

# RMD Expedition

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## Hardware Manual

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## Description and Features

The Resonance Mini-DOAS (RMD) *Expedition* is the culmination of over 25 years of experience in remote gas sensing technology. The philosophy behind the *Expedition* is focused on accurate, reliable, and industry-leading measurements in a system rugged enough to withstand some of nature's most challenging environments. As Resonance's flagship RMD system, the *Expedition* is loaded with features including:

- Thermoelectrically cooled, temperature controlled spectrometer optical bench  
[Stabilizes spectrometer wavelength scale for accurate DOAS measurements](#)
- Suitable for remote sensing of volcanic & industrial SO<sub>2</sub>, NO<sub>2</sub>, BrO, and other gases  
[Better than 6 ppm-m SO<sub>2</sub> sensitivity](#)
- Detachable telescope / fibre-optic assembly which randomizes spatial content of beam within the telescope's field-of-view  
[Minimizes unwanted signal offsets due to clouds crossing the field-of-view](#)



**Fig. 1: The PACA (Pointing and Calibration Assembly) as a detachable module.**

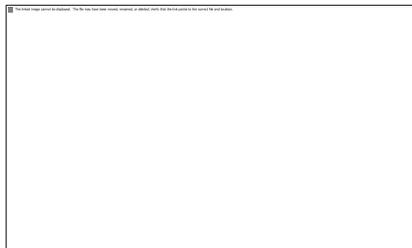
- Automatic calibration system  
[The system automatically self-calibrates using COSPEC-traceable gas cells](#)
- Motorized scanner fully controllable via RMD software  
[180° range of motion with variable scan speed – software allows for automatic or manual pointing & scanning](#)

Sensor package includes GPS, electronic compass, and tilt sensor

[Always know where you are and where your instrument is looking \(latitude, longitude, altitude & azimuth angles\)](#)

## Description and Features (continued)

- Multiple operating modes (See the [“Modes of Operation”](#) section for details)  
[Including a wireless, remote-viewing mode!](#)
- Electronics and the spectrometer are contained inside a rugged, military-grade case  
[Allows operation in challenging environments](#)
- Machined-aluminum case panel with hardware switches and indicators  
[Provides a solid interface between the sensitive internal components and the outside world while giving the user access to the system’s hardware toggles and indicators](#)
- Stable contractor-grade tripod for the sensor head  
[A sturdy platform to suspend the entire instrument from the ground and provide a frame for the weather shroud](#)
- Internal lithium battery packs with integrated charger  
[We researched the most advanced lithium packs to run the system all day. The smart charger is conveniently integrated under a removable top panel for easy access](#)
- Laptop securely docks onto the base station  
[Provides stability and protection during transportation without sacrificing portability the laptop can be used external to the base station!](#)
- Accepts 100 – 240 VAC or 12 – 16 VDC supply  
[Designed to charge from any AC source or run from a suitable DC source](#)
- Deployable [“Weather Shroud”](#) to protect the system from the elements and allow reading the laptop display in sunlight  
[Light and easy to deploy](#)
- LCD information panel showing system telemetry  
[Displays the CCD temperature, system battery capacity and other useful information directly on the instrument panel](#)



**Fig. 2: The “Quick Info” LCD display.**

## Description and Features (continued)

- Hermetically sealed accessory box included  
Holds extra fibres, electronics, or sensitive items and keeps them safe while you take **measurements**
- Wireless control via Smartphone, Tablet, or Laptop  
An ad-hoc WiFi network can be created from the system's laptop which allows the user to remotely connect and control the unit from nearly any wireless device
- Intuitive, powerful software facilitates setup, calibration, and logging of data  
Refer to the Software Manual for more information!

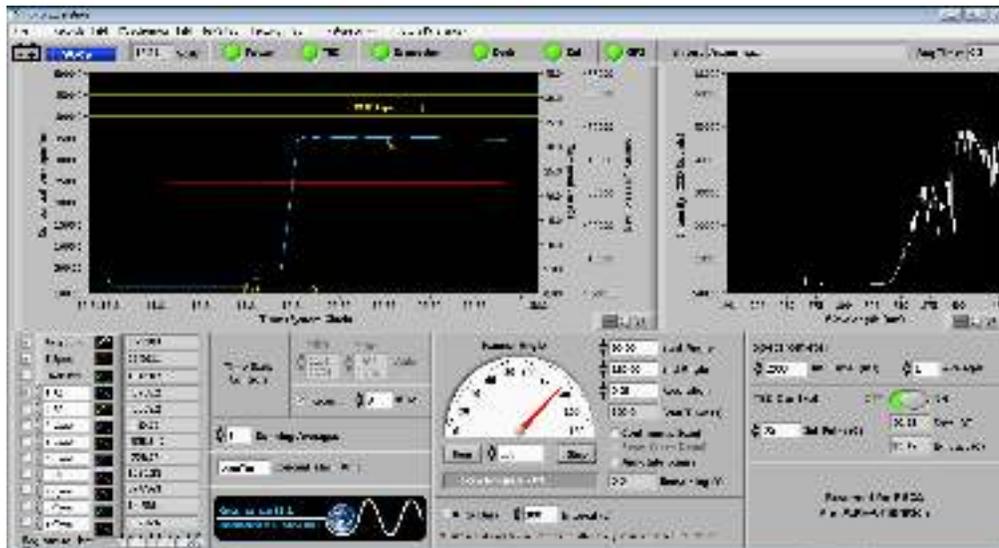


Fig. 3: The Expedition's software.

## Specifications

### General

Base station Dimensions	54.4 cm (L) x 41.9 cm (W) x 20 cm (H)
Base station Weight	15 kg
Accessory Box Dimensions	37.8 cm (L) x 30.8 cm (H) x 17.5cm (H)
Accessory Box Weight	5 kg (With all included cables)
Operating Temperature Range	-10 to 50° C*
Software	LabVIEW-based full control application

\* Control to -40° C achieved with auxiliary heater accessory

### Power Requirements

AC Input	100 – 240 VAC, 50 – 60 Hz, 90 Watts
DC Input	12 – 16 VDC, 90 Watts
Charge Source	AC Only
Run Source	AC, DC, or Batteries

### Batteries

Battery Chemistry	Lithium-Polymer (LiPo)
Battery Voltage	14.8 V
Battery Capacity	474 Watt-Hours + Laptop battery (Typically 60 Watt-Hours)
Battery Time to Charge	4 hours
Battery Life	10+ Hours*

\* System uptime depends on many variables including ambient temperature, spectrometer temperature set-point, scan rates, and laptop power draw

### Spectral Performance

Field of View	0.86° (with standard telescope - options available)
Spectral Range	280 – 420 nm
Spectral Resolution	0.4 nm
Dark Noise	2.5 RMS counts (2.5 / 65535)
Integration Time	100 ms – minutes
Detectable Gases	SO <sub>2</sub> , NO <sub>2</sub> , BrO*, CS <sub>2</sub> *, CHOH, O <sub>3</sub> *, Hg, H <sub>2</sub> S, NH <sub>3</sub> **
Sensitivity (SO <sub>2</sub> )	6 ppm-m
Sensitivity (NO <sub>2</sub> )	100 ppm-m
Concentration Range	1 – 4000 ppm-m
Spectrometer	Ocean Optics USB2000+ UV-VIS with UV2 detector window and L2 collector lens upgrades

\* BrO, CS<sub>2</sub>, CHOH, and O<sub>3</sub> require additional software

\*\* NH<sub>3</sub> requires an active mode with UV light-source accessory

## Specifications (continued)

### PACA (Pointing and Calibration Assembly)

Scan Range*	180°
Scan Resolution	0.25°
Scan Speed**	15° / min (@ 0.25° steps with 1000 ms integration time)

\* Scanner start and finish angles can be set to 0 – 180° and scanner can be manually controlled to stop at any angle

\*\* Linked to integration time (1 step per acquisition period)

### Thermoelectric Temperature Control

Method	Proportional-Integral-Derivative (PID) Control Loop
Maximum Cooling	30° C below ambient temperature
Temperature Stability	± 0.5° C

# Hardware

This section contains a description of all the hardware used in the *Expedition*, which is represented by the block diagram below:

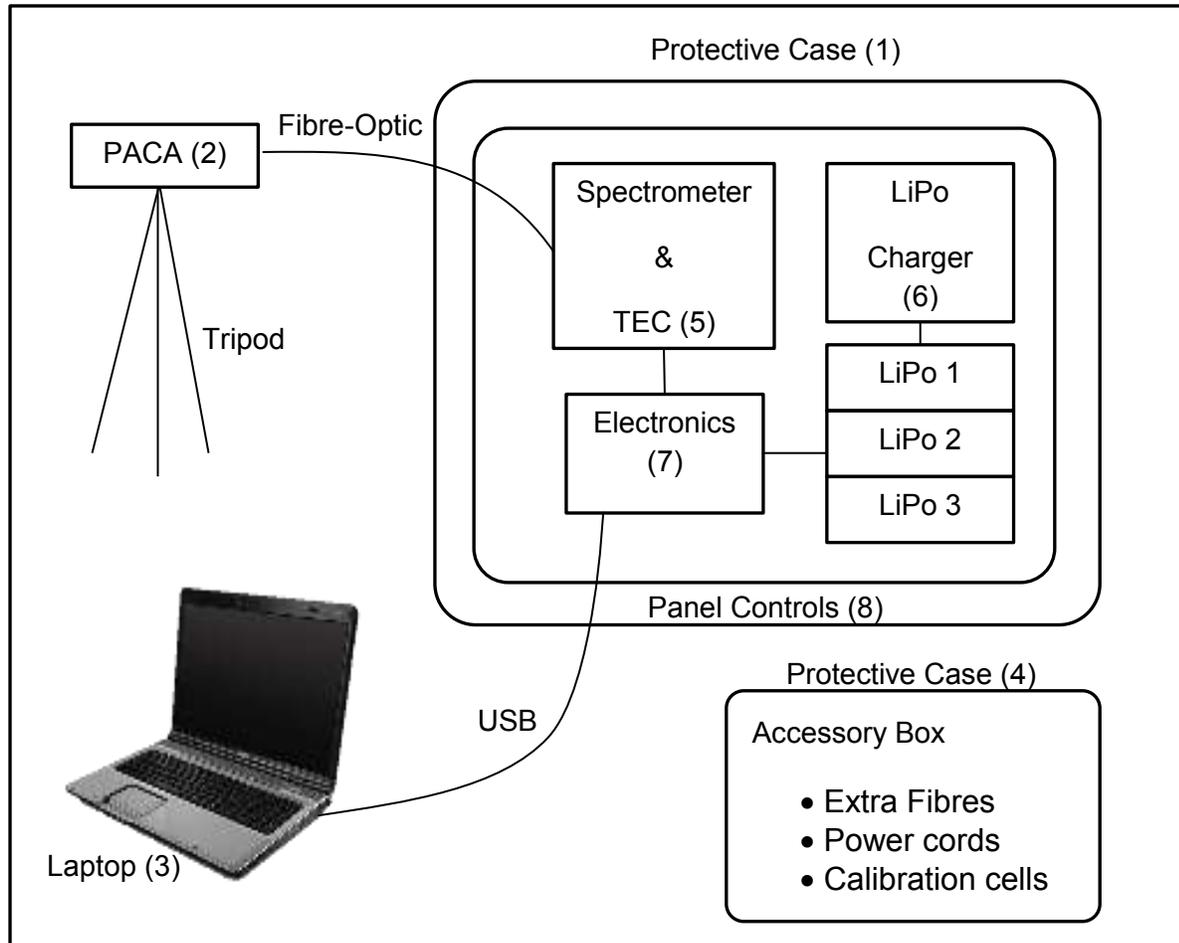
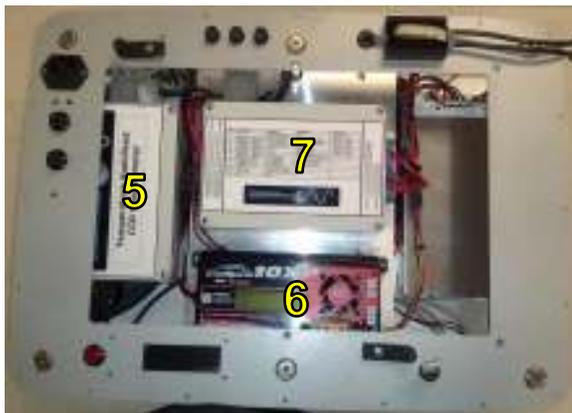


Fig. 4: The hardware block diagram for the RMD Expedition.

# Hardware



← Laptop Removed

Fig. 5: RMD Expedition hardware labeled to match Figure 4.

## PACA (Pointing and Calibration Assembly)

The PACA module contains the following components:

1. Altitude scanner
2. Automatic dark shutter
3. Manual or automatic gas cell changer (auto-calibration)
4. Optional compass and tilt sensor

It is typically mounted on the adjustable ball-joint atop the included tripod, and is aimed at the region of interest where gas measurements are to be made:



**Fig. 6: The PACA assembly mounted on the tripod ball-mount.**

The altitude scanner works by precisely rotating an elliptical mirror set  $45^\circ$  to the optical axis of the PACA. In this configuration scans are then performed by incrementally rotating the mirror and acquiring spectra – which is automated by the RMD software.

A shutter has also been built-in to the PACA which is also automated by the RMD software to facilitate the subtraction and correction for the dark current.

## PACA (continued)

An optional gas cell changer can also be fitted to provide software-controlled, automated calibrations. The changer screws into the PACA and can hold up to 4 calibration cells that can be moved in and out of the optical path.



Fig. 7: The automatic gas cell changer add-on for the PACA.

Additional sensors (see the section titled [“Optional Sensor Package”](#)) can also be added to the PACA – such as a digital compass and tilt sensor. Combined with GPS position, the orientation (heading and tilt) of the PACA can be used to calculate exactly where the system is pointing with every measurement. All sensor data is saved with every measurement in the RMD software.

## Thermoelectric Cooler (TEC)

The spectrometer is housed with the thermoelectrics inside a hermetically-sealed enclosure to prevent any damage that could be caused by condensation while it is being cooled. The cooling performs two important functions for the system:

1. Holding the temperature below ambient allows the spectrometer's CCD to be thermally stabilized. The environment is used as a heat sink and a control loop is used to keep the temperature within a fraction of a degree. This reduces drift from dark current and provides more consistent concentration readings.
2. The cooler the CCD becomes, the lower its dark current (noise). This increases the system's overall sensitivity for detecting gasses.



Fig. 8: The Expedition's hermetically sealed TEC.

The enclosure has a heat sink which must be kept in a ventilated area in order for the cooling to work. The case fans on either side of the *Expedition* are designed to meet this condition. The heat sink is placed directly behind one inlet fan which provides airflow, and the other fan functions to aerate the entire case.

## TEC Thermal Overload

It is possible for the TEC system to become thermally overloaded. If the “hot side” (heat sink side) of the system rises above 70° C power to the TEC (which is also main power) will automatically be cut. The LCD “Quick Info” screen will display a message indicating this, and the green power LED will turn off, and the red LED will turn on. As long as proper ventilation is available for the TEC a thermal shutdown should never be experienced – however environmental factors such as extreme heat may trigger a thermal overload. If an overload occurs, the system simply needs to cool down for a bit. Try keeping the main case out of the sun and ensure both fan ports are unobstructed. Also check the RMD software for the TEC temperature set-point. This should be set about 10 degrees below the ambient temperature. Setting it lower will only increase the thermal loading which increases the chance of an overload.

## Battery System

The *Expedition* was designed using modern lithium battery technology for a maximum power-to-weight ratio. Lithium batteries generally have double the energy density of other chemistries and are also lighter, which allows the *Expedition* to run continuously for 10+ hours. There are 3 main battery packs beneath the charger tray, connected in parallel. The batteries are nominally 14.8 V packs however their voltage varies from 16.80 Volts when fully charged to 12.00 Volts when fully discharged. Each battery pack consists of 4 lithium cells, which must be charged individually. This is why a special “smart” charger is required. Additionally, lithium batteries cannot be discharged below their threshold (12.00 V) and therefore some protection circuitry to prevent over-discharging is built into the *Expedition*.

The charging process is handled by the included charger built into the *Expedition* main case. Because the batteries must be charged in “balance” mode, there is a simple procedure to start the process. Refer to the section titled “[Charging Batteries](#)” for more information.

### Low-Voltage Condition

The protection circuitry will prevent power from being drawn from the *Expedition* system if the battery voltage drops below a critical 12 V level, even if the main power switch is on. Below this threshold lithium batteries (in this configuration) can be damaged if discharged further. A power relay connected to a voltage monitor is used for this purpose. When the system drops to 12 V, the green power LED on the control panel will turn off and the red LED will turn on and flash – indicating main power has been severed.

This voltage check also applies to external power sources, so the relay serves to protect the system both from being over-discharged and underpowered. Once the system has reached a state of complete battery discharge, turn the main power switch off. The protection circuitry uses a small amount of power to monitor the batteries, and this residual draw should be avoided for long periods of time.

## Global Positioning System (GPS)

A GPS receiver is included with the *Expedition* as a standard item. This sensor reports absolute position and provides invaluable location information including:

- Latitude
- Longitude
- Altitude
- Speed
- Heading

All parameters are recorded by the RMD software and saved to file. This ensures all measurements can be traced to an exact position. To facilitate vehicular or mobile measurements, the RMD software can also display GPS information in real-time, and even export in real-time to Google Earth to provide a complete moving-map system. See the RMD software manual for more information.

## Panel Controls

The top of the main *Expedition* case contains an embedded panel with the following items:

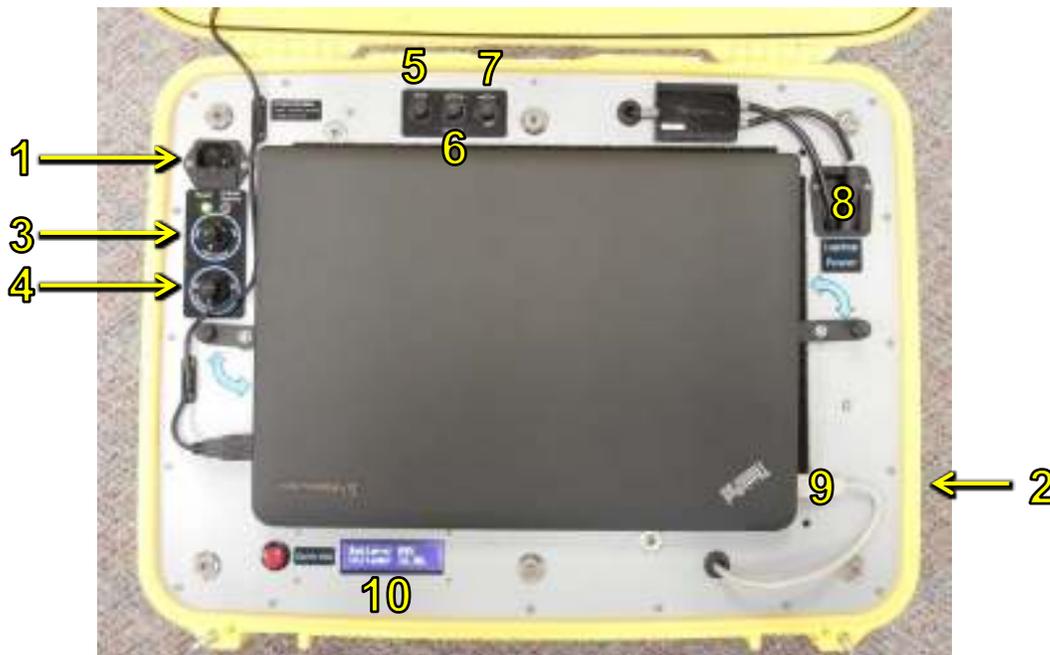


Fig. 9: The Expedition's aluminum main case panel.

### 1. Mains AC Input Inlet

This is the input port for the AC power chord.

### 2. External Input “Automotive-Style” Jack (Side of Case)

This input is for an external DC power source (12-16 V, > 90 Watts)

### 3. Main Power Switch with Green and Red LEDs

This switch must be on for the *Expedition* to function. When this switch is on, and there is no low-voltage or thermal condition, the green LED will indicate power is available to the *Expedition*. If there is a low-voltage or thermal condition, the red LED will be on instead – indicating that power is not available.

Panel Controls Continued on Next Page

## Panel Controls (continued)

### 4. External Power Selector Switch (AC / DC)

This switch governs which power source the *Expedition* should use. In the “AC” position, the system will run on mains AC power via the AC input inlet. In the “DC” position, the *Expedition* will either run off an external DC source via the “banana” jacks, or its internal lithium batteries. A sensing relay is used to automatically select the DC source based on whether the banana jacks are powered. If there is a power source present on the DC banana jacks the *Expedition* automatically runs from that source. As soon as power is removed from the jacks the system switches to its battery pack. Please note that this migration from a DC source to battery power will disrupt the *Expedition* hardware and essentially quickly turn the system off and then on again. Any active software connections may need to be restarted to regain connectivity.

### 5. PACA Fuse (aka Servo Fuse)

This is a fuse to protect against short-circuits from the PACA. The fuse holder is mounted in the panel and can be opened by simply twisting counter-clockwise and pulling the fuse out.

### 6. External Power Fuse

This is a fuse to protect against short-circuits from an AC source. The fuse holder is mounted in the panel and can be opened by simply twisting counter-clockwise and pulling the fuse out.

### 7. Battery Fuse

This is a fuse to protect against short-circuits from a DC source – either external to the *Expedition* or built-in (batteries). The fuse holder is mounted in the panel and can be opened by simply twisting counter-clockwise and pulling the fuse out.

### 8. Laptop Power Cable

Once the laptop has been secured in its dock, it may be plugged in to an available power cable located near its power inlet. This power cable is only activated when the main power switch is on and its green LED is on. The cable can supply enough current to run the laptop and charge its batteries at the same time – however this will drain the *Expedition*'s batteries much more quickly.

### 9. USB Male Connector

Also available to the docked laptop is a male USB cable which is located near its USB ports. This provides a connection to the *Expedition* hardware so the RMD software may function.

### 10. “Quick Info” LCD Display with Button

This is a dedicated LCD display for information directly related to the *Expedition*'s hardware. See the section titled [“Quick Info” LCD Display](#) for more information.

## “Quick Info” LCD Display

This is a dedicated LCD display for information directly related to the *Expedition's* hardware. It has 3 main screens that can be cycled through using its nearby button, with 2 parameters per screen:

### Screen 1 (Normal):



**Line 1:** Battery % or External Power

**Line 2:** System Voltage (V)

The first line will show the battery % remaining if running from the internal pack, or it will show “External Power” when run from an AC or DC external source. The second line shows the system voltage. Note that a DC voltage will appear here even if the system is running from external AC power. This is because the AC input is transformed into DC internally before the measurement occurs.

### Screen 1 (Low Voltage):



**Line 1:** “LOW VOLTAGE!”



**Line 2:** “Charge Batteries” / “Voltage < 12”

If the system is running on batteries and the voltage dips below 12, a low voltage warning will be displayed as well as a message to charge the batteries. If the system is running on external power, the system reports the input voltage being less than 12V.

### Screen 2:



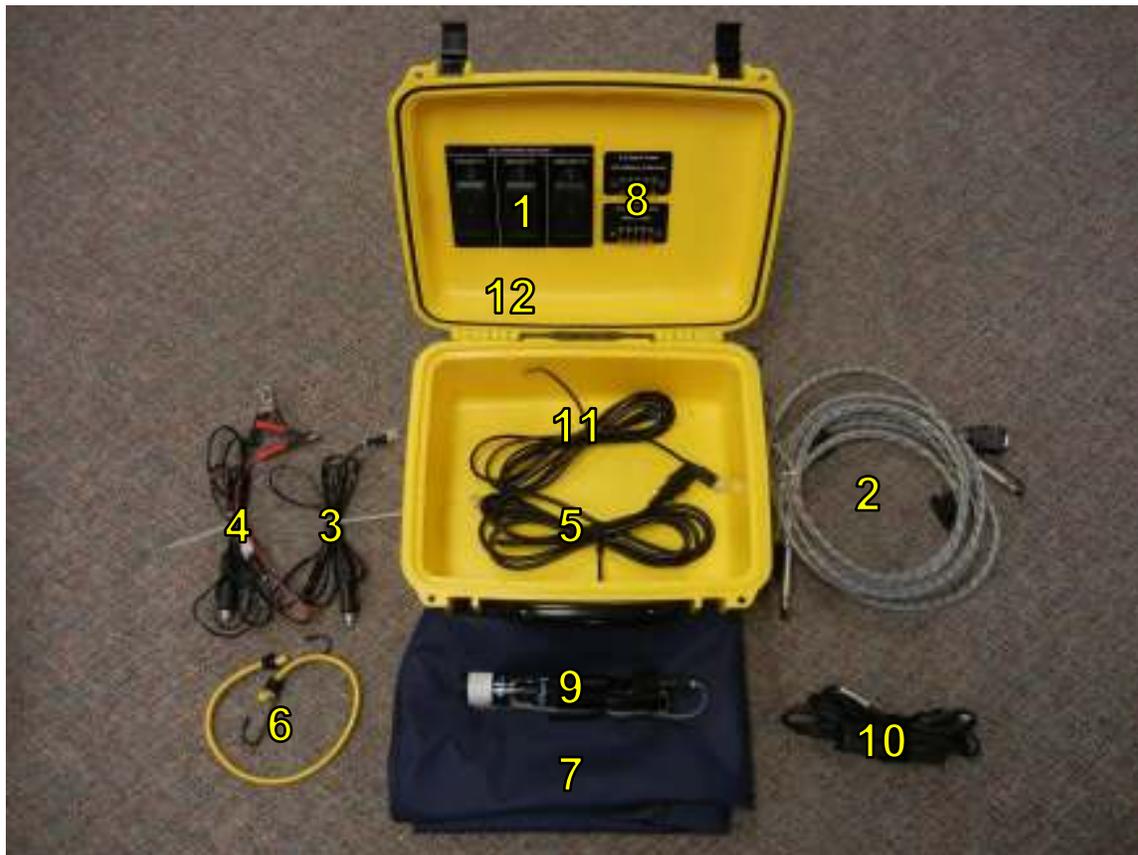
**Line 1:** TEC Set-Point Temperature (°C)

**Line 2:** Spectrometer Temperature (°C)

The first line displays the TEC temperature set-point in degrees Celcius, followed by the spectrometer temperature, which is measured at the TEC cold-plate contacting the spectrometer.

## Accessories

The *Expedition* is packaged with a dedicated ruggedized case to store the system's accessories. Inside the case, shipped with every *Expedition* are the following items:



**Fig. 10: The Expedition's accessory case.**

1. Gas calibration cells in lid-mounted box
2. Fibre optic cables (2)
3. External DC power car adapter
4. External DC power "alligator" clips
5. AC power cord
6. Bungee cord to hold lid up in tripod configuration
7. [Weather Shroud](#)
8. Spare fuses
9. PACA
10. Laptop AC adapter
11. USB Cable

## Tripod

The tripod included with the *Expedition* is much more than a simple stand for the PACA. It can be extended to accommodate the entire main case hanging from its center. The main case includes mounting hardware for this purpose, and having the main case suspended provides many advantages including:

- Keeping the main case off the ground, which may be wet or dirty
- Elevating the main case to a comfortable level for operation, so the user may stand or sit in front of the unit to operate instead of crouching over it
- Providing a stable and level platform regardless of the terrain
- Weighing down the tripod so wind does not cause swaying or the danger of knocking the tripod over
- Added protection against water since it is elevated above the ground



Fig. 11: The Expedition's tripod suspending the main case off the ground.

## Weather Shroud

The *Expedition's* "Weather Shroud" is a canvas add-on made to strap around the tripod to provide a weather-resistant enclosure for the main case while it is being suspended from the tripod. It also functions to block sunlight so the laptop screen may be readable. One of the sides remains open so the user can gain access to the instrument and work on it. The shroud is light and easy to deploy using fix-lock buckles and straps:



Fig. 12: The Expedition's tripod wrapped in the Weather Shroud.

## Expedition Backpack

This accessory has proven to be indispensable in field testing. The backpack is specifically made to hold the *Expedition's* main case. Once the lid of the case has been closed the backpack simply straps around the case and locks to it using buckles. This field-savvy option is much more comfortable than carrying the main case by its handle – especially over long distances!



Fig. 13: The Expedition's custom backpack.

## Optional Sensor Package

The *Expedition* comes standard with a GPS. This provides accurate position and altitude information when stationary, and also heading and speed while moving. An additional compass and tilt sensor can be added to the PACA to supplement the GPS and provide complete position and direction information. With all this sensor data being logged and saved automatically by the RMD software, the *Expedition* can not only know where it is but also where it is pointing.

The sensor package itself consists of a small box that mounts on the PACA assembly. Because it needs to be calibrated, the package needs to be installed at Resonance Ltd. If this option is purchased after the *Expedition*, the PACA assembly will need to be shipped back to Resonance Ltd.

## Modes of Operation

The *Expedition* was designed with flexibility in mind, and as a result can be used in a number of different modes based on measurement requirements:

### Mode 1: Transverse (Vehicular)

In this mode the instrument is deployed in a vehicle such as a car or truck for zenith viewing or an aircraft for nadir viewing. As the vehicle passes over or under the plume a profile is constructed which, along with a plume velocity, will yield a total flux of the gas being measured (for example: tonnes / day).

A sunroof is perfect for this mode; however a half-open window, a small tripod, and some decent duct-tape can also work:



Fig. 14: The Expedition setup for Mode 1: Transverse (Vehicular).

## Modes of Operation (continued)

### Mode 2: Stationary Pointing

The PACA is simply directed at the plume to be measured. The scanner can be used to point at a specific area of the plume, and then remain fixed for the duration of the measurements. The RMD software will log the signal with respect to time - so a chart record is generated.

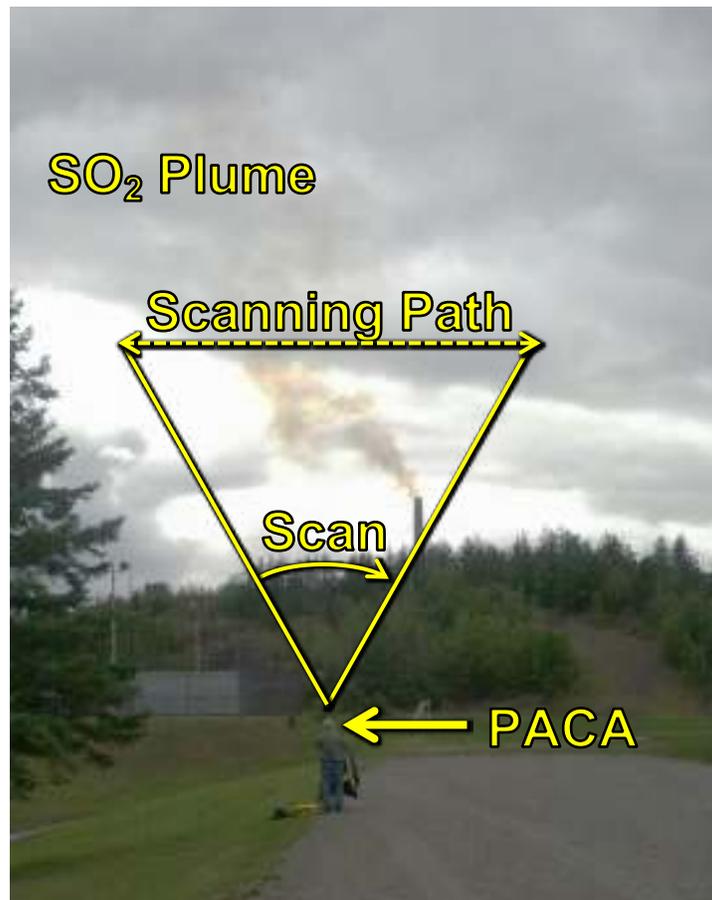


Fig. 15: The Expedition operating in Mode 2: Stationary Pointing at an SO<sub>2</sub>-producing stack in Sudbury, Ontario, Canada – while it's raining!

## Modes of Operation (continued)

### Mode 3: Stationary Scanning

The motorized scanner is used to generate a profile by scanning transversely through the plume. Because the tripod's ball-mount is adjustable it is possible to orient the PACA for scanning through both horizontal and vertical plumes.



## Modes of Operation (continued)

### Mode 4: Wireless

Because the *Expedition's* laptop has WiFi capability, an ad-hoc wireless network can be created at the site. The laptop can be left in the main case running the instrument with the lid closed, and any PC, iOS, or Android device with WiFi can be used to view and control the instrument wirelessly. Because the laptop can handle multiple connected clients, a number of people may collaborate and interface with the RMD software simultaneously while measurements are being taken.

The laptop remaining in the main case with the lid closed further protects the entire system from the elements, with only the fan exhaust ports on either side open to the ambient air. This makes the system fairly weather resistant. For a guide to setting up this mode, see the section titled "[Setting up Mode 4: Wireless](#)".



Fig. 17: The Expedition operating in Mode 4: Wireless.

## Modes of Operation (continued)

### Mode 5: Hiking

Mode 5 is an extension of the collaborative mode. The *Expedition* can be installed into its backpack, and the PACA fixed atop the backpack. Using a mobile laptop, phone, or tablet, as a remote terminal, one can then walk around with the instrument fully self-contained on one's back! Furthermore, the PACA can be held in one hand and the terminal in the other to provide a means of walking, pointing, and taking measurements.



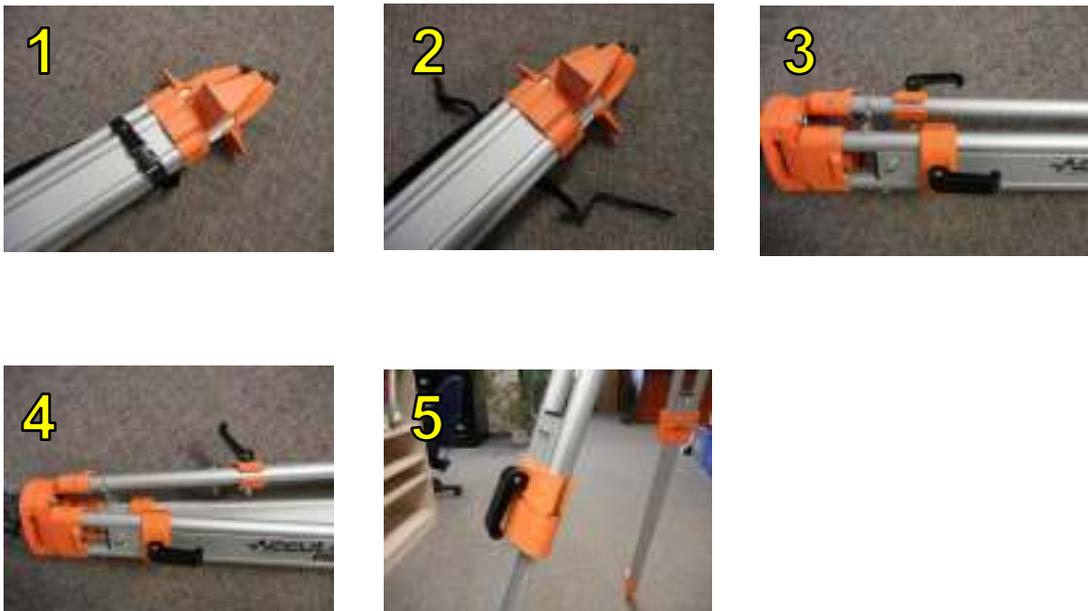
Fig. 18: The Expedition operating in Mode 5: Hiking.

## Procedure

This section contains all the procedures and guides for the hardware-side of the *Expedition*.

### 1. Set Up the Tripod

- a. Find a suitable spot for your measurements to set up the tripod.
- b. Unbuckle the strap holding the tripod together and release each of the three legs using the black plastic lever:



**Fig. 19: Setting up the tripod.**

- c. Extend at least one leg fully and extend the remaining two to fit the terrain. Be sure the legs are fully locked when done adjusting.

Ensure that the three legs are fully spread as far as they can go. The spread has been pre-adjusted to perfectly fit the main case at mid-level.

## Procedure (continued)

### 2. Hang the Main Case from the Tripod

- a. Remove the backpack from the main case if attached.
- b. Leaving the lid closed, use the single point on the rear of the case and attach it to one of the tripod's supporting loops on one of its legs. It helps to use your knee to support the case while the rear hook is being fastened. The case will have to be lifted in order to reach the loop. Make sure the chosen leg is indeed the "rear" leg, depending on the orientation of your intended measurement.
- c. Pull the front of the case up and level using the handle and hook the remaining two points on each of the remaining tripod legs. The main case should now be suspended from the tripod and sitting level.
- d. Open the main case lid and use the included bungee cord to hold the lid up against the tripod's back leg.



**Fig. 20: Hanging the main case from the tripod.**

## Procedure (continued)

### 3. Attach Fibre-Optic Cable to Main Case

- a. Unscrew (loosen) the plastic gland cap and remove the plug.
- b. Carefully insert the end of the fibre-optic with the rubber tube into the hole and using the tube screw the SMA connector into the spectrometer inside the case.
- c. Tighten the cable gland around the fibre and tube to provide a hermetic seal. Press the 9-pin connector onto its receptacle and tighten its screws to prevent an accidental disconnect



**Fig. 21: Connecting the fibre-optic to the main case.**

## Procedure (continued)

### 4. Mount PACA on Tripod

### 5. Attach Fibre-Optic Cable to PACA

- a. Screw the free end of the fibre-optic into the rear SMA connector of the PACA.
- b. Press the 9-pin connectors together and tighten the screws to prevent an accidental disconnect.



**Fig. 22: Connecting the fibre-optic to the mounted PACA.**

### 6. Apply Weather Shroud around Tripod

- a. Place the fibre-optic cable in the strain-relief clamp on the tripod.
- b. Unfold the shroud and locate the open face.
- c. Slide the shroud over the top of the tripod until the ball-mount protrudes through the top opening.
- d. Use the buckle at the top of the shroud to pull it tight just beneath the ball-mount.
- e. Straighten out the fabric and wrap the remaining straps around the tripod legs and use the buckles to fasten them in place.



**Fig. 23: The installed Weather Shroud strapped around the tripod.**

## AC Mode Operation

### To Run the *Expedition* on External AC Power:

1. Move the external source selector switch to the “AC” position.
2. Plug the AC power cable (included) into the AC inlet, and the other end to a suitable 100 – 240 VAC source. The battery charger will power on by default.
3. Turn the main power switch to “ON”.
4. The “Quick Info” display should show “External Power” instead of battery %.

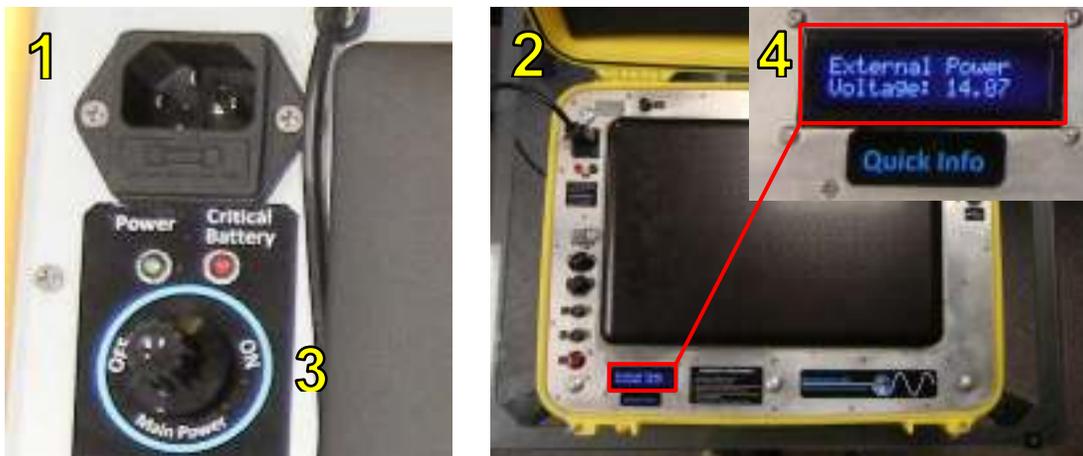


Fig. 24: Running the Expedition from AC external power.

## DC Mode Operation

**WARNING: Never short the positive and negative DC terminals together!**

The *Expedition* can actually run from two possible DC sources – an external source or its internal batteries. Which source is used depends on whether power is available on the external input port. If power is present, it is automatically used. If there is no connection to the port, batteries are used. Even if the “AC / DC” selector switch is in the “AC” position, power will default to the batteries if no AC power is present. Operating the *Expedition* in DC mode is therefore simple:

### To Run the *Expedition* on External DC Power:

1. Move the external source selector switch to the “DC” position.
2. Using the included automotive-style plug, connect the system to a suitable DC power source between 12 – 16 Volts that can source at least 120 Watts.
3. Turn the main power switch to “ON”.
4. The “Quick Info” display should show “External Power” instead of battery %.



**Fig. 25: Running the Expedition from DC external power.**

## Charging Batteries

**WARNING:** Make sure all 3 batteries are fully charged before using the *Expedition*!

**Note:** The *Expedition* can only be charged on AC power.

The *Expedition*'s batteries can be charged only on AC power. Simply plug the AC power cable (included) into the AC inlet, and the other end to a suitable 100 – 240 VAC source. The battery charger will power on automatically – ready for user input, and can be found underneath the laptop docking plate. The charger ships with the correct settings needed for the *Expedition*'s batteries, but these always need to be confirmed before the charging process is started.

### Remove the Laptop to Reveal the Charger:

1. Turn the laptop locking clamps on each side of the laptop to the unlocked position.
2. Lift the laptop and its tray up and out of the case, breaking the *Velcro* bond.

### Charge Batteries:

1. **Configure charger:**
  - a. To review selected preset's settings: **Press MODE button.**
  - b. To select a different preset: **Press MODE button until you see the desired preset's name and settings in display.**
  - c. To change selected preset's settings: **Press and hold MODE button** to set chemistry and/or charge current. **Press and hold to exit.**
  - d. **Select Preset 1: LiPo BAL @ 9.0 A.** If the charge rate differs from **9.0 A**, adjust the rate to **9.0 A**.

## Charging Batteries (continued)

2. **Press START/STOP button for one second to begin charging.**
3. **During Charging:**
  - a. To view charge data: **Press MODE button** repeatedly.
  - b. To cancel charging at any time: **Press START/STOP button for one second.**
4. The Charger will automatically stop charging, and initiate a series of beeps when charging is complete.
5. To end charging session and return to *Preset Menu*, **press START/STOP button for one second.**

The charger will show battery voltage, current put into the pack (in mAH), and elapsed time during the charge. The charging process will automatically stop when the batteries are full, or if an error occurs.

Since the buzzer is enabled, each charger port will communicate via audible tones when the battery has finished charging, if the charging process has been interrupted, or if an error has occurred. The charger LCD display will display information depending on the type of alarm.

# Wireless

Enabling this collaborative mode consists of setting up an ad-hoc WiFi network on the RMD laptop. Clients can then connect to this WiFi network and use remote viewing / control software to interface with the RMD software wirelessly and remotely. This guide covers setting up the WiFi network, but not the remote viewing software. The built-in Windows “Remote Desktop” software can be used, or alternatively a free and open source project called VNC exists which also works well. For further recommendations regarding this mode, please [contact](#) Resonance Ltd.

## Setting up an ad-hoc WiFi Network:

1. Click on **Start** (Windows icon) and type “wireless”. Click on **Manage wireless networks**.
2. Click on **Add**:

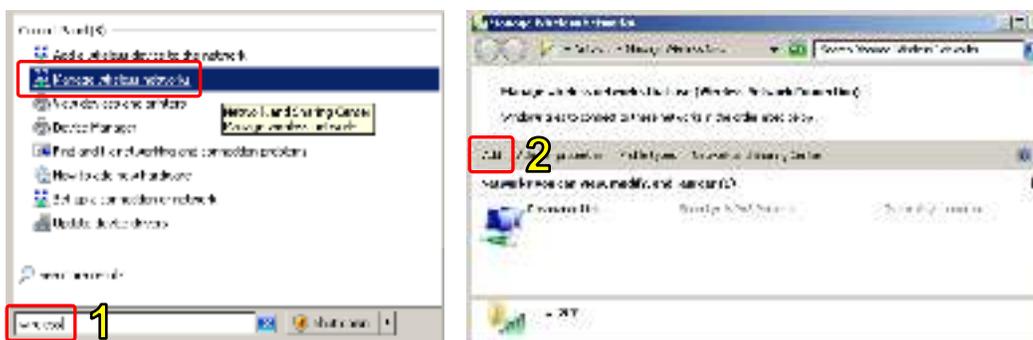


Fig. 26

3. Click on **Create an ad hoc network**.
4. Click on **Next**:

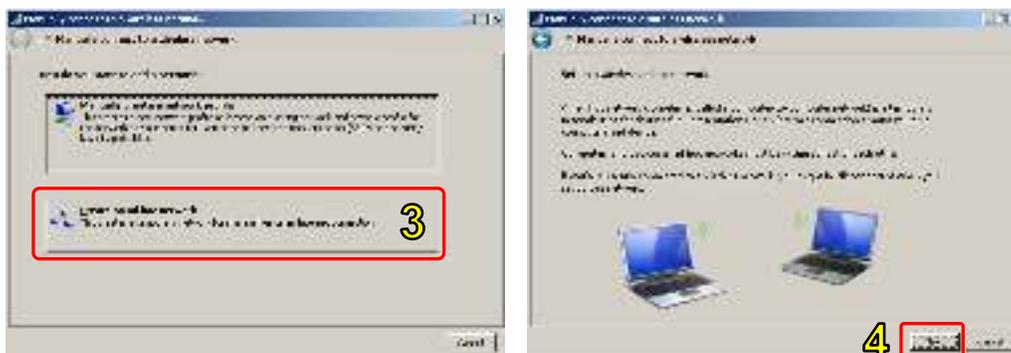


Fig. 27

## Wireless (continued)

5. Enter a name for your network and configure the security type to **No authentication (Open)**. This eliminates the need for clients to use a password when connecting. Click on **Next** when you are done.

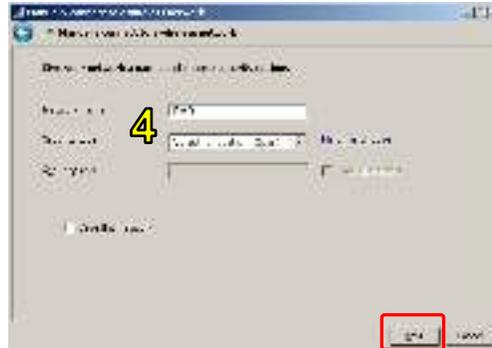


Fig. 28

Now that a wireless network has been created and hosted by the RMD laptop, clients can connect to the WiFi network with the same name (SSID) as the “Network Name” entered above. Using remote-desktop software they can then directly control the software. Resonance Ltd. recommends terminal software such as *UltraVNC* because its clients are freely available on PC, Mac, Linux, Android, iOS, and Blackberry. *UltraVNC* can be found online at:

<http://www.uvnc.com/>

## Case Fan Filter Cleaning

Every so often the *Expedition* case exhaust fan filter should be checked for a buildup of dust or dirt. This can restrict airflow which can negatively affect the TEC efficiency of the system, and also prevent critical electronics from cooling airflow.

### To Clean the Case Exhaust Fan Filter:

1. Remove the square plastic fan guard on the right side of the *Expedition* case by gripping it and pulling it off. It should snap off without too much force.
2. Inside the guard is a foam filter. Remove any dust or debris from the filter using a vacuum cleaner.
3. Re-install the filter inside the plastic fan guard and snap it back on the *Expedition* case.



**Fig. 29: Removing the fan guard to reveal the filter.**

This procedure should be repeated every few months to ensure proper airflow.

## Contact

Resonance Ltd. stands behind every product we sell. We welcome feedback and encourage any of our customers to contact us with questions, or concerns. You may contact us through e-mail, our website, telephone, or fax!

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