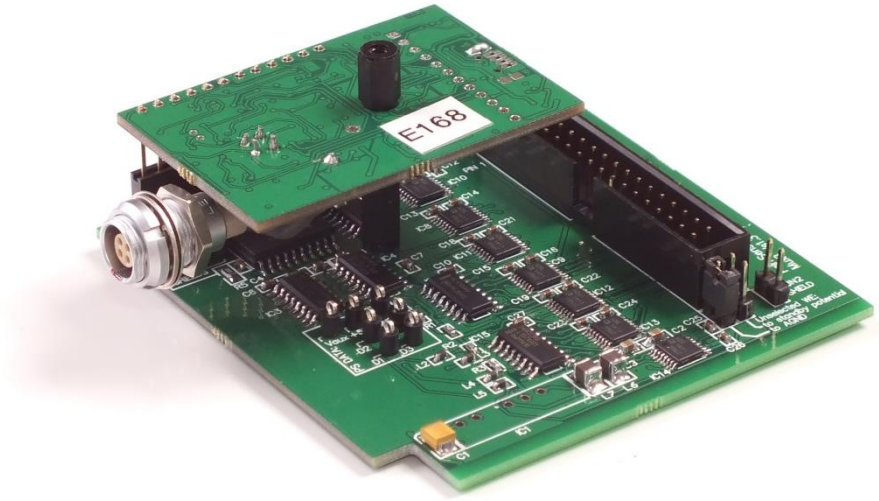
EmStat3-MUX8 for OEM

Connecting a MUX8 board to an EmStat3



PalmSens
Compact Electrochemical Interfaces

Last revision: May 27, 2015

© 2015 PalmSens BV
www.palmsens.com

Contents

1 EmStat3 PCB 3
2 Connecting EmStat board to MUX8 multiplexer 3
2.1 CON1 description 4
2.2 CON2 description 4
2.3 Pinout of sensor connector (CON4): 4
2.4 CON1 to MUX8 5
3 MUX8 PCB 5
3.1 Functional diagram 5
3.2 Set standby potential with the Vaux pin 6
3.3 MUX8 configurations 7
3.4 Electrode connections 9
3.5 Specifications 9
4 PCB dimensions 10
4.1 MUX8 PCB 10
4.2 EmStat^3 PCB 11
4.3 PCB's connected – option 1 12
4.4 PCB's connected – option 2 13

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.

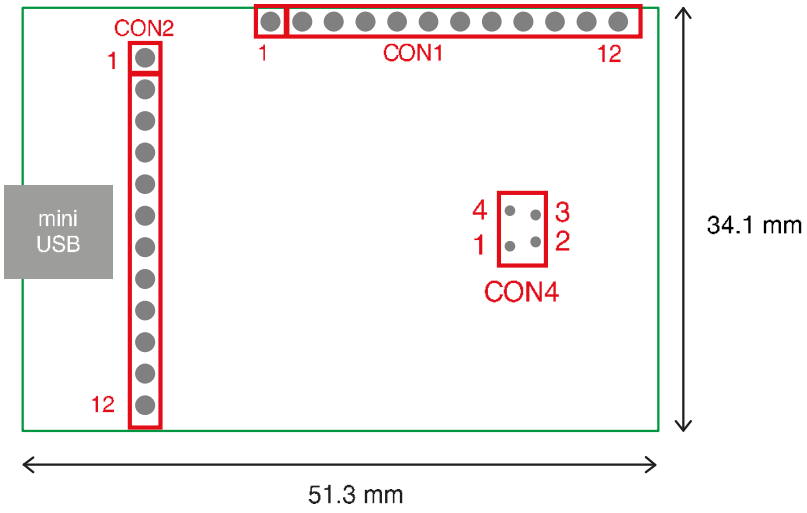
The EmStat and MUX boards can be damaged by static electricity (electrostatic discharge or ESD). Please take adequate precautions against static discharge during handling.

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 MUX8 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.

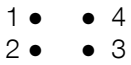
2.1 CON1 description

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):

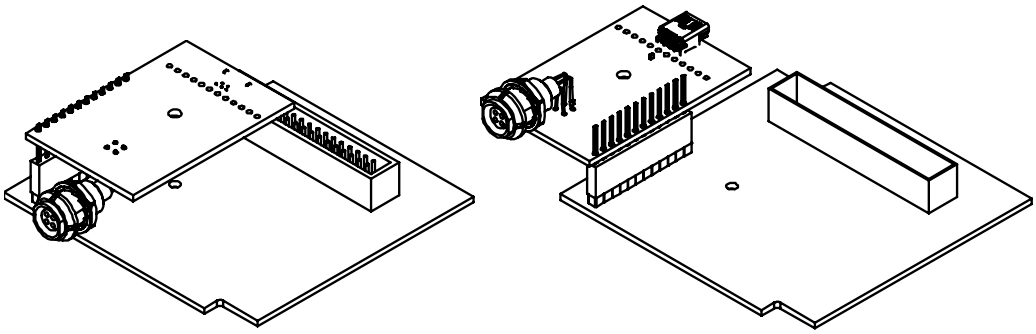


1. RE: blue connector or reference electrode
2. CE: black connector or counter electrode
3. Not connected
4. WE: red connector is working electrode

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

2.4 CON1 to MUX8

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

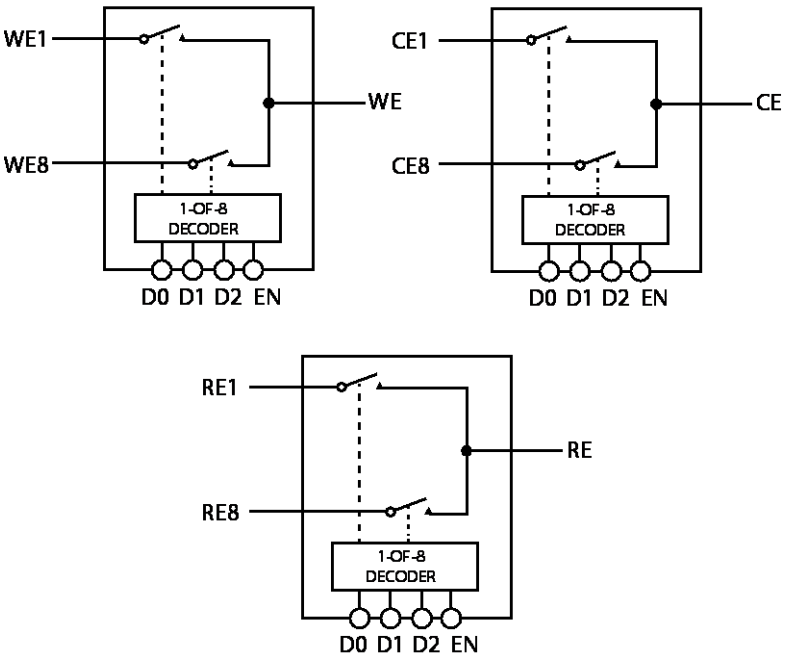


Two ways of connecting the EmStat PCB to the MUX8 PCB

3 MUX8 PCB

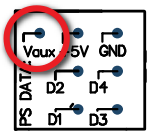
The MUX8 multiplexer is meant for use with 2- or 3- electrode sensors or cells up to 8 channels.

3.1 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.

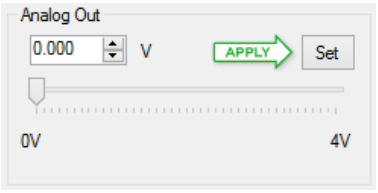


Make sure the following jumpers are placed:

- Unselected WE to AGND: NOT PLACED
- Unselected WE 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.

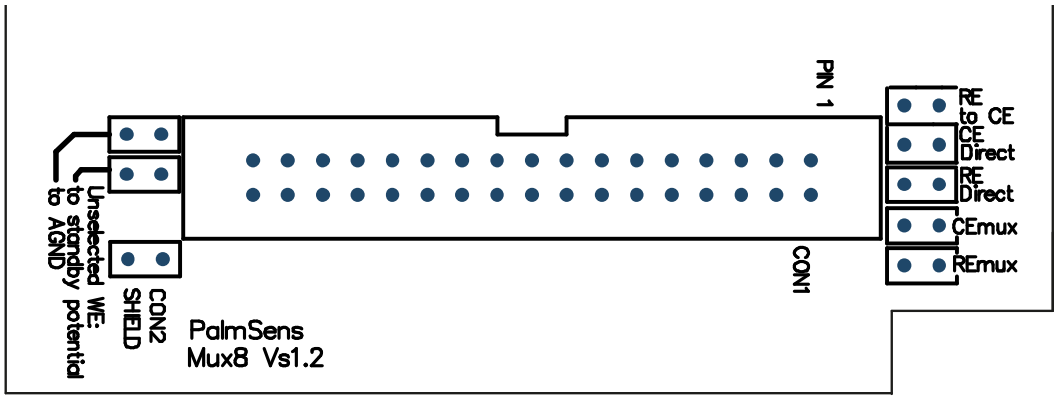
The Vaux pin can be connected to CON2 – pin 10 (DAC) of the EmStat to control the standby potential. In PSTrace the DAC pin can be set in the Analog Out window in the Manual Control tab:



Also the 'SetAnalog' command can be used in the Scripting window.

3.3 MUX8 configurations

The multiplexer can be used in different configurations or modes. Each configuration is set by a number of jumpers which are located on the board as shown in the illustration of the board layout below.



Possible sensor configurations are:

- Sensor arrays with (up to) eight working, reference and counter electrodes
- Sensor arrays with eight working and eight combined reference/counter electrodes
- Sensor arrays with eight working electrodes sharing a reference and a counter electrode
- Sensor arrays with eight working electrodes sharing a combined reference/counter electrode

In all configurations the sensors can be multiplexed, leaving the not-selected sensors or cells at open circuit.
Sensor configurations 2, 3 and 4 have the possibility to leave not-selected sensors or cells at open circuit or to apply the same potential to all sensors or cells.

Jumpers:

J1: RE to CE
: Is placed when the sensor has a combined reference and counter electrode. This jumper therefore connects RE to CE.

J2: CE Direct
: If the sensor array has more than one working electrode, but one counter and/or reference electrode, this jumper is placed. CE from PalmSens is connected directly to pin 1 and pin 2 of CON1

J3: RE Direct
: If the sensor array has more than one working electrode, but one counter and/or reference, this jumper is placed. RE from PalmSens is connected directly to pin 13 and 14 of CON1

J4: CE MUX
: This jumper is placed if CE has to be multiplexed. This is the case when each of the sensors has its own counter electrode using pin3 to 10.

J5: RE MUX
: This jumper is placed if RE has to be multiplexed. This is the case when each of the sensors has its own reference electrode using pin 15 to 22

J6: Unselected WE to AGND:
: If placed, all unselected working electrodes or sensors will remain polarized at the potential set by the PalmSens or EmStat. If this jumper is not placed only the selected channel is polarized leaving the not-selected WE's at open circuit.
When using Conf 1 and CE and RE are multiplexed (J4 and J5 are placed), this jumper is not relevant since only the selected channel's WE, CE and RE are polarized.

J7: Unselected WE to standby potential
: See section 3.3

Jumper settings for the available configurations:

Conf. 1: Sensor array with up to eight working, eight reference and eight counter electrodes:

- Jumpers to be placed are: J4 and J5

The potential is only applied to the selected channel. All channels NOT selected are at open circuit. (See remark below *)

Conf. 2a: Is suitable for working with a sensor array which has up to eight individual electrochemical cells consisting of up to eight working and eight combined reference/counter electrodes:

- Jumpers to be placed are: J1, J4 and J5

Note: all leads CE1-8 and RE1-8 are connected together and this combined lead is connected to all eight combined reference/ counter electrodes.
The potential is only applied to the selected channel. All channels NOT selected are at open circuit. (See remark below *).

When J6 is also placed, the potential is applied to all working electrodes continuously.

Conf. 2b: Sensor array with up to eight working and eight combined reference/counter electrodes:

- Jumpers placed are: J1, J2 and J3

Note: the combined reference/counter electrodes are connected to the leads CE Direct and/or RE Direct

When J6 is also placed, the potential is applied to all working electrodes continuously.

Conf. 3: Sensor array with up to eight working electrodes all sharing one reference and one counter electrode:

- Jumpers placed are: J2 and J3

Note: the reference and counter electrodes are connected to RE Direct and CE Direct respectively.

When J6 is also placed, the potential is applied to all working electrodes continuously.

Conf. 4: Sensor array with up to eight working electrodes all sharing one combined reference/counter electrode:

- Jumpers placed are: J1, J2 and J3

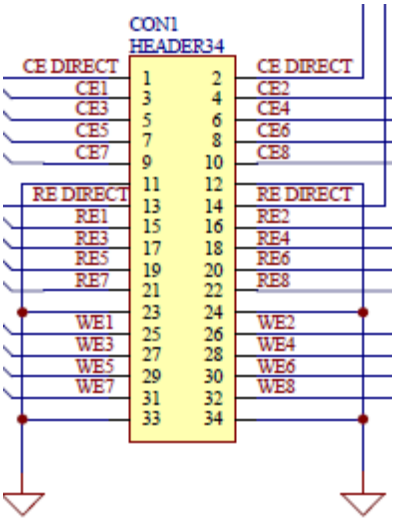
Note: the reference/counter electrode is connected to RE Direct and/or CE Direct.

When J6 is also placed, the potential is applied to all working electrodes continuously.

* IMPORTANT REMARK

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.

3.4 Electrode connections

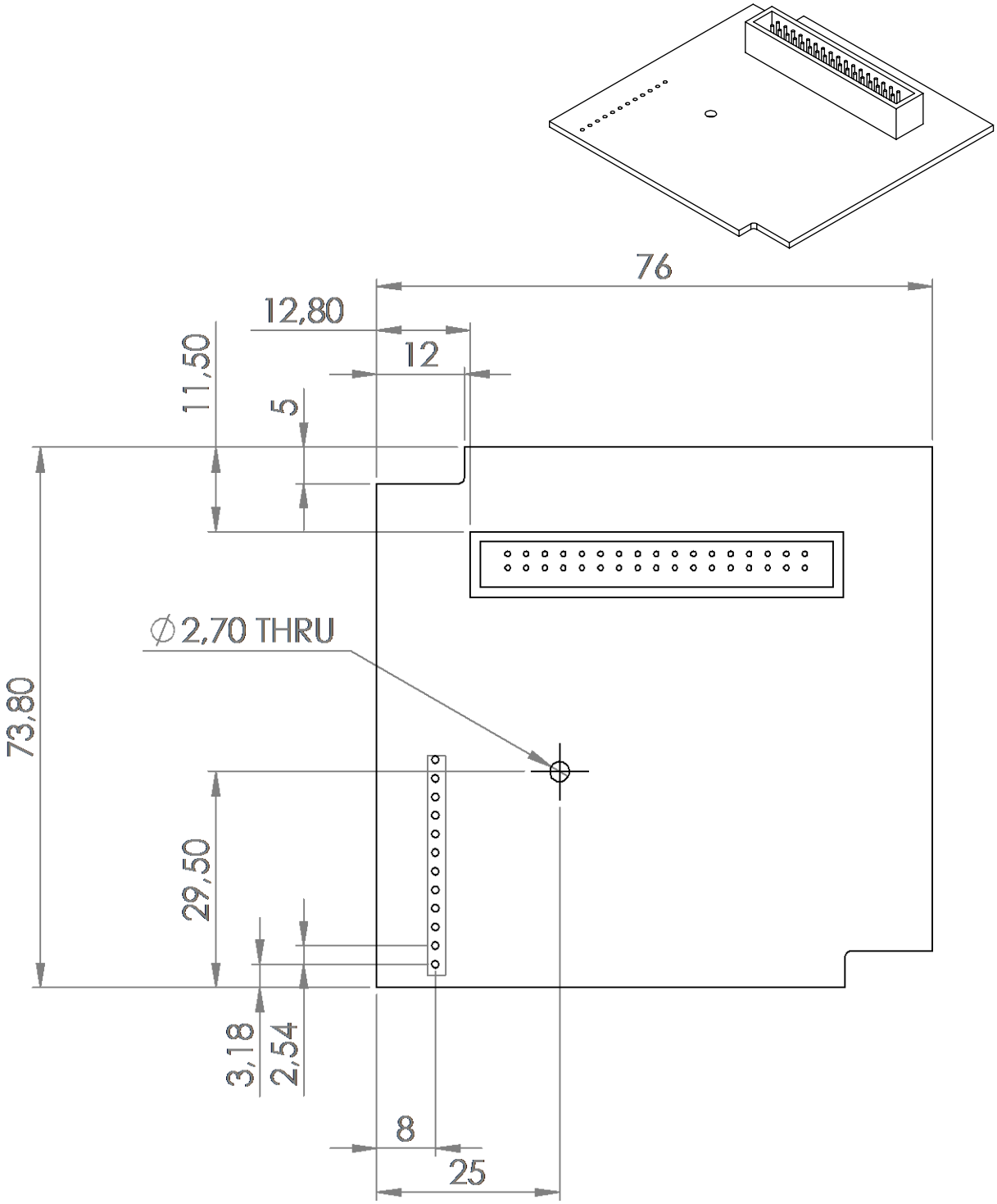


3.5 Specifications

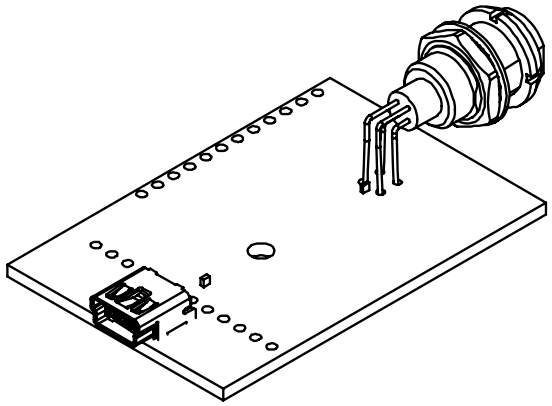
Number of channels	2-8
Multiplexer use:	• Sensor arrays with up to eight working, reference and counter electrodes
	• Sensor arrays with up to eight working and eight combined reference/counter electrodes
	• Sensor arrays with up to eight working electrodes all sharing the same reference and the same counter electrode
	• Sensor arrays with eight working electrodes all sharing the same combined reference/counter electrode
On resistance	WE, CE and RE 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 MUX8 Terminal Block (in shielded housing)
	• eight WE's
	• eight CE's
	• eight RE's
	• one CE used when all WE's share one counter electrode
	• one RE used when all WE's share one reference electrode
	• analogue ground for shielding
Dimensions of PCB	76 x 74 mm

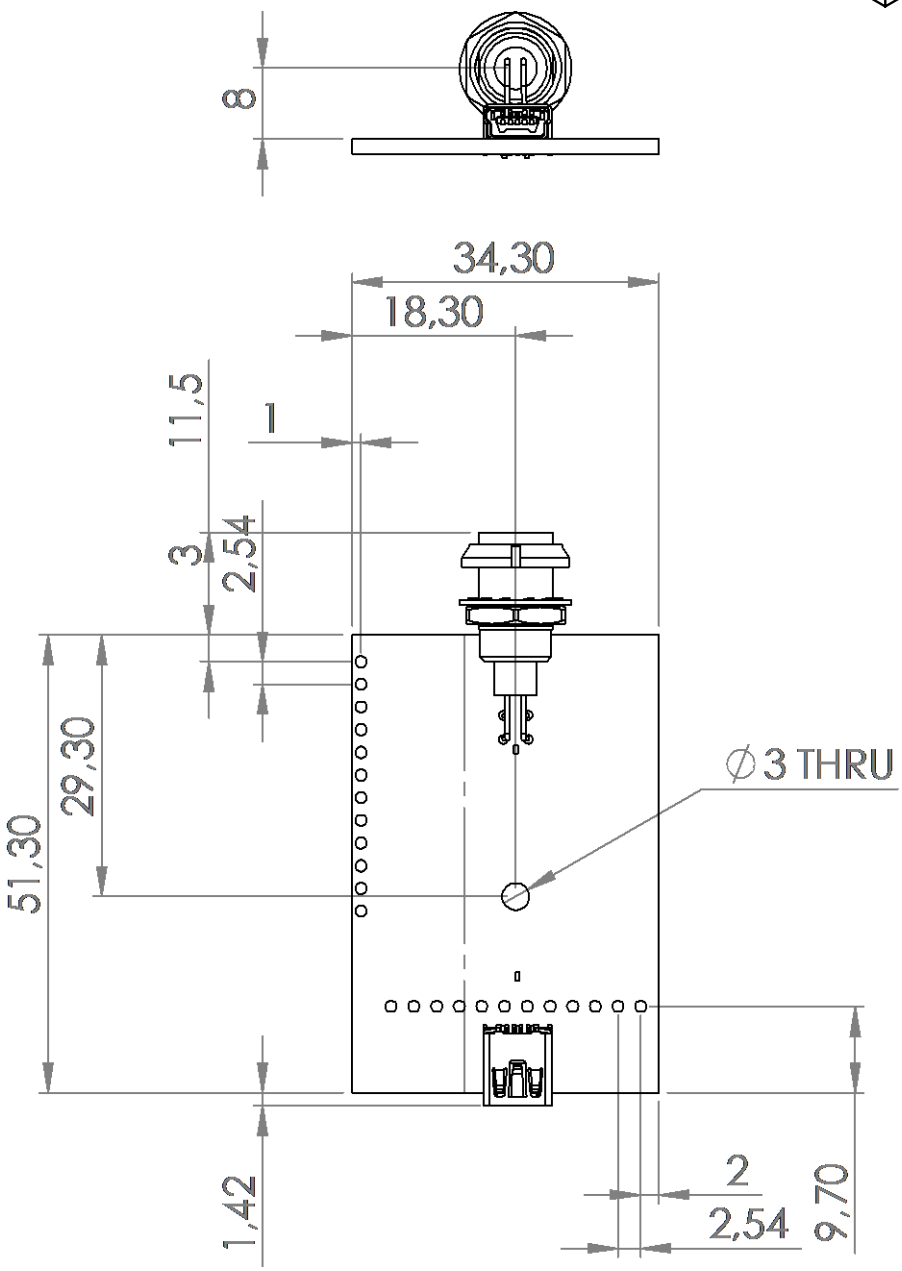
4 PCB dimensions

4.1 MUX8 PCB

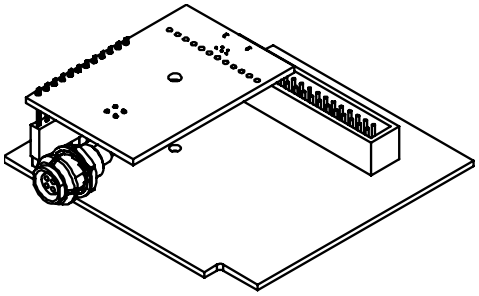


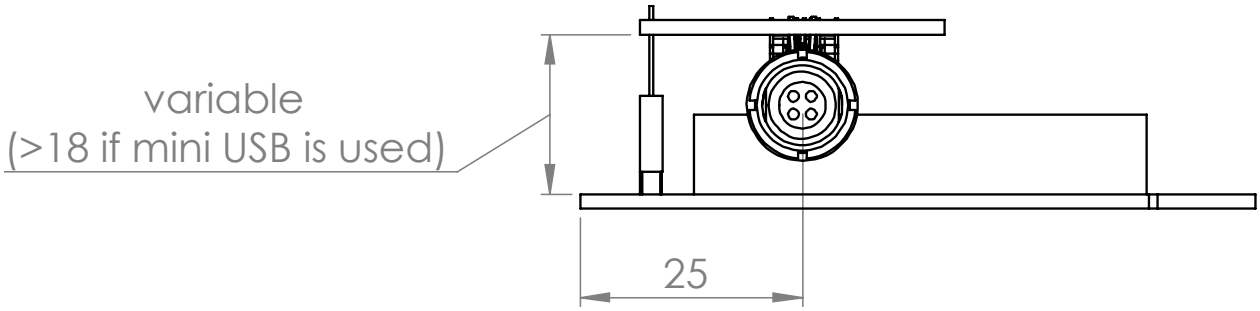
4.2 EmStat^3 PCB

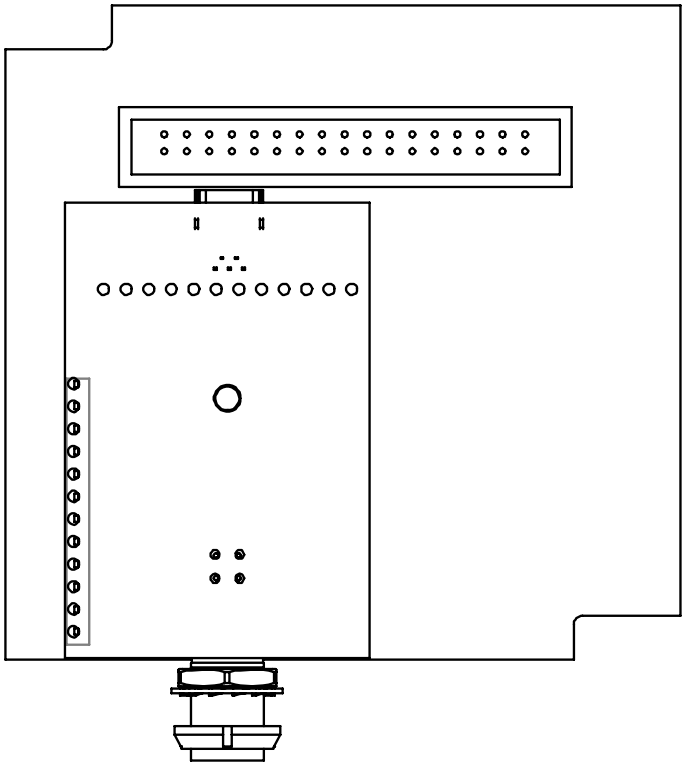
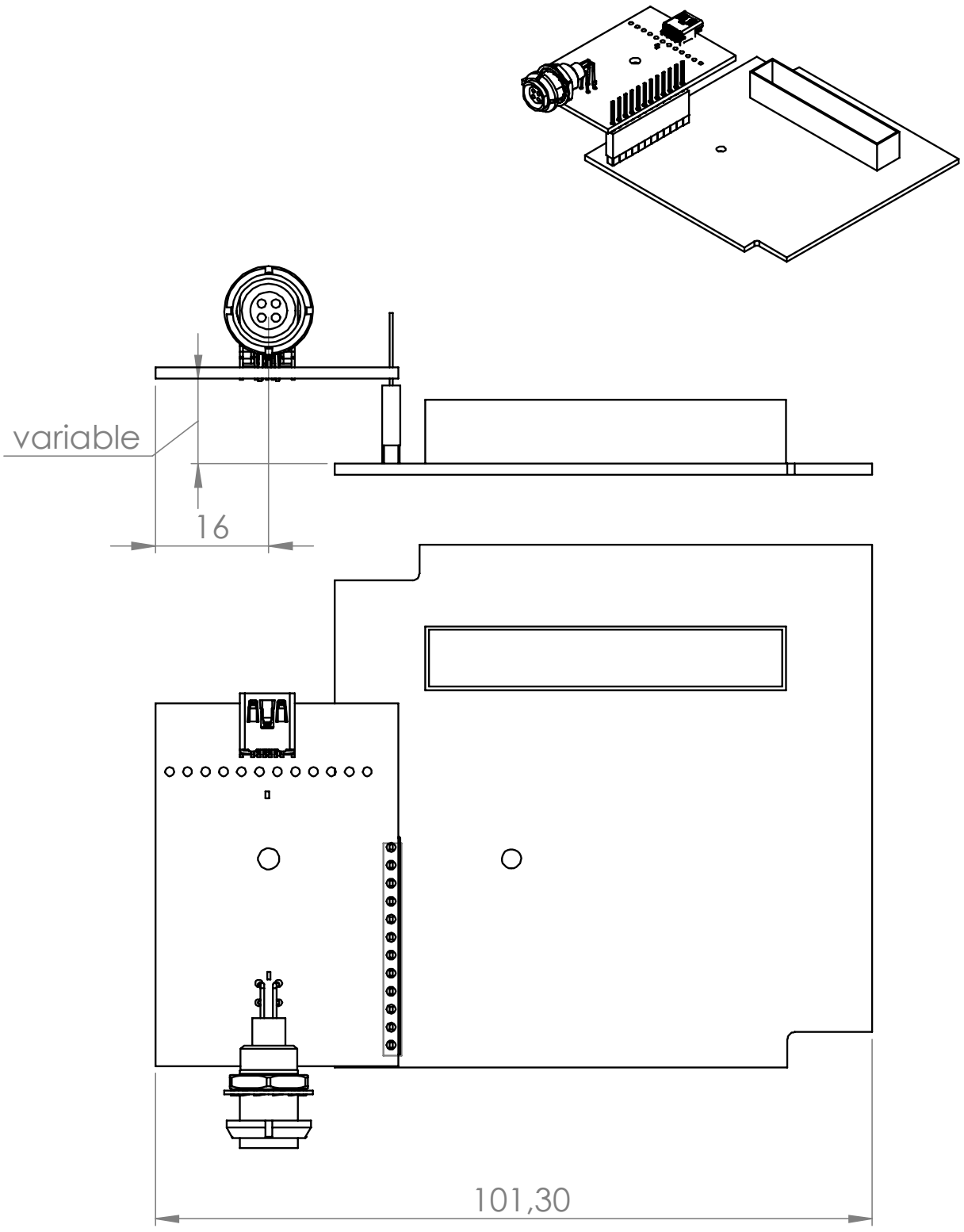




4.3 PCB's connected – option 1







4.4 PCB's connected – option 2