EmStat3-MUX16 for OEM

Connecting a MUX16 board to an EmStat3

PalmSens
Compact Electrochemical Interfaces

Last revision: May 27, 2015

© 2015 PalmSens BV
www.palmsens.com

Contents

Important before you start unpacking

Please read this quick start guide carefully before unpacking the boards from their antistatic bags or using the kit, as it contains important information on how to avoid damage to the PCB's.

> The EmStat and MUX boards can be damaged by static electricity (electrostatic discharge or ESD). Please take adequate precautions against static discharge during handling.

1 EmStat3 PCB

The EmStat-series are potentiostats with an embedded microcontroller. They provide all the major potentiostatic techniques with automatic current ranging and peripheral control.

> See document "EmStat3 for OEM.pdf" for more information about interfacing with the EmStat3 board.

2 Connecting EmStat board to MUX16 multiplexer
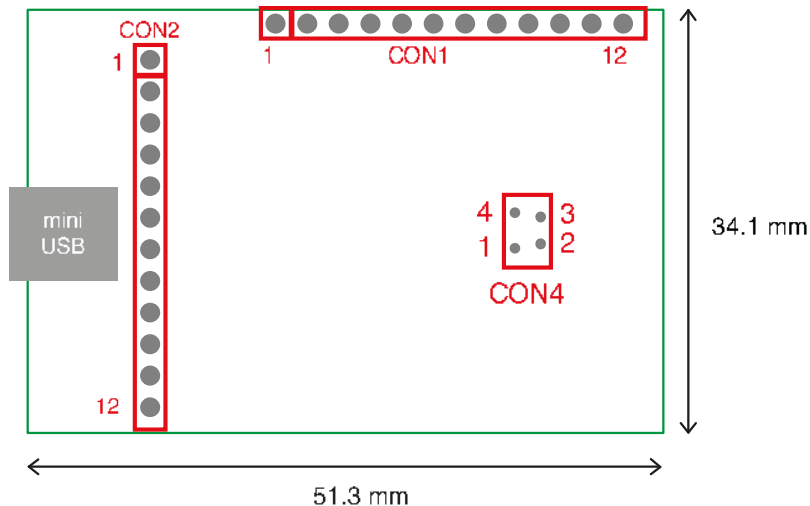
EmStat3 PCB layout

The board has two pin headers: CON1 and CON2
CON1 is used to connect for instance the MUX multiplexer or any other peripheral.
CON2 is used when serial TTL communications is used and provides an external analog input and analog output line, with a range of 0 - 4.095 V and a digital input line.

2.1 CON1 description

Pin | Function
1 | Output line 3 reserved for Mux16 or digital input line 0
2 | Output line 2 reserved for Mux16/8
3 | Output line 1 reserved for Mux16/8 and switch box
4 | Output line 0 reserved for Mux16/8 and switch box and stirrer: 0 -off 1 - on
5 | Output: 5 V digital (max. 30 mA when powered from USB), or input (if not powered from USB): 5 V power supply (100 mA min.),
6 | GND
7 | 5 V analog (max.20 mA when powered from USB)
8 | –5 V analog (max. 10 mA)
9 | AGND
10 | WE
11 | RE
12 | CE

2.2 CON2 description

Pin | Function
1 | Tx (serial port)
2 | Rx (serial port)
3 | Reserved (DO NOT CONNECT)
4 | Voltage reference (4.096 V)
5 | Reserved
6 | GND
7 | Reset (active high)
8 | Download (active low)
9 | ADC ch.2 (range 0 – 4.095 V)
10 | DAC ch.1 (range 0 – 4.095 V)
11 | GND
12 | 5 V output if powered via USB

2.3 Pinout of sensor connector (CON4):
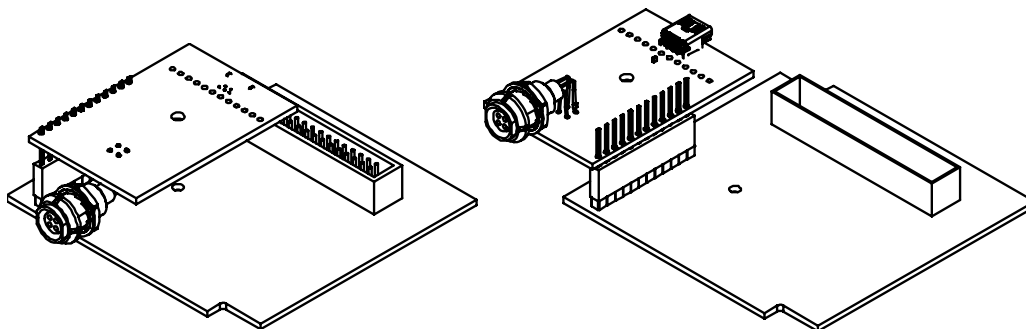
```
1 ●    ● 4
2 ●    ● 3
```
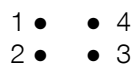
1. RE: blue connector or reference electrode
2. CE: black connector or counter electrode
3. Not connected
4. WE: red connector is working electrode

IMPORTANT:
The shield of the cable must make contact with the metal case of the sensors connector.

2.4 CON1 to MUX16

EmStat is to be connected to the MUX board using CON1. This can be done in two ways:
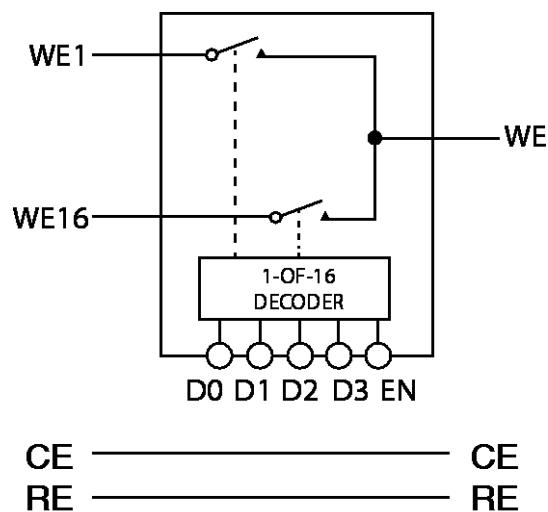

Two ways of connecting the EmStat PCB to the MUX16 PCB

3 MUX16 PCB

The MUX16 multiplexer is used with 2 electrode sensors or cells with up to 16 channels. It can have a shared counter and reference electrode, or each working electrode with each its own combined reference/counter electrode.

3.1.1 Functional diagram

3.2 Set standby potential with the Vaux pin

The Vaux pin can be used to set a standby potential on all unselected channels.
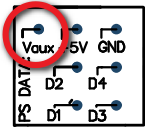

Make sure the following jumpers are placed:
-    J3 to agnd: NOT PLACED
-   J4 to standby potential: PLACED

When using **Conf 1** and CE and RE are multiplexed (J4 and J5 are placed), the Vaux will not be applied on the unselected channels since only the selected channel's WE, CE and RE are polarized.

The Vaux pin can be connected to CON2 – pin 10 (DAC) of the EmStat to control the standby potential. In PSTrace the DAC pin can be set in the Analog Out window in the Manual Control tab:
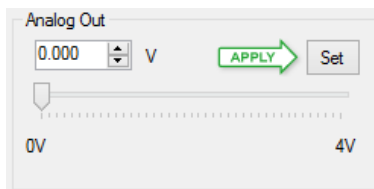
Also the 'SetAnalog' command can be used in the Scripting window.

3.3 MUX16 configurations
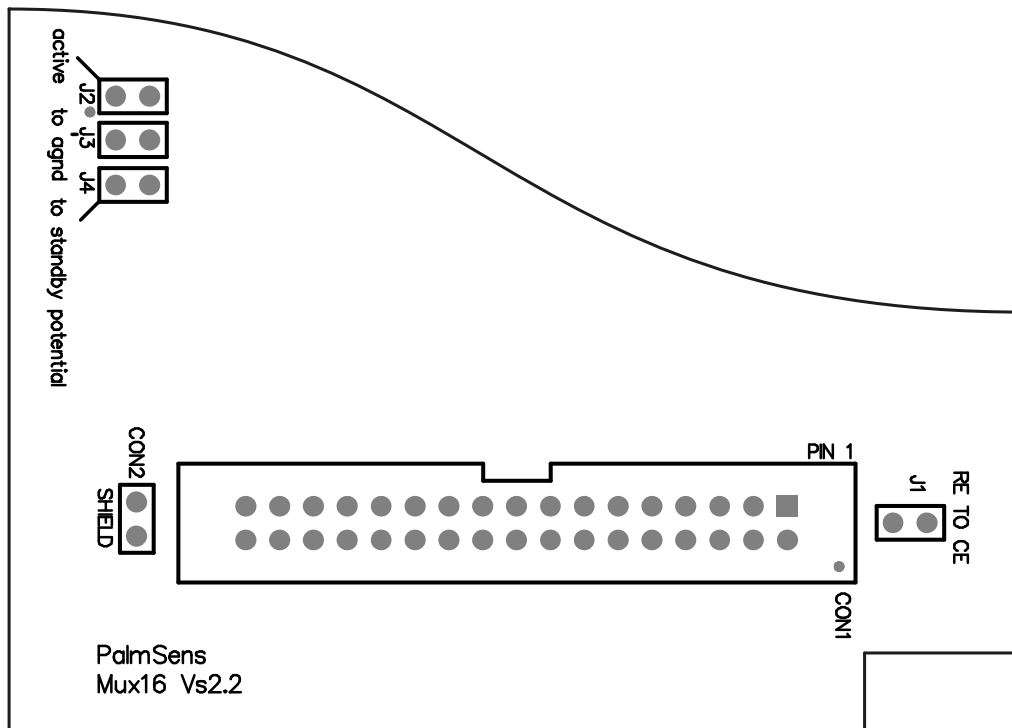
Possible sensor configurations are:
1. Sensor arrays with up to 16 working and 16 combined reference/counter electrodes
2. Sensor arrays with up to 16 working electrodes all sharing a reference and a counter electrode
3. Sensor arrays with up to 16 working electrodes sharing a combined reference/counter electrode

In these configurations the sensors or electrodes can be multiplexed, leaving the not-selected sensors at open circuit when jumper J3 in not placed.
J3 is placed when the potential has to be applied to all working electrodes simultaneously

Jumpers:
J1: RE to CE
        Connects the CE and RE leads when placed. Place J1 when only a combined CE and RE is applied. An alternative is to leave J1 open and always connect both the CE and RE leads to your RE/CE electrode
J2: active
        Jumper is always placed.
J3: (unselected WE) to AGND
        Keeps all WE's at applied potential when placed. If not placed only the selected WE has an applied potential leaving not-selected WE's at open circuit.
J4: (unselected WE) to standby potential
        See section 3.3

Jumper settings for the available configurations:

    Conf. 1: Sensor array with up to 16 working and 16 combined reference/counter electrodes:
- Jumpers to be placed: J1 and J2
  When J3 is also placed, the potential is applied to all working electrodes continuously.
  Use pin 1, 3, 5 …. to 31 to connect all combined RE/CE electrodes.

Conf. 2: Sensor array with up to 16 working electrodes all sharing one reference and one counter electrode:
- Jumper to be placed: J2
  When J3 is also placed, the potential is applied to all working electrodes continuously.
  Use pin 1, 5, 9, 13, 17, 21, 25 or 29 to connect RE
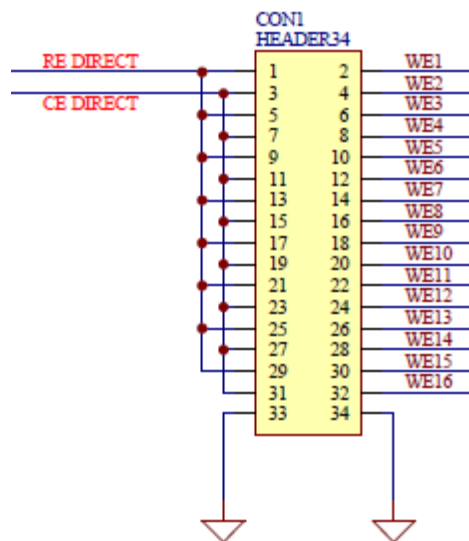 Use pin 3, 7,11, 15,18, 23, 27 or 31 to connect CE

Conf. 3: Sensor array with up to 16 working electrodes all sharing one combined reference/counter
electrode:
- Jumpers placed are: J1 and J2
  When J3 is also placed, the potential is applied to all working electrodes continuously.
  Use pin 1, 3, 5….. to 31 to connect RE/CE

*IMPORTANT REMARKS

It is not possible to apply a potential simultaneously to more than one sensor or cell each with three electrodes. This requires a multipotentiostat, one potentiostat for each channel. This is however possible with two electrode sensors or cells, so when combined counter and reference electrodes are applied. The sensor configuration with 16 WE's all having their own reference and separate counter electrode is NOT applicable with the MUX16 multiplexer.

3.4 Electrodes connections

3.5 Specifications

| Number of channels	2-16
Multiplexer use:	• Sensor arrays with up to 16 working electrodes all sharing the same counter and same reference electrode
	• Sensor arrays with up to 16 eight working and the same combined reference/counter electrode
	• Sensor arrays with up to 16 working electrodes, each with its own combined reference/counter electrode
On resistance	WE channels: 2 ohm typical (see note)
Leakage current	10 pA typical at 25 °C (see note)
Charge injection	20 pC typical (see note)
Connections:	Shielded flat cable, with stripped end leads or by means of the MUX16 Terminal Block (in shielded housing)
	• 16 WE's
	• CE
	• RE
	• RE and CE can be connected together and in this case connected to up to 16 combined CE/RE electrode
	• analog ground for shielding
Dimensions of PCB	76 x 74 mm

Note: for very low current applications, the PCB can be populated with components with lower leakage (10 pA typical) and lower charge injection (1 pC) properties. These components can be used for measurements with currents always below approx. 100 uA.
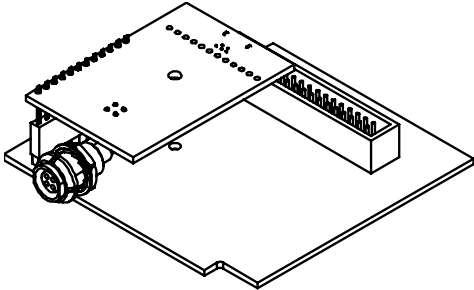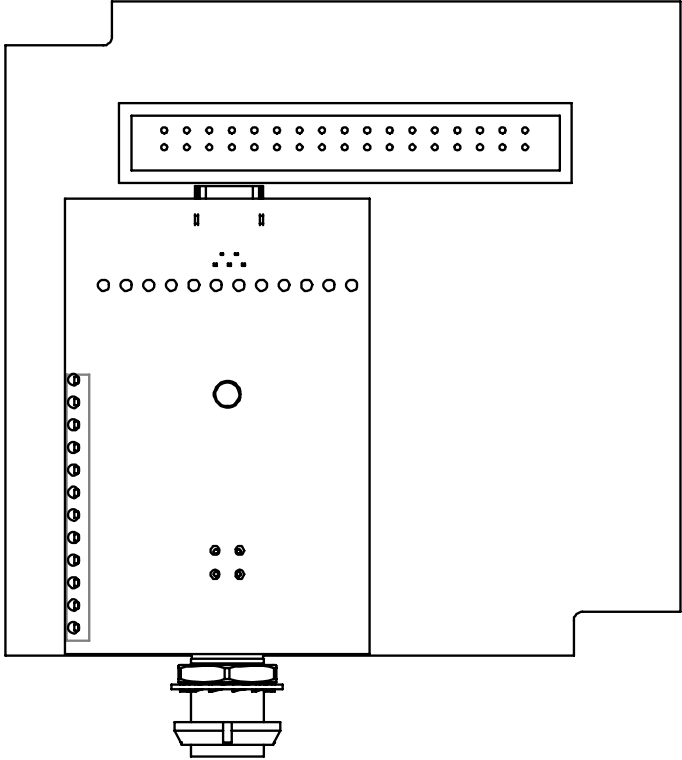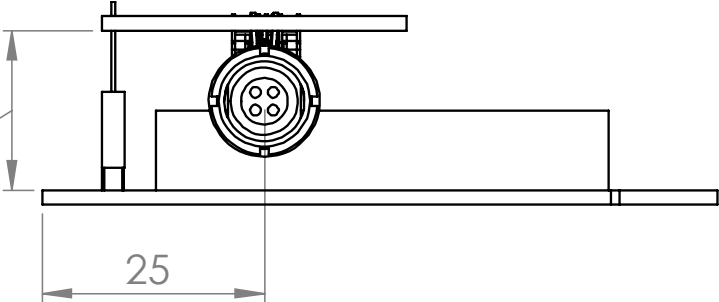
4 PCB dimensions

4.1 MUX16 PCB
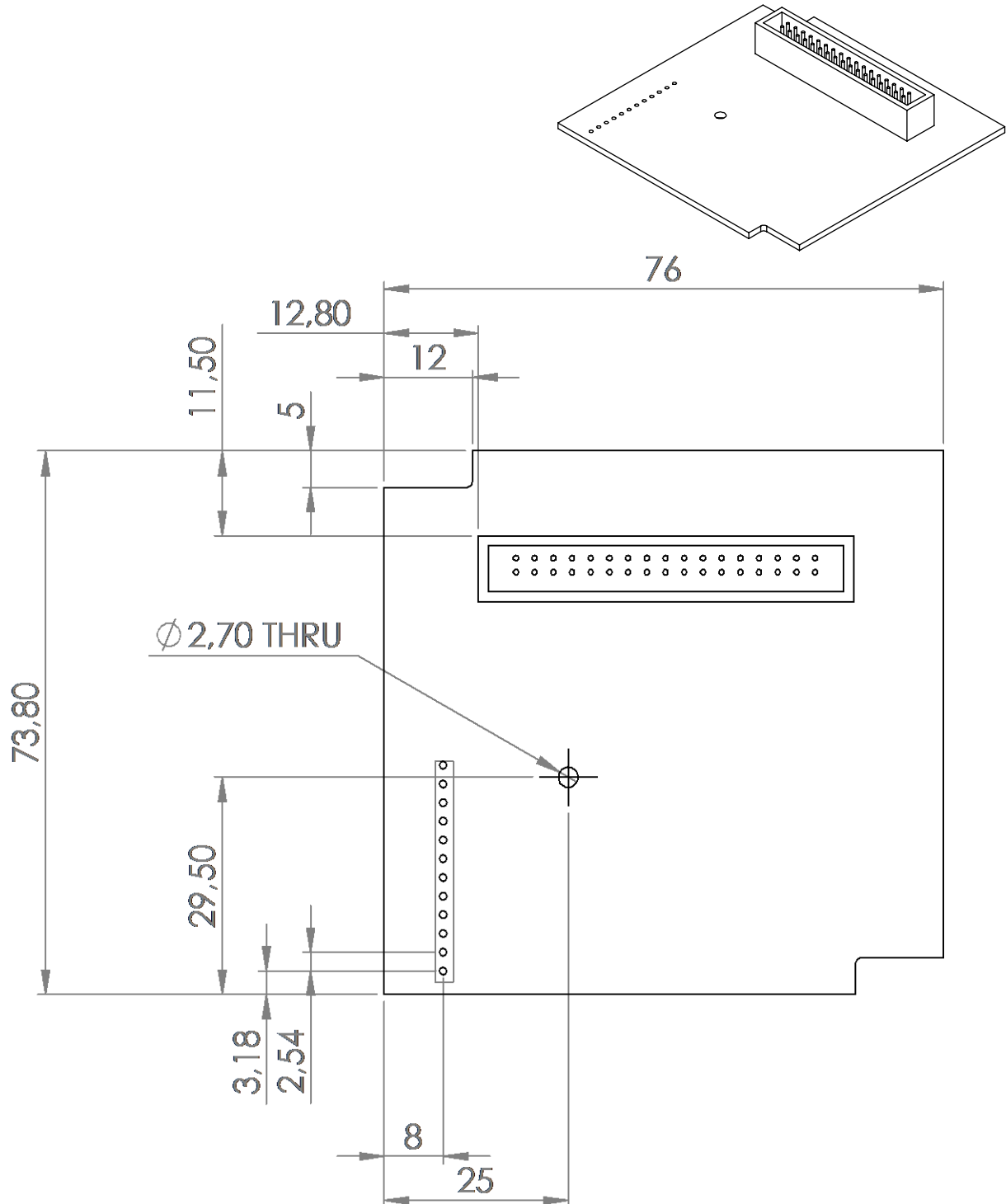
4.2 EmStat[3] PCB
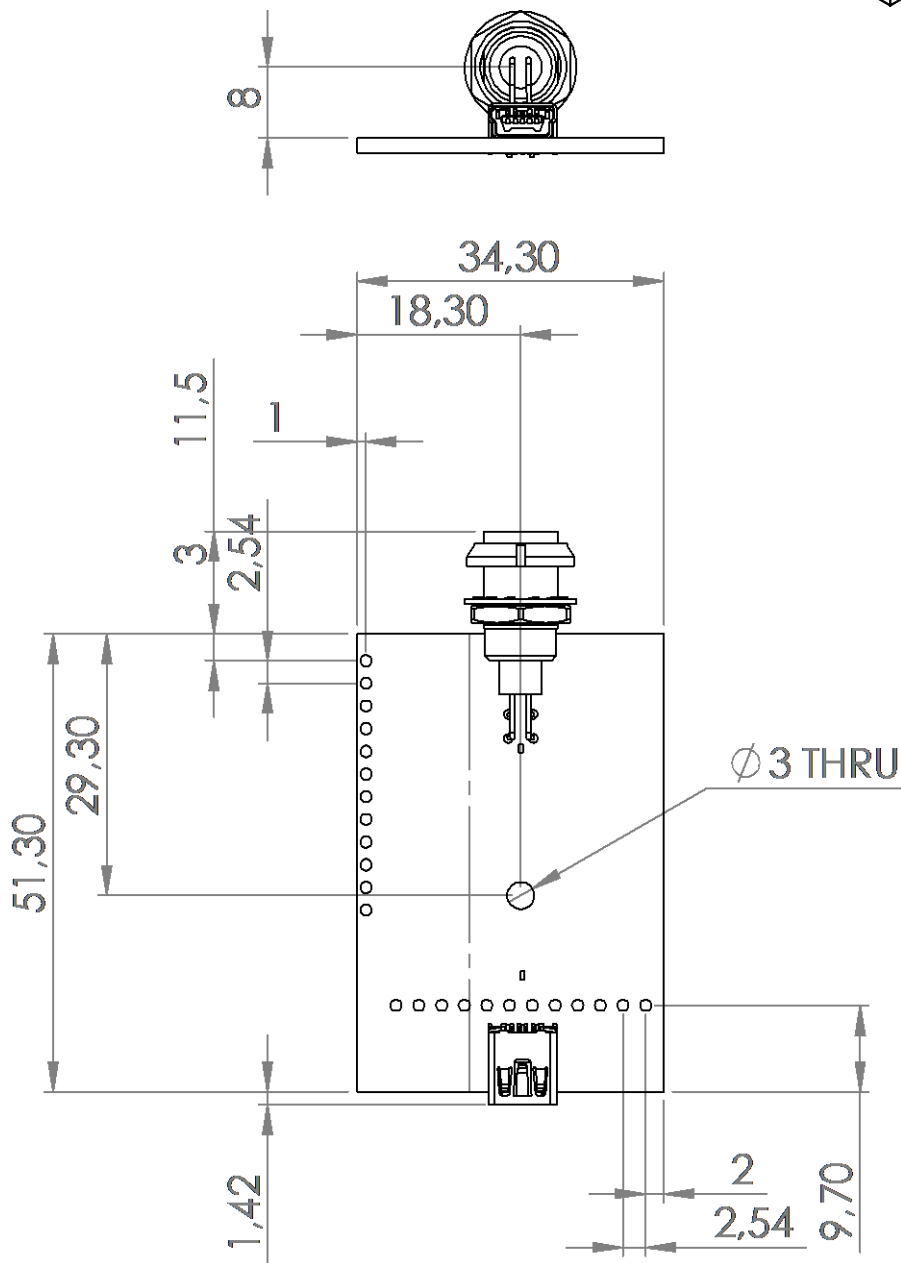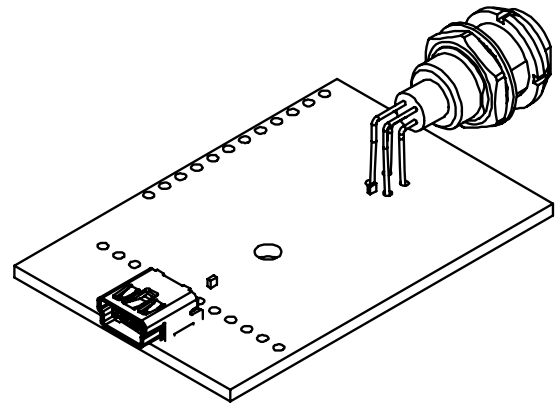
4.3 PCB's connected – option 1

variable
(>18 if mini USB is used)

25

4.4 PCB's connected – option 2

variable

16

101,30