1SYSTEM® TPMS User Guide from bf1systems

1 Modifications

Date	Modifications	Author	Version	Modified Sheets	Approved		
					By	Date	Signed
07/06/2022	First Release	GU	V1_00	All	Draft - Not Approved		
15/09/2022	Updated with additional information	GU	V1_01	All	Draft – Not Approved		
18/10/2022	Updated with additional information	GU/JRS/ MG	V1_02	All	JRS/MG	19/01/23	JRS/MG
03/04/2023	Updated for App v1.4.8 and ECU firmware v2.15	GU	V1_03	All	GA	26/04/23	GA

1SYSTEM®

Tyre Pressure Monitoring System User Guide
from

bf1systems

1SYSTEM@bf1systems.com

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4 Quick Start Guide

When you receive your delivery of 1SYSTEM® Tyre Pressure & Temperature Monitoring System components, the kit will include the wheel sensors corresponding to the system you ordered, ECUs with integrated antennas and the valves to mount the sensor to your wheel rims. The installation instructions for the valves and sensors can be found in Section 23 of this document.

The guidelines for installing the ECUs can be found in Section 7 of this document.

Use the link below will to download the 1SYSTEM® TPMS PC software,

bf1systems (exavault.com)
https://bf1systems.exavault.com/p/1system/App

After installation of the software, a license request will need to be sent to the following email address 1SYSTEM@bf1systems.com.
The PC software is required to communicate with the TPMS ECU and to configure the wheel sensors.
Further information can be requested by emailing the same address.

The 1SYSTEM® TPMS ECU uses a CAN connection to communicate with the PC.
Vector & Peak Systems USB-to-CAN hardware interfaces are supported and are required for the ECUs.

On first installation, the 1SYSTEM® app software will open with a Demo license and no CAN connection.

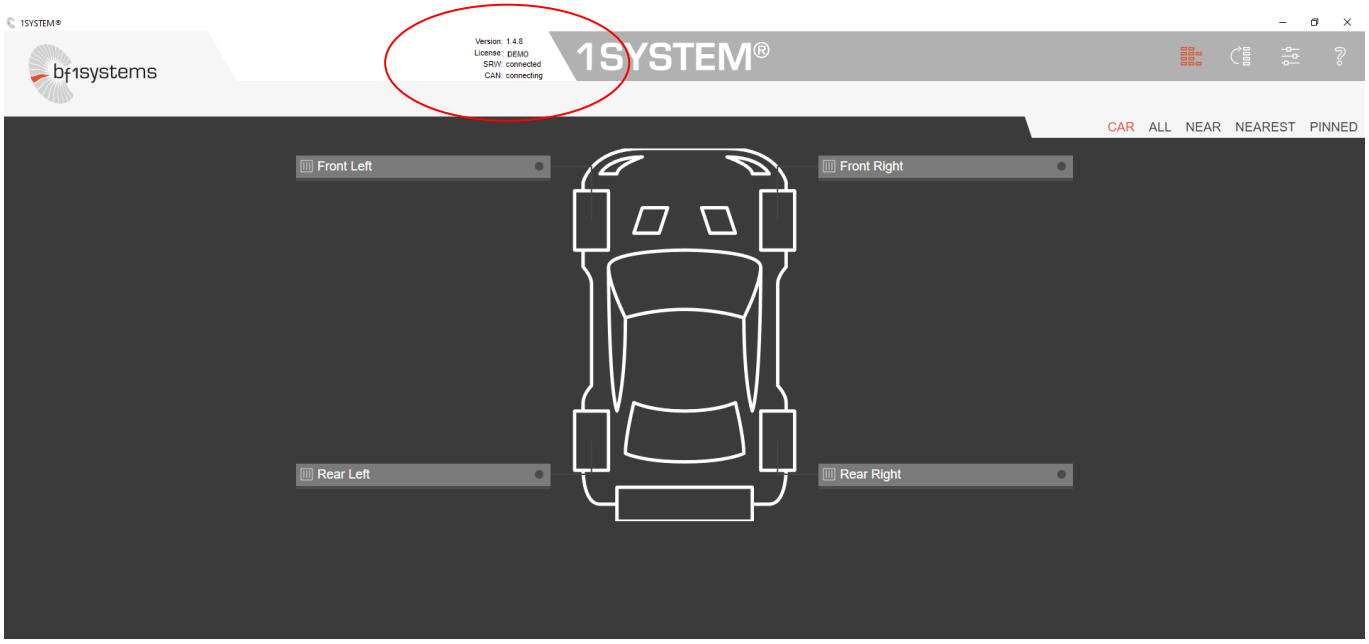


Figure 1 - 1SYSTEM® app demo mode

To activate the version of 1SYSTEM® app purchased, or to update the license in case of expiry, and to include the security codes required to manage your devices one need to generate a license request file. To do this, navigate to the 'License' page, this can be accessed by either clicking where it shows the current license (Demo on the screen above) or by selecting the 'Application' settings menu.

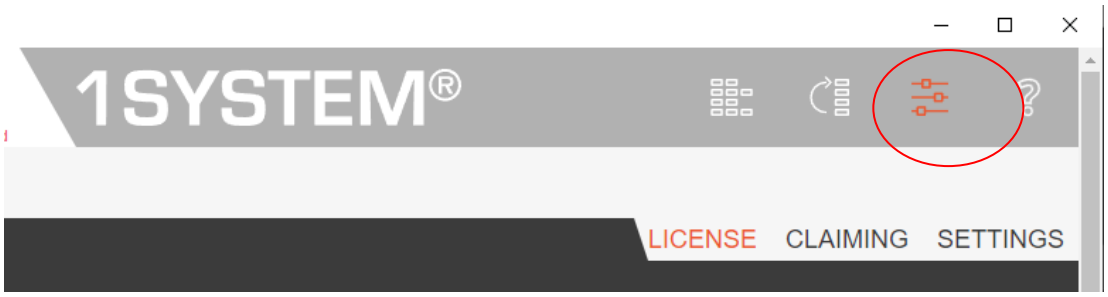


Figure 2 - Application settings button

At the bottom of the license page there is a 'Generate License Request File' button. Press this button, save the file and send it to 1SYSTEM@bf1systems.com .

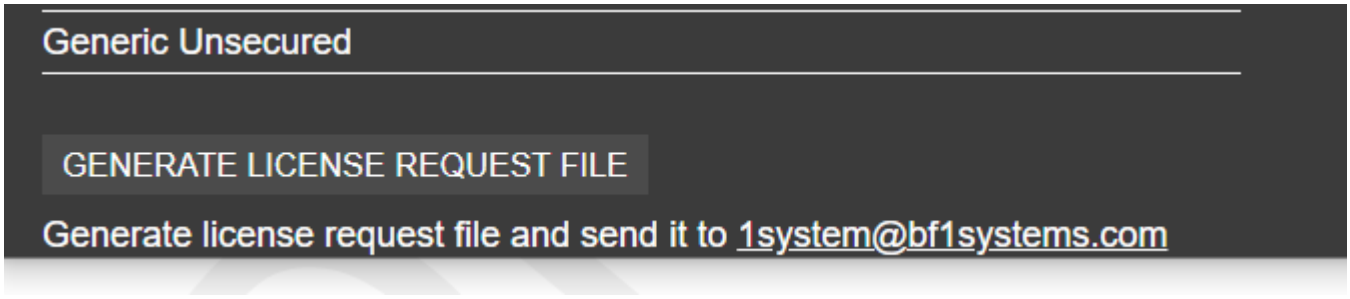


Figure 3 - Generate License Request File button

When you receive the license file, save to your PC then use the *Select License* button to import it. Navigate to the saved file, select the file, press the *Open* button and the app should now indicate that the license file has been imported successfully. Acknowledge the prompt and the page will update to show the license and the security codes for your team or organisation.

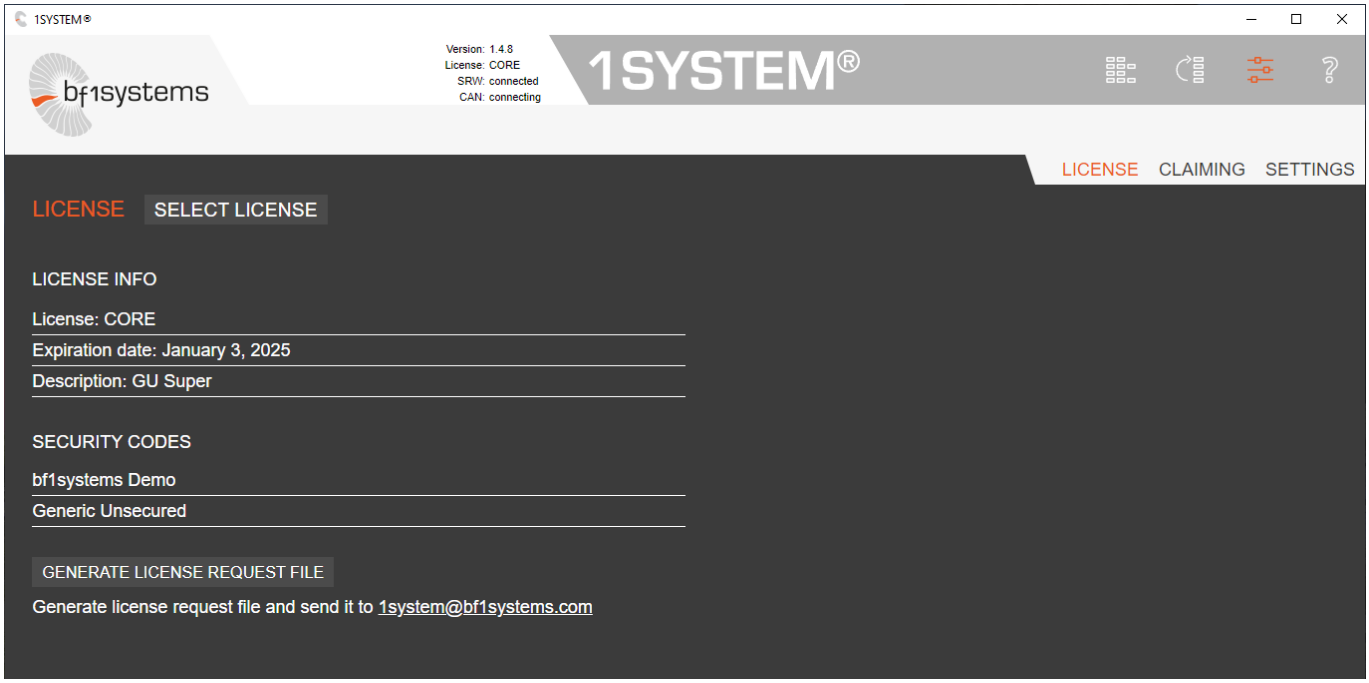


Figure 4 - Example of License update

To configure the CAN communications, select 'Settings' tab on the Applications Configuration page, select the required CAN adapter manufacturer, the CAN adapter type and the CAN channel if using a multi-channel device, all other settings can remain set to default and updated later if needed.

When finished, save the settings using the *Save Settings* button.

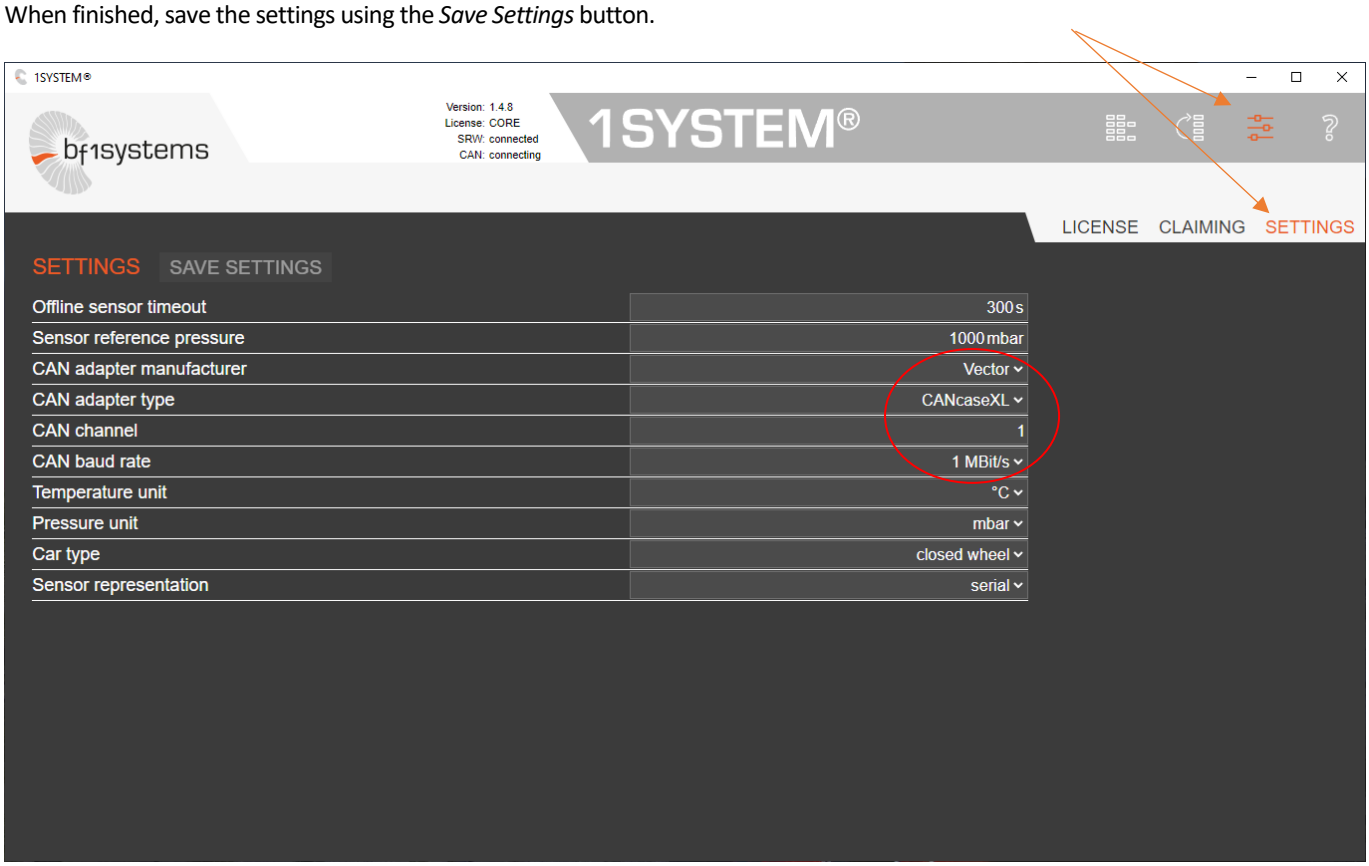


Figure 5 - CAN settings

Please ensure any drivers needed for the CAN adapter are installed.

With the CAN adapter plugged into the PC, and at least one ECU connected to the CAN adapter, click where the CAN status shows as disconnected to update and connect to the system.

Figure 6 - CAN connection status

NOTE: the 1SYSTEM® app will not show as CAN connected unless there is at least one ECU connected and powered

When connected, return to the 'Devices Overview' page then browse to the 'CAR' tab and the screen will show the connected ECUs and the detected sensor for each ECU.

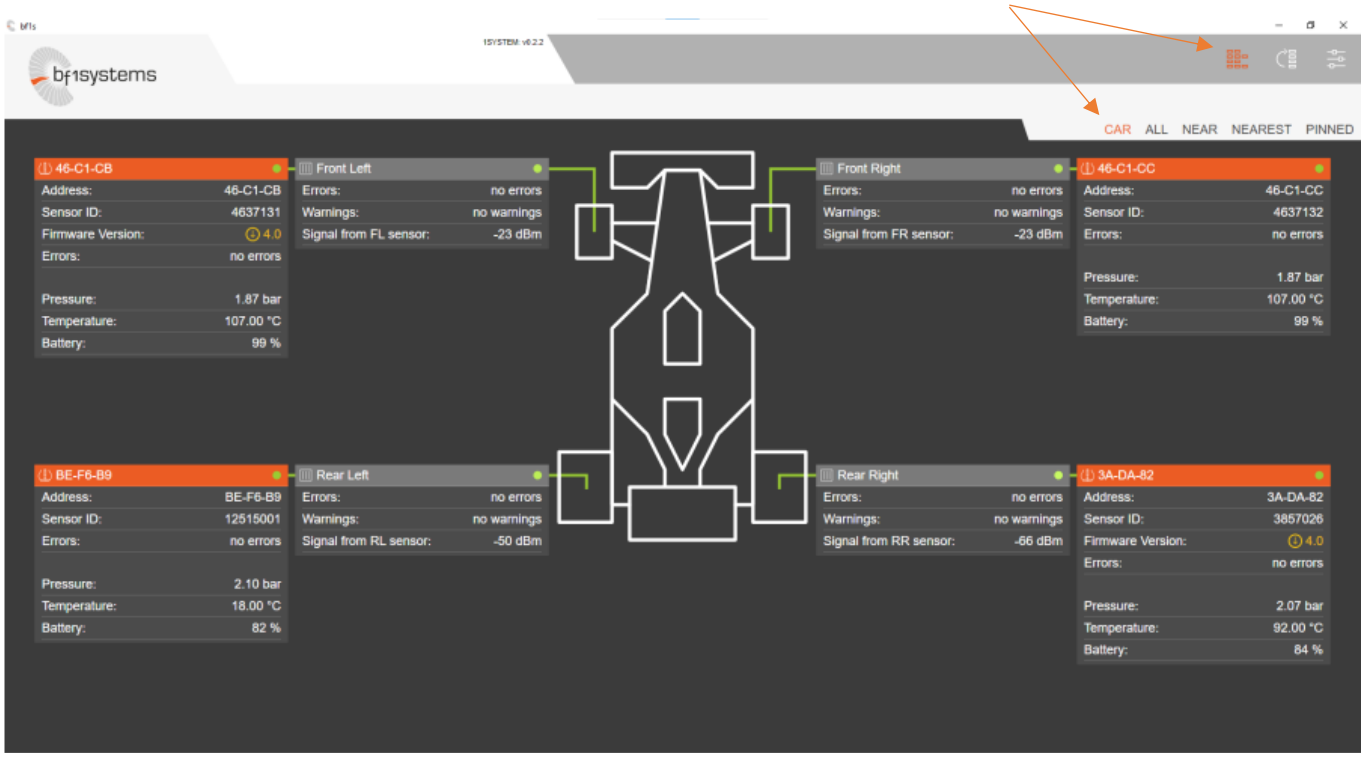


Figure 7 - *CAR* page

Communication with the ECUs will require a direct connection using the CAN adaptor, there is no Bluetooth communication between the 1SYSTEM® app and the ECUs.

Direct communications between your PC/laptop/tablet with the wheel sensors take place using a Bluetooth connection. Therefore, it is necessary for you to either have a built in Bluetooth device, or for an external Bluetooth dongle to be used.

When communicating directly with wheel sensors using the Bluetooth connection, it is strongly recommended that any Bluetooth connections to other devices such as headphones or a mouse are disabled as these will significantly slow down the communication with the wheel sensor.

It is also recommended that if you have a built in Bluetooth device, you understand where in your computer this is, because some functions of 1SYSTEM® rely on having a strong signal strength, and being able to orientate your computer so the Bluetooth device is nearest to the wheel sensor, will help.

5 1SYSTEM® TPMS General Information

The TPMS is part of the 1SYSTEM® product range, which is a new generation of products developed by bf1systems utilising the 2.4GHz frequency for wireless communications. The ECU is intended to be used as the 'core' product and central to evolving a vehicle sensor ecosystem.

The 1SYSTEM® Tyre Pressure Monitoring System (TPMS) consists of:

- 2.4GHz wheel sensors
- Motorsport valve (specified for each customers rim detail)
- ECU with integrated antenna
- Wiring Harness (vehicle specific)
- PC Software - with corresponding license

The 1SYSTEM® TPMS has been specifically developed to meet demanding applications where the vehicle and support team require fast and accurate tyre pressure and temperature data from their wheel electronics. To achieve this, bf1systems have developed the wheel electronics to be even more intelligent to their surroundings – this has been achieved by utilising 2.4GHz functionality and an on-board accelerometer. The wheel electronics contain a battery, absolute pressure sensor, temperature sensor, accelerometer, micro controller, radio frequency (RF) transmitter, and two Infra-Red elements (only present on 1SYSTEM® IR sensors) – all housed in the smallest and lightest housings on the market.

The wheel electronics are mounted onto the rear of a bf1systems supplied valve, or onto a custom stud.

The wheel sensors transmit data at different rates depending on the environmental conditions. All sensors undertake more processes and transmit data when pressurised, meaning that between events it is recommended that sensors are deflated in order to preserve the battery life.

Table 1 shows the three states the wheel sensor operates in, and the conditions which need to occur for each state to be active.

Mode	Pressure (Bar Gauge)	Roll switch	Transmission Rate
Storage	< 0.115	< 30kph	No Transmission
Stationary	> 0.115	< 30kph	Every 2 seconds
Moving	> 0.115	> 30kph	Determined by sensor type (see next table)

Table 1 - Wheel Sensor transmission modes

Wheel Sensor	Moving Transmission Rate [s] Pressure and Air Temperature	Moving Transmission Rate [s] Infrared Tyre Temperature
F1-100-1800-002 Wheel Sensor Lite	3	-
F1-100-1800-003 Wheel Sensor Pro	1	-
F1-100-1850-001 IRTPTMS Wheel Sensor Lite	1	1
F1-100-1850-002 IRTPTMS Wheel Sensor Pro	0.2	1

Table 2 - Wheel Sensor Moving transmission rates

The 1SYSTEM® TPMS can be configured in one of the following ways, depending on the application.

- Learning System: the TPMS can automatically detect which wheel sensor is fitted to each position of the car and starts monitoring it. This requires the fitment of four ECU Antennas to be fitted to the car.
- Positioned System: where specific wheel sensors are assigned to positions on the car. This requires the fitment of between one and four ECU Antennas to be fitted to the car, depending on the application and vehicle construction (will be available as part of coming ECU Firmware version 2.16 and 1SYSTEM App version 1.5 onwards).

5.1 Learning System

The 1SYSTEM® learning function of the TPMS provides teams with a fit and forget Tyre Pressure Monitoring System (TPMS) due to its ability to automatically learn the wheel sensors fitted to the car, and start monitoring them, without the user having to manually allocate sensors to specific corners.

The learning system consists of four 2.4GHz ECU Antenna units, one of which is located near each wheel sensor.

Each ECU functions as an individual sub system of the complete TPMS, the corner identification of the specific ECU on the vehicle is designated by pin assignment within the mating connector. See the wiring schematic in Section 17 for further details.

The ECU receives datagrams from each sensor within range and uses the signal strength to determine which sensor is nearest, the ECU then connects to that sensor and transmits the sensor data over the CAN bus.

Using this method, the system can detect and transmit the sensor data from when the wheels are fitted to the vehicle, and update when the wheels are changed.

When the vehicle is moving, the system locks onto the wheels detected and remains locked until the vehicle speed falls below a specified threshold or the sensor is no longer detected.

Learning systems can be used on all vehicles, closed and open wheel, but four ECUs must be installed on the car.

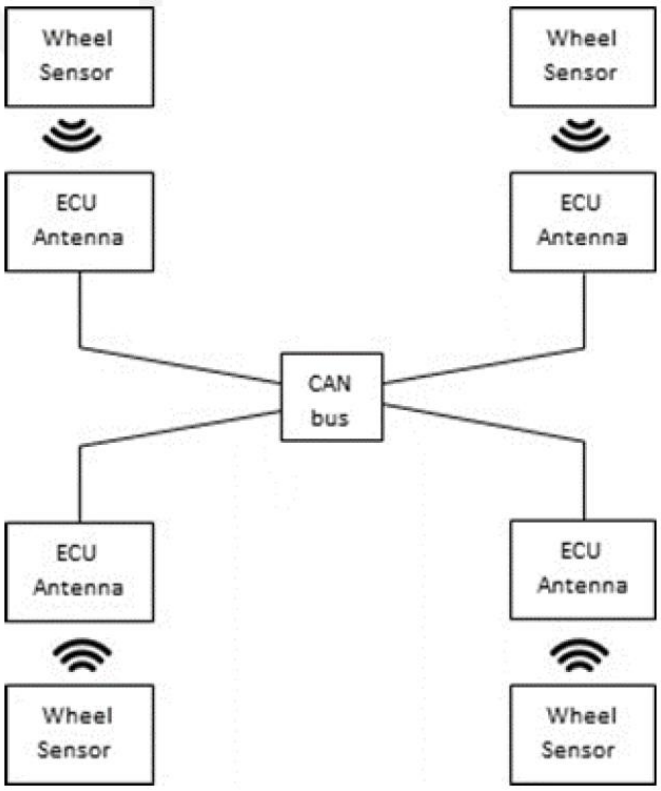


Figure 8 - Learning system architecture

5.2 Positioned System

The bf1systems positioned system is suited for applications where the user does not want to install four ECUs, or it is not practical to do so. The positioned system supports a one, two, three and four ECU layout or system architectures, depending on the type of vehicle, and the positions available to install the ECUs on the vehicle.

With the 1SYSTEM® positioned system, it is no longer necessary to position the wheel sensor serial numbers to corners of the car and write this data into the chassis mounted ECUs. Instead, the wheel sensors themselves are wirelessly programmed with positions and set numbers. This has the advantage that if a wheel sensor position needs to be changed, it is no longer necessary to connect to the car to update a position file, and instead the sensor itself only has to be updated, saving time and simplifying this procedure.

NOTE: Positioned systems will be available as part of coming ECU Firmware version 2.16 and 1SYSTEM App version 1.5 onwards.

6 System Components

6.1 Wheel Sensor

Each sensor contains a battery, radio frequency (RF) transmitter, absolute pressure sensor, temperature sensor, an accelerometer and two Infra-Red elements (only present on 1SYSTEM® IR sensors). The accelerometer is used to detect when the wheel is rotating, enabling the moving transmit mode.

The wheel sensors are contained in a PEEK™ housing and are designed to survive the high temperatures and g loadings found in motorsport.

Multiple sensor types are available, and include:

- 1SYSTEM® Lite TPMS - 25mbar Resolution - 0.33Hz Transmission
- 1SYSTEM® Pro TPMS - 12.5mbar Resolution - 1Hz Transmission
- 1SYSTEM® Pro Plus TPMS - 12.5mbar Resolution - 5Hz Transmission
- 1SYSTEM® Lite IRTPTMS - 12.5mbar Resolution - 1Hz Transmission, 8 IR measurement points
- 1SYSTEM® Pro IRTPTMS - 12.5mbar Resolution - 1Hz Transmission, 28 IR measurement points

Pressure accuracy - ±25mbar

Sensor weights:

- 1SYSTEM® TPMS 15g
- 1SYSTEM® IR TPMS 36g

Wheel sensors can be claimed and programmed with a security code by teams to allows only themselves to view sensor data, which prevents any competitors from seeing data from these sensors. Wheel sensors can be claimed to the 1SYSTEM® app. The sensor validation code (SVC) is used to claim the sensor, and this is engraved on the sensor housing, as highlighted in orange in Figure 9. Claiming instructions can be found in Section 10.2.

Figure 9 - Sensor Validation Code (highlighted in orange)

Figure 10 - 1SYSTEM® TPMS Sensor

Figure 11 - 1SYSTEM® IRTPTMS Sensor

NOTE: Valve kits are supplied separately and not part of the wheel sensor.

6.2 Modes of the 1SYSTEM® TPMS Wheel Sensor

6.2.1 Storage Mode

All sensors are shipped from the factory in the storage mode. This means they are not transmitting data to preserve battery life. The sensor measures air pressure in this state and will change their state when the air pressure is above 0.115bar gauge.
When the sensor detects a pressure change in the tyre, the sensor will continue to transmit for 60 seconds before returning to storage mode

6.2.2 Stationary Mode

Once the sensor is fitted to the rim and the tyre inflated above 0.115bar gauge, the sensor will transition into a stationary state.
In this stationary state the sensor will transmit data at regular intervals. The accelerometer is used to detect when the wheel is rotating above approximately 30kph and at this point transitions the sensor into Moving Mode.

6.2.3 Moving Mode

Once wheel rotation has been detected the sensor enters moving mode where pressure, temperature and IR element datagrams are transmitted at the fastest rate.
The sensor will continue to transmit in Moving Mode for 60 seconds following the wheel becoming stationary (speed <30kph).

6.3 1SYSTEM ECUs

The 1SYSTEM® ECU Antennas are high sensitivity digital antennas capable of receiving datagrams from all types of 1SYSTEM® wheel sensors (standard TPMS and also IRTPTMS). There is no need to reprogram anything when swapping between sensor types on the vehicle.

The distributed system architecture means only +12V, 0V, CANH & CANL connections are required for each ECU on the car, simplifying car wiring and removing a central TPMS ECU.

Advanced learning algorithms within the ECUs provide the fastest ever learning of wheel sensors fitted to the vehicle.

6.3.1 ECU Lite

Figure 12 - 1SYSTEM® ECU Lite

ECU Lite Spec	
bf1systems part no.	F1-100-1799-002
IP Rating	6K7
Operating Temperature Range	0 to 105°C 32 to 221°F
Weight	80g 2.83 ounce
Mating Connector Type	Molex MX150 Series
Mating Connector Manufacturer part no.	0334724801
Mating Connector (Female) Terminal Manufacturer part no.	0330122004
Mating Connector Cavity Plug Manufacturer part no.	0343450001
Mating Connector Backshell Manufacturer part no.	0349510811

Table 3 - ECU Lite Specification

6.3.1.1 ECU Lite Pinout

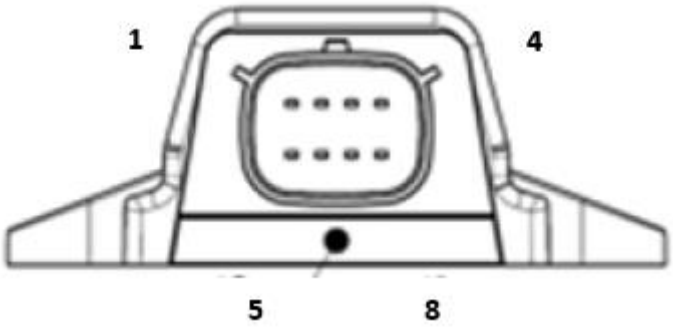


Figure 13 - ECU Lite pinout

Pin Number	Description
1	CAN H
2	POS 1
3	VBAT 12V
4	GND
5	CAN L
6	POS 2
7	POS 3
8	POS4

Corner Position Assignment – Learning system		
POS 1	POS 2	Position
NC	NC	FL
POS 4	NC	FR
NC	POS 3	RL
POS 4	POS 3	RR

Table 4 - Pinout

6.3.2 ECU Pro

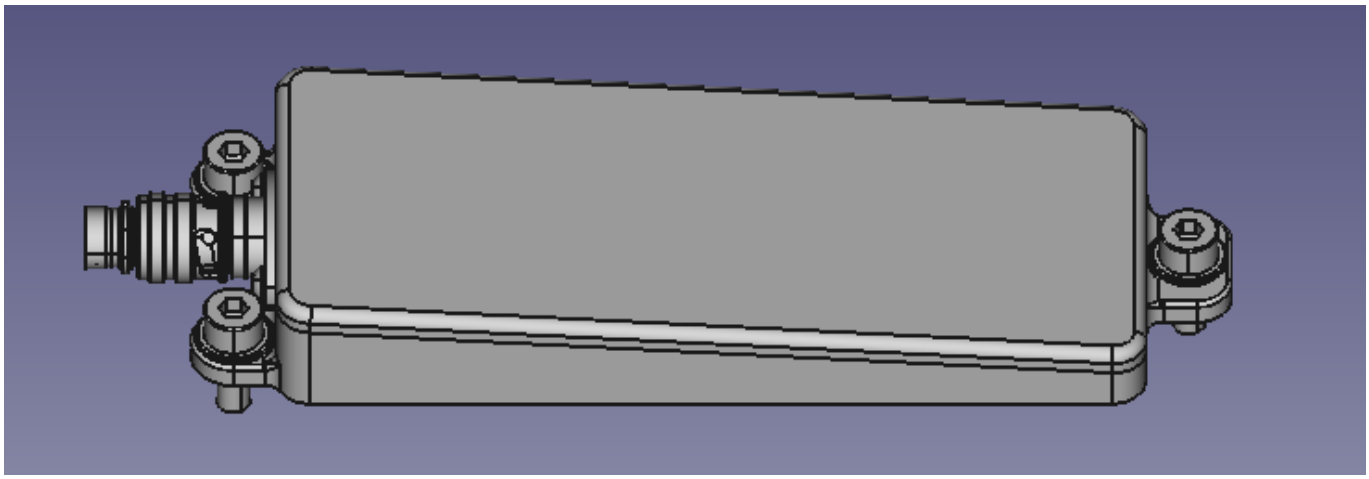


Figure 14 - 1SYSTEM® ECU Pro

ECU Pro Spec	
bf1systems part no.	F1-100-1799-003
IP Rating	6K7
Operating Temperature Range	0 to 105°C 32 to 221°F
Weight	55g 1.94 ounce
Mating Connector Type	Deutsch AS Micro XtraLITE HE 6 Way Connector
Mating Connector Manufacturer part no.	ASX602-06SN-HE-R
Mating Connector Socket Manufacturer part no.	605704
Mating Connector Cavity/Filler Plug Manufacturer part no.	600300-24

Table 5 - ECU Pro Specification

6.3.2.1 ECU Pro Pinout

Figure 15 - ECU Pro Pinout

Pin Number	Description
1	CAN H
2	POS 1
3	VBAT 12V
4	GND
5	CAN L
6	POS 2

Table 6 - ECU Pro pinout

6.3.3 ECU Corner or Position Assignment Pin Selection

ECU layout or architecture	ECU Position	POS 1	POS 2
1 Central ECU	-	NC	NC
1 Front and 1 Rear ECU	Front ECU	NC	NC
	Rear ECU	NC	To GND
1 Front and 2 Rear ECUs	Front ECU	NC	FL
	Rear Left ECU	NC	To GND
	Rear Right ECU	To GND	To GND
4 ECUs (oner per corner)	Front Left ECU	NC	NC
	Front Right ECU	To GND	NC
	Rear Left ECU	NC	To GND
	Rear Right ECU	To GND	To GND
1 Left and 1 Right ECU	Left ECU	NC	NC
	Right ECU	To GND	NC

Table 7 - ECU Pro Position Pin Assignment for Positioned system

POS 1	POS 2	ECU Position
NC	NC	FL
To GND	NC	FR
NC	To GND	RL
To GND	To GND	RR

Table 8 - ECU Pro Corner Pin Assignment for Learning system

7 Component Installation

7.1 Installation of the Learning system

7.1.1 Wiring

The wiring harness schematic for the TPMS can be found in Section 17 of this document.

Please note that if you are manufacturing the wiring harness, some basic rules should be observed:

- All CAN wiring must be a twisted pair
- It is recommended that the +12V and GND wiring to the TPMS ECU should be a twisted pair

7.1.2 Mounting the 1SYSTEM® ECU

With the Learning 1SYSTEM® TPMS you will receive four ECUs for fitment to your vehicle.
Each ECU must be mounted in the wheel arch area. The ECU receives wheel sensors when the car is stationary as well as when it is moving, to allow the system to recognise on which corner each wheel sensor is fitted as quickly as possible.

To ensure reliable reception and learning of the wheel sensors, the ECU must be mounted within the wheel arch area, either around the circumference of the wheel arch or the inner surface adjacent to the wheel (e.g. on the side of the chassis). If the car has wheel arch liners, then it is possible for the ECU to be mounted to the back of the arch liner. However, if the arch liner is manufactured from carbon-fibre, then it is necessary to create a window of either Kevlar or glass-fibre to prevent the signal from the ECU being reduced.

Figure 16 - ECU

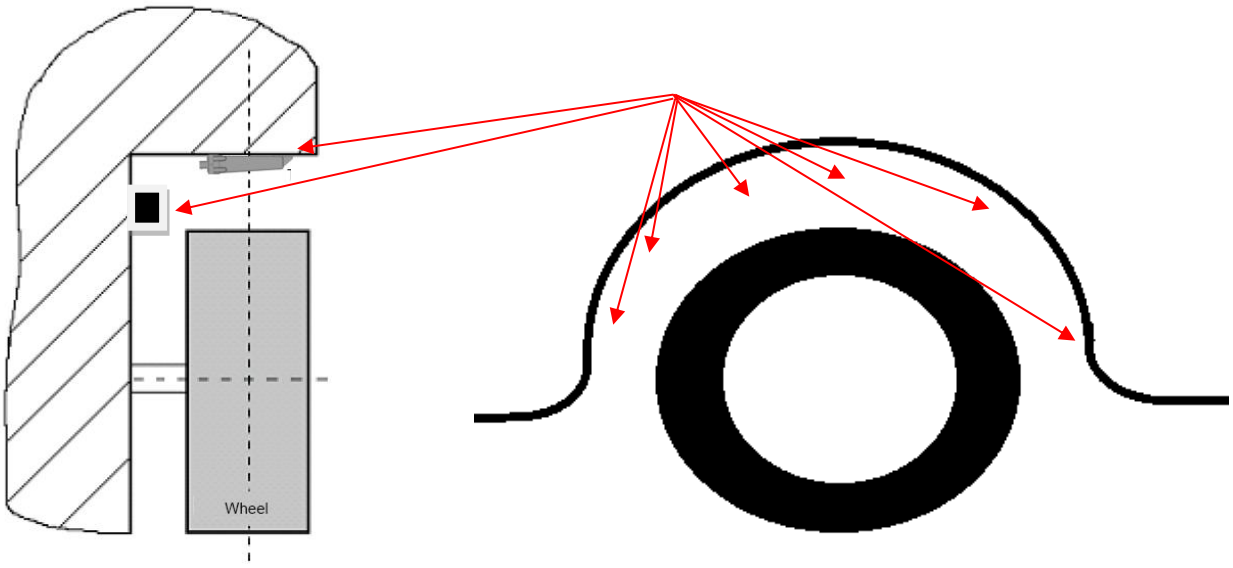


Figure 17 - Suggested ECU mounting areas

To ensure that the ECU learns the closest sensor, it is important that the ECU does not have line of sight to another wheel when mounted on the car. Therefore, shielding the antenna from other corners is important.

If mounting on a vehicle that has an open wheel arch to engine compartment, the ECU should be mounted in an area that has shielding from the wheel on the opposite side and not in open space.

NOTE: Because the system relies on using signal strength to determine the wheel mounted, the ECU position may need to be adjusted following analysis of the reception data.

7.2 Installation of the Positioned system

The positioned system ECUs are designed to receive all wheels on one to four ECUs mounted on the car. Section 6.3.3 provides information of positions on the vehicle for the ECUs when a different number of ECUs are used.

Positioned systems are most commonly used for open wheel race cars, where the number of ECUs is kept to a minimum.

When the ECUs are installed on the vehicle, they should not be located behind carbon fibre or metal which will attenuate the wheel sensor signal and prevent acceptable reception. If the ECU must be located behind such a material, then Kevlar or glass fibre windows should be place around the ECU.

7.3 Wiring

The wiring harness schematic for the TPMS can be found in Section 17 of this document.

Please note that if you are manufacturing the wiring harness, some basic rules should be observed. These are:

- All CAN wiring must be a twisted pair
- It is recommended that the +12V and GND wiring to the TPMS ECU should be a twisted pair

For the pin assignments for the different combinations of ECUs which can be installed on the car for a positioned system, please see Section 6.3.

8 Learning System Operation

The 1SYSTEM® TPMS has the ability to automatically start transmitting data for wheel sensors mounted on the car when the system is powered.

The wheel sensors transmit advertisement data packets to advertise to the ECUs on the vehicle, which are received and used to detect which wheel sensor is fitted in each position.

A sensor will only be received by the ECUs on the car if the security settings (manufacturer ID, series ID and team ID), match in the ECU and also in the wheel sensor. Users are only able to change the team ID themselves using the 1SYSTEM® App. This security is to prevent teams from viewing each other's sensors.

Once the security settings allow a sensor to be received, an average of the signal strength (RSSI) from each sensor is calculated and the wheel sensor with the strongest signal is determined to be the closest to the ECU and therefore the correct wheel sensor for the corner, the ECU and wheel sensor will then lock onto this and the ECU will set the 'TPM1S_XX_WS_NOT_DETECTED' CAN signal to FALSE.
If no wheel sensor is found or the wheel sensor closest cannot be determined, this will remain TRUE.

Once the wheel sensors have been detected, the TPMS CAN signals will be updated on the CAN bus so pressures and temperatures can be displayed.

When the vehicle starts moving, the rotation is determined by the wheel sensors and the transmission rate increases (exact transmit rate is dependent on the specification of sensor fitted). The sensors will transmit a moving status within the data packet.

Using the vehicle speed CAN input, the ECU will detect the car is moving, it will then confirm the wheel sensors for each corner using the signal strength as well as the moving signal transmitted and set the 'TPM1S_XX_WS_NOT_CONFIRMED' CAN signal to FALSE.

If the speed is not received by the ECU or the wheel sensor detected does not transmit the moving status, the 'TPM1S_XX_WS_NOT_CONFIRMED' signal will remain TRUE.

If the ECU had detected a wheel sensor that is not fitted to the car (possible if wheels are close by when the car is stationary) or if a wheel sensor stops transmitting, the ECU will wait 6 seconds and set both the 'TPM1S_XX_WS_NOT_DETECTED' and 'TPM1S_XX_WS_NOT_CONFIRMED' signals to TRUE.

The ECU will continue to check for a replacement sensor. For this reason, it is necessary to setup the ECU RSSI limit from testing so the ECU is not able to detect and confirm a wheel sensor from another corner of the car. The RSSI limits can be set within the ECU configuration using the 1SYSTEM® App, see section 15 for test procedures to determine the correct value.

9 1SYSTEM® Application Software

The 1SYSTEM® PC application is delivered alongside bf1systems TPMS and is allows the user to:

- Claim wheel sensors
- Apply security settings to wheel sensors and ECUs
- Configure CAN Tx & Rx message IDs
  (will be available as part of coming ECU Firmware version 2.16 and 1SYSTEM App version 1.5 onwards).
- Configure the levels for the puncture detect warnings
- Monitor live pressure and temperature data

If you have not received the 1SYSTEM® application, please use the link in section 4 for the latest download.

9.1 Installation and License Update

To install the application, see Section 4.

9.2 Car Page

The user is automatically taken to 'Car' page when the application is launched. This page contains licence information, the version number, and status of SRW (short range wireless connection) and CAN connection.

The status of ECUs and any detected wheel sensors will also be displayed.

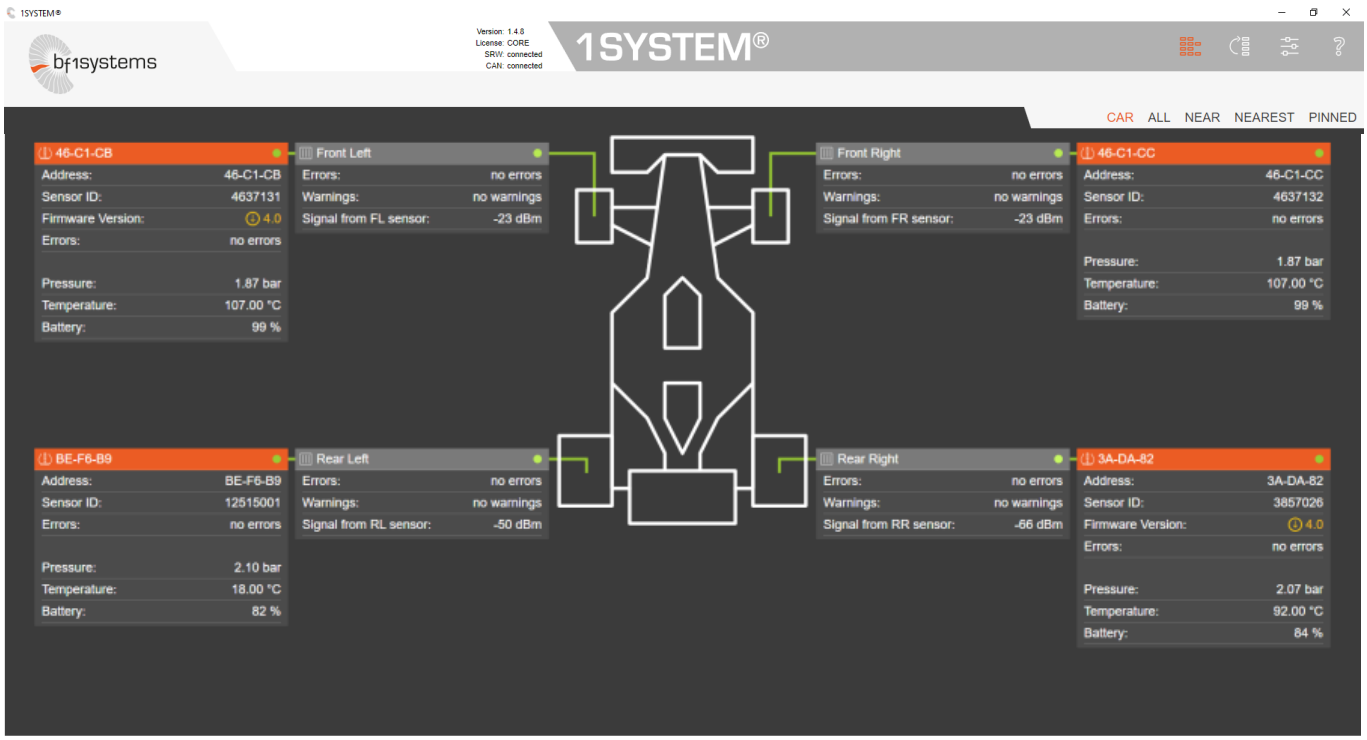


Figure 18 - Car page with a valid licence and connections

9.3 Connected ECUs

The car page shows an overview for each ECU connected.

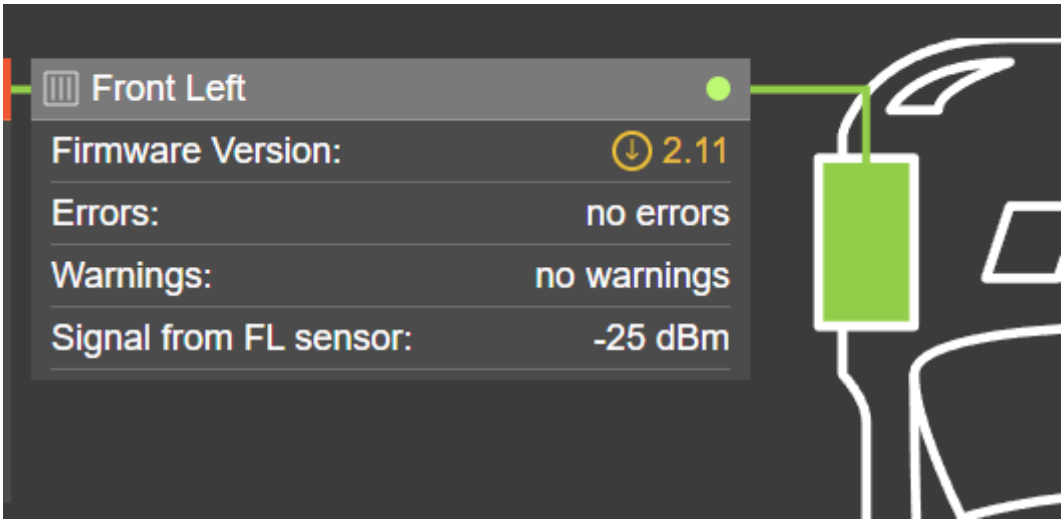


Figure 19 - Front left ECU overview

9.3.1 Live Connection

The flashing green lamp in the top right shows a valid connection.

9.3.2 Firmware Version

A circled arrow will indicate if a firmware update is available. See firmware update Section 9.4.3.
If the firmware is up to date, the version programmed can be seen when the detailed ECU view is selected, see section 9.4

9.3.3 Errors

Live hardware errors are shown when present and the tyre for the corner affected will change colour to orange

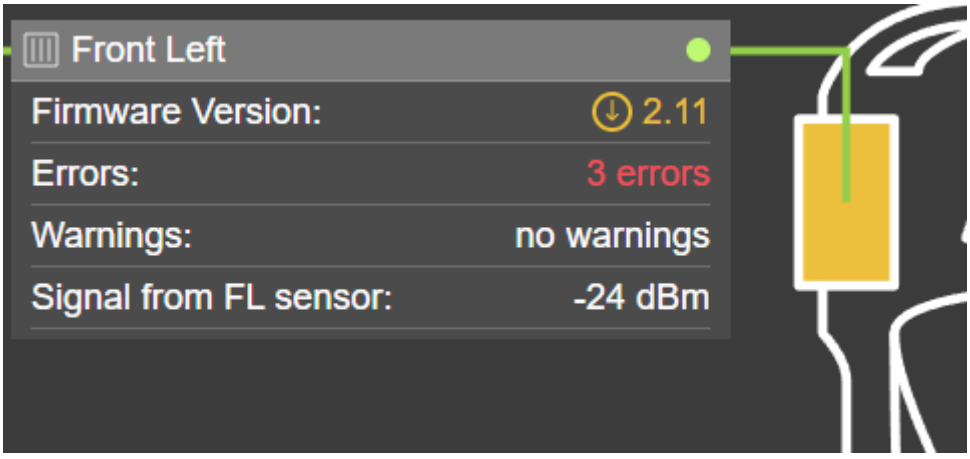


Figure 20 - Hardware errors

To check the Errors, see section 9.4

9.3.4 Pressure Warnings

Live pressure warnings are shown when present and the tyre for the corner affected will change colour to orange or red

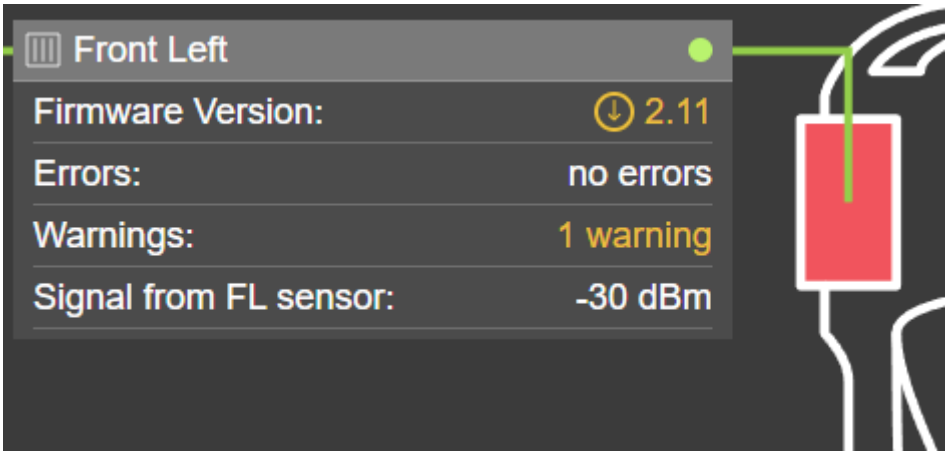


Figure 21 - Live pressure warnings

To check the Warnings, see section 9.4

9.3.5 Signal From XX Sensor

Indicates the average received signal strength of the sensor currently detected by the ECU

9.4 ECU Detail View

A detailed view of each ECU can be achieved by clicking on the grey position indicator block:

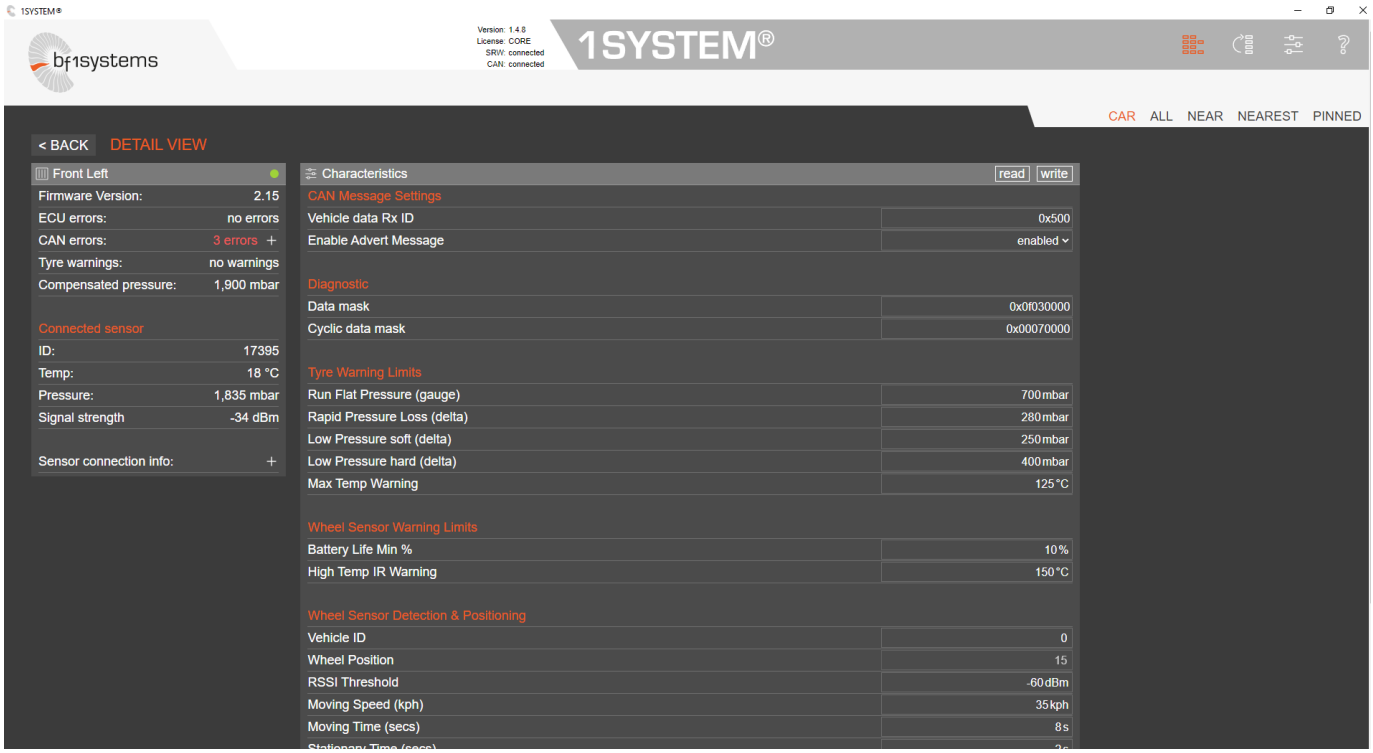


Figure 22 - ECU Characteristics page

The page displays the Characteristics of the selected ECU and enables access to the errors and warnings.

Hovering over the characteristic titles will display a brief description.

9.4.1 Warnings and Errors

A list of any live errors or warning can be viewed by clicking on the +

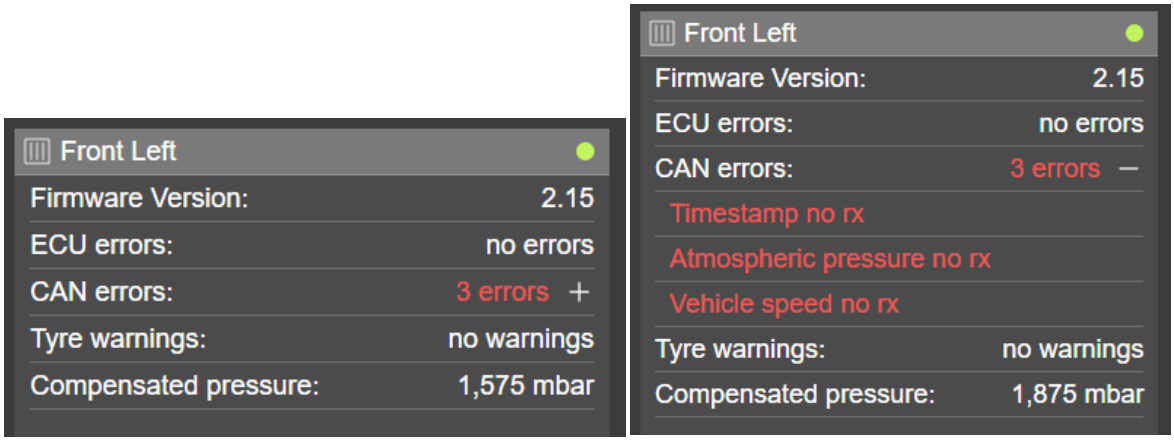


Figure 23 - Live errors

9.4.2 ECU Characteristics

9.4.2.1 Read and Write

When the page is opened, the software will automatically read the characteristics from the ECU.
A read button is also available to re-read from the ECUs.

Any changes made to the setup can be written to the ECUs using the write button

Figure 24 - Characteristics Read and Write buttons

9.4.2.2 CAN Message Settings

Figure 25 - CAN Settings

Vehicle data Rx ID - The CAN message settings enable the user to change the CAN ID of the received data from the vehicle, this data includes the Rx timestamp, Rx atmospheric pressure and the Rx vehicle speed.
When changes have been made to the Rx CAN ID, the ECU will require a power cycle.

Enable Advert Message - The advert message is used to determine the reception for the ECU. When enabled, the data from any senor received by the ECU, stationary or moving, will be transmitted asynchronously onto the CAN bus. The data can be filtered to determine the received signal strength for each sensor.

When the system has been setup, the user can disable this message.

If reception problems are seen during use, bf1systems will require a log of the advert data to assess the performance.

9.4.2.3 Tyre Warning Limits

Figure 26 - Tyre Warning Limits

Run Flat Pressure (gauge) - The lowest acceptable pressure that can be present in a tyre before the ECU transmitted signal 'TPM1S_XX_WS_UNDER_PRESS_HARD_WRN' is triggered. This absolute pressure limit is an actual tyre pressure and not a compensated one.

Rapid Pressure Loss (delta) - This is a parameter that the system can use to determine whether the tyre is losing pressure greater than a pre-determined rate per minute. If the calculated pressure loss rate is greater than the set value, then the ECU transmitted signal 'TPM1S_XX_WS_UNDER_PRESS_HARD_WRN' will triggered, regardless of current pressure value.

Low Pressure soft (delta) - This is the maximum amount of pressure deviation from the normalised pressure before the ECU transmitted signal 'TPM1S_XX_WS_UNDER_PRESS_SOFT_WRN' is triggered.

Low Pressure hard (delta) - This is the maximum amount of pressure deviation from the normalised pressure before the ECU transmitted signal 'TPM1S_XX_WS_UNDER_PRESS_HARD_WRN' is triggered.

Max Temp Warning – This is the maximum acceptable temperature that can be present in a tyre before the ECU transmitted signal 'TPM1S_XX_WS_HIGH_TEMP_WRN' is triggered.

9.4.2.4 Wheel Sensor Warning Limits

Figure 27 - Sensor Warning Limits

Battery Life Min % - The minimum remaining battery life set for the detected sensor

High Temp IR Warning - The maximum acceptable temperature for the tyre carcass pixel points (not yet implemented).

9.4.2.5 Wheel Sensor Detection & Positioning

Wheel Sensor Detection & Positioning	
Vehicle ID	0
Wheel Position	15
RSSI Threshold	-60 dBm
Moving Speed (kph)	35 kph
Moving Time (secs)	8 s
Stationary Time (secs)	2 s
RSSI Threshold (IR)	-70 dBm
Wheel Sensor timeout	8 s
Wheel Sensor moving acceleration	8 g

Figure 28 - Detection and Positioning Settings

Vehicle ID - An optional numerical identifier for the vehicle to enable teams running more than one car. When set, the sensors will also need to be updated to the same vehicle ID to be received by the ECU.

Wheel Position - Not currently used in the system

RSSI Threshold - Sets the minimum received signal strength allowed by the ECU to connect to a **non IR** wheel sensor. This parameter will be used to stop wheels from other corners of the vehicle being detected by the ECU.

Moving Speed (kph) - The minimum vehicle speed needed for the ECU to enter moving mode.

Moving Time (secs) - The amount of time that the car must be in moving mode before the ECU can confirm the detected sensors are correctly positioned.

Stationary Time (secs) - The amount of time that the car must be stationary before new wheels will be accepted by the system.

RSSI Threshold (IR) - Sets the minimum received signal strength allowed by the ECU to connect to an IR wheel sensor. This parameter will be used to stop wheels from other corners of the vehicle being detected by the ECU.

Wheel Sensor timeout - Time for ECU to set timeout pressure value for a detected sensor that is no longer being received.

Wheel Sensor moving acceleration - Force used by the sensor to determine it has transitioned to a moving state

9.4.2.6 General

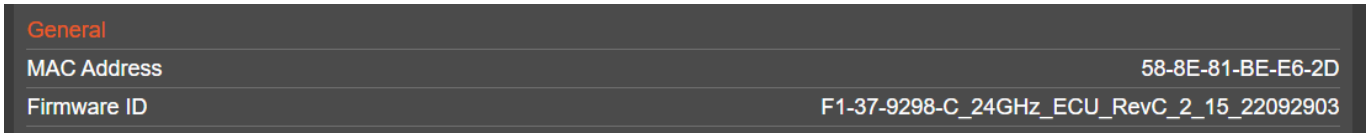


Figure 29 - General settings with CORE License

Figure 30 - General settings with CORE PLUS License

Security Code - The security code for the ECU. Wheel sensors used with the ECU must have matching security codes for the ECU to transmit data.

MAC Address - A unique identification code for each ECU.

Firmware ID - Programmed firmware identification.

9.4.3 ECU Firmware update

An indication to show if the ECU firmware is up to date is displayed in the ECU overview on the CAR page.

If a newer version of firmware is available, a circled arrow will show next to the current firmware version.

Firmware updates will be released with new versions of the 1SYSTEM® app, it will not be possible to update from a separate file.

Select the detail view for the ECU that requires the firmware update.

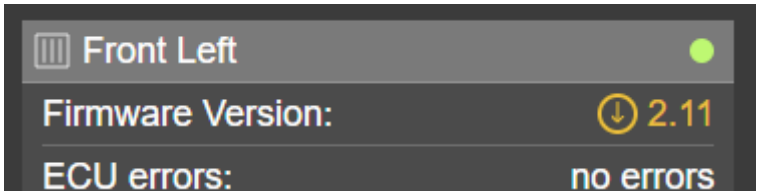


Figure 31 - Firmware version

Click on the circle or the firmware version to open the update page

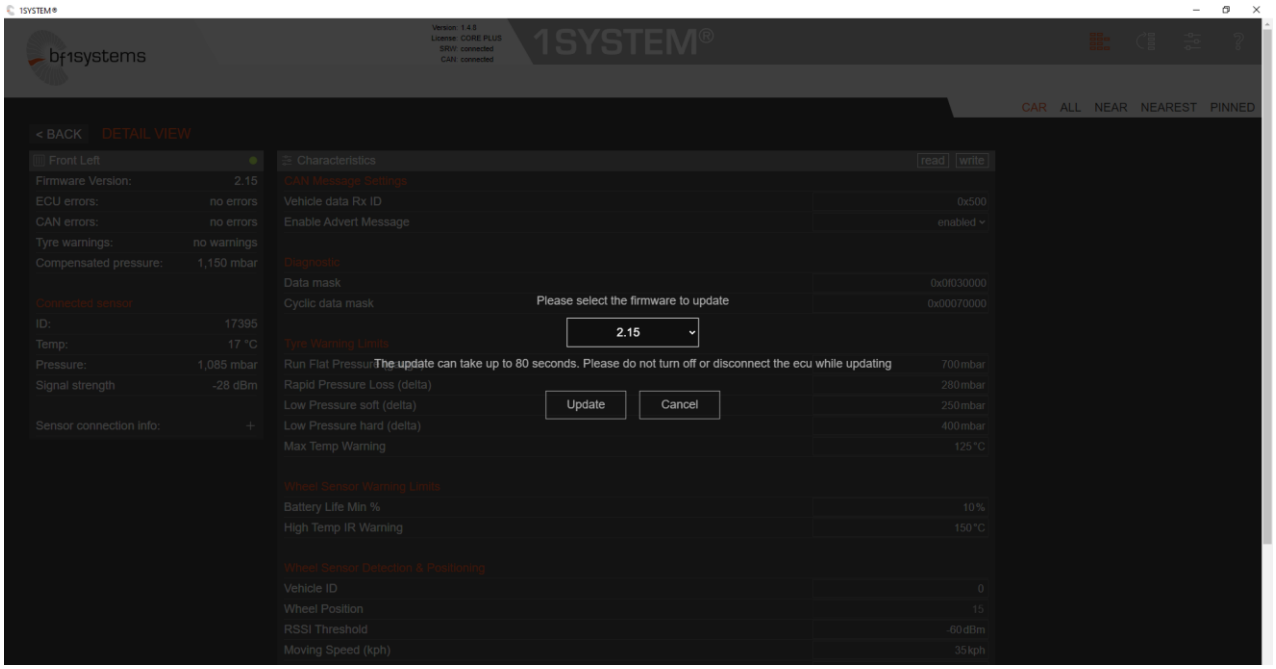


Figure 32 - Firmware update selection

It is possible to go back in firmware versions by selecting an older version from the drop-down list.

To install the firmware, click on the update button, the page will display the progress of the update

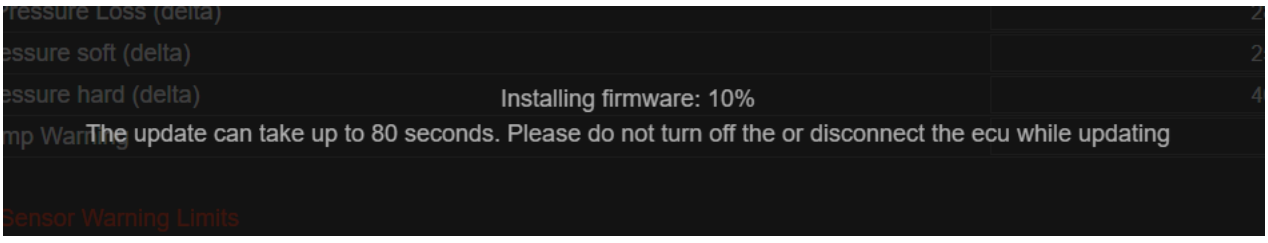


Figure 33 - Firmware update progress

Do not disconnect during the update and ensure vehicle battery is good.

The page will indicate when the update has completed.

9.5 Wheel Sensor Detected By The ECU

The car page shows an overview for the wheel sensor detected by each ECU.

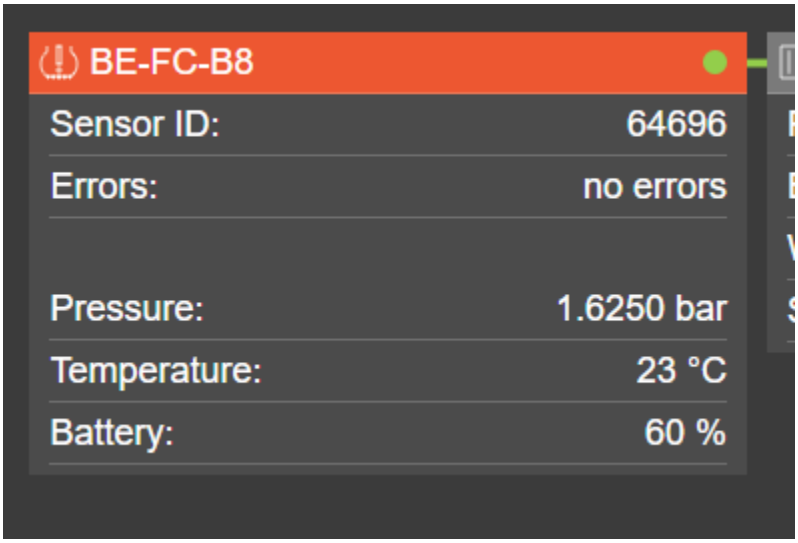


Figure 34 - Wheel sensor overview

9.5.1 Live Connection

The flashing green lamp in the top right shows a valid connection.

9.5.2 Sensor ID

The sensor ID is shown in both hexadecimal and decimal format. The decimal value is conversion of the last two octet's.

FC B8 = 64696

The full hexadecimal MAC address is laser marked on the sensor housing.

This decimal value is laser marked on sensor housings manufactured after June 2022

9.5.3 Errors

Live internal hardware errors are shown when present.

9.5.4 Pressure

Displays the gauge pressure for the sensor currently detected.

9.5.5 Temperature

Displays the temperature for the sensor currently detected.

9.5.6 Battery

Displays the remaining battery life for the sensor currently detected.

10 1SYSTEM® Security

NOTE: The following section requires a CORE PLUS or higher licence to make changes to security.

Previous TPM systems from bf1systems implemented a permit list to keep the sensor data secure to the team.

1SYSTEM® does not require the need for a permit list, each sensor and ECU has a security code to keep the data within your team.

The 1SYSTEM® security consists of 2 levels, these are:

1. 1SYSTEM® Security code
2. Vehicle ID (such as car number)

When purchasing new 1SYSTEM® components, the specific security codes must be confirmed to ensure the correct parts are received, for instance, if you are racing with a manufacturer supplied car such as Porsche, Ferrari or Aston Martin or within a specific series.

The security for your setup will be displayed on the license page in the 1SYSTEM® app.

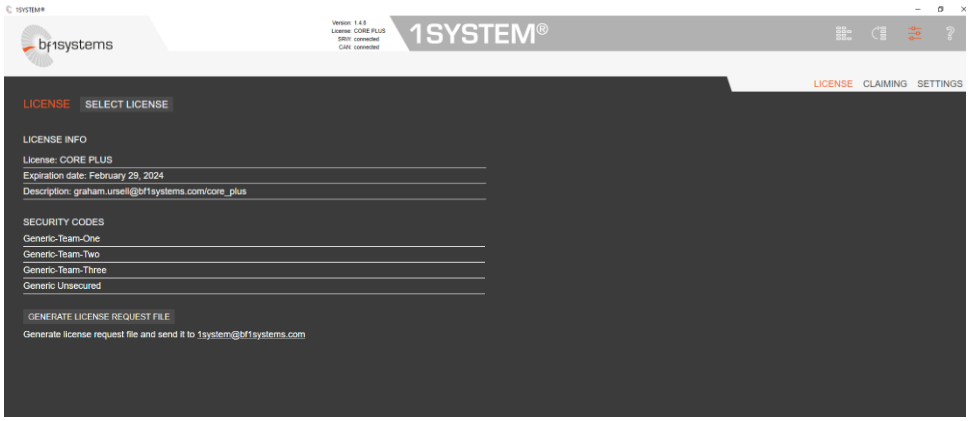


Figure 35 - Security codes

The security code within the wheel sensors will need to match the ECUs otherwise the sensor data will not be processed or passed through to the logger, this will be indicated by the 1SYSTEM® PC software shown in Figure 36 and also in the CAN data message 'TPM1S_XX_WS_DATA' (default ID 0x600, 0x601, 0x602 or 0x603) signal 'TPM1S_XX_WS_MISMATCH' will be set to TRUE (WS security code mismatch)

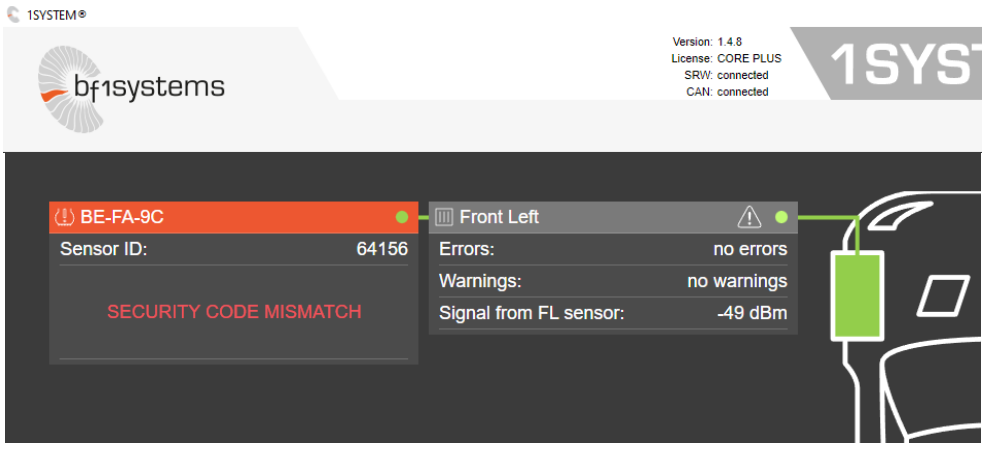


Figure 36 - Security mismatch

10.1 Updating Security Codes

If you have multiple security codes within your license you can update the ECU and sensors for each security code.

10.2 Sensor Claiming

Sensor can be claimed using either the 2.4GHz connection of the laptop or tablet, or by inputting the Sensor Validation Code (SVC). Unclaimed sensors show in the 1SYSTEM® app ALL page and are highlighted in a brown.

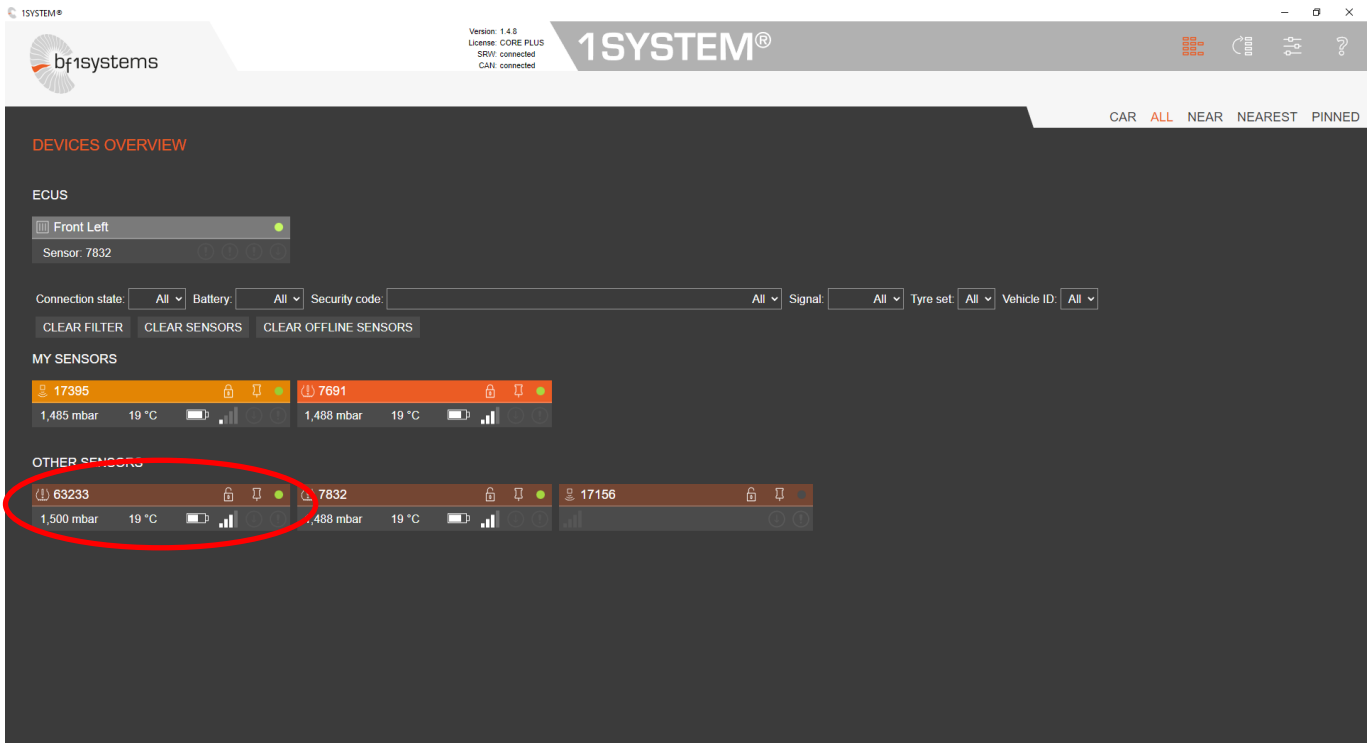
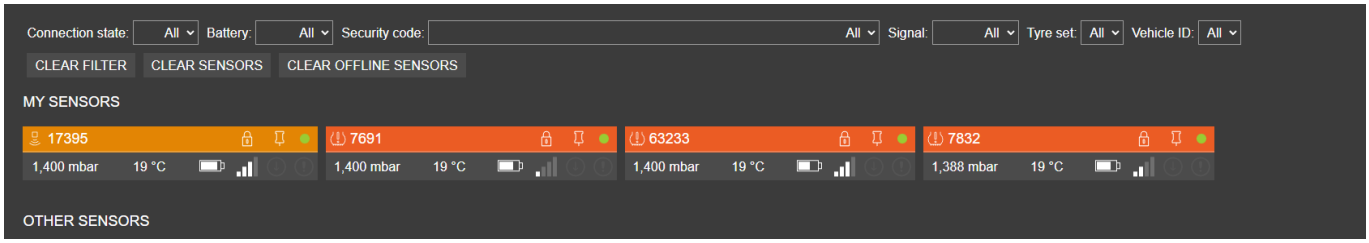


Figure 37 - Unclaimed sensors highlighted in brown

10.3 Claiming A Sensor Over The Wireless Connection

To claim using a 2.4GHz connection, place the PC or tablet close to the pressurised sensor, if the sensor serial number is not known the nearest page of the 1SYSTEM® app can be used, to be able to claim the sensor, the signal strength must be -50dBm or higher, then click on the padlock icon of the sensor detail box. If the sensor has a strong enough signal the claim will be accepted and the box colour will change to orange.



If the signal is not strong enough the user will be prompted to input the SVC to claim the sensor, see section 0.

10.4 Claim Using Sensor Validation Code - SVC

A sensor displayed in the Other Sensors screen can be claimed at any time if the SVC is known.

The SVC is marked on the sensor as a 3-digit number within a rectangular box.

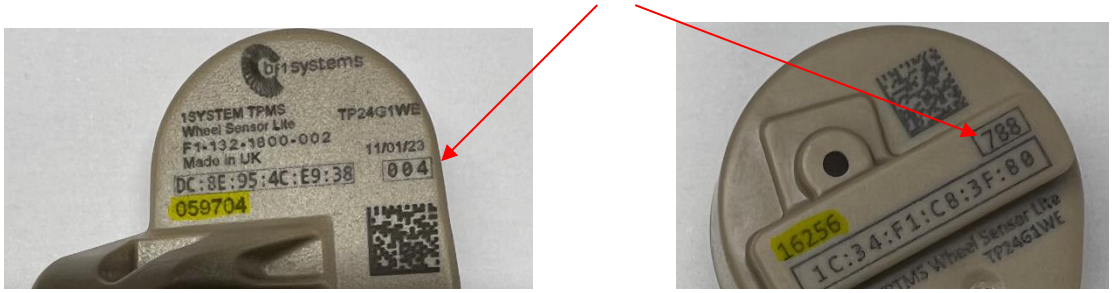


Figure 38 - Sensor SVC code

Find the sensor to be claimed from the other sensor list and click the padlock icon, the user will be prompted to enter the SVC code. Once the code is entered, the sensor will shift to the My Sensors list and the box will change to orange.

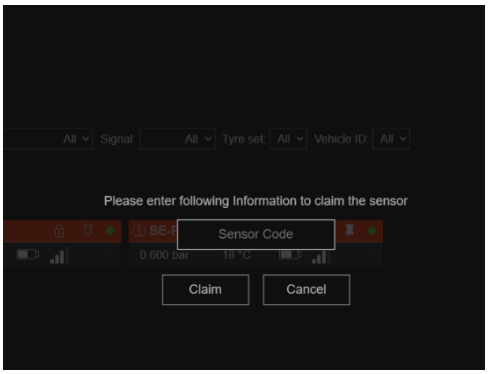


Figure 39 - Sensor claiming using SVC code

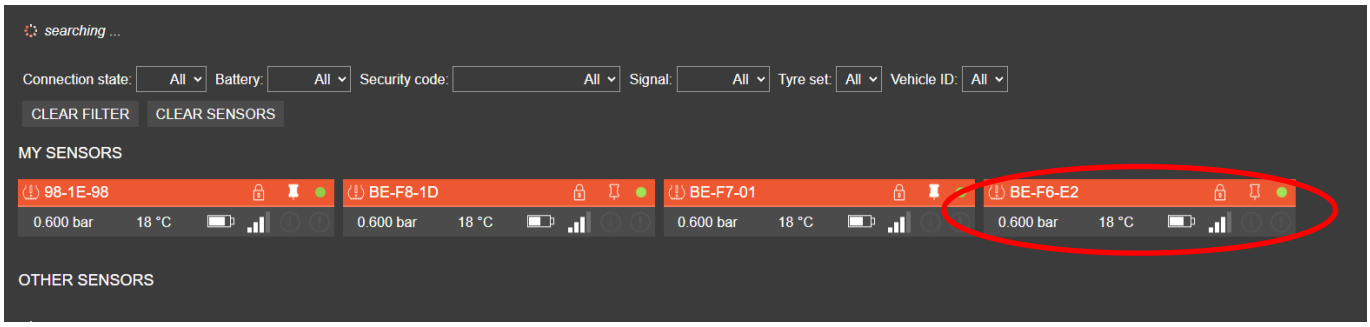


Figure 40 - Claimed sensors highlighted in orange

10.4.1 Updating Security for Wheel Sensors

Before a sensor can be updated it must be claimed. See Section 10.2 for instructions on how to claim a sensor.

To change the security code of the wheel sensor, place the pressurised sensor close to the laptop or tablet, then select the All screen to display the sensors close by then select the sensor from the list.

Figure 41 - All sensor overview page

Read the Characteristics from the sensor

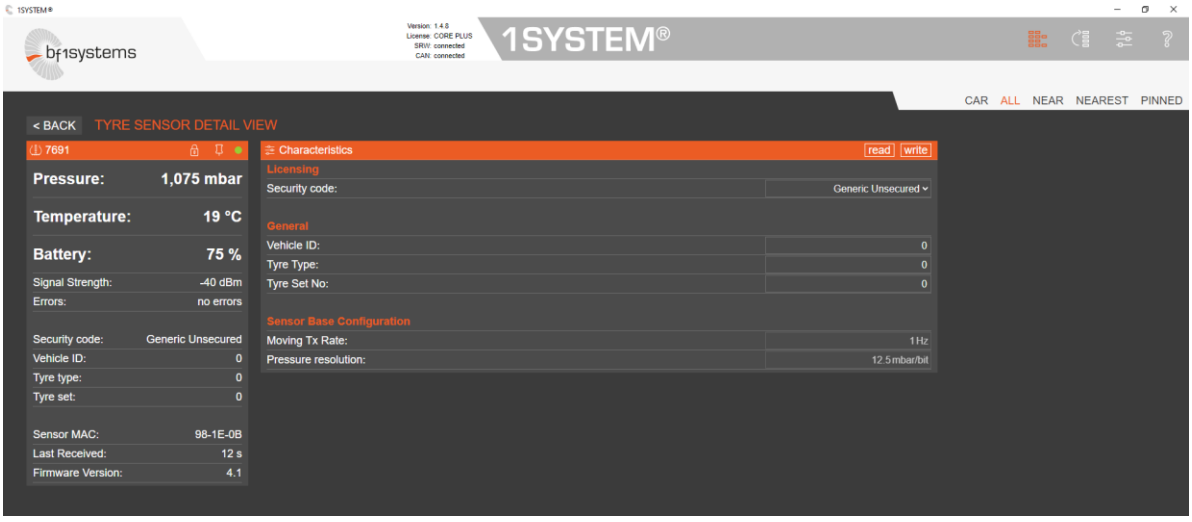


Figure 42 - Selected sensor details

Select the security code from the drop-down list and write the new code to the sensor.

NOTE: Sensors cannot be updated if their temperature reading is above 85°C

11 All Page

The 'All' page displays all sensors, claimed & unclaimed received over the built in 2.4GHz receiver and ECUs connected via CAN. By default, all sensors claimed on the User's PC or tablet will be displayed, live sensors will show the green dot. To remove any sensors that are no longer online click on the 'CLEAR OFFLINE SENSORS' button.

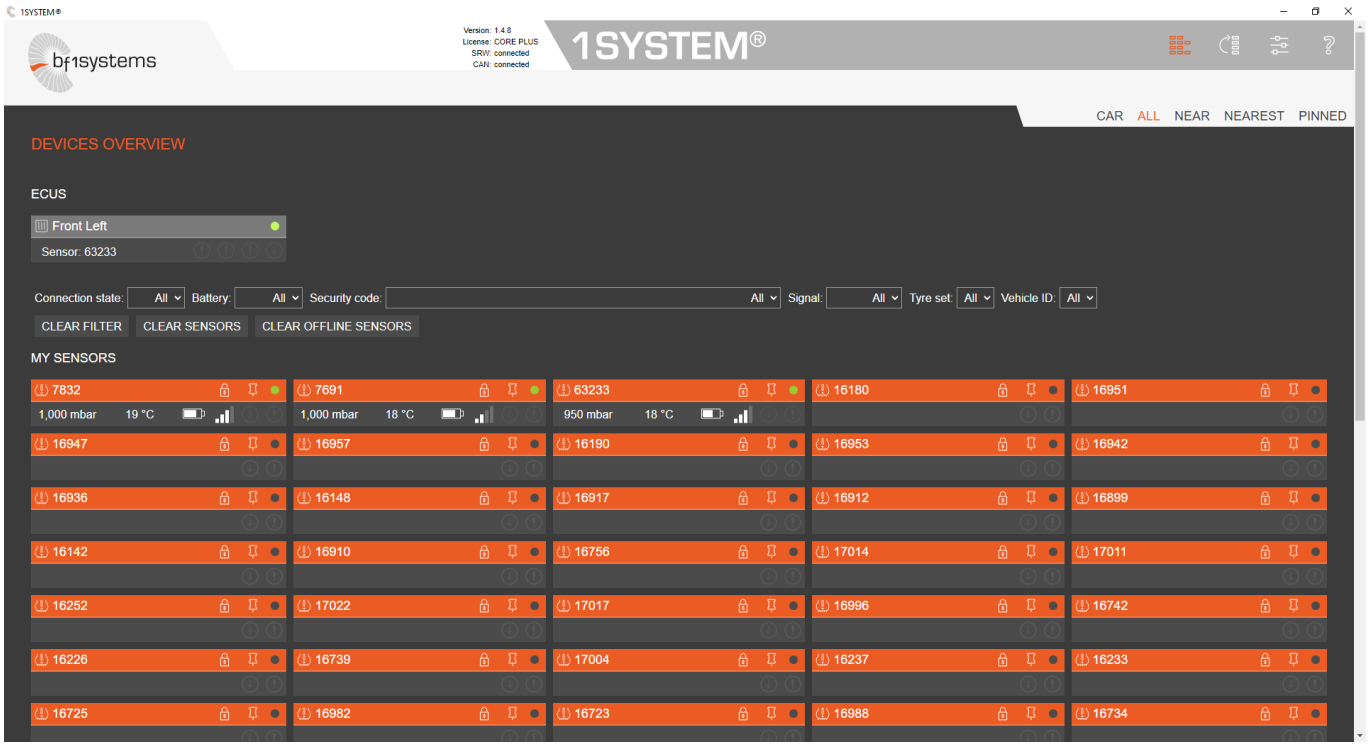


Figure 43 - All Sensors displayed page

TPMS and IRTPMS sensors are shown in different shades of orange and display different icons.

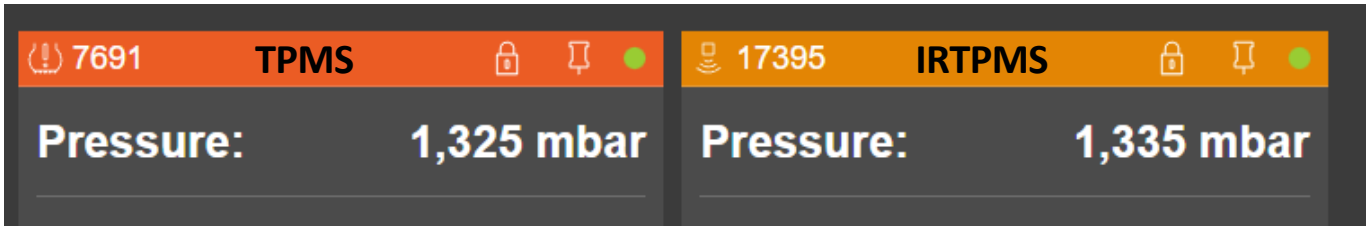


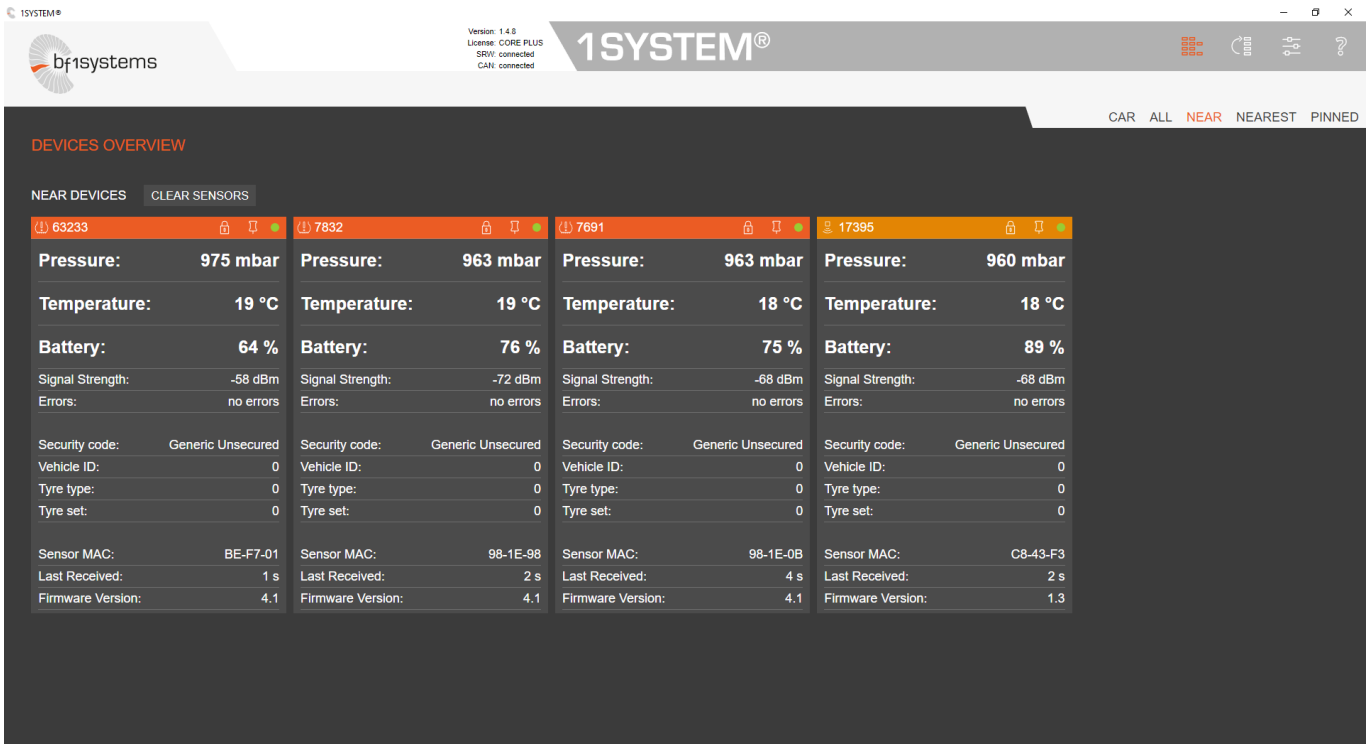
Figure 44 - TPMS and IRTPMS sensor identification in app

Sensors can be filtered using the drop-down categories shown in Figure 45.

Figure 45 - Sensor filtering

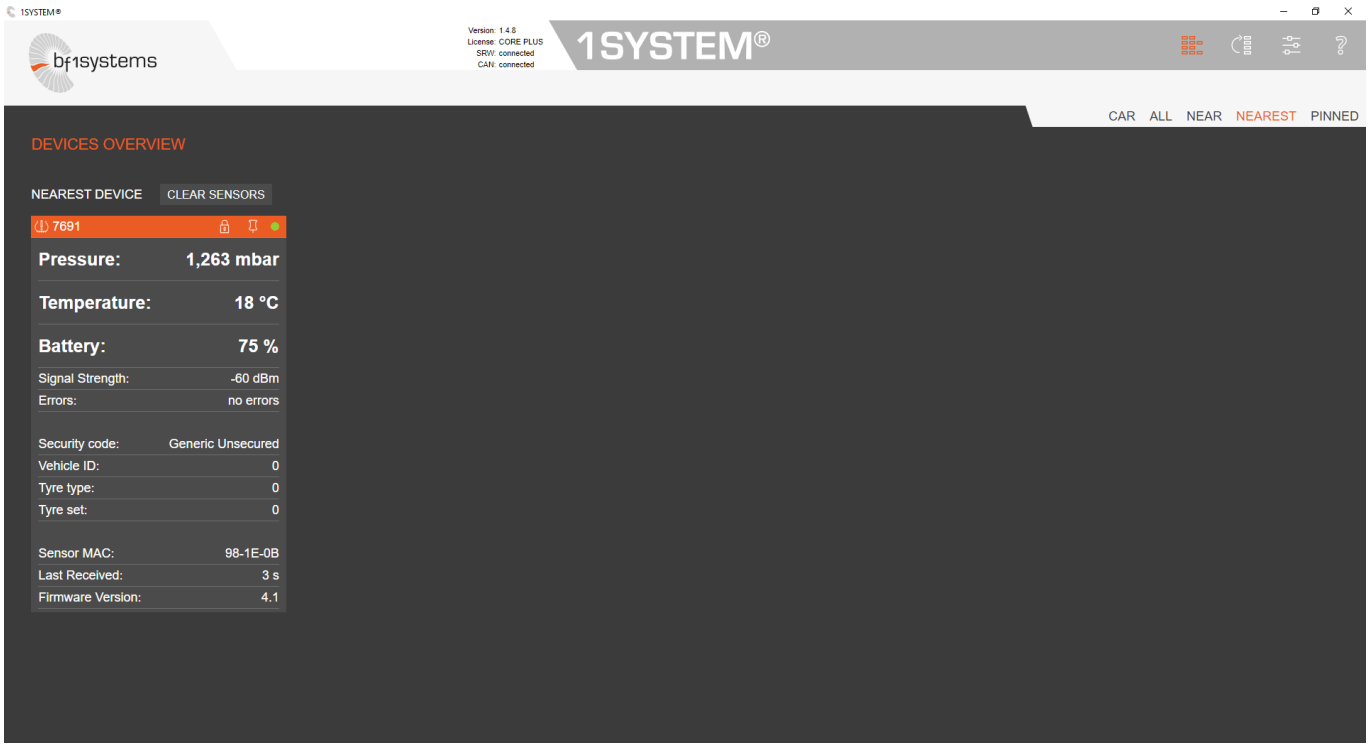
12 Near Page

The 'Near' page will display the 4 sensors with the strongest signals. This page can be used to work with the wheels on the car or in a stack separated from the other tyres.



13 Nearest Page

The 'Nearest' page will display the sensor with the strongest signal.



14 Pinned Page

There will be times when you need to monitor specific sensors from all shown on the screen, this can be achieved by pinning the sensor. Up to four sensors can be pinned at one time.
To pin a sensor, click on the pin icon so the colour changes to white

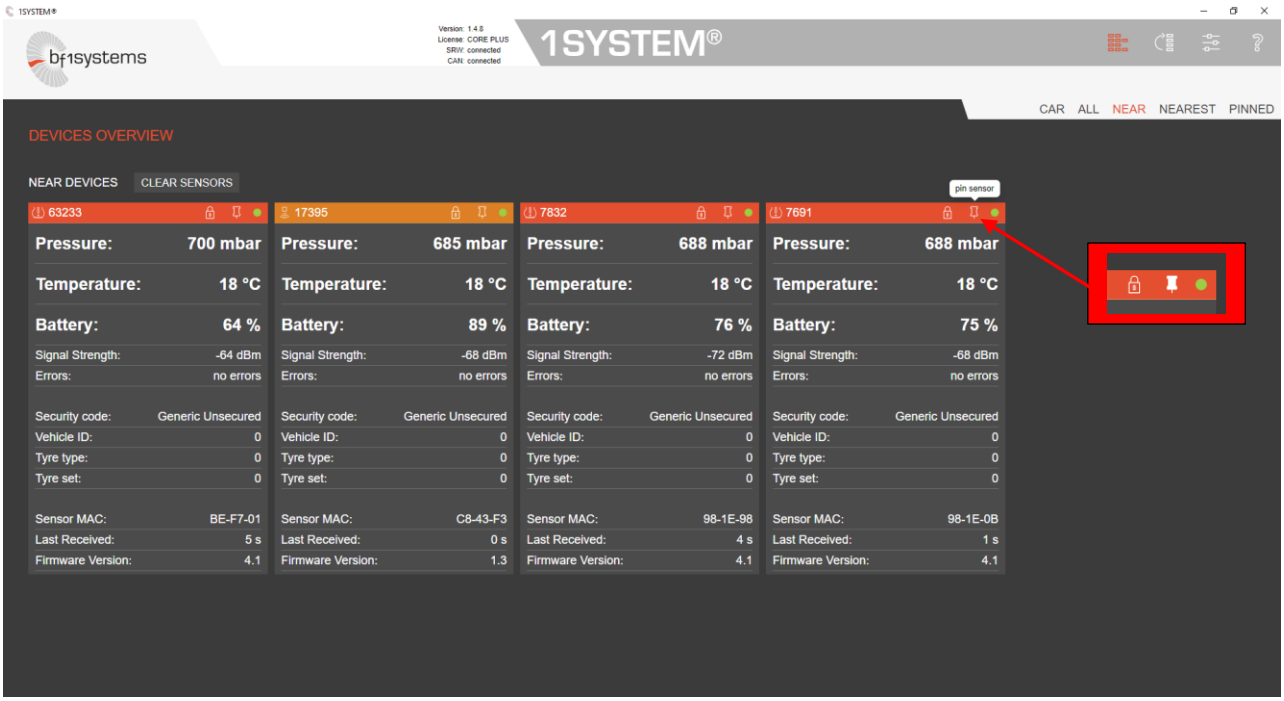


Figure 46 - Pinning a sensor

The pinned sensors can be veiwed on the Pinned page

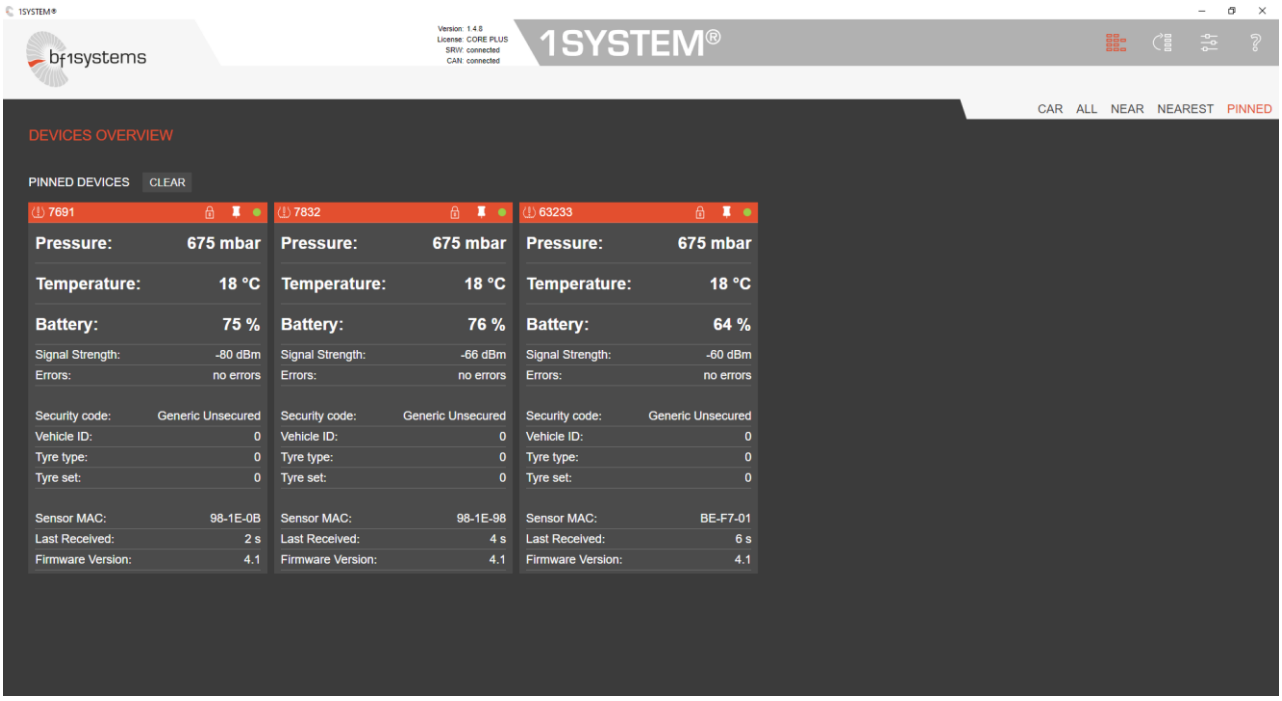


Figure 47 - Pinned sensors

To unpin the sensor, click the pin icon again.

15 IR Sensor Pixel selection

Select the sensor to be configured from the 'ALL' or 'CAR' pages, this will take you to the sensor characteristics page, Figure 48. Sensor must be pressurised to display the details.

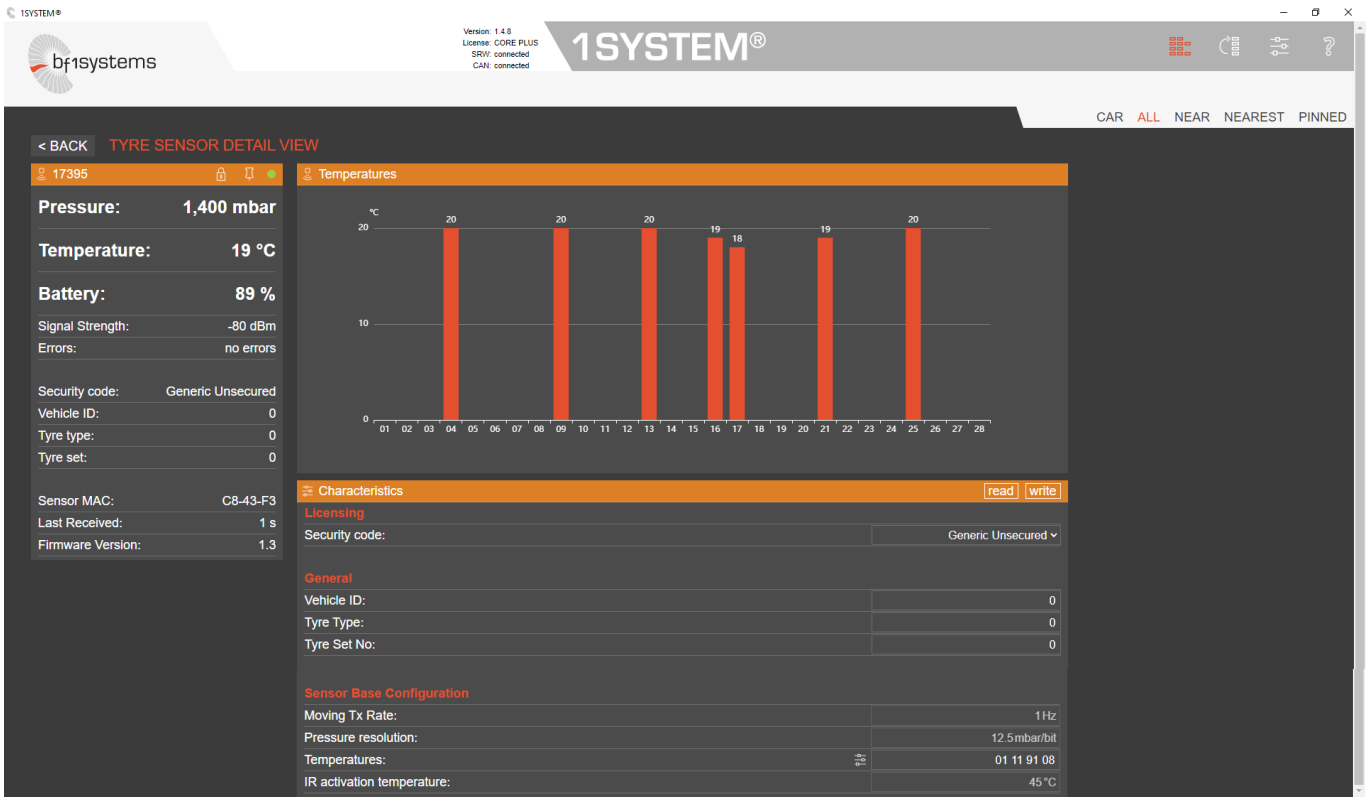


Figure 48 - IR Sensor Characteristics page

Depending on the sensor mode, the current temperatures may be shown. To show the temperatures if not present, bounce the wheel of shake the sensor if in a pressure bottle.

Select the pixel selection pop up by clicking the icon in the Temperatures row

The pixel pop up will show

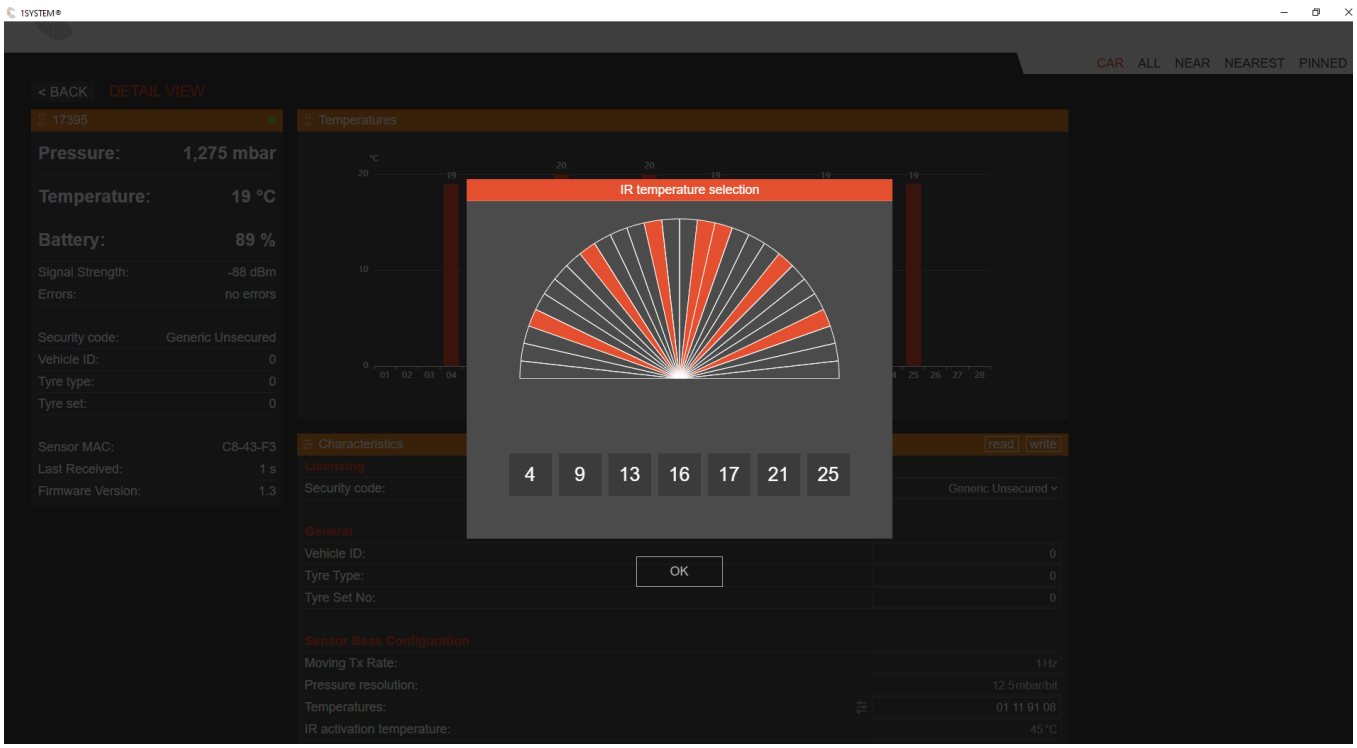


Figure 49 - Pixel selection pop up

Click and hold on the orange triangle of the pixel you wish to change and drag to the desired position.

When all pixels are in the desired positions, click ok then write to the sensor.

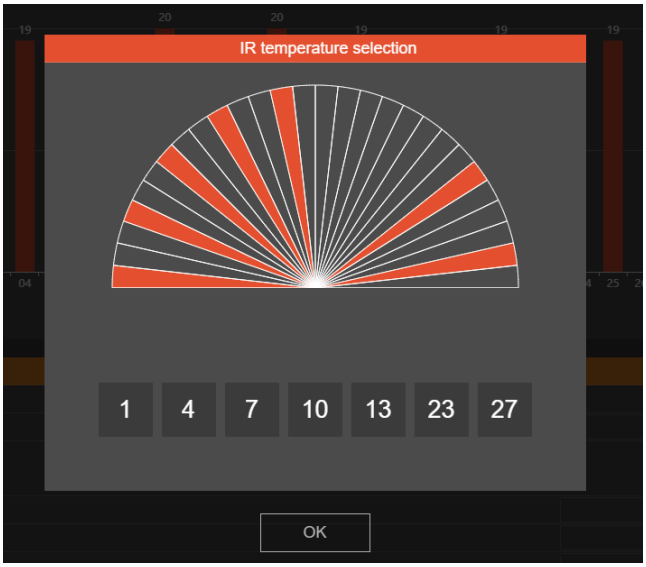


Figure 50 - Drag to change positions

NOTE: Sensors cannot be updated if their temperature reading is above 85°C

16 Confirming Acceptable Reception of Each ECU

Each ECU will receive any TPMS sensor with the correct security that is within the vicinity and has a strong enough signal to be received.

All received sensors are continuously ranked in the list of candidates based solely on their RSSI.

When the vehicle is stationary, the sensor with the strongest average signal is determined to be the closest wheel to the ECU and is set as detected (0x0) by the ECU and therefore positioned. The sensor must have been received in the past 8s, and the signal strength must be stronger than the configurable minimum signal strength (Set to -60dBm by default).

For this reason, the RSSI for the closest wheel sensor is required to be sufficiently higher than the RSSI for the other wheels on the car.

To confirm the RSSI level for each of the sensors received, the ECU transmits the signal strengths and serial numbers for each sensor in the TPMS_XX_DIAG messages (0x714, 0x715, 0x716 & 0x717).

The message is transmitted as a multiplexed message with 8 levels of MUX, each multiplex is a buffer within the ECU memory. As a sensor is received the buffers are filled from buffer 1.

A buffer that has a very weak signal or has not been updated for 8 seconds will become available again once all buffers have been used.

Signals - TPM1S_XX_DIAG_ADV_ID_X
TPM1S_XX_DIAG_ADV_RSSI_X

The signal can be checked in the logged data by checking all 8 MUX in a single graph as shown below:

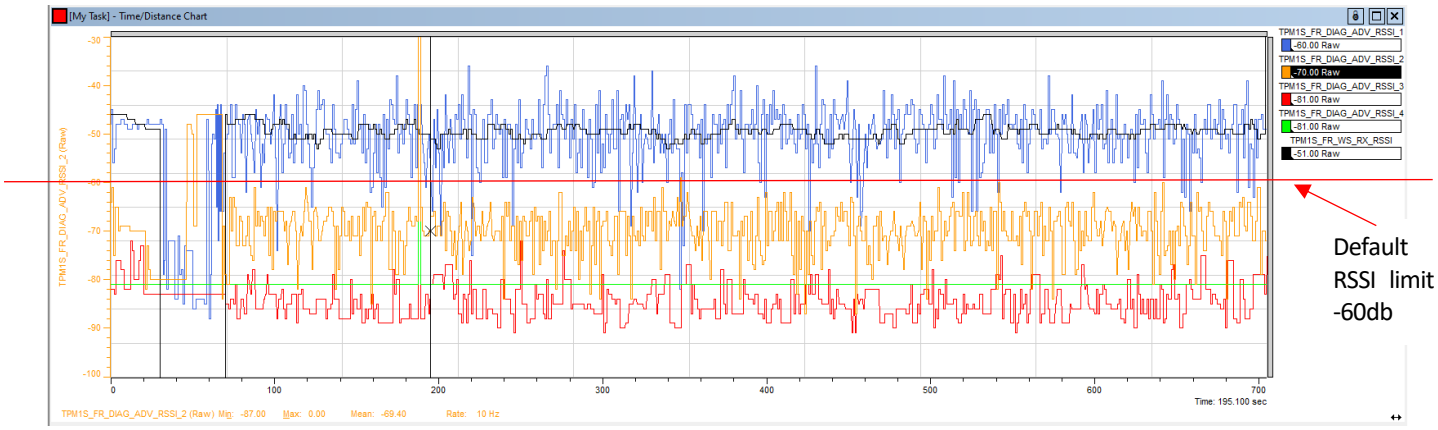


Figure 51 - RSSI of each sensor received by the ECU

Figure 51 shows the RSSI for MUX TPM1S_FR_DIAG_ADV_RSSI_1 is the strongest with the RSSI for TPM1S_FR_DIAG_ADV_RSSI_2, 3 and 4 being below the -60dBm RSSI limit cut off level within the ECU.

The graph also shows the average RSSI used by the ECU to determine the detected sensor TPM1S_FR_WS_RX_RSSI.

With the wheel closest to the ECU above the cut off level and the other 3 wheels below the cut off level, the system will detect the correct wheel for this position.

The same parameters should be checked for each of the ECUs fitted to the car.

17 1SYSTEM® ECU Wiring Schematic

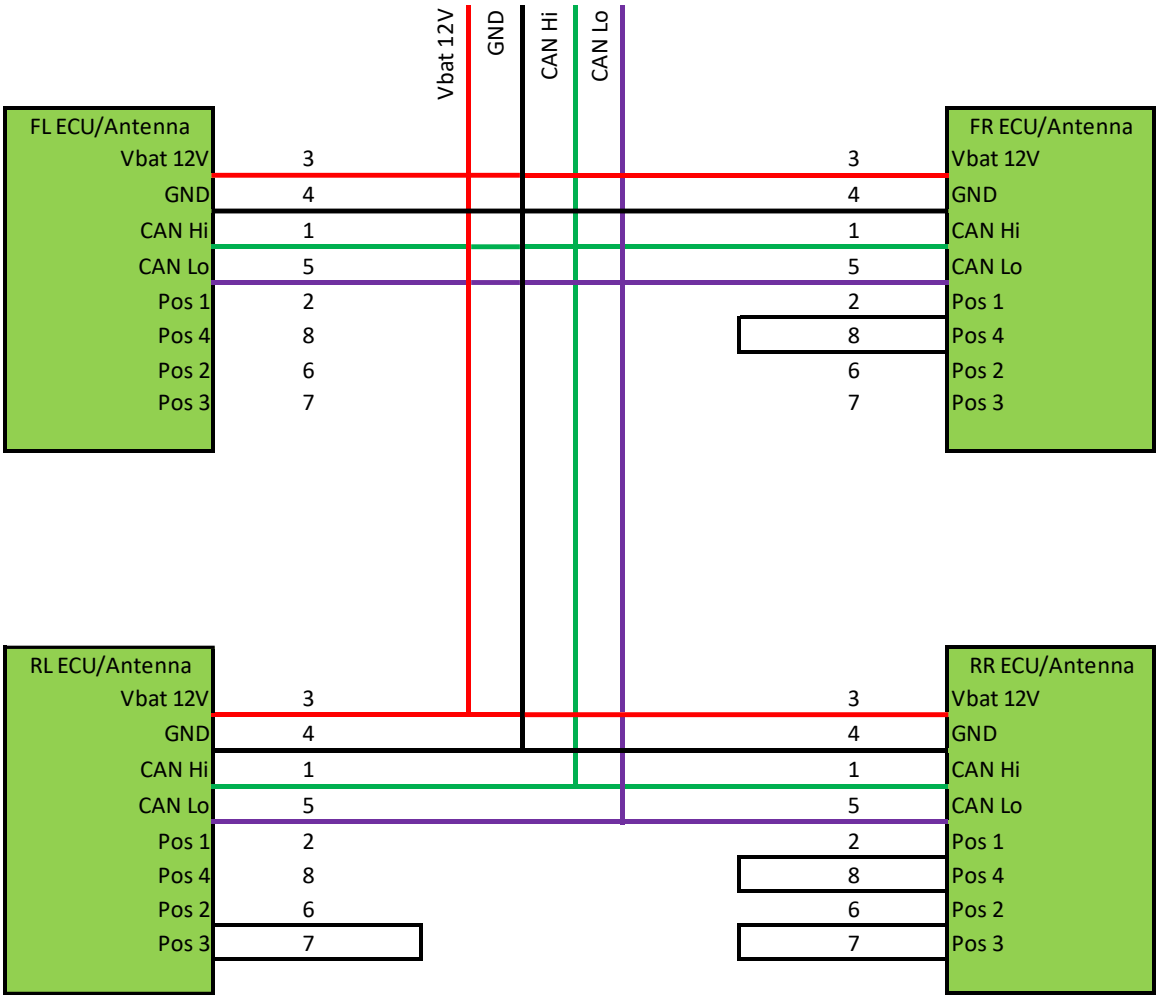


Figure 52 - Wiring schematic for Lite ECUs

18 CAN Specification

A CAN specification and dbc file will be supplied to customers of the system, if you have not received these please request by sending an email to 1system@bf1systems.com

19 System Errors and Warnings

The 1SYSTEM® TPMS transmits warnings on the CAN bus to indicate the status of the system.

CAN message	Signal name	Warning function	Range	Value description
TPM1S_FL_WS_DATA TPM1S_FR_WS_DATA TPM1S_RL_WS_DATA TPM1S_RR_WS_DATA	TPM1S_XX_WS_ACCEL_ERR	The accelerometer has a maximum g force rating, this signal indicates when the accelerometer has gone out of range. The signal can be ignored if set whilst on track but if set whilst stationary will indicate a defective accelerometer	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_BATTERY_ERR	Voltage reading fault. Sensor is unable to read the battery voltage	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_TEMP_ERR	Internal temperature reading fault. Sensor is unable to read the internal temperature	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_PRESS_ERR	Pressure reading fault. Sensor is unable to read the pressure	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_FAULT_GROUP	bf1systems sensor fault codes	0-7	0x0 No Fault 0x1 TPMS Subsystem 0x2 IR Subsystem 0x3 Core 0x4 Firmware Fault 0x5 Unknown Fault 0x6 Abnormal Reset 0x7 Reserved
	TPM1S_XX_WS_MISMATCH	If an ECU detects a sensor with the wrong security code to be the closest and is not able to detect any other sensors with the correct security code the error will be set. No other TPMS data will be transmitted for a sensor with incorrect security.	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_HIGH_TEMP_WRN	Wheel sensor ambient temperature above limit set in ECU configuration	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_UNDER_PRESS_SOFT_WRN	Pressure loss delta greater than soft warning limit	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_UNDER_PRESS_HARD_WRN	Pressure loss delta greater than hard warning limit	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_GAS_LOSS_WRN	Rapid pressure loss greater than warning limit	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_RUN_FLAT_WRN	No pressure in tyre	0-1	0x0 = False 0x1 = True
TPM1S_FL_WS_INFO TPM1S_FR_WS_INFO TPM1S_RL_WS_INFO TPM1S_RR_WS_INFO	TPM1S_XX_WS_RX_TIMEOUT	Wheel sensor not received for 6 seconds	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_BATTERY_LOW	Wheel sensor battery low voltage	0-1	0x0 = False 0x1 = True
	TPM1S_XX_WS_RBL_LOW	Wheel sensor remaining battery life equal or below limit set in ECU configuration	0-1	0x0 = False 0x1 = True

	TPM1S_XX_WS_NOT_DETECTED	No wheel sensor detected by the ECU	0-1	0x0 = Detected 0x1 = Not detected
	TPM1S_XX_WS_NOT_CONFIRMED	Wheel sensor not confirmed by the ECU	0-1	0x0 = Confirmed 0x1 = Not confirmed
TPM1S_FL_ECU_INFO TPM1S_FR_ECU_INFO TPM1S_RL_ECU_INFO TPM1S_RR_ECU_INFO	TPM1S_XX_ECU_HIGH_TEMP	ECU temperature too high	0-1	0x0 = False 0x1 = True
	TPM1S_XX_TIMESTAMP_RX_TIMEOUT	Timestamp CAN signal missing	0-1	0x0 = False 0x1 = True
	TPM1S_XX_ATM_PRESS_RX_TIMEOUT	Atmospheric pressure CAN signal missing	0-1	0x0 = False 0x1 = True
	TPM1S_XX_VEH_SPEED_RX_TIMEOUT	Speed CAN signal missing	0-1	0x0 = False 0x1 = True

20 Tyre pressure warnings

20.1 Gauge / absolute pressure (CAN signal 'TPM1S_XX_WS_PRESS')

Gauge pressure is the value read using a manometer, this is the pressure measured above atmospheric pressure.
When the ECU is supplied with atmospheric pressure, recommended by bf1systems for better accuracy, the pressure transmitted over CAN will be in Gauge. If no atmospheric pressure is transmitted to the ECU, the pressure will be transmitted as the raw absolute pressure.

P_gauge = P_abs – P_atmos

20.2 Compensated pressure (CAN signal 'TPM1S_XX_WE_P_COMP')

Compensated pressure is the value used to calculate the warnings, this is calculated using temperature compensation from the actual pressure @25°C.

P_comp = (P_abs * (273 + 25) / (273 + Temp)) – P_atmos

20.3 Reference pressure (CAN signal 'TPM1S_XX_WE_P_REF')

When automatic pressure calibration is enabled then P_ref is set equal to P_comp (note 1) after the vehicle starts moving (note 2):

P_ref = P_comp

Notes:

1. P_comp is filtered to reject short term noise for purpose of setting P_ref.
2. The vehicle must be moving faster than *Moving Speed** for *Moving Time**.

20.4 Flat tyre warning (CAN signal 'TPM1S_XX_WS_RUN_FLAT_WRN')

The flat tyre warning signal is set when:

P_gauge <= *Run Flat Pressure (gauge)**

20.5 Low pressure soft warning (CAN signal 'TPM1S_XX_WS_PRESS_SOFT_WRN')

The low-pressure soft warning signal is set when:

P_comp <= P_ref – *Low Pressure soft (delta)**

20.6 Low pressure hard warning (CAN signal 'TPM1S_XX_WS_PRESS_HARD_WRN')

The low-pressure hard warning signal is set when:

P_comp <= P_ref – *Low Pressure hard (delta)**

20.7 Rapid pressure loss warning (CAN signal 'TPM1S_XX_WS_GAS_LOSS_WRN')

The rapid gas loss warning signal is set when the tyre has lost more pressure than *Rapid Pressure Loss** during the previous 60 seconds:

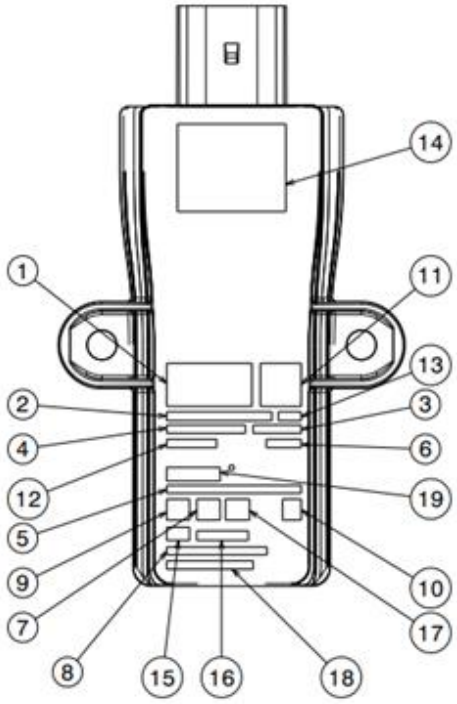
P_comp <= P_comp@t-60s – *Rapid Pressure Loss**

**Characteristics set for the ECU*

21 ECU product markings

21.1 Lite ECU

The ECU Antenna is laser marked to show the information detailed below:



	Description	Marking Detail
1	Manufacturer Logo	Symbol
2	Device Designation	1SYSTEM ECU Lite
3	Model Number	BF24G1EC
4	Part Number	F1-100-1799-002
5	MAC Address	XX:XX:XX:XX:XX:XX
6	Production Date	DD/MM/YYYY
7	Type Approval Symbol FCC	Symbol
8	Type Approval ID FCC	FCC USX-BF24G1EC
9	Type Approval Symbol CE	Symbol
10	WEEE Symbol	Symbol
11	MAC Address Data Matrix	2D Barcode (type ECC200)
12	Country of Origin	Made in UK
13	IP rating	IP6K7
14	Customer Information	If Applicable - Label for Customer
15	Type approval symbol Giteki (MIC-R)	Symbol
16	Type approval ID Giteki (MIC-R)	205-21076
17	Type Approval Symbol UKCA	Symbol
18	Type Approval ID IC	IC 11262A-BF24G1EC
19	Serial No.	XXXXXX

Note: bf1systems Ltd reserve the right to edit/amend/change the product markings and any marking positions on the product without notice

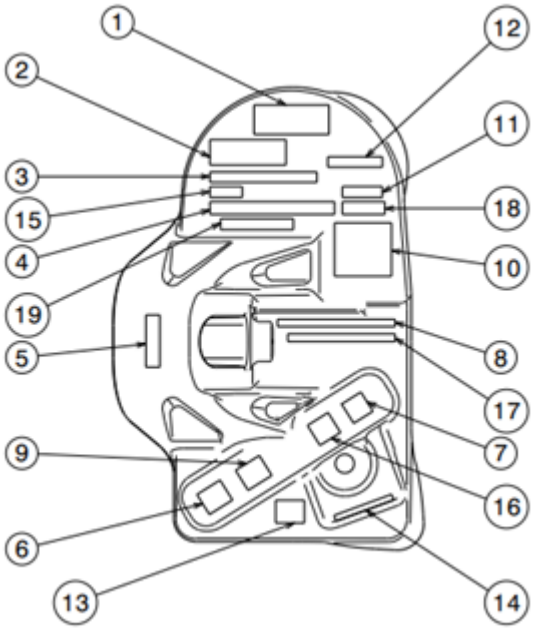
21.2 Pro ECU

TBD

22 Wheel sensor product markings

22.1 TPMS sensor

The Wheel Sensor is laser marked to show the information detailed below.



	Description	Marking Detail
1	Manufacturer Logo	Symbol
2	Device Designation	1SYSTEM TPMS Wheel Sensor Lite
3	Part Number	F1-100-1800-002
4	MAC Address	XX:XX:XX:XX:XX:XX
5	Torque Setting	4.5Nm
6	Type Approval Symbol CE	Symbol
7	WEEE Symbol	Symbol
8	Type Approval ID FCC	FCC USX-TP24G1WE
9	Type Approval Symbol FCC	Symbol
10	MAC Address Data Matrix	2D Barcode (type ECC200)
11	Production Date	DD/MM/YY
12	Model Number	TP24G1WE
13	Type approval symbol Giteki (MIC-R)	Symbol
14	Type approval ID Giteki (MIC-R)	205-21077
15	Country of Origin	Made in UK
16	Type Approval Symbol UKCA	Symbol
17	Type Approval ID IC	11262A-TP24G1WE
18	Sensor Validation Code (SVC)	XXX
18	Serial No.	XXXXXX

Note: bf1systems Ltd reserve the right to edit/amend/change the product markings and any marking positions on the product without notice

22.2 IRTPMS Sensor

TBD

23 Valve and Sensor Fitting Instructions

The valve fitting instructions cover a different range of sensors. Please use the table below to identify the sensor you have as recommended torque settings and wheel sensor screw kits vary depending on the sensor type and/or sensor serial no. Screw kits are supplied as part of the valve kits but can be purchased separately.

Sensor type Part # F1-XXX-		TPMS sensor 			
Installation part	Part no.	Qty req'd per wheel/sensor	Wheel sensor screw torque	Wheel sensor screw Loctite	Wheel valve Hex nut torque
Sensor screw kit	F1-70-6934-B	1	4.5Nm (Torx head)	Screw pre-impregnated	6Nm

Sensor type Part # F1-XXX-		IRTPTMS sensor 			
Installation part	Part no.	Qty req'd per wheel/sensor	Wheel sensor screw torque	Wheel sensor screw Loctite	Wheel valve Hex nut torque
Sensor screw (High strength) kit	F1-02-7561-A	1	7.0 Nm (Hex head)	Use Loctite 242 (Loctite not supplied)	6Nm

Table 9: Sensor installation torques

For ease and to speed up the identifying of wheel sensors once they are installed in the wheel assemblies, we recommend that a sticker is placed on each rim with the serial number of the sensor fitted to the rim. Typically these numbers are placed on the rim in the immediate vicinity of the valve.

The serial numbers for each sensor type are shown in Figure 53 and Figure 54, highlighted in yellow.

Figure 53 - 1SYSTEM® TPMS Wheel Sensor Serial Number

Figure 54 - 1SYSTEM® IRTPTMS Wheel Sensor Serial Number

23.1 Tools Required

The tools required to install the valve are:

- Torque Wrench (With capability to be set to 6Nm and 7Nm)
- 11mm Deep socket
- 4mm hex drive bit

Figure 55 - Torque wrench

23.2 Valve Kit Parts

The valve kit consists of the following:

1. Valve caps
2. Hex nut
3. Washer
4. Valve stem (the stem will have the core and seal fitted when new)
5. Torque bar

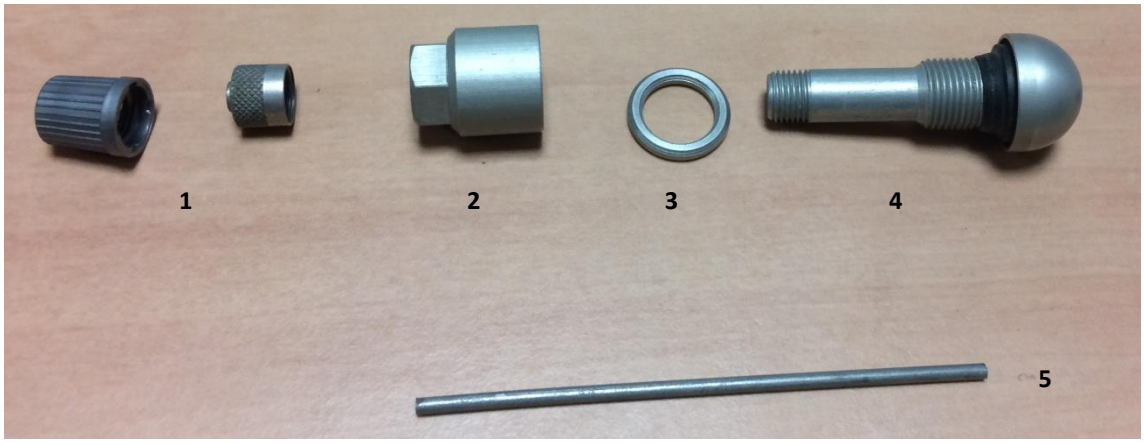


Figure 56 - Valve kit

The TPMS sensor uses the standard bolt.
The IRTPMS sensor uses the High Strength bolt, see 23.4

NOTE: Valve kits may vary depending on rim design, for fitting alternative valves please contact bf1systems

23.3 Valve Installation

If fitted, remove the existing valve from the rim.

Check there are no sharp edges on the valve mating surfaces that could cause damage to the seal and the spot face is clean.

Figure 57 - Valve mounting face

Insert the valve stem through the rim from the internal face, the small torque bar hole in the valve stem dome should be pointing up out from the rim.

Figure 58 - Valve fitted to rim

Fit the washer and the hex nut to the stem, place the torque bar in the stem dome hole then whilst holding the torque bar to stop the stem rotating, tighten the hex nut to **6Nm (this torque must not be exceeded).**

Figure 59 - Valve torque bar

Fit the desired valve cap

Figure 60 - Valve cap options

23.4 Fitting the 1SYSTEM® IR Using the High Strength Bolt Kit

Sensor assembly consists of the following parts:

1. IRTPMS Wheel sensor
2. Load spreading washer
3. Lock washer
4. bf1systems hex bolt
5. Loctite 243

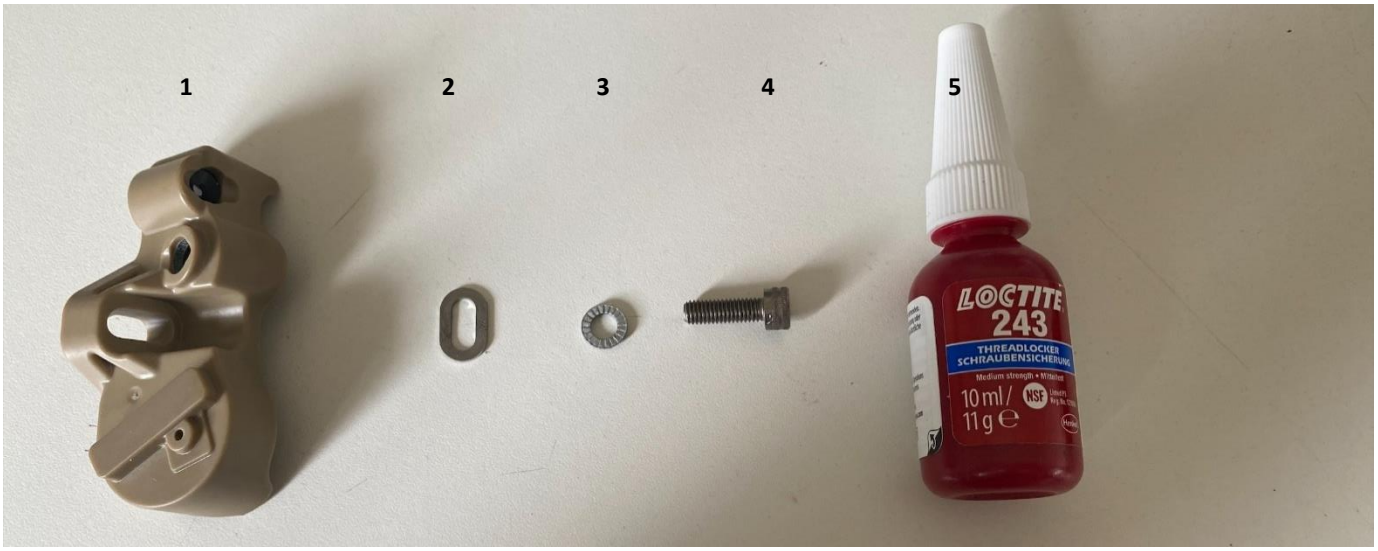


Figure 61 - High strength screw kit

Place the locking washer and the load speeding washer on the bolt and apply Loctite to the thread.

Figure 62 - Assembled screw with Loctite

Place the sensor on the dome of the valve and screw in the high strength bolt assembly.

Ensure the feet of the sensor are touching the rim and no other part of the sensor housing is touching the rim.

Figure 63 - IR sensor mounted on rim

Torque the bolt to **7Nm.**

Figure 64 - Torque to 7Nm

23.5 Notes

DO NOT ROTATE THE VALVE BODY, OR TWIST THE SENSOR ONCE THE VALVE ASSEMBLY HAS BEEN INSTALLED, THIS WILL CAUSE THE VALVE TO LOOSEN AND THE VALVE NUT WILL THEN REQUIRE RE-TORQUING.

THE TORQUE SETTING FOR THE HEX SCREW IS DESIGNED TO SLIGHTLY DEFORM THE SENSOR'S HOUSING, TO ENSURE THAT IT IS FITTED WITH MAXIMUM SECURITY.

THE SENSORS ARE NOT DESIGNED TO BE REPEATEDLY REMOVED FROM THE WHEEL; THEY SHOULD BE FITTED TO RIMS AND LEFT IN SITU FOR AS LONG AS POSSIBLE – i.e. THE LIFE OF THE RIM/SENSOR. PLEASE DO NOT REMOVE SENSORS UNECESSARILY.

IF A SENSOR IS REMOVED FROM A RIM IT IS ESSENTIAL THAT IT IS FITTED TO THE SAME RIM TYPE AS BEFORE, I.E. DO NOT INTERCHANGE FRONT SENSORS WITH REAR SENSORS.

HEX BOLTS: IF A NEW BOLT IS FITTED OR THE OLD BOLT IS RE-USED THEN IT IS ESSENTIAL THAT THE BOLT IS CLEANED AND LOCTITE 243 IS APPLIED PRIOR TO INSTALLATION.

24 Recommended Procedures and Maintenance

24.1 Preserving Wheel Sensor Battery Life

It is always recommended that the air is released from the wheel assembly after each race weekend.

The wheel sensor enters a sleep state when the pressure is below 0.115 bar, and this state reduces the drain on the battery by increasing the time between monitoring for pressure changes and disabling other functions that are not needed in this state.

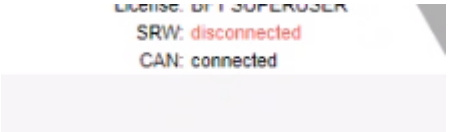
Wheel sensors that are stored in a pressurised wheel will be regularly checking for changes in pressure, will continuously be checking for ECU connections and will start to transmit if subjected to a shock hard enough to set the accelerometer to its moving state, all of which will use up the battery faster than if the sensor was in an unpressurised state.

24.2 Wheel Cleaning

Do not wash the wheel with the sensor fitted, doing so could damage the internal pressure/temperature sensor and leave dirt or marks on the lens of the IR element resulting in an offset in the IR temperature reading.

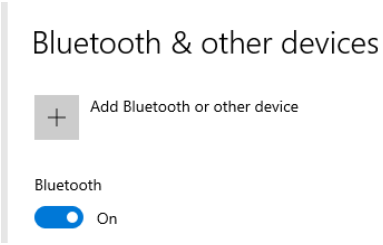
24.3 SRW (Short Range Wireless) not connecting

If your SRW connection shows continuously as ‘connecting’ or as ‘disconnected’ you will not be able to receive the wheel sensors.



Check the bluetooth of the PC is switch on:

Start-Settings-Devices-Bluetooth & other devices



If the Bluetooth is switched on, switch off then back on

24.4 Sensor fails configuration update

Sensor no longer within the Bluetooth range

Sensor is being moved/shocked into moving mode

Sensor is above 85°C