Differential RTD to DC Transmitter — API 4001 G SA-B

Inputs: ***Two 100 Ω 0.00385 RTDs***

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

- ***RTD Leadwire Compensation***
- ***RTD Linearization***
- ***Voltage or Current Output***
- ***Input and Output LoopTracker® LEDs***
- ***Functional Test Pushbutton***

Applications

- **Monitor Heat Exchanger ΔT**
- **Convert and Transmit Δ RTD Signals**
- **Rescale Δ RTD Temperature to Full 4-20 mA**

Specifications

RTD Inputs
Two RTDs, 1 hot and 1 cold
100 Ω Platinum, 0.00385 DIN curve
3-wire preferred, 2-wire acceptable for short lead length applications

Input Differential Span
Minimum: 20°F or 10°C
Maximum: 900°F or 500°C

Input Common Mode Temperature
Entire useable range of Pt 100; –325 to 1300°F (–200 to 700°C)

Leadwire Resistance
40 Ω maximum

Leadwire Effect
Less than ±0.02% of span per Ω of leadwire resistance

LoopTracker
Variable brightness LEDs indicate input/output loop level and status

Output Range
Factory Configured—Please specify output range
Consult factory for special ranges

	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

Outputs clamped not to exceed ±5% over- or under-range

Common Output Ranges	Voltage	Current
	0 to 1 V	0 to 20 mA
	0 to 5 V	4 to 20 mA
	1 to 5 V	
	0 to 10 V	
	±5 V	
	±10 V	

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
Test level potentiometer factory set to approximately 50% of span

Response Time
100 milliseconds typical

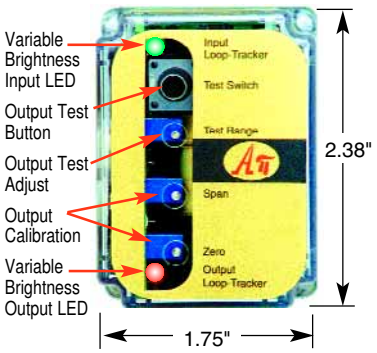
Output Ripple and Noise
Less than 10 mV_{RMS}

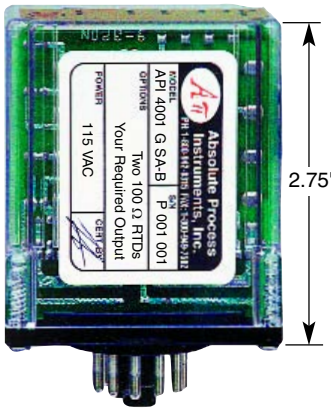
Ambient Temperature Range and Stability
–10°C to +60°C operating ambient
Better than ±0.02% of span per °C stability

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, 2.5 W typical

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Description and Features

The **API 4001 G SA-B** accepts two DIN curve 100 Ω platinum RTD inputs and provides a linear DC voltage or current output proportional to the difference in temperature of the two RTDs. Differential or single-ended input ranges from 20°F through 900°F (10°C through 500°C) can be accommodated.

The **API 4001 G SA-B** is factory configured to a specific RTD temperature span (°C or °F), and corresponding DC voltage or current output. 3-wire RTD leadwire compensation and linearization for accurate output over a wide temperature range is standard.

Eight common DC output ranges are standard. Consult factory for other outputs. The module power supply is isolated from the input and the output.

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 field-adjusted via a multiturn potentiometer. Both the LoopTracker LEDs and functional test pushbutton greatly aid in saving time during initial startup and/or troubleshooting.

The **4001 G SA-B** plugs into an industry standard 11-pin 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 output range and options

API 4001 G SA-B Dual RTD input differential transmitter, 115 VAC

Options—Add to end of model number

A230	Powered by 230 VAC, 50/60 Hz
D	Powered by 9-30 VDC
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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Temperature

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.

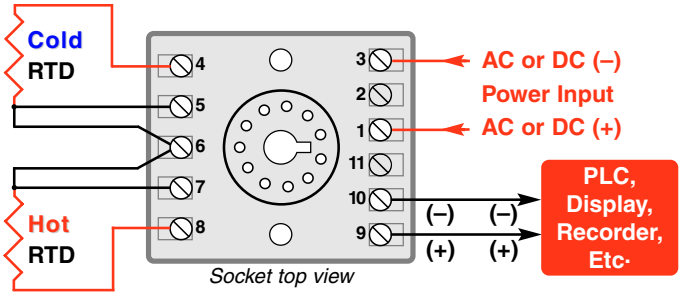
Power Input Terminals – The white label on the side of the API module will indicate the power requirements. AC power is connected to terminals 1 and 3. For DC powered modules, polarity **MUST** be observed. Positive (+) is wired to terminal 1 and negative (–) is wired to terminal 3.

RTD Input – The connections are made to the 11-pin socket. You may wish to check the RTD sensors with an ohmmeter before connecting since RTD wire color-coding varies.

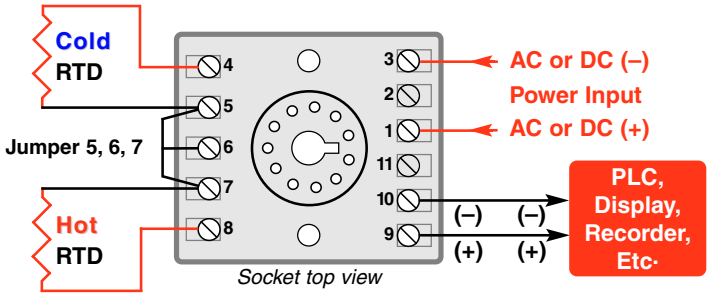
For the **Low** temperature input, the red (or black) wire is connected to terminal 4 and the other two wires with the same color are connected to terminals 5 and 6. When using a 2-wire RTD install a jumper from terminal 5 to terminal 6.

For the **High** temperature input, the red (or black) wire is connected to terminal 8 and the other two wires with the same color are connected to terminals 6 and 7. When using a 2-wire RTD install a jumper from terminal 6 to terminal 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. Note that with current outputs the module provides power to the output loop.



API 4001 G SA-B typical wiring



API 4001 G SA-B typical wiring with 2-wire RTDs
Use only for short lead lengths!

CALIBRATION

The API 4001 G SA-B is factory calibrated to your input/output specifications.

1. Recalibration of the API 4001 G SA-B will require two accurate, matched RTD simulators, plus an accurate DC digital voltmeter, for best results.
2. Be aware that measuring small temperature differentials (20°F to 40°F or 10°C to 20°C) on large offsets such as 800°F (400°C) or more will require very precise matching (±0.1%) of RTDs for acceptable results.
3. To calibrate, connect two RTD simulators to the module input, and an accurate DC voltmeter (or milliammeter, as required) to the module output.
4. For best accuracy, calibrate the unit near the actual ambient temperatures the unit will encounter in the application.
5. Set the cold RTD simulator to the low-end differential temperature compared to the hot RTD simulator.
6. Adjust the module's zero control for the specified 0% (low end) output.
7. Set the hot RTD simulator to the high differential value.
8. Adjust the module span control for the specified high (100%) output level. The zero and span controls normally have little interaction, but adjustments may be repeated for maximum accuracy.

Finally, the Test Cal control may be set to provide the desired output when the Test Pushbutton is held depressed.

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

The API 4001 G SA-B excites the "hot" and "cold" RTDs with constant 5 mA current sources which are linearized for 100 Ω platinum, DIN-curve RTDs. A switched-capacitor technique is used to convert the temperature differential signal into a single-ended signal. A precision amplifier then amplifies this signal. Non-interactive zero and span controls provide a standard level signal to the output stage. The output stage is internally configured for voltage or current output and the gain is scaled to the specific user-requested limits.

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.

The RED *LoopTracker* Output LED – Provides a visual indication that the output signal is functioning. It becomes brighter as the input and the corresponding output change from minimum to maximum. For current outputs, the red LED will only light if the output loop current path is complete. For either current or voltage outputs, failure to illuminate or a failure to change in intensity as the process changes may indicate a problem with the module power or signal output wiring.

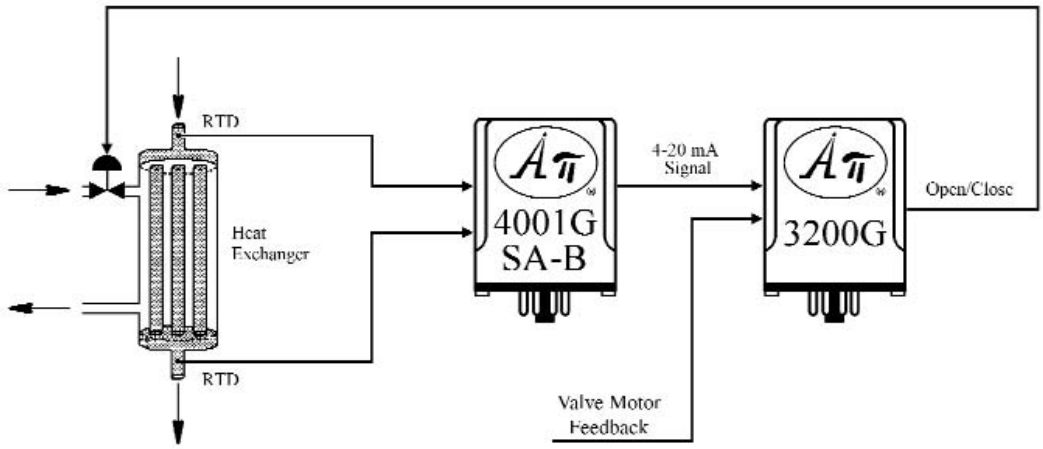
API maintains a constant effort to upgrade and improve its products. Specifications are subject to change without notice. Consult factory for your specific requirements.

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Maintaining a Constant Differential Temperature Across a Heat Exchanger

PROBLEM
A critical process requires precise control of the change in temperature of the process fluid across a heat exchanger.

SOLUTION
Install RTDs at the process fluid heat exchanger inlet and outlet and connect the RTDs to an **API 4001G SA-B** Non-Isolated Differential RTD to DC Transmitter module.

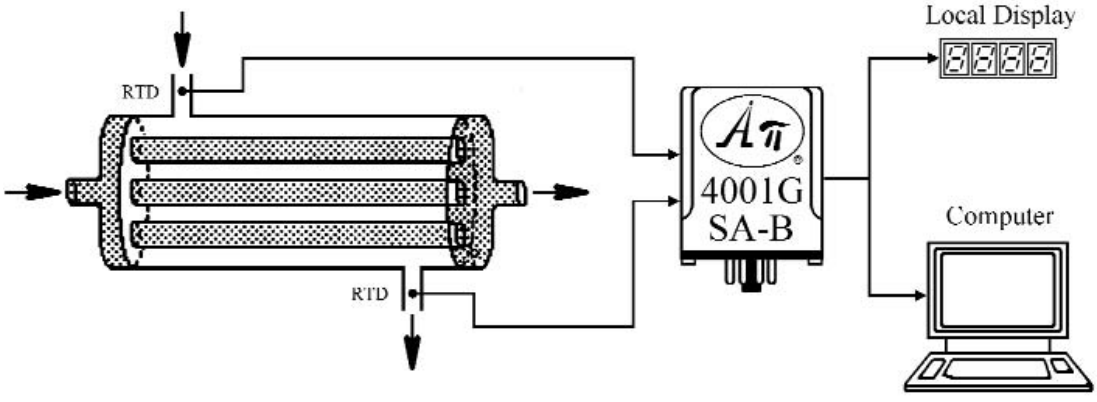


The **API 4001 G SA-B** computes the differential temperature and provides a proportional 4-20 mA output signal which is used by the **API 3200 G** Valve/Actuator Positioner/Controller module to drive the temperature control valve open or closed as necessary to maintain the required process fluid temperature differential.

Monitoring and Controlling Differential Temperature

PROBLEM
Monitor the temperature differential across a heat exchanger and provide an output signal for the process control computer and a local display.

SOLUTION
Install RTDs to measure the heat exchanger inlet and outlet temperatures and connect the RTDs to an **API 4001 G SA-B** Non-Isolated Differential RTD to DC Transmitter module.



The **API 4001 G SA-B** will directly measure the temperature differential and provide an output to drive the local display and the process control computer.



FREE APPLICATION ASSISTANCE
Call Customer Service
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Frequently Asked Questions – RTDs

Do you have a temperature differential unit that will measure a difference of 10° C between the two inputs?

Yes, the **API 4001 G SA-B**, but the two RTDs will require very precise matching (±0.1%) and it would be helpful to know the operating temperature point so the factory can calibrate the unit precisely.

We are using an API 4001 G with an input of 0-100°C and output of 0-20 mA. If the input runs above 100°C (say 150°C) what will the output do?

The output will go higher, maybe to 21 mA but then stop there. If the output must remain at about 20 mA and go no higher, then a special clamp circuit can be ordered.

Will an API 4000 G work with an input temperature range of 1000 to 2000°F?

Yes, however to utilize the charts for selecting the switch positions in the field, we need to convert °F to °C. This would give 550°C to 1100°C which can be selected from the charts.

For modules with a 4-20 mA output signal, what are the minimum and maximum output load resistances?

For the units with 20 V compliance, the output range is 10 to 1000 Ω. For the units with 12 V compliance, the output range is 10 to 600 Ω.

Do you recommend placing a fuse at the power input (115 VAC) for protection?

It is not required, but if desired, a ½ Amp Fast Blow fuse can be used for each module.

We use many different types of your signal conditioners and wish to protect the inputs and outputs from short circuits and over voltage. How can we achieve this?

Applying a short circuit to any of the signal input terminals will not affect the modules. Exposing the signal input to high voltage will damage the unit but using a zener diode, due to its resistance value, will cause the input range to need recalibrating. Try a Varistor or TransZorb®. Do NOT under any circumstances short circuit the signal output, the unit can be damaged.

We are running a 4-20 mA signal between a chart recorder and a DCS over a distance of 5000 feet (10,000 total loop). Can we use your isolator signal conditioner for this?

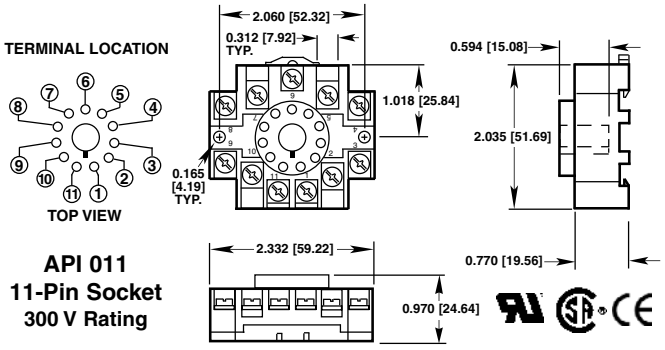
Yes, however you must select the proper gauge wire to reduce the impedance of the system

total load = impedance of the instrument + impedance of the wire

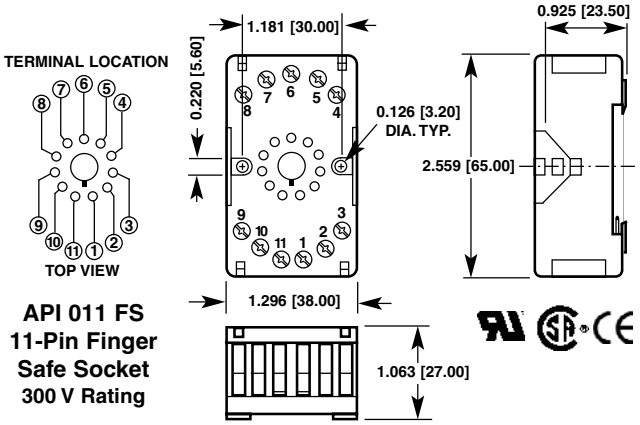
For a 4-20 mA loop, our compliance voltage is 20 V and allows a total of 1000 ohm load. Also, to prevent problems from noise, it is recommended that you use shielded, twisted pair wires.

TransZorb–Reg TM General Semiconductor

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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