Strain Gauge (Bridge) to DC Transmitter, Non-Isolated

API 4051 G

Input: *1 mV/V to 200 mV/V, 4-10 VDC Excitation*

Output: *0-1 V to ±10 V or 0-1 mA to 4-20 mA Non-Isolated*

- ***Internal Bridge Excitation Source***
- ***Input and Output LoopTracker® LEDs***
- ***Functional Test Pushbutton***
- ***Voltage or Currents Outputs***

Applications

- **Transmitter for Load Cells, Pressure Sensors**
- **Use with Strain Gauge Type Sensors**
- **Monitor Tanks, Hoppers, Scales, Etc.**

Specifications

Input Range

Factory Configured—Please specify excitation voltage, sensor mV/V rating, output range, power and options

Minimum sensor rating: 1 mV/V
Maximum sensor rating: 200 mV/V

Millivolt output range is determined by the sensitivity of the sensor (mV/V) and the excitation voltage applied.

mV/V sensitivity X excitation voltage = total mV range

Input Impedance

1 MΩ minimum

Input Protection, Common Mode

600 VDC or 600 VAC_p

Excitation Voltage

Maximum output: 10 VDC maximum at 30 mA
Internal adjustment: 4 to 10 VDC
Stability: ±0.01% per °C

LoopTracker

Variable brightness LEDs indicate input/output loop level and status

Output Range

Factory Configured—Please specify output range

	Minimum	Maximum	Load Factor
Voltage:	0-1 VDC	0-10 VDC	
Bipolar Voltage:	±1 VDC	±10 VDC	
Current (20 V compliance):	0-1 mADC	0-20 mADC	1000 Ω at 20 mA

Output Linearity

Better than ±0.1% of span

Output Zero and Span

Multiturn potentiometers to compensate for load and lead variations
±15% of span adjustment range typical

Functional Test Button

Sets output to test level when pressed
Potentiometer factory set to approximately 50% of span
Adjustable 0-100% of span

Response Time

70 milliseconds typical, faster response times are available

Common Mode Rejection

100 dB minimum

Ambient Temperature Range

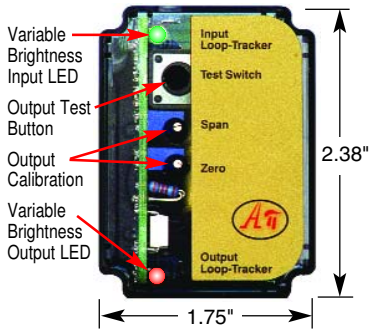
–10°C to +60°C operating

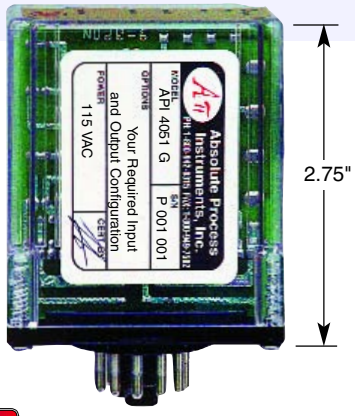
Temperature Stability

Better than ±0.02% of span per °C

Power

Standard: 115 VAC ±10%, 50/60 Hz, 2.5 W max.
A230 option: 230 VAC ±10%, 50/60 Hz, 2.5 W max.
D option: 9-30 VDC, 2.5 W typical





LIFETIME WARRANTY

Free Factory Input & Output Calibration!

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Description and Features

The **API 4051 G** accepts a strain gauge, bridge, or load cell input and provides a proportional, non-isolated DC voltage or current output. It includes filtering and processing to allow effective use of low-level transducers in the noisy environments common in industrial applications.

The built-in bridge excitation power supply generates a stable source of excitation voltage to drive from one to four 350 Ω (or greater) bridge type sensors such as load cells, pressure transducers and strain gauges and amplifies and converts the resulting millivolt signal into the configured output.

The **API 4051 G** requires factory configuration to a specific excitation voltage, millivolt input (mV/V rating of the sensor multiplied by the excitation voltage), DC voltage or DC current output, and power. Inputs can be configured as zero-based (i.e., 0 to 20 mV), bi-polar (i.e., –30 to +30 mV) for push-pull applications, or offset (i.e., 5 to 33 mV) to electronically compensate for deadweights (tare).

Outputs can also be configured as zero-based, bi-polar, or offset. In addition to the standard output ranges, the API 4051 G output can be configured meet most non-standard requirements. Contact the factory for assistance.

API exclusive features include two ***LoopTracker*** LEDs and a **Functional Test Pushbutton**. The LoopTracker LEDs (Green for input, Red for output) vary in intensity with changes in the process input and output signals. Monitoring the state of these LEDs can provide a quick visual picture of your process loop at all times. The functional test pushbutton provides a fixed output (independent of the input) when held depressed. The test output level can be adjusted 0-100% output span. Both the LoopTracker LEDs and functional test pushbutton greatly aid in saving time during initial startup and/or troubleshooting.

The **API 4051 G** plugs into an industry standard 11-pin octal socket sold separately. Sockets **API 011** and finger-safe **API 011 FS** allow either DIN rail or panel mounting.

Models & Options

Factory Configured—Please specify excitation voltage, sensor mV/V rating, output range, power, and options

API 4051 G Strain gauge to DC transmitter, non-isolated, 115 VAC

Options—Add to end of model number

A230 Powered by 230 VAC, 50/60 Hz
D Powered by 9-30 VDC
DF Fast response, 1 millisecond nominal response time
M01 Toggle switch with internal shunt calibration resistor
U Conformal coating for moisture resistance

Accessories—Order as separate line item

API 011 11-pin socket
API 011 FS 11-pin finger-safe socket
API TK36 DIN rail, 35 mm W x 39" L, aluminum

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RANGE SELECTION

The API 4051 G is factory configured to your exact input and output requirements. Consult factory for other available ranges or for special ranges.

When a current output is ordered, it provides power to the output current loop (sourcing).

ELECTRICAL CONNECTIONS

WARNING! All wiring must be performed by qualified personnel only. This module requires an industry-standard 11-pin socket. Order API 011 or finger-safe API 011 FS socket.

Power Input Terminals – The white label on the side of the API module will indicate the power requirements. AC power is connected to terminals 1 and 3.

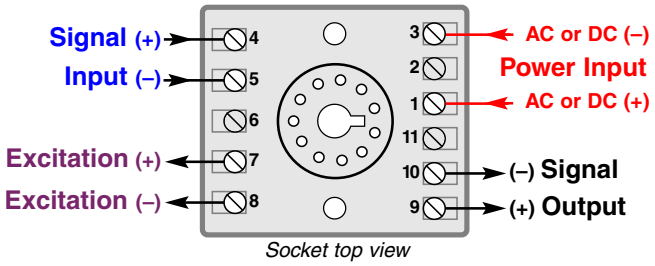
For DC powered modules, polarity **MUST** be observed. Positive (+) is wired to terminal 1 and negative (–) is wired to terminal 3.

Strain Gauge Input – Refer to strain gauge manufacturer's data sheet for wire color-coding. Polarity must be observed when connecting the signal input. The positive connection (+) is applied to terminal 4 and the negative (–) is applied to terminal 5.

Excitation Voltage – *CAUTION: Never short the excitation leads together. This will cause internal damage to the API 4051 G.*

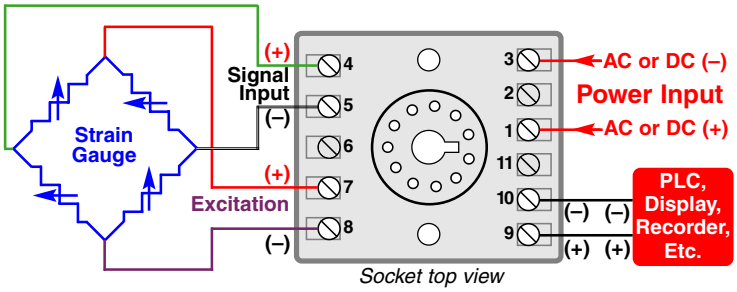
Refer to strain gauge manufacturer's data sheet for wire color coding. Terminals 7 and 8 provide connections for the DC voltage that is used to excite the strain gauge load cell. Polarity must be observed when connecting the Excitation Output. The positive connection (+) is applied to terminal 7 and the negative (–) is applied to terminal 8.

Signal Output Terminals – Polarity must be observed when connecting the signal output to the load. The positive connection (+) is connected to terminal 9 and the negative (–) is connected to terminal 10.



Socket top view

API 4051 G socket wiring



Socket top view

API 4051 G typical wiring.
Refer to strain gauge manufacturer's data sheet for wire color coding.

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API maintains a constant effort to upgrade and improve its products. Specifications are subject to change without notice. Consult factory for your specific requirements.

CALIBRATION

Input and output ranges are pre-configured at the factory as specified on your order. Top-mounted, Zero and Span potentiometers can be used should fine-tuning be necessary. Custom ranges may require factory modification.

1. Apply power to the module and allow a minimum 20 minute warm up time.
2. Provide an input to the module equal to zero or the minimum input required for the application.
3. Using an accurate measurement device for the output, adjust the Zero potentiometer for the exact minimum output desired. The Zero control should only be adjusted when the input signal is at its minimum. This will produce the corresponding minimum output signal. Example: for 4-20 mA output signal, the Zero control will provide adjustment for the 4 mA or low end of the signal.
4. Set the input at maximum, and then adjust the Span pot for the exact maximum output desired. The Span control should only be adjusted when the input signal is at its maximum. This will produce the corresponding maximum output signal. Example: for 4-20 mA output signal, the Span control will provide adjustment for the 20 mA or high end of the signal.
5. This procedure may have to be repeated several times to achieve the desired accuracy over the selected range. This is a basic calibration procedure and does not account for offsets or tare weights. To achieve optimum results, it is recommended that the API 4051 G be calibrated by an accurate bridge simulator before being placed in service.

TEST BUTTON

The Test pushbutton may be set to provide the desired output when depressed. This will drive the device on the output side of the loop (a panel meter, chart recorder, etc.) with a known good signal that can be used as a system diagnostic aid during initial start-up or during troubleshooting. It can be adjusted to vary the output signal from 0 to 100% of the calibrated output range. When released, the output will return to normal.

Turn the multi-turn Test Range potentiometer while holding the Test Switch depressed until the desired output test level is reached.

Example: If you are isolating a 4-20 mA current loop, when the pushbutton is held depressed, the output from the module will be a constant signal between 4 and 20 mA depending on the setting of the Test Range adjustment pot.

OPERATION

Strain gauges and load cells are normally passive devices that are commonly referred to as "bridges" due to the four-resistor Wheatstone bridge configuration used in their design. These sensors require a precise excitation source to produce an output that is directly proportional to the load, pressure, etc. that is applied to the sensor.

The exact output of the sensor (measured in millivolts) is determined by the sensitivity of the sensor (mV/V) and the excitation voltage applied. For example, a load cell rated for 3 mV/V sensitivity and 10 VDC excitation will produce an output of 0 to 30 mV for load variations from 0 to 100%.

3 mV/V sensitivity x **10** VDC excitation = **30** mV range

The API 4051 G provides the excitation voltage as specified on your order to the sensors and receives the resulting millivolt signal in return. This input signal is filtered and amplified, offset, if required, then passed to the output stage where it is scaled to the desired output range.

GREEN *LoopTracker*® Input LED – Provides a visual indication that a signal is being sensed by the input circuitry of the module. It also indicates the input signal strength by changing in intensity as the process changes from minimum to maximum. If the LED fails to illuminate, or fails to change in intensity as the process changes, this may indicate a problem with module power or signal input wiring.

RED *LoopTracker* Output LED – Provides a visual indication that the output signal is functioning. It becomes brighter as the input and the corresponding output change from minimum to maximum. For current outputs, the RED LED will only light if the output loop current path is complete. For either current or voltage outputs, failure to illuminate or a failure to change in intensity as the process changes may indicate a problem with the module power or signal output wiring.

Troubleshooting a Pressure Transducer, Load Cell, Strain Gauge or Bridge

Using a meter with at least 10 mega Ohm input impedance, measure the voltage coming from the strain gauge at the locations shown. Sensitivity is measured in mV/V.

Positive Meter Lead	Negative Meter Lead	Meter Reading No pressure/load	Meter Reading Full pressure/load
+ Exc	– Exc	Excitation Voltage	Excitation Voltage
+ Sig	– Exc	+ ½ Excitation Voltage	½ Excitation Voltage + (½ x Excitation Voltage x Sensitivity)
– Sig	– Exc	+ ½ Excitation Voltage	½ Excitation Voltage – (½ x Excitation Voltage x Sensitivity)
+ Sig	– Sig	Zero Volts	Excitation Voltage x Sensitivity

Typical Wiring Color Code For Load Cells. Always consult manufacturer! Exceptions and/or custom wire colors exist!

Manufacturer	+ Excitation	– Excitation	+ Signal	– Signal	Shield	+ Sense	– Sense
A & D	Red	White	Green	Blue	Yellow		
Allegany	Green	Black	White	Red	Blare		
Artech	Red	Black	Green	White	Blare		
Beowulf	Green	Black	White	Red	Bare		
BLH	Green	Black	White	Red	Yellow		
Cardinal	Green	Black	White	Red	Bare		
Celtron	Red	Black	Green	White	Bare		
Digi Matex	Red	White	Green	Yellow	Silver		
Dillon	Green	White	Black	Red	Orange		
Electroscale	Red	Black	Green	White	Bare		
Entran	Red	Black	Yellow or Green	White			
Evergreen	Green	Black	White	Red	Bare		
Flintec	Green	Black	White	Red	Yellow		
Force Measurement	Red	Black	Green	White	Bare		
Futek	Red	Black	Green	White			
General Sensor	Red	Black	Green	White	Bare		
GSE	Red	Black	White	Green	Bare		
HBM	Green	Black	White	Red	Yellow		
HBM (PLC/SBE)	Red	Black	Green	White	Yellow		
Interface	Red	Black	Green	White	Bare		
Kubota	Red	White	Green	Blue	Yellow		
LeBow	Red	Black	Green	White	Bare		
Mettler Toledo	White	Blue	Green	Black	Orange	Yellow	Red
National Scale	Green	Black	White	Red	Yellow		
NCI	Red	Black	White	Green	Bare	Yellow	Blue
Nikkei	Red	Black	Green	White	Bare		
Pennsylvania	Orange	Blue	Green	White	Blare		
Philips	Red	Blue	Green	Gray	Bare		
Presage Promotion	Blue	White	Red	Black	Yellow		
Revere	Green	Black	White	Red	Orange		
Rice Lake	Red	Black	Green	White	Blare		
Sensortronic	Red	Black	Green	White	Blare		
Sensortronic (column)	Green	Black	White	Red	Blare		
Sensotec	Red	Black	White	Green	Bare		
Strainsert	Red	Black	Green	White	Bare		
T-Hydronics	Red	Black	Green	White	Bare		
Tedea Huntleigh	Green	Black	Red	White	Blare	Blue	Brown
Thames Side	Red	Blue	Green	Yellow	Bare		
Toledo	Green	Black	White	Red	Yellow		
Totalcomp	Red	Black	Green	White	Blare		
Transducers Inc.	Red	Black	Green	White	Orange		
Weigh-Tronix	Green	Black	White	Red	Orange		



FREE APPLICATION ASSISTANCE
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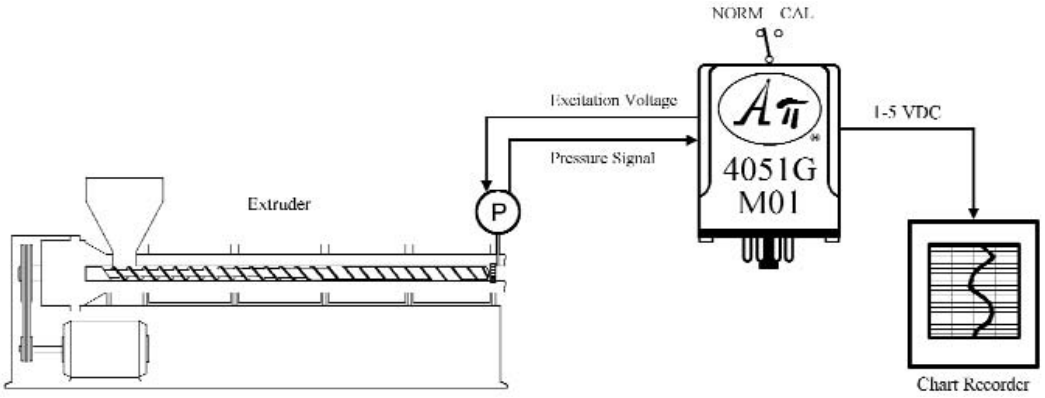
Calibration of a Pressure System

PROBLEM

The pressure of an extrusion process is to be monitored and charted. To ensure ongoing accuracy, the pressure monitoring system must be capable of frequent calibration without having to use any external test equipment.

SOLUTION

An **API 4051 G M01** Strain Gauge (Bridge) Input to DC Transmitter module provides the excitation voltage for the pressure transducer and provides the 1-5 VDC output required by the chart recorder.



The **API 4051 G M01** has an internal calibration resistor to unbalance a 350 ohm bridge to an 80% of span value when the test switch is in the CAL position, allowing for convenient and accurate calibration.

Strain Gauge

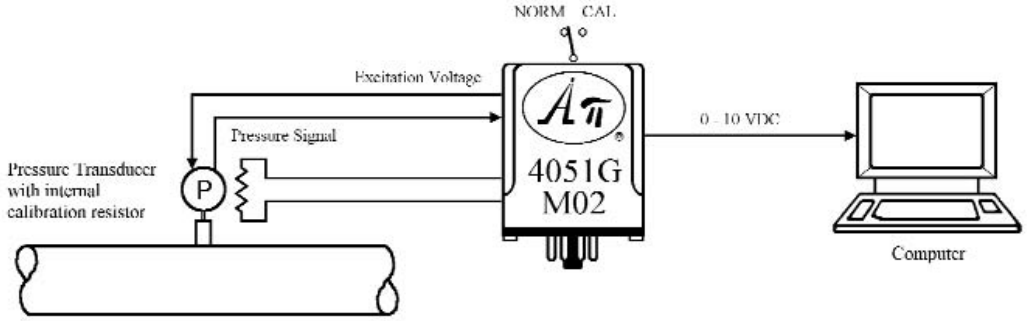
Calibration of a Pressure Transducer

PROBLEM

The pressure of a critical process is to be monitored by a computer. To ensure accuracy and reliability, attention has to be paid to the entire system calibration. How can the pressure system be calibrated using the internal calibration resistor of the pressure transducer?

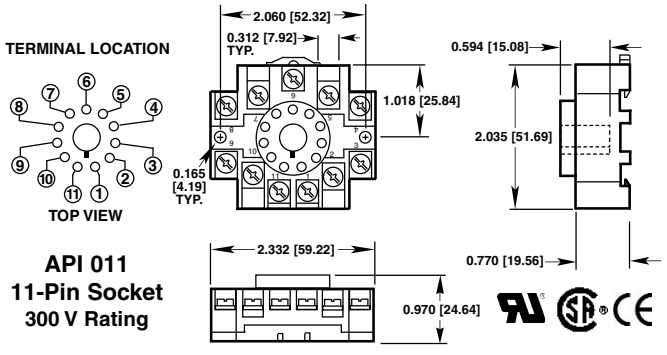
SOLUTION

The **API 4051 G M02** Strain Gauge (Bridge) Input to DC Transmitter module provides the stable excitation voltage for the pressure transducer and produces the required 0-10 VDC output for the computer.

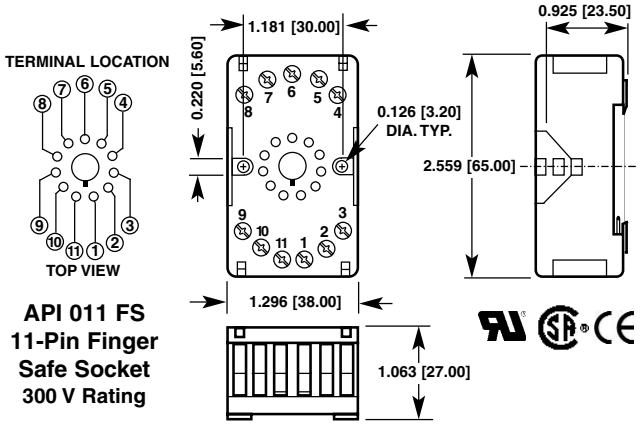


The **API 4051 G M02** utilizes the pressure transducer's internal calibration resistor to unbalance the bridge to a specified value when the test switch is in the CAL position, ensuring accurate system calibration.

API 011 and API 011 FS Sockets



API 011
11-Pin Socket
300 V Rating



API 011 FS
11-Pin Finger Safe Socket
300 V Rating

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