TECH NOTE - Indirect force measurement

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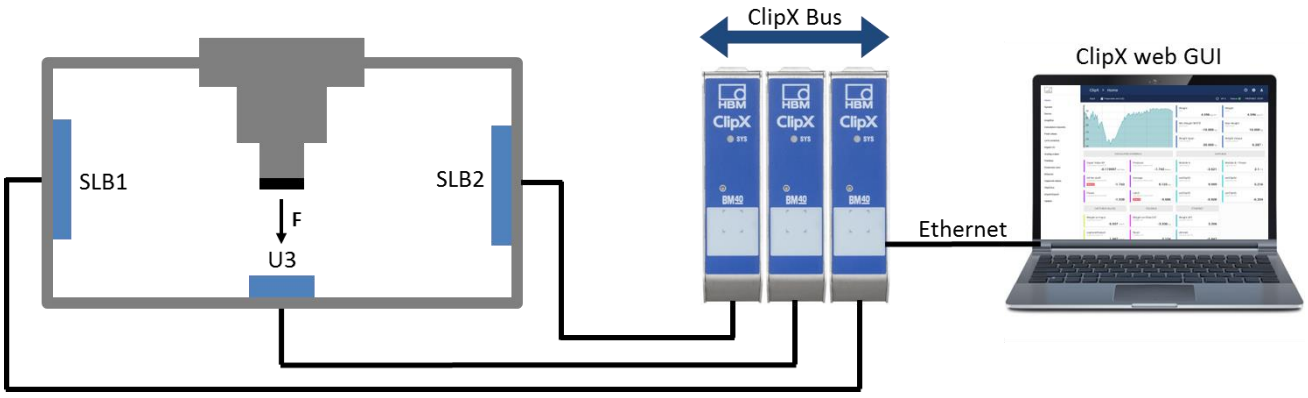
Status: HBM: Public

Brief description

The press model used for this example consists of two strain sensors (SLB) mounted to the left and right leg of a metal frame. Additionally, there is a force sensor (U3) under the punch of the press in the middle. The strain sensors are scaled via the force sensor as reference. So, in fact the pressing force is determined by measuring the strain in the force bypass (indirect force measurement). Every sensor is connected to one of the three ClipX measurement amplifiers. Those amps are connected to each other via the ClipX bus and so are able to exchange and compute measurement values. The setup is shown below.

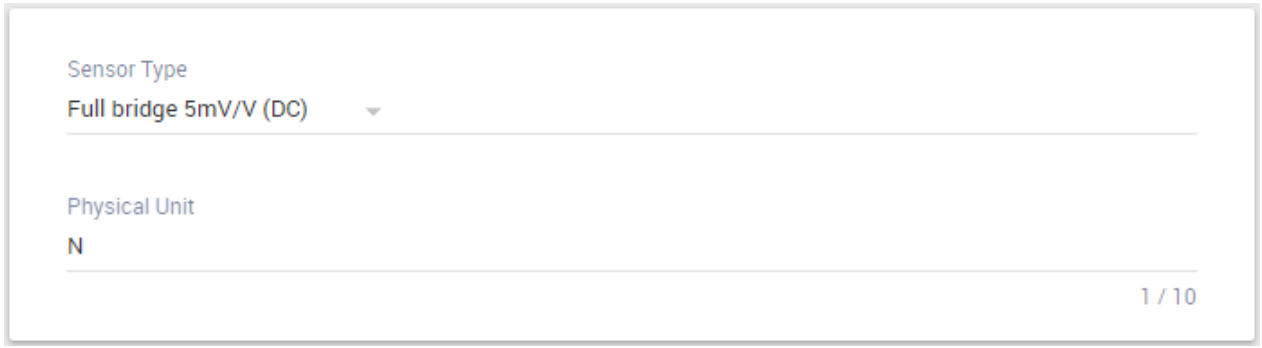


Measuring the direct force value with U3: $F = F_{U3}$ eq.1

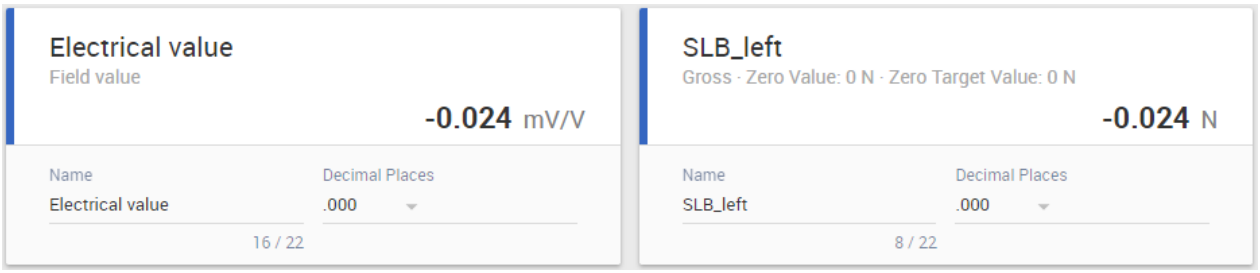
Measuring the indirect force value with both SLBs: $F = F_{SLB1} + F_{SLB2}$ eq.2

Sensor connection and setup

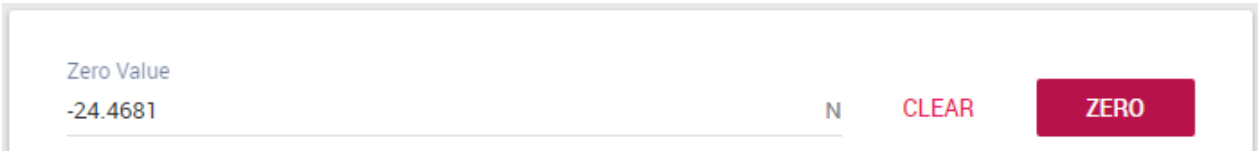
After every sensor is plugged into one ClipX amplifier, open the internet browser of your choice and enter the name or IP address of the first ClipX. When the web GUI has opened, go to the amplifier site. Now select the correct sensor type for the connected sensor (e.g. Full bridge).



Enter a physical unit, select the number of decimal places and give the value a reasonable name.



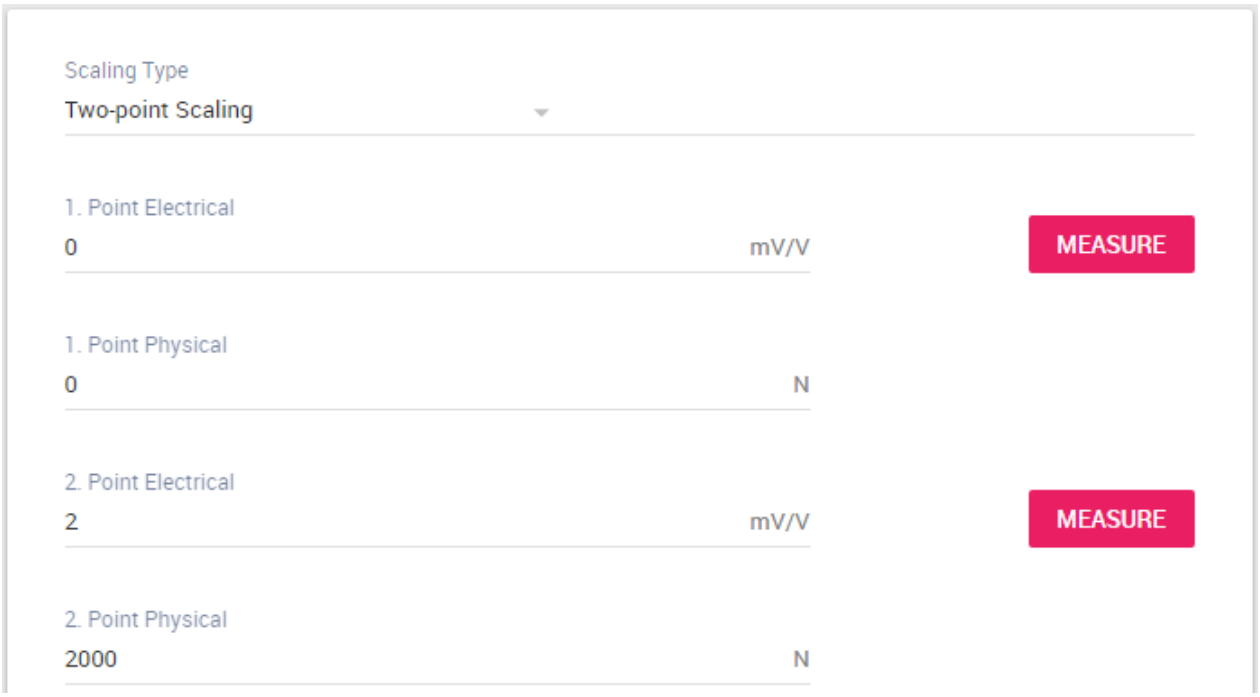
Check that the sensors are unloaded and set the channel to zero.



Repeat for all three amplifiers and sensors

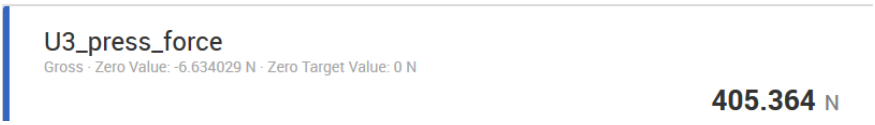
Sensor scaling

Scale the U3 force sensor in the amplifier section. The sensitivity is printed onto the label of the sensor.

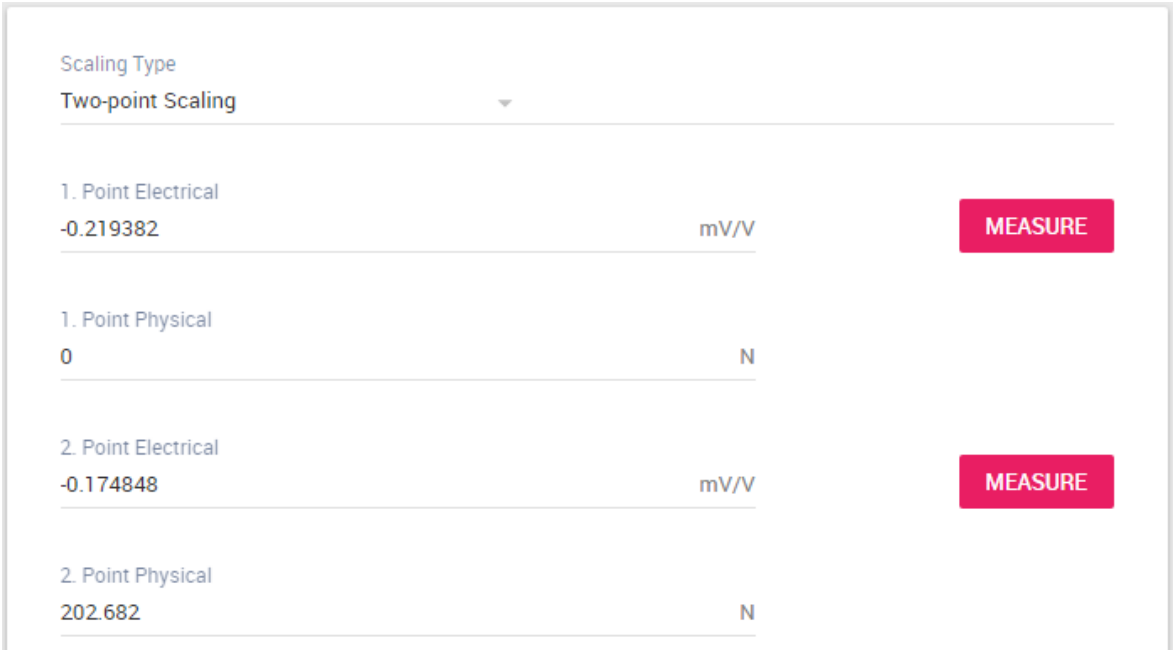


Make sure the sensors are without any load. Then go to the scaling settings for both SLBs. Press measure for the first point electrical.

Then put a load onto the sensors by tightening the screw on top of the press frame. The value of the load does not matter. Just keep in mind that big values generate a better accuracy when scaling with a reference.



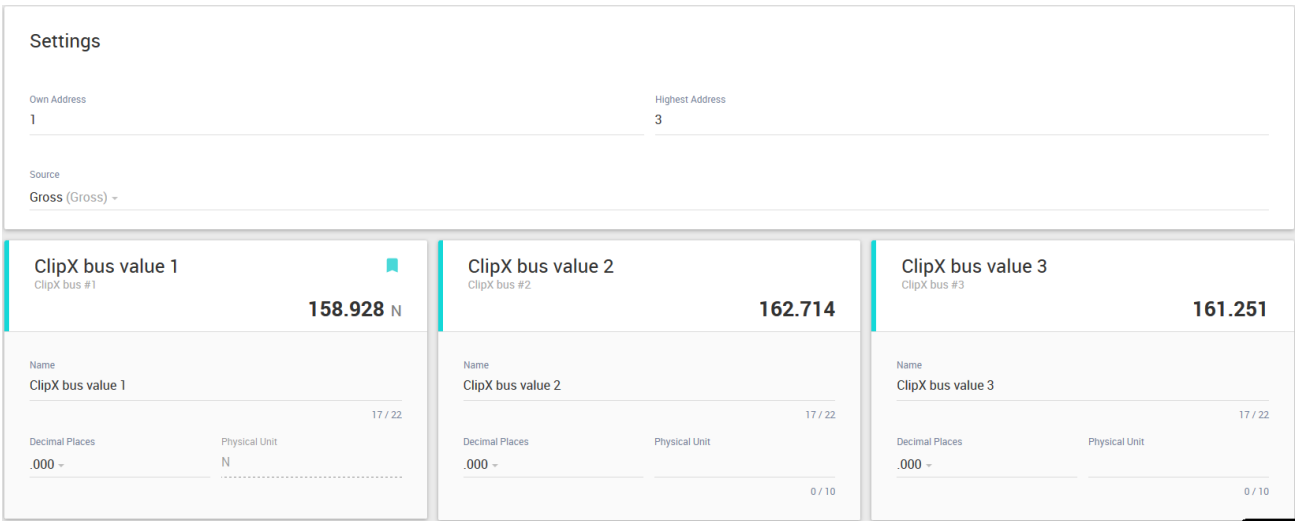
Because the press force is equally split to both strain sensors, enter half the value to scale the second point physical of the SLBs. The corresponding electrical value is then set with the red measure button.



Afterwards be sure to unload again and set all sensors to zero.

ClipX bus values and calculated channels

Go to the ClipX bus section. Give the devices an address (1 to 3). Enter 3 as highest address for all devices. Select the signal that should be sent on the bus as source.

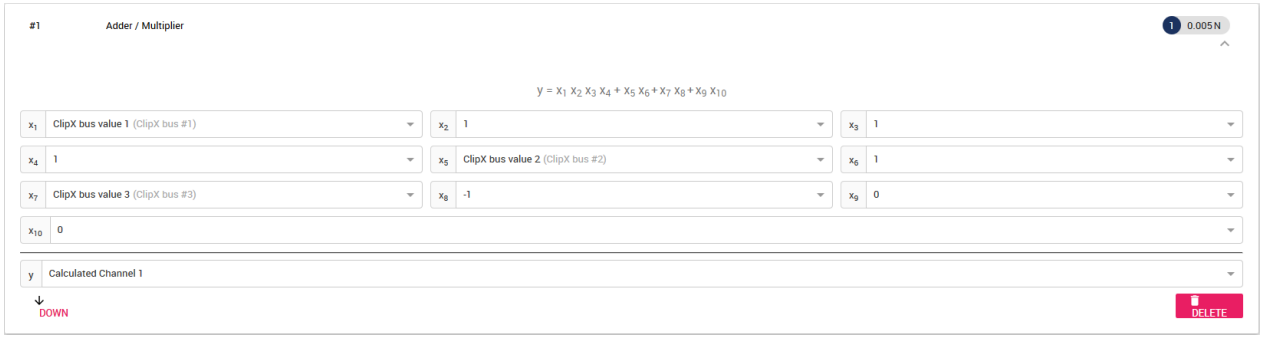


Repeat for every amplifier

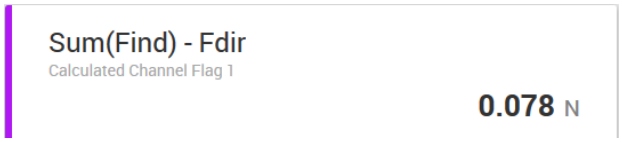
Then go to any of the ClipX calculated channel section. Use an Adder / Multiplier to calculate the difference between direct and indirect force value. The equation that must be entered is:

$$\Delta F = F_{SLB1} + F_{SLB2} - F_{U3}$$

Use the ClipX bus values that have been defined before.



Double-check the difference. The closer the result is to zero, the more accurate the scaling has been.



Disclaimer

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