

1 Input: Any Thermocouple
2 Outputs: Process Voltage or mA + Any Thermocouple, Alarm Relay Options

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

- Split or Convert a T/C to DC Output & Any T/C Output
- Add Additional Isolated Output to Existing T/C
- Zero and Span Output Calibration
- Input LoopTracker® LED
- Sink/Source for DC Output

Applications

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

Thermocouple Input, Factory Set

T/C types: J, K, T, E, M, N, P, R, S, B, C, D, G
 Temp. range: Full ANSI range, or specify °F or °C range
 Linearity: ±0.1°C and 0.001°C resolution
 Linearization: Polynomial, 1°C segments for types M and P
 T/C CJC: Automatic
 T/C current: Less than 10 µA, including burnout sense
 T/C burnout: Upscale (standard), B: downscale, N: none
 Custom: Provide T/C millivolt data, °F or °C range

Status LEDs

LoopTracker: Variable brightness green for input level
 Yellow LED: Output 1 Push-to-Test status, error status
 Red/green LED: Alarm state (with alarm option only)

DC Output, Channel 1, Factory Set

Linearized to temperature
 Voltage: 0-1 V to 0-10 V (10 mA max.), ±1 V to ±10 V
 Current: 0-1 mA to 0-20 mA
 20 V compliance, 1000 Ω at 20 mA
 Sinking or sourcing output
 Loop power: 20 VDC nom., regulated, 25 mADC
 <10 mVRMS max. ripple

Thermocouple Output, Channel 2, Factory Set

T/C types: J, K, T, E, M, N, P, R, S, B, C, D, G
 Output limited by smallest ANSI T/C range
 Linearization: Polynomials, 1°C segments for types M and P
 T/C CJC: Automatic, can be factory disabled

Output Calibration

Zero and span potentiometers for each output, ±15% range

Output Push-to-Test (DC Output 1)

Front push button and terminals enables/disables test level output. Set to 75% of output span. Specify custom setting.

Output Resolution

16 bit

Output Ripple and Noise

Less than ±0.2% of span

Optional Alarm Relay

Single setpoint dual DPST contact sets, factory configured 1 Form A (NO) and 1 Form B (NC) contact sets (4 terminals)
 May be field wired for Form C operation

8 A max @ 240 VAC resistive load

Use external contact protection (RC snubber) for inductive loads

Red/Green bi-color LED indicates alarm status

One set point, 12 turn potentiometer, 0-100% of span

One reset point, 12 turn potentiometer, 0-100% of span

Default: HI alarm, non-latching, normal acting (failsafe)

Relay Test button toggles relay to opposite state or resets relay with HT option

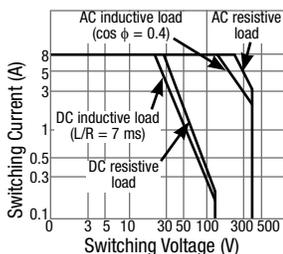
Ambient Temperature Range and Stability

-10°C to +60°C operating ambient

Better than ±0.02% of span per °C stability

Response Time

500 milliseconds minimum



Applications Link
api-usa.com/apps

Free Factory I/O Setup!

Isolation

Full 4-way galvanic: input, output 1, output 2, 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. Allow room for air flow. For use in Pollution Degree 2 Environment.
 Eight 4-terminal removable connectors, 14 AWG max. wire size

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

1.78" W x 4.62" H x 4.81" D
 (45 mm W x 117 mm H x 122 mm D)

Description

The APD 41391 accepts a thermocouple temperature input and provides one DC process output and one thermocouple output. This makes it useful to match up the available thermocouple type with an instrument input type, for data recording, or when isolating the input.

The thermocouple input type and temperature range are factory set. The DC output type and range, and the thermocouple output type and range are factory set. The DC output and the thermocouple output correspond to the input temperature range specified. Mixed T/C types are limited by the ANSI temperature range. Use appropriate thermocouple extension wire as needed.

The input is sampled, CJC compensated, digitally converted to a linearized temperature signal, and then passed to the output stages where it is converted to a DC output and a simulated thermocouple output with CJC compensation. Contact factory if the CJC compensation is to be disabled.

How to Order—Factory Ranged and Configured

Model	Power	Input	Outputs	Alarm	Code	Description
APD 41391	85-265 VAC, 60-300 VDC	Specify T/C type, temperature range in °F or °C	Ch. 1 specify VDC or mA range Custom Push-to-Test % span Ch. 2 specify T/C type	none HI alarm (failsafe) LO alarm	-	Upscale burnout (standard)
APD 41391 D	9-30 VDC, 10-32 VAC				B	Downscale burnout
APD 41391 H	85-265 VAC, 60-300 VDC				N	No burnout, last valid value
APD 41391 DH	9-30 VDC, 10-32 VAC				RA	Reverse-acting alarm
APD 41391 L	85-265 VAC, 60-300 VDC				HP	Latching relay, power-off reset
APD 41391 DL	9-30 VDC, 10-32 VAC				HT	Latching relay, push button reset
					U	Conformal coating for moisture resistance



Removable Plugs

Output Test for DC Channel

Sink or Source Output for mADC Channel

Optional Alarm Relay

Zero and Span for Each Output

Status LED

Input LoopTracker LED

Universal Power

See Wiring Diagrams on Next Page

Note: Temperature range is limited by the smallest ANSI range of the two T/C types selected.

Full 4-way galvanic isolation (input 1, output 1, output 2, power) make this module useful for ground loop elimination, common mode signal rejection, and noise pickup reduction.

LoopTracker

An API exclusive feature includes a green LoopTracker LED that varies in intensity with changes in the input signal and a red LoopTracker LED that varies in intensity with changes in the channel 1 DC output signal. It provides a quick visual picture of your process at all times and can greatly aid in saving time during initial startup and troubleshooting.

Output Push-to-Test

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

The output test level is factory set to approximately 75% of span but a custom test level may be ordered.

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 is 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

This module is factory configured. See the model/serial number label for T/C type, output types, ranges, and options.

* 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!

See wiring diagram at right. The T/C input must match the type indicated on the model/serial number label. Use thermocouple extension wire that matches your T/C type as needed.

Channel 1 output and range are indicated on the model/serial number label. A milliamp output may be wired for sinking or sourcing. Sourcing provides 20 VDC power to your device.

Channel 2 T/C output must use matching thermocouple extension wire. This output is generally connected to a temperature measurement device. Note that red is negative for most thermocouples.

Module Power

See model/serial number label to make sure available power matches module operating voltage. The power supply is fuse protected and the unit may be returned to us for fuse replacement. For 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, outputs, and power off.

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



Calibration

Input and output ranges are factory pre-configured (at 24°C ±1°C). Zero and Span potentiometers can be used to calibrate each output channel as required.

1. It will be necessary to simulate or create a low and a high temperature input to the module and use an accurate measurement device to calibrate each output.
2. Apply power to the module. Allow 20 minutes for warm up time and ensure the module is at a stable temperature during calibration.
3. Set the input to your minimum value for the Zero calibration.
4. Using an accurate measurement device for each output, adjust the Zero potentiometers for the exact minimum output readings desired. For example with a Ch. 1 DC output: 4 mA for a 4-20 mA output or -10 V for a ±10 V output. The Zero controls should only be adjusted when the input signal is at its minimum.
5. Next, set the input at maximum, then adjust the Span pots for the exact maximum output readings desired. For example with a Ch. 1 DC output: 20 mA for a 4-20 mA output. The Span controls should only be adjusted when the input signal is at its maximum.
6. Repeat adjustments for maximum accuracy. You may also be able to fine-tune the outputs by adjusting the calibration of the devices you have connected to the module outputs.

Optional Alarm Relay

See model/serial number label for the factory configured relay option codes, if equipped. A red/green bi-color LED is provided to indicate alarm state. It will be green during a non-alarm condition and red during an alarm condition.

High Alarm (H): The alarm relay changes state when the temperature exceeds the trip point. The relay resets when the temperature drops below the reset point. For a high alarm, the trip point is above the reset point.

Low Alarm (L): The alarm relay changes state when the temperature goes below the trip point. The relay resets when the temperature exceeds the reset point. For a low alarm the trip point is below the reset point.

HT: Latching alarm with push button reset.

HP: Latching alarm with power-off reset. Module power must be turned off to reset alarm.

RA: Reverse-acting alarm. Relay coils energized in an alarm condition. No alarm condition with module power off.

Relay Terminals

See diagram for alarm contact wiring. The module does not provide power to the relay contacts. Use an appropriate RC snubber for inductive loads (motors, solenoids, contactors, etc.) to ensure good relay contact life.

The dual DPST contact sets are in a Form A (NO) and a Form B (NC) configuration and operate in unison with a single setpoint. They may be field wired for Form C operation as required.

Set Point Adjustment

This multi-turn potentiometer allows adjustment of the alarm trip point. This control is adjustable from 0 to 100% of the input range.

Reset Point Adjustment

This multi-turn potentiometer allows adjustment of the alarm reset point. This control is adjustable from 0 to 100% of the input range. Sufficient deadband (difference between trip and reset point) should be used to prevent chattering of the relays or false trips when the process signal is unstable or changes rapidly.

Alarm Adjustments

Set the input signal to a level that represents the desired set point. Adjust the Set Point potentiometer to the point at which the relay changes state from a non-alarm to an alarm condition.

Set the input signal to a level that represents the desired reset point. Adjust the Reset Point potentiometer to the point at which the relay changes state from an alarm to a non-alarm condition.

Operate the signal source through the set and reset points to confirm desired operation and adjust if necessary.

Relay Test Function

This can be used as a diagnostic aid during initial start-up or troubleshooting, or as a manual over-ride function. When the front Relay Test button is depressed or terminals 11 and 12 closed, it will drive the relay and the bi-color alarm LED to their opposite states. When released, the relay and LED will return to their prior states. The Relay Test button also resets the relay on models with the HT option.

Output Test 1

This can be used as a diagnostic aid during initial start-up or troubleshooting, or as a manual over-ride function. When the Test 1 button is depressed or terminals 9 & 12 are closed, it will drive the channel 1 DC output to 75% of span or a customer-specified value set at the factory. When released or the contact opened, the channel 1 output will return to its normal level.

Operation

The APD 41391 accepts a thermocouple input and provides a DC output and a T/C output that are linearized to T/C input temperature. The green LoopTracker® LED varies in intensity as the input is sensed by the module. The red LoopTracker LED varies in intensity with changes in the DC output signal. If either LED fails to illuminate, or fails to change in intensity as the process changes, check the module power or signal wiring. Note that it may be difficult to see the LEDs under bright lighting conditions.

Yellow LED Functions

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

- Normal operation: Off
 Output Push-to-Test: On for Test 1
 Operational error: Blinking 2 digit code
- If an error occurs during operation, the yellow Status LED blinks an error code. Check sensor, wiring, or consult factory.
- 1 1 Analog-digital converter out-of-range ●—●
 - 1 2 Sensor under range ●—●●
 - 1 3 Sensor over range ●—●●●
 - 1 4 CJC sensor abnormal range ●—●●●●
 - 1 5 CJC failure ●—●●●●●
 - 1 6 Hard ADC out-of-range ●—●●●●●●
 - 1 7 Sensor hard fault, open circuit, hard ADC fault, or hard CJC fault ●—●●●●●●●

* Do not make connections to unused terminals!

