DC Current and Voltage Measurement

Overview

The DC current and voltage measurement board is designed for use in battery and other DC systems up to a maximum of 70V to measure DC voltage and current.
The board has two communication interfaces that are both active at all times. The first is a Modbus interface employing RS485 communication at 9600 Baud. The second is a CAN bus interface running at 250kBaud. CAN is provided via a dual RJ45 connector for simple connection to multiple devices with each port fully connected as a straight through bus.

DC Measurement Side

The DC measurement side has a 4 pin pluggable screw terminal connector on 3.81mm pitch on the edge of the board. Connections are to positive and negative battery terminals with two connections to a series resistor placed in the positive battery connection with a resistance calculated to provide approximately 75mV of drop at full scale current. Current measurement is bidirectional thus measuring charging and discharging current as positive and negative values.

Power for the onboard processor and the measurement circuitry is taken from the DC supply inputs.

Communication Side

The communication side of the module is fully isolated from the DC measurement side and power is provided by an isolated DC-DC converter. Only the communication connections are required with no external power connection necessary.

RS485 – Modbus

Connection is via 3 three pin pluggable screw terminal connector with a 3.81mm pitch on the edge of the board. The interface is fully isolated from the DC measurement section but is NOT isolated from the CAN Bus connection. Normally, only one of these communications systems would be used in an installation. Modbus communication is set at 9600Baud with 8 bits and no parity.

The device responds as a Modbus slave at an address defined by the first three jumpers on the board. The base address is defined here…

LK0	LK1	LK2	Base Address
Present	Present	Present	0x010
Omitted	Present	Present	0x014
Present	Omitted	Present	0x018
Omitted	Omitted	Present	0x01D
Present	Present	Omitted	0x020
Omitted	Present	Omitted	0x024
Present	Omitted	Omitted	0x028
Omitted	Omitted	Omitted	0x02C

There are three input registers used to obtain the current values measured by the device.

Input Register	Content
0	Volts – resolution = 10mV
1	Amps (High word) – High word of a 32 bit signed integer with a resolution of 10mA
2	Amps (Low word) – Low word of a 32 bit signed integer with a resolution of 10mA

Calibration is performed by setting the high and low voltage and current values measured in real time. These are set using the following holding registers.

Holding Register	Function
3	Low Voltage
4	High Voltage
6 & 6	Low Current
7 & 8	High Current

Writing to the appropriate register will cause the device to take the relevant measurement and assign the value provided to it. When both high and low values are set the constant and multiplier are calculated which are then used to calculate the values returned.

Calibration procedure is to apply a low voltage measured with a reference meter to the device and set register 3 to the measured value multiplied by 100 from the reference meter. Next, apply a high voltage using the same procedure but write to register 4.

For current, a similar procedure should be followed except the values written should be 32 bits written to two registers using a multiple register write command.

When the calibration values are written they are stored tot he flash memory on the STM32F072 processor on the device so they will not be lost when power is removed.

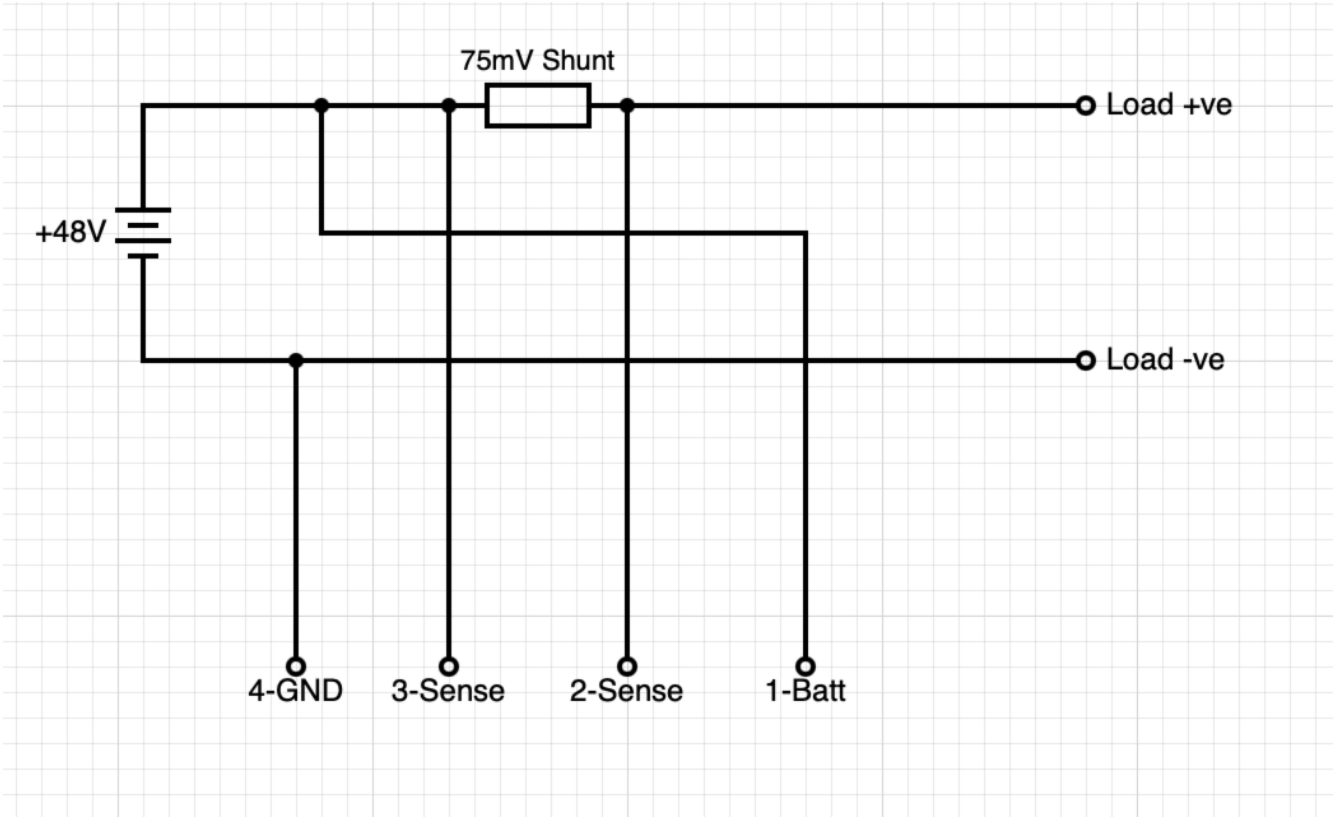
CAN Bus communication is always active running at 250kBaud. Values are transmitted as follows.

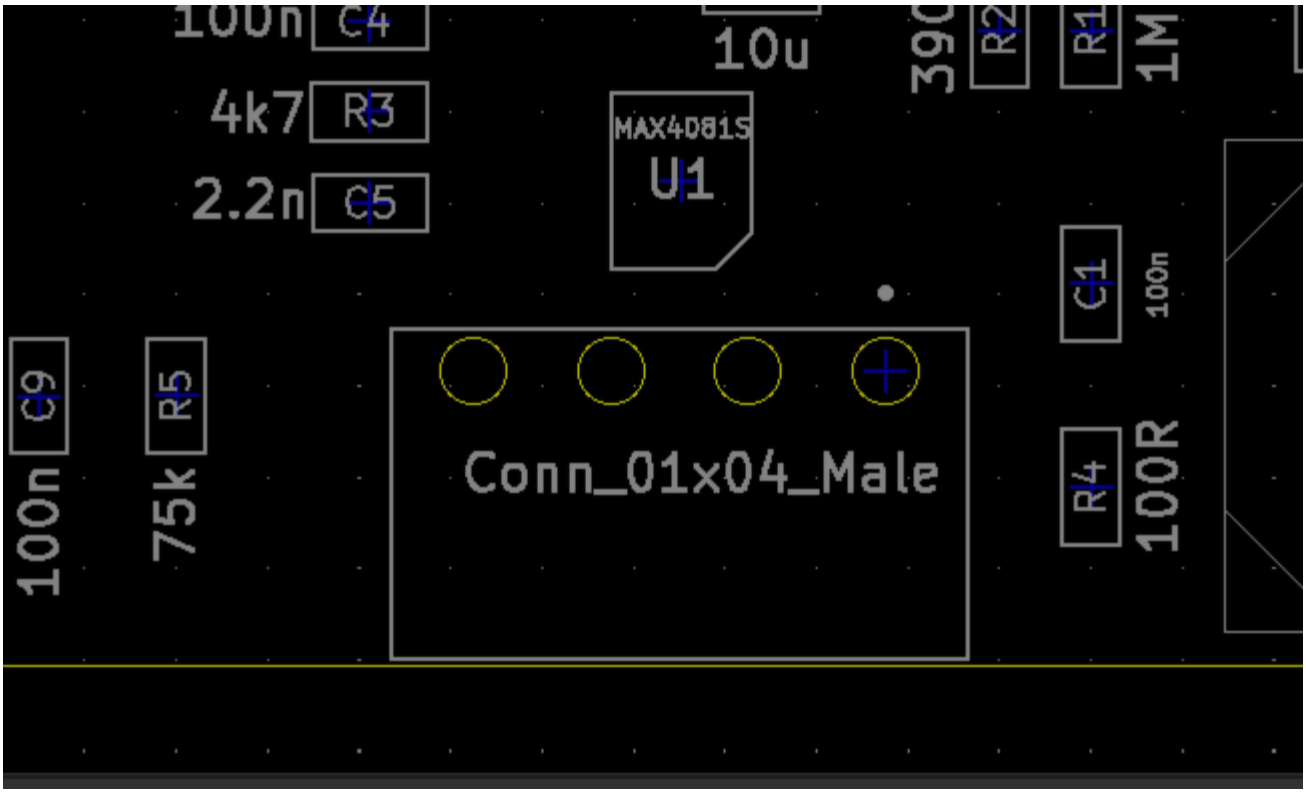
LK0	LK1	LK2	CAN ID	Value
Present	Present	Present	0x050	Voltage
Present	Present	Present	0x051	Current
Omitted	Present	Present	0x054	Voltage
Omitted	Present	Present	0x055	Current
Present	Omitted	Present	0x058	Voltage
Present	Omitted	Present	0x059	Current
Omitted	Omitted	Present	0x05D	Voltage
Omitted	Omitted	Present	0x05E	Current
Present	Present	Omitted	0x060	Voltage
Present	Present	Omitted	0x061	Current
Omitted	Present	Omitted	0x064	Voltage
Omitted	Present	Omitted	0x065	Current
Present	Omitted	Omitted	0x068	Voltage
Present	Omitted	Omitted	0x069	Current
Omitted	Omitted	Omitted	0x06C	Voltage
Omitted	Omitted	Omitted	0x06D	Current

Frame content

ID	Int32-0	Int32-1	Byte 4-7	Int32 4
0x50	Calculated Volts x 100	Raw	Unused	Unused
0x51	Calculated Amps x 100	Raw	Unused	Unused

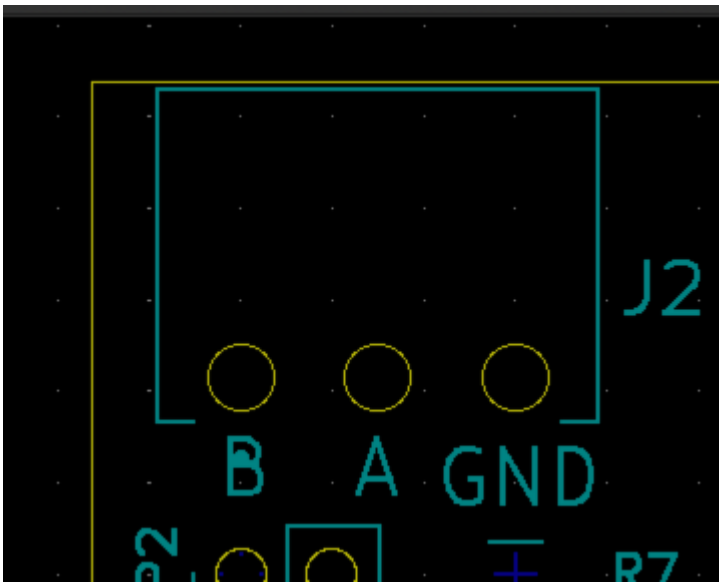
DC Input connections





RS485 Connections

Use the 3 pin pluggable screw terminal to connect to the RS485 bus.



CAN Bus Connections

CAN Bus connection is via two RJ45 connectors. The connections are identical on both connectors and all pins are connected through to allow easy chaining of devices using readily available Ethernet style patch cables.