

# User Manual

## MX1.2+1.3 Series

### Release 1.04





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## 1 – MX1.2+1.3 Series in a few words

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### **What is MX1.2+1.3 Series?**

MX1.2+1.3 Series (from here onwards MX) is a complete range of dashes with different features that offers different dimensions, flexibility, usability and that may manage a wide range of channel inputs.

#### **It features:**

- ECU connection (CAN, RS232 and K-Line)
- 4 speed inputs
- 1 RPM input
- 8 analog inputs
- 2 analog video camera inputs
- up to 8 configurable display pages
- a huge tracks database to automatically selects the track you are racing on
- from 5 to 8 alarm LEDs
- 10 RGB LEDs that you may configure to clearly show if you are improving or not.

### **What about ECU connection?**

MX Series manages CAN, K-Line and RS232 ECU communication lines and its huge database includes more than 1500 ECU protocols.

### **Is MX Series an expandable logger?**

Yes. MX Series can be connected to various AiM expansions like GPS Module, Channel Expansion, TC Hub and LCU-One CAN to maximize your engine performances and to AiM SmartyCam to see your track performances on your PC with all the values you need in overlay.

### **Anything else?**

You may connect up to two additional optional back cameras to the dedicated input in order to show a reverse mirror image directly on its display.



The table here below shows the difference among the loggers.

| FEATURE             | MXG 1.2  | MXG 1.3 | MXP              | MXP 1.3 | MXS 1.2        | MXS 1.3 | MXT 1.3              |
|---------------------|--|---------|------------------|---------|----------------|---------|----------------------|
| Display             | 7" TFT   |         | 6" TFT           |         | 5" TFT         |         | 10" TFT              |
| Resolution          | 800*480 pixels   |         |                  |         |                |         | 1280*480 pixels      |
| Contrast            | 1000:1   |         | 600:1            |         |                |         | 1100:1               |
| Brightness          | 700cd/m <sup>2</sup> - 1,100 Lumen   |         |                  |         |                |         | 800cd/m <sup>2</sup> |
| Light Sensor        | Yes  |         |                  |         |                |         |                      |
| Alarm Display Icons | Yes, freely configurable   |         |                  |         |                |         |                      |
| Alarm RGB LEDs      | 8 configurable   |         | 5 configurable   |         | 6 configurable |         |                      |
| Shift Lights        | 10 configurable RGB LEDs   |         |                  |         |                |         |                      |
| CAN Connection      | 3  |         |                  |         |                |         |                      |
| ECU Connection      | CAN, RS232 or K-Line to 1.000 + industry leading ECUs  |         |                  |         |                |         |                      |
| Expansion Modules   | GPS Module, Channel Expansion, TC Hub ( <b>necessary to connect MX 1.3 and MXT to thermocouples sensors</b> ), Lambda Controller, SmartyCam HD |         |                  |         |                |         |                      |
| Analog Inputs       | 8 fully configurable, max 500 Hz each  |         |                  |         |                |         |                      |
| Digital Inputs      | 4 speed inputs, lap signal, coil RPM input   |         |                  |         |                |         |                      |
| Digital outputs     | 2 (1A each)  |         |                  |         |                |         |                      |
| Second CAN          | Yes  |         |                  |         |                |         |                      |
| WiFi connection     | Yes  |         |                  |         |                |         |                      |
| Inertial platform   | Internal 3 axis gyro, magnetometer and ±5G accelerometer ( <b>MXG 1.2, MXP, MXS 1.2 only</b> )   |         |                  |         |                |         |                      |
| Internal Memory     | 4Gb  |         |                  |         |                |         |                      |
| Body                | Anodized Aluminium   |         |                  |         |                |         |                      |
| Pushbuttons         | Metallic   |         |                  |         |                |         |                      |
| Connectors          | 2 Autosport +1 Binder  |         |                  |         |                |         |                      |
| Dimensions          | 237*127.6*26 mm  |         | 189.6*106.4*24.9 |         | 169.4*97*23 mm |         | 278*135*43.2 mm      |
| Weight              | 950g   |         | 640g             |         | 530g           |         | 1200 g               |
| Power Consumption   | 400mA  |         |                  |         |                |         | 450mA                |
| Waterproof          | IP65   |         |                  |         |                |         |                      |

## 2 – What is in the kit?

---

MX Series kit includes:

- MX Series logger shown below
- 37 pins Deutsch connector harness with mini USB cable
- USB adapter cable (from mini to standard USB)
- GPS09 Module

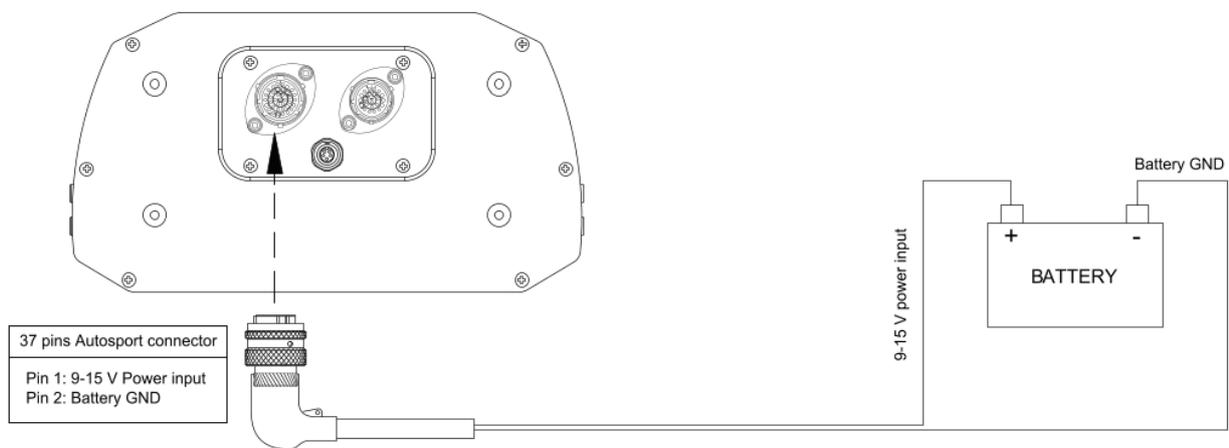


### 3 – Power

The power is managed by two pins of the 37 pins connector:

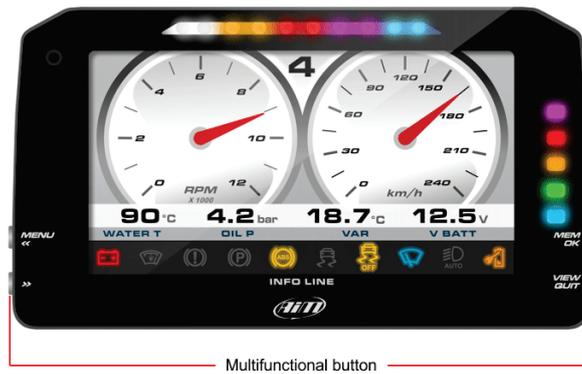
- Pin 1: Power (9-15 Volts)
- Pin 2: Ground

They must be connected as shown in the following diagram.



## 4 – What you can do via keyboard

MX Series needs to be configured via software but there are some functions you can manage via the device lateral buttons,



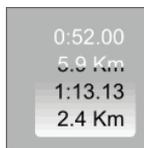
Press "Menu" button and this page appears.



The icons are to manage:



Date/Time



Counters



Wi-Fi connection



Backlight



Reset Gear Calculation



System Info



Video In

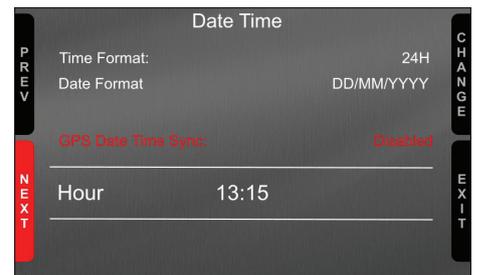


GPS and Tracks

## 4.1 – Set Date/Time

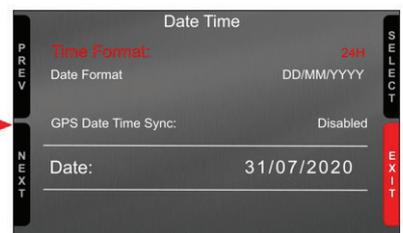
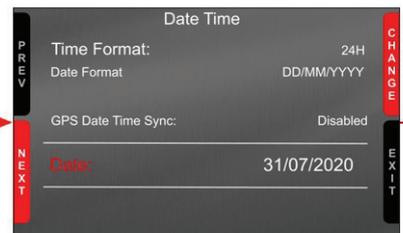
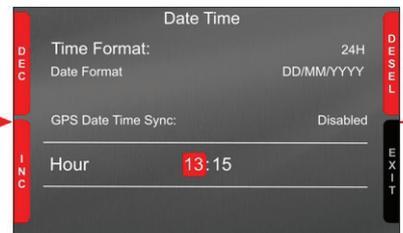
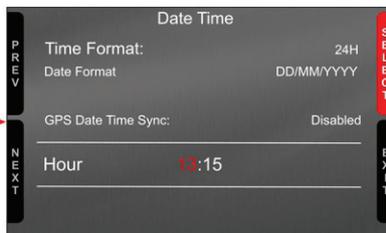
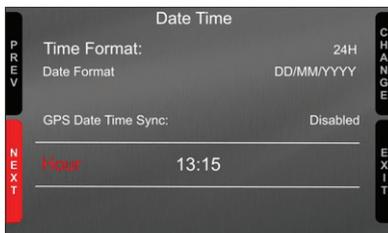
Here you can:

- set time format: 12H or 24h; press “CHANGE” to switch among the options and “NEXT” to scroll to Date format
- set date format: MM/DD/YY or DD/MM/YY or YY/MM/DD; press “CHANGE” to switch among the options
- “GPS Date Time Sync” default setting is “Enabled” (left image below); this means that date and time comes from MX GPS. Press “CHANGE” to disable the synchronization and set date and time manually
- press “NEXT” so start setting time (right image below)



The system enters in manual date/time mode. With reference to the images below:

- press “NEXT” to start setting time → hour becomes selected (13 in red below) → press “SELECT” and hour becomes editable (13 on red background below) → Use “DEC” and “INC” to set hour →
- press “DESEL” and “INC” button switches to “NEXT”: press it to switch to minute option: press “SELECT” and set minute
- press “DESEL” and then “NEXT” and you come back to “Hour”; press “CHANGE” and “Hour” switches to “Date”: press “NEXT”
- set day, month and year as for time setting and press “EXIT”; you come back to “Time Format”: press “EXIT” to save and quit

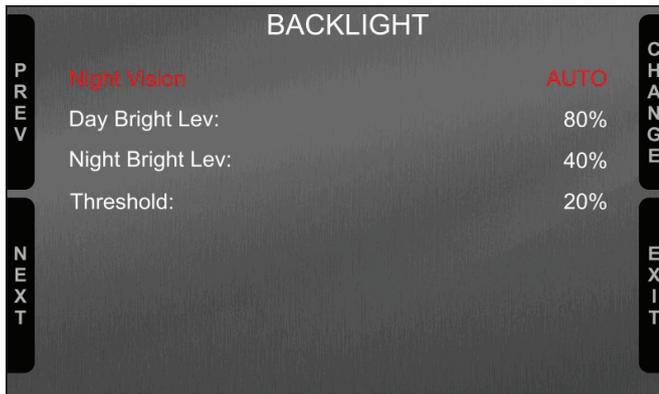




## 4.2 – Set backlight

The brightness of the display and LEDs may be adjusted in two ways, depending on the light captured by a dedicated sensor integrated in the dash

- **AUTOMATIC:** in case ambient light is higher than a defined threshold, the brightness is reduced; you can set day and night brightness level as well as the brightness threshold value that switches from day to night mode (left image below)
- **MANUAL:** you may define the brightness of the display and LEDs choosing among some values: 20%, 40%, 60%, 80%, 100% (right image below).



## 4.3 – Set video input



Video In page manages up to two additional optional back cameras (that cannot be logged).

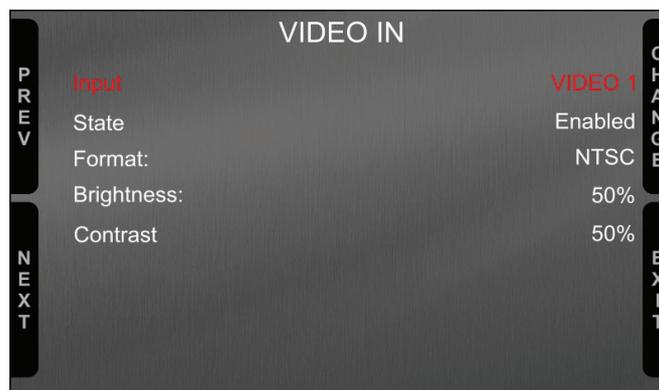
They are to be connected to the Binder 712 female connector rear central of MX Series logger, as shown in the pinout you find at the end of this user guide. Please refer to paragraph 11.1 ("Rear cameras connection and management") for further information.

Features to set are:

- Input: Video 1 / Video 2
- State: Enabled/Disabled
- Format: NTSC/PAL
- Brightness and Contrast from 10 to 100%

Use:

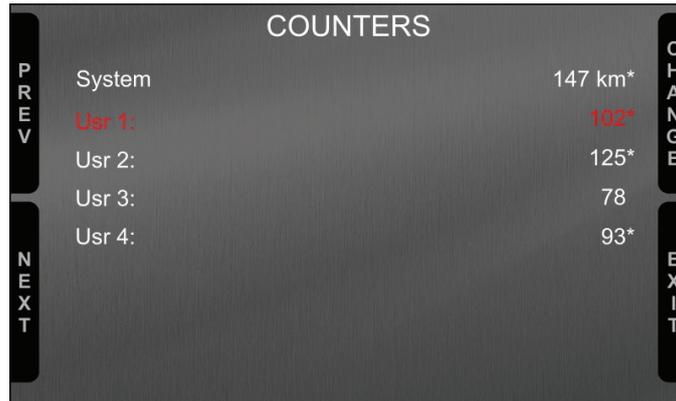
- "CHANGE" button to set each feature
- "NEXT" button to scroll the features
- "EXIT" to save and quit



## 4.4 – Counters management

MX Series features 4 user odometers, labelled User 1 – User 4, plus a non-resettable System Odometer. All odometers are shown on the configuration software Race Studio 3 too (see chapter about MX Series and the PC).

Each odometer can be activated/deactivated and/or reset. To manage an odometer select it and press “CHANGE”.



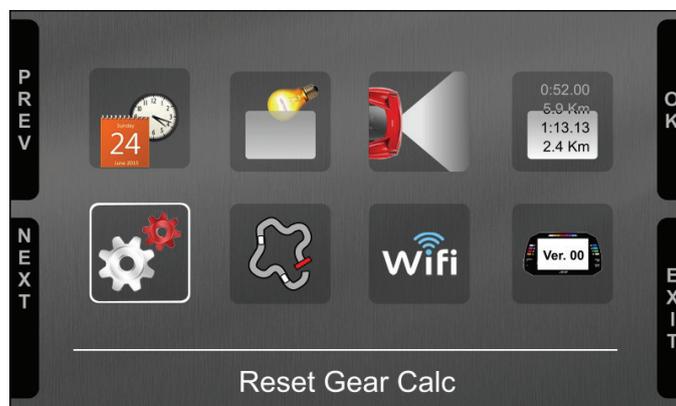
## 4.5 –Reset Gear Calculation

With “Reset Gear Calc” function it is possible to re-start gear calculation. This function is very useful in case something has been modified on the vehicle or if the gear calculation is for any reason invalid or failed. **For this function to be available it is necessary that:**

- the configuration set in Race Studio 3 includes calculated gear (see paragraph 6.2.6 for further information)
- gear calculation has been performed at least once.

To reset gear calculation press “OK”.

The system notifies that gear calculation is being performed. At this point it is necessary to run a track lap engaging all gears and leaving each gear engaged for about 5 seconds. When the max gear has been reached the system records the calculation and starts showing the engaged gear on the display (if the selected layout includes this field) as well recording the gear. For further information concerning gear calculation see “FAQ” section concerning MX series, configuration paragraph of [www.aim-sportline.com](http://www.aim-sportline.com).





## 4.6 – GPS & Tracks management

MX Series can be used on track thanks to AiM GPS09 Module included in the kit. This is used for:

- Lap time calculation
- Speed calculation
- Predictive lap time calculation

To calculate these data the system needs to know the start/finish line coordinates of the racetrack you are racing on; MX Series comes with a long list of the world main tracks, constantly updated by our technicians and automatically loaded to your PC when you run Race Studio 3 software and a connection to the Internet is available.

MX Series provides two track selection modes: automatic and manual.

### **Automatic:**

MX Series automatically recognizes the track you are running on, loads the start/finish line and the possible splits coordinates and calculates lap and split times without optical/magnetic receiver. This is the best mode in most cases.

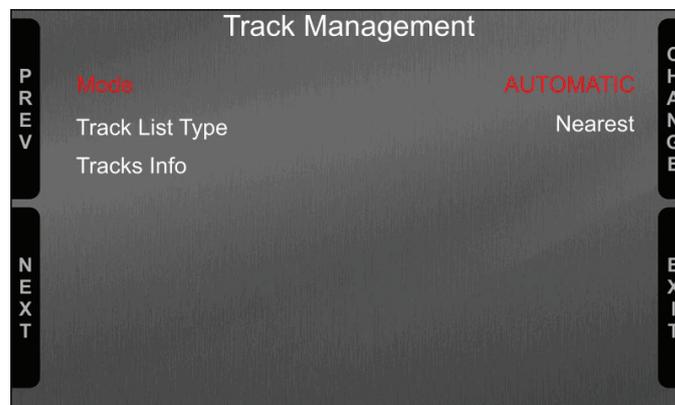
### **Manual:**

Allows to manually select the track from the internal database.

This mode is to be preferred when multiple track configurations are available nearby. In this case MX Series would anyway recognize the track but would need at least one complete track lap.

You can scroll the list of available tracks choosing among these options:

- nearest: shows only tracks in a 10 km distance
- all: shows all tracks stored in the system in alphabetical order
- custom: shows only the tracks you have previously created with Race Studio 3 software (see paragraph 6.3)



## 4.7 – Wi-Fi Management

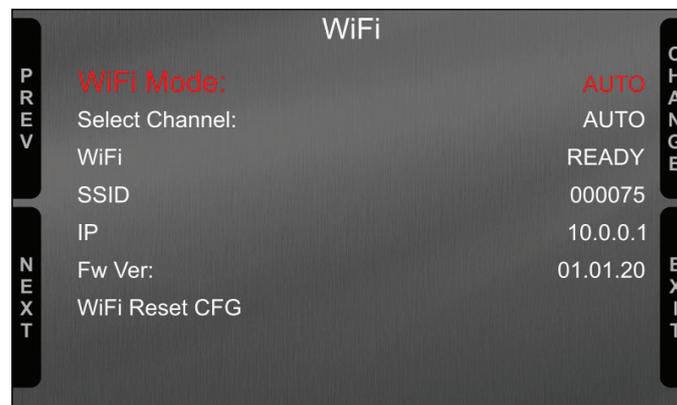
Here you can manage Wi-Fi as well as select the channel to be used (expert users only) and reset its configuration. **Wi-Fi modes** are:

- ON
- Auto: switches Wi-Fi on when the vehicle is stopped and switches it automatically off when MX Series starts recording according to the setting you performed in “Parameters” page of Race Studio 3 software (see paragraph 6.2.8 for further information)
- OFF

**Select Channel** function **is for expert users only**; here it is possible to select which Wi-Fi channel to use; available options are:

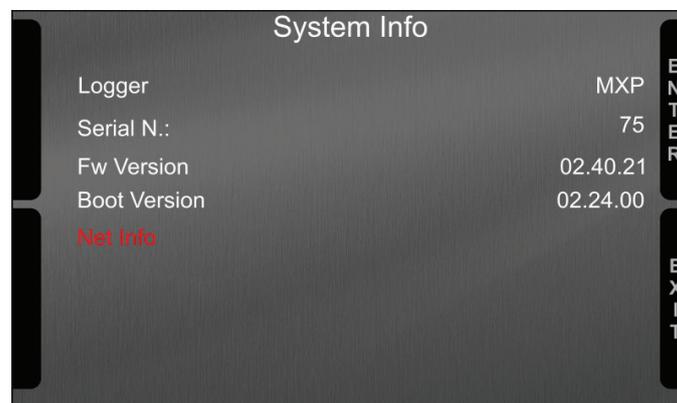
- AUTO (default – recommended)
- 1
- 6
- 11

“**Wi-Fi reset CFG**” resets Wi-Fi configuration and is very useful if you do not remember the Wi-Fi password.



## 4.8 – System Information

This page shows MX info as well as firmware and booter version; if any expansion is connected (please note GPS Module is considered an expansion too) “Net Info” option is shown allowing to enter the page with all information about the expansions connected to MX.

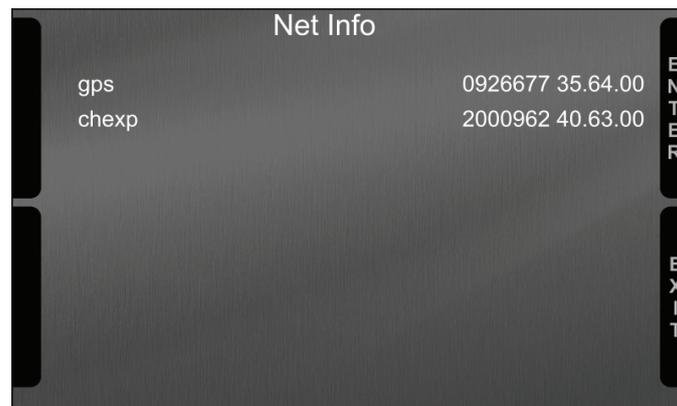


### 4.8.1 – Net Info page

Entering “System Info” page with any expansion connected to MX the system places directly on “Net Info” option and pressing “ENTER” it enters in the page showing all information concerning the devices connected to MX.

For all expansions the system shows serial number and firmware version. In the example below AiM network includes:

- GPS with serial number 0926677 and firmware version 35.64.00
- Channel Expansion with serial number 2000962 and firmware version 40.63.00



## 5 – Wi-Fi configuration

Two possible Wi-Fi connection modes are available.

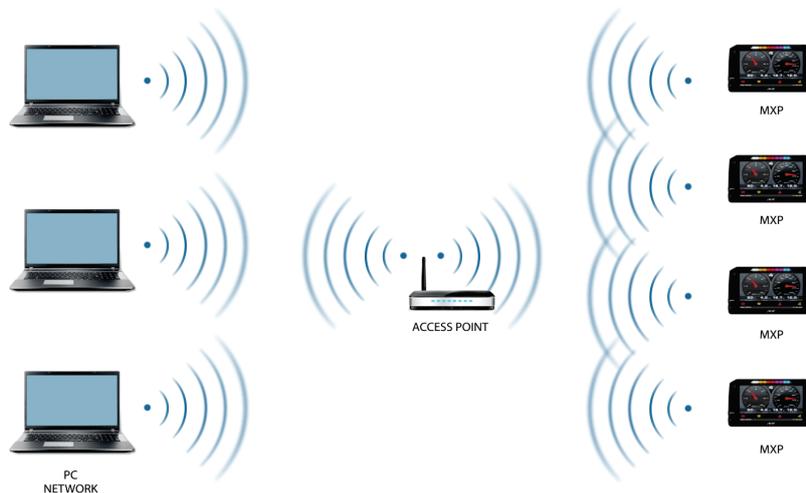
### 1 – As an access point (AP – default)

This is the ideal configuration for one only device and one only computer. In this situation MX Series creates a Wi-Fi network and works as an Access Point the PC can be connected to.



### 2 – Existing network (to connect to an existing Wi-Fi network – WLAN)

This mode is complex and implies an external access point (AP) but it is also more flexible and powerful because allows the communication among more than one device and more than one computer in the same network. MX Series and the PC must connect to an existing Wi-Fi network made by a device that works as an external access point.



When working in WLAN mode MX Series has two available security levels:

- network authentication: network password
- device authentication: MX logger password

Both levels allow the use of different strategies. A PC in WLAN, for example, can see several AiM devices but can only communicate with those he knows the password of.

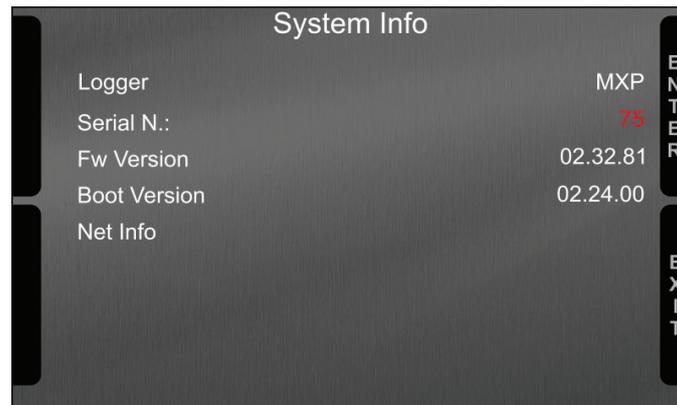
Forgetting the password Wi-Fi configuration can be reset from MX Series menu as explained at paragraph 4.7.

## 5.1 – Configuring MX Series loggers as an access point (AP)

This is MX Series default configuration and is the easiest and most direct connection mode, ideal to communicate with one MX Series logger using one PC. It is free and so completely accessible by anyone. Please set an access password as soon as possible.

To establish a Wi-Fi connection:

- ensure that the Wi-Fi is enabled
- read MX Series Name (75 in the image below)



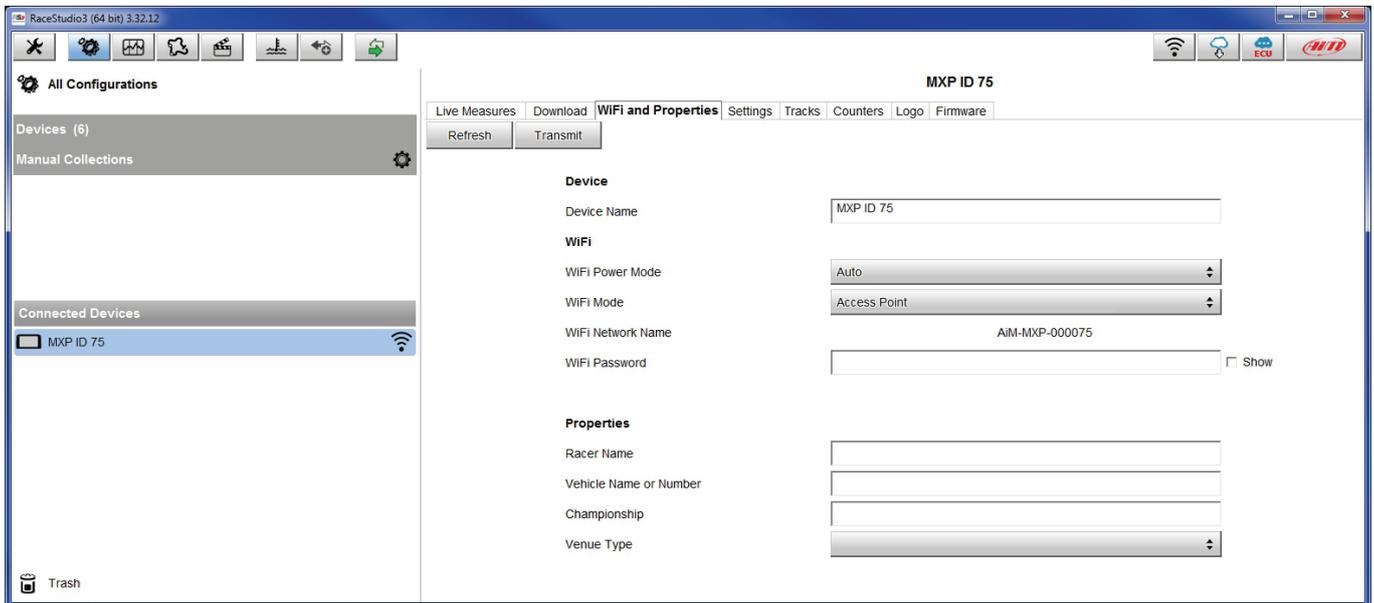
- run Race Studio 3
- click Wi-Fi icon and select your device
- in a few seconds the connection is established





To set other parameters create a unique password to protect the device/ network. With a password the communication is safe and encrypted using WPA2-PSK standard.

Characters allowed in the password are all letters, also capital, all digits and these characters: '+\_{}\$£!?!^#@\*\\\"'=~:;/%"  
"Space" type can be used if it is not the first one because this could cause incomprehension in some Windows™ versions.



This AP or SSID name is unique for the device.

An example of name is: "AiM-MXS12-02523" where:

- "AiM" is the prefix of all AiM devices
- "MXP" is the device identifier
- "000075" is the device serial number assigned by the factory.

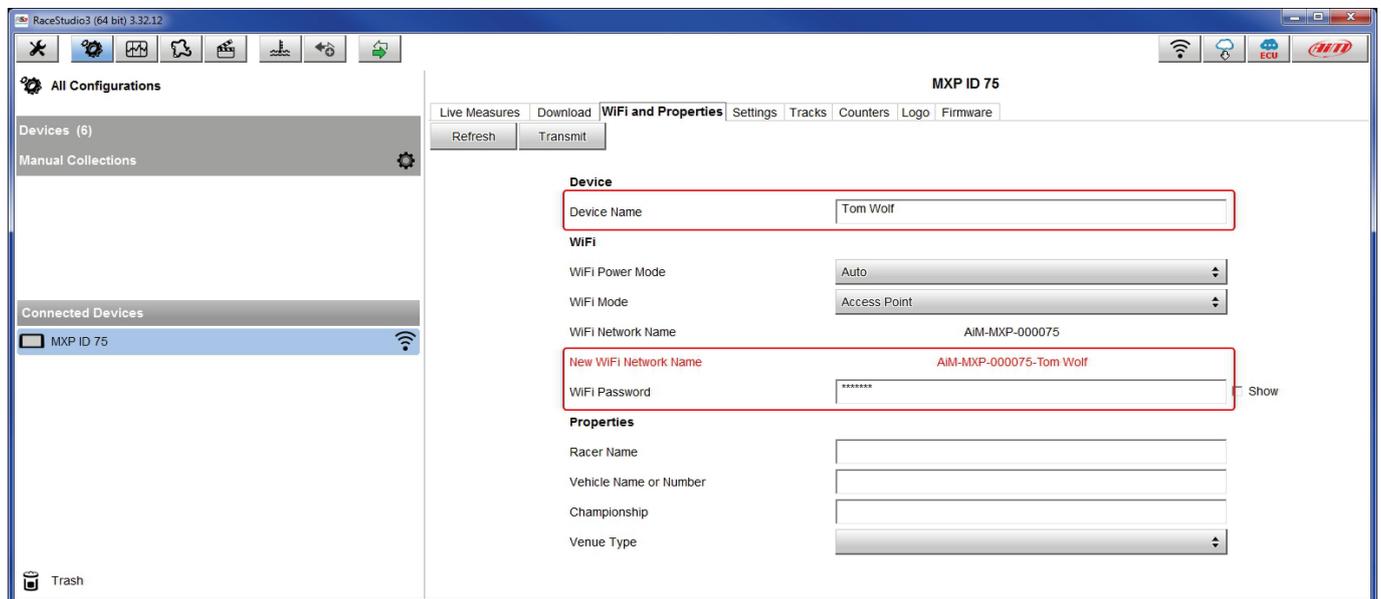
To make a device more recognizable a name can be added to the SSID. With the limit of eight characters. Allowed characters are all letters, capital too, all digits and these characters: ' + \_ ( ) [ ] { } !.

"Space" type can be used provided that it is not the first one because it can cause incomprehension in some Windows™ versions.

Adding, for example, the driver's name, Tom Wolf, the network name (SSID) becomes:

"AiM-MXP-000075-TomWolf"

Once all parameters set click "Transmit". MX Series logger reboots and is configured with the new parameters. If MX Series logger is protected by a password, as recommended, Race Studio 3 will ask that password to authenticate.



**Please Note:** the same Wi-Fi connection can be created with the operative system tool.

Once the device has been authenticated in the Wi-Fi network it can communicate using Race Studio 3.

## 5.2 – Adding MX Series loggers to an existing network

This situation is ideal for a team with multiple drivers and staff members and is desired to communicate with one or more AiM devices using the same PC network. Each MX Series logger can have its password that adds another security and privacy level to the network.

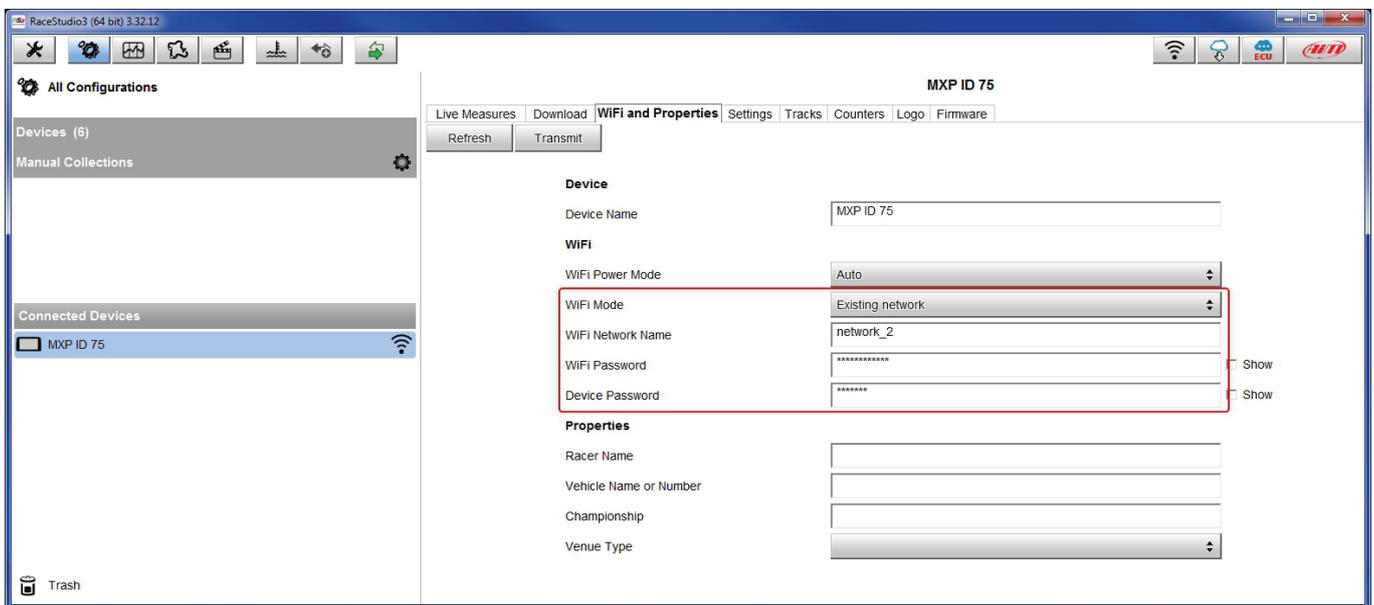
Race Studio 3 will show all MX Series loggers connected to the same network under “Connected devices” label, bottom left of the software page: click the device.

Enter “Wi-Fi and properties” tab and set it on “Existing Network”; fill in network name, network password and device password.

Transmit the network settings to the device clicking “Transmit”: it reboots and joins that network.

**Please note:** the only admitted password are those following WPA2-PSK standard.

To complete this procedure use Race Studio 3 software as here explained.

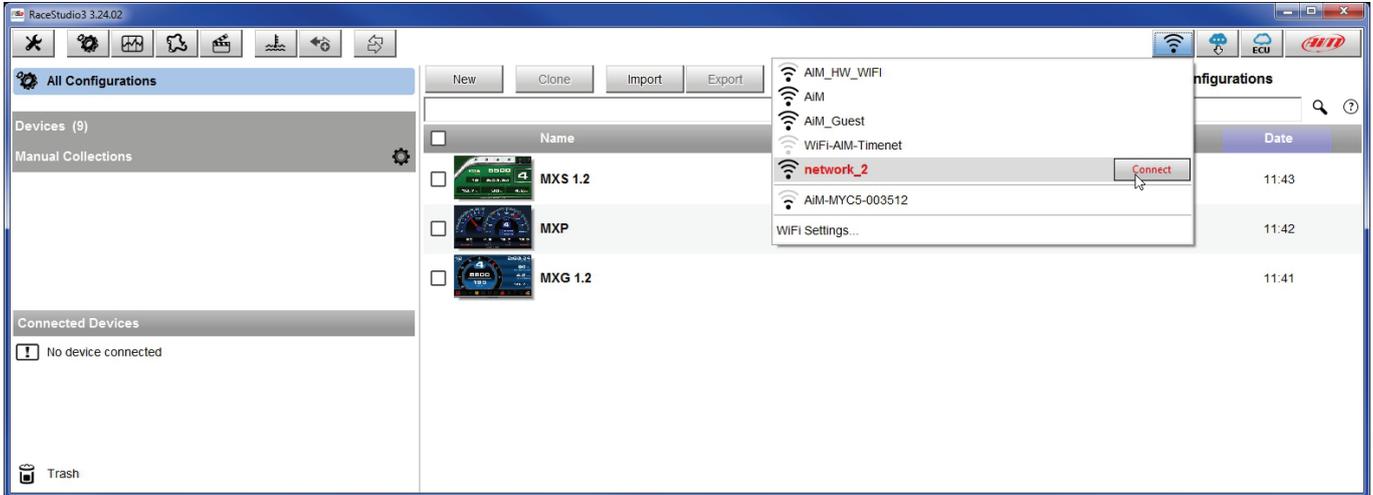


Here above is shown a device “MXP ID 75” that switched from AP to WLAN mode (Existing Network).

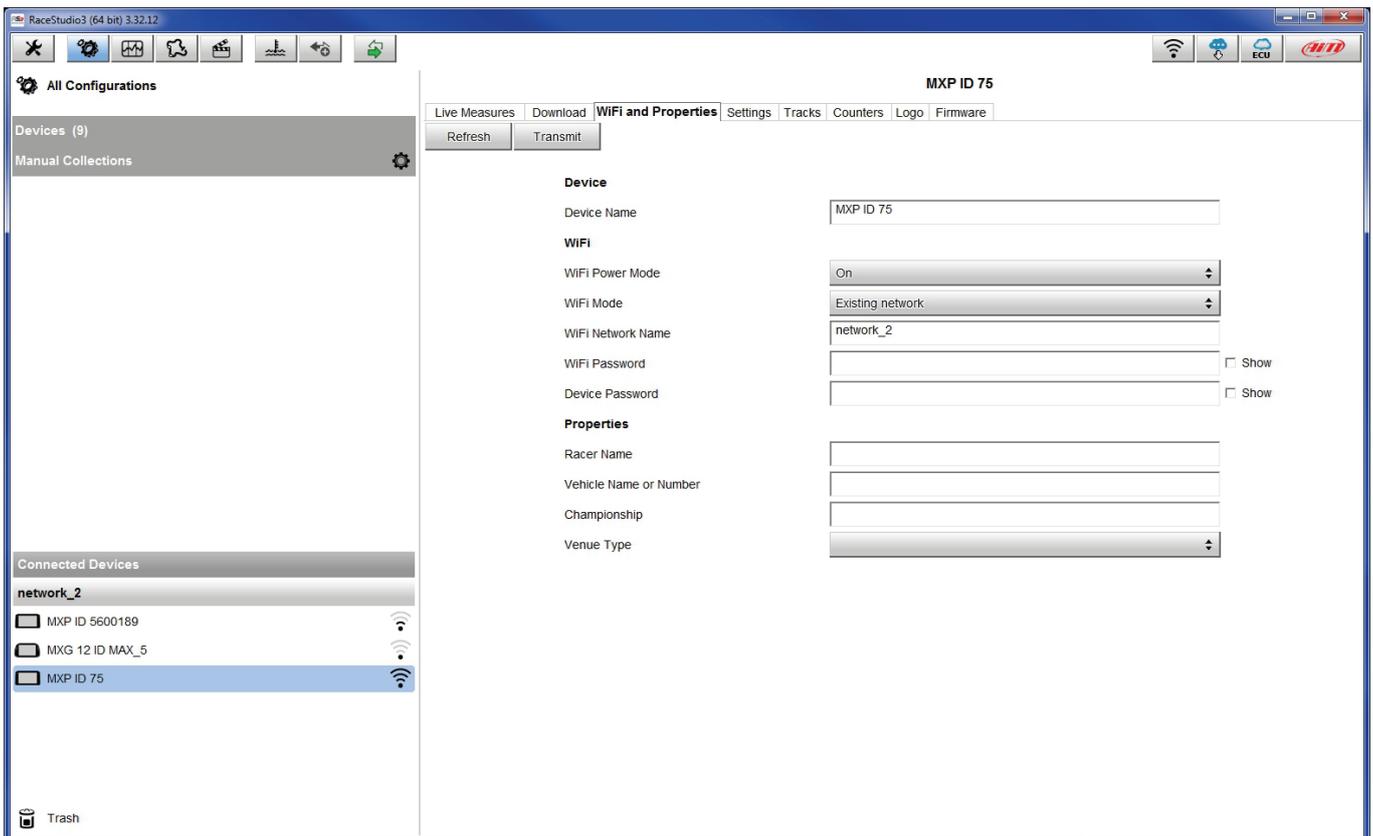
Network name is “network\_2” and does not work with free access because is protected by a password.



To obtain connectivity on the device the PC has to be authenticated to the same network as shown here below.



When the PC is authenticated to the network called "network\_2" it can see all devices you configured to access the same network. In the image below three AiM devices are connected to the same "network\_2" WLAN.



### 5.3 – Wi-Fi network settings

In this chapter is a short description of how to configure a WLAN including AiM devices and a PC.

Here below is an example of configuration.

**ROUTER SETTINGS**

Use this section to configure the internal network settings of your router. The IP Address that is configured here is the IP Address that you use to access the Web-based management interface. If you change the IP Address here, you may need to adjust your PC's network settings to access the network again.

**Router IP Address :**

**Subnet Mask :**

**Device Name :**

**Local Domain Name :**  (optional)

**Enable DNS Relay :**

**DHCP SERVER SETTINGS**

Use this section to configure the built-in DHCP Server to assign IP addresses to the computers on your network.

**Enable DHCP Server :**

**DHCP IP Address Range :**  to

**DHCP Lease Time :**  (minutes)

**Always Broadcast :**  (compatibility for some DHCP Clients)

**NetBIOS announcement :**

**Learn NetBIOS from WAN :**

**NetBIOS Scope :**  (optional)

**NetBIOS node type :**

- Broadcast only (use when no WINS servers configured)
- Point-to-Point (no broadcast)
- Mixed-mode (Broadcast then Point-to-Point)
- Hybrid (Point-to-Point then Broadcast)

**Primary WINS IP Address :**

**Secondary WINS IP Address :**

For better network performances, we suggest the use of a network device equipped with a DHCP server and using 3x3 MIMO technology like, for example a Linksys AS3200.

To maximize the bandwidth the Internet should not be allowed on this WLAN; this means the DHCP server should be configured without any DNS address nor gateway by default.



The parameters for the device network configuration in this example are:

- **Wireless network name: Network\_2**  
It means that the WLAN network name is "Network\_2." A PC has to be authenticated in this network to interact with any AiM device of 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 on this WLAN.)
- **Subnet mask: 255.255.255.248**  
Enable DHCP server: yes  
DHCP IP address range: 192.168.0.2 to 192.168.0.6

These settings enable a DHCP server running on this WLAN and provide an IP address in a 2-6 range. This means that this network allows 5 network hosts.

The number of devices on a WLAN network depends on the subnet mask. Here below are typical examples of network masks and IP addresses range.

The configuration in bold is the one we suggest (if a greater number of devices is not needed), being the one that makes it easier and quicker for Race Studio 3 the identification of the devices in the network.

| <b>Subnet mask:</b>    | <b>IP address range:</b> | <b>Number of devices:</b> |
|------------------------|--------------------------|---------------------------|
| 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                        |
| <b>255.255.255.248</b> | <b>192.168.0.1 – 6</b>   | <b>6</b>                  |



## 5.4 – The Internet connectivity

---

For an optimal speed of AiM device(s) it is recommended not to allow the Internet on the same network and to set the WLAN in the same way.

The Internet access can of course be allowed on the network but this would degrade the communication.

This slightly slower speed can be suitable but a second Wi-Fi connection through an additional hardware (NIC) is to be preferred. This configuration would provide an optimal speed of the data network of your AiM device(s) and at the same time would provide an internet connectivity with the second NIC.

## 5.5 – Connection issues

---

It can occur that MX Series logger is correctly connected to Race Studio 3 via Wi-Fi but the user interface does not show it. This may be because Wi-Fi port setting is set with a static IP. To switch it to dynamic (DHCP):

- open "Network and sharing centre" in the Windows™ research engine
- right click on the Wi-Fi connection and a panel shows up
- select "Properties" option
- double click on "Internet Protocol version 4 (TCP/IPv4)"
- verify that option "Obtain an IP address" is active

For further information refer to FAQ section, Wi-Fi of [www.aim-sportline.com](http://www.aim-sportline.com).

## 5.6 – Working on Mac™ with virtualized Windows™

Race Studio 3 only works on Windows™ operative systems; Mac users can use a virtualized Windows™ machine.

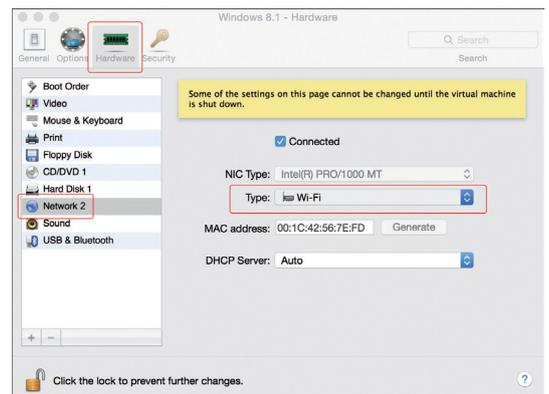
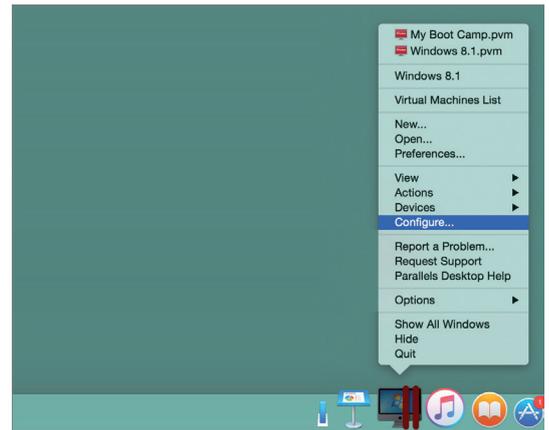
The main problem is that the host OS (Mac) must share its Wi-Fi interface with the virtualized operative system (Windows) as Ethernet interface and not as Wi-Fi interface.

### Configuring Parallels(™)

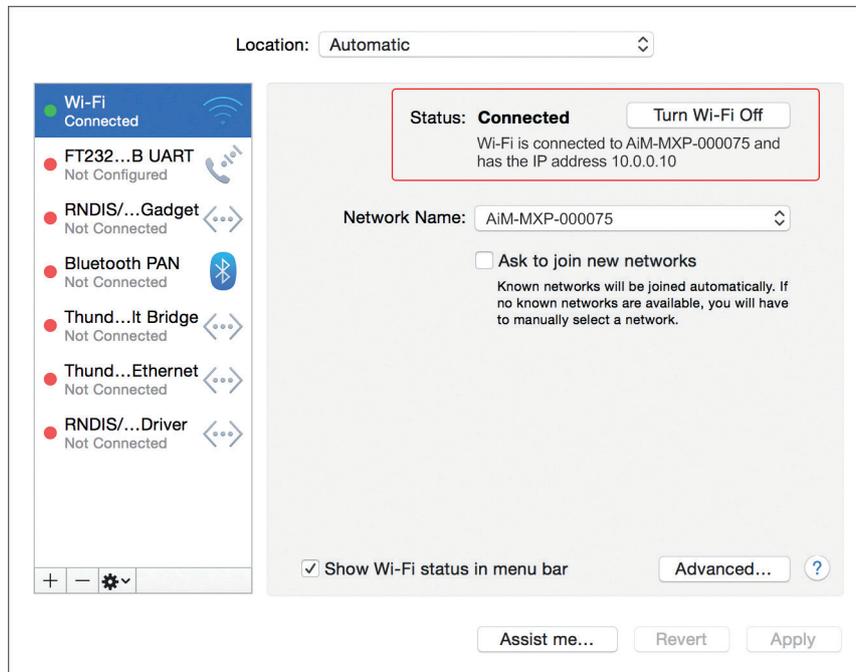
Select “Menu -> Configure...” in Parallels.

Press “Hardware” – top on the page that shows up – and select “Network” in the drop-down menu on the left. Right on the configuration panel set "Type" field on “Wi-Fi”. Then select the device to communicate with.

To ensure that the communication works select “Open Network preferences...” menu.

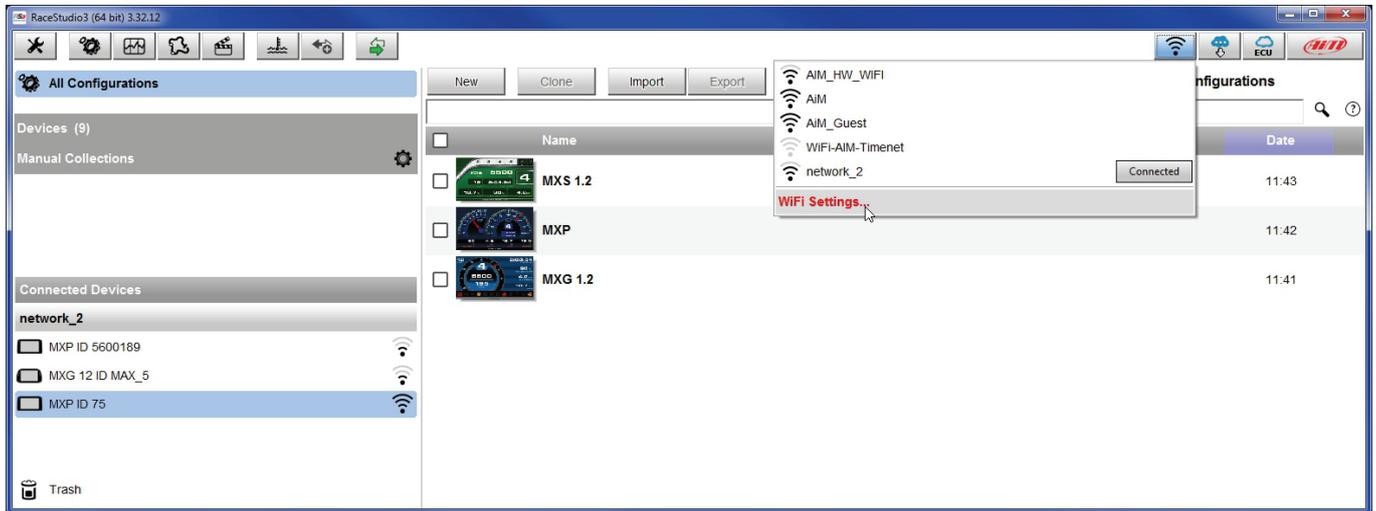


Verify that the status in the window that shows up is “Connected” and that the IP address associated is, for example, 10.0.0.10 (could be 10.0.0.11, 10.0.0.12, or generically 10.0.0.x).



To enable Race Studio 3 correctly working on a Mac with virtualized Windows™.

- press Wi-Fi icon
- select “Wi-Fi Settings” option



- enable the checkbox shown here below.



## 5.7 – Connected device visualization issues

It may occur that using Race Studio 3 on an iMac with virtualized Windows the device connected via Wi-Fi takes some time to be shown in the network or is not shown at all. This is why we always suggest using a Wi-Fi (WLAN) router.

This router work as an Access Point allowing more external devices to connect to its network. MX Series logger Wi-Fi configuration is to be set on Existing Network as explained before.

## 6 – MX Series and the PC

Using AiM Race Studio 3 software you can configure MX Series, manage its tracks database as well as check other device functions through Race Studio 3 device window.

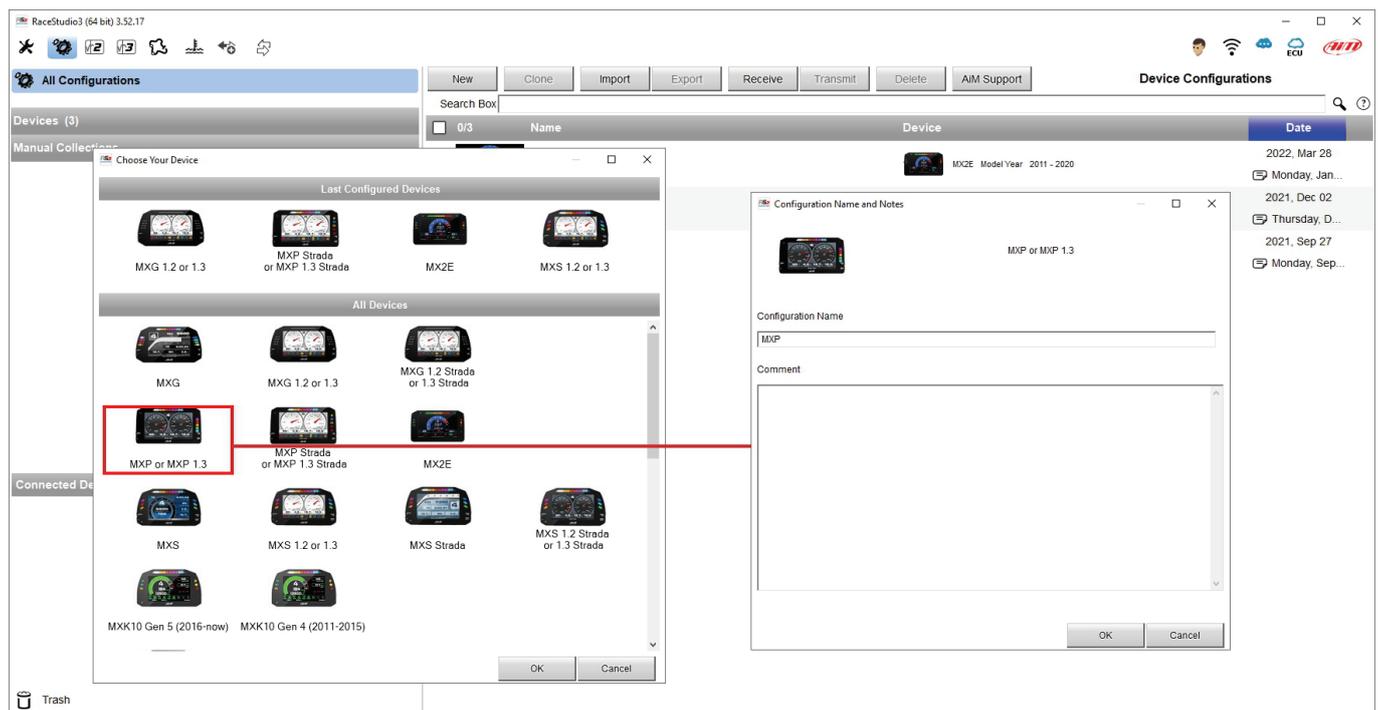
### 6.1 – Connection to the PC

MX Series can be connected to the PC via Wi-Fi or using the USB cable included in the kit: plug it in the cable labelled “USB” of MX Series 37 pins connector harness and in the PC USB port.

### 6.2 – Configuration of MX Series

Once MX Series connected to the PC

- click “Configurations” icon and configurations page appears
- click “New” and new configuration panel appears: select an MX Series logger and press “OK”; when performing subsequent configurations “Select Configuration” panel shows on top the last four devices you configured.



This is the list of the features to be configured:

- Channels: analog and digital sensors directly connected to MX Series loggers.
- ECU: the Engine Control Unit of your vehicle. MX Series logger manages CAN, RS232 and K-Line protocols
- CAN2: in case the system is connected to other CAN devices, beside the ECU, they have to be connected to CAN 2 port
- CAN expansions: other AiM CAN Devices, like, for example, TC Hub (necessary to connect MX1.3 to thermocouple sensors), Lambda controller, GPS Module, Channel expansions etc.
- Math channels: some calculated channels that may be helpful in some situations
- Some other calculated variables, useful for managing alarms, icons, LEDs.

## 6.2.1 – Channels configuration

To set all the device channels.

RPM channel is by default enabled since direct RPM connection is used when the vehicle does not have an ECU; the software automatically disables it when an ECU protocol is selected. See paragraph 6.2.3 for further information about the hardware RPM signal connection.

**Please note:** channels connected to the inertial platform are disabled by default because not supported by MX1.3 loggers. If you have a previous logger please enable them.

| ID    | <input checked="" type="checkbox"/> | Name            | Function       | Sensor                 | Unit      | Freq  | Parameters                |
|-------|-------------------------------------|-----------------|----------------|------------------------|-----------|-------|---------------------------|
| RPM   | <input checked="" type="checkbox"/> | RPM             | Engine RPM     | RPM Sensor             | rpm       | 20 Hz | max: 16000 ; factor: 1 ;  |
| Spd1  | <input type="checkbox"/>            | Speed1          | Vehicle Spd    | Speed Sensor           | kmh 0.1   | 20 Hz | wheel: 1600 ; pulses: 1 ; |
| Spd2  | <input type="checkbox"/>            | Speed2          | Vehicle Spd    | Speed Sensor           | kmh 0.1   | 20 Hz | wheel: 1600 ; pulses: 1 ; |
| Spd3  | <input type="checkbox"/>            | Speed3          | Vehicle Spd    | Speed Sensor           | kmh 0.1   | 20 Hz | wheel: 1600 ; pulses: 1 ; |
| Spd4  | <input type="checkbox"/>            | Speed4          | Vehicle Spd    | Speed Sensor           | kmh 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 |                           |
| Acc1  | <input type="checkbox"/>            | InlineAcc       | Inline Accel   | Internal Accelerometer | g 0.01    | 50 Hz |                           |
| Acc2  | <input type="checkbox"/>            | LateralAcc      | Lateral Accel  | Internal Accelerometer | g 0.01    | 50 Hz |                           |
| Acc3  | <input type="checkbox"/>            | VerticalAcc     | Vertical Accel | Internal Accelerometer | g 0.01    | 50 Hz |                           |
| Gyr1  | <input type="checkbox"/>            | RollRate        | Roll Rate      | Internal Gyro          | deg/s 0.1 | 50 Hz |                           |
| Gyr2  | <input type="checkbox"/>            | PitchRate       | Pitch Rate     | Internal Gyro          | deg/s 0.1 | 50 Hz |                           |
| Gyr3  | <input type="checkbox"/>            | YawRate         | Yaw Rate       | Internal Gyro          | deg/s 0.1 | 50 Hz |                           |
| PAccu | <input checked="" type="checkbox"/> | GPS PosAccuracy | GPS Accuracy   | GPS                    | m 0.01    | 10 Hz |                           |
| Spd   | <input checked="" type="checkbox"/> | GPS Speed       | Vehicle Spd    | GPS                    | kmh 0.1   | 10 Hz |                           |
| Alt   | <input checked="" type="checkbox"/> | Altitude        | Altitude       | GPS                    | m         | 10 Hz |                           |
| OdD   | <input checked="" type="checkbox"/> | Odometer        | Odometer Total | Odometer               | km 0.1    | 1 Hz  |                           |
| Luma  | <input checked="" type="checkbox"/> | Luminosity      | Brightness     | Luminosity             | %         | 1 Hz  |                           |
| Fuel  | <input type="checkbox"/>            | FuelUsed        | Fuel Level     | Fuel Used              | l 0.1     | 10 Hz |                           |
| Tlog  | <input checked="" type="checkbox"/> | LoggerTemp      | Temperature    | Logger Temperature     | C         | 1 Hz  |                           |

To set a channel just click on its line and the related panel shows up.

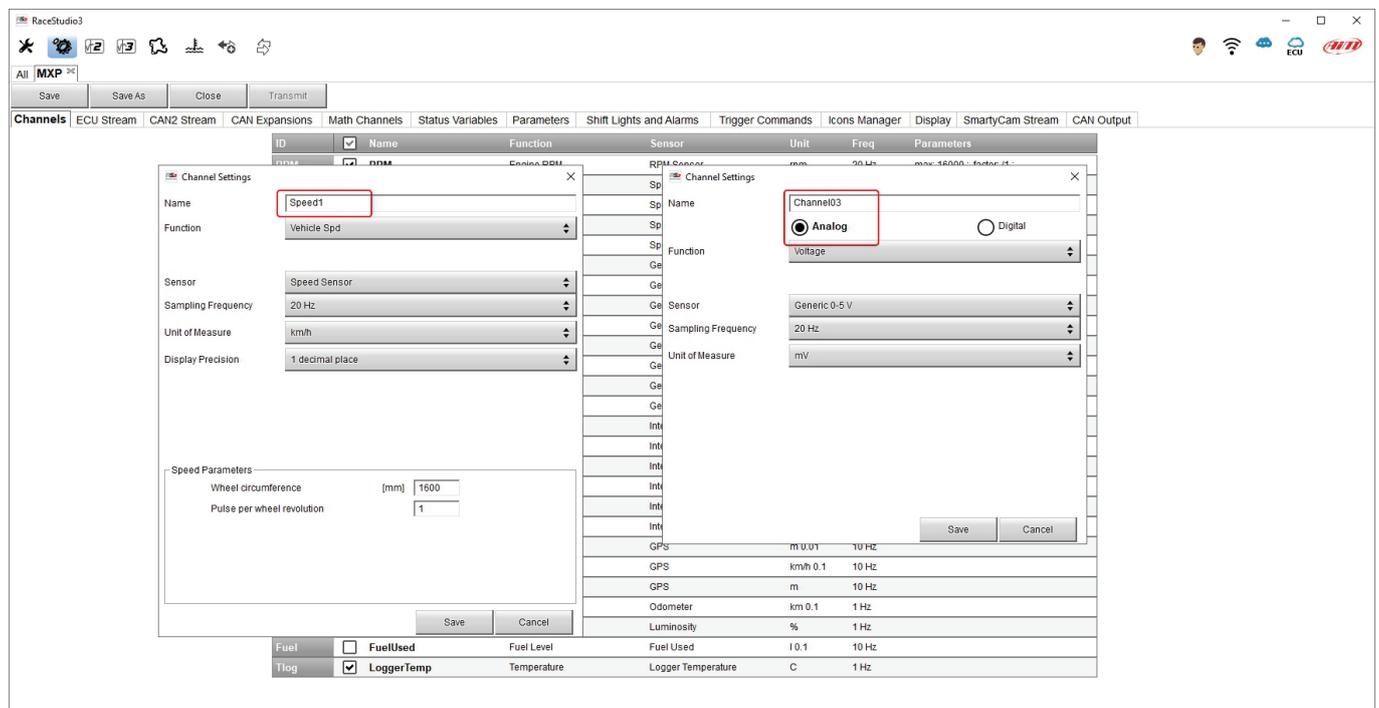
The first channels in the list are RPM and Speed, then we have the configurable channels, that can be managed as analog or as digital according to the sensor you connect.

Typically, analog sensors are pressure sensors, thermocouples (**MX1.2 only**), potentiometers etc... while digital inputs are used for managing pushbuttons that activate Digital outputs.

Selecting “**Analog**” options to be set are

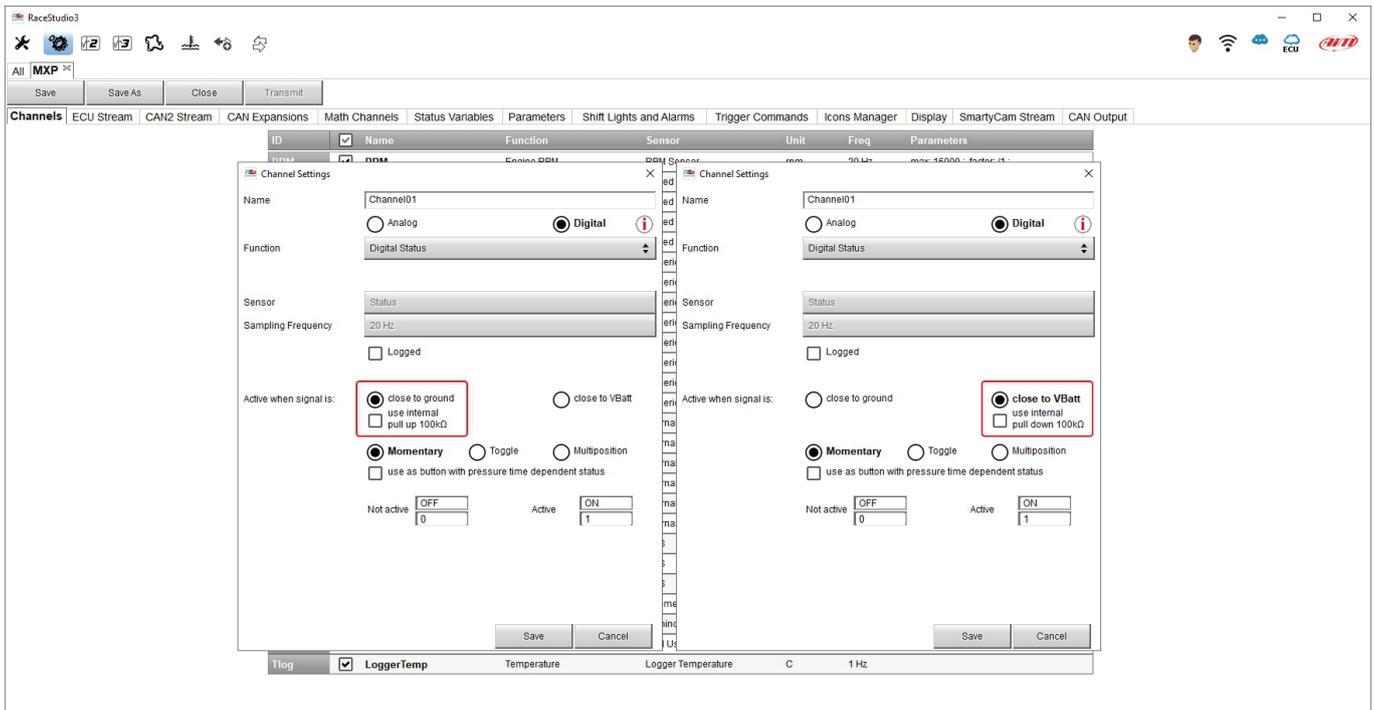
- Channel name
- Function: this parameter is useful in the data analysis process
- Sensor type
- Measure unit
- Sampling frequency
- Display precision: it configures how many decimal digits you will see in your dash
- Specific parameters

In the following image you see two different channels configuration windows.

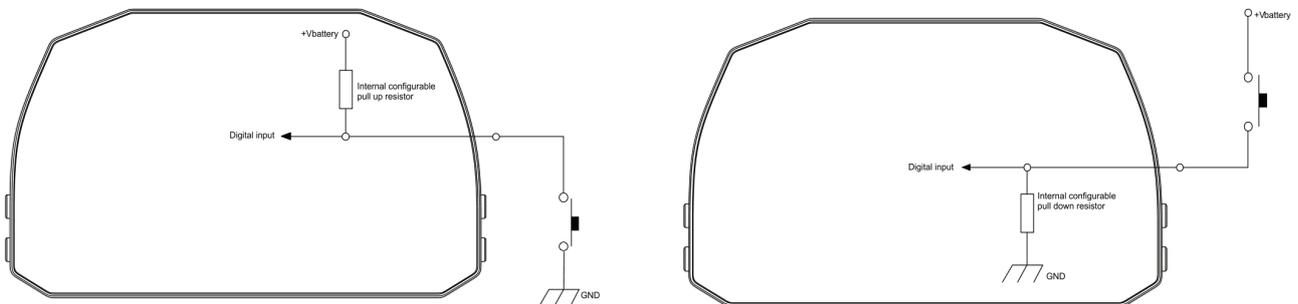


In case you need to use an input as **Digital Input** you have to configure its parameters as explained in the following pages. Pressing the red "i" icon on the setting panel a datasheet explaining digital input working mode can be downloaded. The document is only available in English.

**Please note:** if **Logged** checkbox is flagged the system records the channel, else it can be used and shown but not recorded.

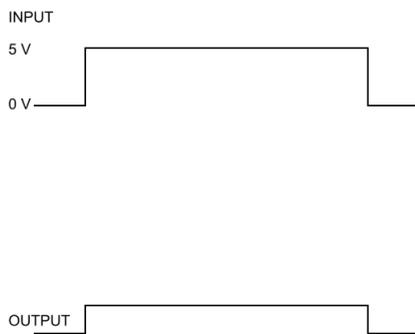


- **Working mode:** a Digital input can work in two different ways:
  - The pushbutton closes to ground (with or without pull up resistor – left image below)
  - The pushbutton closes to VBattery (with or without pull down resistor – right image below)

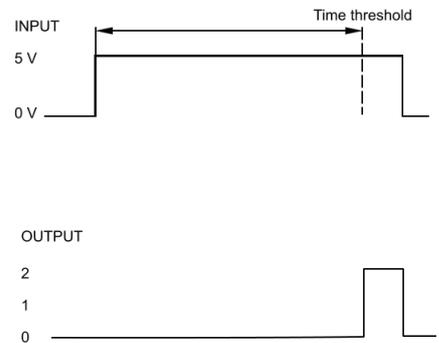
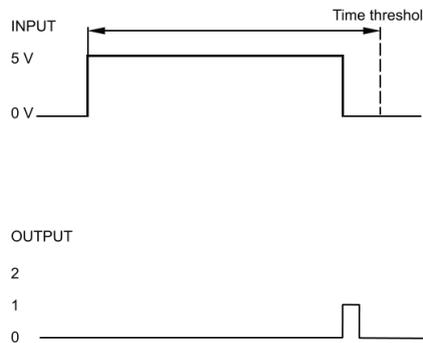


- **Active/Not active labels:** according to the status, a Digital channel may assume the values: 0/1, High/Low, ON/OFF, Closed/Open, True/False, etc; max number of characters for the label is 5.  
The two different labels can be defined and eventually shown on the display, used by Math channels, Icons Management, alarm managements and in general, any time a digital channel is required; the labels appears in Device page too.
- Signal can be momentary, toggle or multiposition, to say
  - **Momentary:** the channel is active when the pushbutton is pressed
  - **Toggle:** the channel is activated the first time button is pressed and deactivated the second time the button is pressed
  - **Multiposition:** the channel can take different status according to the number of pressures and it is possible to add status using the "+" button that appears right of the panel once "Multiposition" option is been selected.
  - **Use as button with pressure time dependent status:** it is possible to configure pressure time so that once the threshold value is reached the pressure switches from short to long and the channel from one status to the other. The image here below shows its working mode.

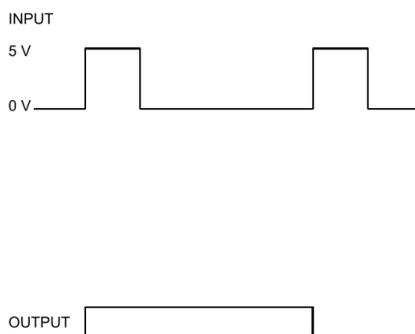
### MOMENTARY



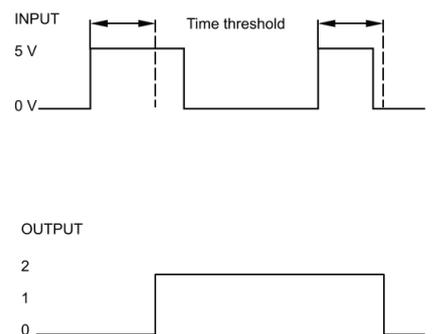
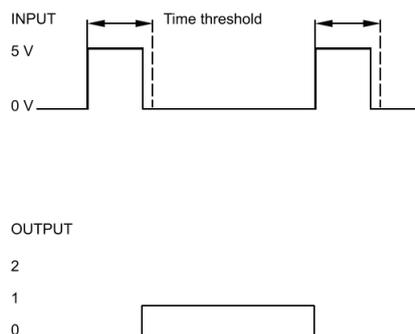
### MOMENTARY WITH TIME THRESHOLD



### TOGGLE



### TOGGLE WITH TIME THRESHOLD



## 6.2.2 – ECU Connection and configuration

MX Series can be connected to the vehicle ECU. Documents explaining how to connect MX Series to the vehicle ECU are published on our website [www.aim-sportline.com](http://www.aim-sportline.com) and a PDF file with protocols updates history can be loaded clicking on the question mark as shown here below. MX Series can communicate through CAN, RS232 and K-Line communication lines.

The ECU protocol includes more than 1500 different protocols and is constantly updated by our technicians. In case of a CAN based ECU whose protocol is not in the database, the ECU Driver Builder function (paragraph 6.4) allows to develop it.

To load the ECU protocol in MX Series configuration:

- enter “ECU Stream” tab
- at the very first configuration panel showing all supported ECU shows up; afterwards press “Change ECU” button
- select “ECU Manufacturer” and “ECU Model” (in the example FORD/ MUSTANG 2010)
- press OK

Click “ECU” icon to know the ECU Protocol Updates History.

The screenshot shows the RaceStudio3 (64 bit) 3.53.06 interface. The main window has a menu bar with options: Save, Save As, Close, Transmit. Below the menu bar is a toolbar with icons for Channels, ECU Stream, CAN2 Stream, CAN Expansions, Math Channels, Status Variables, Parameters, Shift Lights and Alarms, Trigger Commands, Icons Manager, Display, SmartyCam Stream, and CAN Output. The main area displays "ECU: Click button to select a ECU protocol 1 Mbit/sec". A "Change ECU" dropdown menu is highlighted with a red box. To the right, a "Show ECU Protocols Updates History" button is also highlighted with a red box. A dialog box titled "Choose ECU Protocol" is open, showing a list of manufacturers and models. The "FORD" manufacturer is selected, and the "MUSTANG 2010" model is highlighted. The dialog box has "OK" and "Cancel" buttons at the bottom.

| Manufacturer  | Model            | Version       | Protocol |
|---------------|------------------|---------------|----------|
| EDELBROCK     | BOSS 302R X05 OF | (v. 02.00.00) | (CAN)    |
| EFL_EUROPE    | FIESTA           | (v. 02.00.00) | (CAN)    |
| EFL_USA       | FIESTAST150      | (v. 02.00.01) | (CAN)    |
| ELECTROMOTIVE | FOCUS 2005 07    | (v. 02.00.00) | (CAN)    |
| EM            | FOCUS 2008       | (v. 02.00.00) | (CAN)    |
| EMERALD       | FOCUS PZEV0304   | (v. 02.00.00) | (CAN)    |
| EMOTICOM      | FOCUS_2013       | (v. 02.00.02) | (CAN)    |
| EMS           | FR500C_MS        | (v. 02.00.01) | (CAN)    |
| EMTRON        | FiestaCup 2019   | (v. 2.00.04)  | (CAN)    |
| FARTSTRUP     | MUSTANG 2005-9   | (v. 02.00.00) | (CAN)    |
| FAST          | MUSTANG 2010     | (v. 02.00.00) | (CAN)    |
| FERRARI       | MUSTANG 2011     | (v. 02.00.04) | (CAN)    |
| FIAT ABARTH   | MUSTANG 2015     | (v. 02.00.00) | (CAN)    |
| FORD          |                  |               |          |
| FPT           |                  |               |          |
| FUEL_TECH     |                  |               |          |
| GEMS          |                  |               |          |
| GET           |                  |               |          |
| GINETTA       |                  |               |          |



After setting the protocol the system comes back to “ECU Stream” page and two checkbox appears:

- “Enable the CAN Bus 120 Ohm Resistor” (enabled by default; to be disabled in case MX Series logger is additional to the vehicle dash): the CAN Bus needs two 120 Ohm resistors at its two extremes. In case MX Series is the only device connected to the ECU the 120 Ohm resistor should be enabled, else, very easily, it is already present in the existing network and should be disabled;
- “silent on CAN Bus” (disabled by default): usually the ECU expects an acknowledge signal when transmits a message and, as default, the MX Series transmits this signal. Sometimes, particularly when there are other devices in the network, MX Series should not transmit it; in this case, enabling this flag MX Series logger remains completely silent.

ECU: FORD - MUSTANG 2010 (ver. 02.00.00) 500 Kbit/sec

Enable the CAN Bus 120 Ohm Resistor

Silent on CAN Bus

| ID   | Name           | Function      | Unit      | Freq  |
|------|----------------|---------------|-----------|-------|
| CC08 | RPM            | Engine RPM    | rpm       | 10 Hz |
| CC09 | SpeedVeh       | Vehicle Spd   | km/h 0.1  | 10 Hz |
| CC13 | SpeedFL        | Wheel Spd     | km/h 0.1  | 10 Hz |
| CC14 | SpeedFR        | Wheel Spd     | km/h 0.1  | 10 Hz |
| CC15 | SpeedRL        | Wheel Spd     | km/h 0.1  | 10 Hz |
| CC16 | SpeedRR        | Wheel Spd     | km/h 0.1  | 10 Hz |
| CC17 | Gear           | Gear          | gear      | 10 Hz |
| CC25 | WaterTemp      | Water Temp    | C 0.1     | 10 Hz |
| CC04 | TurboBoost     | Number        | #         | 10 Hz |
| CC21 | TCSBrakeEvent  | Number        | #         | 10 Hz |
| CC22 | TCSEngEvent    | Number        | #         | 10 Hz |
| CC23 | StabCtrlTeltal | Number        | #         | 10 Hz |
| CC24 | StabCtrlMTXT   | Number        | #         | 10 Hz |
| CC34 | TyreRvMile     | Number        | #         | 10 Hz |
| CC31 | FuelLevelMean  | Percent       | % 0.01    | 10 Hz |
| CC32 | FuelInst1      | Percent       | % 0.01    | 10 Hz |
| CC33 | FuelInst2      | Percent       | % 0.01    | 10 Hz |
| CC35 | AxleRatio      | Number        | #         | 10 Hz |
| CC10 | PedalPosition  | Percent       | % 0.01    | 10 Hz |
| CC01 | YawRate        | Yaw Rate      | deg/s 0.1 | 10 Hz |
| CC02 | LateralAcc     | Lateral Accel | g 0.01    | 10 Hz |
| CC03 | SWAngle        | Steering Pos  | deg 0.1   | 10 Hz |
| CC05 | TrqAct         | Torque        | Nm 0.1    | 10 Hz |
| CC06 | TrqSource      | Number        | #         | 10 Hz |
| CC07 | BrakeLampSw    | Number        | #         | 10 Hz |

### 6.2.3 – RPM

MX Series can receive RPM value from the ECU. If, on the contrary, the vehicle does not have an ECU RPM can be sampled using the wire labelled “RPM” (corresponding to pin 15) of MX Series 37 pins connector harness.

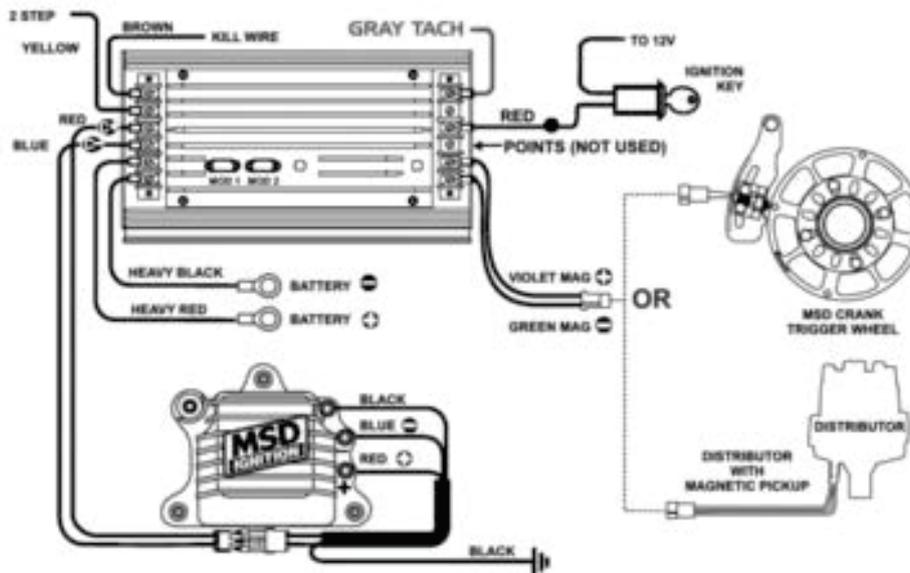
#### RPM from ECU

To get the RPM from the ECU just connect MX Series logger to the ECU and it will automatically sample that value.

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

If the vehicle has no ECU connect wire labelled “RPM” (corresponding to pin 15) of the device 37 pins connector harness to the ignition system. This way MX Series can read the signal from the low voltage of the coil (whose peak can be from 150 to 400 V) or from a possible square wave (the peak can be from 5 to 50 V).

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



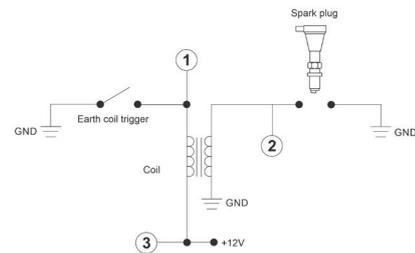
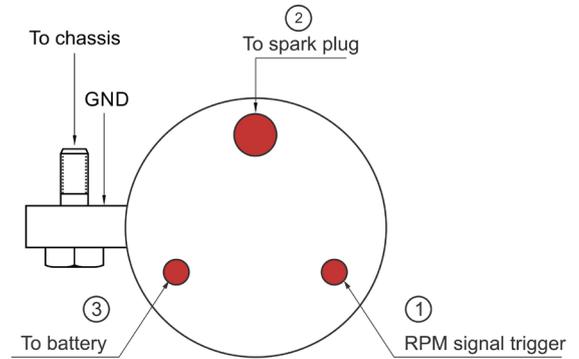
The output labelled “GRAY TACH” gives a 5-50V output that can be directly sampled by MX Series logger.

In case the vehicle ignition system has no output MX Series logger should be connected to the low voltage of the coil as shown in the following images.

**Point 1:** low voltage of the coil

**Point 2:** connected to the spark plug

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





Once MX Series connected to RPM signal enable it and set its parameters in channels page of Race Studio 3 as explained in “Channels configuration” paragraph.

The screenshot shows the RaceStudio3 interface with the Channels page selected. A table lists various channels, and a 'Channel Settings' dialog box is open for the 'RPM' channel. The dialog box has three sections: 'Name' (set to 'RPM'), 'Function' (set to 'Engine RPM'), and 'Sensor' (set to 'RPM Sensor'). Below these is the 'RPM Parameters' section, which includes 'RPM Max' (set to 16000) and 'RPM Factor' (set to /1). The 'Sampling Frequency' is set to 20 Hz. The background table shows the following channels:

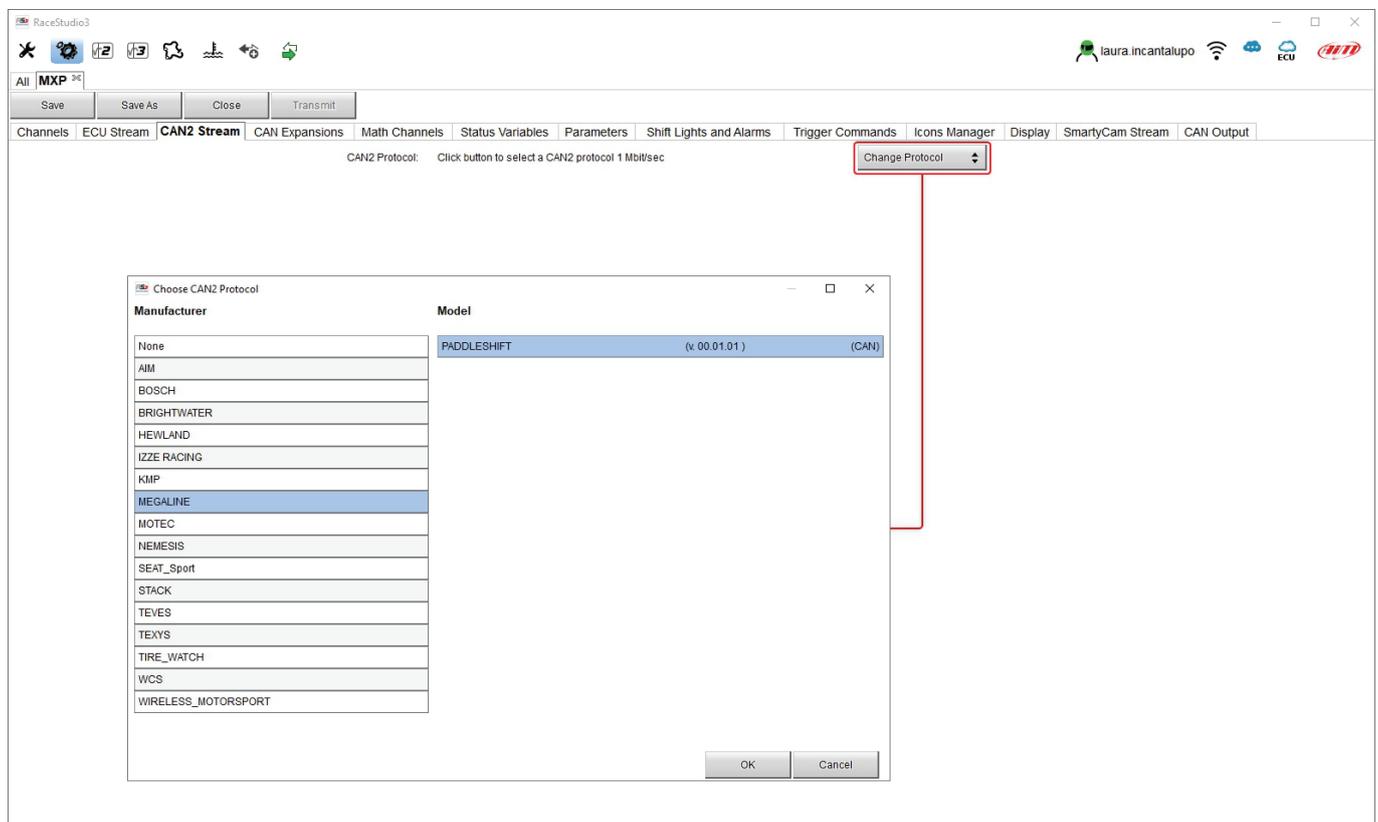
| ID    | Name  | Function       | Sensor             | Unit     | Freq  | Parameters              |
|-------|---|----------------|--------------------|----------|-------|-------------------------|
| RPM   | <input type="checkbox"/> RPM                        | Engine RPM     | RPM Sensor         | rpm      | 20 Hz | max: 16000; factor: /1; |
| Spd1  | <input type="checkbox"/> Speed1                     | Vehicle Spd    | Speed Sensor       | km/h 0.1 | 20 Hz | wheel: 1600; pulses: 1; |
| Spd2  | <input type="checkbox"/> Speed2                     |                |                    |          |       | wheel: 1600; pulses: 1; |
| Spd3  | <input type="checkbox"/> Speed3                     |                |                    |          |       | wheel: 1600; pulses: 1; |
| Spd4  | <input type="checkbox"/> Speed4                     |                |                    |          |       | wheel: 1600; pulses: 1; |
| Ch01  | <input checked="" type="checkbox"/> Channel01       |                |                    |          |       |                         |
| Ch02  | <input checked="" type="checkbox"/> Channel02       |                |                    |          |       |                         |
| Ch03  | <input checked="" type="checkbox"/> Channel03       |                |                    |          |       |                         |
| Ch04  | <input checked="" type="checkbox"/> Channel04       |                |                    |          |       |                         |
| Ch05  | <input checked="" type="checkbox"/> Channel05       |                |                    |          |       |                         |
| Ch06  | <input checked="" type="checkbox"/> Channel06       |                |                    |          |       |                         |
| Ch07  | <input checked="" type="checkbox"/> Channel07       |                |                    |          |       |                         |
| Ch08  | <input checked="" type="checkbox"/> Channel08       |                |                    |          |       |                         |
| Acc1  | <input type="checkbox"/> InlineAcc                  |                |                    |          |       |                         |
| Acc2  | <input type="checkbox"/> LateralAcc                 |                |                    |          |       |                         |
| Acc3  | <input type="checkbox"/> VerticalAcc                |                |                    |          |       |                         |
| Gyr1  | <input type="checkbox"/> RollRate                   |                |                    |          |       |                         |
| Gyr2  | <input type="checkbox"/> PitchRate                  |                |                    |          |       |                         |
| Gyr3  | <input type="checkbox"/> YawRate                    |                |                    |          |       |                         |
| PAccu | <input checked="" type="checkbox"/> GPS PosAccuracy |                |                    |          |       |                         |
| Spd   | <input checked="" type="checkbox"/> GPS Speed       | Vehicle Spd    | GPS                | km/h 0.1 | 10 Hz |                         |
| Alt   | <input checked="" type="checkbox"/> Altitude        | Altitude       | GPS                | m        | 10 Hz |                         |
| OdD   | <input checked="" type="checkbox"/> Odometer        | Odometer Total | Odometer           | km 0.1   | 1 Hz  |                         |
| Luma  | <input checked="" type="checkbox"/> Luminosity      | Brightness     | Luminosity         | %        | 1 Hz  |                         |
| Fuel  | <input type="checkbox"/> FuelUsed                   | Fuel Level     | Fuel Used          | l 0.1    | 10 Hz |                         |
| Tlog  | <input checked="" type="checkbox"/> LoggerTemp      | Temperature    | Logger Temperature | C        | 1 Hz  |                         |

## 6.2.4 – CAN2 Stream configuration

This page works exactly like ECU Stream one. Here you can find additional CAN modules. To load additional CAN protocol modules:

- enter “CAN2 Stream” tab
- at the very first configuration a panel showing all supported non AiM external modules shows up; afterwards press “Change protocol” button
- select “Manufacturer” and “Model” (in the example MEGALINE/PADDLESHIFT)
- press OK

As for ECU Stream a PDF file with protocols updates history can be loaded clicking on the question mark as shown here below and the two checkbox appears as explained before.

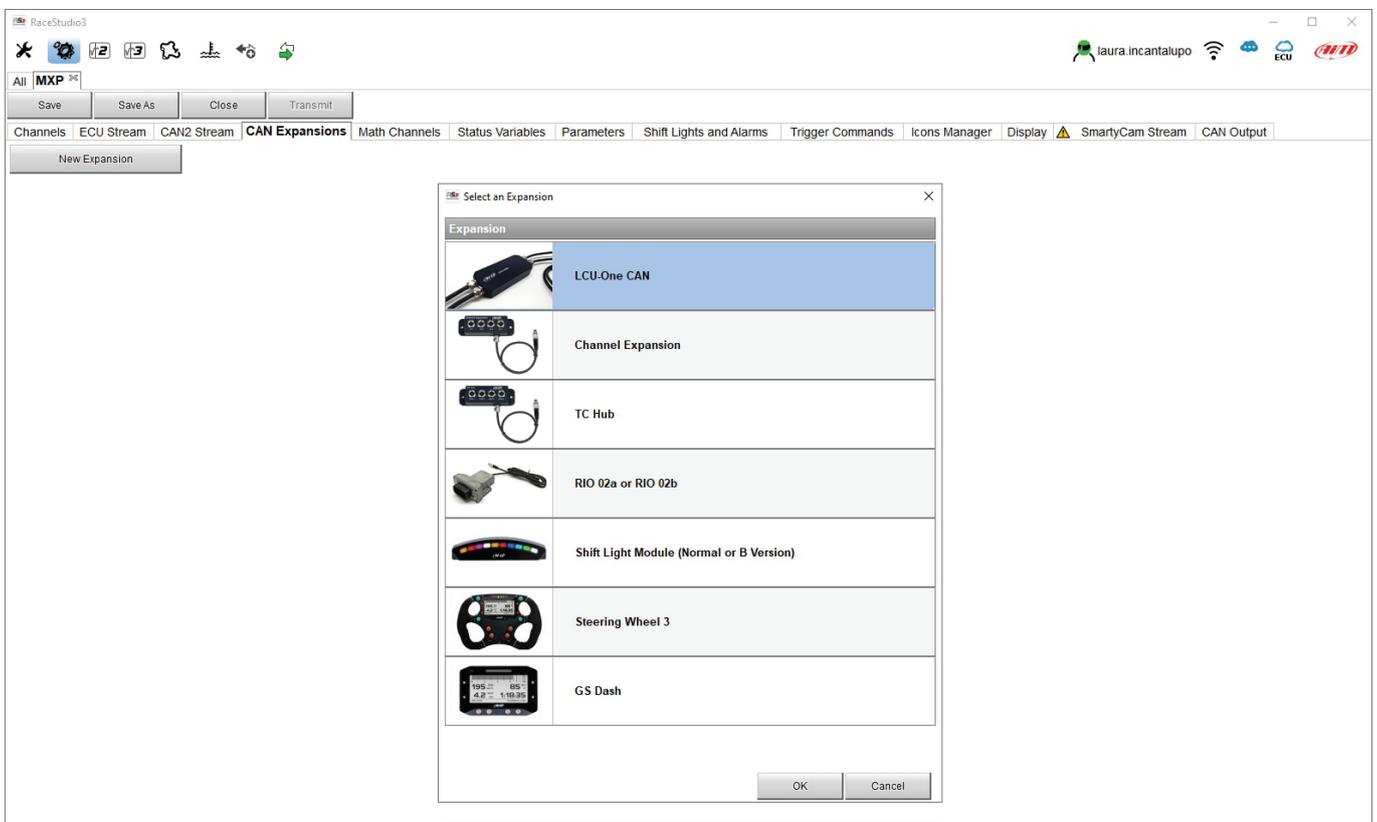


## 6.2.5 – CAN Expansions configuration

MX Series can be connected to various AiM CAN expansions:

- LCU-One CAN
- Channel Expansions
- TC Hub (**necessary to connect thermocouple sensors to MX1.3 loggers**)
- RIO\_02a
- Shift Light Module
- Steering wheel3
- GS Dash

At the very first MX Series connection this page shows up:



Select the CAN expansion to set and press "OK". Each expansion needs to be set filling in the related panel.

## Setting LCU-One CAN

To set an LCU-One CAN:

- press “New Expansion” button;
- select “LCU-One CAN” and press OK
- name the LCU One and fill in its serial number or press “Get SN from a connected expansion” to receive the serial number from the connected LCU-One
- select the multiplier to calculate AFR from lambda (in the example “14.57 Gasoline”) or add a custom value pressing “Add Custom Value” (the related panel shows up)
- set the LCU One channels double clicking on each channel and setting the panel that shows up
- press “Close” to save and exit

Expansion Name ( 6 Characters Max. )

Expansion Serial Number ( S.N. )

Multiplier to calculate AFR (AF) from lambda (AFR = Air Fuel Ratio = pounds of air / pound of fuel)

14.57 - Gasoline

| Multiplier Lambda Values | New Value | Label for New Value |
|--------------------------|-----------|---------------------|
| 6.40 - Methanol          | 14.57     | Gasoline            |
| 9.00 - Ethanol           |           |                     |
| 14.57 - Gasoline         |           |                     |
| 14.60 - Diesel           |           |                     |
| 15.50 - LPG (Propane)    |           |                     |
| 17.20 - CNG              |           |                     |

| ID   | Name  | Function     | Sensor         | Unit        | Freq  |
|------|---|--------------|----------------|-------------|-------|
| Lmd  | <input checked="" type="checkbox"/> 0Lambda | Lambda       | LCU-One Lambda | lambda 0.01 | 10 Hz |
| AFR  | <input checked="" type="checkbox"/> 0AFR    | AFR          | LCU-One AFR    | AF 0.01     | 10 Hz |
| LTrm | <input checked="" type="checkbox"/> 0LmdTmp | Lambda Temp  | LCU-One Temp   | C 0.1       | 10 Hz |
| LDg  | <input checked="" type="checkbox"/> 0Diagn  | Lambda Diagn | LCU-One Diagn  | #           | 1 Hz  |

**Please note:** for any further information about AiM LCU-One CAN refer to the related user manual you find in the box or you can download from AiM website [www.aim-sportline.com](http://www.aim-sportline.com) documentation area, products section.

## Setting Channel Expansion

To set a Channel Expansion:

- press “New Expansion” button;
- select “Channel Expansion” and press OK
- name the Channel expansion and fill in its serial number or press “Get SN from a connected expansion” to receive the serial number from the connected Channel Expansion
- set each channel double clicking on each channel and setting the panel that shows up (it works exactly like channels configuration – see the related paragraph)
- press “Close” to save and exit

The screenshot shows the RaceStudio3 interface with the 'CAN Expansions' window open. The window contains a 'New Expansion' button and a table of channels. A 'Channel Settings' dialog box is also open, showing configuration options for a selected channel.

| ID  | Name       | Function | Sensor        | Unit | Freq  |
|-----|------------|----------|---------------|------|-------|
| C01 | 0Channel01 | Voltage  | Generic 0-5 V | mV   | 20 Hz |
| C02 | 0Channel02 | Voltage  | Generic 0-5 V | mV   | 20 Hz |
| C03 | 0Channel03 | Voltage  | Generic 0-5 V | mV   | 20 Hz |
| C04 | 0Channel04 | Voltage  | Generic 0-5 V | mV   | 20 Hz |

The 'Channel Settings' dialog box shows the following configuration for '0Channel01':

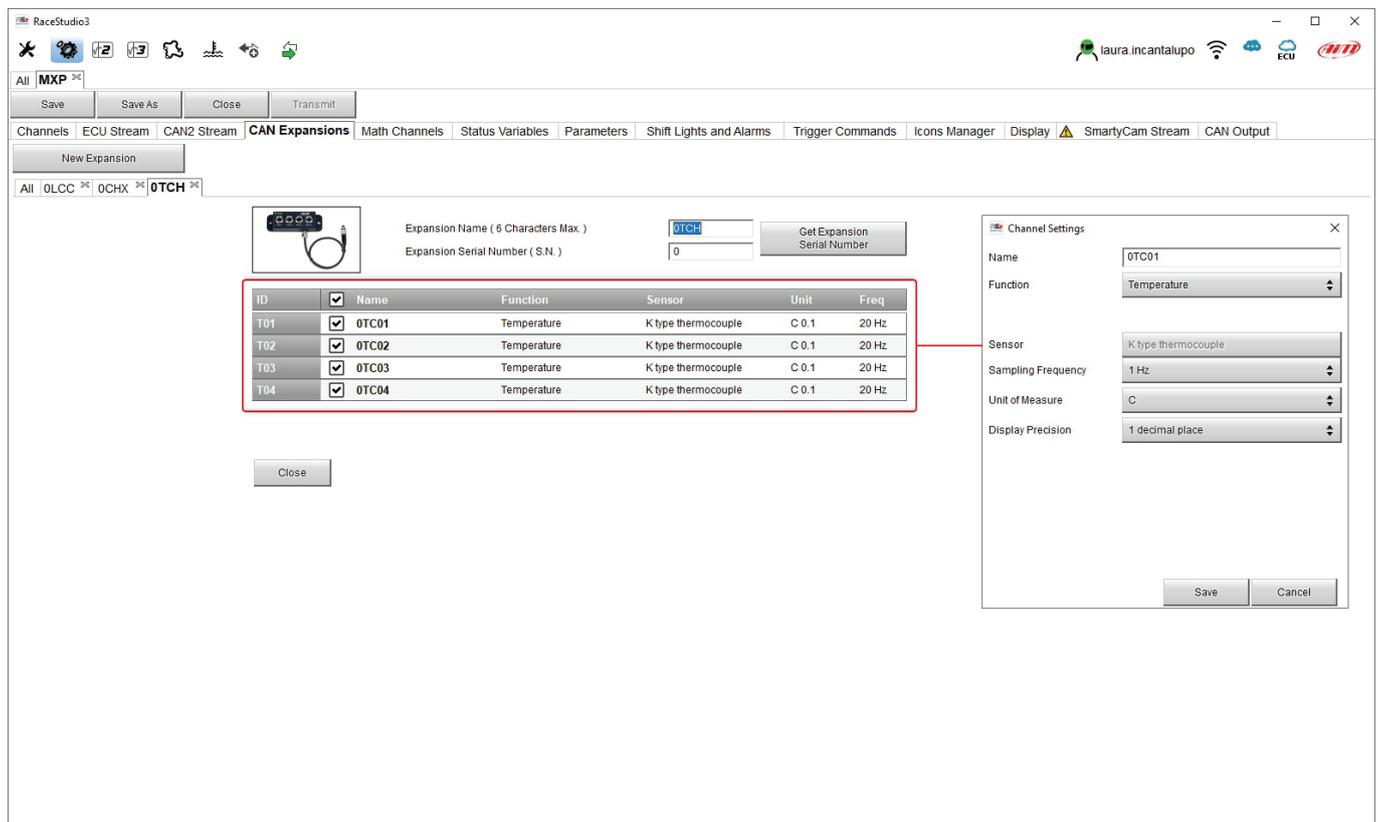
- Name: 0Channel01
- Function: Voltage
- Sensor: Generic 0-5 V
- Sampling Frequency: 20 Hz
- Unit of Measure: mV

**Please note:** for any further information about AiM Channel expansion refer to the related user manual you find in the box or you can download from AiM website [www.aim-sportline.com](http://www.aim-sportline.com) documentation area, products section.

## Setting TC Hub.

This CAN expansion **only supports K type thermo-couples and is necessary to connect thermocouple sensor to MX1.3 loggers**  
 To set a TC Hub:

- press “New Expansion” button;
- select “TC Hub” and press OK
- name the TC Hub expansion and fill in its serial number or press “Get SN from a connected expansion” to receive the serial number from the connected TC Hub
- for each channel set sampling frequency, measure unit and display precision
- press “Close” to save and exit



**Please note:** for any further information about AiM TC Hub refer to the related user manual you find in the box or you can download from AiM website [www.aim-sportline.com](http://www.aim-sportline.com) documentation area, products section.

## Setting RIO\_2a.

This CAN expansion allows to manage external switches.

To set a RIO\_2a:

- press “New Expansion” button;
- select “RIO\_02a” and press OK
- name the RIO\_02a and fill in its serial number or press “Get SN from a connected expansion” to receive the serial number from the connected RIO\_02
- RIO\_02a channels work exactly as all MX series channels; please refer to paragraph 6.2.1 to set the channels
- press “Close” to save and exit

The screenshot shows the RaceStudio3 interface. At the top, there's a menu bar with options like Channels, ECU Stream, CAN2 Stream, and CAN Expansions. Below the menu bar, there's a toolbar with icons for various functions. The main area is divided into several sections. On the left, there's a 'RIO 02a Channels' table. On the right, there's a 'Channel Settings' dialog box.

| ID   | Name  | Function       | Sensor | Unit | Freq  |
|------|---|----------------|--------|------|-------|
| Ch01 | <input checked="" type="checkbox"/> R2a Channel01 | Digital Status | Status |      | 20 Hz |
| Ch02 | <input checked="" type="checkbox"/> R2a Channel02 | Digital Status | Status |      | 20 Hz |
| Ch03 | <input checked="" type="checkbox"/> R2a Channel03 | Digital Status | Status |      | 20 Hz |
| Ch04 | <input checked="" type="checkbox"/> R2a Channel04 | Digital Status | Status |      | 20 Hz |
| Ch05 | <input checked="" type="checkbox"/> R2a Channel05 | Digital Status | Status |      | 20 Hz |
| Ch06 | <input checked="" type="checkbox"/> R2a Channel06 | Digital Status | Status |      | 20 Hz |
| Ch07 | <input checked="" type="checkbox"/> R2a Channel07 | Digital Status | Status |      | 20 Hz |
| Ch08 | <input checked="" type="checkbox"/> R2a Channel08 | Digital Status | Status |      | 20 Hz |
| Ch09 | <input checked="" type="checkbox"/> R2a Channel09 | Digital Status | Status |      | 20 Hz |
| Ch10 | <input checked="" type="checkbox"/> R2a Channel10 | Digital Status | Status |      | 20 Hz |
| Ch11 | <input checked="" type="checkbox"/> R2a Channel11 | Digital Status | Status |      | 20 Hz |
| Ch12 | <input checked="" type="checkbox"/> R2a Channel12 | Digital Status | Status |      | 20 Hz |
| Ch13 | <input checked="" type="checkbox"/> R2a Channel13 | Digital Status | Status |      | 20 Hz |
| Ch14 | <input checked="" type="checkbox"/> R2a Channel14 | Digital Status | Status |      | 20 Hz |
| Ch15 | <input checked="" type="checkbox"/> R2a Channel15 | Digital Status | Status |      | 20 Hz |
| Ch16 | <input checked="" type="checkbox"/> R2a Channel16 | Digital Status | Status |      | 20 Hz |
| Ch17 | <input checked="" type="checkbox"/> R2a Channel17 | Digital Status | Status |      | 20 Hz |
| Ch18 | <input checked="" type="checkbox"/> R2a Channel18 | Digital Status | Status |      | 20 Hz |
| Ch19 | <input checked="" type="checkbox"/> R2a Channel19 | Digital Status | Status |      | 20 Hz |

The 'Channel Settings' dialog box is open, showing the configuration for 'R2a Channel06'. The 'Name' field is 'R2a Channel06', the 'Function' is 'Digital Status', and the 'Sensor' is 'Status'. The 'Sampling Frequency' is '20 Hz'. The 'Logged' checkbox is checked. The 'Active when signal is:' section has three radio buttons: 'close to ground' (selected), 'close to VBat', and 'Momentary'. The 'Momentary' radio button is selected. The 'use as button with pressure time dependent status' checkbox is checked. The 'Threshold for short/long pressure time (sec)' is '0.5'. The 'Rest label' is 'OFF' with a value of '0'. The 'Short time label' is 'SHORT' with a value of '1'. The 'Long time label' is 'LONG' with a value of '2'. There are 'Save' and 'Cancel' buttons at the bottom.

To set a new output:

- fill in output name (1)
- choose channel, working mode and specify if all condition are to be satisfied or only one of them (2-4)
- decide if the circuit is to be open or closed (5)
- decide ending condition ("Untill" – 6) among "condition no longer met", "the device is turned off", "a button is pushed" "data are downloaded"
- "+" buttons right of the panel are to add a new condition (top one) or a new output (bottom one)
- once all operations performed press "Save" in "Create New Alarm" panel.

The screenshot displays the 'Create New Output' dialog in RaceStudio3. The dialog is titled 'Create New Output' and has a 'Description' field (1) and an 'Import/Export' button. Below the description is a dropdown menu (4) set to 'All' and a text field for the description. The main area contains a list of comparison operators (2) such as 'greater than', 'less than', 'between values', 'equal to', 'different from', 'Hysteresis Up to Down', and 'Hysteresis Down to Up'. Below this is the 'Alarm actions in RIO\_02a' section (5) with a dropdown menu set to 'Open Circuit' and a list of actions: 'Open Circuit', 'Closed to Ground', and 'Open Circuit'. At the bottom is the 'Until' section (6) with a dropdown menu set to 'condition no longer met' and a list of options: 'condition no longer met', 'the device is turned off', 'a button is pushed', and 'data is downloaded'. A 'Save' button is at the bottom right. A 'Select Channel' dialog is also open, showing a list of channels (3) with 'Channel01' selected under the 'RPM' source.

## Setting Shift Lights Module.

This CAN expansion works exactly as MX series Shift Lights and can be placed in a position more comfortable than the shift lights for the racer.

To set Shift Light Module:

- press "New Expansion"
- select "Shift Light Module" and press OK
- the module works exactly like MX series shift lights so available options are:
  - use for predictive time
  - use as gear shift lights
- set it as explained in paragraph 6.2.9 and press "SAVE"

The screenshot shows the RaceStudio3 software interface. The main window is titled "RaceStudio3" and contains a toolbar with various icons. Below the toolbar is a menu bar with options: "All", "MXP", "Save As", "Close", and "Transmit". A "New Expansion" button is visible. The "CAN Expansions" tab is selected, showing a list of channels: "All", "0LCC", "0CHX", "0TCH", "R2a", and "SL". The "SL" channel is expanded to show a configuration table for shift lights. The table has columns for "Gear" and "Shift Light" (1-10). The "Use as gear shift lights" radio button is selected. Below the table is a checkbox for "Activate Simulation". At the bottom of the window is a 3D rendering of the shift light module, which is a black, curved device with ten colored lights (green, yellow, red) and the AIM logo.

|     | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10    |    |
|-----|------|------|------|------|------|------|------|------|------|-------|----|
| All | 8200 | 8400 | 8600 | 8800 | 9000 | 9200 | 9400 | 9600 | 9800 | 10000 | ⚙️ |

## Setting Steering Wheel 3 or GS Dash

Steering Wheel and GS Dash are configured in the same way but you can install only one of them

- press "New Expansion";
- select "Formula Steering Wheel 3" and press OK
- the panel here below shows up: select the preferred page layout and press "OK" or double click on the desired layout.

The screenshot shows the RaceStudio3 interface with a 'Select a page to add' dialog box open. The dialog displays a grid of dashboard widget options:

- P1:** Large digital speedometer showing 195 km/h.
- P2:** Large digital tachometer showing 5500 RPM.
- P3:** Digital display for LAM (0.9), A/F (4.2), and WT (85).
- P4 (highlighted with a red box):** A complex multi-gauge display including WT (85), OILP (4.2), Batt (12.5), LAM (0.9), and A/F (4.2).
- Bargraph:** A horizontal bar graph with a needle.
- 4+gear:** Digital display for gear selection (5) and OILP (4.2).
- P8:** A multi-gauge display with OILP (4.2), WT (85), Batt (12.5), LAM (0.7), and A/F (4.2).
- P16:** A multi-gauge display with OILP (4.2), WT (85), Batt (12.5), LAM (0.7), and A/F (4.2).

At the bottom of the dialog, there are 'OK' and 'Cancel' buttons, and a dropdown menu for 'Channel Exp.' currently set to 'RIO 02a Exp'.

The module allows to configure both display page and shift lights and alarms and works exactly like them (paragraphs 6.2.12 and 6.2.9) and is to be configured in the same way.

To configure the **display**

- select the display area where to place the desired channel or the not set row (1)
- choose the group of channels and then the channel to show (2-3) and double click on it to place it in the desired area (4)
- the row becomes configured (5)
- repeat the operation for all the display areas and press "SAVE"

The screenshot shows the RaceStudio3 interface with the following elements:

- Menu Bar:** Channels, ECU Stream, CAN2 Stream, CAN Expansions, Math Channels, Status Variables, Parameters, Shift Lights and Alarms, Trigger Commands, Icons Manager, Display, SmartyCam Stream, CAN Output.
- Toolbar:** Save, Save As, Close, Transmit.
- Display Area (Left):**
  - Page 1:** A large display area showing '5 Gear' (indicated by a circled 4).
  - INFO LINE:** A section below the main display area.
  - Channel Selection:** A list of channels below the INFO LINE, with 'Gear' selected (indicated by a circled 5).
- Channel Selection Area (Right):**
  - Channel Groups:** ECU, CAN 2, Lap Channels, GPS, A/D Channels, Accelerometer, Gyro, Odometer, Internal, Channel Exp., RIO 02a Exp.
  - Channels:** RPM, SpeedVeh, SpeedFL, SpeedFR, SpeedRL, SpeedRR, Gear, WaterTemp, TurboBoost, TCSBrakeEvent, TCSEngEvent.



Shift lights can be set as gear shift lights or for predictive time and it is possible to add new alarms. Please refer to paragraph 6.2.9 to know how to configure shift lights and alarms.

The screenshot shows the RaceStudio3 software interface. At the top, there is a menu bar with options: Channels, ECU Stream, CAN2 Stream, CAN Expansions, Math Channels, Status Variables, Parameters, Shift Lights and Alarms, Trigger Commands, Icons Manager, Display, SmartyCam Stream, and CAN Output. The 'Shift Lights and Alarms' menu is currently selected.

Below the menu bar, there are two radio buttons: 'Use for predictive time' (unselected) and 'Use as gear shift lights' (selected). Below these is a table for configuring shift lights:

| Gear | Shift Light 1 | 2    | 3    | 4    | 5    | 6     |
|------|---------------|------|------|------|------|-------|
| All  | 9000          | 9200 | 9400 | 9600 | 9800 | 10000 |

Each cell in the table contains a small colored circle representing the light's state. Below the table is a checkbox for 'Activate Simulation' which is unchecked.

In the center of the interface is a preview of a digital instrument cluster. The cluster displays: 195 km/h (SPD), 85 WT C (WT), 4.2 bar (OILP), and 1:18:35 (time). It also shows 'GPS: GOOD' and 'THUNDERHILL LONG'.

At the bottom, there is an 'Alarms' section with a table:

| priority                            | Events | Alarms | Output |
|-------------------------------------|--------|--------|--------|
| <input checked="" type="checkbox"/> | Water  | LED: 1 |        |

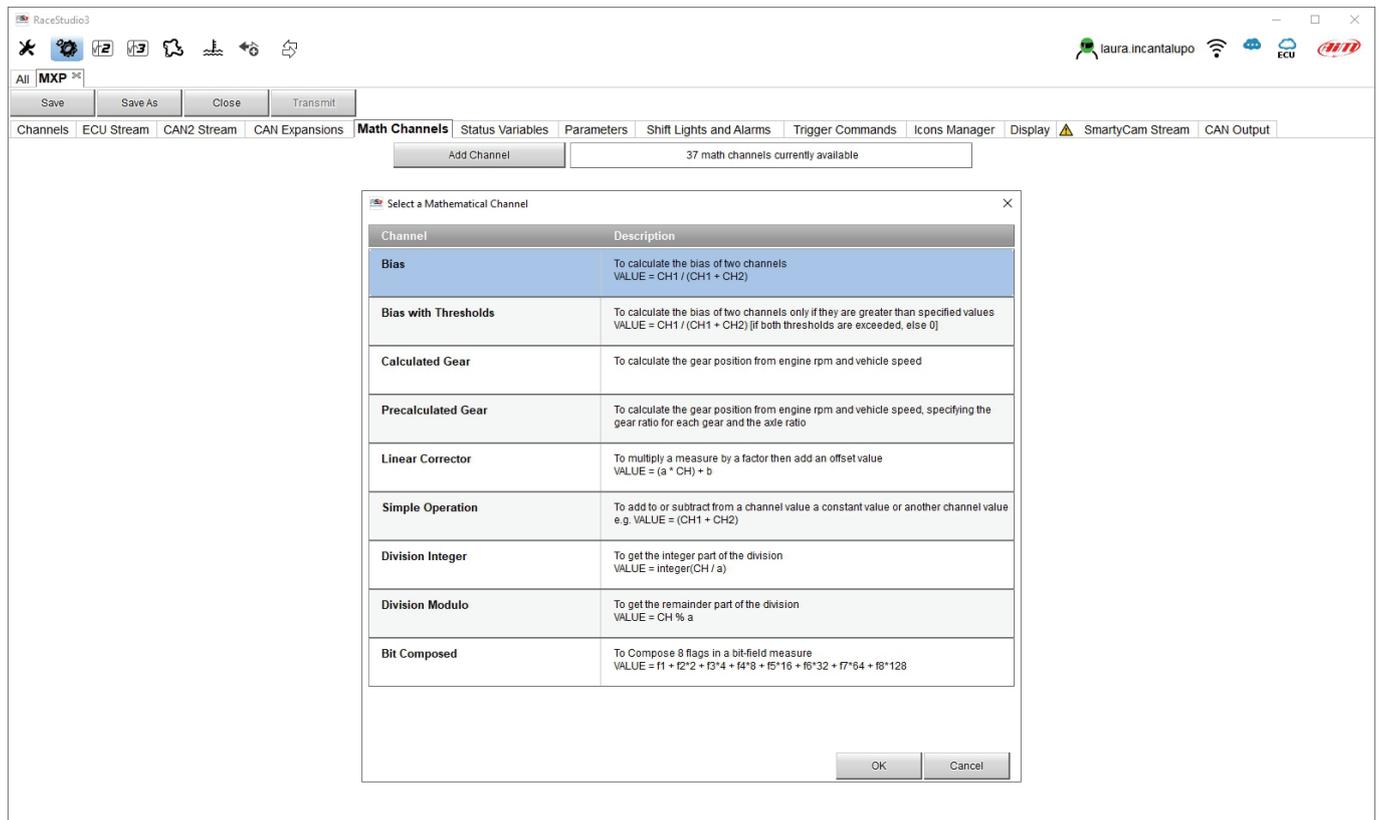
Below the table are buttons for '+ Add New Alarm', 'still available alarms: 35', 'Import Alarm', and 'Export Alarm'.

## 6.2.6 – Math channels configuration

To create math channels; available options are:

- Bias: considering a relation between two mutually compatible channels it computes which one is prevailing (typically used for suspensions or brakes);
- Bias with threshold: it needs the user to set a threshold value for the considered channels; once these threshold are both exceeded the system makes the calculation;
- Calculated gear: it calculates the gear position using engine RPM and vehicle speed
- Precalculated gear: it calculates the gear position using Load/Shaft ratio for each gear and for the vehicle axle too
- Linear correction: typically used when a channel is not available in the desired format or if it is wrongly tuned and cannot be tuned again
- Simple operation: to add or subtract from a channel value a constant value or another channel value
- Division Integer: to get the integer part of the division
- Division Modulo: to get the remainder part of the division
- Bit composed: to compose 8 flags in a bit-field measure

Each option asks the user to fill in a proper panel.



The screenshot shows the RaceStudio3 interface with the 'Math Channels' tab selected. A dialog box titled 'Select a Mathematical Channel' is open, displaying a table of available options:

| Channel                     | Description   |
|-----------------------------|---|
| <b>Bias</b>                 | To calculate the bias of two channels<br>VALUE = CH1 / (CH1 + CH2)  |
| <b>Bias with Thresholds</b> | To calculate the bias of two channels only if they are greater than specified values<br>VALUE = CH1 / (CH1 + CH2) (if both thresholds are exceeded, else 0) |
| <b>Calculated Gear</b>      | To calculate the gear position from engine rpm and vehicle speed  |
| <b>Precalculated Gear</b>   | To calculate the gear position from engine rpm and vehicle speed, specifying the gear ratio for each gear and the axle ratio                                |
| <b>Linear Corrector</b>     | To multiply a measure by a factor then add an offset value<br>VALUE = (a * CH) + b  |
| <b>Simple Operation</b>     | To add to or subtract from a channel value a constant value or another channel value<br>e.g. VALUE = (CH1 + CH2)  |
| <b>Division Integer</b>     | To get the integer part of the division<br>VALUE = integer(CH / a)  |
| <b>Division Modulo</b>      | To get the remainder part of the division<br>VALUE = CH % a   |
| <b>Bit Composed</b>         | To Compose 8 flags in a bit-field measure<br>VALUE = f1 + f2*2 + f3*4 + f4*8 + f5*16 + f6*32 + f7*64 + f8*128   |

The dialog box includes 'OK' and 'Cancel' buttons at the bottom right.

### 6.2.7 – Status variables configuration

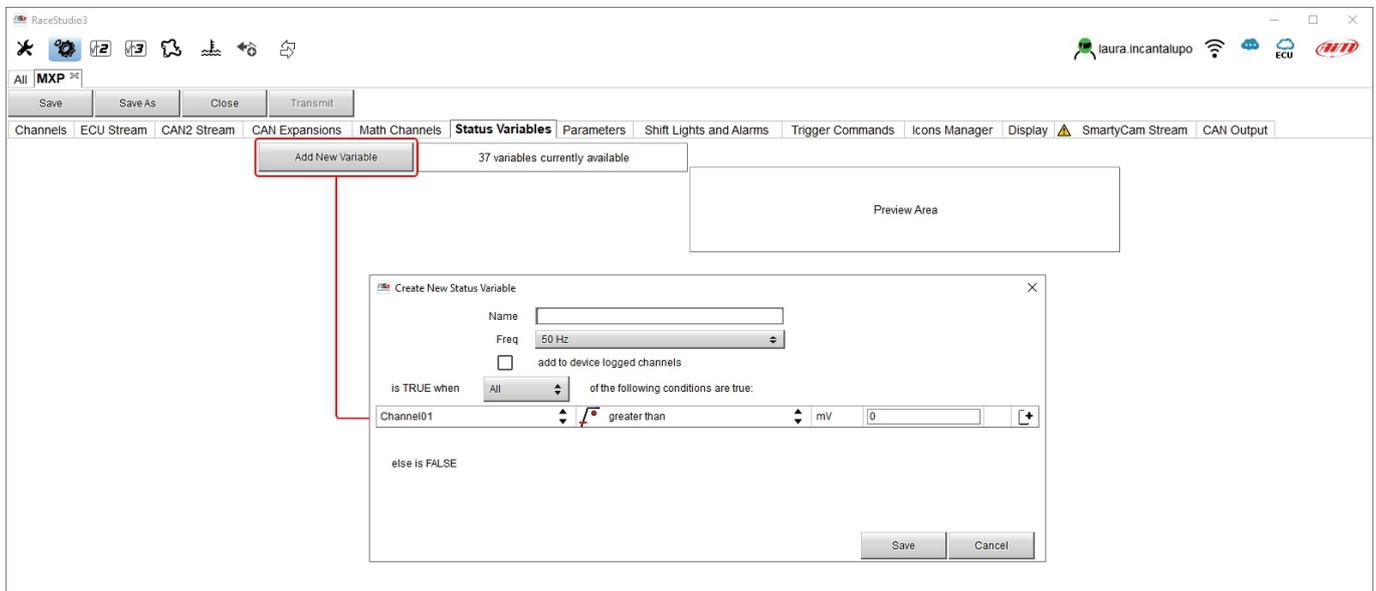
Status Variables are internal math channels that can have only two different values: 1 (TRUE) or 0 (FALSE). They may be useful for simplifying complex configurations, where it is required to evaluate if to activate alarms, LEDs, Icons etc..

Let us explain with an example: we would like to turn ON a LED and an Icon when Water temperature reaches 100°C and the RPM are higher than 2000. Instead of defining the same logic for managing the icon and for managing the LED, we could define a Status Variable, Water Temp Alarm, and link Icon and LEDs to this variable. In this case, we could define:

- Water Temp Alarm is High when:
  - Water Temp is higher than 100°C and
  - RPM is greater than 2000.

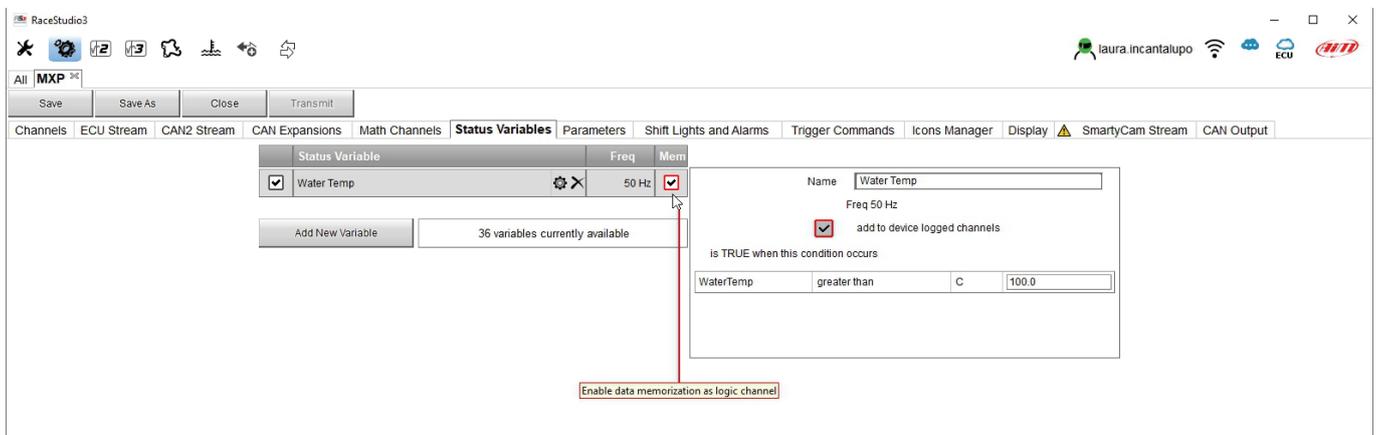
And use Water Temp Alarm for managing Icons and LEDs.

As you may see, the Status Variables are more useful when the logic to be evaluated is complex and involves different channels. In order to define a Status Variable enter the proper TAB.



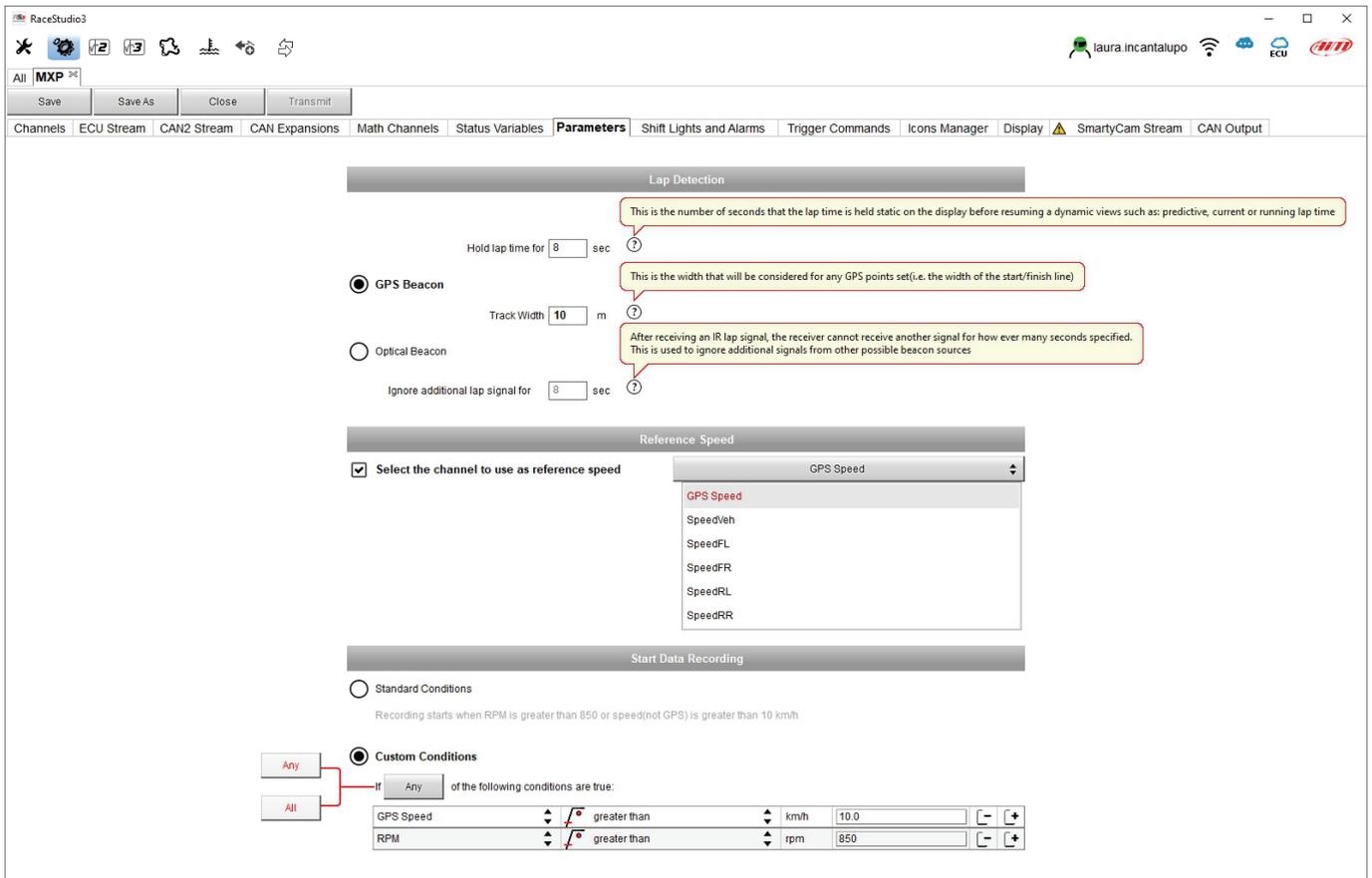
The Status variables can be used as any other channel, so they may be seen online, transmitted to the CAN stream, recorded, used for triggering a command or for turning ON a LED or an Icon.

Mousing over the Status Variable a summary panel appears on the right as shown here below.



## 6.2.8 – Parameters configurationE

To set GPS and/or optional optical beacon (Lap detection) as well as decide the logger start data recording condition (Start Data Recording).



**Lap Detection:** mousing over the question marks a pop up message will explain the working mode of:

- GPS Beacon:
  - hold lap time for: the time period for which lap time is shown on MX Series display
  - the track width: width that will be considered for any GPS point set
- Optical beacon:
  - ignore additional lap signal for: after recording a lap signal, the receiver does not detect another one for the time period fixed in this box. This is very useful if more lap transmitters are placed nearby.

**Reference Speed (Select the channel to use as reference speed):** allows to select the speed to be used as reference one among these available.

### Start Data Recording

- Standard conditions: the logger starts recording with RPM value greater than 850 or speed (not GPS) is higher than 10 km/h
- Custom conditions: to set one or more custom condition(s) to make the logger start recording. Setting more conditions, it is possible to decide whether only one of them or all need to be satisfied.

## 6.2.9 – Shift Lights and Alarms configuration

To set shift lights (on top) and set the alarm LEDs (bottom) of MX Series.

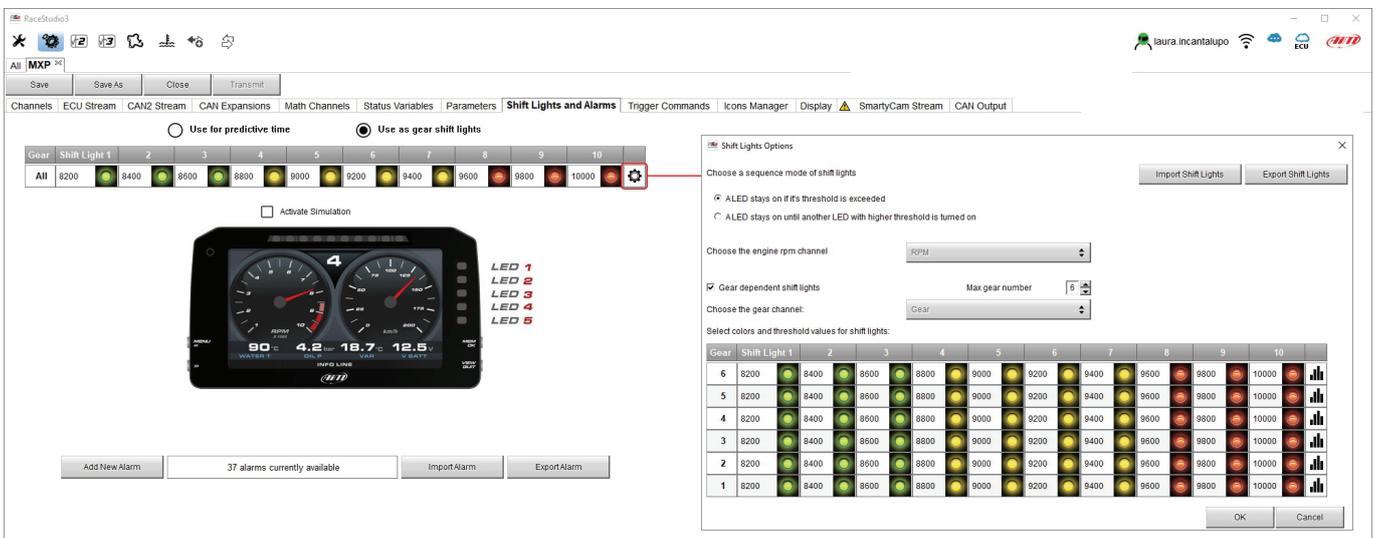


On top MX Series shift lights working mode can be set. Available options are:

- shift lights, for helping in changing gear and
- predictive time: for easily understanding if the actual lap is faster or slower than the reference lap.

**Use as gear Shift Lights** To use the led bar as shift lights click the icon (⚙️) for setting the parameters. Configure:

- at which RPM value the single LED turns ON
- the sequence mode of the LEDs enabling the desired option:
  - a LED stays on if its threshold is exceeded
  - a LED stays on until another LED with higher threshold turns on or
- link the shift lights to the engaged gear enabling the related checkbox;



**Use for predictive time.** Click the icon (⚙️) for setting the parameters.

In this case the LEDs colour are by default fixed in:

- Green if the lap time is improving
- Red if the lap time is worse than the reference lap

The threshold at which one LED is turned ON can be customized. Assuming “0.10 sec” is fixed and the lap time is improving of 0.30 sec toward the reference lap, MX Series will switch on 3 LEDs green; if, on the contrary, the lap time is worsening the LEDs will switch on red.

The screenshot displays the RaceStudio3 interface. At the top, there's a menu bar with options like 'Channels', 'ECU Stream', 'CAN2 Stream', 'CAN Expansions', 'Math Channels', 'Status Variables', 'Parameters', 'Shift Lights and Alarms', 'Trigger Commands', 'Icons Manager', 'Display', 'SmartyCam Stream', and 'CAN Output'. Below the menu, there are two radio buttons: 'Use for predictive time' (selected) and 'Use as gear shift lights'. A table below these buttons shows 'Channel for LED-bars' as '+- Ref Time' and 'Incremental time per LED' as '0.10 sec'. To the right of the table are 'Better' (green) and 'Worse' (red) LED indicators, with a gear icon (⚙️) next to the 'Worse' indicator. Below the table is an 'Activate Simulation' checkbox. In the center, there's a dashboard view showing a tachometer, speedometer, and various data points like '90 °C', '4.2 bar', '18.7 °C', and '12.5 V'. To the right of the dashboard, there are five LED indicators labeled 'LED 1' through 'LED 5'. At the bottom, there are buttons for 'Add New Alarm', '37 alarms currently available', 'Import Alarm', and 'Export Alarm'. On the right side, a 'Predictive Time Bar Options' dialog box is open, showing 'Choose a sequence mode of shift lights' with two options: 'A LED stays on if its threshold is exceeded' (selected) and 'A LED stays on until another LED with higher threshold is turned on'. Below this, there's a 'Predictive Time Increment per LED' field set to '0.1 (sec)'. There are also dropdown menus for 'Better Time LED Color' (set to Green) and 'Worse Time LED Color' (set to Red). At the bottom of the dialog are 'OK' and 'Cancel' buttons.

## Create and set MX Series alarm

To create a new alarm press “Add New Alarm” and the related panel shows up. The software allows the user to set the condition(s) that switches the alarm LED on and the same condition(s) can– all or any – be applied to MX but can also create an event to any of the connected CAN expansion as shown here below and also allows the user to import/export settings too.

The screenshot displays the RaceStudio3 interface. The main window shows a dashboard with gauges and a gear shift light indicator. The 'Shift Lights and Alarms' tab is active, showing a table of gear shift lights and their corresponding RPM ranges. Below the table is a section for 'Add New Alarm' with a button and a text box indicating '37 alarms currently available'. To the right, the 'Create New Alarm' dialog box is open, showing the configuration for a new alarm. The dialog box has a 'Description' field, an 'Import' button, and an 'Export' button. It contains a section for 'If' conditions, where 'Channel01' is selected and the condition is 'greater than' with a value of '0' mV. Below this, there are three sections for 'Alarm actions in MXIP', 'Alarm actions in RIO 02a or RIO 02b', and 'Alarm actions in Steering Wheel 3'. Each section has a 'Message' field and an 'Until' field set to 'condition no longer met'. The 'Add New Alarm' button is highlighted with a red box, and a red line connects it to the 'Create New Alarm' dialog box.

| Gear | Shift Light 1 | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10    |
|------|---------------|------|------|------|------|------|------|------|------|-------|
| All  | 8200          | 8400 | 8600 | 8800 | 9000 | 9200 | 9400 | 9600 | 9800 | 10000 |

To set the new alarm:

- define the Alarm name (Description)
- one or more Alarm condition(s) can be set using the “+” button right of the panel: choose if the conditions are to be ALL valid or just one of them and decide which action(s) is/are to be triggered in the different devices
- decide the alarm ending condition (“Condition no longer met”)
- when all operations have been performed press “Save” in “Create New Alarm” Panel. CAMBIARE IMMAGINE

## 6.2.10 – Trigger commands configuration

“Trigger Command” executes some specific actions on MX Series.

Available commands are:

- Display page (next, previous, first and second camera input or go to a specific display page )
- display button command (any pushbutton)
- reset alarms whose ending condition is “a button is pushed”

To add a new command.

- Press “Add new Command”
- the related panel is prompted CAMBIARE IMMAGINE

The screenshot displays the RaceStudio3 software interface. The main window shows a list of events and alarms, with a red box highlighting the "Add New Command" button. Below this, a "Create New Output Command" dialog box is open, showing a configuration screen for a new command. The dialog includes a "Description" field, a dropdown menu for "If" (set to "All"), and a condition "Speed1 greater than km/h 0.0". Below the condition, there are two sections for "Command actions in MXP" and "Command actions in Steering Wheel 3", both showing "commands not yet associated to this event". The dialog also has "Import", "Export", "Save", and "Cancel" buttons.

- Name the command and fix one or more condition(s) of the Trigger Commands deciding whether the conditions are to be ALL valid or just one of them CAMBIARE IMMAGINE
- decide the action to be performed by the device(s) connected
- Click "Save"

The screenshot shows the RaceStudio3 interface with the 'Trigger Commands' tab selected. A 'Create New Output Command' dialog box is open, showing the configuration for a new command named 'ParkAssistance'. The dialog includes a 'Description' field, a dropdown for 'If' (set to 'All'), and a list of conditions: 'All gears' with a value of 'R'. Below the conditions, there are two action fields: 'Command actions in MXP' with the value 'First Camera Input' and 'Command actions in Steering Wheel 3' with the value 'none'. The 'Save' button is highlighted with a red box.

| Event                               | Alarm            |
|-------------------------------------|------------------|
| <input checked="" type="checkbox"/> | Water Temp Alarm |
| <input checked="" type="checkbox"/> | Fuel             |

34 commands currently available

Create New Output Command

Description: ParkAssistance

If: All of the following conditions are true:

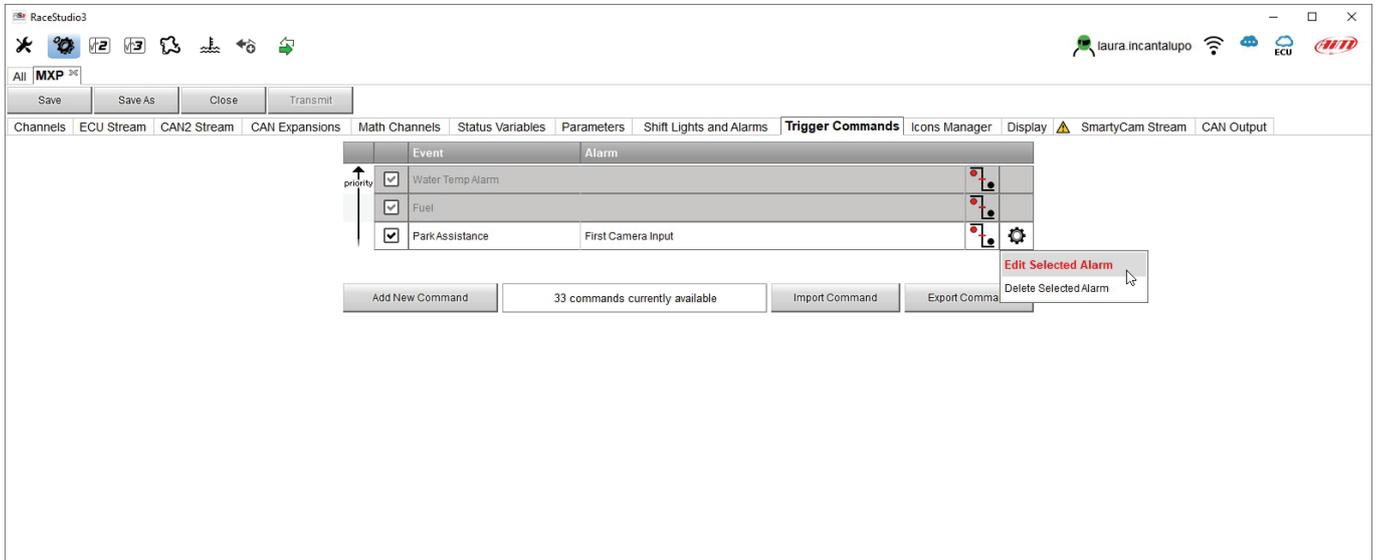
- All gears == equal to R

then trigger the following action(s):

- Command actions in MXP: First Camera Input
- Command actions in Steering Wheel 3: none

Save Cancel

In the Trigger Commands summary page, trigger command can be modified/deleted right clicking on the setting icon placed right of the trigger row.



### 6.2.11 – Icons manager configuration

The “Icon” are a set of images that can be shown on the display when a fixed condition is true. A set of icons is provided by default; they can be modified and it is also possible to load custom icons.

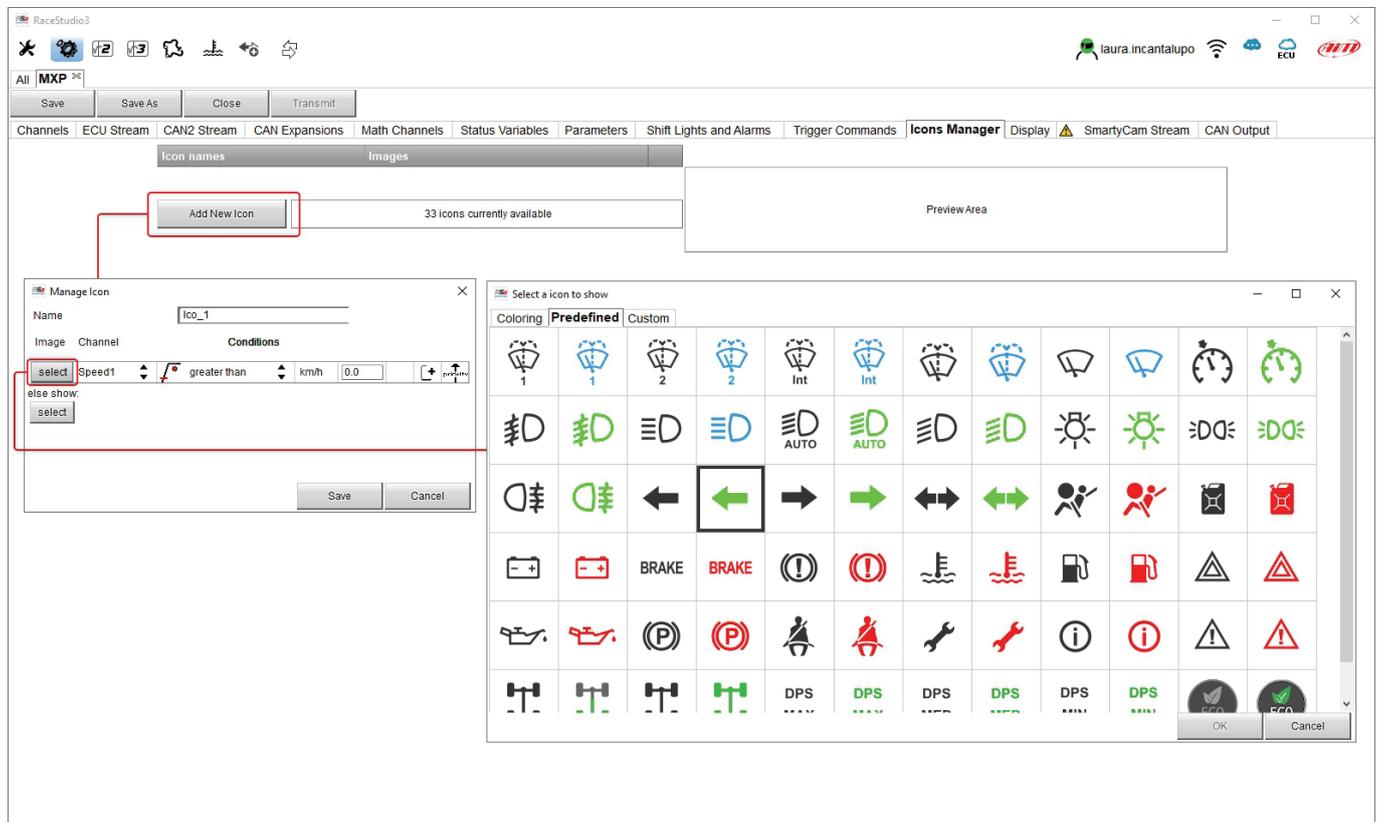


For example:

- the first image is shown when the signal Turn Right is TRUE
- the second when the signal Turn Left is TRUE
- the third when the signal Hazard is TRUE
- the fourth when no signal is TRUE

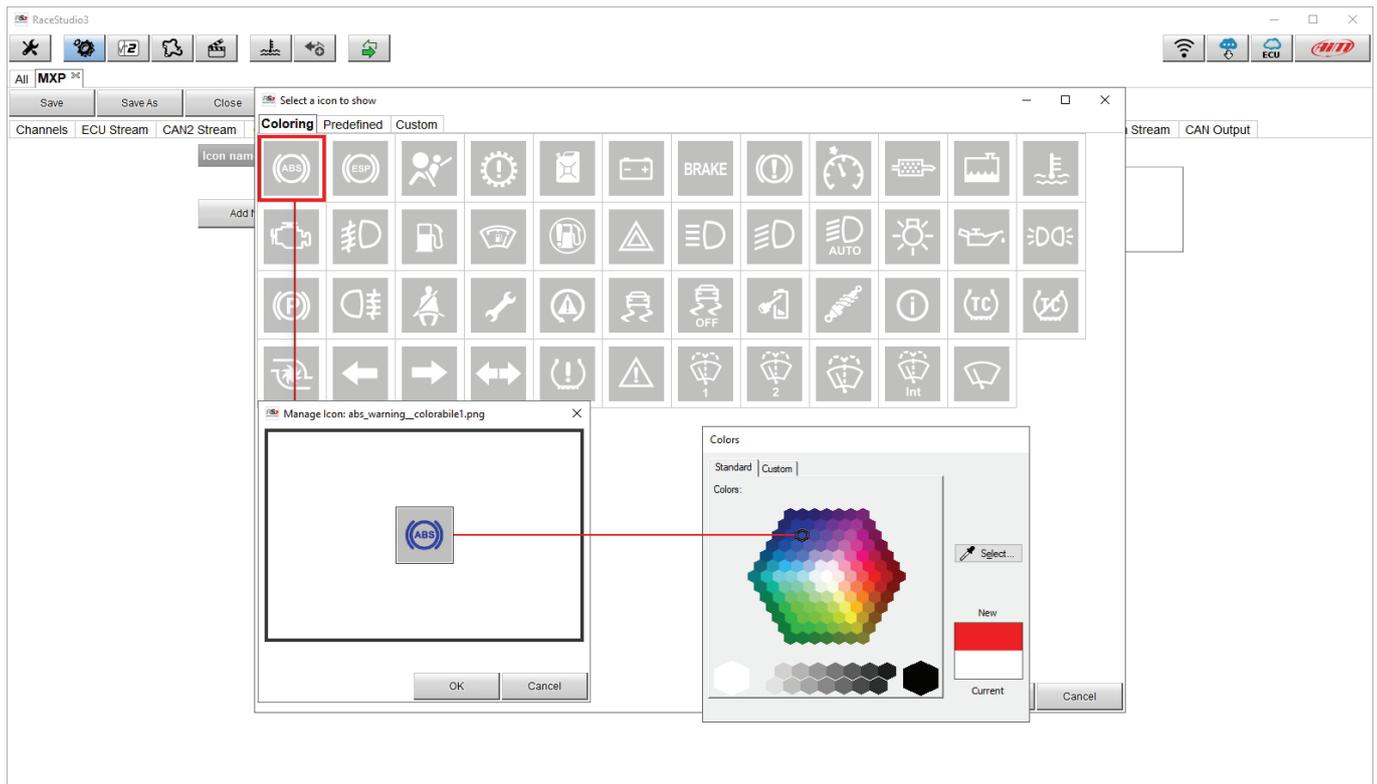
To **configure an icon**:

- press “Add New Icon”
- “Manage Icon” panel shows up
- press “Select” to see the panel showing all images
- select “Predefined” layer to select the image to set among these available by default; select the desired one and press “OK”
- the software comes back to “Manage Icon” panel
- set the image conditions according to the channel they are related to



## To modify an icon colour:

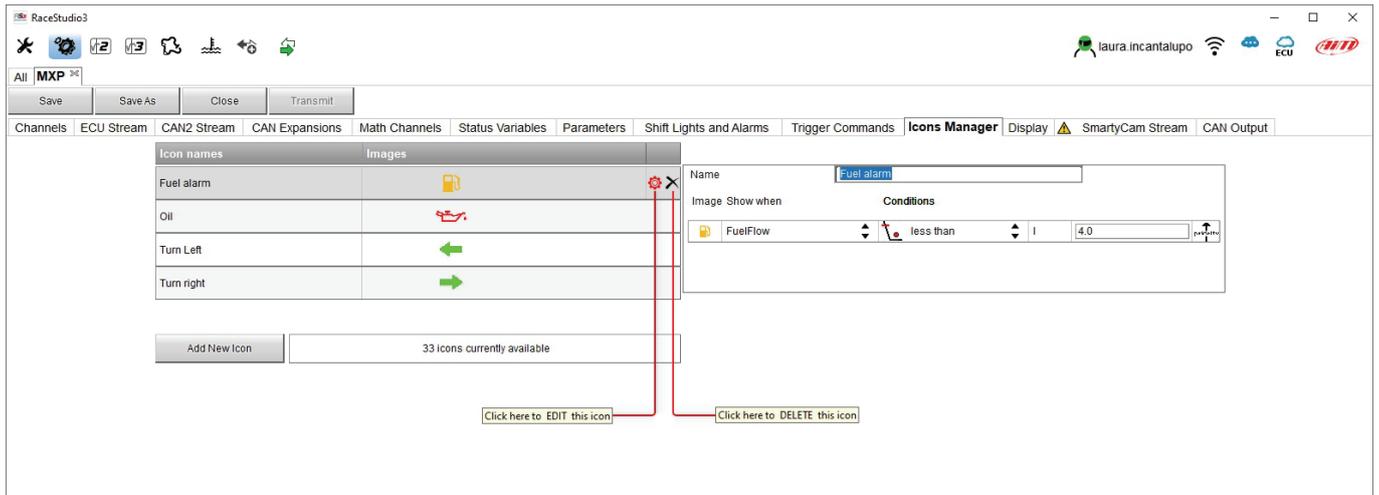
- select "Colouring" layer
- click on the icon to be coloured (ABS in the example below)
- two panel show up: left the panel showing the icon and right the panel where to choose the colour
- click on the desired colour (blue in the example)
- left panel shows the icon coloured
- press "OK"



### To load a custom icon:

- select "Custom2 layer"
- press "Add new"
- browse the folders and load the custom icon; images have to be a .bmp 64x64 pixels format
- press "OK"

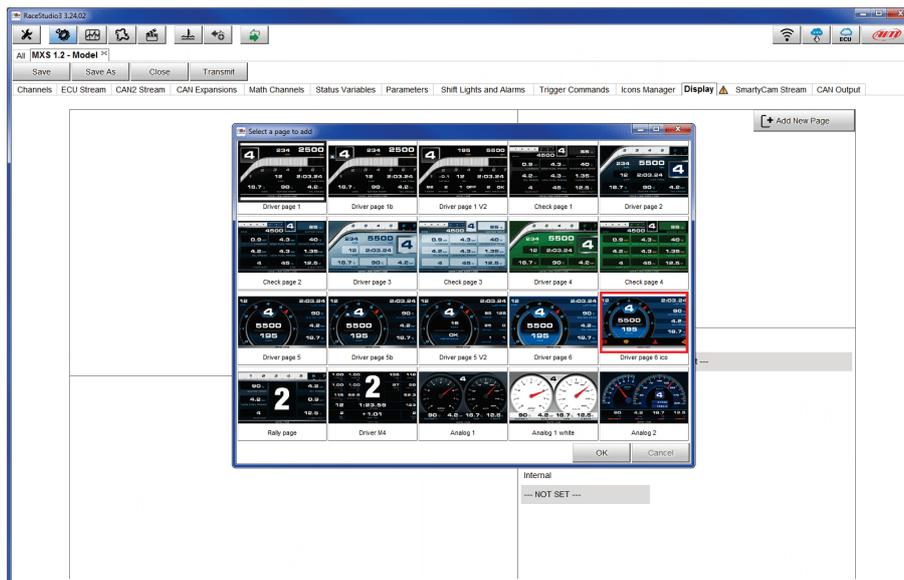
At the end "Icon" page shows the icons set. Click them to modify.



## 6.2.12 – Display configuration

MX Series can have up to eight pages to be set via software.

- enter “Display” tab
- a panel shows up: select a display page (in the example a page with icons bar has been chosen)
- select the page and press “OK”
- repeat the operation for the number of pages to set



When the page has been selected two setting panels appear bottom of the page:

- on the left a panel that shows as many rows as the fields to be set
- on the right a panel that shows the channels group that can be set in that field and all the channels in it included; drag and drop the channel to set in the desired field or double click on it
- if more display pages have been added a label top central of the preview box indicates the one in use as highlighted here below.

The screenshot shows the RaceStudio3 interface. At the top, there's a menu bar with options like 'Channels', 'ECU Stream', 'CAN2 Stream', 'CAN Expansions', 'Math Channels', 'Status Variables', 'Parameters', 'Shift Lights and Alarms', 'Trigger Commands', 'Icons Manager', 'Display', 'SmartyCam Stream', and 'CAN Output'. A 'Page 1' label is highlighted in the top center of the preview area.

The main dashboard displays several data points:
 

- LAP Num: 99999
- Lap Time: 99:99.99
- TCSEngEvent: 99999 #
- FuelInst1: 99.99 %
- WaterTemp: 999.9 C
- Speedometer: 999.9 km/h
- Directional indicator: N

Below the dashboard is an 'INFO LINE' table:

| Field              | Checked                             | Unit/Label     |
|--------------------|-------------------------------------|----------------|
| LAP                | <input checked="" type="checkbox"/> | LAP Number     |
| RPM                | <input type="checkbox"/>            | RPM            |
| RPM                | <input type="checkbox"/>            | RPM 18000      |
| Gear               | <input type="checkbox"/>            | Gear           |
| GPS Speed          | <input type="checkbox"/>            | GPS Speed km/h |
| Lap Time           | <input checked="" type="checkbox"/> | Lap Time       |
| TCSEngEvent        | <input checked="" type="checkbox"/> | TCSEngEvent #  |
| FuelInst1          | <input checked="" type="checkbox"/> | FuelInst1 %    |
| WaterTemp          | <input checked="" type="checkbox"/> | WaterTemp C    |
| Icon: 'Fuel alarm' |                                     |                |
| Icon: 'Oil'        |                                     |                |
| Icon: 'Turn Left'  |                                     |                |
| Icon: 'Turn right' |                                     |                |

On the right side, there are two configuration panels:

- Channel Groups:** A list of data sources including ECU, CAN2, Lap Channels, GPS, AD Channels, Odometer, Internal, Channel Exp., RIO 02a Exp., TC-HUB Exp., LCU-One CAN Exp., Status Variables, and --- NOT SET ---.
- Channels:** A list of specific data points including LAP, Lap Time, Best Time, Predictive Time, Rolling Time, Rolling Sess Time, and \*- Ref Time.
- Digit Font:** MicrogrammaDBolExt, size 42.
- Label Font:** MicrogrammaDBolExt, size 20.
- Position:** Alignment set to left.

### 6.2.13 – SmartyCam stream setting

MX Series can be connected to both AiM SmartyCam2 and SmartyCam 3 through the CAN Bus to show the desired data on SmartyCam video. The logger transmits data to the Cameras in two slightly different ways according to the camera and to the fixed setting. Available options are

- SmartyCam 2 and SmartyCam 3 Default
- SmartyCam 3 Advanced CAMBIARE IMMAGINE

**For MX to transmit each channel when connected to SmartyCam2 or SmartyCam 3 with default setting:**

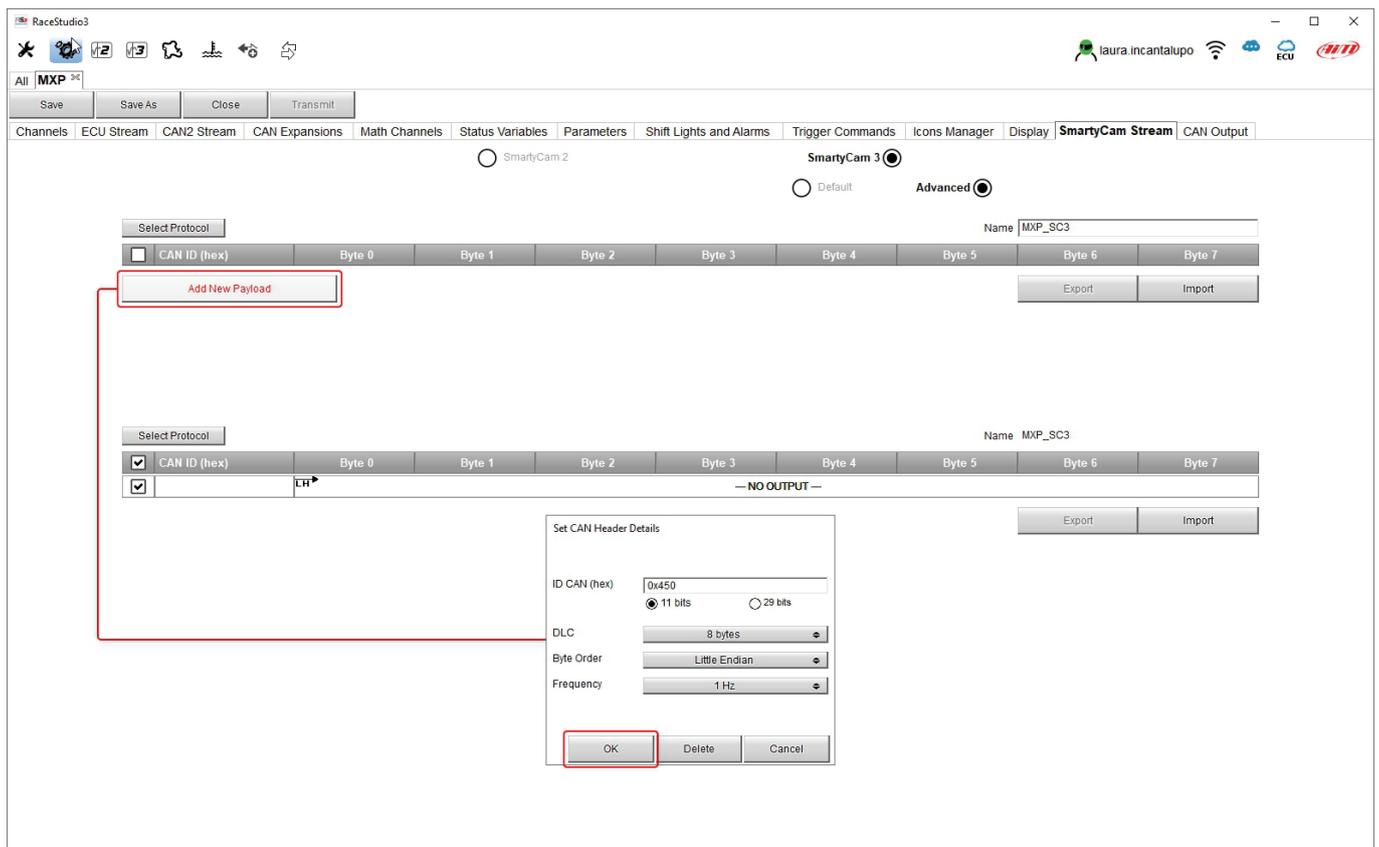
- click on it and a setting panel shows up
- it shows all channels and/or sensors that fits the selected function
- in case the desired channel or sensor is not in the list enable “Enable all channels for functions” checkbox and all channels/sensors will be shown

AiM default protocol transmits a rather limited range of information, enough for a wide range of installation.

| ID   | SmartyCam Function | Channel         |
|------|--------------------|-----------------|
| CC01 | Engine RPM         | RPM             |
| CC02 | Speed              | GPS Speed       |
| CC03 | Gear               | Gear            |
| CC04 | Water Temp         | WaterTemp       |
| CC05 | Head Temp          | --- Not Set --- |
| CC06 | Exhaust Temp       | --- Not Set --- |
| CC07 | Oil Temp           | --- Not Set --- |
| CC08 | Oil Press          | Oil Pressure    |
| CC09 | Brake Press        | --- Not Set --- |
| CC10 | Throttle Pos       | --- Not Set --- |
| CC11 | Brake Pos          | --- Not Set --- |
| CC12 | Clutch Pos         | --- Not Set --- |
| CC13 | Steering Pos       | SWAngle         |
| CC14 | Lambda             | LCU 0Lambda     |
| CC15 | Lateral Accel      | LateralAcc      |
| CC16 | Inline Accel       | --- Not Set --- |
| CC17 | Fuel Level         | --- Not Set --- |
| CC18 | Battery Voltage    | Battery         |
| CC19 | Vertical Accel     | --- Not Set --- |

To transmit a different set of information you need a **SmartyCam3 with advanced setting**; please note: **this function is for expert users only** you may do as follows:

- configure MX logger in order to transmit a different SmartyCam stream
- select the desired SmartyCam stream in SmartyCam 3 configuration
- select **"SmartyCam 3 -> Advanced"** option in SmartyCam Stream tab
- press "Add new Payload"
- create your desired stream defining the required IDs fields and save it pressing "OK"
- name the protocol CAMBIARE IMMAGINE



## 6.2.14 – CAN Output configuration

The logger can transmit a CAN data stream containing the channels required both on CAN1 and CAN2. It works exactly as SmartyCam 3 advanced stream

## 6.2.15 – Transmitting the configuration to MX loggers

When all channels set the configuration is finished:

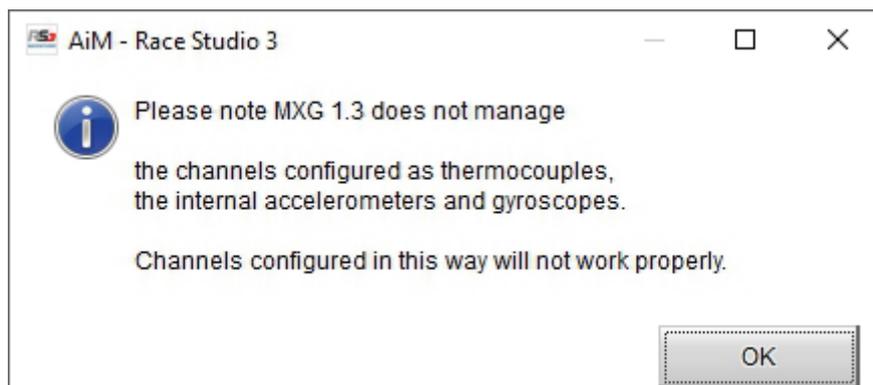
- press “Save” on the page top keyboard
- press “Transmit” to transmit the configuration to MX Series



As said before:

- **MX1.3 loggers do not support thermocouple sensors except through a TC Hub** so if you set these sensors you need to add a TC Hub to AiM network
- **MX1.3 loggers miss the inertial platform**

For this reason if your configuration includes one or both of these features and no TC Hub is connected when you transmit the configuration to the logger the panel shown below is prompted.



### 6.3 – Managing a track on MX Series with Race Studio 3

With Track Manager function of Race Studio 3 tracks can be created, deleted and modified, transmitted and received to/from MX Series. Press “Tracks” icon.



The main page is divided in three columns; on the **left**:

- on top, the filters that allow to collect many tracks following customized criteria; by default, all tracks are shown (light blue “All Tracks” filter in the image below).
- bottom left, the connected devices (in the image, “MXS 1.2 ID 4202523”)

The column **in the middle** shows:

- on top a fast search bar that allows to select the tracks which satisfy personal research criteria; pressing “?” a pop-up window explains research criteria (highlighted in red below), to say:
  - long name is the name in bold in each track box
  - short name is the track name shown on the display of MX Series and is the name shown top right of each track box
  - track city is the name of the city the track is located in
- all the tracks listed in Race Studio 3 database. It automatically updates at start up if a connection to the Internet is available.

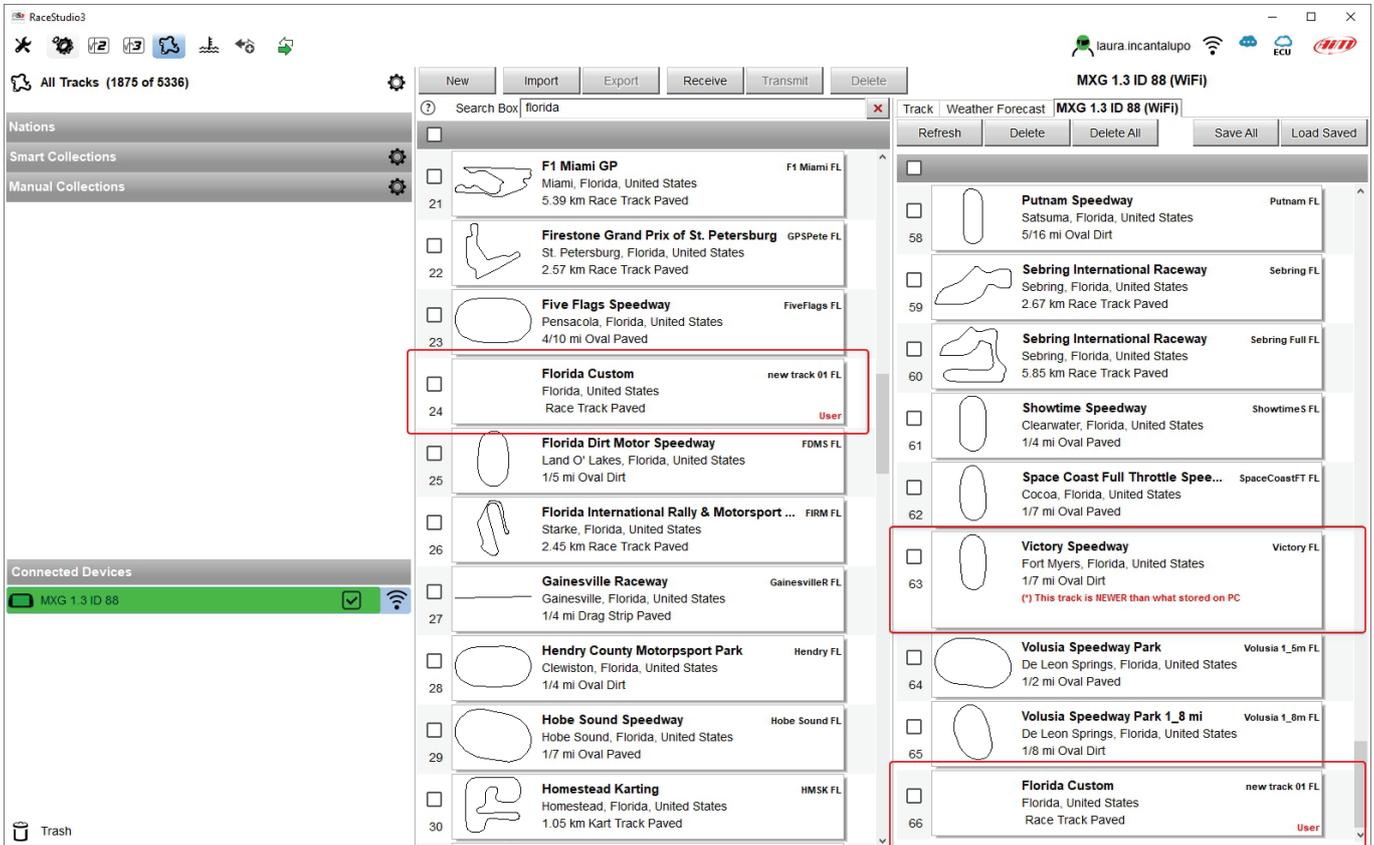
The column on the **Right** shows:

- the data sheet of the track you are mousing over.

The screenshot shows the RaceStudio3 interface. On the left, there's a sidebar with 'All Tracks (1875 of 5336)', 'Nations', 'Smart Collections', and 'Manual Collections'. Below that is 'Connected Devices' showing 'MXG 1.3 ID 88'. The main area has a menu with 'New', 'Import', 'Export', 'Receive', 'Transmit', and 'Delete'. A search box is present with a tooltip that says: 'Words entered in the Search Box are matched against: - track long name contains ... - track short name contains ... - track city begins with ...'. Below the search box is a list of tracks, with 'Barber Motorsports Park' selected. The right panel shows details for 'Barber Motorsports Park', including 'Track Name on Device: BMP Main', '6040 Barber Motorsports Parkway - 35094 - Birmingham, Alabama, United States', '+1 205 298 9040', and a map of the track layout.



When MX Series is connected it is shown on the left bottom part of the page as said before. Clicking on it all the tracks it contains are shown in the right column of the page.



Tracks created by the user are labelled "User" and if the track stored in MX Series logger is different from the one stored on AiM database this is notified as shown here above.

The page keyboards are used to manage the tracks.

The keyboard above the central column allows to:



- **New:** create a new track ("Custom", see paragraph 4.6). To create a custom track:
  - Press "New" and fill in the panel that show sup (you can also fill only the start/finish coordinates) or
  - Edit an existing track
  - Press "Save"
- **Import:** import one or more tracks stored in the device or in another external device
- **Export:** export one or more tracks to a specific PC folder or to another peripheral device
- **Receive:** receive from the connected device tracks user created (if no device is connected the button is disabled)
- **Transmit:** transmit one or more tracks from the PC to the connected device (if no device is connected the button is disabled)
- **Delete:** delete one or more tracks from Race Studio 3 database

The keyboard above the right column allows to:



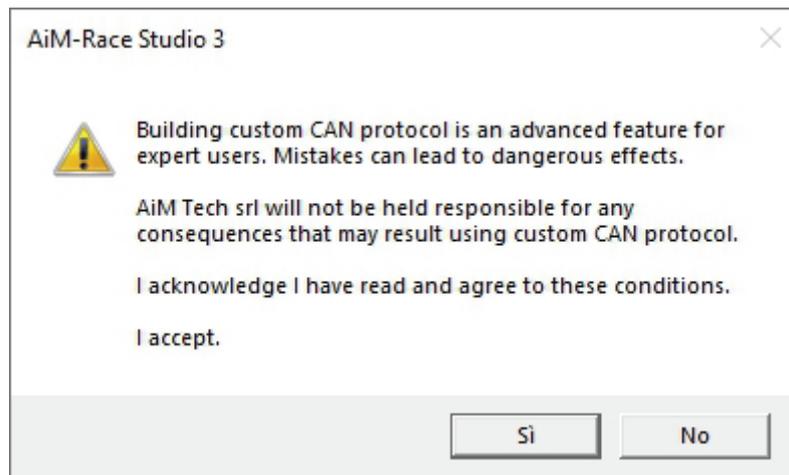
- **Refresh:** refresh the track list stored in the connected device
- **Delete:** delete one or more tracks from the device memory
- **Delete All:** delete all tracks stored in the device memory
- **Save all:** save all the tracks stored in the connected device; it creates a zip file that can be loaded to another AiM device
- **Load Saved:** load the tracks previously saved in the device memory

Since the software is constantly updated, may be other information or features will be available soon. Please check our website [www.aim-sportline.com](http://www.aim-sportline.com), documentation area, software section "Track Manager" manual.

## 6.4 – ECU Driver builder

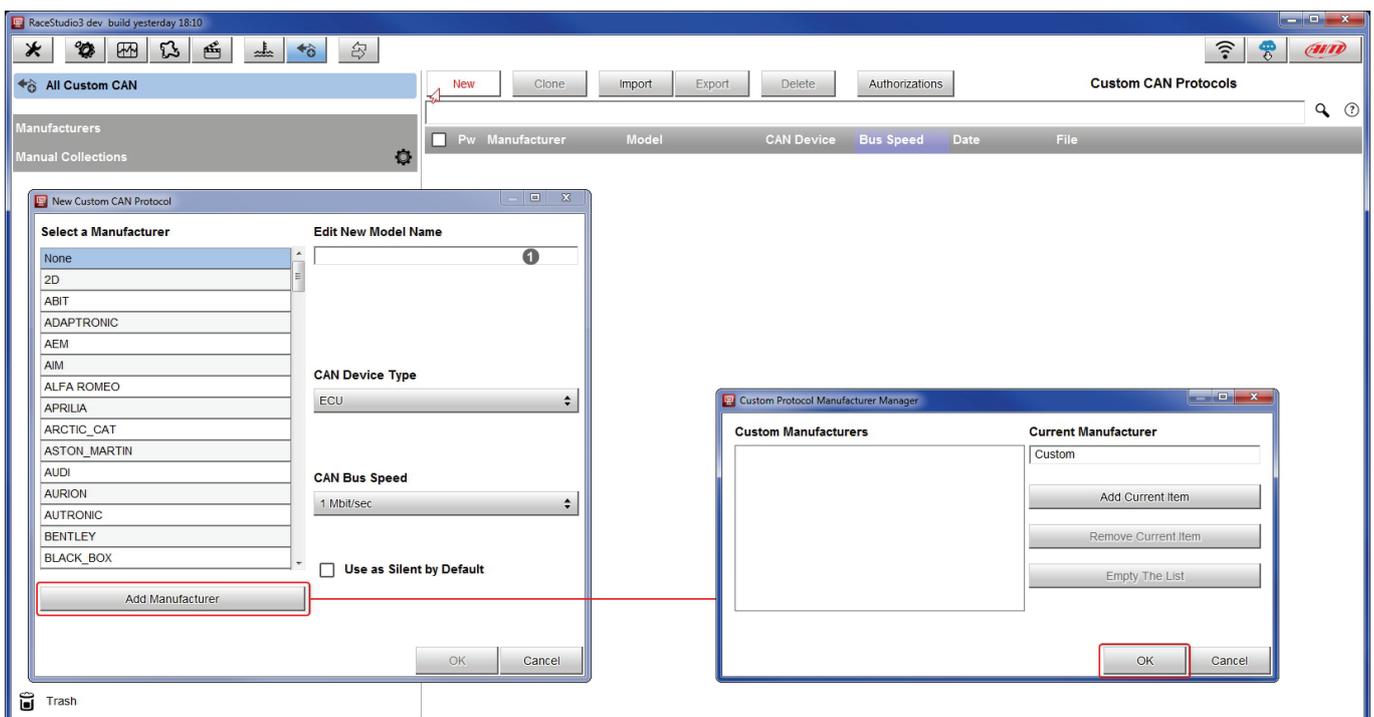


If the vehicle ECU is not included in Race Studio 3 software a specific CAN protocol can be created using CAN Driver builder. **This Race Studio function is for expert users only** as for the panel that shows up pressing the related button.



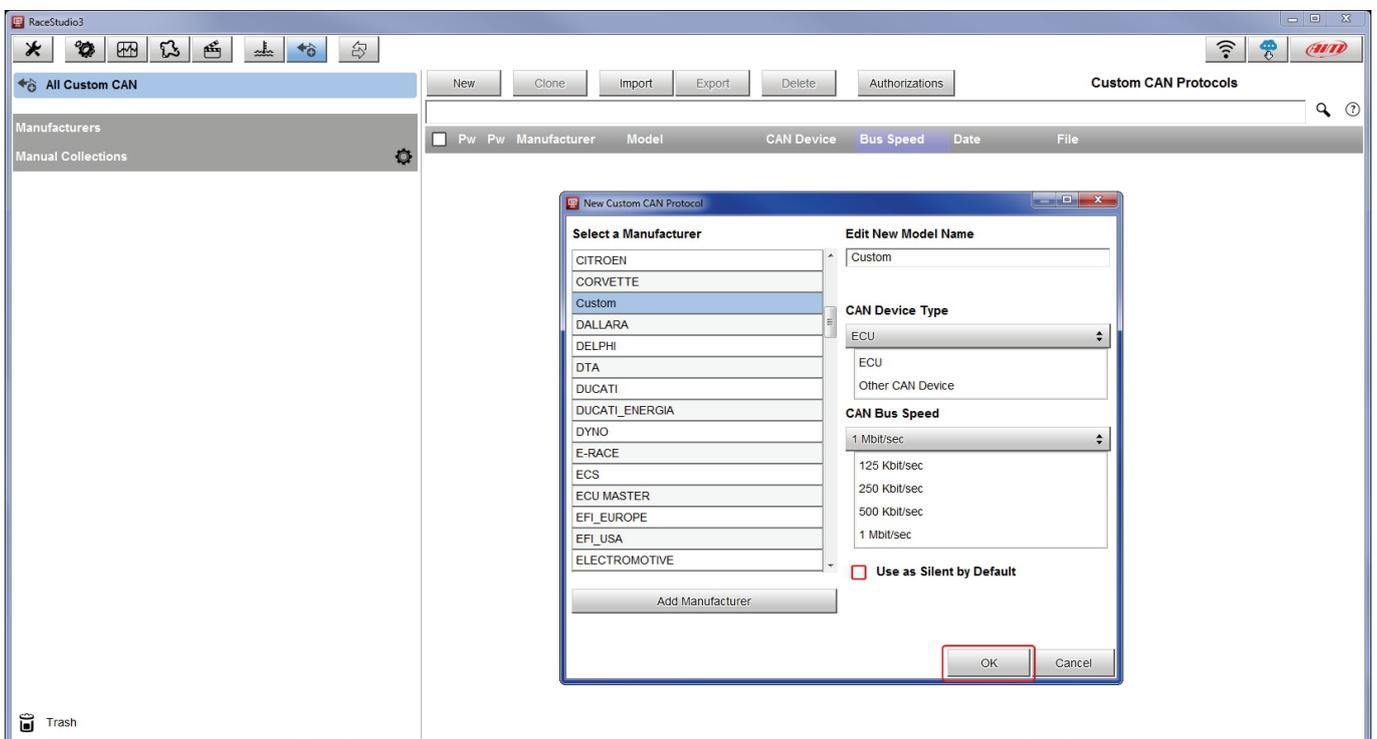
It is possible to add a new ECU Manufacturer and/or a new ECU model. To do so:

- press “New” on the top central keyboard
- “New Custom CAN Protocol” panel shows up
- press “Add Manufacturer” to add a new Manufacturer and “Custom Protocol Manufacturer Manager” panel shows up
- fill in the Manufacturer name (“Custom” in the example below)
- press “OK”
- to add a new ECU Model for an existing Manufacturer just select the manufacturer and fill in “Edit new model name” box.



The software comes back to “New Custom CAN Protocol”:

- select the ECU Manufacturer previously created
- fill in the Model name in the panel top right box
- select the CAN Device type; available options are:
  - ECU
  - other CAN Devices
- select the CAN Bus speed; available options are:
  - 125 Kbit/sec
  - 250 Kbits/sec
  - 500 Kbit/sec
  - 1 Mbit/sec
- if the network features multiple devices we suggest to enable “Use a Silent by Default” checkbox
- press “OK” and a new CAN Driver has been added



For further information about how to set the new CAN Driver refer to the CAN Driver builder user manual downloadable from [www.aim-sportline.com](http://www.aim-sportline.com), documentation area software/firmware section.

## 6.5 – The device window

The device window is shown clicking the device bottom left of the software page.

| Master           |                |                    |              |
|------------------|----------------|--------------------|--------------|
| InlineAcc        | -0.82 g        | Speed2             | 0.0 km/h     |
| LateralAcc       | 0.52 g         | Speed3             | 0.0 km/h     |
| VerticalAcc      | 0.02 g         | Speed4             | 0.0 km/h     |
| RollRate         | -0.7 deg/s     | Logger Temperature | 39.3 C [993] |
| PitchRate        | 2.4 deg/s      | Channel01          | -10 mV [-10] |
| YawRate          | 1.5 deg/s      | Channel02          | -10 mV [-9]  |
| RPM              | 0 rpm          | Channel03          | -10 mV [-12] |
| Speed1           | 0.0 km/h       | Channel04          | -12 mV [-10] |
| Channel05        | -10 mV [-10]   | Channel06          | -13 mV [-9]  |
| Channel07        | -8 mV [-13]    | Channel08          | -8 mV [-10]  |
| External Voltage | 13.3 V [13297] | Luminosity         | 22 % [596]   |

| ECU channels  |       |                 |      |
|---------------|-------|-----------------|------|
| POS PEDAL     | %     | FLAG FBX RELAY2 | 0 #  |
| G CH X        | g     | FLAG ABS        | #    |
| G CH Y        | g     | FLAG TCS OFF    | #    |
| A STE         | mm    | N PTP REMAIN    | #    |
| W CH          | deg/s | POS ENG MAP     | #    |
| FLAG STW OUT1 | 0 #   | S PTP REMAIN    | #    |
| FLAG STW OUT2 | 0 #   | S FUEL          | #    |
| V WHL REF     | km/h  | V WHL RL        | km/h |
| V WHL RR      | km/h  | T AIR           | C    |
| T ENG AIR     | C     | T GBX OIL       | C    |
| T ENG OIL     | C     |                 |      |

Top of the window (red hedged in the image below) are 8 layers used to:

- **Live Measures:** check device channels and force online values; the buttons of the top keyboard are to:
  - start live measures (1)
  - sort the channel visualization as preferred: as managed by the firmware (sort by configuration), alphabetically, by channel type: they will be shown by device then by channel type and at the end by measure type (2)
  - auto-calibrate sensors that need it (3)
  - show the measure in Mv (4)
  - start recording (5)
  - make the device LEDs blink (6); this is the easiest way to test PC-logger connection
- **Download:** to download data stored in MX logger
- **Wi-Fi and Properties:** to name the device, manage MX Wi-Fi (see chapter 5) fill in racer's and vehicle name or number, championship and venue type (generic or qualifying testing, warm up, race, test type)
- **Settings** to:
  - set date
  - enable/disable daylight time
  - set time format and time zone
- **Tracks:** to manage the tracks stored in the device memory
- **Counters:** to set/reset the device odometers
- **Logo:** transmit/receive the logo that shows up when switching the device on; supported image formats are JPEG or BMP; always use the most recent Windows™ versions (Windows8 or Windows10) whose graphic libraries are more updated
- **Firmware:** to check or update MX Series firmware version.

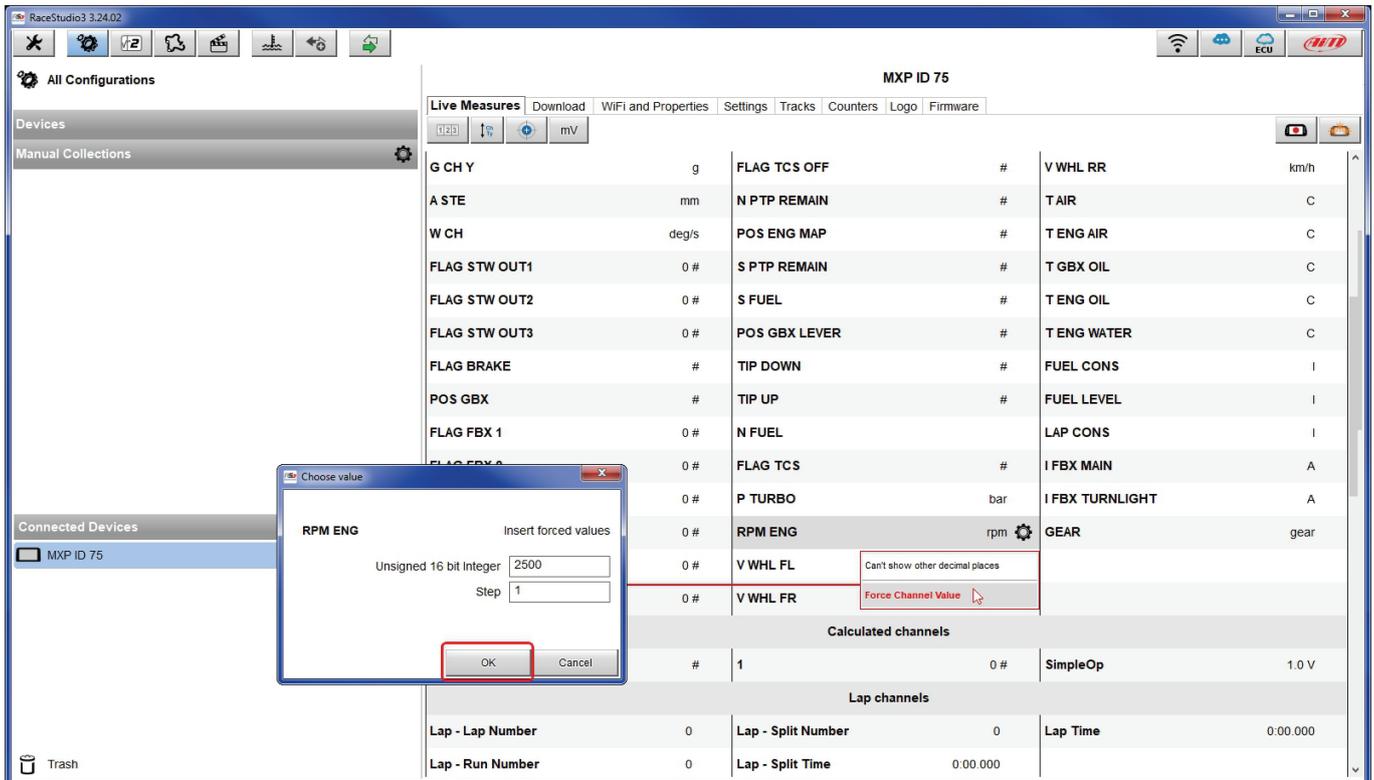
### 6.5.1 – Online value forcing

Device page Live measures layer features a new and very useful option: online measure value forcing. This feature allows the user to simulate one or more channels value to test icons, alarms, power output and harnesses behaviour.

With reference to the configuration we created it is possible to verify if Water Alarm status variable works.

The set conditions (paragraph 6.2.9) are: water Temperature greater than 100 +RPM greater than 2000. To force these values:

- mouse over the value to force and click the setting icon
- a popup menu appears: select “Force Value” option and fill in the panel that appears
- click “OK” and the LED blinks continuously as set in the device configuration.





As shown in the image below, once the values have been forced they are shown right of the page red hedged. With the two "+" and "-" lateral buttons it is possible to change the forced values.

The screenshot displays the RaceStudio3 3.25.00 interface for MXP ID 75. The main window shows a table of live measures. The 'RPM ENG' value is highlighted in red and set to 2500 rpm. A control panel on the right side of the interface allows adjusting this value with '+' and '-' buttons.

| Measure         | Unit  | Value    |
|-----------------|-------|----------|
| G CH Y          | g     |          |
| A STE           | mm    |          |
| W CH            | deg/s |          |
| FLAG STW O...   | 0 #   |          |
| FLAG STW O...   | 0 #   |          |
| FLAG STW O...   | 0 #   |          |
| FLAG BRAKE      | #     |          |
| POS GBX         | #     |          |
| FLAG FBX 1      | 0 #   |          |
| FLAG FBX 2      | 0 #   |          |
| FLAG FBX 3      | 0 #   |          |
| FLAG FBX 4      | 0 #   |          |
| FLAG FBX 5      | 0 #   |          |
| FLAG FBX RE...  | 0 #   |          |
| FLAG TCS OFF    | #     |          |
| N PTP REMAIN    | #     |          |
| POS ENG MAP     | #     |          |
| S PTP REMAIN    | #     |          |
| S FUEL          | #     |          |
| POS GBX LEV...  | #     |          |
| TIP DOWN        | #     |          |
| TIP UP          | #     |          |
| N FUEL          |       |          |
| FLAG TCS        | #     |          |
| P TURBO         | bar   |          |
| RPM ENG         |       | 2500 rpm |
| V WHL FL        | km/h  |          |
| V WHL FR        | km/h  |          |
| V WHL RR        | km/h  |          |
| T AIR           | C     |          |
| T ENG AIR       | C     |          |
| T GBX OIL       | C     |          |
| T ENG OIL       | C     |          |
| T ENG WATER     |       | 104.0 C  |
| FUEL CONS       | I     |          |
| FUEL LEVEL      | I     |          |
| LAP CONS        | I     |          |
| I FBX MAIN      | A     |          |
| I FBX TURNLI... | A     |          |
| GEAR            | gear  |          |

Control Panel:

|             |   |
|-------------|---|
| RPM ENG     | + |
| 2500 rpm    | - |
| T ENG WATER | + |
| 104.0 C     | - |



## 7 – On the track

MX Series can show up to eight pages. To scroll them press ">>" lateral button. Pages can change according to the device configuration.

## 8 – Data recall

At the end of the test sampled data can be recalled pressing "MEM/OK".

First is "Today" page.  
Press "TESTS"

| MAX RPM |           | MAX SPEED     |           |
|---------|-----------|---------------|-----------|
| 10048   |           | 282           |           |
| Lap     | Best Laps | RPM           | Km/h      |
| 4       | 1:57:56   | 10048<br>5592 | 280<br>73 |
| 11      | 1:57:94   | 10100<br>5450 | 277<br>70 |
| 8       | 1:58:02   | 10300<br>5700 | 278<br>69 |

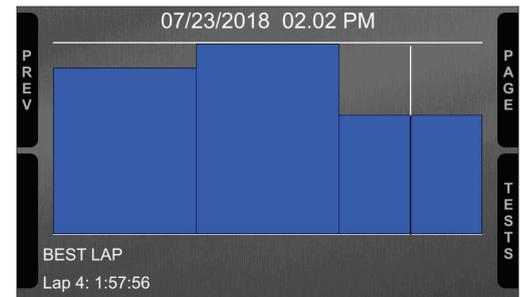
Second is "Summary" page that shows all the last tests with date and place. Select the day you see and press "ENTER".

| TEST SESSIONS         |
|-----------------------|
| TODAY: COTA Austin    |
| 21/07/2018: Albany GA |
| 21/07/2018: Albany GA |
| 20/07/2018: Albany GA |
| 20/07/2018: Albany GA |

Third is "Day Summary" page that shows all tests in a box with time of the test, number of laps and best lap of the test. Select the test to see and press "ENTER".

| TODAY: COTA Austin               |                                  |                                  |
|----------------------------------|----------------------------------|----------------------------------|
| 02.02 PM<br>17 Laps<br>B 1.57.56 | 12.02 AM<br>10 Laps<br>B 1.50.46 | 10.43 AM<br>11 Laps<br>B 1.54.14 |
| 09.52 AM<br>7 Laps<br>B 1.55.56  | 09.02 AM<br>9 Laps<br>B 1.53.46  | 7.39 AM<br>10 Laps<br>B 1.55.16  |

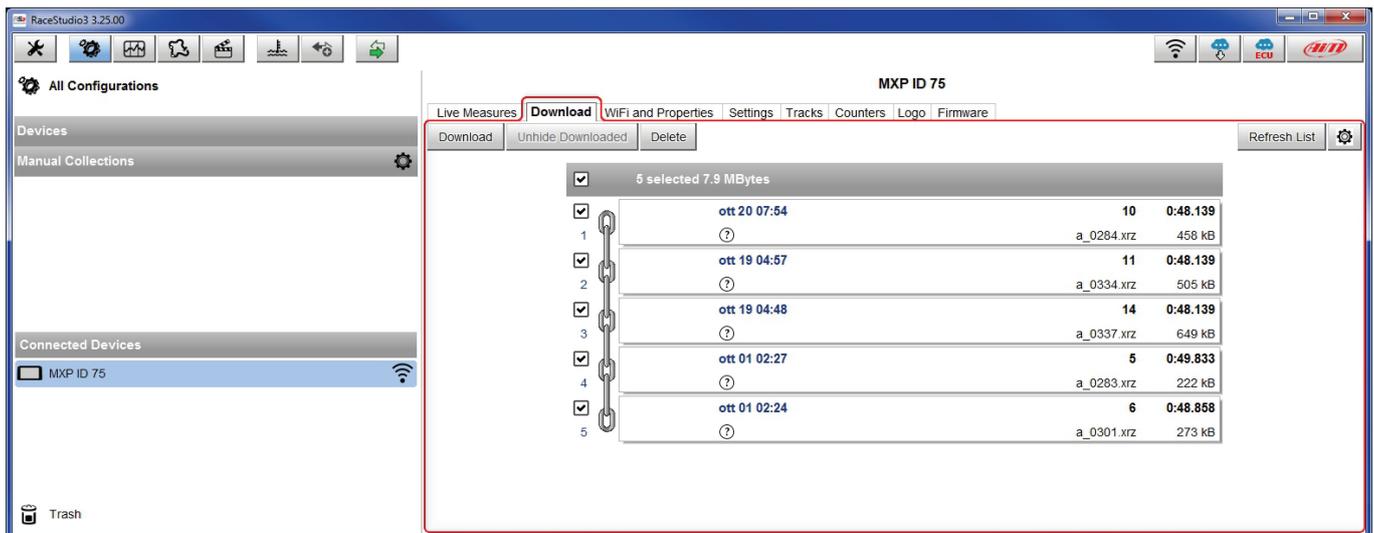
This page is a histogram test summary. Moving the cursor left and right all laps and their lap time are shown.



## 9 – Data download and analysis



Once the test session is over it is possible to download data sampled on a PC. Connect MX Series logger to a PC using the USB cable included in the kit or via Wi-Fi and click on it bottom left of the software page. Once reached the device page activate “Download”. layer It shows all the information concerning the file stored in the logger: number of laps, best lap, date/time, file dimensions. Select the file(s) to download and press “Download” button.



After download press Analysis Icon () and Race Studio Analysis software starts showing all the files available for analysis. Double clicking on the desired one it is possible to start analysing your performance.

## 10 – New firmware upgrade



Our technicians and engineers are constantly working to improve both the firmware (the application that manages the device) and the software (the application installed on the PC).

Each time a new firmware and/or software version is available the icon here above appears with an arrow indicating that something is available for download (otherwise the icon only shows the cloud).

Click it and freely download the new applications.

The screenshot shows the RaceStudio3 (64 bit) 3.32.12 interface. The 'Connected Devices' panel on the left shows 'MXP ID 76'. The main panel has tabs for 'Download', 'Install SW', 'Export', 'Import', and 'Update Device'. Below these tabs, there are buttons for 'On the web', 'Downloaded', and 'Info'. The 'Software' section shows the installed version 'RaceStudio3 (64 bit) 3.32.12'. The 'Firmware' section lists various models with their current and available versions. The following table summarizes the firmware entries shown in the screenshot:

| Model                | Current Version | Available Version | Status       |
|----------------------|-----------------|-------------------|--------------|
| RaceStudio3 (64 bit) | 3.32.12         |                   | Installed    |
| EVO4S                | 01.30.00        | 01.30.00          | Not Selected |
| EVO5                 | 01.30.00        | 01.30.00          | Not Selected |
| MXG                  | 01.30.00        | 01.30.00          | Not Selected |
| MXL2                 | 01.30.00        | 01.30.00          | Not Selected |
| MXS                  | 01.30.00        | 01.30.00          | Not Selected |
| MXS Strada           | 01.30.00        | 01.30.00          | Not Selected |
| MyChron5             | 01.30.00        | 01.30.00          | Not Selected |
| SmartyCam HD         | 01.04.30        | 01.04.30          | Not Selected |
| MX2E                 | 02.32.79        | 02.32.79          | Not Selected |
| MXG 1.2              | 02.32.81        | 02.32.72          | Selected     |
| MXG 1.2 Strada       | 02.32.81        | 02.32.72          | Selected     |
| MXK10                | 02.28.26        | 02.28.26          | Not Selected |
| MXK10(11-15)         | 02.28.12        | 02.28.12          | Not Selected |
| MXP                  | 02.32.81        | 02.32.72          | Selected     |
| MXP Strada           | 02.32.81        | 02.32.72          | Selected     |
| MXS 1.2              | 02.32.81        | 02.32.72          | Selected     |
| MXS 1.2 Strada       | 02.32.81        | 02.32.72          | Selected     |
| MX UTV               | 02.34.10        | 02.34.10          | Not Selected |
| MXm                  | 02.32.78        | 02.32.78          | Not Selected |
| MXm-i                | 02.32.78        | 02.32.78          | Not Selected |

Once the new firmware has been downloaded connect the device to the PC using the USB cable included in the kit or via Wi-Fi to perform a firmware upgrade. In a few seconds the device is ready.

## 11 – Connection with the expansions

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MX Series can be connected to various AiM expansions like AiM GPS08 Module, LCU-One CAN, Channel expansion, TC Hub, RIO\_02, Shift Light Module, Formula Steering Wheel 3 or GS Dash (the configuration only supports one display additional to MX Logger one) SmartyCam HD and SmartyCam GP HD in order to improve its functionality.

**Please note** that LCU-one, Channel expansion TC Hub, Rio 02, Shift Light Module, Formula Steering Wheel 3/GS Dash and SmartyCam HD have to be configured with Race Studio 3 software as already explained in the related paragraphs (“CAN Expansions configuration”, “Channels configuration” and “SmartyCam stream setting”). Moreover, please refer to the related user manuals for further information concerning AiM expansions and AiM SmartCam HD.

### 11.1 – Rear cameras connection and management

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MX Series loggers can manage rear cameras through the 5 pins Binder 712 female connector labelled “VIDEO IN” and placed rear central as shown here below. Please see the logger pinout reported in chapter 12 (Technical information and drawings) for further information about the Binder pinout. The connector allows the connection of up to two analog cameras.



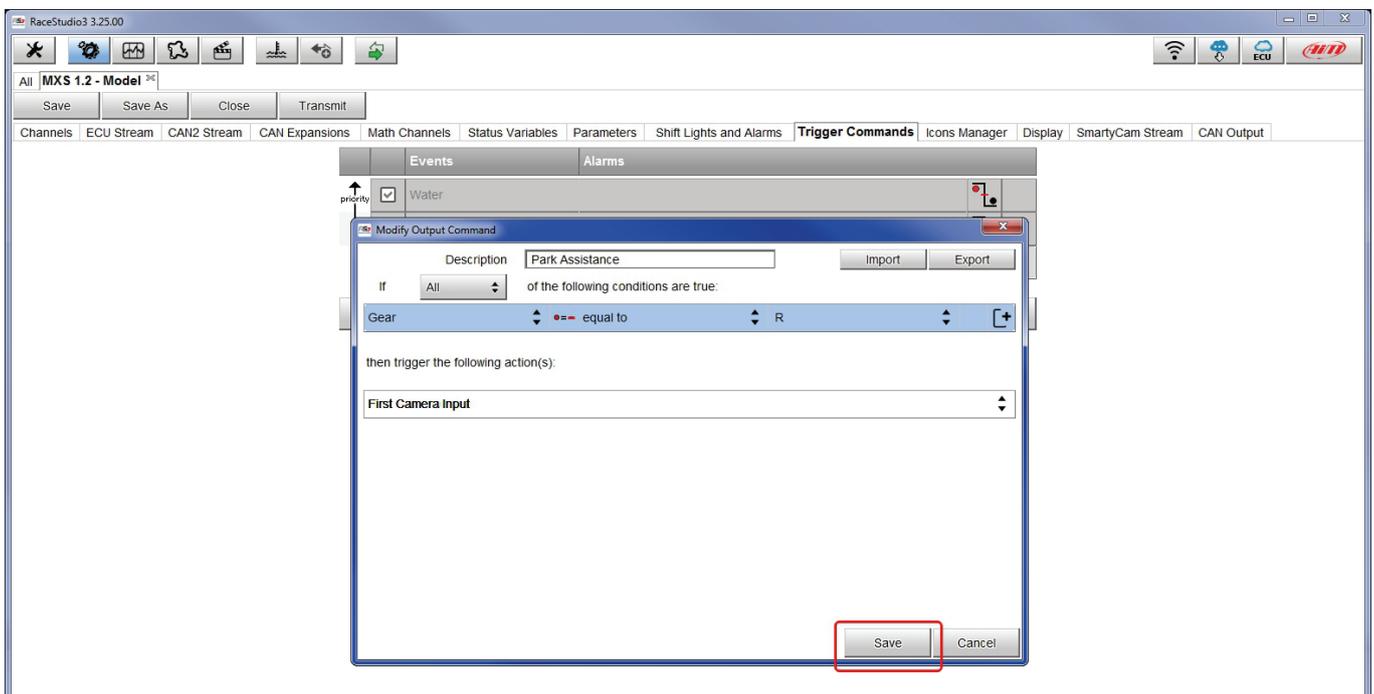
Rear cameras needs to be connected to the logger, set in the logger configuration through Race Studio 3 software and executed through the logger keyboard. Here follows explanation of how to perform all these operations.

A wide number of analog cameras, both PAL and NTSC, are compatible with MX Series loggers and patch cables for connecting most of them are available. Please refer to our website [www.aim-sportline.com](http://www.aim-sportline.com) for more information about them.

**Please note: rear camera dimensions and MX Series camera input pinout are shown in chapter 12.**

Once "Gear" channel has been set it is necessary to create a new "Trigger command". To do so:

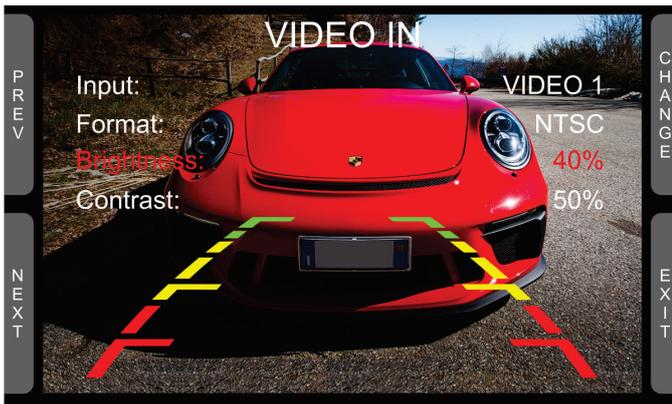
- press "Add new command"
- fill in the panel that shows up, in the example
  - description: park assistance
  - channel "Gear equal to R"
  - trigger the command "First camera input"



To perform the command on the logger press "MENU" button and scroll up to "VIDEO IN".



Set the camera as explained in paragraph 4.3. If no key is pressed in 5 seconds, the menu disappears and the logger shows the camera image in live streaming, that is very useful to check the camera position. Images below shows the image of the camera set on the left and the live stream on the right.



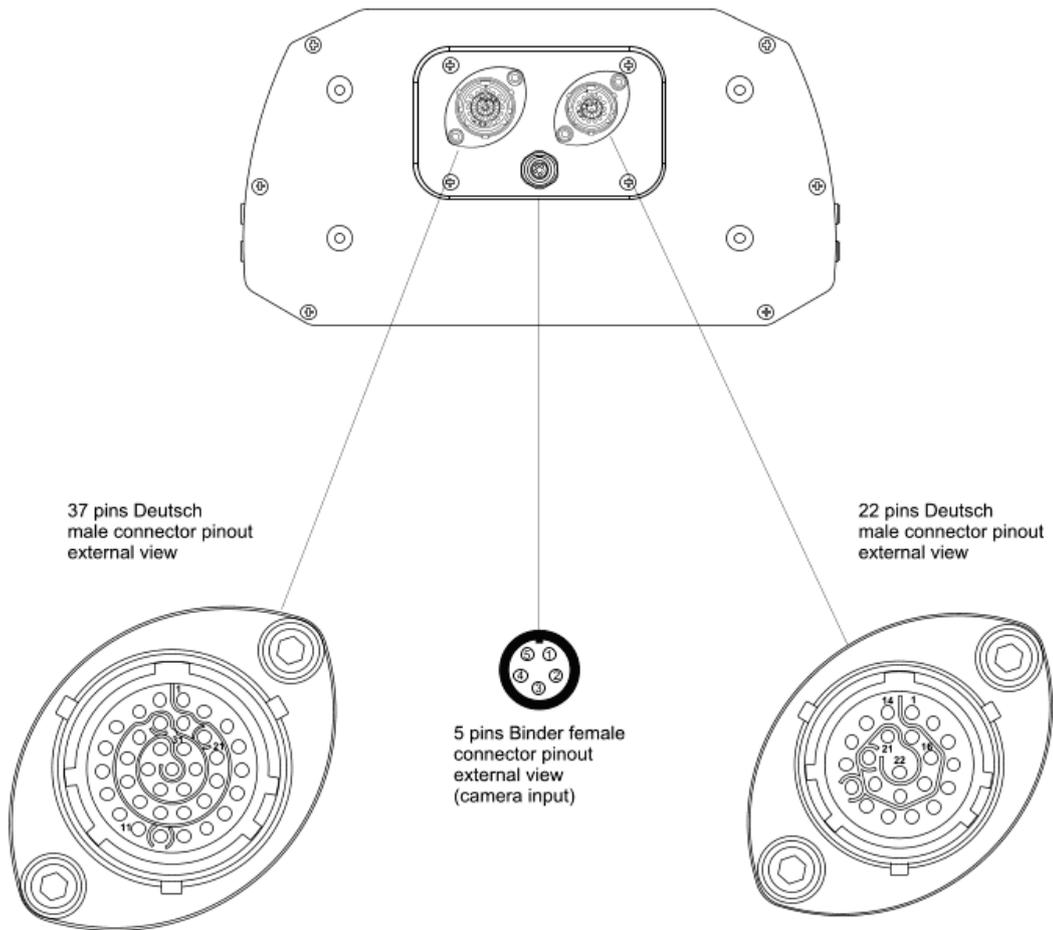


## 12 – Technical specifications and drawings

|                          |  |
|--------------------------|--|
| • TFT display dimensions | 5" (MXS) 6" (MXP) 7" (MXG) 10" (MXT)   |
| • Display resolution     | 800x480 pixels (MXS, MXG, MXP), 1280x480 (MXT)   |
| • Contrast               | 600:1 (MXP, MXS) – 1000:1 (MXG 1.2) – 1.100:1 (MXT)  |
| • Brightness             | 700cd/m <sup>2</sup> (MXS, MXG, MXP) – 1,100 Lumen (MXT)   |
| • Ambient light sensor   | Yes  |
| • Alarm display icons    | Yes, freely configurable   |
| • Alarm RGB LEDs         | 6 (MXS and MXT), 5 (MXP), 8 (MXG 1.2)  |
| • Shift lights           | 10 configurable RGB LEDs   |
| • Display pages          | Up to 8 freely configurable  |
| • Backlight              | YES  |
| • CAN connections        | 3  |
| • Second CAN             | Yes  |
| • ECU Connection         | CAN, RS232, K-Line to 1.000+ leading ECUs  |
| • External Modules       | GPS Module, Channel Expansion, LCU-Lambda Controller, TC Hub (necessary to connect thermocouple sensors on 1.3 and MXT loggers), RIO_02, Shift Light Module, Formula Steering Wheel 3 or GS Dash, SmartyCam HD |
| • Analog inputs          | 8 fully configurable, max 500 Hz each  |
| • Digital inputs         | 4 Speed inputs, lap signal, coil RPM input   |
| • Digital outputs        | 2 (1A max)   |
| • Wi-Fi connection       | Yes  |
| • Inertial platform      | Internal 3 axis gyro, magnetometer and $\pm 5G$ accelerometer  |
| • Internal Memory        | 4GB  |
| • Power consumption      | 400 mA   |
| • Pushbuttons            | Metallic   |
| • Connectors             | 2 motorsport connectors + 1 Binder connector   |
| • Body                   | Anodized Aluminum  |
| • Weight                 | 530g (MXS 1.2) – 640g (MXP) – 950g (MXG) – 1.200g (MXT)  |
| • Dimensions             | 169.4x97x23mm (MXS)<br>189.6x106.4x24.9mm (MXP)<br>237x127.6x26mm (MXG)<br>278x135x43.2mm (MXT)  |
| • Waterproof             | IP65   |

## 12.1 – MX Series Pinout and dimensions

### MX Series pinout



| Pin | Deutsch 37 pin    |
|-----|-------------------|
| 1   | 9-15V Power input |
| 2   | Battery GND       |
| 3   | CAN+ Exp          |
| 4   | GND               |
| 5   | +Vbattery CAN     |
| 6   | CAN- Exp          |
| 7   | +Vb Ext           |
| 8   | CAN1+ ECU         |
| 9   | CAN 1- ECU        |
| 10  | GND               |
| 11  | K Line ECU        |
| 12  | USB D+            |
| 13  | USB D-            |
| 14  | GND               |
| 15  | RPM               |
| 16  | GND               |
| 17  | +Vbattery         |
| 18  | Optical Lap       |
| 19  | Speed1            |

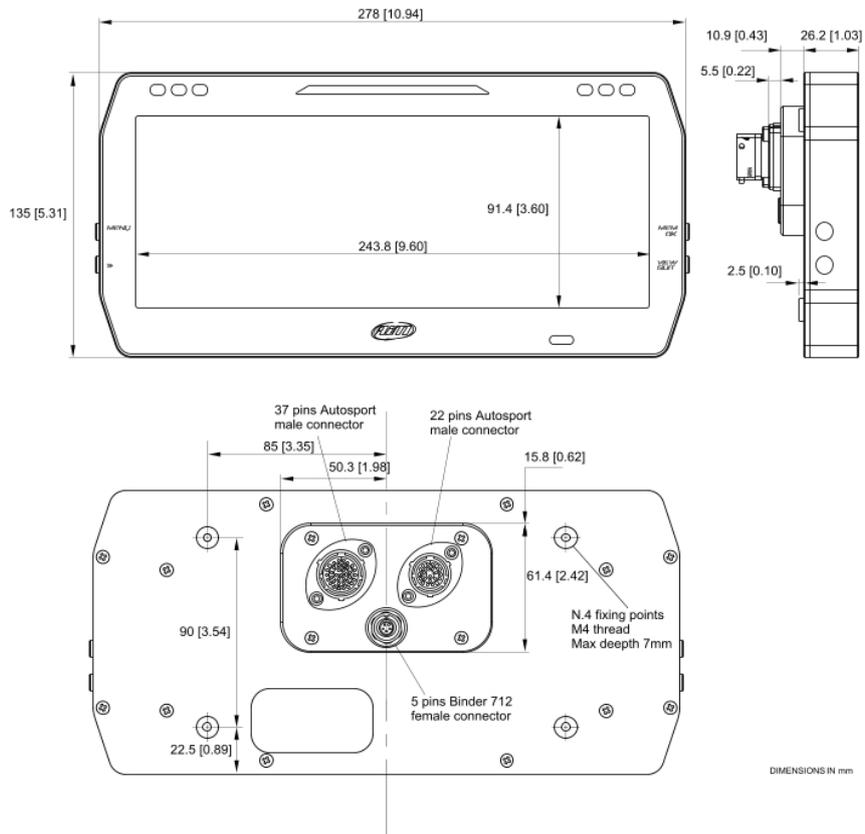
| Pin | Deutsch 37 pin |
|-----|----------------|
| 20  | GND            |
| 21  | +Vbattery      |
| 22  | Analog Input 1 |
| 23  | Analog GND     |
| 24  | +Vbattery      |
| 25  | +Vreference    |
| 26  | Analog Input 2 |
| 27  | Analog GND     |
| 28  | +Vbattery      |
| 29  | +Vreference    |
| 30  | Analog Input 3 |
| 31  | Analog GND     |
| 32  | +Vbattery      |
| 33  | +Vreference    |
| 34  | Analog Input 4 |
| 35  | Analog GND     |
| 36  | +Vbattery      |
| 37  | +Vreference    |

| Pin | Binder            |
|-----|-------------------|
| 1   | Video input 1     |
| 2   | GND               |
| 3   | +Vb output Camera |
| 4   | GND               |
| 5   | Video input 2     |

| Pin | Deutsch 22 pin   |
|-----|------------------|
| 1   | Analog Input 5   |
| 2   | Analog GND       |
| 3   | +Vbattery        |
| 4   | +Vreference      |
| 5   | Analog Input 6   |
| 6   | Analog Input 7   |
| 7   | Analog GND       |
| 8   | +Vbattery        |
| 9   | +Vreference      |
| 10  | Analog Input 8   |
| 11  | Speed 2          |
| 12  | GND              |
| 13  | +Vbattery        |
| 14  | Speed 3          |
| 15  | Speed 4          |
| 16  | GND              |
| 17  | CAN2+ ECU        |
| 18  | CAN2- ECU        |
| 19  | Digital output 1 |
| 20  | Digital output 2 |
| 21  | ECU RS232 Rx     |
| 22  | ECU RS232 Tx     |

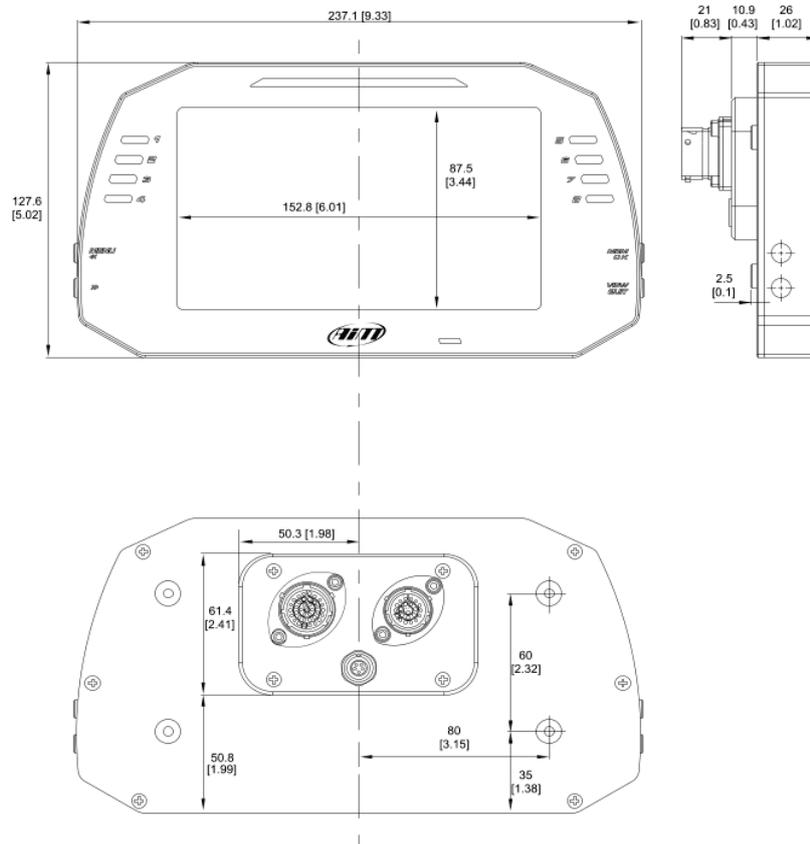


**MXT dimensions in mm [inches]**



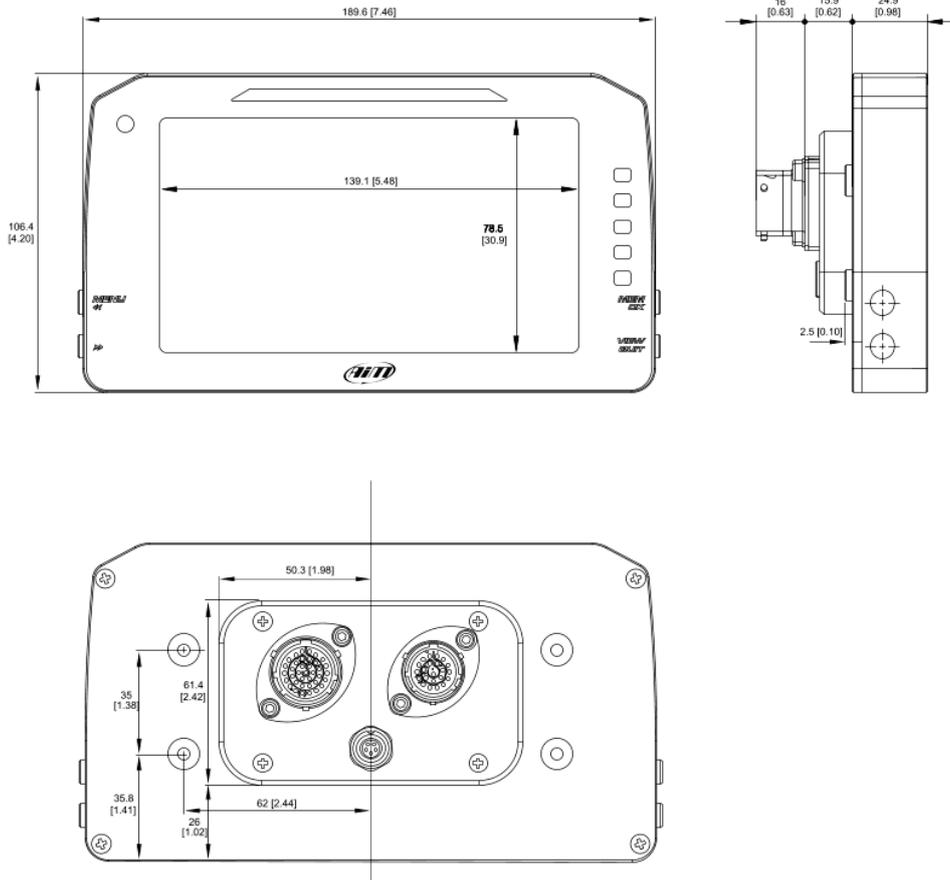


**MXG dimensions in mm [inches]**



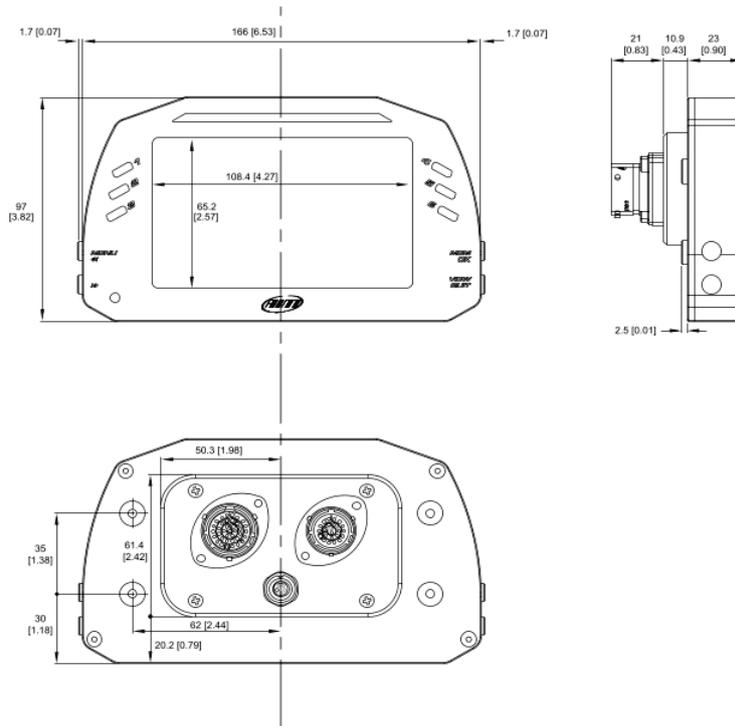


**MXP dimensions in mm [inches]**



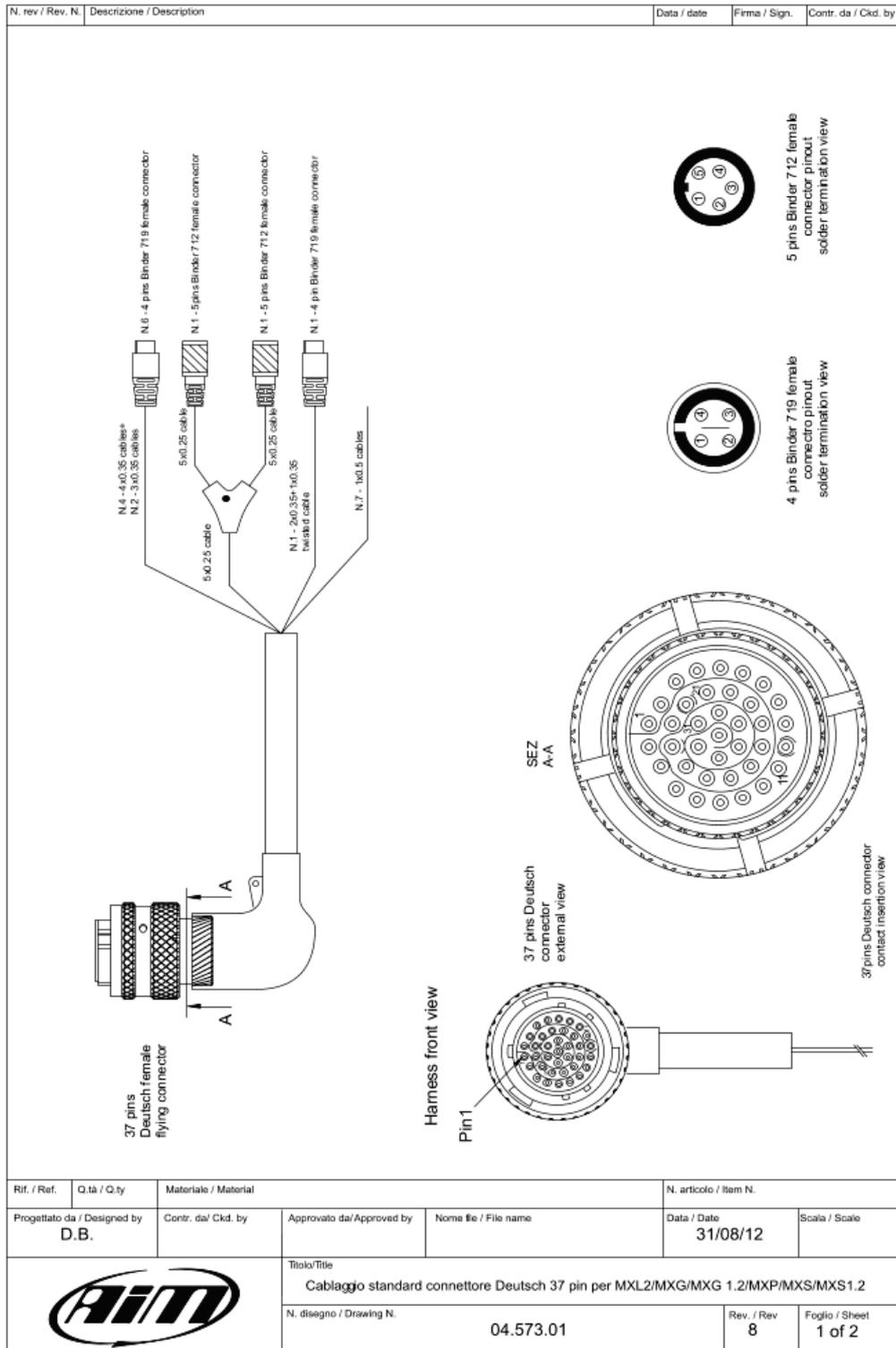


**MXS dimensions in mm [inches]**



## 12.2 – MX series harnesses

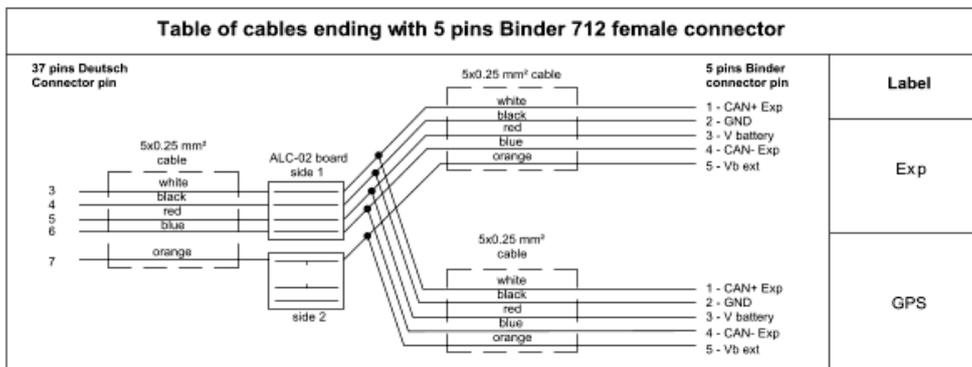
### 37 pins Deutsch connector standard harness



|                  |                           |             |               |                     |
|------------------|---------------------------|-------------|---------------|---------------------|
| N. rev / Rev. N. | Descrizione / Description | Data / date | Firma / Sign. | Contr. da / Ckd. by |
|------------------|---------------------------|-------------|---------------|---------------------|

| Table cables ending with 4 pins Binder 719 female connector |                                  |                           |                           |        |   |         |
|---|----------------------------------|---------------------------|---------------------------|--------|---|---------|
| 37 pins Deutsch connector pin                               | Cable colour                     | Destination connector pin | Cable type                | Length | Channel   | Label   |
| 22<br>23<br>24<br>25  | White<br>Black<br>Red<br>Blue    | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup>     | 340mm  | Analog channel 1<br>GND<br>V Battery<br>V Reference | Ch.1    |
| 26<br>27<br>28<br>29  | White<br>Black<br>Red<br>Blue    | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup>     | 340mm  | Analog channel 2<br>GND<br>V Battery<br>V Reference | Ch.2    |
| 30<br>31<br>32<br>33  | White<br>Black<br>Red<br>Blue    | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup>     | 360mm  | Analog channel 3<br>GND<br>V Battery<br>V Reference | Ch.3    |
| 34<br>35<br>36<br>37  | White<br>Black<br>Red<br>Blue    | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup>     | 360mm  | Analog channel 4<br>GND<br>V Battery<br>V Reference | Ch.4    |
| 19<br>20<br>21  | White<br>Black<br>Blue<br>n.c.   | 1<br>2<br>3<br>4          | 3x0.35mm <sup>2</sup>     | 320mm  | Speed 1<br>GND<br>V Battery<br>n.c.                 | speed 1 |
| 16<br>17<br>18  | n.c.<br>Black<br>Blue<br>White   | 1<br>2<br>3<br>4          | 3x0.35mm <sup>2</sup>     | 320mm  | n.c.<br>GND<br>V Battery<br>Optical lap             | Lap     |
| 12<br>14<br>13  | White*<br>Black<br>Blue*<br>n.c. | 1<br>2<br>3<br>4          | 2x0.35+1x0.35<br>twistato | 1100mm | USB D+<br>GND<br>USB D-<br>n.c.                     | USB     |

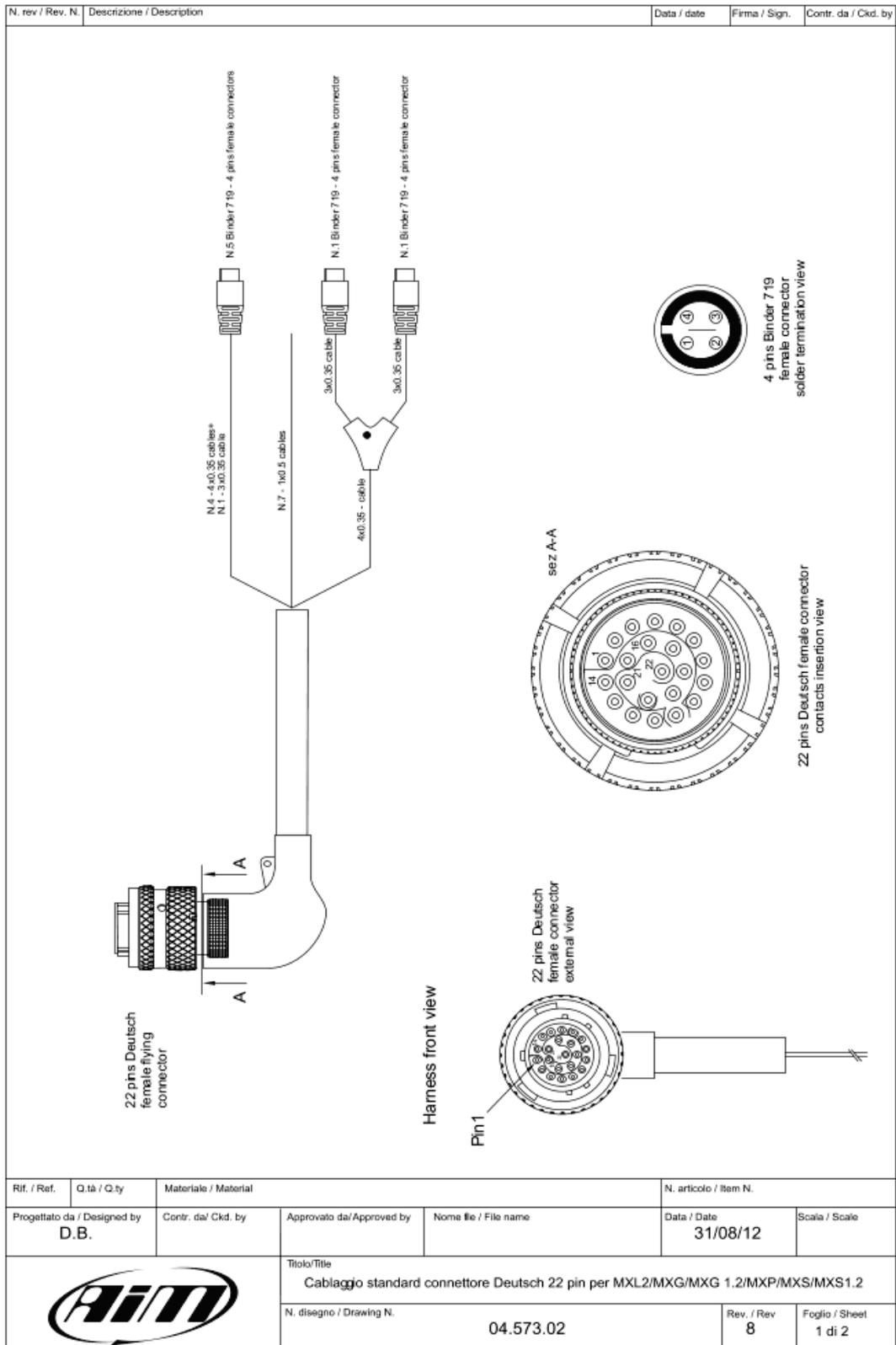
\*= twisted



| Table of not ended cables |                                |  |        |  |
|---------------------------|--------------------------------|--|--------|--|
| Connector pin             | Cable colour                   | Cable type   | Length | Label                                  |
| 15                        | white                          | 1x0.5mm <sup>2</sup>   | 550mm  | RPM                                    |
| 2<br>1                    | black<br>red                   | 1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup>   | 550mm  | GND<br>9-15V Power input               |
| 8<br>9<br>10<br>11        | white<br>blue<br>black<br>blue | 1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup> | 550mm  | CAN1+<br>CAN1-<br>K-Line GND<br>K-Line |

|                                     |                    |   |                       |                         |
|-------------------------------------|--------------------|---|-----------------------|-------------------------|
| Rif. / Ref.                         | Q.tà / Q.ty        | Materiali / Material  | N. articolo / Item N. |                         |
| Progettato da / Designed by<br>D.B. | Contr. da/ Ckd. by | Approvato da/ Approved by   | Nome file / File name | Data / Date<br>31/08/12 |
|                                     |                    | Titolo/Title<br>Cablaggio standard connettore Deutsch 37 pin per MXL2/MXG/MXG 1.2/MXP/MXS/MXS 1.2 |                       |                         |
|                                     |                    | N. disegno / Drawing N.<br>04.573.01  | Rev. / Rev<br>8       | Foglio / Sheet          |

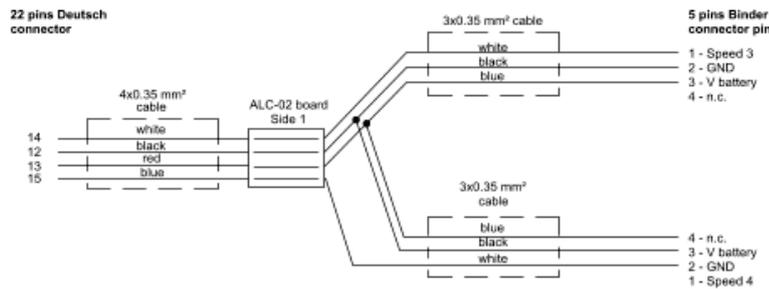
22 pins Deutsch connector standard harness



|                  |                           |             |               |                     |
|------------------|---------------------------|-------------|---------------|---------------------|
| N. rev / Rev. N. | Descrizione / Description | Data / date | Firma / Sign. | Contr. da / Ckd. by |
|------------------|---------------------------|-------------|---------------|---------------------|

**Table of cables ending with 4 pins Binder 719 female connector**

| 22 pins Deutsch connector pin | Cable colour                   | Destination connector pin | Cable type            | Length | Channel   | Label   |
|-------------------------------|--------------------------------|---------------------------|-----------------------|--------|---|---------|
| 1<br>2<br>3<br>4              | White<br>black<br>Red<br>Blue  | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup> | 380mm  | Analog Channel 5<br>GND<br>V Battery<br>V Reference | Ch.5    |
| 5<br>6<br>7<br>8              | White<br>Black<br>Red<br>Blue  | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup> | 380mm  | Analog Channel 6<br>GND<br>V Battery<br>V Reference | Ch.6    |
| 6<br>7<br>8<br>9              | White<br>Black<br>Red<br>Blue  | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup> | 400mm  | Analog Channel 7<br>GND<br>V Battery<br>V Reference | Ch.7    |
| 10<br>11<br>12<br>13          | White<br>Black<br>Red<br>Blue  | 1<br>2<br>3<br>4          | 4x0.35mm <sup>2</sup> | 400mm  | Analog Channel 8<br>GND<br>V Battery<br>V Reference | Ch.8    |
| 11<br>12<br>13                | White<br>Black<br>Blue<br>n.c. | 1<br>2<br>3<br>4          | 3x0.35mm <sup>2</sup> | 320mm  | Speed 2<br>GND<br>V Battery<br>n.c.                 | Speed 2 |

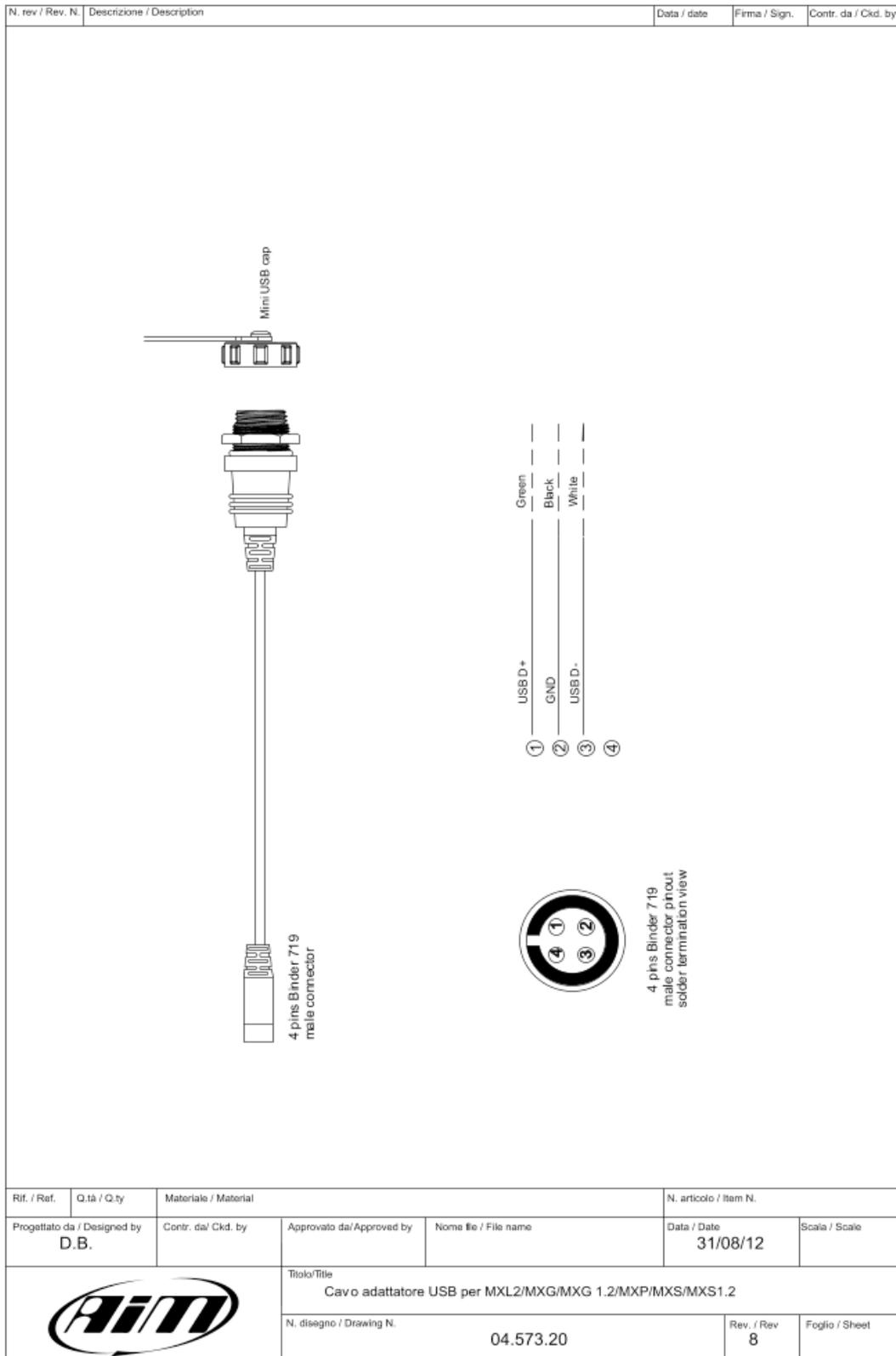


**Table of not ended cables**

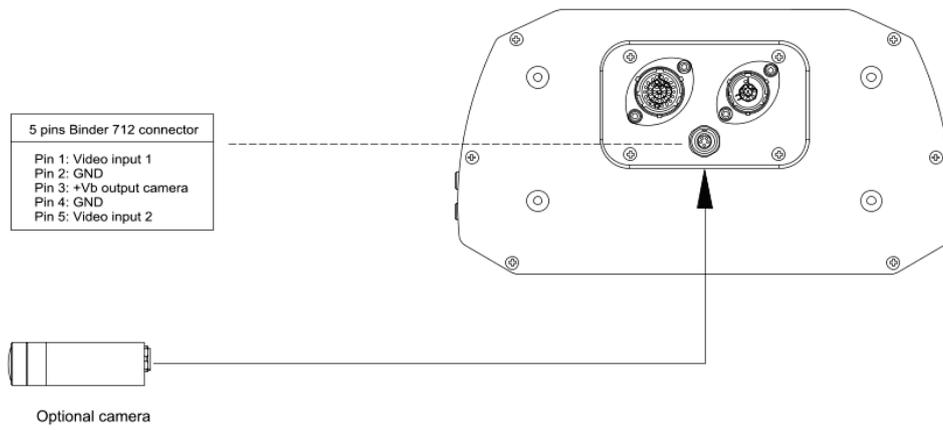
| 22 pins Deutsch connector pin | Cable colour                           | Cable type   | Length | Label   |
|-------------------------------|--|--|--------|---|
| 19<br>20                      | bianco<br>blu                          | 1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup>   | 550mm  | Digital output 1<br>Digital output 2                |
| 17<br>18<br>16<br>21<br>22    | bianco<br>blu<br>nero<br>bianco<br>blu | 1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup><br>1x0.5mm <sup>2</sup> | 550mm  | CAN2+<br>CAN2-<br>GND<br>ECU RS232RX<br>ECU RS232TX |

|                                     |                    |  |                       |                          |               |
|-------------------------------------|--------------------|--|-----------------------|--------------------------|---------------|
| Rif. / Ref.                         | Q.tà / Q.ty        | Materiale / Material   | N. articolo / Item N. |                          |               |
| Progettato da / Designed by<br>D.B. | Contr. da/ Ckd. by | Approvato da/ Approved by  | Nome file / File name | Data / Date<br>31/08/12  | Scala / Scale |
|                                     |                    | Titolo/Title<br>Cablaggio standard connettore Deutsch 22 pin per MXL2/MXG/MXG 1.2/MXP/MXS/MXS1.2 |                       |                          |               |
|                                     |                    | N. disegno / Drawing N.<br>04.573.02   | Rev. / Rev<br>8       | Foglio / Sheet<br>2 di 2 |               |

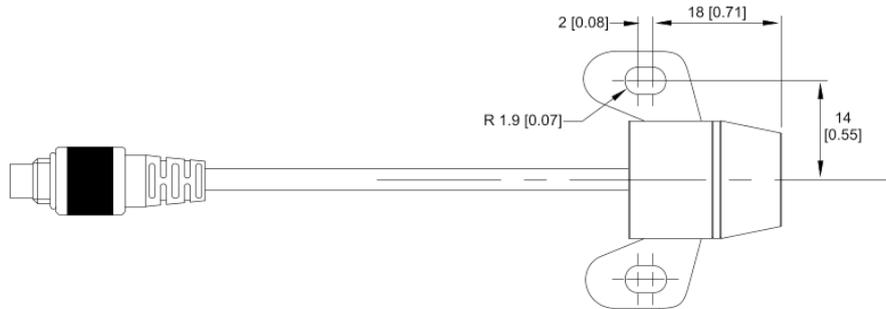
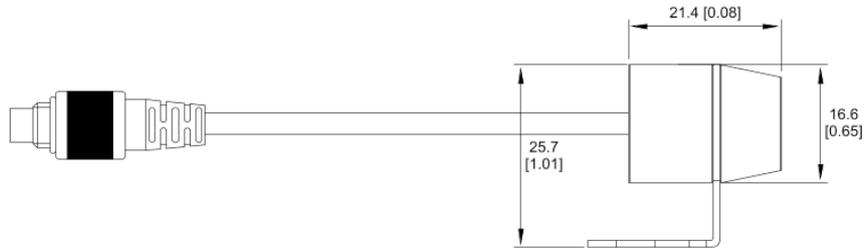
USB cable



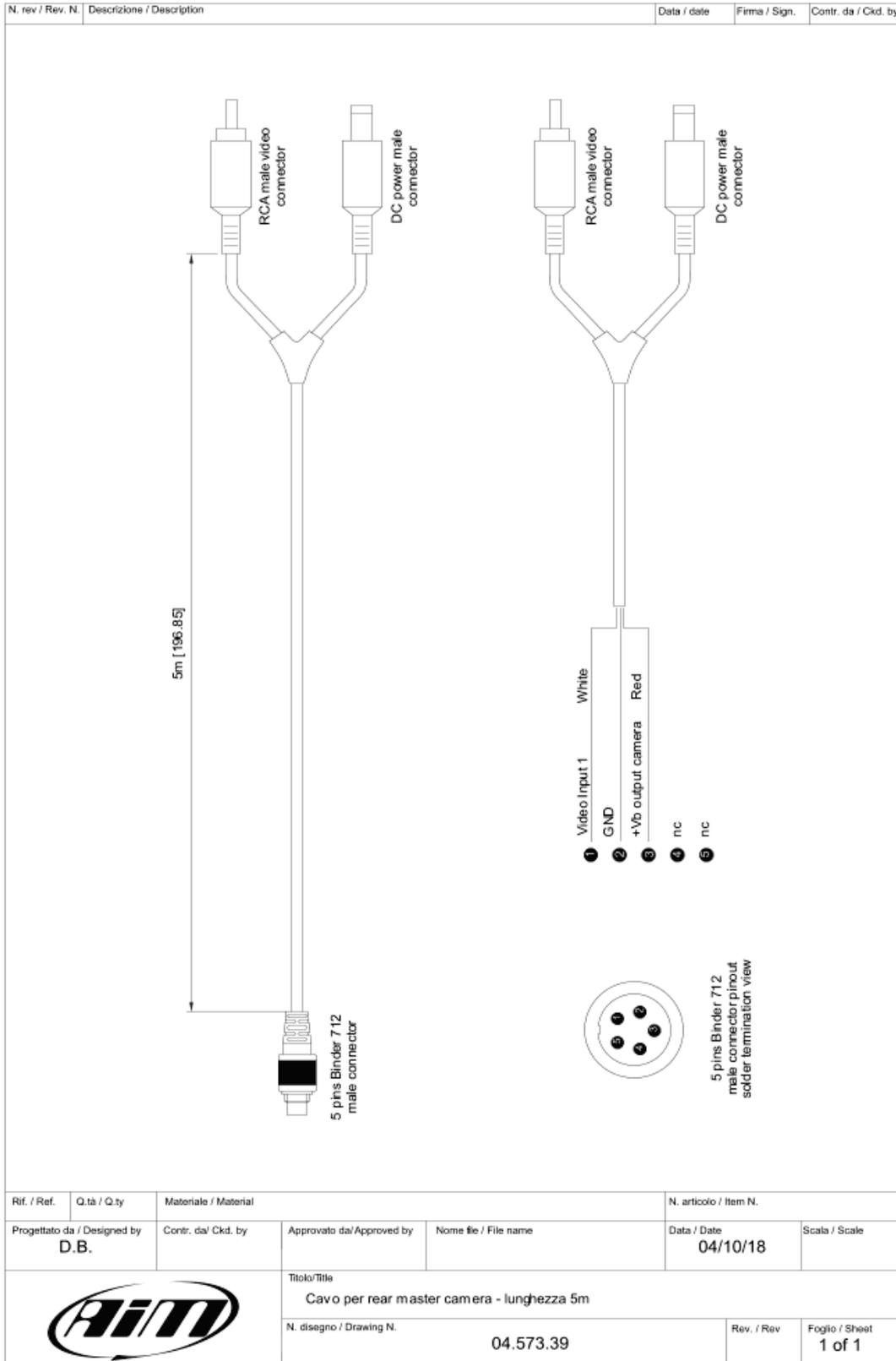
**MX Series mirror camera connection**



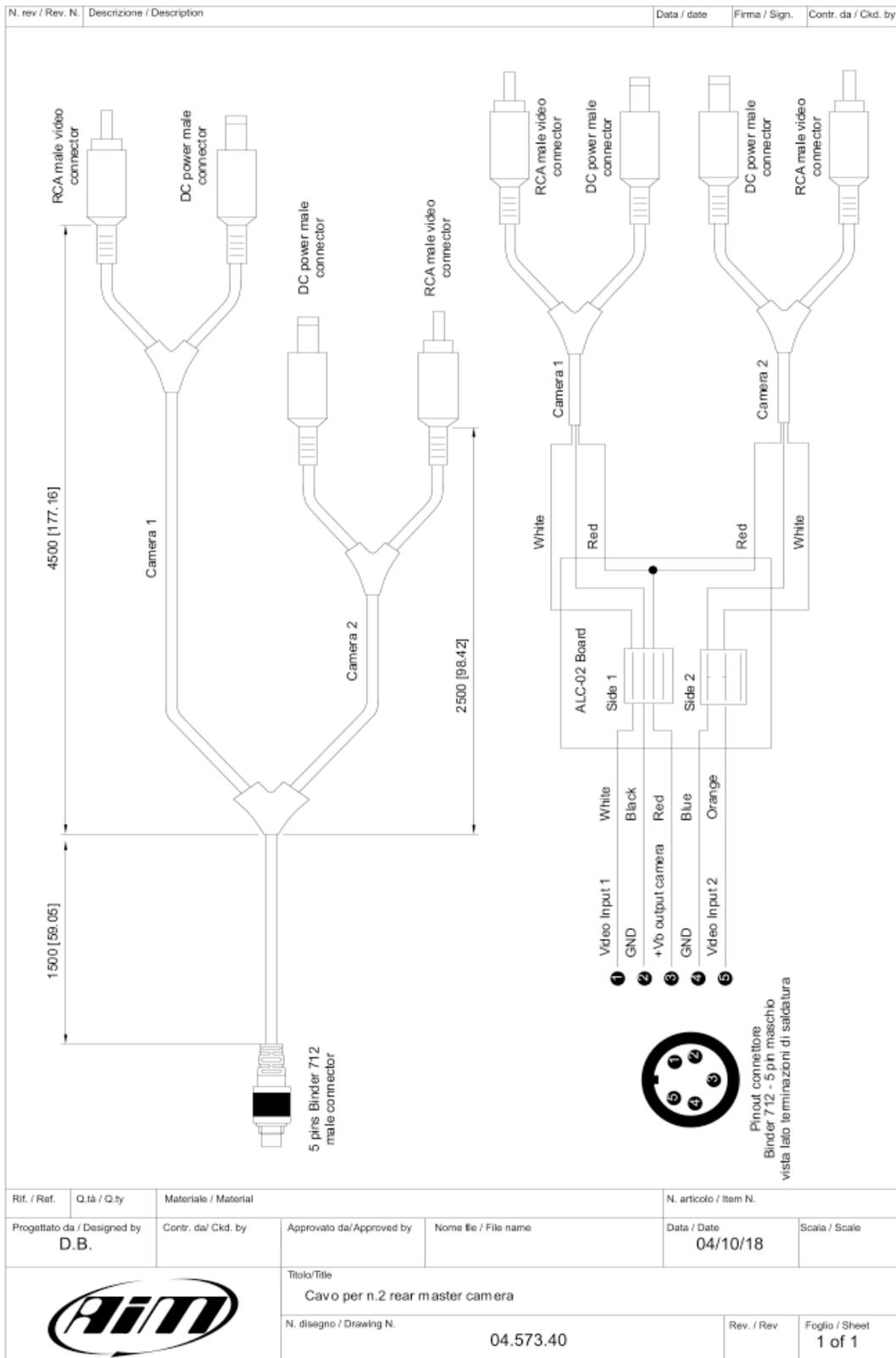
Mirror camera dimensions in mm [inches]



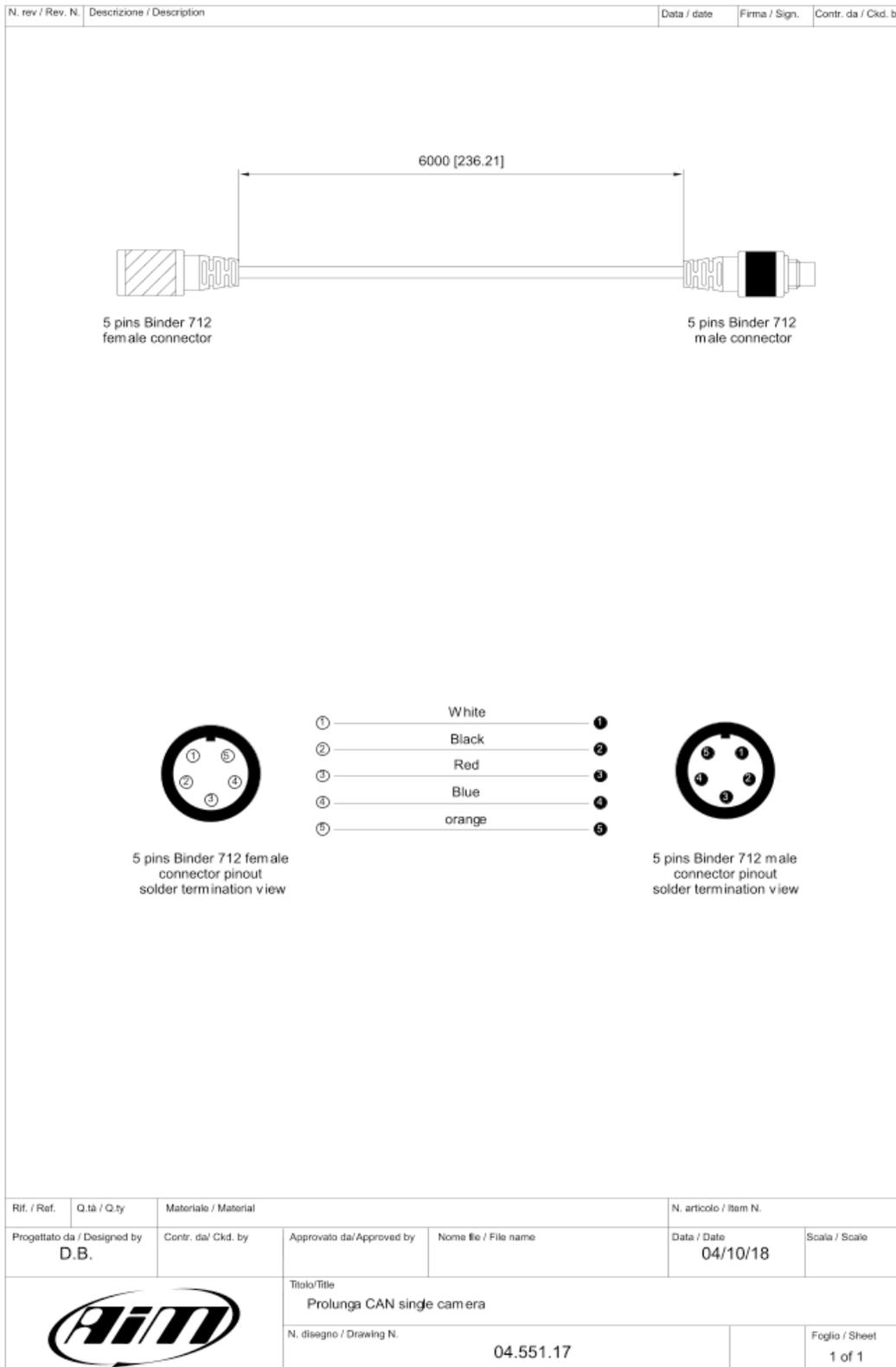
Cable for single rear camera



Cable for n.2 rear cameras



**Cable for single AiM mirror camera**



**MX Series cable for n.2 AiM mirror cameras**

