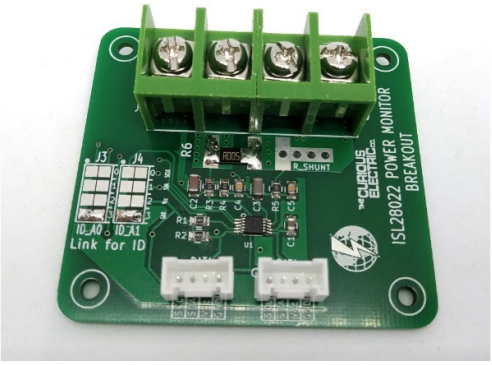
DC Power Monitor

Instructions

Date:	11/06/2021	Version:	1.0	By:	Matt Little

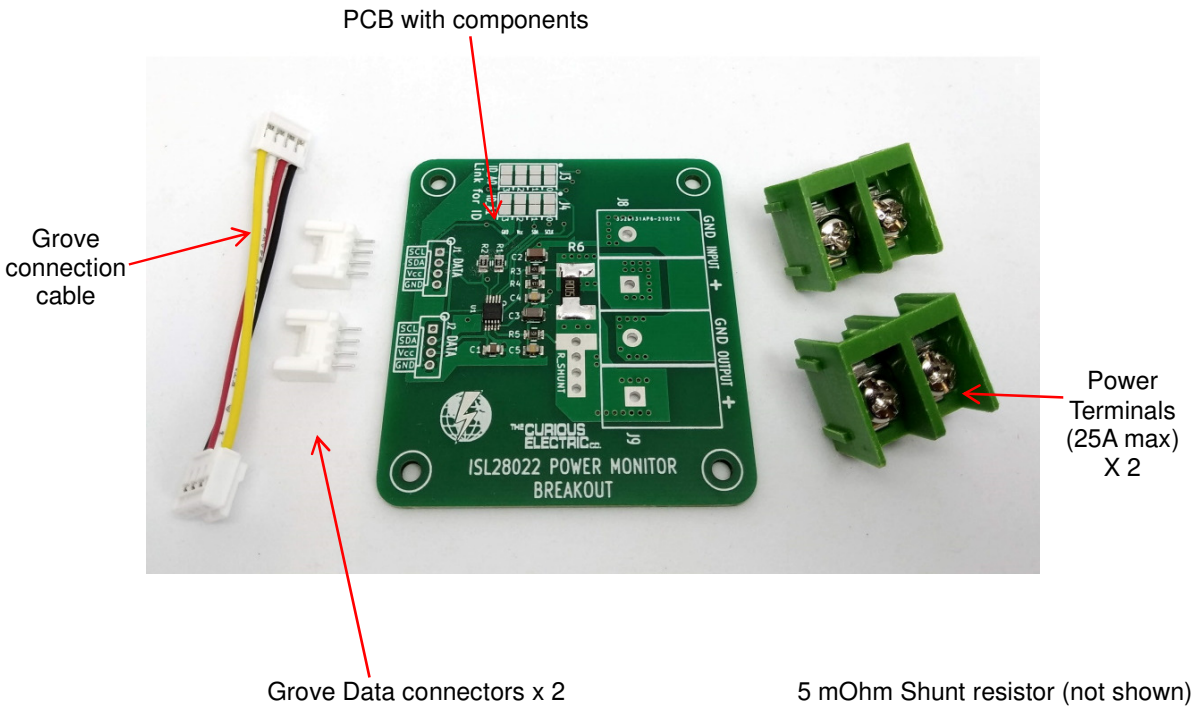


Need to measure DC voltage, current and power? We needed to for a renewable energy project and saw the ISL28022 from Renesas: https://www.renesas.com/eu/en/document/dst/isl28022-datasheet
This is a bidirectional high-side and low-side digital current sense and voltage monitor with an I2C serial interface.
It can measure up to 60V DC and current through a shunt resistor with a shunt voltage of up to 320mV. We supply a 5mOhm shunt resistor, which can measure up to 32 A. This is measured with a high-accuracy analogue to digital converter with better than 0.3%. It can have the shunt in the high or low side and can cope with negative shunt voltages.

We have put this IC on a circuit board with 25A rated screw terminals, ‘Grove’ connectors for the I2C interface. It can work with 3-5V power supply. We have added small smoothing capacitors and interface circuitry. This is surface mount & we have already added these components.

This is a reasonably simple kit which requires some soldering.
It will need wiring to a microcontroller of your choice through an I2C interface. We provide simple example Arduino Uno code.
It should take under 1 hour to build.
Not suitable for under 12 years old.

Parts included:



PCB Parts List:

Ref	Item	Quantity	Ref	Item	Quantity
C1	100nf capacitor (SMD Soldered)	1	J8, J9	Input and Output 25A terminals	2
C2	2.2uf capacitor (SMD Soldered)	1	R1, R2	4.7k (SMD Soldered)	2
C3	1uf capacitor (SMD Soldered)	1	R3, R4, R5	470R (SMD Soldered)	3
C4,C5	10nf capacitor (SMD Soldered)	2	R6	Shunt Resistor. (0.005 Ohm supplied).	1
J1, J2	DATA - Grove connector 4 way	2	U1	ISL28022 Power Monitor (SMD Soldered)	1
	PCB	1			

Tools required:

Soldering Iron

Solder

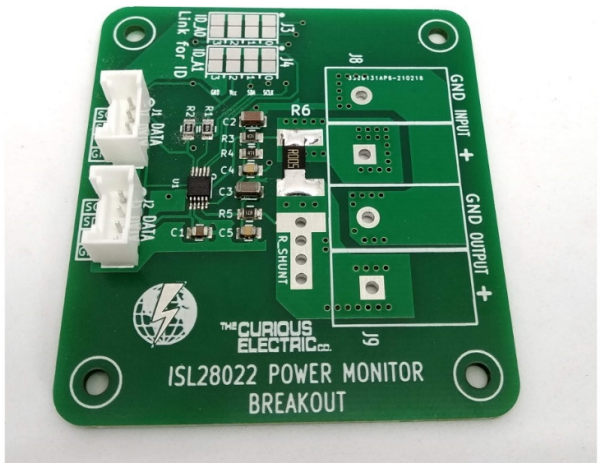
Side cutters

Scissors
(not shown)

Long-nosed Pliers

Posi-drive Screwdriver

Instructions:

Step: 1	Solder ‘Grove’ data connectors
	There are two 4-way ‘Grove’ connectors. This is a standard connector supplied by Seeed Studio (https://wiki.seeedstudio.com/Grove_System/) with lots of compatible boards. Place them into the 4-way holes in the PCB. Ensure that the silk-screen showing the notch is followed with the white connector. There is a small clip on the plug which needs to align with the notch on the socket.

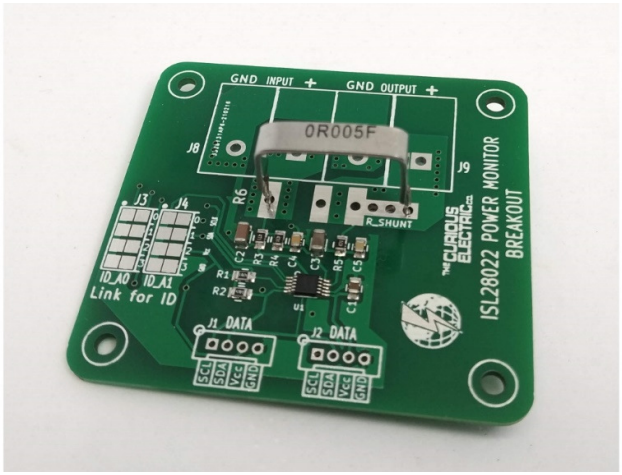
Step: 2	Solder shunt resistor

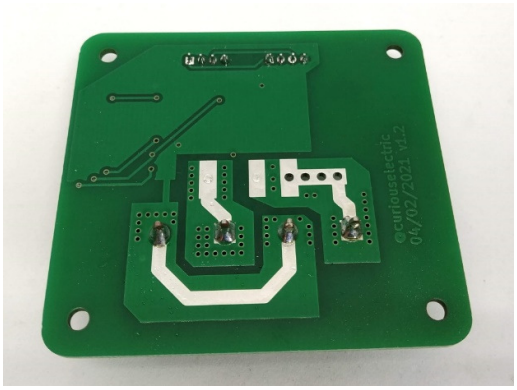
We provide a 5 milli-Ohm shunt resistor which is rated for 5W. This needs to be soldered into the universal shunt pads, as shown here.

You can fit other resistors here, but you may need to change the example code.

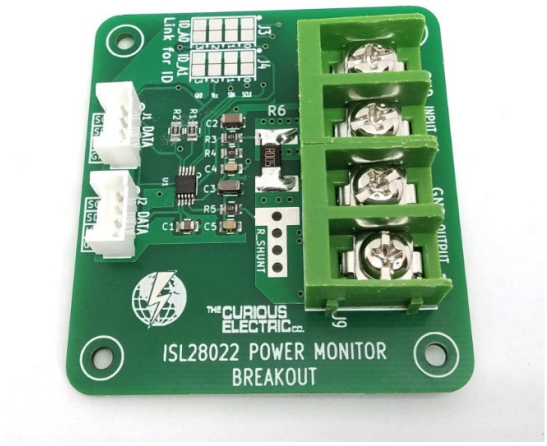
If you are going to use high currents (>10 A for extended periods), then you can add solder to the tracks to increase the current carrying capacity.

Note: It is not recommended to use this board for more than 25 A for any length of time.





Step: 3	Solder power terminals



There are two 2-way screw terminal connectors for the power connections. These are rated to 25 A DC.
They clip together with a small slot. They then fit through the holes.

These can then be soldered. They may require quite a lot of solder and a powerful soldering iron, as they are large connectors.

If you are going to run the unit at higher currents (over 10A for a length of time) then you can solder additional solder onto the bare tracks on the underside of the PCB. This increases the amount of current carrying conductor and hence increase the current rating.

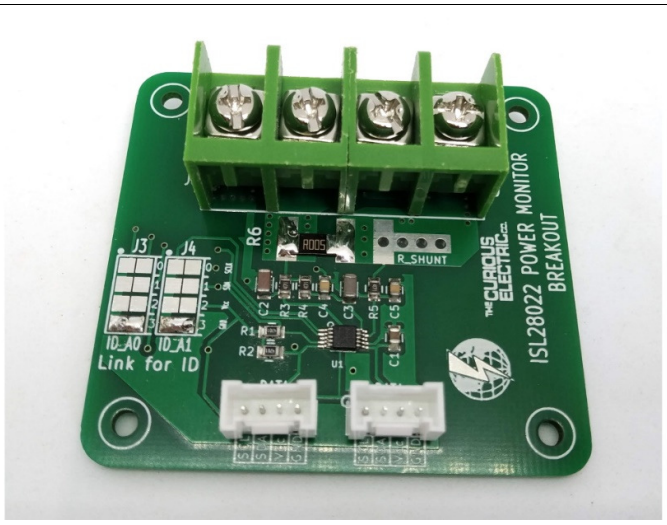
Step: 4	Solder ID connections

Each IC can have a different I2C address. This is enabled by connecting A0 and A1 to: GND, Vcc, SDA or SCL. This gives a total of 16 different addresses. These are given in the IC data sheet.

This is done by using a solder ‘blob’ to join two pads.
The connections to make depend upon the number of sensors you would like to attach. Typically one sensor is attached ,so you just need to connect A0 to GND and A1 to GND, as per the code example:

A0	**A1**	**Address**
GND	GND	1000 000
VCC	GND	1000 001
SDA	GND	1000 010
SCL	GND	1000 011

There are more options than this, so check the data sheet for more information.



Step: 5	PCB is finished!

Have a nice cup of tea!

You are now ready to try it out!

Communication Instructions:

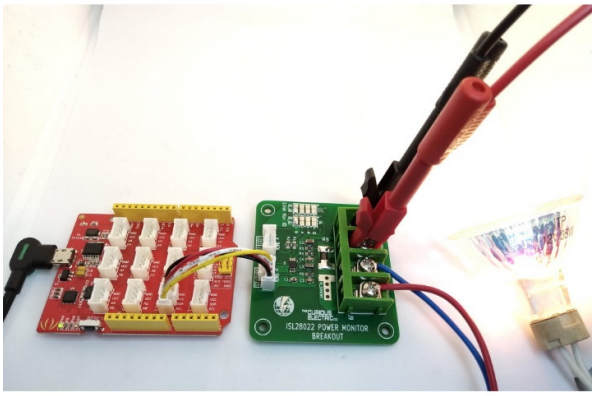
Step: 6	Connect to your microcontroller of choice!

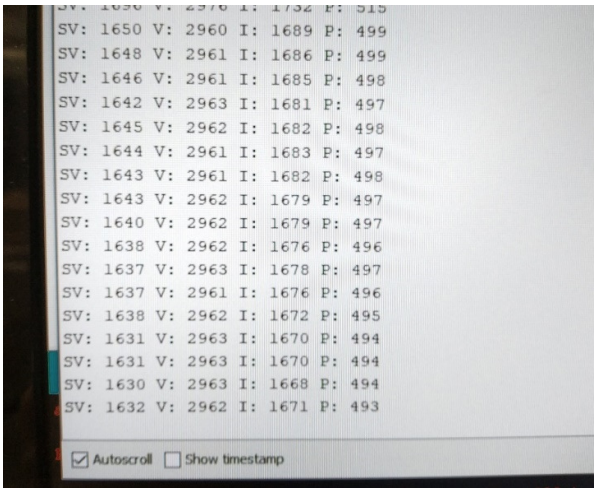
If you have a Grove board with an I2C connection, then please use the short connector wire to link the sensor with an I2C connection. The photo here shows testing with a “Seeeduino Lotus” board.

Otherwise, you will need to make connections between GND, Vcc (which can be 3V3 or 5V) and then to the data (SDA) and clock (SCL) lines of your microcontroller.

Upload the example code (this was tested with an Arduino Uno & Seeduino Lotus & Arduino Nano 33 IoT).

You should see some serial data (at 9600 baud rate) showing the Shunt Voltage (mV), Voltage (V), Current (A) and Power (W).





Testing & Fault Finding

These units have been tested in our lab, so hopefully no issues for you!

You want to try the simple example code and check that the readings look correct for the voltage and load you apply.

Any issues at all then try the following:

- Check soldering.
- Check power connections.
- Check I2C connections.
- Check microcontroller code updated correctly.

Source Code and Design Files

These can be found, along with these instructions, in the repository here:

https://github.com/curiouselectric/ISL28022_breakout

Contact details:

This kit has been designed and produced by:

The Curious Electric Company
hello@curiouselectric.co.uk
www.curiouselectric.co.uk
Unit 23, Block D, Hartley Business Centre, Haydn Road, Nottingham, NG5 1DG, UK

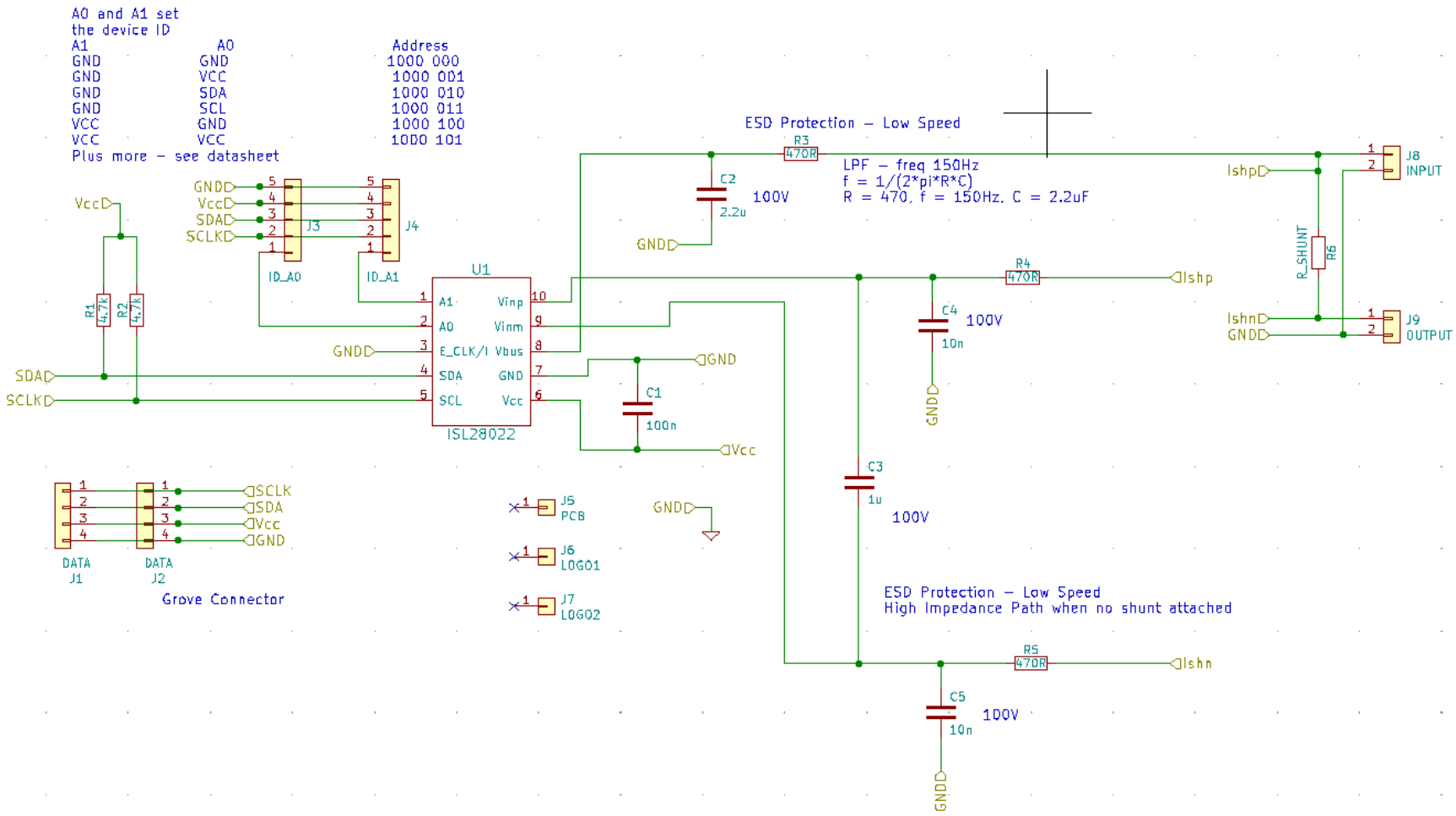
We would like you to be happy with this kit. If you are not happy for any reason, then please contact us and we will help to sort it out.

Please email **hello@curiouselectric.co.uk** with any questions or comments.
Please tweet us at **@curiouselectric**

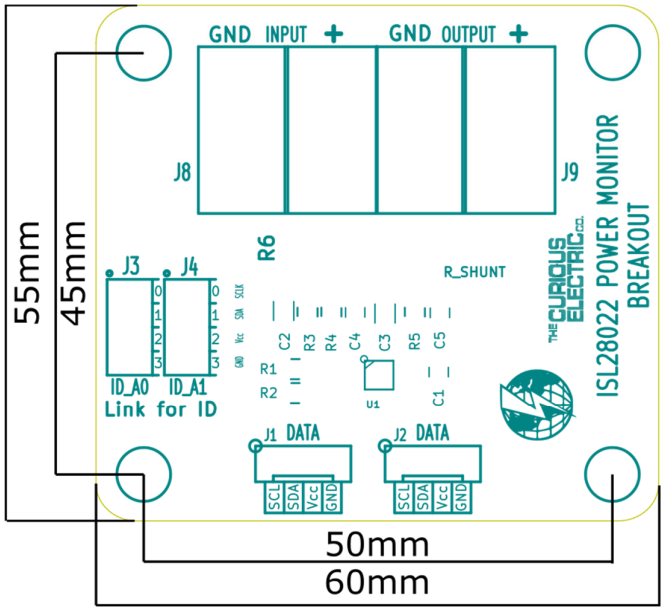
If any parts are missing from your kit then please email **hello@curiouselectric.co.uk** with details, including where the kit was purchased.

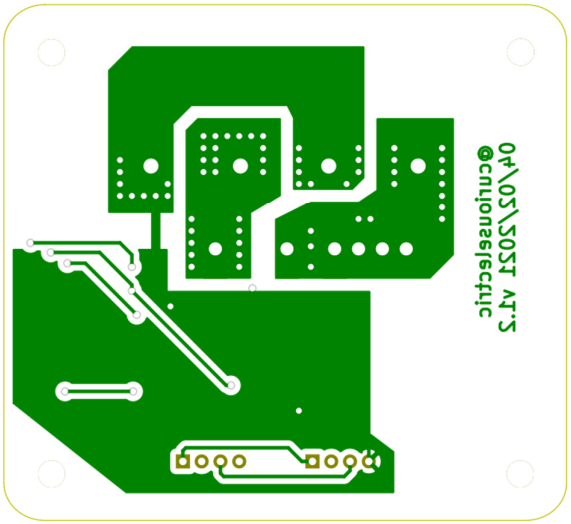
More information can be found via **www.curiouselectric.co.uk**

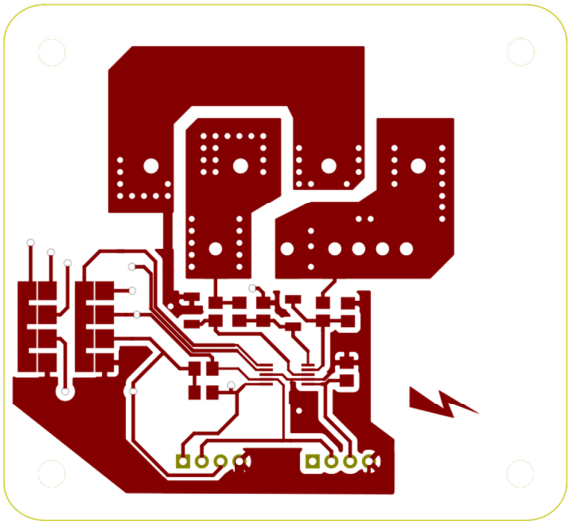
Circuit Schematic:



PCB:







M3 Holes

(Not to scale)