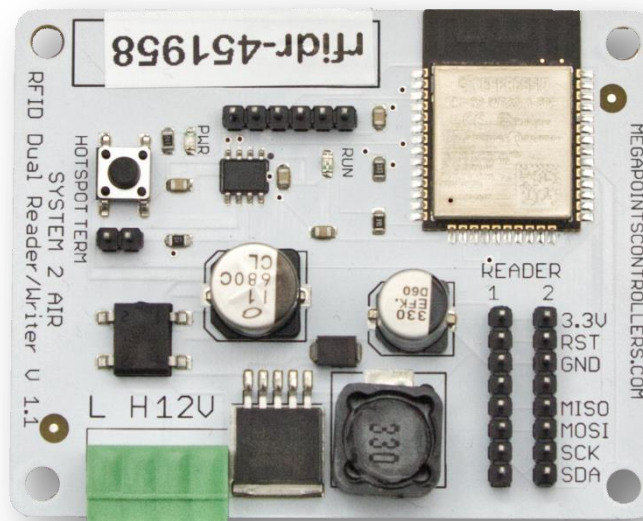


System2 RFID Dual Reader

User Reference by MegaPoints Controllers

A dual RFID reader module for the System2 range.

Includes support for both Wi-Fi and CAN network operation, additionally JMRI and native modes via MQTT.



User Guide

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What is System2 Air?

System2 is our new generation of model railway accessory bus products that feature our V-Port protocol (virtual port) and can address up to 60,000 devices. You can scale an installation from a single Servo-8 Controller (8 V-ports) right up to a huge layout as your needs grow. Flexibility is baked in and as we announce new modules that will work right alongside other System2 modules.

The “Air” in System2 refers to how you configure the system. It’s done wirelessly using Wi-Fi. This means you can configure a device using your PC, tablet or phone and replaces the need for buttons, flashing lights and extension cables to reach under baseboard locations.

We use Wi-Fi for configuration and a CAN network for data. This offers high speed, low latency and above all else reliability. You can even shut down the Wi-Fi network when your configuration is complete making your system secure and robust. It’s not required for operation at all.

MQTT support built right in. Using Wi-Fi and MQTT you can optionally configure the device for wireless operation and avoid the need to cable in a CAN wired network altogether. Our MQTT implementation supports two modes, Native for peer to peer communication and JMRI where we delegate control authority to your JMRI installation.

Software for all System2 Air modules can be updated over the air if your network allows Internet access. A single button push is all that’s needed to download and install the latest version. This means as new ideas and features are introduced everyone gets to benefit from them. You can even see the changes that have been introduced since your last update and choose whether to install or not. You won’t get nagging reminders to update. It’s flexible and entirely up to you when or if you decide to do it.

System2 has been real world tested on some of the largest exhibition model railway layouts in the UK for over a year before launching, so you can be confident it’s fit for your needs and fit for purpose.

Each of our System2 boards has the administrative core baked in. You can connect to any board’s admin web page and from there manage your entire network. There’s no central point of control (or failure) as they are all peers in their own right.

We use standard web protocols for configuration so that your browser can connect and perform all administrative tasks without requiring any special apps and app permissions. This leaves you in control of your network.

System2 Air, for the smallest to the largest layouts and everything in between.

In order to use System2 you’ll need a Wi-Fi router configured for DHCP with optional Internet access. This is the standard router configuration as supplied by your Internet Service Provider.

Designed and manufactured in Cheshire, England.

How to use this document

Treat this guide as a reference. All settings are documented and examples given where appropriate. It is designed to accompany the System2 Air – RFID Introduction video that will demonstrate all the functions and use cases.

System2 Dual RFID Reader Module

Introduction

The RFID reader module is an RFID tag reader and writer for System2 networks. It features a Wi-Fi based intuitive configuration from the comfort of your PC, tablet or phone. You assign each reader/writer to a vPort and the RFID tags read will be directed there.

Tags can be both read and written (programmed) with a numeric value in the range 1 – 9999. Approaching a reader with a tag in programming mode will cause the tag to be reprogrammed with a new value. Tags can be overwritten many times.

You may also need:

- 12 Volt DC regulated power supply.
 - 1 A minimum
- Network cable (twisted pair).
 - Telephone cable
 - Alarm cable
 - Such as CW1109B/Y supplied by CPC/Farnell . See website for cable links. Non twisted pair cable is OK for testing purposes, not for installation.

To use the network features of this board you will require:

- A Wi-Fi Router that is configured for:
 - DHCP (default enabled on most routers)
 - An active internet connection (only required for software updates).
- A current browser that supports HTML5.

To use the MQTT features of this board you require:

- An MQTT broker installed on your local network (see installation video on our System2 website).
- An optional JMRI installation if JMRI is to be used.

This is a 12 Volt device and should be connected to a minimum of 2 Amp regulated power supply.

MegaPoints Controllers use static sensitive components that must be handled with care.

Avoid touching any components or the circuit printed on the bottom of the board.

Avoid placing the board on any metallic surfaces including track.

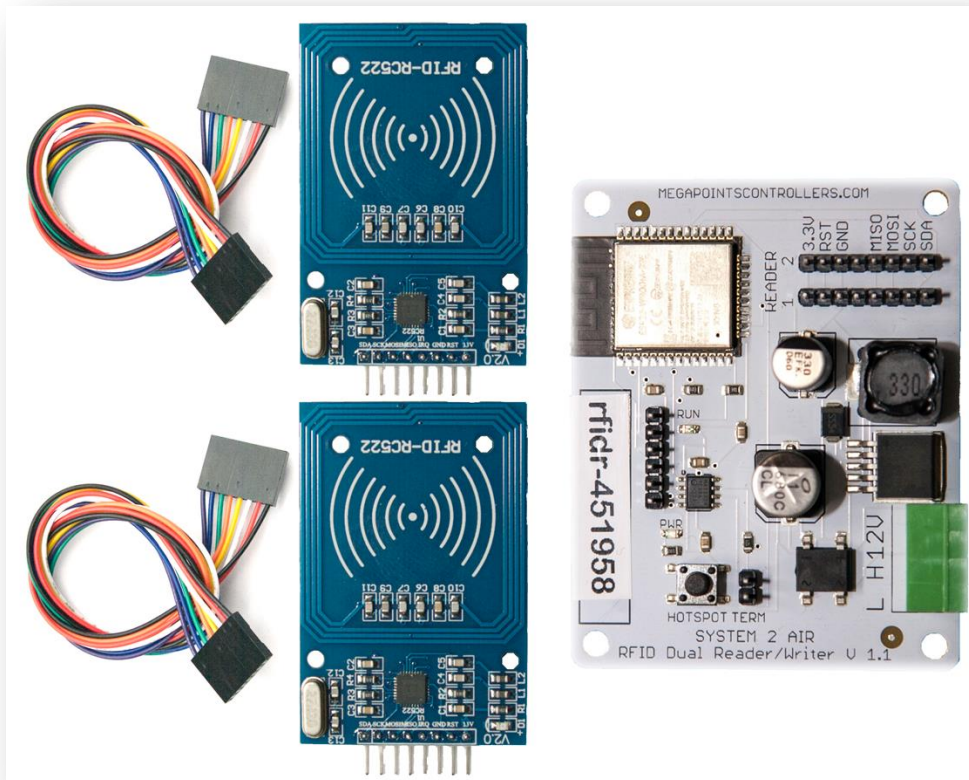
DO NOT connect any part of this device directly to your track bus.

What's included

Refer to the picture below.

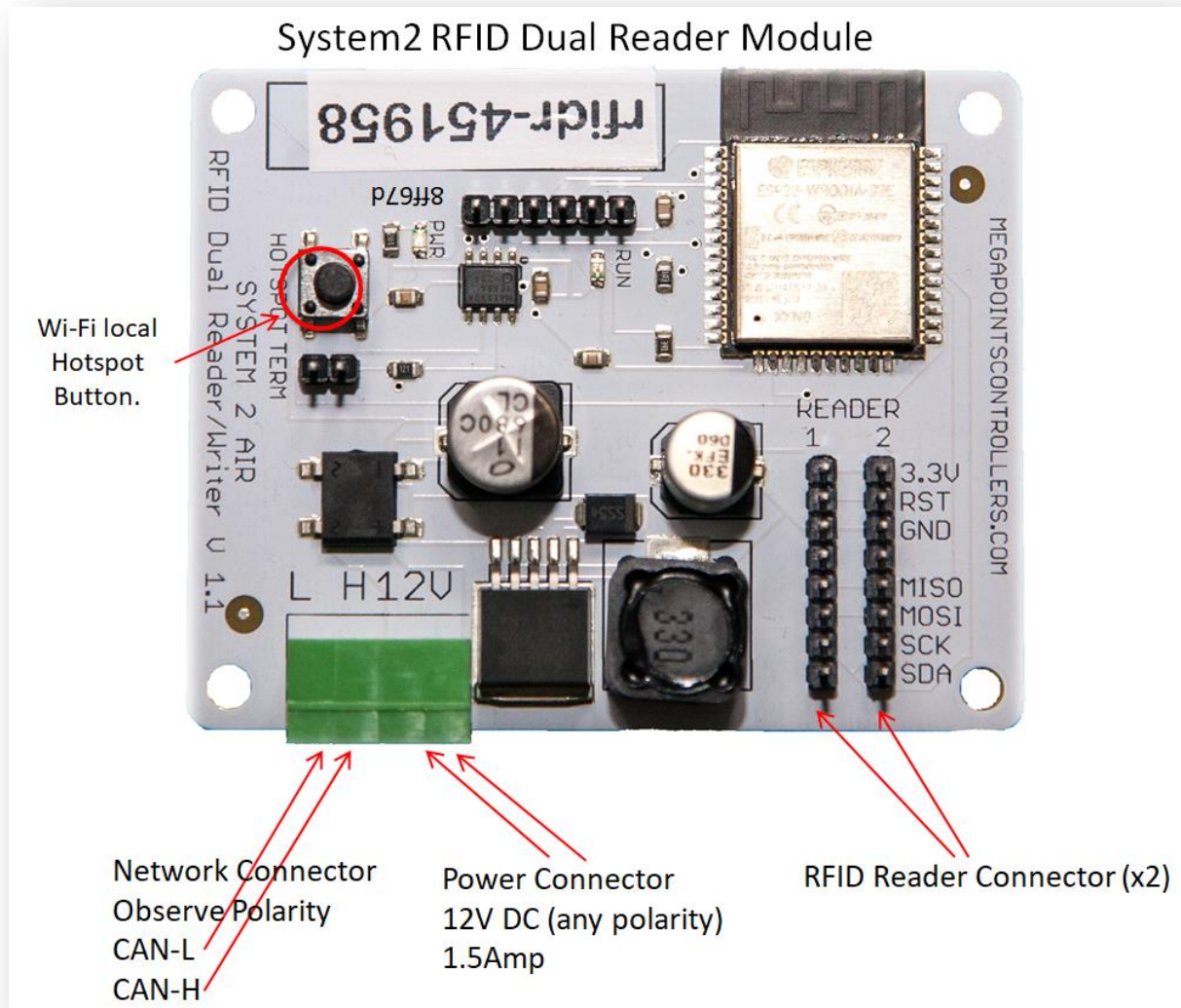
Included with the S2 RFID Reader are:

- 2 x RFID modules (blue)
- 2 x RFID module connector cables



Connecting up

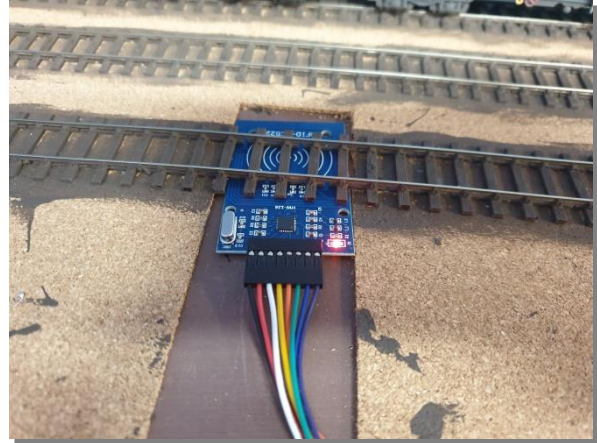
Connect the RFID modules (blue) to each READER connector on the System2 board (white). Ensure the top of the connector (S2 white marked 3.3V) matches the 3.3V connector pin on the blue module (right side as viewed above).



- Connect each board to a 12 Volt regulated power supply, minimum 1A per device.
- Connect the network cable to the two screw terminals. Observe the 'H' and 'L' terminals. Ensure all the 'H' and 'L' wires connect to each other respectively.

Positioning reader modules

The reader operates best when it is placed within 1cm from the tag to be read. This can be adjacent to the track and vertical or under the track. Do not allow any part of the reader (blue board) to come into contact with the track or any metal objects.



Positioning tags

Testing shows that placing tags on logos will reduce the effective reading speed and range due to EMF interference. Better placement is on a coach or wagon a few centimetres from any motors.

Writing and reading your first tags

The admin web page is shown on the page below. It is the place where you will change any settings for the S2 RFID Reader. Each board on the System2 network has its own management web page comprising module specific and System2 generic settings. Refer to the reference section for System2 generic settings description.

Getting to your System2 boards admin web page

Navigate to the RFID Reader admin page by either connecting to the IP address assigned by your network or navigating to the device name. In the screen image below the device name is "rfidr-451998". From your PC, Mac or tablet enter <http://rfidr-451998> "or <http://rfidr-451998.local>".

If you have existing System2 products configured and are using the wired CAN bus you can use the "Locate Board" feature to determine the IP address. It correctly cabled it will appear in the Status Log along with any other boards on the network. In the example below the RFID Display board has no IP address (0.0.0.0) as it is new and not registered with your network.

Status Log

Firmware up to date. (14-APR-2023)
Web client connected.
Report--> CanID: 194, IP Addr: 192.168.0.74 Type: Panel Controller, SwVer: 6.
Report--> CanID: 151, IP Addr: 0.0.0.0 Type: RFID Display, SwVer: 2.
Report--> CanID: 216, IP Addr: 192.168.0.123 Type: RFID Reader, SwVer: 4.

Press the “Share WiFi Credentials” button on any System2 board that is configured and after a few seconds you’ll see the new board appear with an IP address.

Status Log

Firmware up to date. (14-APR-2023)
Web client connected.
Report--> CanID: 194, IP Addr: 192.168.0.74 Type: Panel Controller, SwVer: 6.
Report--> CanID: 151, IP Addr: 0.0.0.0 Type: RFID Display, SwVer: 2.
Report--> CanID: 216, IP Addr: 192.168.0.123 Type: RFID Reader, SwVer: 4.
WiFi credentials shared with all nodes.
Report--> CanID: 194, IP Addr: 192.168.0.74 Type: Panel Controller, SwVer: 6.

Clicking on the blue IP address for the Panel Controller is usually the quickest way to get to the main admin web page. This technique works for all System2 boards.


rfidr-451998



System 2 Air
Location

RFID Tag Monitor

R2:1111 Sec:2396
R1:3333 Sec:2402
R2:3333 Sec:4534
R1:3333 Sec:4541
R1:3333 Sec:4548
R1:3333 Sec:4550
R1:3333 Sec:4550
R1:3333 Sec:4550
R2:3333 Sec:4551
R1:3333 Sec:4736
R2:0007 Sec:4736
R1:3333 Sec:4738
R2:3333 Sec:4932
R1:3333 Sec:5084
R1:0007 Sec:5086
R1:1111 Sec:12052
R1:0007 Sec:12057
R2:1111 Sec:12062
R1:0007 Sec:12066

Create Tag
Reader 1
Reader 2

Reader	vPort	State	vPort
1	<input type="text" value="10"/>	<input type="text" value="1"/>	<input type="text" value="0"/>
2	<input type="text" value="11"/>	<input type="text" value="0"/>	<input type="text" value="1"/>

Auto CAN ID ☒ CAN ID (Manual range 1000-1999.) Locate Board ☐

[Reset to defaults](#) | [Save Changes](#) | [Reload Values](#)
[Erase WiFi Credentials](#) | [Update Firmware](#) | [Reboot](#)
[Reload page](#) | [Documentation](#) | [Network Monitor](#)

RFID Reader S/W Rev: 4 | Templates: 4 | IP Address: 192.168.0.141 | Name: rfidr-451998 | SSID: Megapoints

Protocol Broker Port

Status Log

Firmware up to date. (14-APR-2023)
Web client connected.

Report--> CanID: 194, IP Addr:192.168.0.74 Type:Panel Controller, SwVer:6.
Report--> CanID: 194, IP Addr:192.168.0.74 Type:Panel Controller, SwVer:6.
Report--> CanID: 151, IP Addr:192.168.0.167 Type:RFID Display, SwVer:2.
Report--> CanID: 216, IP Addr:192.168.0.123 Type:RFID Reader, SwVer:4.

To write or read a tag.

- Separate one of the tags from the paper.
- Ensure each reader (blue) is at least 10cm apart from the other.
- Under the “Create Tag” section in the box adjacent to “Reader 1” enter the tag ID “4412”.
- Press the adjacent “Write Tag” button.
- In the status Log youll now see the message “Approach writer 1 with card”. Approach the reader/writer.

- As you approach you'll see the Status Log message "Tag written (4412)." Indicating the tag has been written with the ID 4412.
- Approach either reader with the tag. As you get within 1cm you'll see a message in the RFID Tag Monitor window (light blue window) "R2:4412 Sec:168". This means:

R2	Tag was read from reader #2.
4412	The tag ID read. (Should match the tag we just wrote.)
Sec:168	Number of seconds since the unit was last booted. A relative timestamp.

Tags must be created by the System2 RFID reader in order to be read. Tags created elsewhere such as a smartphone will not read correctly.

Reader vPorts

When a tag is read you control to which vPort the data is sent.

In the adjacent screen image you will see reader 1 is assigned vPort 10 and reader 2 assigned vPort 11. A corresponding S2 RFID Display listening on these vPorts will display the tags in realtime.

Optionally an ON/OFF state can be sent to another vPort. This could trigger an LED indicator, operate points or lower a barrier. The "State" toggles between 0 and 1 (OFF/ON) and you are free to change this.

For example if both State vPorts were set to the same vPort and the states were as indicated in the screen shot, the device on the vPort would be turned on when the first reader is activated and off when the second reader is activated.

To disable a vPort set the value to 0.

JMRI specific features

When the JMRI protocol is selected and an MQTT broker connected the RFID readers will go to the Reporters category within JMRI. For the reporters to display correctly within PanelPro we used the development release version 5.3.5. You therefore require a release that is 5.3.5 or later to use this feature.

The state vPort feature is not available when the JMRI protocol is selected as this will be handled by JMRI itself.

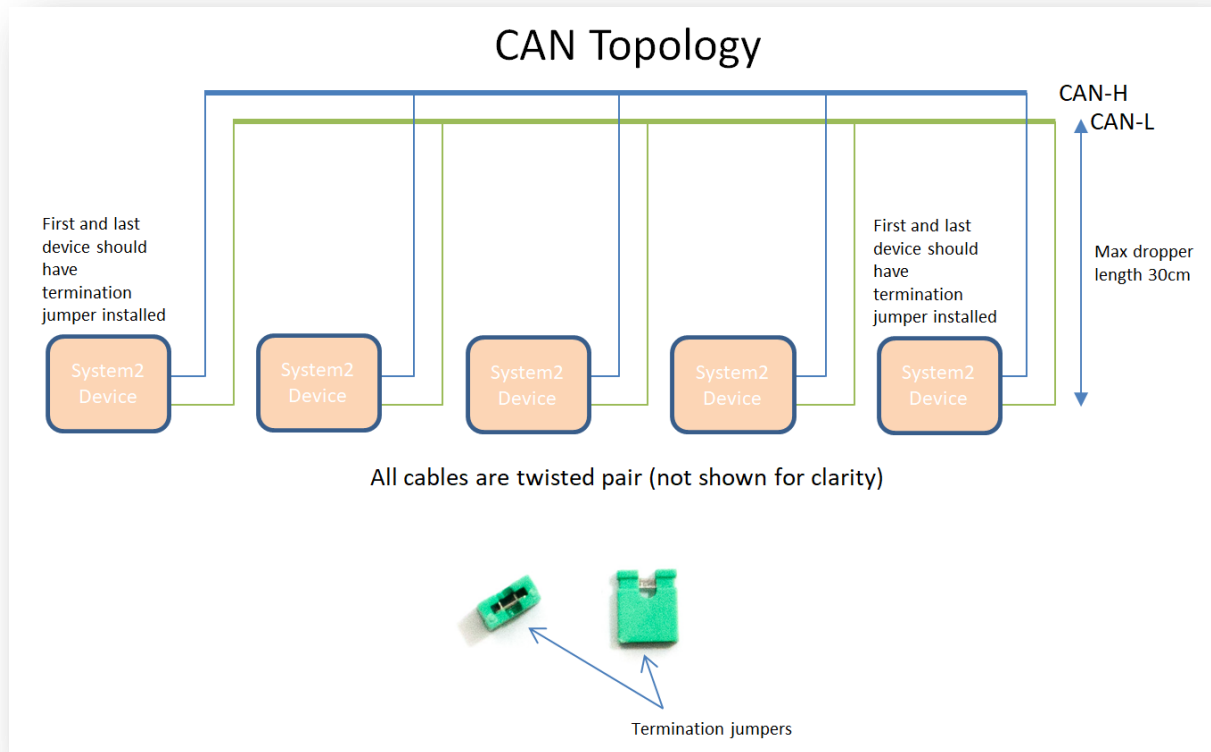
Look for a YouTube video demonstrating this feature.

The screenshot shows a 'Create Tag' window with two sections. The top section has two rows: 'Reader 1' with a text input field containing '10' and a 'Write Tag' button, and 'Reader 2' with a text input field containing '11' and a 'Write Tag' button. The bottom section is a table with four columns: 'Reader', 'vPort', 'State', and 'vPort'. It contains two rows of data.

Reader	vPort	State	vPort
1	10	1	1000
2	11	0	1001

Reference section

Network cabling



You can fit the termination jumpers to the first and last board on your network if not already fitted (see above two diagrams).

See the above diagram for network cabling. All cables should be a twisted pair signal cable. Fit any termination jumpers (supplied as part of a starter kit) to the boards at the ends of the network for a maximum of two jumpers per network.

You can use droppers to a main bus much like DCC or connect boards to each other in daisy chain fashion. Ensure the CAN-H and CAN-L connects to the same terminal in all cases.

Getting your first board on your local Wi-Fi network

There's a dedicated YouTube video demonstrating this. Follow this link to view: <https://youtu.be/G3ajZazycP4>. It will probably be easier than going through the following text.

With your updated software the procedure here overrides that in the Starter Kit Quick Start Guide. It has changed slightly making it more intuitive and easier. The very first board on from your System-2 Air should be configured for your Wi-Fi. This will allow you to connect and adjust the board settings such as servo movement type, speed or range adjustment as well as download future software updates and change port addresses. We suggest using the Panel Controller for this example.

Broadly speaking, here's how to connect to your Wi-Fi:

- Apply 12 DC regulated power to the device.
- Observe the RUN LED flashing about once per second (may take up to 30 seconds on first time boot).
- Hold the HOTSPOT button for 1 second; observe the RUN LED flash rate increase to double.
- From your phone, tablet or other Wi-Fi device scan for Wi-Fi networks and locate the hotspot network for the panel controller (it will be the device name/serial number on the sticker) such as “panel-xxxxxx” or “serv8-xxxxxx”. The name is dependent on the device you are connecting to.
- Connect to this network hotspot network. You may receive a warning stating this network does not connect to the Internet. This is OK.
- If your device states “sign-in required”, select this option and go to the sign-in page.
- If your device does not offer a sign-in page, navigate your browser to “4.3.2.1/admin” (Apple).
- Enter the SSID and password for your local network. Note case sensitivity (screenshot below).
- Press the “Scan WiFi” button. After a few seconds the adjacent text box will populate with scanned networks. Select the appropriate network (strongest signals towards the top).
- Enter a password (case sensitive) and press the save button.
- Your devices IP address will now be displayed near the top (red band). Make a note of this.
- Press the reboot button when ready and access the device via your usual network using the IP address obtained previously.

12:16 4G 99%

Sign in to serv8-451b34
4.3.2.1

MegaPoints Controllers

System 2 AIR WiFi Configuration

Product: Servo-8
Hostname: serv8-451b34
IP Address: 192.168.0.121

Scan Wi-Fi networks automatically.

Scan WiFi Megapoints

Password

Save Reboot

Or enter Wi-Fi details manually.

SSID

Password

Save

Device Management

Refer to the website for how to videos and full documentation
(megapointscontrollers.com/system2).

System2 admin page features

On the main page you can see the following information:

- Device name and serial number
- A photo of the device.
- A location description field. Use this to enter meaningful information such as baseboard number, IE: "B12C7 Tunnel entrance".
- An RFID Tag Monitor. This displays tags read, which reader read the tag (R1, R2), the tag read and the timestamp (seconds since started).
- Auto CAN ID. You can override the CAN ID if required.
- Locate Board: Will cause the LED on the selected board to flash fast helping you to locate the board if you have many.
- Share and revoke Wi-Fi credentials with all boards on the CAN network
- Control buttons (shown in blue text) to:
 - Reset the board
 - Save changes you've made
 - Reload changes (resyncs the web page with board)
 - Erase this boards Wi-Fi credentials (will immediately leave the network)
 - Select the firmware update (requires internet connection)
 - Reboot the board (throws out any unsaved changes if you made a mess)
 - Reload the web page
 - Link to online documentation and support videos
 - A CAN network monitor (for those who prefer watching network packets to trains).
- The next line shows:
 - Product name (RFID Reader)
 - Software version
 - Templates version (should usually match the software version)
 - The local IP address
 - The device network name and serial number
 - The Wi-Fi name you are connected to
- The Protocol configuration. Clicking on the Protocol button toggles between three states:

CAN	The default state that uses a wired CAN network.
Native	Configure your local broker and port details here. Save and reboot to take effect. This is peer to peer mode and offers the same functions as a wired CAN installation, using Wi-Fi instead.
JMRI	Configure your local broker and port details here. Save and reboot to take effect. Uses W-Fi instead of CAN and requires a JMRI installation accessible over your network.

- The last item is a status log (light yellow background). This provides a real time status such as up to date software, or boards joining the network, whether you saved (or should) save your changes etc.

Board Location

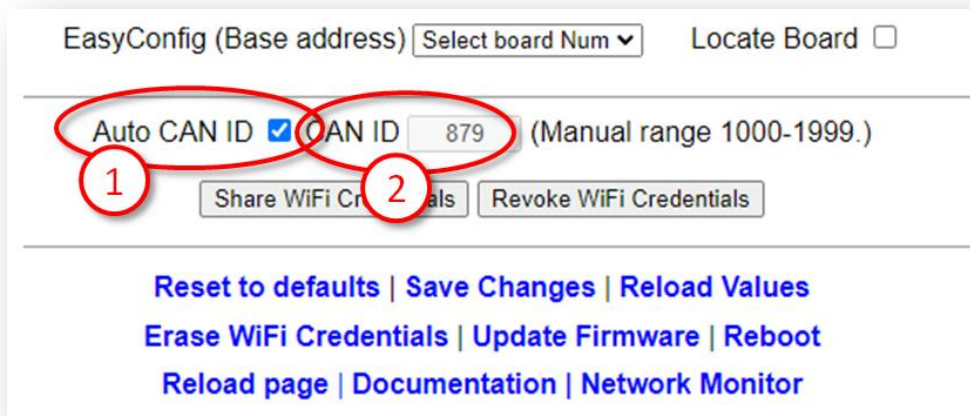
The board location field (top right) should be used to enter meaningful information to help you locate a specific board. We are planning an update for this feature in a future release that will display the first few characters as part of a report when you request all boards to report in (covered later in this document).

We therefore suggest you begin the text with the most meaningful information such as a baseboard number or location for example:

Suggested entry types	B2 Fiddle Yard 12 Station throat A3 Scenic
Avoid	Baseboard B2 Main approach on the left

CAN ID management

The next area down on the main configuration page concerns network parameters. Refer to the screenshot below and explanation text for details.

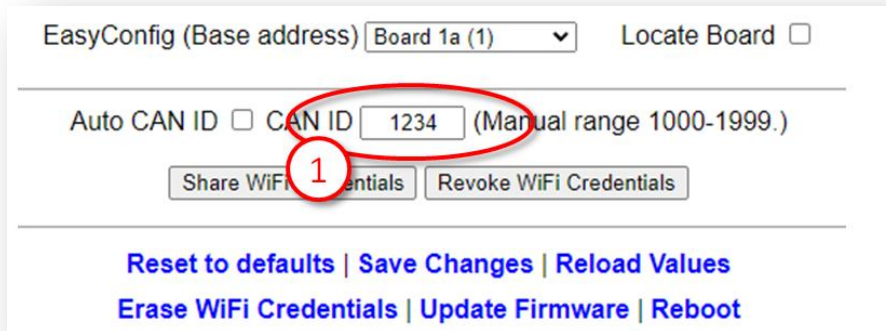


- 1 Auto CAN ID – Normally left selected (default). This will allow the board to automatically assign its CAN address and if a duplicate is detected may automatically reassign to a vacant address.
- 2 The current boards CAN ID. Showed greyed out if auto enabled (default).

Automatic range: The automatic range for the CAN ID is 1 – 9999. If a duplicate is detected and Auto CAN ID is enabled either this or the other board with a duplicate ID will seek out a vacant CAN ID and update its configuration. When Auto CAN ID is selected do not expect CAN IDs to be persistent as

they can change without notice. System2 is designed with this in mind and the board CAN ID is not relevant to operation.

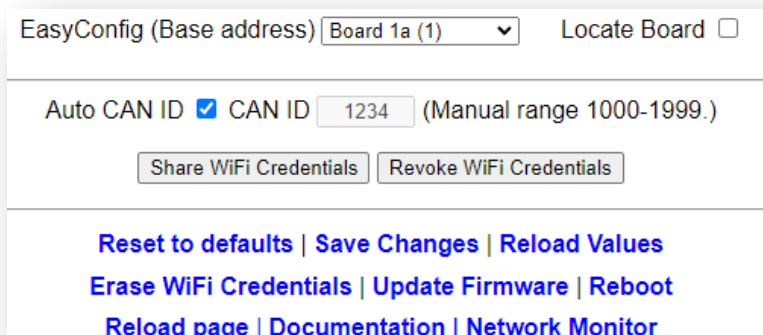
The CAN specification requires all boards to have a unique CAN ID as part of the collision detection mechanism. Forcing duplicates is a bad idea and will lead to data errors.



The screenshot shows the 'EasyConfig' web interface. At the top, there is a dropdown menu for 'EasyConfig (Base address)' set to 'Board 1a (1)' and a 'Locate Board' checkbox. Below this, there is a section for CAN ID configuration. The 'Auto CAN ID' checkbox is unchecked, and the 'CAN ID' is set to '1234' with a note '(Manual range 1000-1999.)'. A red circle with the number '1' is drawn around the 'CAN ID' input field. Below the input field are two buttons: 'Share WiFi Credentials' and 'Revoke WiFi Credentials'. At the bottom, there are several blue links: 'Reset to defaults', 'Save Changes', 'Reload Values', 'Erase WiFi Credentials', 'Update Firmware', and 'Reboot'.

Manual CAN ID selection: We must ask why? There's no possible benefit we can think of, so it's included for edge use cases. Not recommended to change this. Manual range is 1000 – 1999.

When reselecting Auto CAN ID, the current setting will remain until a collision is detected; whereupon the software will automatically reassign the ID (see below).

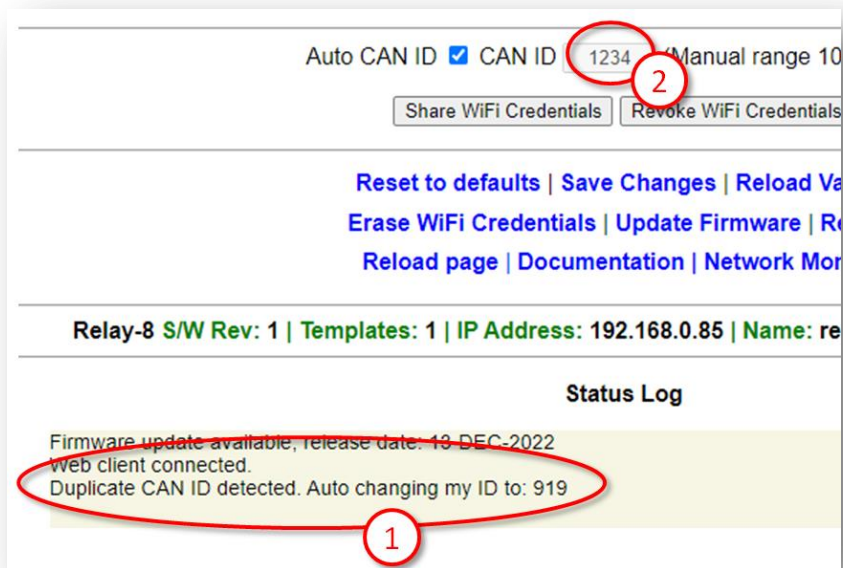


The screenshot shows the 'EasyConfig' web interface. At the top, there is a dropdown menu for 'EasyConfig (Base address)' set to 'Board 1a (1)' and a 'Locate Board' checkbox. Below this, there is a section for CAN ID configuration. The 'Auto CAN ID' checkbox is checked, and the 'CAN ID' is set to '1234' with a note '(Manual range 1000-1999.)'. Below the input field are two buttons: 'Share WiFi Credentials' and 'Revoke WiFi Credentials'. At the bottom, there are several blue links: 'Reset to defaults', 'Save Changes', 'Reload Values', 'Erase WiFi Credentials', 'Update Firmware', 'Reboot', 'Reload page', 'Documentation', and 'Network Monitor'.

If a duplicate ID is detected and the address manually configured you will observe a message in the Status Log (example below) warning of the duplicate address and that auto change is disabled. You need to manually reconfigure this.



With Auto CAN ID enabled the message is slightly different (see below):



The CAN ID was automatically changed to an unused ID. When the board is rebooted or the web page refreshed the CAN ID field will update to the new value.

Wi-Fi credential sharing

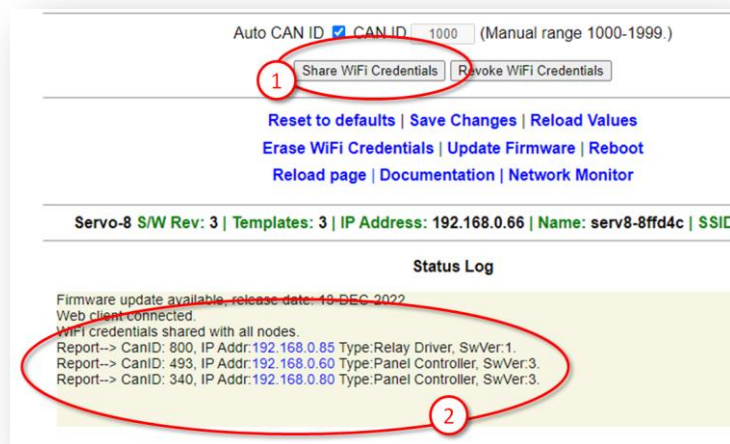
You may recall the procedure to connect the first board to your Wi-Fi network using your phone or tablet to connect to the boards local hotspot? You'll be pleased to know that you don't ever have to go through this again. In this section we'll cover how to share the Wi-Fi configuration with all boards on your CAN bus.

Connect to a System2 board using your browser. Obviously you'll only be able to connect to a board that is connected to your local Wi-Fi.

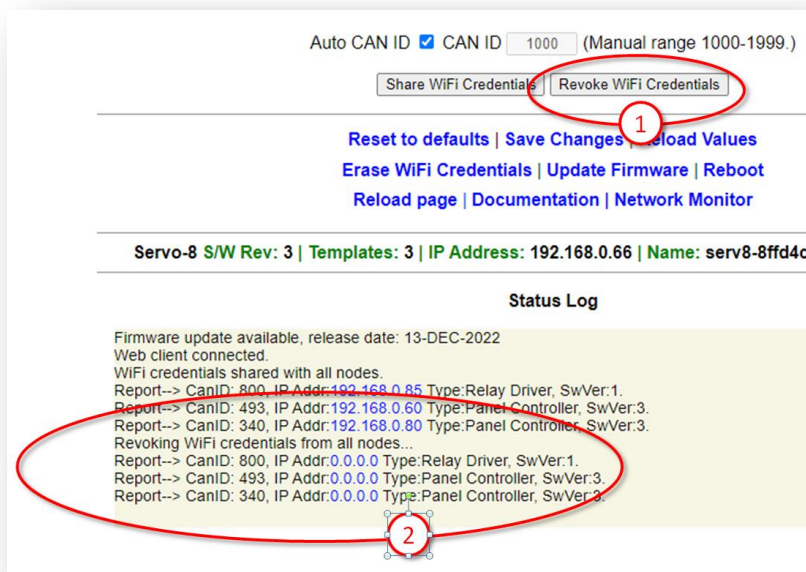
See the diagram below.

Click the "Share WiFi Credentials" button (1).

You will observe all boards on the CAN bus reporting in (Status Log) (2) with an IP address. These boards will now be accessible via a web browser from the same Wi-Fi network.



To revoke Wi-Fi access for all connected boards click the “Revoke WiFi Credentials” (1) button (see below):

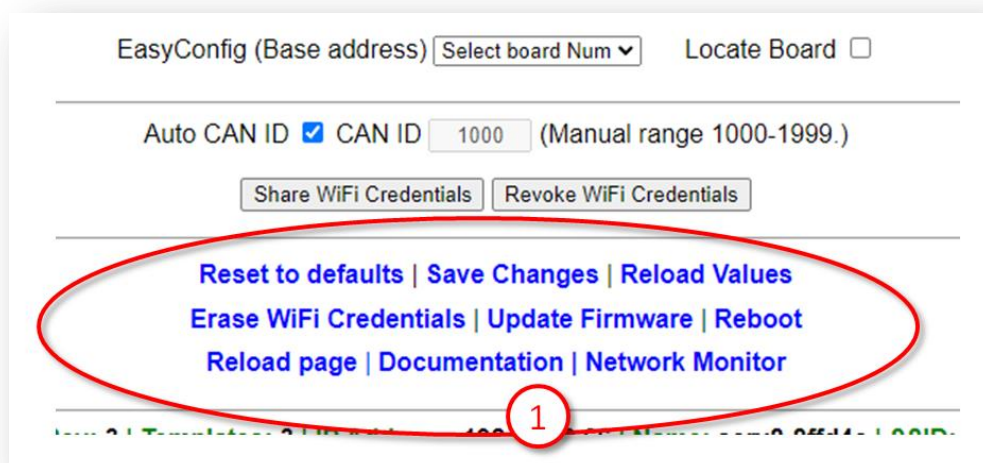


You will observe in the Status Log revocation messages. Each board will restart and show an IP address of “0.0.0.0” showing that it is not connected to any Wi-Fi network.

The board you are issuing the commands from is not affected by this and will remain connected to Wi-Fi until specifically revoked. This is covered later in this guide.

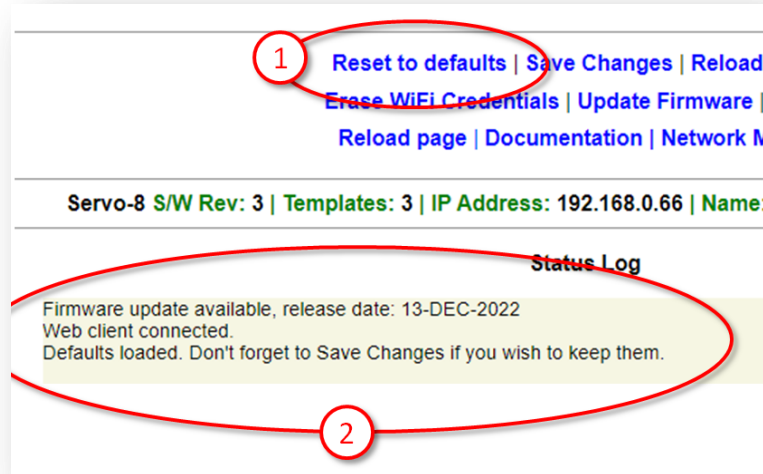
Actions

The action area (1 below) contains blue text that behaves just like buttons. This section covers each in turn.



Reset to defaults

This will reset most of the board values to defaults. Observe the message in the Status Log (2). You have reset to defaults and the default values are live, however will revert back to previous settings upon a reboot unless specifically saved. Particularly useful for testing and reverting.



Resetting to defaults changes the following:

- EasyConfig 1a is selected.
- V-Ports including trigger and feedback set for 1a (above).
- Reversed checkbox cleared.

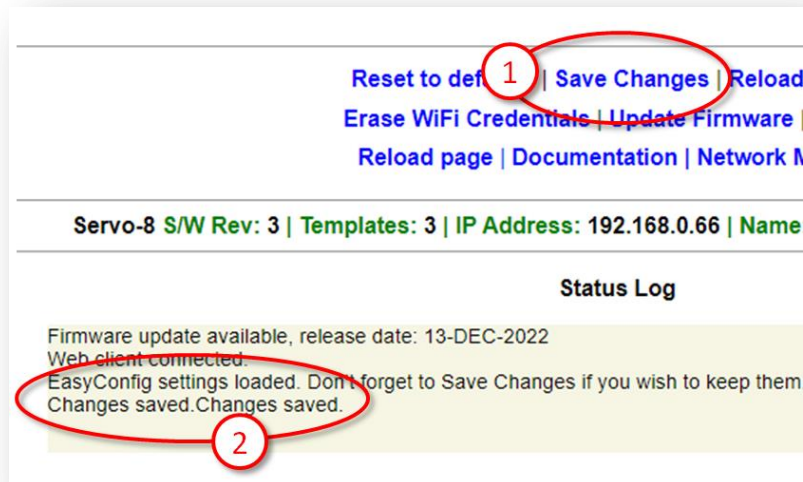
The following are not changed:

- Board location description (upper left of page).
- CAN ID
- IP Address
- Wi-Fi configuration
- Speed

Save Changes

As suggested by the description, this will save all uncommitted changes to non-volatile memory and be retained after reboots.

After saving you'll see the confirmation message (2) in the Status Log below.



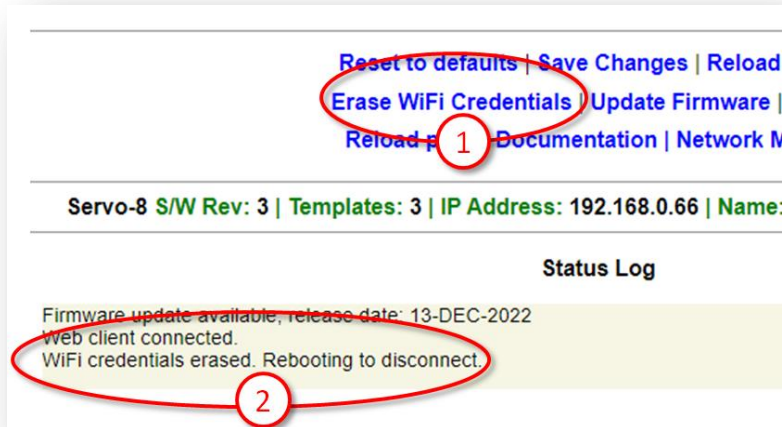
Reload Values

The Reload Values button will reset the parameters to the saved version. This will undo any changes that have not been saved. The browser page will refresh as part of the process.

Erase WiFi Credentials

Erasing the WiFi Credentials will remove the Wi-Fi details and reboot the board you are connected to. This action applies to the board you are connected to only. Other networked boards are unaffected.

If you wish to remove all boards from Wi-Fi see the Wi-Fi Credential Sharing section.




Update Firmware

If your board is connected to your Local Wi-Fi and that Wi-Fi has access to the Internet then you can update firmware. If a new firmware is available a message will be presented in the Status Log area:



Click on the Update Firmware to begin the dialogue. You will be taken to a new page.

Any changes that are available since your last update will automatically be listed in the Software Update section along with the dates they were released.



Servo-8

System 2 Air

Software Update

14-OCT-2022

- o Added board location field for the user to enter meaningful data such as board location or purpose.

13-OCT-2022

- o Added hostname in large lettering to top right of config web page.

You can see the release dates and what's in each release. If you select to update you'll get all the changes right up to the latest version. The update is not mandatory. Installation is up to you.

In this example we're going to select the firmware update. It should complete within 10 minutes. During the update you'll see progress on the web page and the on board LED will flash erratically showing data transfer.

☐ [View full update history.](#)

Examine the release notes above to see what's changed from your installed software. Only the changes will be listed.

To upgrade to the latest software release [Click Here](#).

Once the upgrade has started you must not power off your device until the upgrade is complete. This will take between 4-8 minutes to complete. If successful the device will reboot automatically.

[Click Here](#) to return to the main page.

Below is an example log displayed during the software update process:

```
Update initiated.
Beginning firmware update. Two downloads will be processed.
Onboard LED will flash erratically indicating data transfer.
The update will take between 4-8 minutes to complete.
An active internet connection is required for success.
Please wait, do not reboot! Update in progress...
Download (1/2). Connecting to update server.
Received 926816 bytes from the update server.
Written only: 0/926816. Please Retry.
Received 926816 bytes from the update server.
Wrote: 926816 bytes successfully.
File (1/2) has been updated.
File (1/2) download complete.
Download (2/2). Connecting to update server.
Received 1507328 bytes from the update server.
Wrote: 1507328 bytes successfully.
File (2/2) has been updated.
Rebooting. Please return to the main web page.
```

When complete the board will automatically reboot and re-join the network.

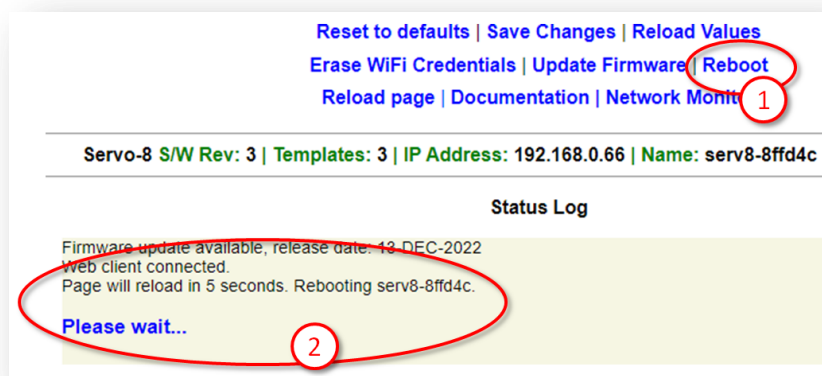
All your configuration data remains unchanged and is preserved across updates.

The update will fail safe. This means that if you interrupt the connection or power off during an update you can return to the update screen and begin the process again though it's not recommended to interrupt the update process.

Select the "Click Here" on the bottom line to return to the main configuration page and not perform any update.

Reboot

Clicking the reboot text will cause the board to immediately restart. You will observe a message in the Status Log that the page will reload automatically after a few seconds along with a "Please wait ..." in blue.



Reload Page

This option reloads the web page and resets the Status Log area. Useful for clearing garbage from the log and confirming you are connected to the board.

Documentation

Clicking the Documentation link will open a new window in your browser and take you to the product page for the board you clicked from. On the product page you'll find links to the relevant documentation and video guides for this product along with recommended accessories.

This option requires an Internet connection.

Network Monitor

WARNING! This section may send you to sleep and is not required reading.

The Network Monitor option takes you to a CAN bus network monitor.

The Network Monitor should be considered experimental, though we relied on it heavily during development.

The Network Monitor will provide a real time display of the traffic on your CAN bus.

Seq	Min	SS	mSS	uSS	CanId	D0	D1	D2	D3	D4	D5	D6	D7	V-Port
0112	17.03.822.345				493	1	0	1	1	0	0	0	0	1
0113	17.03.827.467				1000	1	0	161	3	0	0	0	0	161
0113	17.03.827.467				1000	1	0	161	3	0	0	0	0	161
0114	17.06.093.270				1000	1	1	66	0	0	0	0	0	321
0115	17.08.374.266				1000	1	0	161	0	0	0	0	0	161
0116	21.37.570.266				493	1	0	1	0	0	0	0	0	1
0117	21.37.575.349				1000	1	0	161	3	0	0	0	0	161
0118	21.39.850.069				1000	1	1	66	1	0	0	0	0	321
0119	21.42.130.018				1000	1	0	161	1	0	0	0	0	161

The V-Port the packet is intended for is decoded in the right column (1).

The headers (2) contain the following details:

Header	Description
Seq	Packet sequence as observed by the board the Network Monitor is running on.
Min	Number of minutes since starting. Rolls over at 99.
SS	Seconds within the previous minute.
mSS	Millisecond within the previous second.
uSS	Microsecond within the previous millisecond.
CanId	The CAN ID that created the packet.

D 0-7	Data field of the packed (D0 – D7).
V-Port	Decoded V-Port the message is intended for.

The Network Monitor will only display packets created by remote boards. It will not display packets that are locally transmitted.

The local board that is running the packet monitor remains fully operational while the packet monitor is running. It will respond to events in its usual manner.

The data fields (D0-7) will be covered in separate documentation and are data type dependent.

In the above screen shot you can see network packets that were triggered by a button being pushed twice, once to turn on and again to turn off.

Under the V-Port column observe the following events that occurred at minute 17:

Header	Description
1	An event addressed to V-Port 1 is initiated from CAN ID 493.
161	An event is addressed to V-Port 161 from CAN ID 1000 (packet duplicated).
321	An event is addressed to V-Port 321 from CAN ID 1000.
161	An event is addressed to V-Port 161 from CAN ID 1000 (packet duplicated).

CAN ID 493 is a Panel Controller and looking at its configuration we observe V-Port 1 is a push button attached to physical port 1:

Input Ports									
Phys Port	V-Port	Latch (ms)	Input Type	Invert	RGB Red	LED Green	Colour Blue	Colour B/G	
1	1	400	Push to make btn	<input type="checkbox"/>	0	0	0		<input type="checkbox"/>
2	2	400	Push to make btn	<input type="checkbox"/>	0	0	0		<input type="checkbox"/>
3	3	400	Push to make btn	<input type="checkbox"/>	0	0	0		<input type="checkbox"/>

So we know what created the packet, a button on physical port 1.

The next packet was created by Can ID 1000. Looking at the Status Log (below) we can see (1) this is a Servo-8 board:

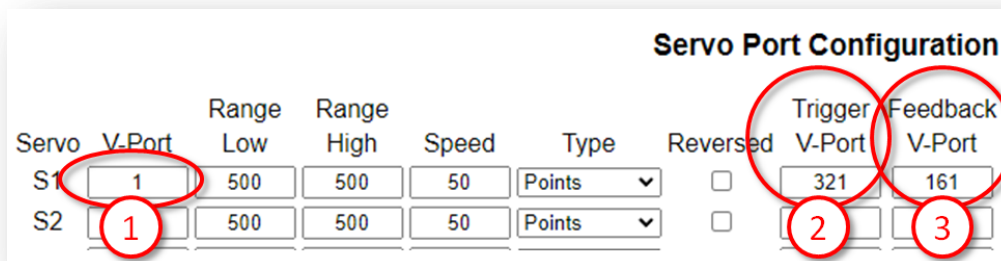

```
web client connected.  
WiFi credentials shared with all nodes.  
Report--> CanID: 493 IP Addr: 192.168.0.68 Type: Panel Controller, SwVer: 3.  
Report--> CanID: 1000 IP Addr: 192.168.0.66 Type: Servo-8 Driver, SwVer: 3.  
Report--> CanID: 900 IP Addr: 192.168.0.65 Type: Relay Driver, SwVer: 1.
```



We are also presented with the IP address of the board (2), so clicking on the blue IP address takes us to the Servo-8 management portal.

The Servo-8 port configuration is reported as:

Servo Port Configuration									
Servo	V-Port	Range Low	Range High	Speed	Type	Reversed	Trigger V-Port	Feedback V-Port	
S1	1	500	500	50	Points	<input type="checkbox"/>	321	161	
S2		500	500	50	Points	<input type="checkbox"/>			

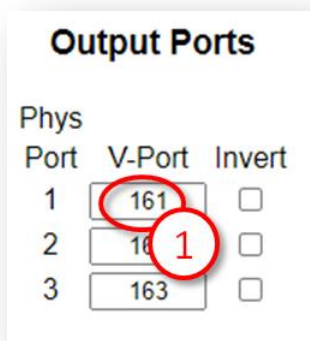


The V-Port (1) is 1 meaning channel S1 (servo 1) is listening for this address (V-Port).

Remember this board has a CAN ID of 1000, and it generated a packet to V-Port 161. This is the configured Feedback V-Port at the marker (3).

If we look at the packet under column D3 you'll observe a "3" in the data byte. Where is this going?

Output Ports		
Phys Port	V-Port	Invert
1	161	<input type="checkbox"/>
2	162	<input type="checkbox"/>
3	163	<input type="checkbox"/>



The Output Ports section of the Panel Controller (1 left) matches the Feedback V-Port of the Servo-8. It is this port that is listening for the event.

The data value of "3" indicates to flash. This will cause the panel Controller to flash the LEDs on physical port 1 and is used to indicate a motor in motion.

When the centre of motion for the servo has been reached another event is triggered to V-Port 321. Look at the Servo Port Configuration above. See the Trigger V-Port is configured for 321. The trigger fires when the servo is at its centre position. Particularly useful for firing a frog when the point blades are dead centre.

Looking at the relay driver port configuration (below) we observe:

Relay Port Configuration

Phys Port	Command V-Port	Pulse m/Sec	Feedback V-Port	Reversed
R1	321	0	0	<input type="checkbox"/>
R2	322	0	0	<input type="checkbox"/>
R3	323	0	0	<input type="checkbox"/>

Relay R1 is configured for events on V-Port 321 and will trigger when the Servo-8 is halfway.

This can be freely changed to respond to the same ports as the push button or any other device. It can also provide feedback data of its own, however setting the Feedback V-Port to "0" disables feedback from the relay.

Finally on the Network Monitor we observe the last packet at minute 17. It's addressed to V-Port 161 and this time contains a 0 in the D3 column. This tells the Panel Controller to stop flashing as the servo has reached its final position.

Skipping ahead to the last packet on the report you can see it's to V-Port 161 and contains a 1 under the D3 column. This is the polar opposite of the previous paragraph and indicates the servo has reached the opposite end of motion and sets the Panel Controller indicator appropriately.

Packet summary	
peak/sec	peak/min
23/0	51/5

At the bottom of the network monitor page are some packet statistics. The leftmost column indicates the peak and current number of packets per second. The rightmost column shows the same data over a one minute interval.

Status area

The status area shows information at the board level and is display only.

Servo-8	SW Rev: 3	Templates: 3	IP Address: 192.168.0.66	Name: serv8-8ffd4c	SSID: Megapoints
---------	-----------	--------------	--------------------------	--------------------	------------------

Board Type (1)

This tells you what the board is. In this case a servo-8.

SW Rev (2)

The current software version loaded.

Templates (3)

Displays the current version of loaded templates. Normally this will match the software version above.

IP Address (4)

The current IP address of the board as allocated from your Wi-Fi.

Board Name and serial (5)

The board serial number. Each is unique and is a combination of the board type and last 3 hexadecimal digits of the MAC address.

SSID(6)

The network name of the configured Wi-Fi network.

In conclusion

We hope you'll agree, System2 Air is a powerful, flexible model railway control system. Future updating is baked in through a trivial firmware update process and new boards are under development to expand the capabilities of the range.

If you've made it this far through the user reference then you'll understand just how much this board is capable of.

Happy railroading!

Contacting us

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If you have any product improvement suggestions we'd be very pleased to hear from you.

NOTE: We operate on a policy of continuous improvement. Colours, specifications and even the placement of components may vary from time to time.