

ENCORE ELECTRONICS INC.  
Model 226-002  
Strain Gage Bridge Calibrator

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DESCRIPTION  
Model 226-002  
Strain Gage Bridge Calibrator

The function of the Model 226-002 bridge calibrator is to provide AC calibration to a strain gage amplifier. The unit will apply a precision CAL resistor across one leg of the bridge at a frequency of 1kHz or 10kHz. The desired CAL resistor is chosen using the front panel decade resistance thumbwheel. Any resistance from zero ohms to 999.99 Kohms is selectable in steps of 10 ohms.

When the peak amplitude of the calibrator signal equals the DC level across the gauge being calibrated, there will be zero current through the CAL resistor. When this current is zero, the gauge will see no effective calibration resistance. Conversely, the full effect of the CAL resistor is applied when the calibrator signal reaches zero volts. The calibrator automatically adjusts its peak to peak output amplitude to match the DC excitation it measures on the gage being calibrated.

To support calibration of any gage in a bridge, the Model 226-002 can accept positive or negative gage voltage. For best noise performance, the BNC shell of J1 should be connected to a low-impedance point, either +P or -P on the bridge. The center conductor of the BNC should go to either +S or -S on the gage to be calibrated. Set rear-panel toggle to +V<sub>gage</sub> or -V<sub>gage</sub>, depending on the polarity of the DC voltage on the gage.

A front panel LED is provided as a power-on indicator and a low-battery indicator. During normal operation, the LED is green. If the battery voltage falls below approximately 6.6V the front panel LED will turn red, indicating a low battery condition. The rechargeable battery pack is located in a rear panel compartment for easy access. Starting in 2012, the standard battery pack changed from NiCd to NiMH; be sure to use the correct charger for your battery type.

SPECIFICATIONS  
Model 226-002  
Strain Gage Bridge Calibrator

EXTERNAL BRIDGE 80 ohm to 1K ohm gauges  
EXT. BRIDGE EXCITATION 1V to 15V  
OUTPUT DRIVE Over 30mARMS

**FRONT PANEL CONTROLS**

POWER SWITCH Locking toggle switch to prevent battery drain by accidental turn-on

PUSH TO TEST BUTTON Connects an internal excitation source and 120 ohm half-bridge, to simulate external bridge for self-testing purposes

FRONT PANEL CAL SELECT Allows selection of any value of CAL resistor, from 10 ohms to 999.99k ohms, with  $\pm 0.1\%$  accuracy on each digit

FREQUENCY SELECT Choose either 1kHz or 10kHz sine wave via locking front panel toggle switch

INDICATORS Combined front panel bicolor LED for Power On/Low Battery indication

Self-test LED lights red or green to indicate self-test results

**REAR PANEL**

STRAIN GAGE BNC Connects to external bridge, across gage to be calibrated

MONITOR BNC Connects internally to RCal decade resistor

BATTERY MONITOR BNC With power switch on, monitors 7.2V battery

OSCILLATOR BNC Monitors sine wave oscillator

VGAGE TOGGLE Selects polarity of voltage attached to strain gage BNC

SPECIFICATIONS (cont'd)  
Model 226-002  
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POWER SUPPLY Operates on 7.2V NiCd or NiMH battery,  
such as Radio Shack 23-230A or 230-1272  
Over three hours continuous operation  
minimum for rated output amplitude

CONSTRUCTION All-aluminum case, with locking toggle  
switches, chain tethered BNC caps, and  
carrying handle on side  
8.5" W x 8.5" D x 3" H

WEIGHT Four pounds, with battery installed

OPERATING TEMPERATURE -15 degrees to 55 degrees C

THEORY OF OPERATION  
Model 226-002  
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The AC Strain Gage Bridge Calibrator consists of the following functional blocks.

POWER SUPPLY:

Raw DC power is provided by a 7.2V rechargeable battery. It supplies the voltage regulator at U12 with 6.6V to 8.5V, which is pre-regulated to 5V, before being reconverted to  $\pm 12$ VDC by U13, a DC/DC converter.

MASTER OSCILLATOR:

U1 is an integrated circuit oscillator, switch selectable to provide a 1kHz or 10kHz sinewave. This sinewave is amplitude controlled by a circuit that detects the DC excitation voltage on the gage being calibrated. In this manner, the peak-to-peak output amplitude of the unit automatically equals the excitation voltage on the gage (normally half the bridge excitation). 5VDC bridge = 2.5VDC gage = 1.768VRMS oscillator

CALIBRATION RESISTANCE SWITCH:

The sinewave source is connected to the strain gage through a five decade thumbwheel-settable resistor. When the peak amplitude of the calibrator signal equals the DC level across the gage being calibrated, there will be zero current through the CAL resistor. When this current is zero, the gage will see no effective calibration resistance. Conversely, the full effect of the CAL resistor is applied when the calibrator signal reaches zero volts. When reading the amplifier's sinewave output, the peak signal represents the calibrated strain and the peak-to-peak signal is equal to twice the calibrated strain.

POWER SUPPLY MONITOR:

U10 and U11 provide a means of monitoring the battery voltage. As the battery gets weaker, the green Power LED will grow dimmer, until the voltage of the battery falls below approximately 6.6VDC. At this point, the battery will have approximately one minute of useful life remaining, and the LED will change from green to red. The short warning is due to the rapid dropoff of voltage on a NiCad battery, as it reaches the end of its charge.

FACTORY TEST DATA  
 Model 226-002  
 Strain Gage Bridge Calibrator

Serial no. \_\_\_\_\_ Tested by \_\_\_\_\_ Date \_\_\_\_\_

Voltage busses: Positive: \_\_\_\_\_ VDC

Negative: \_\_\_\_\_ VDC

Low battery indicated at: \_\_\_\_\_ VDC

Self test supply voltage: \_\_\_\_\_ VDC

Frequency ( $\pm 1\%$ ) 1 kHz: \_\_\_\_\_ kHz

10kHz: \_\_\_\_\_ kHz

Minimum output signal amplitude: \_\_\_\_\_ V P-P

Minimum CAL resistor for 1% tolerance: \_\_\_\_\_ ohms

Maximum RMS current for 1% tolerance: \_\_\_\_\_ mA RMS

Excitation	Measured	Amplitude	Percent error
0.5	VDC	V P-P	%
1	VDC	V P-P	%
2	VDC	V P-P	%
5	VDC	V P-P	%
7	VDC	V P-P	%
10	VDC	V P-P	%
12	VDC	V P-P	%
15	VDC	V P-P	%
Maximum	VDC	V P-P	%

CAL resistor values

900K	K	90K	K	9K	K	.9K	K	.09K	K
700K	K	70K	K	7K	K	.7K	K	.07K	K
500K	K	50K	K	5K	K	.5K	K	.05K	K
300K	K	30K	K	3K	K	.3K	K	.03K	K
100K	K	10K	K	1K	K	1K	K	.01K	K

PERFORMANCE TEST  
Model 226-002  
Strain Gage Bridge Calibrator

1. Remove all chain tethered BNC caps. If this is not done, the gage being calibrated will be intermittently shorted as the chains shift.
2. Set the CAL resistance to 900 kohms, and press the TEST button. Monitor J4 with frequency meter. Verify that measured frequencies of 1kHz and 10kHz meet the specification of  $\pm 1\%$ .
3. Set the CAL resistance to 10 kohms, and press the self-test button. Reduce the value of RCal until the unit drops out of the 1% limit, and the self-test LED turns red. The value of the CAL resistor must be less than 5000 ohms when distortion is observed.
4. Connect an excited bridge to the unit. Monitor bridge voltage on one oscilloscope channel at two volts/division, and J4 voltage on the other channel at one volt/division. Set both oscilloscope vertical zero positions to the bottom grid line on the display. Vary the excitation on the bridge from 1V to 15VDC, and visually check that the sine wave amplitude equals half the bridge excitation voltage.

BATTERY CHARGER OPERATION  
Model 226-002  
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**DANGER:** TO REDUCE THE RISK OF ELECTRIC SHOCK, CAREFULLY FOLLOW THESE INSTRUCTIONS.

Charge battery before use.

To protect the battery and motor, let them both cool for 10 minutes before recharging the battery or operating the vehicle. Supplied charger fully charges 7.2-volt, 2000mAh nickel-cadmium battery packs in about 5 hours. Also charges 7.2-volt, 3000mAh nickel-metal hydride battery packs in about 7.5 hours.

**Instructions:**

1. Before charging, set the selector switch to the type of battery you are charging—Ni-Cd or Ni-MH. The battery included in this package is Ni-Cd.
2. Attach the battery pack's connector to the charger's matching connector. Do not force them! They fit together only one way.
3. Plug the charger into a standard AC outlet.
4. Your charger is equipped with a Safety Guard timer that automatically stops charging when the battery pack is fully charged. The charging indicator light will stay on while the battery is charging. When the light goes off, charging is complete. This charging indicator is red when charging Ni-Cd battery packs, and green when charging Ni-MH battery packs.
5. When charging is complete, unplug the charger from the AC outlet and disconnect the battery pack from the charger.

**Notes:**

- Allow the battery pack to cool before charging. Recharging a warm or hot battery pack reduces the number of times the pack can be recharged.
- Do not overcharge the battery pack.
- After charging, the battery pack feels warm. This is normal.
- For the longest battery pack life, occasionally discharge the battery pack completely before recharging.

**CAUTIONS:**

- Charge only 7.2V Ni-Cd or Ni-MH batteries with this charger. Other types of batteries might burst, causing personal injury and damage.
- Do not dispose of the battery pack in a fire, because it may explode.
- Do not open or mutilate the battery pack.
- Do not expose the charger to rain or moisture.
- Be careful not to short-circuit the battery pack with conducting materials, such as rings, bracelets or keys. The battery pack could overheat and burn.



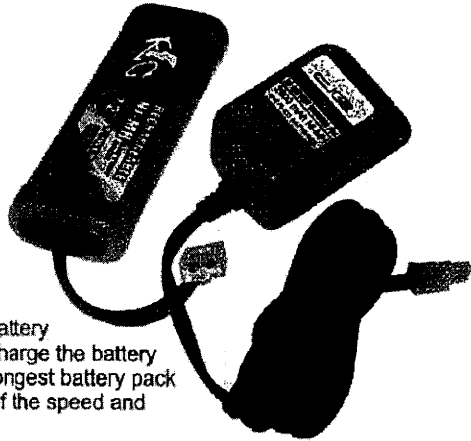
BATTERY CHARGER OPERATION  
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SAVE THESE INSTRUCTIONS  
TO REDUCE THE RISK OF ELECTRIC SHOCK, CAREFULLY  
FOLLOW THESE INSTRUCTIONS.

- 1- Insert the battery pack into the opening on the charger.
- 2- Insert the battery connector into the connector insert slot on the front of the charger.
- 3- Plug the charger into a standard AC outlet.
- 4- After fully charging the battery (10 hours), unplug the charger from the AC outlet and disconnect the battery pack from the charger.

Allow the battery pack to cool before charging. Recharging a warm or hot battery pack reduces the number of times the pack can be recharged. Do not overcharge the battery pack. After charging, the battery pack feels warm. This is normal. For the longest battery pack life, occasionally discharge the battery pack completely before recharging. If the speed and functionality of the RC toy slows down, it is time to recharge the battery.

**CAUTIONS:** Charge only 7.2V Ni-MH or Ni-Cd batteries with this charger. Other types of batteries might burst, causing serious personal injury and damage. Do not dispose of the battery pack in a fire, because it may explode. Do not open or mutilate the battery pack. Do not expose the charger to rain or moisture. Do not recharge battery packs that show leakage or corrosion. Be careful not to short-circuit the battery pack with conducting materials, such as rings, bracelets or keys; this may cause the battery pack to overheat and burn. The Battery Charger is not a toy and should be operated under close and constant adult supervision.



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