

Channel 1: Frequency to DC

Channel 2: Frequency to DC

- Two Independent Channels with Full Isolation
- Zero and Span for Each Output
- Input and Output LoopTracker® LEDs
- Output Test/Manual Override for Each Channel
- Built-In I/O Power Supplies

Applications

- Monitor and Control Motor or Line Speed
- Convert Speed and Frequency Signals

Channel 1 Frequency Input Range

Factory configured, please specify input range  
 Frequency: 0-25 Hz to 0-20 kHz  
 Any waveform with 5 microsecond min. pulse, 100 mV min. amplitude change, 100 mV to 150 VRMS amplitude

Channel 1 Sensor Power Supply

15 VDC ±10%, regulated, 25 mADC, <10 mVRMS max. ripple

Channel 1 Characteristics

Impedance at max. sensitivity: 10 kΩ nom.  
 Impedance at min. sensitivity: 100 kΩ nom.  
 Sensitivity/hysteresis adjustment: Multi-turn potentiometer  
 Sensitivity/hysteresis range: ±25 mV to ±2.5 V typical  
 Normal mode protection: 200% of input rating  
 Common mode protection: 600 V input to ground

Channel 2 Frequency Input Range

Factory configured, please specify input range  
 Frequency: 0-25 Hz to 0-20 kHz  
 Any waveform with 5 microsecond min. pulse, 100 mV min. amplitude change, 100 mV to 150 VRMS amplitude

Channel 2 Sensor Power Supply

15 VDC ±10%, regulated, 25 mADC, <10 mVRMS max. ripple

Channel 2 Characteristics

Impedance at max. sensitivity: 10 kΩ nom.  
 Impedance at min. sensitivity: 100 kΩ nom.  
 Sensitivity/hysteresis adjustment: Multi-turn potentiometer  
 Sensitivity/hysteresis range: ±25 mV to ±2.5 V typical  
 Normal mode protection: 200% of input rating  
 Common mode protection: 600 V input to ground

LoopTracker

Variable brightness LEDs indicate I/O levels for each channel

Channel 1 and Channel 2 Output Ranges

Factory configured, please specify for each output channel  
 Voltage: 0-1 VDC to 0-10 VDC, 10 mA max up to 20 VDC with M19, M29, M39

Bipolar voltage: ±1 VDC to ±10 VDC  
 Current: 0-1 mADC to 0-25 mADC, 4-20 mADC 20 V compliance, 1000 Ω at 20 mA

Output Calibration

Multi-turn zero and span potentiometers for each output channel ±15% of span adjustment range typical

Output Characteristics

Linearity: ±0.1% of span  
 Temperature stability: Better than 0.04% span/°C  
 Output ripple and noise: Less than 10 mVRMS

Isolation

Full 5-way, 1200 VRMS minimum

Output Loop Power Supplies

20 VDC nominal, regulated, 25 mADC for each output channel  
 May be selectively wired for sinking or sourcing mA output

Output Test

Front buttons set each output to test level when pressed  
 Each test level potentiometer adjustable 0-100% of span

Installation Environment

Mount vertically to a 35 mm DIN rail  
 For use in Pollution Degree 2 Environment  
 IP 40 housing, requires installation inside an enclosure  
 -10°C to +60°C operating ambient

Connectors

Eight 4-terminal removable connectors, 14 AWG max wire size

Power

85-265 VAC, 50/60 Hz or 60-300 VDC, 6 W maximum  
 D versions: 9-30 VDC or 10-32 VAC 50/60 Hz, 6 W maximum



**Dimensions**  
 1.78" W x 4.62" H x 4.81" D  
 45 mm W x 117 mm H x 122 mm D  
 Height includes connectors

Description

The APD 2077 DuoPak accepts two frequency inputs and provides two optically isolated DC voltage or current analog outputs that are linearly proportional to the inputs.

The input ranges and the output ranges for each channel are independent and can be specified as required. This provides an economical two channel solution in one device.

Typical applications include signal conversion, isolation, and redundancy (i.e. to prevent failure of the entire loop if one device fails), or a combination of these.

Each input signal is filtered, amplified, and then passed through an opto-coupler to the output stages. Full 5-way isolation (input 1, input 2, output 1, output 2, power) make this module useful for ground loop elimination, common mode signal rejection, and noise pickup reduction.

Output Sink/Source Versatility

Standard on the APD 2077 are 20 VDC loop excitation supplies for each output channel. These power supplies can be selectively wired for sinking or sourcing allowing use with any combination of powered or unpowered milliamp I/O devices.

How to Order

Models are factory ranged. See I/O ranges above left. Ranges and options for each channel must be specified on order

Channel 1 input range

Channel 2 input range

Channel 1 output range

Channel 2 output range

Model	Description	Power
APD 2077	DuoPak 2 channel Freq.-DC converter/isolator/transmitter	85-265 VAC, 50/60 Hz or 60-300 VDC
APD 2077 D		9-30 VDC or 10-32 VAC

Sink or Source mA Output for Each Channel

Output LoopTracker LED for Each Channel

Adjustable Output Test Function for Each Channel

Zero and Span for Each Channel

Input LoopTracker LED for Each Channel

Custom I/O Ranges

15 VDC Sensor Power Available for Each Channel

Universal Power



Removable Plugs

See Wiring Diagrams on Next Page

LoopTracker

API exclusive features include four LoopTracker LEDs (green for each input, red for each output) that vary in intensity with changes in the process input and output signals.

These provide a quick visual picture of your process loop at all times and can greatly aid in saving time during initial startup and troubleshooting.

Output Test/Manual Override

An API exclusive feature includes output test buttons for each channel to provide a fixed output (independent of the input) when held depressed.

Terminals are also provided to operate the test functions remotely for each channel. This also allows use as a remote manual override to provide a temporary fixed output if desired.

The test output level for each channel is potentiometer adjustable from 0 to 100% of the output span. The output test greatly aids in saving time during initial startup and/or troubleshooting.

Options and Accessories

Options—add to end of model number

- R1 Channel 1 I/O reversal (i.e. 20-4 mA out)
- R2 Channel 2 I/O reversal (i.e. 20-4 mA out)
- R3 Channel 1 and channel 2 I/O reversal
- M19 Channel 1 high voltage output >10 V up to 20 V
- M29 Channel 2 high voltage output >10 V up to 20 V
- M39 Channel 1 and channel 2 high voltage output
- U Conformal coating for moisture resistance

Accessory—order as separate line item

API BP4 Spare removable 4 terminal plug, black

**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](http://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](http://www.P65Warnings.ca.gov)

**Electrical Connections**

Polarity must be observed for signal wiring connections. If the input and/or output do not function, check wiring and polarity.

Each product is factory configured to your exact input and output ranges as indicated on the serial number label.

**Outputs**

For milliamp ranges determine if your devices provide power to the current loop or if the loop must be powered by the APD module. Typical voltage may be 9-24 VDC at your device's terminals if it provides power to the loop.

Device for Output Channel 1	Terminal	Terminal
Voltage input device.	3 (-)	4 (+)
Unpowered or passive mA input device. APD module provides the loop power.	3 (-)	4 (+20 V)
mA input device powers the current loop.	2 (-)	3 (+)
Device for Output Channel 2	Terminal	Terminal
Voltage input device.	7 (-)	8 (+)
Unpowered or passive mA input device. APD module provides the loop power.	7 (-)	8 (+20 V)
mA input device powers the current loop.	6 (-)	7 (+)

**Inputs, Frequency**

The input ranges are pre-configured at the factory. No input calibration is necessary. The frequency input is compatible with most types of sensors that produce a minimum 100 mV amplitude change and a minimum 5 microsecond pulse width. A 15 VDC supply is available to power the sensor if required. Always refer to the sensor manufacturer's data sheet to determine supply voltage compatibility and proper wiring.

Frequency Sensor Ch. 1	Signal Com.	Sensor Power	Signal Input
2 wire or Namur requiring external power	n/a	18 (+15 V)	19 (+)
2 wire self generating (VR)	17 (-)	n/a	19 (+)
3 wire PNP or NPN	17 (-)	18 (+15 V)	19 (+)
Frequency Sensor Ch. 2	Signal Com.	Sensor Power	Signal Input
2 wire or Namur requiring external power	n/a	22 (+15 V)	23 (+)
2 wire self generating (VR)	21 (-)	n/a	23 (+)
3 wire PNP or NPN	21 (-)	22 (+15 V)	23 (+)

**Sensor Load**

The frequency signal input 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 kΩ to 500 Ω resistor.

**Module Power Terminals**

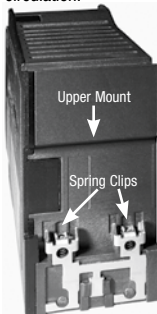
Check label for module operating voltage to make sure it matches available power. The power supplies are fuse protected and the unit may be returned to API for fuse replacement.

When using DC power, either polarity is acceptable, but for consistency, wire positive (+) to terminal 25 and negative (-) to terminal 28.

**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 down and position the lower spring clips against the bottom edge of DIN rail.
2. Push front of module upward until upper mount snaps into place.



**Removal**

Avoid shock hazards! Turn signal input, output, and power off.

1. Push up on bottom back of module.
2. Tilt front of module down to release upper mount from top edge of DIN rail.
3. The module can now be removed from the DIN rail.

**Output Calibration**

Input and output ranges are factory pre-configured (at 24°C ±1°C). 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 30 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 this 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. For example: 4 mA for a 4-20 mA output or -10 V for a ±10 V output.
4. Set the frequency to the maximum input required for the application.
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 each channel 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 ±25 mV.

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

**Output Test Function**

When a Test button is depressed it will drive the output with a known good signal that can be used as a diagnostic aid during initial start-up or troubleshooting. When released, the output will return to normal. They may optionally be externally wired for remote test operation or a manual override. See wiring diagram at right.

Each Test Cal. potentiometer 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 corresponding Test Cal. potentiometer for the desired output level.

**Operation**

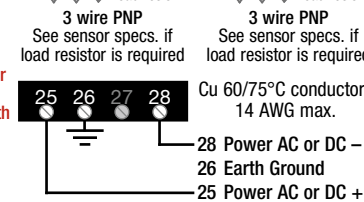
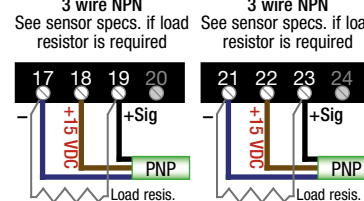
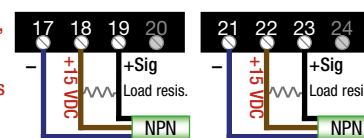
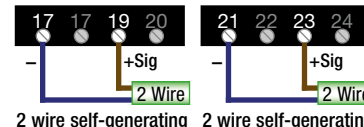
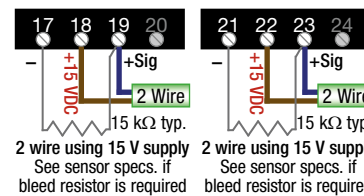
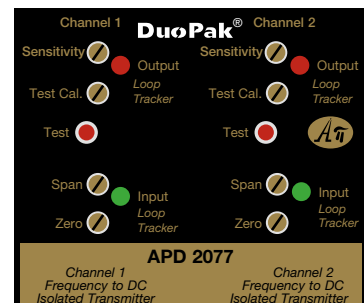
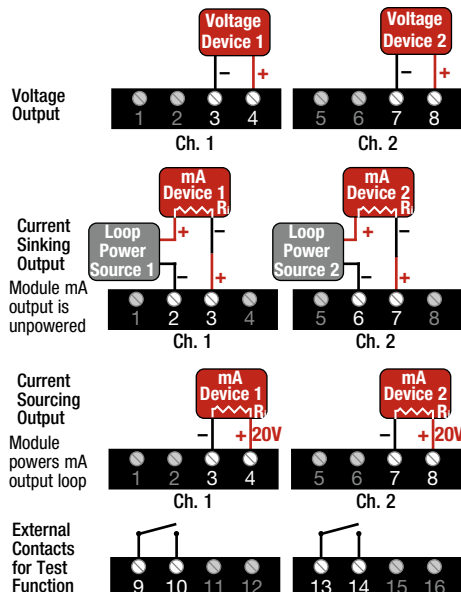
The APD 2077 accepts two frequency inputs and provides two optically isolated DC voltage or current analog outputs that are linearly proportional to the inputs.

Each frequency input 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 opto-coupler to the output stage.

Green LoopTracker® input LEDs provide a visual indication that a signal is being sensed by the input circuitry of each channel. The LEDs illuminate when the input is sufficiently large to trigger the input comparator depending on the input sensitivity adjustment.

They also indicate the input signal range by changing in intensity as the frequency changes from minimum to maximum. If an 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.

Red LoopTracker output LEDs provide a visual indication that the output signals are functioning. Each 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.



To avoid damage to the module, do not make any connections to unused terminals

To maintain full isolation avoid combining power supplies in common with inputs, outputs, or unit power.