



RSI Technical Note 052

# Rockland Data Logger (RDL)

Overview and Comparison with CF2 Systems

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Peter Stern

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Rockland Scientific International Inc.

520 Dupplin Rd

Victoria, BC, CANADA, V8Z 1C1

[www.rocklandscientific.com](http://www.rocklandscientific.com)

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## 1 Revision History

Revision	Date	Description
1.0	2020-11-06	Initial Version
1.1	2020-12-01	Minor typos and phrasing corrections
1.2	2021-01-07	JMM - Removed extra item in table of event types. Fixed typos.
2.0	2021-11-30	Updated for P113R03 hardware and OSv4 Image.

## 2 Rockland Data Logger (P113 board) Overview

The Rockland Data Logger (RDL) is a third-generation data logging board designed for instruments manufactured by Rockland Scientific Inc. (Rockland). The RDL is designed to replace second-generation data logging systems, which use a Persistor CF2 computer. The RDL is based on a Linux Operating System with custom data acquisition software. The standard mass storage for data is a proprietary 64 GB memory module that is referred to as the “RDL memory module”. The Rockland Data Logger board has a built-in backup energy source (supercapacitor) to ensure that the data logging can shutdown properly when power is removed. There is also a small CR2032 3 V battery that maintains the onboard real-time clock. This battery should be replaced every 4 years. The recommended replacement date is labelled with a sticker at the production facility when the instrument is manufactured.

Previous versions of this TN052 related to the R01 and R02 versions of the RDL hardware and software. This v2.0 adds the P113R03 and OSv4 software capabilities released in the fourth quarter of 2021. The new version of the RDL (R03 for short) adds the capability for “sleep” mode while datalogging to reduce average power draw; the use of “interface” software modules to better organize the commands used to interact with the datalogging software; and several other extensions of previous functions.

## 3 Computer Connection and File Transfer (USB Drive)

The RDL eliminates the need to connect to internally recording instruments using a terminal. Therefore, the only required interaction with the instrument is by viewing the contents of the RDL memory module by connecting to it via the built-in file manager found on any personal computer (i.e. File Explorer, Finder). This has been made possible on the RDL through USB Mass Storage capability. When the USB connector on the deck cable is plugged into the computer, a drive, referred to as the “RDL USB Drive”, will appear in the file manager, similar to viewing a USB thumb drive or external hard drive. Subsequently, files can be opened, deleted or transferred (i.e. drag and drop) between the computer and the instrument.

To access files on the instrument from a computer with read and write permissions:

1. Ensure that the instrument is OFF.



To access the files with read and write permissions, the RDL board must be receiving power (5 V) only from the USB connection.

2. Connect the instrument to your computer (refer to Instrument User Manual).
3. After connecting the USB, wait for the RDL memory module to be detected by the computer. A notification from the computer should indicate when the connection has been established.



It can take up to 60 seconds for a connection to be established because the instrument's operating system must boot up first.

4. Access the files using the built-in file manager (i.e. File Explorer, Finder) on the computer.



When the deck cable USB is disconnected from the computer it is important to wait at least 10 seconds before re-connecting it. This allows time for the electronics to properly shut off.



If data logging is started while connected to the RDL USB Drive, the File Manager will reset and reconnect to the drive. Files on the RDL USB Drive will have read only permission while data acquisition is active. The new files will not be visible while they are being created by the data logging process.



If the RDL memory module becomes corrupted, the File Manager will detect the problem, likely indicating that the RDL USB Drive needs to be reformatted. Use the disk formatting tool of the computer's operating system to reformat the RDL USB Drive. This will delete all the files on the drive, so the `setup.cfg` file will need to be copied back to the RDL USB Drive. If data logging is started when there is no `setup.cfg` file on the drive, the RDL will use the factory default `setup.cfg` that is stored in the onboard memory. A file named `MISSING_SETUP_FACTORY_SETUP_USED.txt` will be placed on the RDL USB Drive if the factory default `setup.cfg` is used.

## 4 User Interface with Zissou Essentials

The Zissou Essentials software package<sup>1</sup> can be used to interact with the RDL and perform basic tasks. More specifically, the software can be used to:

- Set the instrument clock
- Check the battery voltage
- Display the software version on the instrument
- Review the instrument log file
- Determine the free space on the memory module
- Check for warnings or errors
- Display channel statistics from a record in a previously recorded data file



Consult the Instrument User Manual for details on how to connect to the instrument with Zissou Essentials.

## 5 Boot-Up and LED Behaviour

### Boot Time

The boot time of a RDL varies depending on the usage of the instrument. More specifically:

- The boot time can take up to two (2) minutes, when the instrument is booted for the first time, or after it has been in storage. This is because the backup energy source needs to charge.
- The boot time is about 40 seconds when the instrument is in regular use because the backup energy source is already charged.

Most instruments, particularly those with an internal battery (e.g. VMP-250-IR, MicroCTD) are configured to start data acquisition automatically, immediately after the boot process is complete.

Instruments that are managed by a host platform may be configured to wait for commands from the host to start and stop data logging. In these configurations, the host platform is connected via a serial port to the RDL.

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<sup>1</sup>Version 1.6 released November 2020

## LED Behaviour

Instruments that have an external LED installed (e.g. VMP-250-IR, MicroCTD) use the light to indicate the status of the RDL board. More specifically:

1. When the instrument is turned on, the LED will blink 1 second on and 1 second off until the boot process is complete (approximately 40 to 120 seconds).
2. When data logging starts, the LED will turn solid red.
3. After approximately 64 seconds of data logging, the LED will turn off, but data logging will continue.



Rockland instruments that do not have an external LED installed (e.g. MicroRider-1000) follow the same boot up sequence.

## 6 Power Draw

The RDL draws approximately 0.4 W more power than the CF2 Persistor. The P113R03 hardware and OSv4 software allow for a "sleep" mode to be enabled. When sleep is enabled the system will reduce power consumption when actively datalogging by shutting down the CPU when the data buffers are filling up. The system will wake up to transfer data or when interrupted by external requests. For the power draw of a specific instrument and sensor configuration, consult your Instrument User Manual, or contact Rockland Support at [support@rocklandscientific.com](mailto:support@rocklandscientific.com).

## 7 System Shutdown Settings

To protect the system from unexpected power loss there are software and hardware settings to shut the system down gracefully.

For R01 and R02 boards:

- The hardware setting is configured at the factory on the P050 Power Supply circuit board. This will shutdown the instrument when the supply voltage declines to the set cutoff limit.
- In the configuration file (`setup.cfg`) there is a `minSystemVoltage` parameter which is set to 6 V. This is done to allow the hardware setting to be the primary shutdown control (Section 9). In the R01/R02 systems this software setting only stops datalogging, it does not power off the electronics.



This software parameter will stop only the data logging. The RDL board and all other electronics will continue drawing power until the cutoff on the Power Supply is triggered.

For R03/OSv4 boards:

- The P050 hardware setting is set to 7.3 V by default. This is the fail-safe shutdown used if the shutdown signal from the P113 does not work.
- The software controlled shutdown signal is set in the P113-DAQ-INI file with `vbat_cutoff`. This will be appropriately set at the factory for the instrument and its application. The user should not have to change or override this and should not do so without consulting Rockland Support. This software shutdown signals the P050 Power Supply to shutdown the instrument, and only works when the system is awake and logging data.

## 8 Data Logging

For data logging to start the following conditions must be met:

1. Raw input power applied (7-18VDC)
2. Onboard super-capacitor is fully charged
3. `setup.cfg` file exists and it is correct
4. ON signal applied
5. instrument software is configured to start data logging automatically on boot

For both RDL and CF2 Persistor systems, data is logged in standard Rockland `*.P` format (See Technical Note 051 for more information). A `logfile.txt` is also created and updated to note key events during data acquisition ([Section 10](#)).

There are several notable differences between the RDL and CF2 Persistor systems. For RDL systems:

- The control settings for data acquisition are built into the system or are set in the `setup.cfg` configuration file. The user only has the ability to start or stop data acquisition. Unlike for CF2 Persistor systems, the user does not have to set any command line flags to begin data acquisition.
- Data is logged continuously when multiple files are created. This implies that there is no data lost when the software closes the current file and starts a new file.
- Damaged data records, i.e. “bad buffer” events, are now automatically flagged in the data file to reduce any errors during data processing.
- The `logfile.txt` has different event codes ([Section 10](#)).

- If data logging exits with an error, then an error log file is copied to the RDL USB Drive. This file will be named `error_log.YYYY-MM-DD_HH-MM-SS`. It contains a series of verbose statements from the different scripts. The file is human readable and may help in troubleshooting the error.

Instruments can be controlled through the command line accessed through the RS232 port. This is typically done with MicroRider class instruments where the supporting vehicle starts and stops datalogging, sets the date/time, and so on.

## 9 Configuration File (*setup.cfg*)

The `setup.cfg` file for a RDL system is very similar to the file used for the CF2 Persistor systems; however, they are NOT interchangeable. Differences between the `setup.cfg` file for RDL and CF2 Persistor systems are outlined below. A full description of the `setup.cfg` file can be found as an Appendix in the Instrument User Manual.



The `setup.cfg` file for an instrument with a RDL board **cannot** be used for an instrument with a CF2 Persistor (and vice versa).

### Special Character

The special character, i.e. `ch=255`, is **not used** for RDL systems. This character was used to test the integrity of the communication in CF2 Persistor systems.

### Root Section

The parameters used for data acquisition are specified in the `[root]` section of the `setup.cfg` file. The parameters used in RDL systems are different than those in CF2 systems. More specifically, the following parameters are **no longer used for RDL systems**:

- `disk`
- `resize`
- `no-fast`
- `no-slow`
- `num_rows`
- `stop_after_release`
- `max_pressure`
- `man_com_rate`

The other significant difference in the `root` section is that for RDL systems, all parameters have default values that will be used for data acquisition if they are not specified.





For RDL systems, each parameter in the root section has a default value so it does NOT need to be specified.

For RDL systems, the available parameters in the [root] section, and their default values (in square brackets), are as follows:

- **prefix** = [DAT\_]
 

Controls the naming of the files written to the memory module. The files will be named incrementally with the prefix followed with an incremental number of the file.
- **maxFileDuration** = [14400] seconds (4 hours)
 

Controls the length of each data file, in seconds. There is no time delay and therefore no data lost between closing and creating a new file. A new data file will automatically be started once the max file duration has been reached.
- **maxFileSize** = [200] MB (approximately 6.8 hours<sup>2</sup>)
 

Controls the maximum size of each data file, in megabytes. There is no time delay and therefore no data lost between closing and creating a new file. A new data file will automatically be started once the max size duration has been reached.
- **minSystemVoltage** = [xx] Volts
 

For R01/R02 systems this is set to 6 V. For R03 systems this parameter overrides the factory shutdown setting and therefore it is not defined and not used. Do not use this without consulting Rockland Support.



Both **maxFileDuration** and **maxFileSize** can be declared. The software will create a new file when the smaller of the two conditions is met.

### SeaBird Sensor Coefficients

For instruments that have a Seabird SBE3/4 installed, the value of the coefficient **coef5** is different for RDL and CF2 Persistor systems due to hardware differences. More specifically:

- For RDL systems: **coef5** = 38.4e6
- For CF2 Persistor systems: **coef5** = 24e6

### Pressure Sensor Coefficients (i.e. Zeroing the Pressure Sensor)

In both RDL and CF2 Persistor systems, the parameter **coef0** is used to zero the pressure sensor. For RDL systems, the following method is recommended to determine the coefficient, and hence zero the pressure sensor:

1. Take a one minute data file at the time and place where the pressure should be set to zero (e.g. in air at the deployment location). See the “Electronics Bench Test” section of the Instrument User Manual for detailed instructions.

<sup>2</sup>For an address matrix with eight columns and a sample rate of 512 Hz

2. Load the data file into Zissou Essentials and plot the pressure channel<sup>3</sup>.
3. Estimate the average value of the pressure from the plot.
4. Use this value to adjust the `coef0` in the P channel section by subtracting from the existing value. The `setup.cfg` file can be modified using either Zissou Essentials or any text editor.
5. Save the updated `setup.cfg` file to the RDL.
6. Take another data file to verify that the value has been zeroed.

## Release Parameters

For instruments that are using the release function, such as a VMP-6000 with a ballast release, the parameters in the `setup.cfg` file for RDL systems are all different from those for CF2 Persistor instruments.

To configure the release for RDL systems, the following options, and their default values (in square brackets), can be used:

- **ReleaseEnable** = [NO]  
The global release flag that either allows or prevents the generation of release events. When set to “NO”, all release events are prevented. When set to “YES”, all configured release mechanisms can generate release events. There is one exception to this rule in that the software can explicitly generate a release even when the release is disabled. All other release events are generated by the FPGA.  
Acceptable Values = YES or NO
- **PressureReleaseEnable** = [YES]  
Enables release events when pressure exceeds a specified value. This is the most common form of release.  
Acceptable Values = YES or NO
- **ReleasePressure** = [500] dbar  
Maximum operating pressure and the point at which a release signal should be generated. Value in dBar so it corresponds to approximately 1 count per meter.  
Acceptable Values = Number > 0 and <12,000
- **PressureChannel** = [P]  
Name of channel from which to acquire the pressure. The calibration coefficients and type of this channel must be correct in order to work as expected.  
Acceptable Values = String matching a channel name with known channel type and channel ID that is being sampled.
- **DeltaPressureReleaseEnable** = [YES]  
Trigger a release when an instrument is stuck and stops falling. Some instruments, such as those mounted on gliders, could appear stuck when they actually are not so

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<sup>3</sup>The ODAS Matlab Library could also be used with the command `show_ch(filename, 'P')`.

this release event can be disabled.

Acceptable Values = YES or NO

- **MinDeltaPressure** = [0.2] dbar per second  
The change in pressure required for an instrument to be considered moving. When the change of pressure is less than this value for a full second, a release can be triggered.  
Acceptable Values = Number < 10
- **StartDeltaPressure** = [50] dBar  
To prevent the release from triggering at the surface, a minimum pressure value is required to enable this release event.  
Acceptable Values = Number > 0 and < 12,000
- **PowerReleaseEnable** = [NO]  
Trigger a release when the input power drops to an unsafe level. Instruments with dedicated release batteries do not require this option and can use the loss of input power to trigger a release. However, some instruments have no such battery so the release must be triggered before the main battery power is fully depleted.  
Acceptable Values = YES or NO
- **ReleasePowerChannel** = [V\_Bat]  
Channel on which the input power voltage can be observed.  
Acceptable Values = String containing channel name with a known type and sampled channel ID.
- **MinValidPower** = [7] Volts  
When the observed input power voltage is below this value for a full second, trigger a power release event.  
Acceptable Values = Number  $\geq$  0 and < 40
- **BrownoutReleaseEnable** = [YES]  
When the CPU stops interacting with the FPGA, a release can be triggered. This protects against software bugs that could prevent a release and expedites the retrieval of an instrument that, for some reason, is not recording data. This option is only valid when recording data. The mechanisms used to detect brownout conditions can change depending on the hardware in use.  
Acceptable Values = YES or NO
- **SoftwareReleaseEnable** = [YES]  
A software release is when the CPU triggers the release in place of the FPGA. An example would be the release generated when data acquisition exits. There could also be other future events covered by the software release label.  
Acceptable Values = YES or NO

A typical example of a [release] section for a VMP is:

```
[release]
ReleaseEnable = YES
ReleasePressure = 2200
```

With these settings, the release would be triggered when the instrument reaches a depth of 2200 dBar. A P channel with correct calibration coefficients is required.

## 10 Logfile (logfile.txt)

The log file is reported in the same format as is generated with a CF2 Persistor. An example of a RDL produced log file is shown below:

```
5e9f6e24 11 0000 Undefined --- 2020-04-21 22:05:24.348 - "power applied"
5e9f6e56 10 0000 Undefined --- 2020-04-21 22:06:14.352 - "start signal received"
5e9f6e56 0b 0001 dat_0002.p --- 2020-04-21 22:06:14.371 - "starting data file"
5e9f7065 0d 01d6 dat_0002.p --- 2020-04-21 22:15:01.030 - "bad buffer"
5e9f7082 11 0000 Undefined --- 2020-04-21 22:15:30.205 - "power applied"
5e9f70ce 10 0000 Undefined --- 2020-04-21 22:16:46.212 - "start signal received"
5e9f70ce 0b 0001 dat_0003.p --- 2020-04-21 22:16:46.236 - "starting data file"
```

A traditional log file `logfile.txt` is generated by the data acquisition software on the RDL. This log file is designed to have the same format as those on CF2 Persistor systems; however, there are some key differences in the log file event types due to differences in the data acquisition systems. These differences are highlighted below in [Table 1](#). The colour scheme is as follows:

- White events can occur on both CF2 and RDL systems.
- Blue events can occur on CF2 only systems.
- Red events are no longer used on either system.

**Table 1:** Possible event types within your log file. Colors are such that white events can occur on both CF2 and RDL systems, red events are no longer used on either system, and blue events can occur only on CF2 systems.

Code	Event Name	Description
01	pressure release	Release triggered because the pressure exceeded max pressure.
02	fall rate release	Release triggered because the fall rate was less than 0.2 dbar/s for 4 consecutive seconds.
03	timeout release	Release triggered because the duration of data acquisition exceeded max time
04	power is bad	Release triggered due to insufficient supply voltage. The power-good signal from the power-supply board (PS) is disabled.
05	power good signal received	The power-good signal from the PS board received. This event has not been used since v4 of the ODAS5IR data acquisition software.
06	switch is off	The power ON/OFF switch was set to OFF.
07	manual stop	Acquisition was stopped manually by an operator.
08	marker	Not used.
09	maximum file size	Data file reached its maximum allowed size.
0a	out of disk space	Disk space was insufficient for data storage.
0b	starting data file	Data acquisition started. The event time corresponds with the creation of a new data file.
0c	acquisition stop	Data acquisition stopped.
0d	bad buffer	Record contains a bad buffer.
0e	maximum file time	Data file reached its maximum allowed time.
0f	10s data timeout	No data observed for 10 seconds. This indicates a serious error.
10	start signal received	A start signal was received. This occurs when data acquisition is first launched but before data acquisition starts.
11	power applied	Instrument switched on and power applied. There will be a delay of 1 to 2 seconds between when the power is applied and when the event is logged.
12	data file trimmed	This event corresponds with power being shut off before data acquisition has stopped. The last record in the data file is removed because it contains invalid data.
13	release due to low voltage	Release triggered because the input voltage fell below the minimum valid voltage specified in the configuration file.
14	release triggered by software	Release triggered by the CPU instead of the FPGA. An example is a release generated when data acquisition exits.

– End of document –