

Input: Thermocouple, or Custom Thermocouple
Output: 0-1 V to 0-10 V, ±5 V, ±10 V, 0-2 mA to 4-20 mA, Reverse Acting Optional

[Quick Link: api-usa.com/apd4351](http://api-usa.com/apd4351)

- One Model Covers All Common Thermocouples
- Easy Setup—No Computer or Software Needed
- Zero and Span Output Calibration Buttons
- Full 1200 V Isolation
- Input LoopTracker® LED, Output Test Function
- Built-In Loop Power Supply for Sink/Source 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 Types, Field Selectable

T/Cs: J, K, T, E, R, S, N, B, C, D, G, M, P
 Full ANSI temperature ranges
 Linearization: 41-55 segment or up to 14th order polynomial
 T/C CJC: Automatic
 T/C current: 10 µA nom., including burnout sense
 T/C burnout: Upscale (standard), downscale, or none
 Custom: Provide thermocouple specifications, temp. vs. millivolt data, and temp. range

For factory setup, specify T/C type and range

LoopTracker

Variable brightness green LED indicates input level and status

Status LED

Yellow LED for setup and operational status

DC Output Ranges, Field Selectable

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, ±5 VDC, ±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 Ω at 20 mA

Reverse Acting Output, Factory Set

R option: Reverse acting output
 Reverse acting models cannot be converted to direct acting

Output Calibration

Zero and span set by using up/down buttons, ±10% range

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 ±0.2% of span

Accuracy

±0.1°C accuracy and 0.001°C resolution

Ambient Temperature Range and Stability

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

Response Time

300 milliseconds nominal

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



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 4351 accepts a thermocouple temperature input and provides an optically isolated and linearized DC voltage or current output.

The sensor type, temperature range and output range are field configurable. The input type is set with switches and its range is configured using front buttons, a multimeter and an input simulator. This provides a versatile solution that works with all commonly available thermocouple sensors.

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 can be set up for common voltage and milliamp output types.

How to Order

Default settings are type J T/C, 0-500°C, 4-20 mA output. For factory configuration, specify the following.

T/C: Thermocouple type, burnout setting
 Custom: Complete T/C data over temperature range
 Temperature: Range in °F or °C
 Output: Range and type (mV, V, mA)

Model	Description	Power
APD 4351	Thermocouple input to DC	85-265 VAC, 50/60 Hz or 60-300 VDC
APD 4351 D	output isolated transmitter	9-30 VDC or 10-32 VAC

Sink or Source mA Output



1 2 3 4

Removable Plugs

5 6 7 8

Setup and Status LED

Adjustable Output Test Function

Zero and Span for Output

Input LoopTracker LED

Universal Thermocouple Input

9 10 11 12

See Wiring Diagrams on Next Page

Universal Power

Output Sink/Source Versatility

Standard on the APD 4351 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*

*Certificate applies to your specified I/O settings. Field changes will void NIST 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

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.

Range Selection

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

Select ranges before installation. Use the tables on the next page to select the I/O ranges. The module side label lists output ranges. Check the model/serial number label for module power, options, or custom range information. A custom range uses switch settings described in the Custom Range Table.

Models with **R** reverse acting output use the same switch settings, except the output range is reversed (4-20 mA is 20-4 mA).

1. Set switches A, B, and C from the table to set input type and range.
2. Set switches D and E from the table to set the output range and set switch E: V for voltage or I for current output.

For output ranges that fall between the listed ranges use the next highest setting. The output can be trimmed using the zero and span buttons.

Electrical Connections

See wiring diagrams at right. A multimeter and a thermocouple simulator are required for setup. 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!

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

Input

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

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.

Blinking Yellow LED Setup Error Codes

If an error occurred or invalid selection was made, the yellow Status LED blinks an error code. Check switches A, B, C, and input wiring.

- 2 1 Invalid sensor selected 
- 2 5 Invalid T/C selected 
- 2 7 Invalid input setting (Zero > Span) 

Range Calibration

Input and output ranges, if specified on your order, are factory pre-configured (at 24°C ±1°C).

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 ±10V 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 steps 1 to 19.

Saving Setup

21. Press and release the Set button to store the settings and lock them into memory. The Status LED will be on during this process.
22. Once the Status LED turns off, setup and configuration is complete. Turn off unit power 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. Perform the following adjustment procedure any time input settings are changed.

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.

Changing I/O Setup

To reset the unit back to factory default without changing any input switch settings press and hold the Set button while the module is being powered up.

If using a new input switch setting, the unit will automatically start in setup mode to allow you to calibrate and store your new configuration.

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.

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 4351 accepts a thermocouple 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.

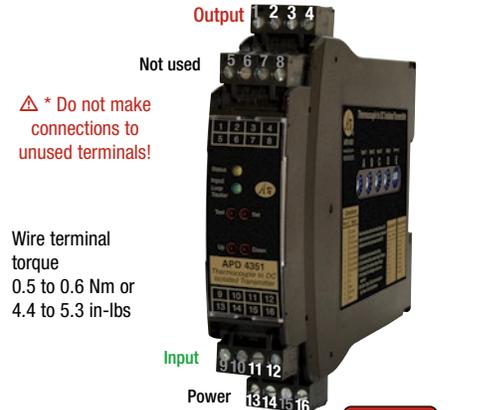
If the LED fails to illuminate, or fails to change in intensity as the process changes, check the module power or signal input wiring. Note that it may be difficult to see the LEDs under bright lighting conditions.

The yellow status LED provides a visual indication of operational modes.
 Normal operation: Off
 Push-to-Test mode: Steadily on
 User setup mode: Blinking

Blinking Yellow LED Operational Error Codes

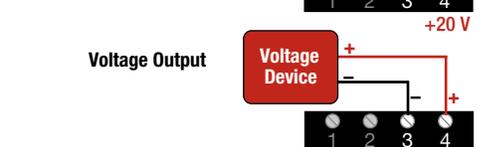
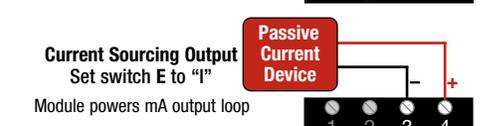
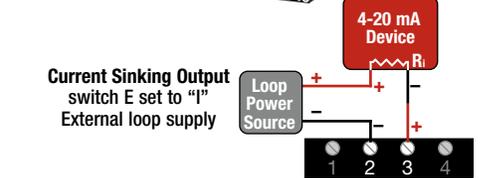
If an error occurs during operation, the yellow Status LED blinks an error code. Check sensor, wiring, or consult factory.

- 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 

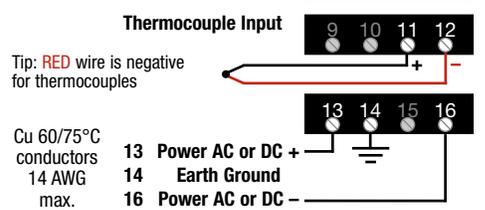
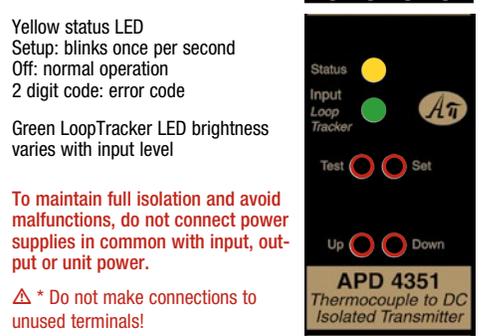


△ * Do not make connections to unused terminals!

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



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



Switch A	7	Single-Ended setting for grounded or ungrounded thermocouples
Switch A	8	Differential setting for ungrounded thermocouples or thermocouples operating in the negative mV range (typically below 0°C)

For models with "R" option, output ranges are reversed

Thermocouple Type	Output Switches Burnout	±10 V	0-10 V	±5 V	2-10 V	0-8 V	0-5 V	1-5 V	0-4 V	0-2 V	0-1 V	0-20 mA	4-20 mA	0-16 mA	0-10 mA	2-10 mA	0-8 mA	0-4 mA	0-2 mA
		BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE	BCDE
B	Upscale	195V	193V	194V	197V	192V	199V	196V	191V	198V	190V	193I	197I	192I	199I	196I	191I	198I	190I
B	Downscale	1A5V	1A3V	1A4V	1A7V	1A2V	1A9V	1A6V	1A1V	1A8V	1A0V	1A3I	1A7I	1A2I	1A9I	1A6I	1A1I	1A8I	1A0I
B	None	1B5V	1B3V	1B4V	1B7V	1B2V	1B9V	1B6V	1B1V	1B8V	1B0V	1B3I	1B7I	1B2I	1B9I	1B6I	1B1I	1B8I	1B0I
C	Upscale	295V	293V	294V	297V	292V	299V	296V	291V	298V	290V	293I	297I	292I	299I	296I	291I	298I	290I
C	Downscale	2A5V	2A3V	2A4V	2A7V	2A2V	2A9V	2A6V	2A1V	2A8V	2A0V	2A3I	2A7I	2A2I	2A9I	2A6I	2A1I	2A8I	2A0I
C	None	2B5V	2B3V	2B4V	2B7V	2B2V	2B9V	2B6V	2B1V	2B8V	2B0V	2B3I	2B7I	2B2I	2B9I	2B6I	2B1I	2B8I	2B0I
D	Upscale	395V	393V	394V	397V	392V	399V	396V	391V	398V	390V	393I	397I	392I	399I	396I	391I	398I	390I
D	Downscale	3A5V	3A3V	3A4V	3A7V	3A2V	3A9V	3A6V	3A1V	3A8V	3A0V	3A3I	3A7I	3A2I	3A9I	3A6I	3A1I	3A8I	3A0I
D	None	3B5V	3B3V	3B4V	3B7V	3B2V	3B9V	3B6V	3B1V	3B8V	3B0V	3B3I	3B7I	3B2I	3B9I	3B6I	3B1I	3B8I	3B0I
E	Upscale	495V	493V	494V	497V	492V	499V	496V	491V	498V	490V	493I	497I	492I	499I	496I	491I	498I	490I
E	Downscale	4A5V	4A3V	4A4V	4A7V	4A2V	4A9V	4A6V	4A1V	4A8V	4A0V	4A3I	4A7I	4A2I	4A9I	4A6I	4A1I	4A8I	4A0I
E	None	4B5V	4B3V	4B4V	4B7V	4B2V	4B9V	4B6V	4B1V	4B8V	4B0V	4B3I	4B7I	4B2I	4B9I	4B6I	4B1I	4B8I	4B0I
G	Upscale	595V	593V	594V	597V	592V	599V	596V	591V	598V	590V	593I	597I	592I	599I	596I	591I	598I	590I
G	Downscale	5A5V	5A3V	5A4V	5A7V	5A2V	5A9V	5A6V	5A1V	5A8V	5A0V	5A3I	5A7I	5A2I	5A9I	5A6I	5A1I	5A8I	5A0I
G	None	5B5V	5B3V	5B4V	5B7V	5B2V	5B9V	5B6V	5B1V	5B8V	5B0V	5B3I	5B7I	5B2I	5B9I	5B6I	5B1I	5B8I	5B0I
J	Upscale	695V	693V	694V	697V	692V	699V	696V	691V	698V	690V	693I	697I	692I	699I	696I	691I	698I	690I
J	Downscale	6A5V	6A3V	6A4V	6A7V	6A2V	6A9V	6A6V	6A1V	6A8V	6A0V	6A3I	6A7I	6A2I	6A9I	6A6I	6A1I	6A8I	6A0I
J	None	6B5V	6B3V	6B4V	6B7V	6B2V	6B9V	6B6V	6B1V	6B8V	6B0V	6B3I	6B7I	6B2I	6B9I	6B6I	6B1I	6B8I	6B0I
K	Upscale	795V	793V	794V	797V	792V	799V	796V	791V	798V	790V	793I	797I	792I	799I	796I	791I	798I	790I
K	Downscale	7A5V	7A3V	7A4V	7A7V	7A2V	7A9V	7A6V	7A1V	7A8V	7A0V	7A3I	7A7I	7A2I	7A9I	7A6I	7A1I	7A8I	7A0I
K	None	7B5V	7B3V	7B4V	7B7V	7B2V	7B9V	7B6V	7B1V	7B8V	7B0V	7B3I	7B7I	7B2I	7B9I	7B6I	7B1I	7B8I	7B0I
M	Upscale	895V	893V	894V	897V	892V	899V	896V	891V	898V	890V	893I	897I	892I	899I	896I	891I	898I	890I
M	Downscale	8A5V	8A3V	8A4V	8A7V	8A2V	8A9V	8A6V	8A1V	8A8V	8A0V	8A3I	8A7I	8A2I	8A9I	8A6I	8A1I	8A8I	8A0I
M	None	8B5V	8B3V	8B4V	8B7V	8B2V	8B9V	8B6V	8B1V	8B8V	8B0V	8B3I	8B7I	8B2I	8B9I	8B6I	8B1I	8B8I	8B0I
N	Upscale	995V	993V	994V	997V	992V	999V	996V	991V	998V	990V	993I	997I	992I	999I	996I	991I	998I	990I
N	Downscale	9A5V	9A3V	9A4V	9A7V	9A2V	9A9V	9A6V	9A1V	9A8V	9A0V	9A3I	9A7I	9A2I	9A9I	9A6I	9A1I	9A8I	9A0I
N	None	9B5V	9B3V	9B4V	9B7V	9B2V	9B9V	9B6V	9B1V	9B8V	9B0V	9B3I	9B7I	9B2I	9B9I	9B6I	9B1I	9B8I	9B0I
P	Upscale	A95V	A93V	A94V	A97V	A92V	A99V	A96V	A91V	A98V	A90V	A93I	A97I	A92I	A99I	A96I	A91I	A98I	A90I
P	Downscale	AA5V	AA3V	AA4V	AA7V	AA2V	AA9V	AA6V	AA1V	AA8V	AA0V	AA3I	AA7I	AA2I	AA9I	AA6I	AA1I	AA8I	AA0I
P	None	AB5V	AB3V	AB4V	AB7V	AB2V	AB9V	AB6V	AB1V	AB8V	AB0V	AB3I	AB7I	AB2I	AB9I	AB6I	AB1I	AB8I	AB0I
R	Upscale	B95V	B93V	B94V	B97V	B92V	B99V	B96V	B91V	B98V	B90V	B93I	B97I	B92I	B99I	B96I	B91I	B98I	B90I
R	Downscale	BA5V	BA3V	BA4V	BA7V	BA2V	BA9V	BA6V	BA1V	BA8V	BA0V	BA3I	BA7I	BA2I	BA9I	BA6I	BA1I	BA8I	BA0I
R	None	BB5V	BB3V	BB4V	BB7V	BB2V	BB9V	BB6V	BB1V	BB8V	BB0V	BB3I	BB7I	BB2I	BB9I	BB6I	BB1I	BB8I	BB0I
S	Upscale	C95V	C93V	C94V	C97V	C92V	C99V	C96V	C91V	C98V	C90V	C93I	C97I	C92I	C99I	C96I	C91I	C98I	C90I
S	Downscale	CA5V	CA3V	CA4V	CA7V	CA2V	CA9V	CA6V	CA1V	CA8V	CA0V	CA3I	CA7I	CA2I	CA9I	CA6I	CA1I	CA8I	CA0I
S	None	CB5V	CB3V	CB4V	CB7V	CB2V	CB9V	CB6V	CB1V	CB8V	CB0V	CB3I	CB7I	CB2I	CB9I	CB6I	CB1I	CB8I	CB0I
T	Upscale	D95V	D93V	D94V	D97V	D92V	D99V	D96V	D91V	D98V	D90V	D93I	D97I	D92I	D99I	D96I	D91I	D98I	D90I
T	Downscale	DA5V	DA3V	DA4V	DA7V	DA2V	DA9V	DA6V	DA1V	DA8V	DA0V	DA3I	DA7I	DA2I	DA9I	DA6I	DA1I	DA8I	DA0I
T	None	DB5V	DB3V	DB4V	DB7V	DB2V	DB9V	DB6V	DB1V	DB8V	DB0V	DB3I	DB7I	DB2I	DB9I	DB6I	DB1I	DB8I	DB0I

Range Table: Custom Input Range

For models with "R" option, output ranges are reversed

Custom Input Type	Output Switches	±10 V	0-10 V	±5 V	2-10 V	0-8 V	0-5 V	1-5 V	0-4 V	0-2 V	0-1 V	0-20 mA	4-20 mA	0-16 mA	0-10 mA	2-10 mA	0-8 mA	0-4 mA	0-2 mA
		ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE	ABCDE
See module side label		FF85V	FF83V	FF84V	FF87V	FF82V	FF89V	FF86V	FF81V	FF88V	FF80V	FF83I	FF87I	FF82I	FF89I	FF86I	FF81I	FF88I	FF80I

Range Setup Record APD 4351 

Date installed	Model	Serial number	Sensor type	Sensor range	Sensor burnout setting	Output range	A	B	C	D	E