**Overview**

The BMScable board mates with a Nucleo 446RE board to provide a unit for testing the battery cable for the BMS board pair (bmsbmsR and bmschgrR boards). The purpose of these notes is to capture some of the thinking about the design.

The basic scheme for testing is to measure the cell voltages with respect to the battery module ground for all 18 possible cells and check that they are in the correct sequence.

The STM32F446 only has 16 ADC inputs so two of the ADC inputs are switched between cell 15/16 and 17/18.

A FTDI header provides for monitoring on a PC with uart-usb. The CAN interface offers possibilities as well. Neither interface is isolated so the PC or CAN bus grounds would be at the battery module ground, but since the battery cable is an integral part of the battery module, i.e. the terminal lugs on the cable are bolted to the battery cells, the testing would be done before the battery module was added to the battery string.

**Cell switching**

A fet drives a 5v DPDT signal relay is to switch between cells 15, 16 and 17, 18, to ADC inputs IN14 and IN15. The use of fets was considered, but becomes complicated since the drains, if P-fets, or sources if N-fets, connect together to the same ADC resistor divider, but the sources, or drains, connect to different battery voltages. This gives rise to essentially a short circuit via the body diode of the fet that is off. To avoid this problem a diode OR could be used, but the diode drop would add error to the measurement. A P/N fet pairing would solve the problem, but the fet drive becomes complicated. Net, a relay is a simple way to multiplex two of the ADC inputs.

**RJ45 – DE-9 adaptor**

A CAN interface, dc-dc-switcher, 2x5 keyed header, and pair of RJ45 jacks were added. Spare boards could be used to adapt the DE-9 bus for the bms battery modules to the RJ45 connectors for the other nodes. This increases the board size but only adds about $4 for the minimum 5 qty board order.

**5V power**

The Nucleo board has a 1x3 header (JP5) for a jumper to select between 5v power from USB, or Vin. A 1x3 female header on this board mates with the JP5 1x3 male header on the Nucleo board, thus bringing the two 5v source selections up to this board. (This header could be avoided by using the 2x19 header pins and thus avoid the alignment issue.) This board also can supply power from the USB-UART module, i.e. from the PC via the USB, or from the dc-dc switcher driven from the CAN bus +12. These four inputs are diode-OR’ed to produce the 5v that goes back to the Nucleo board.