MODEL 6037
8-Channel Strain Gage Amplifier-Digitizer

The 6037 has eight channels of strain gage or transducer signal conditioning amplifiers and digitizer. Each channel has programmable voltage excitation, programmable bridge completion and automatic balance, programmable gain instrumentation amplifier, four-pole low-pass filter and sample and hold amplifier. The amplified channel outputs are multiplexed and digitized to 16 bits then provided to the 6000 data bus.

The 6037 is designed for use with strain gages employing the 3-wire connection. It may also be used with ½ and full bridge transducers, potentiometers and low-level voltage signals. Excitation is programmable from 0 to 12 Volts for each channel. Individual excitation regulators and careful routing of power traces and grounds results in less than 0.01% effect due to loading or a short on other channels. A calibration mode is provided for accurate measurement of excitation voltage.

A gage substitution resistor may be employed to determine and compensate for strain gage desensitation due to input line losses. Shunt calibration is provided for for the strain gage or transducer, gage substitution resistor and completion resistor. PI660 software contains calculators that determine line resistance based on shunt measurements and gage resistance and compensate for gage desensitation.

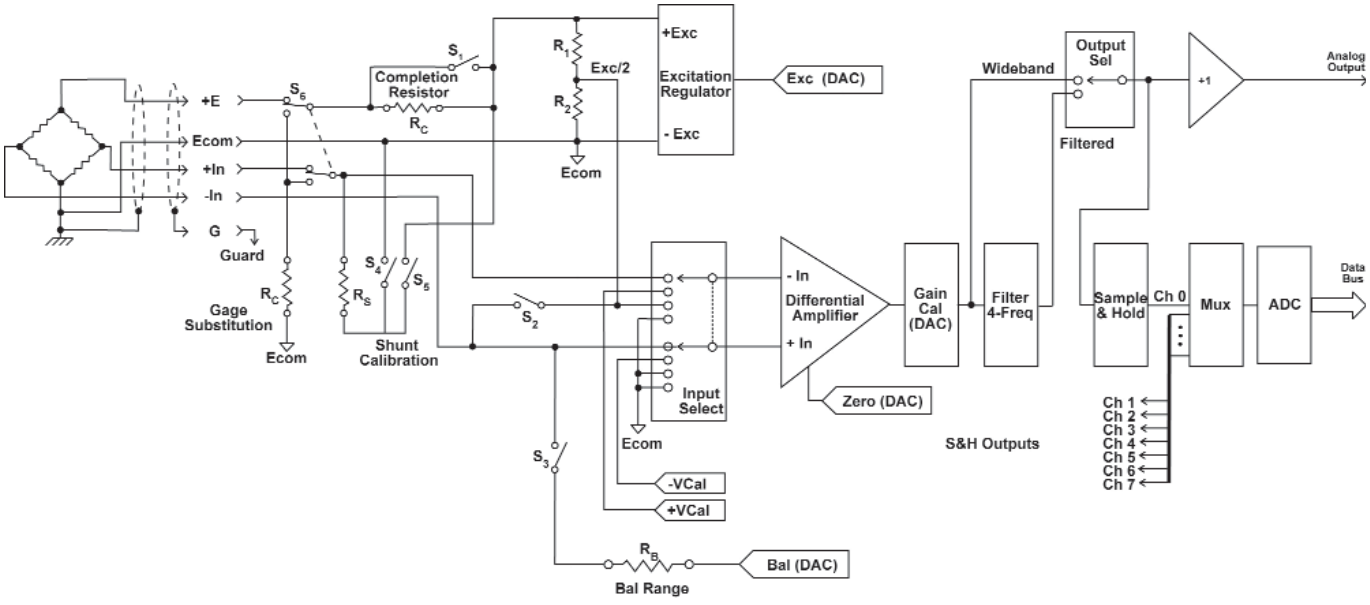
The input may be configured for strain gage, transducer or voltage and has ±50 Volts differential and ±30 Volts common mode protection. The differential instrumentation amplifier has programmable gains from 1 to 5,000 providing full scale input ranges of ±2mV to ±10 Volts. Voltage substitution provides the means to improve measurement accuracy and make data NIST traceable. Using PI660 software measurement data can be corrected in real time to eliminate gain and zero errors providing accuracies in the 0.025% to 0.05% range.

Automatic gain ranging may be user selected and scales the input sensitivity to the signal level. It can eliminate the tedious task of determining the gain to use for each channel. It prevents lost data by automatically up or down scaling gain when the output is above or below threshold levels. Both up and down gain scaling levels are programmable. To prevent erroneous scaling the user may program a delay that prevents a gain change until the output has violated the threshold for a specified number of samples or period of time.

The low-pass, anti-alias filter has four programmable bandwidths to accommodate multiple sample rates. In addition to the digitized output there is a continuous, high-level analog output for each channel. Two alarms with programmable upper and lower limits provide operator warning and digital outputs in response to limits violations.

FEATURES

- **Excitation 0 to 12 Volts programmable by channel**
- **Automatic gain ranging**
- **Automatic balance and zero**
- **Programmable four-frequency low-pass filter**
- **10K samples/second with 16-bit resolution**
- **Strain gage simulation resistor**
- **Bipolar shunt calibration**



6037 Functional Diagram

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PACIFIC INSTRUMENTS

MODEL 6037
8-Channel Strain Gage Amplifier-Digitizer

SPECIFICATIONS

EXCITATION

Voltage .....Programmable for each channel from 0 to 12 Volts in 1 Volt ±0.1% steps with 3.3 mV resolution fine adjustment.
Current .....50 mA, limited to 70 mA. A short on one channel has less than ±0.01% affect on other channels.
Regulation .....±0.2% line and no-load to full-load measured at the input connector.
Stability .....±0.01%, ±0.005%/°C.
Noise .....200 µV peak-to-peak.
Cal Mode .....Voltage monitor, ADC and analog output.

INPUT

Configuration .....2 to 4 wires plus shield for bridge and voltage. Programmable completion for 1/4, 1/2 and full bridge.
Balance .....Automatic by program control. Balance accuracy ±0.05% of range, ±1 mV RTO. Stability ±0.02% for 8 hours, ±0.005%/°C. Installed range resistor provides 20 mV/V for a 120 Ohm gage or bridge.

CALIBRATION

Shunt .....Programmable bipolar shunt. Installed resistor provides 3.0 mV/V ±0.01% for 120 Ohm gage or bridge.
Voltage .....Alternate amplifier input for external voltage calibrator. Programmable attenuator steps of 1, 0.1 and 0.01 with ±0.02% accuracy. Output of the attenuator provided on rear panel connector for accuracy verification.
Zero .....Amplifier input disconnected and shorted.

AMPLIFIER

Input .....50 Megohms, shunted by 1,000 pf.
Protection .....±50 Volts differential, ±30 Volts common mode.
Gain .....Programmable from 1 to 5,000 in 1, 2, 3, 5, 10 steps with ±0.05% accuracy or fine gain with ±0.05% resolution.
Gain Stability .....±0.01%, ±0.004%/°C.
Linearity .....±0.01% for gains <1,000, ±0.02% for gains 1,000 and higher.
Common Mode .....60 dB plus gain in dB up to 106 dB, DC to 60Hz for ±10 Volts.
Zero .....Automatic to ±1 µV RTI, ±0.5 mV RTO.
Zero Stability .....±5 µV RTI, ±1 mV RTO; ±1 µV/°C RTI, ±0.2 mV/°C RTO. Short term: ±2 µV RTI, ±0.4 mV RTO for 8 hours.
Source Current .....±5 nA, ±0.1nA/°C.
Noise (10 Hz).....0.5 µV peak, RTI.
Noise (1kHz) .....1.5 µV peak, RTI.
Bandwidth .....1 kHz (-3dB).
Recovery.....800 µS to ±0.1% for 10X overload to ±10 V.
Analog Output.....±3 Volts full scale.

AUTOMATIC GAIN RANGING

Selection .....Program commands select initial gain and enable or disable automatic up ranging and down ranging..
Limits .....User programmable upper and lower limits for gain change, 0 to 100% of full scale.
persistence.....The number of samples (down ranging) or time (up ranging) for which output must remain in violation of limit before gain change takes place. Down ranging is 1 to 128 samples, upranging is 40 to 90,000 mS.
Gain Readback.....Gain code for channels 0-3 is readback from channel 8 and channels 4-7 from channel 9. Each channel uses a 4-bits to encode the current gain.

FILTER

Type .....Four pole, low pass Butterworth.
Frequencies .....Programmable for 10 Hz, 100 Hz, 200 Hz, 1 kHz and bypass. Other frequencies may be ordered.
Noise .....2 mV peak RTO.

SAMPLE & HOLD, ADC

Sample.....Simultaneous, within ±50 nS channel-to-channel. Droop is less than ±0.005%.
Resolution .....16 bits, two's complement.
Sample Rate.....Up to 10 kS/s per channel.
Linearity .....2 LSB (0.006%).
Continuity.....Monotonic to 15 bits.
Alarms .....Two alarms each with upper and lower limits that are programmable from negative to positive full scale. Limits checked on each ADC sample.
Peak Value .....Peak value read and reset by program command.

GENERAL

Mounting .....Occupies one slot in Series 6000 enclosures.
Connectors .....Input connectors are 50-pin Type D, output connectors are 9-pin Type D. Mates are supplied
Temperature .....0°C to +50°C operating.

ORDERING INFORMATION

6037-120 .....Eight-channel transducer amplifier-digitizer, 120 Ohm completion resistor, 16-bits, 10 kS/s.
6037-350 .....Eight-channel transducer amplifier-digitizer, 350 Ohm completion resistor, 16-bits, 10 kS/s.
6081 .....Screw terminal adapter.
6085-6033 .....Connector adapter for 6005/6006 enclosures.

AUTOMATIC GAIN RANGING

Automatic gain ranging can save considerable setup time and provide the highest signal to noise ratio by insuring that the output level is the highest possible without overscale. Further, it prevents data loss by reducing the gain for channels that go into overscale.

The user has full control to enable or disable autoranging and set the autoranging parameters. Gain ranges down when the high limit is reached in the positive or negative direction and the high-limit persistence time elapses. Both the limit and persistence are programmable. Gain ranges up when the low limit is reached in the positive or negative direction and the low-limit persistence time elapses. Upper and lower limits and their persistences are independently programmable.

Gain for each channel is read and recorded by including phantom channels 8 and 9 in the scan list. A four-bit binary code identifies one of the sixteen possible gain steps that corresponds with the digitized data for each channel PI660 has a text display of gains.

When using automatic gain ranging it is important that all gain steps be gain and offset calibrated for highest accuracy. PI660 software performs this calibration providing NIST traceability.

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