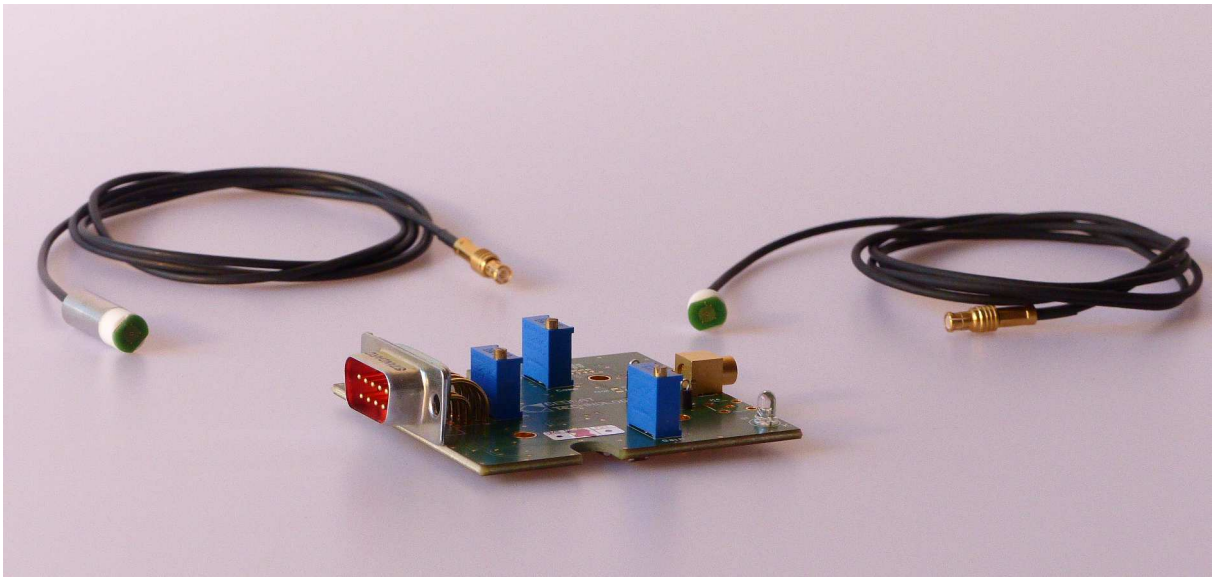
ECSµ10
Compact Eddy Current Sensor conditioner

PRODUCT AND WARRANTY INFORMATION



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CAUTION: READ BEFORE OPENING

For safety purposes these instructions must be read before use of this product.

This Eddy Current Sensor is dedicated to monitor the position of a conductive target without contact.

Only qualified personnel should work on or around this equipment and only after becoming thoroughly familiar with all warnings, safety notices, and procedures contained herein.

The successful and safe operation of this equipment is dependent on proper handling, installation and operation.

A "qualified person" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved. In addition, he/she has the following qualifications :

- **is trained and authorized to energize, de-energize, clean, and ground equipment in accordance with established practices,**
- **is trained in the proper care and use of protective equipment in accordance with established safety practices.**
- **is trained in the soldering process of microelectronic systems.**

TABLE OF CONTENTS

1. INTRODUCTION

The ECSµ10 is a compact Eddy Current Sensor (ECS) conditioner. It can provide conditioning for 1 sensor channels in single configuration. This conditioner is the compact and autonomous version of the ECS75, which means that it is integrated in a specific compact package and supplied directly through a standard DC/DC low voltage converter. The DC/DC converter is not delivered with the conditioner.
The conditioner doesn't integrate a linearization function to correct the output voltage versus the sensing position. The user should calibrate the sensor with an additional reference sensor to obtain a linear output response versus the probe position.

The conditioner should be used in combination with an ECS probe that should be placed faced to the conductive target whose position the user wants to monitor. The details of probe installations are given in the next sections. C-TEC produces two types of probes, the PC75-500 which has a 500µm detection range, and the PC75-2000 which has a 2000µm detection range.

2. ELECTRICAL CONNECTIONS

The ECSµ10 features electrical interfaces on both sides, as shown on the Figure 2-1:

- The SUBD connector includes the connexions for the user.
- The MCX connector connects the probe directly with the conditioner.

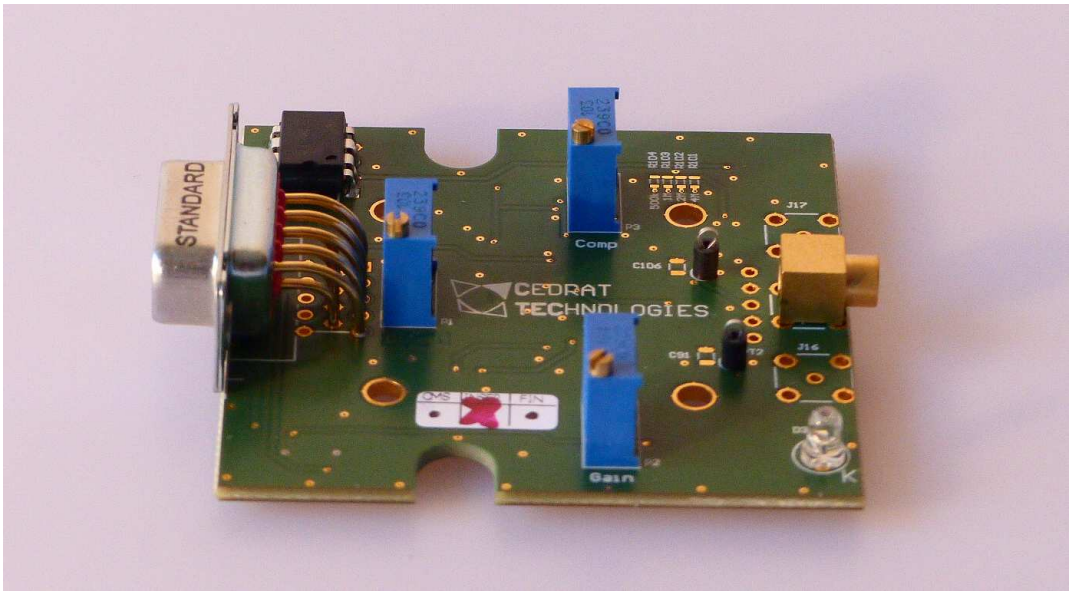


Figure 2-1: Electrical connections of the ECSµ10

Warning: The supply voltage should never exceed +28Vdc. Exceeding +28Vdc will lead to permanent damage of the ECSµ10.

2.1. Connector definition

Connector	Type
J3	Male 9-pin standard DSub
J15, J16, J17	Female MCX 50 Ohm
J1, J2	2.54mm pitch single in line (for PCB connexion

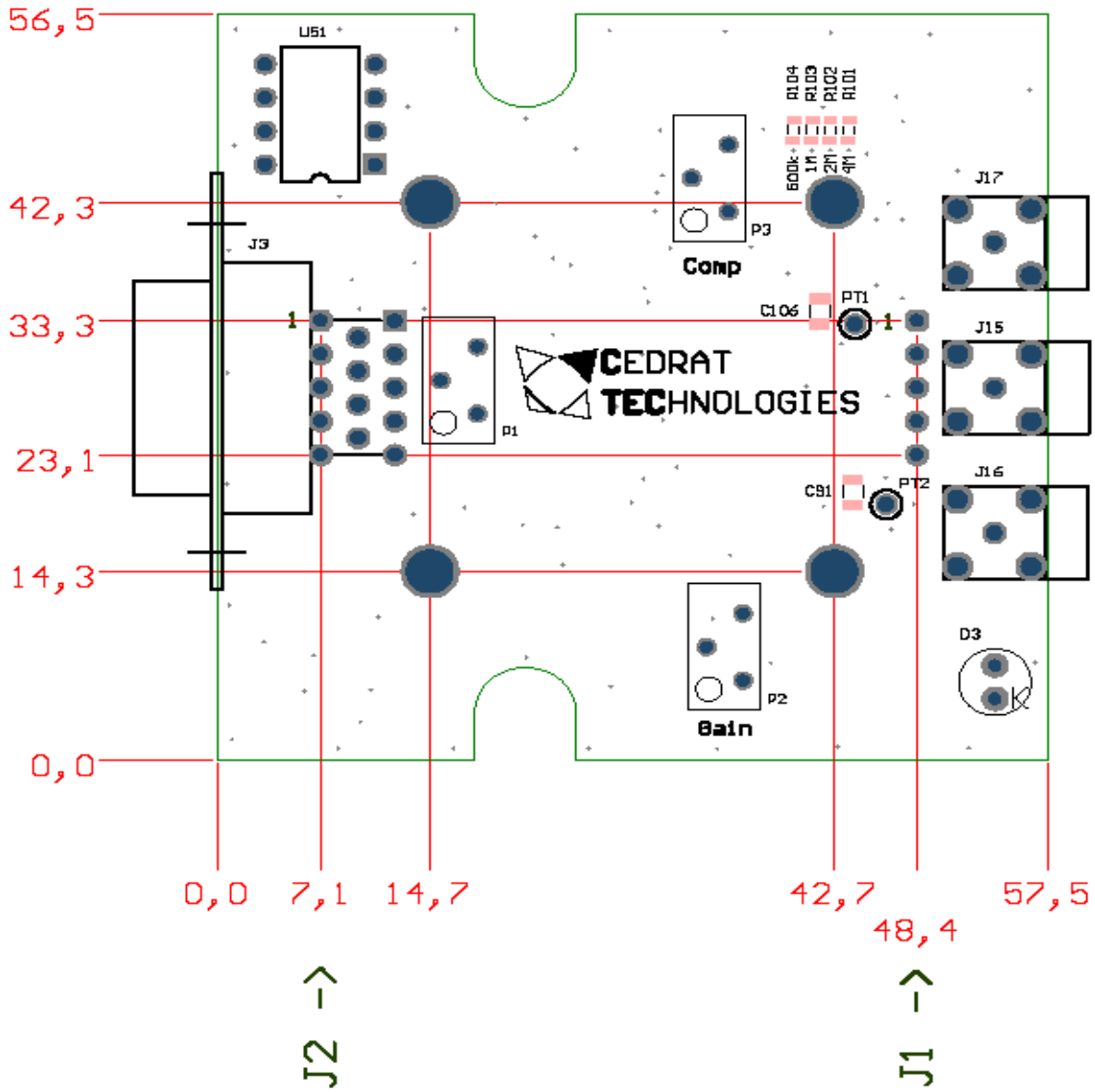
2.2. Main connectors

Connector	Pin #	name	Input/ output	Voltage/Current	Function
J3	1	Vcc	I	12 - 15Vdc	Regulated supply voltage
	2	Sensor U	O	0 – 14Vmax	Sensor voltage output
	3	Sensor I	O	4- 20mA	Sensor 4-20mA current output (gain is 2.56mA/V)
	4	Teds	Digital I / O	0 – 5V	Optional 1-wire TEDS memory I/O (non connected)
	5				Not connected
	6	Gnd		0	Ground
	7	Gnd		0	Ground
	8	Gnd		0	Ground
	9	Gnd		0	Ground
J15	1	Main probe	I / O	±5V	Main probe connexion

2.3. Optional Auxiliary connectors

Connector	Pin #	name	Input/ output	Voltage/Current	Function
J17	1	Clock	Digital I / O	±5V	Clock output/ auxiliary clock input
J1	1	Clock	Digital I / O	±5V	Clock output/ auxiliary clock input
	2	Gnd		0	Ground
	3	Main probe	O	±5V	Main probe direct input
	4	Gnd		0	Ground
J2	1	Vcc	I	12 - 15Vdc	Supply voltage
	2	Sensor U	O	0 – 14V	Sensor voltage output
	3	Sensor I	O	4-20mA	Sensor 4-20mA current output (gain is 2.56mA/V)
	4	Teds	Digital I / O	0 – 5V	1-wire TEDS memory I/O (non connected)
	5	Gnd		0	Ground

2.4. Mechanical drawings



Mounting holes: 4x ⌀3.2mm

Figure 2-2: Mechanical dimensions of the ECSµ10

3. USING THE ECSµ10

3.1. Principle

The ECSµ10 is high resolution impedance to voltage converter.
It measures the resulting amplitude of an RLC tank to determine the position of the probe in regards of the target.

AC current flowing through an inductor will generate an AC magnetic field. If a conductive material, Such as A metal target, is brought into the vicinity of the coil, this magnetic field will induce circulating currents (eddy currents) on the surface of the target.
These eddy currents are a function of the distance, size, and composition of the target. The eddy currents then generate their own magnetic field, which opposes the original field generated by the coil. This mechanism is best compared to a transformer, where the coil is the primary core and the eddy current is the secondary core. The Inductive coupling between both Cores depends on distance and shape. Hence the Resistance and inductance of the secondary core (eddy current), shows up as a distant dependent resistive and inductive component on the primary side (coil)

Basically these types of sensor are very sensitive and could be well adapted to measure high accurate movements.

To obtain the best performance, the user should not to reduce or increase the length of the cable due to the tuning operation done to fix the resonant tank frequency close to the oscillator frequency.
If the cable length of the probe should be modified, please contact Cedrat Technologies to use a specific operation to obtain the new best optimisation.

3.2. Power up

Prior to powering up the ECSµ10, the electrical connections should be made. The probe should be connected to the MCX connector as shown on the Figure 3-1.
Warnings:

1) **Always use the ECSµ10 with probes manufactured by Cedrat Technologies PC75-500 and PC75-2000. The use of other probes will lead to invalid measurement and potential damaging of the ECSµ10.**
2) **Always connect the probe with the initial cable length to obtain the best performance of your product (large sensitivity in V/m)**

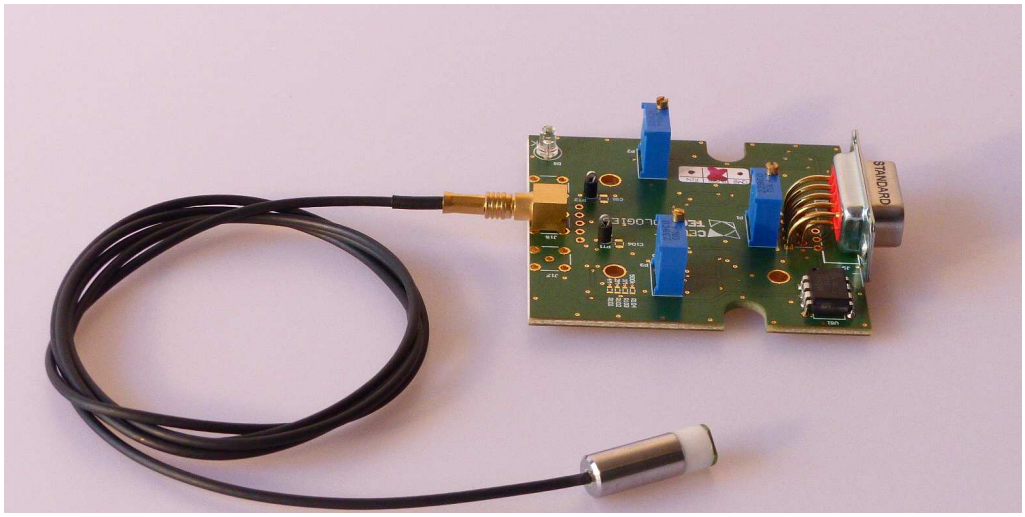


Figure 3-1: Probe connection on the ECSµ10

If several ECSµ10 should be synchronised on several same target and to avoid inter-modulation, Cedrat Technologies could provides an additional coaxial cable with as many connectors as ECSµ10. The coaxial cable provided with the electronics should be connected on the “Sync” terminals of all the boards and a master/slave board should be configured: Please contact Cedrat technologies to realise this configuration

Finally, the SUB D connector is plugged including the power connexion from a DC regulated power supply, as shown on the Figure 3-2:

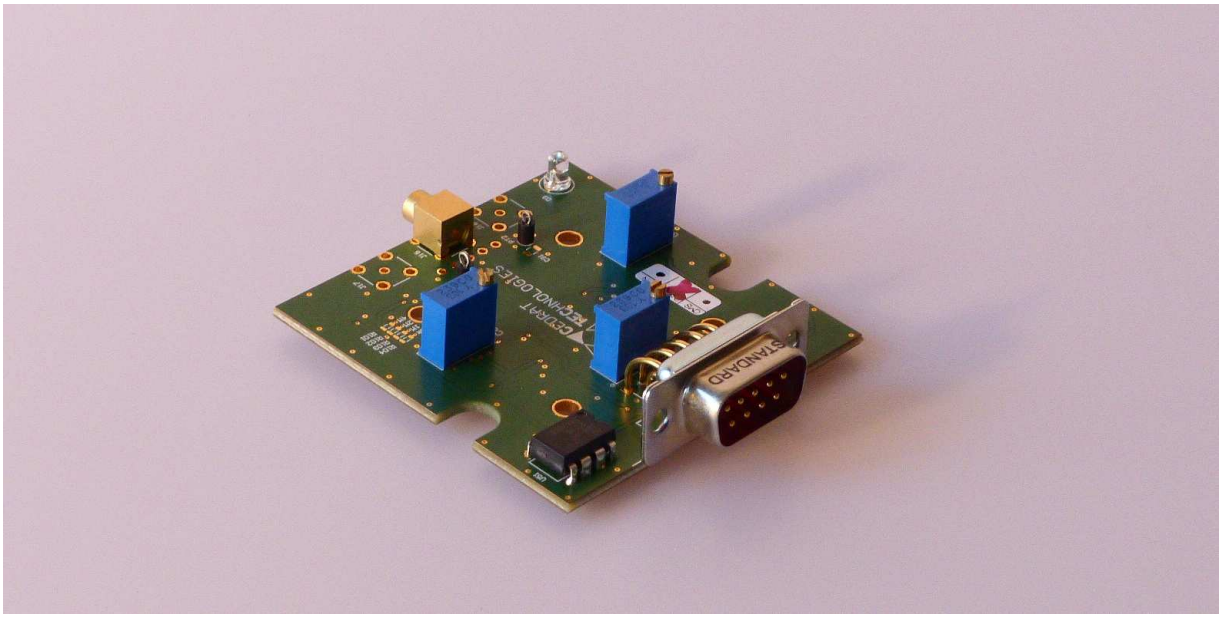


Figure 3-2: SUB D connexion

The blue led should be continuously blinking.

Warning: When connecting a DC power supply to the board, always make sure that it does not deliver a voltage higher than +18Vdc.

3.3. Probe Installation

The ECSµ10 together with a PC75 probe form a high resolution contactless position sensor. However, the functionality can only be guaranteed if proper probe installation is implemented. This section describes the rules to install the probe.

The probe consists in a 1m coaxial cable with a MCX connector, a probe (with or without a steel holder to attach the probe), an isolating support (white) on which the Eddy Current probe is installed. In case of the steel support has a diameter of 7mm it should always be used to attach the probe.

Warnings:

- ➔ **The standard cable length has a 1m length. The user should not attempt to make its own cables as this would reduce the initial performance. If more length is required for the application, please send a specific request to Cedrat Technologies.**

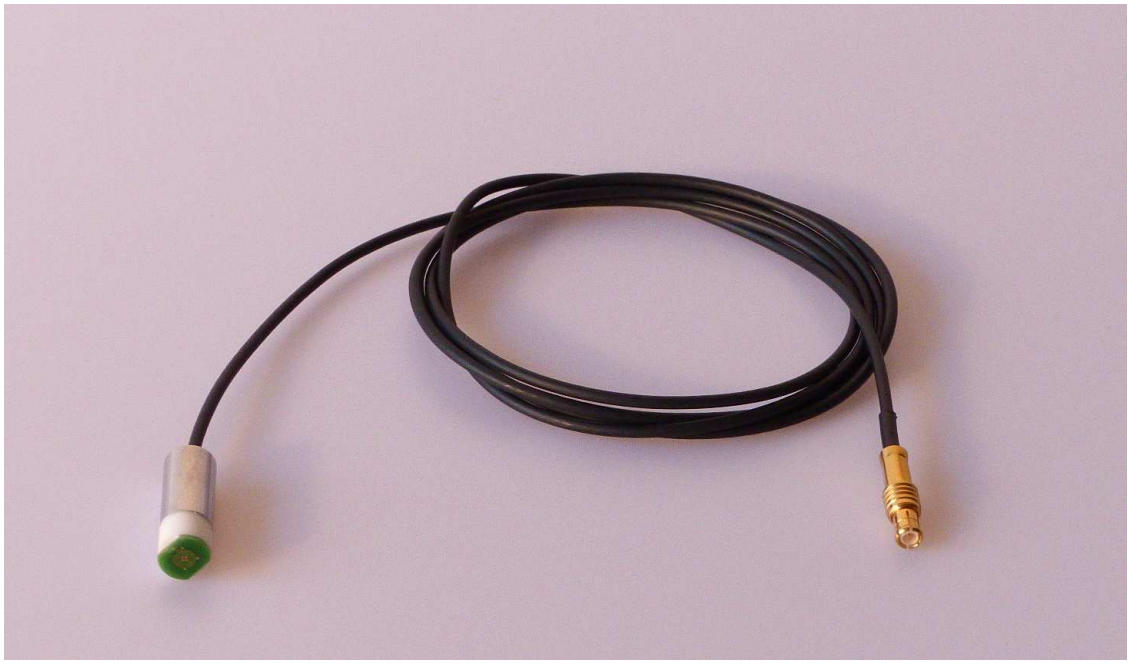


Figure 3-3: PC75 probe.

The target has a strong impact on the performance of the sensor, since it is this surface that is detected by the probe. In standard the target material is aluminium (to improve the sensitivity of the measuring chain), however, the user can address other materials, such as steel. In any case, the target material should be electrically conductive.

Concerning the dimensions of the target, it should have a minimum thickness of 0.5mm and be flat. The target surface in front of the probe should be centred and of at least two-three times the diameter of the probe. Lower diameter could be used but this choice will reduce the overall sensitivity.

The positioning of the probe with reference to the target also has a strong impact on the performance of the sensor. There are two rules for positioning the probe (see Figure 3-4):

1) The surface of the probe should be parallel to the surface of the target. This means that there should not be angle between the two surfaces (+/-10mrad is acceptable). If

the two surfaces are not parallel, this will add some error in the measurement. The user should always try to minimize the installation angle.

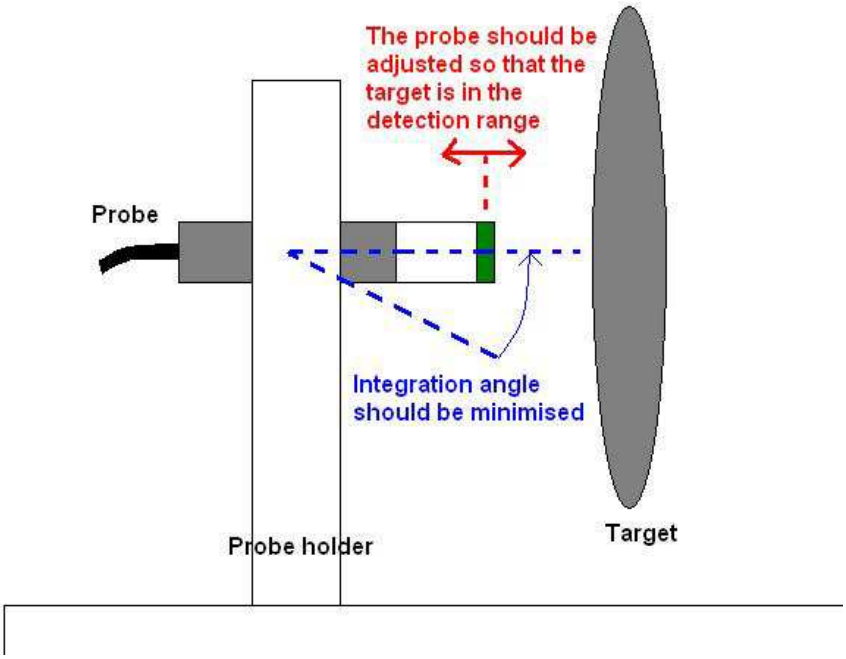


Figure 3-4: Rules for the probe installation.

2) The target should always be in the detection range of the probe. This means [50; 550µm] for the PC75-500, and [200; 2200µm] for the PC75-2000.

Warning: If the installation of the sensor does not fulfil the rules given above, the sensitivity of the sensor will be jeopardised.

3.4. Position measurement

The position of the sensor is given by the SUBD connector. The impedance of the measurement system (scope, controller...) should be at least 10kΩ.

The output provides a voltage proportionate to the distance between the probe and the target. The gain (µm/V), the offset and linearity (% of Full Scale) of the sensor should be adjusted by the user. Once calibrated and based on the voltage measured, the position of the target with reference to the probe is found following this formula:

$$\text{Position (µm)} = \text{Gain (µm/V)} \times V_{ECS\mu10}$$

For practical reasons (to adapt to the DAQ board), the user might want to adjust the offset and the gain of the output signal. The offset and gain adjustments can be performed through the potentiometers on board with a flathead screwdriver, as shown on the Figure 3-5.

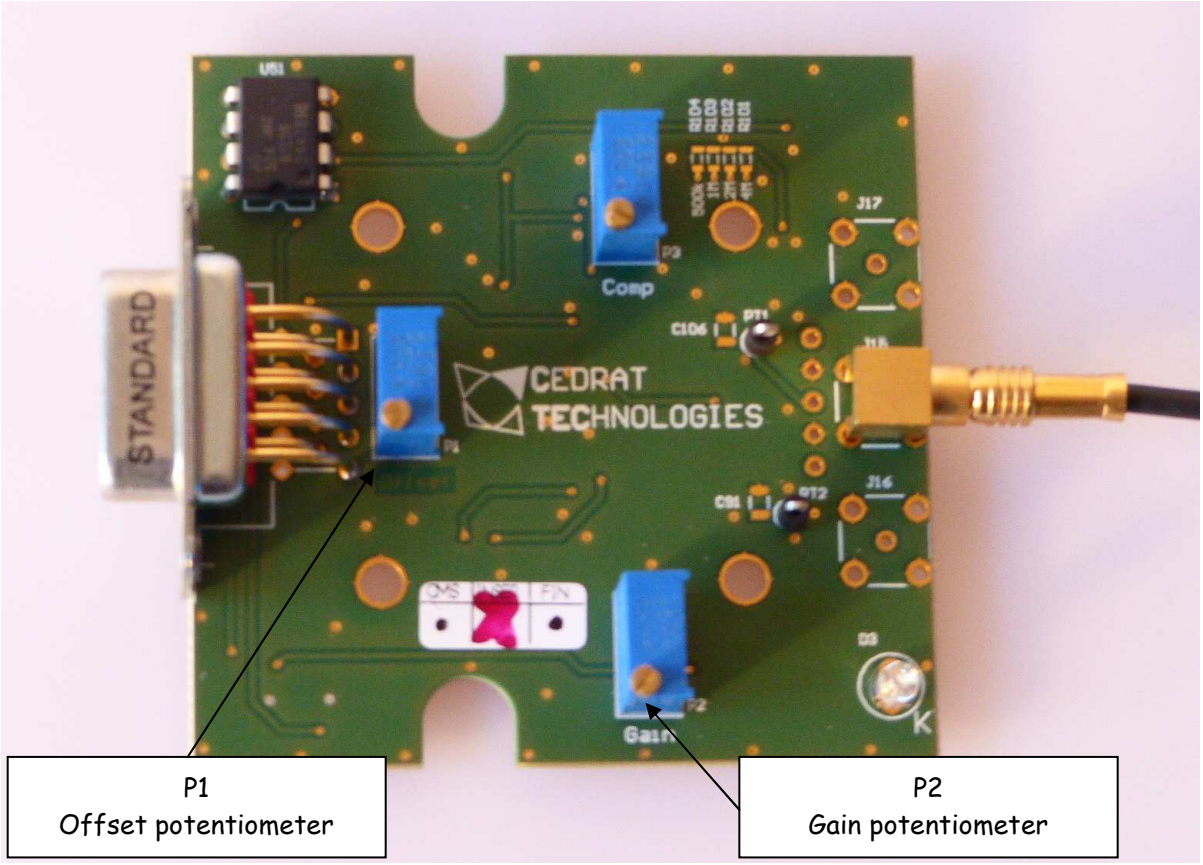


Figure 3-5: Setting the offset and gain of the output.

P1 and P2 potentiometers are respectively the offset adjustment and the gain adjustment. Once these potentiometers adjusted and the board calibrated, don't modified the offset and the gain.

4. INSPECTION UPON RECEIPT

This product has been inspected and shown to operate correctly at the time of Shipment.

Immediately upon receipt of the product, it should be inspected carefully for any signs of damage that may have occurred during shipment. If any damage is found, a claim should be filed with the carrier.

The package should also be inspected for completeness according to the enclosed packing list. If an order is incorrect or incomplete, contact your distributor.