1. INTRODUCTION

SparkEVO is an advanced ignition box for 2-stroke petrol engines. It offers intelligent solutions for interfacing with the user and set-up the system itself. It is versatile and introduces advanced features compared to the products currently on the market.

SparkEVO is applicable to different types of stock ignition, from mechanical contact (points) to inner rotor electronic (PVL, Selettra, etc.) and VR pickup. It can be set up to pilot an actuator (e.g. power jet) or to read an analog sensor (e.g. throttle position sensor).

2. FUNCTIONALITY

SparkEVO can be applied on all types of existing native ignitions. It offers the possibility of intervening on commercial systems and of driving the relative ignition coils. Therefore, it is not necessary to eliminate the complete ignition to create an ad-hoc one to already enjoy new features.

Being an ALL-IN-ONE device it still offers the possibility of creating a custom ignition in order to obtain maximum flexibility and best performance.

The advantages offered by SparkEVO are:

- ✓ AC-CDI operating mode (via stator)
- ✓ TCI operating mode (via stator or battery)
- ✓ Operation with different types of sensors (points, pickups, optical, inductive)
- ✓ Variation of the timing angle respect the RPM changes
- ✓ Programmable speed limiter function
- ✓ Creation / editing of the timing map
- ✓ Selection of timing maps with handlebar switch
- ✓ Quick gear shift
- ✓ Bluetooth connectivity for interfacing via smartphones (Android or iOS), using dedicated app
- ✓ USB connectivity for data transfer and setup via desktop computers (Windows or MacOS)
- ✓ Real-time diagnostics, resettable engine hour counter, maximum RPM reached, count of startups, battery status
- ✓ Data logger function to store RPM, ignition time and engine acceleration based on time
- ✓ Output for driving an actuator (e.g. power jet or solenoid exhaust valve)
- ✓ Analog input for reading a sensor (e.g. TPS)

See chapter “Technical details” for more information on properties and compatibility.

3. APPLICATIONS

SparkEVO is so versatile that it includes all the possible ignition types on the market in a single model and can configure the device for your needs.

The "**ALL-IN-ONE**" type system therefore provides the following configuration possibilities:

1. Application to the stock 1 wire vr pickup AC-CDI
2. Application to the stock 2 wires vr pickup AC-CDI
3. Application to the inner rotor AC-CDI
4. Application to the stock contact point sensor inductive TCI
5. Custom ignition system 12V (e.g. battery-powered TCI)

Each of these applications can use the standard sensor or an additional optical or inductive sensor.

3.1 APPLICATION TO THE 1 WIRE VR PICKUP AC-CDI

SparkEVO is placed between the pickup and the stock AC-CDI module (e.g. in Piaggio electronic engines). It can be powered with the voltage derived from the stator (e.g. service wire) but the use of an external 12V battery is recommended.

The electrical connection scheme is shown below:

SIGNAL TYPE	WIRE COLOR – SPARKEVO
Pick Up (from pickup sensor)	WHITE-BLUE & BLUE
Pick Up (to stock cdi module)	BROWN
Positive supply (from positive battery pole or from stator)	RED
Negative supply (from engine case): **tie to negative battery pole**	BLACK

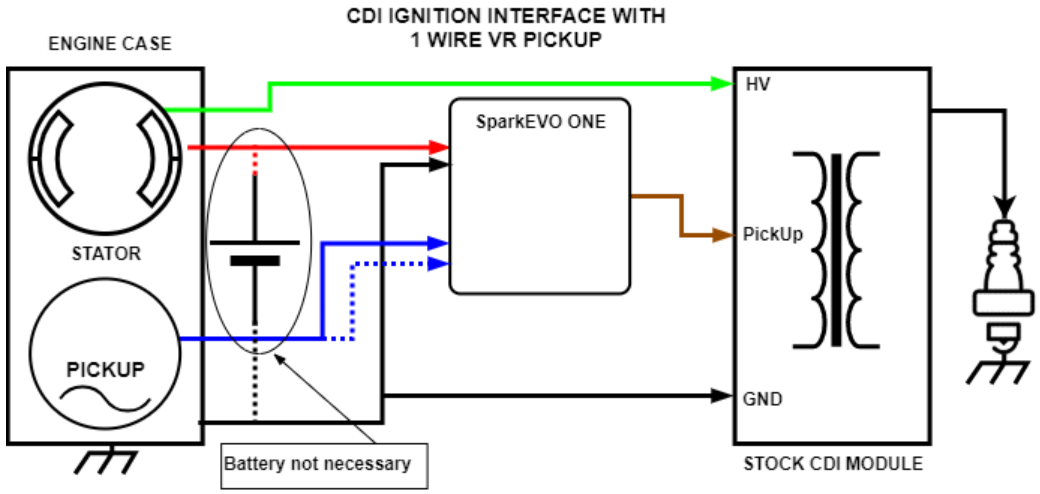


Figure 1: Electrical connection diagram for 1 wire vr pickup AC-CDI

3.2 APPLICATION TO THE 2 WIRES VR PICKUP AC-CDI

SparkEVO is placed between the pickup and the 2 poles ignition coil. The electrical connection scheme is reported below. This scheme is referring to the unit supplied by a battery.

The electrical connection scheme is shown below.

SIGNAL TYPE	WIRE COLOR – SPARKEVO
High voltage wire from stator	ORANGE
High voltage coil faston	VIOLET & TRANSPARENT
Positive supply (from battery positive pole)	RED
Negative supply (from battery negative pole): **connect to the engine case**	BLACK & BEIGE
VR pickup positive (from pickup)	WHITE-BLUE *
VR pickup negative (from pickup)	BLUE *
Positive supply digital sensor (optional instead of VR pickup)	GREY
Digital sensor signal (optional instead of VR pickup)	WHITE
Negative supply digital sensor (optional instead of VR pickup)	WHITE-BLACK

*It could be necessary to invert those wires.

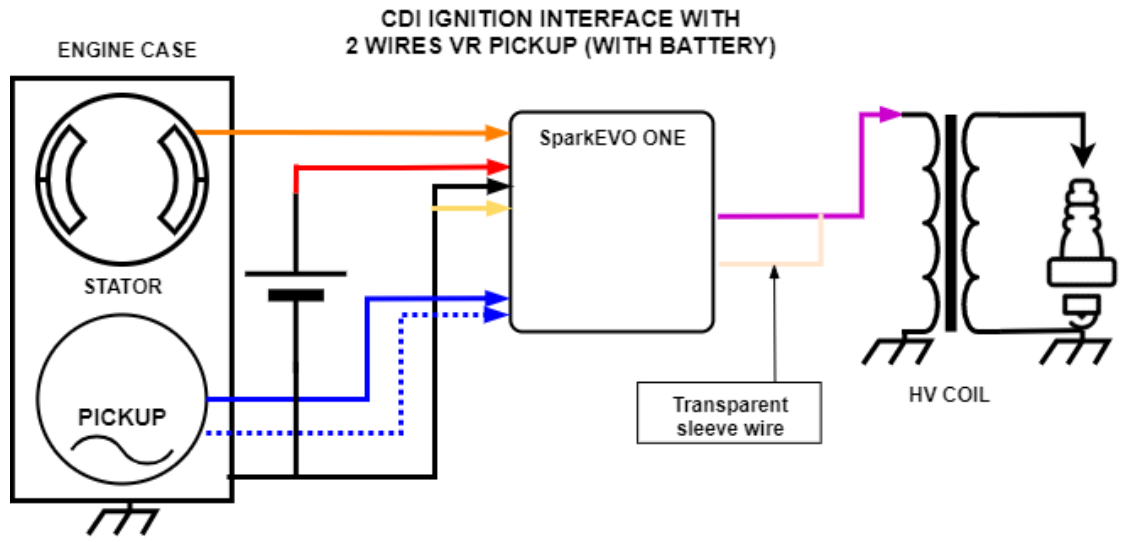


Figure 2: Electrical connection diagram for 2 wires vr pickup (with battery)

Note: if the native ignition system is composed by a AC-CDI module, this one can't be used and shall be substituted with a simple high voltage coil.

This configuration could work with digital sensor also instead of the original VR pickup to achieve better timing. Please follow the above wiring table to connect the digital sensor instead of VR pickup.

3.3 APPLICATION TO THE INNER ROTOR AC-CDI

SparkEVO uses the inner rotor stator, a digital sensor to be applied to the rotor, and a traditional external coil (not the stock one). It must be powered with the use of an external 12V battery.

In this case, the following steps must be followed:

1. Derive the 2 wires from the stator
2. Use a high voltage coil for AC-CDI ignition
3. Mount the sensor in the way the red signed part of it faces the rotor at a distance within 5mm

The electrical connection scheme is shown below.

SIGNAL TYPE	WIRE COLOR – SPARKEVO
Wire 1 from stator	ORANGE
Wire 2 from stator (if present)	BEIGE
Positive supply (from battery positive pole)	RED
Negative supply (from battery negative pole): **connect to the engine case**	BLACK & BEIGE
High voltage coil faston	VIOLET & TRANSPARENT
Positive supply digital sensor 12V (provided by us)	GREY
Digital sensor signal	WHITE
Negative supply digital sensor	WHITE-BLACK

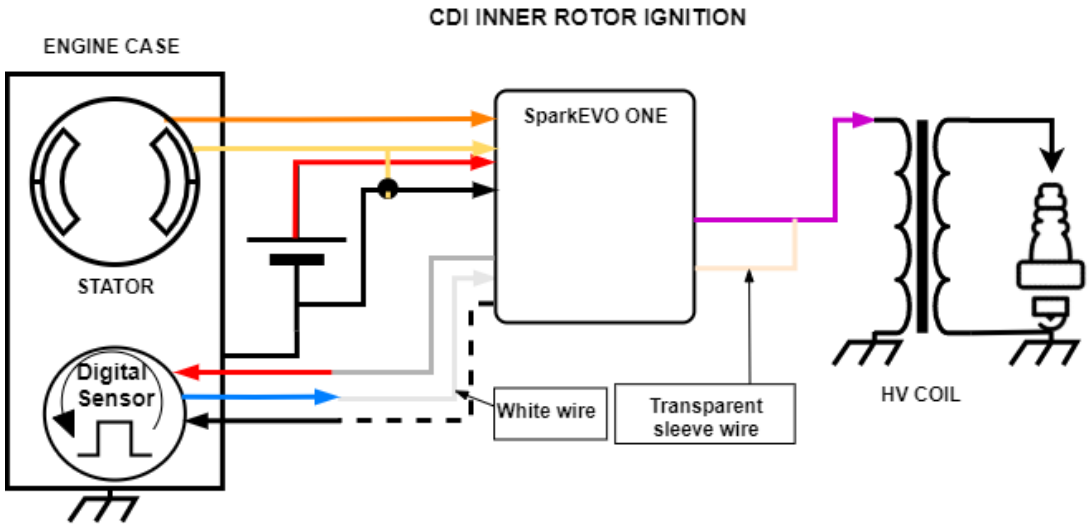


Figure 3: Electrical connection diagram for inner rotor AC-CDI

Notes: Digital sensor wire colors are referred to the sensor provided by us. The sensor mounting is done as described in the paragraph “3.6 Digital Sensor Mounting (Hall sensor)”. The ignition angle setup is done as described in chapter 6.

3.4 APPLICATION TO CONTACT POINT SENSOR INDUCTIVE TCI

SparkEVO is placed between the contact point and the standard ignition coil (e.g. in traditional Piaggio engines); the unit shall be supplied by an external 12V battery.

In this case, the following steps must be followed:

1. Disconnect the native capacitor and the stator wire from the pins
2. Take a wire connected to the contact point out of the engine
3. **Is mandatory invert the high voltage coil wires into the stator**: originally one end of the coil is connected to the frame and the other end is connected to the contact point; it is necessary to disconnect the coil wire from the frame and take it out of the motor and connect the remaining coil wire (originally attached to the contact point) to the frame

The electrical connection scheme is shown below.

SIGNAL TYPE	WIRE COLOR – SPARKEVO
Contact point (from engine)	WHITE
Stator coil (from engine)	ORANGE
High voltage coil	ORANGE
Positive supply (from battery positive pole)	RED
Negative supply (from battery negative pole): **connect to the engine case**	BLACK & WHITE-BLACK & VIOLET

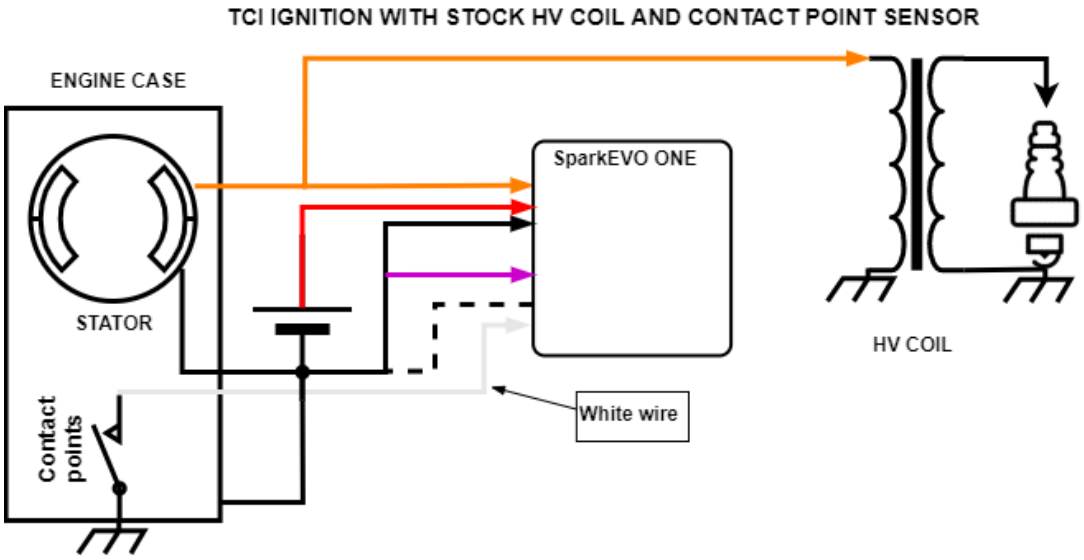


Figure 4: Electrical connection diagram for contact point sensor inductive TCI

3.5 TCI IGNITION SYSTEM WITH HV COIL SUPPLY 12V

SparkEVO can be used to create an ignition system without a stator and using a 2 poles 12V high voltage coil with a resistance of at least 3 ohms. It must be powered with the use of an external 12V battery. The electrical connection scheme is shown below.

SIGNAL TYPE	WIRE COLOR – SPARKEVO
Positive supply (from battery positive pole)	RED
Negative supply (from battery negative pole): **connect to the engine case**	BLACK & BEIGE & VIOLET
Faston 1 high voltage coil	RED
Faston 2 high voltage coil (**do not connect to the engine case or to the negative battery pole**)	ORANGE
Positivie supply digital sensor 12V (provided by us)	GREY
Digital sensor signal	WHITE
Negative supply digital sensor	WHITE-BLACK

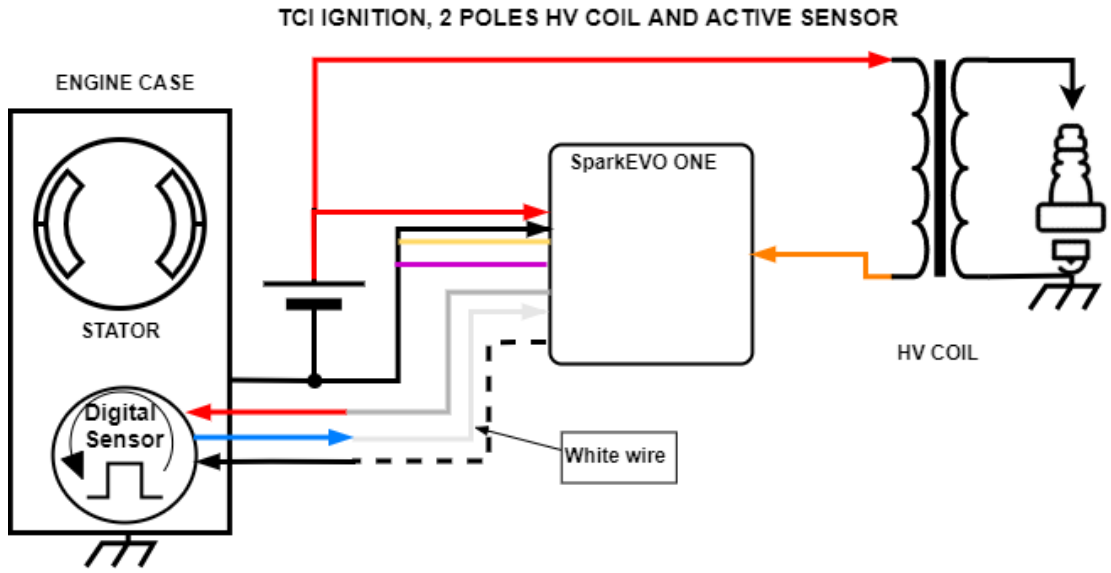


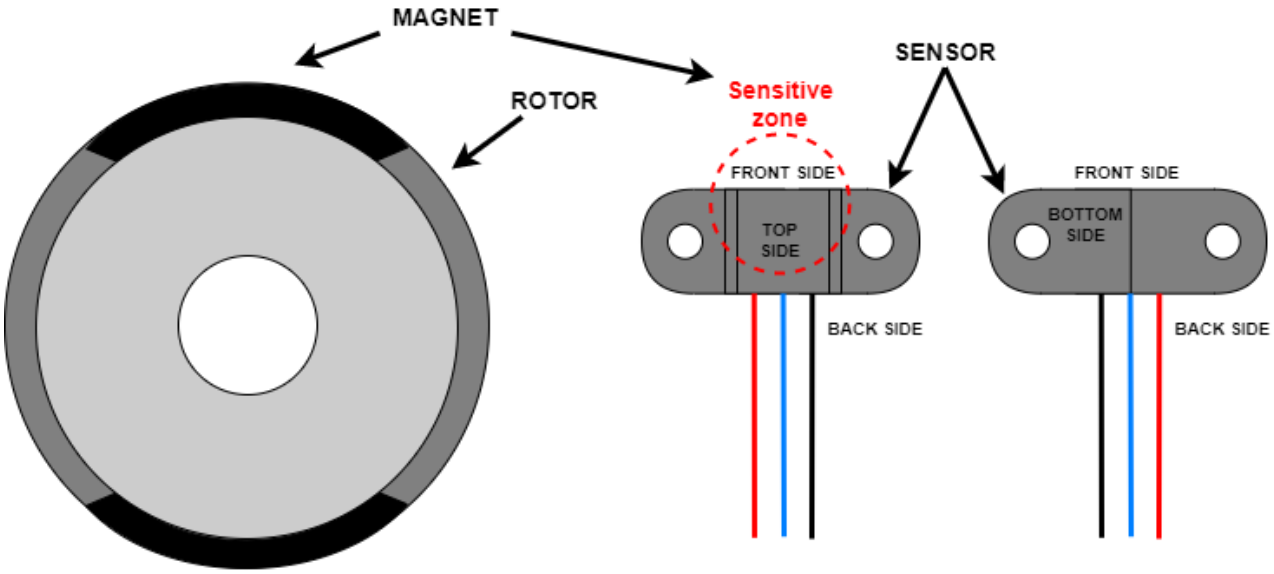
Figure 5: Electrical connection diagram TCI ignition system with HV coil supply 12V

Notes: digital sensor wire colors are referred to the sensor provided by us. This application works also with passive sensors, like contact point sensor or pickups. The sensor mounting is done as described in the paragraph “3.6 Digital Sensor Mounting (Hall sensor)”. The ignition angle setup is done as described in chapter 6. This application has a maximum power consumption of 3AH at 12V supply.

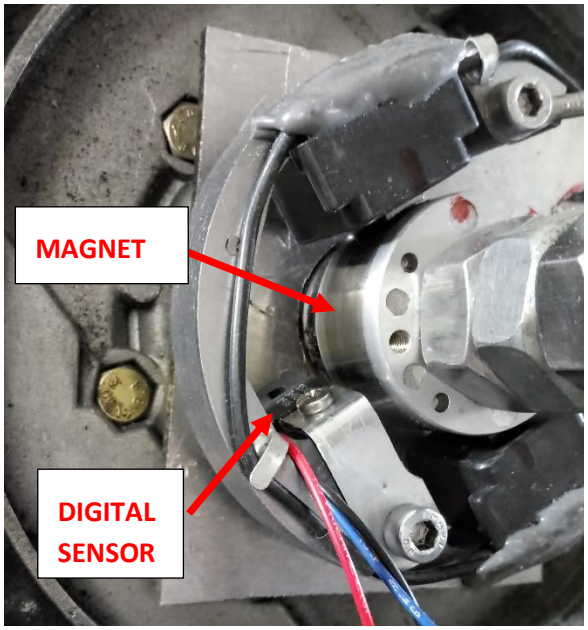
3.6 DIGITAL SENSOR MOUNTING (HALL SENSOR)

The digital sensor provided by us is able to detect a magnetic field and can be applied to sense inner rotors, outer rotors or a custom rotor with a magnet inside.

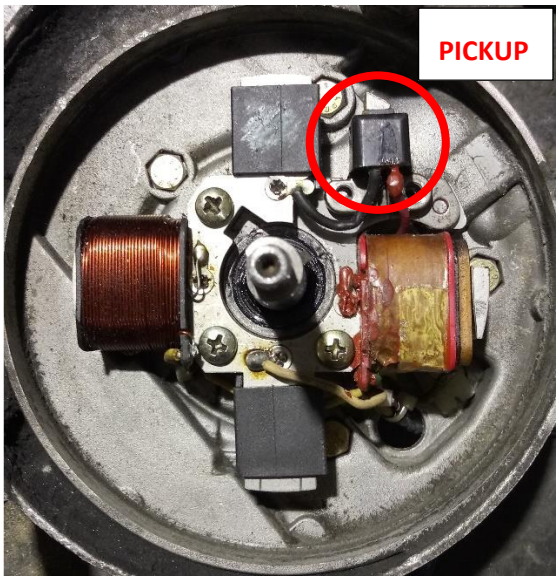
The sensor shall be mounted on a mounting bracket (not provided) in order to face the rotor's magnet with the **front side** or with the **top side** (preferred), within a distance of not more than 5 mm.

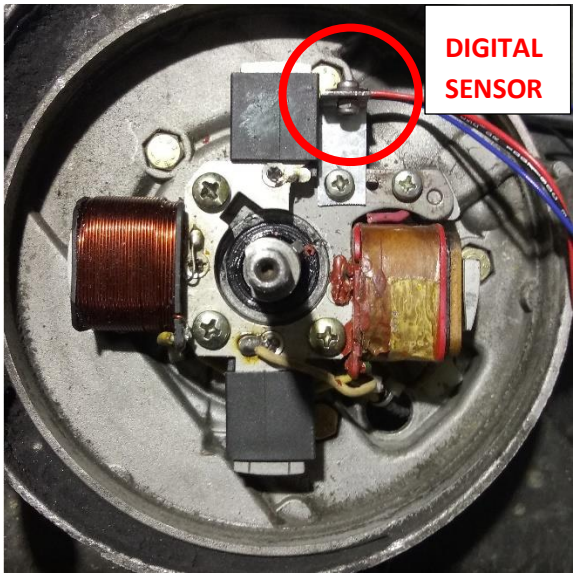


Application example on AC-CDI inner rotor ignition



Application example AC-CDI outer rotor ignition (substitution of VR pickup)





4. TECHNICAL DETAILS

FEATURE	SparkEVO ONE
Supply voltage	7÷200 Vdc
Maximum power consumption	100 maH AC-CDI/TCI – 3 AH in TCI coil 12V
Functioning mode	AC-CDI or TCI (depending on license)
Managed cylinders	2 with wasted spark
Connectivity	Bluetooth BLE (10m max distance) and USB 2.0 *
Analog inputs – TPS provision	1 (5V max)
Status indicator	1 RGB Led
Rpm analog sensor inputs	1 vr pickup, 1 contact point
Rpm digital sensor inputs	1
Ignition maps managed	1 or 6 (depending on license)
Handlebar map switch	YES or NO (depending on license)
Quick gear shift	YES or NO (depending on license)
Available output (exhaust valve/power jet etc)	YES (12V 1A Max) or NO (depending on license)
Data logger	YES or NO (depending on license)
Timing points per map (timing-rpm)	20
Timing resolution	0.1°
RPM resolution	100 RPM
Engine speed reading tolerance	±5 RPM
Maximum engine speed	18000 RPM
Working temperature range	-20°C ÷ 70°C continuously
Body material	High performance plastic, resin filled
Body color	Black or Red
Environment protection	Resistant to dust and water drops (IP68)
Overall dimensions and weight	LxWxH = 88x80x26 mm / 190gr

* The communication with the device is possible with our application software for smartphone and PC. The minimum requirements are:

- For smartphone app: Android 5 and above, or iPhone 4S / iOS 9 and above. Bluetooth 4.0 is needed.
- For desktop application: PC with Windows 7 SP1 and above, or MacOS 10.13 and above. USB support is needed.

4.1 DEVICE PINOUT

SIGNAL TYPE	WIRE COLOR – SPARKEVO
Negative supply	BLACK
Positive supply	RED
Return ground for power valve, shift light, power jet	BLACK
Negative input for high voltage stator	BEIGE
Positive input for high voltage stator	ORANGE
High voltage coil	VIOLET
High voltage coil (only for AC-CDI)	TRANSPARENT
VR pickup input	WHITE-BLUE
VR pickup start input	BLUE
Pickup output for AC-CDI module	BROWN
12V output (max 1A)	GREY
5V output (max 200mA)	PINK
Generic output 12V 1A (power valve, shift light, power jet)	WHITE-BROWN
Return ground for digital sensor and map selector	WHITE-BLACK
Digital sensor or contact point input	WHITE
Map switch selector input	WHITE-GREY
Quick shift input	WHITE-VIOLET
Analog input (5V max)	WHITE-RED

4.2 DEVICE SETUP

Device mounting and connection

- SparkEVO has 2 mounting holes to provide the mounting on the bike frame. To guarantee the reliability we suggest to do not rigid mount it, but through rubber bumpers.
- The electrical connection of the device shall be obtained with a good and short (where possible) ground connection to the engine frame and to the battery.

Auxiliary devices connection

Power valve rave, shift light, power jet: to connect between WHITE-BROWN and YELLOW-GREEN wire.

Customizations and advices

- SparkEVO could be prepared to implement additional functions according to the user's needs. Any device customization shall be evaluated by us and could have development costs.
- We are not responsible for failures on device or motor caused by manumission of the device, or the integration in a setup not approved by us.

4.3 ENVIRONMENTAL PROTECTION

SparkEVO is protected from dust and dripping water. The usage of the USB port cap is required but not mandatory.

5. SPECIAL FUNCTIONS

Data logger

The data logger allows you to record the performance of the RPM and the ignition over time and to download and plot a graph with the relative engine acceleration on the Desktop application, implementing a “dyno test bench like” feature.

Currently, the possibility to Start/Stop the log recording is available on Mobile apps. While the possibility to see and download the recorded data is available only on Desktop app. See paragraph 7. Software for more information.

6. STATUS INDICATOR

RGB LED	**GREEN**	**RED**	**BLUE**
Stuck		Device temperature alarm	RPM sensor reading *
Blinking	Device correct operation	Low battery (if present)	Device Bluetooth connected

* ONLY WITH DIGITAL SENSOR or MECHANICAL (contact points): the blue led is useful to detect the engine ignition angle with the dedicated function in the “utilities” page on the smartphone application. It works at 0 engine speed with digital sensor without the use of the strobe light: depending on the reading polarity of the sensor (setted in the “config” page on the smartphone application), the blue led is ON when the spark is fired. In this way you can measure the static ignition angle quickly.

7. SOFTWARE

The communication with the SparkEVO ignition box is possible with our application software for smartphone and PC. The minimum requirements are:

- For smartphone app: Android 5 and above, or iPhone 4S / iOS 9 and above. Bluetooth 4.0 is needed.
- For desktop application: PC with Windows 7 SP1 and above, or MacOS 10.13 and above. USB support is needed.

To start configuring your device, download the preferred application from the dedicated channels:

- Google Play Store (link)
- App Store (link)
- Windows Desktop (from SparkEVO official website, "Download" section)
- MacOS Desktop: (from SparkEVO official website, "Download" section)

There are some differences between mobile and desktop versions:

FEATURE	MOBILE APPS	DESKTOP APPS
Connection type	Bluetooth only	USB only
Map editor	✓	✓
Configuration	✓	✓
Counters	✓	✓
Real time dashboard	✓	✗
Utilities	✓	✗
Log recording Start/Stop	✓	✗
Log view and download to file	✗	✓
Firmware upgrade	✗	✓

7.1 LICENSE ACTIVATION

Some SparkEVO models require license activation. Without license, it is not possible to configure the ignition box using software apps (SparkEVO for Android, for iOS, for Desktop).

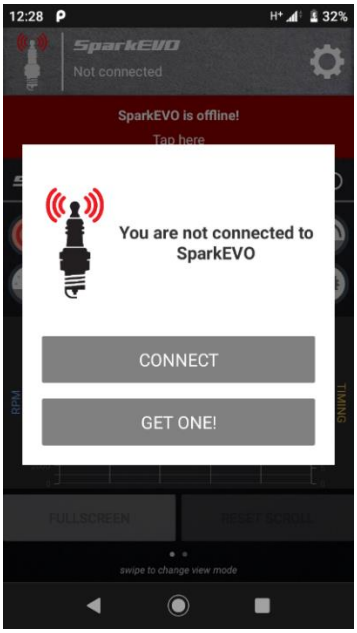
Follow the procedure to activate your ignition box. This procedure is needed only the first time you connect to your device.

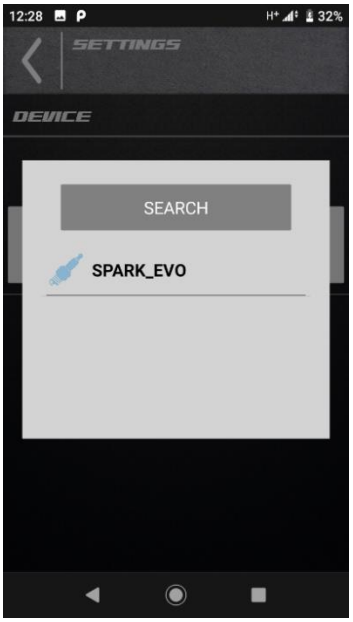
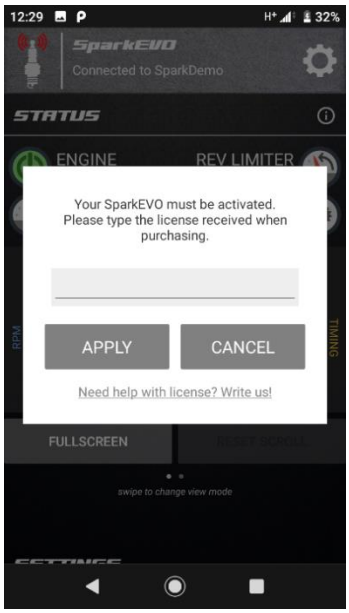
1. Download the latest version of “SparkEVO” for your Android (from Google Play Store) or iOS device (from App Store), or Desktop systems (from official SparkEVO website, “Downloads” section).

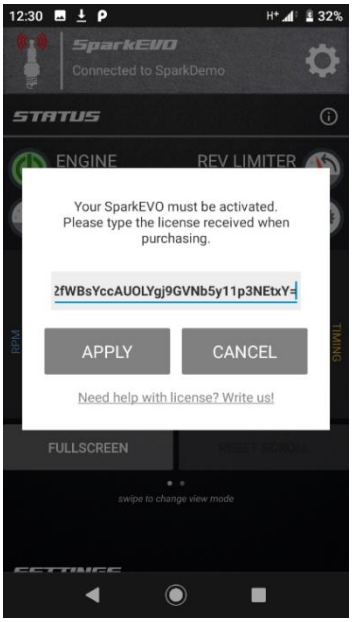
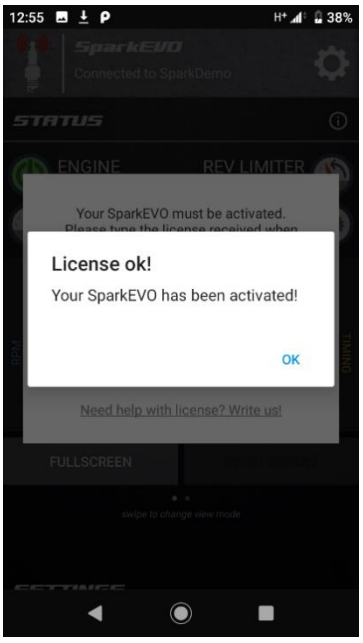
   If you already installed one or more of these apps, ensure you have the very latest version.

2. Turn on the SparkEVO Ignition Box

3. Open the preferred application and connect to the Ignition Box via Bluetooth (for Mobile) or USB (for Desktops). The following section shows the steps for Android version:

If the app does not automatically connect to the SparkEVO, it will show the “Not connected” popup message. Tap the “CONNECT” button. The SparkEVO must be turned on.	

Connect to the found device	
After the connection, only if the SparkEVO is not activated, the License popup will appear	

Copy the License Key that you received when purchasing the product (example via e-mail) and paste it into the text field. Please note: the license string can be composed by letters, numbers and special characters. Ensure you've copied it entirely. Click APPLY.	
If everything is ok, SparkEVO will be activated. If you experience issues, please write us at info@sparkevo.racing specifying the used license and your purchasing information. We will be glad to help you!	

7.2 FIRMWARE UPGRADE

The firmware of some SparkEVO products can be upgraded with newer versions. SparkEVO Team periodically releases new versions of the firmware to introduce performance enhancement and increased compatibility.

Every time a device is connected to smartphone or desktop app, the user is informed if a new firmware release is available for it. At the moment, the upgrade procedure can be performed only on PC and MacOS desktop apps.

Follow the instructions carefully during upgrade. Ensure your PC is connected to AC power plug and do not use USB extension cables.

8. KNOWN INCOMPATIBILITIES

Currently, SparkEVO One does not support engines based on Kokusan systems and DC-CDI ignition types.

Further improvements of the product are always announced via official website, social media platforms and new revisions of the manual.

9. USAGE AND RETURNS POLICY

Our products are reserved exclusively for racing competitions within authorized environments. Any manumission of the device will invalidate the warranty. We are not responsible for damage on device, motor or persons caused by manumission of the device, or the integration in a setup not approved by us.

9.1 NEW UNUSED PRODUCT RETURNS

Your complete satisfaction is our priority and we can assist you before any purchasing to understand the compatibility with your target system. If an item purchased from SparkEVO is found to be incompatible with your setup within 2 months from the purchase date, you may return the new, unused part for a refund.

The product must be in the original, manufacturer's box. Shipping costs are covered by customer. Please contact us at info@sparkevo.racing to receive all the information for a safe return & refund procedure.

9.2 DEFECTIVE PRODUCT RETURNS

If the product appears to be defective within 6 months from the purchase date, the following actions are taken:

1. The SparkEVO team analyzes the issue, in place or remotely, to confirm the unit is actually defective and has not been hacked or used in unapproved setups
2. If the issue is confirmed, the customer can choose to take one of the following actions:
    - Accept a hardware or software fix, if applicable
    - Replace the unit with a working one, if available on stock
    - Ask for a refund equal to the value of the defective unit at the time of purchasing

In case of replacement or refund, the defective unit must first be sent back to the manufacturer. Shipping costs are covered by customer. Only after the unit is returned to the manufacturer and checked, it will be replaced or refunded.

Subsequent requests for technical support or replacement of the product after the warranty period will be evaluated by manufacturer and will require a payment if necessary.

10. REVISION SUMMARY

REVISION	DATE	CHANGES
10	26 March 2021	Replaced “CDI compatibility” with “AC-CDI compatibility” for better understanding. “DC-CDI” is not supported at the moment. Improved “USAGE AND RETURNS POLICY” with information for new unused product return. Added “7.2 FIRMWARE UPGRADE” section.
11	11 October 2021	Technical details updated