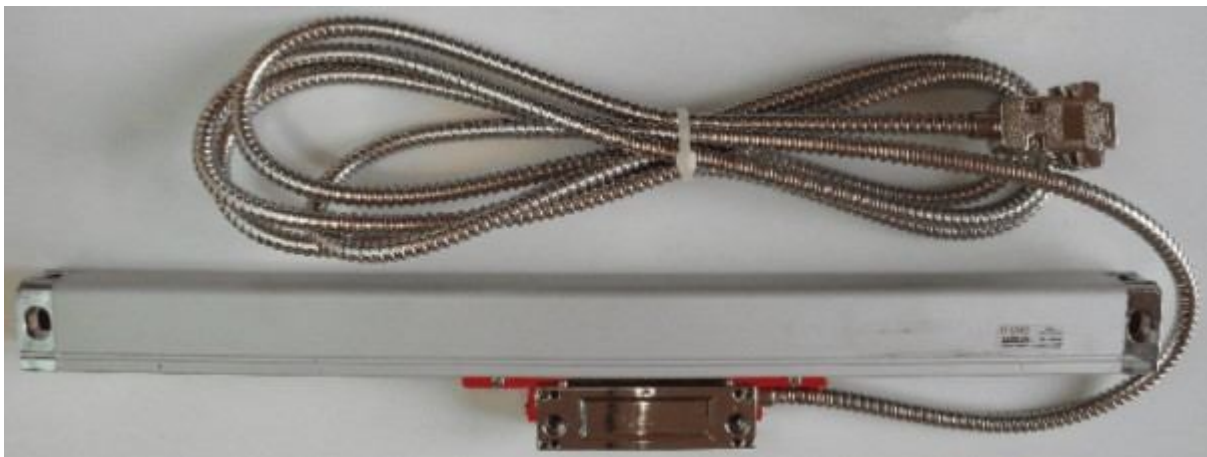


Linear Glass Scales

Glass scales are very precise digital linear scales. They are available in different lengths and in different resolutions (up to $0.1\mu\text{m}$). The measurement principle is electro-optical. Linear glass scales are produced by many manufacturers such as Heidenhain, Mitutoyo, Sino, M-DRO, RSF, DigiMac, Jenix, Accu-Rite, Anilam, Ditron and others. Most linear glass scales have encoders with 5V TTL quadrature output (A, B, Z) and are easily connectable to the Caliper2PC interface.



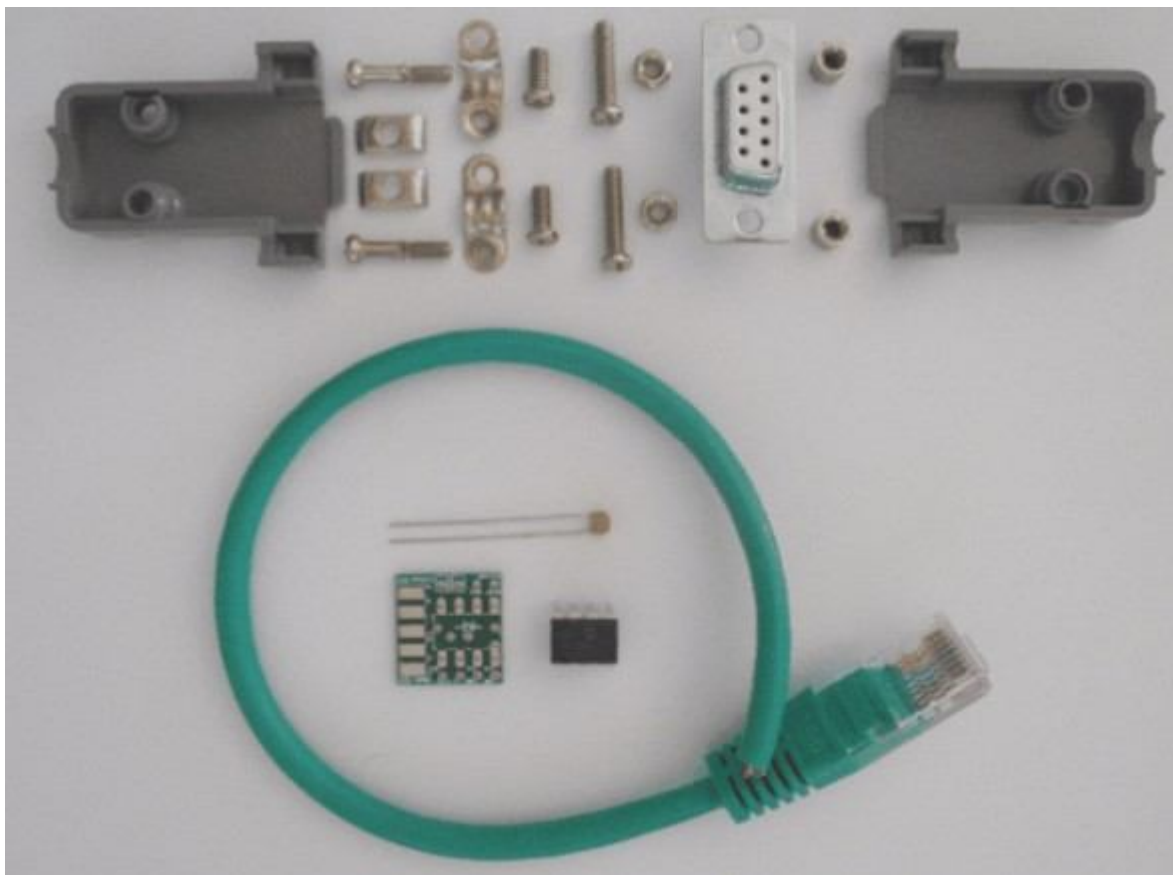
The quadrature adapter kit contains the 9 pin D-SUB connector for the glass scale, the RJ45 patch cable for the Caliper2PC interface as well as the electronics for the step counter. The adapter's PCB is designed to fit into the 9 pin D-SUB connector. This adapter has to be installed between the glass scale and the Caliper2PC interface. In the following will be described how to build and connect the quadrature adapter.

BOM & Tools Needed

- Quadraure Adapter Kit (available at www.caliper2pc.com)
- 1 inch of shrink tube (1.6mm – 3.2mm diameter) or insulating tape
- soldering iron and solder
- wire cutter

Building the Quadrature Adapter

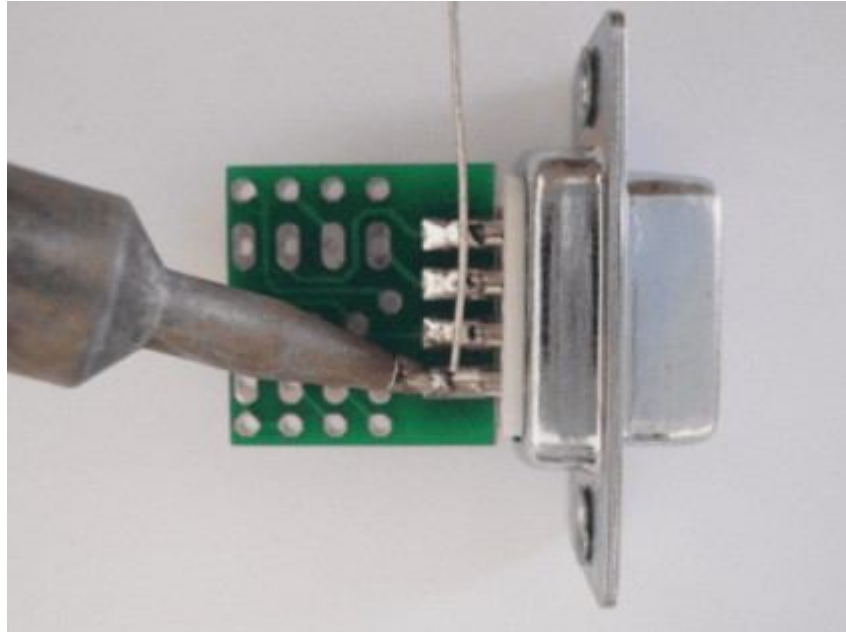
The quadrature adapter kit contains the adapter PCB, the converter IC and a 100nF ceramic capacitor as well as the 9 pin D-SUB connector and the RJ45 patch cable.



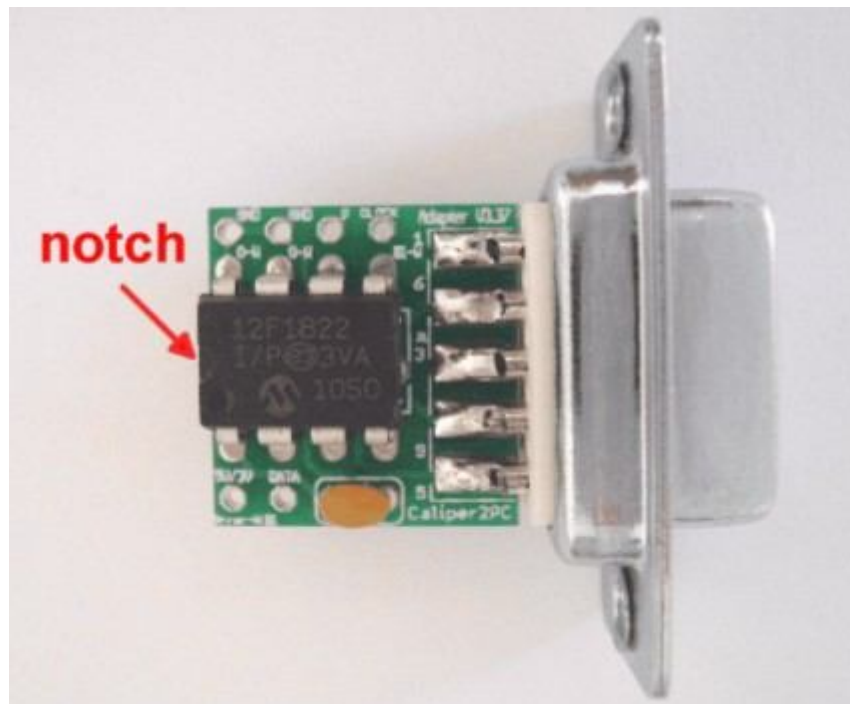
Connecting Linear Glass Scales to the Caliper2PC Interface – A step by step Guide



First, the PCB has to be soldered to the 9 pin D-SUB connector.



Next solder the components as shown in the picture. Please double check that the IC is mounted in the right direction before the device is soldered (notice the notch and the mark on the PCB).



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After the components were soldered, cut the components' leads with a wire cutter.

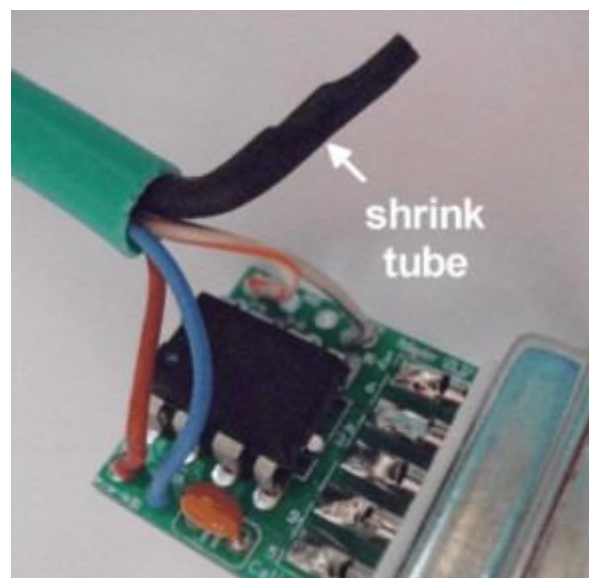
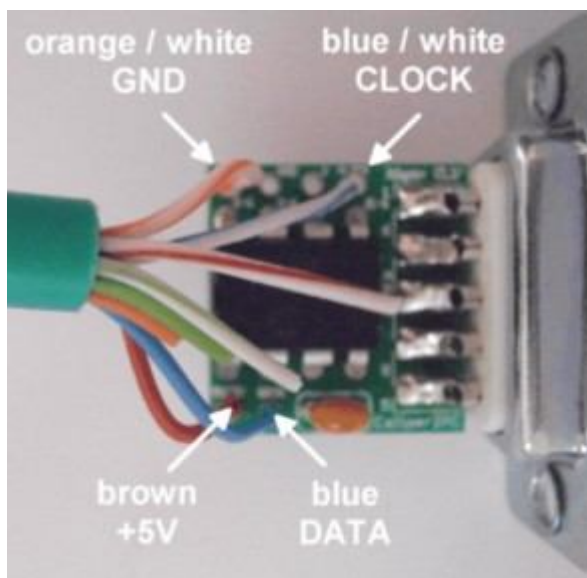
Solder the Patch Cable to the Quadrature Adapter

In the next step, the RJ45 patch cable for connecting the quadrature adapter to the Caliper2PC interface will be prepared. Dismantle the jacket (about 1 inch).

The following 4 wires of the patch cable are needed:

- Brown = +5V
- Orange / White = GND
- Blue / White = CLOCK
- Blue = DATA

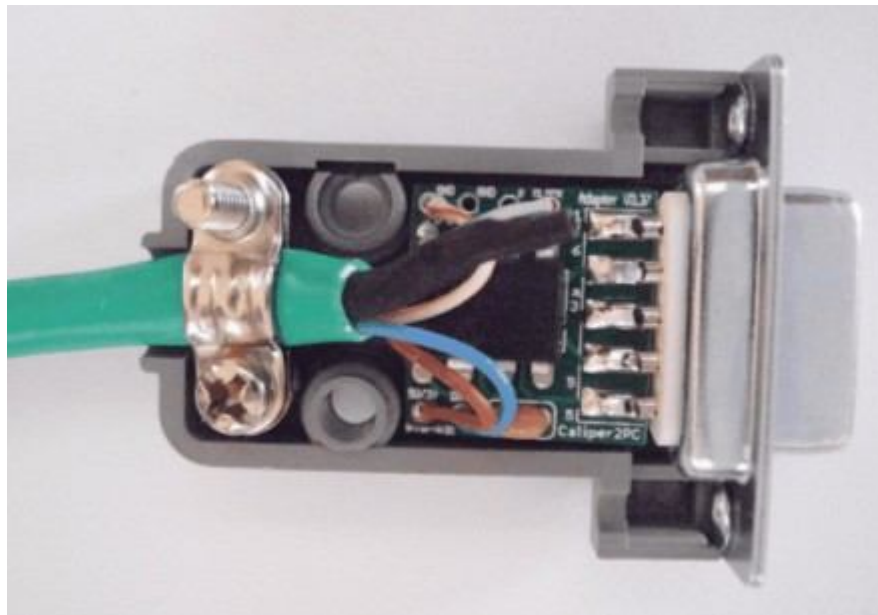
The other wires (green / white, green, orange, brown / white) are not needed and must be cut (in different lengths see pictures below). The cut wires must be insulated with a shrink tube or insulating tape, to avoid short circuits.



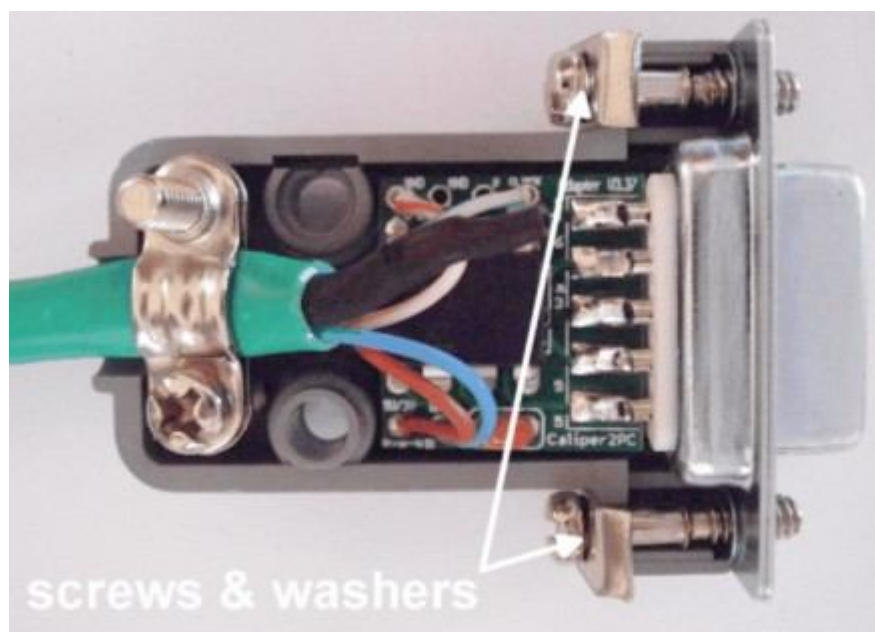
Solder the 4 wires of the patch cable to the quadrature adapter according to the pin assignment.

Mounting the 9 pin D-SUB Connector

Fasten the cable clamp with 2 short screws in the right position to fit into the connector cage.



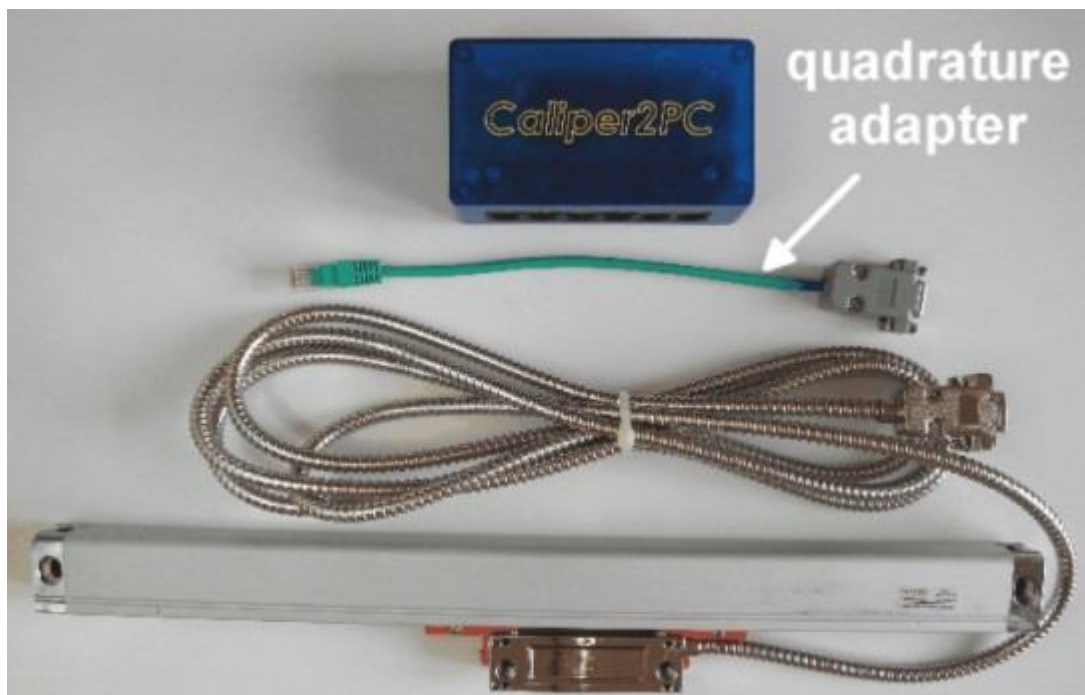
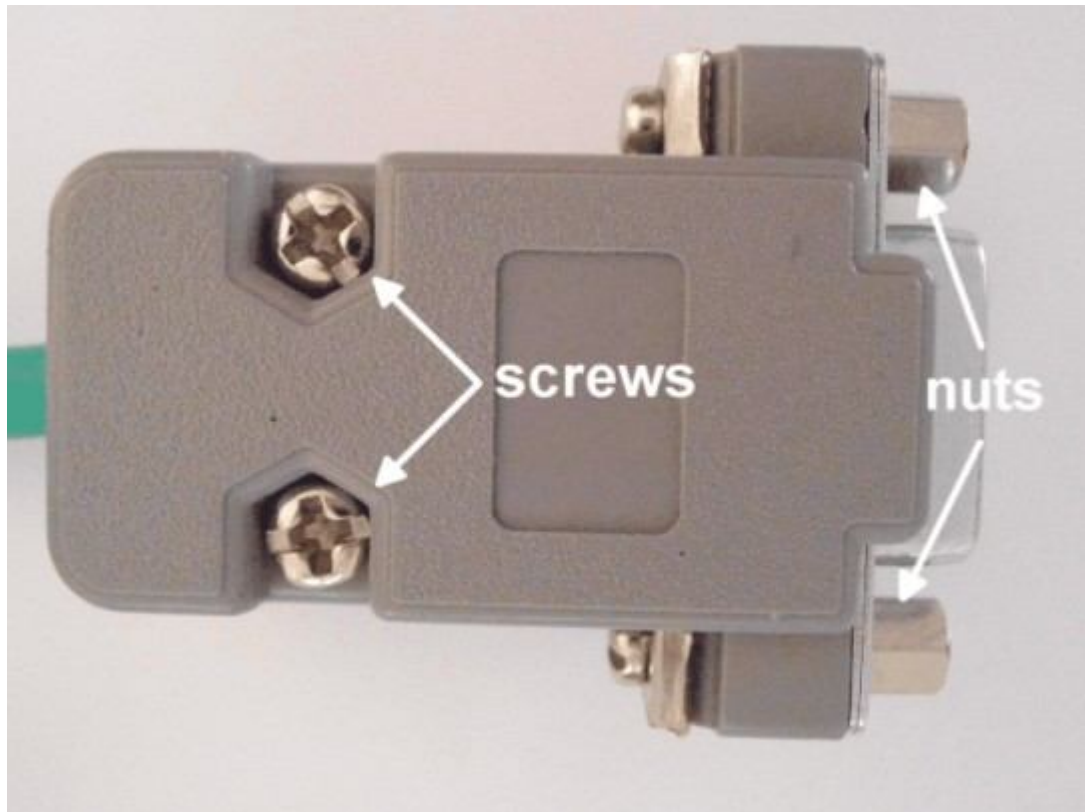
Lay the connector screws with the washers in the right position before closing the cage.



Connecting Linear Glass Scales to the Caliper2PC Interface – A step by step Guide



Close the connector cage with the long screws, and fasten the nuts.

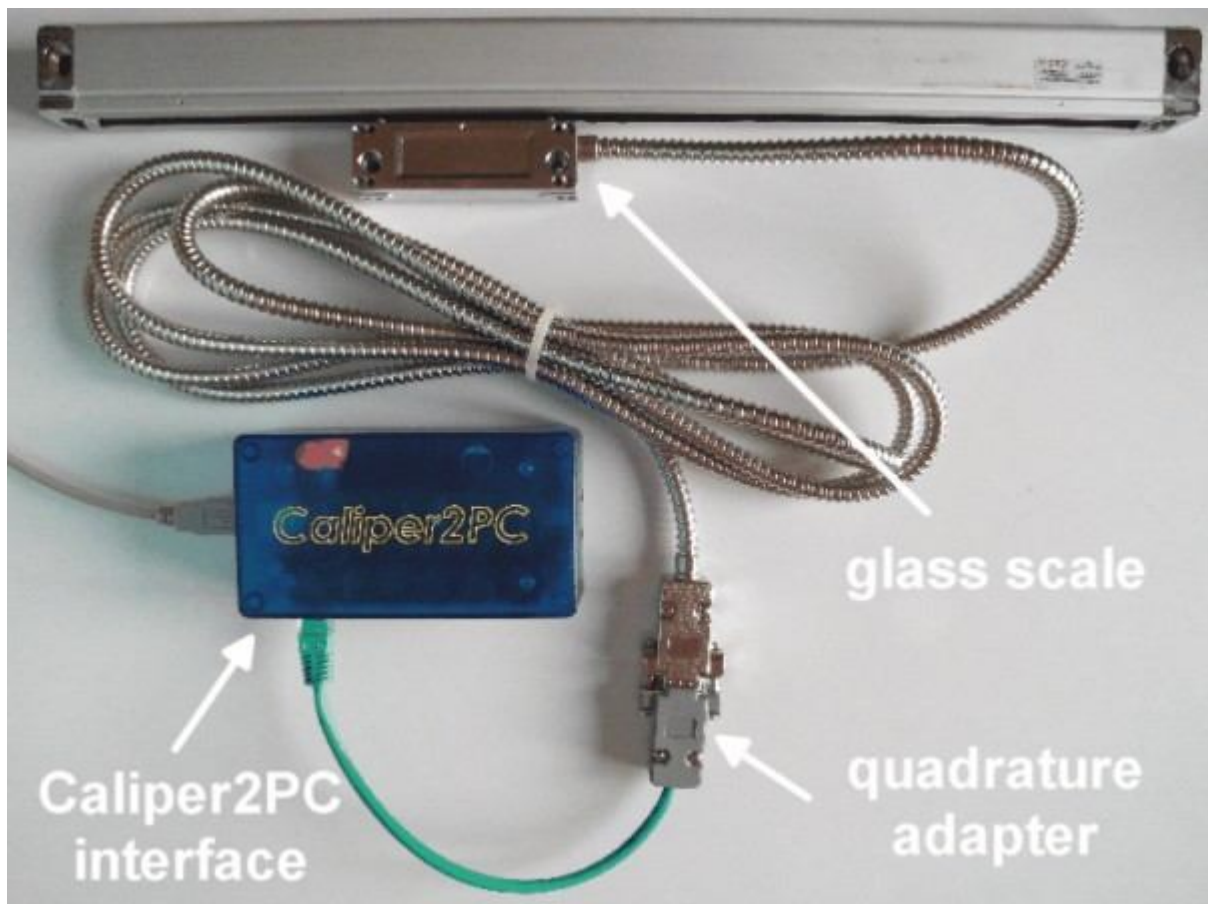


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Connecting the Glass Scale

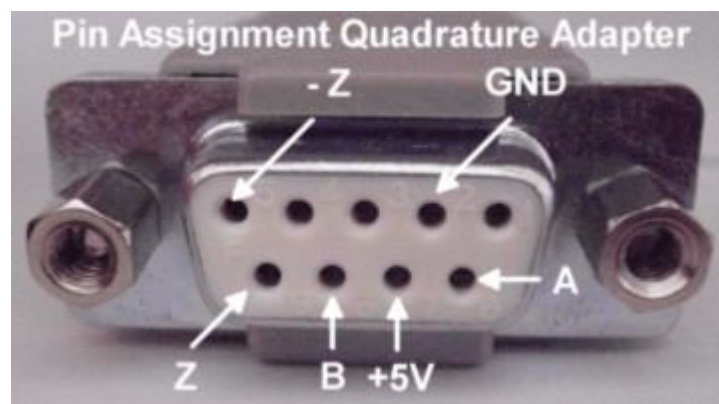
Connect the glass scale and the quadrature adapter as shown in the picture below. To ensure a safe connection between the adapter and the encoder, please fasten the connector's screws.



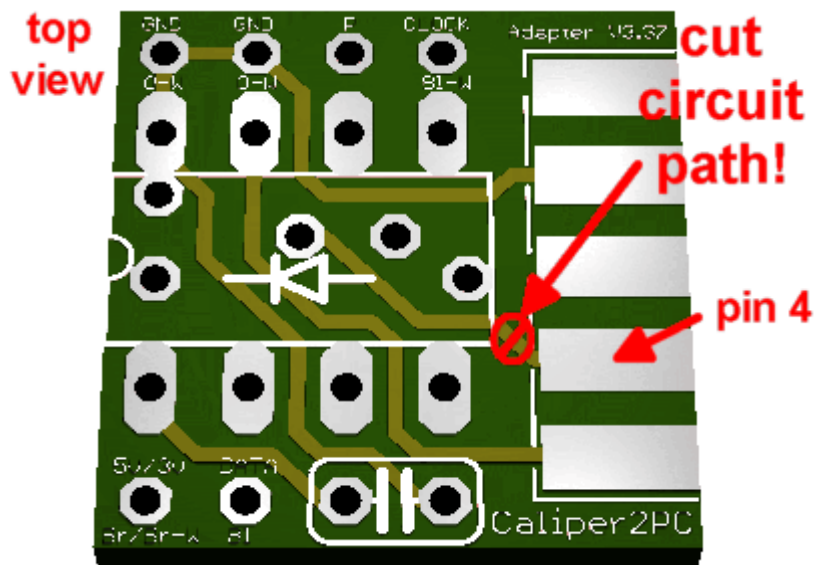
Pin Assignment

The linear glass scale's pin assignment must fit to the quadrature adapter. Although most glass scales use a pin assignment fitting the adapter, it is possible that some types differ from this standard. In this case the scale's wires must be reconnected inside the scale's 9 pin D-SUB connector to fit the adapter's pin assignment. Some encoders don't have a "-Z" connection (it is optional and not obligatory). If your encoder possesses "-A" and "-B" connections (EIA-422), they can be left unconnected. The adapter will work properly without these signals.

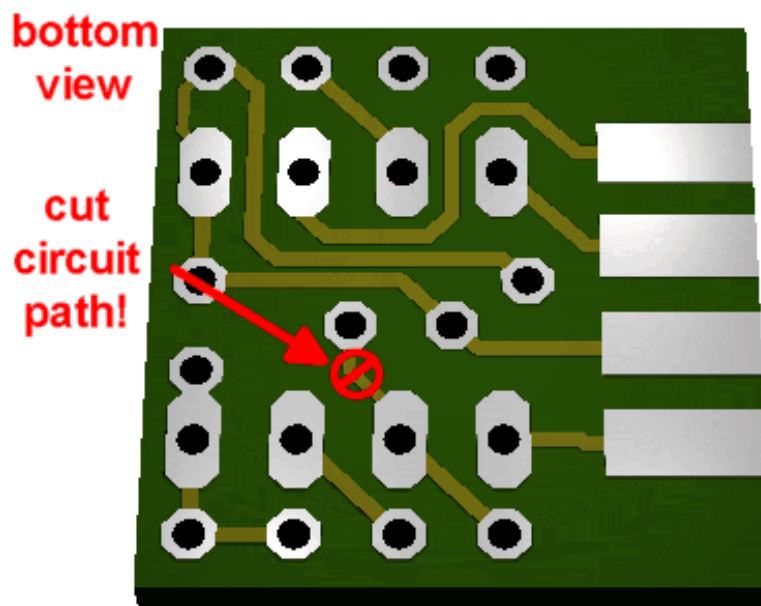
Linear Glass Scales – Pin Assignment								
1	2	3	4	5	6	7	8	9
/	GND	/	/	(-Z)	A	5V	B	Z



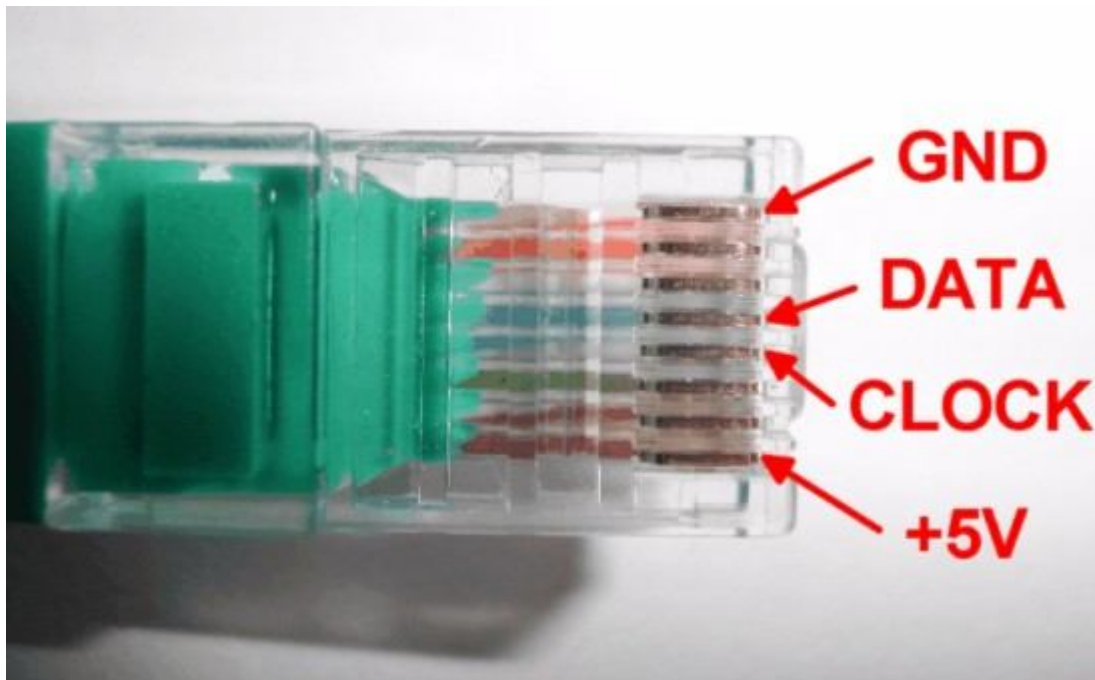
Important! If pin 4 is connected inside your glass scale's connector, pin 4 must be disconnected on the adapter PCB.



The circuit path can be cut with a carpet cutter or with a small Dremel grinder. Alternatively, the circuit path for disconnecting pin 4 can be cut on the bottom side of the PCB.

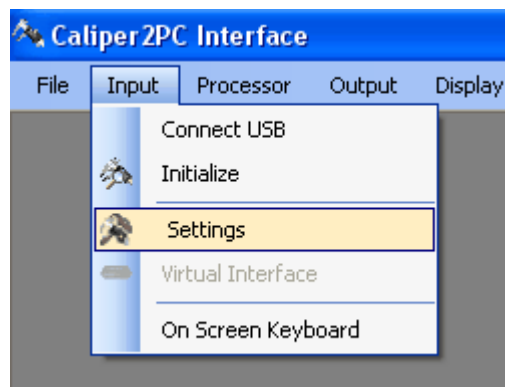


The pin assignment of the RJ45 connector which connects the adapter to the Caliper2PC interface is shown below.



Defining Encoder Resolution in the Caliper2PC Software

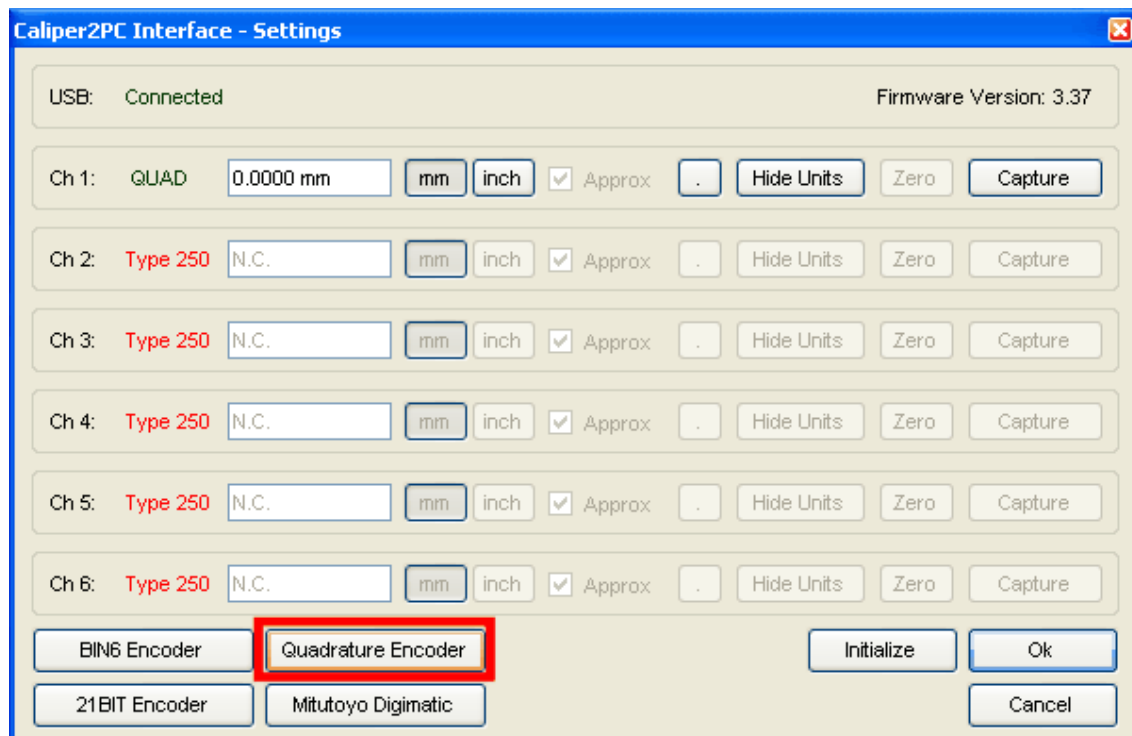
At this point we will define the encoder's resolution in the Caliper2PC software. Open the "Caliper2PC Interface - Settings" window.



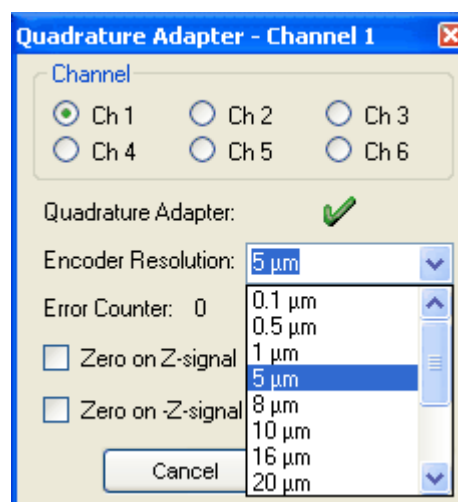
Connecting Linear Glass Scales to the Caliper2PC Interface – A step by step Guide



In the “Caliper2PC Interface - Settings” window click the “Quadrature Encoder” button.



Choose the resolution of your glass scale from the drop down menu (for example 5 μm).



Click “Ok” to close the “Quadrature Adapter” window.

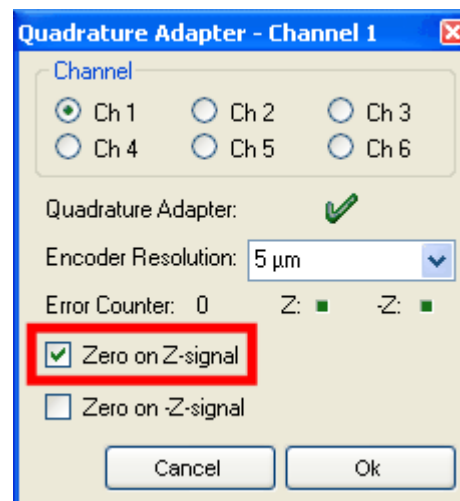
Additional Features

Linear glass scales have reference marks that can provide a repeatable home position. When the encoder reaches a reference mark, the “Z” - signal changes its logical level. The Caliper2PC DRO can be set to zero automatically when reaching a reference mark. The quadrature adapter sends 40 data packages per second to the Caliper2PC interface. For capturing the reference mark, the axis speed must be very slow. The reference mark might be longer than the scale’s resolution. Therefore the axis must always be moved toward the reference mark from the same direction to achieve a precise repeatable home positioning.

For setting up auto zero please open the “Quadrature Adapter” window following this path:

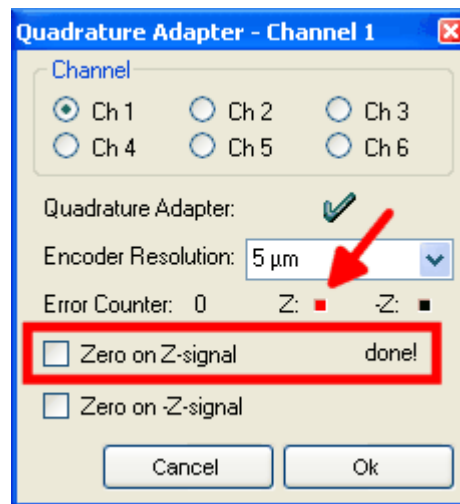
“Input” -> “Settings” -> “Quadrature Encoder”

Check the “Zero on Z-signal” check box to activate the reference mark “auto zero - feature”.

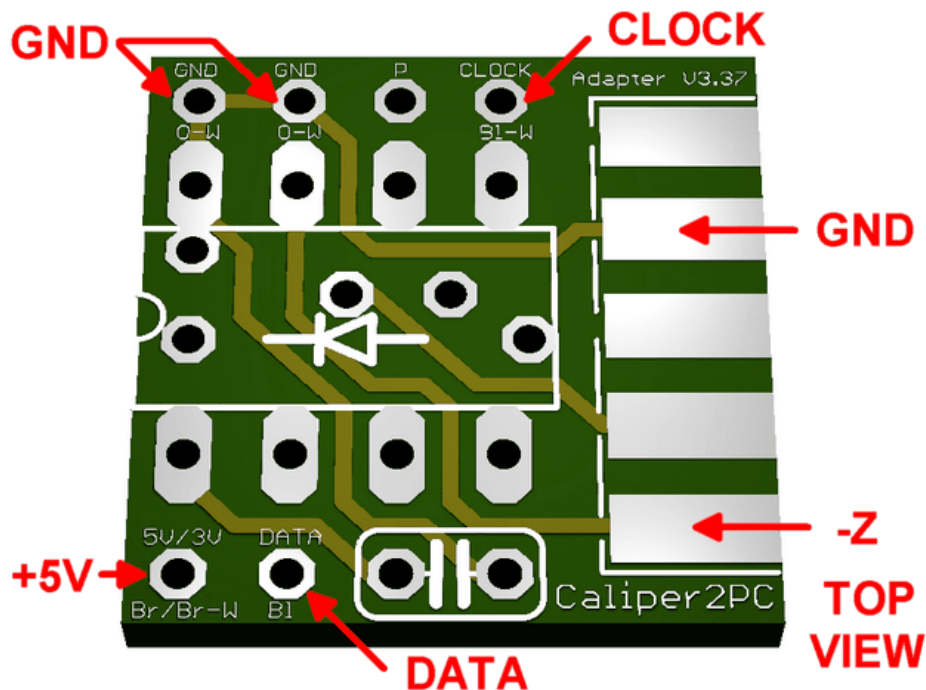


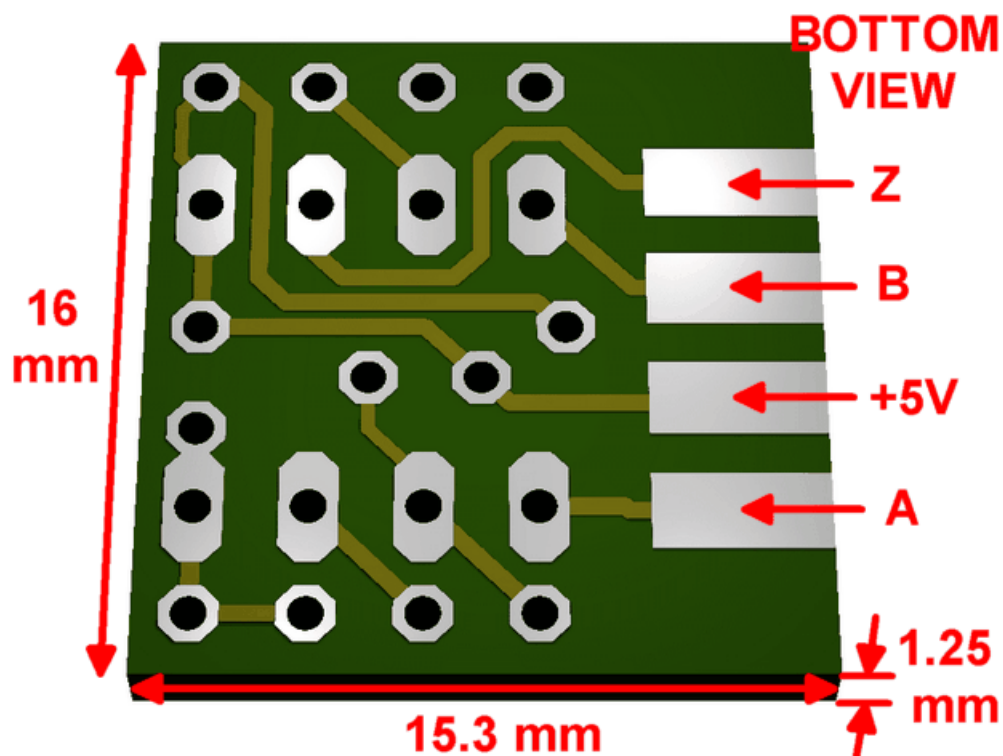
You have to know the approximate position of the reference mark you want to use to auto zero the axis. The Caliper2PC software will capture the precise position of the reference mark while the axis is driven in low speed through the reference mark’s area. The green square “Z-LED” will turn red as soon as the reference mark

is reached. At this position the axis will be zeroed, the check box will be unchecked to avoid multiple zeroing of the axis. The “-Z” – signal can be used the same way, if it is available on your scale.



Data Sheet Quadrature Adapter PCB





Signals to Caliper2PC (RJ45 Patch Cable)

- GND (Orange / White) Pin 1
- DATA (Blue) Pin 4
- CLOCK (Blue / White) Pin 5
- +5V (Brown) Pin 8

Signals to Glass Scale (D-SUB)

- GND Pin 2
- -Z (optional) Pin 5
- A Pin 6
- 5V Pin 7
- B Pin 8
- Z Pin 9

PCB Measuring
(Inch)

Length
0.630

Width
0.602

Height
0.049