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Model CP-01

Capacitance Preamp

Instruction Manual

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Introduction

The Model CP-01 Capacitance Preamp is a small (3.75" x 1.5" x 1.5") box with internal electronics that measures the capacitance of a non-contact probe. The probe is installed in the front panel of the unit. One connector on the rear of the box is used to supply power (+/- 15 volts) to the unit. A second connector on the rear of the box provides an output signal, which the user can connect to a digital voltmeter or data acquisition system. The output signal is calibrated to 1 volt per pico Farad. Capacitance measurements stable to better than 0.0001 pico Farads = 0.1 fempto Farads = 100 atto Farads can be typically achieved with the CP-01. In thermally stable environments, measurements can be made to better than 0.00001 pico Farads = 0.01 fempto Farads = 10 atto Farads. Note that the digital voltmeter or data acquisition system must be able to resolve 0.1 mV or 0.01 mV in order to achieve these results.

The CP-01 and a target, such as a turbine engine blade, can be mounted on an XYZ positioning table. By accurately positioning the target in front of the probe, the capacitance vs target position can be determined.

Probe Installation

To install a capacitive probe into the Model CP-01 Calibration Preamp, first remove the four screws at the corners of the front panel (refer to Figure 1).

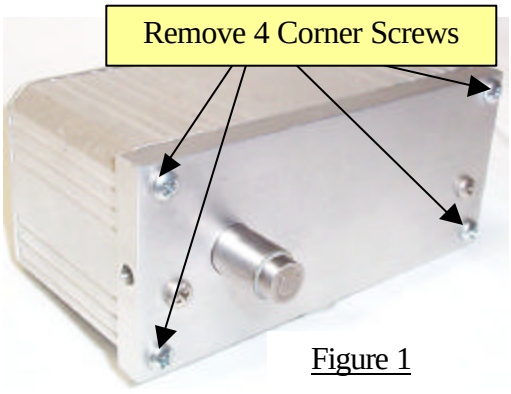

Figure 1

Slide the electronics assembly out of the box (see Figure 2). Cut the probe cable to a length of approximately 1.5" and separate the sensor lead from the outer ground and/or guard leads.

Mount the capacitive probe in the front panel and secure using the nylon-tipped setscrew (see Figure 2). Caution: to avoid damage to the probe, do not over-tighten.

Two probe electrical connection methods can be used. For calibration of probes that will be used for HiBand preamps and other dc-based measurement systems, no Guard connection is used. In this case, the Sensor lead of the probe should be connected to the Sensor connection on the printed circuit board, and all other probe leads should be

connected to the Ground connection (as illustrated in Figure 2). The outer case of the probe, the front panel, and the box will be automatically connected to ground through the front-panel mounting brackets.

For use as a stand-alone, non-contact gage, the Sensor lead should be connected to the Sensor connection on the circuit board, any Guard leads should be connected to the Guard connection, and any Ground leads should be connected to the Ground connection.

Slide the electronics assembly back into the box, making sure that the printed circuit board fits into the correct slot and the connectors are aligned with the cutout on the back panel.

Connect the Power Cable (with 4-pin Molex connector) and the Output Cable (with the 2-pin Molex connector) into the appropriate back-panel connector (see Figure 3). Pin connections for the Power and Output Cables are shown in Figure 4.

Mount the CP-01 and the target on the XYZ table. Connect the Power Cable to a +/- 15 volt power supply. Connect the Output cable to a digital voltmeter or data acquisition system.

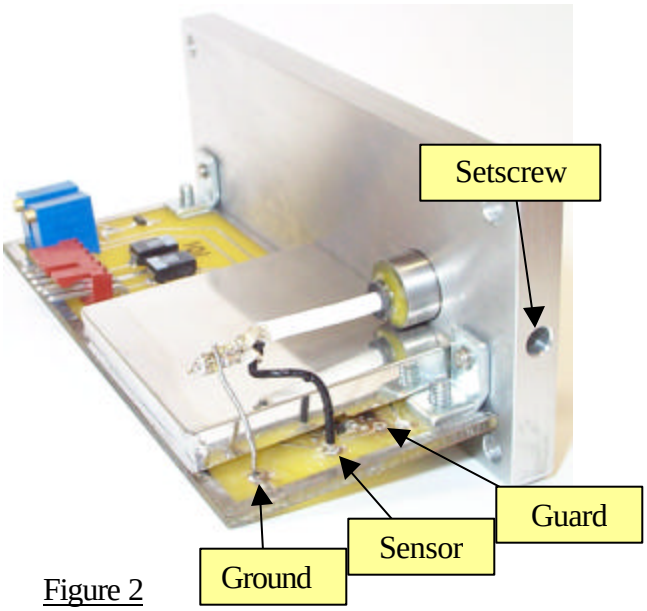

Figure 2

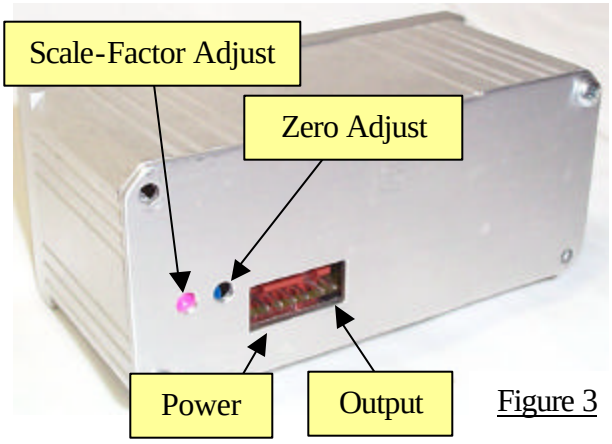

Figure 3

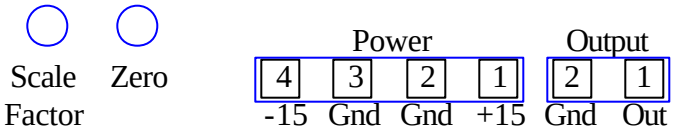

Figure 4. Back Panel Connections

Adjustments and Calibration

The Zero and Scale Factor of the CP-01 output signal can be adjusted by means of the two trim-pots accessible through the rear panel (see Figure 3). The zero adjust is limited to approximately +/- 150 fempto Farads (+/- 150 millivolts). The scale factor is factory set to 1 volt per pico Farad and should not be adjusted unless a precision capacitor is available.

To calibrate the Scale Factor, first open the box and remove the probe connections. Since the CP-01 is able to sense extremely small values of capacitance, make sure that any wires from the probe are sufficiently far away from the Sensor connection on the printed circuit board (see Figure 2). Make sure that the solder is removed from the Sensor and Ground connection points. Adjust the Zero-Adjust trim-pot so that the output voltage is 0.000 volts. Insert (do not solder) a precision reference capacitor (nominally 5 pico Farads is recommended) between the Sensor and Ground connections on the printed circuit board (see Figure 2). Adjust the Scale-Factor trim-pot so that the output voltage in volts is equal to the reference capacitance in pico Farads. Recheck both the zero and scale factor values by removing and reinstalling the reference capacitor. When the calibration process is completed, reinstall the probe and close the box.

The output voltage of the CP-01 is preset to read 0 to +10 volts for a probe capacitance of 0 to 10 pico Farads. Since some probes may exceed 10 pico Farads, the range of the output voltage can be changed to be –10 volts to +10 volts for a probe capacitance of 0 to 20 pico Farads. For 0 to +10 volt operation, a jumper wire should be installed between points 2 and 3; point 1 should have no connection. For –10 volt to + 10 volt operation, remove the jumper between points 2 and 3, and install a jumper between points 1 and 2, leaving point 3 with no connection, as shown in Figure 5.

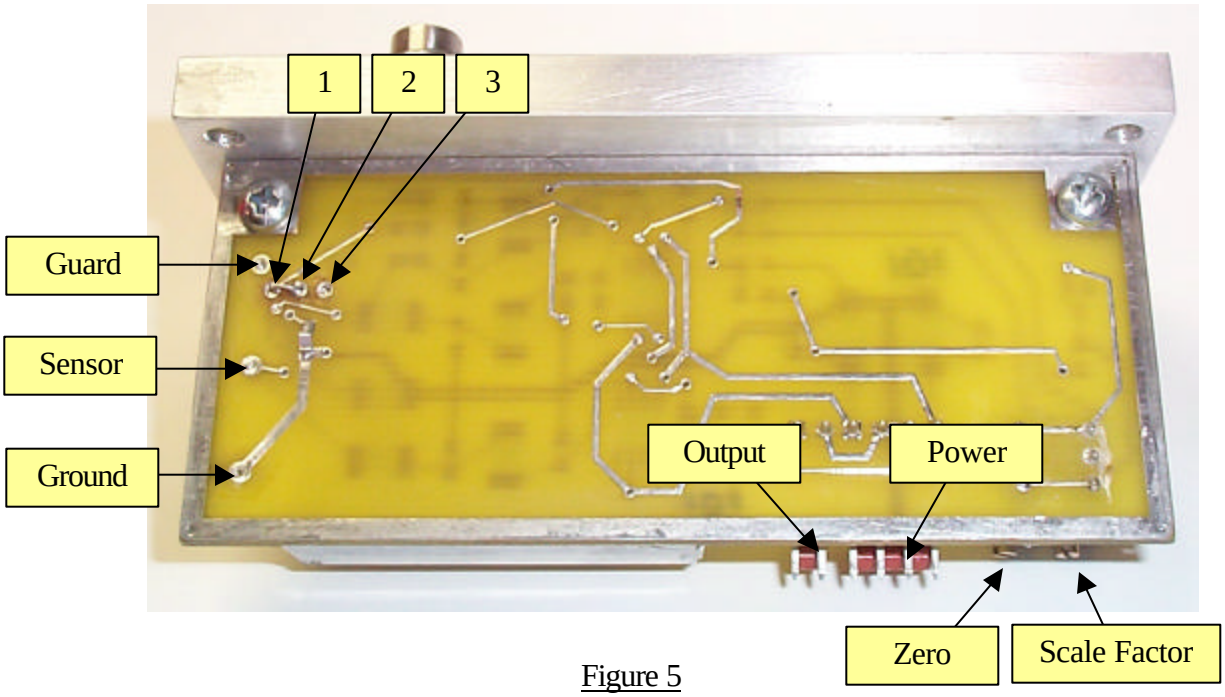

Figure 5