Absolute Process Instruments, Inc.
Manufacturer of Quality Signal Conditioners Transmitters & Isolators
Application Notes

Frequently Asked Questions – General

1. **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.

2. **We are using 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.

3. **How much can you vary the voltage using the output adjustment potentiometer on the API 9046-24?**
   The output adjustment potentiometer is single turn and might provide about ±1.5 volts.

4. **Which direction do we turn the deadband potentiometer screw to give the minimum and the maximum deadband?**
   For the minimum amount (1%), turn the potentiometer screw CCW, counter-clockwise. For the maximum amount (100%), turn the potentiometer screw CW, clockwise.

5. **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 which allows a total of 1000 ohm load. Also, to prevent problems from noise, it is recommended that you use shielded, twisted pair wires.

6. **For modules with a 4-20 mA output signal, what are the minimum and maximum output load resistance?**
   For the units with a 20 V compliance, the output range is 10 to 1000 ohms.
   For the units with a 12 V compliance, the output range is 10 to 600 ohms.

7. **What are the relay contacts rated for in your alarm output modules for a <u>motor</u> load?**
   For inductive loads, our relay contacts are rated for 3.5 Amps Inductive at 250 VAC or 30 VDC.

8. **We have a relay alarm output and would like to adjust the set point for 5 VDC input and the reset point for 4 VDC input. How do we adjust the set point pot and the deadband pot to do this?**
   The deadband is the difference in the input signal between the points at which the relay energizes and de-energizes. The midpoint between the set and reset points is 4.5 VDC. Turn the deadband pot fully counterclockwise for minimum deadband. With a 4.5 VDC input signal, turn the set point pot until the relay changes state. Then, increase the the input signal to 5 VDC. Turn the deadband pot clockwise until the relay changes state.

9. **For the DC output models, what are the output impedances in the voltage and current mode?**
   The DC outputs are FET driven and are active outputs that change depending on the mode and range.

	CURRENT Mode	**VOLTAGE Mode**
DC output with 12 V Compliance	less than 600 ohms	greater than 1000 ohms
DC output with 20 V Compliance	less than 1000 ohms	greater than 1000 ohms

10. **For your DC Input modules in the current mode, the input impedance rating is 50 ohms. For troubleshooting purposes, is that value the same with and without power applied to the module?**
    Yes.

TransZorb–Reg TM General Semiconductor

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800-942-0315

Did You Know...?

That the functional test pushbutton on all Api Alarm Trip modules will toggle the relays independent of the input signal.

Frequently Asked Questions – DC Inputs

1. **Do you have a signal conditioner that will source up to an 800 mA output?**

   No. The highest outputs available are 100 mADC non-isolated (**API 4010 G**) and 50 mADC isolated (**API 4300 G**). The **API 4300 G EXTSUP** will sink up to 200 mADC with an external power supply.

2. **We have a 4-20 mA input and require 4 set points at the output. Do you have a product for this?**

   Yes, you can connect 2 of our **API 1020 G** units in series in the 4-20 mA input loop since the input impedance for current is 50 ohms and the drop is very low.

3. **I have an API 4385 G, with an input range of 12-20 mA and an output range of 4-20 mA. How do you set the offset so that when the input is 12 mA, the output will be 4 mA?**

   Percent offset = Minimum Input Value / Input Span

   For this example it is 12 / 8 = 1.5 x100 = 150%. The offset chart with the **API 4385 G** allows for up to 100% making this is a special. Set switches B, D, E to 3, 4, F.

4. **Do you have a DC-DC transmitter that will accept an input of ±5 VDC and provide an output of ±40 mA, ideally a ±20 mA minimum?**

   No, the maximum bipolar output we can provide is ±6 mA and possibly ±10 mA on the **API 4300 G BP**.

5. **Can you provide a transmitter that will accept a 4-20 mA input and split the output to give two outputs that would be 4-20 mA for output 1 and 20-4 mA for output 2?**

   No. You can use two transmitters in series in the input loop to give the two outputs. Select the **API 4380 G** for the 4-20 mA output and an **API 4385 G** for the 20-4 mA output.

6. **Do you have a 4-20 mA DC transmitter that can operate a load of 1800 to 2000 ohms?**

   The **API 4300 G** with a 4-20 mA output can operate a maximum load of 1000 ohms maximum with its 20 Volt compliance. To control a load of 1800-2000 ohms, you can use the **API 4300 G EXTSUP**. A 42 Volt power supply is required for the 1800 ohm load, and a 48 Volt power supply is required for the 2000 ohm load. The power supply voltage can not be less than these requirements or there will not be enough power to reach 20 mA. Also, the power supply can not be more than these requirements or the **API 4300 G EXTSUP** will be damaged.

7. **We need a 0-10 VDC input with a 0-10 VDC output and be able to adjust the output down to any lower value from the linearized output, for example, if the input is 8 V, then the output can be 8 V or less. Is this possible?**

   Yes. Use the **API 4300 G** set up for 0-10 VDC in and 0-10 VDC output with a 10K ohm potentiometer at the signal input. One side of the pot would wire to the (+) signal, the other side of the pot. would wire to the (–) signal and terminal 6, then wire the wiper from the pot to terminal 5 of the module.

Continued on next page...

Did You Know...?

Api will do non-standard and special ranges for all of our products.

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Frequently Asked Questions – DC Inputs

8. Do you have a signal conditioner that will accept a 0-5 VDC input and provide an output of 0-500 mVDC?

Yes, the **API 4300 G** with these ranges specified at the time of ordering.

9. What is the output impedance of the API 4380 G for the 4-20 mA mode?

The output drive circuit uses a MOSFET which is an active device with an impedance of at least 100 K ohms or greater in the current mode.

10. Can we use the API 4300 G for an input signal of 500 VDC with the negative side of the signal floating and not at true ground?

It depends. The socket is rated to 600 VDC maximum. So with true ground on the socket at the output side, no other point on that socket can be above 600 VDC. Even though the **API 4300 G** is isolated and the input will accept the 500 VDC differential between terminals 5 and 6, the socket rating is between two points anywhere on the surface.

11. We would like to use the API 4380 G DF for the 100 microsecond response time but need an input range of 0 to 25 mV. Can you do this?

Yes, however the unit will be fixed for that input and the specified output. It will not be field selectable. The new part number will be **API 4300 G M80**. The **API 4300 G** does not offer a response time as fast as the **API 4380** product.

12. What is the fastest response time that is available in the API 4385 G DF?

This version offers a response time of 5 milliseconds.

13. What is the maximum current allowed for the 18 VDC unregulated loop power supply and what does the waveform look like?

The maximum current is 25 mA and the waveform is a filtered full wave rectified +18 V with a maximum ripple of 1.5 V p-p.

14. We are using a DCS system that requires a 4-20 mA isolated input which also provides 24 VDC to power the loop. Do you have an isolated signal conditioner that will sink the output loop?

Yes, the **API 4300 G EXTSUP**. This module controls the 4-20 mA output loop but derives the power from an external source. The connection from the output of the **API 4300 G EXTSUP** to the input of the DCS requires no additional components (resistors) other than the connecting wires.

Did You Know...?

Many PLC inputs are isolated only from the backplane they plug into and not channel to channel. Api's isolators can eliminate this problem.

Frequently Asked Questions – Current Loops

1. Are the API LPI-1 and the API LPI-2 UL recognized or listed ?

No. These should not be required for UL listing since the operating current and voltage are below the covered standards.

2. We have an API DPI-2. Can we have an input of 0-20 mA and an output of 0-20 mA?

No. The loop powered device requires a minimum of 4 mA to supply power to the module.

3. For the API DPI-2, what is the maximum voltage we can use with the 4-20 mA input loop?

60 VDC is the maximum voltage that can be used to power the input loop.

Frequently Asked Questions – RTDs

1. 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.

2. 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.

3. 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.

Did You Know...?

Api never charges an expediting fee and will accept American Express, MasterCard, and Visa credit cards.

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Frequently Asked Questions – Thermocouples

1. 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.

2. We have four of your API 4130 GL modules set for a K type thermocouple with an input range of 0-2000°F and an output range of 4-20 mA. For an input of 0°C, the outputs on all 4 units are calibrated to 4 mA. For an input of 2000°F, the outputs of all 4 units are calibrated to 20 mA. When the input is at 1000°F, the outputs of each of the 4 units is different (11.8, 11.9 etc.). Can better performance be achieved?

The linearity specification is ±0.5% of span which is ±10°F for a range of 2000°F. For an input of 1000°F, the output can vary from 990°F to 1010°F.

Also, output span / input temp range gives (20 – 4 = 16), 16 mA / 2000°F = .008 mA per °F for the entire range. For an input of 1000°F, the output can be in the range of 11.92 mA to 12.08 mA. You are getting 11.8, 11.9 etc. which are probably the variations in the accuracy of the four thermocouples, the extension wire, the thermocouple simulator, the multimeter and the wiring connections.

If you want Api to verify this with our NIST traceable simulators just call customer service at 800-942-0315 for an RMA number. The **API 4000 G** is even more accurate which should be used for high precision applications.

3. Can the API 1200 G provide a setpoint of 7°C and a reset point of 6°C with an overall temperature span of 0-10°C?

No. The minimum span we can operate in is a temperature difference equivalent to 5 mV of output change from the thermocouple. For example, a type J will produce 0.000 millivolts thermoelectric voltage at 0°C and 5.268 millivolts at 100°C. Therefore, the minimum temperature span is about 100°C. For the set point at 7°C and reset point at 6°C, the thermocouple itself has enough of a variance (usually 5%) to it that its output will not be exactly the same. So, we can not guarantee the repeatability of the system to trip at 7°C each time.

4. What is cold junction compensation and why is it necessary?

Cold junction compensation is required for accurate temperature measurement when using a thermocouple. A thermocouple junction, created whenever two dissimilar metals are connected together (such as Iron and Copper-Nickel), produces a potential difference that varies with temperature. Thermocouples generate a millivolt signal which increases in proportion to the difference in temperature between the hot and the cold junctions. Thermocouple tables are based on a standard 0°C cold junction temperature. Instruments designed to read thermocouples have a temperature sensor at the instrument connection point designed to electronically correct the reading to the 0°C standard. A millivolt meter can't be used to accurately read a thermocouple directly since it has no 0°C compensation. Additional connections with dissimilar metals create new thermocouple junctions also adding to the error if their temperature varies.

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Did You Know...?

That the **API 4000 G** can accept either thermocouples or RTDs.

Frequently Asked Questions – Frequency

1. **Do you have a product that can provide an output signal of 5 KHz, 50% duty cycle, 20 mA max and 24 V p-p max with no input?**

   Yes, the **API 7500G M03**.

2. **We have an application which requires a signal conversion of ½ Hz to 6 Hz input to a DC output. Do you have a signal conditioner to do this?**

· No. The minimum input frequency range that we offer is 0 to 15 Hz.

3. **We have a PNP proximity sensor powered by the +18 VDC input loop supply of the Api 7580 G. It reads the flywheel gear teeth and a sends a frequency signal to the API 7580 G and works fine throughout the range. However, if the wheel is stopped with a tooth in-line with the sensor, the output will stay high (PNP output) and the API 7580 G output will go high to the maximum of the range. How can we prevent this?**

   The +18 volt loop supply from the **API 7580 G** has a maximum ripple of 1.5 V p-p so the high output from the prox sensor will have this ripple. The signal input to the **7580 G** has a capacitor in series so any DC input charges, then opens the circuit. However with the ripple, there will be a 50/60 Hertz signal present.

   You must use a magnetic pick-up in place of the proximity sensor since the amplitude signal from the magnetic pick-up will decrease as the flywheel slows down and when stopped, there will be no amplitude even with a tooth in-line with the sensor head. The magnetic pick-up generates its own signal as the field changes. When the field stops changing, the signal goes to zero.

4. **Can you provide a module that will generate an output frequency (square wave) that we can vary between 55 and 75 Hz with No input signal?**

   Yes. Our **API 7500 G M03** with a modification to utilize the test circuit that is adjustable with the test range potentiometer. The test circuit is disabled internally and is always on. With the span pot set to the middle of the range, adjust the test range pot to give an output of 65 Hz which is the center point for 55-75 and serves to orient the window. Then, use the span pot to adjust the output frequency from 55 to 75 (the window is actually about 40 Hz). The zero pot and the cutout pot are disabled and have no effect.

5. **We have a 4-20 mA signal and want to convert it to a pulsed output of 0-270 pulses/minute so we can drive a counter. Can you do this?**

   Yes. Convert the output to Hertz (cycles/second) so 270 / 60 = 4.5 Hz. Our **API 7500 G SS** has an output range of 0-5 Hz and the span pot can adjust down by 10 % to allow for 0-4.5 Hz. The counter, which will trip on either rising or falling edges, can be set up to count at the edge of each cycle (square wave).

Did You Know...?

For frequency inputs of 0-100 Hz or greater, select the **API 7580 G** which is field rangeable up to 0-30 KHz.

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Frequently Asked Questions – Strain Gauges

1. **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.

2. **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.

3. **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.

4. **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 by the OEM which supplied the equipment to us. 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. So, you need to verify the maximum load conditions and change the switch settings to 0-25 mV if required.

5. **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.

6. **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.

7. **We have your API 4059 G and are trying to set up the unit 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.

Did You Know...?

The **API 4059 G** is standard with non-interacting zero and span adjust.

Frequently Asked Questions – Strain Gauges

8. 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) x 10 V x 2 mV/V = 7.5 mV. For tension and compression, the signal will be ±7.5 mV.

9. 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.

10. 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 *±(40/50 x Excitation Voltage x 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 which would be 25% too low for the ±20 mV range since the zero & 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 ±(40/50 x 6 x 2) = 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.

11. 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%

12. 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**.

Did You Know...?

The **API 4059 G** comes standard with field adjustable excitation supply, tare offset, input sensitivity and DC voltage or current output.

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Frequently Asked Questions – Valve Actuator

1. We have an API 3200 G M01 with a 0-10 VDC feedback signal and a 0-10 VDC control input. How do we calibrate this?

· Set the deadband potentiometer fully CCW (counter-clockwise). Apply the minimum signal (0 VDC) to both the feedback (terminals 6 & 7) and the control (terminals 4 & 5). Turn the zero potentiometer screw until the relay changes state and has continuity from the common to the close position. The relay LED will be red to indicate the close position.

Now apply the maximum signal (10 VDC) to both the feedback and the control inputs. Turn the span potentiometer screw until the relay changes state and has continuity from the common to the open position. The relay LED will be green signaling the open position.

Finally, apply 5 VDC to both the feedback and the control inputs. The relay contact should have no continuity and the relay LED should be off. Using your multimeter to measure across terminals 4 and 7 (the positive connections for both the feedback and the control) should be within the minimum deadband (about 1% of span) for no relay change of state. Change the feedback voltage to the desired deadband position. Rotate the deadband potentiometer CW (clockwise) until the relay changes state.

2. We would like to compare two signals, each is 4-20 mA. If the DIFFERENCE between the two signals at any point in the 4-20 mA range becomes greater than the deadband configured, an output relay must change state to provide for an alarm. Do you have a product to accomplish this?

· Yes. Order the **API 3200 G M420**. The deadband can be adjusted to allow for a 1 to 25% difference in the two signals. If the difference is less than the deadband configured, then both relay contacts will not have continuity with the common terminal. If the feedback 4-20 mA loop is higher than the control input, then continuity will be from common (9) to open (11). If the feedback is less, than then continuity will be from the common (9) to closed (10).

Did You Know...?

All Api plug-in and DIN-style modules are covered by a LIFETIME WARRANTY.