

Trig-Tek™ 45EMD Portable Calibrator User Manual

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FOR YOUR SAFETY

Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNINGS** and **CAUTION** notices.



This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.



If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.



Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.



Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuit points.

Before operating this instrument:

1. Ensure the proper fuse is in place for the power source to operate.
2. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

Table of Contents

Chapter 1	1-1
Introduction	1-1
Features	1-2
Description	1-2
Specifications	1-3
Frequency	1-3
Amplitude	1-3
Power	1-3
Dimensions	1-3
Chapter 2	2-1
Operation	2-1
Rechargeable Battery	2-1
FREQUENCY and X1-X10 Switches	2-1
AMPLITUDE and X1-X10 Switches	2-2
UNITS mV/pC Switch	2-3
OFFSET Controls	2-3
Chapter 3	3-1
Performance Test.....	3-1
Test Equipment	3-1
Switch Settings.....	3-1
Performance Test.....	3-1
Chapter 4	4-1
Calibration Procedure	4-1
Test Equipment	4-1
Adjustment Potentiometers	4-1
Calibration Procedure	4-1

List of Figures

Figure 1-1, 45EMD Portable Calibrator 1-1

Figure 2-1, 45EMD Control Switches 2-2

Figure 4-1, Potentiometer Adjustment Locations 4-2

DOCUMENT CHANGE HISTORY

Revision	Date	Description of Change
A	02/02/2011	Document Control release
B	01/28/2013	Revised per ECN01650 updating AC accuracy spec in Chapter 1 and Performance Test in Chapter 3.

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Chapter 1

Introduction

The 45EMD Portable Calibrator (**Figure 1-1**) is designed to provide precision signals for field calibration of measurement instrumentation. This hand-held unit generates the required outputs to simulate a variety of transducers including temperature, pressure and vibration, with laboratory accuracy. It is powered by a rechargeable NICAD battery and operates for approximately 6 continuous hours on a single charge.

The 45EMD's output frequency is crystal controlled and accurate to .05%. Frequency is selectable from 10 to 999.9 Hz with 0.1 Hz resolution or 100 to 9999 Hz with 1.0 Hz resolution. A four-digit thumb switch and an X1 or X10 switch allow mV or pC level to be set from 0.1 to 999.9 with a 0.1 resolution or from 1.0 to 9999 with 1.0 resolution. Selectable output units include DC, PK, PK-PK or RMS. The mV output signal is on a BNC and the pC on a microdot connector. A differential pC output is provided on a three-pin connector. A DC offset voltage with selectable polarity can be superimposed on the AC outputs. Also a constant synchronous square wave output is provided. A carrying case and battery charger are included.



Figure 1-1, 45EMD Portable Calibrator

Features

Features include:

- Laboratory Accuracy
- 10 to 9999 Hz (XTAL)
- 0.1 to 9999 mV or pC
- Differential pC Output
- Square wave Output
- Adjustable DC Offset
- Carrying Case
- Battery Charger

Description

The 45EMD Portable Calibrator is a convenient signal generator and is especially useful for field testing of monitoring systems. It has the required outputs to simulate a variety of pickups, temperature pressure, vibration (acceleration, velocity or displacement) or can be used in a laboratory as a precision signal source. The unit has a rechargeable NICAD battery that provides approximately 6 hours of continuous use before recharging.

The 45EMD has many features. It provides a crystal controlled frequency output with a .05% accuracy. Its frequency is set using a four-digit thumbswitch working with an X1-X10 switch thus the frequency can be set with 0.1 Hz resolution from 10 to 999.9 Hz or 1 Hz resolution from 100 Hz to 9999 Hz.

A UNITS switch selects OFF, DC, PEAK, PK-PK, or RMS settings. A four-digit thumbswitch selects in conjunction with an X1-X10 switch provides 0.1 to 999.9 mV (millivolts) and pC (picocoulomb), with 0.1 mV and pC resolution or 1 to 9999 with 1 mV and pC resolution. The mV output is on a BNC and the pC output is on a microdot connector. Also a differential pC signal is available on a three-pin connector (MS3102A.105L-3S). For convenience, the unit has a constant square wave output, on a BNC at the set frequency to be used as a sync or reference signal.

A DC Offset voltage can be superimposed on the AC output signals this is accomplished by a minus-Off switch to allow plus or minus 0 to 12 Volts with a single turn control.

Specifications

Frequency

Range	10 to 9999 in two ranges (usable to 1 Hz)
Accuracy	±0.05%
Resolution	0.1 Hz X1 range 10.0-999.9 Hz 1 Hz X10 range 100-9999 Hz

Amplitude

The mV (Millivolt) output is converted to picocoulomb at the pC (Picocoulomb) output. The Frequency is the same; the Picocoulomb level is the same as the Millivolts ±0.3%.

Impedance	mV (millivolts) less than 50 Ohms pC (picocoulomb) 1000 pF capacitor
AC Accuracy	10 to 9999 Hz 0.5% of reading ±0.3 FS (for set outputs) SQ Wave 5 Volt p-p ±0.5V
Distortion	Less than 1% (30 to 9999 Hz)
DC Accuracy	±0.5% of setting ±0.2% FS

Power

120 or 230 VAC battery charger
9 VDC at 200 mA output

Dimensions

4.75" wide x 6.5" high x 2" deep.

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Chapter 2

Operation

The 45EMD Portable Calibrator is contained in a high impact plastic case. It is light and very durable. It provides settings of 000.1 to 999.9 mV or pC output levels with an X10 to provide 0001 to 9999 mV or pC at the two separate output jacks.

The battery used provides more than 6 hours of operation before recharge is needed. The 45EMD Portable Calibrator is a straight forward instrument with self-explanatory controls. The operation of each control is given and information regarding the battery charging.

Rechargeable Battery

The 45EMD Portable Calibrator contains a six-volt rechargeable battery that should give long, trouble-free service. The battery will supply power to the 45EMD for more than 6 hours when fully charged. In order to fully recharge the battery, it is necessary to plug the charge adapter into 115 V RMS power and connect to the 45EMD Portable Calibrator. To extend the life of the battery, it should be completely discharged before recharging. The battery requires ten hours to fully charge. The 45EMD provides circuitry such that the charger may be left plugged-in indefinitely without damaging the battery.

When the low battery (LOW BATT) light illuminates, it does not necessarily mean the battery is fully discharged. It does mean that the battery has dropped below the voltage required to maintain the specifications for the 45EMD. The 45EMD will probably continue to operate, but the output voltages may not be within specifications to completely discharge the battery leave the unit ON until the Low Battery light goes out, then charge the battery.

FREQUENCY and X1-X10 Switches

The frequency is set by a four station thumbswitch to set from 0001 to 9999. Incorporated with this switch is an X1-X10 slide switch to accomplish two full scale frequencies of 999.9 Hz or 9999 Hz. The low range has a resolution of 0.1 Hz; the high range has 1 Hz resolution.

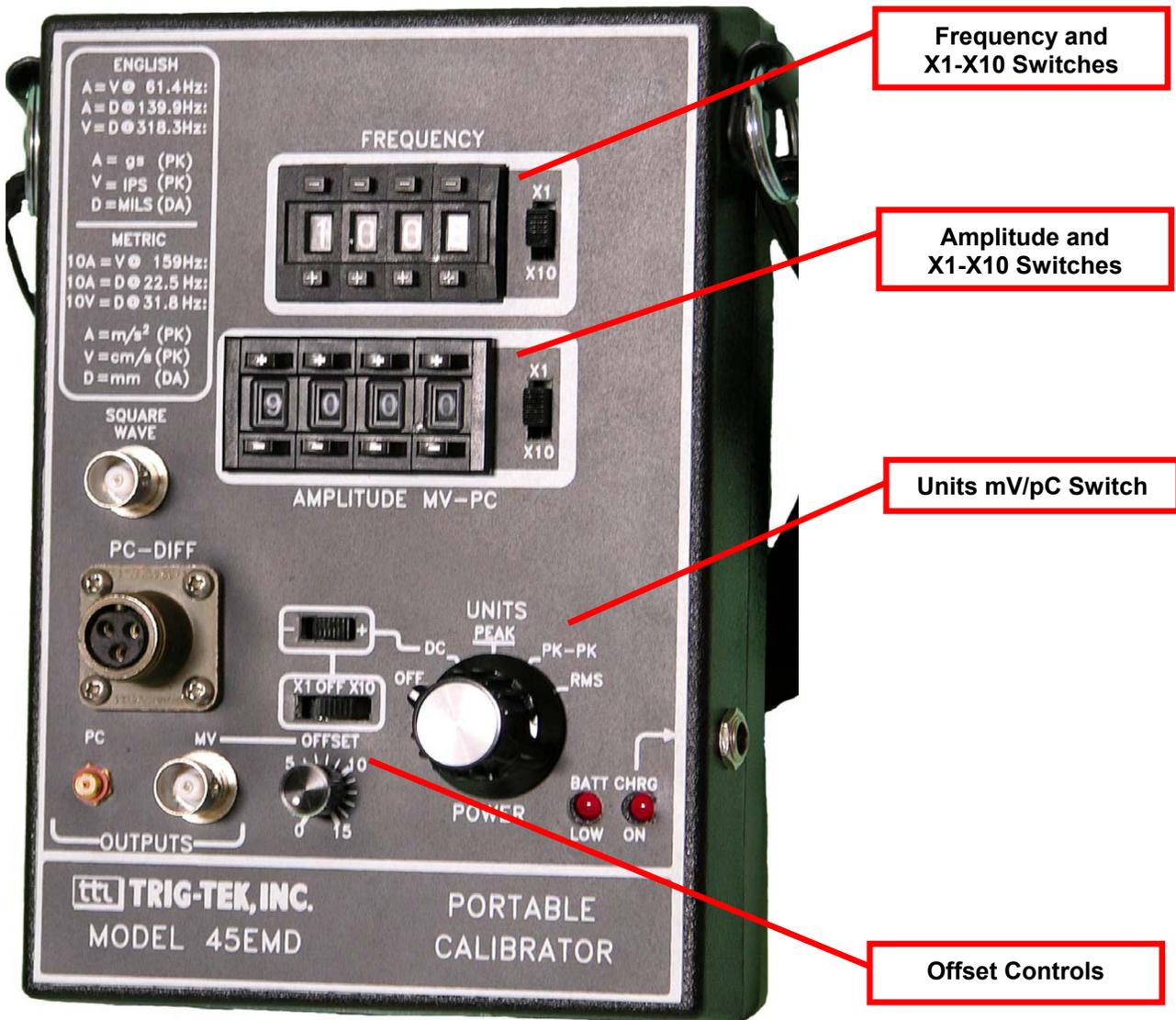


Figure 2-1, 45EMD Control Switches

AMPLITUDE and X1-X10 Switches

The amplitude is set using a four-digit thumbwheel switch (**Figure 2-1**) providing settings from 000.0 to 999.9 mV, or pC amplitude for the units selected by the UNITS switch. The 000.1 to 999.9 Amplitude setting can be multiplied by an X1-X10 Switch. Refer to **Figure 2-1**.

When switched to X1 the amplitude is 000.0 to 999.9 mV and pC. In the X10 position, amplitudes of 0000 to 9999 mV and pC can be set.

UNITS mV/pC Switch

This UNITS mV/pC switch (**Figure 2-1**) has five positions. The first is DC. When the switch is in this position, only DC voltages appear at the mV (millivolt) output. The output level of the DC is determined by the AMPLITUDE switch, and can provide outputs of 000.1 to 999.9 millivolts or 0001 to 9999 millivolts DC in two ranges by placing the X1-X10 Switch to X10. The $\square\square$ +/- Switch selects either a positive or negative DC at the millivolt output.

The next position of the switch is PEAK. When in this position the AMPLITUDE is calibrated for AC millivolts peak at the mV (millivolt) output. The output at the BNC connector labeled pC (picocoulomb) is a charge output equivalent to the applied voltage through a precision capacitor. The precision 0.3% capacitor is 1000 pF. Hence, if 100 mV PEAK is set in on the front panel switch, a voltage of 100 mV is applied through the 1000 pF capacitor providing an equivalent charge of 100 pC peak at the BNC pC output. An MS3106-105L-3S connector also provides a differential picocoulomb output.

The third position of the switch is AC PK-PK. When in this position the mV (millivolt) and pC (picocoulomb) outputs are calibrated in PK-PK units. While in the PK-PK position the mV output can be offset 0 to 12 V DC adjustable by the DC SET control.

When no DC is needed be sure the DC OFFSET Switch is in the OFF position.

OFFSET Controls

The OFFSET Controls (**Figure 2-1**) are the X1-OFF-X10 Switch, the single turn OFFSET control and the +/-SWITCH. Either 0-1.2V DC in the X1 position of the OFFSET Switch or 0-12V DC in the X10 position can be set by the OFFSET control. The polarity of the offsets is set by the +/-SWITCH.

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Chapter 3

Performance Test

The following performance test procedure is a method of testing the 45EMD Portable Calibrator unit to verify that it is performing within the manufacturer's specifications. The unit uses integrated circuits and very stable parts and should not require calibration more often than every twelve months. In the event that a reading is out of tolerance, refer to Chapter 4, Calibration Procedures.

Test Equipment

Note: Equivalent equipment can be used.

AC/DC voltmeter	Keithley 191
Frequency Counter	Leader LDC-822

Switch Settings

- Set the FREQUENCY switch to 100.0 Hz X1.
- Set AMPLITUDE switch to indicate 0000.
- Set UNITS switch to DC.
- Set the AMPLITUDE X1, X10 switch to X10.
- Turn the OFFSET knob to the full counterclockwise position.
- The offset X1-OFF-X10 to switch to OFF.
- Place the +/- Switch to the (+) position.

Performance Test

1. Connect the DC voltmeter to the mV OUTPUT (BNC) jack.
2. Observe an indication of 0 ± 20.0 mV on the DC voltmeter.
3. Set the AMPLITUDE switch to 9999.
4. Observe an indication of 9999 ± 70 mV on the DC voltmeter.
5. Set the AMPLITUDE X1-X10 switch to X1.
6. Set the AMPLITUDE switch to 100.0.
7. Observe an indication of 100 ± 2.5 mV on the DC voltmeter.

8. Set the AMPLITUDE switch to 010.0.
9. Observe an indication of 10.0 ± 2.1 mV on the DC voltmeter.
10. Set the AMPLITUDE switch to 900.0, and the UNITS switch to RMS.
11. Connect an AC voltmeter to the mV OUTPUT (BNC) jack.
12. Observe an indication of 900 ± 7.5 mV RMS on the AC voltmeter.
13. Set the UNITS switch to PEAK.
14. Observe an indication of 636 ± 5.0 mV RMS on the AC voltmeter.
15. Set the UNITS switch to PK-PK.
16. Observe an indication of 318 ± 2.5 mV RMS on the AC voltmeter.
17. Set the Frequency Switch to 999.9.
18. Connect the Frequency Counter to the mV OUTPUTS (BNC) jack.
19. Observe an indication of 999.9 ± 0.5 Hz on the Frequency Counter.
20. Set the FREQUENCY X1-X10 Switch to X10.
21. Observe an indication of 9999 ± 5.0 Hz on the Frequency Counter.
22. Return the UNITS switch to RMS.
23. Observe an indication of 900 ± 7.5 mV RMS on the AC voltmeter.
24. Set the AMPLITUDE X1-X10 switch to X10.
25. Observe a 9000 ± 75 mV RMS on the AC voltmeter.

Chapter 4

Calibration Procedure

The unit has been carefully calibrated using frequency counters and voltmeters that are traceable to the National Bureau of Standards. **Do not make any adjustments unless properly calibrated equipment is available.** Make sure the battery is fully charged.

Test Equipment

Note: Equivalent equipment can be used.

Frequency Counter	Leader LDC-822
Digital Multimeter	Keithley 191

Adjustment Potentiometers

There are five separate adjustments inside the 45EMD Portable Calibrator. See **Figure 4-1**.

Remove the back cover of the 45EMD by removing the six screws found on the back of the Calibrator. Pull the cover back and lift it up and off. Place the unit in front of you with the front panel down. Looking down into the calibrator you will see the five adjustment potentiometers.

The five adjustment potentiometers provide the following.

R1	Peak Level
R2	RMS Level
R3	DC Level
R4	DC Zero
R5	Factory Zero Adjust (factory adjustment only)

Calibration Procedure

1. Connect a DC voltmeter to the MV (BNC) OUTPUT jack.
2. Set FREQUENCY switch to 5000 X1.
3. Place the UNITS switch to DC. (The DC OFFSET Control must be completely counterclockwise), and OFFSET switch to OFF.

4. Set the AMPLITUDE switch to 0000 X1.
5. Adjust the DC Zero ADJ R4 for a 0 ± 0.1 mV indication on the DC Voltmeter.
6. Set the AMPLITUDE switch to 900.0.
7. Set the DC LEVEL ADJ R3 for a 900 ± 1.0 mV indication on the DC voltmeter.
8. Connect an AC voltmeter to the mV (BNC) jack.
9. Place the UNITS switch to RMS. Make sure DC OFFSET Control is in the full counterclockwise position and OFFSET Switch to OFF.
10. Set the RMS LEVEL ADJ R2 for a 900 ± 1.0 mV RMS indication on the AC voltmeter.
11. Place the UNITS switch to PEAK.
12. Set the PEAK LEVEL ADJ R1 for a 636.3 ± 1.0 mV RMS indication on the AC voltmeter.

A high grade 0.3% precision 1000 pF capacitor is in series with the BNC output connector. The above calibrations have automatically adjusted the pC (picocoulomb) output, as these calibrated voltages are used via the capacitor to the pC (picocoulomb) output.

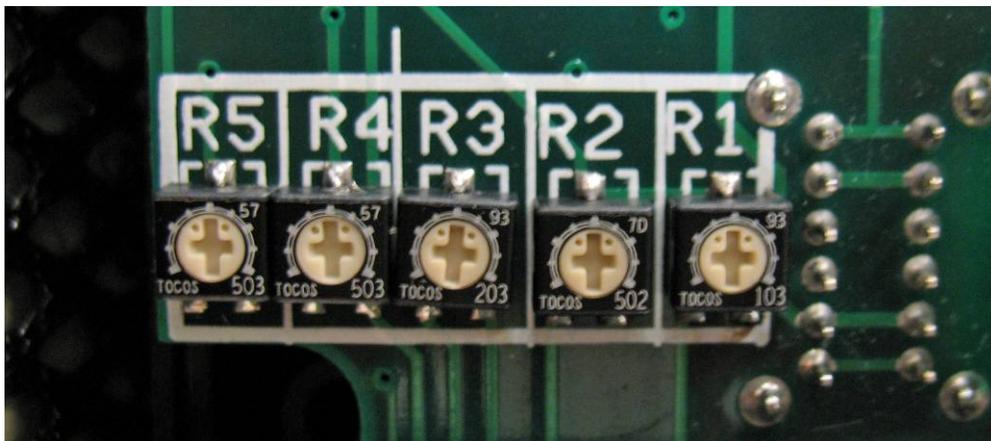


Figure 4-1, Potentiometer Adjustment Locations