RackInjector Firmware Operation Manual
Firmware Version 20180507
Manual Revision 5/7/2018

NOTE: *This is a 'rough draft' of this manual. We would appreciate any feedback about places where the manual is unclear or lacking. We have not taken the time to 'pretty up' this manual yet, as it is still in progress.*

This manual describes the operation of the web interface on the RackInjector. Because the software operation will vary from version to version, this manual does not contain information about setting up the hardware itself – that information is contained within the Hardware Installation manual.

In addition to this manual, you will need to refer to the appendixes for the injection boards which you have installed in the RackInjector system. The appendixes document both the hardware and software operation specific to a particular board. This manual refers to those appendixes when you need to refer to them.

Initial Login

Before login, you should have wired at least one power source to the RackInjector and powered on the RackInjector. Also, you should have connected a computer with a web browser to the Ethernet port. The Hardware Installation Manual describes how to perform these steps.

NOTE: *We develop using several modern web browsers: Mozilla Firefox, Google Chrome, Microsoft Edge, and Opera. Because of subtle differences between web browsers, some portions of the web interface may display differently or operate slightly differently between browsers and versions. If you discover an incompatibility with a specific, modern web browser, please let us know so we can work on improving compatibility with all web browsers.*

The factory setting for the RackInjector is as follows:

IP Address:	**169.254.1.20**
Netmask:	**255.255.0.0**
Default Gateway:	**169.254.1.1**
Admin User Name:	**admin**
Admin Password:	**password**

NOTE: *Be sure to change the admin password of the RackInjector before connecting it to an active network. With the prevalence of hacker activity today, failure to do so is likely to result in an unauthorized user gaining access to the RackInjector.*

Configure your computer to be able to connect to the IP address above. For some computers, they may automatically do this if powered on without being attached to a network. Others will require you to set the IP address manually to an IP address in the 169.254.x.x range (other than the addresses listed above).

Once you have configured your computer and connected it to the Ethernet interface, you should be able to reach the web interface by browsing to the IP address above. Upon initial connection, a window will pop up asking you for your username and password. Please enter the admin username and password and click on OK or whatever the equivalent button is in your web browser. The format of this screen will vary from browser to browser.
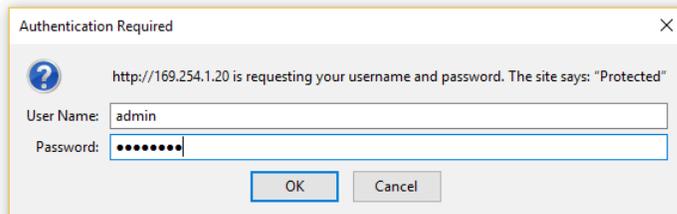
Once you have successfully logged in, the main user interface for the RackInjector will display.

RackInjector Menu Interface

Across the top of the interface (just below the logo) are several menu options. The selected menu option is always shown with a green background.

Hovering over a particular menu item will turn it red, indicating it can be clicked on. Clicking on each menu option will then switch to the page indicated by the description.

The function of each page will be covered in detail below.

Slots and Ports Page

This page displays data about each slot and port on the RackInjector. It is organized hierarchically, using graphical elements to indicate the slots and ports within the RackInjector.

Each slot (which corresponds to a single injection board) is indicated separately on the page.

If a slot is empty (doesn't contain a board), then the web interface will display this fact.
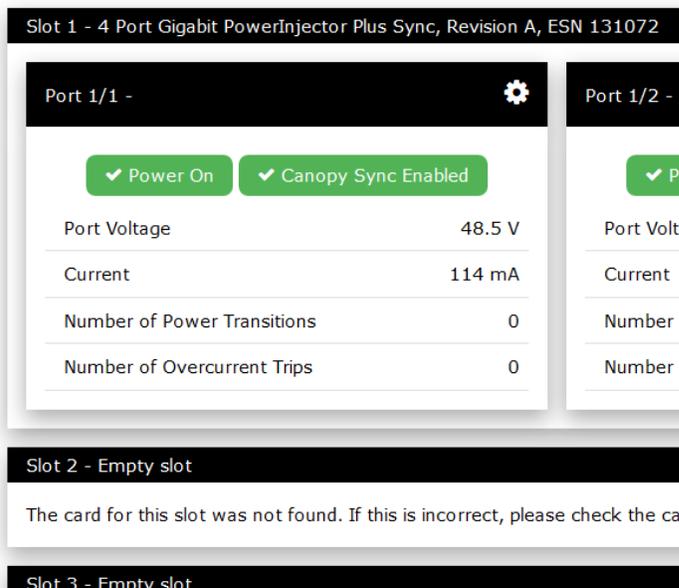
If a slot contains a board, the type of board and the board's serial number is displayed. Each port controlled by that slot is also displayed.

The operation for each port varies based on the type of board installed. For clarity, the description of the operation of the web interface for the ports is contained in the documentation for the board. For more information on the portion of the web interface for a port, see the appendix for the type of board installed.
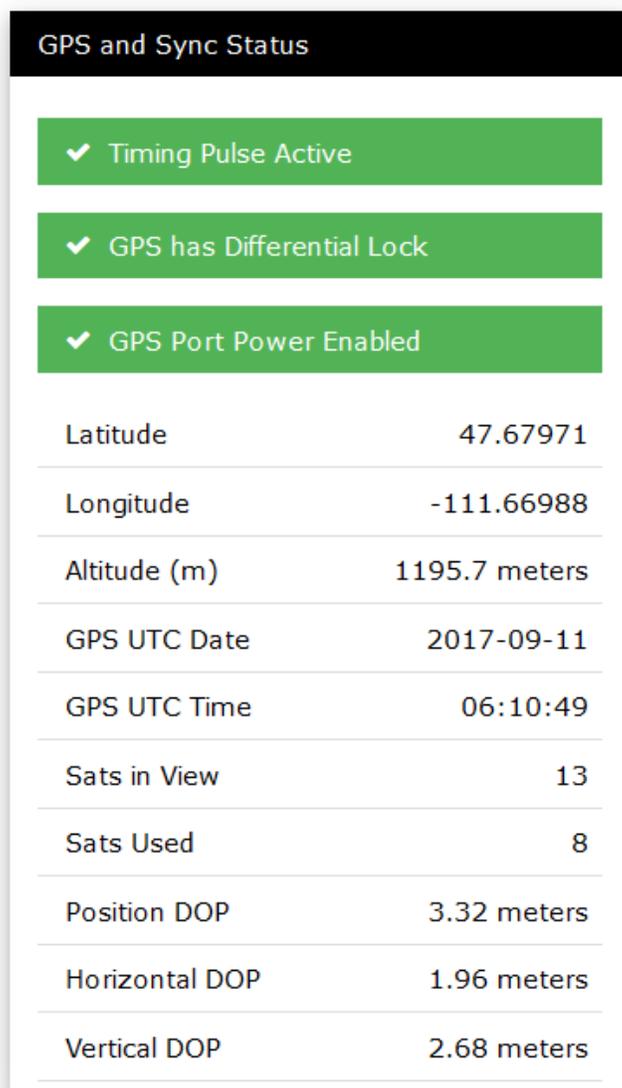
GPS and Sync Status page

If a PacketFlux GPS receiver is attached to the RackInjector, the "GPS and Sync Status" page will display data about the status of the GPS receiver and sync pulse.

Like the Slots and Ports page, the page is subdivided into several sections:

GPS and Sync Status Section: This section provides basic information about the GPS receiver and an overview of the sync status.

- **Timing Pulse Status Indicator.**   This indicator shows the status of the sync pulse coming from the GPS. It will show green and say 'Timing Pulse Active' if the sync pulse is currently being received. It will turn red and say 'No Timing Pulse' if the sync pulse has been lost.
- **GPS Lock Indicator.**   This indicator shows the status of the lock of the GPS receiver. It will be green if the lock is sufficient to provide a good quality synchronization pulse.
- **GPS Port Power Indicator and Button.** This indicator shows the status of the power output to the GPS receiver. If the power is active, the indicator will be green and read "GPS Port Power Enabled." If the power has been shut off or an overcurrent has been detected, this indicator will change to orange or red, and display the current status. Clicking on this button will pop up a screen which will permit you to change the status of the GPS power.
- **Latitude, Longitude, Altitude.** These fields show the position of the GPS receiver in 3D space.

- **GPS UTC Date and Time.** These fields show the date and time last received from the GPS receiver. If the GPS quits providing updates, this will quit updating, and is a good way to ensure that the data is up to date.
- **Sats In View and Used.** These fields display how many satellites are in view of the GPS receiver (could be used), and how many the GPS receiver is using to determine its 3D position and synchronization pulse.
- **Position, Horizontal and Vertical DOP.** These show the estimated accuracy of the position fix for the GPS receiver. Lower numbers are better. If they seem high, you should check the GPS.

Sync Pulse Statistics: This section provides details about the sync pulses received from the GPS receiver. Each statistic describes a certain type of pulse received.

To better understand the statistics below, it is helpful to know that a correct sync pulse arrives once per second. No more, no less. The statistics try to categorize when each sync pulse arrived in comparison to when it was expected.

It is important to understand that an occasional 'incorrect' pulse will not affect the operation of the system. Only when incorrect pulses occur regularly will you see any negative effects.

| Sync Pulse Statistics	
Pulse Alignment	**Count**
Correct	5266
Missing	583
Missing In Row	0
Double	7
Very Early	10
Slightly Early	6
Slightly Late	6
Very Late	4
Total Failed Secs	565
Click here to reset counters	

- **Correct.** This counter shows how many pulses were received exactly when they were supposed to be.
- **Missing.** This counter shows how many pulses the RackInjector has detected as missing. A missing pulse is counted whenever a pulse is not received for nearly two seconds, and then once per second after that.
- **Missing In Row.** In the condition where pulses are being continually missed, i.e., in a GPS receiver failure, it is helpful to know how long it has been since the most recent pulse. This counter counts how many pulses have been missed since the last correct pulse.
- **Double.** This counter counts how many pulses occur right after another. This type of pulse often is a result of coupling between the sync pulse being provided to the radios and the sync pulse being received from the GPS receiver, usually caused by bundling cables together. These pulses are ignored and should not affect the operation of the RackInjector. However, if these occur regularly, then it would be prudent to examine the routing of the GPS receiver cabling to determine if it can be re-routed to limit the cross-coupling.
- **Very Early, Slightly Early, Slightly Late, and Very Late.** These count pulses which are received outside any of the windows above. Each should be fairly self-explanatory.

- **Total Failed Secs.** This counter counts the total number of seconds which are missing enough pulses to likely negatively affect the attached radios. If this counter regularly increments, it is likely an indication of a problem.
- **Click here to reset counters button.** Clicking on this section of the web interface will reset the counters. This is useful after an event or after the RackInjector has been running for a long time.
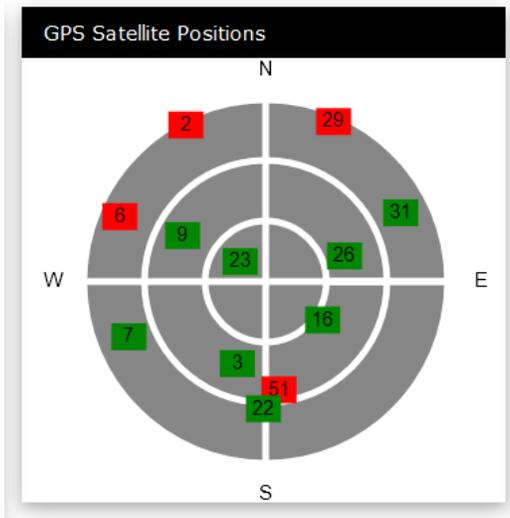
GPS Satellite Positions: This section of the screen is used to determine if you are having visibility problems with a portion of the sky.

On this 'radar' screen each satellite in view is shown. The number of the satellite is drawn at the satellite's approximate position in the sky. The box around the number is colored green if that satellite is used by the GPS receiver in determining its position. A red box indicates that the satellite is visible but was not used.

In the event of a partial blockage, often you will find satellites within a portion of the 'sky' are never used. In this case, you can consider moving the GPS receiver to another location.

GPS Satellite Information: This section provides a detailed version of the data shown on the Position screen. For each satellite, the following information is shown:

- **Type.** This columns displays the constellation the GPS satellite belongs to, for example GPS or GLONASS.
- **Sat.** This is the GPS PRN number of the satellite, which will correspond to the Satellite Position Chart.
- **Az and El.** This is the azimuth and elevation of the satellite, which places it in the sky. Azimuth is relative to north, and elevation is relative to the horizon.
- **SNR.** This is an indicator of the signal received from the GPS. Higher numbers are better.
- **Use.** This column indicates whether that satellite was used in the position fix.

Type	Sat	Az	El	SNR	Use
GPS	32	214	74	37	Y
GPS	10	65	71	23	Y
GPS	14	219	44	22	Y
GPS	48	207	32	37	N
GPS	18	309	31	22	Y
GPS	8	273	27	20	Y

System Status Page

This page provides status about various portions of the RackInjector system. It is divided into two portions:

Hardware Status. This section provides information about the RackInjector Hardware. It contains the following information:

Hardware Status	
Uptime	0d 3h 3m 55s
Reset Reason	Software Reset
Power A	24.0 V
Power B	1.2 V
Power C	1.2 V
GPS Port	23.2 V
Board Temp	26.1 °C
CPU Temp	46.7 °C

- **Uptime.** This shows the current time since the last power on or reset of the control board.
- **Reset Reason**. This shows the reason why the control board last reset, such as power on or a software failure.
- **Power A, B, and C.** This shows the voltage being received by the RackInjector control board on each of the three power inputs.
- **GPS Port.** This shows the voltage being sent out of the GPS port. It is normal for this value to be slightly lower than the highest positive voltage available to the RackInjector.
- **Board Temperature.** This shows the temperature of an onboard temperature sensor on the RackInjector. It shows the temperature inside the RackInjector.
- **CPU Temperature.** This shows the temperature of the CPU silicon.

Ethernet Statistics. This section provides statistics about the Ethernet Interface on the Control Board.

- **Link Speed.** This shows the speed at which the interface has negotiated.
- **Link Duplex.** This shows the duplex that the interface has negotiated.
- **RX OK Packets.** This shows the number of packets the RackInjector Control Board has received from the network.
- **TX OK Packets.** This shows the number of packets the RackInjector Control Board has sent to the network.
- **Receiver Overflows.** This shows the number of packets the RackInjector dropped because it was busy. It is normal for this to occasionally increment, especially during certain web interface activities.
- **Single and Multiple collisions.** These counters show the number of collisions which have occurred when sending packets. These counters are only applicable to Half-Duplex Mode.

Ethernet Statistics	
Link Speed	100Mb/s
Link Duplex	Full Duplex
RX OK Packets	180766
TX OK Packets	233101
Receiver Overflows	7
Single Collisions	0
Multiple Collisions	0
RX FCS Errors	0
RX Alignment Errors	0
RX Symbol Errors	0

- **RX FCS Errors, RX Alignment Errors, RX Symbol Errors.** These counters show the total count of various receiver errors which can occur if there are problems with the Ethernet interface.

Configuration Page

This page is used to configure various portions of the RackInjector's operation. It is divided into two portions:

Network Configuration. This section allows you to display and set the network addresses for the RackInjector. It contains the following information:

Network Configuration	⚙
IP Address	169.254.1.20
Netmask	255.255.0.0
Default Gateway	169.254.1.1
MAC Address	00:1f:6a:ff:00:01

- **IP Address, Netmask, Gateway.** These are the IP addresses currently active in the RackInjector.
- **MAC Address.** This is the MAC address/ESN of the control board in the RackInjector

To change the network configuration, click on the gear icon in this section of the interface. A dialog box will pop up, asking you for the updated IP address. After you click 'Accept Changes', the IP address will be saved and will take effect immediately.

Authentication. This section allows the setting of the administrative password for the RackInjector.

Currently the RackInjector supports a single password for its administration. We expect this to change in an upcoming release to permit the creation of users with different sets of permissions (read only, reboot radios, or change configurations, etc).

Authentication	⚙

Click on the gear icon above to change the password for this web interface.

In a future software release, this section will include more flexible password settings for this device.

For right now, clicking on the gear icon in this section of the interface will permit you to change the password of the web interface. The dialog box which pops up will prompt you for the current password, a new password, and a confirmation of the new password. Once you click accept, if all of the entries are correct (old password matches, new password is valid and matches confirmation), the password will take effect immediately and a new authentication window will pop up. If something has been entered incorrectly, it will silently fail.

ICMP Watchdog. This section allows you to configure the ICMP Watchdog feature. This feature will send ICMP Pings to a specified IP address, and if a reply is not received within a certain amount of time, reset the RackInjector Control Board.

Note: *This reset should not result in the radios connected to the expansion bus losing power. However, it will cause a brief interruption of the power to the GPS receiver, which will subsequently cause a brief interruption of the GPS synchronization pulse to those receivers which need it.*

This section contains the following information:

- **Status.** Shows whether the Watchdog functionality is enabled or disabled.
- **Address to Ping.** This displays the address of the device to ping. We recommend a device close to the RackInjector to avoid network problems causing an unintentional reboot. The default gateway for the RackInjector would be a good choice.
- **Reboot Timeout (mins).** This is the delay before the RackInjector will reboot. The Last Response value must reach this time before the reboot occurs. *If you use the ICMP Watchdog Feature, we recommend you set this value to a fairly high number – 10 minutes or even more.* This will prevent short network events from causing repeated reboots of the RackInjector.
- **Last Response.** This displays how long it has been since the RackInjector has last seen a response to its ping. Once this value reaches the "Reboot Timeout (mins)" value the RackInjector will reboot. It is normal for this value to count to approximately 5 seconds before resetting as the RackInjector sends out pings at 5 second intervals.

To change the ICMP Watchdog configuration, click on the gear icon in this section of the interface. A dialog box will pop up, asking you to update the configuration. After you click 'Accept Changes', the configuration will be saved and will take effect immediately.

Firmware Upgrade Page

This page permits uploading of updated firmware to the RackInjector and activating an already uploaded firmware. This page has two sections.

Existing Firmware Files. This section of the Firmware Upgrade page shows which Firmware files are currently on the RackInjector's SD Card. It contains the following columns:
- **Version.** This corresponds to the date the firmware was released.
- **Status.** This shows the status of this firmware. The status will be one of three types:
  - **Inactive.** This means that the firmware is not running, and is not selected for upgrade.
  - **Run After Reboot.** This means that the RackInjector will upgrade to this firmware version after the next reboot.
  - **Currently Running.** This means that the Firmware shown is the currently running firmware in the RackInjector.
- **Icons.** The icons on the right-hand side of this section allow you to perform actions on the firmware. Currently, the only icon which will appear is the 'download' icon (⤓), which can be clicked on to select this firmware for upgrade.

Upload Firmware Files. This section of the Firmware Upgrade page is used to upload firmware to the RackInjector. The procedure is as follows:

1. Download the latest firmware from the PacketFlux website.
2. Click on the 'Choose File' button. Select the file which you downloaded from the website.
3. Click on 'Upload Firmware File' button. The firmware file will be uploaded to the RackInjector. After the RackInjector processes the upload, the firmware will appear on the list in the 'Existing Firmware Files' section.
4. Once the firmware appears on the list, you can click on the Checkmark next to the firmware file to select the file for upgrade. The status of this firmware file will change to 'Run After Reboot'.
5. Click on the Reboot RackInjector button.
6. The RackInjector will reboot. Once it has completed its reboot process, the Status of the firmware file you selected will change to 'Currently Running'.
7. Click on refresh in your web browser to load the most recent version of the web interface. If you do not perform this step, the web interface will not update, and it will not appear that anything has changed.
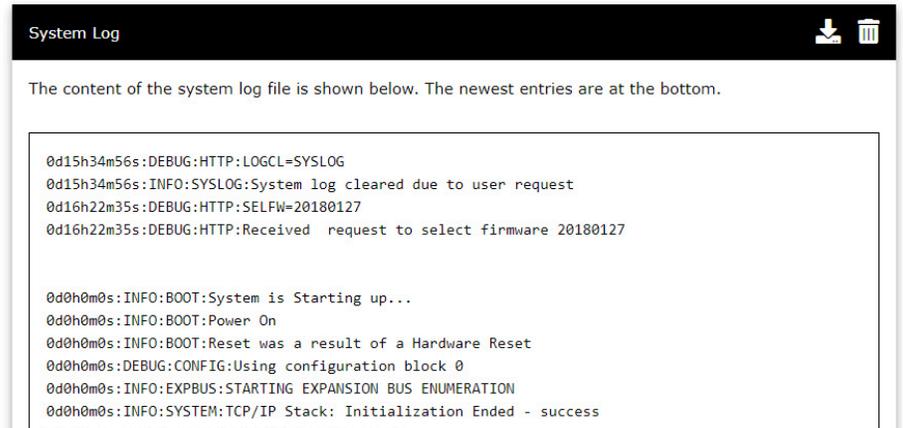
System Log Page

This page displays the content of the system log. It has one section which takes up the entire screen.

The logfile is useful to help troubleshoot problems with the RackInjector. Most customers should not need to refer to it.

Note: *The time shown in the first portion of each line is the length of time since the system was rebooted. In a future version of the firmware, this will be replaced with the actual date and time.*

System Log ⬇ 🗑

The content of the system log file is shown below. The newest entries are at the bottom.

```
0d15h34m56s:DEBUG:HTTP:LOGCL=SYSLOG
0d15h34m56s:INFO:SYSLOG:System log cleared due to user request
0d16h22m35s:DEBUG:HTTP:SELFW=20180127
0d16h22m35s:DEBUG:HTTP:Received  request to select firmware 20180127


0d0h0m0s:INFO:BOOT:System is Starting up...
0d0h0m0s:INFO:BOOT:Power On
0d0h0m0s:INFO:BOOT:Reset was a result of a Hardware Reset
0d0h0m0s:DEBUG:CONFIG:Using configuration block 0
0d0h0m0s:INFO:EXPBUS:STARTING EXPANSION BUS ENUMERATION
0d0h0m0s:INFO:SYSTEM:TCP/IP Stack: Initialization Ended - success
0d0h0m0s:INFO:EXPBUS:FOUND DEVICE 03 00 00
```

In addition, we have currently enabled full debugging logging in this firmware, to help diagnose any problems which our customers may have. We will allow the user to select how much logging they desire in a future release.

If you need to download the log, you can click on the download icon in the upper right-hand corner of the System Log section. This feature will be useful if we ask for a copy of the log file to help diagnose an issue.

If you would like to clear the system log, click on the trash can icon in the upper right hand corner of the System Log section. This should be done when the log gets quite long, and the log is not needed.