# Frequency Input to DC Transmitter, Isolated — API 7010 G

***Input:*** ***0-25 Hz to 0-20 kHz***
***Output:*** ***0-1 V to ±10 VDC or 0-1 mA to 4-20 mA***

- ***Precision Frequency to DC Converter***
- ***Input and Output LoopTracker® LEDs***
- ***Full 2000 VRMS Input/Output/Power Isolation***
- ***Functional Test Pushbutton***

## Applications

- **Monitor and Control Motor or Line Speed**
- **Convert a Square Wave Output to 4-20 mA**
- **Simplify Interfacing of Frequency Type Devices**

## Specifications

### Input Range

*Factory Configured—Please specify input range*

| | Minimum | Maximum |
|---|---|---|
| Frequency: | 0-25 Hz | 0-20 kHz |
| Voltage: | 100 $mV_{RMS}$ | 150 $V_{RMS}$ |

### Input Waveform

Sine wave
Sawtooth
Square wave

Most other waveforms with greater than 100 mV amplitude change

### Input Impedance

100 kΩ minimum

### Input Protection

Normal mode: 200% of input rating
Common mode: 600 VDC or 600 $VAC_p$ input to ground
*System voltages must not exceed socket voltage rating*

### Input Loop Power Supply

18 VDC nominal, unregulated, 25 mADC
Maximum ripple, less than 1.5 $V_{p-p}$

### *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): | 0-2 mADC | 0-20 mADC | 1000 Ω at 20 mA |

Consult factory for other ranges

### Output Linearity

Better than ±0.3% of span

### Response Time

70 milliseconds typical

### 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.
Factory set to approximately 50% of span

### Isolation

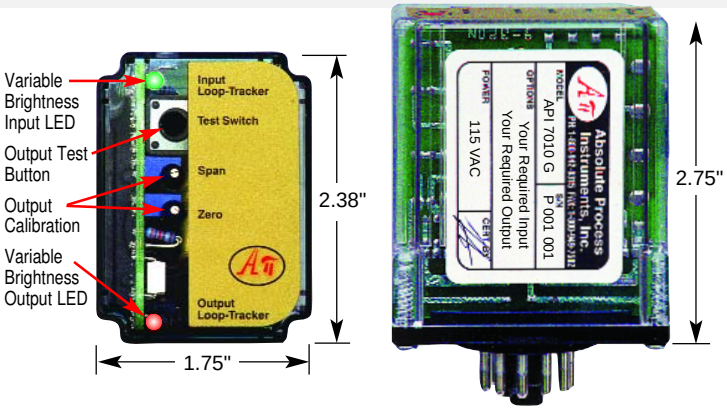
2000 $V_{RMS}$ minimum
Full isolation: power to input, power to output, input to output

### Ambient Temperature Range and Temperature 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. |
| **P** option: | 80-265 VAC or 48-300 VDC, 50/60 Hz, 2.5 W typical |
| **A230** option: | 230 VAC ±10%, 50/60 Hz, 2.5 W max. |
| **D** option: | 9-30 VDC, 2.5 W typical |




LIFETIME WARRANTY

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Free Factory Input & Output Calibration!

## Description and Features

The **API 7010 G** accepts a frequency input and provides an optically isolated DC voltage or current analog output that is linearly proportional to the input. The full 3-way (input, output, power) isolation between input and output makes this module useful for ground loop elimination, common mode signal rejection or noise pickup reduction.

Common applications include frequency to DC conversions from frequency output type devices such as rotary encoders, magnetic pick-ups, variable speed drives and flow meters. For PLCs that do not have analog outputs, often the pulse rate of a discreet output can be programmed to vary. By connecting the **API 7010 G** to this output, a proportional analog signal can be generated.

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 at all times. The functional test pushbutton provides a fixed output (independent of the input) when held depressed. The test output level is fixed at 50% of output span. Both the LoopTracker LEDs and functional test pushbutton greatly aid in saving time during initial startup and/or troubleshooting.

Also standard on the **API 7010 G** is an 18 VDC unregulated loop excitation supply. This supply can be used to power passive input devices, often eliminating the need for an additional external power supply.

The **API 7010 G** plugs into an industry standard 8-pin octal socket sold separately. Sockets **API 008** and finger-safe **API 008 FS** allow either DIN rail or panel mounting.

## Models & Options

*Factory Configured—Please specify input and output ranges*

| | |
|---|---|
| **API 7010 G** | Frequency to DC transmitter, isolated, with loop power supply, 115 VAC |

*Options—Add to end of model number*

| | |
|---|---|
| **P** | Powered by 80-265 VAC or 48-300 VDC, 50/60 Hz |
| **A230** | Powered by 230 VAC, 50/60 Hz |
| **D** | Powered by 9-30 VDC |
| **HC** | High current output, >20 mA to 50 mADC |
| **EXTSUP** | Open collector output when a “sinking” output is required |
| **U** | Conformal coating for moisture resistance |

*Accessories—Order as a separate line item*

| | |
|---|---|
| **API 008** | 8-pin socket |
| **API 008 FS** | 8-pin finger safe socket |
| **API TK36** | DIN rail, 35 mm W x 39" L, aluminum |

DuoPak NEED 2 I/O CHANNELS? SEE PAGE 19




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## RANGES

The input and output ranges are pre-configured at the factory as specified on your order. No input calibration is necessary. Consult factory for other available ranges or for special ranges.

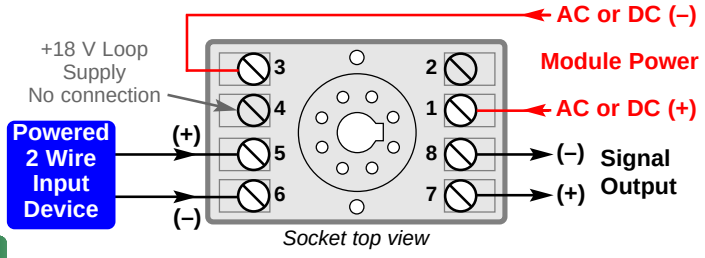
When a current output is ordered, it provides power to the output current loop (sourcing). If an unpowered (sinking) current output is required, order the API 7010 G EXTSUP with open collector output.

## ELECTRICAL CONNECTIONS

**WARNING!** All wiring must be performed by qualified personnel only. This module requires an industry-standard 8-pin socket. Order API 008 or finger-safe API 008 FS socket.

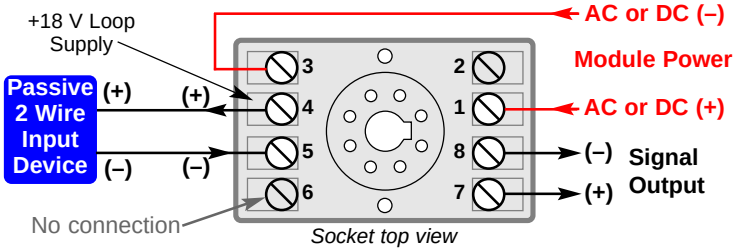
**Power Input Terminals –** The white label on the side of the API module will indicate the power requirements. AC power is connected to terminals 1 and 3. For DC powered modules, polarity **MUST** be observed. Positive (+) is wired to terminal 1 and negative (–) is wired to terminal 3.

**Powered Signal Input –** Polarity must be observed when connecting the signal input. The positive connection (+) is applied to terminal 5 and the negative (–) is applied to terminal 6.




*Connecting an input device which provides power to the input circuit*

**Passive Signal Input –** Polarity must be observed when connecting the signal input. A passive input device can be powered by the 18 volt DC power supply at terminal 4. This may save the expense of purchasing a separate power supply for the input device. A typical example is shown, however it is very important to consult the manufacturer of your specific sensor to determine its compatibility and proper wiring.




*Using the built-in 18 VDC loop supply to power a passive input device*

**Signal Output Terminals –** Polarity must be observed when connecting the signal output to the load. The positive connection (+) is connected to terminal 7 and the negative (–) is connected to terminal 8. When a current output is ordered, it provides power to the output current loop (sourcing). If an unpowered (sinking) current output is required, order the API 7010 G EXTSUP with open collector output.

## TEST BUTTON

The Test Switch pushbutton may be used to 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.

This test signal is factory set to approximately 50% of the calibrated output range. When the button is released, the output will return to normal.

Example: If you are checking a 4-20 mA current loop, when the pushbutton is held depressed, the output from the module will be approximately 12 mA.

## OPERATION

The frequency input to the API 7010 G is filtered to remove unwanted noise, converted to a DC voltage, and then passed through an opto-coupler to the output stage.

The frequency input can be virtually any type of signal (sine wave, sawtooth, square wave, etc.) as long as there is a sufficient change in amplitude (greater than 100mV).

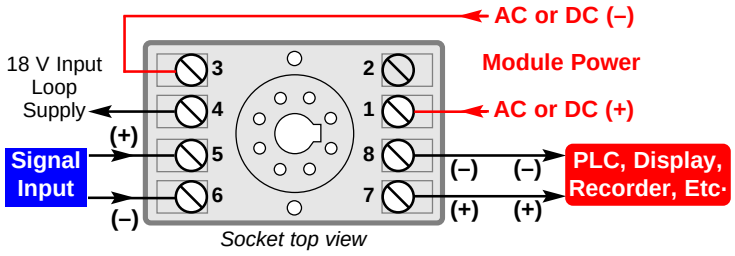
**GREEN *LoopTracker*® Input LED –** Provides a visual indication that a signal is being sensed by the input circuitry of the module. It also indicates the input signal strength by changing in intensity as the process changes from minimum to maximum. If the LED fails to illuminate, or fails to change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

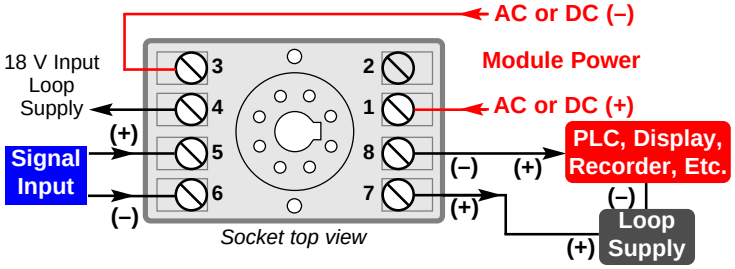
## CALIBRATION

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. Using an accurate calibration source, provide an input to the module equal to 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. Repeat adjustments for maximum accuracy.




*API 7010 G typical output wiring*




*API 7010 G EXTSUP typical 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.

**For Your Local Area Representative See *www.api-usa.com***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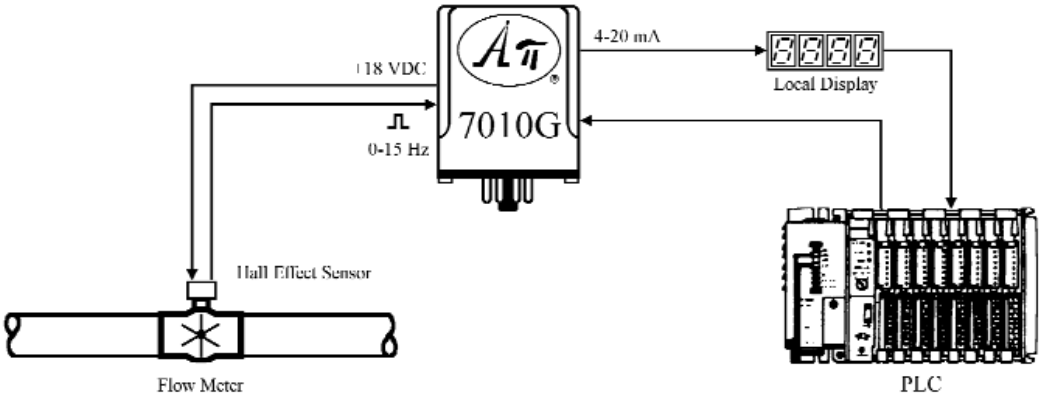
## Using a Hall Effect Flow Sensor

**PROBLEM**
An accurate flow measurement is required at low flow rates for a process controller. A local display is also desired.

**SOLUTION**
Hall effect sensors are recommended when the output frequency from a flow meter over any part of the application flow range is 15 Hz or less. This frequency typically occurs at approximately the 10 to 1 turndown point for flow meters.

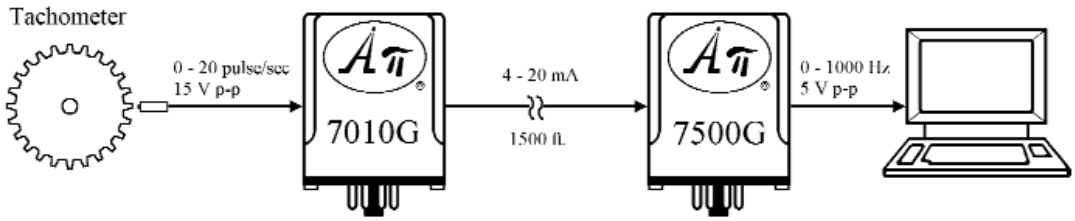



An **API 7010 G** Isolated Frequency to DC Transmitter module provides the DC power for the Hall Effect sensor from its built-in loop excitation supply and converts the 0-15 Hz flow signal into a 4-20 mA signal to drive the local display and the PLC. The 2000 VRMS isolation protects against unwanted ground loops and electrical noise.

## Monitoring Mixer Speed at a Remote Computer

**PROBLEM**
The speed of a mixing machine must be monitored by a computer located 1500 feet away, across an electrically noisy area. The tachometer on the mixer produces 24 pulses per revolution at 15 V peak-to-peak and the mixer runs at speeds up to 50 RPM. The computer input accepts a frequency of 0-1000 Hz at 5 V peak-to-peak.

**SOLUTION**
Api signal conditioning is applied at the tachometer output and at the computer input to provide noise immunity and signal compatibility.




The tachometer output (24 pulse/rev x 50 rev/min x 1 min/60 sec = 20 pulse/sec) is converted to a 4-20 mADC signal by the **API 7010 G** Isolated Frequency to DC Transmitter module. At the computer, the 4-20 mADC signal is converted by the **API 7500 G** Field Selectable Isolated DC to Frequency Transmitter module to a frequency of 0-1000 Hz.

## What is a Ground Loop?

In a process control loop, a ground loop circuit can develop when each device's ground is tied to a different earth potential thereby allowing current to flow between the grounds by way of the process loop (Figure 1).

Ground loops cause problems by adding or subtracting current or voltage from the process loop. This addition and/or subtraction causes the receiving device to be unable to differentiate between the wanted and unwanted signals and thus can't accurately reflect actual process signals.

The probability of multiple grounds and ground loops being established is especially high when new programmable logic controllers (PLCs) or distributed control systems (DCSs) are installed. With so many conditions within a facility referenced to ground, the likelihood of establishing more than one ground point is great. Thus, if an instrumentation system seems to be acting strangely or erratically, and the problem seems to point toward ground loops, the chore of eliminating all unintended ground connections becomes overwhelming.

Keep in mind that eliminating ground loops just isn't feasible for some instruments, such as thermocouples and some analyzers, because they require a ground to obtain accurate measurements. In addition, some instruments must be grounded to ensure personnel safety.

When ground loops can't be eliminated, the solution lies in the use of signal isolators. These devices break the galvanic path (DC continuity) between all grounds while allowing the analog signal to continue throughout the loop. An isolator also can eliminate the electrical noise of AC continuity (common mode voltage).

Signal isolators can use numerous techniques to achieve their function but the best signal isolators usually employ optical isolators (Figure 2). Regardless of the isolation method used, an isolator must provide input, output, and power isolation. If this three-way isolation is not provided, then an additional ground loop can develop between the isolator's power supply and the process input and/or output signal.

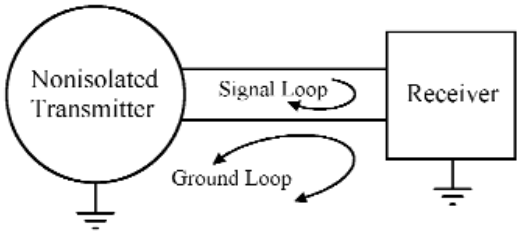



**Figure 1.** *Ground loops may develop with non-isolated transmitters and receivers, resulting in inaccuracy and unreliability.*

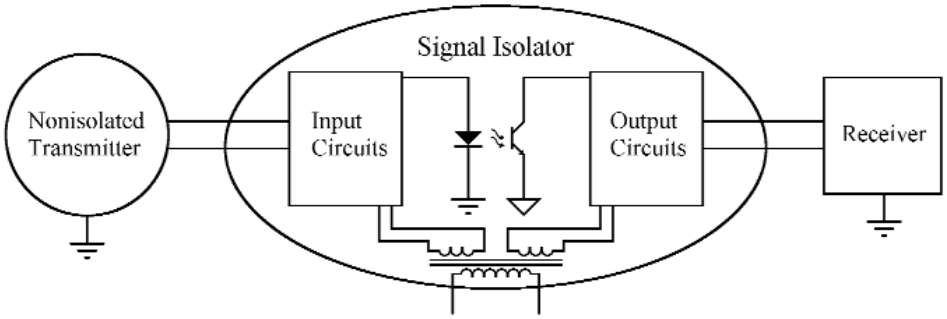
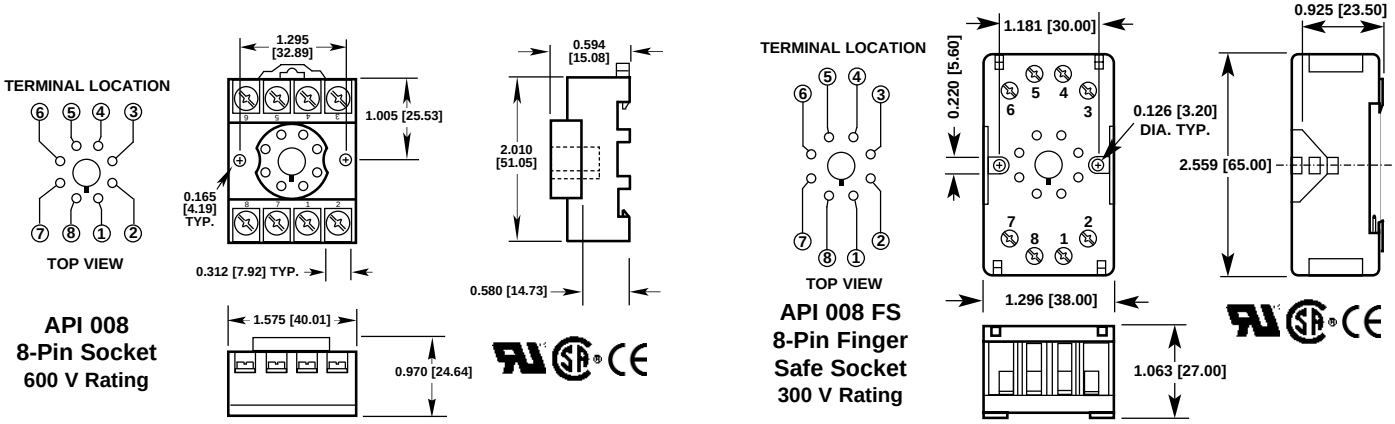



**Figure 2.** *A signal isolator in the process loop blocks ground current to restore signal accuracy and reliability.*

## API Sockets API 008 and API 008 FS

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