SPECTO TECHNOLOGY

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Powermate v3

User Manual

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1 Contents

2 Introduction

Powermate Carry Case provides a portable, powerful and protected monitoring solution.

These weather resistant cases (IP64) are designed to house an Instantel Micromate seismograph, a cell modem, 2 x 12-volt batteries and AC & DC charge controllers

This unit can power a Micromate and Modem for >5 days on a fully charged battery if AC or DC power sources are lost (depending on cell signal strength and ambient temperature)

3 Overview of Operation

Minimum site set up required, batteries provide backup power in case AC or DC sources are lost. Ideal for short or long-term projects that require unattended, wireless data acquisition. Quick and easy to install

- **Before you go to site:**
  a. Configure your Micromate for your application and AutoCallHome.
  b. Test your Micromate's connection to the geophone by running a Sensor Check.
  c. Test your batteries to make sure they are fully charged.
  d. Test your modem is online and remotely accessible

- **When you are in the field:**
  a. Install sensor
  b. Connect the sensor to the Powermate
  c. Insert your batteries into your Powermate case
  d. Connect your power source to Powermate
  e. Power up the Micromate
  f. Contact your IT department (or support@spectotechnology.com if subscribed to Specto ACH hosting) to confirm your Micromate and modem are communicating.
  g. Start monitoring

4 Powermate Version 3

The Powermate consists of a weather resistant carrying case and multi-source power supply for a Micromate and modem.

Protective case and power supply:

Carry case	Weather resistant (IP64) case with external ports for GEO, AUX, MIC, Solar and AC power
AC Charger	5 Amp AC battery charger with fast and float charge modes to maximize battery life
DC Solar Controller	12 V MPPT solar controller rated up to 20 Amps
Voltmeter	Integrated voltmeter displays both the battery charging current and the internal battery voltage
Modem Bracket	Modem bracket to mount a Sierra Wireless RV50 or RV50x modem
4G Cellular Antenna	Ultra wideband 4G antenna for cellular modems
Battery Harness	Wiring harness for two 12 Ah batteries
Micromate boot	Rubber boot to mount Micromate

Accessories:

Batteries	2x 12 Amp-Hr lithium batteries
Modem	Sierra wireless RV50 or RV50x modem
Seismograph	Instantel Micromate seismograph base unit
Geophone	Instantel Micromate geophone
Ground Spikes	Ground spikes for coupling geophone in soil

5 Requirements

The Powermate requires the following hardware and software:

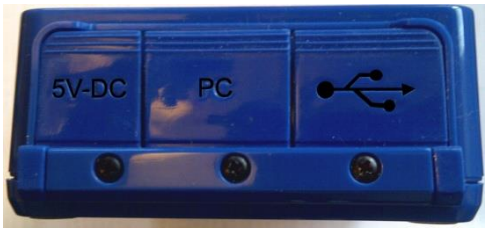
- A cellular modem with a Public Static IP address, such as the Sierra Wireless RV50x or RV50 Airlink modem (Available from Specto Technology)
- Cellular service coverage
- Mains 120VAC power or 12VDC Solar Panel up to 200W (Solar system available from Specto Technology)
- Two 12 Ah lithium batteries (included)
- Micromate Seismograph and sensor (geophone and/or microphone) (Available from Specto Technology)
- Instantel AutoCallHome software (Software and hosting Available from Specto Technology)
- OPTIONAL: Micromate with AUX port, required to use Modem Warmup feature.

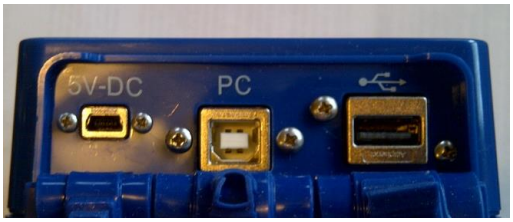
6 Install Sensors and Micromate

1. In your geophone and microphone sensors according to ISEE guidelines and manufacturers recommendations. For more detailed information on sensor installation see 14.
2. Connect the sensors cables to appropriate port on the outside of the Powermate case. Ensure the connector keys line up and do not try to force or twist the connection, it should go in only a short distance and then tighten the threaded collar.
3. Connect the internal sensor cables to the appropriate port on the Micromate. Follow the same procedure as step 2.
4. Optional: connect AUX or WARMUP cable to the AUX port on the Micromate.
    a. If using the modem warmup feature you must connect the WARMUP cable to the AUX port. Please note the AUX power on the Powermate case will not be connected while the WARMUP feature is in use.

b. If using an external auxiliary device such as a remote alarm controller, connect the AUX cable to the AUX port on the Micromate and connect your auxiliary device to the AUX port of the Powermate case.

5. Run a sensor check, if any channels fail check your connections and check if your geophone is level.
6. Connect the data and power ports on the top of the Micromate. 5V-DC goes to the mini USB connector for power and  goes to the USB to Serial Cable for communications with the modem. See the ports illustrated below:





Run a sensor check:
If any channels fail check your connections and check if your geophone is level.

7 Installing the Powermate Batteries

Powermate batteries are shipped separately from your Powermate. They are required for use of the power and should always be installed in your Powermate prior to connecting your Powermate to external power.

1. Insert and connect the batteries. Take care while tightening the battery straps not to short the battery terminals with the strap.
2. Connect the batteries to the wiring harness matching black to black and red to red. Be sure to connect each battery to a pair of red and black connectors to ensure the batteries are connected in parallel and not series.

3. Once your batteries are installed, switch the charging switch to ON, then turn system power to ON 

. You should now be able to see the battery voltage on the integrated meter 

. Refer to the following table to more information on battery voltage:

Voltage (VDC)	Powermate Status	Charging (A)	Powermate Status
<12V	Batteries Too Low, Recharge	**0A**	Not Charging
12-12.6V	Battery Low	**0.1-5A**	Charging
12.6-13V	Battery Charging	**5-15A**	Max Charging
>13V	Battery Full		

8 Connect and activate your power supply

1. When you switch on the System power make note of the battery voltage.

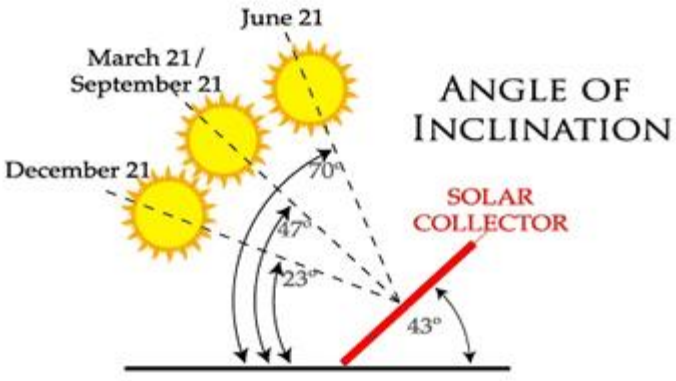
8.1 AC Mains power supply

1. Plug a properly grounded extension cord into the three-prong receptacle on the outside of the Powermate case.
2. Ensure that the internal AC receptacle cable is plugged into the internal battery tender cable
3. Once the AC is plugged in and the switch is turned from Transport-Storage to Charging, you should see the battery charge current on the integrated voltmeter displayed on both 12 Ah lithium batteries. This indicates the unit is charging.

8.2 Solar Power Supply

Only use the Powermate with 12V solar panels rated at no more than 200W. Always use the MC4 to SAE cables supplied by Specto Technology to connect your solar panel to the Powermate.

2. Install your solar panel. Always check your tilt and facing your solar panel. For detailed information on setting up your panel tilt please refer to https://www.solarpaneltilt.com/
3. As a quick rule of thumb always face your panel south and tilt it at an angle of 30-45°



4. Plug the solar panel into the Powermate using the MC4 to SAE cord set. There is only one way to connect each connector.
5. Switch from Transport-Storage to Charging.

6. With system power turned on and the Charge Select switch set to Solar you should see the voltage increase by ~1 VDC when you plug in the solar panel to the Powermate. This indicates the unit is charging.

8.3 Configure the Modem Warmup Switch

The modem warmup switch is used to switch the modem between Power Saver and Always ON modes. Please note: to use Warmup Feature an AUX port is required on the Micromate.

- Always ON: the modem will be powered on as long as the System Power is set to ON. This makes the seismograph more accessible but will use more power.

- Power Saver (or Modem Warmup): the modem will only power on when the Micromate is trying to call home. Power to the modem will be controlled by the Micromates AUX port. At each scheduled call time the AUX port will turn on the modem, wait a predetermined “warmup” period (usually 90-120 seconds) and then the Micromate will Call Home.

Use the Always ON mode when troubleshooting or configuring the unit initially to allow remote access. Then if needed switch back to Warmup. Use of the Modem Warmup feature can triple the battery life of the Powermate system.

9 Configuring the Modem

To configure your modem please email support@spectotechnology.com and provide the ACH Setup Form

9.1 Confirming Micromate and Modem Connectivity

To confirm your seismograph is online please email support@spectotechnology.com.

10 AutoCallHome Setup

To setup the data connection into AutoCallHome please email support@spectotechnology.com and provide the ACH Setup Form.

11 Start Monitoring

1. Before starting to monitor always hit the sensor check button on the Micromate and ensure all sensor pass the sensor check. 

2. If any sensor fail check all the connectors are plugged in correctly, the geophone is level and in the correct orientation according to the label on the geophone (floor or wall mount) and run the sensor check again.

3. Assuming all channels pass the sensor check hit start monitoring 

12 Appendix A – Troubleshooting

SYMPTOM: Built-in Voltmeter not turning on when system power ON.
TROUBLESHOOTING: Check that the batteries are connected red to red and black to black and that none of the connectors is loose.

SYMPTOM: Modem not powering on and Micromate not charging.
TROUBLESHOOTING : Check the battery Voltage on the built-in voltmeter. If battery voltage is less than 9 V check if charge source is working. If charge source is not working follow appropriate troubleshooting. If charger is working give battery 2-3 hours on charge to get above 12V.

Voltage (VDC)	Powermate Status	Charging (A)	Powermate Status
<12V	Batteries Too Low, Recharge	**0A**	Not Charging
12-12.6V	Battery Low	**0.1-5A**	Charging
12.6-13V	Battery Charging	**5-15A**	Max Charging
>13V	Battery Full		

SYMPTOM: Modem on but Micromate not charging.
TROUBLESHOOTING: Plug Micromate into a separate AC wall wart power supply:

1. Micromate charges with a separate power supply – there is a problem with charge control on the Micromate, return Micromate to Instantel for servicing.
2. Micromate doesn't charge in Powermate or with separate supply – There is a problem with the 5VDC charge control on the Powermate, return Powermate unit to Specto Technology for Servicing.

SYMPTOM: Micromate charging but modem won't turn on.
TROUBLESHOOTING: Plug Modem into a separate AC wall wart power supply:

1. Modem powers on with a separate power supply – there is a problem with the modem, return Modem to Sierra Wireless for servicing.
2. Modem doesn't power up in Powermate or with separate supply – There is a problem with the 12VDC power supply on the Powermate, return Powermate unit to Specto Technology for Servicing.

SYMPTOM: Batteries not charging - General.
TROUBLESHOOTING: Check that the Charging Switch is not set to Transport/Storage.

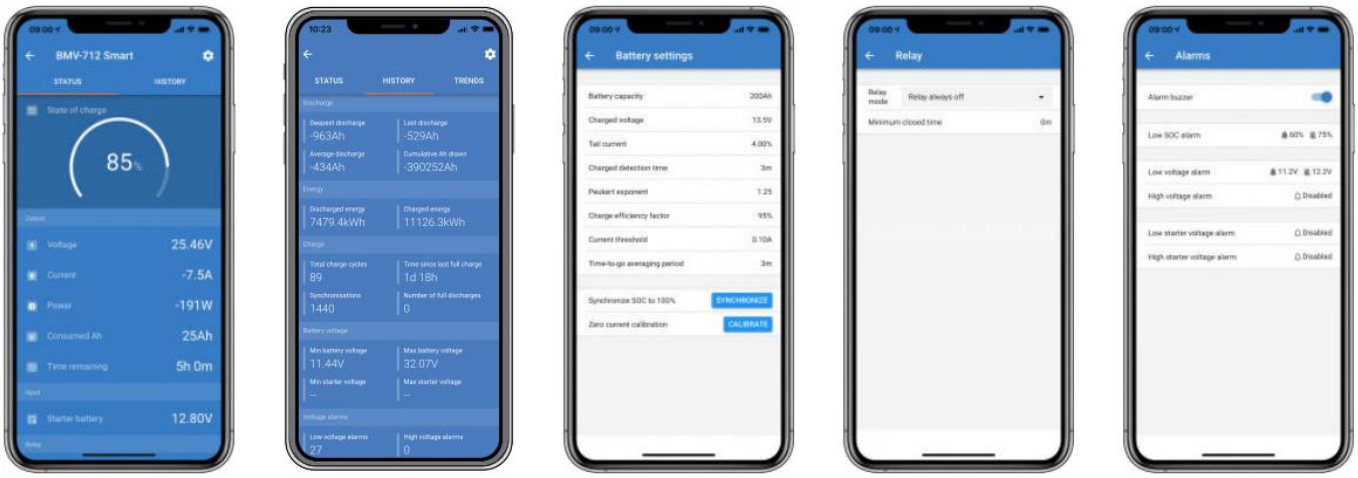
SYMPTOM: Batteries not charging on AC power.
TROUBLESHOOTING: Unplug the AC extension cord from the receptacle on the outside of the Powermate. Make note of the Voltage on the **VictronConnect App**. Plug the Extension cord back in. The Voltage should increase by ~1 VDC if

the charger is working. If it does not check that the AC extension cord is plugged into the AC three prong receptacle. Check that the AC source on site for that extension cord has power.

Within the **VictronConnect App**:

Clicking on 'Battery Monitor' will show the current state of charge, and allows you to toggle between screens showing more detailed information concerning the current battery STATUS, and HISTORY data.

To access 'Settings' click on the cog icon at the top right of the screen. From 'Settings' you can change the data concerning your battery storage; set alarms and relays; change charging parameters; tailor the appearance and quantity of data displayed and set up or join an existing VE.Smart network.



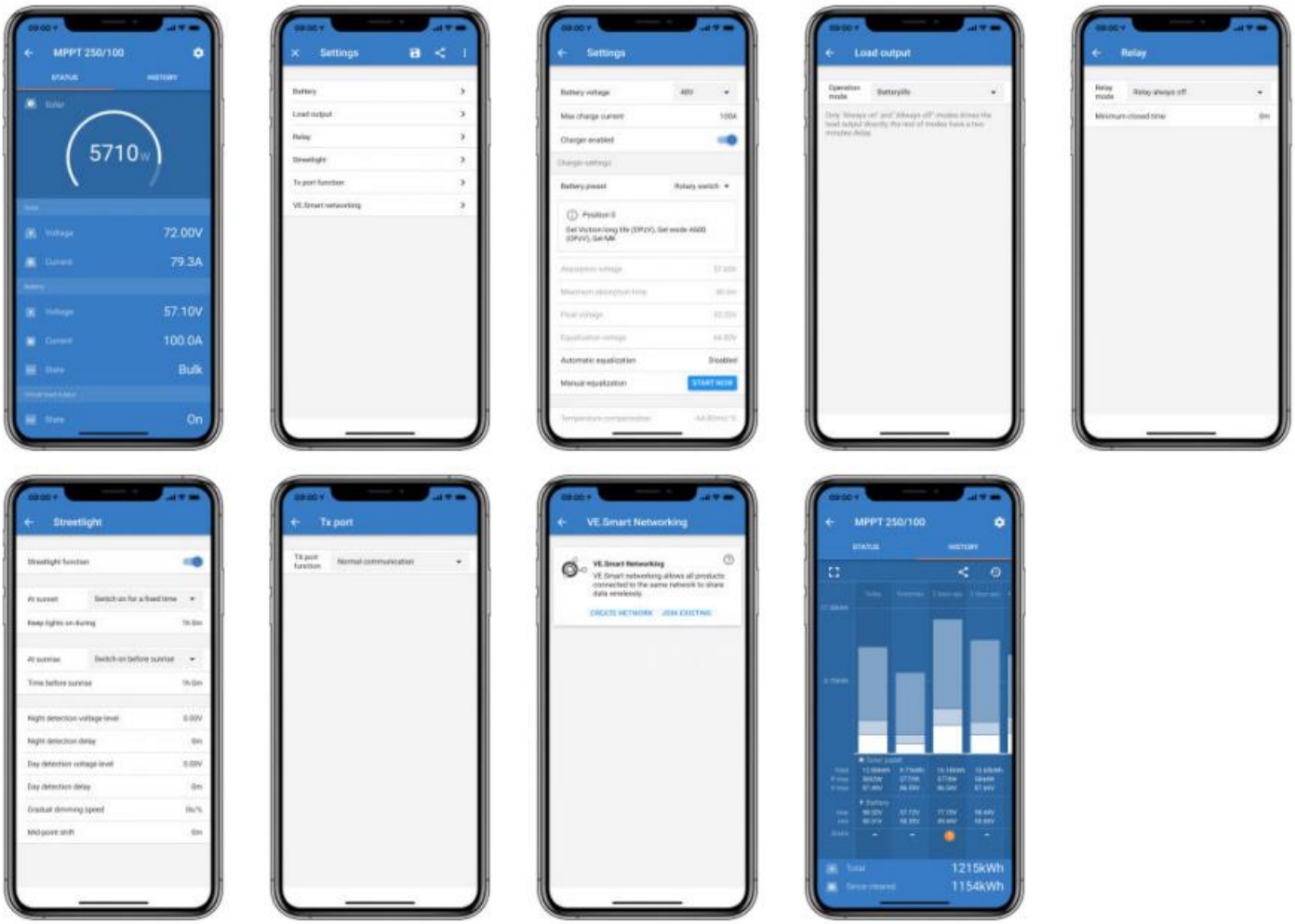
SYMPTOM: Batteries not charging on Solar power.

TROUBLESHOOTING: Test the solar panel when the sun is out and in view of the panel. Unplug the solar panel cable from the SAE port on the outside of the Powermate. Make note of the Voltage on the VictronConnect App. Plug the cable back in. The Voltage should increase by ~1 VDC if the charger is working. Check that the solar panel is plugged into the Powermate.

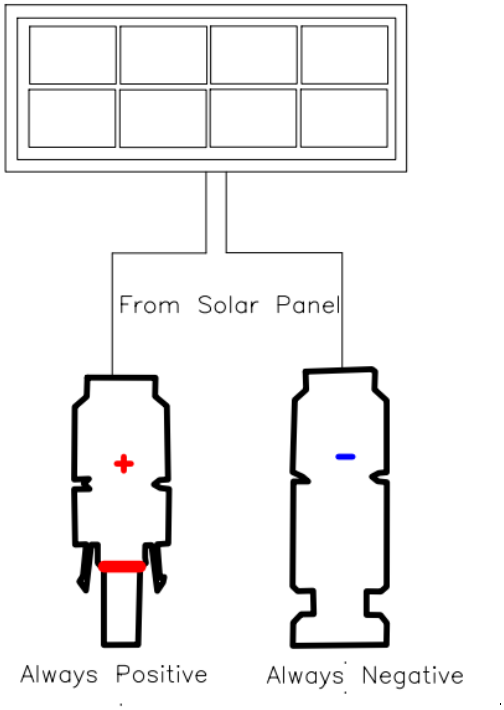
Within the VictronConnect App:

Clicking on your Solar Charge Controller product allows you to view the current charging status.

To access 'Settings' click on the cog icon at the top right of the screen. 'Settings' will allow access to the extensive range of functions available on your solar charge controller, including programming the charge settings; initiating relays which are triggered by solar time, or by voltage parameters; together with comprehensive historical analysis.



Test that there is a power coming out of the Solar Panel using the VictronConnect App. The panel should output at least 19V to be able to charge the Powermate. The polarity is import here; you should measure approx. +19V when reading the panel voltage. See the wiring diagram below:



SYMPTOM: Batteries not staying charged on Solar power even when Solar Status is green.
TROUBLESHOOTING: Check the location of your solar panel. The panel should be installed where is has the most open sky exposure as possible. It should be facing South in the northern hemisphere (North in the southern hemisphere). And it should be installed using this table for the tilt elevation:

Latitude	Full year angle	Avg. insolation on panel	% of optimum
0° (Quito)	0.0	6.5	72%
5° (Bogotá)	4.4	6.5	72%
10° (Caracas)	8.7	6.5	72%
15° (Dakar)	13.1	6.4	72%
20° (Mérida)	17.4	6.3	72%
25° (Key West, Taipei)	22.1	6.2	72%
30° (Houston, Cairo)	25.9	6.1	71%
35° (Albuquerque, Tokyo)	29.7	6.0	71%
40° (Denver, Madrid)	33.5	5.7	71%
45° (Minneapolis, Milano)	37.3	5.4	71%
50° (Winnipeg, Prague)	41.1	5.1	70%

SYMPTOM: No lights on the modem.
TROUBLESHOOTING: Check site power. The seismograph has an internal battery which will keep it running during short power outages. The modem does NOT – so the modem is a better indicator of a power outage.

SYMPTOM: No solid green lights for power, network and signal. Lights may be blinking or they may be amber or red.
TROUBLESHOOTING: There are 4 lights on the modem and, optimally, you want solid green lights for power, network and signal.

a. Power light (circle icon) – Solid green when the modem is powered on. A solid red light means that the modem isn't receiving enough electricity to power up completely.
b. Data light (arrows icon) – This light blinks (green) only when there is data transferring through the modem.
c. Signal light (bars icon) – Solid green means the modem has a strong signal. The modem CAN work with an amber signal light but the signal is weaker and email delivery may be less reliable. Try repositioning the unit until the signal light turns solid green or, alternatively, purchase a geophone extension cord so that the geophone can stay in the poor signal spot while the modem can be moved to a better signal spot.
d. Network light (cell tower icon) – Solid green means that the modem IP address has registered with the provider and it is ready for use. A red light means that the modem cannot register with the provider. Check the antenna for damaged and that it is securely screwed into the cellular port on the modem. If that is not the issue, check that the APN is correct.

SYMPTOM: No communication between the modem and the seismograph

TROUBLESHOOTING: Check that the serial data cable is connected between the modem and the seismograph. The Micromate serial data cable is square on one end (USB end to connect to the USB port on the top of the Micromate) and trapezoidal on the other end (to connect to the modem).
Also check the cable for any physical damage.

SYMPTOM: Seismograph won't power on

TROUBLESHOOTING: Check the power cord of the seismograph and make sure that it is connected to a power source. The seismograph has an internal battery which will keep the it powered on during short power outages. If power at the site has been out for a long time, and the seismograph's internal battery has been completely depleted, it may take a few minutes to power on after power has been restored.

SYMPTOM: The seismograph is powered on but doesn't send a recorded event (either a Minimate Plus or a Micromate).
TROUBLESHOOTING: Check the ACH settings on the seismograph (note the different modem baud rate):

MICROMATE AUTO CALL HOME SETTING:

i. Auto Call Home: Enabled
ii. Session Time Out 30 Minutes
iii. Modem: Generic
iv. Modem Baud Rate: 115200

On a Micromate, push the Setup button and use the arrows and checkmark buttons to browse to View/Edit Preferences and then use the Arrow buttons to browse to Auto Call Home to check that ACH is enabled and that the settings match the list for the Micromate above

SYMPTOM: Micromate is unresponsive whether in Histogram Combo mode or at the Ready to Monitor screen (Micromate only).

TROUBLESHOOTING #1: Try a seismograph reboot. Remove the power cord from the Micromate and then hold down the power button until the confirmation screen about disconnecting the batteries appears (this is normal for a full shut

down). Push the checkmark button on the battery confirmation screen to turn the Micromate completely off. Afterwards, push and hold the red power button to turn the unit back on and then reattach the power cord to see if this fixes the issue.

TROUBLESHOOTING #2: If a Micromate reboot doesn't clear the issue, push the 4 buttons on the front of the Micromate (Sensor Check, Setup, Start Monitor & Cancel) at the same time. This will cause a Micromate reset. The screen will fade to white and the seismograph will reboot. The fade to white is the key that you pushed all 4 buttons at the same time. NOTE: Even though this is called a Micromate Reset, it does not delete any settings on the Micromate. It only clears the unit of issues similar to a computer reboot.

13 Appendix B - Specifications

13.1 Case

Weather resistance:	IP64
Dimensions:	20 x 16 x 8 inches
Weight:	26 lbs (with batteries, Micromate, Geophone and Modem)

13.2 Solar Controller

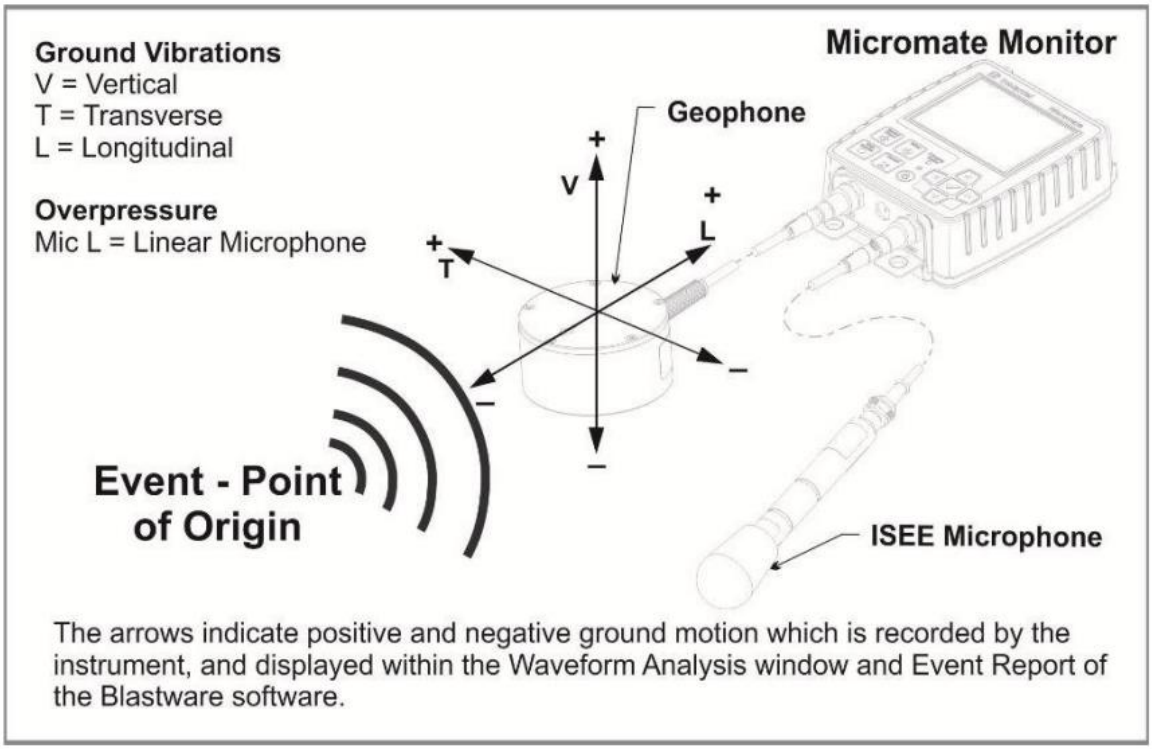
Nominal system voltage:	12 or 24 Vdc
Max. solar input voltage:	30 or 60V
Max. solar current:	6.5 or 10 or 20A
Battery voltage range:	6 -15V or 6-30V
Self-consumption:	< 8 mA
Voltage Accuracy:	1.0 %
Transient Surge Protection:	1500W per connection
Electrical Protections (Solar & Load):	short circuit, over-current, reverse polarity, high temperature, high voltage
Battery Charging:	
Regulation Method:	MPPT

14 Appendix C - Installing the Micromate and Sensor

- ISEE publish field practices guidelines
  www.isee.org/sections/99FldPractStandardsApproved.pdf
  - Know how your seismograph works (We did this in the previous slides)
  - General guidelines on where to setup the seismograph
  - How the geophone should be coupled
  - What basic information should be included in a blast report

14.1 Sensor Positioning General Guidelines

- Ensure the sensors are pointed at the source of the event
- Ensure that the
  geophone(s) are level
  at the time of installation



Where to setup

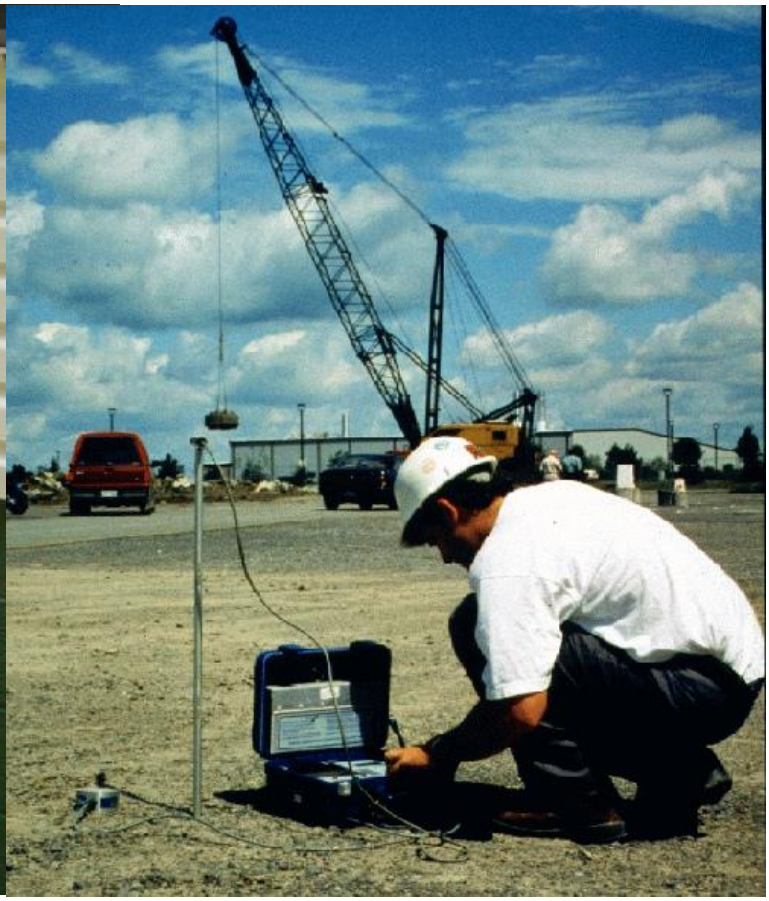
- Within 10 feet or < 10% of the distance to the blast from the structure, whichever is less, on undisturbed soil.
- To minimize reflections from the structure, place the sensors near the corner of the structure
- The microphone should not be shielded by the structure, vehicles or other large objects and should be 3 feet above the ground

14.2 Microphone installation

Where to setup

- Within 10 feet or < 10% of the distance to the blast from the structure, whichever is less, on undisturbed soil.
- To minimize reflections from the structure, place the sensors near the corner of the structure
- The microphone should not be shielded by the structure, vehicles or other large objects and should be 3 feet above the ground
- Do not cover the microphone with a plastic bag

Install the microphone on a mic stand or tripod so by another method that keeps the microphone in a free field environment no less than three feet from and solid surface.



14.3 Geophone Installation and Coupling

- The greater the vibration, the better and more solid coupling is needed
- For example, if the acceleration is expected to be:

Acceleration	Burial or attachment
Less than 0.2 g	Not necessary
Between 0.2 and 1.0 g	Preferred. Spiking may be acceptable.
Greater than 1.0 g	Required (USBM RI 8506)

14.3.1 Coupling in Soils

Burial is the best option for good coupling in soils

- Dig hole at least as deep as 3X the sensor height.
- Level & spike sensor to bottom of hole with longitudinal channel pointing directly towards blast.
- Replace soil & firmly compact around sensor.
- **Shallow burial or surface spiking may be required**
- Remove sod and surface debris.
- Level & spike sensor on cleared surface.
- Place ‘sandbag’ over sensor

Right

Wrong

14.3.2 Coupling on hard ground

When installing a geophone on hard ground sandbags or fastners can be used. When using a sangbag, whether on soil or hard ground the sandbag should be placed on its side so as to spread its weight out around the geophone as much as possible and not stacked vertically.

Right

Wrong

.

If a fastener is to be used follow these guidelines:

1. Choose a level surface. Before beginning to install the fastener, check with a spirit level or run a sensor check in your desired location to ensure it is level enough.
2. Fasten directly to the surface to be measured. Avoid adding extra structure between the geophone and the earth
3. Use a fastener appropriate for the type of material. Wedge anchors for concrete or hard rock, expansion anchor for block or brick, groutable anchor for soft rock, etc., (use your judgement)

Right

Wrong

14.3.3 Installing a Wall Mount

Follow the same guidelines as above for installing a geophone on a hard surface using a fastener but when installing the sensor point the arrow on the lid up, opposite gravity.

14.4 Sensor Check!

4. After installing your sensor always run a sensor check on the Micromate. Hit the sensor check button.
5. If any sensor fails check all the connectors are plugged in correctly, the geophone is level and in the correct orientation according to the label on the geophone (floor or wall mount) and run the sensor check again.
6. If all channels pass your sensor is good to go.