



R900® System Gateway RTC Battery Diagnosis & Replacement Procedure

Applicable to gateways with serial numbers beginning with GPV3 and GPV4
(Not applicable to GPV4E serial numbers)

This document is intended for end users, field service technicians, factory repair staff, customer support personnel, or anyone repairing or maintaining R900® System gateways identified by the following serial number ranges:

- Serial numbers beginning with **GPV3** (Chassis label part number: **13218-xxx**)
- Serial numbers beginning with **GPV4** (Chassis label part number: **13458-xxx**)

This document is **not** applicable to gateways with serial numbers beginning with **GPV4E** (Chassis label part number: **15155-xxx**) as they are equipped with a rechargeable RTC battery.

Recommendation: This diagnosis and replacement procedure is best performed by personnel trained or experienced in maintaining electronic equipment, operating a multimeter and basic diagnostic software.

This document covers how to diagnose and replace the internal Real-Time Clock (RTC) battery in the above-mentioned gateway units. The RTC battery allows the gateway to keep accurate date and time information during power outages and correctly timestamp received meter readings.

Important: The RTC battery is **not** rechargeable.

When you should suspect a failed RTC battery:

You may need to replace the RTC battery if:

- The gateway cannot connect to Neptune® 360™.
- The gateway's date/time resets to a value in the past (for example: January 1st, 1970).

Order Of Operations

This document has a specified order of operations to follow:

1. Materials, Tools & Software Needed
2. Diagnose
3. Replacement Battery Ordering Process
4. RTC Battery Replacement Procedure
5. Battery Recycling Options

Materials, Tools & Software Needed

The following materials, tools and software are needed for both diagnosing and replacing the RTC battery in the gateway should it be deemed necessary:

- T27 Tamper Resistant Torx Screwdriver
- PC with a USB Type A port with PuTTY installed.
- USB 2.0 Type A Male to USB Type mini-B Male Data Cable
- Digital Multimeter with fine probes



Troubleshooting Environment Resources Needed:

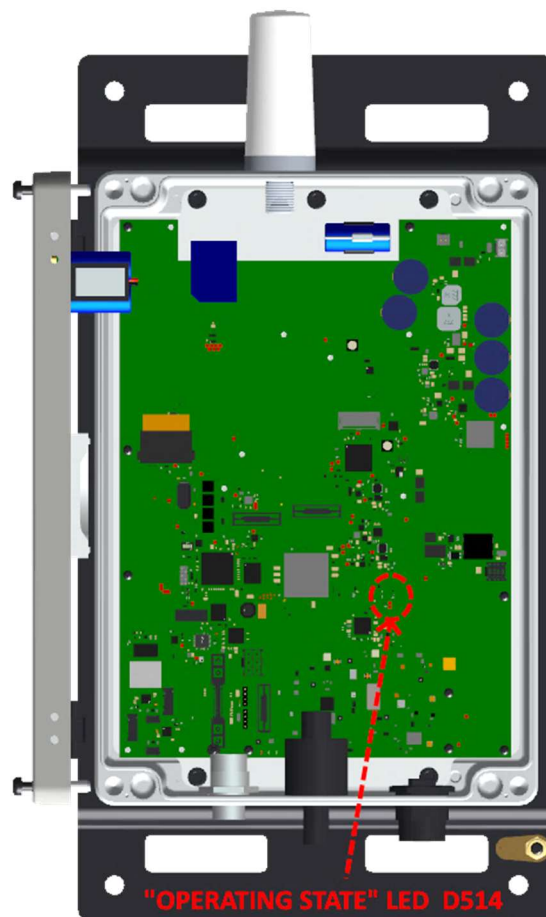
A typical gateway bulkhead connected power source and internet access for the gateway under test are required for these diagnostic troubleshooting procedures.

Diagnose

Before ordering a replacement RTC battery, the following steps should be performed to verify if the RTC battery needs to be replaced.

1. Open the gateway

1. Note down the gateway's serial number as shown on its chassis label. Verify if it's applicable per criteria outlined in this document's introduction.
2. Unfasten the four Torx screws holding the gateway's door shut and open the door.
3. If the gateway is not already powered up, apply external power to the gateway. Wait approximately 3 minutes for the gateway to fully boot before continuing. After waiting 3 minutes, the **"OPERATING STATE" D514** LED should illuminate solid green when ready. The Operating State LED location is shown below:

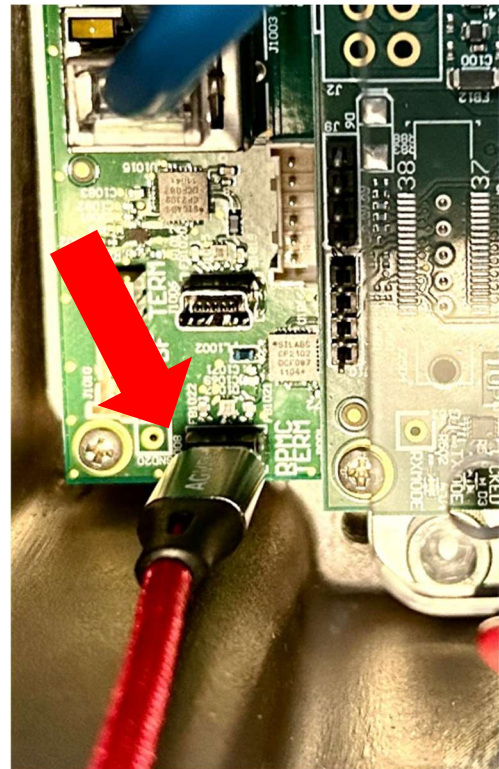
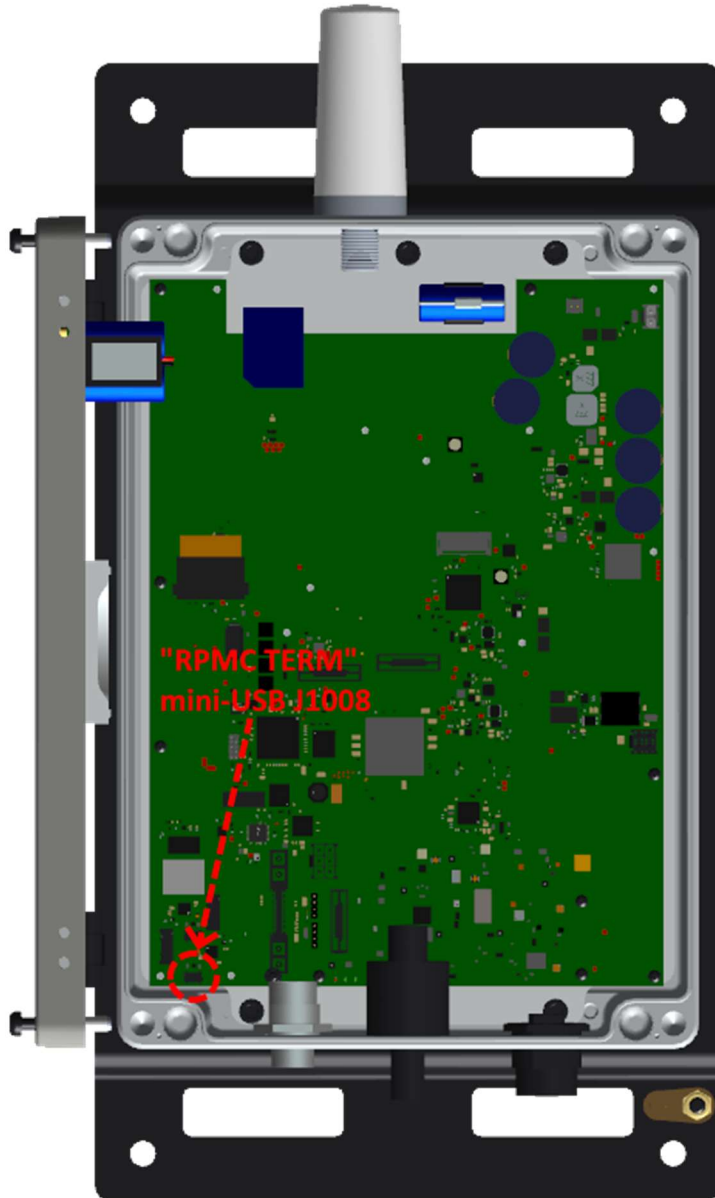


4. **WARNING: Discharge yourself by touching the unpainted gateway's metal chassis (not the door!) to prevent electrostatic damage (ESD) before continuing!**



2. Access the gateway's RPMC Console

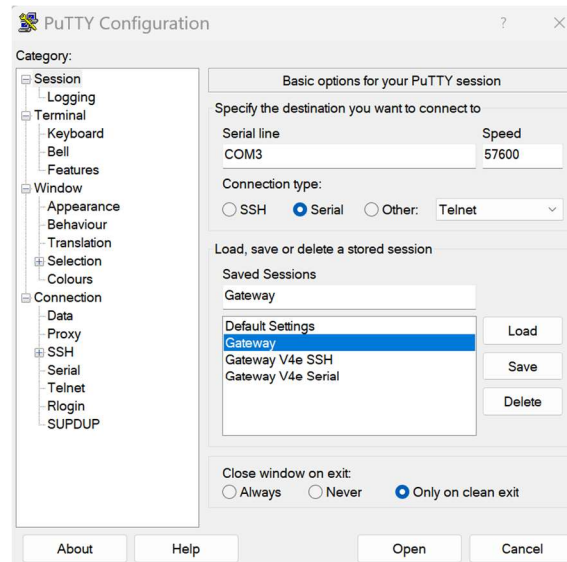
1. Connect to the gateway's RPMC console via the **"RPMC TERM" J1008** mini-B USB connector using a PC running PuTTY and a USB 2.0 data cable as outlined in the Materials, Tools & Software Needed section. The location of this connector is shown below:



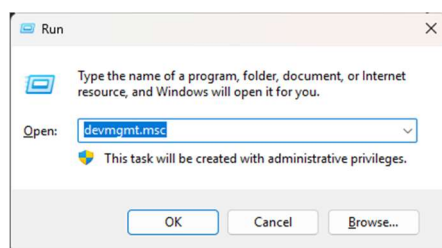


2. Once physically connected, find the COM port (See the note below to find the specific COM port number to connect to) for the gateway's RPMC console in Windows and connect to it in PuTTY with the following serial port settings as shown below:

- Baud rate: **57600**
- Data bits: **8**
- Parity: **None**
- Stop bits: **1**



Note: To find the specific COM port number to connect to check Windows Device Manager. This is accessible via pressing **Windows Key + R** and entering **devmgmt.msc** into the Run dialog box:



In Device Manager, look for a **"Silicon Labs CP210x USB to UART Bridge"** device under the **"Ports (COM & LPT)"** section. The COM port number listed for this device is the gateway's RPMC console.



3. Check Time Values

- Once connected over PuTTY, the RPMC console menu should automatically refresh as shown below. Hit the **Enter** key in the terminal if nothing appears. (Note: You may need to unlock Engineering Mode via the **Eng. Password** option by typing **Z** and entering the password from the main menu if the Clock Controls option is absent. See ETI 29-11 for details). Check the **Current Time** status field. If it doesn't match the present real-world date/time or if it is significantly in the past (for example, January 1st, 1970) as shown below, then that is one point in favor of replacing the RTC battery. Continue the diagnostic procedure:

```

===== NEPTUNE R900 MAIN DIAGNOSTICS MENU CONSOLE =====
Versions                      RPMC: 2.76-GW, Logic: 72
Build Time                   Nov  5 2012 14:00:46
Current Time                 01/01/1970 00:02:12
System Watchdog              4026 Sec
=====
[P] Power Board Logic Diagnostics
[S] Power Supply Diagnostics
[D] Power Domain Diagnostics
[R] Resets Diagnostics
[V] Device Status
[L] Logging Diagnostics
[F] Blackfin Operational Info
[I] Diagnostics IO Control
[C] Clock Controls
[T] Settings
=====
[W] Restore basic user mode
[Y] Config Password: *****
[Z] Eng. Password: *****
=====
[1] Reset Blackfin           Initializing
[2] Signal Report Now
[3] Modem State              On
=====
Requested Power State        All On
Current Power State          All On DCst Wait: 0 Sec
=====
System Power Measurements    13.68V  0.380A  5.201W
Board Temperature            22C

```



4. Check RTC & RTC Battery Status

1. Still in the terminal, enter the **Clock Controls** submenu by typing **C** into the terminal.
2. Check the **Bat** and **Osc** status fields underneath the **RTC Status** line. **Note: It may take up to a minute for these fields to properly update and they may briefly blink their statuses.**
 - If the **Bat** and **Osc** status fields both report as **Ok**, as shown below, then the RTC and its battery are operating normally. Thus, the RTC battery is not required to be replaced. Attempt other troubleshooting as needed.

```
==== RPMC CLOCK DIAGNOSTICS ====
[1] SYS/BF 25MHz Clocks      Enabled
[2] Blackfin USB Clock      Enabled
[3] Supply Clocks           Enabled
[4] RPMC Clock               Disabled
[5] Bluetooth Clock         Enabled
====
[9] Status Flags             0xE8
====
Master Clock Setting         25.000000MHz
RPMC 32kHz Status            Synchronized to RTC 32kHz
RTC Status                   Osc: Ok , Bat: Ok , Alm: Off, Bsy: Ok
[8] Set RTC to build date/time
Check Time Sync              0 Seconds
====
[X] Main Menu
```

- If the **Osc** status field reports as **Bad**, as shown below, then the RTC itself is malfunctioning. The gateway's motherboard will need to be repaired or replaced.

```
==== RPMC CLOCK DIAGNOSTICS ====
[1] SYS/BF 25MHz Clocks      Enabled
[2] Blackfin USB Clock      Enabled
[3] Supply Clocks           Enabled
[4] RPMC Clock               Disabled
[5] Bluetooth Clock         Enabled
====
[9] Status Flags             0xE8
====
Master Clock Setting         25.000000MHz
RPMC 32kHz Status            Synchronized to RTC 32kHz
RTC Status                   Osc: Bad, Bat: Ok , Alm: Off, Bsy: Ok
[8] Set RTC to build date/time
Check Time Sync              0 Seconds
====
[X] Main Menu
```

- If the **Bat** status fields reports as something other than **Ok**, e.g., blinks **<75** as shown below, then the RTC battery will likely need to be ordered and replaced.

```
==== RPMC CLOCK DIAGNOSTICS ====
[1] SYS/BF 25MHz Clocks      Enabled
[2] Blackfin USB Clock      Enabled
[3] Supply Clocks           Enabled
[4] RPMC Clock               Disabled
[5] Bluetooth Clock         Enabled
====
[9] Status Flags             0xE8
====
Master Clock Setting         25.000000MHz
RPMC 32kHz Status            Synchronized to RTC 32kHz
RTC Status                   Osc: Ok , Bat: <75, Alm: Off, Bsy: Ok
[8] Set RTC to build date/time
Check Time Sync              0 Seconds
====
[X] Main Menu
```



5. Diagnosis Close Out:

1. Perform other troubleshooting steps and maintenance and refer to the gateway user manual as needed. Check network connections then, disconnect the USB cable, close the gateway's door and fasten its four Torx door screws shut.
2. Submit an RMA for the gateway, if needed, or proceed to the Replacement Battery Ordering Process section to order a replacement RTC battery as deemed necessary.

Replacement Battery Ordering Process

Contact Neptune Customer Support for assistance, if needed: **(800) 647-4832** or support@neptunetg.com or <https://www.neptunetg.com/support/>

Replacement orderable RTC battery part number: Neptune 8136-025

Example images of the replacement RTC battery are shown below:

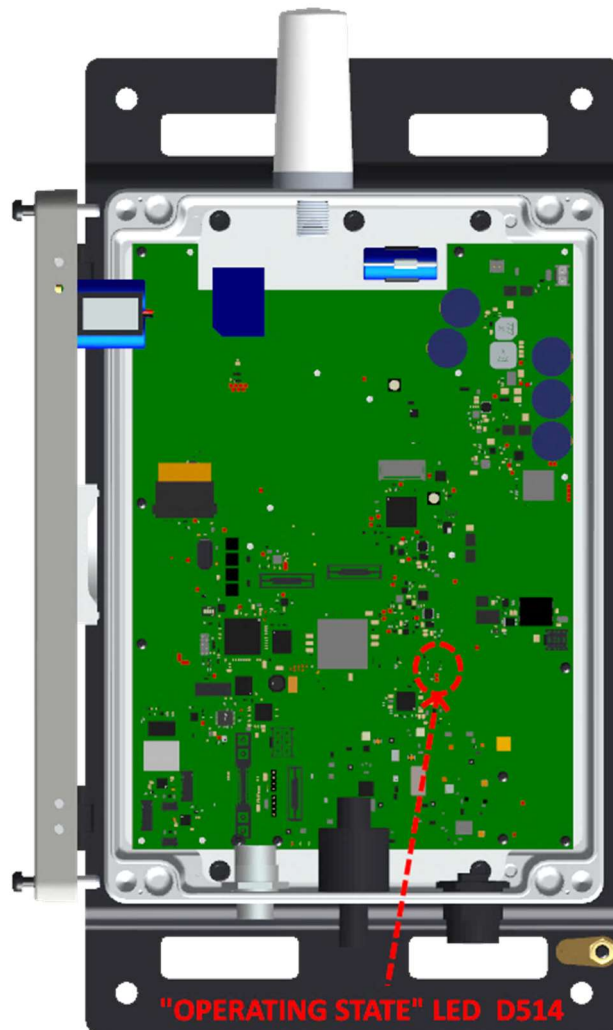




RTC Battery Replacement Procedure

1. Open & power down the gateway

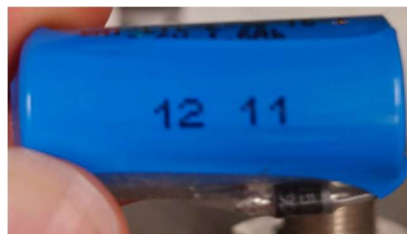
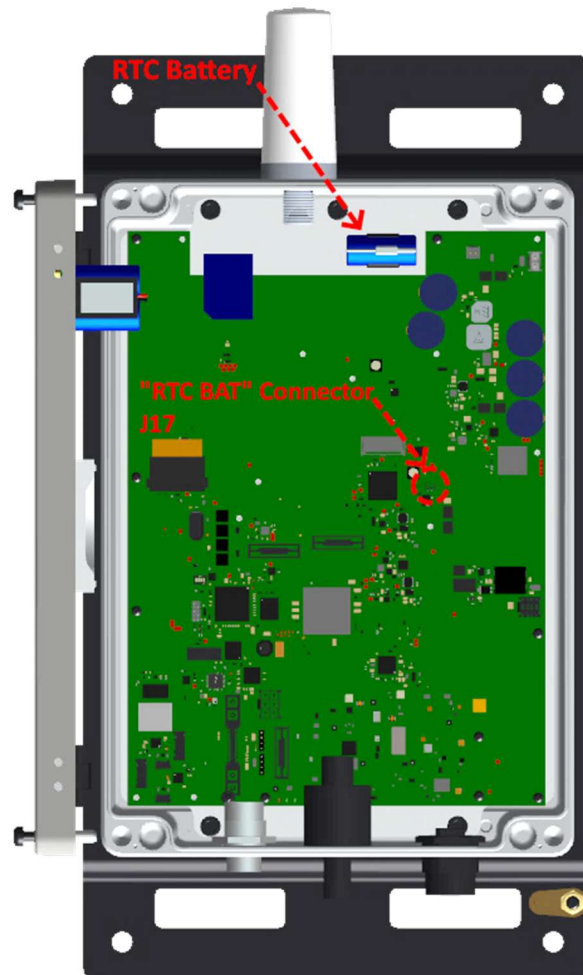
1. Note down the gateway's serial number as shown on its chassis label.
2. Unfasten the four Torx screws holding the gateway's door shut and open the door.
3. Disconnect external power from the gateway and wait at least 2 minutes for the system to safely shut down.
4. Wait until all LEDs except the **"OPERATING STATE" D514** LED have extinguished. Wait until the Operating State LED is either completely off or blinking red before continuing. The Operating State LED location is shown below:



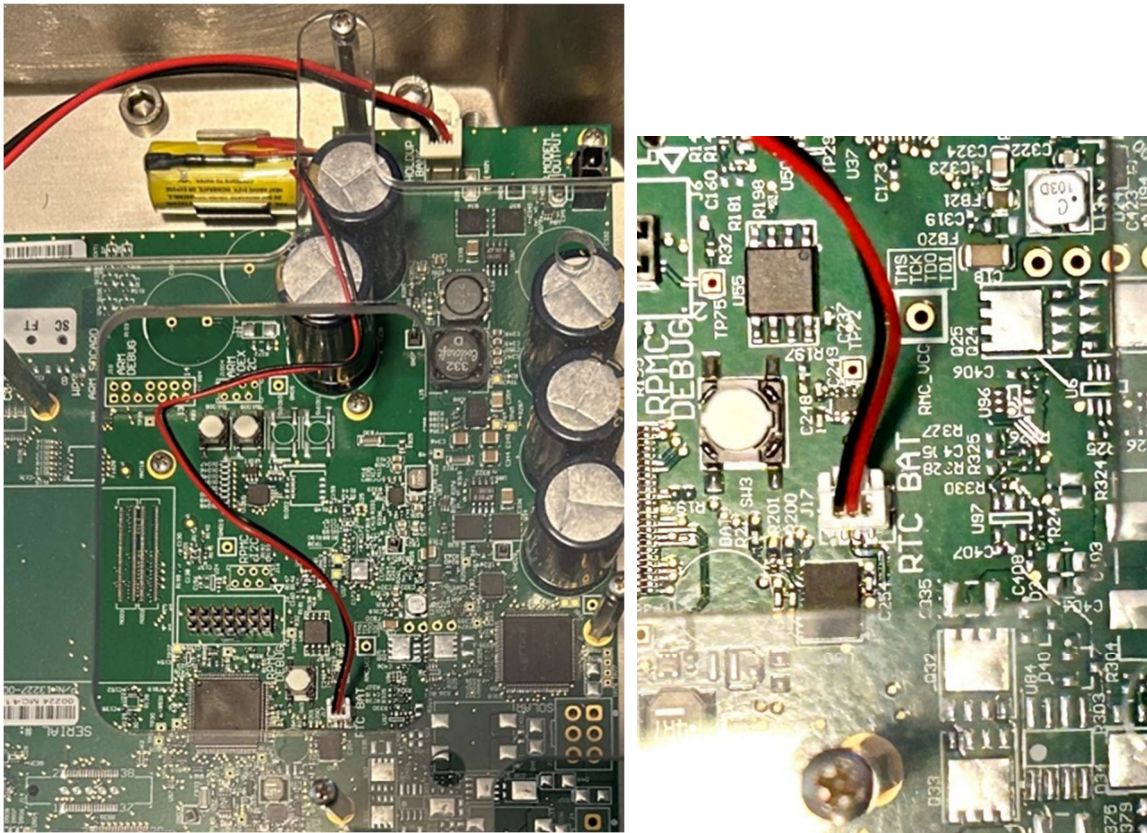


2. Replace & test the RTC Battery

1. **WARNING: Discharge yourself by touching the unpainted gateway's metal chassis (not the door!) to prevent electrostatic damage (ESD) before continuing!**
2. Disconnect the RTC battery from its "**RTC BAT**" J17 connector and remove it from its battery holder. The location of both are shown below. Note down the old RTC battery's date code as printed on its label (e.g., "**1012**" for October 2012). Do not dispose of the old battery in a landfill! See the Battery Recycling Options section for battery recycling options.



(This RTC battery has a date code of December 2011)

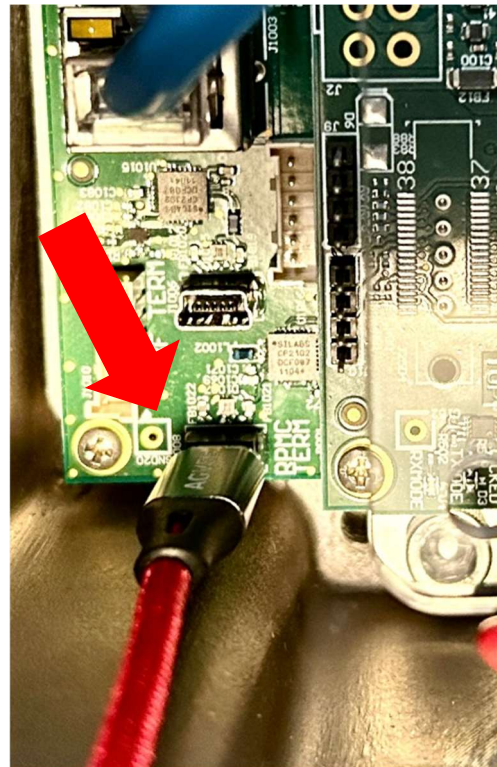
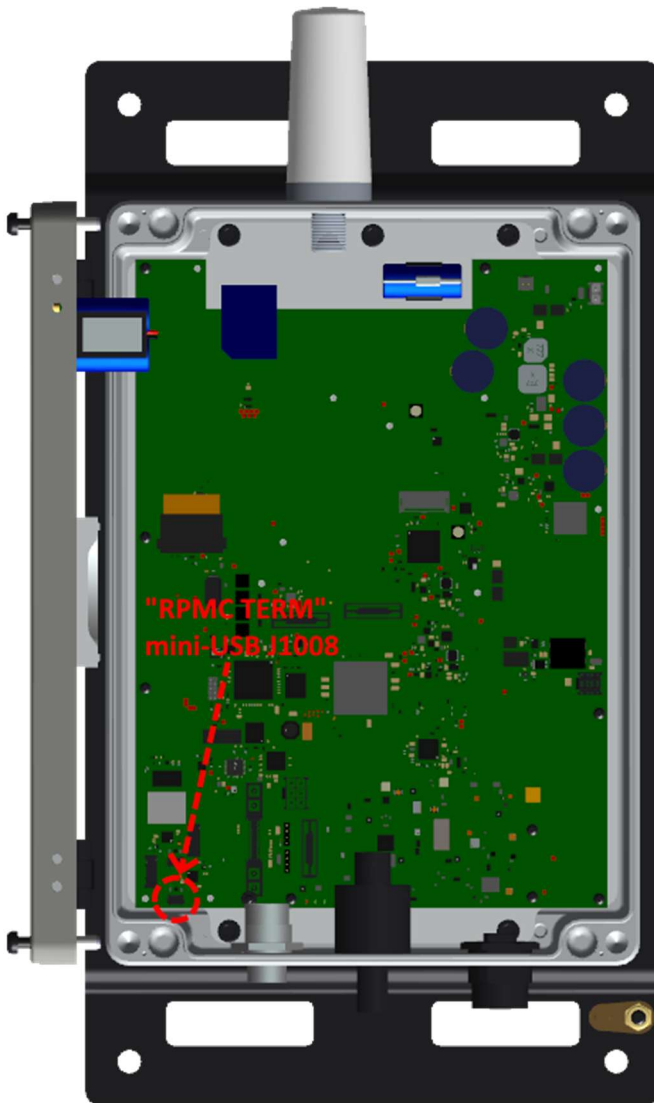


3. Using a multimeter set to voltmeter mode, measure the voltage of the old RTC battery (Red is Positive, Black is Negative). If the RTC battery voltage is below 3V, then it's a dead RTC battery and will need to be replaced. If the RTC battery voltage is within the 3.5V to 3.7V range, then it's a healthy cell that does not need to be replaced and might not be the root cause. If the battery voltage is healthy, then reinstall it into the "**RTC BAT**" **J17** connector and battery holder and seek different diagnostic troubleshooting steps such as later diagnostic steps in this document, otherwise move to the next step.
4. Replace the old RTC battery with a new replacement as ordered from the Replacement Battery Ordering Process section. Install it into the RTC battery holder and plug its connector into the "**RTC BAT**" **J17** connector.
5. Keep the gateway's door open and restore external power to the gateway. Wait approximately 3 minutes for the gateway to fully boot before continuing. After waiting 3 minutes, the "**OPERATING STATE**" **D514** LED should illuminate solid green when ready.



3. Access the gateway's RPMC Console

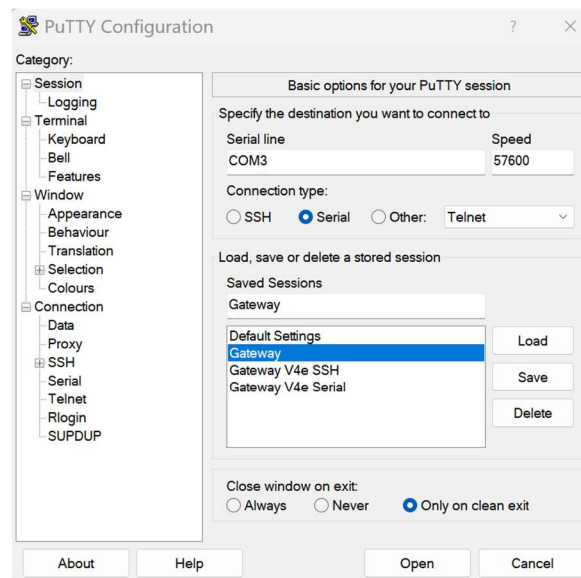
1. Connect to the gateway's RPMC console via the **"RPMC TERM" J1008** mini-B USB connector using a PC running PuTTY and a USB 2.0 data cable as outlined in the Materials, Tools & Software Needed section. The location of this connector is shown below:



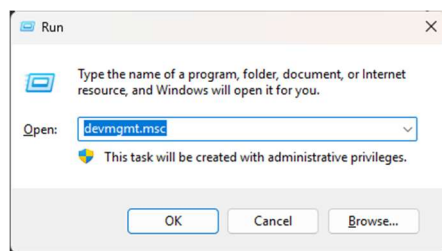


2. Once physically connected, find the COM port (See the note below to find the specific COM port number to connect to) for the gateway's RPMC console in Windows and connect to it in PuTTY with the following serial port settings as shown below:

- Baud rate: **57600**
- Data bits: **8**
- Parity: **None**
- Stop bits: **1**



Note: To find the specific COM port number to connect to, check Windows Device Manager. This is accessible via pressing **Windows Key + R** and entering **devmgmt.msc** into the Run dialog box:



In Device Manager, look for a "**Silicon Labs CP210x USB to UART Bridge**" device under the "**Ports (COM & LPT)**" section. The COM port number listed for this device is the gateway's RPMC console.



4. Verify Initial Time Values

- Once connected over PuTTY, the RPMC console menu should automatically refresh as shown below. Hit the **Enter** key in the terminal if nothing appears. Note down the following information from the RPMC main menu:
 - Build Time** (should reflect a valid date and time from the 2010s)
 - Current Time** (may be significantly in the past such as January 1st, 1970)

```

===== NEPTUNE R900 MAIN DIAGNOSTICS MENU CONSOLE =====
Versions                      RPMC: 2.76-GW, Logic: 72
Build Time                    Nov  5 2012 14:00:46
Current Time                  01/01/1970 00:02:12
System Watchdog               4026 Sec
=====
[P] Power Board Logic Diagnostics
[S] Power Supply Diagnostics
[D] Power Domain Diagnostics
[R] Resets Diagnostics
[V] Device Status
[L] Logging Diagnostics
[F] Blackfin Operational Info
[I] Diagnostics IO Control
[C] Clock Controls
[T] Settings
=====
[W] Restore basic user mode
[Y] Config Password:         *****
[Z] Eng. Password:           *****
=====
[1] Reset Blackfin           Initializing
[2] Signal Report Now
[3] Modem State              On
=====
Requested Power State        All On
Current Power State          All On DCSt Wait: 0 Sec
=====
System Power Measurements    13.68V   0.380A   5.201W
Board Temperature            22C

```



5. Configure RTC Settings

1. Still in the terminal, enter the **Clock Controls** submenu by typing **C** into the terminal.
2. Verify the RTC reports that the new RTC battery is okay and that the RTC oscillator is functioning. The **Bat** and **Osc** statuses should report as **Ok** as shown below:

```

===== RPMC CLOCK DIAGNOSTICS =====
[1] SYS/BF 25MHz Clocks      Enabled
[2] Blackfin USB Clock      Enabled
[3] Supply Clocks           Enabled
[4] RPMC Clock              Disabled
[5] Bluetooth Clock         Enabled
=====
[9] Status Flags             0xE8
=====
Master Clock Setting         25.000000MHz
RPMC 32kHz Status            Synchronized to RTC 32kHz
RTC Status                   Osc: Ok , Bat: Ok , Alm: Off, Bsy: Ok
[8] Set RTC to build date/time
Check Time Sync              0 Seconds
=====
[X] Main Menu
  
```

3. Now type **8** into the terminal to set the RTC to the system **Build Time**. Return to the main RPMC menu by typing **X** and note that the **Current Time** field has been set to the **Build Time** and increments as shown below:

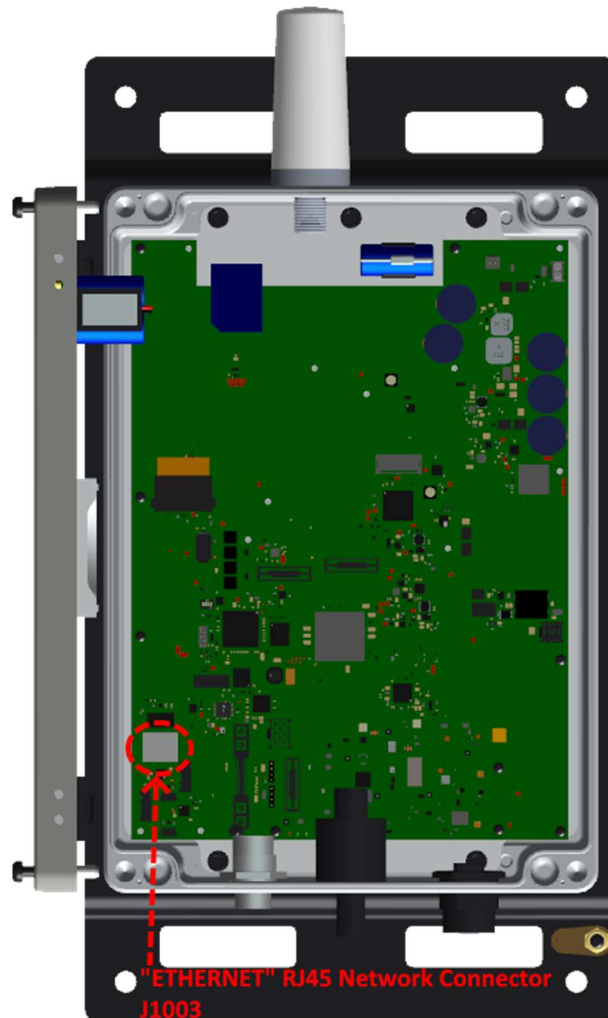
```

===== NEPTUNE R900 MAIN DIAGNOSTICS MENU CONSOLE =====
Versions                     RPMC: 2.76-GW, Logic: 72
Build Time                   Nov  5 2012 14:00:46
Current Time                  11/05/2012 13:57:21
System Watchdog               4094 Sec
=====
[P] Power Board Logic Diagnostics
[S] Power Supply Diagnostics
[D] Power Domain Diagnostics
[R] Resets Diagnostics
[V] Device Status
[L] Logging Diagnostics
[F] Blackfin Operational Info
[I] Diagnostics IO Control
[C] Clock Controls
[T] Settings
=====
[W] Restore basic user mode
[Y] Config Password:        *****
[Z] Eng. Password:          *****
=====
[1] Reset Blackfin          Online
[2] Signal Report Now
[3] Modem State              On
=====
Requested Power State        All On
Current Power State          All On DCst Wait: 0 Sec
=====
System Power Measurements    13.69V   0.382A   5.231W
Board Temperature            22C
  
```



6. Validate Gateway Internet Connection & RTC Battery Retention Test

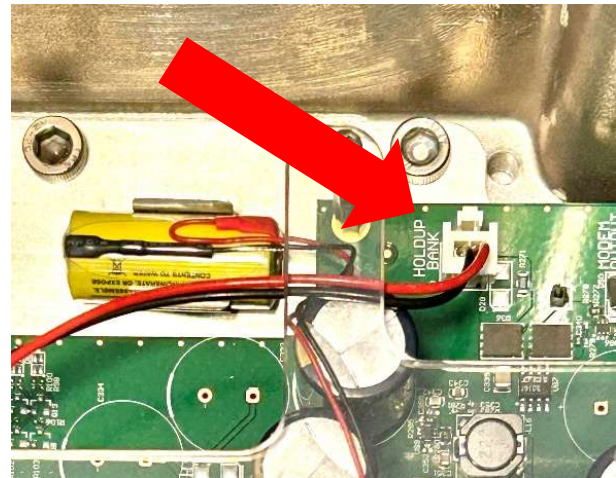
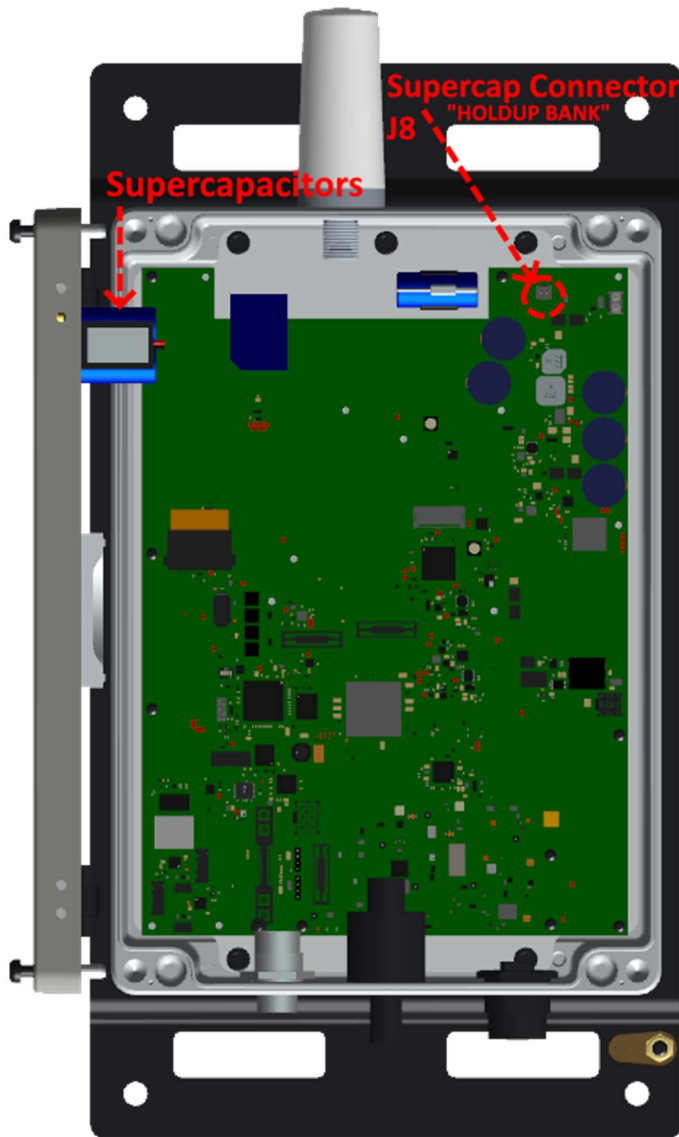
1. Before proceeding, verify that the gateway has an internet connection to receive the actual real time and set its RTC accordingly, automatically. Ethernet LAN backhaul settings, connections or the included cell modem (if the gateway is a cellular variant) will need to be checked, but a quick check of the gateway's "**ETHERNET**" **RJ45 Network Connector J1003**'s LEDs can give a rough indication of network status as shown below. If the **Ethernet J1003** connector's yellow Link LED is on or blinking, then that's a decent rough indication of some network connectivity. Refer to the gateway's user manual for other networking troubleshooting steps as appropriate.



2. Disconnect external power from the gateway and wait at least 2 minutes for the system to safely shut down.
3. Wait until all LEDs except the "**OPERATING STATE**" **D514** LED have extinguished. Wait until the Operating State LED is either completely off or blinking red before continuing.



4. Disconnect the Supercapacitor bank at the **"HOLDUP BANK" J8 connector**.



5. Wait 10 minutes.
6. Reconnect the Supercapacitor bank to the **"HOLDUP BANK" J8 connector**.
7. Restore external power to the gateway. Wait approximately 3 minutes for the gateway to fully boot before continuing. After waiting 3 minutes, the **"OPERATING STATE" D514 LED** should illuminate solid green when ready.



7. Confirm RTC Functionality & Retention

1. Reconnect to the RPMC console using the same PuTTY settings as provided earlier. Hit the **Enter** key in the terminal if nothing appears. Note down the following information from the RPMC main menu:
 - **Build Time**
 - **Current Time**
2. The **Current Time** should now be either close to the previously set **Build Time** or set to the present real-world time (assuming the gateway's internet connection is good) as shown below. Note: It may take several minutes for the Current Time to match the present real-world time if the gateway's internet connection is good.

```

===== NEPTUNE R900 MAIN DIAGNOSTICS MENU CONSOLE =====
Versions                      RPMC: 2.76-GW, Logic: 72
Build Time                    Nov  5 2012 14:00:46
Current Time                   03/27/2026 19:19:48
System Watchdog                4095 Sec
=====
[P] Power Board Logic Diagnostics
[S] Power Supply Diagnostics
[D] Power Domain Diagnostics
[R] Resets Diagnostics
[V] Device Status
[L] Logging Diagnostics
[F] Blackfin Operational Info
[I] Diagnostics IO Control
[C] Clock Controls
[T] Settings
=====
[W] Restore basic user mode
[Y] Config Password:          *****
[Z] Eng. Password:            *****
=====
[1] Reset Blackfin             Online
[2] Signal Report Now
[3] Modem State                 On
=====
Requested Power State          All On
Current Power State            All On DCst Wait: 0 Sec
=====
System Power Measurements      13.69V  0.385A  5.272W
Board Temperature              27C
  
```

Expected Result & Close Out:

1. If the **Current Time** is retained accurately, then the RTC and its battery are functioning correctly and maintaining the system clock independently.
2. Lock the RPMC console from the main menu by selecting the **Restore basic user mode** option by typing **W**.
3. Perform other troubleshooting steps as needed, disconnect the USB cable, close the gateway's door and fasten its four Torx door screws shut.



Battery Recycling Options

Do not dispose of the old, dead RTC battery (a primary lithium thionyl chloride cell) in a landfill! Consult local battery recycling regulations or recycle the dead battery through an R2 certified battery recycler such as these options:

Mexico:

- Grupo Ambiental Del Noroeste, S. de RL de CV / GAN / Northwest Environmental Group (+52 664-607-2861)

Canada:

- e-Cycle Solutions Inc (+1 888-945-2611, insidesales@ecyclesolutions.com)

USA:

- Battery Recycling Made Easy, LLC DBA BRME, LLC (+1 678-721-0022, info@brmellc.com)