**REPLACING GPS BOARD**

**REMOVE OLD BOARD:**
- Turn off all breakers
- Power down GPS with power button
- Unplug all connectors from enclosure wall and remove red/black wires from battery bank
- Remove SIM cards from dial-up modems(s) and keep in safe place
- Remove board from enclosure

**INSTALL NEW BOARD:**
- Record UID for GPS Receiver - Primary Iridium modem - Secondary Iridium modem
- Record timer switch settings (typical 1000m / 1000m for dual, 1000m / 10m for single)
- Verify all breakers off (green showing)
- Verify GPS power plug(s) disconnected
- Place new board into enclosure
- Place regulator temp sensors on batteries
- Connect all cables to enclosure wall: Power, Met, GPS antenna, Iridium antenna(s)
- Connect heat pads to terminal blocks
- Connect red/black wires to battery bank
- Check and record voltages (see MEASURING VOLTAGES section)
- Turn on all breakers (red showing)
- Check regulators:
  - Solar charge LED: green, or red with green flash
  - Solar LVD LED: green (magnet to reset if red)
  - Wind charge LED: green, or red with green flash
  - Battery voltage: voltage increasing?
- Plug in GPS power cable(s)
- Verify GPS front panel operating normally
  - **IF Xeos modem:** Perform Xeos checks (see IRIIDIUM CHECKS section)
  - **IF single dial-up modem:** Install SIM into modem
  - **IF dual dial-up modems:** Load breaker OFF
    - Install active SIM into secondary modem
    - Load breaker ON
    - Place test call to secondary modem (see IRIIDIUM CHECKS section)
    - Load breaker OFF
    - Move active SIM to primary modem
    - Install backup SIM inside secondary modem
    - Load breaker ON
- Photograph GPS board
- Place foam cap over electronics
- Slide board into anti-static bag, attach alligator clip leads from bag to system ground
- Verify ground wires connected from enclosure ground plate to battery negative
- Photograph inside of enclosure AND connectors on enclosure wall
- Verify all breakers still ON
- Close, latch, and strap all enclosures
- Place test call to primary modem (see IRIIDIUM CHECKS section)
REPLACING A GPS RECEIVER

Power down old receiver with power button
Remove all connectors from rear panel of receiver and remove receiver from board
Install new receiver and reconnect all connectors to rear panel

<table>
<thead>
<tr>
<th>TRIMBLE NETRS</th>
<th>TRIMBLE NETR9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power A</td>
<td>to dongle</td>
</tr>
<tr>
<td>Ethernet</td>
<td>to dongle (for Xeos or radio only)</td>
</tr>
<tr>
<td>Power B</td>
<td>lock this connector</td>
</tr>
<tr>
<td>Serial 2</td>
<td>primary dial-up Iridium</td>
</tr>
<tr>
<td>Serial 3</td>
<td>Met station if secondary Iridium used</td>
</tr>
<tr>
<td>Serial 4</td>
<td>secondary Iridium, otherwise Met</td>
</tr>
<tr>
<td>Antenna cable</td>
<td>to type N connector on enclosure wall</td>
</tr>
</tbody>
</table>

Verify GPS operation from front panel

<table>
<thead>
<tr>
<th>TRIMBLE NETRS</th>
<th>TRIMBLE NETR9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite:</td>
<td>red 1Hz</td>
</tr>
<tr>
<td>Data:</td>
<td>yellow 1Hz</td>
</tr>
<tr>
<td>Power A:</td>
<td>solid green</td>
</tr>
<tr>
<td>Power B:</td>
<td>solid yellow</td>
</tr>
<tr>
<td>Lower Left:</td>
<td>Logging / USB</td>
</tr>
<tr>
<td>Upper Left:</td>
<td>SV X (X&gt;5)</td>
</tr>
<tr>
<td>Upper Right:</td>
<td>Battery icon</td>
</tr>
</tbody>
</table>

Record UID of new receiver

REPLACING A DIAL-UP IRIDIUM MODEM

Turn off load breaker (yellow wires)
Remove Iridium modem and its power / serial cable
Move SIM card to new modem
Install new modem and power / serial cable
Serial cable To NetRS serial 2 (primary) or serial 4 (secondary)
Iridium positive lead To timer switch pin 1
Iridium negative lead To timer switch pin 3
Coaxial antenna cable To type TNC connector on enclosure wall

Turn on load breaker
Record UID of new Iridium modem

REPLACING AN IRIDIUM ANTENNA

Unplug the old cable from the enclosure and remove all cable ties from frame
Remove old antenna and cable
Install new antenna and cable. Hand tighten the TNC connector then use pliers to tighten further.
Route cable back to enclosure and plug in. NO SHARP BENDS OR KINKS IN THIS CABLE
Anchor cable with a tie every ~18", taking care to avoid sharp edges

REPLACING A WEATHER STATION

Unplug the old cable from the enclosure and remove all cable ties from frame
Remove weather station by unscrewing small set screw inside base of weather station
Install new weather station on frame
Orient the new weather station so its "north" arrow on bottom points toward true north
Route cable back to enclosure and plug in
Anchor cable with a tie every ~18", taking care to avoid sharp edges
Record UID of new weather station
Record height of weather station above/below (+/-) GPS antenna
REPLACING A SOLAR PANEL

Unplug the old cable from the enclosure and remove all cable ties from frame.
Unscrew 4 saddle clamps from frame and remove panel.
Install new panel using 4 saddle clamps.
Route cable back to enclosure and plug in.
Anchor cable with a tie every ~18”, taking care to avoid sharp edges.

REPLACING A WIND TURBINE

Unplug the old cable from the enclosure and remove all cable ties from frame.
Remove wind turbine from frame.
Install new turbine on frame.
Route cable back to enclosure and plug in.
Anchor cable with a tie every ~18”, taking care to avoid sharp edges.

IRIDIUM CHECKS

TEST CALL TO NETRS THROUGH DIAL-UP MODEM

Connect Iridium handset to laptop serial port. Power the handset and extend antenna vertically.
Make sure you have good sky view for the antenna.
Open previously configured Iridium dial-up Network Connection.
Enter Iridium phone number and click Dial. May take several tries. If persistent failures:
  
  Phone number correct?
  Active SIM card installed on remote modem?
  Remote Iridium modem on?
  Remote modem antenna cable and connectors OK?
  Breakers on?

After "Registering Computer On Network" box disappears, connection has been made to GPS.
In any browser, enter following commands (xx = unique for each remote station)

  Verify you have connected to the right site

  http://192.168.xx.2/prog/show?serialnumber
  Record on checklist

  Running 1.3-2 (or 1.3-1 or 1.3-0). Record on checklist.

  http://192.168.xx.2/prog/show?voltage&input=1
  Voltage 1 is >13V and charging

  Voltage 2 is >13V and charging

  Verify NetRS is logging 60-minute datafile

  Must have nonzero L1snr and L2snr values

CHECKS WITH XEOS MODEM

Upon power up, Power LED flashes then solid yellow <10 seconds
Press DAS Test button. DAS OK LED flashes then solid yellow. Verifies Ethernet connection to GPS. <20 seconds.
Press SAT Test button. SAT OK LED flashes then solid yellow. Verifies Iridium link (up to 90 sec). May take 2-3 tries.
Note: Xeos goes to sleep after 15 minutes. If asleep, cycle load breaker to wake up.
**MEASURING VOLTAGES**

**TURN ALL BREAKERS OFF**

**BATTERY VOLTAGES** (with breakers OFF)

Verify voltmeter is set to measure DC voltage (NOT DC current).
If no individual breakers for auxiliary battery banks:
- Unplug all external battery cables from outside of enclosure
- Measure main bank voltage from port 2 on battery breaker to black terminal blocks
- Measure auxiliary bank voltages at external battery cable (pin B positive)
- Reconnect external battery cables to enclosure

If individual breakers for auxiliary battery banks:
- Measure main bank voltage from port 2 on main battery breaker to black terminal blocks
- Measure auxiliary bank voltages from port 2 on auxiliary battery breakers to black terminal blocks

All battery voltages should be steady ≥13V if system charging on arrival.
All battery voltages should be steady <13V if system not charging on arrival.

**SOLAR PANEL VOLTAGES** (with breakers OFF)

Unplug all but one panel from outside of box.
Measure solar panel voltage from port 2 on solar breaker (orange wires) to black terminal blocks.
  - Should be >20V
Unplug first panel. Connect second panel into different plug.
Measure voltage again.
Repeat for panels 3 and 4 if necessary.
Reconnect all panels to enclosure.

**WIND TURBINE VOLTAGES** (with breakers OFF)

Unplug all but one turbine from outside of box.
Measure wind turbine voltage from port 2 on wind breaker (blue wires) to black terminal blocks.
  - Should be >15V when spun by hand
Unplug first turbine. Connect second turbine into different plug.
Measure voltage again.
Reconnect both turbines to enclosure.

**HEAT PAD RESISTANCE** (with breakers OFF)

Set voltmeter to resistance.
Measure purple to black blocks.
  - Should be ~7ohms when cold.

**TURN ALL BREAKERS ON**

**LOAD VOLTAGE** (with breakers ON)

Measure load voltage from yellow terminal blocks to black terminal blocks.
  - Should equal battery voltage.