# Strain Gauge/Bridge/Load Cell/Pressure Transducer to DC Transmitters, Field Rangeable — API 4059 G

**Input:** One to Four 350 Ω Sensors, 0-5 mV to 0-400 mV, 4-10 VDC Excitation

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

- *Drive up to Four 350 Ω Bridges*
- *Adjustable Excitation Power Supply*
- *Sense Lead Compensation*
- *Easy to Cancel or Tare Out Deadweights*
- *One Minute Setup for Hundreds of I/O Ranges*
- *Full 3-Way Input/Output/Power Isolation*
- *Hot-Swappable Plug-In Design*
- *Non-Interactive Zero and Span*
- *Full 3-Way Input/Output/Power Isolation*
- *Input and Output LoopTracker® LEDs*
- *Output Test or Calibration Resistor Options*

## Applications

- *Load Cell Weighing Systems and Scales*
- *Strain Gauge Pressure Sensors and Transducers*
- *Tanks, Scales, Extruder Melt Pressure, Crane Loads*

### Strain Gauge Input Ranges

| | | |
|---|---|---|
| Minimum: | 0 to 5 mV range | 0.5 mV/V sensitivity |
| Maximum: | 0 to 400 mV range | 40 mV/V sensitivity |

Millivolt output range is determined by the sensor sensitivity (mV/V) and the excitation voltage:
mV/V sensitivity X excitation voltage = total mV range

### Input Impedance
200 kΩ typical

### Common Mode Rejection
100 dB minimum

### Calibration Resistor Options
M01 option: Toggle switch with calibration resistor inside module. Specify resistor value.
M02 option: Toggle switch for external (load cell) calibration resistor.

### Excitation Voltage

| | |
|---|---|
| Maximum output: | 10 VDC maximum at 120 mA |
| Drive capability: | Up to four 350 Ω bridges at 10 VDC |
| Switch-selectable: | 0-10 VDC in 1 V increments |
| Fine adjustment: | ±5% via multi-turn potentiometer |
| Stability: | ±0.01% per °C |

### Sense Lead Compensation
Better than ±0.01% per 1 Ω change in leadwire resistance.
10 Ω max. for 10 VDC excitation w. 350 Ω bridge

### Zero Offset (Tare)
±100% of span in 15% increments

### LoopTracker
Variable brightness LEDs for input/output loop level and status

### DC Output Ranges

| | |
|---|---|
| Voltage: | 0-1 VDC to 0-10 VDC |
| Bipolar voltage: | ±1 VDC to ±10 VDC |
| Current: | 0-2 mADC to 0-25 mADC |
| | 20 V compliance, 1000 Ω at 20 mA |

### Output Calibration
Non-interactive multi-turn zero and span potentiometers
±15% of span adjustment range typical

### Output Test
Sets output to test level when pressed
Adjustable 0-100% of span
Not available with M01 or M02 options

### Output Ripple and Noise
Less than 10 $mV_{RMS}$

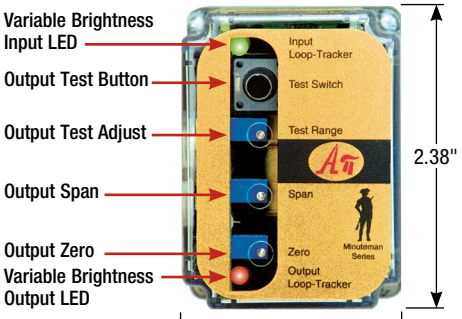
### Linearity
Better than ±0.1% of span

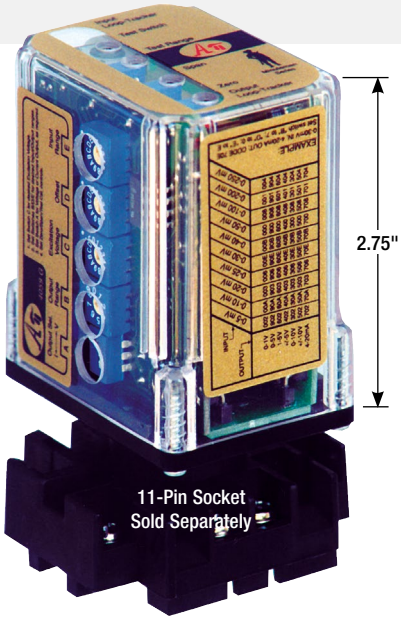
### Ambient Temperature Range and Stability
–10°C to +60°C operating ambient
Better than ±0.02% of span per °C stability, calculated, not tested

### Response Time
70 milliseconds typical (14.2 Hz)
DF option: 10 millisecond response time typical (100 Hz)

### Isolation
2000 $V_{RMS}$ minimum
Full isolation: power to input, power to output, input to output

### Housing and Sockets
IP 40, requires installation in panel or enclosure
Plugs into API 011 or API 011 FS socket
Socket mounts to 35 mm DIN rail or can be surface mounted

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Free Factory I/O Setup!

6 YEAR WARRANTY

Quick Link api-usa.com/4059

1 Minute Setup!

### 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

### Description
The API 4059 G accepts a strain gauge, bridge, load cell, or a summed input from up to four sensors, and provides a proportional, isolated DC voltage or current output. It includes filtering and processing to allow effective use of low-level transducers in the noisy environments found in industrial applications. The full 3-way (input, output, power) isolation makes this module useful for ground loop elimination, common mode signal rejection or noise pickup reduction.

The 120 mA adjustable 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 selected output. Sense lead circuitry is included to cancel the effects of leadwire resistance, if required.

Input, output, excitation and zero offset are field configurable, via external rotary and slide switches. Common ranges are on the module label. Offsets up to ±100% of span can be used to cancel sensor offsets or non-zero deadweights (taring). Non-interactive zero and span simplifies calibration.

### LoopTracker
API exclusive features include two LoopTracker LEDs (green for input, red for output) that vary in intensity with changes in the process input and output signals. These provide a quick visual picture of your process loop at all times and can greatly aid in saving time during initial startup and/or troubleshooting.

### Output Test
An API exclusive feature includes the test button to provide a fixed output (independent of the input) when held depressed. The output test button greatly aids in saving time during initial startup and/or troubleshooting. The test output level is potentiometer adjustable from 0 to 100% of output span.

The output test is not available with the M01 or M02 options. A calibration resistor switch replaces the test button.

### Mounting
The API 4059 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.

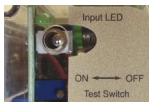
| Model | Input | Output | Power |
|---|---|---|---|
| API 4059 G | Field configurable. Specify the following if factory is to set switches<br>Bridge mV/V or mV range<br>Excitation voltage | Field configurable. Specify following if factory is to set switches<br>Output range<br>Output type (V or mA) | 115 VAC |
| API 4059 G A230 | | | 230 VAC |
| API 4059 G D | | | 9-30 VDC |

### Options—add to end of model number

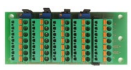
| | |
|---|---|
| **M01** | Switch with built-in calibration resistor. Specify resistor value. |
| **M02** | Switch for external calibration resistor |
| **DF** | 10 millisecond response time, or consult factory DF option will cause output noise levels greater than standard specifications. |
| **U** | Conformal coating for moisture resistance |

### Accessories—order as separate line item

| | |
|---|---|
| **SG-EQ4** | Junction/sum board with trim pots for up to 4 strain gauges. For 4- or 6-wire load cells. |
| **SG-EQ4-BOXPG7** | Junction/sum box with trim pots for up to 4 strain gauges. For 4- or 6-wire load cells. |
| **API 011** | 11-pin socket |
| **API 011 FS** | 11-pin finger-safe socket |
| **API CLP1** | Module hold-down spring for high vibration or mobile applications |



M01/M02 Switch


SG-EQ4 Board


SG-EQ4-BOXPG7

API 011 FS
300 V Rating


API 011
300 V Rating


API CLP1


ABSOLUTE PROCESS INSTRUMENTS
1220 American Way Libertyville, IL 60048
Phone: 800-942-0315 Fax: 800-949-7502
api-usa.com

### Precautions

WARNING! All wiring must be performed by a qualified electrician or instrumentation engineer. See diagram for terminal designations and wiring examples. Consult factory for assistance.

WARNING! Avoid shock hazards! Turn signal input, output, and power off before connecting or disconnecting wiring, or removing or installing module.

### Précautions

ATTENTION! Tout le câblage doit être effectué par un électricien ou ingénieur en instrumentation qualifié. Voir le diagramme pour désignations des bornes et des exemples de câblage. Consulter l'usine pour assistance.

ATTENTION! Éviter les risques de choc! Fermez le signal d'entrée, le signal de sortie et l'alimentation électrique avant de connecter ou de déconnecter le câblage, ou de retirer ou d'installer le module.

API maintains a constant effort to upgrade and improve its products. Specifications are subject to change without notice. See api-usa.com for latest product information. Consult factory for your specific requirements.

**WARNING:** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer or birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

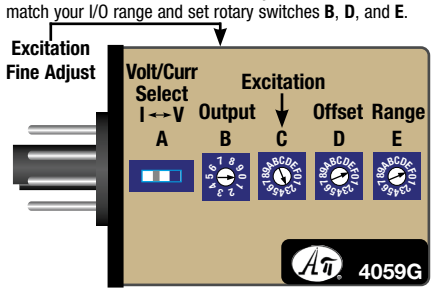
### Excitation Voltage and Range Selection

It is easier to set the switches before installation. Common ranges are listed on the module label.

1. See table below and set Excitation rotary switch **C** to the desired voltage. The excitation voltage should match the sensor manufacturer's recommendations.

| Excitation | 10V | 9V | 8V | 7V | 6V | 5V | 4V | 3V | 2V | 1V | 0V |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Switch C | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

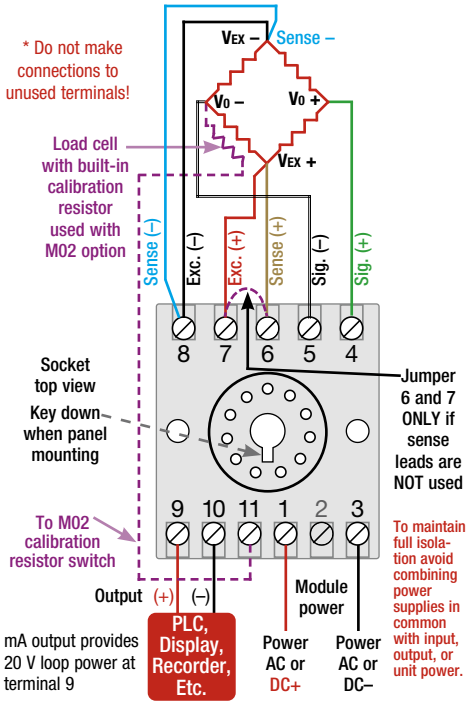
2. Set Volt/Curr slide switch **A** to voltage "V" or current "I" depending on output type.
3. From the table above, find the rotary switch combination that match your I/O range and set rotary switches **B**, **D**, and **E**.




### Socket and Mounting

Install module in a protective panel or enclosure. Allow space around module for air flow. Use API 011 or API 011 FS socket. See specifications for maximum allowable socket voltages. The socket clips to a standard 35 mm DIN rail or can be mounted to a flat surface.

**1 strain gauge shown. Connect up to 4 in parallel if all leads are equal length. Unequal length leads or strain gauges with calibration variances may require sum box SG-EQ4 to aid in equalization.**




| | Output | 0-1 V | 0-2 V | 0-4 V | 1-5 V | 0-5 V | 0-8 V | 2-10 V | 0-10 V | ±5 V | ±10 V | 0-2 mA | 2-10 mA | 0-10 mA | 0-16 mA | 4-20 mA | 0-20 mA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Switches | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE | ABDE |
| Input | 0-5 mV | V002 | V802 | V102 | V602 | V902 | V202 | V702 | V302 | V402 | V502 | I007 | I602 | I902 | I202 | I702 | I302 |
| | ±10 mV | V033 | V833 | V133 | V633 | V933 | V233 | V733 | V333 | V433 | V533 | I033 | I633 | I933 | I233 | I733 | I333 |
| | 0-10 mV | V00A | V80A | V10A | V60A | V90A | V20A | V70A | V30A | V40A | V50A | I00A | I60A | I90A | I20A | I70A | I30A |
| | ±20 mV | V03B | V83B | V13B | V63B | V93B | V23B | V73B | V33B | V43B | V53B | I03B | I63B | I93B | I23B | I73B | I33B |
| | 0-20 mV | V003 | V803 | V103 | V603 | V903 | V203 | V703 | V303 | V403 | V503 | I003 | I603 | I903 | I203 | I703 | I303 |
| | 0-25 mV | V006 | V806 | V106 | V606 | V906 | V206 | V706 | V306 | V406 | V506 | I006 | I606 | I906 | I206 | I706 | I306 |
| | 0-30 mV | V00E | V80E | V10E | V60E | V90E | V20E | V70E | V30E | V40E | V50E | I00E | I60E | I90E | I20E | I70E | I30E |
| | 0-40 mV | V00B | V80B | V10B | V60B | V90B | V20B | V70B | V30B | V40B | V50B | I00B | I60B | I90B | I20B | I70B | I30B |
| | 0-50 mV | V000 | V800 | V100 | V600 | V900 | V200 | V700 | V300 | V400 | V500 | I000 | I600 | I900 | I200 | I700 | I300 |
| | 0-100 mV | V008 | V808 | V108 | V608 | V908 | V208 | V708 | V308 | V408 | V508 | I008 | I608 | I908 | I208 | I708 | I308 |
| | 0-200 mV | V001 | V801 | V101 | V601 | V901 | V201 | V701 | V301 | V401 | V501 | I001 | I601 | I901 | I201 | I701 | I301 |
| | 0-250 mV | V004 | V804 | V104 | V604 | V904 | V204 | V704 | V304 | V404 | V504 | I004 | I604 | I904 | I204 | I704 | I304 |
| | 0-300 mV | V00C | V80C | V10C | V60C | V90C | V20C | V70C | V30C | V40C | V50C | I00C | I60C | I90C | I20C | I70C | I30C |
| | 0-400 mV | V009 | V809 | V109 | V609 | V909 | V209 | V709 | V309 | V409 | V509 | I009 | I609 | I909 | I209 | I709 | I309 |

### Input Terminals

Refer to diagram and strain gauge manufacturer's data sheet for wiring and color coding. Polarity must be observed when connecting inputs. Connect up to 4 strain gauges or load cells. Sensor shield wire (if equipped) should be grounded at one end only.

### Excitation Voltage Connection

Polarity must be observed. Never short the excitation leads together. This will cause internal damage to the module.

### Sense Leads

Connect the sense leads as shown. If no sense leads are used, jumper terminals 6 and 7.

### Signal Output Terminals

Polarity must be observed when connecting the signal output. Current output provides power to the output loop (sourcing).

### Module Power Terminals

The module operating voltage shown on the model/serial number label must match available power. AC power can be connected with either polarity. Polarity MUST be observed for DC powered modules.

### Calibration

Input and output ranges, if specified on your order, are factory pre-configured (at 24°C ±1°C). This procedure does not account for offset or tare weight calibration. To achieve optimum results, calibrate using an accurate bridge simulator.

Note: Perform the following calibration procedure any time switch settings are changed.

1. Power the module and allow a minimum 20 minute warm up time.
2. Using an accurate voltmeter across terminals 7 and 8, adjust the excitation voltage fine adjust potentiometer to the required voltage.
3. With the input set at zero or the minimum, adjust the front Zero pot for a zero or low-end output (for example, 4 mA for a 4-20 mA output or –10 V with a ±10 V output).
4. The zero pot may also be adjusted for a zero reading on the output display instrumentation, e.g. control system or process indicator. Adjusting the zero pot this way eliminates calibration errors in the display instrumentation.
5. Set the input at maximum, and then adjust the Span potentiometer 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.
6. The calibration procedure should be repeated to achieve the desired accuracy over the selected range.

### Calibration, Models with Option M01 or M02

The M01 option uses a switch and a calibration resistor inside the API module. Ensure that the correct resistance value was specified. Note: Perform the following calibration procedure any time switch settings are changed.

The M02 option uses a switch for the transducer's internal calibration resistor. The transducer's calibration resistor wires are connected to terminals 5 and 11 on the API 4059 G socket.

The sensor manufacturer should provide the percentage of full-scale transducer output when using the calibration resistor.

1. Power the module and allow a minimum 20 minute warm up time.
2. Using an accurate voltmeter across terminals 7 and 8, adjust the excitation voltage fine adjust potentiometer to the required voltage.
3. With the input set at zero or the minimum, adjust the front Zero pot for a zero or low-end output (for example, 4 mA for a 4-20 mA output or –10 V with a ±10 V output).
4. The zero pot may also be adjusted for a zero reading on the output display instrumentation, e.g. control system or process indicator. Adjusting the zero pot this way eliminates calibration errors in the display instrumentation.
5. Set the Test toggle switch to the Test position. The calibration resistor is switched into the circuit to unbalance the bridge.
6. Adjust the span pot for an 80% FS output or 80% reading on the process indicator, or per the manufacturer's percentage of FS output.
7. Return the Test switch to the opposite position and readjust the zero pot if necessary. The calibration procedure should be repeated to achieve the desired accuracy over the selected range.

### Using Offset Switch D

Offset switch **D** can be used to cancel or tare non-zero readings by offsetting the low end of the input range. This can be used to compensate for tare weights or scale deadweight to get zero output when a load is on the platform. It can be used to compensate for low-output sensors (e.g., < 1 mV/V) that may have large zero offsets. Switch **D** can realign the zero control so it has enough range to produce the desired zero output. It can also raise the offset to allow calibration of bi-directional sensors or lower the offset to compensate for elevated input ranges such as 10-20 mV.

1. Switch **D** does not interact with any other switch and is the only switch needed to correct zero offsets. Its only purpose is to adjust or cancel effects of the low end of the input range not corresponding nominally to 0 mV. Setting switch **D** to "0" results in no offset.
2. To raise the output zero, rotate switch **D** clockwise from 1 through 7 until the zero potentiometer is within range of your desired output.
3. To lower the output zero, rotate switch **D** through ranges 9 through F until the zero potentiometer is within range of your desired output. This range is often used for elevated input ranges.

### Output Test Function

Note that models with the M01 or M02 option do not have a Test function and the Test Cal. potentiometer is non-functional.

The output test potentiometer is factory set to provide approximately 50% output. When the test button is depressed it will drive the output with a known good signal that can be used as a diagnostic aid during initial start-up or troubleshooting. When released, the output will return to normal.

The Test Cal. potentiometer can be used to set the test output to the desired level. It is adjustable from 0 to 100% of the output span. Press and hold the Test button and adjust the Test Cal. potentiometer for the desired output level.

### Operation

Strain gauges and load cells are commonly referred to as bridges due to their four-resistor Wheatstone bridge configuration. These sensors require a precise excitation source to produce an output that is directly proportional to the load, pressure, etc. 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 module provides a precise excitation voltage to the sensors and receives the resulting millivolt signal in return. The input signal is filtered and amplified, then offset if required, and passed to the output stage. An isolated DC voltage or current output is generated.

**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 level 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.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