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***



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

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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

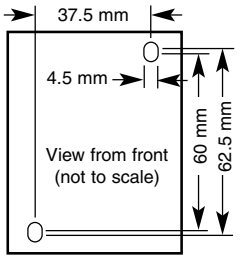
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Strain Gauge

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.

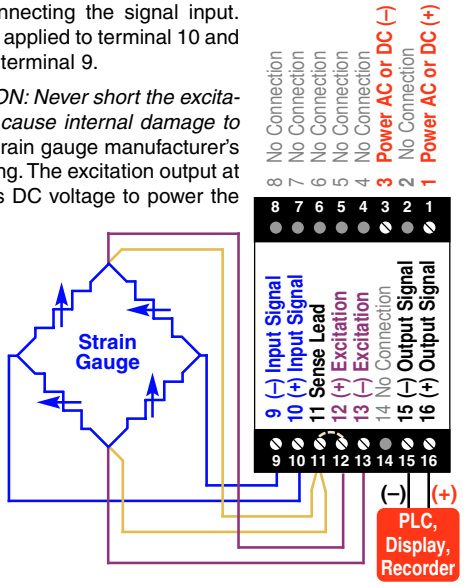


Surface mounting dimensions

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.



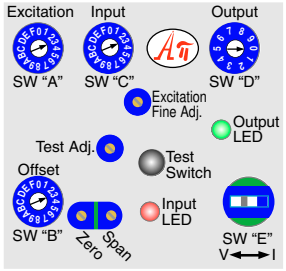
API 4059 DIN typical wiring
Jumper 11 & 12 for Non-Sense Bridges

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.

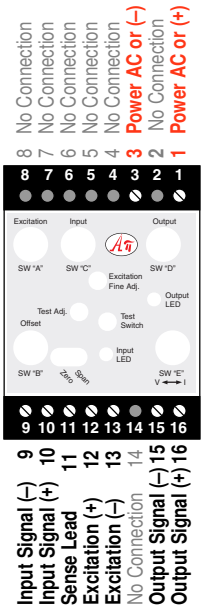
The API 4059 DIN provides the excitation voltage to the sensors and receives the resulting millivolt signal in return. This input signal is filtered and amplified, then offset, if required, and passed to the output stage. Depending on the output configuration selected, a DC voltage or current output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

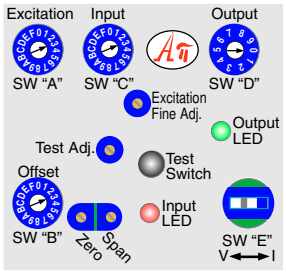
GREEN *LoopTracker*® Input LED – Provides a visual indication that a signal is being sensed by the input circuitry of the module. It also indicates the input signal level by changing in intensity as the process changes from minimum to maximum. If the LED fails to illuminate, or fails to change in intensity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