

The Shot

Current Loop Source and Transmitter Simulator

Introduction

The Shot™ is a current loop source capable of providing calibrated 4 mA, 12 mA and 20 mA signals. In source mode, no other power is required. The Shot™ is also capable of simulating a transmitter. Coarse and fine potentiometers are provided to generate (or simulate) any desired signal between 4 and 20 mA.

The Shot™ uses only one 9V battery. Yet The Shot™ can send 20 mA into a 1 kΩ load. Using Ohms law, this means The Shot™ has to produce $1\text{ k}\Omega \times 20\text{ mA} = 20\text{V}$. In watts, $(W = I \times E)$, $20\text{ mA} \times 20\text{ V} = 0.4\text{ W}$. At 9V, 0.4W is equivalent to 44 mA, at 7V, 57 mA, at 6V, 66 mA (if Shot™ were 100% efficient in converting the energy). These are relatively high loads for a 9V battery. Since a 9V battery has limited energy capacity, The Shot™ has several strategies to extend battery life.

The first way to extend battery life is to make sure no power is used when The Shot™ is not being used. The Shot™ senses when either a load (in source mode) or a power source (in simulate mode) is connected. When not connected, The Shot™ turns off completely, using no power whatsoever.

The second method used by The Shot™ is load sensing. The Shot™ increases battery voltage only to the point required by the load. If the load doesn't require 20V, then The Shot™ only generates as much as is required.

A special feature of The Shot™ is the ON light. It does more than indicate power is flowing through the loop. The light actually indicates whether The Shot™ is providing the calibrated signal as selected by the three position current selector switch. If for some reason the loop impedance is too high, or some other condition causes the current to be different than that which is selected, the ON indicator will not turn on.

The 1mV/mA output of The Shot™ is more accurate than the mA scales of most handheld multimeters. The most accurate measurements of loop current are with this feature.

Specifications:

Environmental

Ambient Operating Range: 0 to 50°C

Storage Temperature: -40 to 60°C (-40 to 140°F)

Humidity: 0% to 90% (0 to 35°C)

0% to 70% (35 to 50°C)

Basic Accuracy: (@23 ±5°C Calibration)

0.1% of setting at preset points of 4, 12 or 20 mA.

mV Output: 1mV/mA.

mV Output Accuracy: 0.05% of reading.

Maximum Load: 1kΩ in Source Mode, 2.1KΩ in Simulate Mode with 50V supply.

Supply Voltage in Simulate Mode: 6 to 50V

General

Maximum Load in Source Mode: 1kΩ

Maximum Load in Simulate Mode: 2.1kΩ

(w/50V supply).

Weight: 6 oz., 170 grams.

Length: 4 1/2", 114 mm.

Width: 2 3/8", 60 mm.

Battery: Alkaline 9V Battery (Eveready No. 522 or equivalent)

Battery life: 4 hours minimum while sourcing 20 mA into a 1kΩ load. Battery life is substantially longer with lower loads and while sourcing less milliamps.

Output Connections: Standard 4mm banana plugs.

Accessories:

Test Lead Set (included)

Use and Operation

The Shot™ has two toggle switches. The switch that toggles left to right selects either the preset ranges of 4/12/20mA or the continuous adjustment position, using the coarse and fine potentiometers. Set this selector to the desired position.

For 4, 12 or 20 mA set the left toggle switch to the right. Use the right toggle switch to select the preset points.

To power an indicator, actuator or I to P converter, use the source mode of The Shot™. Connect the source jack of The Shot™ to the positive point in the loop. Connect the common jack of The Shot™ to the negative point in the loop.

To simulate a transmitter connect the loop to the common and simulate terminals. The Shot™ uses a diode bridge on these inputs so the polarity of the loop in simulate mode does not matter.

To stroke a valve, or generate mA other than 4, 12 or 20 mA, set the left toggle switch to the left position. Use a multimeter to monitor the output current. Put the milliammeter in series with the loop, or use the mV scale of the multimeter connected to the 1mV/mA output of The Shot™ (the second method is more accurate). Use the COARSE and FINE knobs to adjust the current to the precise, desired value.

To change the battery, disconnect The Shot™ from all external connections. Remove the battery compartment cover and replace the battery with a quality alkaline battery. Press on the battery cover (it has our name and phone number on it) and slide the cover away from the case.

Due to the high current requirements of The Shot™, only alkaline batteries should be used. Other types of batteries do not have the peak current capability required by The Shot™, and The Shot™ will not meet specifications (such as maximum loop resistance and, of course, minimum battery life).

The ON light verifies the output of the shot. If the ON light fails to turn on while connected to a loop, the output signal is not accurate. The loop impedance is probably too high.

When the LOW BATTERY light turns on, battery life of 30 minutes under maximum load remain. With light loads, battery life can be significantly longer. As long as the ON light turns on, The Shot™ is in calibration, even with the LOW BATTERY light on.

The LOW BATTERY LIGHT turns on briefly when you disconnect The Shot™ from your loop. This is normal, and occurs because the Low Battery circuitry senses the shutoff, but it has enough remaining energy to turn on the lamp for a few seconds.

To use the 1mV/mA OUTPUT, connect the millivolt DC inputs of a digital voltmeter to the 1mV/mA output of The Shot™.

The Shot™ Calibration Procedure

A calibration cycle of one year is recommended to maintain The Shot™ within specifications. ~~A calibration cycle of 1 year is recommended to maintain The Shot™ within specifications.~~ Recommended equipment is listed in Table 1. Use Calibration Procedure 1 for use with any multimeter. Use Calibration Procedure 2 to match The Shot™ to a specific meter.

Table 1: Required Equipment

Instrument (digital)	Minimum Specification	Recommended Model
mA meter	0.05% of reading	Fluke 45
Voltmeter	0.01% of reading	Fluke 8840A

Calibration Procedure 1

Use this procedure to calibrate The Shot™ for use with any meter:

1. Allow ~~the Multimeter~~ ^{THE SHOT™} to stabilize at room temperature, away from drafts, for at least 30 minutes before proceeding with calibration.
2. Verify the condition of the battery and replace the battery if necessary.
3. Disassemble The Shot™. First, remove the battery cover and battery (disconnect the battery). Next, remove the two phillips screws. Place your thumb on the case directly above the serial number tag. Place the rest of your fingers on the edge of the case where the yellow arrows point to SOURCE, COMMON, etc. Squeeze your fingers together and the bottom half of the case will separate from the top half. Reconnect the battery.
4. Connect the source terminals of The Shot™ to the milliammeter.
5. Connect the 1mV/mA output of The Shot™ to the DC millivolt input of the voltmeter.
6. Set The Shot™ to the calibrated 20 mA output.
7. Compare the readings between the voltmeter and the milliammeter. Refer to Figure 1 for trimmer potentiometer locations. Adjust R35 until both meters indicate the same value.
8. Set The Shot™ to the calibrated 12 mA output. Adjust R12 until the mA output is 12 mA, ± 0.006 mA.
9. Set The Shot™ to the calibrated 4 mA output. Adjust R9 until the mA output is 4 mA, ± 0.002 mA.
10. Set The Shot™ to the calibrated 20 mA output. Adjust R7 until the mA output is 20 mA, ± 0.01 mA.
11. Reassemble The Shot™. Remove the battery, slide the bottom half of the case onto the top and

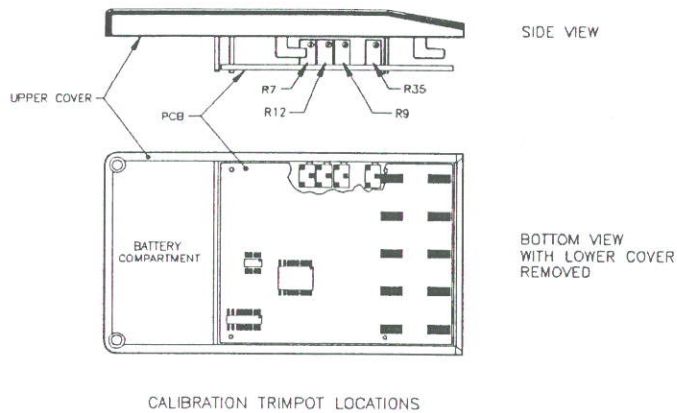


Figure 1: Trimmer Potentiometer Locations

reinstall the two phillips screws. Reinstall the battery and battery cover.

Calibration Procedure 2

Use this procedure to calibrate The Shot™ for use with a specific meter:

1. Allow the MultiCal™ to stabilize at room temperature, away from drafts, for at least 30 minutes before proceeding with calibration.
2. Verify the condition of the battery and replace the battery if necessary.
3. Disassemble The Shot™. First, remove the battery cover and battery (disconnect the battery). Next, remove the two phillips screws. Place your thumb on the case directly above the serial number tag. Place the rest of your fingers on the edge of the case where the yellow arrows point to SOURCE, COMMON, etc. Squeeze your fingers together and the bottom half of the case will separate from the top half. Reconnect the battery.
4. Connect the source terminals of The Shot™ to the milliammeter.
5. Connect the 1mV/mA output of The Shot™ to the DC millivolt input of the voltmeter that The Shot™ will be matched with.
6. Set The Shot™ to the calibrated 20 mA output.
7. Compare the readings between the voltmeter and the milliammeter. Refer to figure 1 for trimmer potentiometer locations. Adjust R35 until both meters indicate the same value.
8. Set The Shot™ to the calibrated 12 mA output. Adjust R12 until the mA output is 12 mA, ± 0.006 mA.
9. Set The Shot™ to the calibrated 4 mA output. Adjust R9 until the mA output is 4 mA, ± 0.002 mA.
10. Set The Shot™ to the calibrated 20 mA output. Adjust R7 until the mA output is 20 mA, ± 0.01 mA.

11. Reassemble The Shot™. Remove the battery, slide the bottom half of the case onto the top and reinstall the two phillips screws. Reinstall the battery and battery cover.

For application or operation assistance or information on Crystal Engineering products call:

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Grover Beach, CA. 93433
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Warranty

Crystal Engineering Corporation warrants The Shot™ and test lead set to be free from defects in material and workmanship under normal use and service for 1 year from date of purchase to the original purchaser. It does not apply to batteries or when the product has been misused, altered or damaged by accident or abnormal conditions of operation.

For warranty service call 1 (800) 444-1850

Have ready the model number, serial number, date of purchase and reason for return. You will receive instructions for returning the device to Crystal Engineering.

Crystal Engineering will, at our option, repair or replace the defective device free of charge and the device will be returned, transportation prepaid.

However, if we determine the failure was caused by misuse, alteration, accident or abnormal condition of operation, you will be billed for the repair.

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