

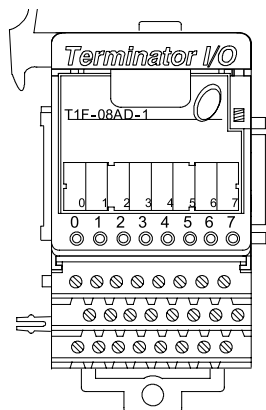
# Analog Current Input Module

**T1F-08AD-1 \$503.00**

## 8-channel

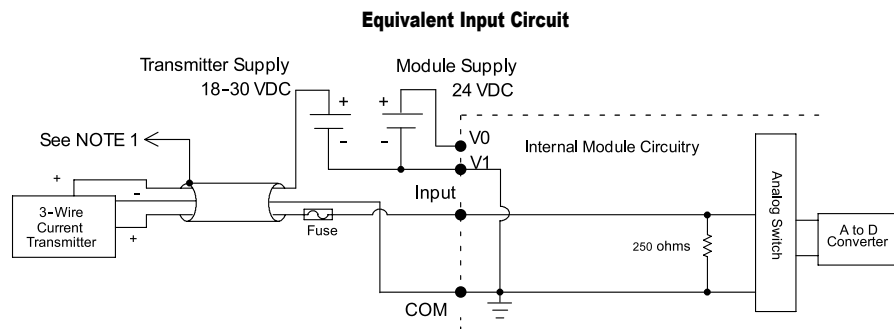
### analog current input module

The 8-channel current input module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08AD-1 Analog Input Specification	
<b>Number of Channels</b>	8, single-ended (1 common)
<b>Input Ranges</b>	-20 to 20mA, 0-20 mA, 4-20 mA
<b>Resolution</b>	14-bit (13-bit plus sign bit)
<b>Frequency Response</b>	-3db @ 500Hz, -20 db/decade
<b>Input Resistance</b>	250q
<b>Absolute Max. Ratings</b>	8V max. input
<b>Conversion Time</b>	Normal mode: 5 ms per channel (default); Fast mode*: 0.5 ms per channel
<b>Linearity Error</b>	± 2 counts max.
<b>Input Stability</b>	Normal mode: ± 1 count (default); Fast mode*: ± 5 counts
<b>Full Scale Error (Offset Error Not Included)</b>	16 counts max.
<b>Offset Error</b>	2 counts max.
<b>Max. Full Scale Inaccuracy (% of full scale); All errors included</b>	0.18% @ 25°C 0.36% @ 60°C
<b>Master Update Rate</b>	8 channels per scan max.
<b>Input Points Required</b>	256 discrete pts. or 8 Dwords (32-bit words) (Network interface dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Module Power Required</b>	21.6-26.4 VDC, 50mA, class 2
<b>Recommended Fuse</b>	0.032 A, Series 217 Fast Acting
<b>Weight</b>	136g

\* Fast mode is supported in module hardware version B or later.  
Fast mode is only supported when using the analog module with the T1H-EBC(100) Interface module.



#### NOTES:

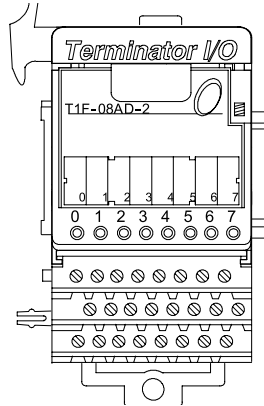
- 1: Shields should be grounded at the signal source.
- 2: More than one external power supply can be used, provided all the power supply commons are connected.
- 3: A Series 217, 0.032 A fast-acting fuse is recommended for 4-20 mA current loops.
- 4: If the power supply common of an external power supply is not connected to the 0V terminal on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
  - For 2 or 3 wire connections: Isolation between the input supply signal and the power supply.
  - For 4 wire connections: Isolation between the input supply signal, the power supply and the 4-20mA output.

# Analog Voltage Input Module

## T1F-08AD-2 \$503.00

### 8-channel analog voltage input module

The 8-channel voltage input module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.

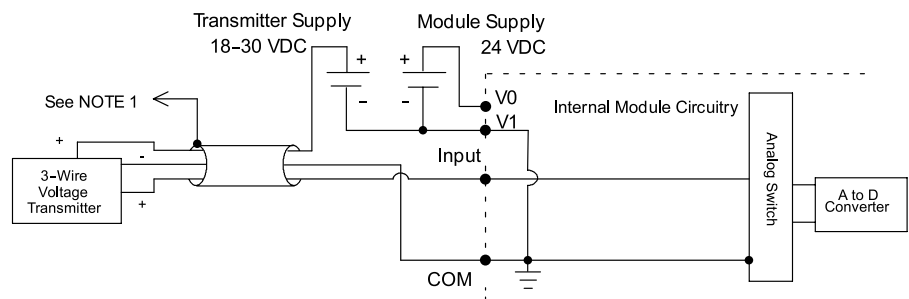


T1F-08AD-2 Analog Input Specification	
<b>Channels Per Module</b>	8 single-ended (1 common)
<b>Input Ranges</b>	0–5 V, 0–10 V, $\pm 5V$ , $\pm 10V$
<b>Resolution</b>	14-bit (13-bit plus sign bit)
<b>Frequency Response</b>	-3db @ 500Hz, -20db/decade
<b>Input Resistance</b>	200k $\Omega$ min.
<b>Absolute Max. Ratings</b>	Fault protected input 130V(rms) or 100VDC
<b>Conversion Time</b>	Normal mode: 5ms per channel (default); Fast mode*: 0.5 ms per channel
<b>Linearity Error</b>	$\pm 2$ count max.
<b>Input Stability</b>	Normal mode: $\pm 1$ count (default); Fast mode*: $\pm 5$ counts
<b>Calibration Full Scale Error</b>	8 counts max.
<b>Calibration Offset Error</b>	2 counts max.
<b>Max. Full Scale Inaccuracy (% of full scale); All errors included</b>	0.08% @ 25°C 0.26% @ 60°C
<b>Master Update Rate</b>	8 channels per scan max.
<b>Input Points Required</b>	256 discrete pts. or 8 Dwords (32-bit words) (Network Interface Dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Module Power Required</b>	21.6–26.4 VDC, 50mA, class 2
<b>Weight</b>	136g

\* Fast mode is supported in module hardware version B or later.

Fast mode is only supported when using the analog module with the T1H-EBC(100) Interface module.

### Equivalent Input Circuit



#### NOTES:

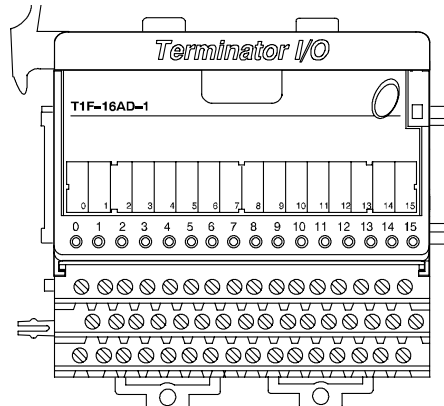
- 1: Shields should be grounded at the signal source.
- 2: Unused inputs should be connected to common (0 VDC).
- 3: More than one external power supply can be used, provided all the power supply commons are connected.

# Analog Current Input Module

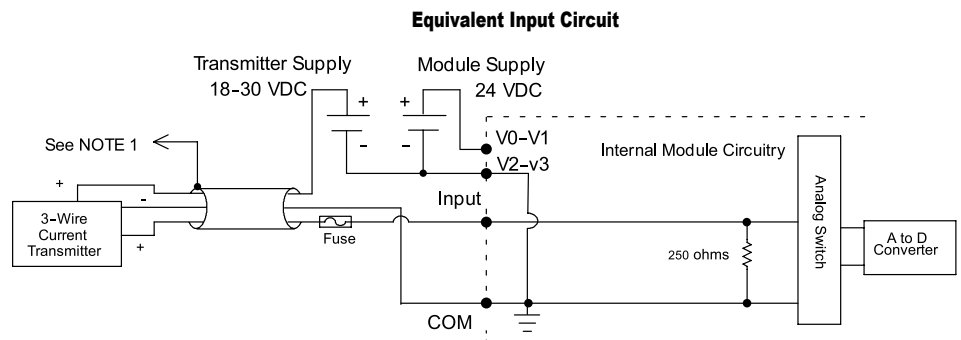
## T1F-16AD-1 \$708.00

### 16-channel analog current input module

The 16-channel current input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16AD-1 Analog Input Specification	
<b>Number of Channels</b>	16, single ended (1 common)
<b>Input Ranges</b>	-20 to 20 mA, 0–20 mA, 4–20 mA
<b>Resolution</b>	14-bit (13-bit plus sign bit)
<b>Frequency Response</b>	-3db @ 500Hz, -20db/decade
<b>Input Resistance</b>	250q
<b>Absolute Max. Ratings</b>	8V max. input
<b>Conversion Time</b>	5ms per channel
<b>Linearity Error</b>	± 2 counts max.
<b>Input Stability</b>	± 1 count
<b>Full Scale Error (Offset Error not included)</b>	16 counts max.
<b>Offset Error</b>	2 counts max.
<b>Max. Full Scale Inaccuracy (% of full scale). All errors included</b>	0.18% @ 25°C 0.36% @ 60°C
<b>Master Update Rate</b>	16 channels per scan max.
<b>Input Points Required</b>	512 discrete pts. or 16 Dwords (32-bit words)(network interface dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Module Power Required</b>	21.6–26.4 VDC, 50mA, class 2
<b>Recommended Fuse</b>	0.032 A, Series 217 fast acting
<b>Weight</b>	168g



#### NOTES:

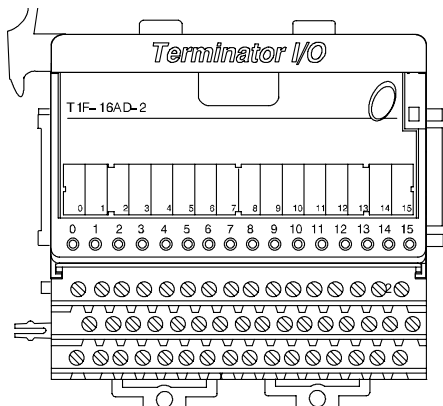
- 1: Shields should be grounded at the signal source.
- 2: More than one external power supply can be used, provided all the power supply commons are connected.
- 3: A Series 217, 0.032 A fast-acting fuse is recommended for 4-20 mA current loops.
- 4: If the power supply common of an external power supply is not connected to the 0V terminal on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
  - For 2 or 3 wire connections: Isolation between the input supply signal and the power supply.
  - For 4 wire connections: Isolation between the input supply signal, the power supply and the 4-20 mA output.

# Analog Voltage Input Module

## T1F-16AD-2 \$710.00

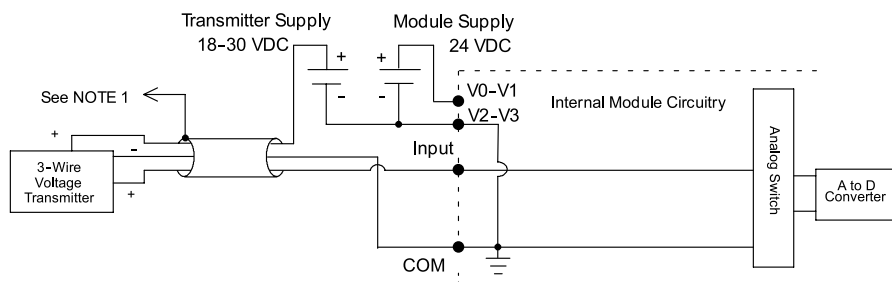
### 16-channel analog voltage input module

The 16-channel voltage input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16AD-2 Analog Input Specification	
<b>Number of Channels</b>	16, single ended (1 common)
<b>Input Ranges</b>	0-5 V, 0-10 V, $\pm 5V$ , $\pm 10 V$
<b>Resolution</b>	14-bit (13-bit plus sign bit)
<b>Frequency Response</b>	-3db @ 500Hz, -20db/decade
<b>Input Resistance</b>	200k $\Omega$ min.
<b>Absolute Max. Ratings</b>	Fault protected input 130V (rms) or 100VDC
<b>Conversion Time</b>	5ms per channel
<b>Linearity Error</b>	$\pm 2$ count max.
<b>Input Stability</b>	$\pm 1$ count
<b>Calibration Full Scale Error</b>	8 counts max.
<b>Calibration Offset Error</b>	2 counts max.
<b>Max. Full Scale Inaccuracy (% of full scale). All errors included</b>	0.08% @ 25°C 0.26% @ 60°C
<b>Master Update Rate</b>	16 channels per scan max.
<b>Input Points Required</b>	512 discrete points or 16 Dwords (32-bit words) (Network Interface Dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Module Power Required</b>	21.6-26.4 VDC, 50mA, class 2
<b>Weight</b>	160g

### Equivalent Input Circuit



#### NOTES:

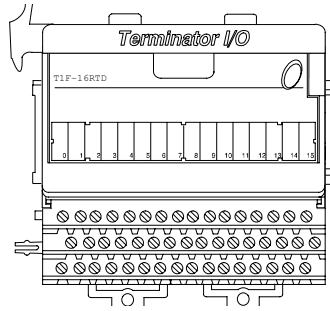
- 1: Shields should be grounded at the signal source.
- 2: Unused inputs should be connected to common (0 VDC).
- 3: More than one external power supply can be used, provided all the power supply commons are connected.

# RTD Input Module

**T1F-16RTD \$697.00**

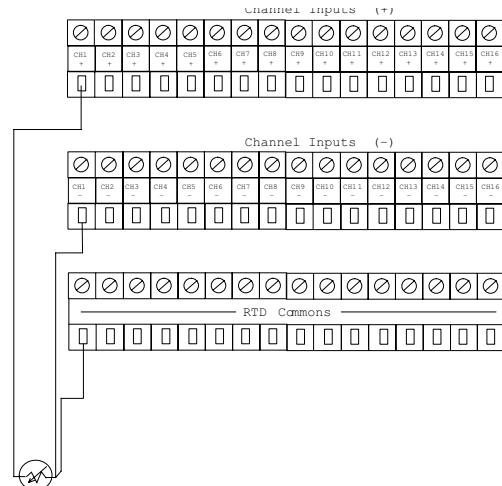
**16-channel  
RTD input module**

The 16-channel RTD input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16RTD 16-Channel RTD Input Specifications	
Number of Channels	16
Common Mode Range	0-5 VDC
Resolution	± 0.1 °C or °F
Notch Filter	>50db notches @ 50/60 Hz; f - 3db = 13.1 Hz
Absolute Maximum Ratings	±50 VDC
Converter Type	Charge balancing, 24-bit
Master Update Rate	16 channels per scan max.
Input Points Required	512 Discrete I/O points /16 Double Words Network Interface Dependent
Sampling Rate	140ms / channel
Base Power Required	150mA max., 5VDC
Temperature Drift	25ppm / °C (max.)
Maximum Inaccuracy	± 1 °C
RTD Excitation Current	200µA
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304
Weight	168g

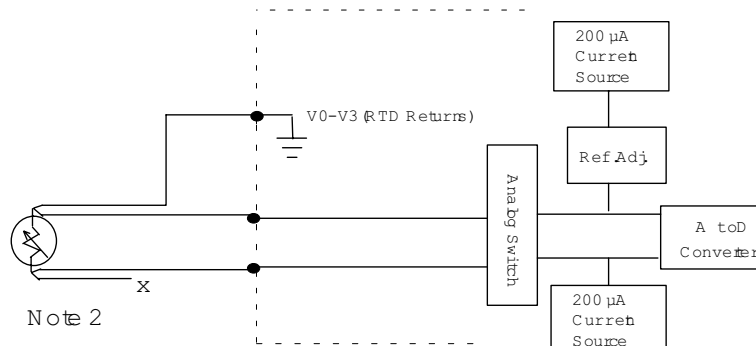
RTD Input Ranges	
Input Ranges	Pt100 -200 to 850°C -328 to 1562°F
	Pt1000 -200 to 595°C -328 to 1103°F
	Pt100 -38 to 450°C -36 to 842°F
	Type CU 10 -200°C to 260°C -328 to 500°F
	Type CU 25 -200°C to 260°C -328 to 500°F
	120Ω Nickel -80 to 260°C -112 to 500°F



**Notes:**

- 1: The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for the third connection.
- 2: If an RTD sensor has four wires, the plus sense wire should be left unconnected as shown.

**Equivalent Input Circuit**

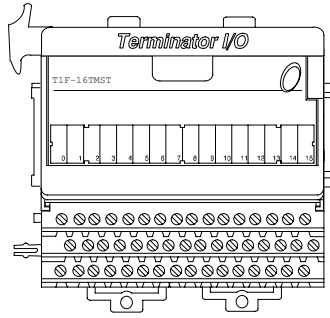


# Thermistor Input Module

**T1F-16TMST \$629.00**

**16-channel Thermistor input module**

The 16-channel Thermistor input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.

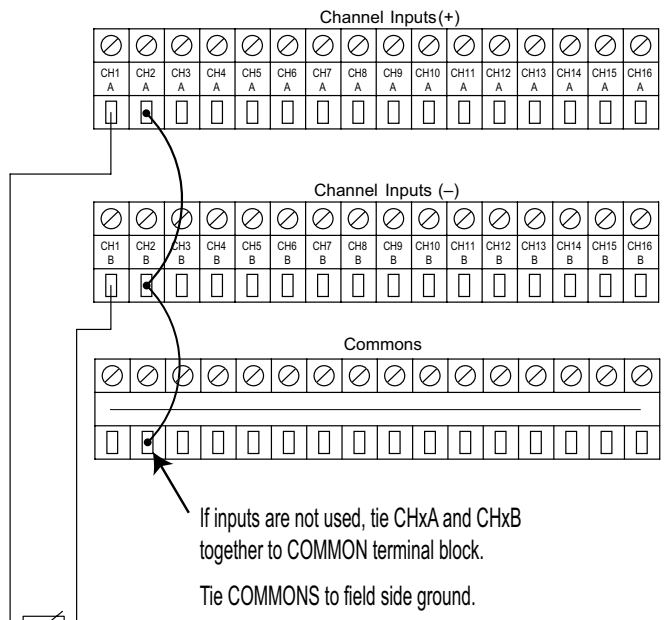
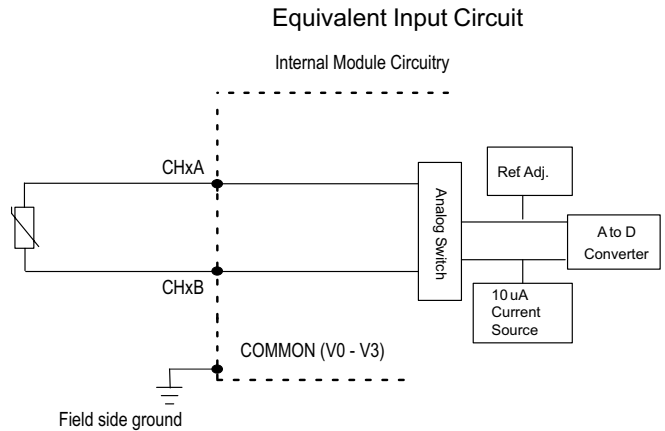


Specifications	
Number of Channels	16
Resolution	±0.1° C or °F
Input Impedance	> 1MΩ
Common Mode Range	0–5 VDC
Absolute Max. Ratings	±50VDC
Converter Type	Charge balancing, 24-bit
Sampling Rate	140ms / channel
Master Update Rate	16 channels per scan max.
Input Points Required	512 discrete pts. or 16 dwords (d (double) word = 32 bit word) Network Interface dependent
Base Power Required	150mA @ 5VDC
Operating Temperature	0° to 60° C (32° to 140° F)
Storage Temperature	-20° to 70° C (-4° to 158° F)
Temperature Drift	25ppm / °C (max.)
Maximum Inaccuracy 1	±1°C
Excitation Current	10µA
Electrical Isolation	1500VDC field wire to backplane
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC 60068-2-6 (Test FC)
Shock	IEC 60068-2-27 (Test Ea)
Noise Immunity	EN61131-2:2007 2
Recommended Cable	AutomationDirect P/N: PLTC3-16-1S-1-(XXX) Belden 8761 or equivalent
Weight	168g

1 "Accuracy" pertains to module only and does not include tolerances of thermistor element, wiring resistance, etc. For example, 22 gauge wire is 0.016Ω per foot, so 200 feet of wire adds 3.2Ω.

2 Meets EMC & Safety Requirements

Thermistor Input Ranges	
Input Ranges	Range
10K-AN (Type 3)	-40° to 150° C (-40° to 300° F)
10K-CP (Type 2)	-40° to 150° C (-40° to 300° F)
5K	-40° to 150° C (-40° to 300° F)
3K	-40° to 150° C (-40° to 300° F)
2252	-40° to 150° C (-40° to 300° F)
1.8K	-40° to 150° C (-40° to 300° F)

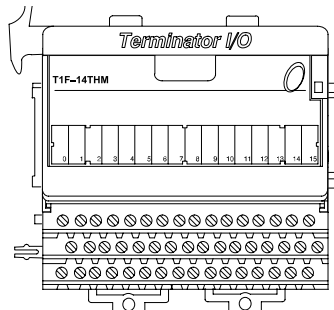


# Thermocouple Input Module

**T1F-14THM \$915.00**

## 14-channel thermocouple input module

The 14-channel thermocouple input module uses a T1K-16B screw-type terminal base only, which is purchased separately.

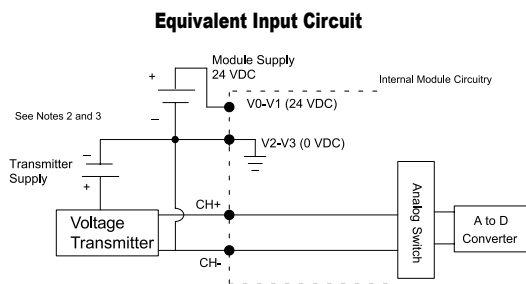
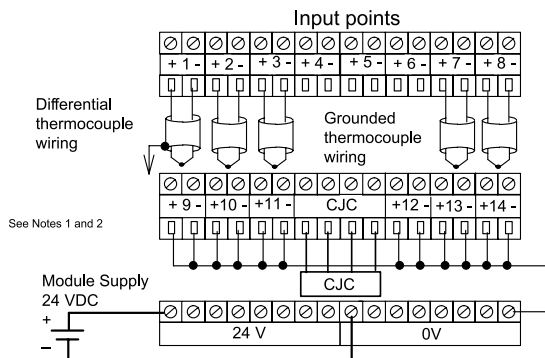


T1F-14THM 14-Channel Thermocouple Input Specifications	
<b>Use I/O Base</b>	T1K-16B Only
<b>Number of Channels</b>	14, differential
<b>Common Mode Range</b>	±5VDC
<b>Common Mode Rejection</b>	90dB min. @ DC, 150dB min. @ 50/60 Hz.
<b>Input Impedance</b>	1 MΩ
<b>Absolute Maximum Ratings</b>	Fault-protected inputs to ±50VDC
<b>Accuracy vs. Temperature</b>	±5 ppm/°C maximum full scale calibration. (including maximum offset change)
<b>Master Update Rate</b>	14 channels per scan max.
<b>Input Points Required</b>	512 Discrete I/O points /16 Double Words Network Interface Dependent
<b>External Module Power Required</b>	70mA maximum, 24VDC ± 5%
<b>Base Power Required</b>	60mA max., 5VDC
<b>Operating Temperature</b>	32° to 140°F (0° to 60°C)
<b>Storage Temperature</b>	-4° to 158°F (-20° to 70°C)
<b>Relative Humidity</b>	5 to 95% (non-condensing)
<b>Environmental Air</b>	No corrosive gases permitted
<b>Vibration</b>	MIL STD 810C 514.2
<b>Shock</b>	MIL STD 810C 516.2
<b>Noise Immunity</b>	NEMA ICS3-304
<b>Weight</b>	168g

Thermocouple Specifications (Cont.)	
<b>Input Ranges</b>	Type J -190 to 760°C -310 to 1400°F
	Type E -210 to 1000°C -346 to 1832°F
	Type K -150 to 1372°C -238 to 2502°F
	Type R 65 to 1768°C 149 to 3214°F
	Type S 65 to 1768°C 149 to 3214°F
	Type T -230 to 400°C -382 to 752°F
	Type B 529 to 1820°C 984 to 3308°F
	Type N -70 to 1300°C -94 to 2372°F
	Type C 65 to 2320°C 149 to 4208°F
	<b>Display Resolution</b>
<b>Cold Junction Compensation</b>	Automatic; CJC (part #: T1F-CJC) included with module must be installed in terminal base (refer to the module's data sheet)
<b>Conversion Time</b>	100ms
<b>Warm-Up Time</b>	30 minutes typically ± 1°C repeatability
<b>Linearity Error (End to End)</b>	±.05 °C maximum, ±.01°C typical
<b>Maximum Inaccuracy</b>	±3 °C (excluding thermocouple error)
<b>Voltage Input Specifications</b>	
<b>Voltage Ranges</b>	0-5 V, ±5V, 0-156.25 mV, ±156.25 mVDC
<b>Resolution</b>	16 bit (1 in 65535)
<b>Full Scale Calibration Error (Offset Error Included)</b>	±13 counts typical ±33 maximum
<b>Offset Calibration Error</b>	±1 count maximum, @ 0V input
<b>Linearity Error (End to End)</b>	±1 count maximum
<b>Maximum Inaccuracy</b>	±0.02% @ 25°C (77°F)

**Notes:**

- 1: Shields should be grounded at the signal source.
- 2: Connect unused inputs to a common terminal (0 VDC).
- 3: When using 0-156 mV and 5V ranges, connect (-) or (0) volts terminal to 0V to ensure common mode range acceptance.
- 4: The Cold Junction Compensation (CJC) temperature sensing unit must be installed into the I/O base terminals to perform CJC of the thermocouple inputs.



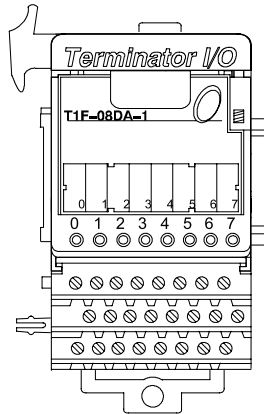


# Analog Current Output Module

**T1F-08DA-1 \$645.00**

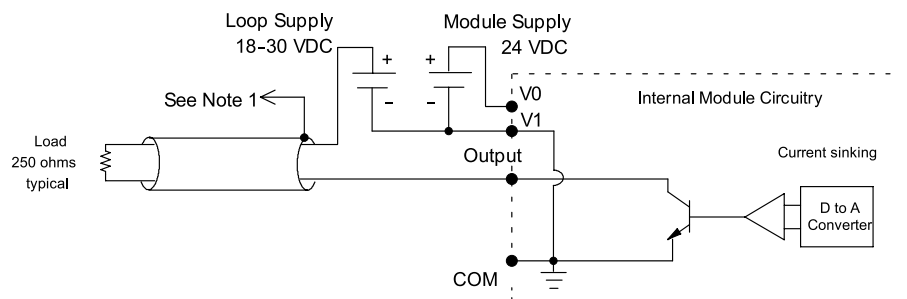
**8-channel  
analog current output module**

The 8-channel current output module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08DA-1 Analog Output Specification	
<b>Channels Per Module</b>	8
<b>Output Ranges</b>	0–20 mA, 4–20 mA
<b>Output Type</b>	Single-ended, 1 common
<b>Resolution</b>	12-bit (1 in 4096)
<b>Max. Loop Supply</b>	30VDC
<b>Peak Output Voltage</b>	30VDC
<b>Load Impedance</b>	0 Ω (min)
<b>Max. Load (ohm) / Power Supply</b>	620/18 V, 910/24 V, 1200/30 V
<b>Min. Load (ohm) / Power Supply</b>	0 Ω/24 V, 350/30 V @ 40°C 250 Ω/24V, 600/30 V @ 60°C
<b>Linearity Error (end to end)</b>	± 2 counts max. ± 0.05% of full scale max.
<b>Conversion Settling Time</b>	400µs max. full scale change
<b>Full Scale Calibration Error</b>	± 12 counts max.
<b>Offset Calibration Error</b>	0–20 mA: ± 6 counts max. 4–20 mA: ± 6 counts max.
<b>Accuracy vs. Temperature</b>	± 50 ppm/°C full scale calibration change
<b>Max. Full Scale Inaccuracy (% of full scale); all errors included</b>	0.2% @ 25°C 0.4% @ 60°C
<b>Master Update Rate</b>	8 channels per scan max.
<b>Output Points Required</b>	256 discrete pts. or 8 Dwords (32-bit words) (network interface dependent)
<b>Base Power Required</b>	75mA @ 5 VDC
<b>External Module Power Required</b>	21.6–26.4 VDC, 150mA, class 2
<b>Weight</b>	145g

### Equivalent Output Circuit



#### NOTES:

1. Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
2. Unused current outputs should remain open (no connections) for minimum power consumption.

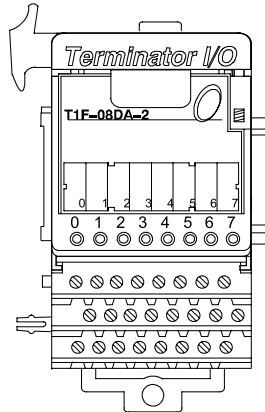


# Analog Voltage Output Module

**T1F-08DA-2 \$694.00**

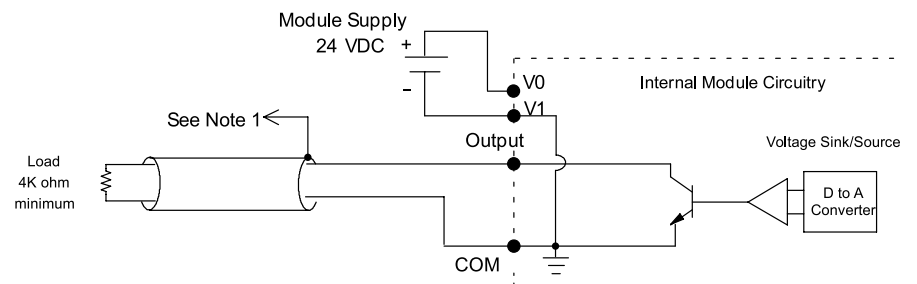
## 8-channel analog voltage output module

The 8-channel voltage output module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08DA-2 Analog Output Specification	
<b>Number of Channels</b>	8
<b>Output Ranges</b>	0–5 V, 0–10V, $\pm 5V$ , $\pm 10V$
<b>Output Type</b>	Single-ended, 1 common
<b>Resolution</b>	12-bit (1 in 4096)
<b>Peak Output Voltage</b>	15VDC
<b>Load Impedance</b>	4k $\Omega$ min.
<b>Load Capacitance</b>	0.01 $\mu$ F max.
<b>Linearity Error (end to end)</b>	$\pm 2$ counts max. $\pm 0.05\%$ of full scale max.
<b>Conversion Settling Time</b>	100 $\mu$ s max. full scale change
<b>Full Scale Calibration Error</b>	$\pm 12$ counts max.
<b>Offset Calibration Error</b>	10V ranges: $\pm 6$ counts max. 5V ranges: $\pm 11$ counts max.
<b>Accuracy vs. Temperature</b>	$\pm 50$ ppm/ $^{\circ}$ C full scale calibration change
<b>Max. Full Scale Inaccuracy (% of full scale), all errors included</b>	10V ranges: 0.2% @ 25 $^{\circ}$ C 0.4% @ 60 $^{\circ}$ C 5V ranges: 0.3% @ 25 $^{\circ}$ C 0.5% @ 60 $^{\circ}$ C
<b>Master Update Rate</b>	8 channels per scan max.
<b>Output Points Required</b>	256 discrete pts. or 8 Dwords (32-bit words) - network interface dependent
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Module Power Required</b>	21.6–26.4 VDC, 150mA, class 2
<b>Weight</b>	145g

### Equivalent Output Circuit



#### NOTES:

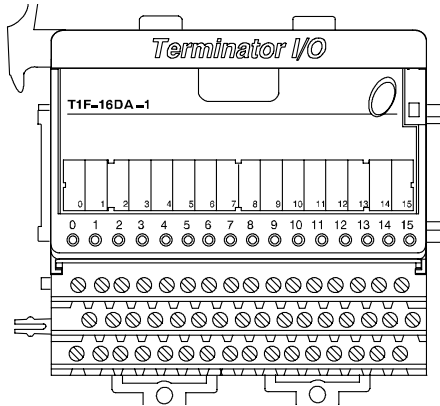
- 1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
- 2: Unused current outputs should remain open (no connections) for minimum power consumption.

# Analog Current Output Module

**T1F-16DA-1 \$995.00**

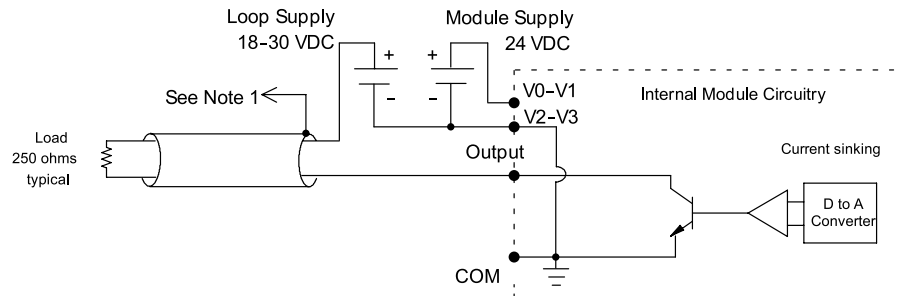
**16-channel analog current output module**

The 16-channel current output module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16DA-1 Analog Output Specification	
<b>Number of Channels</b>	16
<b>Output Ranges</b>	0–20 mA, 4–20 mA
<b>Output Type</b>	Single-ended, 1 common
<b>Resolution</b>	12-bit (1 in 4096)
<b>Max. Loop Supply</b>	30VDC
<b>Peak Output Voltage</b>	30VDC
<b>Max. Load (q) / Power Supply</b>	620Ω/18 V; 910Ω/24 V; 1200Ω/30 V
<b>Min. Load (q) / Power Supply</b>	0 Ω/24V; 350Ω/30 V, @ 40°C 250 Ω/24V; 600Ω/30 V @ 60°C
<b>Linearity Error (end to end)</b>	± 2 counts max. ± 0.05% of full scale max.
<b>Conversion Settling Time</b>	100µs max. full scale change
<b>Full Scale Calibration Error</b>	± 12 counts max.
<b>Offset Calibration Error</b>	± 4 counts max.
<b>Accuracy vs. Temperature</b>	± 50 ppm/°C full scale calibration change
<b>Max. Full Scale Inaccuracy (% of full scale), All errors included</b>	0.2% @ 25°C 0.4% @ 60°C
<b>Master Update Rate</b>	16 channels per scan max.
<b>Output Points Required</b>	512 discrete points or 16 Dwords (32-bit words) (network interface dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Power Supply</b>	21.6–26.4 VDC, 150mA, class 2
<b>Weight</b>	172g

**Equivalent Output Circuit**



**NOTES:**

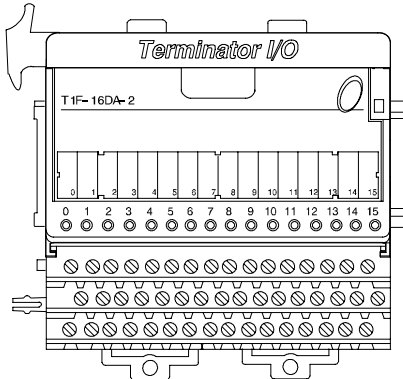
- 1. Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
- 2. Unused current outputs should remain open (no connections) for minimum power consumption.

# Analog Voltage Output Module

## T1F-16DA-2 \$1,069.00

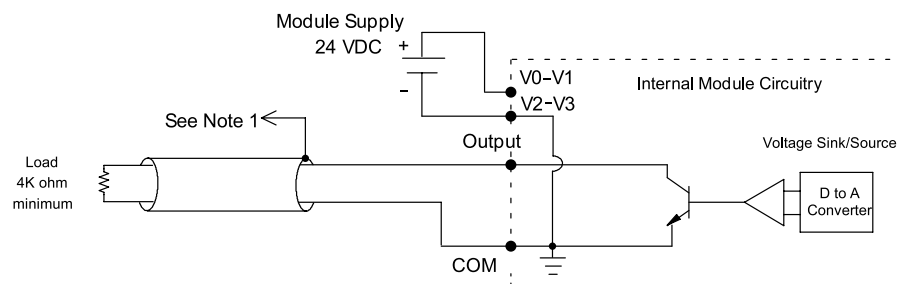
### 16-channel analog voltage output module

The 16-channel voltage output module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16DA-2 Analog Output Specification	
<b>Number of Channels</b>	16
<b>Output Ranges</b>	0-5 V, 0-10 V, $\pm 5V$ , $\pm 10V$
<b>Output Type</b>	Single-ended, 1 common
<b>Resolution</b>	12 bit (1 in 4096)
<b>Peak Output Voltage</b>	15VDC
<b>Load Impedance</b>	4k $\Omega$ min.
<b>Load Capacitance</b>	0.01 $\mu F$ max.
<b>Linearity Error (end to end)</b>	$\pm 2$ counts max. $\pm 0.05\%$ of full scale max.
<b>Conversion Settling Time</b>	100 $\mu s$ max. full scale change
<b>Full Scale Calibration Error</b>	$\pm 12$ counts max.
<b>Offset Calibration Error</b>	10V ranges: $\pm 6$ counts max. 5V ranges: $\pm 11$ counts max.
<b>Accuracy vs. Temperature</b>	$\pm 50$ ppm/ $^{\circ}C$ full scale calibration change
<b>Max. Full Scale Inaccuracy (% of full scale), All errors included</b>	10V ranges: $\pm 0.2\%$ @ 25 $^{\circ}C$ $\pm 0.4\%$ @ 60 $^{\circ}C$ 5V ranges: $\pm 0.3\%$ @ 25 $^{\circ}C$ $\pm 0.5\%$ @ 60 $^{\circ}C$
<b>Master Update Rate</b>	16 channels per scan max.
<b>Output Points Required</b>	512 discrete points or 16 Dwords (32-bit words) (Network Interface Dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Power Supply</b>	21.6-26.4 VDC, 150mA, class 2
<b>Weight</b>	172g

### Equivalent Output Circuit



#### NOTES:

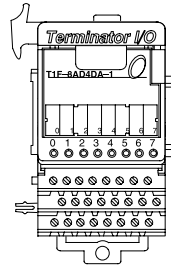
- 1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
- 2: Unused current outputs should remain open (no connections) for minimum power consumption.

# Analog Current Combination Module

## T1F-8AD4DA-1 \$613.00

**8-channel analog current input**  
**4-channel analog current output**

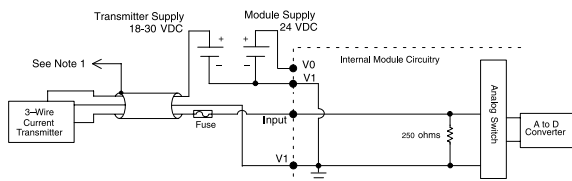
The combination 8-in and 4-out current module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-8AD4DA-1 Analog Input Specification	
<b>Number of Channels</b>	8, single-ended (1 common)
<b>Input Ranges</b>	-20 to 20 mA, 0-20 mA, 4-20 mA
<b>Resolution</b>	14-bit (13-bit plus sign bit)
<b>Frequency Response</b>	-3db @ 500Hz, -20db/decade
<b>Input Resistance</b>	250Ω
<b>Absolute Max. Ratings</b>	8V max. input
<b>Conversion Time</b>	5ms per channel
<b>Linearity Error</b>	± 2 counts max.
<b>Input Stability</b>	± 1 count
<b>Full Scale Error (Offset Error not included)</b>	16 counts max.
<b>Offset Error</b>	2 counts max.
<b>Max. Full Scale Inaccuracy (% of full scale), all errors included</b>	0.18% @ 25°C 0.36% @ 60°C
<b>Master Update Rate</b>	8 channels per scan max.
<b>Input Points Required</b>	256 discrete pts. or 8 Dwords (32-bit words) (Network Interface Dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Power Required</b>	21.6-26.4 VDC, 60mA, class 2 (plus 20mA per output loop)
<b>Recommended Fuse</b>	0.032 A, Series 217 Fast Acting
<b>Weight</b>	136g

Analog Output Specification	
<b>Channels Per Module</b>	4, sink/source by wiring
<b>Output Ranges</b>	4-20 mA
<b>Output Type</b>	Single-ended, 1 common
<b>Resolution</b>	12-bit (1 in 4096)
<b>Max. Loop Supply</b>	30VDC
<b>Source Load / Loop Power Supply</b>	0-400 Ω / 18-30 VDC
<b>Sink Load / Loop Power Supply</b>	0-600 Ω / 18VDC 0-900 Ω / 24VDC 0-1200 Ω / 30VDC
<b>Total Load (Sink + Source)</b>	600Ω/18V, 900Ω/24V, 1200Ω/30V
<b>Linearity Error (End to End)</b>	± 2 counts max. ± 0.05% of full scale max.
<b>Conversion Settling Time</b>	400μs max. full scale change
<b>Full Scale Calibration Error (Note: source error depends upon the load from the source terminal to ground)</b>	SINK: ± 12 counts max. @ any load SOURCE: ± 26 counts max. @ 400Ω ± 18 counts max. @ 250Ω ± 12 counts max. @ 125Ω
<b>Offset Calibration Error</b>	SINK: ± 6 counts max. @ any load SOURCE: ± 10 counts max. @ 400Ω ± 8 counts max. @ 250Ω ± 6 counts max. @ 125Ω
<b>Max. Full Scale Inaccuracy (% of Full Scale) All Errors Included</b>	SINK: (any load) 0.3% @ 25°C (any load) 0.5% @ 60°C SOURCE: 400Ω load 0.63% @ 25°C 400Ω 0.83% @ 60°C 250Ω 0.44% @ 25°C 250Ω load 0.64% @ 60°C 125Ω load 0.30% @ 25°C 125Ω load 0.50% @ 60°C
<b>Master Update Rate</b>	4 channels per scan max.
<b>Output Points Required</b>	128 discrete pts. or 4 Dwords (32-bit words) (network interface dependent)

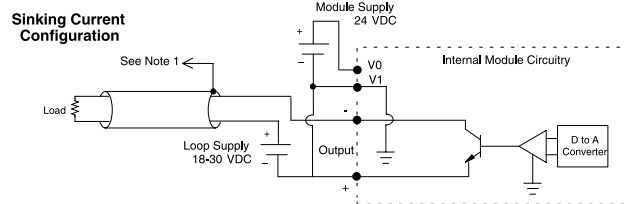
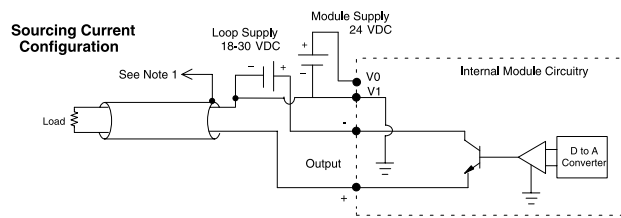
### Equivalent Input Circuit



**NOTES:**

- 1: Shields should be grounded at the signal source.
- 2: More than one external power supply can be used, provided all the power supply commons are connected.
- 3: A Series 217, 0.032 A fast-acting fuse is recommended for 4-20 mA current loops.
- 4: If the power supply common of an external power supply is not connected to the 0V terminal on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
  - For 2 or 3 wire connections: Isolation between the input supply signal and the power supply.
  - For 4 wire connections: Isolation between the input supply signal, the power supply and the 4-20 mA output.

### Equivalent Output Circuit



**NOTES:**

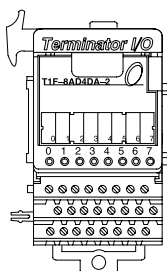
- 1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
- 2: Unused current outputs should remain open (no connections) for minimum power consumption.

# Analog Voltage Combination Module

**T1F-8AD4DA-2 \$613.00**

**8-channel analog voltage input  
4-channel analog voltage output**

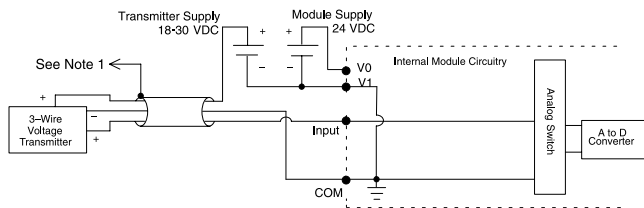
The combination 8-in and 4-out voltage module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-8AD4DA-2 Analog Input Specification	
<b>Channels Per Module</b>	8 single-ended (1 common)
<b>Input Ranges</b>	0-5 V, 0-10 V, ± 5V, ± 10 V
<b>Resolution</b>	14-bit (13-bit plus sign bit)
<b>Frequency Response</b>	-3db @ 500Hz, -20db/decade
<b>Input Resistance</b>	200kΩ min.
<b>Absolute Max. Ratings</b>	Fault Protected Input 130V (rms) or 100VDC
<b>Conversion Time</b>	5.5 ms per channel
<b>Linearity Error</b>	± 2 count max.
<b>Input Stability</b>	± 1 count
<b>Calibration Full Scale Error</b>	8 counts max.
<b>Calibration Offset Error</b>	2 counts max.
<b>Max. Full Scale Inaccuracy (% of full scale), all errors included</b>	0.08% @ 25°C 0.26% @ 60°C
<b>Master Update Rate</b>	8 channels per scan max.
<b>Input Points Required</b>	256 discrete pts. or 8 dwords (32-bit words) (Network Interface Dependent)
<b>Base Power Required</b>	75mA @ 5VDC
<b>External Power Supply</b>	21.6-26.4 VDC, 70mA, class 2
<b>Weight</b>	136g

T1F-8AD4DA-2 Analog Output Specification	
<b>Number of Channels</b>	4
<b>Output Ranges</b>	0-5 V, 0-10 V, ± 5V, ± 10V
<b>Output Type</b>	Single ended, 1 common
<b>Resolution</b>	12-bit (1 in 4096)
<b>Peak Output Voltage</b>	15VDC
<b>Load Impedance</b>	4kΩ min.
<b>Load Capacitance</b>	0.01 μF max.
<b>Linearity Error (End to End)</b>	± 2 counts max. ± 0.05% of full scale max.
<b>Conversion Settling Time</b>	300μs max. full scale change
<b>Full Scale Calibration Error</b>	± 12 counts max.
<b>Offset Calibration Error</b>	10V ranges: ± 5 counts max. 5V ranges: ± 9 counts max.
<b>Accuracy vs. Temperature</b>	± 50 ppm/°C full scale calibration change
<b>Max. Full Scale Inaccuracy (% of full scale) All errors and temp drift included</b>	10V ranges: ± 0.2% @ 25°C ± 0.4% @ 60°C 5V ranges: ± 0.3% @ 25°C ± 0.5% @ 60°C
<b>Master Update Rate</b>	4 channels per scan max.
<b>Output Points Required</b>	128 discrete pts. or 4 Dwords (32-bit words) (Network Interface Dependent)

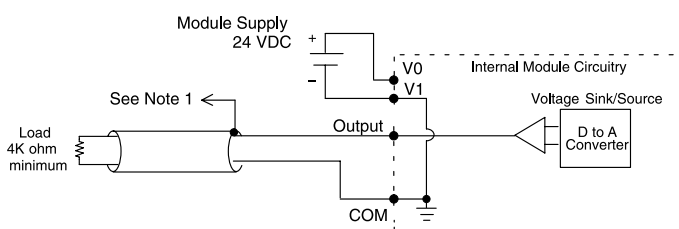
**Equivalent Input Circuit**



**NOTES:**

- 1: Shields should be grounded at the signal source.
- 2: Unused inputs should be connected to common (0 VDC).
- 3: More than one external power supply can be used, provided all the power supply commons are connected.

**Equivalent Output Circuit**



**NOTES:**

- 1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
- 2: Unused current outputs should remain open (no connections) for minimum power consumption.

# Dimensions and Installation

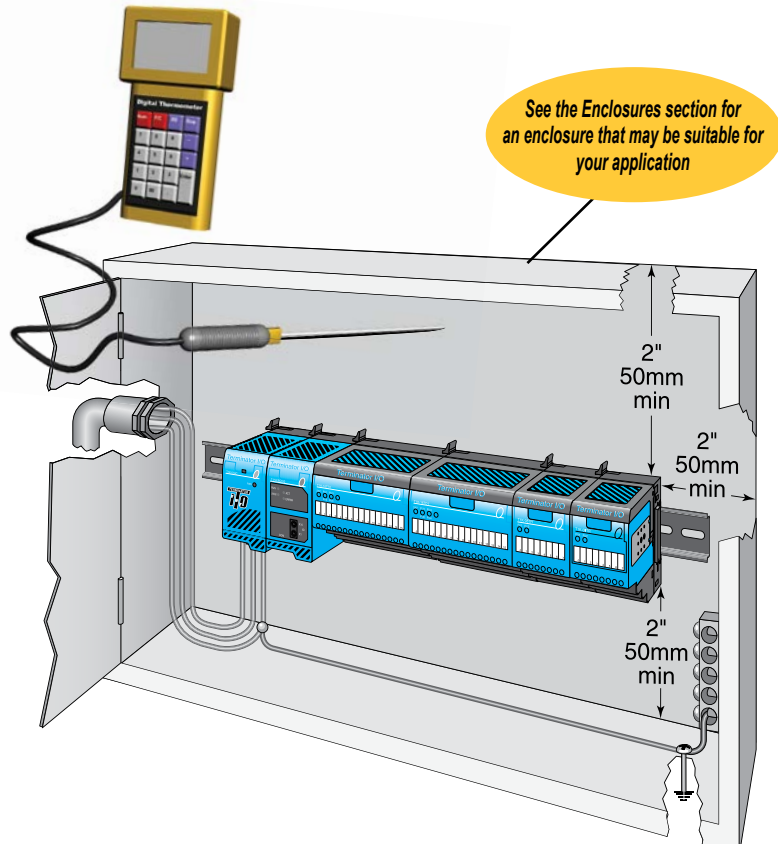
It is important to understand the installation requirements for your Terminator I/O system. This will ensure that the Terminator I/O products work within their environmental and electrical limits.

## Plan for safety

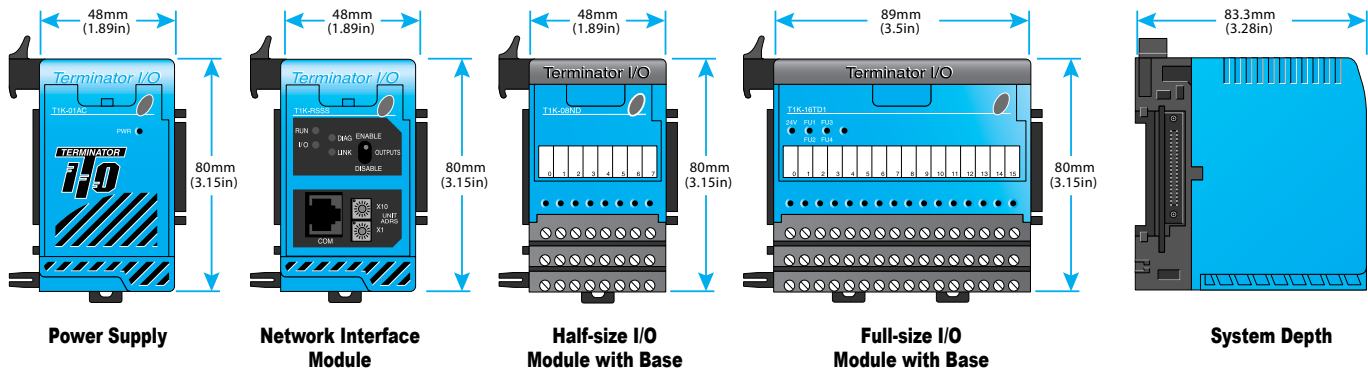
This catalog should never be used as a replacement for the technical data sheet that comes with the products or the T1K-INST-M Installation and I/O Manual (available online at [www.automationdirect.com](http://www.automationdirect.com).) The technical data sheet contains information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

## Unit dimensions and mounting orientation

Use the following diagrams to decide if the Terminator I/O system can be installed in your application. Terminator I/O units should be mounted horizontally. To ensure proper airflow for cooling purposes, units should not be mounted upside-down. It is important to check the Terminator I/O dimensions against the conditions required for your application. For example, it is recommended to leave 2" depth for ease of access and cable clearance. However, your distance may be greater or less. Also, check the installation guidelines for the recommended cabinet clearances.



Terminator I/O Environmental Specifications	
<b>Ambient Operating Temperature</b>	32°F to 131°F (0°C to 55°C)
<b>Storage Temperature</b>	-4°F to 158°F (-20°C to 70°C)
<b>Ambient Humidity</b>	5% to 95% (Non-condensing)
<b>Atmosphere</b>	No corrosive gases. The level of environmental pollution = 2 (UL 840)
<b>Vibration Resistance</b>	MIL STD 810C, Method 514.2
<b>Shock Resistance</b>	MIL STD 810C, Method 516.2
<b>Voltage Withstand (Dielectric)</b>	1500VAC, 1 minute
<b>Insulation Resistance</b>	500 VDC, 10 M $\Omega$
<b>Noise Immunity</b>	NEMA ICS3-304 Impulse noise 1 $\mu$ s, 1000V FCC class A RFI (144MHz, 430MHz 10W, 10cm)
<b>Agency Approvals</b>	UL, CE, FCC class A, NEC Class 1 Division 2





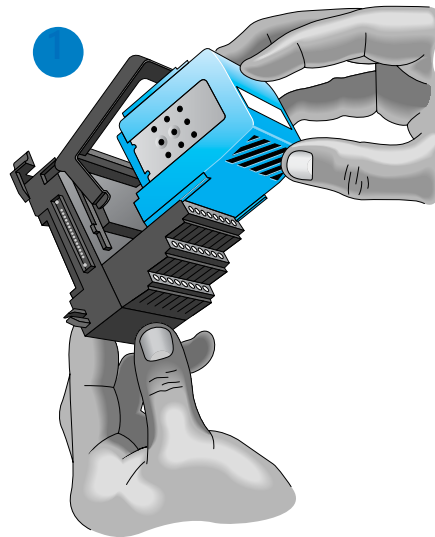
# I/O Module Installation

## I/O module installation

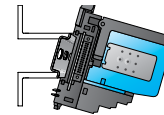
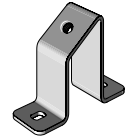
Terminator I/O modules feature separate terminal bases for easy installation.

To install I/O modules:

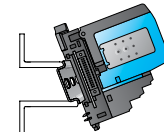
1. Slide the module into its terminal base (until it clicks into position)
2. Hook upper DIN rail tabs over the top of DIN rail, and press the assembly firmly onto the DIN rail.
3. Slide the module along the DIN rail until it engages with the adjacent module.



### DN-ASB1 angled mounting bracket

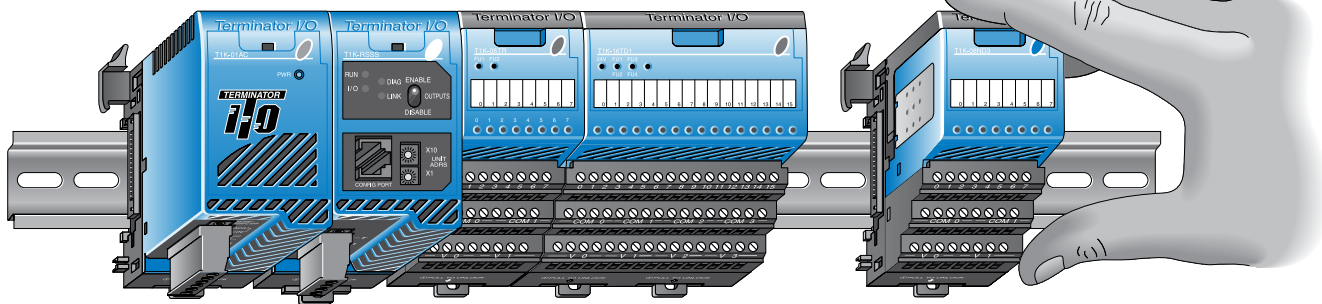
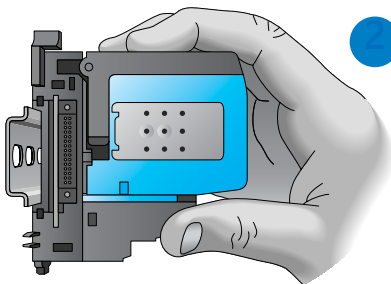


Great for mounting in upper locations



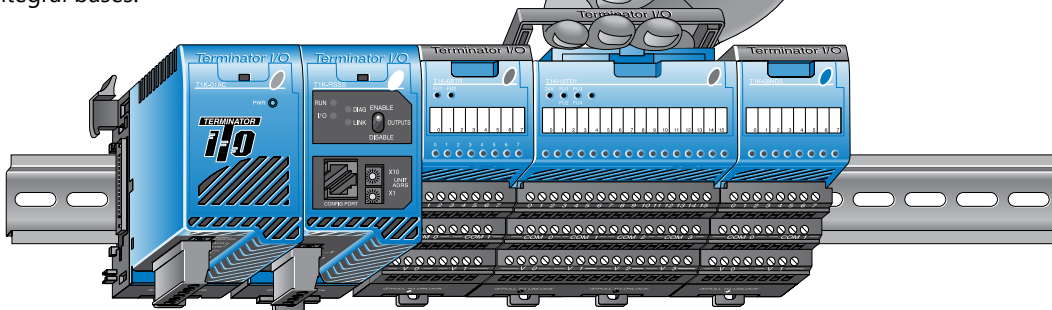
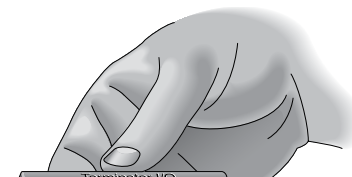
Great for mounting in lower locations

Optional angled support bracket raises and tilts the mounting rail for easier access and wiring. Use with 35mm DIN rail. See the Connection Systems in this catalog for details.



## Removing I/O modules is a snap

Grip the locking handle, as shown, and pull gently to eject the I/O module from its base. The module will slide out for easy replacement. This procedure does not apply to network interface modules or power supplies, which have integral bases.



### Hot-swappable I/O modules

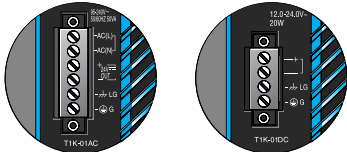
You can remove I/O modules under power, but exercise caution while doing so. Do not touch the terminals with your hands or any conductive material. Always remove power when possible.



# Power Supplies and Power Requirements

## Power supplies

The Terminator I/O product line offers two power supply options: AC or DC. The power supplies are always positioned to the left of the modules to which they supply power. Consult the system configuration examples and the power budgeting example for more information on positioning power supplies.



## Power supply specifications

Power Supply Specifications		T1K-01AC \$159.00	T1K-01DC \$167.00
<b>Input Voltage Range</b>		110/220 VAC	12/24 VDC
<b>Input Frequency</b>		50/60 Hz	N/A
<b>Maximum Power</b>		50VA	30W
<b>Max. Inrush Current</b>		20A	10A
<b>Insulation Resistance</b>		> 10M $\Omega$ @ 500 VDC	
<b>Voltage Withstand</b>		1 min. @ 1500VAC between primary, secondary and field ground	
<b>5VDC PWR</b>	<b>Voltage</b>	5.25 VDC	5.25 VDC
	<b>Current Rating</b>	2000 mA max (see current option note below)	2000mA max
	<b>Ripple</b>	5% max.	5% max.
<b>24VDC PWR</b>	<b>Voltage</b>	24VDC	N/A
	<b>Current Rating</b>	300mA max. (see current option note below)	N/A
	<b>Ripple</b>	10% max.	N/A
<b>Fuse</b>	1 (primary), not replaceable		
<b>Replacement Terminal Block (Phoenix Contact)</b>	MVSTBW 2.5/4-ST- 5.08 BK	MVSTBW 2.5/6-ST- 5.08 BK	
<b>Note:</b> 500mA @ 24VDC can be achieved by lowering the 5VDC from 2000mA to 1500mA.			

## Power requirements

Module	5VDC	24VDC	Module	5VDC	24VDC	Module	5VDC	24VDC		
<b>Interface Modules</b>			<b>DC Output Modules</b>			<b>Analog Input Modules</b>				
<b>T1H-EBC100</b>	300	0	<b>T1H-08TDS</b>	200	0	<b>T1F-08AD-1</b>	75	50*		
<b>T1K-DEVNETS</b>	250	45	<b>T1K-08TD1</b>	100	200*	<b>T1F-08AD-2</b>	75	50*		
<b>T1K-MODBUS</b>	300	0	<b>T1K-16TD1</b>	200	400*	<b>T1F-16AD-1</b>	75	50*		
<b>DC Input Modules</b>			<b>T1K-08TD2-1</b>	200	0	<b>T1F-16AD-2</b>	75	50*		
<b>T1K-08ND3</b>	35	0	<b>T1K-16TD2-1</b>	200	0	<b>T1F-16RTD</b>	150	0		
<b>T1K-16ND3</b>	70	0	<b>AC Output Modules</b>			<b>T1F-16TMS</b>	150	0		
<b>AC Input Modules</b>			<b>T1K-08TA</b>			250	0	<b>T1F-14THM</b>	60	70*
<b>T1K-08NA-1</b>	35	0	<b>T1K-16TA</b>			450	0	<b>Analog Output Modules</b>		
<b>T1K-16NA-1</b>	70	0	<b>T1K-08TAS</b>			300	0	<b>T1F-08DA-1</b>	75	150*
<b>AC Output Modules</b>			<b>Relay Output Modules</b>			<b>T1F-08DA-2</b>			75	150*
<b>T1K-08TR</b>			<b>T1K-08TR</b>			350	0	<b>T1F-16DA-1</b>	75	150*
<b>T1K-16TR</b>			<b>T1K-16TR</b>			700	0	<b>T1F-16DA-2</b>	75	150*
<b>T1K-08TRS</b>			<b>T1K-08TRS</b>			400	0	<b>Combination Analog Modules</b>		
<b>Specialty Modules</b>			<b>T1H-CTRIO</b>			400	0	<b>T1F-8AD4DA-1</b>	75	60*
<b>T1H-CTRIO</b>			<b>T1F-8AD4DA-2</b>			75	70*	<b>* Use either internal or external source for 24VDC</b>		

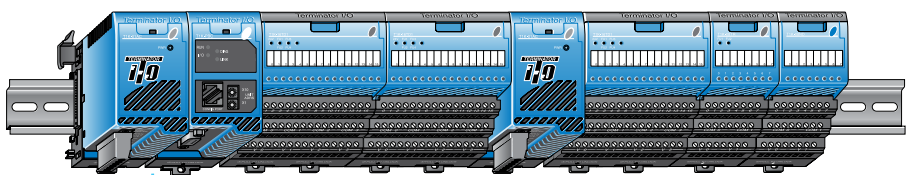
### Calculating the power budget

To calculate the power budget, read the available power (current rating) from the Power Supply Specifications table and subtract the power consumed by each module to the right of the power supply. Do not include modules to the right of an additional power supply.

### Adding additional power supplies

Each power supply furnishes power only to the network interface and I/O modules to its right. Inserting a second power supply closes the power loop for the power supply to the left, while also powering the modules to its right. Perform a power budget calculation for each power supply in the system.

Power Budget Example		
Module	5VDC	24VDC
<b>T1K-01AC</b>	+2000mA	+300mA
<b>T1H-EBC100</b>	-300mA	-0mA
<b>T1K-16ND3</b>	-70mA	-0mA
<b>T1K-16TD2</b>	-200mA	-0mA
<b>T1F-08AD-1</b>	-75mA	-50mA
<b>Remaining</b>	+1355mA	+250mA



This power supply powers the network interface module and the next two I/O modules

This power supply powers these three I/O modules

# Expansion I/O Configurations

## Expansion cables

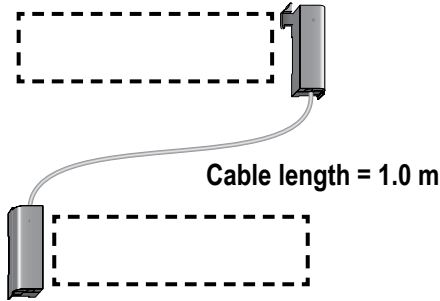
<b><u>T1K-10CBL</u></b>	<b>\$104.00</b>
<b><u>T1K-10CBL-1*</u></b>	<b>\$138.00</b>

### **Right side to left side expansion cable**

The T1K-10CBL(-1) connects the right side of an I/O base to the left side of the next I/O base. A maximum of two T1K-10CBL(-1) cables can be used per expansion system.

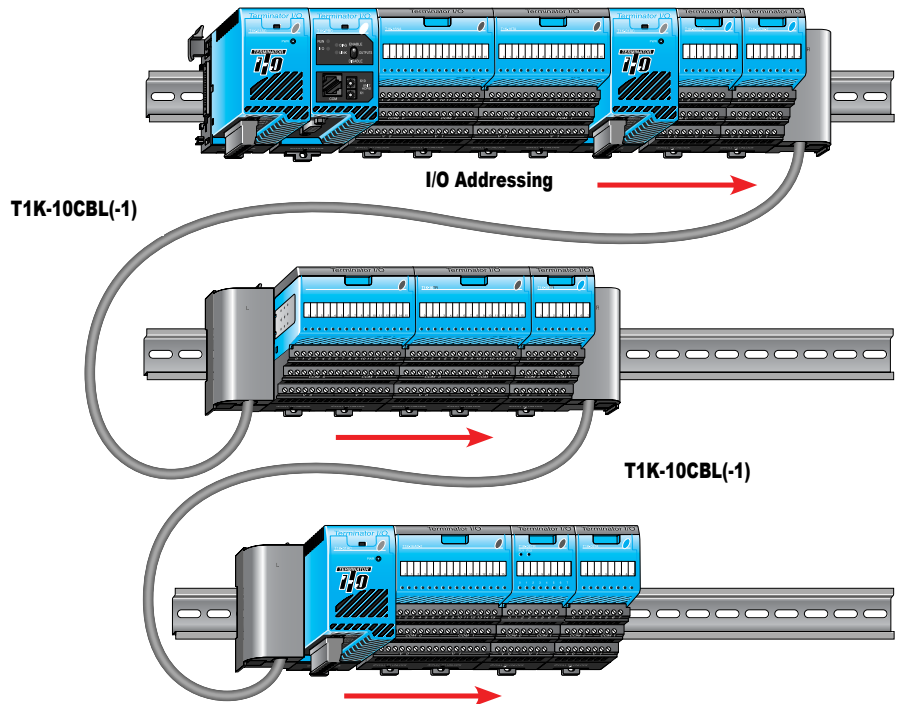


\*Note: The (-1) versions of the expansion cables pass 24VDC through on an isolated wire. (All cables pass the 5VDC base power.) Any local expansion DC input module configured for "internal power" (current sourcing) must either have a power supply preceding it on the same base or, have a (-1) version cable pass 24VDC from a power supply on the preceding base.



### **Using two T1K-10CBL expansion cables**

In the system below, power supplies can be used anywhere.



# Field Device Wiring and Power Options

## Terminal base specifications

Terminator I/O terminal bases are available in screw clamp and spring clamp versions for both half-size and full-size modules. Hot stamp silk screen labeling is used for numbering I/O points, commons, and all power terminals.

Terminal Base Specifications		
<b>Terminal Type</b>	Screw type	Spring clamp
<b>Recommended Torque</b>	1.77–3.54 lb-in (0.2–0.4 N·m)	N/A
<b>Wire Gauge</b>	Solid:	Solid:
	25–12 AWG	25–14 AWG
	Stranded:	Stranded:
	26–12 AWG	26–14 AWG

### Field device wiring options

Power your DC input devices from the integrated 24VDC power supply bus. T1K-08ND3 and T1K-16ND3 DC input modules include jumpers for selecting the internal 24VDC power supply available for 2- and 3-wire field devices. Clearly labeled triple stack terminals make it easy to wire 2- and 3-wire devices ensuring clean wiring with only one wire per termination.

External user supplied 24VDC power, or auxiliary 24VDC terminals from T1K-01AC, can be easily applied directly to one end of the terminal rows and jumpered across each base in the system.

This is a convenient solution for powering analog I/O and discrete DC output devices whose modules do not have direct access to the internal bussed 24VDC. If current consumption increases, simply add additional T1K-01AC power supplies into the system.

## Hot-swap feature

The hot-swap feature allows Terminator I/O modules to be replaced while system power is on. Be careful not to touch the terminals with your hands or other conductive material to avoid the risk of personal injury or equipment damage. Always remove power if it is equally convenient to do so.

Note: Before hot-swapping analog or

DC output modules in a Terminator I/O system, make sure that each of the analog and DC output module's 24VDC and 0 VDC base terminals are wired directly to the external power supply individually. If the external 24VDC and 0 VDC is jumpered from base to base in a daisy chain fashion, and an analog or DC output

module is removed from its base, the risk of disconnecting the external 24VDC and 0 VDC to the subsequent I/O modules exists.