ZERO EMISSION
VEHICLES AUSTRALIA

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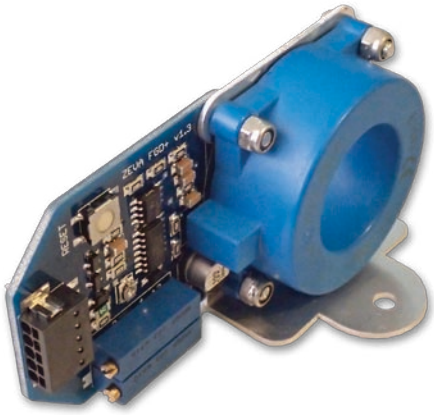
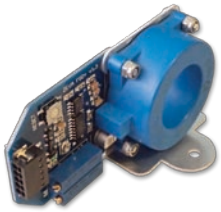


Fuel Gauge Driver Plus v1.3

Intuitive instrumentation for your EV

Please read these instructions carefully
for proper installation and use of this product.

INTRODUCTION



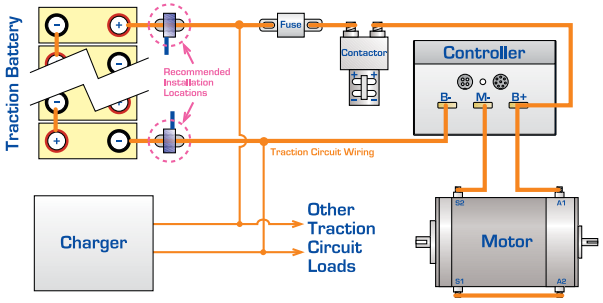
Building on the success of the original ZEVA Fuel Gauge Driver, the Plus version offers several extra features. As well as using your original fuel gauge to display battery State of Charge (SoC), the FGD Plus can also make use of your vehicle's tachometer to display instantaneous current for an indication of realtime power consumption.

The FGD Plus also features non-vollatile SoC storage - that is, the device can lose power without forgetting the state of charge. As such it may be powered down when the vehicle is idle, to reduce quiescent power consumption.

INSTALLATION

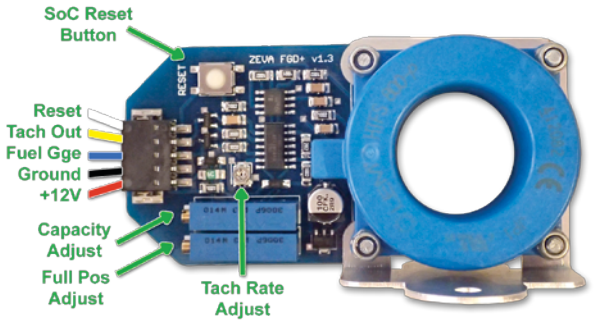
The device should be securely fastened to the vehicle using the integrated mounting bracket. It should be installed where it is protected from the elements. It is usually most convenient to mount it close to the positive or negative battery terminal, along the path of the power cables.

Route the power cable from the battery through the hole in the FGD's toroidal current sensor. Ensure that all loads in your traction circuit (including charger, DC/DC conveter, etc) are connected *after* the FGD, or current flowing to/from them will not be monitored. The diagram below shows recommended installation locations in a typical EV circuit:



Recommended install location(s)

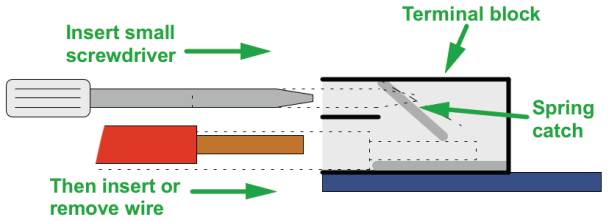
The flow of conventional current (+ve to -ve) should go from the back to the front of the current sensor – that is, the side with the mounting bracket should be oriented towards the positive terminal.



Wiring pins, adjustment pots and reset button

WIRING

The FGD+ uses a spring-lock terminal block for quick, secure connection of wires. Simply insert a small screwdriver (or paperclip) in the upper hole to lift the internal spring, then insert or remove wire, and remove screwdriver to lower the spring and lock the wire in place.



Using spring-lock terminal blocks

Wires should have about 8mm of exposed conductor for optimum penetration. A light tug on the wire once inserted should ensure that the spring lock has engaged.From top to bottom, the pins are as follows:

- **Reset** (optional): Connect to a button which momentarily connects this pin to ground/chassis to reset the SoC.
- **Tach Out** (optional): Connect to the tachometer input on your instrument cluster.
- **Fuel Gauge**: Connect to the input on your original fuel gauge, replacing the wire to the fuel tank sensor.
- **Ground**: Connect to ground / vehicle chassis.
- **+12V**: Connect to a permanent 12V supply (or the same supply as battery isolation contactors)

NON-VOLATILE S.O.C STORAGE

A new feature in the FGD+ is non-volatile SoC storage, which allows it to remember the state of charge even if the device loses power.

Of course, while the device is unpowered it is unable to monitor current flow in or out of the battery, so it is essential that there are no loads on the battery while the FGD+ is off, or it will lose SoC synchronisation.

If your FGD loses synchronisation, simply do a full charge then press the Reset button (or momentarily pull the reset input pin to ground) and the SoC will be reset to 100%.

The FGD+ also stores zero-point calibration information for its current sensor in memory. This is factory set, but if you suspect it may have drifted (such as if your FGD is not maintaining good SoC synchronisation), you can do a manual recalibration by holding down the Reset button for more than 2 seconds. Note that it is essential there is no current flowing at this time for correct zero-point detection.

CALIBRATION

The FGD+ is calibrated using two 10-turn adjustment pots and one single turn pot. The 10-turn pots are adjusted with a small flat blade screwdriver, and the single turn with a small Philips screwdriver (available from most hardware or electronics stores).

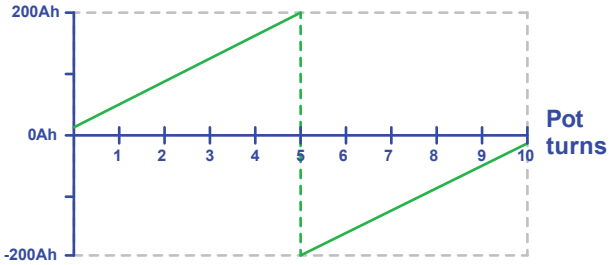
The 10-turn pots have no end-of-travel indication; simply complete 10 full turns in either direction to ensure you start at one end or the other as a reference point.

Adjustment pot functions are as follows:

- **Pot 1 (bottom / closest to mounting bracket), "Full" position adjustment, 10-turn:** Adjust this to change the fuel gauge needle position when the battery is full (100% SoC). This calibration is best performed when the device first powers up. (Note: you may need your ignition key on for the factory gauge to activate, and some fuel gauges move very slowly.)

- **Pot 2, rate and direction, 10-turn:** This pot allows you to tune the device for your battery pack capacity, with an approximate range of 200Ah to -200Ah (i.e allowing gauges with reversed operation), depending on OEM gauge scaling. Minimum capacity settings are found

at each end of the pot's travel, and the sensor polarity swaps in the middle as shown in the diagram below.



Effective battery capacity vs pot turns

Note that observed capacity is dependent on the scaling of the original gauge, which varies somewhat between vehicles.

Capacity calibration is best performed after one full-depth discharge cycle. After a full charge, simply drive the vehicle to its maximum range (approx 3.2V/cell for LiFePO4 or 12V/batt for PbA is a good reference point) then adjust this tuning pot until the fuel gauge needle sits on Empty.

- **Pot 1 (small single-turn), tachometer multiplier:** This changes the scaling for the tachometer output. Tachometers expect different pulse rates depending on the number of cylinders in your vehicle's original engine. For four cylinder vehicles, set this pot fully anticlockwise. For six cylinder vehicles, set it in the middle (approximate is fine). For eight cylinders, set it fully clockwise. The tachometer units will be in hundreds of amps, instead of thousands of RPM.

The FGD will come factory set for normal gauge polarity and minimum capacity setting. This is a good place to start testing, both to confirm your gauge polarity and to verify gauge movement during a short drive.

TECH NOTE ON SoC SYNCHRONISATION

The FGD uses 100% SoC as its synchronisation point. Once it reaches 100% SoC, it will ignore any further charge current. Lithium batteries have approximately 1% charge inefficiency – that is, your charger will put 1% more power into the cells than you will get back out. This 1% is useful to give the FGD a brief synchronisation window at the top-of-charge, to compensate for any SoC drift from measurement inaccuracy. In most cases it will allow the FGD to maintain

synchronisation with the pack's SoC automatically.

The device does not stop counting current flow when it reaches 0% SoC, so you can recalibrate your low point anytime without truncating the SoC counter.

ACCURACY AND SOC DRIFT

This device uses a Hall Effect sensor to measure current flow. Whilst offering good accuracy and linearity, they can suffer from a small amount of zero-point drift and inaccuracy when measuring very low levels of current. If a vehicle is not driven for a period of weeks or longer, the FGD may have accumulated SoC error due to quiescent current flow. In such cases simply recharge your pack then reset the FGD to allow it to resynchronise.

This device should only be used to give an indication of the battery's SoC and can not replace a battery management system for protecting your cells from overcharging or over-discharging.

SPECIFICATIONS

- Power supply input voltage: 6-28VDC (12V nominal)
- Reverse voltage and fuse protected
- Power consumption: 20mA approx
- Current measurement range: ±1200A
- Capacity range: 1-200Ah approx, depending on gauge
- Traction circuit voltage range: Limited by power cable insulation only
- Dimensions: 82x42x20mm, plus bracket

TECHNICAL SUPPORT

If you have any queries not covered by this manual, feel free to contact us via our website: **www.zeva.com.au**

Products are covered against manufacturing faults for a period of 12 months from date of purchase. If you believe your module may be faulty, please contact us for RMA information.

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