

## Energy Meter and

# **Current Transducer**

## **Assembly Manual**

# Draft - 2016

## Formula SAE-A 2016



The energy meter assembly is made of two separate boxes and associated accessories, as follows:

- Energy Meter (EM) Box, with three cables feeding directly out from the box
- Current Transducer (CT) Box
- USB Flash Memory
- 100cm Male Micro USB to USB Memory Stick (supplied as one assembly including custom adapter PCB)

### **Current Transducer (CT) Box**

Fig.1 shows the picture of the CT box. Each CT box has a center hole of 20mm diameter which the positive side cable coming out of the high voltage battery must pass through.



Figure 1 Current Transducer Box (2015 housing shown, connector type is changing for 2016)

Each CT is marked with a symbol (arrow) which indicates its correct mechanical orientation. Find the arrow on the CT and install the CT with its arrow pointing in the direction of current flow from the battery positive terminal. Fig. 2 shows a guidance picture of the installation of the CT box:





### Formula SAE-A 2016



Each CT box is fitted with a 4 way terminal block. This terminal block is used to connect the CT I/O signals to the EM box via EM-CT Cable. Next to the terminal block there is a label marked as:

#### "BWYR"

#### B: Black – W: White – Y: Yellow – R: Red

The EM-CT Cable must follow this color coding to ensure the correct and safe operation of the CT and the EM boxes. Fig. 3 shows a picture of this assembly:



Figure 3 EM-CT Cable Installation (2015 housing shown, connector type is changing for 2016)

## Energy Meter (EM) Box

Fig.4 shows the picture of the Energy Meter box. Each box has four mounting, three directly connected cables, and one USB port, as follows:



Figure 4 Energy Meter Box (2015 housing shown, connections are changing for 2016)

### Formula SAE-A 2016

**High Voltage Measurement Cable (1.5 m long):** This cable comes directly out of the EM box, and is used to connect to the main battery (0V to 800V) for the purpose of high voltage measurement. The cable connection is to be made to the external voltage measurement test points that are fitted to the car, on the non-battery side of the current limiting resistors that connect these measurement points to the main battery terminals. Connect the positive measurement test point to the test point to the red cable core, and the negative measurement test point to the black cable core.



Figure 5 Battery HV Connections (2015 housing shown, terminals will be replaced with preconnected cables for 2016)

**CT Measurement Cable (1.5 m max):** This cable comes directly out of the EM box, and is used to connect the EM and the CT box together. The cable must be installed to connect between the EM and the CT boxes, and then re- terminated at the CT box end.



Fig. 6 shows a picture of this assembly.

Figure 6 EM-CT Cable Installation (2015 connector shown, connector will be a different type for 2016)

**Power Connection Cable:** This cable comes directly out of the EM box, and is to connect the low voltage power supply (9V to 36V). Connect the low voltage supply positive terminal to the red cable core, and the low voltage supply negative terminal to the black cable core, as shown in Fig. 7.





Figure 7 Auxiliary Power Supply Connections (2015 housing shown, terminals will be replaced with preconnected cables for 2016)

**USB Port:** This port is to connect flash memory for logging energy data via the cables supplied to you as shown in Fig. 8.



Figure 8 USB Port (2015 arrangement shown, USB will be changed for 2016 to smaller version, and only 100cm cable will be supplied

### Micro USB Cable

This cable is used to connect the flash memory to the EM box. The cable has a length of 1m, and plugs into the USB port on the EM box. The other end of the cable must be

## Formula SAE 2016



mounted to allow free external access to the USB by the race scrutineers. Typically it can be taped to a car frame strut, using the (supplied) foam backing to minimize vibration.



Figure 9 100cm Male Micro USB to USB Memory stick (2015 version shown, a custom interface PCB is being used for 2016 instead of the female-to-female version shown here.

If you have any questions, please do not hesitate to contact Prof. Grahame Holmes at grahame.holmes@rmit.edu.au

