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*
- *Hot-Swappable Plug-In Design*
- *Non-Interactive Zero and Span*
- *Full 3-Way Input/Output/Power Isolation*
- *Input and Output LoopTracker® LEDs*
- *Adjustable Output Test*
- *External Calibration Resistor Option*

Applications

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

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 sensitivity X excitation voltage = total mV range

Input Impedance
200 kΩ typical

Calibration Resistor Option
M02 option: Toggle switch for external shunt resistor

Excitation Voltage
Maximum output: 10 VDC maximum at 120 mA
Drive capability: Up to four 350 Ω bridges at 10 VDC
Adjustability: Switch-selectable, 0-10 VDC in 1 V increments
Fine adjustment: ±5% via multiturn 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

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 Linearity, Ripple & Noise
Better than ±0.1% of span, <10 mVRMS ripple and noise

Output Zero and Span
Non-interactive multi-turn potentiometers to compensate for load and lead variations, ±15% of span adjustment range typical

Functional Test Button
Sets output to test level when pressed, adjustable 0-100% of span. Not available with M02 option

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

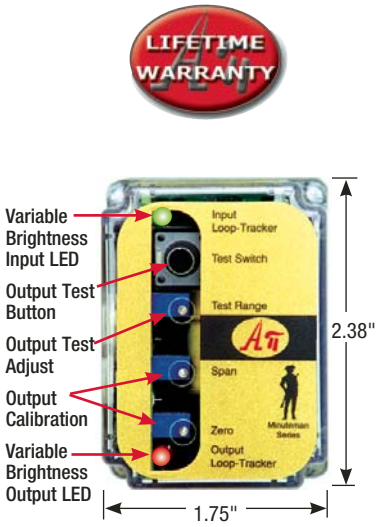
Common Mode Rejection
100 dB minimum

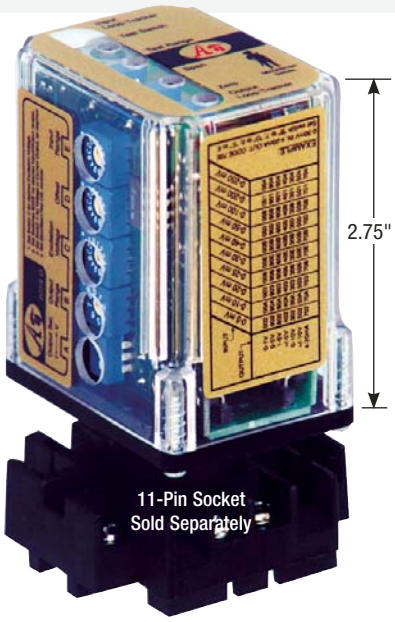
Isolation
2000 VRMS min. Full isolation: power to input, power to output, input to output

Ambient Temperature Range and Stability
–10°C to +60°C operating ambient
Better than ±0.02% of span per °C stability

Housing and Sockets
IP 40, plugs into API 011 or API 011 FS socket
Socket mounts to 35 mm DIN rail or can be surface mounted

Power
Standard: 115 VAC ±10%, 50/60 Hz, 2.5 W max.
A230 option: 230 VAC ±10%, 50/60 Hz, 2.5 W max.
P option: 60-265 VAC, 50/60 Hz or 85-300 VDC, 2.5 W typ.
D option: 9-30 VDC, 2.5 W typical





Hot Swappable Plug-In Design

Free Factory I/O Setup!

1 Minute Setup!

Quick Link api-usa.com/4059

Made in USA

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 test output level is potentiometer adjustable from 0 to 100% of output span. The output test button greatly aids in saving time during initial startup and/or troubleshooting.

The output test is not available with the M02 option. 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.

How to Order

Please specify
Model **API 4059 G** (operates on 115 VAC)
A230 for 230 VAC operation
D for operation on low voltage power
P for wide ranging power
Add options to end of model number

Switches can be pre-set to your specifications.
Please provide
Bridge mV/V
Excitation voltage
Output range

Model	Input	Output	Power
API 4059 G	Field configurable Specify mV/V and excitation voltage if factory is to set switches	Field configurable Specify output range if factory is to set switches	115 VAC
API 4059 G A230			230 VAC
API 4059 G P			60-265 VAC or 85-300 VDC
API 4059 G D			9-30 VDC or 10-32 VAC

Options–add to end of model number

M02	Toggle switch for external shunt calibration resistor
DF	10 millisecond response time, or consult factory
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

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

Installation Precautions
WARNING! All wiring must be performed by a qualified electrician or instrumentation engineer. Consult factory for assistance.

The module is designed to be mounted in a housing or panel. Mount the socket to a 35 mm DIN rail or suitable surface.

Avoid shock hazards! Turn signal input, output, and power off before connecting or disconnecting wiring. Connect power last.

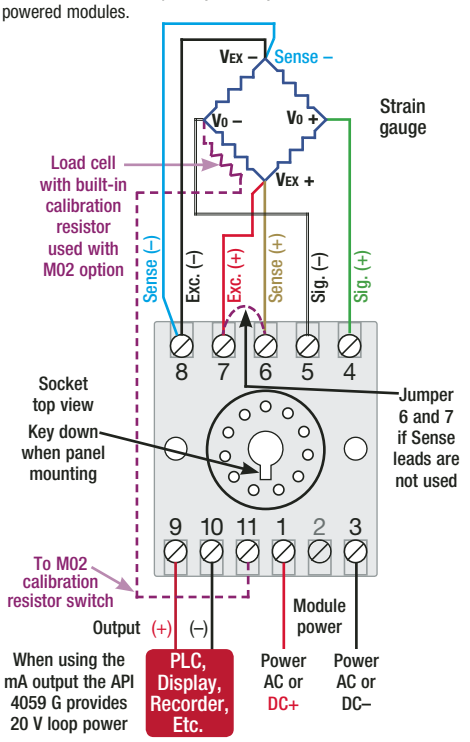
Input Terminals
Refer to diagram below and strain gauge manufacturer's data sheet for wiring and color coding. Polarity must be observed when connecting inputs. Connect up to 4 strain gauges or load cells. Sensor shield wire (if equipped) should be grounded at one end only.

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

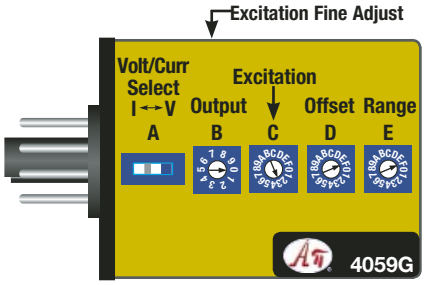
Sense Leads
Connect the sense leads as shown. If no sense leads are used, jumper terminals 6 and 7.

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 white model/serial number label must match available power. AC power can be connected with either polarity. Polarity MUST be observed for DC powered modules.



Excitation Voltage and Range Selection
The API 4059 G excitation voltage, input, and output are switch selectable via 4 rotary switches and a slide switch on the side of the module. 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

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

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**.

Calibration
Top-mounted Zero and Span potentiometers are used to fine-tune the output signal. An excitation voltage fine adjust potentiometer is located on the side of the module.

This procedure and does not account for offset or tare weight calibration. To achieve optimum results, it is recommended that the API 4059 G be calibrated using an accurate bridge simulator before being placed in service.

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. 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., less than 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 bipolar sensors such as ±10 mV 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.

Calibration Resistor Option M02
The M02 option is specified when the transducer incorporates a calibration resistor. The transducer must be connected as per the manufacturer's specifications. The transducer's calibration resistor wires are connected to terminals 5 and 11 on the API 4059 G socket. See wiring diagram.

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

1. With the API 4059 G powered and the transducer at operating temperature, adjust the zero pot for a zero or low-end output, e.g. 4 mA (assuming the selected output is 4-20 mA).
2. 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.
3. Set the API 4059 G Test toggle switch to the Test position. The transducer's shunt resistor is switched into the circuit to unbalance the bridge.
4. 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.
5. Return the Test switch to the opposite position and readjust the zero pot if necessary.

Output Test Function
Note that models with the M02 option do not have a TEST function. With this option the Test switch operates the calibration resistor 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 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 mV/V sensitivity X **10** VDC excitation = **30** mV range

The API 4059 G provides a precise 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.

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