

**Input:** Thermocouple or Custom Thermocouple Type  
**Output:** 0-1 V to 0-10 V,  $\pm 5$  V,  $\pm 10$  V, 0-2 mA to 4-20 mA, Reverse Acting Optional

[Quick Link: api-usa.com/apd4131](http://api-usa.com/apd4131)

- $\pm 0.1\%$  Accuracy for All Common Thermocouples
- Zero and Span for Output
- Full 1200 V Isolation
- Input LoopTracker® LED
- Output Test Function
- Built-In Loop Power Supply for Sink/Source Output



Sink or Source  
mA Output

1 2 3 4  
5 6 7 8

Removable Plugs

## Applications

- Convert/Isolate Thermocouples for PLC Input, Control and/or Validation
- Interface Thermocouples with Panel Meters, PLCs, Recorders, Data Acq., DCS, & SCADA Systems

## Input Types, Factory Set

Thermocouples: J, K, T, E, R, S, N, B, C, D, G, M, P

Full ANSI temperature ranges

Automatic CJC

T/C burnout: Upscale, downscale or last valid output

Custom: Provide thermocouple specifications, temp. vs. millivolt data, and temp. range



[Applications Link  
api-usa.com/apps](http://api-usa.com/apps)

**Free Factory  
I/O Setup!**

## LoopTracker

Variable brightness green LED indicates input level and status

## Status LED

Yellow LED for setup and operational status

## DC Output Ranges, Factory Set

Voltage: 0-1 V, 0-2 V, 0-4 V,  
0-5 V, 1-5 V,  
0-8 V, 0-10 V, 2-10 V,  
 $\pm 5$  VDC,  $\pm 10$  VDC

Current: 0-2 mA, 0-4 mA,  
0-8 mA, 0-10 mA, 2-10 mA,  
0-16 mA, 0-20 mA,  
4-20 mA  
20 V compliance, 1000  $\Omega$  at 20 mA

## Reverse Acting Output, Factory Set

R option: Reverse acting output  
increasing input = decreasing output signal

Reverse acting models cannot be converted to direct acting

## Output Calibration

Zero and span set by using up/down buttons,  $\pm 10\%$  range

## Output Ripple and Noise

Less than  $\pm 0.2\%$  of span

## Output Loop Power Supply

20 VDC nom., regulated, 25 mADC,  $< 10$  mVrms max. ripple  
May be selectively wired for sinking or sourcing mA output

## Output Test

Front push button switch enables/disables test level output  
Adjustable 0-100% of span via up/down buttons

## Output Resolution

18 bit

## Output Ripple and Noise

Less than  $\pm 0.2\%$  of span

## Accuracy

$\pm 0.1^\circ\text{C}$  input accuracy,  $0.001^\circ\text{C}$  input resolution

## Ambient Temperature Range and Stability

$-10^\circ\text{C}$  to  $+60^\circ\text{C}$  operating ambient  
Better than  $\pm 0.02\%$  of span per  $^\circ\text{C}$  stability

## Response Time

300 milliseconds typical

## Isolation

Full 3-way isolation: input, output, power, 1200 Vrms min.  
600 VACp or 600 VDC common mode protection  
75 dB minimum common mode rejection  
Simultaneous 50 Hz and 60 Hz rejection

## Housing and Connectors

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

Setup and Status  
LED

Adjustable Output  
Test Function

Zero and Span for  
Output

Input LoopTracker  
LED

Factory Configured  
Thermocouple Input

Universal  
Power

## Power

85-265 VAC, 50/60 Hz or 60-300 VDC, 3 W maximum  
D versions: 9-30 VDC or 10-32 VAC 50/60 Hz, 3 W maximum

## Dimensions

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

## Description

The APD 4131 accepts a thermocouple temperature input and provides an optically isolated and linearized DC voltage or current output.

The thermocouple type, temperature range and output range are factory set. The unit can be set up for all commonly available thermocouple types and temperature ranges.

Microprocessor-based linearization uses 41 to 55 segments or up to a 14th order polynomial depending on the sensor type.

The input is sampled, digitally converted to a linearized temperature signal and then passed through an optocoupler to the output stage.

Full 3-way isolation (input, output, power) make this module useful for ground loop elimination, common mode signal rejection, and noise pickup reduction.

The low noise 18 bit analog output is isolated and is factory set for common voltage and milliamp output types.

## How to Order

Models are factory ranged. You must specify the sensor type and the following information.

T/C: Thermocouple type, burnout setting

Custom: Complete T/C data over temperature range

Temperature: Range in  $^\circ\text{F}$  or  $^\circ\text{C}$

Output: Range and type (mV, V, mA)

Model	Description	Power
APD 4131	Thermocouple input to DC output isolated transmitter	85-265 VAC, 50/60 Hz or 60-300 VDC
APD 4131 D		9-30 VDC or 10-32 VAC



See Wiring  
Diagrams on  
Next Page

## Output Sink/Source Versatility

Standard on the APD 4131 is a 20 VDC loop excitation supply for the milliamp output. The output can be selectively wired for sinking or sourcing allowing use with a powered or unpowered milliamp device.

## LoopTracker

An API exclusive feature includes a green LoopTracker LED that varies in intensity with changes in the process input signal.

It provides a quick visual picture of your process input at all times and can greatly aid in saving time during initial startup and troubleshooting.

## Output Test

An API exclusive feature includes an output test switch to provide a fixed output (independent of the input) when pressed. The output test greatly aids in saving time during initial startup and/or troubleshooting.

The test output level is adjustable from 0 to 100% of the output span.

## Options and Accessory

### Options—add to end of model number

- NC5** 5 point NIST traceable calibration certificate
- NC11** 11 point NIST traceable calibration certificate
- U** Conformal coating for moisture resistance
- R** Reverse acting output

### Accessory—order as separate line item

**API BP4** Spare removable 4 terminal plug, black

**Note:** Units are set up at the factory, but an appropriate simulator and multimeter may be required to adjust calibration in the field.

**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**

See wiring diagrams at right. A multimeter and a temperature simulator may be used to check setup. Observe polarity. If the output does not function, check wiring and polarity.

The power supplies are fuse protected and the unit may be returned to API for fuse replacement.

**Input**

The thermocouple is connected as shown in the wiring diagrams at right. If a custom input was specified, see the model/serial number label for thermocouple type, temperature range and options.

**Output**

For milliamp ranges, determine if your device provides 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.

Models with **R** reverse acting output have the output range reversed. For example, 4-20 mA is 20-4 mA.

**Module Power**

Check model/serial number label for module operating voltage to make sure it matches available power.

When using DC power, either polarity is acceptable, but for consistency with similar API products, positive (+) can be wired to terminal 13 and negative (-) can be wired to terminal 16.

**Calibration**

The module is factory calibrated, but the output may be adjusted to account for lead length and load variations.

1. Connect a multimeter to the output terminals 2 - 3, or 3 - 4 depending on output type. See wiring diagram at right.
2. Connect a temperature simulator to the input of the module.
3. Connect power to the unit (terminals 13, 14, and 16) and apply power to the module.
4. Wait until the yellow Status LED starts blinking once per second.

**Low End Input Calibration**

5. Use the simulator to apply the low end of the input signal.
6. Push the Set button to store the low end input value.
7. The Status LED will turn on to indicate the reading was saved.
8. Use the Up and Down buttons to adjust the output to the desired low output reading. For example: 4 mA for a 4-20 mA output or -10 V for a  $\pm 10$  V output.

9. Press and release the Set button to store the low output.

**High End Input Calibration**

10. Wait until the Status LED blinks once per second.
11. Use the simulator to apply the high end of the input signal.
12. Push the Set button to store the high end input value.
13. The Status LED will turn on to indicate the reading was saved.
14. Use the Up and Down buttons to adjust the output to the desired high output reading (i.e. 20 mA for a 4-20 mA output).

15. Press and release the Set button to store the high output.

**Output Test Level Adjustment**

16. Wait until the Status LED turns on and stays on.
17. Using the Up and Down buttons adjust the test output for the desired level (i.e. 12 mA for a 4-20 mA output).
18. Press and release the Set button to store the test output.
19. Wait until the Status LED starts blinks once per second.
20. To change any value, turn off the power and repeat above steps.

**Saving Setup**

21. Press and release the Set button to store the value and lock it into memory. The Status LED will turn on during the storing process.
22. Once the Status LED turns off, setup and configuration is complete. Turn off power to the unit and remove the simulator and multimeter.

**Adjusting Output After Installation**

It may be necessary to fine-tune the output signal after installation to account for offset, tare, lead length, or operating temperature.

1. Press and release the **Set** button. This will turn on the yellow Status LED.
2. Use the **Up** and **Down** buttons to adjust the output to the desired level. The Status LED will turn off during the adjustment.
3. Once the desired output level has been met, press and release the **Set** button to save the adjustment. The "Status" LED will flash indicating that the change has been made.

The unit has an auto Zero/Span detection for knowing which to adjust. If the output signal is greater than 50% of the Span, the unit will adjust the output signal Span.

If the output signal is less than 50% of the Span, the unit will adjust the output signal Zero.

**Resetting to Factory Values**

To reset the unit calibration and test output back to factory default, press and hold the Set button while the module is being powered up.

**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 clip the lower mount with spring clips to 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 before removing module.

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

**Output Test Function**

When the Test button is pressed 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 pressed again, the output will return to normal. The button allows hands-free operation of the Test Mode.

The Test level can be adjusted by using the Up and Down buttons.

The level can be set by pressing the Set button, or it can default back to the setup value by not pressing the Set button.

**Operation**

The APD 4131 accepts a temperature input and provides a linearized and optically isolated DC voltage or current output.

The 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, check the module power or signal input wiring. Note that it may be difficult to see the LEDs under bright lighting conditions.

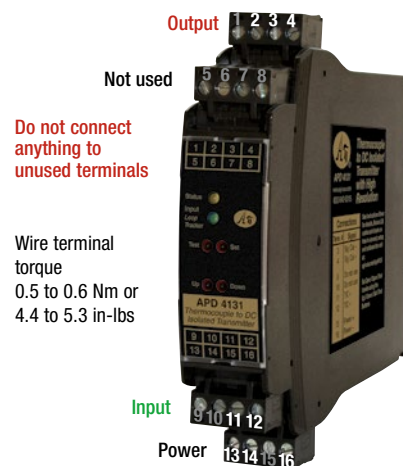
The yellow status LED provides a visual indication of operational modes.

Normal operation: Off  
Push-to-Test mode: Steadily on  
Operational error: Blinking 2 digit code

**Operational Error Codes, Yellow LED**

If an error occurs during operation, the yellow Status LED blinks an error code. Check sensor, wiring, or consult factory.

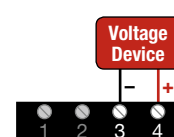
- |   |                   |
|---|-------------------|
| 11 Analog-digital converter out-of-range                              | ● — ●             |
| 12 Sensor under range   | ● — ● ●           |
| 13 Sensor over range  | ● — ● ● ●         |
| 14 CJC sensor abnormal range  | ● — ● ● ● ●       |
| 15 CJC failure  | ● — ● ● ● ● ●     |
| 16 Hard ADC out-of-range  | ● — ● ● ● ● ● ●   |
| 17 Sensor hard fault, open circuit, hard ADC fault, or hard CJC fault | ● — ● ● ● ● ● ● ● |



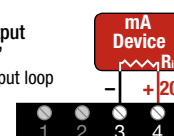
Do not connect anything to unused terminals

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

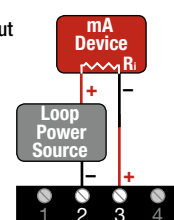
Voltage Output  
Switch E set to "V"



Current Sourcing Output  
Switch E set to "I"  
Module powers mA output loop



Current Sinking Output  
Switch E set to "I"  
Module mA output is unpowered



Do Not Connect to Unused Terminals  
1, 5, 6, 7, 8, 9,  
10, 15



Yellow status LED  
Setup: blinks once per second  
Off: normal operation  
2 digit code: error code



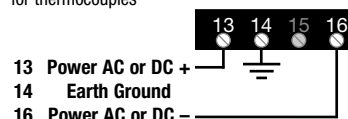
Green LoopTracker LED brightness varies with input level

To maintain full isolation and avoid malfunctions, do not connect power supplies in common with input, output or unit power.

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

**Thermocouple Input**

Tip: RED wire is negative for thermocouples



Cu 60/75°C conductors 14 AWG max.