

DATA ACQUISITION

KIT DESCRIPTION

- EVO 3 data logger (8 or 13 channels version)
- Interface “Junction Box” Aim
- Infrared transmitter
- 12 Volts power cable for infrared transmitter
- Infrared receiver
- Wirings to ECU
- 2 speed sensors
- 2 brackets for speed sensors
- 2 magnetic phonic wheels
- Patch cable for speed channel (Speed split cable)
- USB data download cable
- CD-Rom including **Race Studio 2**
- Documentation

INSTALLATION LAYOUT

Wirings connections

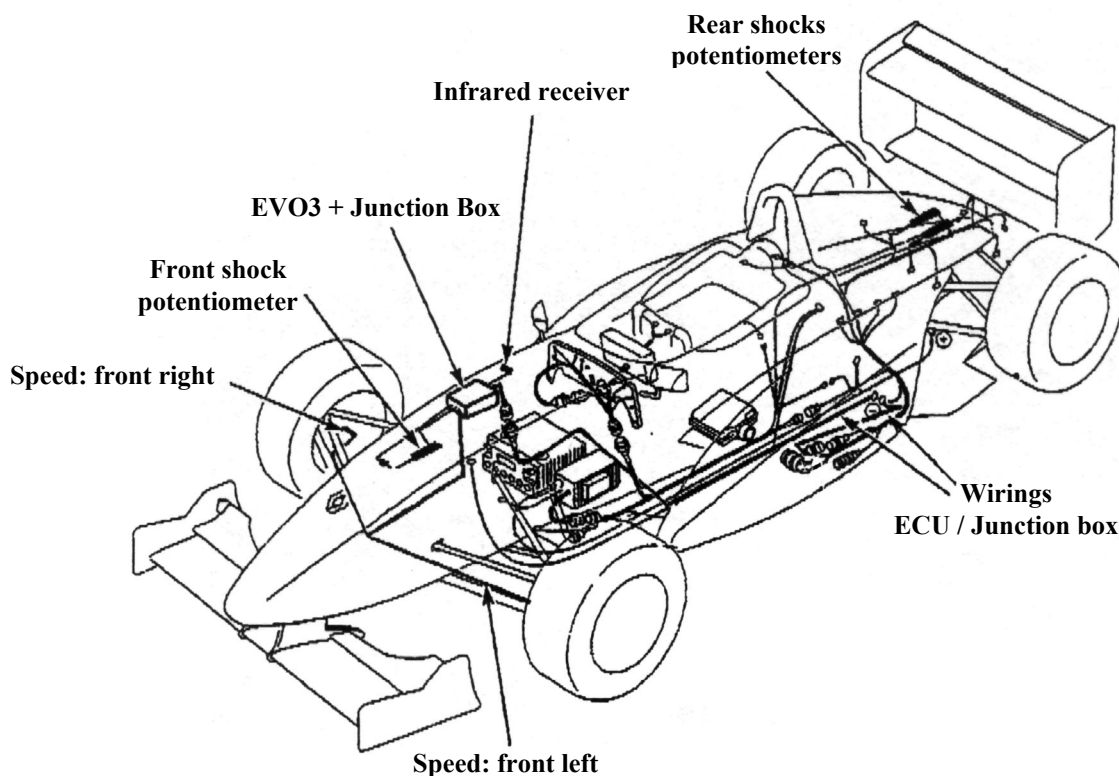


Figure 1: FR2000 installation layout

EVO 3 “8 channels” installation

Install the data logger and the Junction Box as shown either in Figure 2 or in Figure 3.

The data logger and the Junction Box have to be installed on the front cockpit.

Figure 2: the front shock is installed with the spring **near** the body cell.

Figure 3: the front shock is installed with the spring **near** the front wheels.



Figure 2: EVO 3 installation on a FR2000

When installing the data logger and the Junction Box it is reminded to fix them to the chassis using a large piece of Velcro.

Ensure that the data logger is firmly mated to the chassis, in order to avoid possible movements during the race and damages to the unit.

It is suggested to use plastic wrappers to group and fix the wirings.



Figure 3: EVO 3 installation on a FR2000

Your **EVO 3 (8 or 13 channels)** data logger is equipped with 2 internal accelerometers. In order to correctly record the **longitudinal** (i.e. parallel to the vehicle speed) and the **lateral** (i.e. perpendicular to the vehicle speed) acceleration, it is reminded to install the data logger as shown in Figure 4.

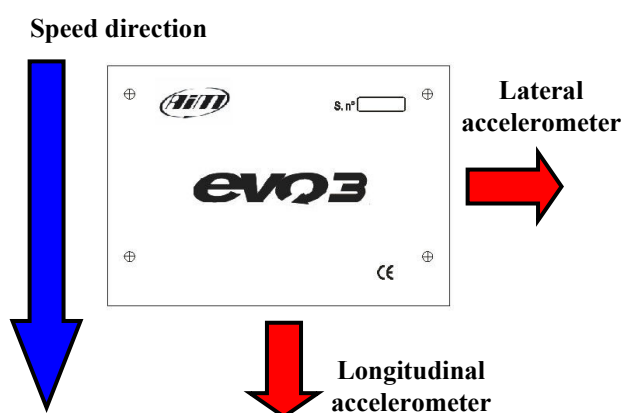


Figure 4: EVO 3 internal accelerometers' axis

Connect the wirings from the Junction Box to the data logger as here above explained:

- Connect the “8 plastic connectors” cable inside the EVO 3’s input connector.
- Channels “Throttle”, “Oil P.” and “Water T.” have to be connected on the corresponding plastic connectors of the input cable.
- Channels “Air P.”, “Air T.”, “Lambda” have to be connected, respectively, on the plastic connectors labelled from number “4” to number “6”. [Channels “7” and “8” are free].
- Channels “RPM”, “SPEED”, “USB/Power” and “BEACON” have to be plugged in the corresponding metallic connectors of the data logger.
- Connect the “ECU input” to the “Junction Box to ECU” patch cable.

See Figure 5 for further information concerning the **EVO 3 “8 channels”** installation layout.

EVO 3 “8 channels”

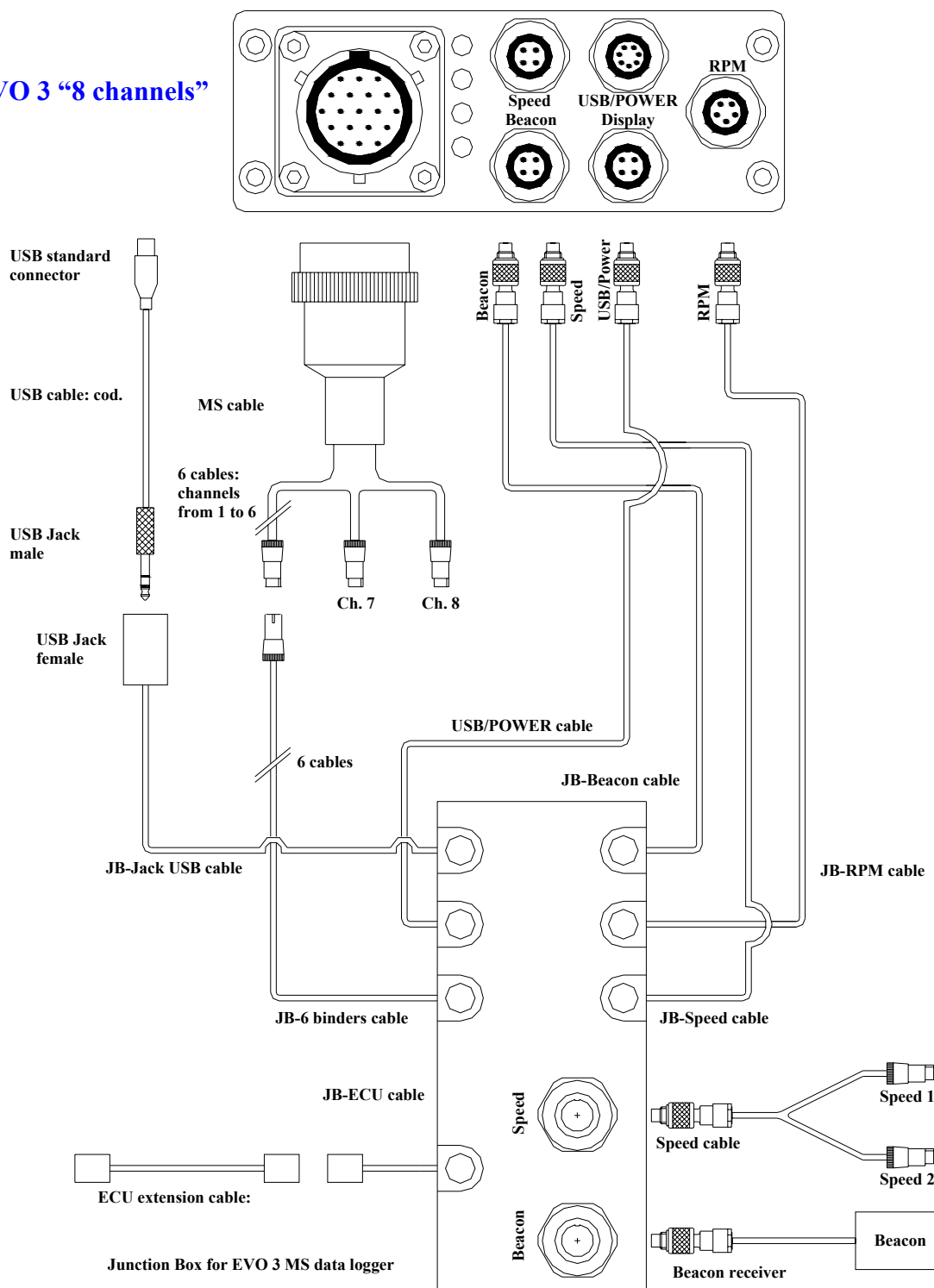


Figure 5 EVO 3 “8 channels” installation layout

EVO 3 “13 channels” installation

The installation procedure is similar to the one previously described for the **EVO 3 “8 channels”**. Please refer to Figure 6 for further information concerning the installation layout of an **EVO 3 “13 channels”** on a **FR2000**.

EVO 3 “13 channels”

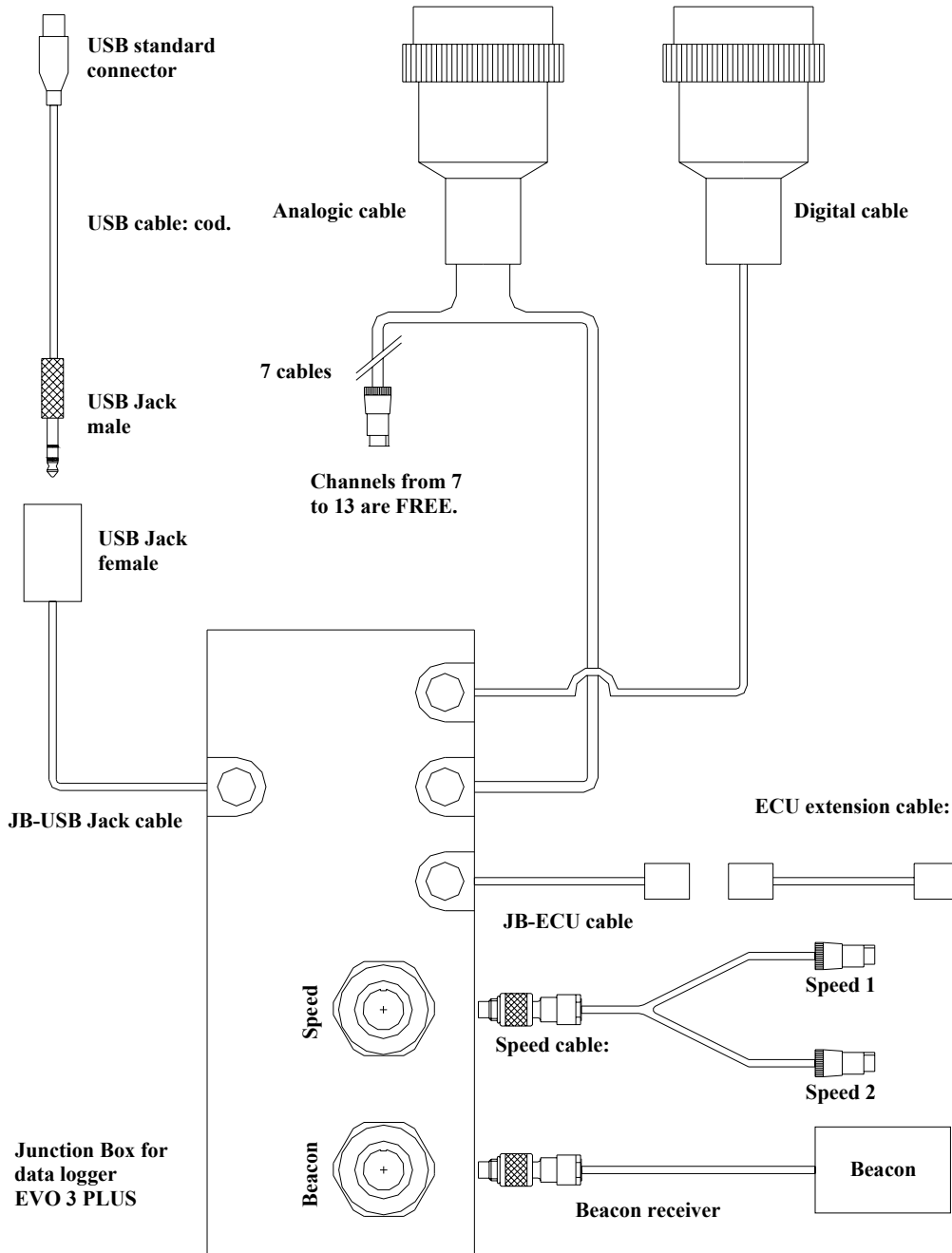
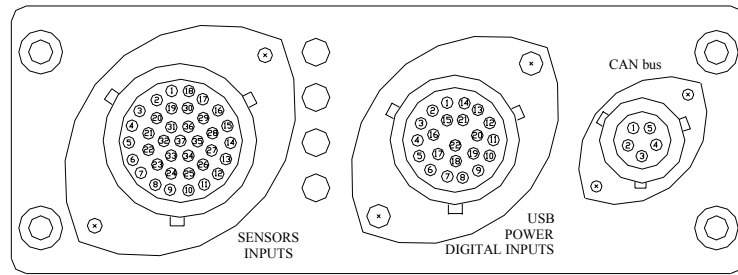


Figure 6 EVO 3 “13 channels” installation layout

“Wirings to ECU” installation

The ECU patch cable has to be plugged both in the Junction Box and in the Magneti Marelli ECU.

The patch cable has to run on the left of the interior body cell, as shown in Figure 7.

Use the hole (red circled) on the left of the body cell to let the patch cable pass from the interior body cell to the left side of your FR2000 vehicle.

When running the patch cable in the interior body cell, it is suggested to fix them to the chassis using plastic wrappers.

Connect the “Wirings to ECU” male connector to the ECU’s female connector as shown in Figure 8.

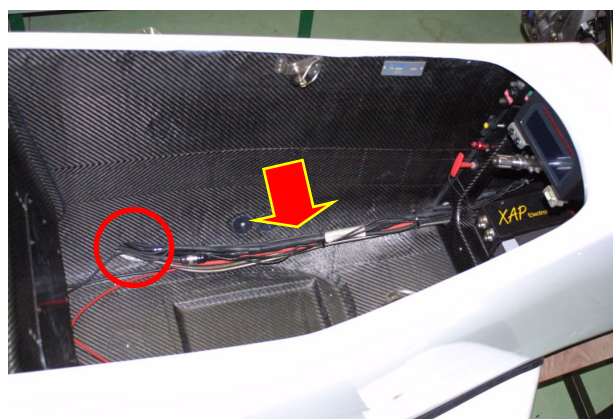


Figure 7: Interior body cell and ECU patch cable photo



Figure 8: ECU connection

USB data download cable installation

It is suggested to install the USB female Jack connector inside the interior body cell, under the display, as shown in Figure 9.

It is recommended to fix the connector to the display unit using either a piece of **Velcro** or a piece of **bi-adhesive tape**.



Figure 9: USB data download cable installation

Speed sensor installation

Install the 2 magnetic phonic wheels coaxially to the front wheels.

Then mount the metal bracket on the wheel hub and install the speed sensor on the bracket as shown in Figure 10.

The sensing distance is included between 8 and 15 mm (0.3 and 0.6 inches).

Once the sensor is correctly installed, you may run the speed cables along the front suspension lower triangle and insert them inside the chassis using the hole located on the right of the oil brake pump.

It is suggested to use plastic wrappers to fix the speed cable to the suspension triangle (see Figure 11).

It is recommended to pay particular attention when inserting the cable inside the cockpit in order to avoid damages to the speed cable.

Connect the 2 speed cables to the Junction Box using the proper “Speed split cable”.

Infrared lap receiver installation

The Infrared lap receiver has to be installed as shown in Figure 12.

- The “receiver eye” has to see the transmitter placed on the track side.
- The receiver has to be fixed to the chassis using either a piece of Velcro or a piece of bi-adhesive tape.
- The hole on the front fairing facing the “receiver eye” has to be of 8 mm diameter minimum (20 mm suggested).
- Plug the infrared receiver in the Junction Box.

NOTE: depending on the circuit, the receiver must be installed either on the left or on the right side of the vehicle.

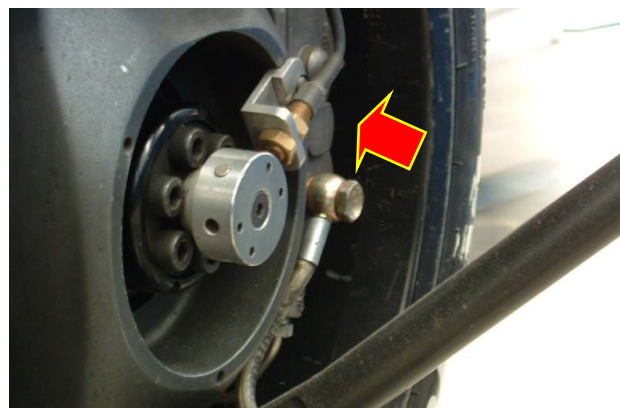


Figure 10: Magnetic phonic wheel installation (front right wheel)

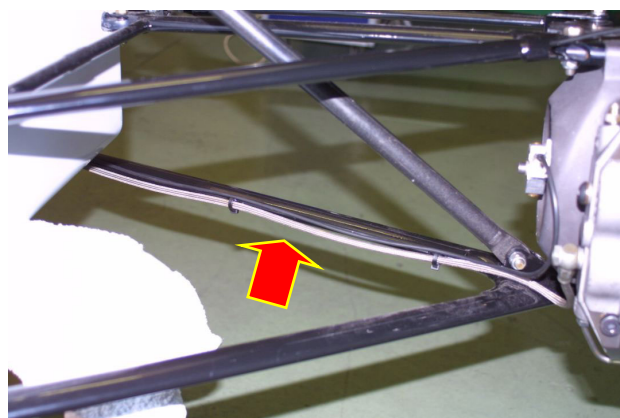


Figure 11: Speed cable running along the front lower suspension triangle

ATTENTION: the speed sensor is fragile. Do not exceed the suggested tightening torque.

- MAX tightening torque = 2.5 Nm
- Use Loctite threadlocking to fix the nuts

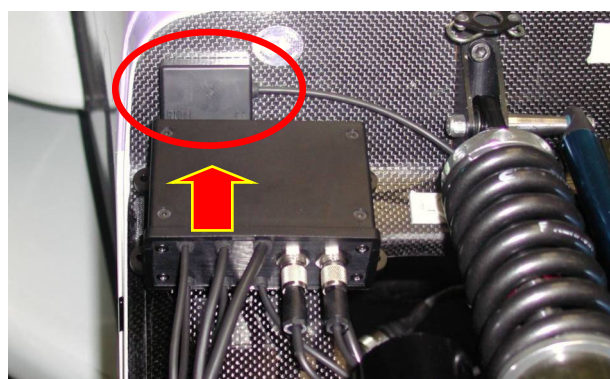


Figure 12: Infrared lap receiver installation

Infrared transmitter installation

The optical infrared transmitter has to be installed on the trackside, perpendicular to the track. It is recommended to fix the transmitter to the pit-lane wall.

The lap transmitter has to be powered by a 12 Volt external power source using the proper power cable (furnished as equipment) and a 12 Volt battery (optional).

In case you do not have an external battery, the transmitter is equipped with a 9 Volt internal battery. **It is reminded that the internal battery has a limited autonomy.**

Rolling potentiometer installation

The rolling potentiometer has to be installed as shown in Figure 13.

Connect the potentiometer on the desired input channel.

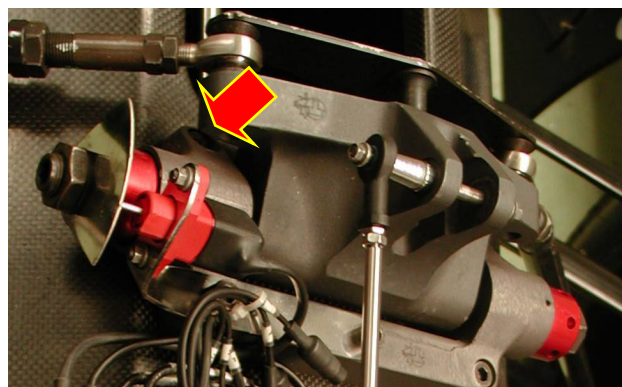


Figure 13: Rolling potentiometer installation

Steering angle potentiometer

The steering angle may be measured either using a **rotary potentiometer** installed on the steering column or using a **linear potentiometer** installed on the steering rack.

In Figure 14 it is shown the installation of a linear potentiometer on the steering rack.

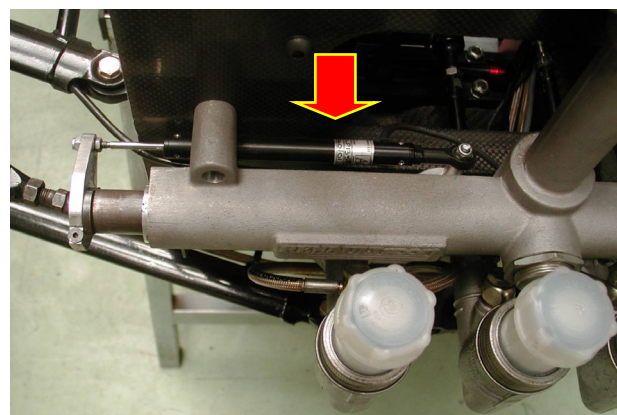


Figure 14: Steering angle – Linear potentiometer

In Figure 15 it is shown a rotary potentiometer, which has to be installed on the steering column.

Once the potentiometer has been correctly installed, connect it on the desired logger's input channel.



Figure 15: Steering angle – Rotary potentiometer

Suspension potentiometers installation

In Figure 16 it is shown 2 drawings describing the installation procedure for the rear shocks potentiometer (upper drawing) and for the front shock one (lower drawing).

It is reminded to use a 100 mm linear potentiometer for both the front and rear shocks.

Connect the potentiometer on the desired input channel.

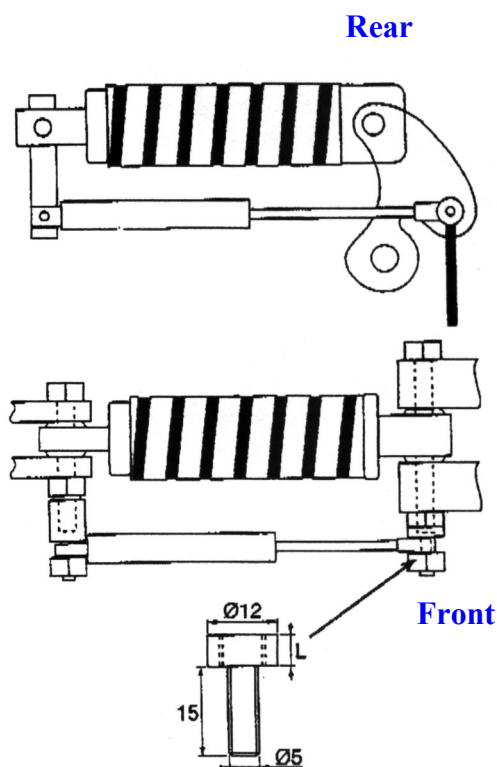


Figure 16: Rear and fronts shocks potentiometers installation

Installation of a linear potentiometer on the rear shocks.

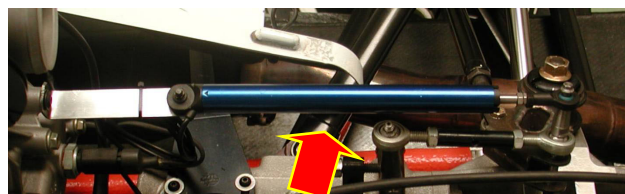


Figure 17: Rear shocks potentiometer

Installation of a linear potentiometer on the front shocks.

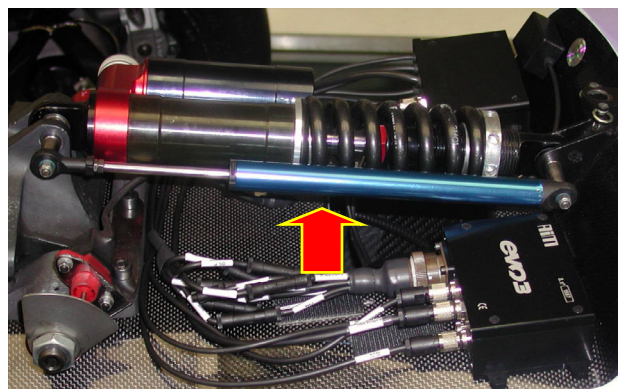


Figure18: Front shock potentiometer

CONFIGURATION VIA SOFTWARE

Race Studio 2 installation

NOTE: The installation procedure described here below refers to the software Race Studio 2 and not to the software **Race Studio 1** or **Wdrack**.

- Insert the CD-ROM including the software **Race Studio 2** in your CD-ROM drive and follow the instruction prompted on your PC's monitor.
- Connect the data logger (switched off) to the PC's USB port using the USB data download cable. Once connected, switch on the data logger and install the USB drivers: the driver's name is **WDUSB503.inf**.
- Restart the PC if prompted.

How to use Race Studio 2

- Run **Race Studio 2** using the proper shortcut on the PC's desktop.
- Select **EVO 3** and press button *Logger manager*.
- Import the default configurations for FR2000 using the *Import configuration* function. These configurations are located inside the installation directory of **Race Studio 2** (usually C:\Program files\AIM).
- *Threshold* acquisition means that the logger samples data only when speed is greater than 10 km/h. When speed becomes lower than the threshold value for more than 3 seconds, the data acquisition stops.
- Set the desired unit of measure.

N	Channel ider	Enabled/dis	Channel name	Sampling fr	Sensor type	Measu	Lower bound	Upper bound	Param. 1	Param. 2
1	RPM	Enabled	Engine	10 Hz	Engine revolution speed	rpm	0.000	20000.000	0.167	25000.000
2	SPD_1	Enabled	Speed #1	10 Hz	Speed	mph	0.000	250.000	65.591	1.000
3	SPD_2	Enabled	Speed #2	10 Hz	Speed	mph	0.000	250.000	-17.874	1.000
4	CH_1	Enabled	Channel 1	10 Hz	Air temp. (FR2000)	°C	0.000	150.000		
5	CH_2	Enabled	Channel 2	10 Hz	Oil press. (RENAULT)	bar	0.000	50.000		
6	CH_3	Enabled	Channel 3	10 Hz	Water temp. DPS (FR2000)	°C	0.000	150.000		
7	CH_4	Enabled	Channel 4	1 Hz	Potentiometer distance	degree	0.000	500.000	0.000	
8	CH_5	Enabled	Channel 5	1 Hz	Zero based potentiometer	degree	0.000	150.000		
9	CH_6	Enabled	Channel 6	10 Hz	Mid zero potentiometer	degree	0.000	500.000		
10	CH_7	Enabled	Channel 7	1 Hz	Pressure VDD 0-5 bar	bar	0.000	150.000		
11	CH_8	Enabled	Channel 8	100 Hz	AIRBOX pressure sensor	bar	0.000	500.000		
12	ACC_1	Enabled	Acc. 1	10 Hz	Longitudinal accelerometer	g	-3.000	3.000		
13	ACC_2	Enabled	Acc. 2	10 Hz	Lateral accelerometer	g	-3.000	3.000		
14	LOG_TMP	Enabled	Data logger Temp.	10 Hz	Cold joint	°C	0.000	50.000		
15	BATT	Enabled	Battery	1 Hz	Battery	V	5.000	15.000		

Configuration name	Logger name	Display name	Available time	Total frequency
Pippo	EVO3 - 8 channels - 32 Mb	Mychron 3	22:50.41 (h.m.s)	204 (Hz)

Figure19: Race Studio 2 configuration window

- Click *Channels* and set the desired input channels (see Figure 19):
 - Channels must be **enabled**;
 - Verify that the wheel circumference is correct;
 - Verify that the RPM parameters are correct;
 - If you set a *Potentiometer distance* sensor, insert the potentiometer's total travel;
- Connect the data logger to the PC's USB port, switch it on (use button *Ignition* inside the car's switchboard) and press button *Transmit*;
- Press button *Calibrate*:
 - Accelerometers number 1 and 2 and channel "Potentiometer distance" need to be autocalibrated. Press button *Start autocalibration*;
 - Channels "Mid zero potentiometer" and "Zero based potentiometer" need to be calibrated. Select the channel you wish to calibrate, press button *Start calibration* and follow the instruction prompted on your PC's desktop;
- Once the desired channels have been calibrated/autocalibrated, press button *Transmit* in order to transmit the calibration to the data logger;
- Press button *Online*. Verify that the accelerometers show a lateral g-force of 0 g. Move the throttle (if a throttle displacement sensor is installed), the front/rear shocks (if a shock potentiometer is installed) and verify that such sensors have been correctly calibrated.

DOWNLOADING DATA

Once a test session has finished, it is possible to download the data stored in the instrument's memory. In order to correctly download these data, connect your **EVO 3** to the PC's USB port, using the USB cable, and switch on the data logger.

- Run **Race Studio 2**;
- Select **EVO 3** and press button *Download*. It will appear the screenshot shown in Figure 20;

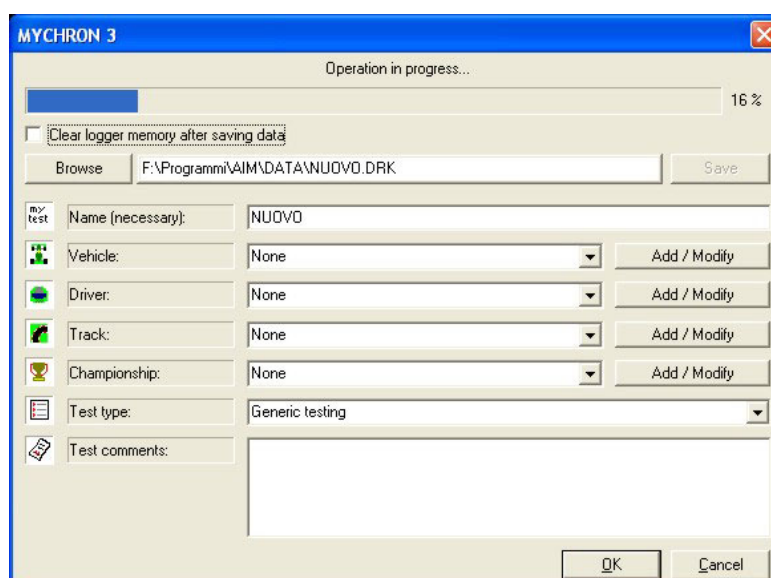


Figure20: Race Studio 2 data download window

- Insert the file name (necessary) and *browse* the folder where you wish to save the test file (default folder C:\Program files\AIM\DATA);
- Insert the database's desired sub-categories pressing button *Add/Modify*. If no sub-category is specified, the test will be included inside the tests database as "None" for the Vehicle, the Driver, the Track and the Championship type, and as "Generic testing" for the Test type;
- Once the download has finished, press button *Save*.
- Checkbox *Clear logger memory after saving data* allows the user to clear the logger's memory after the data have been downloaded.

ANALYZING DOWNLOADED DATA

How to use Race Studio Analysis

Race Studio Analysis will allow you the ability to plot the recorded laps and the sampled channels versus time, distance and frequency.

- Press the shortcut *Race Studio Analysis* on your PC's desktop in order to run **Race Studio Analysis**.

If you wish to plot engine's RPM and the vehicle speed versus time, for instance, first of all you have to select these measures by clicking on them in the *Measures and laps* toolbar (see Figure 22) located on the left of **Race Studio Analysis** window, and then you have to click on the *Plot vs. time* icon. An example of a *Plot vs. time* (RPM in red and Speed in black colour) is shown in Figure 21.

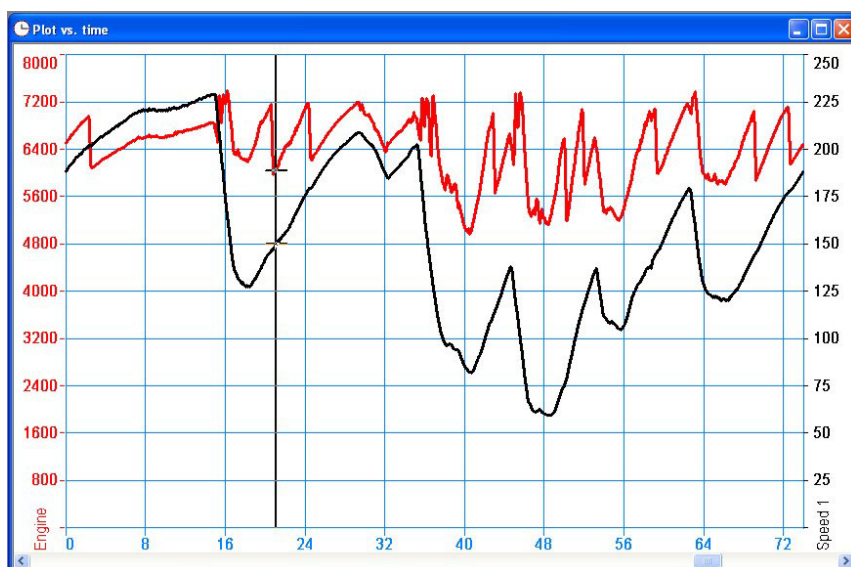


Figure 21: Plot Vs. time

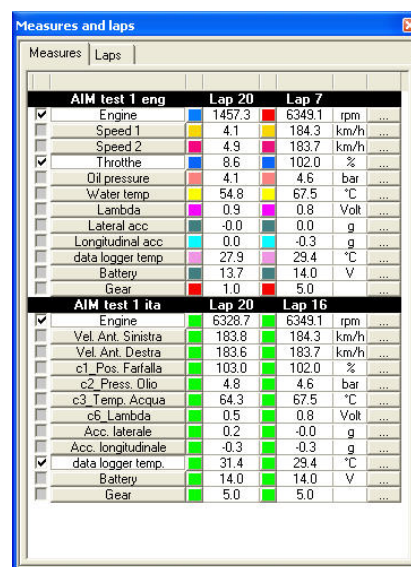


Figure 22: Measures and laps toolbar

Left click on the coloured-boxes column (Figure 22) if you wish to change the graph colour: the user may set the desired colour for each recorded lap and for each sampled channel. If you wish to add the scale to the graph, left click in the checkbox corresponding to the desired channel name.

Left click on the pushbuttons of the last column of the *Measures and laps* toolbar to load the *Measure information* window: this function allows the user to change the channel name, the plotting scale and the unit of measure.

How to create the track map

The internal lateral g-sensor allows you the ability to create the circuit map on your PC. In order to create it, once loaded a test and selected a good lap (labelled as “Lap marker” in the Lap cause column of the Lap manager dialog box) please press *Map \ New* from the Command toolbar or “Shift+F4” keys: it will appear the following screenshot

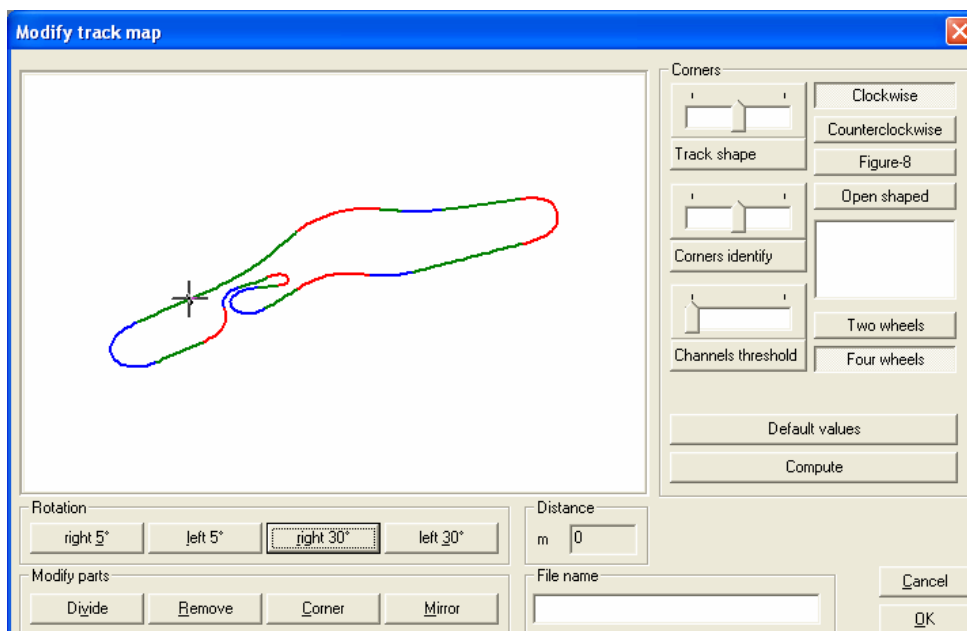


Figure 23: Map creation window (Valllunga – Rome track)

- *Track shape* cursor: this button allows the user to modify the curves’ radius of curvature, obtaining more or less open shaped curves.
- *Track type*: it is possible to choose the track type between 4 choices: Clockwise, Counter Clockwise, Figure-8 and Open Shaped. Most of circuits belong to the first two types, while, for instance, the circuit of Suzuka (Japan) is a Figure-8 track type.
- *Two Wheels / Four Wheels*: this option has to be set to “Four Wheels” if using a car or to “Two Wheels” if using a bike.
- *Default values*: this pushbutton loads the default values for the different parameters that can be set during the map creation.
- *File name*: once the map has been correctly created, it is possible to save it by choosing its “file name” and clicking the OK pushbutton.
- *Rotation pushbuttons*: by using these buttons it is possible to right (Clockwise) or left (Counter Clockwise) rotate the circuit map of a 5 or 30 degrees angle.
- *Modify parts pushbuttons*: these four buttons will allow the user to modify the track map.

Once the map has been created and saved, it is possible to recall it from the *Map Manager* window (shortcut “SHIFT+F2”) by double clicking on the desired one.

TROUBLESHOOTING

Speed

Symptom	Most probable causes	Suggested solution
No speed signal is sampled	<ul style="list-style-type: none"> Verify that the distance between the sensor and the phonic wheel is included between 8 and 15 mm Verify that the speed sensor's connector is plugged in the corresponding logger's connector The speed cable is broken or damaged The sensor is damaged 	<ul style="list-style-type: none"> Fix the distance between the sensor and the phonic wheel Plug the Speed connector in the logger's speed input Replace the cable with a new one Replace the sensor with a new one
Speed values are incorrect	<ul style="list-style-type: none"> Verify that the wheel circumference is correct (default value 1666 mm) Verify that the magnet's number of the phonic wheel is correct 	<ul style="list-style-type: none"> Set the correct wheel circumference in <i>Configuration – Channels</i> Set the correct number of pulses per engine revolution in <i>Configuration – Channels</i>
High/low peak values	<ul style="list-style-type: none"> Verify that the distance between the sensor and the phonic wheel is included between 8 and 15 mm The sensor is damaged 	<ul style="list-style-type: none"> Fix the distance between the sensor and the phonic wheel Replace the sensor with a new one

Data

Symptom	Most probable causes	Suggested solution
The logger has stored no data	<ul style="list-style-type: none"> The logger switched off during race The logger switched off during race The infrared lap receiver is broken and the logger has a <i>Threshold</i> start The configuration has been re-transmitted to the logger before downloading data 	<ul style="list-style-type: none"> Ensure that the logger is powered by the car's 12 Volts battery Ensure there is no short-circuit on the wirings of lap, potentiometer and speed sensors Replace the infrared receiver with a new one Each time the configuration is transmitted to the logger, its memory is erased

<p>Sampled data are incorrect</p>	<ul style="list-style-type: none"> • Sensors are damaged or broken • Sensors' cables are damaged • Channels have not been calibrated / autocalibrated 	<ul style="list-style-type: none"> • Replace the sensor • Replace the sensor • Run Race Studio 2, press button <i>Calibrate</i> and calibrate / autocalibrate the sensors
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Lap times

Symptom	Most probable causes	Suggested solution
<p>Some laps are grouped</p>	<ul style="list-style-type: none"> • Incorrect lap receiver installation 	<ul style="list-style-type: none"> • Re-install the Beacon receiver
<p>All laps are grouped</p>	<ul style="list-style-type: none"> • Verify that the lap receiver is installed on the car side facing the lap transmitter • Verify the lap receiver, or the cable, are not broken • Verify the lap transmitter is not broken • The hole in the front fairing is too little • The transmitter's battery is low-charged • The Beacon is incorrectly fixed 	<ul style="list-style-type: none"> • If broken, replace them • If broken, replace it • The hole must be of 8 mm at least (20 mm suggested); enlarge the hole • Use the 12 Volts power cable and a 12 Volts battery to power the lap transmitter • Re-fix the Beacon
<p>Lap times too short</p>	<ul style="list-style-type: none"> • Verify you are not on the pit lane or inside the paddock • Check if more than 1 transmitter is installed at the track side • Verify the Beacon is not installed near sources of electrical interference (i.e. coil) • The data logger switches off/on during race 	<ul style="list-style-type: none"> • Hide these laps in Race Studio Analysis using the <i>Hide lap</i> function • Set the Beacon's <i>obscuring time</i> to a value lower than a few seconds of the best lap time • Install the lap receiver where suggested, i.e. under the front fairing • Check the "Junction Box to ECU" patch cable

Communication

Symptom	Most probable causes	Suggested solution
No communication when interfacing the logger with the PC	<ul style="list-style-type: none"> The logger is switched off USB drivers not installed or incorrectly installed The PC's USB port is broken The USB cable is damaged The USB cable is incorrectly connected either to the PC or to the logger 	<ul style="list-style-type: none"> Switch on the data logger Re-install the USB drivers If available, try another USB port Replace the USB cable Correctly connect the USB cable.

Track map

Symptom	Most probable causes	Suggested solution
The track map does not correspond to the real track or an error message is prompted	<ul style="list-style-type: none"> Incorrect EVO 3 installation Incorrect EVO 3 installation: the logger is non firmly fixed to the chassis The internal accelerometers have not been autocalibrated Problems on the <i>Reference speed</i> channel The created track map does not correspond to the real track map <i>Invalid data to compute track map</i> warning message is shown 	<ul style="list-style-type: none"> Install the data logger as shown in Figure 4 Firmly fix the logger to the chassis using a large piece of Velcro Run Race Studio 2 and select the <i>Autocalibration</i> function <i>Race Studio Analysis – Modify – Reference speed</i> and double click on the new reference speed channel Use functions <i>Mirror</i>, <i>Corners identity</i> and <i>Rotation</i> to modify the track map Select a lap labelled as “lap marker” inside the <i>Test database and Lap manager</i> window