Unmounts the data storage on the computer host.

3.3.13.3 Usage

unmount-storage [-h|--help] | [-v|–version]

3.3.13.4 Options

-h, --help Display this help message and exit.

-v, --version Output version information and exit.

3.3.13.5 Description

Restarts internal services and unmounts the data storage from the computer. When an update package is detected, it will initialize the update process.

3.3.13.6 Examples

```
1 BRcervello> RBRcervello> unmount-storage
2 Mounting data partition as read-only
3 Restarting services...
4 Unmounting data from computer
```

4 Repairs

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

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

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

5 Troubleshooting

5.1 GSM/LTE modem troubleshooting

This test requires the RBR*cervello* to have an activated SIM-card installed in the GSM modem as described in Telemetry. If 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 GSM test will wait for any ongoing communication to finish and will diagnose the connection to the internet via the GSM modem.

```
RBRcervello> diagnose gsm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Starting GSM test
I think the GSM modem is on /dev/ttymxc1 at 230400 baud.
Waiting for the modem to come up for 68 seconds...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: 860195999999999
IMSI: 302729999999999
ICCID: 89302720533999999999
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.
The serial link has been brought down.
Powering off the modem.
Brought the gsm connection up successfully.
```

Failure, bad SIM-card

```
RBRcervello> diagnose gsm
Checking deployment status...
Stopping services...
Waiting for publisher to terminate...
Starting GSM test
I think the GSM modem is on /dev/ttymxc1 at 230400 baud.
Waiting for the modem to come up for 68 seconds...
Modem is up.
Waiting for PPP connection to the modem...
Established PPP connection to the modem. Modem identifiers:
IMEI: 860195999999999
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!
The serial link has been brought down.
Powering off the modem.
RBRcervello>
```

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

6 Revision history

Earlier revisions of this document were issued as PDF editions and are available on request.

Revision No.	Release date	Notes
D	14 September 2026	Migrated. Reformatted and reviewed; no technical changes.