Strain Gauge (Bridge) Input Alarm Trips

API 1500 G
API 1520 G

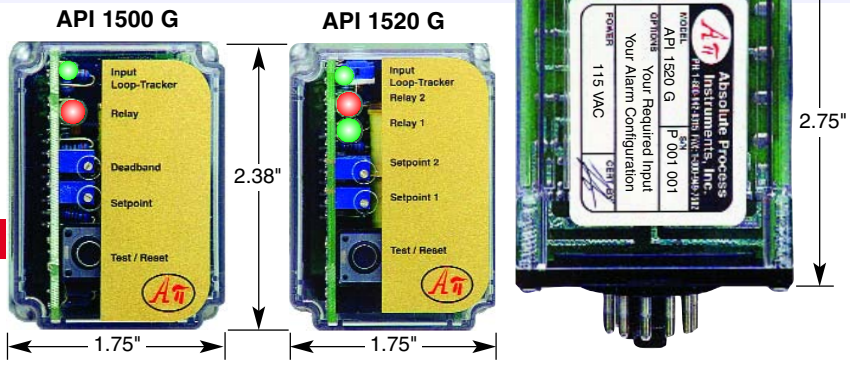
Input: ***0-5 mVDC to 0-1200 mVDC, 4-10 VDC Excitation***

Outputs: ***One DPDT Relay or Two SPDT Relays***

- ***Internal Bridge Excitation Source***
- ***Field Adjustable Setpoints***
- ***High Capacity 7 Amp Relay Contacts***
- ***Input LoopTracker® and Alarm Status LEDs***
- ***Alarm Test/Reset Pushbutton***

Applications

- **Limit Alarm for Load Cell, Pressure Sensors**
- **Hi/Lo Alarm for Weighing, Pressure**
- **Strain Gauge Over, Under, Out-of-Range Alarm**



LIFETIME WARRANTY

Free Factory Input & Output Calibration!

Specifications

Input Range
Factory Configured—Please specify input range
Minimum: 0-5 mVDC
Maximum: 0-1200 mVDC

350 Ω (or greater) bridge, load cell, pressure transducer, or strain gauge

Input Impedance
1 MΩ minimum

Input Protection, Common Mode
600 VDC or 600 VAC_p

Excitation Voltage
10 VDC maximum at 30 mA
Internal adjustment 4 to 10 VDC

Excitation Stability
±0.01% per °C

LoopTracker
Variable brightness LED indicates input level and status

Relay Output
Factory Configured—See Options for other relay configurations

API 1500 G One SPDT contact
HI alarm, normal action (failsafe), non-latching standard
7 A @ 240 VAC maximum resistive load
3.5 A @ 240 VAC maximum inductive load

API 1520 G One SPDT and One SPST contact
HI/LO, normal action (failsafe), non-latching standard
7 A @ 240 VAC maximum resistive load
3.5 A @ 240 VAC maximum inductive load

CAUTION: Socket contacts may limit system rating.
External contact protection such as an RC snubber is recommended for inductive loads.

Alarm Setpoint
12 turn potentiometer, field adjustable from 0 to 100% of span

Deadband
API 1500 G 1.0 to 100% of span 12 turn potentiometer
API 1520 G Fixed at 1% of span, standard
API 1520 GA 1.0 to 100% of span 1 turn potentiometer

Functional Test/Reset Button
Toggle relay(s) to opposite state when pressed
Resets latching relay on 1500 G with **HT** option

Response Time
70 milliseconds typical, faster response times are available

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

Power
Standard: 115 VAC ±10%, 50/60 Hz, 3.5 W max.
A230 option: 230 VAC ±10%, 50/60 Hz, 2.5 W max.
D option: 9-30 VDC, 2.5 W typical

Description and Features

The **API 1500 G** and **API 1520 G** provide a stable source of excitation voltage to bridge-type sensors such as load cells, pressure transducers and strain gauges. The resulting signal is received as an input to the module and the module provides alarm contact outputs. Heavy-duty relay contacts allow the module to directly control high capacity loads.

The modules can be factory configured for most 350 Ω (or greater) bridges. Consult the factory for assistance with your specific application.

API exclusive features include a ***LoopTracker*** LED that varies in intensity with changes in the process signal, alarm status LEDs for each alarm, and a **Functional Test Pushbutton** to toggle the relays independent of the input.

The **API 1500 G** provides a single setpoint adjustment and DPDT relay contacts. The alarm output can be factory configured for HI or LO operation, non-latching or latching, normal (fail-safe) or reverse (non-fail-safe) acting.

The **API 1520 G** contains two independent setpoints with two SPDT relay contact outputs. The alarm output can be factory configured for HI/HI, HI/LO, LO/HI or LO/LO operation, normal acting (fail-safe) or reverse acting (non-fail-safe).

Models & Options

Factory Configured—Please specify input range and options

API 1500 G Strain gauge input alarm trip, 1 SPDT relay, HI alarm, normal action (failsafe), non-latching, w. loop supply, 115 VAC

API 1520 G Strain gauge input alarm trip, 1 SPDT & 1 SPST relay, HI/LO, normal action (failsafe), non-latching, w. loop supply, 115 VAC

Options—Add to end of model number

A230	Powered by 230 VAC, 50/60 Hz
D	Powered by 9-30 VDC
R	Reverse-acting alarms (non-failsafe)
L	Low trip (on decreasing signal) for 1500 G
HT	Latching alarm with pushbutton reset, API 1500 G only
HP	Latching alarm with power-off reset, API 1500 G only
A	Adjustable deadbands for 1520 G
HH	High/High trip for 1520 G instead of High/Low
LL	Low/Low trip for 1520 G instead of High/Low
U	Conformal coating for moisture resistance

Accessories—Order as a 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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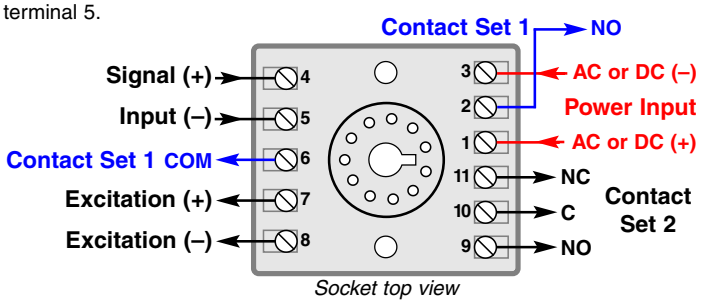
ELECTRICAL CONNECTIONS

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 separately.

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.

Signal Input – 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.



Socket top view

Relay Output Terminals – Terminals 2, 6, and 9, 10, 11 provide the appropriate connections for the desired relay operations. (NO = Normally Open, NC = Normally Closed, C = Common). NOTE: Although the API 1500 G has a pair of relays, these relays will energize and de-energize in unison. The API 1520 G will accommodate independent relay operations.

SETUP

The input range and alarm types are pre-configured at the factory as specified on your order. No input calibration is necessary. Contact factory for custom ranges or modifications.

Setpoint Control – This multi-turn potentiometer (one for each setpoint on the API 1520 G) allows the operator to adjust the level at which the alarm is activated. This control is adjustable from 0 to 100% of the input range.

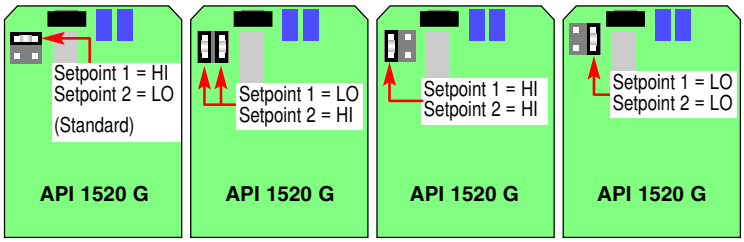
Deadband Control – The API 1500 G deadband potentiometer allows the alarm trip and reset window to be adjusted symmetrically about the setpoint from 1 to 100% of the span.

The deadband is fixed at 1% of span on the API 1520 G. The API 1520 GA with adjustable deadband option allows deadbands to be adjusted symmetrically about each setpoint from 1 to 100% of the span.

Adjustable deadband allows the operator to fine tune the point at which the alarm trips (alarm condition) and resets (non alarm condition). The deadband is typically used to prevent chattering of the relays or false trips when the process signal is unstable or changes rapidly.

API 1520 G Alarm Configuration – The alarm configuration of the API 1520 G is pre-configured at the factory per your order, but if a change is necessary, internal jumpers can be used to modify the alarm type as follows.

1. Unplug the module from the socket.
2. Remove the 4 screws from the module bottom and remove the plastic case.
3. Unplug the circuit board with the test button from the base.
4. Note location of jumper block at top left of circuit board next to test button.
5. Place jumpers as indicated for desired alarm operation. The standard HI/LO setting is with one jumper across the two top pins or with no jumper at all. Never place a jumper across the two bottom pins!
6. Replace board, cover, and screws.



TEST BUTTON

The functional test pushbutton toggles the alarm status independent of the input when depressed. It verifies the alarm and system operation and provides the additional function of unlatching the alarm on the API 1500 G HT with the latching alarm option.

OPERATION

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 to provide a quick visual picture of your process loop at all times. 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. This features greatly aid in saving time during initial start-up or troubleshooting.

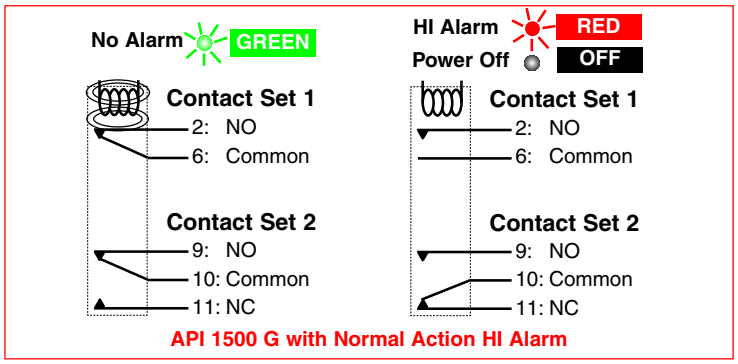
The bi-color alarm LED provides a visual indication of the alarm status. In all configurations, a GREEN LED indicates a non-alarm condition and a RED LED indicates an alarm condition.

Alarm Relays – In the normal mode of operation (failsafe), the relay coil is energized in a non-alarm condition and de-energized in an alarm condition. This will create an alarm condition if the module loses power. For a normal acting, non-latching configuration, the alarm will activate when the input signal exceeds the setpoint (HI alarm) or falls below the setpoint (LO alarm), then will automatically reset when the alarm condition no longer exists.

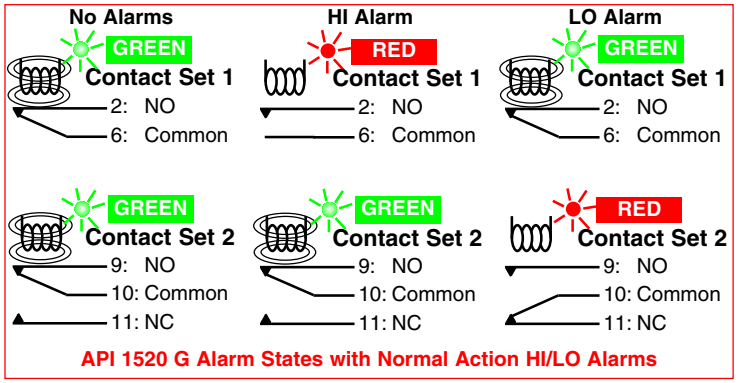
If reverse acting mode is selected (non-failsafe), the relay coil is de-energized in a non-alarm condition and energized in an alarm condition. The alarm will activate when the input signal exceeds the setpoint (HI alarm) or falls below the setpoint (LO alarm), then will automatically reset when the alarm condition no longer exists.

API 1500 G HT Latching Alarm – For units with the **HT** latching alarm option, the Test Switch is also used to reset the alarm relays. The alarm relay contacts will remain in the alarmed condition until the input signal falls below the high alarm setpoint (or above low alarm setpoint, depending on configuration) and the Test/Reset pushbutton has been pressed or power to the unit has been switched off.

API 1500 G HP Latching Alarm – For units with the **HP** latching alarm option, the alarm relay contacts will remain in the alarmed condition until the input signal falls below the high alarm setpoint (or above low alarm setpoint, depending on configuration) and the power to the unit has been switched off.



API 1500 G with Normal Action HI Alarm



API 1520 G Alarm States with Normal Action HI/LO Alarms

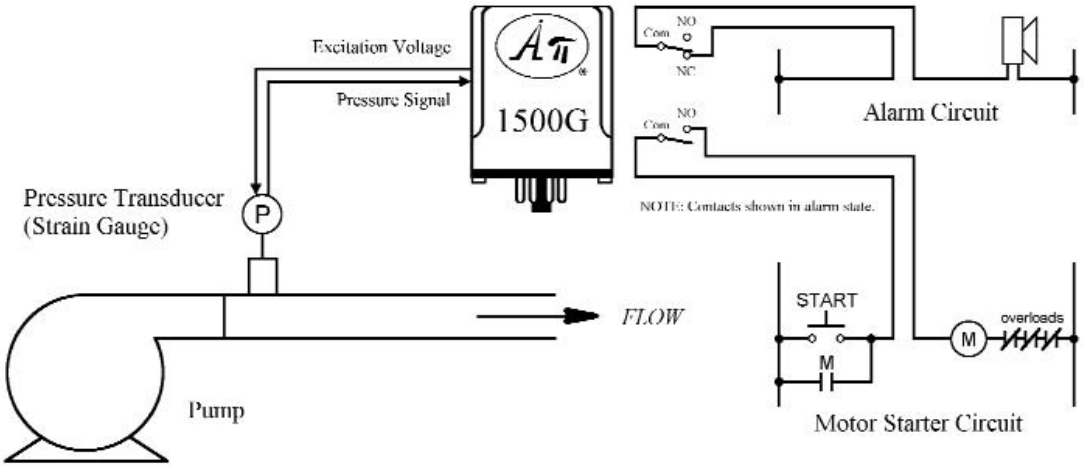
Pumping System High Pressure Alarm and Shutdown

PROBLEM

A pump is supplying liquid to a process which requires the line pressure to be maintained below some maximum value. If the pressure exceeds the preset limit, the pump must be shut down and a remote alarm activated.

SOLUTION

A pressure transducer is installed in the line on the discharge side of the pump. The pressure transducer is connected to an **API 1500 G** Strain Gauge (Bridge) Input Single Alarm Trip module which provides two isolated Form C (NO/NC) relay contacts. One set of these contacts is wired in series with the coil of the pump motor starter and shuts down the pump when tripped. The other set of contacts is wired to a remote alarm or annunciator panel to alert the proper personnel of the over-pressure shutdown. The setpoint is field adjustable from 0-100% of the input span.



The **API 1500 G** provides the stable excitation voltage for the pressure transducer from its built-in excitation supply. The standard heavy-duty relay contacts are rated 7A @ 240 VAC and can directly control most devices.

Relay Protection and EMI Suppression

When using Api alarm module relays to switch inductive loads, maximum relay life and transient EMI suppression is achieved by using external protection. All external protection devices should be placed directly across the load and all leads lengths should be kept to a minimum length.

For AC inductive loads (see Figure 1), place a properly rated MOV across the load in parallel with a series RC snubber. A good RC snubber consists of a 0.1 µF polypropylene capacitor of sufficient voltage and a 47 Ohm ½ Watt carbon film resistor.

For DC inductive loads (see Figure 2), place a diode across the load (1N4006 recommended) being sure to observe proper polarity. Use of an RC snubber is an optional enhancement.

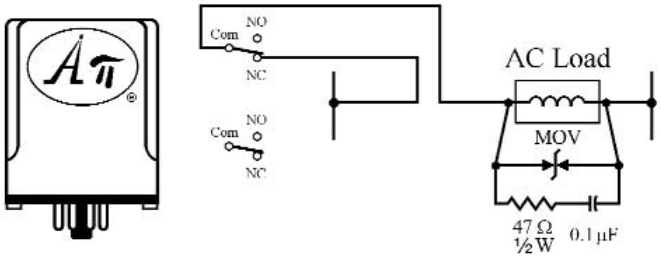


Figure 1: AC inductive loads.

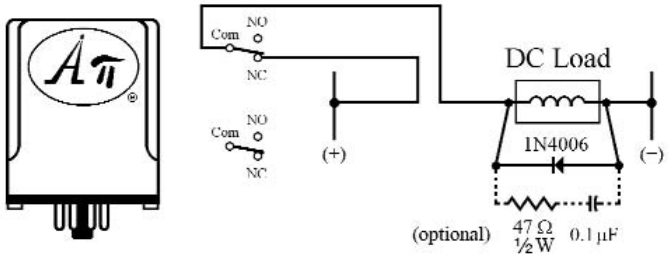


Figure 2: DC inductive loads.

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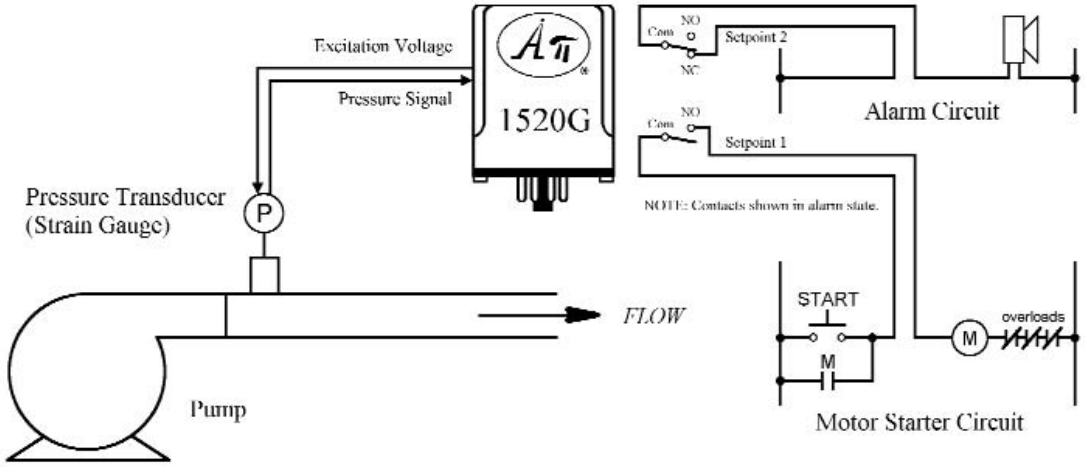
Pumping System High/High Pressure Alarm and Shutdown

PROBLEM

A pump is supplying liquid to a process which requires the line pressure to be maintained below some maximum value. If the pressure exceeds a preset warning limit, an alarm must be activated. If the pressure exceeds a preset shutdown limit, the pump must be stopped.

SOLUTION

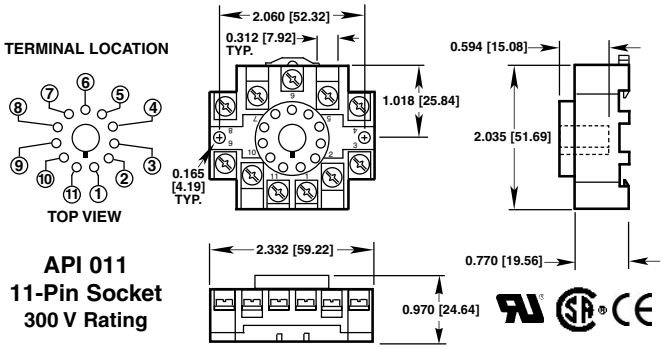
A pressure transducer is installed in the line on the discharge side of the pump. The pressure transducer is connected to an **API 1520 G** Strain Gauge (Bridge) Input Dual Alarm Trip module which provides two independent setpoints and two independent isolated Form C (NO/NC) relay contacts. One set of these contacts is wired to an alarm or annunciator panel to alert the proper personnel of the overpressure condition. The other set of contacts is wired in series with the coil of the pump motor starter and shuts down the pump when tripped.



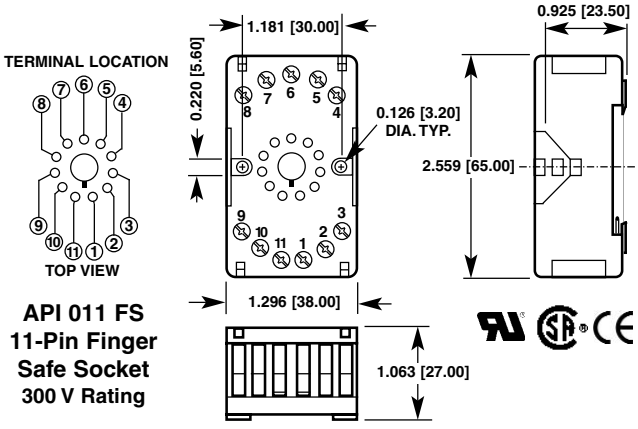
The **API 1520 G** provides the stable excitation voltage for the pressure transducer from its built-in excitation supply. Setpoint 2 is adjusted to the warning pressure limit, and Setpoint 1 is adjusted to the pressure shutdown limit. The standard heavy-duty relay contacts are rated 7A @ 240 VAC and can directly control most devices. Both setpoints are adjustable from 0-100% of the input span.

Strain Gauge

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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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

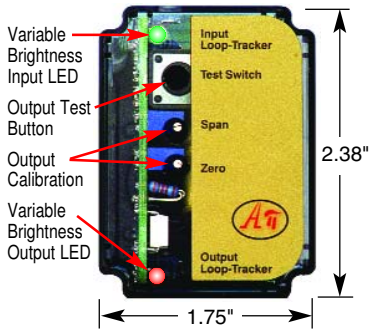
–10°C to +60°C operating

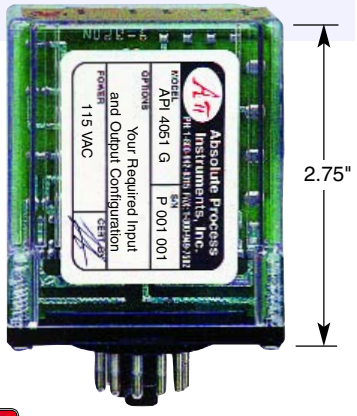
Temperature Stability

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

Strain Gauge

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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.

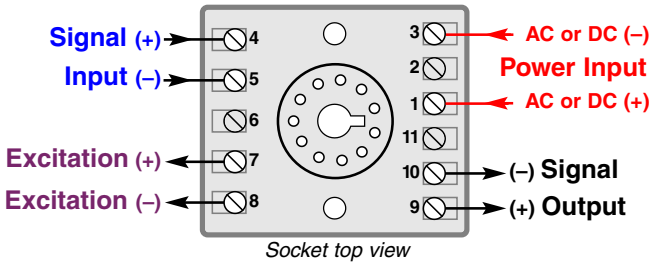
For DC powered modules, polarity **MUST** be observed. Positive (+) is wired to terminal 1 and negative (–) is wired to terminal 3.

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.*

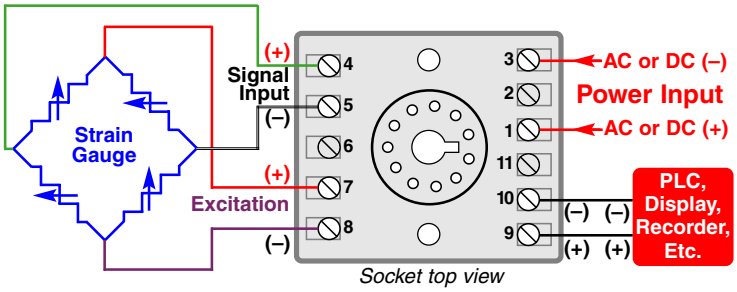
Refer to strain gauge manufacturer's data sheet for wire color coding. Terminals 7 and 8 provide connections for the DC voltage that is used to excite the strain gauge load cell. Polarity must be observed when connecting the Excitation Output. The positive connection (+) is applied to terminal 7 and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

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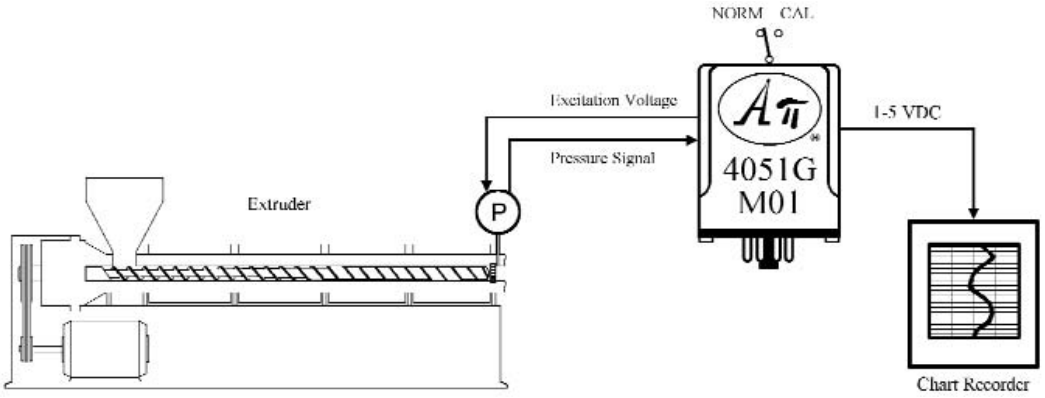
Calibration of a Pressure System

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

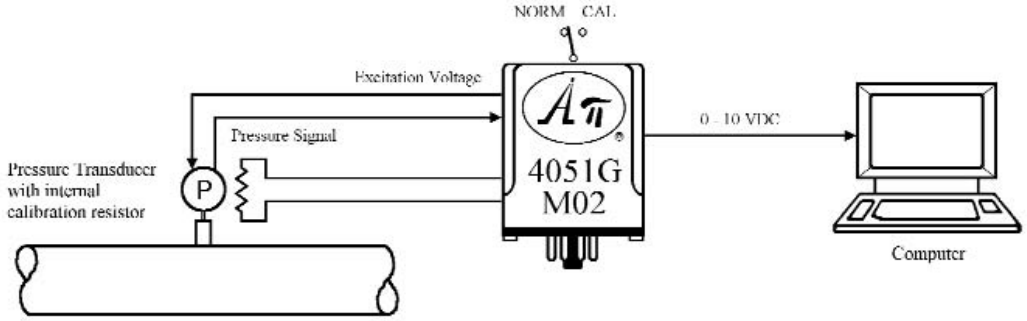
Calibration of a Pressure Transducer

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?

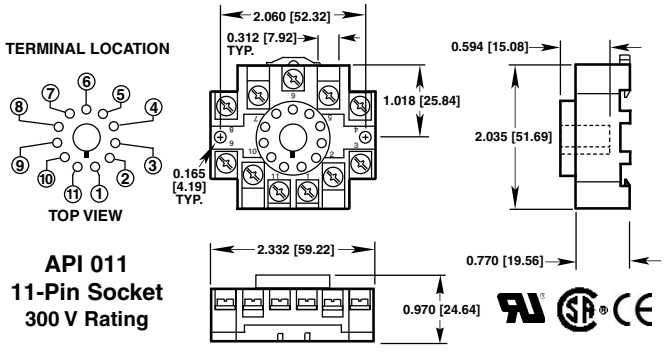
SOLUTION

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.

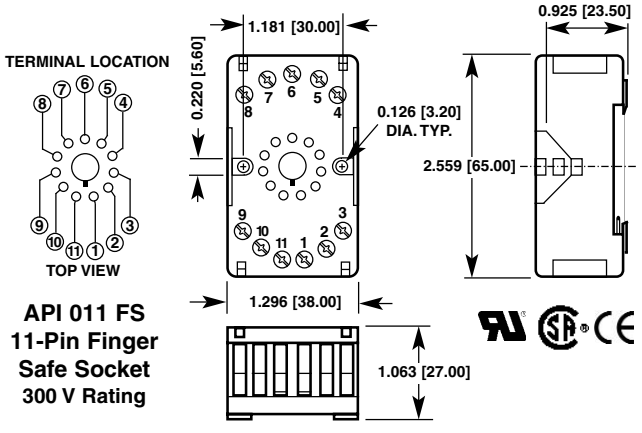


The **API 4051 G M02** utilizes the pressure transducer's internal calibration resistor to unbalance the bridge to a specified value when the test switch is in the CAL position, ensuring accurate system calibration.

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

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

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

API 4058 G

Input: ***0-5 mV to 0-1200 mVDC, 4-10 V Excitation***

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

Field Selectable

One Minute Setup!

- ***Drive up to Four 350 Ω Bridges***
- ***Selectable Excitation Voltage***
- ***Selectable Voltage or Current Outputs***
- ***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.**

LIFETIME WARRANTY

Free Factory Input & Output Calibration!

Specifications

Input Range

Minimum range:	0 to 5 mV
Maximum range:	0 to 1200 mV
Minimum sensitivity:	0.5 mV/V
Maximum sensitivity:	120 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 typical

Excitation Voltage

Maximum output:	10 VDC maximum at 115 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:	±2.5% via multiturn potentiometer
Stability:	±0.01% per °C

Internal Shunt Calibration Resistor Option

Option **M01**: Toggle switch for ??? Ω internal shunt resistor

Zero Offset

±100% of span in 15% increments

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. Adjustable 0-100% of span
Potentiometer factory set to approximately 50% of span

Response Time

70 milliseconds typical, faster response times are available

Common Mode Rejection

100 dB minimum

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, 3.5 W max.
A230 option:	230 VAC ±10%, 50/60 Hz, 2.5 W max.
D12 option:	12 VDC, 3 W typical with 4 load cells
D24 option:	24 VDC, 3 W typical with 4 load cells

Description and Features

The **API 4058 G** accepts a strain gauge, bridge, load cell, or a summed input from up to four sensors, 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 found 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 selected output.

Input, output, excitation and zero offset are field-configurable, via external rotary and slide switches. Common ranges are on the module label. An offset switch is standard for applications requiring cancellation of sensor offsets or non-zero deadweights (taring).

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 4058 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 4058 G	Field selectable strain gauge to DC transmitter, non-isolated, 115 VAC

Options—Add to end of model number

A230	Powered by 230 VAC, 50/60 Hz
D12	Powered by 12 VDC
D24	Powered by 24 VDC
M01	Toggle switch with internal shunt calibration resistor
DF	Fast response, 1 millisecond nominal response time
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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Strain Gauge

ELECTRICAL CONNECTIONS

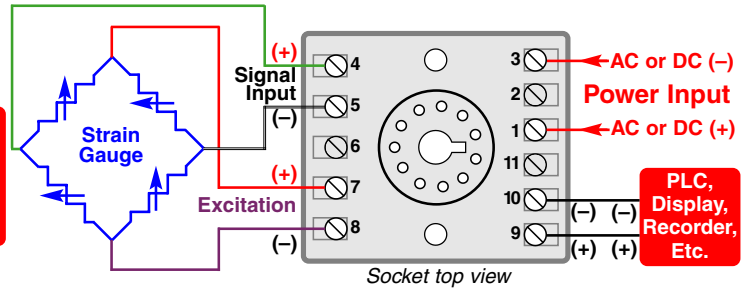
WARNING! All wiring must be performed by qualified personnel only. This module requires an industry-standard 11-pin socket. Order API 011 or finger-safe API 011 FS socket.

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 4058 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.

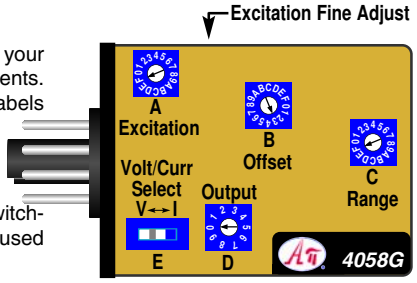


API 4058 G typical wiring.
Refer to strain gauge manufacturer's data sheet for wire color coding.

RANGE SELECTION

The API 4058 G is configurable to your exact input and output requirements. Ranges are listed on the module labels and at right. See www.api-usa.com or contact factory for special ranges.

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



1. See table and set **Excitation** rotary switch **A** 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 A	A	9	8	7	6	5	4	3	2	1	0

2. Set **Volt/Curr** switch **E** 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**, **C**, and **D**.
4. The Excitation Fine Adjust, Zero, Span and Test Range potentiometers can now be adjusted for the desired output range.

		API 4058 G INPUT RANGES										
	Rotary Switches →	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	0-1000 mV
		BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
OUTPUT RANGES	Switch E to V											
	0-1 V	E10	E90	E30	E50	ED0	EB0	E00	E80	E20	E40	E60
	0-2 V	E11	E91	E31	E51	ED1	EB1	E01	E81	E21	E41	E61
	0-5 V	E13	E93	E33	E53	ED3	EB3	E03	E83	E33	E43	E63
	1-5 V	C12	C92	C32	C52	CD2	CB2	C02	C82	C22	C42	C62
	0-10 V	E16	E96	E36	E56	ED6	EB6	E06	E86	E26	E46	E66
	±5 V	E18	E98	E38	E58	ED8	EB8	E08	E88	E28	E48	E68
	±10 V	E19	E99	E39	E59	ED9	EB9	E09	E89	E29	E49	E69
	E to I											
	4-20 mA	C15	C95	C35	C55	CD5	CB5	C05	C85	C25	C45	C65
	0-20 mA	E16	E96	E36	E56	ED6	EB6	E06	E86	E26	E46	E66

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

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 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 4058 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.

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 4058 G consists of four rotary switches and one slide switch that must be configured to match the specifications of the input sensor(s) and the output requirements.

The API 4058 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 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.

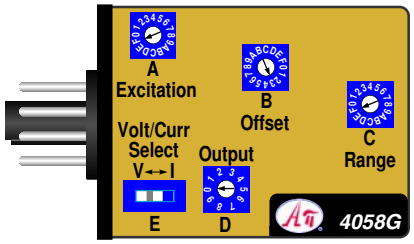
Strain Gauge

RANGE SELECTION

The API 4058 G is configurable to your exact input and output requirements. Ranges are listed on the module labels and at right. See www.api-usa.com or contact factory for special ranges.

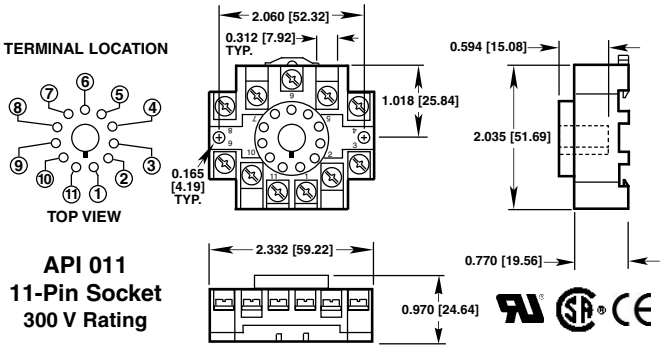
Four rotary switches and a slide switches on the side of the module are used to select input and output ranges.

1. See table and set **Excitation** rotary switch **A** to desired excitation voltage.
2. Set **Volt/Curr** switch **E** 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**, **C**, and **D**.
4. The Excitation Fine Adjust, Zero, Span and Test Range potentiometers can now be adjusted for the desired output range.

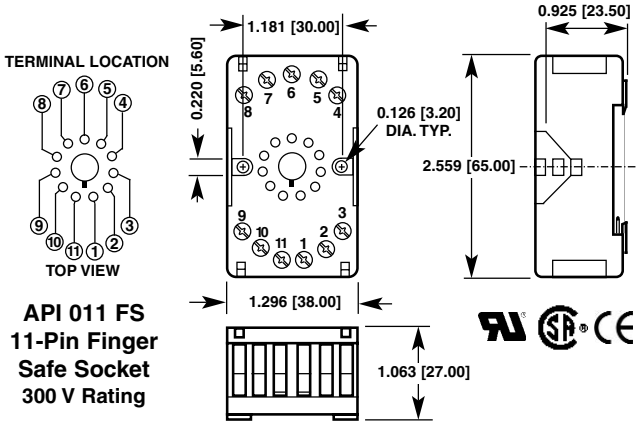


OUTPUT RANGES		API 4058 G INPUT RANGES																		
	Rotary Switches	0-5 mV	±10 mV	0-10 mV	±20 mV	0-20 mV	0-25 mV	±30 mV	0-30 mV	0-40 mV	0-50 mV	0-100 mV	0-200 mV	0-250 mV	0-300 mV	0-400 mV	±500 mV	0-1000 mV	0-1200 mV
		BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
Switch E to "V"	0-1 V	E10		E90		E30	E50		ED0	EB0	E00	E80	E20	E40	EC0	EA0	A60	E60	EE0
	0-2 V	E11		E91		E31	E51		ED1	EB1	E01	E81	E21	E41	EC1	EA1	A61	E61	EE1
	0-4 V	E12		E92		E32	E52		ED2	EB2	E02	E82	E22	E42	EC2	EA2	A62	E62	EE2
	0-5 V	E13	A33	E93	AB3	E33	E53	A03	ED3	EB3	E03	E83	E33	E43	EC3	EA3	A63	E63	EE3
	1-5 V	C12		C92		C32	C52		CD2	CB2	C02	C82	C22	C42	CC2	CA2	AE3	C62	CE2
	0-8 V	E15		E95		E35	E55		ED5	EB5	E05	E85	E25	E45	EC5	EA5	A65	E65	EE5
	2-10 V	C15		C95		C35	C55		CD5	CB5	C05	C85	C25	C45	CC5	CA5	AE6	C65	CE5
	0-10 V	E16	A36	E96	AB6	E36	E56	A06	ED6	EB6	E06	E86	E26	E46	EC6	EA6	A66	E66	EE6
	±5 V	E18	A38	E98	AB8	E38	E58	A08	ED8	EB8	E08	E88	E28	E48	EC8	EA8	A68	E68	EE8
	±10 V	E19	A39	E99	AB9	E39	E59	A09	ED9	EB9	E09	E89	E29	E49	EC9	EA9	A69	E69	EE9
Switch E to "I"	0-2 mA	E10		E90		E30	E50		ED0	EB0	E00	E80	E20	E40	EC0	EA0	A60	E60	EE0
	0-10 mA	E13		E93		E33	E53		ED3	EB3	E03	E83	E23	E43	EC3	EA3	A63	E63	EE3
	2-10 mA	C12		C92		C32	C52		CD2	CB2	C02	C82	C22	C42	CC2	CA2	AE3	C62	CE2
	0-16 mA	E15		E95		E35	E55		ED5	EB5	E05	E85	E25	E45	EC5	EA5	A65	E65	EE5
	4-20 mA	C15	A35	C95	AB5	C35	C55	A05	CD5	CB5	C05	C85	C25	C45	CC5	CA5	AE6	C65	CE5
	0-20 mA	E16		E96		E36	E56		ED6	EB6	E06	E86	E26	E46	EC6	EA6	A66	E66	EE6

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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Frequently Asked Questions

What is the performance over the entire range for the API 4058 G? How well does the output track the input over the entire range?

The linearity specification for the **API 4058 G** is ±0.1% of span. The **API 4059 G** is the same.

Is the API 4058 G approved for Europe's CE standards?

No, but if the entire system in the application needs to be CE approved, then our unit does not.

Our weighing scale uses a strain gauge with an excitation voltage of 10 V and a calibrated sensitivity of 2.2447 mV/V. The API 4058 G has been set up for an input of 0-20 mV. Are these switch settings correct?

If you are using all of the available range of the strain gauge, the maximum input signal to the module will be 22.447 mV, which is beyond the switch settings. You need to verify the maximum load conditions and change the switch settings to 0-25 mV if required.

When trying to adjust the span potentiometer on an API 4058 G the output signal, which drives a numerical display, jumps by too large an amount when barely turning the potentiometer screw. What is wrong?

The resolutions of the zero and span potentiometers are related to the amount of turns of the pot screw and the amount of adjustment capability (±15%). The factory can provide a finer resolution which means that the potentiometer screw must be turned more to have the same amount of change in signal, however the total amount of adjustment capability of the potentiometer will be reduced.

We have a load cell application with a very low output signal and we would like to drive the cell with a higher excitation voltage (the load cell is rated 24 VDC max. and 10 VDC typical). Can your modules provide an excitation voltage higher than 10 VDC?

No, however you can use an **API 9046-24** power supply with 24 VDC output to excite the load cell. The output signal would then be higher for the same load which could then drive an API 4310 G, narrow input span.

We are trying to set up your API 4059 G to allow a ±30 mV input signal (3mV/V load cell operating in the tension/compression mode) with a ±10 V output signal. The unit does not have a code to select for the input of ±30 mV. Can we have this input option?

No, the **API 4059 G** will not accept ±30 mV and the span potentiometer does not have enough adjustment for this special range. You can lower the excitation voltage to 7 VDC so that you would have a ±20 mV input (7V excitation x 3 mV/V = 21 mV). If isolation is not necessary, select the **API 4058 G** which allows a ±30 mV to ±10 VDC input/output combination.

What would be the input range for our load cell that has a maximum capacity of 200 pounds, an excitation voltage of 10 VDC, a rating of 2 mV/V, operating in the tension/compression mode, and measuring 75 pounds full scale?

Full-scale input to our module would be

$$(75 / 200) \times 10\ V \times 2\ mV/V = 7.5\ mV.$$

For tension and compression, the signal will be ±7.5 mV.

We have an API 4058 G and need to set it up with a load cell for tension and compression operation. The load cell has a sensitivity of 2 mV/V and a maximum capacity of 50 pounds. Our largest load will be 40 pounds. We also need the output to provide a 4-20 mA signal. What are the switch settings?

The maximum input signal to our module will be

$$\pm(40 / 50 \times \text{Excitation Voltage} \times 2\ mV/V)$$

This input value needs to be close to one of the available input ranges for the **API 4058 G**. If we had an excitation voltage of 10 V, then the input signal would be ±16 mV. this would be 25% too low for the ±20 mV range since the zero and span potentiometers only have ±15% adjustment.

The excitation voltage should be lowered to provide an input signal that is close to our next lower range of ±10 mV. If the excitation voltage is set to 6 V, then the signal from the load cell will be

$$\pm(40 / 50 \times 6 \times 2) = \pm 9.6\ V$$

Then we can adjust the zero and span potentiometers to allow a 4 mA output for a –9.6 V input and a 20 mA output for a +9.6 V input.

We have 4 load cells in our application each with a resistance of 350 ohms. Can we use your API 4051 G in this application?

No. The **API 4051 G** excitation circuit can only source 30 mA maximum. Since your 4 load cells require about 114 mA total current, you must use either the **API 4058 G** or the **API 4059 G**.

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905-457-6322 or 800-794-5883
www.mod-tronic.com

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***

Free Factory Input & Output Calibration!

LIFETIME WARRANTY

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 sensitivity X excitation voltage = 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 multiturn 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_{RMS} 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

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

A230	Powered by 230 VAC, 50/60 Hz
D	Powered by 9-30 VDC
M02	Toggle switch for external shunt calibration resistor
DF	Fast response, 10 millisecond nominal response time
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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Strain Gauge

Strain Gauge

ELECTRICAL CONNECTIONS

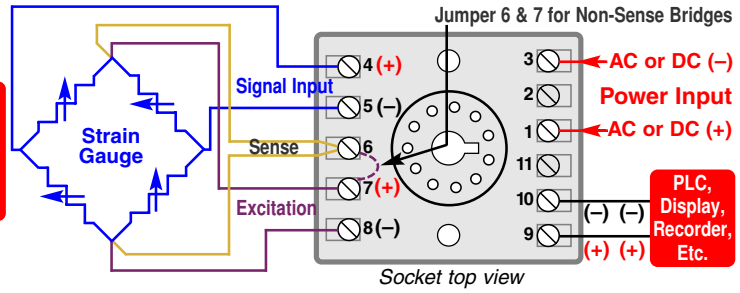
WARNING! All wiring must be performed by qualified personnel only. This module requires an industry-standard 11-pin socket. Order API 011 or finger-safe API 011 FS socket.

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.

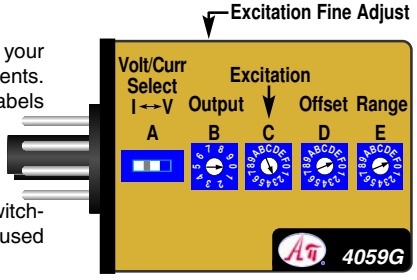


API 4059 G typical wiring

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 or contact factory for special ranges.

Four rotary switches and a slide switches 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 →	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	Switch A to V: 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
	A to I: 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

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

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 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.

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

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

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 or contact factory for special ranges.

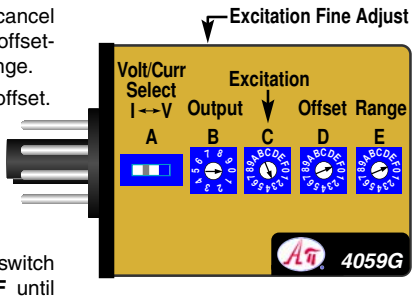
Four rotary switches and a slide switches on the side of the module are used to select input and output ranges.

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

   To raise the output zero, rotate switch **D** clockwise from **1** through **7** until the zero potentiometer is within range of your desired output.

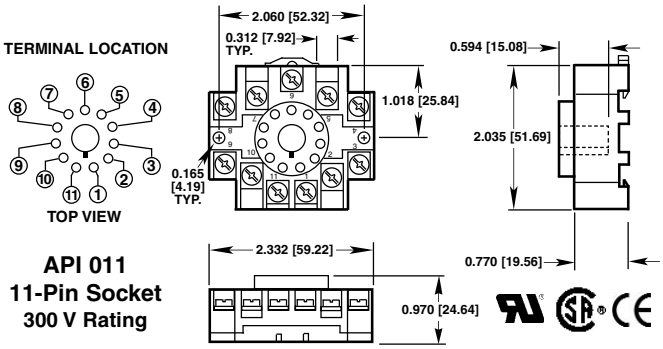
   To lower the output zero, rotate switch **D** through ranges **9** through **F** until the zero potentiometer is within range of your desired output. This range is often used for elevated input ranges.



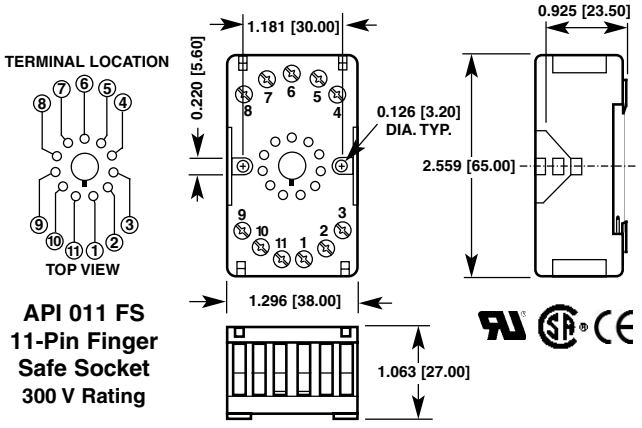
		Rotary Switches →	API 4059 G INPUT RANGES													
			0-5 mV	±10 mV	0-10 mV	±20 mV	0-20 mV	0-25 mV	0-30 mV	0-40 mV	0-50 mV	0-100 mV	0-200 mV	0-250 mV	0-300 mV	0-400 mV
			BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE	BDE
OUTPUT RANGES	Switch A to "V"	0-1 V	002	033	00A	03B	003	006	00E	00B	000	008	001	004	00C	009
		0-2 V	802	833	80A	83B	803	806	80E	80B	800	808	801	804	80C	809
		0-4 V	102	133	10A	13B	103	106	10E	10B	100	108	101	104	10C	109
		1-5 V	602	633	60A	63B	603	606	60E	60B	600	608	601	604	60C	609
		0-5 V	902	933	90A	93B	903	906	90E	90B	900	908	901	904	90C	909
		0-8 V	202	233	20A	23B	203	206	20E	20B	200	208	201	204	20C	209
		2-10 V	702	733	70A	73B	703	706	70E	70B	700	708	701	704	70C	709
		0-10 V	302	333	30A	33B	303	306	30E	30B	300	308	301	304	30C	309
		±5 V	402	433	40A	43B	403	406	40E	40B	400	408	401	404	40C	409
		±10 V	502	533	50A	53B	503	506	50E	50B	500	508	501	504	50C	509
	Switch A to "I"	0-2 mA	007	033	00A	03B	003	006	00E	00B	000	008	001	004	00C	009
		2-10 mA	602	633	60A	63B	603	606	60E	60B	600	608	601	604	60C	609
		0-10 mA	902	933	90A	93B	903	906	90E	90B	900	908	901	904	90C	909
		0-16 mA	202	233	20A	23B	203	206	20E	20B	200	208	201	204	20C	209
		4-20 mA	702	733	70A	73B	703	706	70E	70B	700	708	701	704	70C	709
		0-20 mA	302	333	30A	33B	303	306	30E	30B	300	308	301	304	30C	309

Strain Gauge

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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Frequently Asked Questions

What is the performance over the entire range for the API 4059 G? How well does the output track the input over the entire range?

The linearity specification for the **API 4059 G** is ±0.1% of span. The **API 4058 G** is the same.

Is the API 4059 G approved for Europe's CE standards?

No, but if the entire system in the application needs to be CE approved, then our unit does not.

What does the 70 msec response time mean on the API 4059 G? Are faster times available? If a signal with pulse width of less than 70 msec is present at the input, will it show up at the output?

The output will track the input with about a 70msec delay. The **API 4059 G** can be factory set to 10 msec minimum. If a pulse of less than the response time (70 msec or 10 msec) occurs at the input, the output will not reveal it, or there might be a small blip.

When trying to adjust the span potentiometer on an API 4059 G the output signal, which drives a numerical display, jumps by too large an amount when barely turning the potentiometer screw. What is wrong?

The resolutions of the zero and span potentiometers are related to the amount of turns of the pot screw and the amount of adjustment capability (±15%). The factory can provide a finer resolution which means that the potentiometer screw must be turned more to have the same amount of change in signal, however the total amount of adjustment capability of the potentiometer will be reduced.

We have a load cell application with a very low output signal and we would like to drive the cell with a higher excitation voltage (the load cell is rated 24 VDC max. and 10 VDC typical). Can your modules provide an excitation voltage higher than 10 VDC?

No, however you can use an **API 9046-24** power supply with 24 VDC output to excite the load cell. The output signal would then be higher for the same load which could then drive an **API 4310 G**, narrow input span.

We are trying to set up the API 4059 G to allow a ±30 mV input signal (3mV/V load cell operating in the tension/compression mode) with a ±10 V output signal. The unit does not have a code to select for the input of ±30 mV. Can we have this input option?

No, the **API 4059 G** will not accept ±30 mV and the span potentiometer does not have enough adjustment for this special range. You can lower the excitation voltage to 7 VDC so that you would have a ±20 mV input (7 V excitation x 3 mV/V = 21 mV). If isolation is not necessary, select the **API 4058 G** which allows a ±30 mV to ±10 VDC input/output combination.

What would be the input range for our load cell that has a maximum capacity of 200 pounds, an excitation voltage of 10 VDC, a rating of 2 mV/V, operating in the tension/compression mode, and measuring 75 pounds full scale?

Full scale-input to our module would be

$$(75 / 200) \times 10\ V \times 2\ mV/V = 7.5\ mV.$$

For tension and compression, the signal will be ±7.5 mV.

We have two load cells and wish to wire them to your API 4059 G. How do we accomplish this?

Connect both load cells in parallel. Each load cell would be wired the same, excitation voltage and return signals, to the **API 4059 G** so there would be two sets of wires to terminals 4 & 5 and 7 & 8.

We use an API 4059 G with a load cell that comes with a calibration resistor to simulate 80% of full load. The load cell will be used in both the tension and compression modes. How do we connect the calibration resistor to your API 4059 G?

For both tension and compression modes, the signal will be bipolar (±). The tension mode (negative) places the resistor between the (+) excitation signal, terminal 7, and the (–) signal input, terminal 5. This will simulate –80% of full tension load. To calibrate the output, adjust the zero potentiometer to set the output to 10% of span.

The compression mode (positive) places the resistor between the (+) excitation signal, terminal 7, and the (+) signal input, terminal 4. This will simulate +80% of full compression load. To calibrate the output, adjust the span potentiometer to set the output to 90% of span.

Total span is ±100 % (bipolar) = 200% of full capacity, with 100% being the midpoint.

$$-80\% = 20\% / 200\% = 10\%$$

$$+80\% = 180\% / 200\% = 90\%$$

We have 4 load cells in our application each with a resistance of 350 ohms. Can we use your API 4051 G in this application?

No. The **API 4051 G** excitation circuit can only source 30 mA maximum. Since your 4 load cells require about 114 mA total current, you must use either the **API 4058 G** or the **API 4059 G**.

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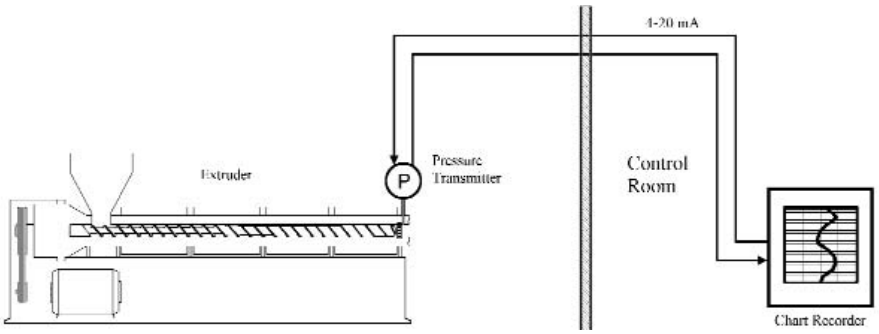
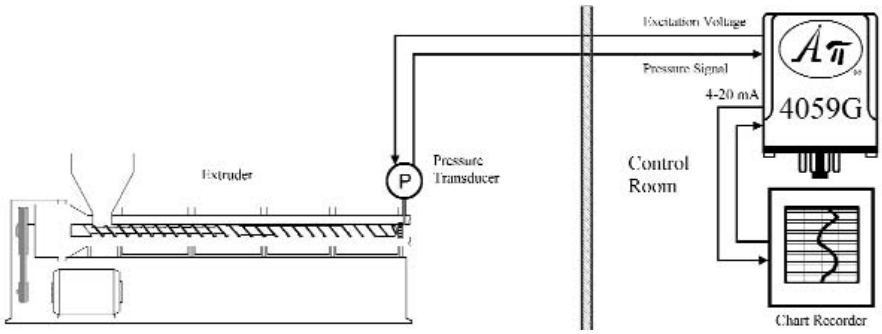
Why Take the Heat When You are Under Pressure?

Sometimes it is necessary to locate a pressure sensor where it is continuously exposed to temperatures near or exceeding its upper temperature limits. When a pressure transmitter is used, the high temperatures gradually degrade the electronics and considerably shorten the life of the sensor. The cost of production downtime and repair or replacement of the sensor can run into thousands of dollars.

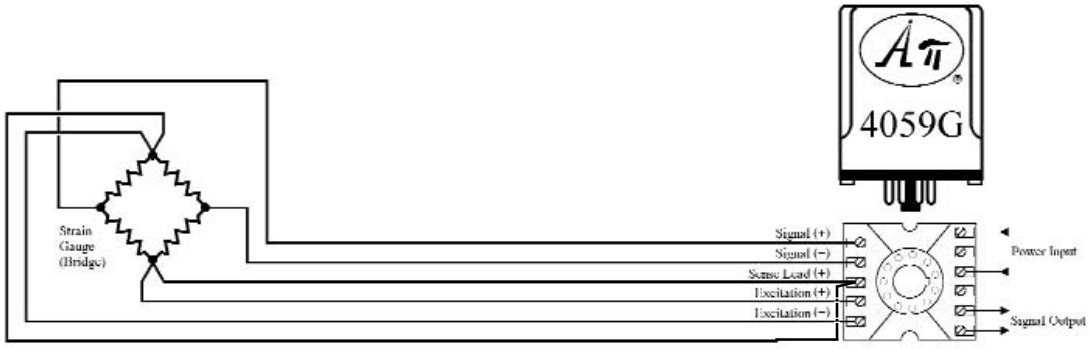


A solution would be to use a pressure transducer in the high temperature area and an Api Strain Gauge Signal Conditioner mounted in a remote location such as the control room. The transducer will likely withstand the high temperatures for longer periods of time and is less costly to replace should it become necessary. The **API 4059 G** module provides the power to the transducer and is fully field rangeable for the excitation supply, sensitivity and DC voltage or current output. The **API 4059 G** can be calibrated and fine tuned to the new transducer in minutes reducing the downtime to a minimum.



When Does Six Make Sense Over Four?

Many strain gauges (bridges) are located a considerable distance from the Api Strain Gauge Signal Conditioner. The long leads add an additional lead resistance that can result in a drop in the excitation supply voltage at the bridge and unwanted errors in the measurement. Although the excitation supply on all Api Strain Gauge Signal Conditioners is adjustable, it is suggested a six-wire bridge be used to compensate for variations in the lead resistance due to temperature changes. The additional two wires are called Sense Leads.



The **API 4059 G** Isolated Strain Gauge Signal Conditioner accepts a Sense Lead input. Internal circuitry in the module monitors the voltage drop in the bridge leads and automatically compensates the excitation voltage at the module so the actual excitation voltage at the bridge remains constant. Due to the design of the **API 4059 G**, it is only necessary to connect one of the sense leads for the feature to be effective.

FREE APPLICATION ASSISTANCE
Call Customer Service
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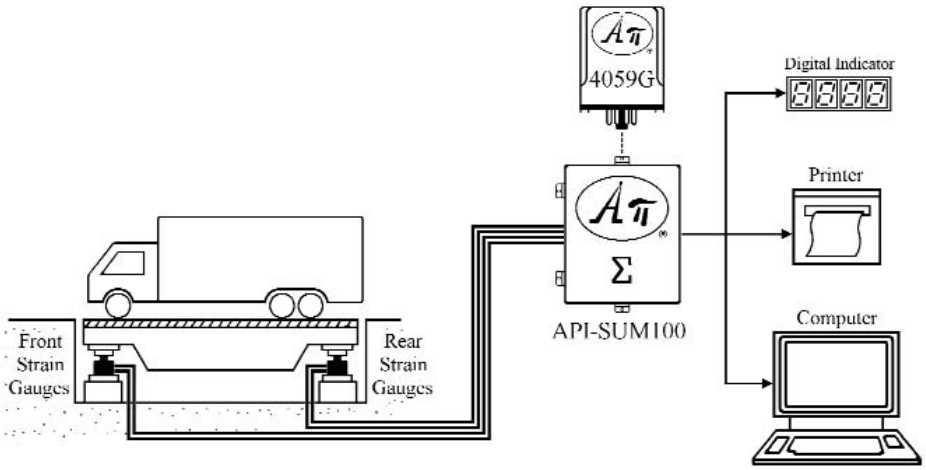
Truck Scale System

PROBLEM
Total vehicle weight is to be displayed, printed out and sent to a computer for record keeping purposes.

SOLUTION
A weighing platform is equipped with strain gauges at each of its four corners, and the strain gauges are wired to an API summing box **API-SUM 100** with an **API 4059 G** Field Selectable Isolated Strain Gauge (Bridge) to DC Transmitter module.

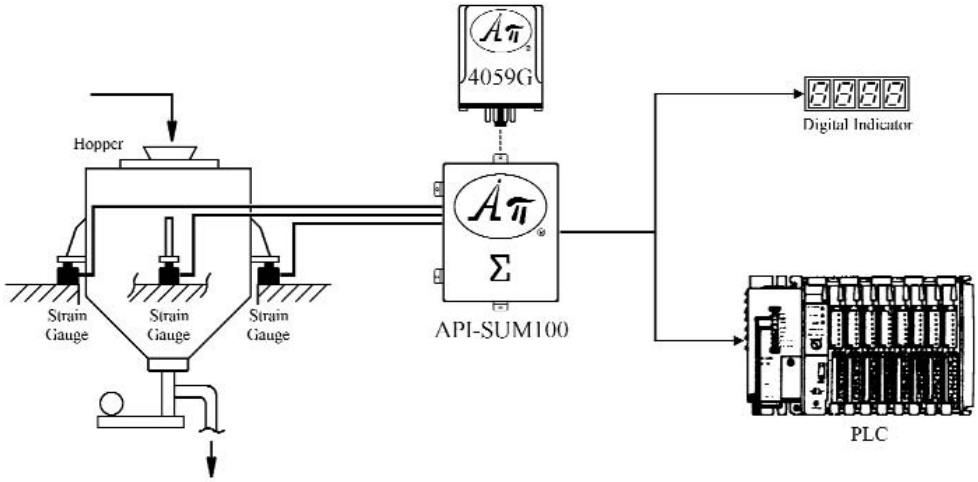


The **API 4059 G** plugs into a socket on the **API SUM 100** board and provides excitation voltage for all four of the strain gauges from its built-in excitation power supply. The **API SUM 100** summing box combines the four strain gauge outputs and the **API 4059 G** converts the signal and drives the display, the printer and the computer.

Automation of a Dispensing Operation

PROBLEM
Automatically control the amount and rate of feed to a hopper dispensing dog food into a container.

SOLUTION
The hopper is equipped with three strain gauge load cells which are wired to an Api summing box with an **API 4059 G** Isolated Strain Gauge Input to DC Transmitter Module.



The **API 4059 G** plugs into a socket on the **API SUM 100** board and provides excitation voltage for all three of the strain gauges from its built-in excitation power supply. The **API SUM 100** summing box combines the three strain gauge outputs and the **API 4059 G** converts the signal and drives the display and the PLC.

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Strain Gauge (Bridge) to DC Transmitter, Isolated

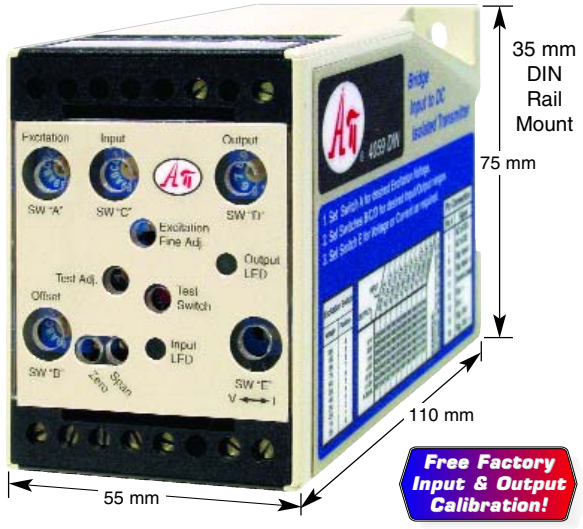
API 4059 DIN

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 & Setup Tables***
- ***Input and Output LoopTracker® LEDs***

LIFETIME WARRANTY



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 sensitivity X excitation voltage = 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 multiturn 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

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. Adjustable 0-100% of span.
Potentiometer factory set to approx. 50% 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_{RMS} 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

Case Material

Polycarbonate, gray UL #94V-1 housing and black UL #94V-2 terminals

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

Description and Features

The **API 4059 DIN** 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 DIN** mounts to an industry standard DIN rail or it can be panel mounted.

Models & Options

Please specify power and options

API 4059 DIN	Field rangeable strain gauge to DC transmitter, isolated, 115 VAC
API 4059 DD	Field rangeable strain gauge to DC transmitter, isolated, 9-30 VDC

Options—Add to end of model number

A230	Powered by 230 VAC, 50/60 Hz
DF	Fast response, 10 millisecond nominal response time
U	Conformal coating for moisture resistance

Accessories—Order as separate line item

API TK36	DIN rail, 35 mm W x 39" L, aluminum

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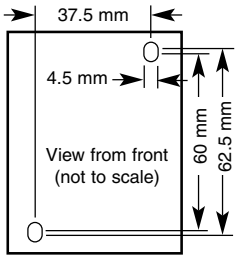
Strain Gauge

ELECTRICAL CONNECTIONS

WARNING! All wiring must be performed by a qualified electrician or instrumentation engineer. The housing can be clipped to a standard 35 mm DIN rail or surface mounted.

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.

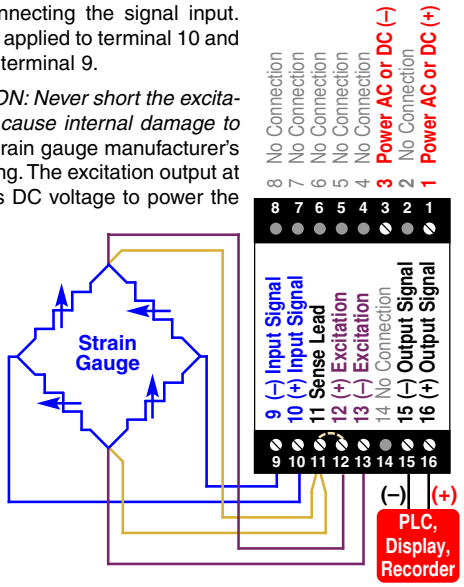


Surface mounting dimensions

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 10 and the negative (–) is applied to terminal 9.

Excitation Voltage – *CAUTION: Never short the excitation leads together. This will cause internal damage to the API 4059 DIN.* Refer to strain gauge manufacturer's data sheet for wire color-coding. The excitation output at terminals 12 and 13 provides DC voltage to power the strain gauge load cell. Polarity must be observed. The positive connection (+) is applied to terminal 12 and the negative (–) is applied to terminal 13. Connect the sense leads to terminal 11. If no sense lead is available, jumper terminals 11 and 12.

Signal Output Terminals – Polarity must be observed when connecting the signal output to the load. The positive connection (+) is connected to terminal 16 and the negative (–) is connected to terminal 15.



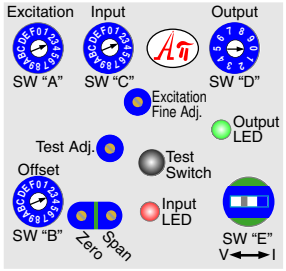
API 4059 DIN typical wiring
Jumper 11 & 12 for Non-Sense Bridges

RANGE SELECTION

Common ranges are listed on the module labels. See www.api-usa.com or contact factory for special ranges. Four rotary switches and a slide switches on the side of the module are used to select input and output ranges.

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

1. See table and set **Excitation** rotary switch **A** to desired excitation voltage.
2. Set switch **E** 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**, **C**, and **D**.
4. The Excitation Fine Adjust, Zero, Span and Test Range potentiometers can now be adjusted for the desired output range.



	Rotary Switches	API 4059 DIN INPUT RANGES										
		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
		BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
OUTPUT RANGES Switch E to V	0-1 V	020	0A0	030	060	0E0	0B0	000	080	010	040	090
	0-2 V	028	0A8	038	068	0E8	0B8	008	088	018	048	098
	0-4 V	021	0A1	031	061	0E1	0B1	001	081	011	041	091
	1-5 V	026	0A6	036	066	0E6	0B6	006	086	016	046	096
	0-5 V	029	0A9	039	069	0E9	0B9	009	089	019	049	099
	0-10 V	023	0A3	033	063	0E3	0B3	003	083	013	043	093
	±5 V	024	0A4	034	064	0E4	0B4	004	084	014	044	094
	±10 V	025	0A5	035	065	0E5	0B5	005	085	015	045	095
E to I	4-20 mA	027	0A7	037	067	0E7	0B7	007	087	017	047	097
	0-20 mA	023	0A3	033	063	0E3	0B3	003	083	013	043	093

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

Zero, Span, and Excitation Fine Adjust – These potentiometers are used to fine-tune the output if necessary.

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 module be calibrated by an accurate bridge simulator before being placed in service.
7. Offset switch **B** 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 **B** clockwise from **1** through **7** until the zero potentiometer is within range of your desired output.

   To lower the output zero, rotate switch **B** 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 and Test Range – 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.

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

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.

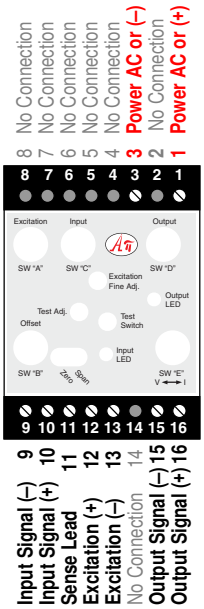
The API 4059 DIN provides the excitation voltage to the sensors and receives the resulting millivolt signal in return. This input signal is filtered and amplified, then offset, if required, and passed to the output stage. Depending on the output configuration selected, a DC voltage or current output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

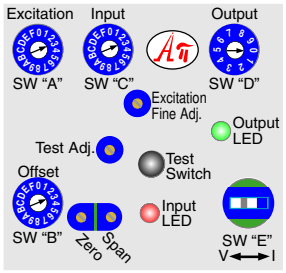
GREEN *LoopTracker*® Input LED – Provides a visual indication that a signal is being sensed by the input circuitry of the module. It also indicates the input signal level by changing in intensity as the process changes from minimum to maximum. If the LED fails to illuminate, or fails to change in intensity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

Strain Gauge

API 4059 DIN





Quick Setup

1. Set switch **A** for desired excitation voltage.
2. Set switches **B, C, D** for desired input & output ranges per table.
3. Set switch **E** for voltage (V) or current (I) output as required.
4. Set Zero and Span controls.
5. Set output test level by holding Test Switch and adjusting Test Adj. potentiometer.

INPUT RANGES

OUTPUT RANGES / Rotary Switches	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	0-300 mV	0-400 mV	±10 mV	±20 mV
	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
0-1 V	020	0A0	030	060	0E0	0B0	000	080	010	040	0C0	090	330	3B0
0-2 V	028	0A8	038	068	0E8	0B8	008	088	018	048	0C8	098	338	3B8
0-4 V	021	0A1	031	061	0E1	0B1	001	081	011	041	0C1	091	331	3B1
1-5 V	026	0A6	036	066	0E6	0B6	006	086	016	046	0C6	096	336	3B6
0-5 V	029	0A9	039	069	0E9	0B9	009	089	019	049	0C9	099	339	3B9
0-8 V	022	0A2	032	062	0E2	0B2	002	082	012	042	0C2	092	332	3B2
2-10 V	027	0A7	037	067	0E7	0B7	007	087	017	047	0C7	097	337	3B7
0-10 V	023	0A3	033	063	0E3	0B3	003	083	013	043	0C3	093	333	3B3
±5 V	024	0A4	034	064	0E4	0B4	004	084	014	044	0C4	094	334	3B4
±10 V	025	0A5	035	065	0E5	0B5	005	085	015	045	0C5	095	335	3B5
0-2 mA	070	0A0	030	060	0E0	0B0	000	080	010	040	0C0	090	330	3B0
2-10 mA	026	0A6	036	066	0E6	0B6	006	086	016	046	0C6	096	336	3B6
0-10 mA	029	0A9	039	069	0E9	0B9	009	089	019	049	0C9	099	339	3B9
0-16 mA	022	0A2	032	062	0E2	0B2	002	082	012	042	0C2	092	332	3B2
4-20 mA	027	0A7	037	067	0E7	0B7	007	087	017	047	0C7	097	337	3B7
0-20 mA	023	0A3	033	063	0E3	0B3	003	083	013	043	0C3	093	333	3B3

API 4059 DIN Setup and Calibration

1. First examine your transducer to determine what excitation voltage to use and select that voltage using switch A. The excitation fine adjust may be used to precisely trim this voltage, if desired.
2. For a five- or six-lead bridge with a "sense" lead, use this lead to allow the Api 4059 DIN to compensate for leadwire resistance effects. For four-wire bridges, it is best to connect the sense terminal on the 4059 DIN to the (+) excitation terminal. It is not necessary to do this, but the final trim adjustment should be done after all bridge connections are made.
3. Determine how much full-scale output in millivolts the load cell will produce at full load.
4. Look in the setup table on the side of the unit for the setup code for your desired input/output ranges and set switches B, C, and D according to the table.
5. Switch E must be set to select voltage or current output, as required.
6. After all switches are set, the Zero and Span controls must be set to precisely adjust the module output. This can be done easily with a suitable calibration device or simulator, or in actual use with dummy loads or weights.
7. The Test Cal control should be set with the Test button pressed to obtain the desired Test level.

Using Offset Switch B

The Api 4059 DIN offset switch B allows canceling or taring of non-zero deadweights or other sensor offsets. Often the desired zero, or low end, of the transmitter output may not coincide with zero output from the sensor. For example, a user may want a 0 to 10 VDC output from the transmitter when a 10 lb load is on the platform. In this case, the 10 lb deadweight results in a non-zero output from the sensor when a zero output is required.

Certain low-output sensors (e.g., less than 1 mV/V) may have zero offsets large enough that the Zero control may not produce the desired zero output. The switch B setting may be changed from the table values to realign the zero output by following steps 8-10.

8. Switch B is the only switch needed to correct zero offsets. Switch B does not interact with any other switch. Its only purpose is to adjust or cancel effects of the low end of the input range not corresponding nominally to 0 mV. Setting this switch to "0" results in no offset.
9. To RAISE the output zero, rotate switch B clockwise from "1" thru "7", until the Zero control can be set for your application. This elevation of the output is useful for bipolar input ranges such as ±10 mV.
10. To LOWER the output zero, rotate switch B clockwise from "9" thru "F", until the Zero control can be set for your application. This suppression of the output is useful for elevated input ranges such as 10-20 mV.

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

Using a meter with at least 10 megaohm 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		

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Strain Gauge (Bridge) Summing Assembly

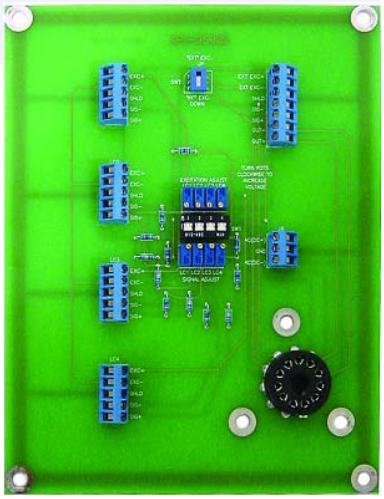
API SUM Series

Input: ***Up to 4 Strain Gauges or Load Cells*** ***Individual Excitation & Trim***

Output: ***Use with API 4058 G or API 4059 G***

- ***Sums up to 4 Strain Gauges or Load Cells***
- ***Available with Field-Rangeable Signal Conditioner***
- ***4 Excitation and Signal Trim Potentiometers***
- ***Switch for Internal or External Excitation Voltage***

LIFETIME WARRANTY



API SUM 000

Applications

- **Platform Scales & Weighing systems**
- **Easy Setup & Adjustment of Load Cells**
- **Easy Summation of Multiple Strain Gauges**

Board Specifications

Input
1 to 4 strain gauges, bridges, or load cells
4 switches to enable or disable individual strain gauges

Strain Gauge Connections
Individual terminal blocks for up to 4 strain gauges with provisions for signal (+), signal (–), signal shield, excitation (+), and excitation (–)

Strain Gauge Trim Adjustment
4 multiturn potentiometers to adjust output of each strain gauge

Excitation Supply
Switch to select internal (with **API 4058** or **API 4059**) or customer-provided external excitation supply
Terminals provided for connecting external excitation

Excitation Supply Adjustment
4 multiturn potentiometers to adjust excitation voltage for each strain gauge to compensate for lead variations

Signal Conditioner Socket
Standard 11-pin socket. See other side for pin-out diagram.

Output Connection
Signal (+) and signal (–) terminals for combined output signal

Power Connection
Terminals for AC or DC external power and ground

Specifications with API 4058 or API 4059

Power
Standard: 115 VAC, 2.5 Watts maximum
A230 option: 230 VAC ±10%, 50/60 Hz, 2.5 W max.
D option: 9-30 VDC, 3 W typical with 4 load cells

Strain Gauge Excitation Supply
Field-rangeable from 1 to 10 VDC

Strain Gauge Sensitivity
Field-rangeable from 0.5 mV/V up to 120 mV/V

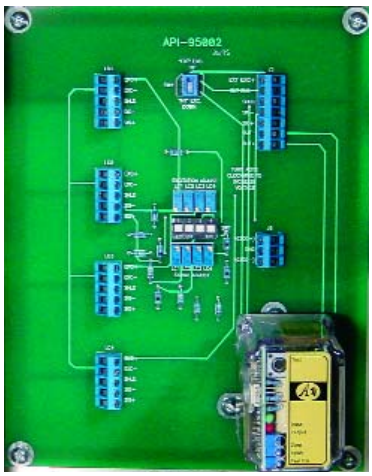
Strain Gauge Signal
Field-rangeable from 5 mVDC to 1200 mVDC with the API 4058 G
Field-rangeable from 5 mVDC to 400 mVDC with the API 4059 G

Outputs
Field-rangeable DC voltage or current
DC voltages from –10 VDC to +10 VDC
DC currents up to 20 mADC at 20 VDC compliance

Dimensions

Board Only
6.85" wide x 8.75" high x 0.75" deep

Signal Conditioner and Board
6.85" wide x 8.75" high x 3.75" deep



API SUM 025

Description and Features

The **API-SUM xxx** strain gauge summing assembly consists of a sum board and an optional, field-rangeable strain gauge signal conditioner that plugs into an existing socket on the board. The board will accept up to four 350 Ω (or greater) strain gauges (load cells) and with the signal conditioner provide a DC voltage or current output proportional to the sum of the active strain gauges.

API exclusive features include four excitation trim potentiometers, four signal trim potentiometers, a switch to select internal or external excitation voltage and switches to activate or deactivate individual load cells. These features allow easy setup, testing, and calibration of many types of weighing systems.

Models & Options

Common **API-SUM xxx** configurations are listed below. Consult factory for special configurations to meet your requirements.

API SUM 000 Summing board only
For applications where no on-board signal conditioning or enclosure is required. Customer is responsible for proper installation inside a protective enclosure.

API SUM 025 Summing board with API 4059
Summing assembly board with API 4059 strain gauge signal conditioner. For installation in an existing or customer supplied enclosure. Customer is responsible for proper installation inside a protective enclosure.

MOD-TRONIC INSTRUMENTS LIMITED
1 Delta Park Blvd #12
Brampton, ON L6T 5G1
905-457-6322 or 800-794-5883
www.mod-tronic.com

INSTALLATION AND ELECTRICAL CONNECTIONS

WARNING! All wiring must be performed by a qualified electrician or instrumentation engineer.

For protection, the API-SUM xxx board must be mounted in an appropriate enclosure. We recommend mounting it in a NEMA 4 or NEMA 4X enclosure depending on your requirements.

The sum board includes several terminal blocks for wiring the four load cells, AC or DC power, DC voltage or current output, external excitation and signal output.

For detailed instructions, refer to both the API-SUM xxx instruction manual and the strain gauge signal conditioner data sheet.

CALIBRATION SUMMARY

Separate excitation and signal trim pots are used for individual fine-tuning of each strain gauge. Slide switches allow each strain gauge to be switched in or out of the circuit as required. Another slide switch allows switching between internal and external excitation supply. For detailed calibration instructions refer to both the API-SUM xxx instruction manual and the strain gauge signal conditioner data sheet.

If the optional signal conditioner is being used, it must first be calibrated to the proper excitation voltage, input sensitivity and DC voltage or current output. These parameters are dependent upon the specifications of the strain gauges being used as well as the desired process output.

If no signal conditioner is being used, ensure that the external excitation switch position is selected and wired accordingly.

1. Complete all wiring and module calibration.
2. Turn each Excitation Trim potentiometer fully clockwise.
3. Measure the excitation voltage for each strain gauge. Adjust as necessary to equalize the voltages.
4. Apply a known weight sequentially over each strain gauge and measure the sensitivity voltage of each strain gauge being used. Record these readings.
5. Again apply the known weight over each strain gauge and adjust the Signal Trim potentiometer for that cell so that the meter reads the same as the lowest value recorded.
6. Fine-tune the offset, zero and span of the signal conditioner as required.

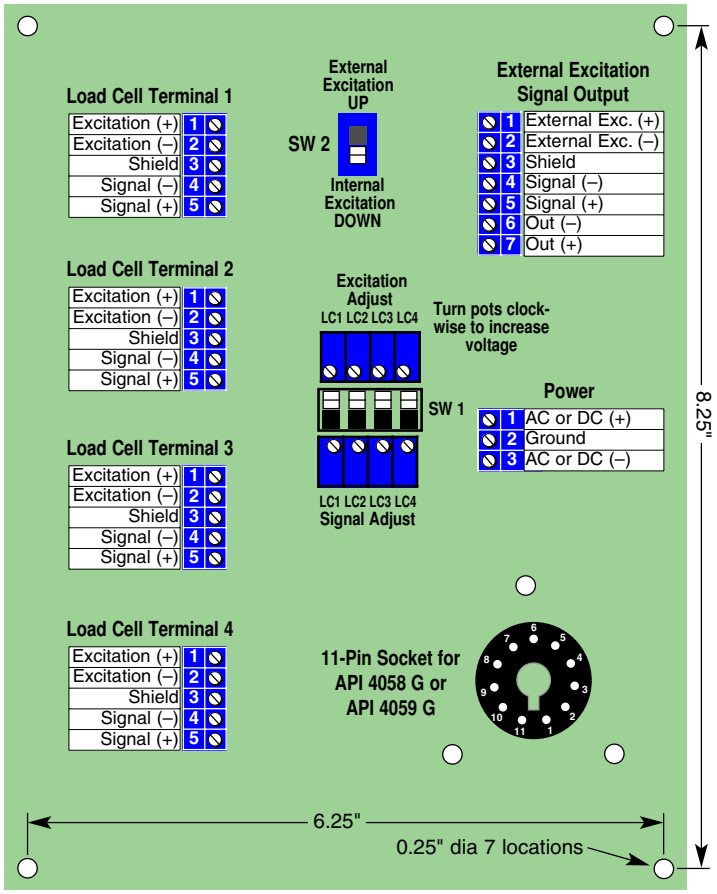
OPERATION

The API-SUM xxx strain gauge summing assembly consists of a sum board and an optional, field-rangeable strain gauge signal conditioner that plugs into an existing socket on the board. The board will accept up to four 350 Ω (or greater) strain gauges (load cells).

The optional strain gauge signal conditioner provides a field-rangeable excitation supply (from 1 to 10 VDC) to each strain gauge, receives the resulting mVDC signal back from each strain gauge, sums these signals and provides a single DC voltage or current output in proportion to this sum.

The signal conditioner can also be field-ranged for input sensitivities from 0.5 to 120 mV/V (signals up to 1200 mVDC), DC voltage outputs up to ±10 VDC or DC current outputs up to 20 mADC. An offset adjustment on the signal conditioner allows the user to cancel or tare non-zero deadweights in the application.

API exclusive features four excitation trim potentiometers, four signal trim potentiometers, a switch to select internal or external excitation voltage and switches to activate or deactivate individual load cells. These features allow easy setup, testing, and calibration of many types of weighing systems.



Board Dimensions: 6.85" W x 8.75" high x 0.7" deep
Board Material Thickness: 0.094"

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