RR4 manual

RR4 is a radio receiver for Windsond S2 radiosondes and Sparvio systems from Sparv Embedded AB. RR4 receives radio telemetry transmissions from the airborne systems. The data is sent to a PC over USB and/or logged to an internal SD card. RR4 also has a built-in barometer and GPS.
This manual describes RR4 firmware 1.4.x and S2 firmware 3.x. It complements the S2 radiosonde manual.

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Parts

RR4 is delivered with:

- RR4 device with internal battery and attached connector caps for USB, SMA and the sonde cable
- 433 MHz antenna with magnetic base, with SMA connector and 2m cable

- 433 MHz whip antenna, with SMA connector
- Sonde cable, 20 cm
- USB A-to-C cable

PC software, a personal license file and documentation are delivered electronically. The Windsond software is available for Windows, and for Linux by special request. A command-line interface is also available by special request.

Operation

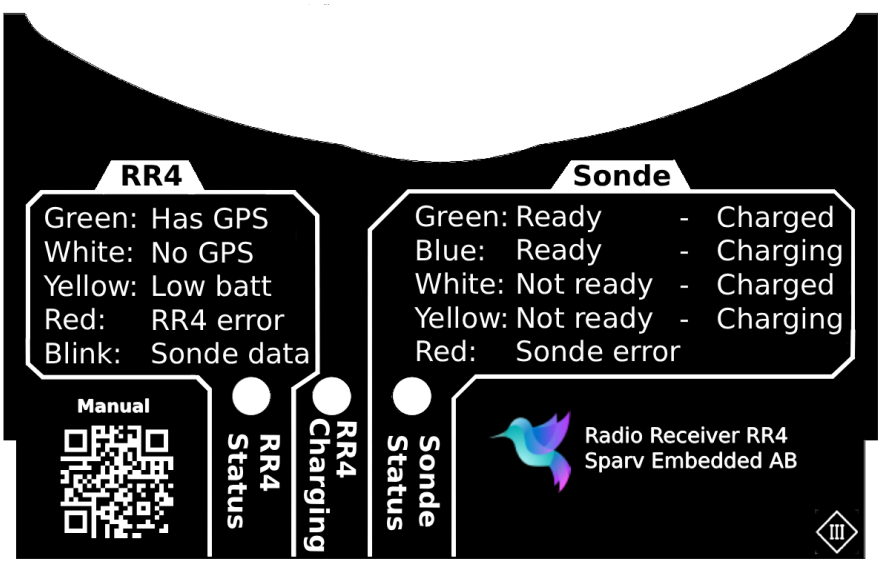
Turn on RR4 with the pushbutton. The device will beep and two LEDs will blink momentarily. RR4 will then automatically receive all compatible transmissions on the configured radio settings. RR4 will also acquire a GPS fix.
A S2 sonde can be connected via the custom cable, called “RR4cable”. This is not required to do a sounding.

Charging RR4

The RR4 has a 1800mAh rechargeable battery. When RR4 is connected to a PC via a USB C cable, the RR4 battery will charge and the middle “charger LED” will turn orange. Charging an empty battery takes 9 hours. A USB cable is included. The battery will not charge outside the temperature range 0 ~ 50 ℃ or if the battery is already charged. (Note that the battery is only certified for charging in range +10 ~ +45 ℃.)
The charger is independent from the operation of RR4; the charger LED will light up also when the RR4 is turned off but this does not turn on the RR4. The button must still be pushed to turn RR4 on or off.
Even with a discharged, missing or broken battery, RR4 has full functionality while powered from USB.

LED signals

RR4 has three status lights.



RR4 status

- **Blue flash**: A radio packet was received and logged to the SD card. If the PC program is connected, the received data is also sent to the PC.
- **Purple flash**: A radio packet was received. If the PC program is connected, the received data is sent to the PC. Otherwise, the data will be lost.
- **Green**: RR4 is turned on, the battery level is good and RR4 has a GPS fix
- **White**: RR4 is turned on and the battery level is good.
- **Yellow**: RR4 runs from battery and there is less than an hour of battery left.
- **Red**: RR4 hardware malfunction that prevents data reception.
- **Turned off**: RR4 is turned off.

RR4 charging

Note that this LED reflects the battery in RR4, not the battery in S2.

- **Orange**: the RR4 battery is being charged from USB
- **Turned off**: RR4 is not charging. Either it is fully charged, or the temperature is outside the charging range (0 ~ +50 ℃) or RR4 is not connected to USB.

Sonde status

This shows the status for a sonde connected via cable, not for sondes in flight. Sondes in flight only make this LED blink when RR4 receives data from them – regardless of whether the PC program is connected to register the data.

- **Green**: The connected sonde is ready for launch and is fully charged
- **Blue**: The sonde is ready for launch but it's still charging.
- **White**: The connected sonde is not ready for launch but it is fully charged.
- **Yellow**: The connected sonde is not ready for launch and it is being charged.
- **Red**: The connected sonde malfunctions, or the temperature is too low to charge the S2 battery to an acceptable level.
- **Turned off**: A sonde isn't connected via cable.

The power LED and sonde LED blink when RR4 starts, in the sequence red, green, blue, to show that all the colors are working. The charger LED doesn't blink during start.

Connecting a sonde

Connecting a sonde to RR4 via the sonde cable has several effects:

- The sonde battery will be charged. If RR4 is connected to USB, the power will come from USB. Otherwise, the battery inside RR4 will charge the smaller sonde battery. It takes about 90 minutes to fully charge an empty sonde battery.
- The sonde is powered from RR4 instead of from the sonde battery.
- If RR4 is connected to Windsond Desktop and RR4 has a GPS fix, the GPS data will be transferred to the sonde, speeding up the sonde's GPS acquisition time.
- If RR4 is connected to Windsond Desktop, RR4 will transfer its radio settings to the sonde.
- The RR4 "sonde status" will show if the sonde is ready for launch. (Note that a sonde that is turned off will never be ready for launch.)

It is advisable to keep the sonde connected right until the launch, or at least a few minutes before launch. This avoids discharging the sonde battery more than necessary before launch.

Older versions

In older versions (S2 firmware older than 3.019 and RR4 firmware older than 1.2.12) the sonde can not be turned on when already connected to RR4. When the sonde is connected, pressing the button will just cause the sonde to blink green, signalling that it

is turning off. Turn on the sonde before connecting, or turn on the sonde after disconnecting it.

Charging S2

When S2 is connected to RR4 via the cable, RR4 will charge the S2 battery. The power for this is drawn from USB if USB is connected, otherwise from the RR4 internal battery. Note that charging is only performed if the S2 is in the temperature range 0 ~ +45 ℃.

Sondes are delivered with partially charged batteries, due to battery shipping regulations. This charge is normally enough for a sounding. If you wish to further improve the battery time, keep the sonde connected to a turned on RR4. The S2 battery will be charged in half an hour. For a reused sonde with a fully depleted battery, a full recharge takes 90 minutes.

When RR4 is turned on, S2 will also draw power for its operation from USB or the RR4 battery to preserve the small S2 battery. It is therefore advisable to keep S2 connected until it’s time for launch.

Frequency and radio settings

The radio frequency and other configurations for receiving telemetry are stored on the RR4. These settings must match those of the sonde for telemetry to work. The PC program is used to view and change settings. RR4 also transfers settings to sondes when they are connected to RR4 via the cable.

Older versions of RR4 required the PC program to be running in order to transfer settings to connected sondes. This has changed as of RR4 firmware 1.2.15, but older RR4 that have been upgraded will require connecting RR4 to the PC program before this feature becomes available.

GPS

RR4 contains an internal GPS. This has three benefits:

- The GPS fix is transferred to a S2, when S2 is connected via the cable and the Windsond PC program is running. This speeds up the S2 GPS acquisition.
- Exact timing of radio transmissions and logging.
- Providing a position which the PC software will utilize in the future.

Place RR4 with the battery lid and LEDs upwards with a clear view of the sky to help the GPS.

Audio signals

RR4 can be configured to beep when a radio packet is received. Higher pitch indicates a stronger radio signal. The signal strength always drops as the sonde drifts farther. Even weak signals are received without data error, but a weak signal indicates a risk that the signal will drop out in the future.

Weather-proofing

RR4 is designed for IP65 (withstanding rain) on condition that the battery lid is screwed in and that the S2 cable is connected or the corresponding connector cap is screwed on. The rubber USB dust cover stops particles from clogging the USB connector but is not needed to weather-proof the device.
A membrane valve equalizes the pressure inside the enclosure without letting in water, assuring the barometric pressure readings remain accurate.

Logging

If a micro SD card is installed, all received data is automatically logged to the SD card. This logging is independent of whether RR4 is connected to a PC and continues also if USB is plugged in or unplugged during a sounding.

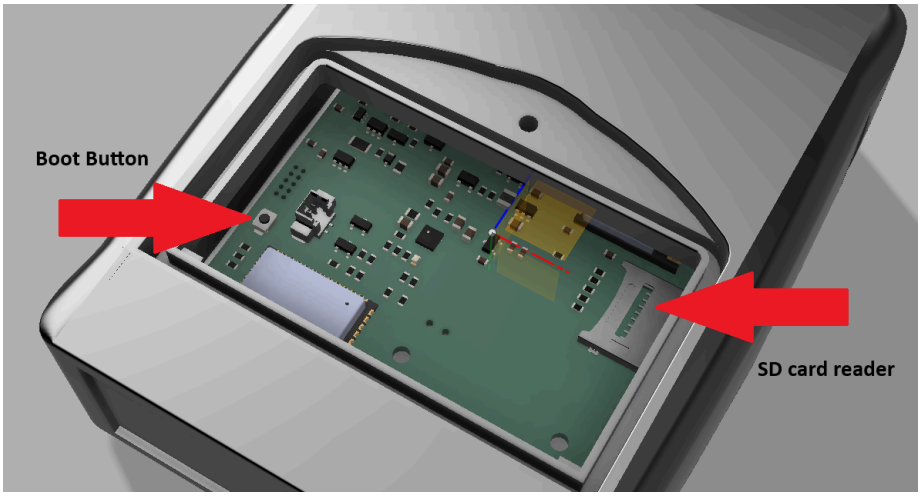
Micro SD cards should be formatted as FAT32. It is recommended to use a capacity of 32GB or less.

Data is logged to a separate .sounding file for each sonde. The files are stored in the /sparv/soundings/ directory on the SD card. If the directory doesn't exist, RR4 will create it.

If RR4 is restarted during a sounding, a new .sounding file is created for the second part. The user can splice the two files together manually.

The user can check whether logging works by observing the color of the 'sonde LED' when radio packets are received. If the LED blinks blue, the packet could be logged. If white, the packet was not logged. The reason might be a missing or broken SD card. Since logging is optional, it's up to the user to decide if this is an error.

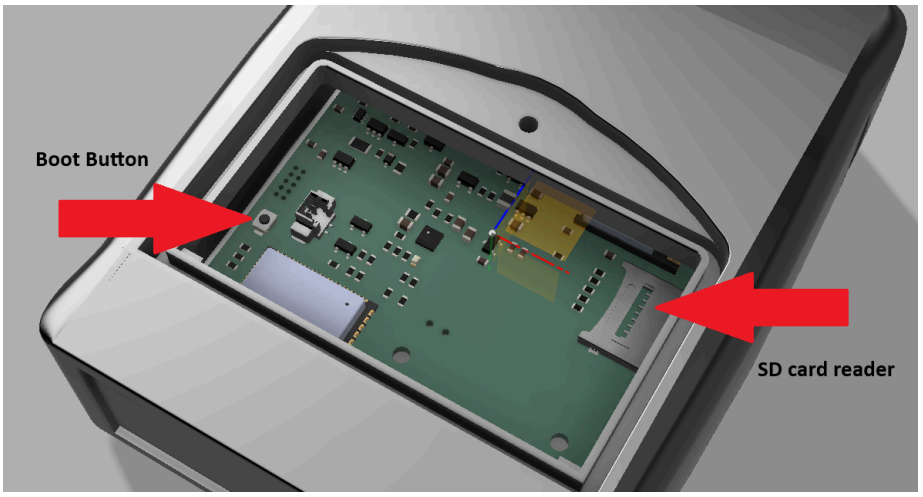
Accessing the SD card



Access the micro SD card slot by turning off RR4, unscrewing the lid, removing the battery (it can remain connected) and removing the insulation pads. To unlock the SD card, push the SD slot metal case parallel with the PCB towards the PCB edge. The case can now swing up on a non-removable hinge to give access to the SD card.

To insert a SD card, swing the metal case open and place the SD card straight in the case. The card doesn't lock in place until the metal case is closed again.

Factory default



The RR4 may have factory default settings configured. It can be reset to those settings by pressing the boot button while the RR4 is on.

It is also possible to perform a factory reset, or a flash reset, via Sparvio App.

Firmware Upgrade

The RR4 firmware can be upgraded by a special Windows program. Sparv Embedded makes the latest program link available when needed. The program must match the letter of the RR4 hardware revision, for example “D”. If running Windsond desktop on PC, close the program before upgrading. You also need to close any other program that might use the COM port, like Sparvio App.

Simplified method

The simplest way is to just connect the RR4 to a PC and run the upgrade program. It may be necessary to run the program twice this way. If this doesn’t work you will have to perform the “Full method” sequence below.

1. Connect the receiver via USB to a PC.
2. Turn on the RR4 by pushing the button.
3. Run the firmware upgrade PC program.
4. The program will run in a new terminal window. After about 30 seconds, the program will succeed with the text “Firmware upgrade done”.
5. Close the terminal window.

Full method

The most reliable way to upgrade the firmware is to put the receiver in boot mode and then run the upgrade PC program.

1. Unscrew the battery lid and move the battery to reveal the boot button. (See the marked location in the illustration.) The battery can be either connected or disconnected during this procedure.
2. Connect the receiver via USB to a PC
3. If the receiver is turned on, power it off by pressing the power button
4. Press and hold the boot button
5. Power on the receiver by pressing the power button. If done correctly, the receiver will not make any sound and the LEDs will not turn on.
6. Release the boot button
7. Run the firmware upgrade PC program – see link below
8. The program will run in a new terminal window. After about 30 seconds, the program will succeed with the text “Firmware upgrade done”
9. Close the terminal window. Insert the battery again and screw the lid in place.