User Manual

AiM Steering Wheel 4

Release 1.00

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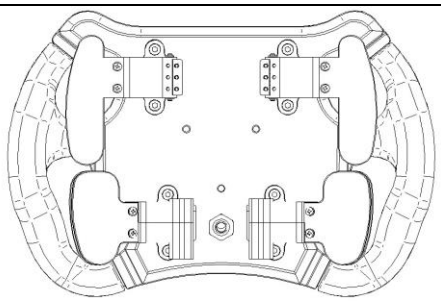
1 – AiM SW4 in a few words

AiM SW4 is the new range of AiM steering wheel with integrated logger properly designed and developed for professional racers; available in different models they feature:

- ECU connection
- CAN 2
- AiM CAN expansion
- Colour TFT display
- 10 freely configurable pushbuttons
- 3 freely configurable rotary switches
- Freely configurable alarm display icons
- 4 configurable alarm RGB LEDs
- 8 RGB LEDs configurable as shift lights or predictive time
- Internal datalogger with 4 Gb internal memory

SW4 Accessories

	Paddle shifts and Paddle clutches are available as option

SW4 Expansions

SW4 can be connected to AiM GPS09 Module, Channel Expansion, TC Hub, Lambda Controller, SmartyCam HD and RIO02.

2 – SW4 models

AiM Steering wheel 4 (from here onwards SW4) range includes different models with different characteristics as shown in the table below.

	SW4 270	SW4 280	SW4 320	SW4 350
Display	4.3" TFT		5" TFT	
Resolution 800x480 pixels	●	●	●	●
Contrast 800:1	●	●	●	●
Brightness	800cd/m2 – 1,100 Lumen		800cd/m2 – 1,200 Lumen	
Ambient light sensor	●	●	●	●
Configurable Alarm icons	●	●	●	●
8 configurable RGB LEDs shift lights	●	●	●	●
4 configurable Alarm RGB LEDs	●	●	●	●
3 CAN connections	●	●	●	●
4 GB Internal memory	●	●	●	●
Anodized Aluminium body	●	●	●	●
10 Pushbuttons*	●	●	●	●
Rotary switches*	3	3	3	3
22 pins Deutsch male Autosport Connector	●	●	●	●
Dimensions in mm	270x183.5x42.6	280x183.5x42.6	320X183.5X42.5	350x183.5x45.5
Weight	2400 g	2400 g	2600 g	2600 g
Power consumption: 500 mA	●	●	●	●
Waterproof IP 65	●	●	●	●

* **Please note**: both pushbuttons and rotary switches have RGB backlights.

3 – LEDs, pushbuttons, and rotary switches

With reference to the image below, SW4 features

- 2 buttons (Right and Left Buttons 1): They work as free contacts, closing the circuit between two pins each in the connector
- 8 pushbuttons, freely configurable using RaceStudio3 software
- 4 RGB alarm LEDs, freely configurable using RaceStudio3 software
- 8 top RGB LEDs to be used as shift lights or as predictive lap time, configurable using Race Studio 3 software
- 3 rotary switches, all with RGB backlight freely configurable using Race Studio 3 software

3.1 – Buttons labels set

SW4 comes with a set of stickers that can be used to identify the function buttons as well as the remaining eight pushbuttons. Here below they are shown with the meaning that is typically associated to each stick.

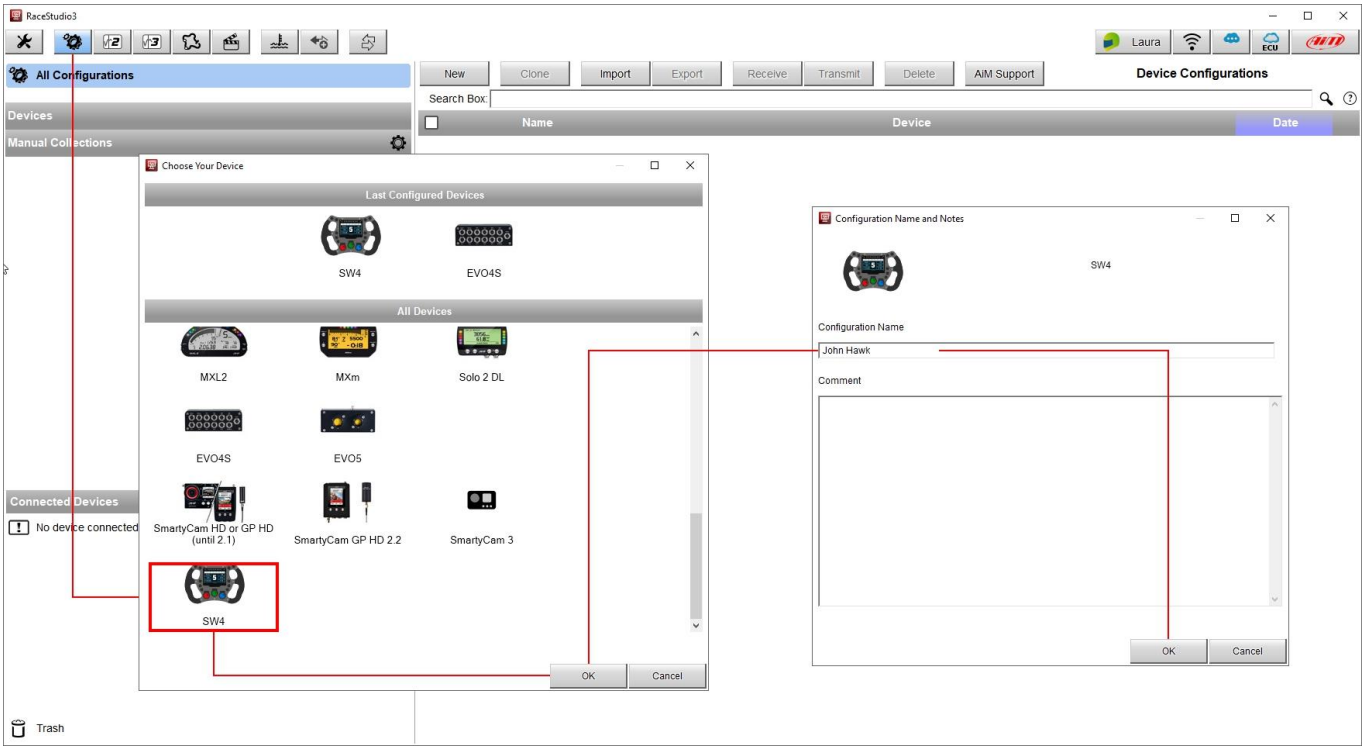
FCY	**Full Course Yellow**: set a steady speed at 80 km/h.	>>	Scrolls the options forward.	SF	
LC	**Launch Control**.	PASS	Increases the engine power during an overtaking.	START STOP	Activate **Start and stop** function.
M	**Mark**: it sets a space or time marker on a point of the track.	PIT	Limits the vehicle speed in the **pit** lane.	TALK	Allows the communication with the team in the paddock.
MARK	**Mark**: it sets a space or time marker on a point of the track.	PTP	**Push to Pass**: Increases the engine power during an overtaking.		High Beam
MEM OK	**MEM/OK**: recalls stored data and enters a page	VIEW QUIT	Navigates data recall and exit a display page.		Right arrow
MENU <<	Enters the logger Menu and scrolls the options back.	RAD	Allows the communication with the team in the paddock (**Radio**).		Left arrow
N	**Neutral** gear.	R	**Reverse** gear.		Windscreen wiper

Each button can be configured as momentary toggle or Multiposition and is to be configured according to the function it is associated with.

4 – SW4 Configuration

In order to configure your SW4, please, execute the following steps:

- Run RaceStudio3 and press the setting icon
- "Choose your Device" window is prompted: scroll it up to SW4 icon and select it
- Press "OK"
- "Configuration name and notes" window is prompted: fill in Configuration Name and note if you wish; if you don't the configuration is named as the device (John Hawk in this case) and progressively numbered if more configurations of the same devices are created
- Press "OK"

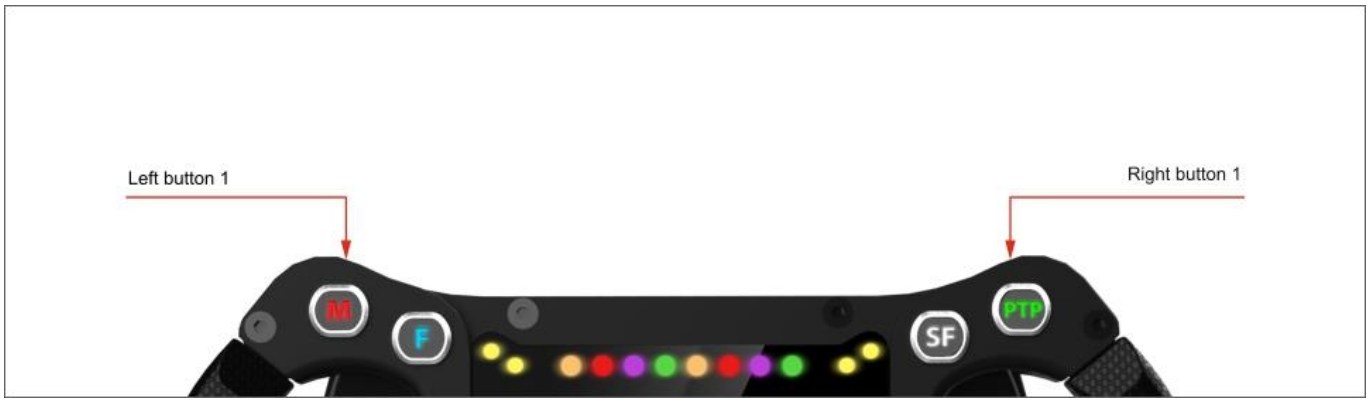


4.1 – Buttons, Rotary Switches and Paddles

SW4 features 12 pushbuttons and 3 eight positions rotary switches.

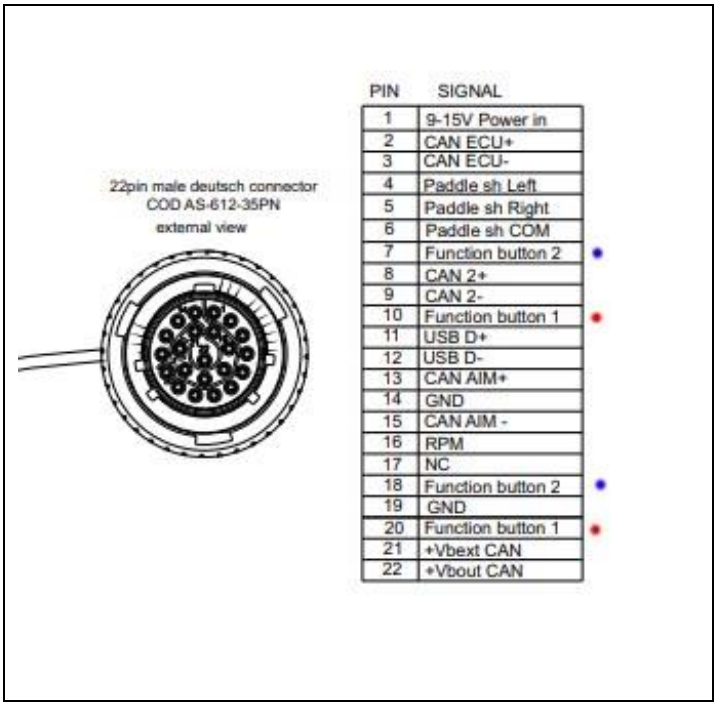
4.1.1 – Free contact pushbuttons

Two buttons, Left Button 1, and Right Button 1, shown in the picture, simply close a free contact

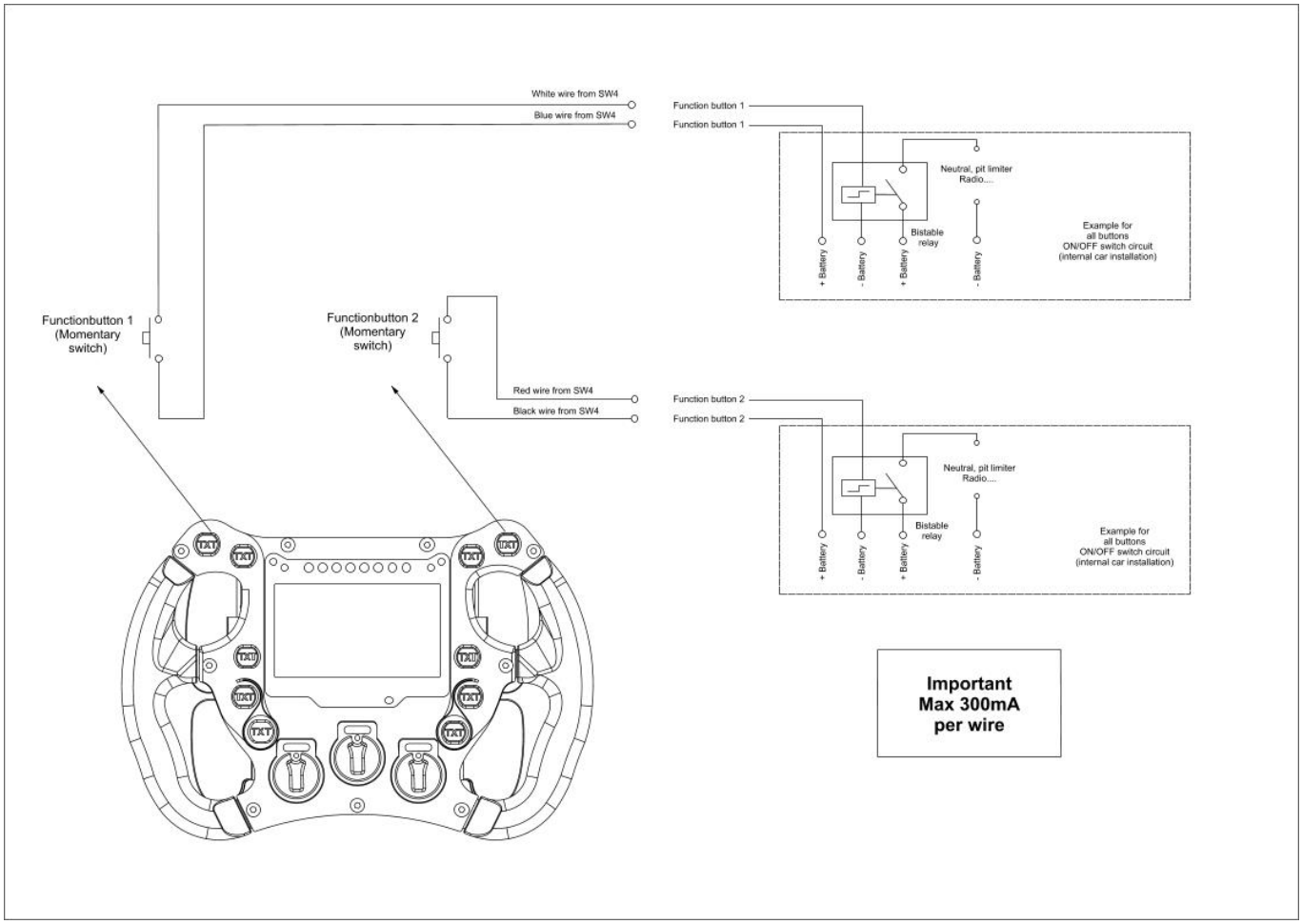


The pins correlated to these two pushbuttons are:

Let Button : Pin 10 – Pin 20
Right Button: Pin 7 – Pin 18



PIN	SIGNAL
1	9-15V Power in
2	CAN ECU+
3	CAN ECU-
4	Paddle sh Left
5	Paddle sh Right
6	Paddle sh COM
7	Function button 2
8	CAN 2+
9	CAN 2-
10	Function button 1
11	USB D+
12	USB D-
13	CAN AIM+
14	GND
15	CAN AIM -
16	RPM
17	NC
18	Function button 2
19	GND
20	Function button 1
21	+Vbext CAN
22	+Vbout CAN



4.1.2 – CAN Output pushbuttons

The other 8 pushbuttons, which status is to be transmitted through a CAN connection, need be configured in order to be used. This is possible through our software Race Studio3, selecting the "Buttons layer"

The pushbuttons may be used in the following ways:

- **Display pushbuttons**: The display needs, for a complete management, 4 dedicated pushbuttons:
  - **Menu / <<**: Enters the display Menu and scrolls the options back.
  - **View / Quit**: Navigates data recall and leave a display page.
  - **>>** : Scrolls the options forward.
  - **MEM/OK** : Recalls stored data and enters a page

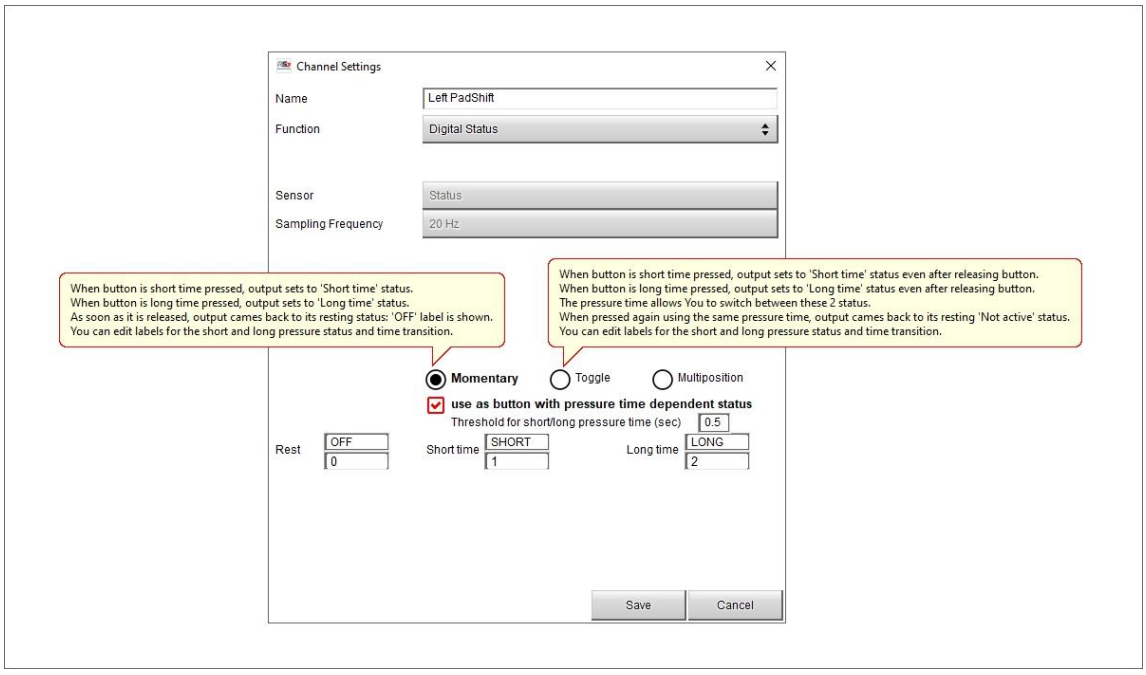
- **Momentary pushbuttons**: when the button is pressed output sets to "Active" status: as soon as it is released it goes back to its "Not active" status. The pushbuttons may be:
    - **Time Independent:** in this case, the pushbutton may have only two statuses: "Active", when pushed, and "Not Active" when released.
    - **Time Dependent:** when the button is short time pressed output sets to "Short time" status; when the button is long time pressed, output sets to "Long Time" status; as soon as it is released output comes back to its "Not Active" status

- **Toggle pushbuttons**: when the button is pressed output sets to "Active" status even after releasing the button; when pressed again output comes back to its resting "Not active" status

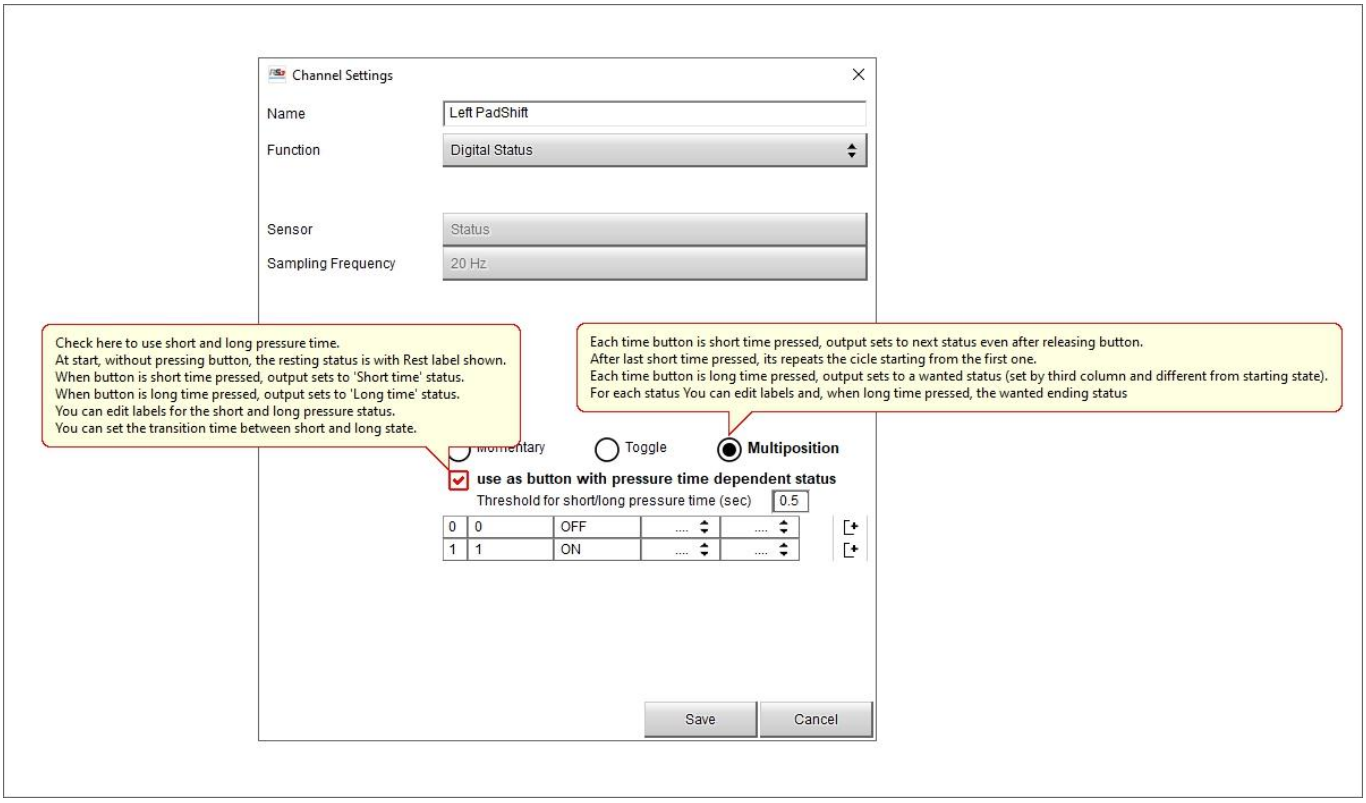
  Here too, a pushbutton may be configured in two ways:
    - **Time Independent:** in this case, the pushbutton may have only two status: "Active" and "Not Active" .
    - **Time Dependent** when the button is short time pressed output sets to "Short time" status even after releasing button; when button is long time pressed, output sets to "Long Time" status even after releasing button. The pressure time allows you to switch between these 2 statuses; when pressed again using the same pressure time, it goes back to its "Not Active" status;

- **Multiposition**: each time the button is short time pressed, output sets to next status even after releasing the button; after last status it repeats the cycle starting from the first one. Here too, the actions for passing from a status to another status can be **Time Dependant**: the next status depends upon how long you push the pushbutton.

Momentary and Toggle working modes are shown here below.

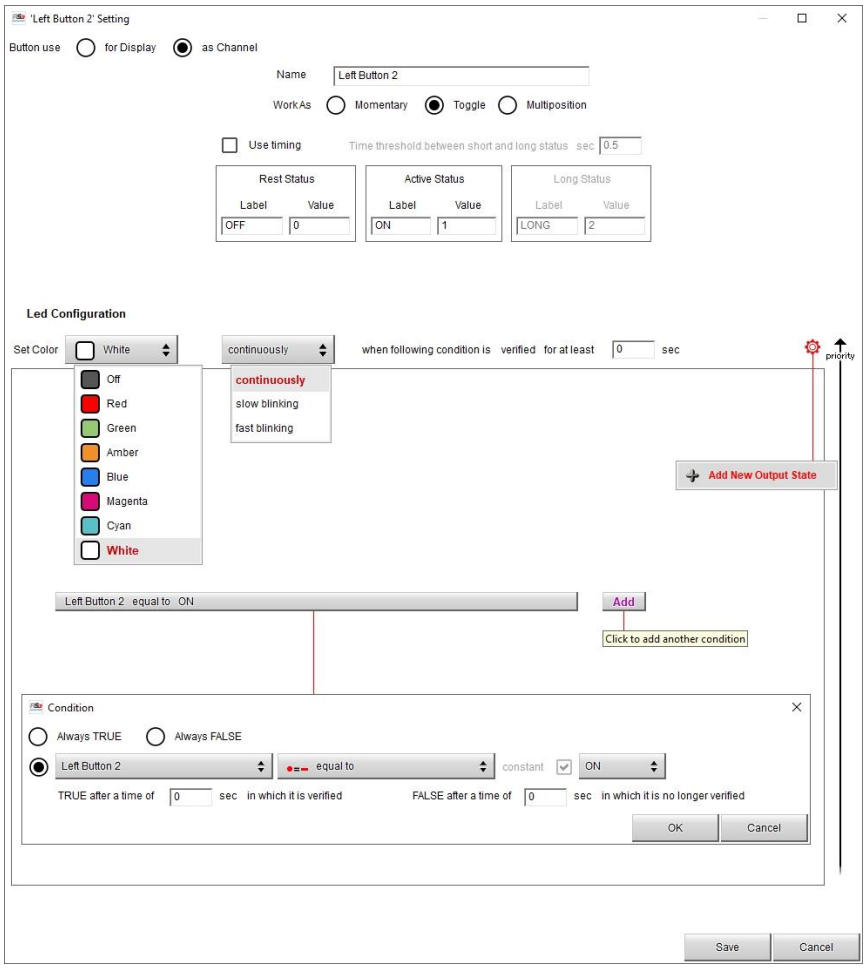


Multiposition working mode is shown here below.

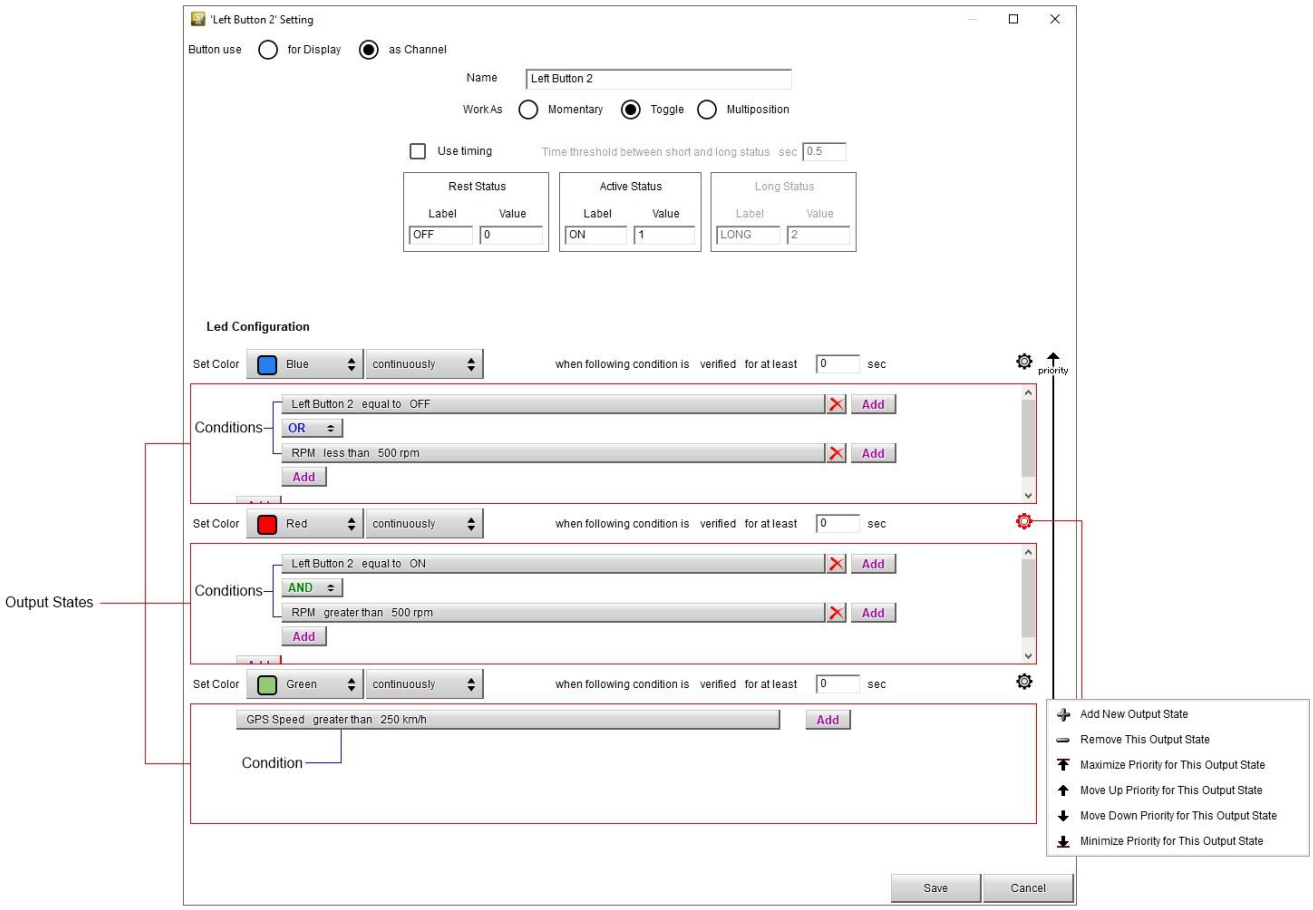


4.1.3 – Pushbutton LEDs

Every pushbutton has an associated RGB LED, used for enlightening it in night usage or even as a feedback after having required an action: you may choose the colour depending upon a single status and the logic for turning it ON. Finally, the lights may be slow or fast blinking.



You can configure every LED in order to be turned ON in different colours in dependence upon the conditions you may describe through math channels.



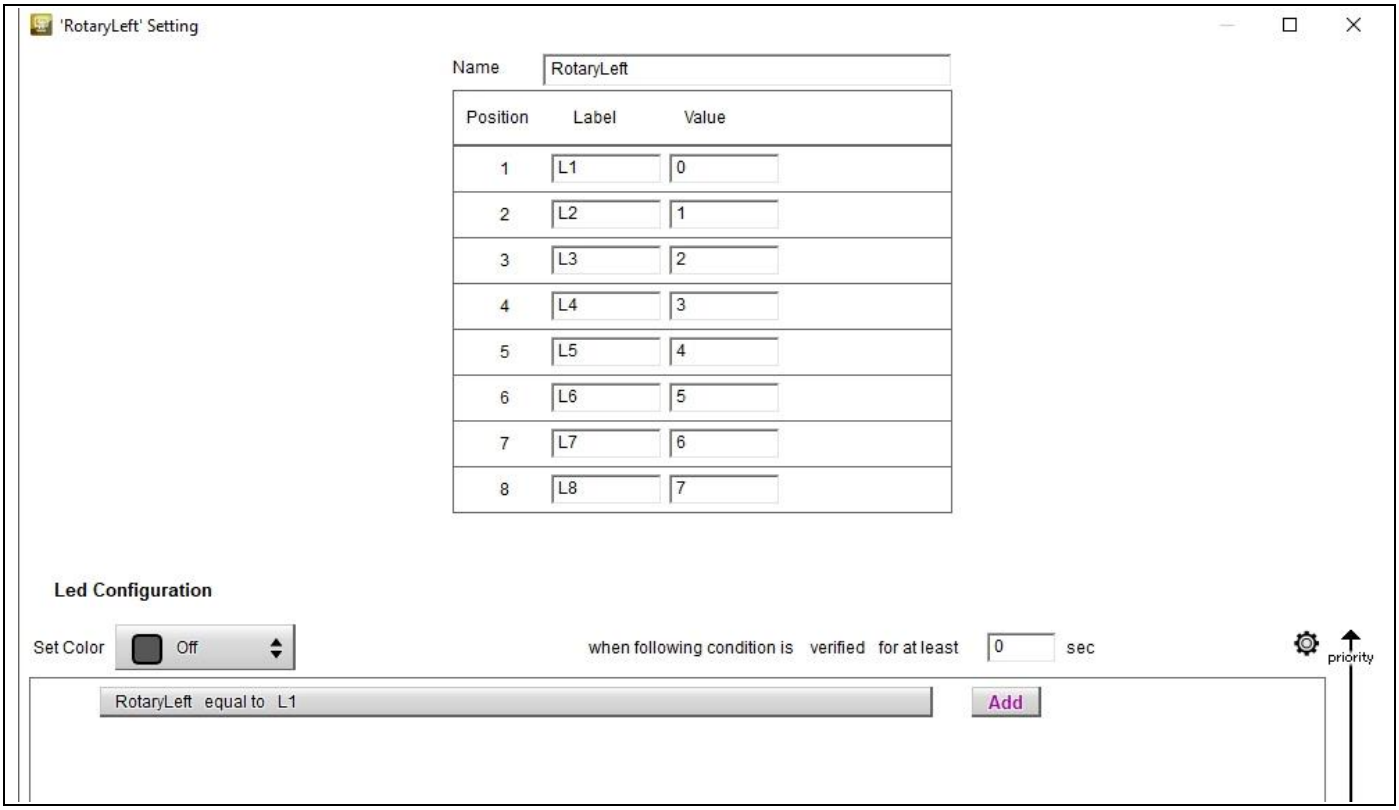
4.1.4 – Rotary switches

The three rotary switches may be set in eight different positions, each one recognized through a numeric value and a label.

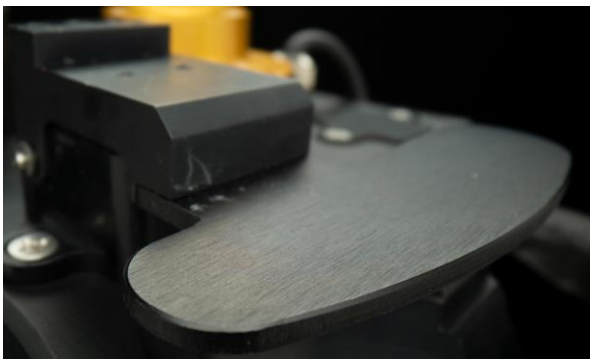
The RBG LEDs colour may be defined in dependence of a freely configurable rule

Per every position, you can:

- name each status setting the corresponding Label, for eventually show the status on your display
- set different values corresponding to different positions
- set the rotary LED colour per every position.

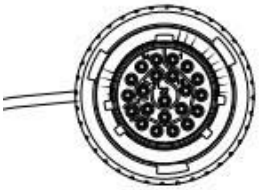


4.1.5 – Gear Paddles



The two optional Gear Paddles have two contacts each. One closes a free contact, while the other is managed by the internal processor and may be transmitted to the CAN connection

22pin male deutsch connector
COD AS-612-35PN
external view

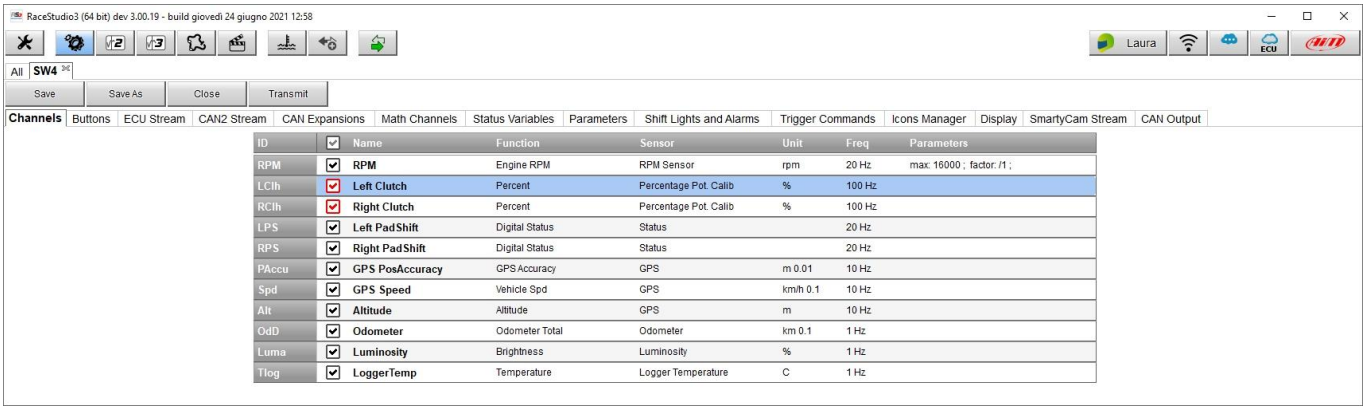


PIN	SIGNAL
1	9-15V Power in
2	CAN ECU+
3	CAN ECU-
4	Paddle sh Left
5	Paddle sh Right
6	Paddle sh COM
7	Function button 2
8	CAN 2+
9	CAN 2-
10	Function button 1
11	USB D+
12	USB D-
13	CAN AIM+
14	GND
15	CAN AIM -
16	RPM
17	NC
18	Function button 2
19	GND
20	Function button 1
21	+Vbext CAN
22	+Vbout CAN

4.1.6 – Clutch Paddles

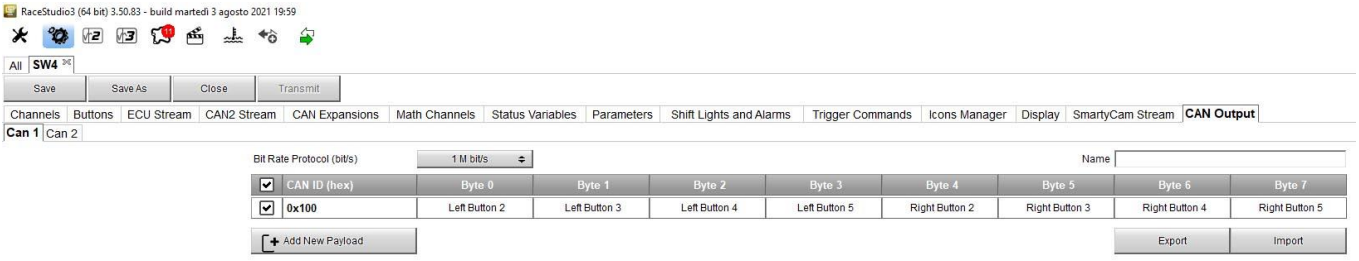
The Clutch Paddles move two internal analog potentiometers, managed by the processor and whose value may be transmitted to the external device through the CAN connection.

Being SW4 clutches optional the related channels are by default disabled. To use them enable the left checkbox.



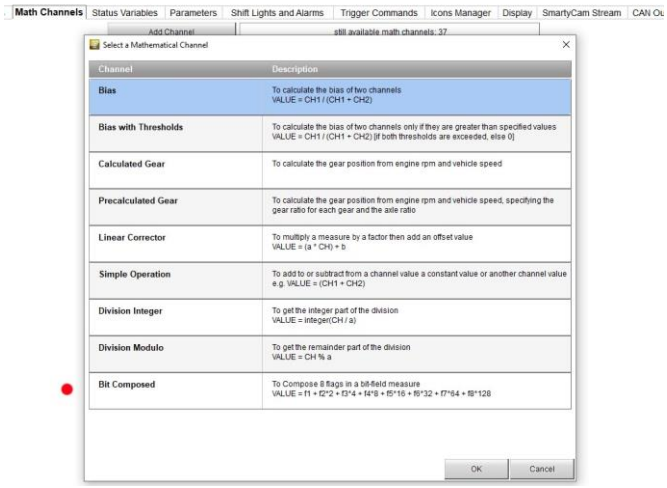
4.1.7 – Buttons/Rotary/Paddles Status transmission

The status of the buttons, of the rotary switches and of the paddles are intended to be transmitted to an external device through the CAN connection: you have to create a CAN message, using the CAN Output Tab:

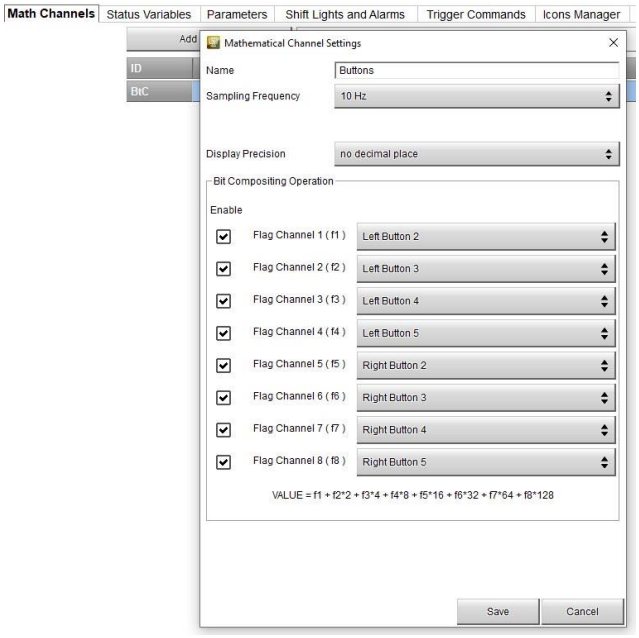


In this example, we have created a message at ID 0x100 with 8 fields, one per every pushbutton status.

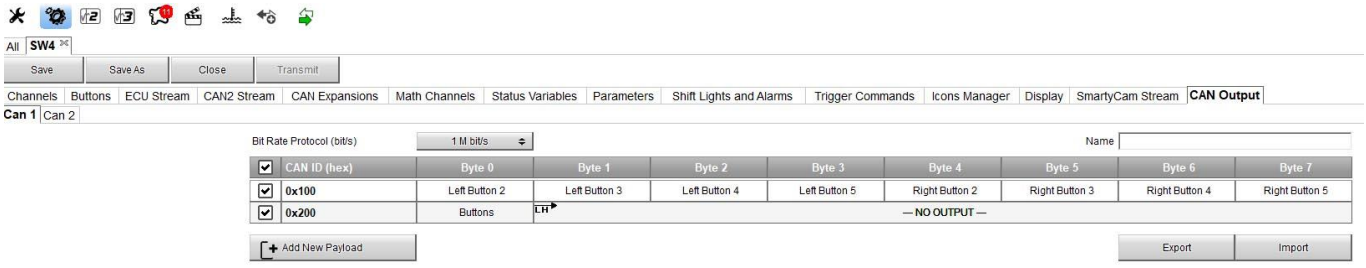
In case you need to transmit the pushbutton status as bits, one bit per every pushbutton, you have to create a math channel, called Bit Composed, in which one byte is composed by 8 different bits, one per every pushbutton:



You need to create a channel including the status of all the pushbuttons:



Finally, you may transmit this channel through CAN:

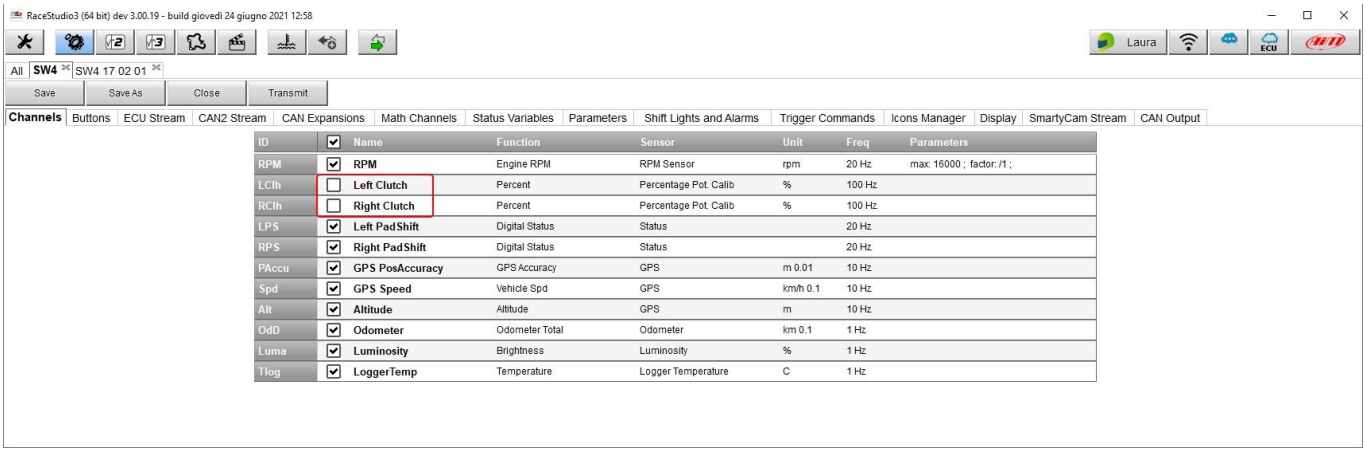


5 – Channels

Once the configuration created, the software "Channels" page is prompted. It shows the logger default channels.

They come from the paddles, clutch or gear, from internal sensors or calculations (Odometer, Luminosity and internal temperature), from the RPM connection and from the optional GPS: Accuracy, Speed, Altitude

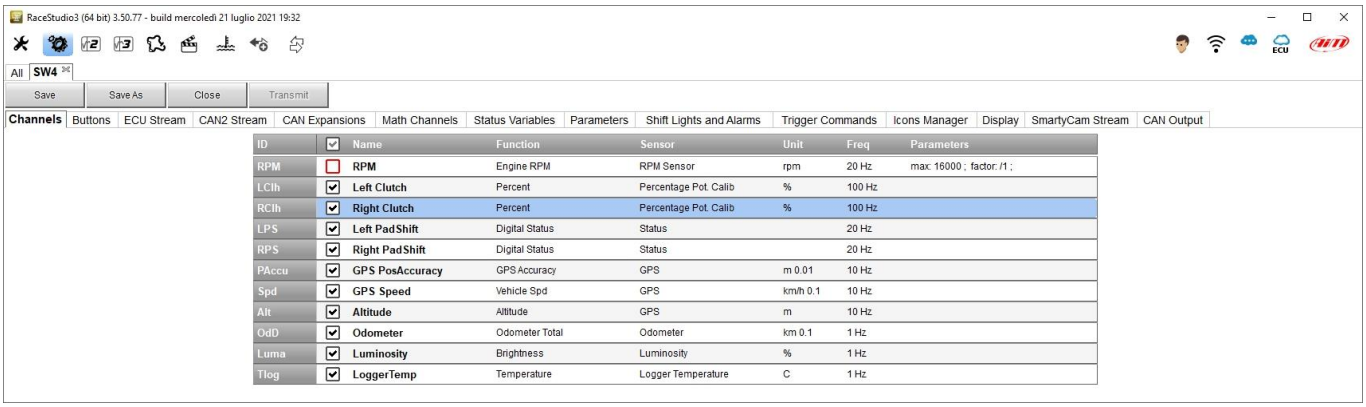
Left and Right clutch are disabled by default; in case, please enable the corresponding channels.



ID	Name	Function	Sensor	Unit	Freq	Parameters
RPM	RPM	Engine RPM	RPM Sensor	rpm	20 Hz	max: 16000 ; factor: /1 ;
LClh	Left Clutch	Percent	Percentage Pot. Calib	%	100 Hz	
RClh	Right Clutch	Percent	Percentage Pot. Calib	%	100 Hz	
LPS	Left PadShift	Digital Status	Status		20 Hz	
RPS	Right PadShift	Digital Status	Status		20 Hz	
PAccu	GPS PosAccuracy	GPS Accuracy	GPS	m 0.01	10 Hz	
Spd	GPS Speed	Vehicle Spd	GPS	km/h 0.1	10 Hz	
Alt	Altitude	Altitude	GPS	m	10 Hz	
OdD	Odometer	Odometer Total	Odometer	km 0.1	1 Hz	
Luma	Luminosity	Brightness	Luminosity	%	1 Hz	
Tlog	LoggerTemp	Temperature	Logger Temperature	C	1 Hz	

5.1 – RPM Channel

As explained before, once the ECU protocol loaded in SW4 configuration if, like in this case, the ECU supplies RPM channel the similar channel in "Channel" layer is automatically disabled.



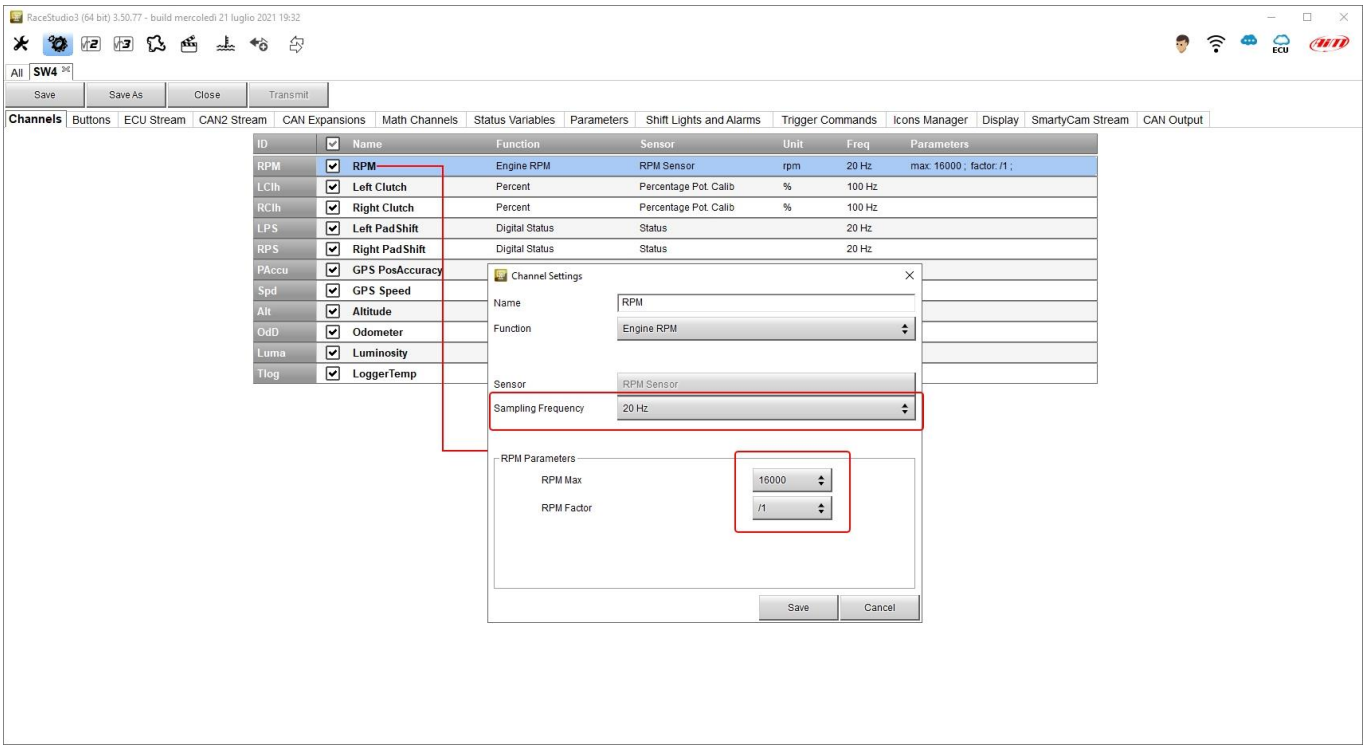
ID	Name	Function	Sensor	Unit	Freq	Parameters
RPM	RPM	Engine RPM	RPM Sensor	rpm	20 Hz	max: 16000 ; factor: /1 ;
LClh	Left Clutch	Percent	Percentage Pot. Calib	%	100 Hz	
RClh	Right Clutch	Percent	Percentage Pot. Calib	%	100 Hz	
LPS	Left PadShift	Digital Status	Status		20 Hz	
RPS	Right PadShift	Digital Status	Status		20 Hz	
PAccu	GPS PosAccuracy	GPS Accuracy	GPS	m 0.01	10 Hz	
Spd	GPS Speed	Vehicle Spd	GPS	km/h 0.1	10 Hz	
Alt	Altitude	Altitude	GPS	m	10 Hz	
OdD	Odometer	Odometer Total	Odometer	km 0.1	1 Hz	
Luma	Luminosity	Brightness	Luminosity	%	1 Hz	
Tlog	LoggerTemp	Temperature	Logger Temperature	C	1 Hz	

You have two ways for getting RPM value of your engine:

RPM from ECU
To get the RPM from the ECU just connect SW4 to the ECU and it will automatically sample that value.

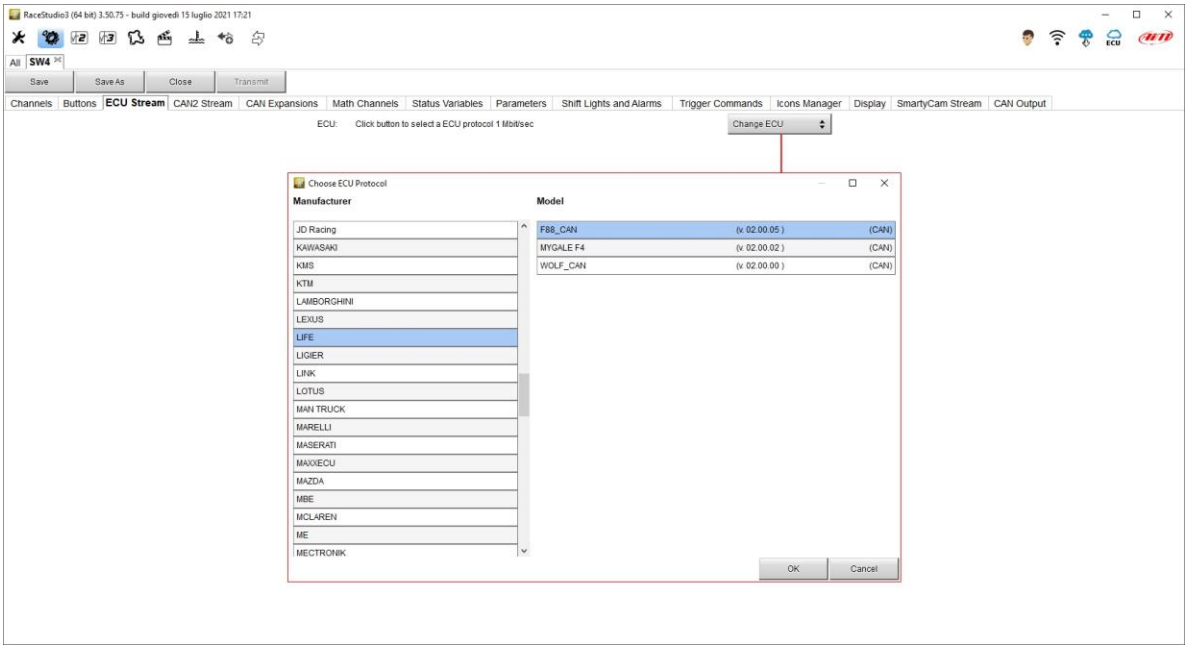
RPM via a 5-50V square wave or a 150-400V low level coil signal.
If the vehicle has no ECU, please connect pin 16 of the 22 pins connector harness to the low voltage of the coil (whose peak can be from 150 to 400 V) or eventually to a possible square wave (the peak can be from 5 to 50 V).

Finally, enable the RPM channel and set its parameters in the Channels page of Race Studio.



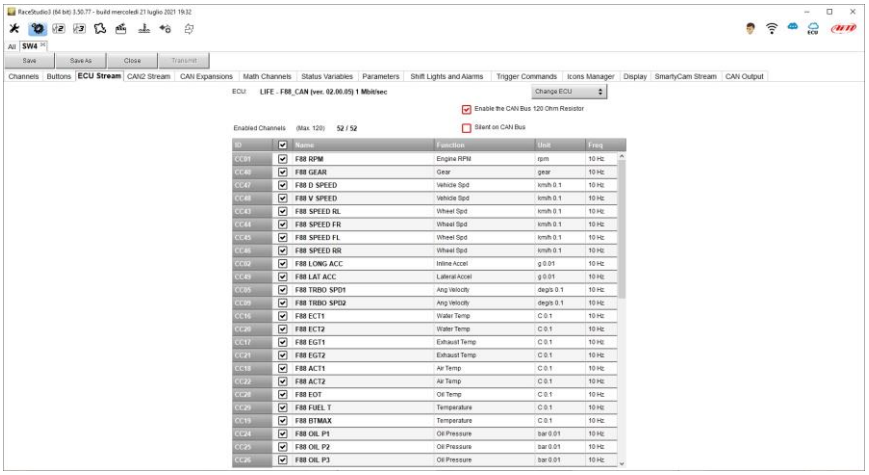
5.2 – ECU Stream

As all AiM loggers SW4 can be connected to your vehicle ECU. Race Studio3 Database includes more than 2000 ECU protocols. To set your ECU protocol in SW4 configuration press “Change ECU” and select your vehicle Manufacturer and model.



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

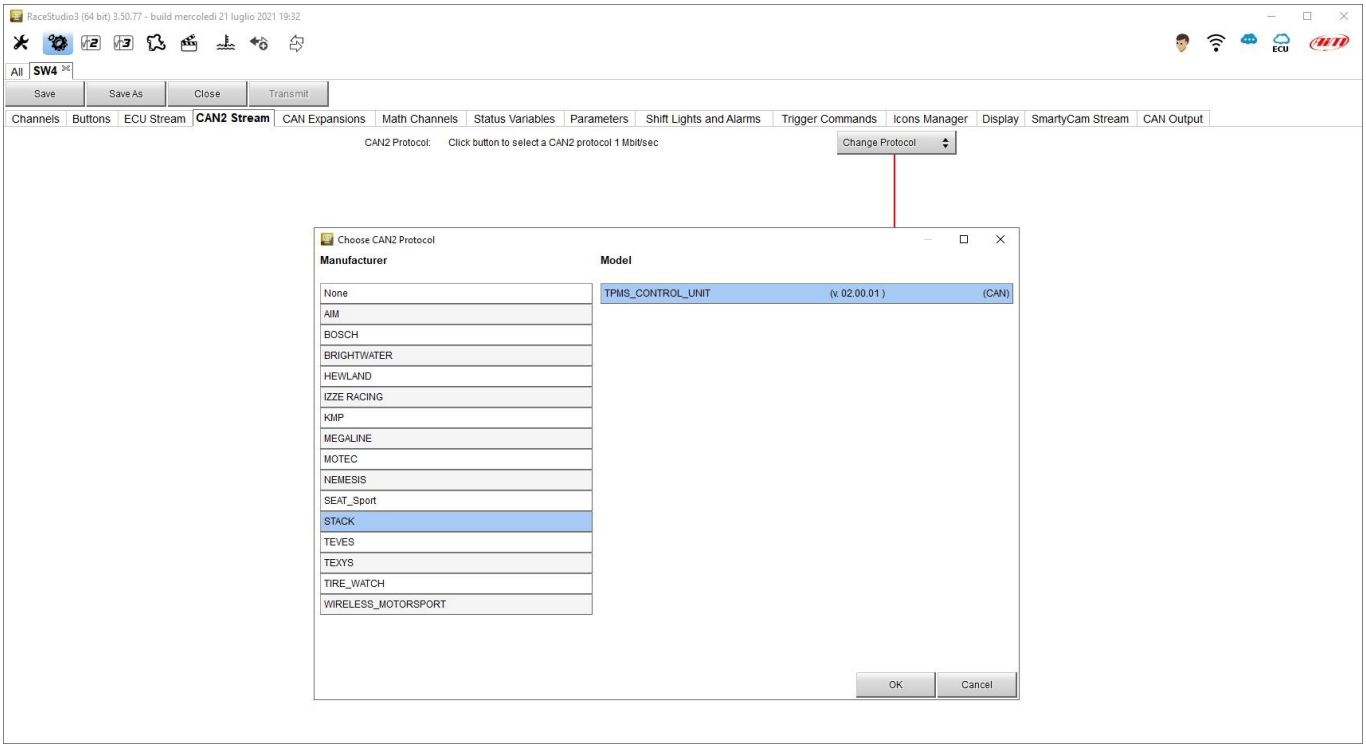
- “Enable the CAN Bus 120 Ohm Resistor” (enabled by default; to be disabled in case SW4 logger is additional to the vehicle dash): the CAN Bus needs two 120 Ohm resistors at its two extremes. In case sw4 is the only device connected to the ECU the 120 Ohm resistor should be enabled, else, very easily, 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, SW4 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 SW4 logger remains completely silent.



5.3 – 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”
- press OK

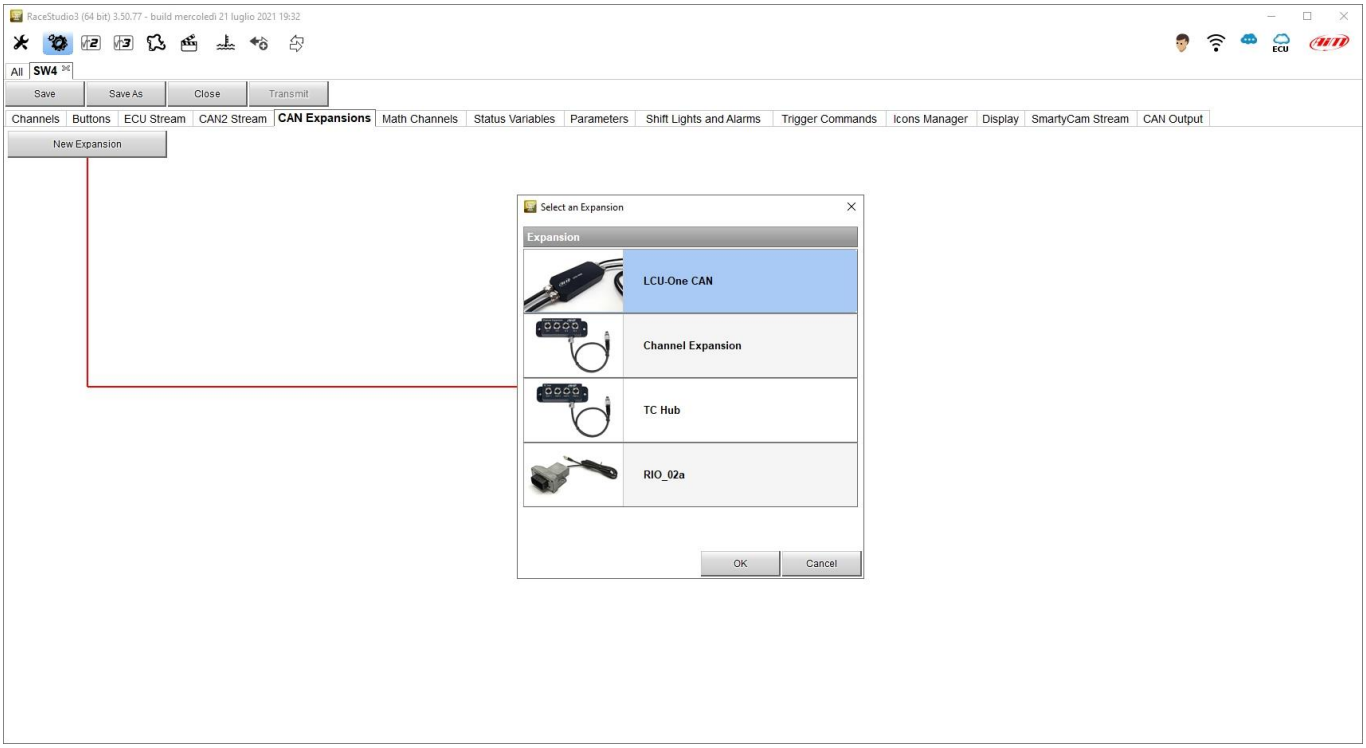


5.4 – AiM CAN Expansions

SW4 can be connected to various AiM CAN expansions:

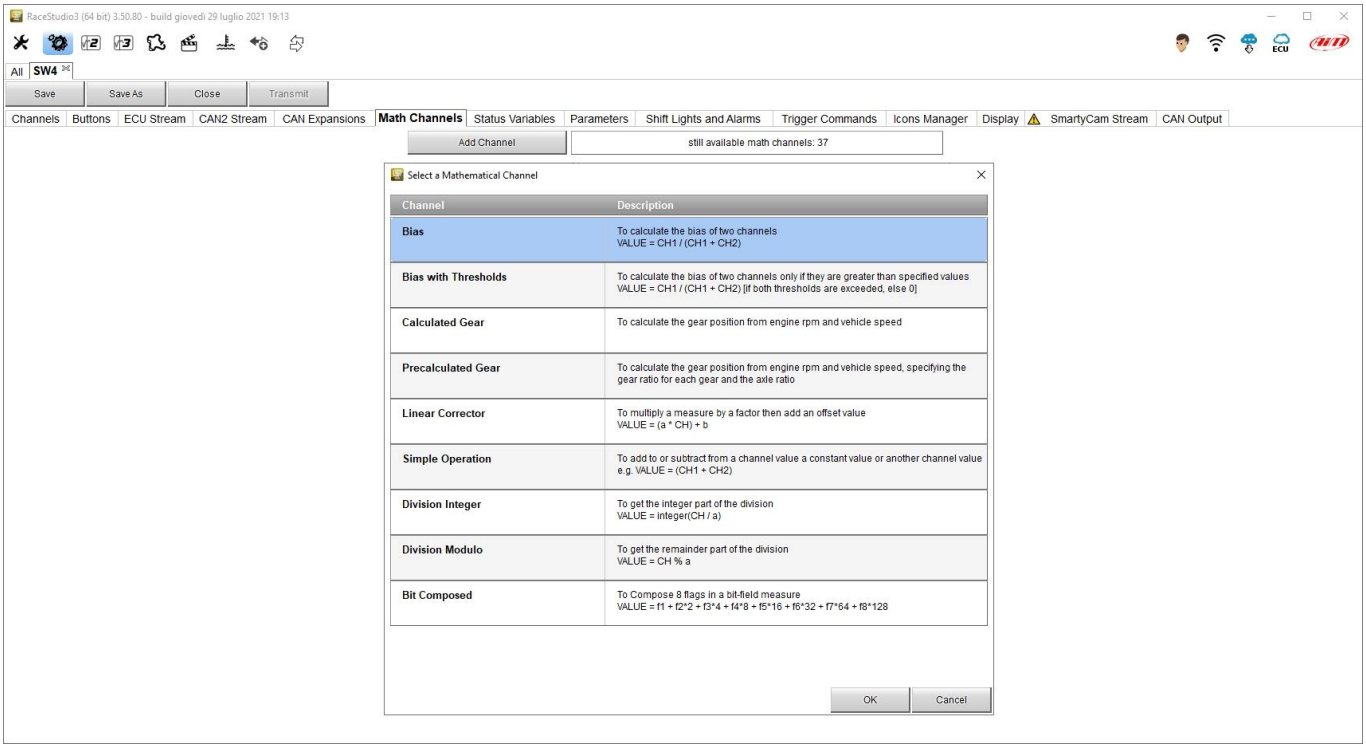
- LCU-One CAN
- Channel Expansions
- TC Hub
- RIO_02A

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



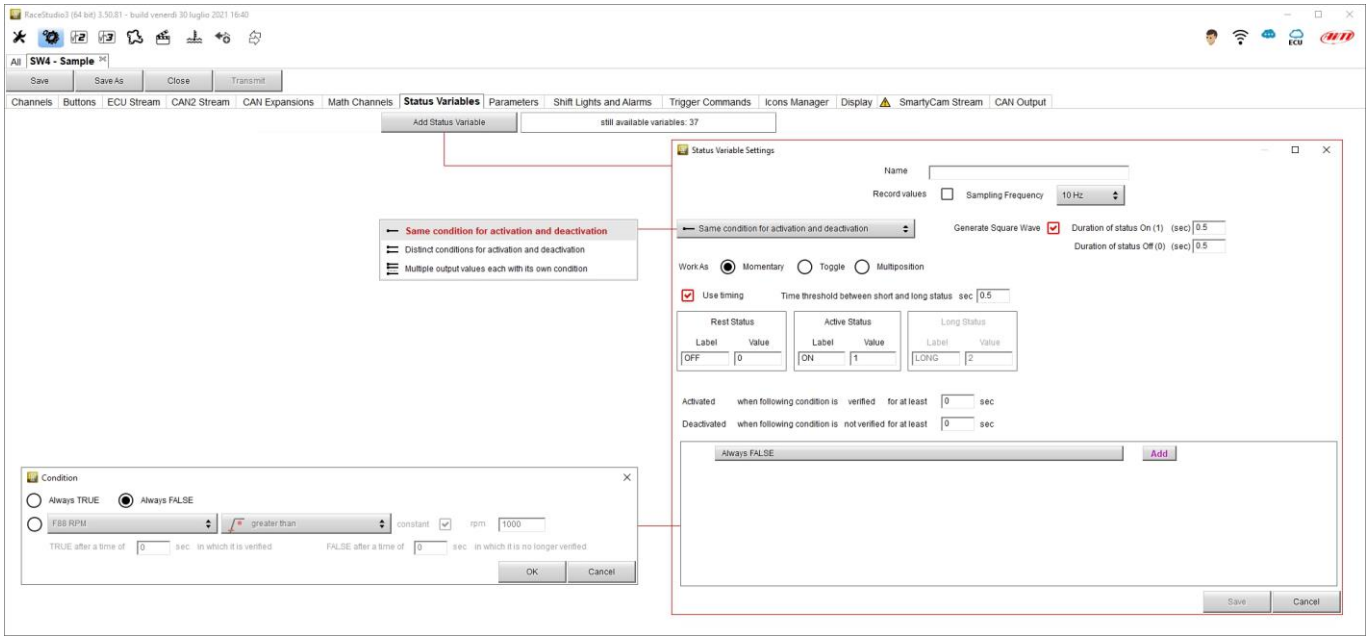
5.5 – Math Channels

Race Studio 3 software supplies nine different types of math channels. At very first configuration this window is prompted. To set each available math channel click on it and the related setting panel is prompted.



5.6 – 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.. Entering the related layer for the very first configuration the panel red squared below is prompted and can be recalled pressing "Add status variable" button. Each status variable can also be set as to generate a square wave like if linked to widescreen wipers for example.

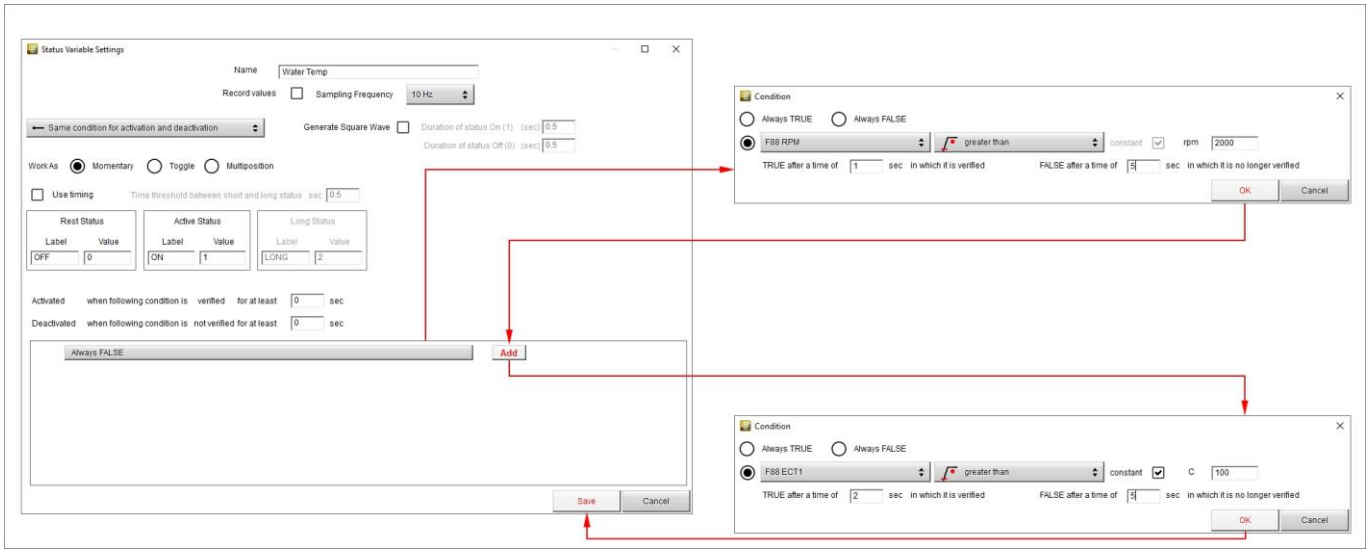


Let us explain with an example: we would like to turn a LED and an Icon ON when Water temperature reaches 100°C and RPM are higher than 2000. Instead of defining the same logic for managing the icon and for managing the LED, we could define a Status Variable, Water Temp Alarm, and link Icon and LEDs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

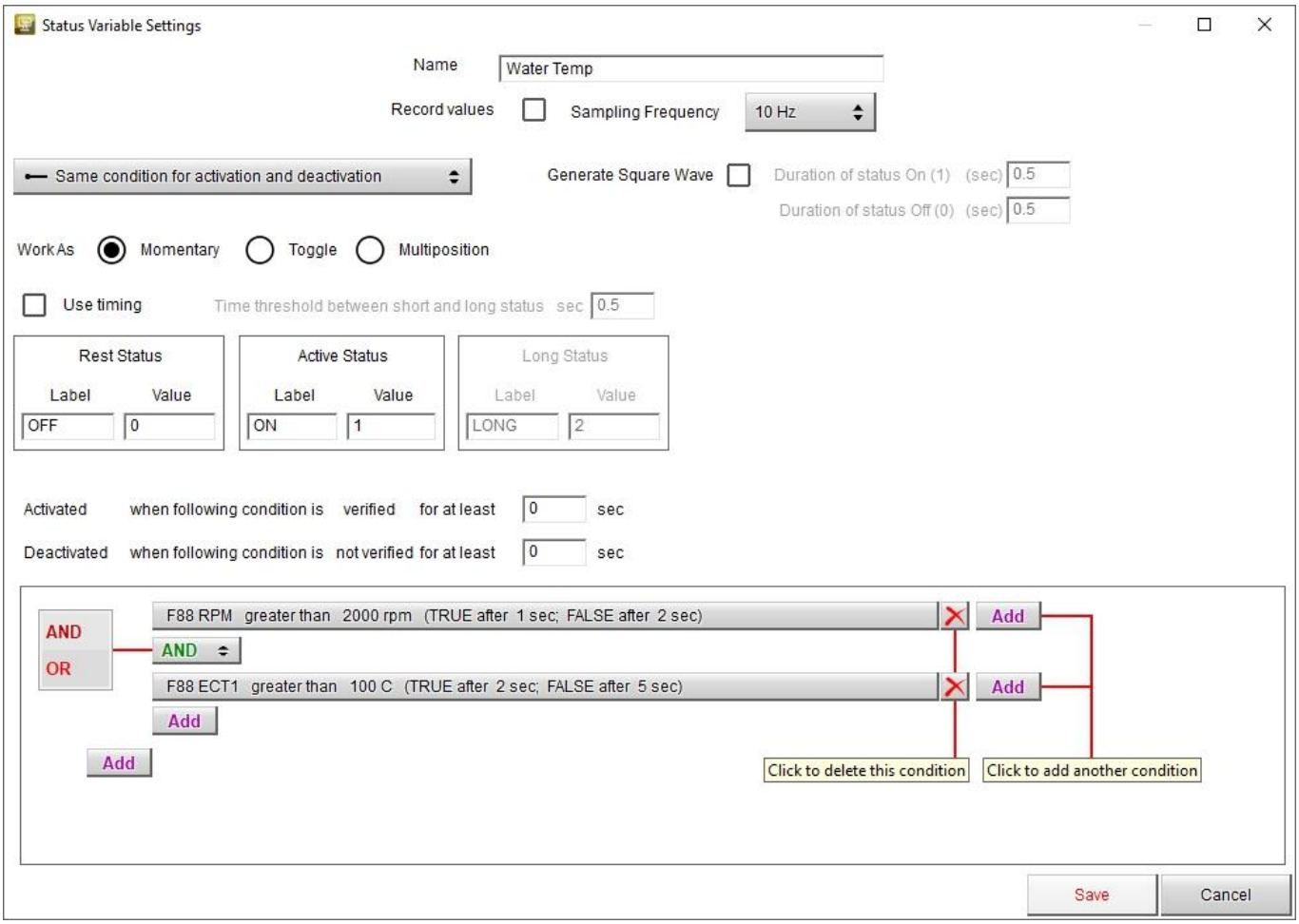
- Water Temp Alarm is High when:
    - Water Temp is higher than 100°C
    - RPM is greater than 2000.

And use Water Temp Alarm for managing Icons and LEDs.

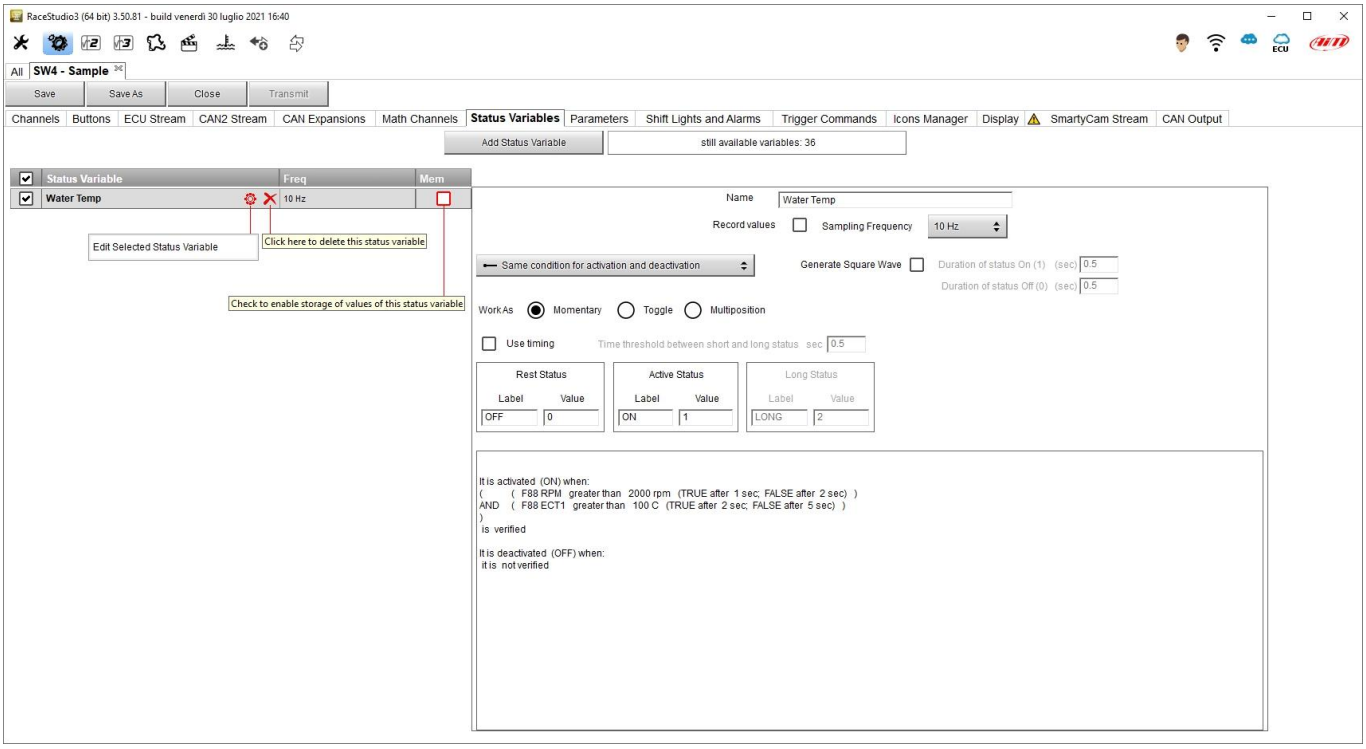
Here below the conditions of the example above are set.



Once all conditions set press “Save” and the status variable is set.

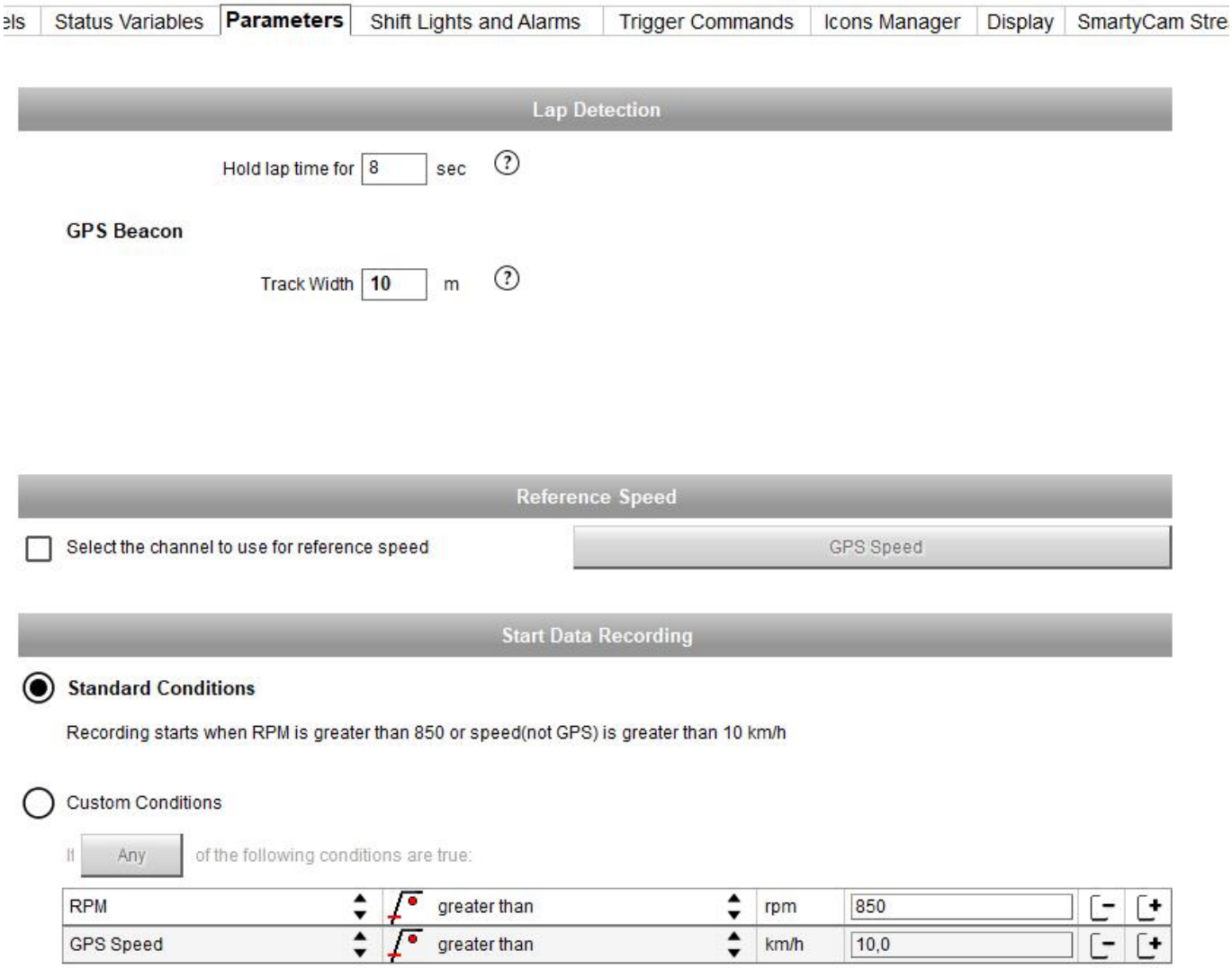


Once the status variable set you come back to "Status Variable" layer and all set status variables are listed in the page and enabled. Mousing over any of them the related panel is prompted right of the page, and you can edit, delete and log it. To log it enable the related checkbox.



5.7 – Parameters

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



Lap Detection: you may set two parameters, necessary for better managing the GPS Beacon:

- hold lap time for: the time period for which lap time is shown on SW4 display
- the track width: width that will be considered for any set GPS point

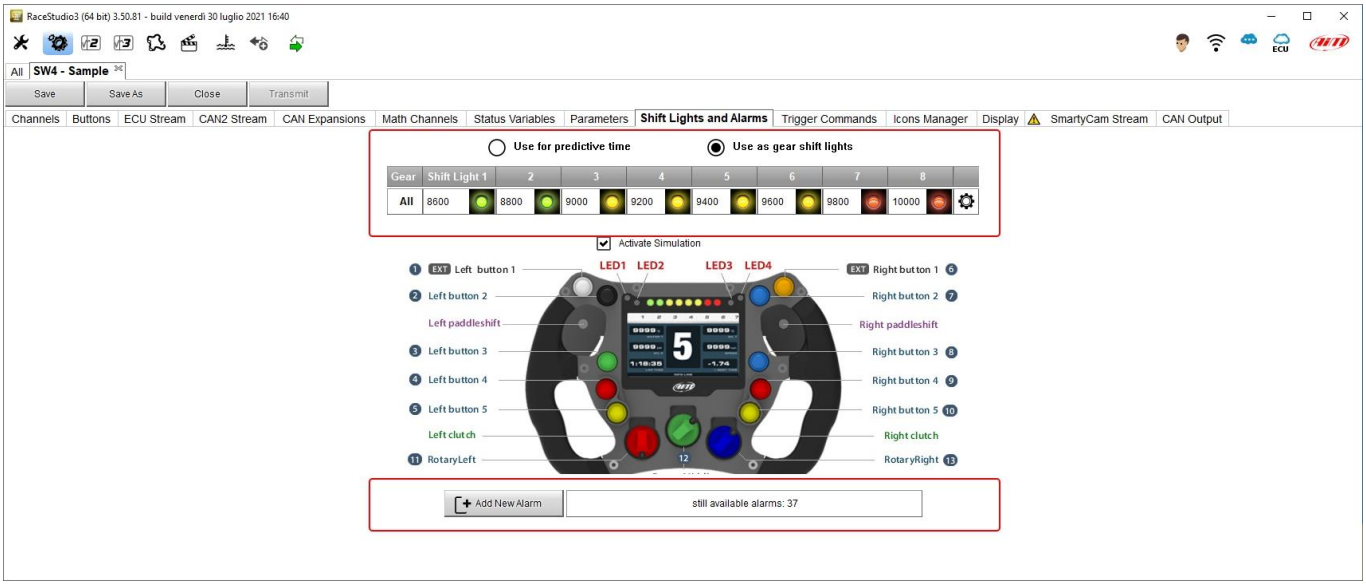
Reference speed: allows to select the channel to use as reference speed among these available

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.

5.8 – Shift Lights and alarms

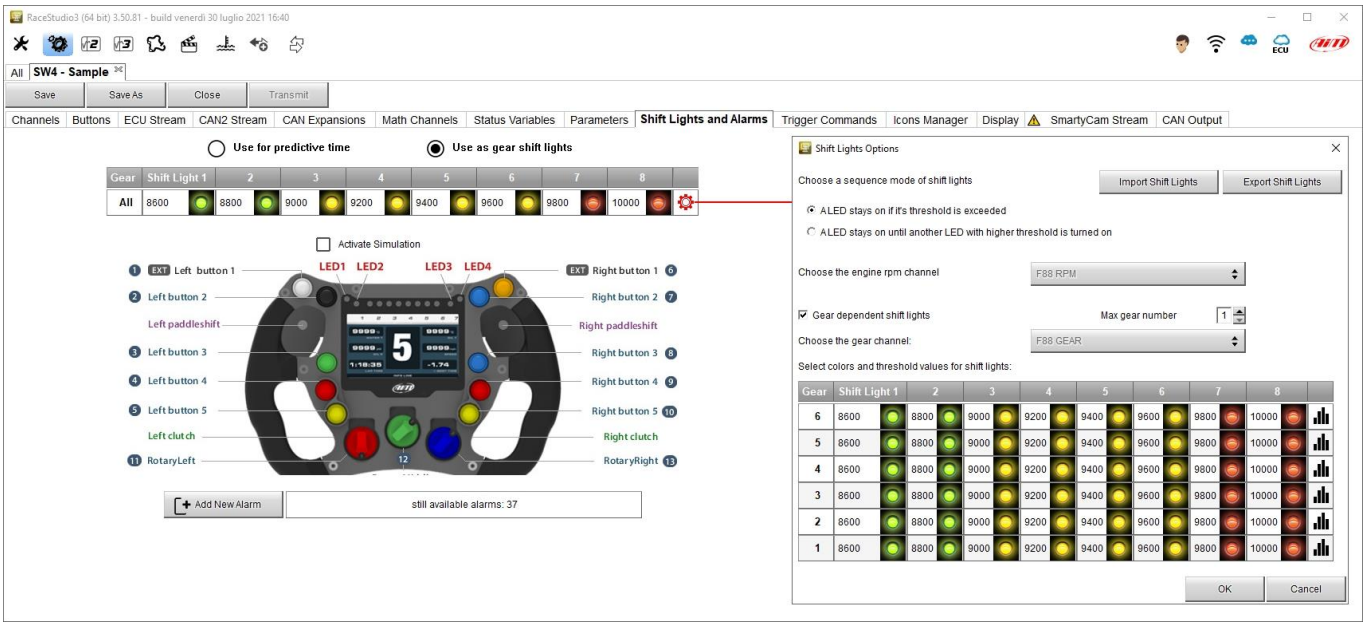
To set shift lights (top) and Alarm (bottom) of SW4.



SW4 shift lights can be set as shift lights (default) and as predictive time.
Use as gear Shift Lights To use the led bar as shift lights click the setting icon highlighted below ad set:

- RPM value that turns the single LED 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.

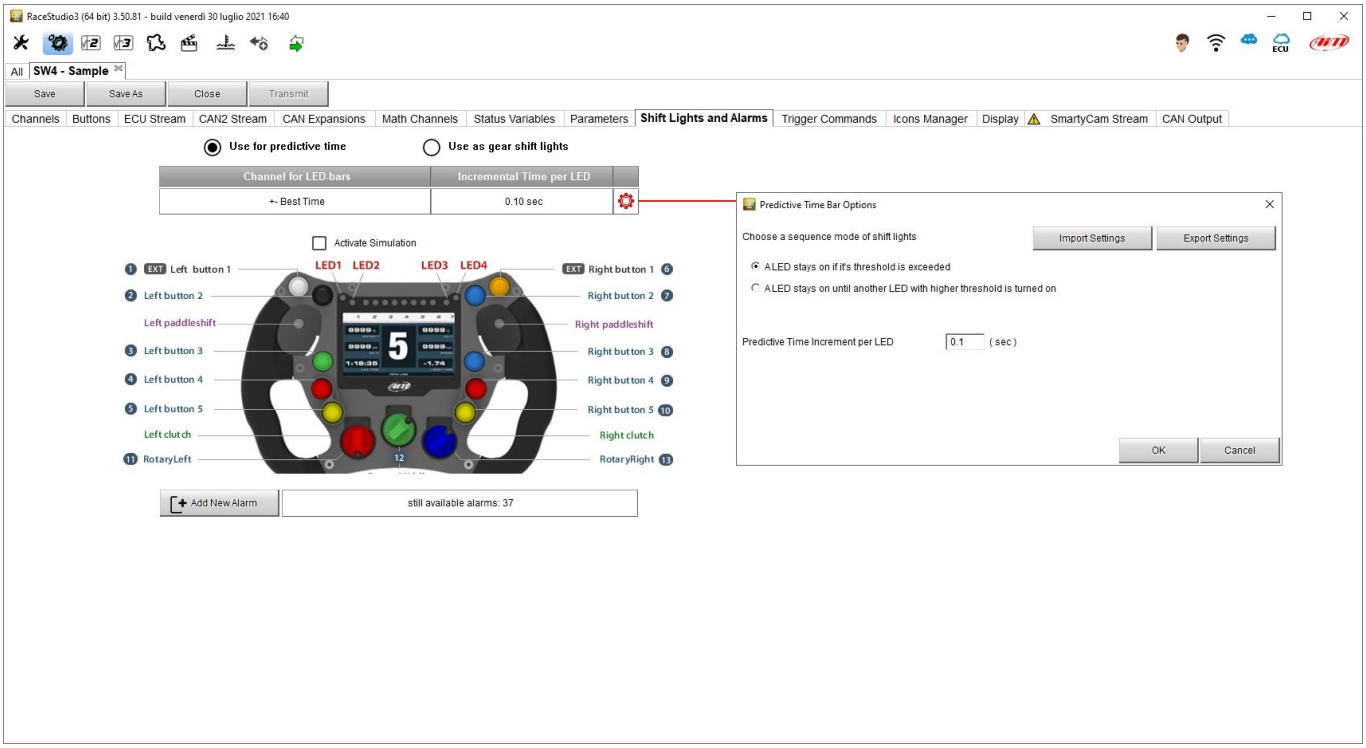
Shift Lights can also be imported/exported through the dedicated buttons.



Use for predictive time. Click the setting icon highlighted in red below.
In this case the LEDs colour are fixed in:

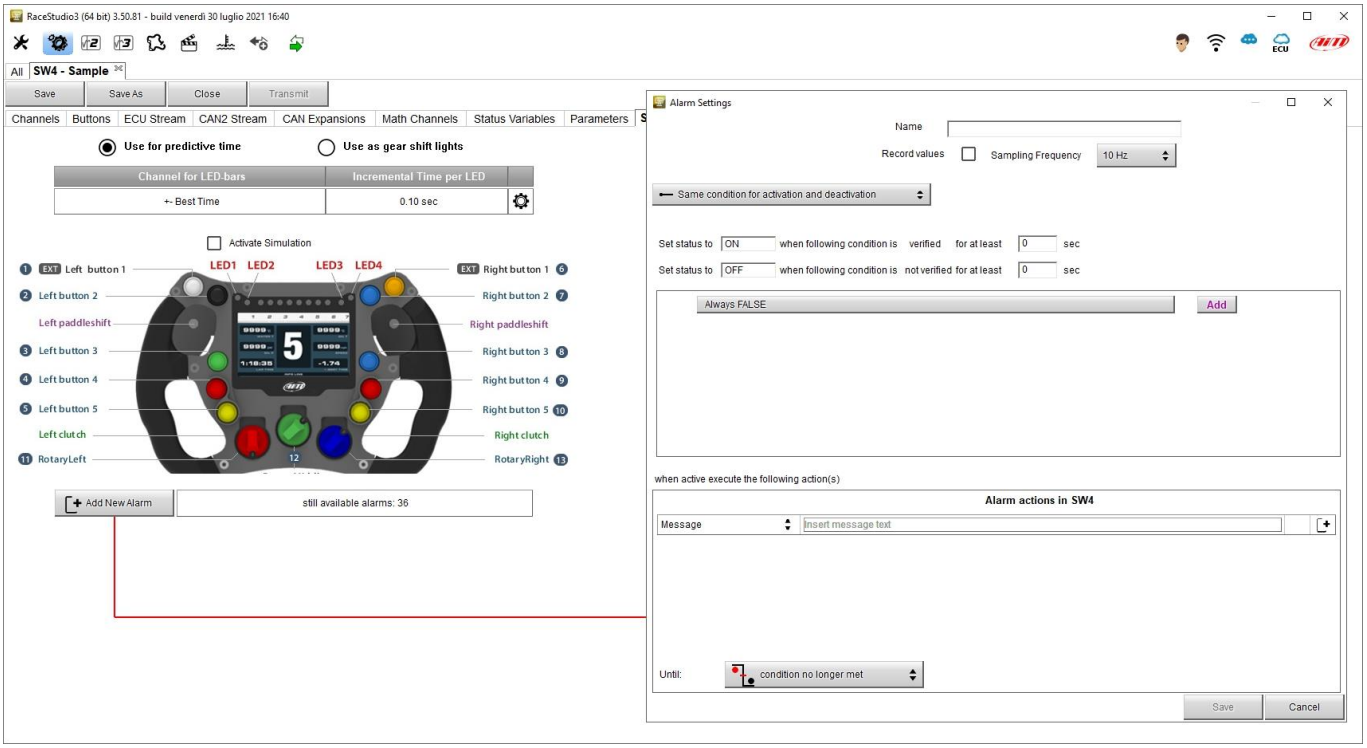
- Green if the lap time is improving
- Red if the lap time is worse than the reference lap

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, SW4 will switch on 3 LEDs green; if, on the contrary, the lap time is worsening the LEDs will switch on red. The LEDs colour follows the racer performance so if the lap time starts worse and than begins improving the LEDs starts red and continues switching on red while the lap is worse. When the lap improves the LEDs comes progressively back to the first one and re-starts green.

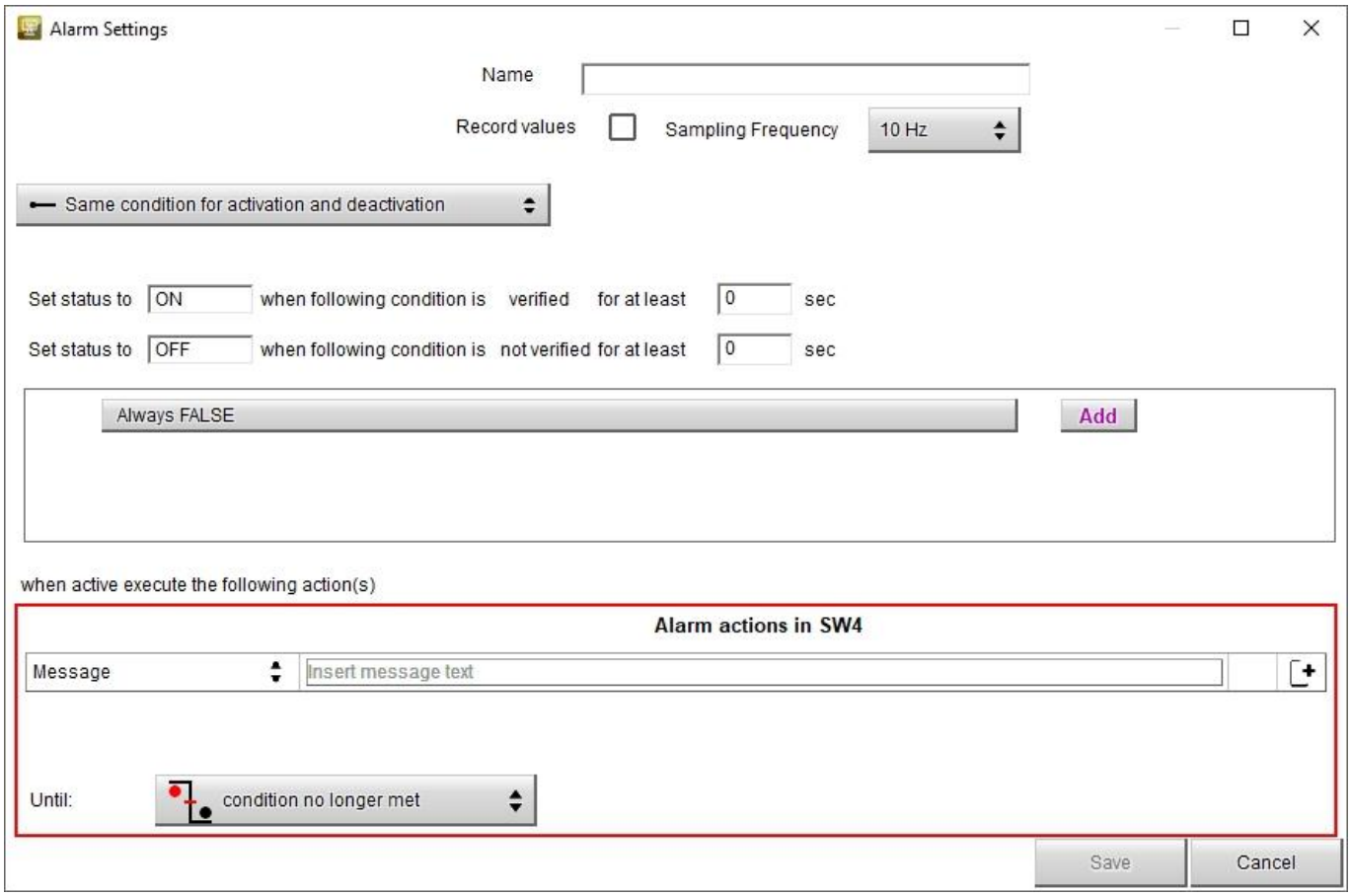


Create and set SW4 alarm

To create a new alarm press “Add New Alarm” and the related panel shows up.

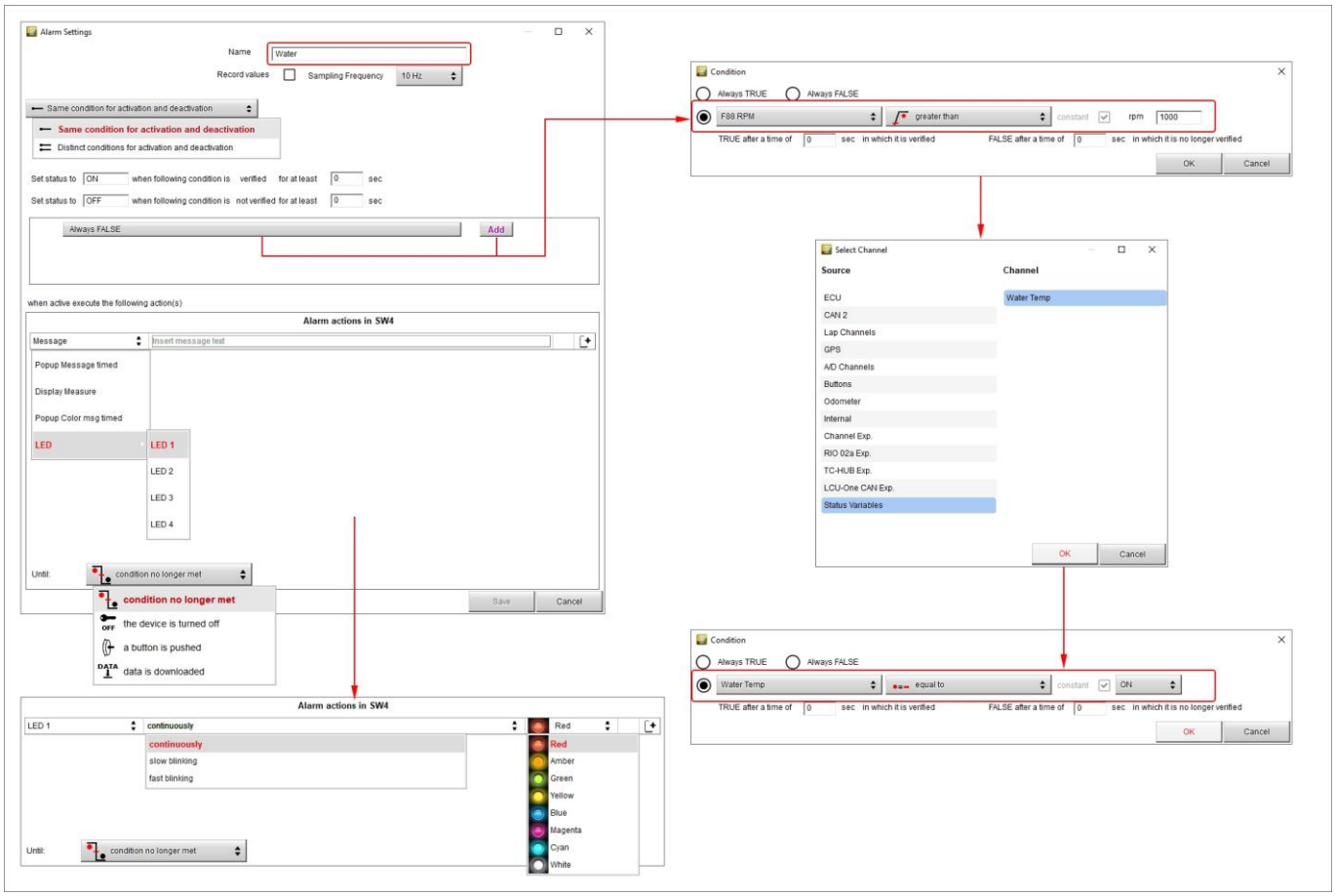


Alarm setting panel allows you to add an action to the same alarm through the bottom part of the panel highlighted below.

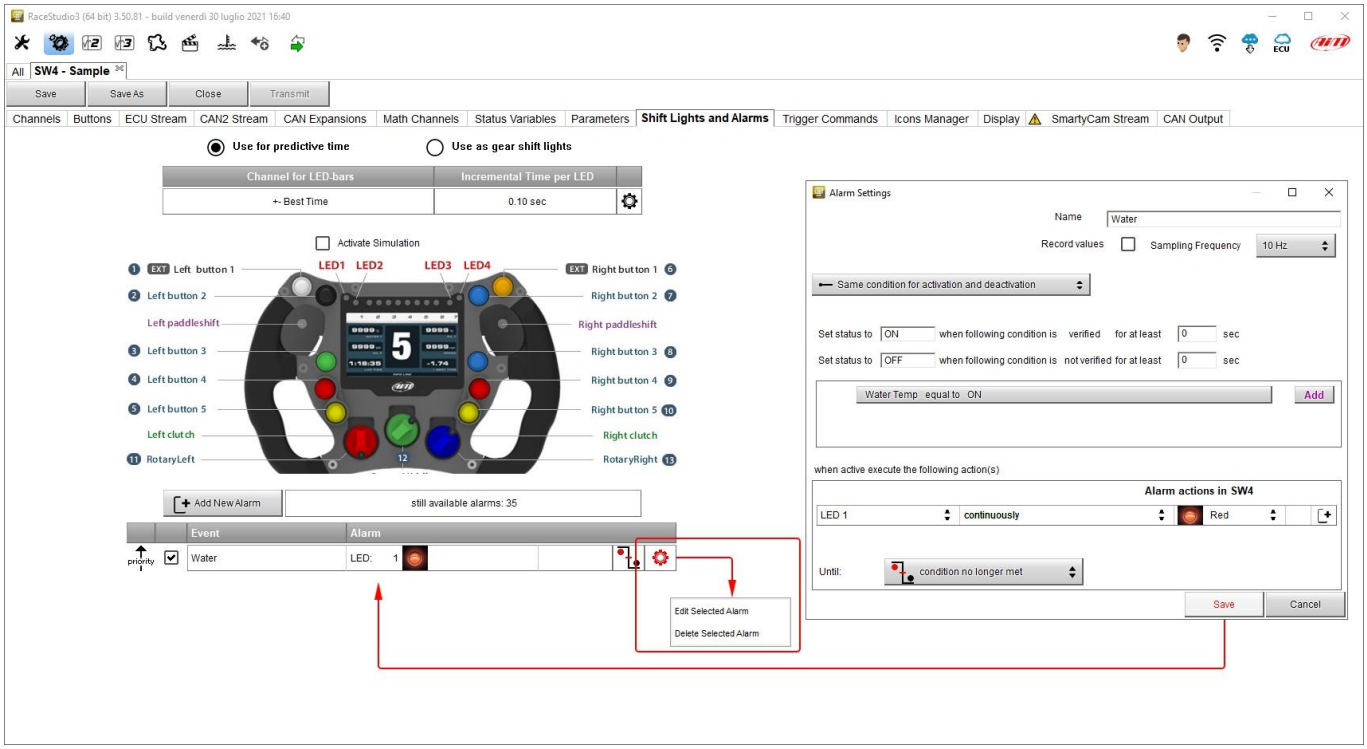


To set the new alarm:

- name the Alarm filling in the related box top of "Alarm Settings" dialog window and decide if log it or not and at which frequency
- Select the condition for activation/deactivation
- To fix the condition that activates the alarm click it and, as shown here below, a "Condition" dialog window is prompted; in the example we have decided to use the status variable to activate an alarm
- Select the action to execute filling in the bottom part of the dialog window

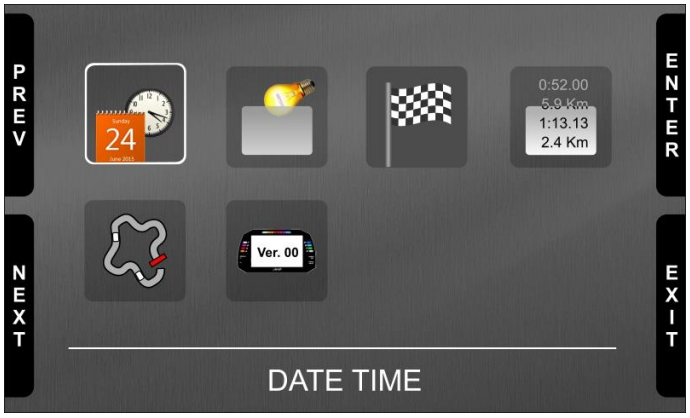

Alarm Settings
Name
Water
Record values
Sampling Frequency
10 Hz
Same condition for activation and deactivation
Same condition for activation and deactivation
Distinct conditions for activation and deactivation
Set status to ON when following condition is verified for at least 0 sec
Set status to OFF when following condition is not verified for at least 0 sec
Always FALSE
Add
when active execute the following action(s)
Alarm actions in SW4
Message
Insert message text
Popup Message timed
Display Measure
Popup Color msg timed
LED
LED 1
LED 2
LED 3
LED 4
Until:
condition no longer met
condition no longer met
the device is turned off
a button is pushed
data is downloaded
Save
Cancel
Alarm actions in SW4
LED 1
continuously
continuously
slow blinking
fast blinking
Red
Red
Amber
Green
Yellow
Blue
Magenta
Cyan
White
Until:
condition no longer met
Condition
Always TRUE
Always FALSE
F88 RPM
greater than
constant
rpm
1000
TRUE after a time of 0 sec in which it is verified
FALSE after a time of 0 sec in which it is no longer verified
OK
Cancel
Select Channel
Source
Channel
ECU
CAN 2
Lap Channels
GPS
A/D Channels
Buttons
Odometer
Internal
Channel Exp.
RIO 02a Exp.
TC-HUB Exp.
LCU-One CAN Exp.
Status Variables
Water Temp
OK
Cancel
Condition
Always TRUE
Always FALSE
Water Temp
equal to
constant
ON
TRUE after a time of 0 sec in which it is verified
FALSE after a time of 0 sec in which it is no longer verified
OK
Cancel

When all conditions are fixed press “Save” and the Alarm is added to “Shift Lights and Alarm” layer.
Through the setting icon right of the alarm row you can edit and delete the Alarm.



6 – Display Menu

When the buttons to manage SW4 display have been configured you can access the display navigation menu. Press “MENU” and this page is prompted.



The icons stays for:

Date and time setting

Backlight: setting

Lap Time Setup

SW4 counters management

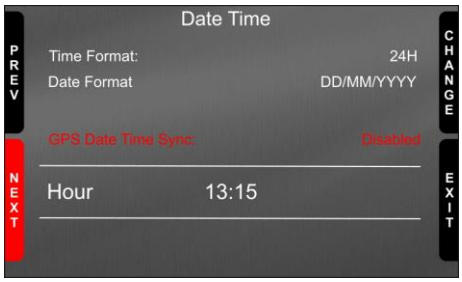
SW4 tracks and GPS management

System information

6.1 – Setting date and 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 can come from the optional GPS Module if connected. If no GPS Module is connected or if you prefer to set It manually press “CHANGE” to disable the synchronization
- press “NEXT” so start setting time (right image below)



SW4 enters in manual date/time mode. With reference to the images below:

- press “NEXT” to start setting time –> hour becomes selected (13 in red) –> press “SELECT” and hour becomes editable (13 on red background) –> 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

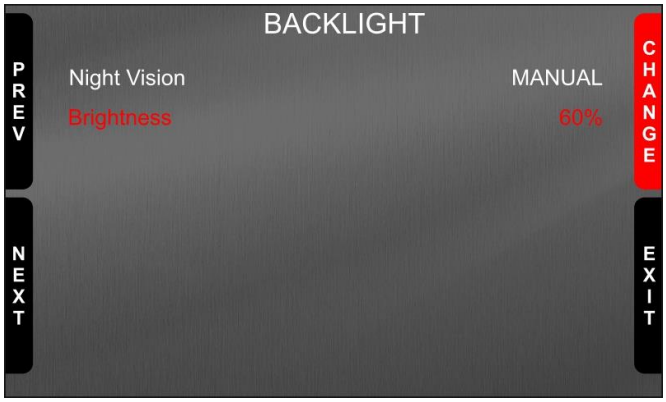
6.2 – Setting Backlight

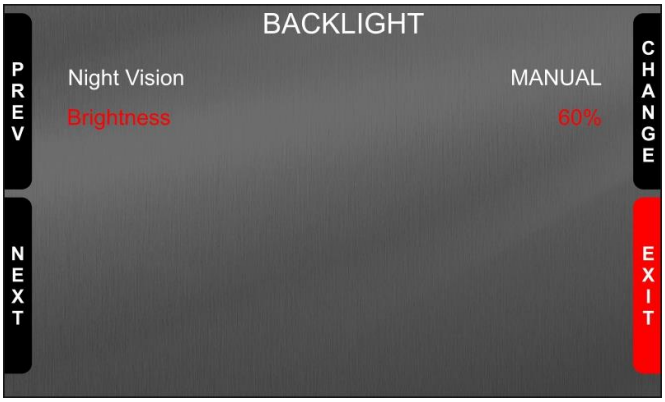
The brightness of the display and LEDs may be adjusted in two ways, depending on the light captured by a dedicated sensor integrated in the dash

- 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).

Press:

- "CHANGE" button to switch from "Auto" to "Manual"
- "NEXT" to scroll the voices
- "CHANGE" button again to select your option
- "EXIT" to quit and save.





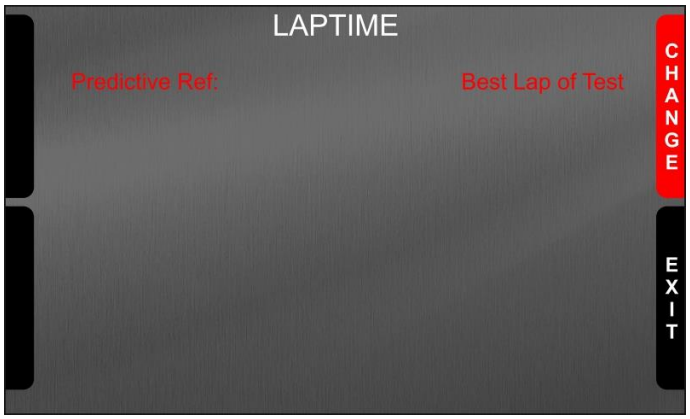
6.3 – Lap time setup (GPS09 Module needed)

To get lap times you need the optional GPS09 Module. Once connected you can decide which lap time the system takes as reference to compute predictive lap time. Available options are:

- Best Lap of Test
- Best Lap of Today

Use:

- "CHANGE" button to change the setting
- "EXIT" to save and quit

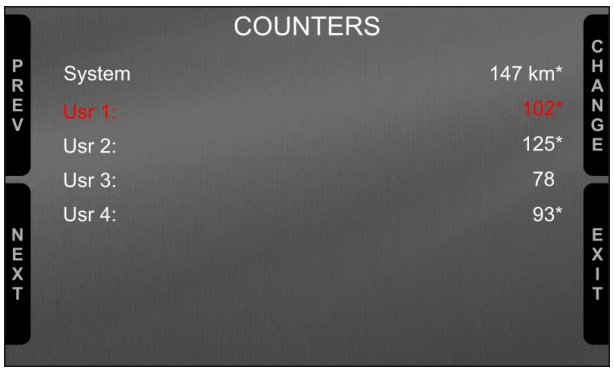


6.4 – Managing SW4 counters

SW4 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 SW4 and the PC).

Each odometer can be activated/deactivated and/or reset. To manage an odometer select it and press "CHANGE". You enter counters management page. Press:

- "CHANGE" button to change the counter status
- "PREV" and "NEXT" button to scroll the options
- "EXIT" button to save and quit



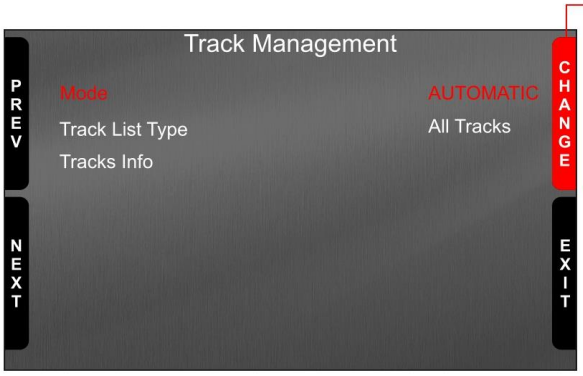
6.5 – Managing GPS & Tracks (GPS09 Module needed)

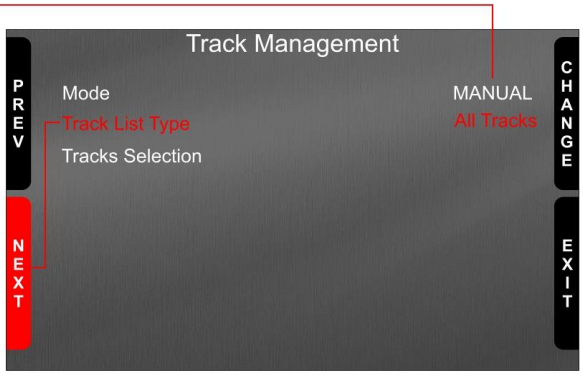
Pressing the icon above GPS&TRACKS page is prompted: press "ENTER" and "Track Management" page is prompted. Menu options are:

- Mode: AUTOMATIC (default) or MANUAL
- Track List Type: Nearest (default: it shows only tracks in a 10 km area), All Tracks or Custom
- The bottom line
    - warns if there are no tracks on the device or nearby
    - shows "Tracks info" if in Automatic Mode
    - allows "Track selection" if in Manual mode

Use:

- "CHANGE" button to switch the options
- "PREV"/"NEXT" to scroll the options
- "EXIT" to quit and save





When in "MANUAL" mode setting the track list type on "All tracks" you can choose the track to set also if you are not nearby. To do so:

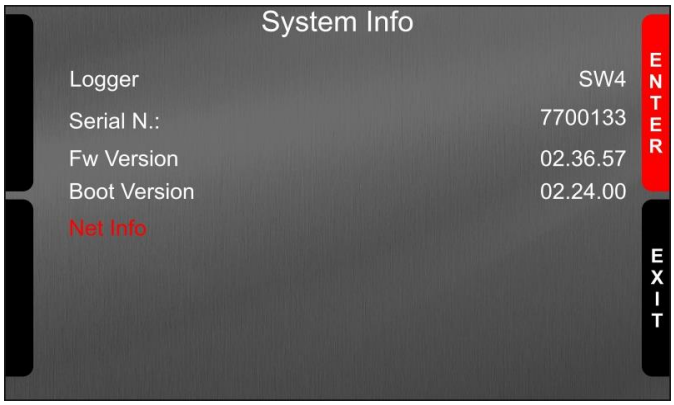
- Scroll the menu up to "Track selection"
- Press "ENTER" (left image below)
- Use "PREV"/"NEXT" buttons to scroll the tracks and "ENTER" to select the desired track. It appears bottom of the page (right image)

In "AUTOMATIC" mode pressing enter the system shows the tracks it detects in a 10 km distance if available or "NO TRACKS FOUND YET" if there are no tracks in a 10 km area.

6.6 – System Information

Pressing the icon above "SYSTEM INFORMATION" page is prompted. It shows:

- Logger name
- Serial number
- Firmware version
- Boot version
- Net Info option: pressing "ENTER" "Net Info" page is prompted. It shows all connected devices with the related serial number and firmware version.


System Info
Logger SW4
Serial N.: 7700133
Fw Version 02.36.57
Boot Version 02.24.00
Net Info
ENTER
EXIT

Net Info
gps 0926677 35.65.00
EXIT