ENCORE ELECTRONICS INC.
FL639-006
Strain Gage Amplifier

- Description
- Specifications
- Operation
- Connection Diagrams
- Calculations
- Schematic B15536

DESCRIPTION
FL639-006
Strain Gage Amplifier

The Model FL639-006 Strain Gage Amplifier is a low-priced, compact bridge amplifier, complete with voltage and current excitation, adjustable gain, zero, and bridge balance, lowpass filtering, and resistive shunt calibration.

The FL639-006 is configured for six-wire full bridge only, with provision for remote sensing of the excitation voltage. A bridge balance adjustment is provided, as well as a zero offset adjust pot, with a front panel balance monitor tipjack for setting the balance. An internal precision resistor can be connected across any leg of the bridge, simulating a known strain for calibration.

Two-pole lowpass filtering is provided to help remove noise from the output signal. The filter is set to 1kHz at the factory, but may be changed from 10Hz to 20kHz with components on a plug-in header. One 30Hz and one 60Hz header are supplied with the FL639-006 version.

A standard voltage output is provided, as well as a 4-20mA current output. The current output may be connected to follow either the signal voltage output or the excitation voltage output. If connected to the excitation voltage output, the current output can be used as a constant current excitation source, replacing the constant voltage excitation.

When the 4-20mA current output is following the signal output, the voltage output signal must stay above 0 volts DC for proper operation. The front panel ZERO pot can be used to offset the signal up by several volts to allow an AC signal to be applied to the current output. If the voltage output needs to swing above and below zero volts, internal jumper J2 must be set to EXC.

SPECIFICATIONS
FL639
Strain Gage Amplifier

Bridge modes:	A full bridge only can be connected to the FL639-005
Bridge excitation:	4-10VDC, with front panel trimpot adjustment Constant current (10-20 mA) also available
Bridge calibration:	Internally mountable 1% shunt cal resistor, connected from front panel terminal to either +Ps or -Ps by internal jumper
Bridge balance:	Front panel trimpot to balance bridge, with panel mounted monitor tipjack
Gain range:	Settable from 2-2000, with coarse and fine trimpots FL639-001: 80-1000 FL639-002: 100-200 FL639-003: 40-50 FL639-006: 80-1050
Lowpass filter:	Factory set to 1kHz ±15%, changeable from 10Hz to 20kHz with plug-in header
Voltage output:	7VRMS, ±10VDC, with panel mounted output monitor tipjack
Current output:	4-20mA, tracks voltage output at 1.6mA per volt out; 0-10VDC at Vout gives 4-20mA at Iout Current output may also be used for constant current bridge excitation 4mA offset may be disabled at factory, giving 0-20mA range.
Noise:	< 2 μVRMS, 20Hz-20 kHz, measured with AC voltmeter Configured with active bridge, gain = 1000, no filter header installed

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SPECIFICATIONS (cont'd)
FL639
Strain Gage Amplifier

Panel controls:	Bridge balance trimpot Coarse gain adjust trimpot Fine gain adjust trimpot Excitation adjust trimpot Zero (offset) adjust trimpot
Power supply:	±15VDC regulated at 35mA and 10mA respectively, plus bridge excitation current
Connections:	Twelve front panel wireclamp terminals for all bridge connections, outputs and supplies
Mechanical:	2.9" x 3.1" x 1.9" plastic enclosure, mounts on standard 35mm DIN-rail

Versions:

-001 Gain range 100-500, 4-20mA CC
-002 Gain range 5-2000, 0-20mA CC
-003 Gain range 80-2000, 0-20mA CC
-004 Ruggedized 125 Deg. C version
-005 Gain range 80-1050, 15Hz L.P., 350 shunt cal resistor
-006 Gain range 80-1050, 30 and 60Hz L.P. filter headers provided

If a shunt calibration resistor will be used, calculate its value and solder it onto the internal component header. Set jumper J1 to either +P or -P, depending on what leg of the bridge you wish the calibration resistor to be placed across. If the 4-20mA output will not be used, set the internal jumper J2 to EXC. If J2 is set to SIG, the voltage output will not be able to go below zero volts DC.

Connect a regulated +/-15VDC power supply to the +15V, COM, and -15V terminals. Allow 5-10 minutes for the amplifier to stabilize at its operating temperature. Connect the full bridge as in the following diagram. If resistive shunt calibration is desired, calculate the appropriate resistor value and solder that resistor on the internal header as well. Monitor the excitation voltage from +Ps to -Ps, and adjust the EXC pot for the desired DC excitation voltage. Monitor the voltage at the BAL and COM tipjacks, and adjust the BAL pot for zero volts out. Monitor the voltage at the OUT and COM tipjacks, and adjust the ZERO pot for zero volts out.

If constant current excitation will be used, move internal jumper J2 to EXC, and move the bridge connections from the +P terminal to the Iout terminal. The constant current level may be measured with a DC ammeter, or calculated by measuring the DC excitation voltage from -P to +P, and multiplying by 1.6mA/V. For a 15mA constant current source, adjust the EXC pot for 9.375VDC at the +P terminal. Once the bridge is set up, adjust the BAL and ZERO pots as above.

Apply a known mechanical strain to the bridge, or connect the calculated shunt calibration resistor across one leg of the bridge. Turn the Fine GAIN pot fully clockwise, and then about ten turn counterclockwise, to set it to the middle of its adjustment range. Adjust the Coarse and Fine GAIN pots for the desired scaling of the output voltage.

CALCULATIONS
FL639
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FILTER CUTOFF CHANGES

To raise the filter cutoff frequency above the factory setting of 1kHz, install three resistors Rf1, Rf2, and Rf3 on the internal component header, as shown on the schematic. Calculate the values for Rf1, Rf2, and Rf3 as follows:

$$Rf1 = 20k\Omega \Big/ \left[\frac{Fc}{1khz} - 1 \right]$$

$$Rf2 = 16k\Omega \Big/ \left[\frac{Fc}{1khz} - 1 \right]$$

$$Rf3 = 40k\Omega \Big/ \left[\frac{Fc}{1khz} - 1 \right]$$

To lower the filter cutoff frequency below the factory setting of 1kHz, install two capacitors Cf1 and Cf2 on the internal component header, as shown on the schematic. Calculate the values for Cf1 and Cf2 as follows:

$$Cf1 = 0.015\mu f * \left[\frac{1kHz}{Fc} - 1 \right]$$

$$Cf2 = 0.0022\mu f * \left[\frac{1kHz}{Fc} - 1 \right]$$

SHUNT CALIBRATION RESISTOR

Calculate Rcal, as follows:

$$Rcal = \frac{Rg * 1E6}{GF * \varepsilon}$$

Where Rg = gage resistance, GF = gage factor (nominally 2) and ε = desired strain, in microstrains.