PROTECTION & RELIABILITY
OPTIMIZATION INSTRUMENTS
A CTC COMPANY

Product Manual

MNX10010 / REV B

MODEL PS03

3-Channel Power Supply

Contents

Section I
Overview

Introduction

The PRO Model PS03 Power Supply unit is a battery operated 3-channel, portable power unit designed to operate Integrated electronics, piezo electric (IEPE) sensors.

NOTE: SENSORS may refer to accelerometers, pressure sensors, hammers and force transducers, etc. The words SENSOR and TRANSDUCER are used interchangeably in this guide.

Sensors require a source of constant current, usually in the range of 2 to 20 mA at a supply (compliance) voltage range of +18 to +30 VDC.

Model PS03 supplies fixed constant current (called sensor drive current) to up to three sensors, of 2 mA at a +18 Volt compliance voltage level.

Power to operate the sensors is supplied by two 9 Volt transistor radio type dry cell batteries, operating in series, to produce +18 Volts DC.

A low current voltmeter located on the front panel of the PS03 constantly monitors the voltage appearing at the 'Sensor' jack of any of the three sensors selected for monitoring by a front panel rotary switch. This DC voltage is the quiescent bias voltage of the sensor and measuring this voltage is very useful in testing for faulty operation of cables and sensors.

A momentary pushbutton switch located just below the meter checks the battery voltage without disturbing the test in progress.

Both 'Sensor' and 'Output' jacks are BNC.

Description (*Figure 1*)

Model PS03 utilizes three 2 mA current regulating JFET diodes to supply the sensor drive current to up to 3 sensors. The metering circuit draws only 25µA at mid-scale (its normal operating level). With this low current drain, the battery life, starting out with a fresh pair of alkaline batteries, will be about 80 hours. Figure 1 is a schematic diagram of one channel of Model PS03. The voltmeter normally monitors the sensor bias voltage which is nominally about +10 Volts DC. Consult the specification sheet for your particular sensor to verify the actual bias voltages since some sensors have various other bias voltages.

The 'BATT TEST' switch momentarily connects the meter directly across the battery terminals when depressed, to allow the user to check the actual battery voltage during operation. This procedure will not disturb the test in progress.

The dynamic signal from the sensor is superimposed upon the bias voltage and appears at the "Sensor' jack. This signal is de-coupled from the DC bias by the 10µf coupling capacitor and connected to the 'Output' jack.

It can be seen, by examination of Figure. 1, that the dynamic signal may also be read by coupling to the 'Sensor' jack as well. However, if this is attempted, a means of dealing with the +10 Volt DC offset must be considered.

This type of connection can be useful when it is desirable to direct couple the readout to the sensor rather than to AC couple. More on this topic later.

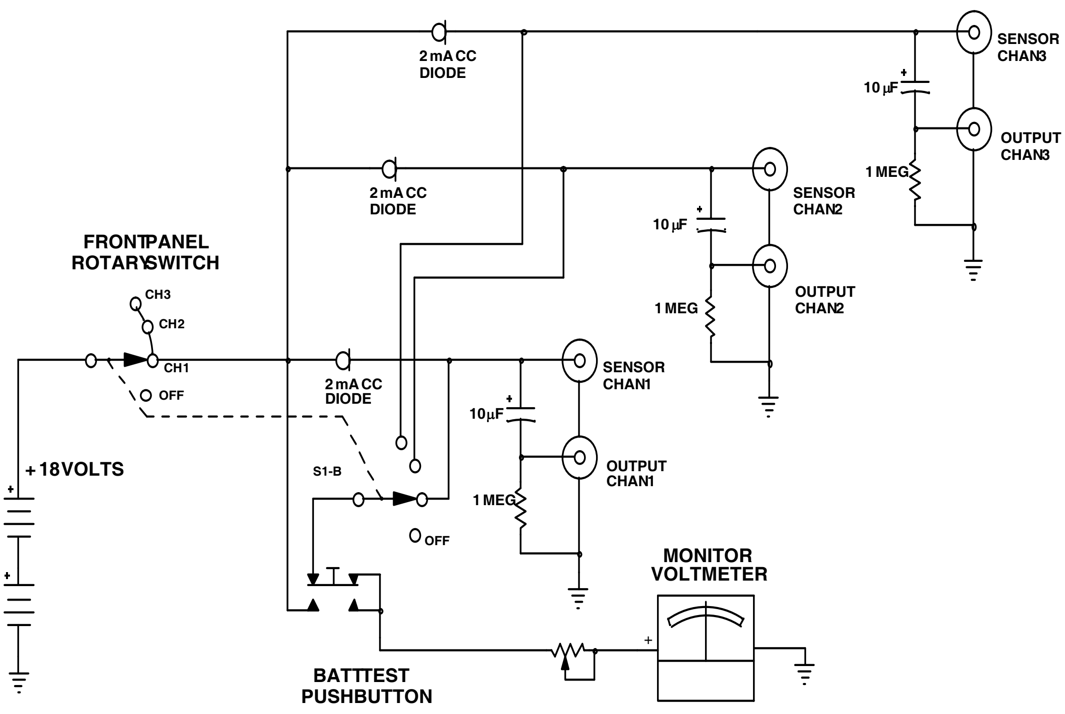

Figure 1. Schematic Diagram, PS03

MODEL PS03 3-CHANNEL
CURRENT SOURCE POWER UNIT,
BATTERY POWERED

SPECIFICATION	VALUE	UNITS
SENSOR SUPPLY CURRENT, FIXED, NOM.	**2.0**	**mA**
COMPLIANCE VOLTAGE	**+18**	**VDC**
VOLTAGE GAIN	**UNITY**	
COUPLING TIME CONSTANT INTO 10 MEGOHM LOAD	**10**	**SEC**
COUPLING TIME CONSTANT INTO 1 MEGOHM LOAD	**5**	**SEC**
LOW FREQUENCY -3db FREQ., 10 MEGOHM LOAD	**0.016**	**Hz**
LOW FREQUENCY -3db FREQ., 1 MEGOHM LOAD	**.032**	**Hz**
HIGH FREQUENCY RESPONSE	DETERMINED BY SENSOR, CABLE LENGTH AND SIGNAL LEVEL	
COUPLING CAPACITOR, NOM.	**10**	**µF**
PULLDOWN RESISTOR	**1.0**	**MEGOHMS**
MONITOR VOLTMETER RANGE, F.S.	**20**	**VDC**
ELECTRICAL NOISE, WIDEBAND	**60**	**µV, RMS**
SENSOR CONNECTOR	**BNC**	**JACK**
OUTPUT CONNECTOR	**BNC**	**JACK**
POWER SOURCE △1	**9 VOLT BATTERIES (2) ea.**	
BATTERY LIFE, TYP.	**40**	**HOURS**
SIZE (H x W x D)	**2.5 x 5.2 x 3.3**	**INCHES**
WEIGHT	**12**	**OUNCES**

Table 1. Specifications

△1 Any type of transistor radio 9-Volt battery may be use to power the PS03. However, longest battery life will be obtained by use of high grade alkaline type batteries.

Section II
Installation

The PS03 is a bench top unit that requires no special installation instructions.

Section III
Operation

Operating Procedure

To operate the PS03 with a sensor, connect the sensor cable to the BNC 'Sensor' jack on the channel one of the PS03 using the appropriate cable and or adaptor. *(Refer to Figure 2.)*

Connect the 'Output' jack for channel one to the input of the readout instrument (oscilloscope, voltmeter, recorder, etc.) using an appropriate cable. The BNC output jack on the PS03 eliminates the need for cable adaptors for the readout connection.

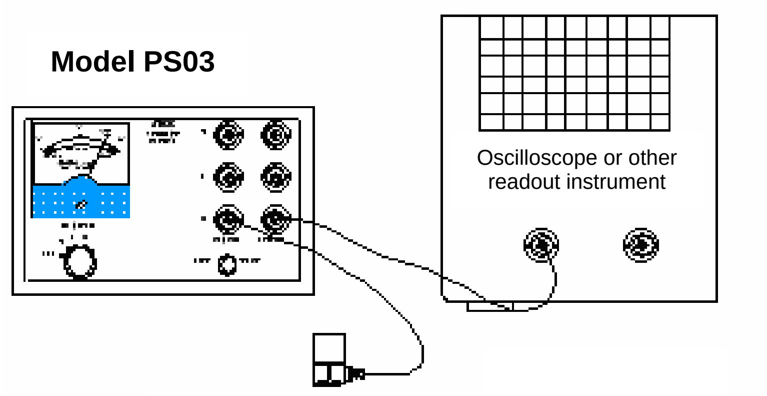

Figure 2. Systems Interconnect

Move the rotary channel select switch on the front panel to the channel 1 position which turns the power on and selects channel 1 for monitoring on the front panel voltmeter. Wait a few seconds for the coupling capacitor(s) to fully charge. The meter may indicate a slow drift while the capacitor is charging.

When conditions stabilize, observe the front panel meter. Normal operation of the sensor is indicated by a mid-scale reading on this meter. The normal mode of operation for most sensors is in the "Normal' area of the meter scale.

Depress the 'Batt Test' pushbutton switch and observe the battery voltage. The meter should read to the right of the 'Batt OK' line at the right hand end of the meter scale if the batteries are fresh. When the battery test function yields a reading well below the Batt OK line, it is time to replace the batteries. While the sensor will continue to function even with low batteries, clipping of the signal may occur on the top (positive) side of the dynamic signal if the sensor signal plus the sensor bias approaches the battery voltage.

The system is now ready to operate. Connect two more sensors if desired and follow the same procedure as for channel 1.

NOTE: To prolong battery life, remember to switch power off when the system is not in use.

COUPLING TIME CONSTANT AND LOW FREQUENCY RESPONSE

The low frequency capability of a piezoelectric measurement system may be limited by several factors about which the average user of such systems may not be aware.

The specifications each sensor will delineate the discharge time constant which controls the basic low frequency response of that sensor. However, the power unit and the readout may also play a part in this specification and may, in many cases, be the limiting factor rather than the sensor itself.

The low frequency response of any AC coupled system is limited by the coupling time constant (TC) of the composite measurement system. The coupling capacitor and the 1 megohm ‘pulldown’ resistor in each channel of the PS03, in parallel with the DC input resistance of the readout instrument constitute a first order high pass filter.

The TC of this filter is the product of the 10μF capacitor and the parallel combination of the 1 megohm pulldown resistor and the input resistance of the readout instrument.

The relationship between the coupling TC and the lower -3db frequency is:

Eq 1.

$$f_{-3db} = \frac{0.16}{TC}$$

Where: TC is the product of R and C, in Seconds

If the readout instrument is of the order of 10 megohms, it may be ignored. The TC is then 10μF x 1 megohms = 10 seconds. The lower -3db frequency is then:

Eq 2.

$$f_{-3db} = \frac{0.16}{10} = 0.016\ \text{Hz}$$

If the readout instrument input resistance is 1 megohm, the parallel combination of the pulldown resistor and the input resistance is 500k ohms. The TC is then 10μF x 500,000 or 1 second. The lower -3db frequency is then:

Eq 3.

$$f_{-3db} = \frac{0.16}{10} = .16\ \text{Hz.}$$

The importance of this illustration is to show that the sensor itself may not be the deciding factor in low frequency response and to stress the importance of the input impedance of the readout instrument on the low frequency response of AC coupled sensor systems.

OPTIONAL DIRECT COUPLED CONNECTION FOR QUASI-STATIC MEASUREMENTS

For some types of measurements such as when using dead weight testers to calibrate pressure sensors or when making long term measurements with force sensors with long TC's, it is desirable to direct couple to the sensor instead of AC coupling as through the 'Output' jack of the PS03.

To avoid the low frequency limitations as described in the previous section, it is possible, with some precautions, to use the 'Sensor' jack to measure the sensor signal, direct coupled instead of AC coupled through the 'Output' jack.

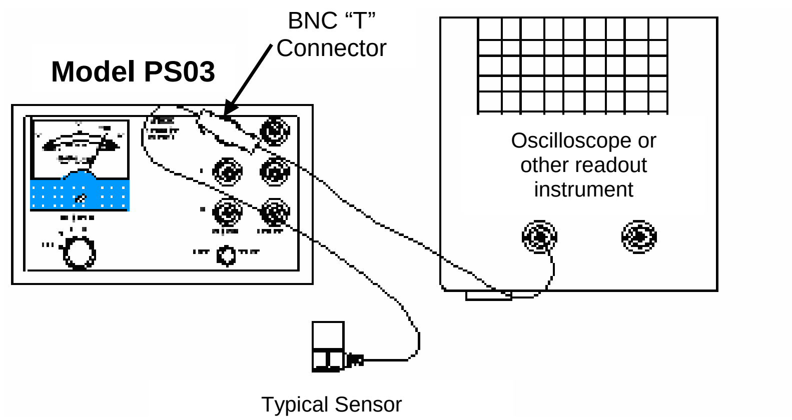

Figure 3. Optional Direct Coupled Connections

To do this, a BNC 'T' is connected to the 'Sensor' jack with one arm of the T connected to the sensor and the other arm connected to the readout. (Refer to Figure 3 above). The problem with this arrangement is that the readout must have the capability of 'nulling out' the approximate +10 Volt DC offset created by the sensor bias. Most readout instruments will not have this capability.

A better solution is to use a power unit which has a direct coupling option such as the CTC PS06 or PS02. These line powered current sources feature a summing amplifier which sums the sensor signal with a variable DC voltage and which nulls the sensor bias precisely to zero with no coupling capacitors, i.e., direct coupled to the output jack. With this power unit, the only limiting factor in the low frequency or quasi-static response of the measurement system is the discharge TC of the sensor itself.

HIGH FREQUENCY RESPONSE

The high frequency response of any piezoelectric system is determined by a number of factors. These are:

1. The response characteristics of the sensor itself,
2. The length and type of cable between the sensor and the power unit,
3. The length and type of cable from the sensor to the readout, (in unbuffered units such as the 4103B),
4. The amplitude of the sensor signal, and,
5. The level of drive current to the sensor.

With the PS03, the user has no choice of drive current settings since the sensor drive current is fixed at approximately 2 mA.

This amount of current should be sufficient to drive most sensors (except for some of the high frequency pressure sensors) to their full frequency range driving 100 ft. of combined input and output cable.

Experimentation is the only sure way to determine the effect of these various parameters on the high frequency response of the measurement system.

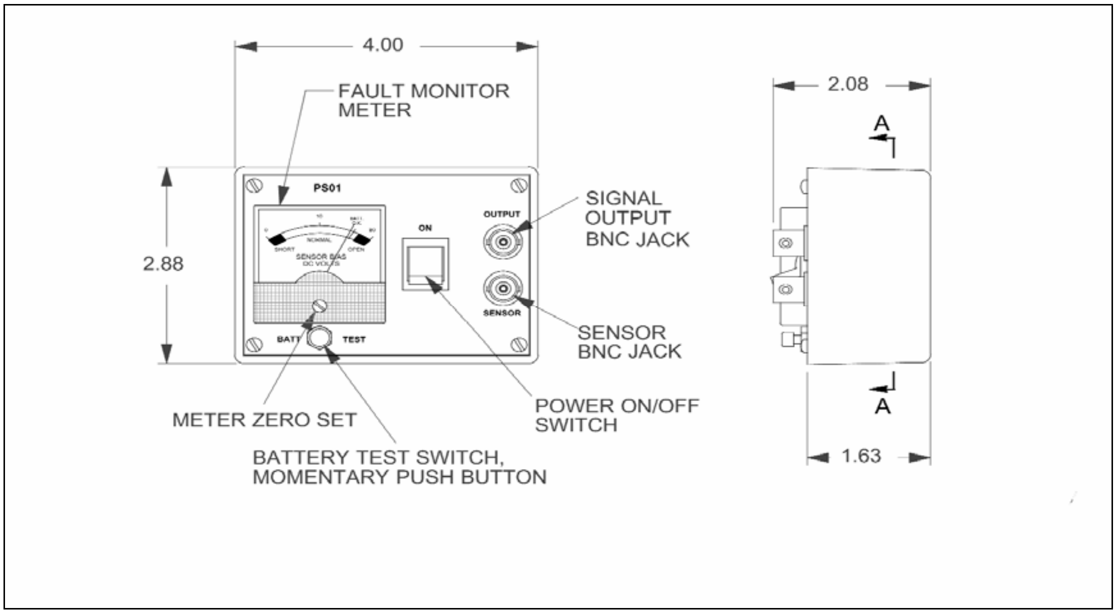

Figure 4. PS03 Power Supply Diagram

Section IV
Maintenance

CHANGING THE BATTERIES

When the 'BATT TEST' switch is depressed (or when the sensor is disconnected), the meter will indicate the battery voltage. When this reading drops below the 'BATT OK' mark on the meter dial, it is time to replace the batteries.

NOTE: Under some circumstances, it is possible to continue to use the PS03 even with low batteries as in emergencies. If the measurement level is low and there is no danger of clipping the signal in the positive direction, then it is OK to use the system. As an example, if the battery voltage drops to 14 Volts and the sensor bias is +10.5 Volts, the available signal swing is 14 - 10.5 = 3.5 Volts. If 3.5 Volts is adequate range for the measurement, the measurement will be valid.

To change the batteries, proceed as follows:

1. Remove the two screws at the bottom of the unit and separate the two halves of the case. Remove the bottom half of the case.
2. Carefully unsnap the connectors from the battery terminals using care not to overstress the wires to the terminals.
3. Remove the batteries from the battery clips and replace both with a good brand of 9V dry cell such as Duracell © MN1604, Eveready Energizer © alkaline no. 522, or equivalent. Before installing the batteries, make sure that they will fit into the clips. Some brands of battery may be oversize and these should not be used since there may not be adequate room for them in the PS03.
4. Re-attach the battery terminals and re-assemble the unit and outer case. Use caution not to over tighten the front panel retaining screws to avoid stripping the plastic threads in the case.

General

Aside from battery replacement, there is no routine maintenance required for the PS03.

Should the meter require re-zeroing, place the unit on a level table, face up with the power off, and adjust the zero adjust screw located directly below the meter face.

It is not likely that the meter should need recalibration but should this become necessary, a potentiometer is located inside the unit mounted on the circuit board. This pot sets the full scale reading of the meter. First measure the battery voltage with a DVM connected across the appropriate battery terminals (the batteries are in series) then set the meter scale to match by adjusting the potentiometer.

The connectors may be cleaned with a soft brush dipped in a solvent which is friendly to the atmosphere and to the plastic face of the meter and the outer case of the instrument. Avoid solvents such as methylene chloride and acetone which will attack the meter face and other plastic parts.

Should the PS03 develop a problem, contact the factory Customer Service Department for help in trouble shooting or for instructions in returning the unit to the factory for evaluation. At this time, a **R**eturned **M**aterial **A**uthorization (**RMA**) number will be assigned to help track the unit through the repair process, should it be necessary to return the unit to the factory.

Warranty

If any PRO product should ever fail, we will repair or replace it at no charge, as long as the product was not subjected to misuse, natural disasters, improper installation or modification which caused the defect.

CONTACT INFORMATION:
Connection Technology Center, Inc (CTC)
7939 Rae Blvd.
Victor, NY 14564
1-800-999-5290 (US & Canada) 1-585-924-5900 (International)
sales@ctconline.com – www.ctconline.com