

# Strain Gauge (Bridge) to DC Transmitter, Isolated

# API 4059 G



**Input:** 0-5 mV to 0-400 mVDC, 4-10 V Excitation  
**Output:** 0-1 V to ±10 V or 0-1 mA to 4-20 mA *Isolated*

**Field Selectable**  
**One Minute Setup!**



- Drive up to Four 350 Ω Bridges
- Non-Interactive Zero and Span Controls
- Easy to Cancel or Tare out Deadweights
- Easy-to-use External Rotary Switches and Setup Tables
- Input and Output LoopTracker® LEDs

## Applications

- Strain Gauge or Load Cell Weighing Systems
- Strain Gauge Pressure Sensors
- Monitor Tanks, Hoppers, Scales, Etc.

## Specifications

### Input Range

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:  $mV/V \text{ sensitivity} \times \text{excitation voltage} = \text{total mV range}$

### Input Impedance

200 kΩ typical

### Excitation Voltage

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

### Sense Lead Compensation

Compensation better than ±0.01% per 1 Ω change in leadwire resistance  
 Leadwire resistance 10 Ω maximum for 10 VDC excitation for 350 Ω bridge

### Zero Offset (Tare)

±100% of span in 15% increments

### Shunt Calibration Resistor Provision

Option **M02**: Toggle switch for customer-supplied external shunt resistor

### LoopTracker

Variable brightness LEDs indicate input/output loop level and status

### Output Ranges

	Minimum	Maximum	Load Factor
Voltage:	0-1 VDC	0-10 VDC	
Bipolar Voltage:	±1 VDC	±10 VDC	
Current (20 V compliance):	0-2 mADC	0-25 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 approx. 50% of span. Adjustable 0-100% of span

### Response Time

70 milliseconds typical, faster response times are available  
 Option **DF**: 10 millisecond response time

### Common Mode Rejection

100 dB minimum

### Isolation

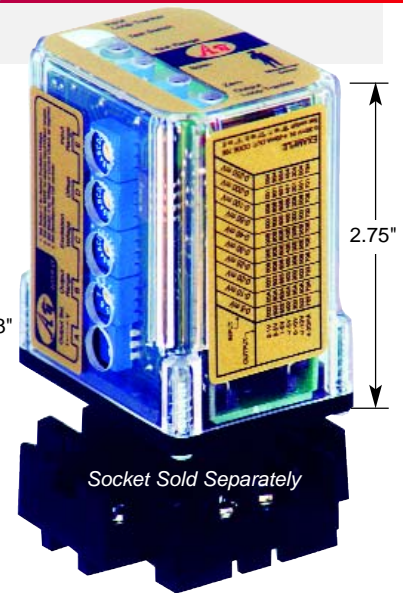
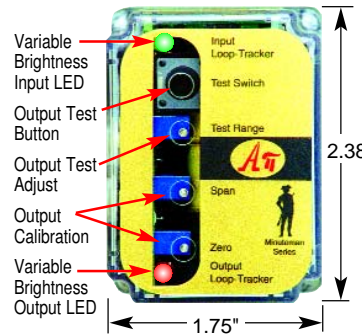
2000 V<sub>RMS</sub> min. Full isolation: power to input, power to output, input to output

### Ambient Temperature Range and Stability

-10°C to +60°C operating ambient  
 Better than ±0.02% of span per °C stability

### 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, 3 W with 4 load cells



**Free Factory**  
**Input & Output**  
**Calibration!**

## Description and Features

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 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.

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 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.

## Models & Options

Please specify power and options

**API 4059 G** Field rangeable strain gauge to DC transmitter, isolated, 115 VAC

Options—Add to end of model number

<b>A230</b>	Powered by 230 VAC, 50/60 Hz
<b>D</b>	Powered by 9-30 VDC
<b>M02</b>	Toggle switch for external shunt calibration resistor
<b>DF</b>	Fast response, 10 millisecond nominal response time
<b>U</b>	Conformal coating for moisture resistance

Accessories—Order as separate line item

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

1220 American Way Libertyville, IL 60048  
 Phone: 800-942-0315 Fax: 800-949-7502

[api-usa.com](http://api-usa.com)



## ELECTRICAL CONNECTIONS

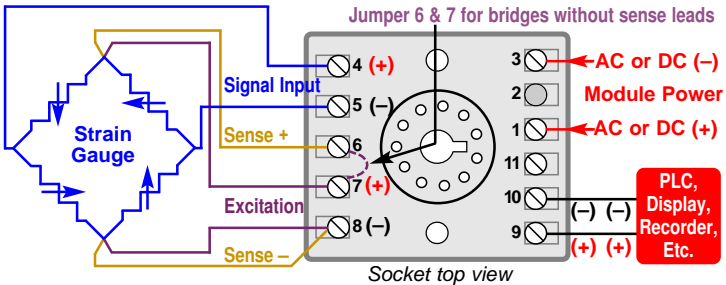
**WARNING!** All wiring must be performed by qualified personnel only. This module requires an industry-standard 11-pin socket. Order API 011 or finger-safe API 011 FS socket.

**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 4059 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. Connect the sense leads to terminal 6. If no sense lead is available, connect pin 6 to pin 7.

**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.



API 4059 G typical wiring

## RANGE SELECTION

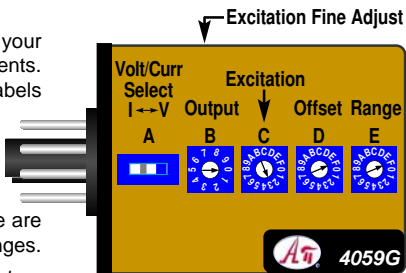
The API 4059 G is configurable to your exact input and output requirements. Ranges are listed on the module labels and below. See [www.api-usa.com](http://www.api-usa.com) or contact factory for special ranges.

Four rotary switches and a slide switch on the side of the module are used to select input and output ranges.

1. See table and set **Excitation** rotary switch **C** to desired excitation voltage.

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

2. Set **Volt/Curr** switch **A** to voltage (V) or current (I) depending on output type.
3. From the table, find the rotary switch combination that match your input/output ranges and set rotary switches **B**, **D**, and **E**.
4. The Excitation Fine Adjust, Zero, Span and Test Range potentiometers can now be adjusted for the desired output range.



		API 4059 G INPUT RANGES										
Rotary Switches	A to V	0-5 mV	0-10 mV	0-20 mV	0-25 mV	0-30 mV	0-40 mV	0-50 mV	0-100 mV	0-200 mV	0-250 mV	0-400 mV
		BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE
OUTPUT RANGES	0-1 V	002	00A	003	006	00E	00B	000	008	001	004	009
	0-2 V	802	80A	803	806	80E	80B	800	808	801	804	809
	0-4 V	102	10A	103	106	10E	10B	100	108	101	104	109
	1-5 V	602	60A	603	606	60E	60B	600	608	601	604	609
	0-5 V	902	90A	903	906	90E	90B	900	908	901	904	909
	0-10 V	302	30A	303	306	30E	30B	300	308	301	304	309
	±5 V	402	40A	403	406	40E	40B	400	408	401	404	409
	±10 V	502	50A	503	506	50E	50B	500	508	501	504	509
	4-20 mA	702	70A	703	706	70E	70B	700	708	701	704	709
	0-20 mA	302	30A	303	306	30E	30B	300	308	301	304	309

## CALIBRATION

Top-mounted, Zero and Span potentiometers can be used should fine-tuning of the output be necessary. An excitation voltage fine adjust potentiometer is located on the side of the module.

1. Apply power to 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 for the exact output desired.
3. Provide an input to the module equal to zero or the minimum input required for the application.
4. Using an accurate measurement device for the module 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.
5. 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.
6. 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 4059 G be calibrated by an accurate bridge simulator before being placed in service.
7. Offset switch **D** can be used to cancel or tare non-zero readings by offsetting the low end of the input range. Switch position 0 results in no offset. To raise the output zero, rotate switch **D** clockwise from 1 through 7 until the zero potentiometer is within range of your desired output. 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.

## TEST BUTTON

The Test pushbutton can 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.

## OPERATION

Strain gauges and load cells are normally passive devices that 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. 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%.

$$3 \text{ mV/V sensitivity} \times 10 \text{ VDC excitation} = 30 \text{ mV range}$$

An additional input, the "sense" lead, monitors the voltage drop in the sensor leads and automatically compensates the excitation voltage at the module in order to maintain a constant excitation voltage at the sensor.

The API 4059 G provides the excitation voltage to the sensors and receives the resulting millivolt signal in return. This input signal is filtered and amplified, then offset, if required, and passed to the output stage. Depending on the output configuration selected, a 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.

## RANGE SELECTION

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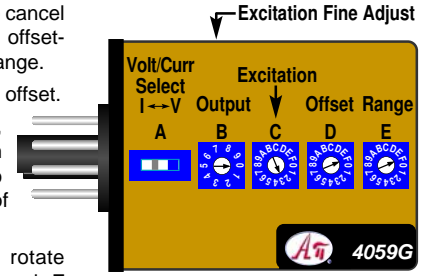
1. See table and set **Excitation** rotary switch **C** to desired excitation voltage.
2. Set **Volt/Curr** switch **A** to voltage (**V**) or current (**I**) depending on output type.
3. From the table, find the rotary switch combination that match your input/output ranges and set rotary switches **B**, **D**, and **E**.
4. The Excitation Fine Adjust, Zero, Span and Test Range potentiometers can now be adjusted for the desired output range.

5. Offset switch **D** can be used to cancel or tare non-zero readings by offsetting the low end of the input range.

Switch position 0 results in no offset.

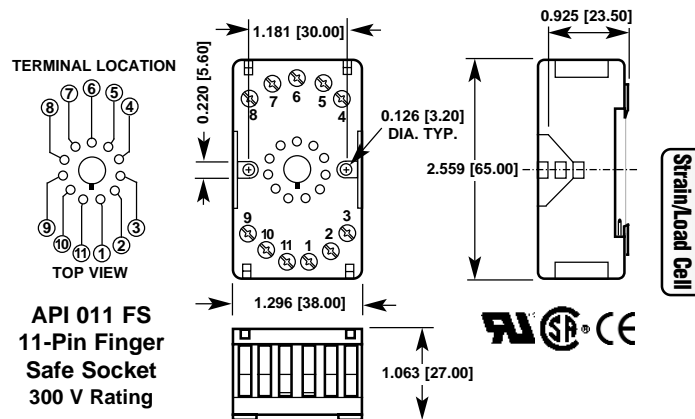
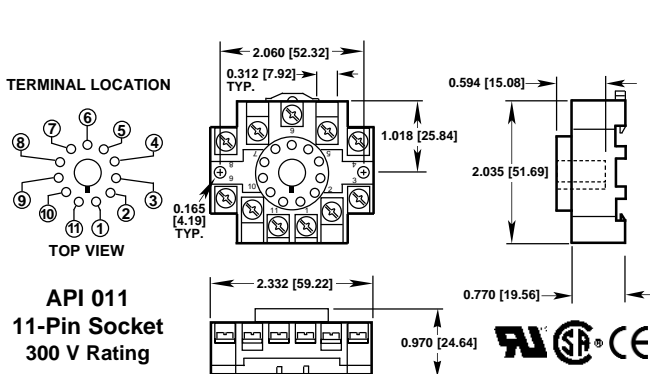
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Rotary Switches		0-5 mV	±10 mV	0-10 mV	±20 mV	0-20 mV	0-25 mV	0-30 mV	0-40 mV	0-50 mV	0-100 mV	0-200 mV	0-250 mV	0-300 mV	0-400 mV	
→		BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	
OUTPUT RANGES	Switch A to "V"	0-1 V	0-2 V	0-4 V	1-5 V	0-5 V	0-8 V	2-10 V	0-10 V	±5 V	±10 V					
		002	802	102	602	902	202	702	302	402	502					
		033	833	133	633	933	233	733	333	433	533					
		00A	80A	10A	60A	90A	20A	70A	30A	40A	50A					
		03B	83B	13B	63B	93B	23B	73B	33B	43B	53B					
		003	803	103	603	903	203	703	303	403	503					
		006	806	106	606	906	206	706	306	406	506					
		00E	80E	10E	60E	90E	20E	70E	30E	40E	50E					
		00B	80B	10B	60B	90B	20B	70B	30B	40B	50B					
		000	800	100	600	900	200	700	300	400	500					
	008	808	108	608	908	208	708	308	408	508						
	001	801	101	601	901	201	701	301	401	501						
	004	804	104	604	904	204	704	304	404	504						
	00C	80C	10C	60C	90C	20C	70C	30C	40C	50C						
	009	809	109	609	909	209	709	309	409	509						
OUTPUT RANGES	Switch A to "I"	0-2 mA	2-10 mA	0-10 mA	0-16 mA	4-20 mA	0-20 mA									
		007	602	902	202	702	302									
		033	633	933	233	733	333									
		00A	60A	90A	20A	70A	30A									
		03B	63B	93B	23B	73B	33B									
		003	603	903	203	703	303									

## API 011 and API 011 FS Sockets



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