

Input: 0-25 Hz to 0-20 kHz
Output: 0-1 V to 0-10 VDC, ±1 VDC to ±10 VDC, 0-1 mA to 20 mADC

[Quick Link: api-usa.com/7010](http://api-usa.com/7010)

- Precision Frequency to DC Converter
- Zero and Span Output Calibration Potentiometers
- Full 1200 V Input/Output/Power Isolation
- Input and Output LoopTracker® LEDs
- Output Test Button
- Built-In Loop Power Supply for Sink/Source Output



Applications Link
api-usa.com/apps

Free Factory I/O Setup!



Dimensions
 0.89" W x 4.62" H x 4.81" D
 22.5 mm W x 117 mm H x 122 mm D
 Height includes connectors

Description
 The APD 7010 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, and noise pickup reduction.

Also standard on the APD 7010 is a 15 VDC input excitation supply. If needed, this supply can be used to power a passive sensor, eliminating the need for an additional external power supply.

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.

A PLC pulse rate output can be programmed to vary. By connecting the APD 7010 to this output, a proportional analog signal can be generated.

How to Order

All models are factory configured.
 Order APD 7010 D for operation on low voltage power
 Milliamp outputs can be field wired for sink or source.

Model	Input	Output	Power
APD 7010	Factory ranged	Factory ranged	85-265 VAC or 60-300 VDC
APD 7010 D	0-25 Hz to 0-20 kHz	voltage or milliamps	9-30 VDC or 10-32 VAC

Options—add to end of model number
M01 Input/output reversal, such as 20-4 mA output
M09 High voltage output up to 20 V (specify range)
U Conformal coating for moisture resistance



Connect mA Output for Sink or Source

1 2 3 4

Removable Plugs

Adjustable Output Test Function

5 6 7 8

Adjustable Input Sensitivity

1 2 3 4
5 6 7 8

Input LoopTracker LED

Zero and Span for Output

Output LoopTracker LED

9 10 11 12
13 14 15 16

15 VDC Sensor Power Available

9 10 11 12

Universal Power

13 14 15 16

See Wiring Diagrams on Next Page

Applications

- Monitor and Control Motor or Line Speed
- Convert Speed and Frequency Signals
- Simplify Interfacing of Frequency Sensors

Frequency Input Range

Factory configured, please specify input range
 Frequency: 0-25 Hz to 0-20 kHz
 Sine wave, sawtooth, or square wave with min. 5 µsec pulse

Input Amplitude Range

100 mV to 150 VRMS
 Any waveform with minimum 100 mV amplitude change

Input Impedance

10 kΩ nominal (maximum sensitivity)
 100 kΩ nominal (minimum sensitivity)

Input Sensitivity/Hysteresis

Multi-turn potentiometer for sensitivity adjustment
 Maximum sensitivity: ±25 mV typical
 Minimum sensitivity: ±2.5 V typical

Input Protection

Normal mode: 200% of input rating
 Common mode: 600 VDC or 600 VAC_p input to ground

Input Power Supply

15 VDC ±10%, regulated, 25 mADC
 Max. ripple, less than 10 mVRMS
 May be used to power sensor

LoopTracker

Variable brightness LEDs indicate I/O loop level and status

DC Output Range

Factory configured, please specify output range
 Voltage: 0-1 VDC to 0-10 VDC
 Voltage, M09 option: 0-10 VDC to 0-20 VDC
 Bipolar voltage: ±1 VDC to ±10 VDC
 Current: 0-2 mADC to 0-20 mADC
 20 V compliance, 1000 Ω at 20 mA

Output Calibration

Multi-turn zero and span potentiometers, ±15% adj. range typ.

Output Loop Power Supply

20 VDC nominal, regulated, 25 mADC
 Max. ripple, less than 10 mVRMS
 May be selectively wired for sinking or sourcing mA output

Output Test/Override

Front momentary button or external contact closure sets output to test level. Potentiometer adjustable 0-100% of span.

Output Ripple and Noise

Less than 10 mVRMS ripple and noise

Linearity

Better than ±0.1% of span

Ambient Temperature Range and Stability

-10°C to +60°C operating ambient
 Better than ±0.02% of span per °C stability

Isolation

1200 VRMS minimum
 Full isolation: power to input, power to output, input to output

Housing and Connectors

IP 40, requires installation in panel or enclosure
 For use in Pollution Degree 2 Environment
 Mount vertically to a 35 mm DIN rail
 Four 4-terminal removable connectors, 14 AWG max wire size

Power

85-265 VAC, 50/60 Hz or 60-300 VDC, 2.5 W maximum
 D versions: 9-30 VDC or 10-32 VAC 50/60 Hz, 2.5 W max.

Precautions

WARNING! All wiring must be performed by a qualified electrician or instrumentation engineer. See diagram for terminal designations and wiring examples. Consult factory for assistance.

WARNING! Avoid shock hazards! Turn signal input, output, and power off before connecting or disconnecting wiring, or removing or installing module.

Précautions

ATTENTION! Tout le câblage doit être effectué par un électricien ou ingénieur en instrumentation qualifié. Voir le diagramme pour désignations des bornes et des exemples de câblage. Consulter l'usine pour assistance.

ATTENTION! Éviter les risques de choc! Fermez le signal d'entrée, le signal de sortie et l'alimentation électrique avant de connecter ou de déconnecter le câblage, ou de retirer ou d'installer le module.

API maintains a constant effort to upgrade and improve its products. Specifications are subject to change without notice. See api-usa.com for latest product information. Consult factory for your specific requirements.

WARNING: This product can expose you to chemicals including nickel, which are known to the State of California to cause cancer or birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

Electrical Connections

See wiring diagrams at right. Observe polarity. If the output does not function, check wiring and polarity.

* Do not make any connections to unused terminals or use them as wiring junctions for external devices. This may cause permanent damage to the module!

Output

The output range is pre-configured at the factory as specified on your order. Polarity must be observed when connecting the signal output to the load. See the table below and the wiring diagrams at right.

The APD 7010 output can be wired to provide power to drive a current loop. Determine if your receiving device provides power to the current loop or if the loop must be powered by the APD module.

Use a multi-meter to check for voltage at your device's input terminals. Typical voltage may be 9-24 VDC if it provides power to the loop.

Type of Device for Output	Output -	Output +
Device accepts a voltage input.	3 (-)	4 (+)
Device accepts an unpowered or passive mA (current) input.	3 (-)	4 (+20 V)
APD module provides the loop power.	3 (-)	4 (+20 V)
Device accepts a mA (current) input and provides power to the current loop.	2 (-)	3 (+)

Input

The input range is pre-configured at the factory as specified on your order. No input calibration is necessary. The APD 7010 is compatible with most types of sensors as long as the waveform produces a minimum 100 mV amplitude change and a minimum 5 microsecond pulse width. Always refer to the sensor manufacturer's data sheet to determine supply voltage compatibility and proper wiring. A 15 VDC supply is available to power the sensor if required.

Sensor Type	Signal -	Sensor Power	Signal +
2 wire or Namur, externally powered	9	10	n/a
2 wire self generating (VR)	9	n/a	11
3 wire PNP current sourcing output	9	10	11
3 wire NPN current sinking output	9	10	11

Sensor Load

The signal input of the APD 7010 is capacitively coupled to prevent any DC in the input. Some sensors, typically those without an internal load resistor, require a resistive load in order to function.

The resistor value may be specified by the sensor manufacturer as the "minimum resistive load" or calculated from the sensor manufacturer's specified "load current range".

The 15 VDC power supply is capable of providing 25 mA. A load current range of 3 mA to 25 mA would typically use a 5 k Ω to 500 Ω resistor.

NPN sensors may require an external resistor across sensor signal and sensor power. See sensor manufacturer's specifications.

PNP sensors may require an external resistor across sensor signal and sensor ground. See sensor manufacturer's specifications.

Module Power

Check model/serial number label for module operating voltage to make sure it matches available power. For DC power, either polarity is acceptable, but for consistency, positive (+) can be wired to terminal 13 and negative (-) can be wired to terminal 16.

Mounting to a DIN Rail

Install module vertically on a 35 mm DIN rail in a protective enclosure away from heat sources. Do not block air flow. Allow 1" (25 mm) above and below housing vents for air circulation.

1. Tilt front of module downward and position against DIN rail.
2. Clip lower mount to bottom edge of DIN rail.
3. Push front of module upward until upper mount snaps into place.

Removal

1. Push up on the bottom back of the module.
2. Tilt front of module downward to release upper mount from top edge of DIN rail.

Output Calibration

Input and output ranges are factory pre-configured (at 24°C \pm 1°C). Front-mounted Zero and Span potentiometers are used to calibrate the output to compensate for load and lead variations.

1. Apply power to the module and allow a minimum 20 minute warm up time. An accurate frequency calibration source such as a signal generator may be required for calibration.
2. Provide an input to the module equal to the minimum input required for the application. In the most cases the minimum input signal will be 0 Hz.
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 frequency to the maximum input required for the application. This is generally done using a signal generator.
5. Using an accurate measurement device for the output, 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.
6. Repeat adjustments for maximum accuracy.

Sensitivity Adjustment

This multi-turn potentiometer provides an adjustable threshold level that the incoming signal must overcome before an output can be produced. This is used to limit noise and minimize false input signals that may cause erroneous readings.

Fully clockwise: (max. sensitivity), input threshold is \pm 25 mV.

Fully counterclockwise: (min. sensitivity), input threshold is \pm 2.5 volts.

Output Test Function

When the Test button is depressed it will drive the output with a known good signal that can be used as a diagnostic aid during start-up or troubleshooting. When released, the output will return to normal.

The Test Cal. potentiometer is factory set to approximately 50% output. It can be adjusted to set the test output from 0 to 100% of the output span. Press and hold the Test button and adjust the Test Cal. potentiometer for the desired output level.

Operation

The APD 7010 accepts a frequency input and provides an optically isolated DC voltage or current output that is linearly related to the input. 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 100 mV).

The frequency input to the APD 7010 is capacitively coupled (to remove any DC component at the input) to a comparator whose threshold is determined by the setting of the sensitivity control. The output from the comparator passes through an optocoupler to the output stage.

The green LoopTracker[®] input LED provides a visual indication that a signal is being sensed by the input circuitry of the module. The LED illuminates when the input is sufficiently large to trigger the input comparator depending on the input sensitivity adjustment.

It also indicates the input signal range by changing in intensity as the frequency changes from minimum to maximum. If the LED fails to illuminate, or change in intensity as the frequency changes, it may indicate a problem with module power, or signal input wiring.

Note that it may be difficult to see the LEDs under bright lighting conditions.

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.

Output terminals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

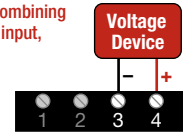
Δ * Do not make connections to unused terminals!

Wire terminal torque
0.5 to 0.6 Nm or
4.4 to 5.3 in-lbs



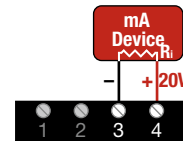
To maintain full isolation avoid combining power supplies in common with input, output, or unit power.

Voltage Output

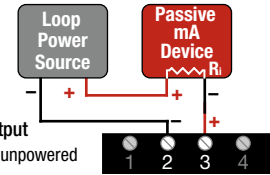


Current Sourcing Output

Module powers mA output loop

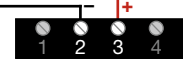


3- or 4-wire transmitter or 2 wire transmitter with external power supply

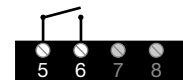


Current Sinking Output

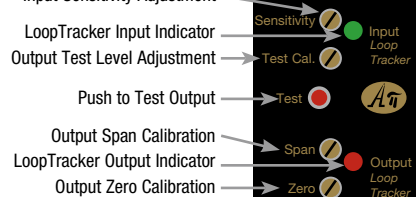
Module mA output is unpowered



External Contact for Test Function



Input Sensitivity Adjustment



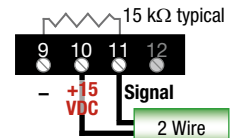
See sensor manufacturer's data sheet for sensor wiring recommendations and wire colors.

Two wire powered

10 Power (+15 VDC)

11 Signal

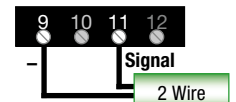
Some sensors may require a bleed resistor from signal to ground.



Two wire self-generating

9 Common (-)

11 Signal



Three wire NPN

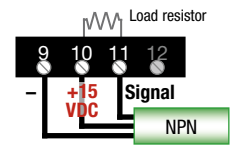
9 Common (-), Blue or Black

10 Power (+15 VDC)

Brown or Red

11 Signal, Black or White

Some sensors may require a load resistor from 10 to 11



Three wire PNP

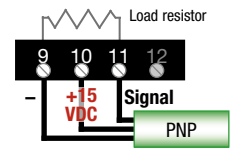
9 Common (-), Blue or Black

10 Power (+15 VDC)

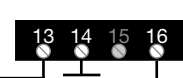
Brown or Red

11 Signal, Black or White

Some sensors may require a load resistor from 9 to 11



Cu 60/75°C conductors
14 AWG max.



13 Power AC or DC +

14 Earth Ground

16 Power AC or DC -

Δ * Do not make connections to unused terminals!