



MXL2 Dash Logger

USER GUIDE

1.02



MXL2 Dash Logger

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Thanks.

Dear Customer,

First, we would like to thank you for choosing the MXL2 dash logger as the tool for improving your racing craft setup and on-track performances.

The MXL2, with its high contrast display, advanced expansions and sampling capabilities, gives you the flexibility for reviewing your data in your preferred way and recording them from a variety of sensors and sources.

Please, before digging into your new data system, keep in mind that we are constantly working on bettering our software and firmware.

So, be sure to check our website periodically for any updates.

www.aim-sportline.com



What is MXL2?

MXL2 is a color, high-contrast brilliant traditional LCD dash logger developed for race car installations. It is fully customer configurable.

Which data does it manage?

Data come from a wide range of sources, including your vehicle ECU, the internal accelerometers and gyro, the GPS module included in the kit, the analog/digital inputs, the external expansions as well as predefined math channels.

How many pages does it show?

You can define up to eight different fully customizable pages.

Is it possible to configure the pages?

You can choose among a wide library of page styles, defining the data to be shown. Also end of scales and units of measure can be easily configured, using the Race Studio 3 software, included in the kit.

How do alarm LEDs work?

You can configure alarm LEDs choosing color, blinking frequency and defining the logic for turning them on or off.

What is it possible with WiFi?

You can use a WiFi connection for transmitting the data of your test, sending data online and for configuring the system.

Are the data recorded by MXL2 compatible with the old MXL/EVO4 data?

Yes, MXL is used to produce data in .DRK format. MXL2 offers an improved data management and produces .XRK format that only RaceStudio3 can read.

Nevertheless, the last releases of RaceStudio2 can detect .XRK files and transform them into old .DRK files that are compatible with MXL1 and EVO4 files.

What is the difference between the old .DRK format and new .XRK?

.XRK, taking advantage of GPS technology, associates absolute time and GPS position to each data with the precision of 1 millisecond. In this way, it is possible to better compare different laps and tests.

What about Race Studio 3? What are the differences between the old .DRK format and new .XRK?

Race Studio 3 is the new software for managing configuration, data download and data analysis for all the future AiM systems.

It is going to substitute Race Studio 2, which has accompanied us for almost 15 years.

Based on a totally new and much more flexible architecture, it is a work in progress as some features are continuously improved.

We are going to upgrade it very often,

so, please, don't forget to check our web site at www.aim-sportline.com.



2. What is in the kit

The MXL2 kit includes:

MXL2 dash logger



Harness



GPS08 Module



Software

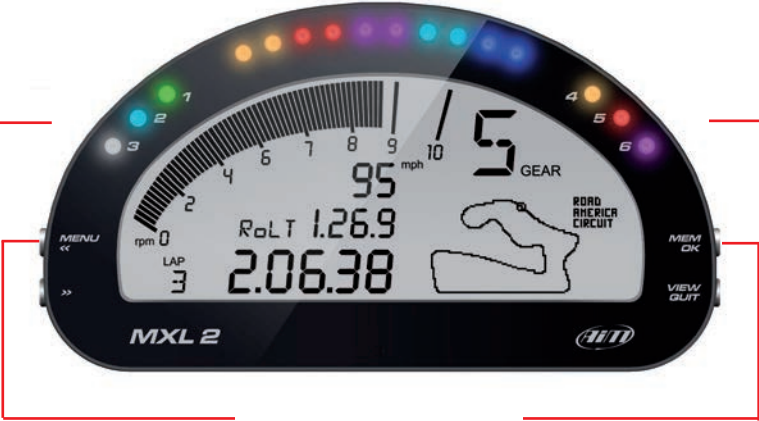


MXL2 Dash Logger

Configurable Alarm LEDs 1-3

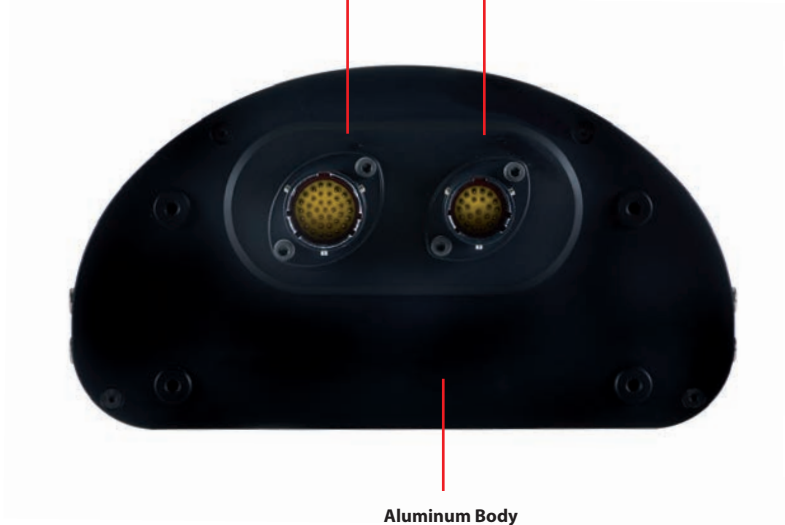
Shift Lights

Configurable Alarm LEDs 4-6



Multifunction Pushbuttons

Motorsport Connectors



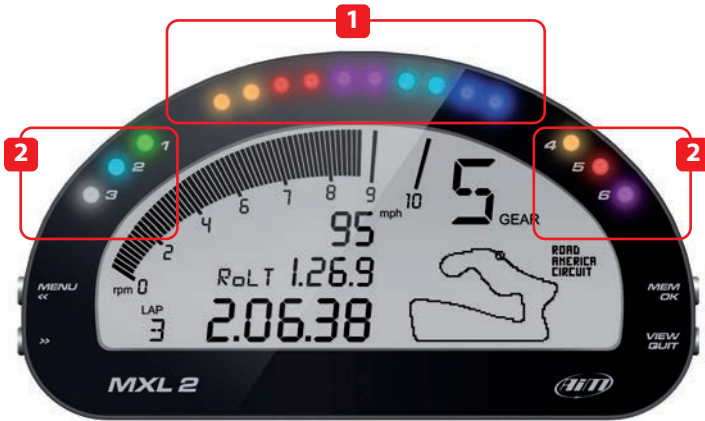
Aluminum Body

4. Gear Flashes and Alarm LEDs

1

The system features 10 RGB gear flash LEDs that can be freely configured in a very flexible way. For each LED, you can define the

RPM value that turns it on and the colour. You can also define different RPM values of each gear number.



2

The system has 6 different alarm LEDs too, that you can configure in order to turn them on or off depending on the value of the analog or digital inputs, ECU values, expansion values, GPS information or math channels.

You can associate an alarm LED, a message and a digital output with each event.

You can configure them in order to be turned off when the condition disappears, when you push a pushbutton, when the test is finished or when the data are downloaded after the test.

Please refer to the related paragraph in order to see how to manage gear flashes and alarm LEDs.

5. ECU connection

The system can acquire data from the ECU of your vehicle. The list of the available ECU protocols is published on our site: [www.aim-sportline.com/download area](http://www.aim-sportline.com/download_area), ECU connections.

This list includes more than 1000 different protocols and is constantly updated with new protocols.

When possible documents explaining how to configure your ECU to ensure compatibility between the data flow transmitted are available, too.

From an hardware point of view, the system is compatible with all currently available connections: CAN, RS232 or K Line.

The steps to manage the data coming from the ECU are the following:

1. Determine which hardware connection is available for your ECU.
2. Read the documentation about your ECU at www.aim-sportline.com and identify the name of the proper software driver to be specified.
3. Using Race Studio 3, configure the system setting your ECU driver with the menu shown here below, that appears when you create a new configuration.



The ECU has to be set when configuring your system with RS3 configuration software. The steps are explained in the related section.

6. RPM

The system can receive the RPM signal from three different sources:

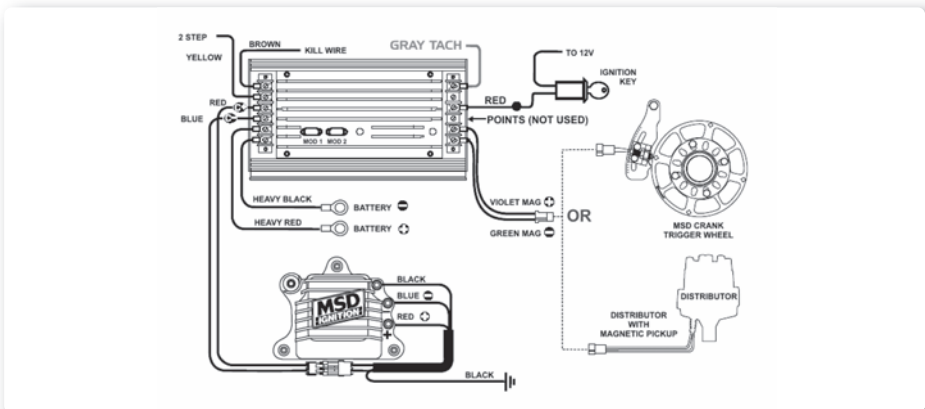
- from ECU
- through a square wave signal (8 to 50 V)
- from the low voltage (from 150 to 400 V) of the coil

6.1 RPM from ECU

To get RPM from the ECU, please configure your device and enable RPM channel. RPM is one of the many data flowing from your ECU.

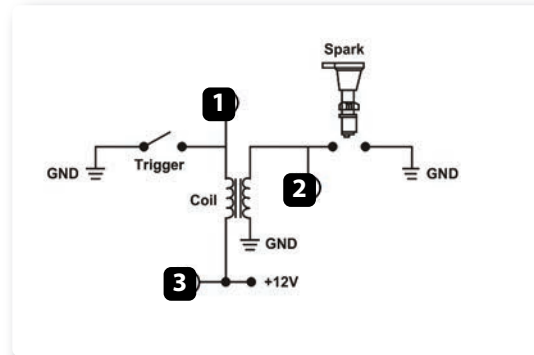
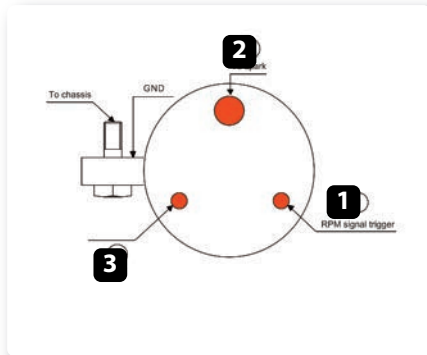
6.2 RPM via a 5-50 V square wave signal or coil (150-400 V)

In case your engine is not managed by any ECU, the device can read the signal from the low voltage of the coil (whose peak can be from 150 to 400V) or from a possible square wave (the peak can be from 5 to 50V). The pin labelled **"RPM"** reported in appendix **"Pinout"** receives the signal:



The image shows an example of wiring for the ignition system.

The output, labelled **"GRAY TACH"** gives a 5-50V output that can be directly acquired. If the output is not available from the ignition system, the system has to be connected to the low voltage of the coil, as shown in the following schematic.



Point 1: low voltage of the coil

Point 2: connected to the spark plug

Point 3: connected to the +12V of the battery

After connecting the RPM signal, please use the software Race Studio 3 for enabling the RPM channel.

7. Speed

The system can receive the speed signal from three different sources:

- from the ECU
- from the GPS receiver included in the kit
- from the wheel sensors (digital channels)

It is therefore possible to receive and store different values of speed at the same time; the more powerful ECUs transmit up to four wheel speed values.

7.1 Speed read from the ECU

If your ECU sends the value of speed in its data stream, it is obviously possible to read, record and show that value.

Simply enable it using RaceStudio3 software when setting the channels.

7.2 Speed read from the GPS receiver

The GPS receiver you find in the kit is configured in order to obtain the best performance in term of reactivity and accuracy.

For getting GPS speed you don't need any configuration.

Simply connect the GPS08 Module to your system and after a setup period of some seconds the data will be received and automatically recorded.

7.3 Speed read from wheel sensors

MXL2 has four wheel speed inputs, one in the 37 pins connector and the other three in the 22 pins connector.

The digital sensor X02SNVM00 detects the presence of a metallic tooth placed at a distance between 0.5 and 2 mm.



ID	<input checked="" type="checkbox"/>	Name	Function
RPM	<input checked="" type="checkbox"/>	RPM	RPM
Spd	<input type="checkbox"/>	Speed	Vehicle Spd

Please use the software RaceStudio3 to load the sensor in the system configuration.

Just enter the program configuration panel and, after enabling the desired speed channels, set the wheel circumference and the number of pulses per revolution.

8. Analog inputs

MXL2 has 8 analog inputs, recorded up to 1000 times per second each. You can connect:

- 0-5 Volt signals
- ratiometric potentiometers
- pressure sensors
- thermo-resistances
- K-type thermocouples

Please follow these steps, using the software RaceStudio3 to set the channels:

- connect the sensor to the desired input
- enable the channel in the Channels table
- select the proper sensor type; sensors of many different types are properly handled
- set the sampling frequency
- set the unit of measure.

The screenshot shows the RaceStudio3 3.01.14 interface. The 'Channels' tab is active, displaying a table of configured channels for the MXL2 01 device. The table has columns for Id, Name, Function, Sensor, Unit, Freq, and Parameters. All channels are checked in the 'Name' column.

Id	Name	Function	Sensor	Unit	Freq	Parameters
RPM	<input checked="" type="checkbox"/> RPM	RPM	RPM Sensor	rpm	20 Hz	max: 10000; factor: 1;
Spd1	<input checked="" type="checkbox"/> Speed1	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1666; pulses: 1;
Spd2	<input checked="" type="checkbox"/> Speed2	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1666; pulses: 1;
Spd3	<input checked="" type="checkbox"/> Speed3	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1666; pulses: 1;
Spd4	<input checked="" type="checkbox"/> Speed4	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1666; pulses: 1;
Ch01	<input checked="" type="checkbox"/> Channel01	Voltage	Generic 0-5 V	mV	20 Hz	
Ch02	<input checked="" type="checkbox"/> Channel02	Voltage	Generic 0-5 V	mV	20 Hz	
Ch03	<input checked="" type="checkbox"/> Channel03	Voltage	Generic 0-5 V	mV	20 Hz	
Ch04	<input checked="" type="checkbox"/> Channel04	Voltage	Generic 0-5 V	mV	20 Hz	
Ch05	<input checked="" type="checkbox"/> Channel05	Voltage	Generic 0-5 V	mV	20 Hz	
Ch06	<input checked="" type="checkbox"/> Channel06	Voltage	Generic 0-5 V	mV	20 Hz	
Ch07	<input checked="" type="checkbox"/> Channel07	Voltage	Generic 0-5 V	mV	20 Hz	
Ch08	<input checked="" type="checkbox"/> Channel08	Voltage	Generic 0-5 V	mV	20 Hz	
AccX	<input checked="" type="checkbox"/> AccelerometerX	Inline Accel	AIM Internal Accelerometer	g 0.01	20 Hz	
AccY	<input checked="" type="checkbox"/> AccelerometerY	Lateral Accel	AIM Internal Accelerometer	g 0.01	20 Hz	
AccZ	<input checked="" type="checkbox"/> AccelerometerZ	Vertical Accel	AIM Internal Accelerometer	g 0.01	20 Hz	
GyroX	<input checked="" type="checkbox"/> GyroX	Ang Velocity	AIM Internal Gyro	deg/s	20 Hz	
GyroY	<input checked="" type="checkbox"/> GyroY	Ang Velocity	AIM Internal Gyro	deg/s	20 Hz	
GyroZ	<input checked="" type="checkbox"/> GyroZ	Ang Velocity	AIM Internal Gyro	deg/s	20 Hz	

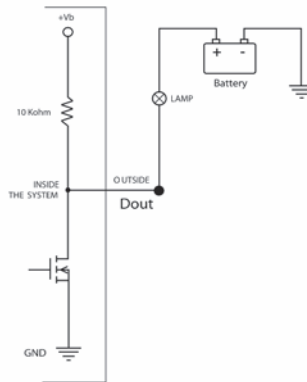
9. Digital outputs

The system features two digital inputs on the 22 pins connector. Each of them can give an output of 1 amp at 12 volts.

The digital output (Dout) is a LOW-SIDE type with internal 10 Kohm weak pull-up resistor.

Here below are some connecting examples.

Connecting examples



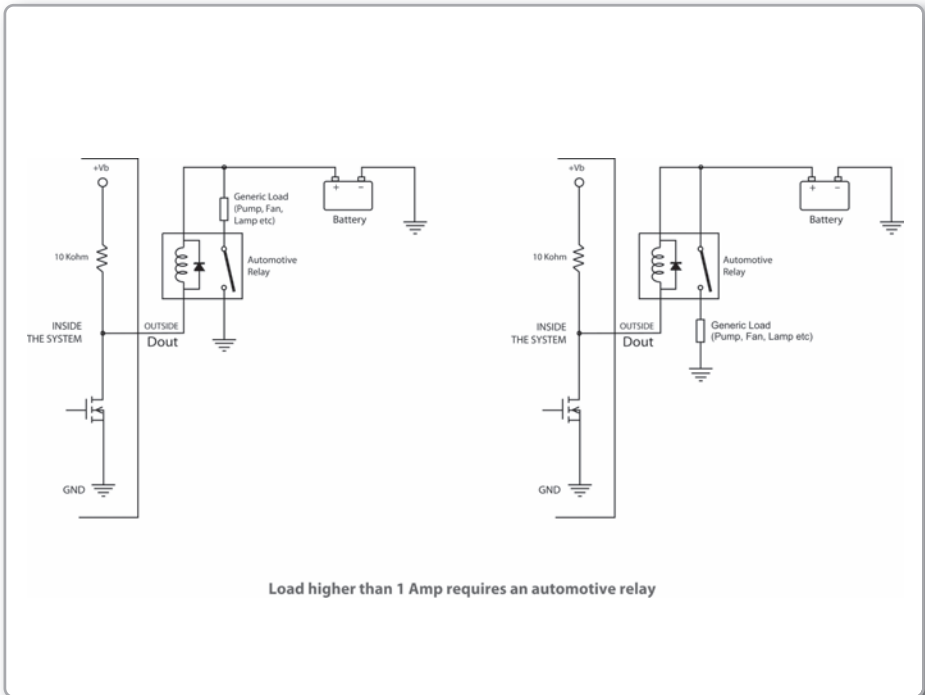
Load up to 1 Amp
Directly managed by the system digital output

You can configure them in order to turn them on or off depending on the value of the analog or digital inputs, ECU values, expansions values, GPS information or math channels.

To each event you can associate an alarm LED, a message and a digital output.

You can configure it in order to turn them off when the condition disappears, when you turn the system off, when you push a pushbutton or when the data are downloaded.

Please refer to the related section in order to see how to use RaceStudio3 to manage the Output Signals.



10. WiFi Configuration

WiFi connectivity is set on AUTO by default. This means that if the vehicle is stopped WiFi is on and goes OFF as the vehicle speed increases. Your system can be configured for WiFi communication in one of two ways.

1) As an Access Point (AP)

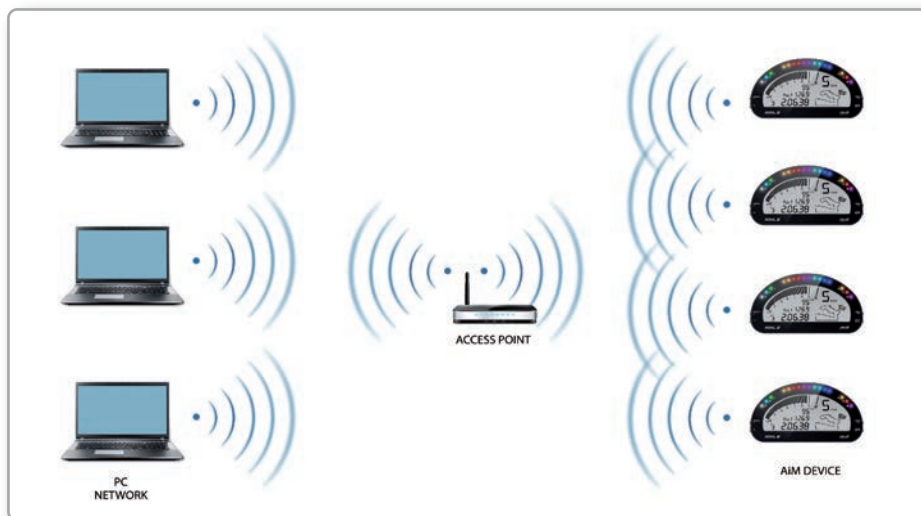


This is ideal when you have one device and one computer. In this configuration your AiM device creates its own WiFi network, which acts as an AP to which you can connect your PC.

2) To join an existing Wireless Local Area Network (WLAN)

This is more complex and requires an external AP but is more flexible and powerful. In this way you can communicate with more than one PC on the same network.

In this configuration both your device and your PC have to join a pre-existing WiFi network, called WLAN, in order to communicate with one another. The network is now created by a network device, which is acting as an external AP by permitting the device connectivity.



In WLAN mode there are two layers of security available:

- network authentication: the network password
- device authentication: a unique device password

Using both network and device authentication allows for various security strategies where multiple people, PCs and AiM devices are involved. For example a PC on a WLAN may see several AiM devices but can only communicate with AiM devices for which it has the password.

10.1 Configuring your device as an AP

Follow these steps to create an AP, allowing you to connect your PC to the device via WiFi.

This is the most simple and direct WiFi connection method and is ideal when you wish to communicate with only one device using one PC.

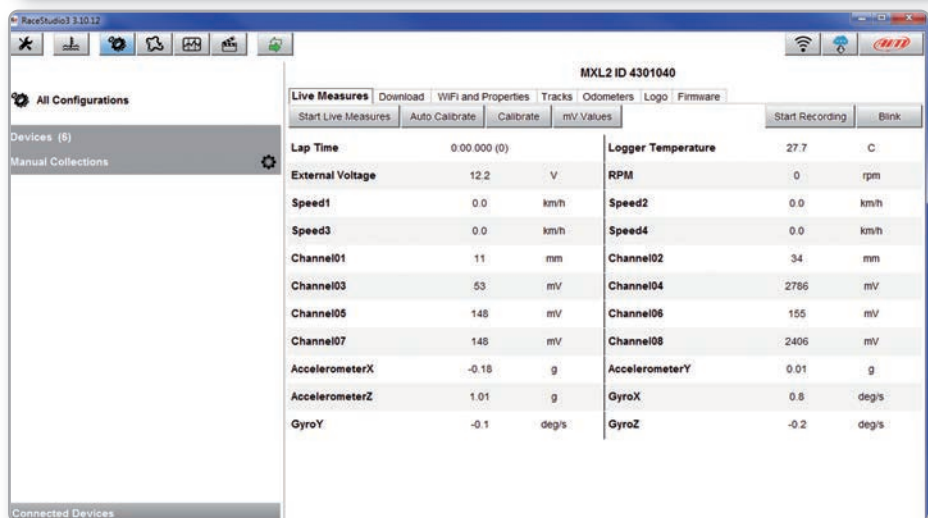
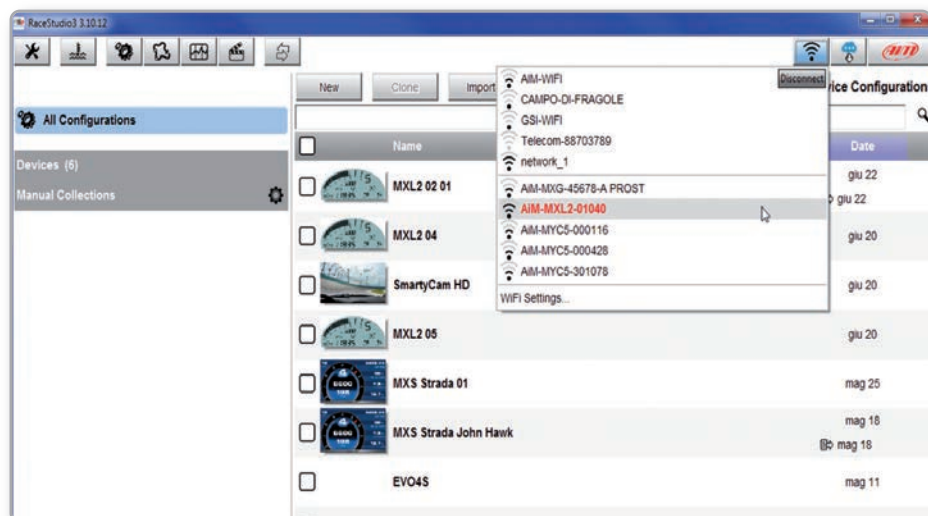
By default AiM system is configured as an Access Point and creates a network without a password completely accessible to everyone.



So, for establishing the WiFi connection:

- be sure your AiM system has the WiFi enabled.
- read its name in the lower part of the Live Measures page.
- click the WiFi icon of RaceStudio3 and select your AiM system.

In a few seconds the communication will be established.



For setting other parameters it is therefore recommended that you create a unique password to secure your device/network immediately. With the use of a password, the communication is secure and encrypted using the WPA2-PSK standard.

The name of this AP, or SSID, is unique to your device. An example is: **"AiM-MXL2-01040"** whereas:

- "AiM" is the prefix for all AiM devices
- "MXL2" is type of system identifier
- "01040" is a unique serial number for your device assigned at the factory.

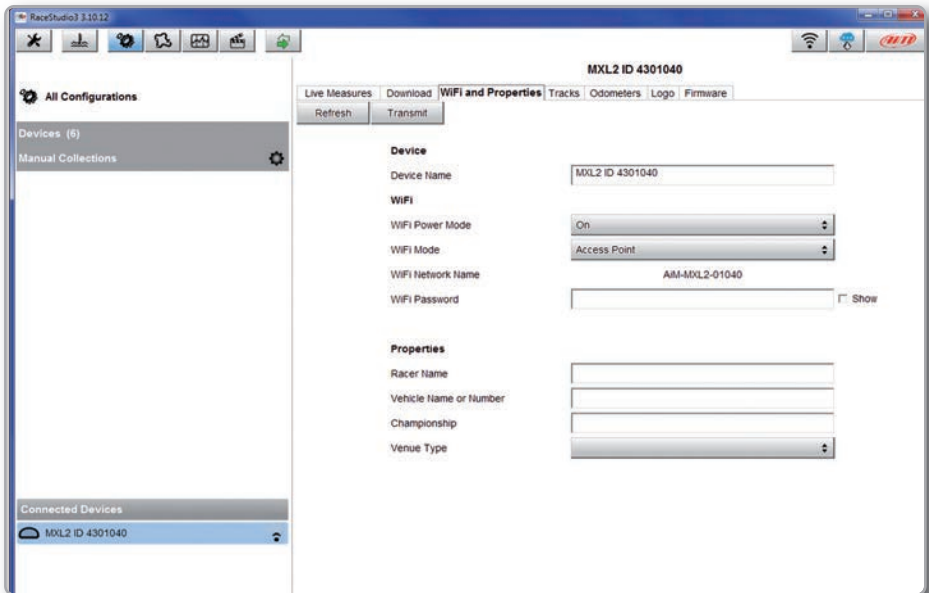
To make your device more recognizable you can append a friendly name to the SSID. There is a limit of eight characters.

For example if you add the driver's name, Tom Wolf, the resulting network name (SSID) will be:

"AiM-MXL2-01040-TomWolf".

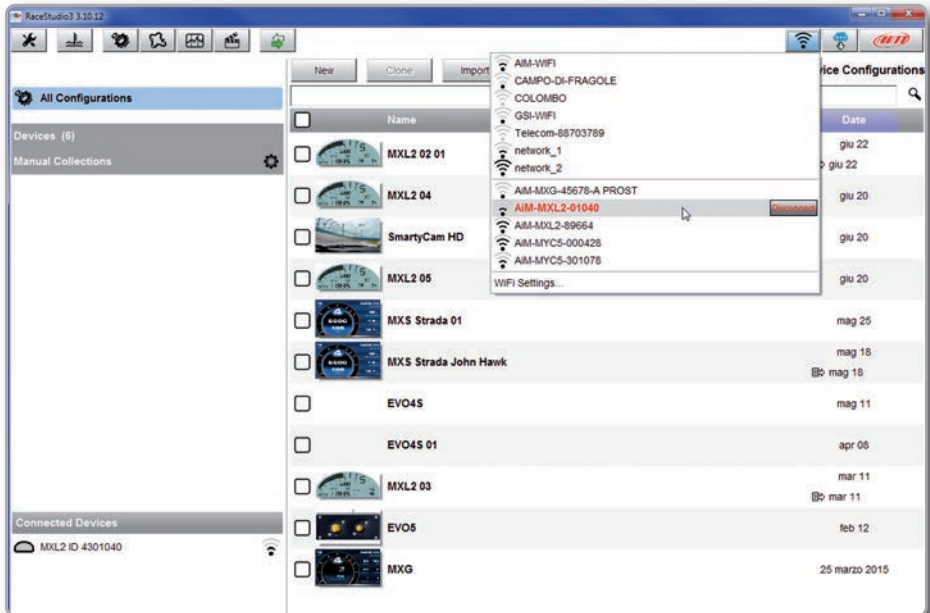
After having set all the parameters click "Transmit" button. WiFi communication only will be restarted with the new parameters.

To connect your device simply choose it from the list of available WiFi connections. If your device is protected by a password, as recommended, RaceStudio3 will then require that password to authenticate.



Please note that it is also possible to make the same WiFi connection using the WiFi tools of your operating system.

Once the WiFi authentication with the device has been established, users can interact with the device clicking on it.



10.2 Joining Your AiM system to an existing network

In this scenario, both your AiM system and the PC join an existing WiFi network (WLAN).

This scenario is ideal for a race team with multiple drivers and crewmembers that communicate with one or more AiM devices using the same PC network.

Note again that each AiM system can have a unique password, which is in addition to the network password, thus adding an additional layer of privacy and security.

RaceStudio3 will display all devices connected to the same network.

Connected devices can be seen under the "Connected Devices" header, just as if they were connected via USB: simply click on your device in the left panel under Connected Devices.

Go to the WiFi configuration tab and set the mode to Existing Network. Then, enter the network password and the device password, should you choose to add one, in the appropriate fields.

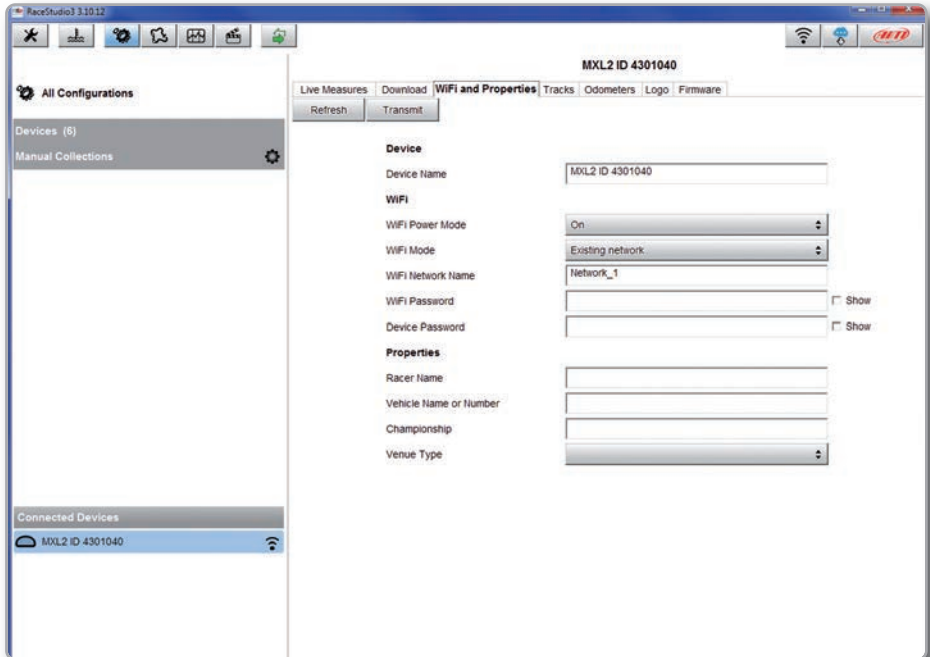
To commit the network settings to your device, click "Restart" button on this same tab. Your device will restart and join the network you specified.

Connect your PC to the same network and you will see your device under Connected Devices, just as if connected via USB.

If the AiM device is connected to your PC using a WLAN, it is possible to have two different passwords: the device password and the network password.

Please note that only passwords following the WPA2-PSK code are admitted.

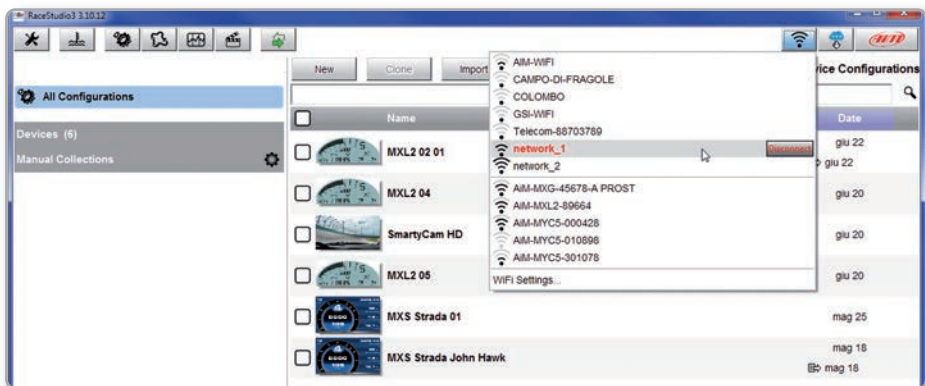
In order to accomplish these tasks, Race Studio 3 has to be used as clarified in the following figure.



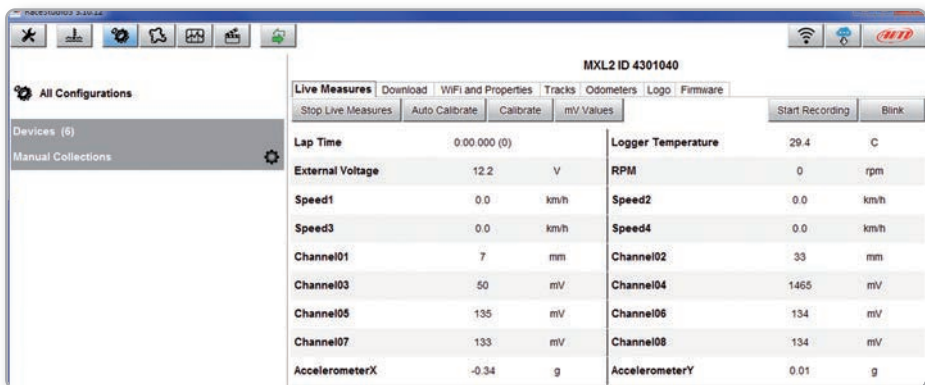
As you can see in the picture above, one device called "MXL2 ID 5000999" is switched from AP mode to WLAN mode.

The network name is "network_1" and it is not working in open authentication mode since it is protected by a network password.

In order to get the connectivity to the device, the user's PC also has to be authenticated to the same network, as clarified in the following figure.



Once the user's PC is authenticated to the same network called "network_1," it can see the AiM device previously configured to gain access to the target network.



In the previous picture, two AiM devices are connected to the WLAN network_1.

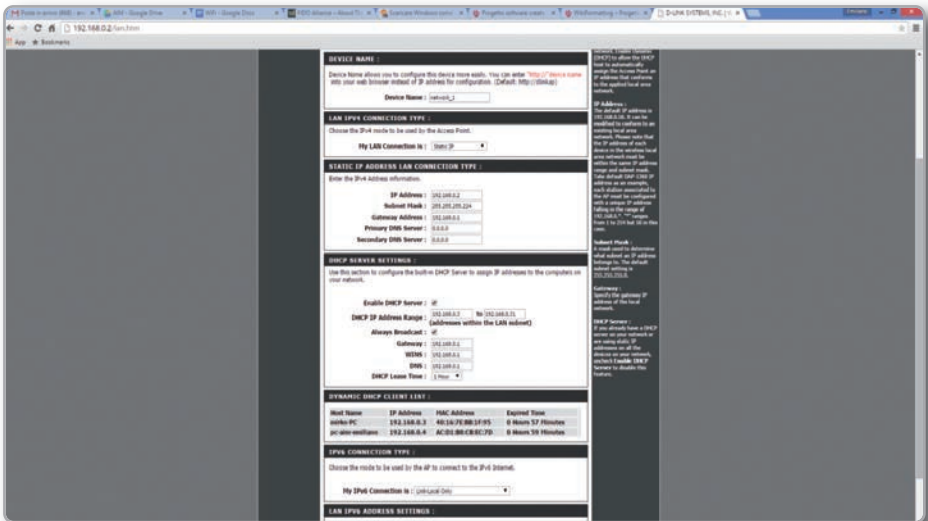
10.3 High performance WLAN setup

This chapter reports a basic description of one WLAN configuration having an AiM devices and a user's PC on it.

AiM suggests the use of a Linksys AS3200 device as the network device in order to provide a WLAN. However, you can use any other network device that has at least both one 3x3 MIMO and one DHCP server.

Moreover, in order to maximize the bandwidth, the Internet should not be allowed through this WLAN. Hence, the DHCP server has to be configured without both DNS and default gateway addresses.

A typical example of configuration is shown below.



As you can see in the picture, the network device configuration parameters are the following:

■ **Wireless network name: network_1**

It states the network name belonging to the WLAN is "AiM-WLAN". Hence one user's PC needs to be authenticated to this network in order to interact with any AiM device on this network.

■ **Gateway address: 192.168.0.1**

Primary DNS server: 0.0.0.0

Secondary DNS server: 0.0.0.0

These settings prevent internet connectivity through this WLAN.

■ **Subnet mask: 255.255.255.224**

Enable DHCP server: yes

DHCP IP address range: 192.168.0.3 to 192.168.0.31

These settings enable a DHCP server running on this WLAN. It gives IP addresses belonging to the range 3-31. Hence, 29 network hosts are permitted on this network.

The number of network devices on one WLAN depends on the subnet mask.

This guide suggests the use of the following network masks and IP address range:

Subnet mask:	IP address range:	Number of devices:
255.255.255.0	192.168.0.1 - 254	254
255.255.255.128	192.168.0.1 - 126	126
255.255.255.192	192.168.0.1 - 62	62
255.255.255.224	192.168.0.1 - 30	30
255.255.255.240	192.168.0.1 - 14	14
255.255.255.248	192.168.0.1 - 6	6

The bold one is the configuration we suggest (if a greater number of devices is not needed), as it makes it easier and quicker for RaceStudio3 to identify devices on the network.

10.4 About Internet Connectivity

For optimal network speed of your AiM device(s) we recommend not to allow an Internet connection on the same network and to provide WLAN settings that prohibit an internet connection.

Please know that it is certainly possible to allow internet access on the same network as your AiM device(s) but doing so can degrade the performance of AiM device communication. These slightly slower network speeds may be suitable for your needs.

Also note that it is possible to have a second WiFi connection through an additional hardware (NIC – Network interface card or WiFi adapter).

Such a configuration would provide optimal data network speed for your AiM device(s) and simultaneously provide internet access via the second NIC.

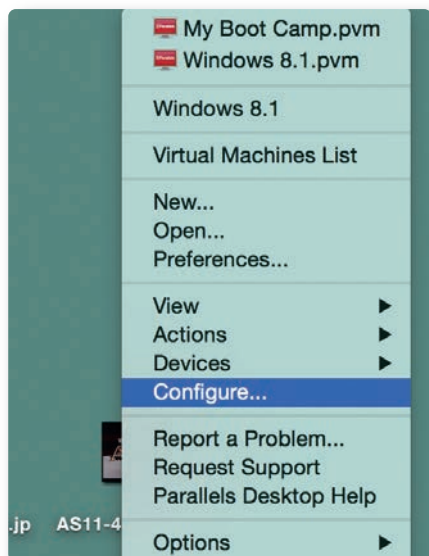
10.5 Working with Mac™ OS and Virtualized Windows™

RaceStudio3 software runs exclusively on Windows operating systems but, if the OS is virtualized on an Apple Mac OS too.

The main issue in this case is that the host OS (Mac) shares the WiFi interface with the virtualized OS (Windows) not as a WiFi interface but as an Ethernet interface.

Configuring Parallels™

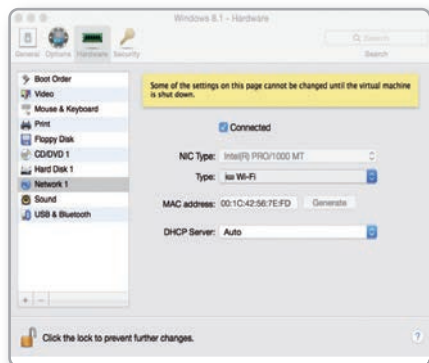
Choose "Configure..." option in Parallels Menu.



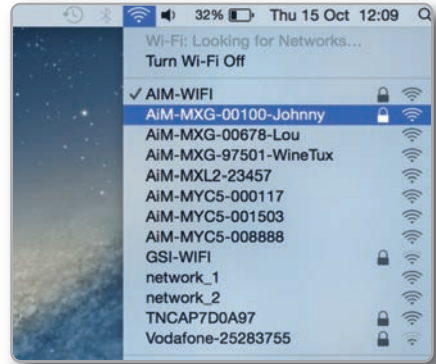
In the window you're prompted, select Hardware icon and then choose "Network" option on the left.

In the right part of the window, be sure to choose "Wi-Fi" in "Type" field.

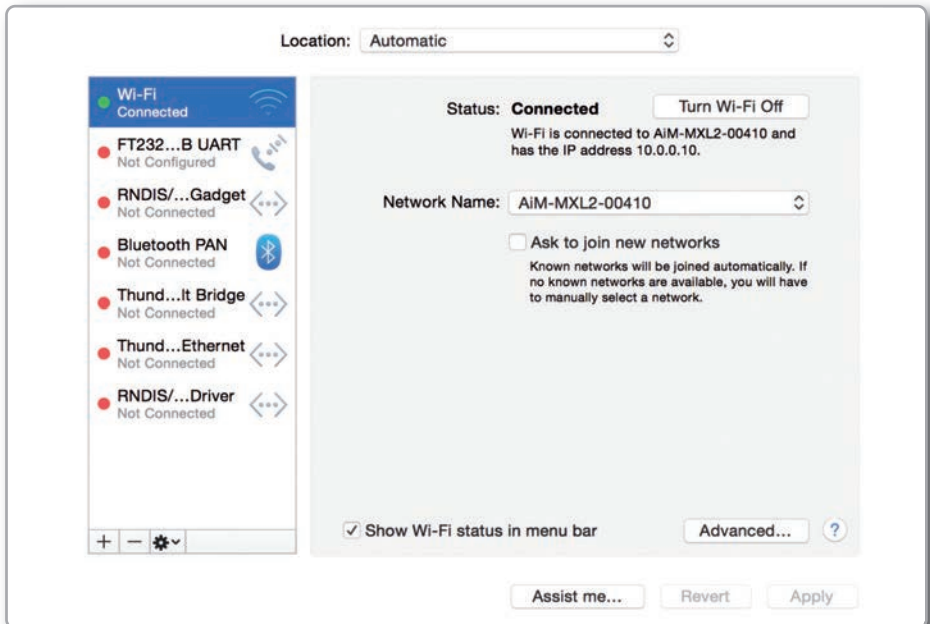
Then choose the device you want to communicate with.



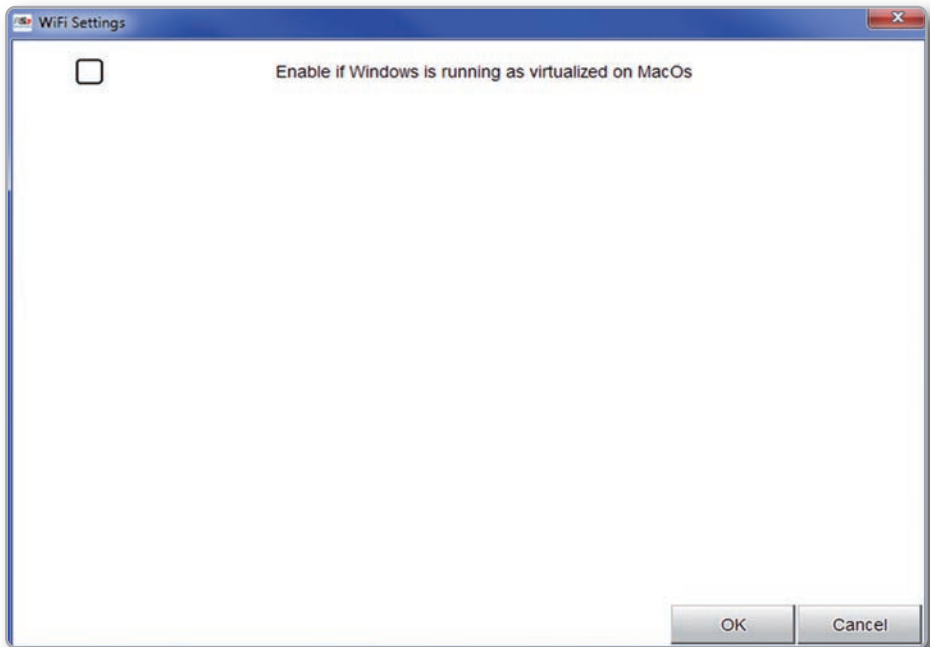
If you want to be sure the communication is working, choose the "Open Network Preferences..." menu.



In the window you are prompted verify that the status is shown as "Connected" and that the given IP is, for example, 10.0.0.10 (it could be 10.0.0.11, 10.0.0.12 or generically 10.0.0.x).



In RaceStudio3 flag the checkbox you find in "Preferences -> WiFi Settings"



11. RaceStudio3 software

RaceStudio3 is the powerful software that you are going to use for all the activities regarding your system.

It is provided on a CD included in the kit or can be downloaded from Download area of www.AiM-Sportline.com.

When you start RaceStudio3 with your system connected and switched on, you can see a row of pushbuttons top left of the screen that give you different options:



- Preferences
- Custom sensors
- Configurations
- Tracks
- Analysis
- Movies
- Devices

Preferences

For setting software measure units (pressure, speed, temperature, brake and oil pressure) and fixing download settings.

Custom sensors

Creates, imports, exports and modifies custom sensors.

Configurations

Create, modify, delete, export and import configuration with all channels, ECU drivers, Math channels, digital outputs and all the expansions.

Tracks

Creates, imports, exports and modifies the map of your racing tracks.

Analysis

For looking at and comparing your data.

Movies

For watching and comparing up to two track laps movies.

Devices

To establish the connection with the loggers and to receive data.

Top right of the screen is a row of three pushbuttons.



They can be used to:

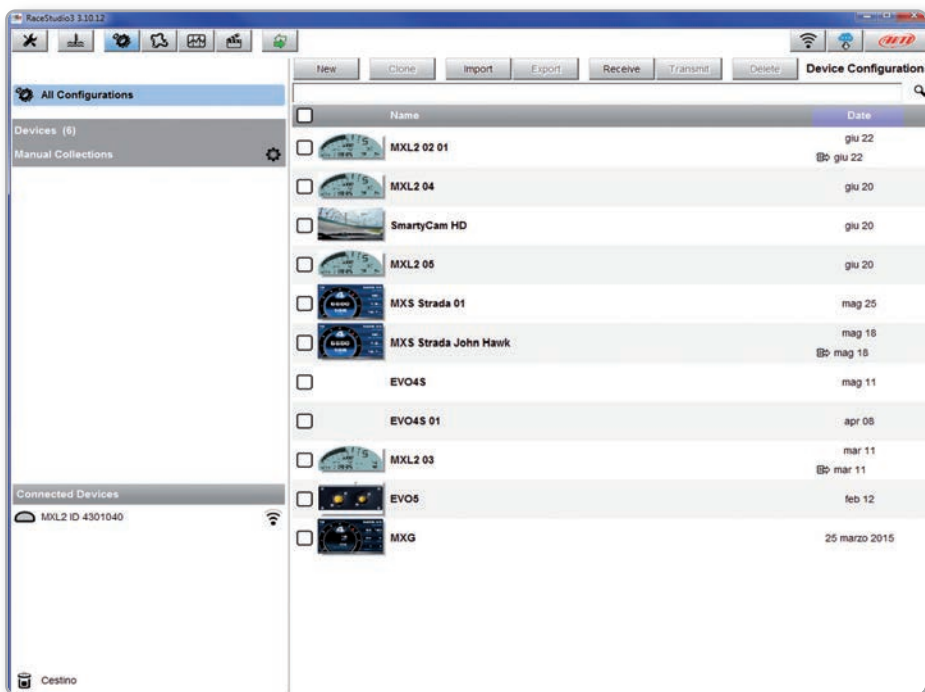
See available WiFi networks

Download web updates

It automatically detects which new firmware and software releases are available and let you download them from our site www.aim-sportline.com.

Connect to AiM website

11.1 Configuration



The configuration page is divided in two sections.
 The left side is dedicated to the folders that you can create and manage in order to better organize your configurations. Simply push the setting icon in order to create a new one.

When you connect an AiM logger, its serial number appears in the left side of your screen. In the right side of the screen you can see all the configurations of the selected folder. Please click on the desired one for editing it or push the **“NEW”** pushbutton for creating a new one.

After having entered the configuration page you can see different tabs, which are useful for selecting one of the following configuration features:

- Channels
- ECU Stream
- CAN2 Stream
- Math channels
- Parameters
- Shift Lights and alarms Display
- SmartyCam Stream
- CAN Expansions
- CAN Output

11.1.1 Channels Configuration

Push "**Channels**" tab.

"Channels" configuration page will appear.

In this page you can define all the parameters for your analog inputs, speed inputs and digital RPM inputs as well as enable/disable any channel.

ID	<input checked="" type="checkbox"/>	Name	Function	Sensor	Unit	Freq	Parameters
RPM	<input checked="" type="checkbox"/>	RPM	RPM	RPM Sensor	rpm	20 Hz	max: 16000 ; factor: /1 ;
Spd1	<input checked="" type="checkbox"/>	Speed1	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1600 ; pulses: 1 ;
Spd2	<input checked="" type="checkbox"/>	Speed2	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1600 ; pulses: 1 ;
Spd3	<input checked="" type="checkbox"/>	Speed3	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1600 ; pulses: 1 ;
Spd4	<input checked="" type="checkbox"/>	Speed4	Vehicle Spd	Speed Sensor	km/h 0.1	20 Hz	wheel: 1600 ; pulses: 1 ;
Ch01	<input checked="" type="checkbox"/>	Channel01	Voltage	Generic 0-5 V	mV	20 Hz	
Ch02	<input checked="" type="checkbox"/>	Channel02	Voltage	Generic 0-5 V	mV	20 Hz	
Ch03	<input checked="" type="checkbox"/>	Channel03	Voltage	Generic 0-5 V	mV	20 Hz	
Ch04	<input checked="" type="checkbox"/>	Channel04	Voltage	Generic 0-5 V	mV	20 Hz	
Ch05	<input checked="" type="checkbox"/>	Channel05	Voltage	Generic 0-5 V	mV	20 Hz	
Ch06	<input checked="" type="checkbox"/>	Channel06	Voltage	Generic 0-5 V	mV	20 Hz	
Ch07	<input checked="" type="checkbox"/>	Channel07	Voltage	Generic 0-5 V	mV	20 Hz	
Ch08	<input checked="" type="checkbox"/>	Channel08	Voltage	Generic 0-5 V	mV	20 Hz	
AccX	<input checked="" type="checkbox"/>	AccelerometerX	Inline Accel	AIM Internal Accelerometer	g 0.01	50 Hz	
AccY	<input checked="" type="checkbox"/>	AccelerometerY	Lateral Accel	AIM Internal Accelerometer	g 0.01	50 Hz	
AccZ	<input checked="" type="checkbox"/>	AccelerometerZ	Vertical Accel	AIM Internal Accelerometer	g 0.01	50 Hz	
CanX	<input checked="" type="checkbox"/>	CanX	Can Data	AIM Internal Can	1000 Bps	50 Hz	

By clicking on each line, a menu appears.
You can define:

- The name of the channel
- The function
- The sensor connected
- The sampling frequency
- The measure unit

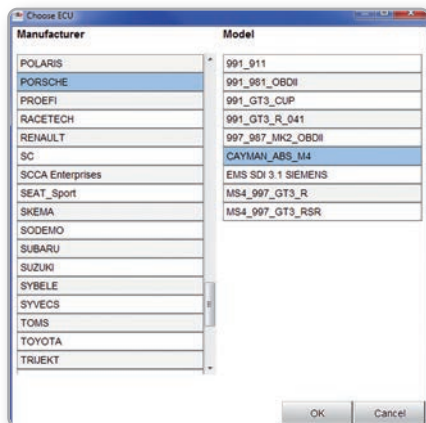
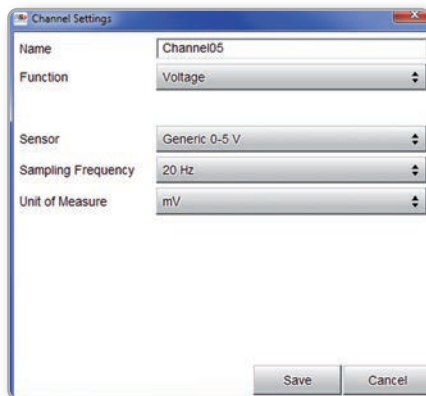
11.1.2

ECU Stream configuration

Push "ECU Stream" tab.

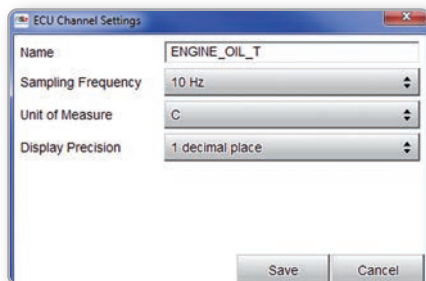
Here you set the ECU driver as well as enable or disable the data coming from your ECU.

To set the ECU driver of your vehicle click "Change ECU" and select ECU Manufacturer and ECU Model.



Each ECU channel can be enabled/
disabled and you can define:

- Name
- Sampling frequency
- Unit of measure
- Display precision



11.1.3 CAN2 Stream

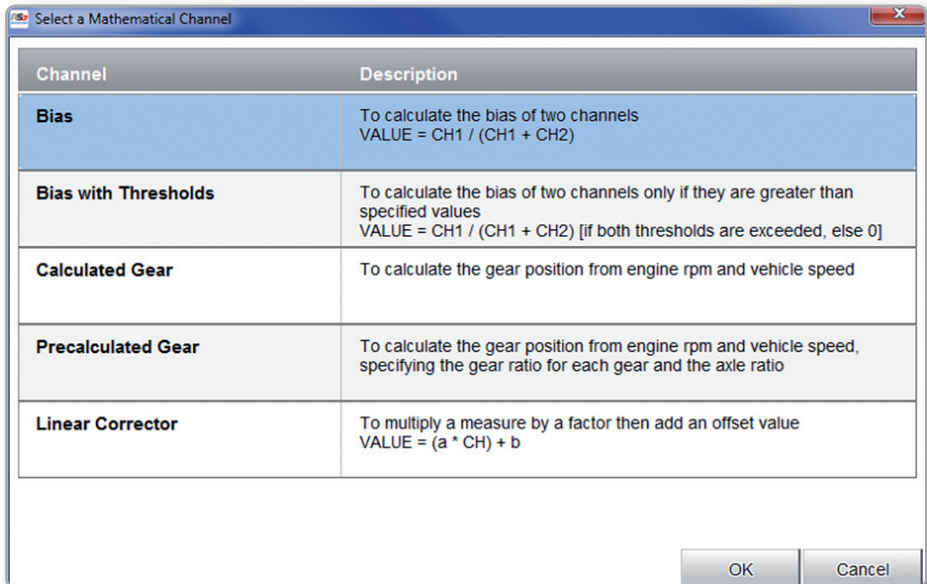
Push the tab "**CAN2 Stream**".

CAN2 Stream works like ECU Stream and is normally used for non engine control units like for example ABS management, suspension kits or similar.

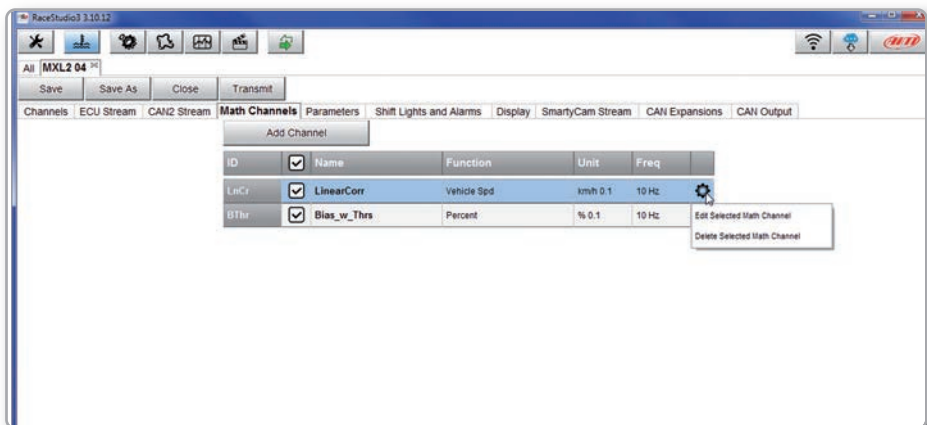


11.1.4 Math Channels

Press "Math channels" tab. Using the button "Add Channel" you can calculate the engaged gear both with a learning lap (calculated gear) and filling in the RPM values (precalculated gear). You can as well configure Bias channels and add linear corrector channels.

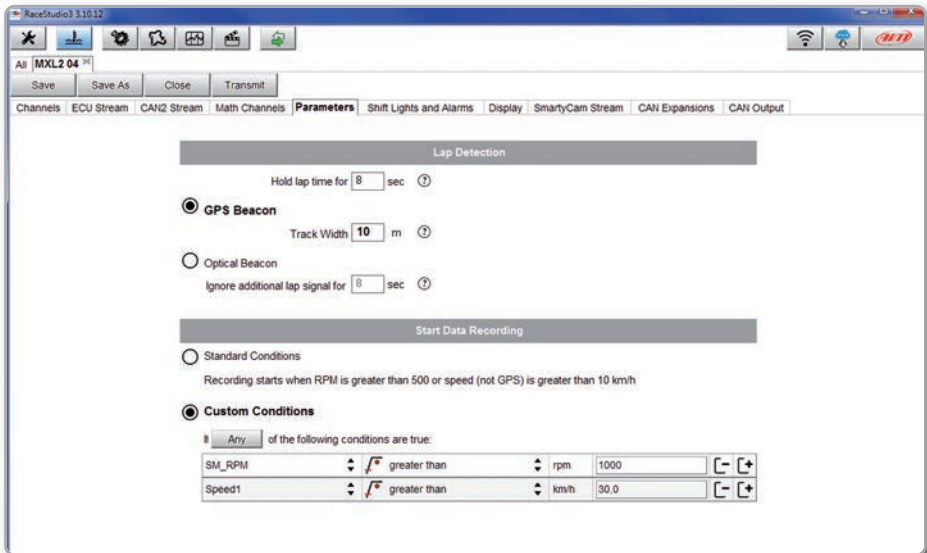


To modify/delete a math channel click the corresponding icon and select the desired option.



11.1.5 Parameters

Press "Parameters" tab. Here you can set the lap detection (GPS or Optical beacon) as well as decide when start recording.



1) Lap Detection

You can decide the time during which showing the lap time and choose whether detecting a lap signal from GPS or using optical transmitter/receiver.

GPS beacon requires the track width while optical beacon requires you to insert a time during which the system does not record additional lap signals.

2) Start Data Recording

By default the system starts recording when RPM value is greater than 500 or speed (not GPS) is greater than 10 km/h.

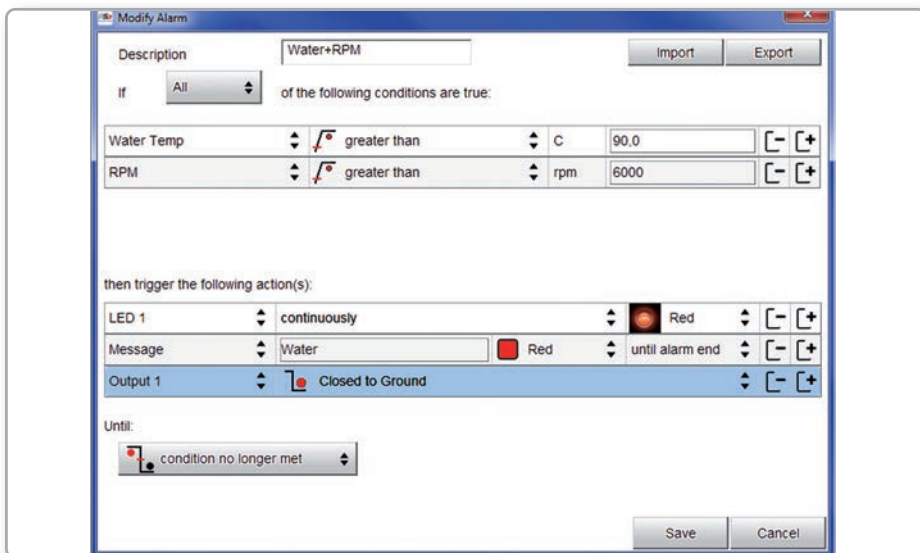
Using custom condition option you can define one or more custom conditions and decide to start recording when one or all set conditions occur.

11.1.6 – Shift Lights, Alarms and Output Signals

Alarms and digital output configuration

Push "Shift Lights and Alarms" tab.

At the very first configuration you are asked to configure an alarm with this panel.



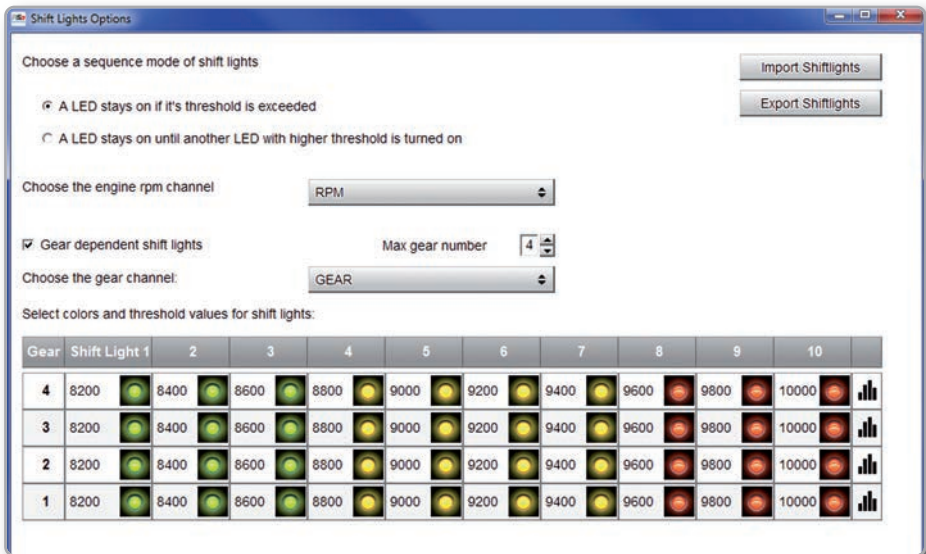
Here you can define the condition to meet and the action to perform. In the example below when water temperature is higher than 90°C and RPM value is higher than 6000 LED1 starts blinking continuously with a red light, a text message "Water" on a red background is shown on the display and the circuit is closed to ground until the condition is no longer met.

You can also decide LED blinking frequency and colour, message text, background colour and duration time, action to perform and alarm ending condition.

Moreover you can decide if the action is to be performed when all conditions occur or when any of them does.

Shift Lights configuration

Pushing the shift light setting icon top of the window you can manage, for each LED, color and RPM threshold value which will turn it on.



You can decide if:

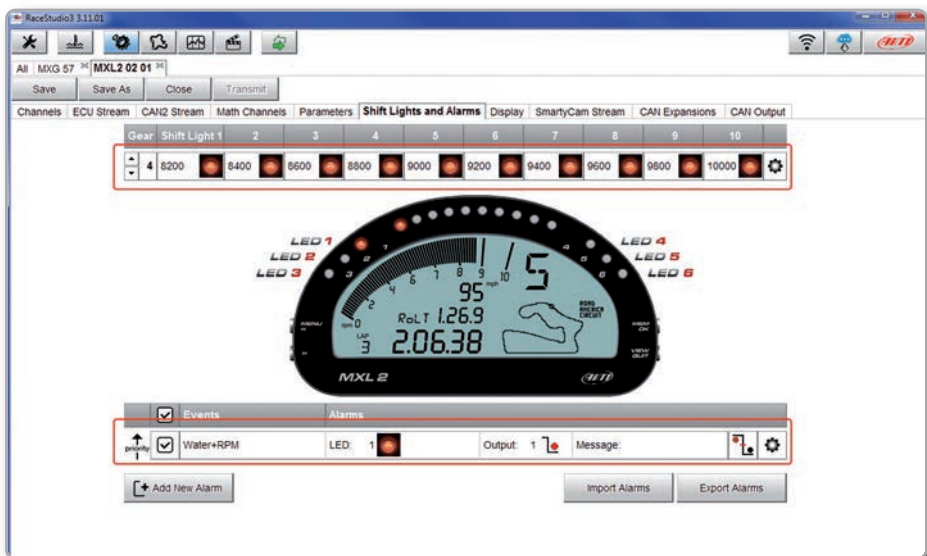
- Keeping the LED on if its threshold is exceeded as in the example above
- Keeping the LED on until another LED with higher threshold is turned on

You can select the Engine RPM channel to be used: typically between engine RPM and Analog/digital (ECU) RPM.

If LEDs are managed in dependence upon the gear number like in the example above you have to fill in the Max gear number and per each gear number you have to define colours and levels at which to turn them on.

Using the top right push button you can import/export shiftlights settings.

Press "OK" to save and exit.



Once alarms and shift lights are set summaries appear: on top is shift lights summary while bottom is alarm led and digital output summary.

To change shift lights settings, click on the setting icon right on the shift lights summary line and proceed.

If shift lights depend upon the gear number use the arrows left of the summary bar to show set values of each gear. In the

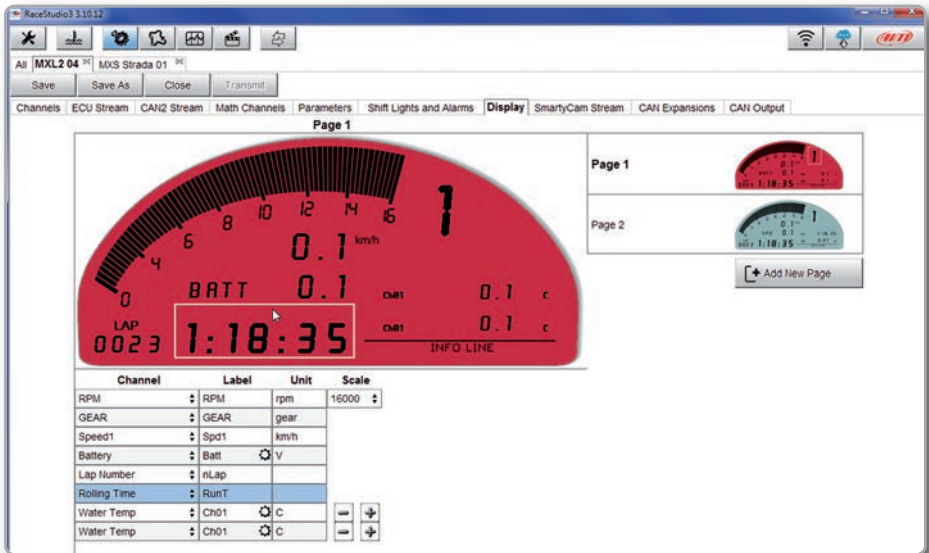
example you are showing shift lights values set for gear 4.

To change alarm LEDs and Digital output settings click on the setting icon right on the alarm LEDs and digital output summary line and proceed.

The icon left of it recalls the condition you chose to turn the LED off; in the example the alarm goes off when the condition is no longer met.

11.1.7 – Display configuration

Press "Display" tab to configure the system display.



The page is divided in two different sections.

On the right you can add up to eight pages setting its background as well as choosing the system lateral button to be used to browse this page, while on the left you will manage the different fields, selecting the proper information to be shown, the parameters, labels and the unit of measure.

Please use the lower left part of the display for configuring each channel.

You can define:

- the channel
- the label
- the measure unit
- the end of scale for each channel shown on the page (scale)

When the panel shows the desired configuration push "Save" or "Close" for saving the configuration. In case you have connected your system to the PC, "Transmit" pushbutton is available for transmitting the new configuration to your device.

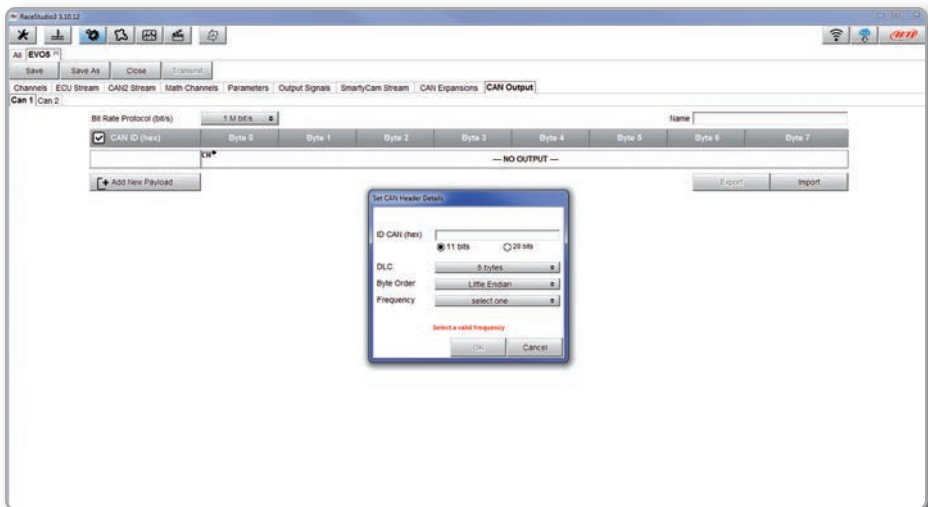
11.1.8 CAN Output

Push "**CAN Output**" tab to define a CAN Stream Output.

For each payload you can define:

- ID CAN (Hex)
- Byte number (DLC): up to 8 bytes
- Byte Order: little endian or big endian
- Frequency: up to 20 Hz

Moreover you can transmit each field coming from Analog, digital, internal channel, expansions, ECU or GPS Module.



WARNING: Please be advised that this function allows you to send messages directly to your vehicle CAN network. Sending messages that can potentially conflict with the CAN-bus frame may cause malfunction of your vehicle's safety systems, resulting in personal injury or death. It is your responsibility to fully understand your vehicle's CAN-bus. AiM cannot be held responsible for any damage or injury caused by misuse of this function.

11.2 Modify or delete an existing configuration

Push "All" tab top left of RaceStudio3 page; just under the pushbuttons.



All configurations are shown on the right part of the page. For modifying an existing configuration, right click on it and select the desired option.

To delete an existing configuration, right click on it and select "**Delete**".

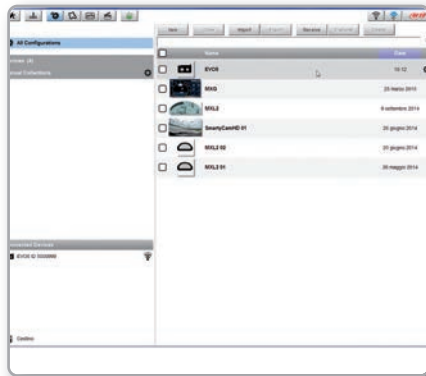


11.3 Connect your system to a PC

When you connect your system to the PC, it is automatically recognized and on the left side of the PC display the name of your device appears, as shown in the picture.

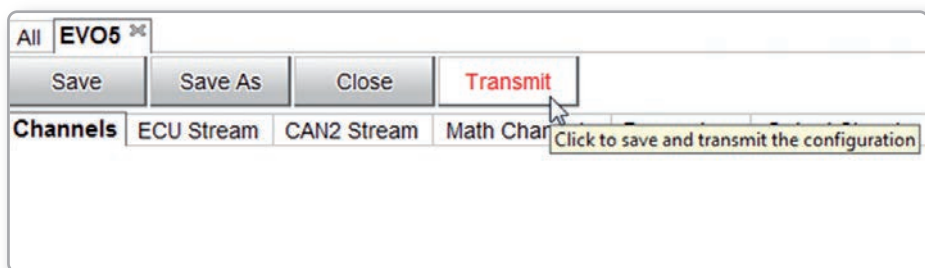
At this point you can transmit the configuration or, clicking on the configuration:

- see live measures
- calibrate sensors
- download data



11.3.1 Configuration transmission

When you connect a system to your PC and select it, the **"Transmit"** pushbutton enables top of the configuration page. Push it and the configuration is transmitted.



11.3.2 Live Measures and calibration

The screenshot shows the RaceStudio 3.0 interface for an EVOS ID 5000999. The 'Live Measures' tab is active, displaying a table of sensor data. The table is organized into two columns of data.

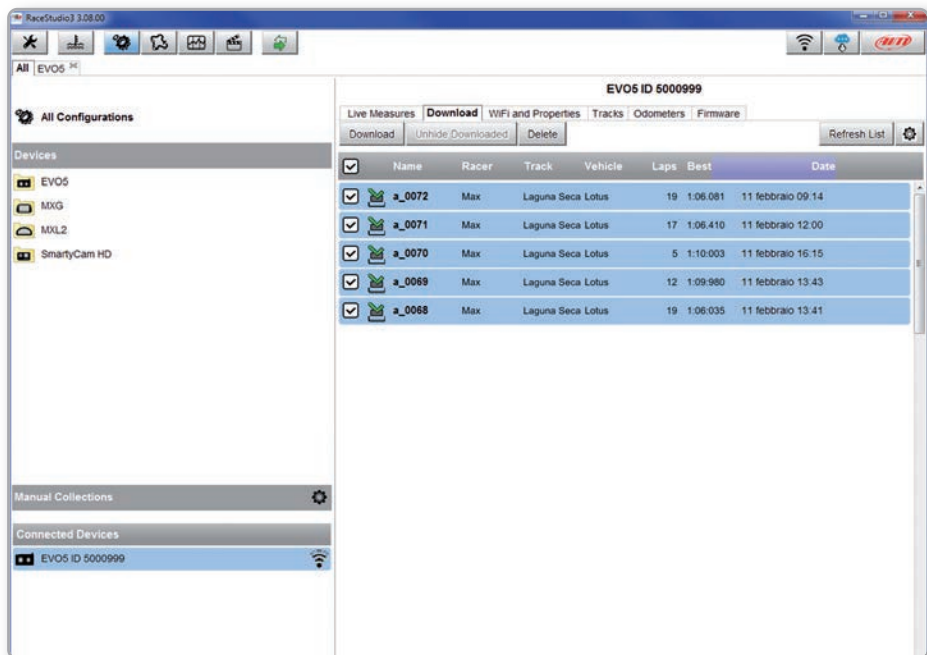
EVOS ID 5000999				
Live Measures Download WiFi and Properties Tracks Odometers Firmware				
Start Live Measures Auto Calibrate Calibrate Stop Recording mV Values Blink				
Lap Time	0.00.000 (0)		Logger Temperature	38.9 C
External Voltage	14 mV		Speed1	0.0 km/h
Speed2	0.0 km/h		Speed3	0.0 km/h
Speed4	0.0 km/h		Channel01	-26 mV
Channel02	-45 mV		Channel03	-277.3 C
Channel04	21 mV		Channel05	-46 mV
Channel06	-45 mV		Channel07	-45 mV
Channel08	-45 mV		AccelerometerX	0.15 g
AccelerometerY	-0.00 g		AccelerometerZ	0.98 g
GyroX	1.2 deg/s		GyroY	0.3 deg/s
GyroZ	4.5 deg/s		RPM_ENG	--- rpm
V_WHL_RL	km/h		V_WHL_RR	km/h
V_WHL_FL	km/h		V_WHL_FR	km/h
GEAR	gear		A_STE	deg
POS_GB_X_LEVER	---	#	G_CH_Y	g
G_CH_X	g		W_CH	deg/s
POS_PEDAL	%		P_TURBO	bar
FLAG_BRAKE	---	#	TIP_DOWN	---

Once the system connected, click on it to enter "Live Measures".

Push "Start Live Measures" to look the data coming from your system. You can change the measure unit double-clicking on the measure.

From "Live Measures" view you can calibrate the channels requiring it.

11.3.3. Data download



The system can download data via USB, via WiFi or placing the SD card in the PC slot. To download data click on your system name in "**Connected Devices**" panel bottom left of the software main page.

The device window appears on the right. Push "**Download**" button for downloading the data.

You will see the information about the files recorded in the system: dimension and date/time of the file creation.

Please select a file and push "**Download**" for transferring it to your PC.

12. GPS and track management

GPS08 Module included in the kit provides these information, updated ten times per second:

- Position (latitude, longitude, altitude)
- Speed
- Longitudinal acceleration
- Lateral acceleration

If the system knows the finish line of the track and the split coordinates, it can calculate and show:

- Lap Times
- Split times

To transmit/receive track information, use "Tracks" feature, as explained in this section.



12.1 Tracks feature

With "Tracks" you can update, modify, transmit and receive to and from the system the coordinates of the start/finish line and split points of all the tracks you are going to run on.

Opening the software, with no logger connected to your PC, you will see the screen shown here on the right. As you can see, the screen is divided in three parts.

On the left are track collections and connected devices.

Central is the track list. If available, each track label shows you the track layout, its address and the type of vehicle that usually races on that track.

On the right side of the screen, if available, you will find the track page with its logo, address, contact information, website and coordinates.

- 1** Shows all available tracks
- 2** Select all tracks of the list
- 3** Track info
- 4** Track page
- 5** Shows all connected devices
- 6** Shows Manual Collections
- 7** Shows Smart Collections
- 8** Shows all nations whose track are included in the database

The screenshot displays the RaceStudio 3.07.11 software interface for track management. The interface is organized into several key sections:

- Top Toolbar (1):** Contains icons for file operations and system settings.
- Action Buttons (2, 3):** A row of buttons including 'New', 'Import', 'Export', 'Receive', 'Transmit', and 'Delete'.
- Track List (4):** A central table listing tracks with checkboxes, track icons, names, locations, and distances. The selected track is 'Buriram United International Circuit' (2.8 km).
- Left Sidebar (5, 6, 7, 8):** A navigation pane with sections for 'All Tracks', 'Nations (39)', 'Smart Collections' (containing 'Auto Inghilterra' and 'Kart Italia'), 'Manual Collections', 'Connected Devices' (showing 'No device connected'), and 'Trash'.
- Right Panel:** Provides detailed information for the selected track, including a logo, address (352 Hwy 4, Tambon Isan, Muang District, Thailand), phone number (+66-2945-6759), website (www.buric.co.th), a track map, and coordinates (Latitude: 14.958127° N, Longitude: 103.085400° E).

ID	Track Name	Location	Distance
1	Buriram United International Circuit	Buri Ram	2.8 km Race Track Paved
2	Buriram United International Circuit	Tambon Isan, Muang District	4.6 km Race Track Paved
3	Castle Combe Circuit	Chippenham	3.0 km Race Track Paved
4	Rockingham	Corby, Northamptonshire	2.7 km Race Track Paved
5	Rockingham	Corby, Northamptonshire	3.1 km Race Track Paved
6	Donington	Derby	3.2 km Race Track Paved
7	Donington	Derby	4.0 km Race Track Paved
8	Anglesey	Gwynedd	2.5 km Race Track Paved
9	Anglesey	Gwynedd	3.4 km Race Track Paved
10	Mallory Park	Kirby Mallory(Leicestershire)	2.2 km Race Track Paved
	Oulton Park	Little Budworth (Cheshire)	

12.2 Tracks Collections

You can see collections of tracks selecting the Nation they belong to (1), setting some filtering criteria and creating Smart Collections (2) or selecting some tracks and creating Manual Collections (3).

1) Nations

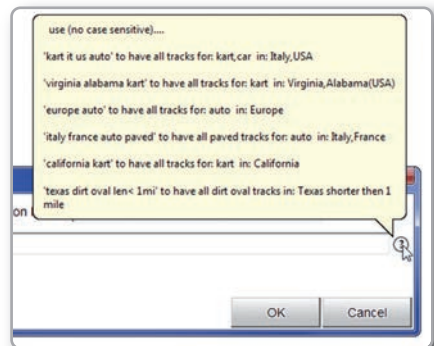
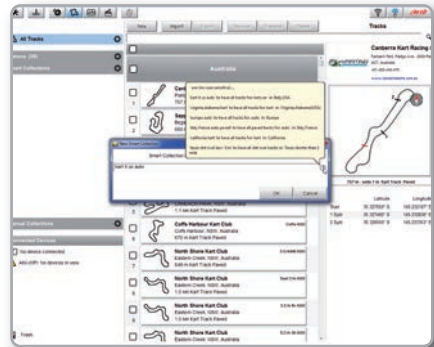
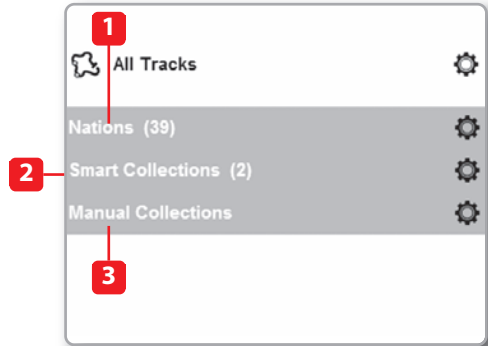
Select a Nation and you will see only the tracks belonging to that Country.

2) Smart collections

To create a Smart Collection of tracks click the setting icon highlighted top left on the software page.

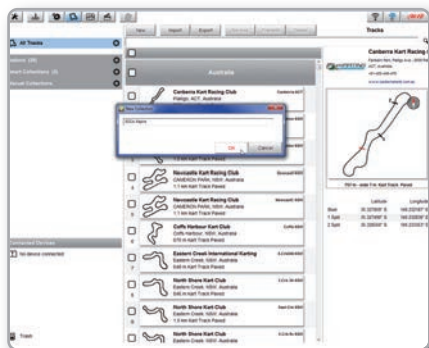
"Selection criteria" panel appears.

To know how to perform a search click the question mark on the right and some examples show up in a yellow pop up panel as shown here on the right.



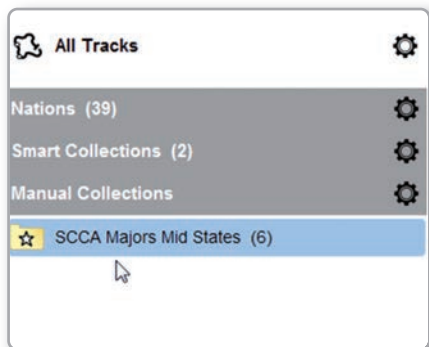
3) Manual collections

To create a Manual Collection of tracks click on the setting icon, fill in the Collection name and click OK.

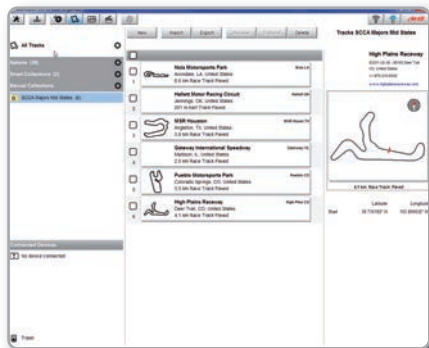


The new collection appears in the "Manual Collections" list.

Drag and drop the tracks you want to insert in the collection from the central panel.

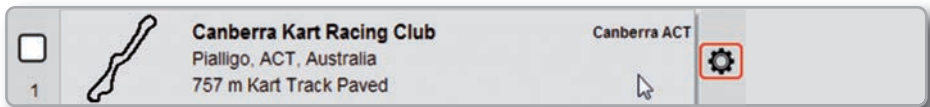


Click on the Manual list name and the tracks you included appear in the central panel.



12.3 How to Modify track data in the PC database

Click the setting icon that appears right of the track label mousing over it. Select **"Edit"** to modify all track information.



12.4 How to delete a track from the PC database

The tracks you find in the software by default and provided by AiM cannot be deleted. To delete a track you imported just select it and press **"Delete"** on the software top central keyboard.



12.5 How to transmit track information to the system

To transmit track information to your system select the tracks you want to load and click "**Transmit**" on the software keyboard.

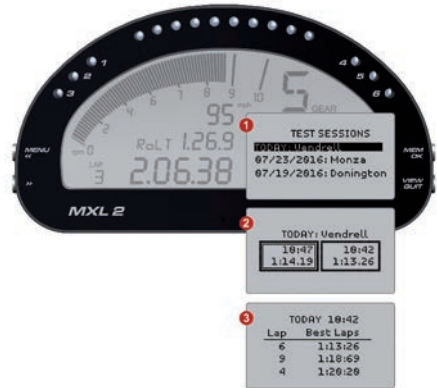


13. Data Recall

(1)
At the end of each test- clicking MEM/OK pushbutton you can give a glance at your best laps with max/min speed and RPM...

(2)
... and check the same data for all tests of your session pressing again MEM/OK. To select a test press >>/<<

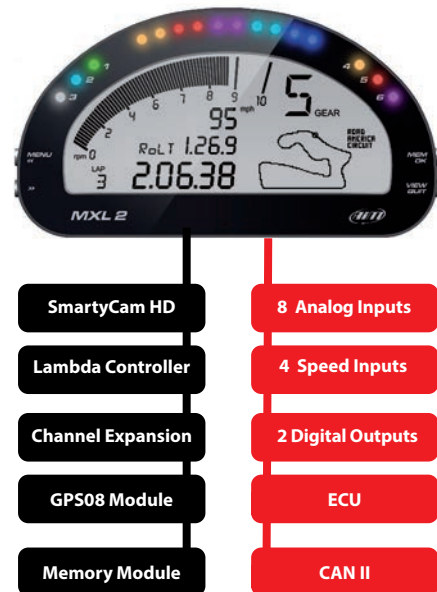
(3)
The same info can be recalled from all previous sessions of the same day or before, just clicking VIEW/QUIT.



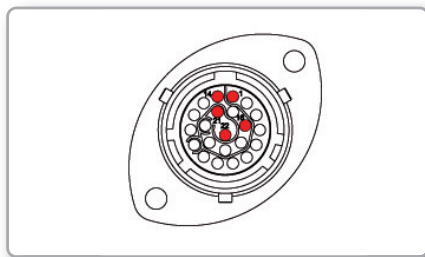
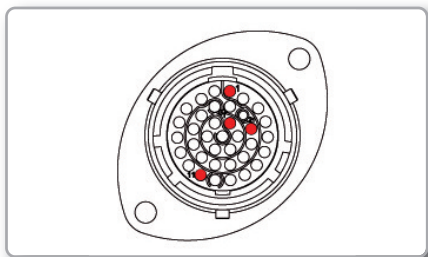
14. Expansions

Using our built in CAN bus you can add expansion modules like GPS, channel expansions, lambda controllers.

These are only some of the items that can be added to our system range for incrementing the performance and the data acquired.



15. MXL2 Pinout

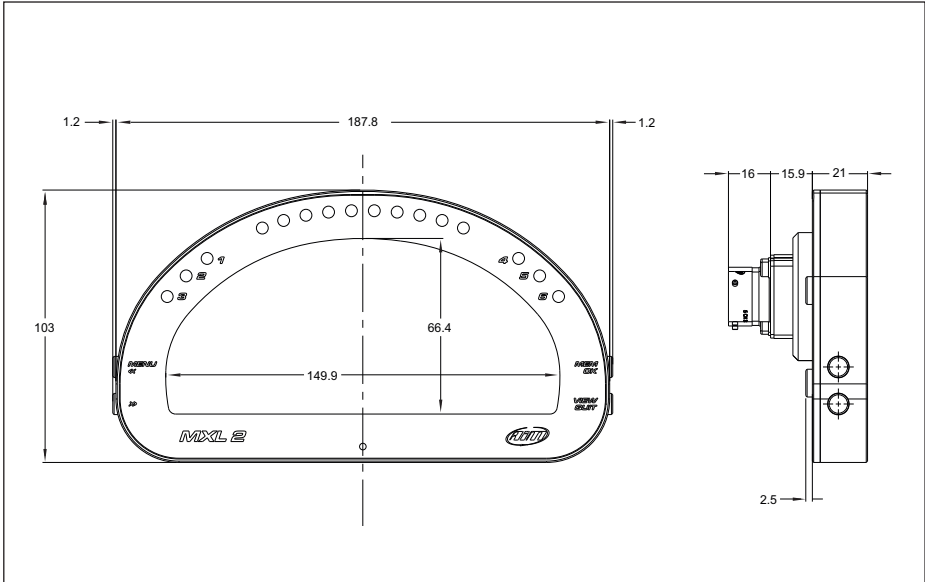


PIN Deutsch 37pin.

01	9-15V Power Input	20	GND
02	Battery GND	21	+Vbattery
03	CAN+ Exp	22	Analog Input 1
04	GND	23	Analog GND
05	+Vbattery CAN	24	+Vbattery
06	CAN- Exp	25	+Vreference
07	+Vbext	26	Analog Input 2
08	CAN1+ ECU	27	Analog GND
09	CAN1- ECU	28	+Vbattery
10	GND	29	+Vreference
11	K Line ECU	30	Analog Input 3
12	USB D+	31	Analog GND
13	USB D-	32	+Vbattery
14	GND	33	+Vreference
15	RPM	34	Analog Input4
16	GND	35	Analog GND
17	+Vbattery	36	+Vbattery
18	Optical lap	37	+Vreference
19	Speed1		

PIN Deutsch 22pin.

01	Analog Input 5	20	Digital output 2
02	Analog GND	21	RS232TX ECU
03	+Vbattery	22	RS232RX ECU
04	+Vreference		
05	Analog Input 6		
06	Analog Input 7		
07	Analog GND		
08	+Vbattery		
09	+Vreference		
10	Analog Input 8		
11	Speed2		
12	GND		
13	+Vbattery		
14	Speed 3		
15	Speed4		
16	GND		
17	CAN2+ ECU		
18	CAN2- ECU		
19	Digital output 1		



- Display	LCD Display+graphical portion
- Backlight	White or red
- Ambient light sensor	Yes
- Alarm LEDs	6 RGB freely configurable
- Shift Lights	10 integrated freely configurable RGB LEDs
- CAN connections	3
- ECU connections	CAN, RS232, K-Line
- External modules connection	GPS Module, Channel Expansion, Lambda controller, SmartyCam HD
- Connectors	2 motorsport connectors
- Analog inputs	8 fully configurable, max frequency 1 KHz each.
- Digital inputs	4 speed inputs, LAP signal, coil RPM input
- Digital outputs	2 up to 1 Amp each
- Inertial platform	Internal 3 axis +/-5G accelerometer + 3 axis gyro
- WiFi connection	Yes
- Internal memory	4 Gb
- Body	Anodized aluminium
- Pushbuttons	Metallic
- Dimensions	187,8x103x21 mm
- Weight	530g
- Power consumption	400 mA
- Waterproof	IP65



Our web site aim-sportline.com is constantly updated.

Please, check it frequently and download the latest versions of the firmware of your products.





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